NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File:

House Committee on Finance

HB 174, HD2, RELATING TO FOOD

Testimony of Loretta J. Fuddy, A.C.S.W., M.P.H.
Director of Health

February 22, 2013
3:00 p.m.

Department's Position: The department opposes this bill.

Fiscal Implications: The department has not included or funded this initiative in the Executive Biennium Budget and therefore may adversely affect other spending priorities.

Purpose and Justification: The Department does not object in principle to a labeling policy to enhance public awareness of the absence of genetically engineered food or food ingredients in Hawaii markets. However, the Department is not in a position to enforce such legislation as we do not conduct work in recombinant DNA; and therefore, do not possess the requisite scientific expertise and experience to test and determine whether a suspected food or food product has been genetically engineered. Currently, there is no conclusive scientific evidence of negative health effects associated with the consumption of genetically engineered food or food products. As such we do not believe such labeling is a health issue and thus do not support any such program being assigned to the Department to administer.

The Department would like to focus its limited resources in areas such as controlling the incidence of food borne illness risk factors in the food establishments through proper inspection

frequencies that have been proven to produce consistent compliance with food safety regulations which are directly related to outbreaks of food borne illness.

Thank you for the opportunity to testify.

Margaret Wille
Council Member
District 9 - North and South Kohala

Phone No. Hilo: (808) 961-8027
Phone No. Waimea: (808) 887-2043
Fax No.: (808) 887-2072
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HAWAI'I COUNTY COUNCIL

County of Hawai'i

Hawai'i County Building
25 Aupuni Street
Hilo, Hawai'i 96720

Holomua Center
64-1067 Mamalahoa Highway, Suite C-5
Waimea, Hawai'i 96743

West Hawai'i Civic Center Bldg. A
74-5044 Ane Keohokalole Hwy.
Kailua-Kona, Hawai'i ,96740

House Committee on Finance
Friday, 02-22-13, 3:00PM, Rm 308
HB174 HD2 Related to the Environment

Aloha Chair Luke, Vice Chair Nishimoto and Members of the Committee,

My name is Margaret Wille, Chair of the Hawai' i County Council Committee on Agriculture, Water and Energy Sustainability, testifying in ***SUPPORT of HB174 HD2 Relating to the Food Labeling.***

This bill imposes labeling requirements and import restrictions on imported genetically engineered produce and authorizes labeling of non-genetically engineered food and creates a private right of action to enjoin violations.

Consumers have a right to know what they are eating and the companies who produce GE foods should be proud enough of their products to label them. With more education, consumers will gain a thorough understanding of GE food and the role they can and do play in the agricultural sector. The education that labeling supports will minimize misconceptions of GE foods and would likely increase their acceptance among consumers. The cost of labeling will become a production cost that will not likely result in a large price increase to consumers.

With labeling, misconceptions over the safety or risks of eating GE foods can be raised and addressed in the public forum, as can questions over potential for allergic reactions, nutritional value as compared to non-GE foods, comparative costs between GE and non-GE foods, the increased or decreased-use of pesticide-application associated with GE foods as well as religious or ethical concerns.

This is a small step in the right direction that does not harm Hawai□i farmers. GE food labeling is an idea that is long in coming. Mahalo for passing HB174 HD2.

Margaret Wille
Council Member District 9
North & South Kohala

COUNTY COUNCIL
Jay Furfaro, Chair
Nadine K. Nakamura, Vice Chair
Tim Bynum
Gary L. Hooser
Ross Kagawa
Mel Rapozo
JoAnn A. Yukimura

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Council Services Division
4396 Rice Street, Suite 209
Līhu'e, Kaua'i, Hawai'i 96766

February 21, 2013

TESTIMONY OF GARY L. HOOSER
COUNCILMEMBER, KAUA'I COUNTY COUNCIL
ON
H.B. NO. 174, HD2, RELATING TO FOOD LABELING
House Committee on Finance
February 22, 2013
3:00 p.m.
Conference Room 308

Dear Chair Luke and Members of the House Committee on Finance:

I am testifying in strong support of H.B.174, HD2, requiring labeling of GMO foods and suggesting the measure be amended to include all whole foods, both foreign and domestic.

It's not about eating the corn.

Not for me anyway. The decision to eat or not eat the corn is only a small reason I support the labeling of genetically modified foods and hold deep reservations about the industry as a whole.

People on my island are getting sick. Many believe their sickness is being caused by the secondary and cumulative impacts connected to the growing of genetically modified organisms.

Yet, when I have asked these companies directly and officially in writing to disclose what chemicals and in what quantities they are spraying, the industrial agrochemical GMO companies on Kaua'i have refused to do so.

For me, that alone is enough to keep me from buying their products or supporting their industry, and to support full labeling requirements.

Sixty-three (63) countries around the world, including all of Europe, Russia, Japan, Australia, and New Zealand, require mandatory labeling of GMO products. Some countries have banned these products completely.

Many questions exist and many doubts persist. There are valid health concerns ranging from allergen sensitivities to hormonal disruption to cancer, related to the GMO's and to the pesticide spraying that accompanies them.

There are concerns about the globalization and corporate ownership of the world's food supply. There are ethical and moral questions pertaining to the concept of corporations owning patents on living organisms both plant and animal, and to the increased diminishment of bio-diversity. These are all valid reasons consumers may not want to buy these products and thus the need to require labeling.

For me, it's personal.

Kaua'i is ground zero in the GMO industry. These industrial agrochemical operations dominate the landscape of Kaua'i's west side and are now moving into the southern and eastern land as well. The fields of mostly genetically modified corn not intended for human consumption grow on approximately 12,000 acres of prime farmland stretching from the base of the mountains down to within just feet of the pristine ocean waters.

These crops are subject to spraying with toxic pesticides up to 6 days a week.

Over 200 residents of Waimea Valley have filed suit claiming negative impacts from pesticide laden dust blowing into their homes and onto their bodies. Biologists estimate over 50,000 sea urchins died last year in near shore west-side waters.

People in all parts of Kaua'i County are growing increasingly concerned about the impacts that result from these companies spraying their fields with toxic and experimental chemicals that then flow into streams and near shore waters and cling to the dust which blows daily into neighborhoods and schools.

Yet these agrochemical companies, who are required by law to keep records of their pesticide use, tell me blithely to go elsewhere for the data.

About half the land used for GMO production on Kaua'i are public lands upon which zero property tax is paid, but they refuse to disclose to the public what they are growing or what they are spraying on these public lands. These large transnational corporations transfer their end products to related subsidiaries, benefit from Enterprise Zone and other GET exemptions, and consequently pay zero GET tax on the products they produce.

State law and terms of the public lands lease/license require compliance with Hawaii's environmental review law Chapter 343, H.R.S., yet no documentation demonstrating compliance exists; no Exemption Declaration, no Environmental Assessment, and no Environmental Impact Statement.

Growing genetically modified organisms, using experimental pesticides, and spraying a wide array of restricted and non-restricted pesticides on a mass scale have impacts on our island, our health, and our environment. There are direct impacts, secondary impacts and cumulative impacts but we do not know what those impacts, are because they have never been properly evaluated – and the companies in question will not even give us the information needed to make a proper evaluation.

So yes, I support labeling. Absolutely.

Labeling, mandatory disclosure, and a permitting process that requires a comprehensive review of the significant environmental and health impacts to our island and our community caused by this industry – I support them all, because as you can see this is about much more than just eating the corn.

For the reasons stated above, I am in support of H.B. No. 174, HD2, and ask for your favorable support. Again, thank you for this opportunity to submit testimony.

Sincerely,

Gary L. Hooser

GARY L. HOOSER
Councilmember, Kaua'i County Council

AO:mn

HAWAIIAN AFFAIRS CAUCUS

DEMOCRATIC PARTY OF HAWAII

1050 ALA MOANA BLVD D-2150, HONOLULU, HI 96814

LEGISLATIVE TESTIMONY

HOUSE COMMITTEE ON FINANCE

ALOHA MAI KAKOU,
CHAIR SYLVIA LUKE AND VICE CHAIR SCOTT NISHIMOTO
FINANCE COMMITTEE MEMBERS
HEARING: Rm.308 2/22/2013 3:00 PM

HB 174 HD2 – RELATING TO FOOD LABELING
POSITION: STRONG SUPPORT

The Hawaiian Affairs Caucus of the Democratic Party of Hawaii is submitting testimony in **STRONG SUPPORT** of HB 174 HD2 which involves GMO Food labeling and the people's right to know.

The standard of the people's right to know what is in their food is clearly a universal and global human right. Hawaiian culture and core values are also dedicated to these ideals determined for centuries by utilizing hui kulanakauhale, ohana and the stewardship of aloha aina.

The cost for GMO labeling is borne upon the marketplace and the fiscal responsibility of corporate enterprise. The multi billion dollar industry created by GMO companies should pay it's fair share through corporate taxes and good accounting practices to properly label it's content and inform the consumer of the impacts on the health of all people. Consumerism was born for the protection of people's rights to safety and health. We cannot devalue or disregard this corporate responsibility because commercial enterprise chooses to cut corners and practice poor accountability to the consumer. It is the duty of every one to respect the right to choose, it does not automatically eliminate the commercial producer's advantage but will permit the buyer to be informed and therefore allow their choices to be based on their ability to purchase or not purchase. Good sound corporate practices insure economic growth and development for everyone. A good company works to care for the consumer not to deceive them.

For these reasons, we the Hawaiian Affairs Caucus of the Democratic Party of Hawaii stand in **STRONG SUPPORT** of this bill.

'O ia ihola nö me ke aloha.

Juanita Kawamoto
Committee Chair
Agriculture/Energy/Environment

Lela M. Hubbard
Chairperson
HACDPH

The Chamber of Commerce of Hawaii
The Voice of Business in Hawaii

Testimony to the House Committee on Finance
Friday, February 22, 2013 at 3:00 P.M.
Conference Room 308, State Capitol
Agenda #3

RE: HB 174 HD 2 Relating to Food Labeling

Chair Luke, Vice Chairs Nishimoto and Johanson, and Members of the Committee:

The Chamber of Commerce of Hawaii **opposes** HB 174 HD 2 Relating to Food Labeling.

This would be another additional cost on businesses and consumers. Also the administrative burden and costs to differentiate and research food material would be great.

The Chamber understands consumer information is important. We believe that jurisdiction for these matters are generally handled by the Food and Drug Administration and are in line with generally accepted scientific principles. The American Medical Association (AMA), World Health Organization, National Academy of Sciences, and the European Union have thoroughly examined the evidence and found that consuming genetically engineered foods are no riskier than consuming conventionally grown foods.

The Chamber is the largest business organization in Hawaii, representing more than 1,000 businesses. Approximately 80% of our members are small businesses with less than 20 employees. As the "Voice of Business" in Hawaii, the organization works on behalf of its members, which employ more than 200,000 individuals, to improve the state's economic climate and to foster positive action on issues of common concern.

Thank you for this opportunity to express our views.

MOLOKAI CHAMBER OF COMMERCE

P.O. Box 515
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February 22, 2013

HOUSE HEARING
Committee on Finance
Friday, February 22, 2013
3:00 P.M.
Conference Room 308
State Capitol
415 South Beretania Street

Testimony OPPOSING HB 174 HD2
Relating to Food Labeling

Aloha Chair Luke, Vice Chair Nishimoto, Vice Chair Johanson and Respected Committee Members,

As a representative organization of the neighbor-island of Molokai, we are respectfully submitting testimony in opposition of HB 174 HD2. We would also like to clarify any misunderstanding that may arise from other testimony attributed to the people of Molokai on the above measure. The Molokai Chamber of Commerce, which represents dozens of businesses that employ hundreds of people, that provide for their families, stands in STRONG OPPOSITION to HB 174 HD2.

We humbly ask you to consider the following:

- How can the State of Hawaii mandate labeling of imported genetically engineered produce and not require it of our own agricultural producers if it truly is meant to inform the consumer?
- How would this measure affect the distribution of our agricultural products on the U.S. Mainland if we make it more difficult for mainland farmers to distribute their produce in Hawaii?
- What will be the cost to Hawaii taxpayers of implementation and enforcement of this unnecessary measure?
- What will be the increased cost of offshore produce to Hawaii residents and families as the increased financial burden of compliance to offshore agricultural producers inevitably gets passed on to the consumer?
- What will be the exponential cost increase to the neighbor islands as a result of this measure due to the additional leg of shipping and increased levels of interisland shipping compliance?
- There is no scientific evidence to warrant the labeling of any genetically engineered food – imported or otherwise. How can this possibly be good legislation?
- Is the intent of this proposed resolution to sincerely inform and protect the public or to simply pay deference to an extreme ideology and it's followers?
- This measure would open up the possibility of infinite frivolous lawsuits based solely upon an ideology. What would be the cost, financial and otherwise, of overwhelming our justice system when there are more pressing items that must to be adjudicated to ensure the safety and orderly conduct of the people of Hawaii?

We humbly ask that you hold HB 174 HD2.

Sincerely,

Robert Stephenson, President & CEO

HOUSE HEARING
Committee on Finance
Friday February 22, 2013
3:00pm, Conference Room 308
State Capitol, 415 South Beretania Street

Testimony OPPOSING HB174 HD2
Relating to Food Labeling

Aloha Chair Luke, Vice Chairs Nishimoto, Johanson, and respected Committee Members

As President of the Molokai Farm Bureau and on behalf of our participating members, I respectfully submit the following comments:

- **FOOD PRODUCT LABELLING IS THE KULEANA OF OUR US FOOD AND DRUG ADMINISTRATION:** Food product labeling is best handled on a nationwide basis. State and County legislation related to food labeling will only add confusion, cost and unnecessary litigation. We may even see restrictions on the volume and variety of food shipped to Hawaii.
- **GMO CROPS ARE SAFE AND NO DIFFERENT:** The FDA has determined that where genetically-modified crops don't differ from non-GM crops, that products containing them don't have to be labeled. FDA does require the product to be labeled if the ingredient is a potential allergen, or somehow changes the nutritional properties of the food. To date, no approved biotech crop is either an allergen, or has any significant nutritional differences from non-GM counterparts.
- **VOLUNTARY LABELING ALREADY ENSURES CONSUMER CHOICE**: Individuals who make a personal decision not to consume food containing GM ingredients can easily avoid such products. They can purchase products that are certified as organic under the National Organic Program.
- **THE ACTIVIST EXTREMISTS AND THEIR SUPPORTERS IN OUR LEGISLATURE ARE SIMPLY GRASPING AT STRAWS WITH HB 174 HD 2**. It is a bad bill that will establish bad state policy. Labeling "out of State" products under the guise of protecting the public health is illogical and not legally defendable. Please refer to the HI Attorney General's testimony on the bill.

I strongly oppose HB174 HD2. Please kill it and return scientific logic and reason to our legislative process!

Respectfully submitted,

Raymond J. Foster
President, Molokai Farm Bureau

HAWAII FOOD INDUSTRY ASSOCIATION (HFIA)
1050 Bishop St. PMB 235
Honolulu, HI 96813
Fax : 808-791-0702
Telephone : 808-533-1292

DATE: Friday, February 22, 2013
TIME: 3:00 P.M.
PLACE: Conference Room 308
State Capitol
415 South Beretania Street

TO:
COMMITTEE ON FINANCE
Rep. Sylvia Luke, Chair
Rep. Scott Y. Nishimoto, Vice Chair
Rep. Aaron Ling Johanson, Vice Chair

Rep. Ty J.K. Cullen	Rep. Richard H.K. Onishi
Rep. Mark J. Hashem	Rep. Gregg Takayama
Rep. Kaniela Ing	Rep. James Kunane Tokioka
Rep. Jo Jordan	Rep. Justin H. Woodson
Rep. Bertrand Kobayashi	Rep. Kyle T. Yamashita
Rep. Nicole E. Lowen	Rep. Beth Fukumoto
Rep. Dee Morikawa	Rep. Gene Ward

FROM: Hawaii Food Industry Association - Lauren Zirbel, Executive Director

RE: HB 174, HD 2 RELATING TO FOOD LABELING

Imposes labeling requirements and import restrictions on imported genetically engineered produce. Authorizes labeling of non-genetically engineered food and creates a private right of action to enjoin violations. Effective July 1, 2112.

Chairs & Committee Members:

The Hawaii Food Industry Association opposes this bill.

The practical reality of enforcing this bill will be a nightmare. If the distributor/grower does not label the produce or advise the retailer that the product is GMO then the retailer is potentially liable for the mislabeling. A retailer cannot identify GMO product by visual or taste inspection.

As proposed, this labeling required would be inconsistent to federal requirements, and therefore, costly to implement. Hawaii imports 85% of the food consumed in the state. **Hawaii's food demands are not large enough to force domestic and foreign food suppliers to meet these labeling requirements**. As such, the cost will be borne by Hawaii's consumers.

This is a federal issue and should be dealt with at that level, with the onus for labeling resting with manufacturers and suppliers, not retailers. Thank you for the opportunity to provide testimony.

FINTestimony

From: Don Heacock [koadonheacock@yahoo.com]
Sent: Thursday, February 21, 2013 1:57 PM
To: FINTestimony
Cc: Rep. Derek Kawakami; Dee Morikawa

Honorable House Committee on Finance:

I strongly support the labeling of GMO (Genetically Engineered) produce (foods and beverages), including the amendments for the labeling of both local and imported GMO produce, because I firmly believe that the public has the Right to know what they are eating and feeding to their children, and because of the additional reasons:

- 63 countries around the world require labeling, including Europe, Russia, Japan Australia, New Zealand, India, South Africa, and Pakistan

- Current GMO labeling bills or initiative in several states including California, Washington, Maryland, New Mexico, Vermont

- surveys show that over 90% of public in US and over 70% in Hawaii support labeling of GMO crops and

- in the state all Hawaii Counties and six (6) Oahu neighborhood boards have issued resolutions in support of GMO labeling

- labeling has been endorsed by the Democratic Caucus in Hawaii, and by the Democratic Party in California

- calls for labeling were made in 2012 by 55 members of the U.S. Congress

- Wheat farmers in Washington State, support GMO labeling

Therefore Committee members please vote yes in support of HB 174, HD 2 Labeling.

Aloha no e malama pono,

Don Heacock, Owner

Kauai Sustainable AgroecoSystems

PO Box 1323

Lihue, Kauai, HI 96766

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 3:28 PM
To: FINTestimony
Cc: gottlieb@hawaii.rr.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Alan Gottlieb	Hawaii Cattlemen's Council	Oppose	No

Comments:

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HAWAII ORGANIC FARMING ASSOCIATION

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hofa@hawaiiorganic.org www.hawaiiorganic.org
Toll Free: 1-877-ORG-ISLE (674-4753)

Thursday, February 21, 2013

Committee Chair Luke, Vice Chairs Nishimoto & Ling Johanson, Committee Members
House Committee on Finance

Re: H.B. 174 HD2 Relating to the Labeling of Genetically Modified Foods

HOFA (Hawaii Organic Farming Association) supports the passage of H.B. No. 174 HD2 relating to the labeling of genetically modified (GM or GMO) foods.

HOFA, established in 1994 is an Association of Hawaii organic farmers, distributors, retailers, other organic industry members, and organic consumers. HOFA's vision is to create a sustainable future for Hawaii and our mission is to further organic and sustainable agriculture, land care, and lifestyles in Hawaii, thus giving meaning and life to our state motto: *Ua mau ke ea o ka aina I ka pono* "The Life of the Land is Perpetuated in Righteousness".

HOFA strongly advocates that the growing of organic foods is best for Hawaii, its' land, the environment, and for the people, as it excludes the use of genetic engineering, irradiation, the use of toxic sludge, and the use of harmful chemical fertilizers, pesticides, herbicides, etc. We believe that farming in this way helps to provide food self-sufficiency and food security for the people of Hawaii in a way that is *pono* and in everybody's best interests.

HOFA supports passage of this bill for the following reasons:

1. Without labeling consumers are unable to identify GM foods and don't know if they are consuming them or not.

2. Consumers have the ***right to know*** whether the foods they eat are produced using GM techniques, the overwhelming majority of consumers (as much as 90% in major media surveys) want to know whether the foods they consume are GM or not.

3. For a number of reasons GM foods are clearly and significantly different from non GM foods and should be labeled so consumers can identify GM foods and avoid them should they choose to do so. Some of the key differences between GM and non GM foods are as follows:

   a. Food production should be moving towards more sustainable methods of agriculture, foods and farming methods that are in harmony with nature, i.e. not using harmful chemicals such as insecticides, herbicides, chemical fertilizers etc. **GM foods are moving in the opposite direction and their production results in unnatural foods with increased chemical use in the production of food.** For example, the two principal traits found in commercialized GM foods are:

      i. Resistance to Round-Up herbicide, which has resulted in increased use of Round-Up and consequent increased chemical residues in our food, water, soil, and air, and a

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host of other negatives such as "super-weeds" which are becoming resistant to the ever increasing amounts of poison being sprayed on them.

ii. The insertion of insecticide, Bt, directly into the genes of the food we eat.

b. **GM crops are generally mono crops** (i.e. large areas of land are used for their production, and the same crop is repeatedly replanted year after year) which results in the degradation of the soil and topsoil loss with long term consequences to our ability to feed ourselves.

c. **GM food has a different genetic makeup** than regular foods as GM foods contain genetic material from other species of life; this is not possible in the natural environment or by other plant breeding techniques.

d. There are ***unknown human health and environmental risks*** associated with GM foods:

i. Numerous independent scientific studies show causes for concern.

ii. While the biotech industry alleges that their products are safe, it should be kept in mind that some of these same companies claimed that Agent Orange and DDT were safe.

iii. The tobacco industry similarly denied any test or study results that showed concerns for human health from consuming their products.

4. HB 174 HD2 is a very limited in its application. As written it relates only to imported produce items, and does not cover any Hawaii produce. HOFA believes that all foods containing GMOs should be labeled. This bill, while very limited, is a start, and a move in the right direction and thus should be supported.

HOFA further advocates that the bill should be amended to:

1. To ensure that the bill will be constitutional and not run afoul of the commerce clause, that all produce items, including produce items grown in Hawaii be labeled if they contain GMOs
2. To allow industry time to prepare for the required labeling, the implementation date should be changed to be January 1, 2015

Please vote in favor of H.B. No. 174 HD2 with the suggested amendments.

Respectfully submitted,

Mark Fergusson
President

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 10:28 AM
To: FINTestimony
Cc: alohalevey@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Dr. Joel Levey	Malama Ka'Aina Farm, North Kohala	Support	No

Comments: HB174 is an important measure and we and our organization STRONGLY urge you to support the labeling of any GMO related foods/products in the State of Hawaii and the private right of action associated with this. Please protect the health of our people and the integrity of our food supply. Dr. Joel Levey, Malama Ka'Aina Farm, North Kohala

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 4:07 PM
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Cc: cochonlibre@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Cathy Goeggel	Animal Rights Hawai'i	Support	No

Comments: Please make the effective date 2014

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 10:04 PM
To: FINTestimony
Cc: snsmith808@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Stephanie Smith	Ohana O' Kauai	Support	No

Comments: The labeling of imported whole foods is the bare minimal legislation we need to be informed consumers. I strongly support the amending of this bill to include the labeling of all GMO foods. Mahalo

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EARTHJUSTICE

ALASKA CALIFORNIA FLORIDA MID-PACIFIC NORTHEAST NORTHERN ROCKIES
NORTHWEST ROCKY MOUNTAIN WASHINGTON, DC INTERNATIONAL

REPRESENTATIVE SYLVIA LUKE, CHAIR
REPRESENTATIVE SCOTT Y. NISHIMOTO, VICE-CHAIR
HOUSE COMMITTEE ON FINANCE

TESTIMONY RE: HOUSE BILL NO. 174, HD 2
RELATING TO FOOD LABELING

February 22, 2013, 3:00 p.m.
Room 308

Good morning Chair Luke, Vice-Chair Nishimoto, and members of the Committee:

My name is Paul Achitoff, and I am an attorney with Earthjustice, a public interest environmental nonprofit law firm that has been operating in Hawai'i for over 25 years. I appreciate the opportunity to offer this testimony regarding House Bill No. 174. Earthjustice supports this bill, which requires that foods produced through genetic engineering sold in Hawai'i be labeled as such.

I personally have been working on issues concerning genetic engineering for over ten years, and have litigated numerous lawsuits on the issue, in Hawai'i and across the United States, against Monsanto, Syngenta, and the U.S. Department of Agriculture. This has allowed me to become intimately familiar with both the regulatory process as well as the realities of the science behind genetically engineered products. Unlike representatives of Monsanto, the Hawai'i Crop Improvement Association, and virtually all others who testify in opposition to this bill, I have no personal financial interest in this matter. I am testifying because, based on a great deal of study, I have concluded that labeling of genetically engineered foods is in the public interest.

Although anti-labeling interests repeat their mantra that genetically engineered foods are safe, this is far from an established fact, and it also is largely irrelevant to the issue of labeling presented by this bill. When it recently became known throughout Europe that horse meat had found its way into the food supply, people were outraged. No one imagined the appropriate response was "So what? Meat is meat." It was

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universally acknowledged that people have a right to decide for themselves whether to buy and eat that product, without having to first prove that horse meat is unsafe to eat. No one thinks it's appropriate to argue that it's none of the consumer's business. No one thinks it's appropriate to argue that having to supply beef instead of horse meat might raise prices, or that, if people knew a product contained horse meat they might not buy it. Yet these are the kinds of arguments anti-labeling interests are now presenting in opposition to this bill.

Moreover, the federal government has never tested genetically engineered foods for safety, and is not required to do so as a matter of policy, rather than as a result of any scientific determination that genetically engineered foods are safe. Instead, Monsanto and the other developers of these products submit data produced by scientists on their payroll and the federal government relies on it. Genetic engineering companies will not allow access to the seed unless the scientists agree to the companies' oversight. Nonetheless, one peer-reviewed study after another has emerged finding that these products can cause serious abnormalities in laboratory animals, and they may cause allergic reactions in susceptible individuals.

Those with a financial stake in maintaining secrecy emphasize the supposed lack of proof that the products it does not freely allow to be independently tested cause harm to human health because they cannot dispute that these products cause many other harmful environmental and socioeconomic effects that are very well established. The people of Hawai‘i have a <u>right to decide for themselves</u> whether they want to eat and serve those foods to others, and also whether they want to subsidize the production of crops that cause these widespread harms.

While the industry has tried to dupe the public into imagining that genetically engineered products are somehow better for them or serve some public purpose, the large majority of genetically engineered crops are designed solely to resist the effects of pesticides, and in particular, Monsanto's Roundup herbicide, with the active ingredient glyphosate. These crops were created to (1) sell herbicide, and (2) allow private businesses to own and control use of the seeds used to grow our major commodity crops. Continued secrecy has allowed the industry to force consumers to go along with this, regardless of the environmental, social, and health costs.

It is an established fact that hundreds of millions of additional pounds of herbicide have been used on America's agricultural lands due specifically to the use of these crops. It is also an established fact that as a result of farmers having doused their fields over and over with Roundup, many millions of acres of U.S. farmland are now infested with herbicide resistant "superweeds." This problem has been widely reported, and has been the subject of congressional hearings. Nearly half of all U.S. farmers now report that their fields are infested with Roundup-resistant weeds, up from 34 percent in 2011. Farmers must now use other methods to kill these weeds, and many have turned to using more toxic herbicides for this purpose, and some have had to go back to hand weeding.

The herbicide used on most genetically engineered crops, glyphosate, is now found in virtually all of the ground and surface waters of many states, and even in the rain, according to a recent study by the U.S. Geological Survey.

It is an established fact that U.S. farmers have suffered well over a billion dollars in documented damages as a result of having their crops contaminated with genetically engineered varieties that destroy their market, either because other nations, dozens of which now require labeling, refuse to accept them, or because consumers and processors want no part of them. The contamination of the U.S. long grain rice crop a few years ago alone has resulted in hundreds of millions of dollars in damages awarded to rice farmers after trial, or through settlements, and there have been other, similar contamination events involving other genetically engineered products that have mistakenly ended up on supermarket shelves or in the fields of farmers who do not want them.

Poll after poll has shown a very large majority of people—up to 90 percent—want genetically engineered foods labeled so that they can decide for themselves what to purchase, what to eat, what to feed their children, and what kinds of businesses to support with their dollars. Neither the companies that genetically engineer the crops, nor the farmers who choose to grow them for their own convenience have a right to profit by forcing everyone to buy their products by preventing them from learning what they are purchasing. Secrecy at the expense of others is not an ethical, acceptable method of marketing. The argument that we ought not to tell people what they are buying because they might decide not to buy our product is one that our society rejected a long time ago. We are not here discussing a requirement that products be labeled deceptively, but merely

that they be truthfully, neutrally labeled so that consumers may make up their own minds, and not have their minds made up for them by a company that profits from secrecy.

No credible evidence has been submitted showing that requiring labeling would meaningfully increase costs to consumers. Growers currently label their crops with stickers that cost very little, and often do so voluntarily to market the product. Much of the fruit and vegetables in the supermarket bears a label, and we've seen no evidence that it costs consumers more than unlabeled counterparts. Such labeling is a very small part of the cost of doing business in a marketplace where we value transparency and the consumer's right to choose among competing products.

We respectfully ask you to pass HB174. Thank you again for the opportunity to offer this testimony.

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Jeri Di Pietro	Hawai`i SEED and GMO Free Kaua`i	Support	Yes

Comments: Aloha member of the Finance Committee, We support HB 174. The time is now to begin the labeling of GMO food. Many countries have banned these uniquely created lifeforms from the food supply altogether. Most other countries require labeling. There is not enough pre or post market testing on eating these foods. It is highly questionable that these foods are not being studied, while the American public has experienced this silent change in our food supply. Please support the process of our right to know the true nature of our food. Mahalo for taking this first step, Jeri Di Pietro

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http://www.commondreams.org/view/2013/01/02-9

Food Poisoning on a Global Scale

Food is supposed to provide us nourishment and health but because of the toxins it contains, what we consume has become a major threat to our health. Some toxic substances are added to our food physically, through adulteration, while some enter our food system chemically, through pesticide residues. And some toxins enter the food chain genetically, through genetic engineering of seeds and crops. Even food packaging can be a source of toxins in food.

While physical adulteration, like stones in pulses, can be removed, the chemicals can't be. The pollutants will stop entering our food system only when poisonous chemicals are banned. Genetic pollution and contamination of food is the new, big threat to food safety and it cannot be undone. Once toxic genes are put into a plant, they are in the genetic code. There is no rollback. Which is why the debate on biosafety of GMOs is so intense.

With growing consumerism and greed, food safety is being bypassed. The distance between growers and eaters is getting larger and being ignorant about what comprises our food is getting deeper. Traders adulterate food to make more money, and consumers, manipulated to focus on the cosmetic appearance, buy adulterated food not knowing what they are eating. Government agencies, which are supposed to inspect and stop adulteration, fail because of corruption and inadequate support.

We are eating hazardous substances every day. Copper salts are used to colour pickles and canned vegetables green. The craze for the cosmetic appearance of food has created a market for dyes injected in watermelon, peas, capsicum and brinjal. Brick dust in chilli powder, coloured chalk powder in turmeric, and papaya seeds in black pepper are old tricks.

With new chemicals available in the market, adulteration has reached new levels. Apples are sprayed with lead arsenate; turmeric and mixed spices are adulterated with lead chromate. These substances can cause anaemia, abortion and paralysis.

One of the worst tragedies of food adulteration was the 2008 Chinese milk scandal, which was a food safety issue involving milk and infant formula adulterated with melamine. Melamine is an industrial chemical used to manufacture melamine-formaldehyde resin, a type of plastic known for its flame retardant properties. When added to milk, it caused it to appear to have higher protein content. But melamine causes renal and urinary problems and its use in food production is universally banned. The milk scandal broke in July 2008. By November there were 300,000 victims, with six infants dying from kidney stones and other kidney complications.

If the Chinese were using melamine in milk, the Indians are using urea to make synthetic milk. Synthetic milk is produced by mixing urea, caustic soda, cheap cooking oil, detergents, water and a tiny bit of natural milk. It has the colour, the structure and even the fat levels of natural milk and thus clears the basic tests. Synthetic milk can cause loss of sight and hearing and is even said to cause cancer.

Oxytocin is a hormone secreted and stored by the posterior pituitary gland that contributes to the second stage of labour. It has uterine-contracting and milk-ejecting actions. Oxytocin is now available as an artificial drug for use in emergencies. The drug can lead to the rupture of the uterus and, in rare cases, rupture of the womb. While the oxytocin for humans is priced at `15 per ampule, veterinary oxytocin is priced at 50 paise per ampule.

The dairy industry uses it on animals in the mistaken belief that it increases milk production when all it does is make the milk come faster, while destroying the cow's reproductive system. The cow goes dry in three years and is abandoned.

Not only is the cow harmed, but those who drink milk from oxytocin-injected cows are also at risk, especially children. Oxytocin causes imbalanced hearing and weak eyesight. For expecting mothers, oxytocin increases the risk of post-partum haemorrhage and can inhibit breastfeeding. Because of hormones in food, minor girls are attaining early puberty. Oxytocin is also used for growing vegetables. Injected into a pumpkin or squash, it doubles the size overnight.

Pesticides are becoming a major threat to our health. India has gone through three major tragedies — the Bhopal gas tragedy, the endosulfan tragedy in Kerala and the tragedy of Punjab's cancer train — related to pesticides that should have woken us to the fact that pesticides kill and cripple.

We are using 750 times more pesticides than Europe, foolishly equating poisons with progress. A study carried out by the All-India Coordinated Research Project on pesticide residues in food under the India Council of Agricultural Research concluded that 51 per cent of all food items have pesticide residues, and 20 per cent had pesticide residues above permissible levels. Globally the figures are 21 per cent and two per cent respectively. Indians are being poisoned at much higher levels than the rest of the world. And these poisons have consequences for our health.

Dr Rashmi Sanghi, a research scientist at the LNM Institute of Information Technology, Jaipur, found organochlorine and organophosphorous pesticide residues in human breast milk. When other researchers analysed the blood samples of women with breast cancer in Jaipur and compared it to blood samples of women without breast cancer, they found significantly higher levels of pesticide residues in the samples from women suffering from cancer.

Even as we have an increasing disease burden due to chemicals and pollutants, there is an attempt to push GMOs despite the serious health risks they pose. We need to assess these risks on the basis of the Precautionary Principle. The principle implies that there is a social responsibility to protect the public from exposure to harm when scientific investigation has thrown data and evidence of health risks. Suppressing research on risk assessment of GMOs does not make the risks go away. A “don’t look, don’t see” policy does not make for safety.

The last Indian deserves healthy, nutritious and safe food. That is why we at Navdanya have started the campaign “Know your food, Know your farmer”. Join us, for the sake of earth and for the sake of your health.

Dr. Vandana Shiva is a philosopher, environmental activist and eco feminist. She is the founder/director of Navdanya Research Foundation for Science, Technology, and Ecology. She is author of numerous books including, Soil Not Oil: Environmental Justice in an Age of Climate Crisis;Stolen Harvest: The Hijacking of the Global Food Supply; Earth Democracy: Justice, Sustainability, and Peace; and Staying Alive: Women, Ecology, and Development. Shiva has also served as an adviser to governments in India and abroad as well as NGOs, including the International Forum on Globalization, the Women’s Environment and Development Organization and the Third World Network. She has received numerous awards, including 1993 Right Livelihood Award (Alternative Nobel Prize) and the 2010 Sydney Peace Prize.

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 7:16 AM
To: FINTestimony
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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Roberta Oaks Power	Roberta Oaks, Hawaii	Support	No

Comments: We deserve to know whether or not our food is GMO. It's a huge issue these days and there are millions of us who are against GMO foods. We want the right to be able to choose. Manufacturers should not be able to hide this information from us. Thank you, Roberta Oaks CEO, Roberta Oaks Hawaii

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W.H. Shipman
est.1882
Limited

TESTIMONY BEFORE THE HOUSE COMMITTEE ON FINANCE

HOUSE BILL 174, HD2

RELATING TO FOOD LABELING

PRESENTED TO THE TWENTY-SEVENTH LEGISLATURE STATE OF HAWAII

FEBRUARY 2013

CHAIRPERSON LUKE and Members of the Committee:

OPPOSE.

My name is Loren Mochida, Director of Agricultural Operations at W. H. Shipman, Limited in Keaau on the Big Island. We are a local kamaaina-family owned land management company that is engaged in Agriculture and Commercial/Industrial development and leasing. We currently lease lands to over 125 individually growers at W.H. Shipman, Ltd.

W. H. Shipman, Ltd., and their growers are strongly opposed to HB 174, HD2, Relating to Food Labeling. Labeling requirements, as regulated by the Food and Drug Administration (FDA), is intended to communicate information that is relevant to health, safety, and nutrition. FDA states that there is no significant difference between foods produced using biotechnology and their conventional counterparts.

The Hawaii Papaya Industry Association (HPIA) coordinated the deregulation of the genetically engineered papaya "RAINBOW" in CONUS and Canada. Both countries do not require labeling of this safe papaya as it was developed no differently then the

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www.whshipman.com

W.H. Shipman Limited

conventional breeding techniques. Without the biotechnology of the Rainbow papaya, there would be no papaya industry in the state of Hawaii today.

The United States Department of Agriculture (USDA), Environmental Protection Agency (EPA), and Food and Drug Administration (FDA) have already proven that the biotechnology "Rainbow" papaya is safe for the environment and human consumption. Due to this reason the legislature finds that there are no federal and state requirements that these foods be labeled. We have been eating this delicious biotech papaya for over 12 years without any ill or side effects.

GMO foods imported and approved by the U. S. government are not any different from GMO foods that were produced and approved in Hawaii? My recommendation is to label GMO food to Hawaii only from foreign countries. Authorizing labeling requirements of non-genetically engineered foods will give people more choices.

Thank you very much for the opportunity to provide testimony on HB 174, HD 2.

Cindy Goldstein, Ph. D
Business and Community Outreach Manager
DuPont Pioneer
Waialua Parent Seed, Kekaha Parent Seed
Kunia Research Center, Waimea Research
PO Box 520
Waialua, HI 96791

HB 174 HD2 , Relating to Food Labeling
House Finance Committee
Feb 22, 2013
Room 308, at 3:00 p.m.

Position: Opposed

Chair Luke, Vice Chairs Nishimoto and Johanson, and Members of the House Committee on Finance,

DuPont Pioneer opposes HB 174 H.D.2, imposing labeling requirements on imported genetically engineered produce.

DuPont Pioneer is a seed company with operations in four locations in Hawaii. We carry out plant breeding for crop improvement with both genetically engineered and non GE plant materials. DuPont Pioneer employs approximately 350 people full time and an additional 150 part time workers in a wide range of types of jobs on Oahu and Kaua`i.

The US Food and Drug Administration already has oversight of food labeling, and carries out evaluation of genetically engineered foods. This requires a great deal of expertise and it is costly to evaluate food safety of genetically engineered foods, substantial equivalence of composition, and nutritional analysis.

It would be costly to task our Hawaii state agencies with the oversight that will be required to assure imported produce is labeled appropriately as it arrives at our docks and air terminals, as it is transported to local stores, and appropriately labeled at the point of sale to Hawaii's consumers. Costs associated with testing to ensure imported produce is properly labeled, and expenses related to oversight of produce will be passed on to Hawaii's taxpayers. With FDA already carrying out oversight of labeling of genetically engineered foods, it is redundant for our state agencies to also be engaged with labeling requirements.

Imposing labeling requirements will increase our already high food prices, and some suppliers of produce may decide to no longer send their products to Hawaii. Reduced availability of produce in our local grocery stores and required labeling will drive up prices for Hawaii's consumers shopping at our local markets.

Invasive species have had significant negative impacts on farming and ecosystems throughout Hawaii. Preventing entrance of invasive species into Hawaii is of great importance. Bill language requiring compliance with recommendations of the Invasive Species Council has the potential to set vague standards, subject to broad interpretation in the identification and consideration of threatening species.

Years of scientific evaluation show biotech whole foods and foods with genetically engineered ingredients are substantially equivalent and these foods have consistently been shown to be safe. DuPont Pioneer strongly believes in the importance of research and innovation to develop crops that feed a growing world population. Our work is science-based and the introduction of new genetically engineered crops follows years of evaluation and testing under a robust regulatory system.

Food producers are already using organic and GMO-free labels on produce and food products. Consumers with a preference for GMO-free foods are able to find them in local markets with labels that differentiate them as organic or GMO-free.

Thank you for the opportunity to present testimony in support of science-based decision making, in opposition to proposed legislation requiring labeling of genetically engineered produce imported into Hawaii.

GMO MYTHS AND TRUTHS

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

Michael Antoniou
Claire Robinson
John Fagan

June 2012

earthopensource

GMO Myths and Truths

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

Version 1.1

by
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June 2012

About the authors

Michael Antoniou, PhD is reader in molecular genetics and head, Gene Expression and Therapy Group, King's College London School of Medicine, London, UK. He has 28 years' experience in the use of genetic engineering technology investigating gene organisation and control, with over 40 peer reviewed publications of original work, and holds inventor status on a number of gene expression biotechnology patents. Dr Antoniou has a large network of collaborators in industry and academia who are making use of his discoveries in gene control mechanisms for the production of research, diagnostic and therapeutic products and safe and efficacious human somatic gene therapy for inherited and acquired genetic disorders.

Claire Robinson, MPhil, is research director at Earth Open Source. She has a background in investigative reporting and the communication of topics relating to public health, science and policy, and the environment. She is an editor at GMWatch (www.gmwatch.org), a public information service on issues relating to genetic modification, and was formerly managing editor at SpinProfiles (now Powerbase.org).

John Fagan, PhD is a leading authority on sustainability in the food system, biosafety, and GMO testing. He is founder and chief scientific officer of Global ID Group, through which he has pioneered the development of innovative tools to verify and advance food purity, safety and sustainability. He co-founded Earth Open Source, which uses open source collaboration to advance sustainable food production. Earlier, he conducted cancer research at the US National Institutes of Health. He holds a PhD in biochemistry and molecular and cell biology from Cornell University.

Earth Open Source

Earth Open Source is a not-for-profit organization dedicated to assuring the sustainability, security, and safety of the global food system. It supports agroecological, farmer-based systems that conserve soil, water, and energy and that produce healthy and nutritious food free from unnecessary toxins. It challenges the use of pesticides, artificial fertilizer and genetically modified organisms (GMOs) on the grounds of the scientifically proven hazards that they pose to health and the environment and because of the negative social and economic impacts of these technologies. Earth Open Source holds that our crop seeds and food system are common goods that belong in the hands of farmers and citizens, not of the GMO and chemical industry.

Earth Open Source has established three lines of action, each of which fulfils a specific aspect of its mission:

- Science and policy platform
- Scientific research
- Sustainable rural development.

Science and policy

Because the quality of our food supply is intimately connected with political and regulatory decisions, for example, on pesticides and GMOs, Earth Open Source functions as a science and policy platform to provide input to decision-makers on issues relating to the safety, security and sustainability of our food system.

Earth Open Source has published and co-published several reports that have had impact internationally:

- Roundup and birth defects: Is the public being kept in the dark?
- GM Soy: Sustainable? Responsible?
- Conflicts on the menu: A decade of industry influence at the European Food Safety Authority (EFSA)
- Europe's pesticide and food safety regulators – Who do they work for?

Scientific research and sustainable rural development

Earth Open Source has laboratory and field research projects under way on several continents. Farmer-led agricultural development projects are ongoing in Asia. Details will be released as these projects come to fruition.

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EXECUTIVE SUMMARY

Genetically modified (GM) crops are promoted on the basis of a range of far-reaching claims from the GM crop industry and its supporters. They say that GM crops:

- Are an extension of natural breeding and do not pose different risks from naturally bred crops
- Are safe to eat and can be more nutritious than naturally bred crops
- Are strictly regulated for safety
- Increase crop yields
- Reduce pesticide use
- Benefit farmers and make their lives easier
- Bring economic benefits
- Benefit the environment
- Can help solve problems caused by climate change
- Reduce energy use
- Will help feed the world.

However, a large and growing body of scientific and other authoritative evidence shows that these claims are not true. On the contrary, evidence presented in this report indicates that GM crops:

- Are laboratory-made, using technology that is totally different from natural breeding methods, and pose different risks from non-GM crops
- Can be toxic, allergenic or less nutritious than their natural counterparts
- Are not adequately regulated to ensure safety
- Do not increase yield potential
- Do not reduce pesticide use but increase it
- Create serious problems for farmers, including herbicide-tolerant "superweeds", compromised soil quality, and increased disease susceptibility in crops
- Have mixed economic effects
- Harm soil quality, disrupt ecosystems, and reduce biodiversity
- Do not offer effective solutions to climate change
- Are as energy-hungry as any other chemically-farmed crops
- Cannot solve the problem of world hunger but distract from its real causes – poverty, lack of access to food and, increasingly, lack of access to land to grow it on.

Based on the evidence presented in this report, there is no need to take risks with GM crops when effective, readily available, and sustainable solutions to the problems that GM technology is claimed to address already exist. Conventional plant breeding, in some cases helped by safe modern technologies like gene mapping and marker assisted selection, continues to outperform GM in producing high-yield, drought-tolerant, and pest- and disease-resistant crops that can meet our present and future food needs.

1. THE GENETIC ENGINEERING TECHNIQUE

1.1 **Myth:** Genetic engineering is just an extension of natural breeding
Truth: Genetic engineering is different from natural breeding and poses special risks

Section at a glance

- Genetic engineering is completely different from natural breeding and entails different risks. The genetic engineering and associated tissue culture processes are imprecise and highly mutagenic, leading to unpredictable changes in the DNA, proteins, and biochemical composition of the resulting GM crop that can lead to unexpected toxic or allergenic effects and nutritional disturbances.
- Foods produced by cisgenic or intragenic methods are as hazardous as any other GM crop.
- It is misleading to compare GM with radiation-induced mutation breeding and to conclude that, as crops bred by the latter method are not tested for safety or regulated, neither should GM crops be tested or regulated. Radiation-induced mutation breeding is potentially even more mutagenic than GM, and at least as destructive to gene expression, and crops produced by this method should be regulated at least as strictly as GM crops.
- It is unnecessary to take risks with GM when conventional breeding – assisted by safe modern gene mapping technologies – is capable of meeting our crop breeding needs.

GM proponents claim that genetic engineering is just an extension of natural plant breeding. They say that GM crops are no different from naturally bred crops, apart from the inserted foreign GM gene (transgene) and its protein product. But this is misleading. GM is completely different from natural breeding and poses different risks.

Natural breeding can only take place between closely related forms of life (e.g. cats with cats, not cats with dogs; wheat with wheat, not wheat with tomatoes or fish). In this way, the genes that carry information for all parts of the organism are passed down the generations in an orderly way.

In contrast, GM is a laboratory-based technique that is completely different from natural breeding. The main stages of the genetic modification process are as follows:

1. In a process known as tissue culture or cell culture, tissue from the plant that is to be genetically modified is placed in culture.
2. Millions of the tissue cultured plant cells are subjected to the GM gene insertion process. This results in the GM gene(s) being inserted into the DNA of a few of the plant cells in tissue culture. The inserted DNA is intended to re-programme the cells' genetic blueprint, conferring completely new properties on the cell. This process would never happen in nature. It is carried out either by using a device known as a gene gun, which shoots the GM gene into the plant cells, or by linking the GM gene to a special piece of DNA present in the soil bacterium, Agrobacterium tumefaciens. When the A. tumefaciens infects a plant, the GM gene is carried into the cells and can insert into the plant cell's DNA.
3. At this point in the process, the genetic engineers have a tissue culture consisting of hundreds of thousands to millions of plant cells. Some have picked up the GM gene(s), while others have not. The next step is to treat the culture with chemicals to eliminate all except those cells that have successfully incorporated the GM gene into their own DNA.
4. Finally, the few cells that survive the chemical

treatment are treated with plant hormones. The hormones stimulate these genetically modified plant cells to proliferate and differentiate into small GM plants that can be transferred to soil and grown on.

5. Once the GM plants are growing, the genetic engineer examines them and eliminates any that do not seem to be growing well. He/she then does tests on the remaining plants to identify one or more that express the GM genes at high levels. These are selected as candidates for commercialisation.
6. The resulting population of GM plants all carry and express the GM genes of interest. But they have not been assessed for health and environmental safety or nutritional value. This part of the process will be discussed later in this document.

The fact that the GM transformation process is artificial does not automatically make it undesirable or dangerous. It is the consequences of the procedure that give cause for concern.

Muddying the waters with imprecise terms

GM proponents often use the terminology relating to genetic modification incorrectly to blur the line between genetic modification and conventional breeding.

For example, the claim that conventional plant breeders have been "genetically modifying" crops for centuries by selective breeding and that GM crops are no different is incorrect (see 1.1). The term "genetic modification" is recognised in common usage and in national and international laws to refer to the use of recombinant DNA techniques to transfer genetic material between organisms in a way that would not take place naturally, bringing about alterations in genetic makeup and properties.

The term "genetic modification" is sometimes wrongly used to describe marker-assisted selection (MAS). MAS is a largely uncontroversial branch of biotechnology that can speed up conventional breeding by identifying genes linked to important traits. MAS does not involve the risks and uncertainties of genetic modification and is supported by organic and sustainable agriculture groups worldwide.

Similarly, the term "genetic modification" is sometimes wrongly used to describe tissue culture, a method that is used to select desirable traits or to reproduce whole plants from plant cells in the laboratory. In fact, while genetic modification of plants as carried out today is dependent on the use of tissue culture (see 1.1), tissue culture is not dependent on GM. Tissue culture can be used for many purposes, independent of GM.

Using the term "biotechnology" to mean genetic modification is inaccurate. Biotechnology is an umbrella term that includes a variety of processes in which biological functions are harnessed for various purposes. For instance, fermentation, as used in wine-making and baking, marker assisted selection (MAS), and tissue culture, as well as genetic modification, are all biotechnologies. Agriculture itself is a biotechnology, as are commonly used agricultural methods such as the production of compost and silage.

GM proponents' misleading use of language may be due to unfamiliarity with the field – or may represent deliberate attempts to blur the lines between controversial and uncontroversial technologies in order to win public acceptance of GM.

1.2 **Myth:** Genetic engineering is precise and the results are predictable
Truth: Genetic engineering is crude and imprecise, and the results are unpredictable

GM proponents claim that GM is a precise technique that allows genes coding for the desired trait to be inserted into the host plant with no unexpected effects.

The first step in genetically engineering plants, the process of cutting and splicing genes in the test tube, is precise, but subsequent steps are not. In particular, the process of inserting a genetically modified gene into the DNA of a plant cell is crude, uncontrolled, and imprecise, and causes mutations – heritable changes – in the plant's DNA blueprint.[1] These mutations can alter the functioning of the natural genes of the plant in unpredictable and potentially harmful ways.[2,3] Other procedures associated with producing GM crops, including tissue culture, also produce mutations.[1]

In addition to the unintended effects of mutations, there is another way in which the GM process generates unintended effects. Promoters of GM crops paint a picture of GM technology that is based on a naïve and outdated understanding of how genes work. They propagate the simplistic idea that they can insert a single gene with laser-like precision and insertion of that gene will have a single, predictable effect on the organism and its environment.

But manipulating one or two genes does not just produce one or two desired traits. Instead, just a single change at the level of the DNA can give rise to multiple changes within the organism.[2,4] These changes are known as pleiotropic effects. They occur because genes do not act as isolated units but interact with one another, and the functions and structures that the engineered genes confer on the organism interact with other functional units of the organism.

Because of these diverse interactions, and because even the simplest organism is extremely complex, it is impossible to predict the impacts of even a single GM gene on the organism. It is even more impossible to predict the impact of the GMO on its environment – the complexity of living systems is too great.

In short, unintended, uncontrolled mutations occur during the GM process and complex interactions occur at multiple levels within the organism as a result of the insertion of even a single new gene. For these reasons, a seemingly simple genetic modification can give rise to many unexpected changes in the resulting crop and the foods produced from it. The unintended changes could include alterations in the nutritional content of the food, toxic and allergenic effects, poor crop performance, and generation of characteristics that harm the environment.

These unexpected changes are especially dangerous because they are irreversible. Even the worst chemical pollution diminishes over time as the pollutant is degraded by physical and biological mechanisms. But GMOs are living organisms. Once released into the ecosystem, they do not degrade and cannot be recalled, but multiply in the environment and pass on their GM genes to future generations. Each new generation creates more opportunities to interact with other organisms and the environment, generating even more unintended and unpredictable side-effects.

How can these unintended, unexpected and potentially complex effects of genetic engineering be predicted and controlled? Promoters of GM crops paint a simplistic picture of what is needed for assessing the health and environmental safety of a GMO. But the diversity and complexity of the effects, as well as their unpredictable nature, create a situation where even a detailed safety assessment could miss important harmful effects.

1.3 **Myth:** GM is just another form of mutation breeding and is nothing to worry about
Truth: Mutation breeding brings its own problems and should be strictly regulated

Proponents often describe GM as just another form of mutation breeding, a method of plant breeding which they say has been successfully used for decades and is not controversial. They argue that mutation breeding is regulated no differently than conventional breeding, that genetic modification is just another form of mutation breeding, and that therefore, genetic modification should not be regulated any more stringently than conventional breeding.

However, scientific evidence exposes flaws in this logic.

1.3.1. What is mutation breeding?

The physical form of an organism's genetic blueprint is the sequence of the four "letters" of the genetic alphabet structured within the DNA molecules. Mutations are physical alterations in the sequence of letters within the DNA. Mutation breeding is the process of exposing plant seeds to ionizing radiation (x-rays or gamma rays) or mutagenic chemicals in order to increase the rate of mutation in the DNA.

Just as you can change the meaning of a sentence by changing the sequence of letters in the sentence, you can change the "meaning" of a gene by changing the sequence of letters within the genetic code of the DNA of an organism. A mutagen is a physical or chemical agent that causes such changes.

This process of change in the DNA is known as mutagenesis. Mutagenesis can either completely destroy the function of a gene – that is, "knock out" its function, or it can change the sequence of letters of the genetic code in the gene, causing it to direct the cell to produce one or more proteins with altered function. The resulting plant is called a mutant.

1.3.2. Where did radiation-induced mutation breeding come from?

Mutation breeding using radiation was first seriously investigated in the 1950s, after the US atomic bombing of Japan at the end of World War II in 1945. In the wake of the devastation, there was a desire to find uses for the "peaceful atom" that were helpful to humanity. Atomic Gardens were set up in the US and Europe with the aim of creating high-yielding and disease-resistant crops. They were laid out in a circle with a radiation source in the middle that exposed plants and their seeds to radiation. This would cause mutations in the plants that it was hoped would be beneficial. To the lay population this was euphemistically described as making the plants "atom energized". The results were poorly documented – certainly they do not qualify as scientific research – and it is unclear whether any useful plant varieties emerged from Atomic Garden projects.[5]

Today, radiation-induced mutation breeding is carried out in laboratories, but this branch of plant breeding retains strong links with the nuclear industry. The main database of crop varieties generated using radiation- and chemically-induced mutation breeding is maintained by the UN Food and Agriculture Organisation and the International Atomic Energy Agency.[6] Many studies and reports that recommend radiation-induced mutation breeding are sponsored by organizations that promote nuclear energy.[7 8]

1.3.3. Is mutation breeding widely used?

Mutation breeding is not a widely used or central part of crop breeding, though a few crop varieties have apparently benefited from it. A database maintained by the UN Food and Agriculture Organisation and the International Atomic Energy Agency keeps track of plant varieties that have been generated using mutation breeding and by cross-breeding with a mutant plant.[6] There are only around 3,000 such plant varieties. This number includes not only crop plants but also

ornamental plants.[9] It also includes not only the direct mutant varieties, but also varieties bred by crossing the mutants with other varieties by conventional breeding. Thus the actual number of primary mutant varieties is significantly lower than 3000.

Some commercially important traits have come out of mutation breeding, such as the semi-dwarf trait in rice, the high oleic acid trait in sunflower, the semi-dwarf trait in barley, and the low-linolenic acid trait in canola (oilseed rape).[9,10,11]

But conventional breeding, in contrast, has produced millions of crop varieties. The Svalbard seed vault in the Arctic contains over 400,000 seed varieties,[12] which are estimated to represent less than one-third of our most important crop varieties.[13] So relatively speaking, mutation breeding is of only marginal importance in crop development.

The reason mutation breeding is not more widely used is that the process of mutagenesis is risky, unpredictable, and does not efficiently generate beneficial mutations. Studies on fruit flies suggest that about 70% of mutations will have damaging effects on the functioning of the organism, and the remainder will be either neutral or weakly beneficial.[14]

Because of the primarily harmful effects of mutagenesis, the genetic code is structured to minimize the impacts of mutations and organisms have DNA repair mechanisms to repair mutations. In addition, regulatory agencies around the world are supposed to minimise or eliminate exposure to manmade mutagens.

In plants as well as fruit flies, mutagenesis is a destructive process. As one textbook on plant breeding states, "Invariably, the mutagen kills some cells outright while surviving plants display a wide range of deformities."[15] Experts conclude that most such induced mutations are harmful, and lead to unhealthy and/or infertile plants.[15,16] Occasionally, mutagenesis gives rise to a previously unknown feature that may be beneficial and can be exploited.

The process of screening out undesirable traits and identifying desirable ones for further breeding has been likened to "finding a needle in a haystack".[15] The problem is that only certain types of mutations, such as those affecting shape or colour, are obvious to the eye. These plants can easily be discarded or kept for further breeding as desired. But other more subtle changes may not be obvious, yet may nonetheless have important impacts on the health or performance of the plant. Such changes can only be identified by expensive and painstaking testing.[15]

A report by the UK government's GM Science Review Panel concluded that mutation breeding "involves the production of unpredictable and undirected genetic changes and many thousands, even millions, of undesirable plants are discarded in order to identify plants with suitable qualities for further breeding."[17]

In retrospect, it is fortunate that mutation breeding has not been widely used because that has reduced the likelihood that this risky technology could have generated crop varieties that are toxic, allergenic, or reduced in nutritional value.

1.3.4. How does GM create mutations?

Just as mutation breeding is highly mutagenic, so is the process of creating a GM plant. The GM transformation process involves three kinds of mutagenic effects: insertional mutagenesis, genome-wide mutations, and mutations caused by tissue culture – described below.[1,2]

Insertional mutagenesis

Genetic modification or genetic engineering of an organism always involves the insertion of a foreign gene into the genome (DNA) of the recipient organism. The insertion process is uncontrolled, in that the site of insertion of the foreign gene is random. The insertion of the GM gene (transgene) disrupts the normal sequence of the letters of the genetic code within the DNA of the plant, causing what is called insertional mutagenesis. This can occur in a number of different ways:

- The GM gene can be inserted into the middle of one of the plant's natural genes. Typically this blocks the expression of ("knocks out") the natural gene, destroying its function. Less frequently the insertion event will alter the natural plant gene's structure and the structure

and function of the protein for which it is the blueprint.

- The GM gene can be inserted into a region of the plant's DNA that controls the expression of one or more genes of the host plant, unnaturally reducing or increasing the function of those genes.
- Even if the GM gene is not directly inserted into a host gene or its control region, its mere presence within an active host gene region can alter the ability of that region of the plant's DNA to form chromatin (the combination of DNA and proteins that make up the contents of a cell nucleus) structures that influence the ability of any gene in that region to be expressed. The inserted gene can also compete with host genes for gene expression control elements (comparable to switches that turn the expression of a gene on or off) or regulatory proteins, resulting in marked disturbances in the level and pattern of gene expression.

Since the insertion of the GM gene is an imprecise and uncontrolled process, there is no way of predicting or controlling which of the plant's genes will be influenced – or the extent of the changes caused by the inserted gene.

Genome-wide mutations

In most cases, the insertion process is not clean. In addition to the intended insertion, fragments of the GM gene's DNA can be inserted at other locations in the genome of the host plant. Each of these unintended insertional events may also be mutagenic and can disrupt or destroy the function of other genes in the same ways as the full GM gene.

It is estimated that there is a 53–66% probability that any insertional event will disrupt a gene.[1] Therefore, if the genetic modification process results in one primary insertion and two or three unintended insertions, it is likely that at least two of the plant's genes will be disrupted.

Research evidence also indicates that the GM transformation process can also trigger other kinds of mutations – rearrangements and deletions of the plant's DNA, especially at the site of insertion of the GM gene[1] – which are likely to compromise the functioning of genes important to the plant.

Mutations caused by tissue culture

Three of the central steps in the genetic modification process take place while the host plant cells are being grown in a process called cell culture or tissue culture. These steps include:

(i) The initial insertion of the GM gene(s) into the host plant cells

(ii) The selection of plant cells into which the GM gene(s) have been successfully inserted

(iii) The use of plant hormones to induce cells selected in (ii), above, to develop into plantlets with roots and leaves.

The process of tissue culture is itself highly mutagenic, causing hundreds or even thousands of mutations throughout the host cell DNA.[1,2] Since tissue culture is obligatory to all three steps described above and these steps are central to the genetic engineering process, there is abundant opportunity for tissue culture to induce mutations in the plant cells.

Given the fact that hundreds of genes may be mutated during tissue culture, there is a significant risk that a gene important to some property such as disease- or pest-resistance could be damaged. In another example, a gene that plays a role in controlling chemical reactions in the plant could be damaged, making the crop allergenic or reducing its nutritional value. The effects of many such mutations will not be obvious when the new GM plant is growing in a greenhouse and so genetic engineers will not be able to select them out.

In the process of insertion of a GM gene into the plant host DNA (step i, above), the GM gene is linked with an antibiotic resistance "marker" gene, which will later enable the genetic engineer to identify which plant cells have successfully incorporated the GM gene into their genome.

The host plant cells are then exposed simultaneously to the GM gene and the antibiotic resistance gene in the hope that some will successfully incorporate the GM gene into their genome.

This is a very inefficient process because genomes are designed to exclude foreign genetic material – for example, invading viruses. So out of hundreds of thousands or even millions of host plant cells exposed to the GM gene, only a few will

successfully incorporate the GM gene.

In order to identify and propagate the plant cells that have successfully incorporated the GM gene (step ii, above), biotechnologists usually use antibiotic resistance marker genes. This is because a cell that has successfully integrated the antibiotic resistance marker gene into its genome and expressed that gene is likely also to have integrated the GM gene into its genome and expressed that gene. Therefore, when the population of plant cells is exposed to the antibiotic, the vast majority of recipient plant cells die, leaving only the few cells that have incorporated and expressed the antibiotic resistance marker gene. In almost all cases these cells have also incorporated the GM gene.

Interestingly, this antibiotic-based selection process relies on the expression of the marker gene. This expression is required to make the plant resistant to the antibiotic. If this gene does not express its protein, it will not confer resistance to the antibiotic.

However, not all regions of the plant cell DNA are *permissive* for the gene expression process to take place. In fact, the vast majority of any cell's DNA is *non-permissive*. Because the process of inserting the DNA that contains the GM gene and the antibiotic resistance marker gene is essentially random, most insertions will occur in non-permissive regions of the plant cell DNA and will not result in expression of either the marker gene or the GM gene. Cells in which such insertions have occurred will not survive exposure to the antibiotic. Only when the antibiotic resistance marker gene happens to have been inserted into a permissive region of the plant cell DNA will the cell express the marker gene and be resistant to the antibiotic.

Permissive regions are areas of DNA where genes important to the functioning of the recipient plant cells are present and active. Thus, selection for antibiotic resistance also selects for recipient cells in which the antibiotic marker gene (and by default the GM gene) have inserted into permissive regions of DNA. The consequence of this is an increased likelihood that the insertion of the GM gene and antibiotic marker gene may cause mutational damage to the structure or function of a gene or genes that are important to the function and even the survival of the recipient plant cell.

This means that the GM procedure maximises the likelihood that incorporation of the GM gene will result in insertional mutagenesis to – *damage to* – one or more genes that are active and important to the functioning of the plant host.

We conclude from this analysis of the mechanisms by which the GM process can cause mutations that it is not the elegant and precisely controlled scientific process that proponents claim but depends on a large measure of good fortune as to whether one obtains the desired outcome without significant damage.

1.3.5. Is GM technology becoming more precise?

Technologies have been developed that can target GM gene insertion to a predetermined site within the plant's DNA in an effort to obtain a more predictable outcome and avoid complications that can arise from insertional mutagenesis.[18,19,20,21,22]

However, these GM transformation methods are not fail-safe. Accidental mistakes can still occur. For example, the genetic engineer intends to insert the gene at one particular site, but the gene might instead be inserted at a different site, causing a range of side-effects.

More importantly, plant biotechnologists still know only a fraction of what there is to be known about the genome of any crop species and about the genetic, biochemical, and cellular functioning of our crop species. That means that even if they select an insertion site that they think will be safe, insertion of a gene at that site could cause a host of unintended side-effects that could:

- Make the crop toxic, allergenic or reduced in nutritional value
- Reduce the ability of the GM crop to resist disease, pests, drought, or other stresses
- Reduce the GM crop's productivity or compromise other agronomic traits, or
- Cause the GM crop to be damaging to the environment.

Moreover, because tissue culture must still be carried out for these new targeted insertion methods, the mutagenic effects of the tissue

culture process remain a major source of unintended damaging side-effects.

These newer methods are also cumbersome and time-consuming, so much so that to date no GM crop that is currently being considered by regulators for approval or that is in the commercialisation pipeline has been produced using these targeted engineering methods.

1.3.6. Why worry about mutations caused in genetic engineering?

GM proponents make four basic arguments to counter concerns about the mutagenic aspects of genetic engineering:

"Mutations happen all the time in nature"

GM proponents say, "Mutations happen all the time in nature as a result of various natural exposures, for example, to ultraviolet light, so mutations caused by genetic engineering of plants are not a problem."

In fact, mutations occur infrequently in nature.[9] And comparing natural mutations with those that occur during the GM transformation process is like comparing apples and oranges. Every plant species has encountered natural mutagens, including certain types and levels of ionizing radiation and chemicals, throughout its natural history and has evolved mechanisms for preventing, repairing, and minimising the impacts of mutations caused by such agents. But plants have not evolved mechanisms to repair or compensate for the insertional mutations that occur during genetic modification. Also, the high frequency of mutations caused by tissue culture during the GM process is likely to overwhelm the repair mechanisms of crop plants.

Natural recombination events that move large stretches of DNA around a plant's genome do occur. But these involve DNA sequences that are already part of the plant's own genome, not DNA that is foreign to the species.

"Conventional breeding is more disruptive to gene expression than GM"

GM proponents cite studies by Batista and colleagues[23] and Ahloowalia and colleagues10 to claim that "conventional" breeding is at least as disruptive to gene expression as GM.24 They argue that if we expect GM crops to be tested extensively because of risks resulting from mutations, then governments should require conventionally bred plants to be tested in the same way. But they do not, and experience shows that plants created by conventional breeding are not hazardous. Therefore crops generated by conventional breeding and by genetic engineering present no special risks and do not require special testing.

This argument is based on what appears to be an intentional misrepresentation of the studies of Batista and Ahloowalia. These studies did not compare conventional breeding with GM, but gamma-ray-induced mutation breeding with GM.

The research of Batista and colleagues and Ahloowalia and colleagues actually provides strong evidence consistent with our arguments, above, indicating that mutation breeding is highly disruptive – even more so than genetic modification.

Batista and colleagues found that in rice varieties developed through radiation-induced mutation breeding, gene expression was disrupted even more than in varieties generated through genetic modification. They concluded that for the rice varieties examined, mutation breeding was more disruptive to gene expression than genetic engineering.[23]

Thus, Batista and colleagues compared two highly disruptive methods and concluded that genetic engineering was, in the cases considered in their study, the less disruptive of the two methods.

The GM proponents used the work of Batista and colleagues and Ahloowalia and colleagues to argue that, since mutation breeding is not regulated, genetic modification of crops should not be regulated either. The amusing part of their argument is that they represent the mutation-bred crop varieties as "conventionally bred", not even mentioning that they were generated through exposure to high levels of gamma radiation. They then argue that, since these supposedly "conventionally bred" varieties are disrupted similarly to the GM varieties studied, it was not justified to require GM crop varieties to be subjected to safety assessment when

"conventionally bred" varieties were not.[24]

Their argument only carries weight if the reader is unaware of the biotech proponents' misrepresentation of mutation bred varieties as "conventionally bred". When this fact comes to light, it not only causes their argument to disintegrate, but also exposes what appears to be a willingness to bend the truth to make arguments favouring GM technology. This in turn raises questions regarding the GM proponents' motives and adherence to the standards of proper scientific debate.

Interestingly, the GM proponents' conclusions were diametrically opposite to the conclusions that Batista and colleagues drew from their findings. The researchers concluded that crop varieties produced through mutation breeding and crops produced through genetic engineering should both be subjected to rigorous safety testing.[23]

In contrast, the GM proponents ignored the conclusions of Batista and colleagues and concluded the opposite: that as mutation-bred crops are not currently required to be assessed for safety, GM crops should not be subjected to such a requirement either.

We agree with the conclusions of Batista and colleagues. Although their study does not examine enough GM crop varieties and mutation-bred crop varieties to make generalised comparisons between mutation breeding and genetic engineering, it does provide evidence that both methods significantly disrupt gene regulation and expression, suggesting that crops generated through these two methods should be assessed for safety with similar levels of rigour. The fact that the risks of mutation breeding have been overlooked in the regulations of some countries does not justify overlooking the risks of GM crops.

We recommend that regulations around the world should be revised to treat mutation-bred crops with the same sceptical scrutiny with which GM crops should be treated. In fact, the Canadian government has reached a similar conclusion and requires mutation-bred crops to be assessed according to the same requirements as GMOs produced through recombinant DNA techniques.[25]

"Mutations occurring in genetic modification are no different from those that occur in natural breeding"

GM proponents say that in conventional breeding, traits from one variety of a crop are introduced into another variety by means of a genetic cross. They point out that the result is offspring that receive one set of chromosomes from one parent and another set from the other. They further point out that, during the early stages of development, those chromosomes undergo a process (sister chromatid exchange) in which pieces of chromosomes from one parent are recombined with pieces from the other.

They suggest that the result is a patchwork that contains tens of thousands of deviations from the DNA sequences present in the chromosomes of either parent. They imply that these deviations can be regarded as tens of thousands of mutations, and conclude that because we do not require these crosses to undergo biosafety testing before they are commercialised, we should not require GM crops, which contain only a few genetic mutations, to be tested.

But this a spurious argument, because sister chromatid exchange (SCE) is not the random fragmentation and recombination of the chromosomes of the two parents. Exchanges occur in a precise manner between the corresponding genes and their surrounding regions in the chromosomes donated by the two parents. SCE is not an imprecise, uncontrolled process like genetic modification.

Natural mechanisms at work within the nucleus of the fertilized egg result in precise recombination events between the copy of the maternal copy of gene A and the paternal copy of gene A. Similarly, thousands of other precise recombination events take place between the corresponding maternal and paternal genes to generate the genome that is unique to the new individual.

This is not an example of random mutations but of the precision with which natural mechanisms work on the level of the DNA to generate diversity within a species, yet at the same time preserve, with letter-by-letter exactness, the integrity of the genome.

When a fertilised ovum undergoes sister chromatid exchange as part of conventional breeding, the chromosome rearrangements do not take place in a random and haphazard way, but are precisely guided so that no information is lost. There can be defects in the process, which could lead to mutations. But the process works against defects occurring by employing precise cellular mechanisms that have evolved over hundreds of thousands of years to preserve the order and information content of the genome of the species.

Genetic engineering, on the other hand, is an artificial laboratory procedure that forcibly introduces foreign DNA into the cells of a plant. Once the engineered transgene is in the nucleus of the cells, it breaks randomly into the DNA of the plant and inserts into that site. Furthermore, GM plants do not contain only a few mutations. The GM transformation process produces hundreds or thousands of mutations throughout the plant's DNA.

For these reasons, conventional breeding is far more precise and carries fewer mutation-related risks than genetic engineering.

"We will select out harmful mutations"

GM proponents say that even if harmful mutations occur, that is not a problem. They say that during the genetic engineering process, the GM plants undergo many levels of screening and selection, and the genetic engineers will catch any plants that have harmful mutations and eliminate them during this process.

As explained above, the process of gene insertion during the process of genetic modification selects for engineered GM gene insertion into active gene regions of the host (recipient) plant cell. This means that the process has a high inherent potential to disrupt the function of active genes present in the plant's DNA.

In many cases, the disruption will be fatal – the engineered cell will die and will not grow into a GM plant. In other cases, the plant will compensate for the lost function in some way, or the insertion will occur at a location that seems to cause minimal disruption of the plant cell's functioning. This is what is desired. But just because a plant grows vigorously does not mean that it is safe to eat and safe for the environment. It could have a mutation that causes it to produce substances that harm consumers or to damage the ecosystem.

Genetic engineers do not carry out detailed screening that would catch all potentially harmful plants. They introduce the GM gene(s) into hundreds or thousands of plant cells and grow them out into individual GM plants. If the gene insertion process has damaged the function of one or more plant cell genes that are essential for survival, the cell will not survive this process. So plants carrying such "lethal" mutations will be eliminated. But the genetic engineer is often left with several thousand individual GM plants, each of them different, because:

- The engineered genes have been inserted in different locations within the DNA of each plant
- Other mutations or disturbances in host gene function have occurred at other locations in the plants through the mechanisms described above (1.3.4).

How do genetic engineers sort through the GM plants to identify the one or two that they are going to commercialise? The main thing that they do is to verify that the trait that the engineered transgene is supposed to confer has been expressed in the plant. That is, they do a test that allows them to find the few plants among the many thousands that express the desired trait. Of those, they pick one that looks healthy, strong, and capable of being bred on and propagated.

That is all they do. Such screening cannot detect plants that have undergone mutations that cause them to produce substances that are harmful to consumers or lacking in important nutrients.

It is unrealistic for GM proponents to claim that they can detect all hazards based on differences in the crop's appearance, vigour, or yield. Some mutations will give rise to changes that the breeder will see in the greenhouse or field, but others give rise to changes that are not visible because they occur at a subtle biochemical level or only under certain circumstances. So only a small proportion of potentially harmful mutations will be eliminated by the breeder's superficial

inspection. Their scrutiny cannot ensure that the plant is safe to eat.

Some agronomic and environmental risks will be missed, as well. For instance, during the GM transformation process, a mutation may destroy a gene that makes the plant resistant to a certain pathogen or an environmental stress like extreme heat or drought. But that mutation will be revealed only if the plant is intentionally exposed to that pathogen or stress in a systematic way. Developers of GM crops are not capable of screening for resistance to every potential pathogen or environmental stress. So such mutations can sit like silent time bombs within the GM plant, ready to "explode" at any time when there is an outbreak of the relevant pathogen or an exposure to the relevant environmental stress.

An example of this kind of limitation was an early – but widely planted – variety of Roundup Ready® soy. It turned out that this variety was much more sensitive than non-GM soy varieties to heat stress and more prone to infection.[26]

1.4 **Myth:** Cisgenics/intragenics is a safe form of GM because no foreign genes are involved
Truth: Cisgenic/intragenic foods are just as risky as any other GM food

Some scientists and GM proponents are promoting a branch of genetic engineering they have termed "cisgenics" or "intragenics", which they say only uses genes from the species to be engineered, or a related species. They say that cisgenic/intragenic GMOs are safer and more publicly acceptable than transgenic GMOs, on the claimed grounds that no foreign genes are introduced.[27,28]

An article on the pro-GM Biofortified website, "Cisgenics – transgenics without the transgene", bluntly states the public relations value of cisgenics: "The central theme is to placate the misinformed public opinion by using clever technologies to circumvent traditional unfounded criticisms of biotechnology."[29]

An example of a cisgenic product is the GM "Arctic" non-browning apple, which a Canadian biotechnology company has applied to commercialise in the US and Canada.[30,31]

GM proponents appear to see intragenics/cisgenics as a way of pushing GM foods through regulatory barriers. As two researchers write: "A strong case has been made for cisgenic plants to come under a new regulatory tier with reduced regulatory oversight or to be exempted from GM regulation."[31]

However, in reality, cisgenics and intragenics are just transgenics by another name. The artificial nature of the transgene construct and its way of introduction into the host plant genome make cisgenics/intragenics just as transgenic as cross-species transfers.

The word "intragenic" implies that only genes within the genome of a single species are being manipulated. But although it is possible to isolate a gene from maize, for example, and then put it back into maize, this will not be a purely intragenic process. This is because in order to put the gene back into maize, it is necessary to link it to other sequences at least from bacteria and possibly also from viruses, other organisms, and even synthetic DNA. Inevitably, "intragenic" gene transfer uses sequences from other organisms. Thus, though the gene of interest may be from the same species as the recipient organism, the totality of the genetically modified DNA introduced is not purely intragenic, but is transgenic, in the sense that some of the genetic elements that are introduced into the recipient plant are derived from another species.

The supposedly intragenic Arctic apple is clearly transgenic, in that sequences from foreign species were part of the DNA construct that was introduced into the apple. This introduces major uncertainties into the plant's functioning, because the effects that those foreign sequences might have on the recipient organism are unknown.

The process of inserting any fragment of DNA, whether intragenic or transgenic, into an organism via the GM transformation process carries the same risks. These risks have been discussed in detail, above. Insertion takes place in an uncontrolled manner and results in at least one insertional mutation event within the DNA of the recipient organism. The insertional event will interrupt some sequence within the DNA of the organism and interfere with any natural function that the interrupted DNA may carry. For instance, if the insertion occurs in the middle of a gene, the gene's function could be destroyed. As a result, the organism will lose the cellular function that the gene encodes. In addition, mutagenic effects on the plant's DNA caused by the tissue culture process occur with cisgenics/intragenics, just as with transgenics.

In conclusion, cisgenic/intragenic plants carry the same environmental and health risks as transgenic GM plants.

Conclusion to Section 1

GM proponents claim that genetic engineering of crops is no more risky than natural/conventional breeding. But in fact, genetic engineering is different from natural/conventional plant breeding and poses special risks. In particular, the genetic engineering and associated tissue culture processes are highly mutagenic, leading to unpredictable changes in the DNA and proteins of the resulting GM crop that can lead to unexpected toxic or allergenic effects.

Cisgenic or intragenic GM crops pose the same risks as any other transgenic crop. There is nothing "new" about cisgenics/intragenics. These methods only differ from transgenic methods with regard to the choice of organism from which the gene of interest is taken.

Sometimes GM proponents misleadingly compare genetic engineering with radiation-induced mutagenesis, claiming that the latter is natural or conventional breeding, and conclude that genetic engineering is safer than "conventional" breeding. In fact, while radiation-induced mutagenesis is occasionally used in conventional breeding, it is not in itself conventional breeding. Like genetic engineering, radiation-induced mutagenesis is risky and mutagenic. It is not widely used in plant breeding because of its high failure rate. Some researchers have called for crops bred through mutation breeding to be subjected to the same kind of safety assessments as GM crops, a measure required by Canada's food safety authority.

Comparing genetic engineering with radiation-induced mutagenesis and concluding that it is less risky and therefore safe is like comparing a game of Russian Roulette played with one type of gun with a game of Russian Roulette played with another type of gun. Neither game is safe. Both are risky.

A more useful comparison would be between genetic engineering and conventional breeding that does not involve radiation- or chemical-induced mutagenesis. In fact, this is the method that has safely produced the vast majority of our crop plants over the centuries. It is also the method that is most widely used today.

In challenging genetic modification, we are not rejecting science and are not rejecting the most advanced forms of biotechnology, such as marker assisted selection, which speed up and make more precise the methods of conventional breeding. We are only challenging the premature and misguided commercialisation of crops produced using the imprecise, cumbersome, and outdated method of genetic engineering (recombinant DNA technology). Why use these methods when there are better tools in the biotechnology toolbox?

It is unnecessary to take risks with genetic engineering when conventional breeding – assisted by safe modern technologies such as marker assisted selection – is capable of meeting our crop breeding needs (see 7.3.2).

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2. SCIENCE AND REGULATION

2.1 **Myth:** GM foods are strictly regulated for safety **Truth:** GM food regulation in most countries varies from non-existent to weak

"Monsanto should not have to vouchsafe the safety of biotech food. Our interest is in selling as much of it as possible. Assuring its safety is the FDA's job."
– Philip Angell, Monsanto's director of corporate communications[1] (the FDA is the US government's Food and Drug Administration, responsible for food safety)

"Ultimately, it is the food producer who is responsible for assuring safety."
– US Food and Drug Administration (FDA)[2]

"It is not foreseen that EFSA carry out such [safety] studies as the onus is on the [GM industry] applicant to demonstrate the safety of the GM product in question."
– European Food Safety Authority (EFSA)[3]

Industry and some government sources claim that GM foods are strictly regulated.[4] But GM food regulatory systems worldwide vary from voluntary industry self-regulation (in the US) to weak (in Europe). None are adequate to protect consumers' health.

Section at a glance

- The regulatory regime for GM crops and foods is too weak to protect consumers from the hazards posed by the technology. Regulation is weakest in the US, but is inadequate in most regions of the world, including Europe.
- The US regime assumes that GM crops are safe if certain basic constituents of the GM crop are "substantially equivalent" to those of their non-GM counterparts – a term that has not been legally or scientifically defined. The European regime applies the same concept but terms it "comparative safety assessment". However, when systematic scientific comparisons of a GM crop and its non-GM counterpart are undertaken, the assumption of substantial equivalence is often shown to be false.
- Pro-GM lobbyists have weakened the regulatory process for GM crops, including through the industry-funded group ILSI. No long-term rigorous safety testing of GMOs is required and regulatory assessments are based on data provided by the company that is applying to commercialise the crop.
- The GM industry restricts access to its products by independent researchers, so effects on health and the environment cannot be properly investigated.
- Independent researchers who have published papers containing data that is not supportive of GMOs have been attacked by pro-GM industry groups and individuals (the "shoot the messenger" tactic).

2.1.1. The regulatory process in the USA

"One thing that surprised us is that US regulators rely almost exclusively on information provided by the biotech crop developer, and those data are not published in journals or subjected to peer review... The picture that emerges from our study of US regulation of GM foods is a rubber-stamp 'approval process' designed to increase public confidence in, but not ensure the safety of, genetically engineered foods."
– David Schubert, professor and head, Cellular Neurobiology Laboratory, Salk Institute, commenting on a comprehensive peer-reviewed study of US government's regulation of GMOs that he co-authored[5,6]

GM foods were first commercialised in the US in the early 1990s. The US food regulator, the Food

and Drug Adminstration (FDA), allowed the first GM foods onto world markets in spite of its own scientists' warnings that genetic engineering is different from conventional breeding and poses special risks, including the production of new toxins or allergens.[7,8,9,10,11,12] The FDA overruled its scientists in line with a US government decision to "foster" the growth of the GM industry.[13] The FDA formed a policy for GM foods that did not require any safety tests or labelling.

The creation of this policy was overseen by Michael Taylor, FDA's deputy commissioner of policy – a position created especially for Taylor. Taylor was a former attorney for the GM giant Monsanto and later became its vice president for public policy.[14]

Contrary to popular belief, the FDA does not have a mandatory GM food safety assessment process and has never approved a GM food as safe. It does not carry out or commission safety tests on GM foods. Instead, the FDA operates a *voluntary* programme for pre-market review of GM foods. All GM food crops commercialised to date have gone through this review process, but there is no legal requirement for them to do so. Companies that develop GM crops are allowed to put any GMO (genetically modified organism) on the market that they wish, though they can be held liable for any harm to consumers that results from it.

The outcome of the FDA's voluntary assessment is not a conclusion, underwritten by the FDA, that the GMO is safe. Instead, the FDA sends the company a letter to the effect that:

- The FDA acknowledges that the company has provided a summary of research that it has conducted assessing the GM crop's safety
- The FDA states that, based on the results of the research done by the company, the company has concluded that the GMO is safe
- The FDA states that it has no further questions
- The FDA reminds the company that it is responsible for placing only safe foods in the market
- The FDA reminds the company that, if a product is found to be unsafe, the company may be held liable.[15]

Clearly, this process does not guarantee – or even attempt to investigate – the safety of GM foods. While it does not protect the public, it may protect the FDA from legal liability in the event that harm is caused by a GM food.

2.1.2. The sham of substantial equivalence

> *"The concept of substantial equivalence has never been properly defined; the degree of difference between a natural food and its GM alternative before its 'substance' ceases to be acceptably 'equivalent' is not defined anywhere, nor has an exact definition been agreed by legislators. It is exactly this vagueness that makes the concept useful to industry but unacceptable to the consumer…*
>
> *"Substantial equivalence is a pseudo-scientific concept because it is a commercial and political judgment masquerading as if it were scientific. It is, moreover, inherently anti-scientific because it was created primarily to provide an excuse for not requiring biochemical or toxicological tests."*
>
> – Millstone E, Brunner E, Mayer S. Beyond "substantial equivalence". Nature. 1999; 401(6753): 525–526.[16]

The US FDA's approach to assessing the safety of GM crops and foods is based on the concept of substantial equivalence, which was first put forward by the Organisation for Economic Cooperation and Development (OECD), a body dedicated not to protecting public health but to facilitating international trade.[17]

Substantial equivalence assumes that if a GMO contains similar amounts of a few basic components such as protein, fat, and carbohydrate as its non-GM counterpart, then the GMO is substantially equivalent to the non-GMO and no compulsory safety testing is required.

Claims of substantial equivalence for GM foods are widely criticized as unscientific by independent researchers.[18,19,20,21] A useful analogy is that of a BSE-infected cow and a healthy cow. They are substantially equivalent to one another, in that their chemical composition is the same. The only difference is in the shape of a minor component

of a protein (prion), a difference that would not be picked up by a substantial equivalence assessment. Yet few would claim that eating a BSE-infected cow is as safe as eating a healthy cow.

When claims of substantial equivalence have been independently tested, they have been found to be untrue. Using the latest molecular analytical methods, GM crops have been shown to have a different composition to their non-GM counterparts. This is true even when the two crops are grown under the same conditions, at the same time and in the same location – meaning that the changes are not due to different environmental factors but to the genetic modification.

Examples include:

- GM soy had 12–14% lower amounts of cancer-fighting isoflavones than non-GM soy.[22]
- Canola (oilseed rape) engineered to contain vitamin A in its oil had much reduced vitamin E and an altered oil-fat composition, compared with non-GM canola.[23]
- Experimental GM rice varieties had unintended major nutritional disturbances compared with non-GM counterparts, although they were grown side-by-side in the same conditions. The structure and texture of the GM rice grain was affected and its nutritional content and value were dramatically altered. The authors said that their findings "provided alarming information with regard to the nutritional value of transgenic rice" and showed that the GM rice was not substantially equivalent to non-GM.[24]
- Experimental GM insecticidal rice was found to contain higher levels of certain components (notably sucrose, mannitol, and glutamic acid) than the non-GM counterpart. These differences were shown to have resulted from the genetic manipulation rather than environmental factors.[25]
- Commercialised MON810 GM maize had a markedly different profile in the types of proteins it contained compared with the non-GM counterpart when grown under the same conditions.[21]

GM crops also have different effects from their non-GM counterparts when fed to animals (see 3.1.1).

2.1.3. The US government is not impartial regarding GM crops

The US government is not an impartial authority on GM crops. In fact, it has a policy of actively promoting them.[26] Through its embassies and agencies such as the US Department of Agriculture (USDA), the US government pressures national governments around the world to accept GM crops. This has been made clear in a series of diplomatic cables disclosed by Wikileaks, which reveal that:

- The US embassy in Paris recommended that the US government launch a retaliation strategy against the EU that "causes some pain" as punishment for Europe's reluctance to adopt GM crops.[27]
- The US embassy in Spain suggested that the US government and Spain should draw up a joint strategy to help boost the development of GM crops in Europe.[28]
- The US State Department is trying to steer African countries towards acceptance of GM crops.[29,30]

This strategy of exerting diplomatic pressure on national governments to adopt GM crops is undemocratic as it interferes with their ability to represent the wishes of their citizens. It is also inappropriate to use US taxpayers' money to promote products owned by individual corporations.

2.1.4. The regulatory process in Europe and the rest of the world

> *"I suggest to biotechnology companies that they publish results of studies on the safety of GM foods in international peer-reviewed journals. The general population and the scientific community cannot be expected to take it on faith that the results of such studies are favourable. Informed decisions are made on the basis of experimental data, not faith."*
>
> – Domingo JL. Health risks of GM foods: Many opinions but few data. Science. 2000; 288(5472): 1748–1749.[31]

Many governments, including those of the EU, Japan, Australia, and New Zealand, have an

agency that assesses the safety of GM crops. Based on its assessment, the agency recommends approval or rejection of the crop for use in food or animal feed. The final decision is made by the government.

In Europe, the relevant agency is the European Food Safety Authority (EFSA). Typically the EU member states fail to agree on whether to approve a GM crop, with most voting not to approve it, but the vote does not achieve the "qualified majority" required to reject the GMO. The decision passes to the European Commission, which ignores the desires of the simple majority of the member states and approves the GMO.

Worldwide, safety assessments of GMOs by government regulatory agencies are not scientifically rigorous. As in the US, they do not carry out or commission their own tests on the GM crop. Instead, they make decisions regarding the safety of the GMO based on studies commissioned by the very same companies that stand to profit from the crop's approval.

The problem with this system is that industry studies have an inbuilt bias. Published reviews evaluating studies assessing the safety/hazards of various products or technologies have shown that industry-sponsored or industry-affiliated studies are more likely to reach a favourable conclusion about the safety of the product than independent (non-industry-affiliated) studies. The most notorious example is industry studies on tobacco, which succeeded in delaying regulation for decades by sowing confusion about the health effects of smoking and passive smoking.[32] But a similar bias has been found in studies on other products, including pharmaceuticals[33,34] and mobile phones.[35]

Studies on GM crops and foods are no exception. Two published reviews of the scientific literature show that industry-sponsored or –affiliated studies are more likely than independent studies to claim safety for GMOs.[36,37]

Another problem is the frequently unpublished status of the studies that companies submit to regulatory agencies. The fact that they are not published means that they are not readily available for scrutiny by the public or independent scientists.

Unpublished studies fall into the category of so-called "grey literature" – unpublished documents of unknown reliability.

Such grey literature stands in stark contrast with the gold standard of science, peer-reviewed publication. The peer-reviewed publication process, while far from perfect, is the best method that scientists have come up with to ensure reliability. Its strength lies in a multi-step quality control process:

- The editor of the journal sends the study to qualified scientists ("peers") to evaluate. They give feedback, including any suggested revisions, which are passed on to the authors of the study.
- Based on the outcome of the peer review process, the editor publishes the study, rejects it, or offers to publish it with revisions by the authors.
- Once the study is published, it can be scrutinised and repeated (replicated) by other scientists. This repeat-testing is the cornerstone of scientific reliability, because if other scientists were to come up with different findings, this would challenge the findings of the original study.

The lack of availability of industry studies in the past has resulted in the public being deceived over the safety of GMOs. For example, industry's raw data on Monsanto's GM Bt maize variety MON863 (approved in the EU in 2005) were only forced into the open through court action by Greenpeace. Then independent scientists at the France-based research organisation CRIIGEN analysed the raw data and found that Monsanto's own feeding trial on rats revealed serious health effects – including liver and kidney toxicity – that had been hidden from the public.[38,39]

Since this case and perhaps as a result of it, transparency has improved in Europe and the public can obtain industry toxicology data on GMOs from EFSA on request. Only a small amount of information, such as the genetic sequence of the GMO, can be kept commercially confidential.[40]

Similarly, the Australian and New Zealand food safety agency FSANZ makes industry toxicology

data on GMOs available on the Internet. However, in the US, significant portions of the data submitted to regulators are classified as "commercially confidential" and are shielded from public scrutiny.[41]

2.1.5. Europe's comparative safety assessment: Substantial equivalence by another name

Europe's GMO safety assessment process is still evolving. The European Food Safety Authority (EFSA) is in danger of following the US FDA in adopting the concept of substantial equivalence in its GM food assessments – but under another name. EFSA does not use the discredited term "substantial equivalence" but has replaced it with another term with the same meaning: "comparative safety assessment".

The change of name was suggested in a 2003 paper on risk assessment of GM plants.[42] The paper was co-authored by the chair of EFSA's GMO Panel, Harry Kuiper, with Esther Kok. In 2010 Kok joined EFSA as an expert on GMO risk assessment.[43] In their paper, Kuiper and Kok freely admitted that the concept of substantial equivalence remained unchanged and that the purpose of the name change was in part to deflect the "controversy" that had grown up around the term.[42]

At the same time that Kuiper and Kok published their 2003 paper, they were part of a task force of the industry-funded International Life Sciences Institute (ILSI), that was working on re-designing GMO risk assessment.[44] In 2004 Kuiper and Kok co-authored an ILSI paper on the risk assessment of GM foods, which defines comparative safety assessment. The other co-authors include representatives from GM crop companies that sponsor ILSI, including Monsanto, Bayer, Dow, and Syngenta.[45]

EFSA has followed ILSI's suggestion of treating the comparative safety assessment as the basis for GM safety assessments. EFSA has promoted the concept in its guidance documents on assessment of environmental risks of GM plants[46] and of risks posed by food and feed derived from GM animals,[47] as well as in a peer-reviewed paper on the safety assessment of GM plants, food and feed.[48]

In 2012, the EU Commission incorporated the industry- and EFSA-generated concept of the comparative safety assessment into its draft legislation on GM food and feed.[49]

A major problem with the comparative safety assessment is that, as the name suggests, the authorities are beginning to treat it as a safety assessment in itself, rather than as just the first in a series of mandatory steps in the assessment process. In other words, EFSA and the EU Commission are moving towards a scenario in which GM crops and foods that pass this extremely weak initial screening may not be subjected to further rigorous testing.

2.1.6. GM foods would not pass an objective comparative safety assessment

The comparative safety assessment is a weak test of safety. Yet if it were applied objectively, GM crops and foods would not pass even this stage of the risk assessment. This is because as is explained above (2.1.2), many studies on GM crops show that they are not substantially equivalent to the non-GM counterparts from which they are derived. There are often significant differences in the levels of certain nutrients and types of proteins, as well as unexpected toxins or allergens.

GM proponents have sidestepped this problem by widening the range of comparison. Adopting a method originally used by Monsanto in an analysis of its GM soy,[50,51] they no longer restrict the comparator to the GM plant and the genetically similar (isogenic) non-GM line, but recommend as comparators a range of non-isogenic varieties that are grown at different times and in different locations. Some of this "historical" data even dates back to before World War II.[52]

ILSI has created a database of such published data, including data on unusual varieties that have untypically high or low levels of certain components. EFSA experts use this industry database to compare the composition of the GM plant with its non-GM counterparts in GMO risk assessments.[44,53]

If, on the basis of this "comparative safety assessment", EFSA experts judge the GM crop to be equivalent to its non-GM counterpart, it is assumed to be as safe as the non-GM variety.[44,54]

Further rigorous testing is not required, so unexpected changes in the GM crop are unlikely to be identified. Also, testing for interactions between the genome of the GM crop and the environment is not required.

However, the degree of similarity that a GM plant needs to have to non-GM counterparts in order to pass this comparative safety assessment has never been defined. A comparative assessment of a GM plant often reveals significant differences in its composition that are outside the ranges of other non-GM varieties, including historical varieties. But even in these extreme cases, according to scientists who have served on regulatory bodies, the differences are often dismissed as "biologically irrelevant" (see 3.1.2).[52]

Independent scientists have heavily criticised substantial equivalence and comparative safety assessment as the basis of safety assessments of GM crops.[6,16,52,55]

2.1.7. Weakening comparative assessment further by widening the range of comparison

The comparative safety assessment is itself a flawed basis for assessing GMO safety. Yet recent developments have further weakened this already inadequate method.

An EU Directive on the deliberate release of GMOs requires that the comparator against which the GMO should be assessed for safety should be "the non-modified organism from which it is derived".[56] The EU regulation on GM food and feed agrees that the comparator should be the non-GM counterpart.[57]

These rules ensure that the GM crop or food is compared with its genetically similar (isogenic) non-GM counterpart. The comparator will have the same genetic background, but without the GM transformation. So the comparison is correctly designed to find changes caused by the genetic modification process – which should be the purpose of a GMO safety assessment.

Historically, EFSA has followed this principle in its Guidances and Opinions. Yet in a Guidance published in late 2011, EFSA departed from its past practice and EU legislative requirements and broadened the range of acceptable comparators. EFSA even proposed to allow the use of GM plants, rather than the usual non-GM isogenic line, as comparators for stacked events (crops containing multiple GM traits) and concluded that in some cases plants from different species might be accepted as comparators.[58] EFSA's new approach is in line with industry's practices.[50,51] But whether it complies with EU legislation is questionable.

More importantly, the approach of comparing a GM crop with unrelated or distantly related varieties grown at different times and in different locations is scientifically flawed. In order to determine any unintended disruption to gene structure and function and consequent biochemical composition brought about by the GM transformation process, the only valid comparator is the non-GM isogenic line, when the two have been grown side-by-side at the same time. This serves to minimize variables external to the GM transformation process. Thus any changes seen are likely to be caused by the GM process and not some other factor. In contrast, comparisons with unrelated or distantly related varieties grown at different times and in different locations introduce and increase external variables and serve to mask rather than highlight the effects of the GM transformation.

In parallel with the trend of widening the range of comparison in the comparative assessment of a GM plant's composition, industry and regulators have adopted a similar scientifically invalid approach to assessing the health effects of a GMO in animal feeding trials. In these cases, they dismiss statistically significant changes seen in the animals fed the GMO as compared with those fed a non-GM diet as "not biologically meaningful" or "within the range of biological variation" (see 3.1.2–3.1.4 for a detailed discussion of this practice and how it places public health at risk).

These practices run counter to good scientific method and could be described as a way of "disappearing" inconvenient findings of the experiment in question by bringing in data from other experiments until the convenient answer (that the GMO is no different from its non-GM counterpart) is reached.

2.1.8. GM corporations and the US government have designed the GMO regulatory process around the world

The agricultural biotechnology corporations have lobbied long and hard on every continent to ensure that weak assessment models are the norm. Often working through the US government or nonprofit groups, they have provided biosafety workshops and training courses to smaller countries that are attempting to grapple with regulatory issues surrounding GM crops. The result, according to critics, has been models for safety assessment that favour easy approval of GMOs without rigorous assessment of health or environmental risks.

For example, a report by the African Centre for Biosafety (ACB) described how the Syngenta Foundation, a nonprofit organization set up by the agricultural biotechnology corporation Syngenta, worked on "a three-year project for capacity building in biosafety in sub-Saharan Africa". The Syngenta Foundation's partner in this enterprise was the Forum for Agricultural Research in Africa (FARA), a group headed by people with ties to Monsanto and the US government.

The ACB identified the Syngenta Foundation/FARA project as part of an "Africa-wide harmonisation of biosafety policies and procedures" that will "create an enabling environment for the proliferation of GMOs on the continent, with few biosafety checks and balances".[59]

In India, the US Department of Agriculture led a "capacity building project on biosafety" to train state officials in the "efficient management of field trials of GM crops"[60] – the first step towards full-scale commercialisation. And in 2010, a scandal erupted when a report from India's national science academies recommending release of GM Bt brinjal (eggplant/aubergine) for cultivation was found to contain 60 lines of text copy-pasted almost word for word from a biotechnology advocacy newsletter – which itself contained lines extracted from a GM industry-supported publication.[61]

2.1.9. Independent research on GM foods is suppressed

> *"Unfortunately, it is impossible to verify that genetically modified crops perform as advertised. That is because agritech companies have given themselves veto power over the work of independent researchers… Research on genetically modified seeds is still published, of course. But only studies that the seed companies have approved ever see the light of a peer-reviewed journal. In a number of cases, experiments that had the implicit go-ahead from the seed company were later blocked from publication because the results were not flattering… It would be chilling enough if any other type of company were able to prevent independent researchers from testing its wares and reporting what they find… But when scientists are prevented from examining the raw ingredients in our nation's food supply or from testing the plant material that covers a large portion of the country's agricultural land, the restrictions on free inquiry become dangerous."*
>
> – Editorial, Scientific American[62]

The problem of basing the regulatory process for GM crops on industry studies could be solved by considering independent (non-industry-affiliated) science in the risk assessment. But independent studies on GM foods and crops are rare, because independent research on GM crop risks is not supported financially – and because industry uses its patent-based control of GM crops to restrict independent research. Research that has been suppressed includes assessments of health and environmental safety and agronomic performance of GM crops.[41] Permission to study GM crops is withheld or made so difficult to obtain that research is effectively blocked. For example, researchers are often denied access to commercialised GM seed and the non-GM isogenic lines.

Even if permission to carry out research is given, GM companies typically retain the right to block publication.[63,64] The industry and its allies

also use a range of public relations strategies to discredit and silence scientists who publish research that is critical of GM crops.[65]

In 2009, 26 scientists took the unusual step of making a formal complaint to the US Environmental Protection Agency. They wrote, "No truly independent research can be legally conducted on many critical questions involving these crops."[66] An editorial in Scientific American reported, "Only studies that the seed companies have approved ever see the light of a peer-reviewed journal. In a number of cases, experiments that had the implicit go-ahead from the seed company were later blocked from publication because the results were not flattering."[62]

In response, a new licensing agreement for researchers on GM crops was reached between US Department of Agriculture (USDA) scientists and Monsanto in 2010.[67] However, this agreement is still restrictive, which is not surprising given that the US Department of Agriculture has a policy of supporting GM crops and the companies that produce them (see 2.1.3). Whether this new policy will make a real difference remains to be seen.

The limited amount of independent research that is conducted on GM foods and crops is often ignored or dismissed by regulatory agencies. In addition, findings of harm, whether in independent or industry studies, are explained away as not "biologically relevant" (see 3.1.2).

2.1.10. Researchers who publish studies that find harm from GM crops are attacked

There is a well-documented history of orchestrated attacks by GM proponents on researchers whose findings show problems with GM crops and foods. The GM proponents adopt a variety of tactics, including criticizing the research as "bad science", finding any small flaw or limitation (which almost all studies have) and claiming that this invalidates the findings, and using personal (ad hominem) attacks against the researcher.

Scientific debate is nothing new and is to be welcomed: it is the way that science progresses. A researcher publishes a study; another researcher thinks that certain aspects could have been done better and repeats it with the desired modifications; these findings in turn are added to the database of knowledge for future researchers to build on. But the trend of attempting to silence or discredit research that finds problems with GMOs is unprecedented and has grown in parallel with the commercialization of GM crops.

Unlike in traditional scientific debate, too often the criticism does not consist of conducting and publishing further research that could confirm or refute the study in question. Instead, the critics try to "shout down" the study on the basis of claims that are spurious or not scientifically validated.

There are numerous cases of this pattern, of which the following are just a few examples.

Gilles-Eric Séralini

In 2007 Professor Gilles-Eric Séralini, researcher in molecular biology at the University of Caen and president of the independent research institute CRIIGEN, and his research team published a re-analysis of a Monsanto 90-day rat feeding study that the company had submitted in support of application for the approval of its GM maize MON863. Approval was granted for food and feed in the EU in 2005. Monsanto tried to keep the feeding trial data secret, claiming commercial confidentiality, but it was forced into the open by a court ruling in Germany.

Séralini's re-analysis of the Monsanto data showed that the rats fed GM maize had reduced growth and signs of liver and kidney toxicity. Seralini concluded that it could not be assumed that the maize was safe and asked for such studies performed for regulatory purposes to be extended beyond 90 days so that the consequences of the initial signs of toxicity could be investigated.[38]

After Séralini and his team published this and other papers showing harmful effects from GM crops and the glyphosate herbicide used with GM Roundup Ready crops, he was subjected to a vicious smear campaign. The smears appeared to come from the French Association of Plant Biotechnologies [Association Française des Biotechnologies Végétale] (AFBV), chaired by Marc Fellous.

Séralini believed the researchers Claude Allegre, Axel Kahn, and Marc Fellous were behind

the defamation and intimidation campaign in France. He sued Fellous for libel, arguing that the campaign had damaged his reputation, reducing his opportunities for work and his chances of getting funding for his research.

During the trial, it was revealed that Fellous, who presented himself as a "neutral" scientist without personal interests, and who accused those who criticise GMOs as "ideological" and "militant", owned patents through a company based in Israel. This company sells patents to GM corporations such as Aventis. Séralini's lawyer showed that other AFBV members also have links with agribusiness companies.

The court found in Séralini's favour. The judge sentenced the AFBV to a fine on probation of 1,000 Euros, 1 Euro for compensation (as requested by Séralini) and 4,000 Euros in court fees.[68]

Emma Rosi-Marshall

In 2007 Emma Rosi-Marshall's team published research showing that Bt maize material got into streams in the American Midwest and that when fed to non-target insects, it had harmful effects. In a laboratory feeding study, the researchers fed Bt maize material to the larvae of the caddis fly, an insect that lives near streams. The larvae that fed on the Bt maize debris grew half as fast as those that ate debris from non-GM maize. And caddis flies fed high concentrations of Bt maize pollen died at more than twice the rate of caddis flies fed non-Bt pollen.[69]

Rosi-Marshall was subjected to vociferous criticism from GM proponents, who said that her paper was "bad science". They complained that the study did not follow the type of protocol usual for toxicological studies performed for regulatory purposes, using known doses – even though such protocols are extremely limited and are increasingly coming under fire from independent scientists for being unable to reliably detect risks (see "Jorg Schmidt…" below). Rosi-Marshall replied that her study allowed the caddis flies to eat as much as they wanted, as they would in the wild.[65]

The critics also objected that laboratory findings did not give accurate information about real field conditions. Rosi-Marshall responded that only in the laboratory is it possible to control conditions tightly enough to allow firm conclusions.

Henry I. Miller of the pro-free-market think tank, the Hoover Institution, co-authored and published an opinion piece in which he called the publication of Rosi-Marshall's study an example of the "anti-science bias" of scientific journals and accused the authors of scientific "misconduct". According to Miller, the authors' main crime was failing to mention in their paper another study that concluded that Bt maize pollen did not affect the growth or mortality of filter-feeding caddis flies.[70] Rosi-Marshall responded that she had not cited these findings because they had not been peer-reviewed and published at the time and because they focused on a different type of caddis fly, with different feeding mechanisms from the insects in her study.[65]

Rosi-Marshall and her co-authors stand by their study. In a statement, they said, "The repeated, and apparently orchestrated, ad hominem and unfounded attacks by a group of genetic engineering proponents has done little to advance our understanding of the potential ecological impacts of transgenic corn."[65]

Jorg Schmidt, Angelika Hilbeck and colleagues

A laboratory study (Schmidt, 2009) showed that GM Bt toxins increased the mortality of ladybird larvae that fed on it, even at the lowest concentrations tested. The study showed that claims that Bt toxins are only harmful to a limited number of insect pests and their close relatives are false. Bt toxins were found to harm non-target organisms – ladybirds – that are highly beneficial to farmers.[71] Ladybirds devour pests such as aphids and disease-causing fungi.

Based on this study and over 30 others, in 2009 Germany banned the cultivation of Monsanto's Bt maize MON810, which contains one of the Bt toxins that Schmidt's team found to be harmful.[71] This triggered two opinion pieces that questioned the scientific basis of the German ban[72,73] and one experimental study (Alvarez-Alfageme et al, 2011) that claimed to disprove the adverse effects of the

Bt toxins on ladybird larvae. The authors of the experimental study found no ill effects on ladybird larvae fed on Bt toxins and said that the "apparent harmful effects" found by Schmidt were due to "poor study design and procedures".[74]

The following year a study (Hilbeck et al, 2012) by some of the same authors as Schmidt's study was published, confirming its findings. This study too found that Bt toxins increased the mortality of ladybird larvae. The researchers addressed the main criticisms raised by Alvarez-Alfageme and gave reasons why that study had found no effect. The main reason given was that Alvarez-Alfageme had chosen to expose the ladybird larvae only in a single dose fed over 24 hours and then allowed them to recover by feeding them Bt toxin-free food.[75] Schmidt, on the other hand, had exposed the larvae continuously over 9–10 days[75] – arguably a far more realistic scenario.

In a separate commentary on the controversy, some of the authors of the confirmatory study criticised the confrontational tone, unscientific elements, and "concerted nature" of the three studies that attacked Schmidt's initial findings. The authors noted that the "dogmatic 'refutations'" and "deliberate counter studies" that routinely appear in response to peer-reviewed results on potential harm from GMOs were also a feature of the debate on risks of tobacco, asbestos, the controversial food packaging chemical bisphenol A, and mobile phones.

The authors also criticised the "double standards" that led the European Food Standards Authority (EFSA) to apply excessive scrutiny to papers that draw attention to the risks of GM crops while overlooking obvious deficiencies in studies that assert the safety of GM crops.

For example, Hilbeck and co-authors pointed to major deficiencies in a routine biosafety test performed for regulatory purposes in the approval process of GM Bt crops. The test is supposed to look for toxic effects on non-target insects. In the test protocol, larvae of the green lacewing, a beneficial pest predator insect, are given moth eggs coated in Bt toxin to eat.

However, as Hilbeck and her team noted, lacewing larvae feed by piercing the eggs and sucking out the contents – meaning that they are "truly incapable of ingesting compounds deposited on the exterior of the eggs".

In other words, this supposed biosafety test is incapable of detecting toxic effects even when they occur. This deficiency has even been noted by the US Environmental Protection Agency. And yet, the authors noted, no criticisms of these clearly inappropriate tests were levelled by Alvarez-Alfageme and the other critics of Schmidt's paper.[76]

Arpad Pusztai

On 10 August 1998 the GM debate changed forever with the broadcast of a current affairs documentary on British television about GM food safety. The programme featured a brief but revealing interview with the internationally renowned scientist Dr Arpad Pusztai about his research into GM food safety. Pusztai talked of his findings that GM potatoes had harmed the health of laboratory rats. Rats fed GM potatoes showed excessive growth of the lining of the gut similar to a pre-cancerous condition and toxic reactions in multiple organ systems.

Pusztai had gone public with his findings prior to publication for reasons of the public interest, particularly as the research had been funded by the British taxpayer. He gave his television interview with the full backing of his employers, the Rowett Institute in Scotland.

After the broadcast aired, a political storm broke. Within days, Pusztai had been gagged and fired by the Rowett, his research team was disbanded, and his data was confiscated. His telephone calls and emails were diverted. He was subjected to a campaign of vilification and misrepresentation by pro-GM scientific bodies and individuals in an attempt to discredit him and his research.[77,78,79,80,81]

What caused the Rowett's turnaround? It was later reported that there had been a phone call from Monsanto to the then US president Bill Clinton, from Clinton to the then UK prime minister Tony Blair, and from Blair to the Rowett.[77]

Untruths and misrepresentations about Pusztai's research continue to be circulated by GM proponents. These include claims that no GM potatoes were fed at all and that the experiment

lacked proper controls. Both claims are easily shown to be false by a reading of the study, which subsequently passed peer-review by a larger-than-usual team of reviewers and was published in The Lancet.[82]

Criticisms of the study design are particularly unsound because it was reviewed by the Scottish Office and won a GBP 1.6 million grant over 28 other competing designs. According to Pusztai, it was also reviewed by the BBSRC, the UK's main public science funding body.[77] Even Pusztai's critics have not suggested that he did not follow the study design as it was approved – and if his study had lacked proper controls, the BBSRC and the Scottish Office would have faced serious questions.

Interestingly, one of the critics who claimed that Pusztai's experiment lacked proper controls[83] had previously co-authored and published with Pusztai a study on GM peas with exactly the same design.[84] In fact, the only notable difference between this study and Pusztai's GM potatoes study was the result: the pea study had concluded that the GM peas were as safe as non-GM peas, whereas the potato study had found that the GM potatoes were unsafe.

Pusztai's GM potato research continues to be cited in the peer-reviewed literature as a valid study.

Ignacio Chapela

In 2001 biologist Ignacio Chapela and his colleague David Quist tested native varieties of Mexican maize and found that they had been contaminated by GM genes.[85] The findings were of concern because at the time, Mexico had banned the planting of GM maize out of concern for its native varieties. Mexico is the biological centre of origin for maize and has numerous varieties adapted to different localities and conditions. The GM contamination came from US maize imports.

Chapela started talking to various government officials, who, he felt, needed to know. As his findings were approaching publication in the journal Nature, events took a sinister turn. Chapela said he was put into a taxi and taken to an empty building in Mexico City, where a senior government official threatened him and his family. Chapela had the impression that he was trying to prevent him from publishing his findings.[86,77,87]

Chapela went ahead with publication. Immediately, a virulent smear campaign against him and his research was launched, with most of the attacks appearing on a pro-GM website called AgBioWorld. While AgBioWorld has many scientists among its subscribers, the attacks were not fuelled by scientists, but by two people called Mary Murphy and Andura Smetacek. Murphy and Smetacek accused Chapela of being more of an activist than a scientist. Smetacek suggested that Chapela's study was part of an orchestrated campaign in collusion with "fear-mongering activists (Greenpeace, Friends of the Earth)".[77]

Murphy and Smetacek successfully shifted the focus from the research findings onto the messenger. The journal Science noted the "widely circulating anonymous emails" accusing researchers, Ignacio Chapela and David Quist, of "conflicts of interest and other misdeeds".[88] Some scientists were alarmed at the personal nature of the attacks. "To attack a piece of work by attacking the integrity of the workers is a tactic not usually used by scientists," wrote one.[89]

Investigative research by Jonathan Matthews of the campaign group GMWatch and the journalist Andy Rowell traced Murphy's attacks to an email address owned by Bivings Woodell, part of the Bivings Group, a PR company with offices in Washington, Brussels, Chicago and Tokyo. Bivings developed "internet advocacy" campaigns for corporations and had assisted Monsanto with its internet PR since 1999, when the biotech company identified that the internet had played a significant part in its PR problems in Europe.[77]

Attempts to uncover the identity of Murphy and Smetacek led nowhere, leading the journalist George Monbiot to write an article about the affair entitled, "The fake persuaders: Corporations are inventing people to rubbish their opponents on the internet".[90]

Chapela's finding that GM genes had contaminated native Mexican maize was confirmed by tests carried out by the Mexican government, as reported in Chapela's published study and in a separate article.[85,91]

Conclusion to Section 2

The regulatory regime for GM crops and foods is weakest in the US, the origin of most such crops, but is inadequate in most regions of the world, including Europe. The US regime assumes that GM crops are safe if certain basic constituents of the GM crop are "substantially equivalent" to those of their non-GM counterparts – a term that has not been legally or scientifically defined. The European regime applies the same concept but terms it "comparative safety assessment". But often, when a scientific comparison of a GM crop and its non-GM counterpart is undertaken, the assumption of substantial equivalence is shown to be false, as unexpected differences are found.

No regulatory regime anywhere in the world requires long-term or rigorous safety testing of GM crops and foods. Regulatory assessments are based on data provided by the company that is applying to commercialise the crop – the same company that will profit from a positive assessment of its safety.

The regulatory procedure for GM crops is not independent or objective. The GM crop industry, notably through the industry-funded group, the International Life Sciences Institute (ILSI), has heavily influenced the way in which its products are assessed for safety. ILSI has successfully promoted ideas such as the comparative safety assessment, which maximize the chances of a GMO avoiding rigorous safety testing and greatly reduce industry's costs for GMO authorisations.

The GM crop industry restricts access to its products by independent researchers, so their effects on human and animal health and the environment cannot be properly investigated. Independent researchers who have published papers containing data that is not supportive of GMOs have been attacked by the industry and pro-GMO groups and individuals. This has had a chilling effect on the debate about GM crops and has compromised scientific progress in understanding their effects.

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3. HEALTH HAZARDS OF GM FOODS

3.1 **Myth:** GM foods are safe to eat
Truth: Studies show that GM foods can be toxic or allergenic

> *"Most studies with GM foods indicate that they may cause hepatic, pancreatic, renal, and reproductive effects and may alter haematological [blood], biochemical, and immunologic parameters, the significance of which remains to be solved with chronic toxicity studies."*
>
> – Dona A, Arvanitoyannis IS. Health risks of genetically modified foods. Crit Rev Food Sci Nutr. 2009; 49: 164–175[1]

There are three possible sources of adverse health effects from GM foods:

- The GM gene product – for example, the Bt toxin in GM insecticidal crops – may be toxic or allergenic
- The GM transformation process may produce mutagenic effects, gene regulatory effects, or effects at other levels of biological structure and function that result in new toxins or allergens and/or disturbed nutritional value
- Changes in farming practices linked to the use of a GMO may result in toxic residues – for example, higher levels of crop contamination with the herbicide Roundup are an inevitable result of using GM Roundup Ready® crops (see Sections 4, 5).

Evidence presented below and in Sections 4 and 5 suggests that problems are arising from all three sources – throwing into question GM proponents' claims that GM foods are as safe as their non-GM counterparts.

Section at a glance

- Peer-reviewed studies have found harmful effects on the health of laboratory and livestock animals fed GMOs. Effects include toxic and allergenic effects and altered nutritional value.
- Most animal feeding studies on GMOs have only been short-term or medium-term in length. What is needed are long-term and multi-generational studies on GMOs to see if the worrying changes commonly reported in short- and medium-term studies develop into serious disease. Such studies are not required by government regulators.
- Industry and regulators dismiss findings of harm in animal feeding trials on GMOs by claiming they are "not biologically significant" or "not biologically relevant" – scientifically meaningless terms that have not been properly defined.
- No GM nutritionally enhanced (biofortified) foods are available on the market. In contrast, conventional plant breeding has successfully and safely produced many biofortified foods.
- The most-hyped GM nutritionally enhanced food, Golden Rice, aimed at combating vitamin A deficiency, has wasted millions in development funds – yet has not been proven safe to eat and is still not ready for the market. Meanwhile, proven and inexpensive solutions to vitamin A deficiency are available and only need proper funding to be more widely applied.
- Conventional plant breeding has successfully and safely produced many biofortified foods.

3.1.1. Feeding studies on laboratory and farm animals

Feeding studies on laboratory and farm animals show that GM foods can be toxic or allergenic:

- Rats fed GM tomatoes developed stomach lesions (sores or ulcers).[2,3] This tomato, Calgene's Flavr Savr, was the first commercialized GM food.
- Mice fed GM peas (not subsequently commercialized) engineered with an insecticidal

protein (alpha-amylase inhibitor) from beans showed a strong, sustained immune reaction against the GM protein. Mice developed antibodies against the GM protein and an allergic-type inflammation response (delayed hypersensitivity reaction). Also, the mice fed on GM peas developed an immune reaction to chicken egg white protein. The mice did not show immune or allergic-type inflammation reactions to either non-GM beans naturally containing the insecticide protein, to egg white protein fed with the natural protein from the beans, or to egg white protein fed on its own. The findings showed that the GM insecticidal protein acted as a sensitizer, making the mice susceptible to developing immune reactions and allergies to normally non-allergenic foods. This is called immunological cross-priming. The fact that beans naturally containing the insecticidal protein did not cause the effects seen with the peas that expressed the transgenic insecticidal protein indicated that the immune responses of the mice to the GM peas were caused by changes in the peas brought about by the genetic engineering process. In other words, the insecticidal protein was changed by the GM process so that it behaved differently in the GM peas compared with its natural form in the non-GM beans – and the altered protein from the GM peas stimulated a potent immune response in the mice.[4]

- Mice fed GM soy showed disturbed liver, pancreas and testes function. The researchers found abnormally formed cell nuclei and nucleoli in liver cells, which indicates increased metabolism and potentially altered patterns of gene expression.[5,6,7]
- Mice fed GM soy over their lifetime (24 months) showed more acute signs of ageing in the liver than the control group fed non-GM soy.[8]
- Rabbits fed GM soy showed enzyme function disturbances in kidney and heart.[9]
- Female rats fed GM soy showed changes in uterus and ovaries compared with controls fed organic non-GM soy or a non-soy diet. Certain ill effects were found with organic soy as well as GM soy, showing the need for further investigation into the effects of soy-based diets (GM and non-GM) on reproductive health.[10]
- A review of 19 studies (including industry's own studies submitted to regulators in support of applications to commercialise GM crops) on mammals fed with commercialised GM soy and maize that are already in our food and feed chain found consistent toxic effects on the liver and kidneys. Such effects may be markers of the onset of chronic disease, but long-term studies, in contrast to these reported short- and medium-term studies, would be required to assess this more thoroughly. Unfortunately, such long-term feeding trials on GMOs are not required by regulators anywhere in the world.[11]
- Rats fed insecticide-producing MON863 Bt maize grew more slowly and showed higher levels of certain fats (triglycerides) in their blood than rats fed the control diet. They also suffered problems with liver and kidney function. The authors stated that it could not be concluded that MON863 maize is safe and that long-term studies were needed to investigate the consequences of these effects.[12]
- Rats fed GM Bt maize over three generations suffered damage to liver and kidneys and alterations in blood biochemistry.[13]
- A re-analysis of Monsanto's own rat feeding trial data, submitted to obtain approval in Europe for three commercialised GM Bt maize varieties, MON863, MON810, and NK603, concluded that the maize varieties had toxic effects on liver and kidneys. The authors of the re-analysis stated that while the findings may have been due to the pesticides specific to each variety, genetic engineering could not be excluded as the cause.[14] The data suggest that approval of these GM maize varieties should be withdrawn because they are not substantially equivalent to non-GM maize and are toxic.
- Old and young mice fed GM Bt maize showed a marked disturbance in immune system cells and in biochemical activity.[15]
- Rats fed GM MON810 Bt maize showed clear signs of toxicity, affecting the immune system, liver and kidneys.[14,15]
- Female sheep fed Bt GM maize over three generations showed disturbances in the functioning of the digestive system, while

their lambs showed cellular changes in the liver and pancreas.[16]

- GM Bt maize DNA was found to survive processing and was detected in the digestive tract of sheep. This raises the possibility that the antibiotic resistance gene in the maize could move into gut bacteria, an example of horizontal gene transfer.[17] In this case, horizontal gene transfer could produce antibiotic-resistant disease-causing bacteria ("superbugs") in the gut.
- Rats fed GM oilseed rape developed enlarged livers, often a sign of toxicity.[18]
- Rats fed GM potatoes showed excessive growth of the lining of the gut similar to a pre-cancerous condition and toxic reactions in multiple organ systems.[19,20]
- Mice fed a diet of GM Bt potatoes or non-GM potatoes spiked with natural Bt toxin protein isolated from bacteria showed abnormalities in the cells and structures of the small intestine, compared with a control group of mice fed non-GM potatoes. The abnormalities were more marked in the Bt toxin-fed group. This study shows not only that the GM Bt potatoes caused mild damage to the intestines but also that Bt toxin protein is not harmlessly broken down in digestion, as GM proponents claim, but survives in a functionally active form in the small intestine and can cause damage to that organ.[21]
- Rats fed GM rice for 90 days had a higher water intake as compared with the control group fed the non-GM isogenic line of rice. The GM-fed rats showed differences in blood biochemistry, immune response, and gut bacteria. Organ weights of female rats fed GM rice were different from those fed non-GM rice. The authors claimed that none of the differences were "adverse", but they did not define what they mean by "adverse". Even if they had defined it, the only way to know if such changes are adverse is to extend the length of the study, which was not done. The authors conceded that the study "did not enable us to conclude on the safety of the GM food".[22]
- Rats fed GM Bt rice developed significant differences as compared with rats fed the non-GM isogenic line of rice. These included differences in the populations of gut bacteria – the GM-fed group had 23% higher levels of coliform bacteria. There were differences in organ weights between the two groups, namely in the adrenals, testis and uterus. The authors concluded that the findings were most likely due to "unintended changes introduced in the GM rice and not from toxicity of Bt toxin" in its natural, non-GM form.[23]
- A study on rats fed GM Bt rice found a Bt-specific immune response in the non-GM-fed control group as well as the GM-fed groups. The researchers concluded that the immune response in the control animals was due to their inhaling particles of the powdered Bt toxin-containing feed consumed by the GM-fed group. The researchers recommended that for future tests involving Bt crops, GM-fed and control groups should be kept separate.[24] This indicates that animals can be extremely sensitive to very small amounts of GM proteins, so even low levels of contamination of conventional crops with GMOs could be harmful to health.

In these studies, a GM food was fed to one group of animals and its non-GM counterpart was fed to a control group. The studies found that the GM foods were more toxic or allergenic than their non-GM counterparts.

3.1.2. Masking statistical significance through the concept of "biological relevance"

Study findings such as those described above have made it increasingly difficult for GM proponents to continue to claim that there are no differences between the effects of GM foods and their non-GM counterparts – clearly, there are.

To sidestep this problem, the GM industry and its allies have shifted their argument to claim that statistically significant effects, such as those found in the above studies, are not "biologically relevant".

The concept of biological relevance was initially promoted by the industry-funded group, the International Life Sciences Institute (ILSI), and affiliates to argue against regulatory restrictions

on toxic chemicals.[25] But increasingly, it has been extended to the field of GM crops and foods.[26] Biological relevance offers a route through which GM proponents can admit that feeding experimental animals a GM diet can cause statistically significant observable effects, but at the same time argue that these effects are not important.

However, this argument is scientifically indefensible. Biological relevance with respect to changes brought about by GM foods has never been properly defined, either scientifically or legally. Most feeding trials on GM foods, including those carried out by industry to support applications for GM crop commercialisation, are not long-term but medium-term studies of only 30–90 days long and therefore cannot thoroughly assess the safety of GMOs.

In order to determine whether changes seen in these medium-term studies are biologically relevant, the researchers would have to:

- Define in advance what "biological relevance" means with respect to effects found from feeding GM crops
- Extend the current study design from a medium-term to a long-term period. In the case of rodent studies, this would be two years – the approximate duration of their life-span[11]
- Examine the animals closely to see how the changes found in 90-day studies progress – for example, if they disappear or develop into disease or premature death
- Analyze the biological relevance of the changes in light of the researchers' definition of the term
- Carry out additional reproductive and multigenerational studies to determine effects on fertility and future generations.

Since these steps are not followed in cases where statistically significant effects are dismissed as not "biologically relevant", assurances of GM food safety founded on this line of argument are baseless.

In parallel with "biological relevance", a trend has grown of claiming that statistically significant effects of GM feed on experimental animals are not "adverse".[27] However, the term "adverse" is not defined and the experiments are not extended to check whether changes are the first signs of disease. So again, the term is technically meaningless.

We conclude that GM proponents and regulatory bodies should cease masking findings of statistically significant effects from GM crops through poorly defined and scientifically indefensible concepts.

3.1.3. How misuse of "biological relevance" places public health at risk: Monsanto GM maize study

In 2007 a team led by Professor Gilles-Eric Séralini at the independent research institute CRIIGEN in France published a new analysis of a rat feeding study conducted by Monsanto with one of its GM maize varieties.

The maize, called MON863, was approved for feed and feed in Europe in 2005–2006.[28] The maize was approved partly on the basis of the Monsanto study, which, however, could not be scrutinized by independent scientists and the public because the raw data were kept hidden on claimed grounds of commercial confidentiality. Only after court action in Germany forced disclosure of Monsanto's data could Séralini and associates conduct their analysis.[12]

Séralini's team found that according to Monsanto's own data, rats fed GM maize over a 90-day period had signs of liver and kidney toxicity. Also, the GM-fed rats had statistically significant differences in weight from those fed non-GM maize control diets. The GM-fed females had higher concentrations of certain fats in their blood, and excretion of certain minerals was disturbed in GM-fed males.[12]

However, all statistically significant effects found in Monsanto's study were dismissed by the European Food Safety Authority (EFSA) in its favourable safety assessment of the maize. They claimed that the statistically significant effects were not "biologically meaningful".[29,30] EFSA and GM proponents cited differences in response to the GM feed between male and female animals, claiming that toxic effects should be the same in both sex groups.[11,31,32,33] However, this is scientifically indefensible as toxins with hormone-disrupting properties are

well known to have different effects on males and females.[34,35]

Séralini commented on the dangerous trend of dismissing statistically significant effects by claiming lack of biological relevance in a 2011 review of the scientific literature assessing the safety of GM crops: "The data indicating no biological significance of statistical effects in comparison to controls have been published mostly by [GM crop development] companies from 2004 onwards, and at least 10 years after these GMOs were first commercialized round the world". Séralini called the trend a matter of "grave concern".[11]

After years of heavy criticism of the "biological relevance" tactic by independent scientists and a member of the European Parliament,[36,11,37] in late 2011 EFSA issued an Opinion on the relationship between statistical significance and biological relevance.[38]

But EFSA's Opinion failed to give a rigorous scientific or legal definition of what makes a statistically significant finding not "biologically relevant". Instead, it allowed industry to come to its own conclusion on whether changes found in an experiment are "important", "meaningful", or "may have consequences for human health". These are vague concepts for which no measurable or objectively verifiable endpoints are defined. Thus they are a matter of opinion, not science.

Moreover, the lack of a sound definition of biological relevance means that regulators have no strong scientific or legal grounds to disagree with industry's claim that a statistically significant finding is not biologically relevant. This, in effect, makes GMOs impossible to regulate.

The conclusions of the EFSA Opinion are not surprising, given that it is authored by several affiliates of the industry-funded group, the International Life Sciences Institute (ILSI), including Harry Kuiper[39] (also the chair of EFSA's GMO panel), Josef Schlatter, and Susan Barlow.[40] Because ILSI is funded by GM crop development companies, allowing ILSI affiliates to write EFSA's scientific advice on how to assess the safety of GM foods and crops is akin to allowing a student to write his or her own examination paper – or allowing scientists to review their own papers submitted for publication!

3.1.4 Masking statistical significance through the concept of "normal variation"

Studies often find statistically significant differences in the composition of GM foods compared with their isogenic or near-isogenic non-GM counterparts (isogenic means genetically identical except for the one gene of interest, in this case the genetically modified gene). Studies also find statistically significant differences in animals fed a GM crop variety compared with animals fed the isogenic or near-isogenic variety.

However, GM proponents consistently dismiss these statistically significant differences in the experiment under examination by claiming that they are within the "normal variation range" or "within the range of biological variation".

This tactic was used in a review of animal feeding studies on GMOs (the review included many of the studies summarised in this report). In spite of the significant differences found in the GM-fed animals, the reviewers used the concept of normal variation to argue that "GM plants are nutritionally equivalent to their non-GM counterparts and can be safely used in food and feed".[26]

However, this is scientifically unjustifiable. GM proponents define the "normal range of variation" by collecting values from many different studies carried out across a wide range of dates, using different experimental conditions and measurement methods. The result is a set of numbers that vary widely, but there is no scientific justification for including those numbers in the same dataset. On the contrary, there is much justification for excluding most of the values.

By using a dataset with such an unjustifiably wide range of variation, GM proponents are able to hide the genuine and meaningful differences between the GMO of interest and the valid controls – namely the isogenic or near-isogenic variety.

This is an attempt to minimize statistically significant differences brought about by the

GM process by artificially widening the range of values compared beyond what can be scientifically justified. The practice runs counter to the aim of scientific experiments, which are designed to minimise variables. According to rigorous scientific practice, in any single experiment, the scientist manipulates just one variable in order to test its effect. In this way, any changes that are observed can be traced to a probable single cause.

In an animal feeding trial with GMOs, the manipulated variable is the GMO. One group of animals, the "treated" group, is fed a diet containing the GMO. Another group, the control group, is fed a similar diet, with the only difference being that it has not been subject to genetic modification. All conditions of the experiment outside the GM component of the treated group's diet must be the same. Within this tightly controlled setup, any changes seen in the treated group are likely to be caused by the GM process.

Therefore, in any experiment to discover the effects of a GMO in an animal feeding trial, the only valid comparator is the control group within that same experiment (the concurrent control).

By comparing the treated group with a wide variety of control groups from other experiments (sometimes called "historical control data"), GM proponents are masking the effects of the GM process or GM diet, as any GM-related changes will disappear in the "noise" of the changes caused by many variables.

3.1.5. Regulators currently do not require long-term tests on GMOs

In order to detect health effects caused over time in humans eating GM foods, long-term (chronic) animal feeding trials are needed. But currently, no long-term tests on GM crops or foods are required by regulatory authorities anywhere in the world. Reproductive and multigenerational tests, which are necessary to discover effects of GM crops or foods on fertility and future generations, are also not required.[11]

This contrasts with the testing requirements for pesticides or drugs, which are far more stringent. Before a pesticide or drug can be approved for use, it must undergo one-year, two-year, and reproductive tests on mammals.[12] Yet GM foods escape such testing, in spite of the fact that virtually all commercialised GM foods are engineered either to contain an insecticide or to tolerate being sprayed with large amounts of herbicide, so they are likely to contain significant amounts of pesticides.

The longest tests that are routinely conducted on GM foods for regulatory assessments are 90-day rodent feeding trials, and even these are not compulsory.[11] While a 2012 EU draft regulation requests such tests for the time being, the wording is weak and foresees a situation in which they are not required.[41] Also, the type of findings that would trigger a regulatory requirement for such tests has not been specified.[42]

Such 90-day rodent trials are medium-term (subchronic) tests that correspond to only a few years in terms of human lifespan and are too short to show long-term effects such as organ damage or cancer.[43] In addition, too few animals are used in these industry tests to reliably detect harmful effects.

In spite of these serious shortcomings of regulatory tests, statistically significant harmful effects have been found even in industry's own 90-day rodent feeding trials. The most common effects observed are signs of toxicity in the liver and kidney, which are the major detoxifying organs and the first to show evidence of chronic disease.[11]

These observations are consistently interpreted by GM proponents and regulators as "not biologically significant" or as "within the range of normal variation", using the spurious arguments described in Section 3.1.4, above.

3.1.6. Stacked-trait crops are less rigorously tested than single-trait crops

Most GM crops currently on the market and in the approvals pipeline are not single-trait crops but stacked-trait crops. "Stacked-trait" means that several GM traits are combined in one seed. For example, GM SmartStax maize has eight GM traits: six for insect resistance (Bt) and two for tolerance to different herbicides.

Biotech companies have had to resort to

developing multi-trait crops because of the failure of single traits. For example (see Section 5):

- Bt crops have fallen victim to secondary insect pests
- Pests have developed resistance to single Bt toxins
- Weeds have become increasingly resistant to glyphosate, the herbicide that most first-generation GM crops were engineered to tolerate.

Stacked GM crops present more of a regulatory challenge than single-trait crops because of the risk of unexpected interactions between the different GM genes introduced into the crop – and between the introduced GM genes and the genes of the host plant. There is also the risk of combination effects from toxins produced in the plant and/or pesticide residues. In short, the addition of multiple traits to a single crop increases the risk of unexpected and unintended harmful side-effects.

However, stacked-trait GM crops are even less rigorously investigated for possible health effects than single-trait GM crops. While the US does not require toxicological testing of any GM crops, Europe currently requires 90-day toxicological testing on single-trait GM crops. But in the case of stacked-trait crops, the EU food safety authority EFSA does not require toxicity testing of the final stacked-trait crop, believing that it can assess the toxicity of the final stacked-trait crop by looking at industry test findings on the single-event crops that were used to develop it.[44]

This move is irresponsible in the extreme, as such an assessment process depends on a series of assumptions, not on scientific testing. It fails to look at the actual effects of the mixed transgenes and their products within the crop.

3.2 **Myth:** EU research shows GM foods are safe **Truth:** EU research shows evidence of harm from GM foods

GM proponents often refer to research studies that they claim show the safety of GM foods. However, on closer examination, these same studies raise serious safety concerns. A related tactic is to claim that regulatory authorities have pronounced GM foods to be safe – when the regulators' actual statements are either equivocal or are based on industry-provided data.

The success of these tactics relies on the likelihood that few people will look at the source documents that are claimed to provide evidence for the safety of GM foods.

An example of such misrepresented sources is a group of fifty research projects funded by the European Union around the topic of the safety of GMOs for animal and human health and the environment. The results of the projects were published in 2010 by the European Commission in a report called *A Decade of EU-Funded GMO Research (2001–2010)*.[45]

This EU report has been seized upon by GM proponents and some EU officials to bolster their claims that GMOs are safe. Some says that EU regulators have also reached this conclusion, based on the projects' findings. Those who have cited the projects in this way include:

- The GM industry lobby group ISAAA[46]
- Jonathan Jones, a British Monsanto-connected scientist[47 48]
- Nina Fedoroff, former science and technology adviser to US secretary of state Hillary Clinton[49]
- Máire Geoghegan-Quinn, European Commissioner for research, innovation and science.[50]

Oddly, however, ISAAA, Jones, and Federoff do not cite any actual studies performed by the EU researchers. They do not even cite the findings or conclusions of the Commission's report on the studies, *A Decade of EU-Funded GMO Research.*

Instead, they cite a quote from an EU Commission press release announcing the publication of its report. The press release cites Máire Geoghegan-Quinn, European Commissioner for research, innovation and science, as stating that the EU research projects provided "no scientific evidence associating GMOs with higher risks for the environment or

for food and feed safety than conventional plants and organisms".[50]

But it was not the studies' findings, nor even the Commission's report of those findings, but Geoghegan-Quinn's soundbite about the report that found its way into the GM proponents' statements. Closer examination of the case shows why.

Tracing the evidence back to its source, we examine first the report to which Geoghegan-Quinn was referring in her quote: *A Decade of EU-Funded GMO Research*. Of the fifty research projects discussed in the report, just ten are listed as relating to safety aspects of GM foods.[45]

However, within those ten projects, there is astonishingly little data of the type that could be used as credible evidence regarding the safety or harmfulness of GM foods. Such evidence would normally consist of long-term animal feeding studies comparing one group of animals fed a diet containing one or more GM ingredients with a control group fed a diet containing the same ingredients in non-GM form. Instead, the studies examine such topics as risk assessment of GM foods, methods of testing for the presence and quantity of GMOs in food and feed, and consumer attitudes to GM foods.

This data is not relevant to assessing the safety of any GM food. In fact, the report makes clear that the food safety research studies were not designed to do so – though taxpayers would be entitled to ask why the Commission spent 200 million Euros of public money[45] on a research project that failed to address this most pressing of questions about GM foods. Instead, the research studies were designed to develop "safety assessment approaches for GM foods".[45] One of the published studies carried out under the project confirms that the aim was "to develop scientific methodologies for assessing the safety" of GM crops.[23]

Nonetheless, a few animal feeding studies with GM foods were carried out as part of the EU project. It is difficult to work out how many studies were completed, what the findings were, and how many studies passed peer review and were published, because the authors of the EU Commission report fail to reference specific studies to back up their claims. Instead, they randomly list references to a few published studies in each chapter of the report and leave the reader to guess which statements refer to which studies.

In some cases it is unclear whether there is any published data to back up the report's claims. For example, a 90-day feeding study on hamsters is said to show that "the GM potato was as safe as the non-GM potato", but no reference is given to any published study or other source of data, so there is no way of verifying the claim.[45]

Our own search of the literature uncovered three published studies on GM food safety that were carried out as part of SAFOTEST, one of the ten food safety-related projects. Our examination of these studies below reveals that, contrary to the claims of GM proponents and Commissioner Geoghegan-Quinn, they do not show the safety of GM food but rather give cause for concern.

3.2.1. Poulsen (2007)[22]

A feeding trial on rats fed GM rice found significant differences in the GM-fed group as compared with the control group fed the non-GM parent line of rice. These included a markedly higher water intake by the GM-fed group, as well as differences in blood biochemistry, immune response, and gut bacteria. Organ weights of female rats fed GM rice were different from those fed non-GM rice. Commenting on the differences, the authors said, "None of them were considered to be adverse". But they added that this 90-day study "did not enable us to conclude on the safety of the GM food."[22]

In reality, a 90-day study is too short to show whether any changes found are "adverse" (giving rise to identifiable illness). Yet no regulatory body requires GM foods to be tested for longer than this subchronic (medium-term) period of 90 days.

The study found that the composition of the GM rice was different from that of the non-GM parent, in spite of the fact that the two rice lines were grown side-by-side in identical conditions. This is clear evidence that the GM transformation process had disrupted gene structure and/or function in the GM variety, making it non-substantially equivalent to the non-GM line.

3.2.2. Schrøder (2007)[23]

A study on rats fed GM Bt rice found significant differences in the GM-fed group of rats as compared with the group fed the non-GM isogenic line of rice. These included differences in the distribution of gut bacterial species – the GM-fed group had 23% higher levels of coliform bacteria. There were also differences in organ weights between the two groups, namely in the adrenals, testis and uterus. The authors concluded that the "possible toxicological findings" in their study "most likely will derive from unintended changes introduced in the GM rice and not from toxicity of Bt toxin" in its natural, non-GM form.[23]

The study found that the composition of the GM rice was different from that of the non-GM isogenic (with the same genetic background but without the genetic modification) variety in levels of certain minerals, amino acids, and total fat and protein content.[23] These differences were dismissed on the basis that they were within the range reported for all varieties of rice in the literature. However, comparing the GM rice to genetically distinct, unrelated rice varieties is scientifically flawed and irrelevant. It serves only to mask the effects of the GM process (see 2.1.5, 2.1.6, 2.1.7).

Despite this flawed approach, the level of one amino acid, histidine, was markedly higher in the GM rice compared with the non-GM isogenic variety and outside the variability range for any rice.[23] Does this matter? No one knows, as the required investigations have not been carried out. What is known is that in other studies on rats, an excess of histidine caused rapid zinc excretion[51] and severe zinc deficiency.[52]

In addition, the level of the fatty acid, stearic acid, was below the value reported in the literature for any rice.[23]

3.2.3. Kroghsbo (2008)[24]

A study on rats fed GM Bt rice found a Bt-specific immune response in the non-GM-fed control group as well as the GM-fed groups. This unexpected finding led the researchers to conclude that the immune response in the control animals must have been due to their inhaling particles of the powdered Bt toxin-containing feed consumed by the GM-fed group. The researchers recommended that for future tests on Bt crops, GM-fed and control groups should be kept in separate rooms or with separate air handling systems.[24]

3.2.4. Conclusion on the SAFOTEST studies

The three SAFOTEST studies examined above provide no evidence of safety for GM foods and crops. On the other hand, they provide evidence that:

- Over a decade after GM foods were released into the food and feed supplies, regulators still have not agreed on methods of assessing them for safety
- The GM foods tested were markedly different in composition from their non-GM counterparts – probably due to the mutagenic or epigenetic (producing changes in gene function) effects of the GM process
- The GM foods tested caused unexpected, potentially adverse effects in GM-fed animals that should be investigated further in long-term tests
- The authors were not able to conclude that the GM foods tested were safe.

3.3 **Myth:** Those who claim that GM foods are unsafe are being selective with the data, since many other studies show safety
Truth: Studies that claim safety for GM crops are more likely to be industry-linked and therefore biased

> *"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 [with] study outcomes that cast genetically modified products in a favourable light."*
> – Diels J, 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. 2011; 36: 197–203

When it comes to hazardous products, the bias of industry-sponsored or industry-linked studies is well documented. Every time industry-linked studies are compared with studies on the same product from the independent (non-industry-linked) scientific literature, the same verdict is reached: industry studies are biased towards conclusions of safety for the product.

The best known example is tobacco industry studies, which successfully delayed regulation for decades by manufacturing doubt and controversy about the negative health effects of smoking and passive smoking.[53] More recently, studies sponsored by the pharmaceutical and mobile phone industry have been shown to be more likely to portray their products in a favourable light than non-industry-funded studies.[54,55,56]

The case of GM crops is no different. Reviews of the scientific literature on the health risks of GM foods demonstrate that the studies that show safety are more likely to be industry-linked and are therefore inherently biased:

- A review of 94 published studies on health risks and nutritional value of GM crops found that they were much more likely to reach favourable[53] conclusions when the authors were affiliated with the GM industry than when the authors had no industry affiliation. In the studies where there was such a conflict of interest, 100% (41 out of 41) reached a favourable conclusion on GMO safety.[57]
- A literature review of GM food safety studies found that most studies concluding that GM foods are as nutritious and safe as non-GM counterparts were performed by the developer companies or associates.[58]

In spite of the fact that industry-linked studies have been shown to be biased, approvals for GM crops are based solely on such industry studies.

Another tactic used by GM proponents is to point to lists of studies which they say show that GM foods are safe, but which actually show nothing of the sort. An example is on the GMO Pundit blog site, which claims that the over 400 cited studies "document the general safety and nutritional wholesomeness of GM foods and feeds."[59]

But closer examination reveals:

- Most of the studies cited are not safety studies on GM foods. In other words, they are not animal feeding studies that look for health effects in animals fed GM foods. Some are compositional studies that compare the levels of certain major nutrients, such as fat or protein, in a GM crop with levels in a non-GM crop. Others are feed conversion studies that measure how efficiently a livestock animal converts GM feed into a food product, such as meat or milk.
- Many of the studies, on examination of the actual data, show problems with GM foods. These include unintended differences in a GM food compared with the non-GM counterpart and harmful effects in animal feeding trials. In fact, some of these studies are cited in this report as evidence that GM foods are not safe. Readers are encouraged to examine the original studies, where available, and form their own conclusions.

In contrast with these lists on GM proponents' websites, the two peer-reviewed literature reviews cited above identified and evaluated the studies that specifically examine the food safety and nutritional value of GM foods. Their conclusions were clear: industry-linked studies are more likely to conclude safety, whereas independent studies are more likely to find problems.[57,58]

3.4 **Myth:** GM foods have been proven safe for human consumption **Truth:** The few studies that have been conducted on humans show problems

GM foods are not properly tested for human safety before they are released for sale.[60,19] The only published studies that have directly tested the safety of GM foods for human consumption found potential problems but were not followed up:

- In a study on human volunteers fed a single GM soybean meal, GM DNA survived processing and was detected in the digestive tract. There was evidence of horizontal gene transfer to gut bacteria.[61,62] Horizontal gene transfer is a process by which DNA is transferred from one organism to another through mechanisms other than reproductive mechanisms. These mechanisms enable one organism to incorporate into its own genome genes from another organism without being the offspring of that organism.
- In a study on humans, one of the experimental subjects showed an immune response to GM soy but not to non-GM soy. GM soy was found to contain a protein that was different from the protein in non-GM soy. This shows that GM foods could cause new allergies.[63]
- A GM soy variety modified with a gene from Brazil nuts was found to react with antibodies present in blood serum taken from people known to be allergic to Brazil nuts. Based on current immunological knowledge, this observation indicates that this soy variety would produce an allergic reaction in people allergic to Brazil nuts.[64]
- A study conducted in Canada detected significant levels of the insecticidal protein, Cry1Ab, which is present in GM Bt crops, circulating in the blood of pregnant women and in the blood supply of their foetuses, as well as in the blood of non-pregnant women.[65] How the Bt toxin protein got into the blood (whether through food or another exposure route) is unclear and the detection method used has been disputed by defenders of GM crops. Nevertheless, this study raises questions as to why GM Bt crops are being commercialised widely, when existing research raises serious concerns about their safety and yet no systematic effort is under way to replicate and thereby assess the validity of that research.

These studies should be followed up with controlled long-term studies and GM foods and crops should not be commercialised in the absence of such testing.

3.5 **Myth:** No one has ever been made ill by a GM food **Truth:** There is no scientific evidence to support this claim

GM proponents claim that people have been eating GM foods in the United States for 16 years without ill effects. But this is an anecdotal, scientifically untenable assertion, as no epidemiological studies to look at GM food effects on the general population have ever been conducted.

Furthermore, there are signs that all is not well with the US food supply. Reports show that food-related illnesses increased two- to ten-fold in the years between 1994 (just before GM food was commercialized) and 1999.[66,67] No one knows if there is a link with GM foods because they are not labelled in the US and consumers are not monitored for health effects.

Under the conditions existing in the US, any health effects from a GM food would have to meet very specific and unusual conditions before they would be noticed. They would have to:

- Occur soon after eating a food that was known to be GM – in spite of its not being labelled – so that the consumer could establish a causal correlation between consumption and the harmful effect. Increases in diseases like cancer, which has a long latency period, would not be traceable to a GM food.
- Cause symptoms that are different from common diseases. If GM foods caused a rise in common diseases like allergies or cancer, nobody would know what caused the rise.
- Be dramatic and obvious to the naked eye or to the consumer of the GMO. No one examines a person's body tissues with a microscope for harm after they eat a GM food. But just this type of examination is needed to give early warning of problems such as pre-cancerous changes.

In addition, health effects would have to be recorded and reported by a centralized body that the public knew about and that could collate data as it came in and identify correlations. Currently, there is no such monitoring body in place anywhere.

Moderate or slow-onset health effects of GM foods could take decades to become apparent through epidemiological studies, just as it took decades for the damaging effects of trans fats (another type of artificial food) to be recognised. Slow-poison effects from trans fats have caused millions of premature deaths across the world.[68] To detect important but subtle effects on health, or effects that take time to appear (chronic effects), long-term controlled studies on large populations would be needed.

3.5.1. Two outbreaks of illness linked to GM foods

Two high-profile cases have emerged in which a GM food was suspected of causing illness in people. In both cases, industry and regulators denied that genetic engineering was the cause, but an examination of the evidence gives no such reassurance.

L-tryptophan

In 1989 in the US, a food supplement, L-tryptophan, produced using GM bacteria, was found to be toxic, killing 37 people and permanently disabling over 1500 others.[69,70,71] The resulting disease was named eosinophilia myalgia syndrome (EMS). Symptoms included an overproduction of white blood cells called eosinophils, severe myalgia (muscle pain), and in some cases, paralysis.

The L-tryptophan that affected people was traced back to a single source, a Japanese company called Showa Denko. In July 1990, a study published in the Journal of the American Medical Association mentioned that Showa Denko had introduced a new genetically engineered bacterium, called Strain V, in December 1988, a few months before the main epidemic hit.[71]

There is an ongoing debate about whether the toxin's presence in the L-tryptophan was due to genetic engineering or to Showa Denko's sloppy manufacturing processes. The company had made changes to its carbon filtration purification process before the toxic contaminant was discovered.

However, the authors of a 1990 study on the outbreak published in the New England Journal of Medicine (NEJM) pointed out that blaming a failure in the carbon filtration process leaves unanswered the question of how the toxin got into the product in the first place.[72] This was a novel toxin that was not found in other companies' L-tryptophan products. The authors of the study, which was sponsored by the US Centers for Disease Control, noted that the new GM bacterial strain introduced by the manufacturer before the outbreak "may have produced larger quantities" of the toxin than earlier strains.[72]

One of the study's co-authors, Dr Michael Osterholm, an epidemiologist at the Minnesota Department of Health, commented in a press article of August 1990 that the new bacterial strain "was cranked up to make more L-tryptophan and something went wrong. This obviously leads to that whole debate about genetic engineering."[73]

Following Osterholm's comment, a number of press articles appeared voicing doubts about the safety of genetic engineering. The FDA took on the role of exonerating genetic engineering from blame for the EMS epidemic. An article in Science magazine quoted FDA official Sam Page as saying that Osterholm was "propagating hysteria". Tellingly, Page added, "The whole question: Is there any relation to genetic engineering? is premature – *especially given the impact on the industry*"[74] (our emphasis).

Osterholm countered: "Anyone who looks at the data comes to the same conclusion [that there may be a link with genetic engineering]... I think FDA doesn't want it to be so because of the implications for the agency."[74]

James Maryanski, FDA biotech policy coordinator, blamed the EMS epidemic on Showa Denko's changes to the purification process.[75] Maryanski also said that genetic engineering could not have been solely or even chiefly responsible for EMS because cases of the illness had been reported for several years before Showa Denko introduced its genetically engineered bacterial Strain V in December 1988.[76]

However, a study published in 1994 shows that this argument is misleading. Showa Denko had named its bacterial strain "V" because there had been four previous strains of the bacterium. Over a period of years, Showa Denko had progressively introduced more genetic modifications into the bacteria used in its manufacturing process. It began using Strain V in December 1988, shortly before the EMS main outbreak in 1989.[69] But it had begun using its first genetically modified strain, Strain II, in 1984, according to lawyers who took on the cases of EMS sufferers.[77] This timescale means that Showa Denko's genetically engineered bacteria could have been responsible for the EMS epidemic.

The FDA responded to the crisis by claiming that all L-tryptophan was dangerous and temporarily banning all L-tryptophan from sale.[78] But a study sponsored by the Centers for Disease Control said if that were true, then "all tryptophan products of equal dose produced from different companies should have had the same [effect]". The study concluded that this was not the case, since out of six manufacturers of L-tryptophan, only Showa Denko's product was clearly associated with illness.[79]

If Showa Denko's L-tryptophan were produced today, it would have to be assessed for safety, since it was derived from GM bacteria. However, since this L-tryptophan was greater than 99% pure and devoid of DNA, it would be passed as substantially equivalent to the same substance obtained from non-GM organisms. In other words, the tests that would be required to detect novel toxins of this type would be seen as unnecessary and no labelling would be required. So the same tragedy would result.[80]

StarLink maize

In 2000 in the US, people reported allergic reactions, some of them severe, to maize (corn) products. A GM Bt maize called StarLink was found to have contaminated the food supply. Regulators had allowed StarLink to be grown for animal feed and industrial use but had not approved it for human food because of suspicions that the Bt insecticidal protein it contained, known as Cry9C, might cause allergic reactions.

The number of people who reported allergic reactions to maize products is not known because

there was no centralized reporting system. The US Food and Drug Administration (FDA) analyzed reports that had reached it and asked the US Centers for Disease Control (CDC) to investigate just 28 cases that met its criteria. CDC carried out tests on blood serum taken from these people but concluded that the findings did not provide evidence that the allergic reactions were associated with the Cry9C protein.[81]

However, there were problems with the CDC investigation, many of which were identified by the researchers themselves. For example, the control group of serum was obtained from blood samples taken before the 1996 release of StarLink. Yet this serum showed a more dramatic allergic response to Cry9C than the serum from people who had reported allergic reactions to StarLink.[81] The researchers stated that this is common in samples that have been frozen and stored, as the control samples had been. But they expressed no concern that this would skew the results towards a false conclusion of no effect from StarLink. Neither did they replace the problem control samples with more reliable ones – for example, samples freshly taken from people who were unlikely to have been exposed to StarLink.

CDC's test and findings were reviewed by a panel convened by the US Environmental Protection Agency (EPA) – which criticised them on several grounds. The panel pointed out that the CDC researchers had isolated the Cry9C protein from E. coli bacteria rather than from StarLink maize. So the protein tested would have been different from the Cry9C protein suspected of causing allergic reactions.[82] Specifically, the Cry9C protein from E. coli bacteria would have lacked sugar molecules, which would have been attached through a process called glycosylation to the same protein derived from maize. Glycosylation can be crucial in eliciting an allergic reaction. CDC's use of the incorrect protein invalidates its analysis and conclusions.

The seriousness of CDC's error in using E. coli- rather than maize-derived Cry9C protein is graphically illustrated by the study on GM peas containing an insecticidal protein from beans (see 3.1.1).[4] The study found marked changes in the pattern of sugar molecules on the insecticidal protein expressed in the GM peas, as compared with its native form in beans. The authors concluded that this change in the nature and structure of the sugar molecules was the reason why the GM insecticidal protein caused immune and allergic-type inflammation reactions in mice.

This case shows that it is necessary to derive the GM protein being studied from the GM crop rather than an unrelated source, as sugar molecule patterns will differ and the potential to cause immune and allergic reactions could vary significantly between the two.

Furthermore, the EPA panel criticised the CDC's test for its lack of proper controls. It also questioned the methodology and sensitivity of the test used. The EPA panel concluded, "The test, as conducted, does not eliminate StarLink Cry9C protein as a potential cause of allergic symptoms". The panel's verdict was that there is a "medium likelihood" that the Cry9C protein is an allergen.[82]

3.5.2. Conclusion

Claims that no one has been made ill by a GM crop or food are scientifically unjustifiable, since no epidemiological studies have been carried out. However, the cases of L-trypophan produced with GM bacteria and StarLink maize give cause for concern.

3.6 **Myth:** GM Bt insecticidal crops only harm insects and are harmless to animals and people
Truth: GM Bt insecticidal crops pose hazards to people and animals that eat them

Many GM crops are engineered to produce Bt toxin, a type of insecticide. Bt toxin in its natural, non-GM form is derived from a common soil bacterium and is used as an insecticidal spray in chemically-based and organic farming.

Regulators have approved GM Bt crops on the assumption that the GM Bt toxin is the same as the natural Bt toxin, which they say has a history of safe use. They conclude that GM crops engineered to contain Bt insecticidal protein must also be harmless.

But this is false, for the following reasons:

- Natural Bt toxin is not necessarily the same as the Bt toxin expressed by GM Bt plants. The Bt toxin protein in GM plants may be truncated or otherwise modified. For example, there is at least a 40% difference between the toxin in Bt176 maize (formerly commercialised in the EU, now withdrawn) and natural Bt toxin.[11] Such changes can mean that they have very different effects on people or animals that eat them. Prions (the folded proteins found in BSE-infected cows), venoms, and hormones, are all proteins, but are far from harmless.[83]
- The natural Bt toxin used in insecticidal sprays behaves differently in the environment from the Bt toxin produced in GM plants. Natural Bt breaks down rapidly in daylight and only becomes active (and toxic) in the gut of the insect that eats it. It does not persist in the environment and so is unlikely to find its way into animals or people that eat the crop. With GM Bt crops, however, the plant is engineered to express the Bt toxin protein in active form in every cell. In other words, the plant itself becomes a pesticide, and people and animals that eat the plant are eating a pesticide.
- Even natural Bt toxin has been found to have negative health effects. In farm workers, exposure to Bt sprays was found to lead to allergic skin sensitisation and immune responses.[84] And laboratory studies found that natural Bt toxin has ill effects on mammals, producing a potent immune response and enhancing the immune response to other substances.[85,86,87]
- Safety tests for regulatory purposes are generally not carried out on the Bt toxin protein as expressed in the GM plant. The Bt toxin protein that is tested is usually derived from genetically engineered E. coli bacteria, as GM companies find it too difficult and expensive to extract enough Bt toxin from the GM crop itself. As we have seen, the GM process gives rise to unexpected changes in the desired protein, so it cannot be assumed that the Bt toxin protein derived from E. coli bacteria is the same as the protein derived from the GM plant that people and animals will eat. Indeed, the US Environmental Protection Agency, in its review of the commercialised Monsanto GM maize MON810, said it produces a "truncated" version of the protein – in other words, a protein that is not the same as the natural form.[60] Such changes can make a protein more toxic or allergenic.

3.6.1. Bt toxin does not only affect insect pests

GM proponents claim that the Bt toxin engineered into GM Bt crops only affects the target pests and is harmless to mammals, including people or animals that eat the crops.[88] Based on this assumption, regulators do not require human toxicity studies on GM Bt crops.

But the assumption is incorrect. In a 2012 test-tube (in vitro) study, genetically engineered Bt toxins were found to be toxic to human cells. One type of Bt toxin killed human cells at the dose of 100 parts per million. The findings showed that GM Bt toxin does affect humans, contrary to claims from the GM lobby and regulators.[83]

The GM lobby responded by saying that in vitro studies do not accurately reflect what happens in a living human or animal that eats GM Bt crops. But

other independent studies have found that GM Bt crops have adverse effects when fed to laboratory animals. Findings include:

- Toxic effects on the small intestine, liver, kidney, spleen, and pancreas[12,14,16,21,40]
- Disturbances in the functioning of the digestive system[16]
- Reduced weight gain[12]
- Immune system disturbances.[15]

Aside from laboratory animals and human cells, GM Bt crops have been found to have toxic effects on butterflies and other non-target insects,[89,90,91] beneficial pest predators,[92,93] bees,[94] and aquatic[95,96] and soil organisms[97] (see section 4).

It is premature to say that the toxic effects associated with GM Bt crops are due to the Bt toxin from the crops. The effects may be due to one or more of the following causes:

- The Bt toxin as produced in the GM crop
- New toxins produced in the Bt crop by the GM process, and/or
- Residues of herbicides or chemical insecticides used on the Bt crop. Many Bt crops have added herbicide-tolerant traits,[98] making it likely that herbicide residues will be found on them.

3.6.2. Bt toxin protein may not be broken down harmlessly in the digestive tract

GM proponents claim that the Bt toxin insecticidal protein in GM plants is broken down in the digestive tract and so cannot get into the blood or body tissues to cause toxic effects.

But digestion is generally an incomplete process and studies show that Bt toxin protein is not always fully broken down:

- A study on cows found that Bt toxins from GM maize MON810 were not completely broken down in the digestive tract.[99]
- A study simulating human digestion found that the Bt toxin protein was highly resistant to being broken down in realistic stomach acidity conditions and still produced an immune response.[100]
- A study conducted on pregnant and non-pregnant women in Canada found Bt toxin protein circulating in the blood of pregnant women and the blood supply to their foetuses, as well as in the blood of non-pregnant women.[65] Questions have been raised about the validity of the detection method, but further investigation is needed before Bt crops can be claimed to be safe for humans.

3.6.3. Conclusion

Studies on GM Bt crops show that Bt toxin is not specific to a narrow range of insect pests but can affect a wide variety of non-target organisms. Taken together, the studies on GM Bt crops and natural Bt toxin raise the possibility that eating GM crops containing Bt toxin may cause toxic or allergic reactions and/or sensitise people to other food substances.

3.7 **Myth:** GM foods are properly tested for ability to cause allergic reactions

Truth: No thorough allergenicity testing is conducted on GM foods

> *"There is more than a casual association between GM foods and adverse health effects…. Multiple animal studies show significant immune dysregulation, including upregulation of cytokines [protein molecules involved in immune responses] associated with asthma, allergy, and inflammation."*
>
> – American Academy of Environmental Medicine[101]

Most food allergies are caused by a reaction to a protein in a food. The DNA of an organism contains instructions for making proteins. Genetic engineering changes the DNA of a food, and that altered DNA can in turn can create new proteins. Therefore, GM foods could create new allergies in two ways: the new proteins could cause allergic reactions (be "allergens") themselves, or the new proteins could sensitise people to existing food proteins.

The website GMO Compass, which is run by the public relations firm Genius GmbH, claims that GM plants pose no greater risk than new varieties of crops obtained through conventional breeding, or the importation of new exotic foods, which can also result in new allergens appearing in the diet.[102]

But independent scientists disagree. A 2003 review states that compared with conventional breeding, GM has a "greater potential to introduce novel proteins into the food supply" and increase the likelihood of allergic reactions.[103] This was confirmed by a rare study on humans, in which one of the experimental subjects showed an immune response to GM soy but not to non-GM soy. GM soy was found to contain a protein that was different from the protein in the non-GM variety.[63]

3.7.1. The EU system for assessing GM plants for allergenicity

Under European law, GM plants must be assessed for their potential to cause allergies before they are allowed onto the market. Proponents claim that any potentially allergenic GM foods are likely to be caught by these regulatory checks. The GMO Compass website calls these assessments "rigorous" and adds, "If a GM plant is found to contain a potential allergen, its chances of receiving approval in the EU are slim to none."[102,104]

But in reality, the European regulatory process, though stronger than the US process, has no rigorous system for assessing the allergenic potential of GM foods. This is largely because reliable scientific tests to predict allergenicity have not been developed.

The process that EU regulators use to assess the allergenicity of GM foods[102,105] is based on a system proposed in 2001 by the Food and Agriculture Organisation of the United Nations and the World Health Organisation.[106] This system was actually designed by two GM industry-funded groups, the International Life Sciences Institute (ILSI), and the International Food Biotechnology Council (IFBC), as the FAO/WHO freely states.[106]

The process begins with a comparison of the protein that the GM plant is designed to produce with known allergenic proteins. Depending on the outcome of this initial assessment, further investigations can include:

- Tests to see if the new protein reacts with the blood serum of sensitive individuals
- Artificial stomach tests to see if the protein is broken down easily (if it is, it is thought unlikely to be an allergen)
- Animal feeding trials.[102]

3.7.2. Why the allergy assessment process is ineffective

Independent scientists have stated that the EU's allergenicity assessment is unlikely to reliably predict whether a GM food is likely to cause allergic reactions.

The most important reason is that the new protein that is assessed in the regulatory process is normally not the protein as expressed in the whole GM plant. Instead, it is what is known as a surrogate protein. This surrogate protein is isolated from sources such as GM E. coli bacteria or, occasionally, a different plant species.[107] This is scientifically unjustifiable because the protein can change as a result of the genetic engineering process and according to the organism within which it is expressed (see 3.1.1 and 3.5.1: StarLink maize). In other words, the same GM gene introduced into a GM plant and into E. coli bacteria can produce proteins that can have very different effects on the people and animals that eat them. In particular, bacteria and plants process newly synthesized proteins in different ways. So even though the amino acid sequences of the two proteins may be identical, their functions can be quite different.

Other reasons why the allergenicity decision tree model is unsatisfactory include:

- A comparison of the new protein in the GM food with the database of known allergens may not detect new allergens.
- Blood serum tests are problematic because allergenic sensitization is an allergen-specific process. So unless the transgenic protein expressed in the GMO is already a common allergen, there is unlikely to be a single sensitized person in the world whose blood serum would react with it.[103]
- Blood serum tests are not useful in detecting uncommon allergens (substances that few people are allergic to).[103]
- A phenomenon known as cross-reactivity can make it difficult to identify from blood serum testing which specific protein out of several is the allergen.[103]
- The artificial stomach tests carried out for regulatory purposes are performed under unrealistic conditions – levels of acidity and digestive enzymes are much higher than would be present in the digestive systems of individuals that would consume the GMO. This makes it likely that the new GM protein will be broken down into fragments that are too small to be potent allergens. In real life, however, the levels of acidity and digestive enzymes in people's stomachs vary, according to age, health status, length of time since they ate their last meal, and other factors. One study found that under the standard conditions used in artificial stomach tests, one of the insecticidal proteins commonly present in GM Bt crops was broken down. But when the researchers adjusted the acidity and enzymes to more realistic levels, the insecticidal protein was highly resistant to being broken down. The authors called for regulatory tests to be carried out in "more physiologically relevant" conditions of lower acidity and lower enzyme levels.[100]

One review concluded that the allergenicity assessment might be useful in assessing GM foods containing a known allergenic protein, but that assessing proteins of unknown allergenicity is "more problematic" and "the predictive value of such an assessment is unknown".[103] A separate review agrees that the standard tests are "not always conclusive", especially when the organism from which the GM gene is taken has no history of dietary use or has unknown allergenicity.[108]

The current allergy assessment system is not reliable because it relies heavily on in vitro tests (test-tube tests on non-living systems, such as the blood serum and artificial stomach tests). But unfortunately, an effective alternative does not yet exist. In vivo tests (tests on living organisms such as animals or humans) are useful for detecting nutritional or toxicological effects of foods, but no animal testing methods have yet been established for allergenicity testing of foods.[103,108,109,110] Independent scientists have asked for such animal tests to be developed.[109,103,108,110]

At present, the only reliable approach to assessing the allergenicity of GMOs would be post-commercialisation monitoring under conditions where consumers are clearly informed when they consume the new GMO and are requested to report any adverse effects to designated authorities. Such post-commercialisation assessments are not required in any country. In countries such as the US and Canada, where consumers are not even informed by labelling of the presence of GMOs in the foods they are eating, the likelihood that allergenicity would be linked to a GMO would be extremely low, unless it caused

acute allergenicity problems to a large portion of the population.

3.7.3. Studies on GM foods confirm existing allergy assessments are inadequate

Studies on GM foods confirm that current allergy assessments are inadequate to detect new allergens created by the genetic engineering process.

In a study on mice fed GM peas containing an insecticidal protein from beans (see 3.1.1), mice showed antibody immune reactions and allergic-type inflammatory responses to the GM protein and chicken egg white protein when it was fed to them with the GM peas.

The mice did not show antibody immune reactions and allergic-type inflammatory responses to beans that naturally contain the insecticidal protein or to egg white protein when it was fed with the natural insecticidal protein obtained from beans. They also did not have an immune response to the egg white protein when it was fed on its own.

These outcomes show that the GM insecticidal protein made the mice more susceptible to developing allergic-type inflammatory reactions to foods eaten with the GM food. This is called immunological cross-priming.

The results indicated that the reaction of the mice to the GM peas was caused by changes brought about by the genetic engineering process. The normally non-immunogenic and non-allergenic insecticidal protein naturally produced in beans was altered in structure and/or function when engineered into peas, becoming a potent immunogen (substance that produces an immune response) and allergen.[4]

It is important to note that this study was not required by regulators, but was carried out as part of the developer's voluntary research programme. The allergenicity of the GM peas would likely not have been spotted by the EU's screening process because the natural, non-GM version of the bean insecticidal protein is not a known allergen. Because of this, blood serum from sensitised individuals would not have been available for regulatory serum tests.

Overall, the study shows that GM foods can contain new allergens and cause new allergic reactions – and that the GMO's allergenicity is unlikely to be detected using the current allergy assessment process.

Two other studies confirm the inadequacy of the current allergy assessment process:

- A study on a commercialised GM insecticidal maize, MON810, showed that the GM plant's proteins were markedly altered compared with those in the non-GM counterpart. Unexpected changes included the appearance of a new form of the protein zein, a known allergen, which was not present in the non-GM maize variety. A number of other proteins were present in both their natural forms and in truncated and lower molecular mass forms.[111] The findings suggest major disruptions in gene structure and function in this GM crop. The EU's allergy assessment failed to pick up these changes and failed to detect the presence of the newly created allergen.
- A GM soy variety modified with a gene from Brazil nuts was found to be capable of producing an allergic reaction in people who are allergic to Brazil nuts. The researchers had genetically engineered the Brazil nut gene into the soy in order to increase its nutritional value. When they tested the effect of this GM soy on blood serum from people allergic to Brazil nuts, they found that the serum produced an allergic response to the soy. Through scratch tests on skin, they confirmed that people allergic to Brazil nuts were allergic to the modified soybean.[64] This study is often cited by GM proponents as evidence of the effectiveness of regulatory processes in identifying allergenic foods before they reach the marketplace. But this is untrue. Tests such as this are not required to be carried out as part of the regulatory assessment of GM foods in any country.

3.7.4. Conclusion

The absence of reliable methods for allergenicity testing and the lack of rigour in current allergy assessments mean that it is impossible to reliably predict whether a GM crop will prove to be allergenic.

3.8 **Myth:** GM animal feed poses no risks to animal or human health **Truth:** GM feed affects the health of animals and may affect the humans who eat their products

Most GM crops go into animal feed. The GM industry and government regulators claim that meat, eggs, and dairy products from GM-fed animals do not need to carry a GM label because GM molecules – DNA and protein – are broken down in the animals' digestive tracts and is not detectable in the final food product.

But this assumption is false. Studies have found:

- GM DNA present in animal feed has been detected in milk sold on the Italian market, though the authors of the study said it was unclear whether the source of the GM DNA was ingestion by the animal or external contamination.[112]
- GM DNA in feed was taken up by the animal's organs and detected in the meat and fish that people eat.[113,114,115,116]
- GM feed was found to affect the health of animals that eat it. GM DNA from soy was detected in the blood, organs, and milk of goats. An enzyme, lactic dehydrogenase, was found at significantly raised levels in the heart, muscle, and kidneys of young goats fed GM soy.[117] This enzyme leaks from damaged cells during immune reactions or injury, so high levels may indicate such problems.
- Bt toxin protein was found circulating in the blood of pregnant women and the blood supply to their foetuses, as well as in the blood of non-pregnant women.[65]
- MicroRNAs (molecules that affect gene expression) of plants have been found in the blood of mammals that have eaten them and were biologically active in those mammals, affecting gene expression and the functioning of important processes in the body. While this study was not carried out on GM plants, it showed that plants that are eaten, including GM plants, could exercise a direct physiological effect on human and animal consumers.[118] The study suggested that the saying, "You are what you eat", may have some scientific credibility.

Given the growing evidence that a diet containing GM crops can damage the health of animals, there could be risks associated with the consumption of products derived from GM-fed animals. We conclude that the argument that meat and dairy products from GM-fed animals do not need to carry a GM label cannot be scientifically justified.

3.9 **Myth:** Genetic engineering will deliver more nutritious crops **Truth:** No GM crop that is more nutritious than its non-GM counterpart has been commercialised and some GMOs are less nutritious

GM proponents have long claimed that genetic engineering will deliver healthier and more nutritious "biofortified" crops. However, no such nutritionally enhanced GM foods are available in the marketplace. In some cases, GM foods have been found to be less nutritious than their non-GM counterparts, due to unexpected effects of the genetic engineering process.

Examples include:

- GM soy had 12–14% lower levels of cancer-fighting isoflavones than non-GM soy.[119]
- Canola (oilseed rape) engineered to contain vitamin A in its oil had much reduced vitamin E and an altered oil-fat composition, compared with the non-GM control.[120]
- Experimental GM rice varieties had unintended major nutritional disturbances compared with non-GM counterparts, although they were grown side-by-side in the same conditions. The structure and texture of the GM rice grain was affected and its nutritional content and value were dramatically altered. The variation ranged from 20 to 74% for amino acids, from 19 to 38% for fatty acids, from 25 to 57% for vitamins, from 20 to 50% for nutritionally important trace elements, and 25% for protein. GM rice varieties variously showed markedly decreased levels of vitamin E, protein, and amino acids. The authors said that their findings "provided alarming information with regard to the nutritional value of transgenic rice" and showed that the GM rice was not substantially equivalent to non-GM.[121]

3.9.1. Golden Rice: More hype than hope?

The best-known attempt to nutritionally improve a GM crop is beta-carotene-enriched "Golden Rice".[122,123] The crop is intended for use in poor countries in the Global South, where vitamin A deficiency causes blindness, illness, and deaths. However, despite over a decade's worth of headlines hyping Golden Rice as a miracle crop, it is still not available in the marketplace.

GM proponents blame excessive regulation and anti-GM activists for delaying the commercialisation of Golden Rice. But the real reasons for the delay seem to be basic research and development problems. The first Golden Rice variety had insufficient beta-carotene content and would have needed to be consumed in kilogram quantities per day to provide the required daily vitamin A intake.[122] As a result, a totally new GM rice variety had to be generated with much higher beta-carotene content.[123]

Also, the process of backcrossing Golden Rice with varieties that perform well in farmers' fields in order to ensure a viable product has taken many years.[124,125] A 2008 article in the journal Science said that there was still a "long way to go" in the backcrossing process.[124]

It has taken over a decade to develop Golden Rice. Yet as of 2012, field trials have not been completed to ensure that it grows successfully in local conditions. Nor has it been tested in toxicological feeding trials on animals to establish whether it is safe to eat. Nevertheless, the rice was fed to human subjects (adults and children) in experiments conducted by researchers at Tufts University, Boston, MA. This was not a safety study but an efficacy test to see whether the human subjects assimilated sufficient beta-carotene and converted it to vitamin A. The efficacy test was conducted without basic toxicological testing having been carried out. This was condemned as a breach of medical ethics and the Nuremberg Code (established after World War II to prevent a repeat of inhumane Nazi experiments on humans) by a group of international scientists in a letter of protest to the Tufts researchers.[126]

In contrast with the problematical Golden Rice, inexpensive and effective methods of combating

vitamin A deficiency have long been available. The most commonly used method is Vitamin A supplements. A review published in the British Medical Journal assessed 43 studies involving 200,000 children and found deaths were cut by 24% if children were given the vitamin. The researchers estimated that giving vitamin A supplements to children under the age of five in developing countries could save 600,000 lives a year. They concluded, "Vitamin A supplements are highly effective and cheap to produce and administer."[127,128]

The World Health Organization's long-standing project to combat vitamin A deficiency uses vitamin A supplements, backed up with education and development programmes. These programmes encourage mothers to breastfeed and teach people how to grow carrots and leafy vegetables in home gardens – two inexpensive, effective, and generally available solutions. WHO says its programme has "averted an estimated 1.25 million deaths since 1998 in 40 countries."[129] According to WHO malnutrition expert Francesco Branca, these approaches are, for now, more promising approaches to combating vitamin A deficiency than Golden Rice.[124]

If the resources that have been poured into developing Golden Rice had been put into such proven programmes, thousands of children and adults could have been saved. The food writer Michael Pollan wrote in an article for the New York Times entitled "The great yellow hype": "These ridiculously obvious, unglamorous, low-tech schemes are being tried today, and according to the aid groups behind them, all they need to work are political will and money."[130]

Pollan is one of several critics who suggested that the real value of Golden Rice lies in its usefulness as a public relations strategy to boost the tarnished image of the biotechnology industry. Pollan wrote that Golden Rice seemed less like a solution to vitamin A deficiency than "to the public-relations problem of an industry that has so far offered consumers precious few reasons to buy what it's selling – and more than a few to avoid it."[130]

3.9.2. Purple cancer-fighting tomato

The John Innes Centre (JIC) in the UK has developed a purple tomato engineered to contain high levels of anthocyanin antioxidants, which have anti-cancer properties. The JIC announced the development of the tomato in 2008 in a press release headlined, "Purple tomatoes may keep cancer at bay".[131] Professor Cathie Martin, who led the research, published an article in the press entitled, "How my purple tomato could save your life".[132]

These claims were based on the results of a preliminary feeding study on cancer-susceptible mice, which found that those fed with the purple tomato had an extended lifespan, measured against control groups fed non-GM tomatoes and a standard rodent diet.[133] Yet as one of the researchers pointed out, the study did not test for possible toxicity, so "We're far from considering a human trial".[134]

Meanwhile, anthocyanins are available in abundance in many common fruits and vegetables, including raspberries, blackberries, blueberries, bilberries, blood oranges, red cabbage, red onions, and aubergine (eggplant).

The JIC's Cathie Martin has argued that tomatoes are consumed by people who might not normally consume many fruits and vegetables, for example, on pizzas and in tomato ketchup on burgers.[132] It is questionable, however, whether people who are conservative in their food choices would eat a tomato that looks, in the words of one journalist, "like a cross between an orange and a black pudding"[135] – let alone a tomato that, at least in Europe, will carry a GM label.

In 2010, a year after the JIC announced its purple GM tomato, Italian researchers announced a non-GM tomato with higher-than-usual levels of the anti-oxidant lycopene.[136] Lycopene, like anthocyanin, has anti-cancer properties.

In 2011 the JIC's GM purple tomato became entirely redundant when Brazilian researchers announced that they had developed a non-GM purple tomato with high levels of anthocyanins and vitamin C.[137] In contrast with the JIC's GM tomato, the non-GM tomatoes received little publicity.

3.9.3. "Biofortified" crops are not a sensible solution to hunger

Most "biofortified" crops, whether produced through GM or conventional breeding, target the

poor and hungry in the Global South and focus on one or two nutrients, such as Vitamin A or iron. Even if we assume that GM can produce more crops with high levels of one or two nutrients, some important topics need to be addressed before concluding that biofortifying crops by whatever means is a sensible approach to malnutrition:

Malnourished people are hungry not because of a lack of biofortified crops, but because they lack money to buy food and, increasingly, access to land on which to grow it. This type of poverty is often due to political conflicts in the country. Another cause is ill-advised "development" programmes that, in return for foreign loans and investment, have forced countries to convert farmland from growing food for people to eat into growing cash crops for export. These are political and economic problems that cannot be solved by offering a biofortified crop, for which the grower will need to be paid. People who have no money to buy basic food will certainly be unable to buy a biofortified food that has taken millions in investment funds to develop.

Malnourished people are not usually deficient in just one or two nutrients, but in many. Focusing on a crop that can deliver one or two nutrients is unhelpful because a balance of nutrients is needed for proper absorption. For example, in order to absorb vitamin A, people need to have enough fat in their diet. This problem would need to be addressed before they could benefit from vitamin A-enriched food.

Manipulating nutrients in food is controversial because it can be viewed as medicating food. Dosage is difficult to control and certain nutrients may be needed by one person, yet be excessive and potentially dangerous for the next. Also, nutritional theory is a fast-moving discipline, with today's desirable nutrient becoming tomorrow's undesirable contaminant.[138]

3.9.4. Non-GM biofortified crops are already available

If we assume that biofortified foods are a desirable approach to malnutrition, plenty of non-GM crop varieties are available now that do not present the risks and uncertainties of genetic engineering (see Section 7).

In addition, there are ways of adding nutrients to people's diets that do not involve the considerable expense of crop breeding. These include a rice fortified with iron and vitamins, which has been reported in a preliminary study to have caused dramatic falls in anaemia and vitamin B1 deficiency in children.[139]

Conclusion to Section 3

Contrary to frequent claims that there is no evidence of dangers to health from GM foods and crops, peer-reviewed studies have found harmful effects on the health of laboratory and livestock animals fed GMOs. Effects include toxic and allergenic effects and altered nutritional value.

Most animal feeding studies on GMOs have only been medium-term in length (30–90 days). While GM proponents claim that the observed harmful effects on health are not "biologically relevant" or "adverse", such claims are scientifically unjustifiable; these terms have not even been properly defined.

What is needed are long-term and multi-generational studies on GMOs to see if the changes found in medium-term studies, which are suggestive of harmful health effects, will develop into serious disease, premature death, or reproductive or developmental effects. Today, such studies are not required by regulators anywhere in the world.

Moreover, the system for assessing the allergenic potential of GM foods in place in the EU today – although it is probably the most rigorous of any assessment system anywhere in the world – is inadequate and unlikely to identify new allergens.

While GM proponents claim that GM can provide nutritionally enhanced (biofortified) foods, no such GM foods are available on the market.

The most widely publicised example of a GM nutritionally enhanced food, Golden Rice, has used up millions of dollars' worth of research and development money. Yet it has not undergone

proper toxicological testing and, after more than a decade, is still not ready for the market. In contrast, tried, tested, and inexpensive means of preventing and curing vitamin A deficiency are successful when applied but are under-utilised due to underfunding.

Aspirational claims of nutritionally enhanced GM crops are a dangerous distraction from the real causes of hunger, which are poverty and a lack of access to land on which to grow food. But if society decides that nutritionally enhanced foods are an important route to food security, it need not wait for expensive GM "solutions". Conventional plant breeding has already successfully and safely produced many such biofortified foods.

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4. HEALTH HAZARDS OF ROUNDUP & GLYPHOSATE

Over 75% of all GM crops are engineered to tolerate herbicides. Roundup Ready (RR) soy is the most widely grown GM crop, making up 52% of all GM crops.[1] RR soy is engineered to tolerate Roundup herbicide, the main ingredient of which is glyphosate. The RR gene enables farmers to spray the field liberally with herbicide. All plant life is killed except the crop.

The widespread adoption of GM RR soy in North and South America has led to massive increases in the use of Roundup and other glyphosate herbicides.[2]

In South America, a public health crisis has emerged around the spraying of Roundup on GM soy, which is often carried out from the air. The problem made headlines on the publication of a 2010 study by Argentine researchers showing that glyphosate and Roundup caused malformations (birth defects) in frog and chicken embryos at doses far lower than those used in agricultural spraying. The malformations seen in the experimental embryos were similar to human birth defects reported in GM soy-growing areas of South America.

The researchers said the results were relevant to humans because humans have the same developmental mechanisms as frogs and chickens. The study identified the pathway through which glyphosate and Roundup affect embryonic development, the retinoic acid signalling pathway.[3]

A report by physicians in Argentina based on clinical data reported the following health effects in people exposed to spraying of agrochemicals (mostly glyphosate) on GM Roundup Ready soy: increased incidence of birth defects, miscarriages, infertility, cancers, DNA damage (which can lead to cancer and birth defects), neurological developmental problems in children, kidney failure, respiratory problems, and allergies.[4]

A report commissioned by the provincial government of Chaco, Argentina, found that the rate of birth defects increased fourfold and rates of childhood cancers tripled in only a decade in areas where rice and GM soy crops are heavily sprayed. The report noted that problems centred on "transgenic crops, which require aerial and ground spraying with agrochemicals"; glyphosate was named as a chemical of concern.[5]

These issues are relevant not only to people living in regions where GM RR crops are grown, but for consumers who eat products made from crops sprayed with glyphosate. GM RR crops do not break down glyphosate, but absorb it. Some is broken down (metabolised) into a substance called aminomethylphosphonic acid (AMPA). Both glyphosate and AMPA remain in the plant and are eaten by people and animals. Both are toxic.

Scientific evidence suggests that Roundup and other commercial formulations are more toxic than glyphosate alone – yet it was glyphosate alone that was tested by industry prior to market authorization and approved by regulators. The herbicide formulations as they are sold and used have not been properly tested and assessed for safety.

Section at a glance

- Roundup, the herbicide that most GM crops are engineered to tolerate, based on the chemical glyphosate, is marketed as a "safe" herbicide, based on outdated and largely unpublished studies by manufacturers.
- But laboratory and epidemiological studies confirm that Roundup poses serious health hazards, including endocrine (hormone) disruption, DNA damage, cancer, birth defects, and neurological disorders.
- Some of these effects are found at low, realistic doses that could be found as residues in food and feed crops and in contaminated water. People who eat foods made from GM crops could be ingesting potentially dangerous levels of Roundup residues.
- Roundup and glyphosate have been detected in air, rain, groundwater, in people's urine, and even circulating in women's blood. Glyphosate can cross the placental barrier and the unborn foetus could thus be exposed.
- The "safe" dose for Roundup exposure set by regulators is not based on up-to-date objective evidence; thus current regulations do not protect the public.

4.1 **Myth:** Roundup is a safe herbicide with low toxicity **Truth:** Roundup poses major health hazards

Roundup is marketed as a "safe" herbicide, based on outdated and largely unpublished studies by manufacturers.[6] But independent toxicological and epidemiological studies confirm that Roundup and glyphosate pose serious health hazards, as detailed below.

4.1.2. People who eat Roundup Ready crops may be eating toxic residues

The effects on animals and humans of eating increased amounts of glyphosate herbicide residues on such crops have not been properly investigated. On the contrary, regulators have ignored risks and changed safety rules to allow higher levels of glyphosate residues into the food and feed chain.

For example, after the 1996 commercialisation of GM RR soy, EU regulators raised the allowed maximum residue limit (MRL) for glyphosate in imported soy 200-fold, from 0.1 mg/kg to 20 mg/kg.[7] The UK government claimed that the move was necessary to accommodate the new farm practice of using glyphosate as a desiccant to "burn down" crops before harvest, making grains or beans easier to gather.[8] But it also conveniently coincided with the introduction of RR soy.

Indeed, a 1994 report of the Joint FAO/WHO Meetings on Pesticide Residues (JMPR) indirectly admitted that GM soy was a factor in the need for the higher limit. This JMPR meeting appears to have been the source of the recommendation for the new higher residue limit. In its report, the JMPR recommended the higher limit of 20 mg/kg for soybeans. The JMPR said the change was needed because of a combination of two factors: glyphosate's use as a desiccant before harvest; and to accommodate "sequential application of glyphosate in the crop"[9] – a practice that is only possible with GM RR soy, as it would kill non-GM soy.

In a 1999 press interview, Malcolm Kane, the then recently-retired head of food safety at UK supermarket chain Sainsbury's, confirmed that the European regulators raised the residue limit to "satisfy the GM companies" and smooth the path for GM soy to enter the food and feed market. Kane added, "One does not need to be an activist or overtly anti-GM to point out that herbicide-resistant crops come at the price of containing significant chemical residues of the active chemical in the commercial weedkiller."[8]

This high residue limit is potentially unsafe, based on data from independent studies that EU regulators ignored in setting their claimed safe daily dose.[10,11,12] Glyphosate, AMPA, and especially the commercial formulation Roundup have been found to be toxic, in some cases at extremely low levels.[13,14,15] Roundup damages and kills human cells at levels below those used in agriculture[16] and at residual levels to be expected in food and feed derived from Roundup-treated crops.[13] Roundup is a potent endocrine disruptor (disturbs hormone function) at concentrations up to 800 times lower than the highest permitted levels in food and feed.[17] So people who eat food products from GM RR crops are eating amounts of these substances that may have toxic effects.

4.1.3. Studies show toxic effects of glyphosate and Roundup

Independent studies on human cells and experimental animals have shown that glyphosate and Roundup have serious toxic effects, in many cases at low levels that could be found in the environment or as residues in food or feed.[13,14,15] The added ingredients (adjuvants) in Roundup are themselves toxic and increase the toxicity of glyphosate by enabling it to penetrate human and animal cells more easily.[13,18,19] Findings include:

- Glyphosate and Roundup caused malformations in frog and chicken embryos.[3]
- Roundup caused skeletal malformations in rat foetuses.[20]
- Industry's own studies conducted for regulatory purposes as long ago as the 1980s show that glyphosate caused birth defects in rats and rabbits. These effects were seen not only at high, maternally toxic doses, but also

at lower doses. Interestingly, these effects were discounted by regulators, who approved glyphosate for use in food production.[10]

- Roundup caused liver and kidney toxicity in fish at sublethal doses. Effects in the liver included haemorrhage and necrosis (death of cells and living tissue).[21]
- Roundup caused total cell death in human cells within 24 hours at concentrations far below those used in agriculture and corresponding to levels of residues found in food and feed.[13]
- Roundup caused death of human cells and programmed cell death at a concentration of 50 parts per million, far below agricultural dilutions.[16]
- Roundup was a potent endocrine disruptor at levels up to 800 times lower than residue levels allowed in food and feed. It was toxic to human cells and caused DNA damage at doses far below those used in agriculture.[17]
- Glyphosate was toxic to human placental cells and is an endocrine disruptor in concentrations lower than those found with agricultural use. Roundup adjuvants amplified glyphosate's toxicity by enabling it to penetrate cells more easily and to bioaccumulate in cells.[15]
- Glyphosate and Roundup damaged human embryonic and placental cells at concentrations below those used in agriculture, suggesting that they may interfere with human reproduction and embryonic development.[14]
- Glyphosate's main metabolite (environmental breakdown product), AMPA, altered cell cycle checkpoints by interfering with the cells' DNA repair machinery.[22,23,19,24] The failure of cell cycle checkpoints is known to lead to genomic instability and cancer in humans.
- Glyphosate and AMPA irreversibly damaged DNA, suggesting that they may increase the risk of cancer.[25,26]
- Glyphosate promoted cancer in the skin of mice.[27]
- Roundup caused cell and DNA damage to epithelial cells derived from the inside of the mouth and throat, and glyphosate alone caused DNA damage, raising concerns over the safety of inhaling the herbicide, one of the most common ways in which people are exposed.

Importantly, both glyphosate and Roundup caused DNA damage at concentrations below those required to induce cell damage, suggesting that the DNA damage was caused directly by glyphosate and Roundup instead of being an indirect result of cell toxicity.[28]

4.1.4. Epidemiological studies on Roundup show links with serious health problems

Epidemiological studies show a link between Roundup/glyphosate exposure and serious health problems, including:

- DNA damage[27]
- Premature births and miscarriages[28,29]
- Birth defects including neural tube defects and anencephaly (absence of a large part of the brain and skull)[32,33]
- Multiple myeloma, a type of cancer[34]
- Non-Hodgkin's lymphoma, a type of cancer[35,36,37]
- Disruption of neurobehavioral development in children of pesticide applicators – in particular, attention-deficit disorder (ADD) and attention-deficit hyperactivity disorder (ADHD).[38]

Epidemiological studies cannot prove a cause-and-effect relationship between exposure to a suspect substance and a health effect. However, in the case of glyphosate/Roundup, toxicological studies carried out under controlled laboratory conditions confirm the causal relationship to health problems (see 4.1.3).

4.1.5. People are widely exposed to glyphosate

Glyphosate-based herbicides are widely used outside of the farm environment – for example, by municipal authorities to control weeds on roadsides and in parks and school grounds, as well as by home gardeners. So even when farm use is excluded, people's exposure to glyphosate is significant. In agricultural areas where GM glyphosate-resistant crops are grown, exposure is likely to increase exponentially.

Study findings on human exposures and body burdens include:

- Glyphosate was detected in between 60 and

100% of air and rain samples taken in the American Midwest during the crop growing season.[39] Roundup Ready GM crops are widely planted in this region.

- Glyphosate and its main breakdown product, AMPA, were frequently detected in streams in the American Midwest during the growing season.[40]
- Glyphosate and its main breakdown product AMPA were washed out of the root zone of clay soils in concentrations that exceeded the acceptable quantities for drinking water (0.1 µg/l), with maximum values of over 5 µg/l.[41]
- Glyphosate was found circulating in the blood of non-pregnant women, albeit at low levels.[42]
- Urinary body burdens of glyphosate in farm and non-farm families in Iowa were over 900 parts per billion (0.9 mg per kg of body weight) in 75% of farmers, 67% of wives, and 81% of farmers' children. Urinary burdens in non-farm children were slightly higher than those in farm children. The authors suggested that this was because of the widespread use of glyphosate in non-farm areas, such as in people's gardens.[43]

The placental barrier in mammals is often claimed to protect the unborn foetus from glyphosate exposures. But this claim was shown to be false by a research study modeling human exposures, in which 15% of administered glyphosate crossed the human placental barrier and entered the foetal compartment.[44]

4.1.6. People are not protected by the current regulations on glyphosate

An analysis of glyphosate's current approval in the EU and in the US suggests that the "acceptable daily intake" (ADI) level, the level of exposure that is deemed safe for humans over a long period of time, is inaccurate and potentially dangerously high.[10]

Regulators calculate the ADI on the basis of industry studies submitted to the regulators in support of the chemical's approval. The figure used to set the ADI is the highest dose at which no adverse effect is found (the No Observed Adverse Effect Level or NOAEL), which is also lower than the lowest dose that has a toxic effect (the Lowest Observed Adverse Effect Level or LOAEL). The ADI is derived by dividing this figure by 100, to allow a safety margin.

The current ADI for glyphosate is 0.3 mg per kg of body weight per day (written as 0.3 mg/kg bw/d).

But this ADI has been shown to be inaccurate by two independent studies on Roundup using an animal (rat) and exposure route (oral feeding) approved by EU and international regulators. The studies found that:

- Roundup was a potent endocrine disruptor and caused disturbances in the reproductive development of rats when the exposure was performed during the puberty period. Adverse effects, including delayed puberty and reduced testosterone production, were found at all dose levels, including the LOAEL of 5 mg/kg bw/d.[11]
- Glyphosate herbicide caused damage to rats' liver cells that the researchers said was probably "irreversible" at a dose of just 4.87 mg/kg bw/d.[12]

These studies did not find a safe or "no effect" level (NOAEL). Even the lowest dose tested produced a toxic effect and no further experiments were done with lower doses to establish the NOAEL. A reasonable estimate of the NOAEL might be 2.5 mg/kg of body weight (though this estimate should, of course, be tested). Then, applying the 100-fold safety factor, the ADI should be 0.025 mg/kg bw/d – 12 times lower than the one currently in force.

Even if only the industry studies are considered, the current ADI should still be lower. An objective analysis of these studies results in a more objectively accurate ADI of 0.1 mg/kg bw/d, one-third of the current ADI.[10]

4.1.7. Arguments that Roundup replaces more toxic herbicides are false

GM proponents often argue that Roundup has replaced more toxic herbicides and that GM RR crops therefore reduce the toxic burden on humans and the environment. But this is false. GM RR crops have not only increased the use of glyphosate herbicides but have also increased

the use of other, potentially even more toxic herbicides, due to the spread of glyphosate-resistant weeds (see Section 5). And as we have seen, the presumed safety of Roundup owes more to clever marketing than to objective scientific findings.

Conclusion to Section 4

GM Roundup Ready (RR) soy is the most widely grown GM crop. It is engineered to tolerate being sprayed with Roundup herbicide, based on the chemical glyphosate. Widespread planting of GM soy in North and South America has led to large increases in the amount of glyphosate herbicide used. Regulators have responded by raising the allowed residue limit of glyphosate in crops eaten by people and animals. So people and animals that eat GM RR crops are eating potentially toxic herbicide residues.

Regulators and industry claim that this is safe because Roundup has low toxicity. But these claims – as well as the supposed "safe" level of glyphosate set by regulators – are based on outdated industry studies, the findings of which have been thrown into question by numerous independent studies. These studies show that Roundup and glyphosate are not safe but pose serious health risks. Effects found in animal studies and test-tube studies on human cells include cell death and damage, damage to DNA, disruption of hormones, birth defects, and cancer. Some of these effects have been found at levels far below those used in agriculture and corresponding to low levels of residues in food and feed. The added ingredients in Roundup (adjuvants) increase the toxicity of glyphosate, and the main breakdown product of glyphosate, AMPA, is also toxic.

Effects of exposure to glyphosate herbicides on humans found in epidemiological studies include DNA damage, premature birth and miscarriage, cancer, and attention deficit disorder in children.

The widespread use of glyphosate herbicides – not just on farms but in gardens, on roadsides, and in parks and school grounds – means that many people are exposed. In addition, glyphosate does not stay where it is applied but moves around the environment. It is frequently found in rain, air, streams, and groundwater, and even in women's blood.

GM crops have increased the use of glyphosate and thus people's exposure to it, presenting a risk that has not been adequately considered in regulatory assessments of GM crops.

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5. GM CROPS – IMPACTS ON THE FARM AND ENVIRONMENT

Section at a glance

- GM does not increase intrinsic yield. Some GM crops have lower yields than non-GM counterparts.
- GM crops have increased pesticide use by 383 million pounds in the US in the first 13 years since their introduction.
- The modest reduction in chemical insecticide sprays from GM Bt insecticidal crops is swamped by the large increase in herbicide use with GM herbicide-tolerant crops.
- GM herbicide-tolerant crops have caused an over-reliance on a single herbicide, glyphosate, leading to the emergence of resistant superweeds and causing farmers to use more herbicides, including older toxic ones like dicamba and 2,4-D.
- The GM companies' solution to the glyphosate-resistant superweeds problem is stacked trait GM crops that tolerate applications of multiple herbicides – and mixtures of herbicides. Weed scientists warn that this will cause herbicide use to triple, foster multi-herbicide-resistant superweeds, and undermine sustainable farming.
- Claims of environmental benefits from no-till of farming as used with GM herbicide-tolerant crops collapse once herbicide use is taken into account.
- GM Bt crops do not eliminate insecticide use – they merely change the way in which insecticides are used. The plant itself becomes an insecticide.
- GM Bt technology is being undermined by the spread of insect pests that are resistant to Bt crops, forcing farmers to use chemical insecticides as well as buying expensive Bt seed.
- Bt toxins in GM Bt crops are not specific to insect pests, but harm beneficial insect pest predators and soil organisms.
- Roundup used on GM herbicide-tolerant crops is not environmentally safe. It persists in the environment and has toxic effects on wildlife as well as humans (section 4).
- Roundup increases plant diseases, notably Fusarium, a fungus that causes sudden death and wilt in soy plants and is toxic to humans and livestock.
- The economic impacts on farmers of adopting GM crops were described in a study for the US Dept of Agriculture as "mixed or even negative".
- "Coexistence" between GM and non-GM crops is impossible as non-GM and organic crops become contaminated, resulting in lost markets and massive economic losses.
- The possibility that GM traits could spread not only to related species by cross-pollination but also to unrelated species by horizontal gene transfer, should be investigated before commercialising GM crops.

"Over the past decade, corporate and government managers have spent millions trying to convince farmers and other citizens of the benefits of genetically modified (GM) crops. But this huge public relations effort has failed to obscure the truth: GM crops do not deliver the promised benefits; they create numerous problems, costs, and risks; and … consumers and foreign customers alike do not want these crops.

"It would be too generous even to call GM crops a solution in search of a problem: These crops have failed to provide significant solutions, and their use is creating problems – agronomic, environmental, economic, social, and (potentially) human health problems."

– National Farmers Union of Canada[1]

GM crops are promoted on the claimed basis that they give higher yields, reduce pesticide use, and benefit farmers and the environment. But independent studies either contradict these claims or show them to be inflated. GM crop technology is already failing under the onslaught of developments such as the spread of herbicide-resistant superweeds and pests resistant to the Bt toxin engineered into crops. These failures mean increasing costs to farmers and harm to the environment.

On-farm and environmental impacts of GM crops are not limited to the effects of the GM crop itself – for example, GM genes can spread to non-GM and organic crops. They also include the effects of the pesticide that the crop is engineered to contain or that it is designed to be grown with. Research shows that impacts are occurring from all these sources.

Some of these impacts occur with industrially-grown non-GM crops, too. But often, GM proponents obscure the negative effects of GM crops by comparing them with crops grown under chemically-based agricultural systems. They then draw the conclusion that GM crops have less harmful impacts.

But this is to compare one unsustainable agricultural system with another. A more meaningful comparison, and one that would help advance agricultural technology, would be to compare GM with agroecological or integrated pest management (IPM) systems. Many farmers outside the certified organic sector already use agroecological and IPM methods. This progressive trend should be encouraged. Instead, it is being delayed by the false hope offered farmers by GM crops. In contrast to agroecological methods, GM agriculture is an extension of chemically-based, high-input agriculture.

Below, we point out some of the flaws in the common arguments used to promote GM crops.

5.1 **Myth:** GM crops increase yield potential **Truth:** GM crops do not increase yield potential – and in many cases decrease it

GM crops are often claimed to give higher yields than naturally bred varieties. But the data do not support this claim. At best, GM crops have performed no better than their non-GM counterparts, with GM soybeans giving consistently lower yields.[3]

Controlled field trials comparing GM and non-GM soy production suggested that 50% of the drop in yield is due to the disruption in genes caused by the GM transformation process.[4] Similarly, field tests of Bt maize hybrids showed that they took longer to reach maturity and produced up to 12% lower yields than their non-GM counterparts.[5]

A US Department of Agriculture report confirmed the poor yield performance of GM crops, saying, "GE [genetically engineered] crops available for commercial use do not increase the yield potential of a variety. In fact, yield may even decrease.... Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative."[6]

The definitive study to date on GM crops and yield is *Failure to Yield,*[2] by Dr Doug Gurian-Sherman, senior scientist at the Union of Concerned Scientists and former biotech adviser to the US Environmental Protection Agency. The study, which is based on peer-reviewed research and official US Department of Agriculture (USDA) data, was the first to tease out the contribution of genetic engineering to yield performance from the gains made through conventional breeding. It is important to bear in mind when evaluating the yield performance of GM crops that biotech companies insert their proprietary GM genes into the best-performing conventionally bred varieties.

The study also differentiated between intrinsic and operational yield. Intrinsic or potential yield, the highest that can be achieved, is obtained when crops are grown under ideal conditions. In contrast, operational yield is obtained under field conditions, when environmental factors such as pests and stress result in yields that are considerably less than ideal. Genes that improve operational yield reduce losses from such factors.

> *"Commercial GE crops have made no inroads so far into raising the intrinsic or potential yield of any crop. By contrast, traditional breeding has been spectacularly successful in this regard; it can be solely credited with the intrinsic yield increases in the United States and other parts of the world that characterized the agriculture of the twentieth century."*
> – Doug Gurian-Sherman, former biotech advisor to the US Environmental Protection Agency (EPA) and senior scientist at the Union of Concerned Scientists in Washington, DC[2]

The study found that GM technology has not raised the intrinsic yield of any crop. The intrinsic yields of corn and soybeans did rise during the twentieth century, but this was not as a result of GM traits, but due to improvements brought about through traditional breeding.

The study found that GM soybeans did not increase operational yields, either. GM maize increased operational yields only slightly, mostly in cases of heavy infestation with European corn borer. Bt maize offered little or no advantage when infestation with European corn borer was low to moderate, even when compared with conventional maize that was not treated with insecticides.

The study concluded, "Commercial GE crops have made no inroads so far into raising the intrinsic or potential yield of any crop. By contrast, traditional breeding has been spectacularly successful in this regard; it can be solely credited with the intrinsic yield increases in the United States and other parts of the world that characterized the agriculture of the twentieth century."[2]

In 2009, in an apparent attempt to counter criticisms of low yields from its GM soy, GM seed producer Monsanto released its new generation of

supposedly high-yielding GM soybeans, RR2 Yield. But a study carried out in five US states involving 20 farm managers who planted RR2 soybeans in 2009 concluded that the new varieties "didn't meet their [yield] expectations".[7] In June 2010 the state of West Virginia launched an investigation of Monsanto for false advertising claims that RR2 soybeans gave higher yields.[8]

If GM cannot increase yields even in the United States, where high-input, irrigated, heavily subsidised commodity farming is the norm, it is irresponsible to assume that it would improve yields in the Global South, where farmers may literally bet their farms and livelihoods on a crop.

We agree with the conclusion of *Failure to Yield* that the funding and research that are currently poured into trying to produce high-yield GM crops should be redirected toward approaches that are proven effective in improving crop yields, including conventional plant breeding as well as use of agroecological practices. These are by far the most efficient, affordable, and widely practised methods of improving yield.

5.2 **Myth:** GM crops decrease pesticide use **Truth:** GM crops increase pesticide use

> *"GE crops have been responsible for an increase of 383 million pounds of herbicide use in the US over the first 13 years of commercial use of GE crops (1996–2008). This dramatic increase in the volume of herbicides applied swamps the decrease in insecticide use attributable to GE corn and cotton, making the overall chemical footprint of today's GE crops decidedly negative… The primary cause of the increase [is] the emergence of herbicide-resistant weeds."*
> – Dr Charles Benbrook, agronomist[9]

> *"The promise was that you could use less chemicals and produce a greater yield. But let me tell you none of this is true."*
> – Bill Christison, president of the US National Family Farm Coalition[10]

GM crops are claimed by proponents to reduce pesticide use (the term "pesticide" includes herbicides, which technically are pesticides). But this is untrue. Herbicide-tolerant crops have been developed by agrochemical firms specifically to depend upon agrochemicals and have extended the market for these chemicals. Far from weaning agriculture away from environmentally damaging chemicals, GM technology has prolonged and extended the chemically-based agricultural model.

The adoption of GM Roundup Ready crops, especially soy, has caused massive increases in the use of glyphosate worldwide.[9,11,12,13,14]

A report by agronomist Dr Charles Benbrook using official US Department of Agriculture data looked at the effects on pesticide use of the first thirteen years of GM crop cultivation in the United States, from 1996 to 2008.[9] Crops taken into account were GM herbicide-tolerant and GM Bt maize varieties, GM Roundup Ready soy, and GM herbicide-tolerant and GM Bt cotton varieties.

The report found that Bt maize and cotton delivered reductions in chemical insecticide use totalling 64.2 million pounds (29.2 million kg) over the thirteen years – though even the sustainability of this trend is questionable, given the emergence of Bt-resistant pests and the changes in insecticide use patterns (see 5.3, below).

But herbicide-tolerant maize, soy, and cotton caused farmers to spray 383 million more pounds (174 million kg) of herbicides than they would have done in the absence of herbicide-tolerant seeds. This massive increase in herbicide use swamped the modest 64.2 million pound reduction in chemical insecticide use attributed to Bt maize and cotton.

The report showed that recently, herbicide use on GM fields has veered sharply upward. Crop years 2007 and 2008 accounted for 46% of the increase in herbicide use over thirteen years across the three herbicide-tolerant crops. Herbicide use on GM herbicide-tolerant crops rose 31.4% from 2007 to 2008.

The report concluded that farmers applied 318 million more pounds of pesticides as a result of planting GM seeds over the first thirteen years of commercial use. In 2008, GM crop fields required over 26% more pounds of pesticides per acre (1 acre = 0.4 hectares) than fields planted to non-GM varieties.

The report identified the main cause of the increase in herbicide use as the spread of glyphosate-resistant weeds.

5.2.1. Glyphosate-resistant superweeds

The widespread use of Roundup Ready crops has led to over-reliance on a single herbicide – glyphosate, commonly sold as Roundup. This has resulted in the rapid spread of glyphosate-resistant weeds in countries where GM crops are planted.[15] Resistant weeds include pigweed,[16] ryegrass,[17] and marestail.[18]

The Herbicide Resistance Action Committee (HRAC), financed by the pesticide industry, lists 21 glyphosate-resistant weeds around the world. In the United States, glyphosate-resistant weeds have been identified in 22 states.[19]

When resistant weeds first appear, farmers

often use more glyphosate herbicide to try to control them. But as time passes, no amount of glyphosate herbicide is effective and farmers are forced to resort to potentially even more toxic herbicides, such as 2,4-D, and mixtures of herbicides.[15,16,17,18,20,21,22,23,24,25,26]

US farmers are going back to more labour-intensive methods like ploughing – and even pulling weeds by hand.[25] In Georgia, tens of thousands of acres of farmland have been abandoned after being overrun by glyphosate-resistant pigweed.[27,28]

An article in Monsanto's hometown newspaper, the St Louis Post-Dispatch, said of the Roundup Ready system, "this silver bullet of American agriculture is beginning to miss its mark."[29] As glyphosate-resistant weeds undermine the Roundup Ready farming model, Monsanto has taken the extraordinary step of subsidizing farmers' purchases of competing herbicides to supplement Roundup.[25,30]

5.2.2. How are superweeds created?

Many glyphosate-resistant weeds appear through what is known as selection pressure – only those weeds that survive being sprayed with glyphosate herbicides pass on their genes, leading to a steady increase in glyphosate-resistant plants in the weed population.

But there is a second route through which glyphosate-resistant weeds develop: GM crops can pass on their genes for herbicide tolerance to wild or cultivated non-GM relatives. GM canola has been found to pass on its glyphosate-tolerance genes to related wild plants such as wild mustard, turning them into difficult-to-control superweeds. The GM herbicide-tolerance gene was shown to persist in these weed populations over a period of six years.[31]

GM canola itself has also become a weed. Feral canola populations have acquired resistance to all of the main herbicides used in Canada,[24] making it difficult and expensive to control "volunteer" canola in soy and maize fields. Feral herbicide-resistant canola has also become a problem in sugar beet fields in the US, where canola seeds are reported to be deposited by defecation from geese migrating from Canada.[32]

5.2.3. GM industry "solution" to superweeds: More herbicides

The industry's solution to the glyphosate-tolerant superweeds crisis has been first, to aggressively market pre-mix herbicide products to farmers, and second, to develop "stacked trait" crop varieties resistant to multiple herbicides. These stacked trait crops enable farmers to spray mixtures of weedkillers freely, instead of having to apply them carefully in order to spare crops.[26] Simple arithmetic indicates that this will double or triple the amount of herbicide applied to a given field.

In 2011 Dow released its multi-herbicide-tolerant soybean, engineered to tolerate being sprayed with glyphosate, glufosinate, and 2,4-D[34] – an ingredient of the defoliant Agent Orange. In 2012 Dow sparked public outrage when it applied to the US Department of Agriculture to commercialise its 2,4-D-tolerant sweetcorn – a product that, unlike maize destined for animal feed, is intended for people's dinner plates.[35]

Weed scientists warn that such multi-herbicide-tolerant crops will cause an increase in 2,4-D use, trigger an outbreak of still more intractable weeds resistant to both glyphosate and 2,4-D, and undermine sustainable approaches to weed management.[33]

In fact, weed species that are resistant to dicamba,[36] to 2,4-D,[37] and to multiple herbicides[38] already exist.

Most stacked-trait superweeds emerge through what is known as selection pressure, where only those weeds that can tolerate herbicide survive to pass on their genes.

But there is another route through which superweeds can emerge: cross-pollination of GM herbicide-tolerant crops within the crop species or with wild relatives. "Stacked trait" multi-herbicide-resistant oilseed rape (canola) plants have already appeared as a result of accidental cross-pollination between GM crops engineered to tolerate different herbicides. As early as 1998, oilseed rape plants were found that tolerated up to three different herbicides.[39]

A Canadian government study showed that after just 4–5 years of commercial growing, GM oilseed rape engineered to tolerate different single herbicides had cross-pollinated to create stacked trait plants resistant to up to three broad-

spectrum herbicides, posing a serious problem for farmers.[22,23,24]

5.2.4. Conclusion

GM herbicide-tolerant crops have led to massive increases in herbicide use and a resulting spread of herbicide-resistant weeds. Farmers have to resort to spraying more herbicide, or mixtures of herbicides, to try to control weeds. This "chemical treadmill" model of farming is especially impractical for farmers in the Global South, who cannot afford to buy more or different herbicides in an effort to control resistant weeds.

5.3 **Myth:** No-till farming with GM crops is environmentally friendly **Truth:** Claims of environmental benefits from GM no-till farming are unsound

GM proponents claim that GM herbicide-tolerant crops, especially GM Roundup Ready (RR) soy, are environmentally friendly because they allow farmers to adopt the no-till system of cultivation. No-till farming avoids ploughing in order to conserve soil and water, and supposedly to reduce carbon dioxide emissions. In no-till cultivation of GM Roundup Ready soy, weeds are controlled through herbicide applications rather than mechanically, through ploughing.

There are at least two problems with this argument:

- No-till or low-till farming can be – and is – practised in chemically-based and agroecological farming. Farmers do not have to adopt GM crops or use herbicides to practise no-till.
- Claims of environmental benefits for GM crops with no-till cultivation have been shown to be misleading. One study compared the environmental impacts of growing GM RR and non-GM soy, using an indicator called Environmental Impact Quotient (EIQ). EIQ assesses the negative environmental impacts of the use of pesticides and herbicides on farm workers, consumers and ecology (fish, birds, bees and other beneficial insects). The study found that in Argentina, the negative environmental impact of GM soy was higher than that of non-GM soy in both no-till and tillage systems because of the herbicides used. Also, the adoption of no-till raised the EIQ, whether the soy was GM RR or non-GM. The main reason for the increase in herbicides used in no-till systems was the spread of glyphosate-resistant superweeds.[40]

We conclude that claims of environmental benefits from no-till farming with GM crops are unjustified.

Herbicide-tolerant crops undermine sustainable agriculture

"Agricultural weed management has become entrenched in a single tactic – herbicide-resistant crops – and needs greater emphasis on integrated practices that are sustainable over the long term. In response to the outbreak of glyphosate-resistant weeds, the seed and agrichemical industries are developing crops that are genetically modified to have combined resistance to glyphosate and synthetic auxin herbicides. This technology will allow these herbicides to be used over vastly expanded areas and will likely create three interrelated challenges for sustainable weed management. First, crops with stacked herbicide resistance are likely to increase the severity of resistant weeds. Second, these crops will facilitate a significant increase in herbicide use, with potential negative consequences for environmental quality. Finally, the short-term fix provided by the new traits will encourage continued neglect of public research and extension in integrated weed management." – Mortensen DA, et al. Navigating a critical juncture for sustainable weed management. BioScience 2012; 62: 75-84[33]

5.4 **Myth:** GM Bt crops reduce insecticide use **Truth:** GM Bt crops merely change the way in which insecticides are used

GM proponents claim that GM Bt crops reduce insecticide use, as farmers do not have to spray chemical insecticides. But this claim does not stand up to analysis, since the Bt gene turns the plant itself into an insecticide and because pest adaptation makes the GM pesticide less effective over time, making it necessary for farmers to revert to the use of chemical pesticides after just a few years. The genetically modified insecticide is present in active form in every part of the crop, including the parts that people and animals eat.

So Bt crops do not reduce or eliminate insecticides. They temporarily change the type of insecticide and the way in which it is used – from sprayed on, to built in. But in the long term, use of chemical pesticides must be resumed, as long as the industrial agricultural model is followed.

Even if we choose to ignore this factor and only consider the temporary reduction in chemical insecticide sprays due to Bt crops, the figure is unspectacular (see 5.2, above) – a reduction of 64.2 million pounds (29.2 million kg) over the first thirteen years of GM crop cultivation in the United States. This reduction is swamped by the massive increase in pesticide use resulting from the adoption of GM herbicide-tolerant crops, which has caused farmers to spray 383 million more pounds (174 million kg) of herbicides than they would have done in the absence of GM herbicide-tolerant seeds (herbicides are technically pesticides).[9]

Even the modest reduction in chemical insecticides attributed to GM Bt crops is proving unsustainable, due to the emergence of pests resistant to Bt toxin and secondary pests, as explained below. Moreover, there is a question mark over whether Bt crops can truly be said to have reduced chemical insecticide use in view of changes in the types of insecticides used and in the methods of application.

5.4.1. Resistant pests are making Bt technology redundant

GM Bt insecticidal crops express the Bt toxin in every cell for their entire lifetime, constantly exposing pests to the toxin. This is different from the traditional use of natural Bt as a spray, where the targeted pests are only exposed for a brief period before the Bt breaks down in daylight. Exposing pests to a pesticide for long periods of time inevitably speeds up the emergence of resistant pests, since selective pressure eliminates all but the most resistant pests, which then reproduce and pass on their genes.

For this reason, Bt crop technology sometimes enjoys short-term success in controlling pests but is soon undermined by the emergence of pests resistant to the toxin.[43,44,45] By 2009, the western corn rootworm had evolved resistance to a Bt maize specifically engineered to target the pest that was first commercialised only six years previously.[46] Bt-resistant rootworm populations have been reported in Iowa[46,47] and Illinois.[48]

5.4.2. The "refuge" concept breaks down

Farmers are encouraged to plant "refuges" of non-Bt crops as a resistance management strategy to delay the emergence of Bt-resistant pests. The idea is that the non-Bt crop acts as a refuge where Bt-susceptible pests can survive, ensuring the existence of a population of Bt-sensitive pests to mate with any Bt-resistant pests that survive in the adjacent field where the Bt crop is under cultivation. The theory is that the Bt-susceptible pest population will dilute out the Bt-resistant population that survives in the Bt crop, assuring that the predominant population is Bt-susceptible.

But a study on rootworm resistance in Iowa found that refuges were redundant in the case of substantial Bt-resistant rootworm populations, as the pests were able to live and reproduce in Bt maize fields. The study concluded, "Even with resistance

management plans in place, sole reliance on Bt crops for management of agriculture pests will likely hasten the evolution of resistance in some cases."[46]

Also, the effectiveness of refuges relies on the Bt crops expressing doses of Bt toxin that are high enough to kill pests, and the non-Bt refuges remaining free from Bt toxin-expressing genes. But cross-pollination between GM Bt maize has been found to cause "low to moderate" Bt toxin levels in the refuge plants,[49] making refuges less effective.

5.4.3. Secondary pests attack Bt crops

Nature abhors a vacuum. So even when Bt toxin succeeds in controlling a primary pest, secondary pests move into the ecological niche. For instance, in the United States, the Western bean cutworm has increased significantly in Bt maize fields.[50] In China and India, Bt cotton was initially effective in suppressing the target pest, the boll weevil. But secondary pests that are resistant to Bt toxin, especially mirids and mealy bugs, soon took its place.[51,52,53,54,55,56]

Two studies from China on GM Bt insecticidal cotton show that GM Bt technology is already failing under the onslaught of secondary pests:

A study of 1,000 farm households in five provinces found that farmers noticed a substantial increase in secondary pests after the introduction of Bt cotton. The researchers found that the initial reduction in pesticide use in Bt cotton cultivars was "significantly lower than that reported in research elsewhere" and that "more pesticide sprayings are needed over time to control emerging secondary pests" such as aphids, spider mites, and lygus bugs. In addition, a quarter of the farmers thought Bt cotton yielded less than non-GM varieties. Close to 60% said that overall production costs had not decreased, due to the higher price of Bt cotton seed.[57]

Field trials conducted over ten years in northern China show that mirid bugs have increased in cotton and multiple other crops, in proportion to a regional increase in Bt cotton adoption. The researchers' analyses show that "Bt cotton has become a source of mirid bugs and that their population increases are related to drops in [chemical] insecticide use in this crop." Moreover, mirid bug infestation of other food crops (Chinese dates, grapes, apples, peaches, and pears) increased in proportion to the regional planting area of Bt cotton.[58]

It is clear from these developments that GM Bt technology is not a "silver bullet" solution but is economically and environmentally unsustainable, as farmers who have paid premiums for Bt insecticidal seed have had to return to spraying costly and toxic pesticides.

5.4.4. Bt cotton farmers don't always give up insecticides

GM proponents often assume that farmers who adopt Bt crops give up chemical insecticides – but this is not necessarily the case. Tabashnik (2008) reported that while bollworms have evolved resistance to Bt toxin in one type of GM cotton, this has not caused widespread crop failure because "insecticides have been used from the outset" to control the pest.[45] So claims of reductions in insecticide use from Bt crop adoption are unreliable unless there is evidence that the farmer does not use chemical insecticides.

Moreover, most Bt crops currently commercialised or in the pipeline have added herbicide tolerance traits and so are likely to be grown with herbicides.[59] It is with good reason that one independent scientist

Pesticide use number-crunching

The most optimistic claim for reduced pesticide use from GM crops, in a paper by the private consultancy firm to the GM industry, P G Economics, and based on "farm-level impact data" from an unnamed source, is 6.9%.[41]

In 2008 in the US, according to official government data, GM crop acres required over 26% more pounds of pesticides per acre than acres planted to conventional varieties.[9]

A 2011 study by French government scientists found that pesticide use could be reduced by 30% without impairing yields or farm income[42] – and without GM crops.

has called GM crops "pesticide plants".[60]

5.4.5. Hidden chemical insecticides in Bt maize

Studies claiming reductions in insecticide use due to Bt crops have previously focused on insecticides that are applied to the soil or sprayed onto the plant after it has begun to grow. They may neglect to mention a different, potentially environmentally destructive type of pesticide: those that are applied to the seed before it sprouts.

According to a study by US entomologists, all commercially available rootworm-directed Bt maize seed is now treated before it is planted with the controversial chemical insecticides known as neonicotinoids. The authors suggested that the adoption of Bt maize "may shift insecticide use patterns" from sprayed insecticides to such seed treatments.[61]

So GM Bt crops may have done little more than help cause a shift in the type and means of application of chemical insecticide, rather than reducing or eliminating such chemicals. Where insecticides used to be applied to the soil or the plant while it is growing, now they are applied to the seed before planting.

Dr Doug Gurian-Sherman, senior scientist at the Union of Concerned Scientists, commented that neonicotinoid treatments on Bt maize seed aim to kill the insect pests that are not well controlled by Bt toxins. He added that these seed treatments are not confined to Bt maize: most maize seed, apart from organic, and an increasing proportion of the seed of other row crops, is now routinely treated with neonicotinoids.[62,63]

Neonicotinoids are systemic insecticides, meaning that they spread throughout all tissues of the crop plant as it grows and are even present in the pollen and nectar. Like the Bt toxin engineered into GM plants, neonicotinoids differ from sprayed insecticides in that they are persistently present in the growing plant and always active. Because of this long exposure period, pests are more likely to develop resistance to them, and non-target and beneficial insects are more likely to be exposed, too.

Neonicotinoids are toxic to a wide variety of beneficial creatures, including some that help protect crops.[64,65] They have been found to have highly toxic effects even at very low doses because they persist over long periods in soil and water.[66] The rise in the use of neonicotinoid seed treatments has been implicated in bee die-off and colony collapse.[67,68] Bees living near agricultural fields have been found to be exposed by multiple routes, including contaminated wild flowers growing near fields, and neonicotinoids have been found in dead bees.[68]

The chief – seemingly the only – concern of defenders of Bt crop technology is the volume of insecticide applied as sprays after planting. If that volume decreases, they consider that Bt crops reduce insecticide use. But they are not reporting the whole story. The case of neonicotinoid seed treatments shows that it is necessary to consider other types of insecticide applications, how toxic the insecticides are (based on peer-reviewed research, not industry data), how they behave and persist in the environment, and the acreage over which they are applied.[62]

Given the extreme toxicity of neonicotinoids to bees and other beneficial organisms, their high degree of persistence and spread, and the vast acreage over which they are applied, it is questionable whether seed-treated Bt crops have had a beneficial effect on insecticide use.

5.4.6. Conclusion

Studies claiming that Bt crops reduce insecticide use have failed to take into account important aspects such as:

- The toxicity to non-target and beneficial organisms of the engineered Bt toxins
- The amount, type, and toxicity of insecticides actually used by farmers in the field even when Bt seeds are used – reflecting pest resistance and ineffectiveness of refuges
- Changes in the way insecticides are used, such as the transition from sprayed pesticides to use of insecticidal seed treatments.

Also, when evaluating the impact of GM Bt crops on insecticide use, a more useful comparator than chemically-grown non-GM crops would be non-GM crops under organic or integrated pest management, where insecticide use is reduced or eliminated. This would quickly make clear which farming methods can best reduce insecticide use while maximizing yield and farmer incomes.

5.5 **Myth:** GM Bt crops only affect target pests and their relatives **Truth:** GM Bt crops are not specific to pests but affect a range of organisms

GM proponents claim that Bt crops only affect target pests and their close relatives. Regulators have uncritically accepted this claim and allowed the commercialisation of Bt crops with a minimum of oversight. But research studies show that this assumption is false.

5.5.1. Bt crops harm soil organisms

Mycorrhizal fungi benefit plants by colonising their roots, helping them take up nutrients, resist disease, and tolerate drought. A study comparing Bt and non-Bt maize found a lower level of mycorrhizal colonisation in the roots of Bt maize plants. Residues of Bt maize plants, ploughed under at harvest and kept mixed with soil for up to four months, suppressed soil respiration (carbon dioxide production), markedly altered bacterial communities, and reduced mycorrhizal colonisation.[69] A separate field study on Bt maize residues ploughed into soil after harvest confirmed that Bt toxin resisted breakdown and persisted in soil for months.[70]

Arbuscular mycorrhizal fungi (AMF) are beneficial fungi that penetrate the root cells of the host plant. Bt maize has been found to decrease arbuscular mycorrhizal fungi (AMF) colonisation of the roots, compared with non-GM maize.[71,72]

5.5.2. Bt crops harm non-target and beneficial insects

GM Bt insecticide-producing crops have been found to have toxic effects on non-target insect populations,[73] including butterflies[74,75,76] and beneficial pest predators such as ladybirds[77 78] and lacewings.[79] Bt crops have more negative than positive impacts on beneficial insects.[80] Bt toxin impacts bee learning behaviour, interfering with bees' ability to find nectar sources for food.[81]

5.5.3. Bt crops harm aquatic organisms

A study conducted in Indiana, USA found that Bt insecticide released from GM Bt maize was polluting 25% of streams tested.[82] Other studies have found that GM Bt maize biomass is toxic to aquatic[83] and soil organisms.[69] Water fleas (an organism often used as an indicator of environmental toxicity) fed GM Bt maize showed toxic effects including reduced fitness, higher mortality, and impaired reproduction.[84]

5.5.4. Conclusion

Bt crops are not specific to the target pests and close relatives but negatively affect a range of non-target organisms, including beneficial insects that help protect crops.

5.6 **Myth:** Roundup is a benign and biodegradable herbicide **Truth:** Roundup persists in the environment and has toxic effects on wildlife

Manufacturers claim that Roundup, the glyphosate-based herbicide used on most GM crops, breaks down quickly and harmlessly in the environment. But research shows that this is untrue:

- In soil, glyphosate has a half-life (the length of time taken to lose half its biological activity) of between 3 and 215 days, depending on soil conditions.[85,86] In water, glyphosate's half-life is 35–63 days.[87]
- Although glyphosate binds well to soil particles, the Danish National Pesticide Monitoring Program showed that glyphosate and its main breakdown product AMPA are washed out of the root zone of clay soils in concentrations that exceed the acceptable quantities for drinking water (0.1 µg/l), with maximum values of over 5 µg/l.[88]
- Glyphosate was detected in between 60 and 100% of air and rain samples taken in the American Midwest during the crop growing season in the American Midwest, where Roundup Ready GM crops are widely planted.[89]
- Glyphosate and its main breakdown product, AMPA, were detected in streams in the American Midwest during the crop growing season.[90]
- Glyphosate is toxic to earthworms[91] and reduces bird populations due to habitat changes.[92]
- Roundup is highly toxic to amphibians. A study in a natural setting found that Roundup application at the rate recommended by the manufacturer eliminated two species of tadpoles and nearly exterminated a third species, resulting in a 70% decline in the species richness of tadpoles. Contrary to common belief, the presence of soil does not reduce the chemical's effects.[93] Further experiments with lower concentrations, well within levels to be expected in the environment, still caused 40% amphibian mortality.[94]
- Claims that Roundup and glyphosate are safe for human health and the environment have been overturned in courts in the United States[95] and France. The French court forced Monsanto to withdraw advertising claims that Roundup is biodegradable and leaves the soil clean after use.[96]

Regulatory bodies around the world have not caught up with the state of the science on Roundup and glyphosate. Instead they continue to rely on decades-old studies, mostly sponsored by manufacturers, to claim it is safe. An objective up-to-date review of Roundup and glyphosate's persistence and toxicity is long overdue.

5.7 **Myth:** Roundup is a benign herbicide that makes life easier for farmers
Truth: Roundup causes soil and plant problems that impact yield

GM Roundup Ready crops are marketed on the basis that Roundup is a safe herbicide that simplifies weed control and makes the farmer's life easier. But recent studies show that Roundup and glyphosate can accumulate in plants, have negative effects on soil organisms, and harm the growth and health even of soy plants that are genetically engineered to tolerate it. These effects may be partly responsible for yield decline and disease outbreaks found in GM Roundup Ready soy and maize.

5.7.1. Glyphosate causes or exacerbates plant diseases

> *"When you spray glyphosate on a plant, it's like giving it AIDS."*
>
> – Michael McNeill, agronomist and farm consultan[97]

Manufacturers claim that glyphosate kills plants by inhibiting an enzyme necessary for plant growth. But research shows that glyphosate has another way of killing plants: it makes the plant more susceptible to disease, potentially leading to the plant's death from the disease. Spraying glyphosate on a plant is, as US agronomist Michael McNeill said, "like giving it AIDS".

One possible mechanism for this process is offered in a study on GM RR soybeans. The study found that once glyphosate is applied to the plant, it accumulates in the plant tissues and then is released into soil through the roots. There, it stimulates the growth of certain fungi, notably Fusarium, a fungus that causes wilt disease and sudden death syndrome in soy plants.[98] Other studies confirm the link between glyphosate applications and increased infection with Fusarium.[99,100,101,102,103]

Interestingly, one study found that Fusarium colonisation of roots was greater in GM RR soy compared with non-GM soy even when glyphosate is not applied. The researchers suggested that this was due to an unintended change in the GM crop brought about by the genetic engineering process.[98]

Fusarium is of especial concern because it does not only affect plants. It produces toxins that can enter the food chain and harm humans[104] and livestock. In pigs, Fusarium-contaminated feed impairs reproduction[105] and increases stillbirths.[106]

Glyphosate has also been shown to increase the incidence and severity of other fungal diseases in plants, including take-all in wheat and Corynespora root rot in soy.[107,108]

In an attempt to combat soil-borne diseases such as Fusarium, Monsanto markets its new Roundup Ready 2 Yield soy seed with a proprietary fungicide/insecticide coating.[109] In other words, Monsanto has created a problem (fungal infection) by genetically modifying the soy seeds and is then profiting from a techno-fix "solution" to that problem. Such chemical treadmills are profitable for seed and chemical companies, but hurt farmers, consumers, and the environment.

5.7.2 Glyphosate makes nutrients unavailable to plants

Glyphosate binds vital nutrients such as iron, manganese, zinc, and boron in the soil, preventing plants from taking them up.110 So GM soy plants treated with glyphosate have lower levels of essential nutrients and reduced growth, compared with GM and non-GM soy controls not treated with glyphosate.[111] Lower nutrient uptake may partly account for the increased susceptibility of GM soy to disease, as well as its lower yield. It could also have implications for humans and animals that eat the crop, as it is less nutritious.

5.7.3 Glyphosate impairs nitrogen fixation

The yield decline in GM RR soy may be partly due to glyphosate's negative impact on nitrogen fixation, a process that is vital to plant growth and depends on the beneficial relationship between the soy plants and nitrogen-fixing bacteria. In young RR soy plants, glyphosate has been found to delay nitrogen

fixation and reduce the growth of roots and sprouts, resulting in yield decline. In drought conditions, yield can be reduced by up to 25%.[112]

The mechanism may be explained by another study, which found that glyphosate enters root nodules and negatively affects beneficial soil bacteria that are essential for the nitrogen fixation process. It inhibits root development, reducing root nodule biomass by up to 28%. It also reduces by up to 10% an oxygen-carrying protein, leghaemoglobin, which helps bind nitrogen in soybean roots.[113]

To counter such problems, seed and agrochemical companies have begun to market a "techno-fix" in the form of nitrogen-fixing bacterial inoculants, which are either applied to soy seed before sale or to the soil after sowing. The companies claim that this will increase yield potential.[114] However, a soybean inoculant evaluation trial conducted in Iowa concluded, "none of the inoculants resulted in a significant yield increase over the non-inoculated plots".[115] Inevitably, the cost of such treatments, even when they do not work, are borne by farmers.

5.7.4. Conclusion

Roundup and other glyphosate herbicides are not benign but have negative effects on soil and crops, some of which impact plant health and yield. Glyphosate's link with Fusarium infection is especially serious as Fusarium can harm humans and livestock.

5.8 **Myth:** GM crops help biodiversity
Truth: The herbicides used with GM crops harm biodiversity

> *"Many farmland birds rely on seeds from weeds for their survival and the [UK] government's farm scale trials showed that GM beet and GM spring oilseed rape [canola] reduced seed numbers by up to 80% compared with conventional beet and oilseed rape. The commercialisation of GM beet and oilseed rape could be disastrous for birds. The government is committed to reversing bird declines and has promised to ban GM crops if they damage the environment. The Farm Scale Evaluations (FSEs) show that two GM crops harm the environment and ministers now have no choice but to refuse their approval."*
>
> – Dr Mark Avery, director of conservation at the UK's Royal Society for the Protection of Birds (RSPB) and member of the UK government's Science Review Panel[116]

In the early 2000s the UK government conducted three-year farm-scale trials to examine the impacts of managing GM herbicide-tolerant crops (maize, sugar beet and canola) on farmland biodiversity. Each field was divided in half, with one half planted with a non-GM variety managed according to the farmer's normal practice, and the other half planted with a GM herbicide-tolerant variety. The GM beet was tolerant to the glyphosate-based herbicide Roundup and the GM maize and canola were tolerant to glufosinate ammonium. The herbicide-tolerance genes enabled farmers to spray the crops with these broad-spectrum (kill-all) herbicides, killing all weeds but allowing the crop to survive.

Weeds provide food and habitat for birds, insects, and other wildlife, so the farm-scale trials recorded levels of weeds and invertebrates in the fields and field margins. Selected groups of other organisms with wider foraging ranges (beetles, bees, and butterflies) were also studied. The trials looked at whether the changes in management associated with GM crops would reduce weed levels and have wider impacts on farmland biodiversity.

The findings showed that the cultivation of GM herbicide-resistant crops reduces wildlife populations and damages biodiversity, due to the effects of the broad-spectrum herbicides with which they are grown.[117,118,119,120,121,122]

GM herbicide-resistant maize was found to be better for wildlife than non-GM maize, with more weed species and insects in and around the field.[117,118,119,120,121,122] But the GM maize was measured against a non-GM maize grown with atrazine, a toxic herbicide that was banned in Europe soon after the trials ended. With such a toxic control, it was highly likely that the GM maize would be found to be better for wildlife.A more useful comparator would have been a maize grown in an organic or integrated pest management (IPM) system, which eliminate or reduce herbicide use.

In the EU, this is not a purely idealistic notion. A 2009 European Directive asks member states to implement national plans to adopt integrated pest management and alternative approaches in order to reduce pesticide use.[123]

5.9 **Myth:** GM crops bring economic benefits to farmers **Truth:** Economic impacts of GM crops on farmers are variable

> *"Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative."*
>
> – J. Fernandez-Cornejo, W. D. McBride, The adoption of bioengineered crops, US Department of Agriculture[6]

The question of economic impacts of GM crops on farmers is complex and a thorough examination is beyond the scope of this report. Results vary and depend on many factors, including:

- Suitability of the crop for local conditions
- Climate
- Pest and disease prevalence
- Cost of weed management
- Subsidies and incentives offered by governments or corporations
- Cost of seed
- Availability of markets for the crop.

The following studies give an overview of the issue.

Fernandez-Cornejo (2002)

This report on farm-level economic impacts of adopting GM crops found that they were "mixed or even negative". The report, mostly based on data from USDA surveys, found that adoption of herbicide-tolerant maize had a positive effect on net returns, but the effect was negative for Bt maize. GM soybeans had no effect either way.[6]

Gómez-Barbero (2006)

This review for the European Commission of the economic impact of the main GM crops worldwide found that herbicide-tolerant soybeans had a negative effect on US farmers' income. But the same crop brought income gains to Argentine farmers, due to lower prices for GM seed in that country.[124]

Why do US farmers adopt GM soy if it brings no financial gain? The authors suggested that the reason may be simpler weed control,[124] though the data cited to back up this claim pre-date the explosion of herbicide-resistant superweeds that has caused the cost of GM soy production to rise (see 5.2).

The review found that Bt cotton in China had produced economic gains for farmers, mostly because of reduced expenditure on pesticide sprays. Bt cotton in India was claimed to provide economic benefits, though with considerable "local variability".[124] These studies were also carried out before the full impact of pest resistance and emergence of secondary pests was experienced by Chinese and Indian farmers.

Morse (2005)

This study found that Bt cotton in India produced better profit margins for farmers than non-GM cotton. However, the authors pointed out that these benefits will only be sustained if pests do not evolve resistance to Bt cotton.[125] Recent studies suggest that they are already evolving resistance (see 5.4).

These findings are confirmed by a leaked advisory from the Indian government which blamed Bt cotton for the spate of farmer suicides across the subcontinent. The advisory stated, "Cotton farmers are in a deep crisis since shifting to Bt cotton. The spate of farmer suicides in 2011–12 has been particularly severe among Bt cotton farmers." The advisory added that Bt cotton's success had only lasted five years. Since then, yields had fallen and pest attacks had increased: "In fact cost of cotton cultivation has jumped… due to rising costs of pesticides. Total Bt cotton production in the last five years has reduced."[126]

5.9.1. The rising cost of GM seed

An important factor in assessing the economic impact of GM crops is the cost of seed. In the United States, where GM firms dominate the seed market, a 2009 report documents that prices for GM seeds have increased dramatically compared with prices for non-GM and organic seeds. This cut average farm incomes for US farmers growing GM crops. The $70 per bag price set for RR2 soybeans

for 2010 was twice the cost of conventional seed and reflected a 143% increase in the price of GM seed since 2001.[127]

US farmers have grown increasingly concerned about the high price and poor performance of GM seed. A 2011 media report said that the seed companies had responded by withdrawing a high-performing non-GM variety of maize, which gave higher yields than GM varieties. The report added that the companies are hiking the prices of herbicides used by non-GM farmers to artificially increase the cost of non-GM production.[128]

Farmers have little choice but to tolerate such price hikes because of consolidation within the seed industry. In other words, the GM industry dictates which seed varieties are available. In 2008, 85% of GM maize patents and 70% of non-maize GM plant patents in the US were owned by the top three seed companies: Monsanto, DuPont, and Syngenta. Even these three companies are not independent of each other but increasingly network to cross-license GM seed traits.[131]

The largest of the big three companies is Monsanto. In 2010 Monsanto raised its prices for its RR2 soybeans and SmartStax maize seeds so steeply that the US Department of Justice launched an investigation into the consolidation of agribusiness firms that has led to anti-competitive pricing and monopolistic practices. Farmers actively gave evidence against companies like Monsanto.[132,133]

The same pattern has been reported in India. Moreover, as prices of GM Bt cotton seed have escalated,[134] non-GM varieties – in some cases better-performing than the GM varieties – have been withdrawn from the market.[135,136] The result is that farmers are forced into dependency on the GM industry. Such reports expose claims that GM crops increase "farmer choice" as misleading.

5.9.2. Conclusion

The economic impacts of GM crops on farmers are variable and depend on complex factors. However, consolidation in the seed market has led to steep increases in the price of GM seed as compared with non-GM seed. This consolidation has also led to competing high-performing non-GM seed varieties being withdrawn from the market, restricting farmer choice.

The importance of independent information

Some who claim that GM crops bring economic benefits to farmers cite upbeat reports written by Graham Brookes and Peter Barfoot. But such reports are not independent. Brookes and Barfoot are the directors of a private consultancy firm called PG Economics, which has GM and agrochemical firms as its primary clients.[129] Generally, PG Economics' reports are commissioned by GM firms or industry lobby groups such as Agricultural Biotechnology in Europe,[130] whose members include the large GM seed companies. Most PG Economics reports are not peer reviewed and rely heavily on industry data.

5.10 **Myth:** GM crops can "coexist" with non-GM and organic crops **Truth:** Co-existence means widespread contamination of non-GM and organic crops

> *"OK, we know that cross-pollination will occur but we've got thirty years of experience to say we know how far pollen will travel. And therefore what we've done is we'll grow a GM crop at a distance away from a non-GM crop, so the people that want non-GM can buy non-GM, and the people that want GM can buy GM. The two will not get mixed up. Everybody will have the right to choose."*
>
> – Paul Rylott, seed manager for Aventis CropScience (now Bayer)[137]

The GM industry used to claim that GM contamination of non-GM crops could not occur. After it became clear that this was false, it shifted the argument to lobbying for "co-existence" of GM, non-GM, and organic crops. The industry now argues that farmers should be able to choose to plant GM crops if they wish and says that no serious problems are caused for non-GM and organic farmers.

But experience has shown that the arrival of GM crops in a country removes choice. "Coexistence" rapidly results in widespread contamination of non-GM crops, resulting in lost markets. Contamination occurs through cross-pollination, spread of GM seed by farm machinery, and inadvertent mixing during storage. Farmers are gradually forced to grow GM crops or have their non-GM crops contaminated.

Scientific studies confirm that GM contamination is unavoidable once GM crops are grown in a region. For example, GM herbicide-tolerant oilseed rape (canola) seed can persist and remain viable in soil for years. GM herbicide-resistant "volunteers" – plants that were not deliberately planted but are the result of germination of residual GM seeds from crops previously grown in the field – were found growing ten years after the GM oilseed rape crop had been planted.[138] GM herbicide-resistant oilseed rape was found to be thriving in the wild in North Dakota, often far from areas of agricultural production. GM genes were present in 80% of the wild canola plants found.[139,140]

5.10.1. Who is liable for GM contamination?

In countries where legal liability for GM contamination is clearly established, GM crop cultivation has become severely restricted. In Germany, a law has been passed making farmers who grow GM crops liable for economic damages to non-GM and organic farmers resulting from GM contamination.[141,142] The law has virtually halted the planting of GM crops in the country because farmers are not prepared to accept liability for contamination.[142]

The fact that farmers who previously chose to grow GM crops have ceased to do so because of the fact that they could be held liable for damages is clear evidence that coexistence is impossible. In light of this, it is not surprising that the GM seed industry has lobbied forcefully against the implementation of similar liability laws in the US and Canada.

The GM seed industry also knows it cannot contain or control its GM genes. In February 2011, after years of industry lobbying, the EU dropped its policy of zero tolerance of animal feed with unapproved GMOs, allowing contamination of up to 0.1%.[143,144] In doing so, it granted industry release from liability for damages resulting from GM contamination with up to 0.1% of GM crop varieties ("Low Level Presence") that are under evaluation but not yet approved in the EU.

In the United States, federal courts have recognised that GM crops are likely to contaminate non-GM crops. Two court rulings reversed US Department of Agriculture (USDA) approvals for the commercial planting of GM sugar beet and GM alfalfa. The courts ordered the USDA to halt planting of the GM crops until it had completed an environmental impact statement

(EIS) on the environmental and economic effects of contamination of non-GM crops.

In the case of GM sugar beet, the USDA defied the court order and allowed farmers to continue planting the crop while it worked on the EIS. In the case of GM alfalfa, USDA completed an EIS in which it admitted that cross-contamination with non-GM alfalfa could occur and that the economic interests of non-GM growers could be harmed. But, bowing to heavy lobbying from the GM industry, USDA "deregulated" GM alfalfa, an action that superseded the court ruling and allowed planting of the crop without restriction.[145]

5.11 **Myth:** If GM contamination occurs, it is not a problem **Truth:** GM contamination has had severe economic consequences for farmers, food and feed companies, and markets

> *"If some people are allowed to choose to grow, sell and consume GM foods, soon nobody will be able to choose food, or a biosphere, free of GM. It's a one way choice, like the introduction of rabbits or cane toads to Australia; once it's made, it can't be reversed."*
>
> – Roger Levett, specialist in sustainable development[163]

GM contamination of crops has had severe economic consequences, threatening the livelihoods of farmers who receive premiums for growing organic and GM-free crops and blocking export markets to countries with strict regulations on GMOs.

Examples of GM contamination problems include:

- In 2011 an unauthorized GM Bt pesticidal rice, Bt63, was found in baby formula and rice noodles on sale in China.[146] Contaminated rice products were also found in Germany[147] and Sweden.[148] The same rice was found in rice products in New Zealand in 2008, leading to product recalls.[149] GM Bt rice has not been shown to be safe for human consumption. Periodic recalls of products contaminated with Bt63 rice continue to be reported even today in Europe.
- In 2009 an unauthorized GM flax called CDC Triffid contaminated Canadian flax seed supplies, resulting in the collapse of Canada's flax export market to Europe.[150,151]
- In 2006 an unapproved experimental GM rice, grown only for one year in experimental plots, was found to have contaminated the US rice supply and seed stocks.[152] Contaminated rice was found as far away as Africa, Europe, and Central America. In 2007 US rice exports were down 20% from the previous year as a result of the GM contamination.[153] In 2011 the company that developed the GM rice, Bayer, agreed to pay $750 million to settle lawsuits brought by 11,000 US farmers whose rice crops were contaminated.[154] A court ordered Bayer to pay $137 million in damages to Riceland, a rice export company, for loss of sales to the EU.[155]
- In Canada, contamination from GM oilseed rape has made it virtually impossible to cultivate organic, non-GM oilseed rape.[156]
- Organic maize production in Spain has dropped as the acreage of GM maize production has increased, due to contamination by cross-pollination with GM maize.[157]
- In 2000 GM StarLink maize, produced by Aventis (now Bayer CropScience), was found to have contaminated the US maize supply. StarLink had been approved for animal feed but not for human consumption. The discovery led to recalls of StarLink-contaminated food products across the US, spreading to Europe, Japan, Canada, and other countries. Costs to the food industry are estimated to have been around $1 billion.[158] In addition, the US government bore indirect costs of between $172 and $776 million through the USDA's Loan Deficiency Payments Program, which offers producers short-term loans and direct payments if the price of a commodity crop falls below the loan rate.[159] Aventis paid out $110 million to farmers who brought a class action suit against the company[160] and spent another $110 million buying back StarLink-contaminated maize.[152]

As no official body keeps records of GM contamination incidents, Greenpeace and Genewatch UK have stepped into the gap with their GM Contamination Register.[161] In the years 2005–2007 alone, [216] contamination incidents were recorded in the database.[162]

5.12 **Myth:** Horizontal gene transfer from GM crops is unlikely or of no consequence
Truth: GM genes can escape into the environment by horizontal gene transfer with potentially serious consequences

Most GM contamination incidents occur through cross-pollination, contamination of seed stocks, or failure to segregate GM from non-GM crops after harvest. But for years, scientists have warned that GM genes could also escape from GM crops into other organisms through a mechanism called horizontal gene transfer (HGT). HGT is the movement of genetic material between unrelated species through a mechanism other than reproduction. Reproduction, in contrast, is known as vertical gene transfer because the genes are passed down through the generations from parent to offspring.

GM proponents and government regulators often claim that, based on available experimental data, HGT is rare. The EU-supported website GMO Compass states, "So far, horizontal gene transfer can only be demonstrated under optimised laboratory conditions."[164] Alternatively, they argue that if it does happen, it does not matter, as GM DNA is no more dangerous than non-GM DNA.

But there are several mechanisms through which HGT can occur, some of which are more likely than others. HGT via some of these mechanisms occurs easily and frequently in nature. The consequences of HGT from GM crops are potentially serious, yet have not been adequately taken into account by regulators.

The basic mechanisms by which HGT could occur are:

- Uptake of GM DNA by bacteria
- Uptake of DNA from the digestive tract into the tissues of the organism
- Transmission of GM DNA via Agrobacterium tumefaciens, a bacterium that is often used to introduce GM genes into plants because of its natural ability to carry and transfer foreign DNA and to infect plants through wounds in their outer layer
- Gene transfer by viruses.

The following sections outline these mechanisms and provide a perspective on the frequency at which these events can occur, as well as their potential impacts.

5.12.1. DNA uptake by bacteria

Bacteria are promiscuous. They are always exchanging DNA between themselves and taking up DNA from their environment. Some of this environmentally acquired DNA can be incorporated to their genome and may be expressed. There are two scenarios in which DNA uptake by bacteria could result in HGT of GM genes.

The first is the transfer of GM DNA from GM food into intestinal bacteria. DNA from a GM plant is released into the intestinal tract of the consumer during digestion. Contrary to frequent claims, GM DNA is not always broken down in digestion and can survive in sufficiently large fragments that can contain intact genes that are potentially biologically active (see 3.1.1, 3.6.2).

Bacteria of many different species are present in the digestive tract, some of which can take up DNA from their environment and incorporate it into their own DNA. In the case of GMOs, this could be problematic. For example, if the GM plant contained a gene for antibiotic resistance, the bacterium could incorporate that antibiotic resistance gene into its genome, and thereby become resistant to the antibiotic. If the bacteria in question happened to be pathogenic (disease-causing), this process would have created an antibiotic-resistant pathogen – a "superbug".

Since bacteria in the intestinal tract frequently exchange DNA, the creation of a superbug could be a two-stage process. First, the antibiotic resistance gene could initially be taken up and incorporated into a non-pathogenic bacterium in the intestinal tract. Subsequently, if a pathogenic bacterial species becomes part of the intestinal flora, the non-pathogenic bacterium could transfer the antibiotic resistance gene to the pathogenic

bacterium, thereby creating a "superbug".

The transfer of GM genes from food to intestinal bacteria has been documented in a study on humans, which found that the intestinal bacteria of a person whose diet included soy carried sequences unique to the GM soy that was part of their diet.[165]

The second scenario in which DNA uptake by bacteria could result in HGT of GM genes is the transfer of GM DNA to soil bacteria. Cultivation of transgenic crops leads to the degradation of GM plant material in the environment, liberating GM genes into the soil. Every cubic centimetre of soil contains thousands of different species of bacteria, only a small percentage of which have been identified and characterised. Some of the known soil bacteria can, and do, take up free DNA that may be present in the soil, incorporating that DNA into their genomes.[166] This could result in the transfer of GM genes to natural soil bacterial populations. Based on limited currently available data, this type of event has been calculated to be extremely rare.[167] However, it has been shown that GM DNA can persist in soil at detectable levels for at least a year,[168] increasing the likelihood of HGT.

In addition, we only know a small fraction of the soil bacteria that could potentially take up DNA from their environment.[166] Furthermore, if the uptake of a GM gene, for example for antibiotic resistance, gives the bacterium a survival and growth advantage, this can allow them to outcompete other bacterial strains in the presence of widely used antibiotics in agriculture and medicine. Therefore, this initial rare event could still result a significant environmental and health outcome.[169]

5.12.2. DNA uptake during digestion of GM foods

A study on mice demonstrated that foreign DNA present in food can be transferred from the digestive tract to the bloodstream of animals that eat the food. This foreign DNA was also found in white blood cells and in the cells of many other tissues of the mice.[170] In a separate study, foreign DNA in a diet fed to pregnant mice was found in the organs of their foetuses and newborn offspring. The foreign DNA was believed to have reached the foetus through the placenta.[171]

It has also been shown that GM DNA in feed can be taken up in the organs of the animals that eat it and can be detected in the meat and fish that people eat.[172,173,174,175]

Most of the GM DNA in food is fragmented before it reaches the blood or tissues. However, a few copies of GM DNA large enough to contain the sequence of a full and functional gene will also be present in the digestive tract and can be taken up into the blood at lower frequency, where it can be transported by the blood and taken up by cells of some tissues or organs.[170] Once taken up by a cell, such a GM gene could be integrated into the DNA of the cell, causing either direct mutation of a host gene function or reprogramming the host cell to produce the protein for which that GM gene codes, or both.

At present, this scenario is speculative. Although it is clearly possible to detect transgenic DNA is the tissues of organisms that consume GM feed, no research has been published that shows that the GM DNA is expressed in the tissues of those organisms. It would be expected that if such expression did occur, it would not occur frequently. In order to find out whether such expression events actually occur, it would be necessary to conduct very large-scale studies – though identifying a suitable experimental design would be challenging.

It should be pointed out, however, that although such events may be of low frequency, because of the widespread consumption of GMOs by both humans and animals, the fact that such events are of low frequency does not eliminate them as important to the biosafety assessment of GMOs.

Though the mechanism is still unclear, GM feed has been found to affect the health of animals that eat it. GM DNA from soy was detected in the blood, organs, and milk of goats. An enzyme, lactic dehydrogenase, was found at significantly raised levels in the heart, muscle, and kidneys of young goats fed GM soy.[176] This enzyme leaks from damaged cells during immune reactions or injury, so high levels may indicate such problems.

5.12.3. Horizontal gene transfer by Agrobacterium tumefaciens

Agrobacterium tumefaciens (A. tumefaciens) is a soil bacterium that is often used to introduce GM genes into plants.

The introduction of GM genes into plants by infection with A. tumefaciens is carried out by exploiting a Ti plasmid – a small circular molecule of DNA that is naturally found in A. tumefaciens. When A. tumefaciens infects a plant, the Ti plasmid is introduced into the plant cells. Parts of the Ti plasmid may then insert themselves into the DNA of the plant.

Plant biotechnologists have adapted this natural process in order to introduce foreign DNA into plants and thereby produce GM crops. First, the naturally occurring genes of the Ti plasmid in the region that can insert into host plant cell DNA are removed and replaced with the GM gene of choice. The now genetically modified Ti plasmid is then introduced into A. tumefaciens, which in turn is used to infect plant cells. Once inside the plant cell, some of the genetically modified Ti plasmid can insert into host plant cell DNA, thereby permanently altering the genetic makeup of the infected cells.

Although A. tumefaciens is a convenient way of introducing new genes into plants, it can also serve as a vehicle for HGT from the GM plant to other species. This can happen via two mechanisms.

First, residual A. tumefaciens carried in a GM plant could infect plants of other species, thereby carrying the GM gene(s) from the intentionally genetically modified plant into other plants. A. tumefaciens can serve as a vehicle for HGT to hundreds of species of plants, since A. tumefaciens has been found to infect a wide range of plant species.

The second mechanism creates the risk that A. tumefaciens could pass GM genes on to an even wider range of species, including, but not limited to, plants. It consists of certain types of fungi functioning as intermediate hosts in the transfer of transgenes from GM A. tumefaciens to other organisms.

A 2010 study found that under conditions found in nature, A. tumefaciens introduced DNA into a species of disease-causing fungi that is known to infect plants. The study also found that GM DNA sequences in the A. tumefaciens were incorporated into the DNA of the fungi. In other words, the A. tumefaciens was genetically engineering the fungi.

The authors concluded that in cases where a GM plant is infected with fungi, A. tumefaciens in the GM plant could infect the fungi, introducing GM genes into the fungi.[177] Such fungi could, in turn, pass the GM genes onto other plants that they infect.

Genetic engineers had previously assumed that A. tumefaciens only infects plants. But this study showed that it can infect fungi, a different class of organism. The study stated, "A. tumefaciens may be able to [genetically] transform non-plant organisms such as fungi in nature, the implications of which are unknown."[177] The authors pointed out that A. tumefaciens is already known to transform – genetically modify – human cells in the laboratory.[177,178]

One of the study's co-authors, Andy Bailey, a plant pathologist at the University of Bristol, UK, said, "Our work raises the question of whether [A. tumefaciens's] host range is wider than we had thought – maybe it's not confined only to plants after all."[179]

The implications of this research are that it is possible that GM gene(s), once introduced by A. tumefaciens into a GM crop and released into the environment, could then be introduced into an organism outside the plant kingdom – in this case, a fungus – and genetically modify it. This would be an uncontrolled and uncontrollable process, with unpredictable consequences.

Implications of horizontal gene transfer through A. tumefaciens

Could A. tumefaciens transfer GM genes from a GM plant to another organism under realistic farming conditions? The answer depends on whether any A. tumefaciens carrying GM genes remains in the GM crop that is planted in open fields. Genetic engineers use antibiotics to try to remove the A. tumefaciens from the GM plant after the initial GM transformation process is complete in the laboratory. But this process has

been found to be unreliable and incomplete:

- A study on GM brassicas, potato and blackberry found that the use of three antibiotics failed to completely remove A. tumefaciens. Instead, the A. tumefaciens contamination levels increased from 12 to 16 weeks after the GM transformation process and the A. tumefaciens was still detected 6 months after transformation.[180]
- A study on GM conifers found that residual A. tumefaciens remained in the trees 12 months after the genetic transformation but were not detected after this time in the same plants.[181]

However, these experiments only examined the first GM plant clones. In the GM development process, such GM clones go through a long process of back-crossing and propagation with the best-performing non-GM or GM plant relatives in order to try to produce a GM plant that performs well in the field and expresses the desired traits. The important question is whether A. tumefaciens carrying GM genes survives this back-crossing and propagation process and remains in the final GM plant that is commercialised.

To the best of our knowledge there have been no studies to assess whether any A. tumefaciens remains in the final commercialised GM plant. The study on GM conifers examined the initial GM clones that were grown on, not plants that had been cross-bred and propagated over several generations, as GM crops are before they are commercialised, so it does not provide an answer to this question.

However, this question should be answered before a GM variety is commercialised, in order to avoid unwanted consequences that could be caused by residual A. tumefaciens in the final GM plant. Examples of consequences that should be excluded are the transfer of insecticidal properties to bacteria, or of herbicide tolerance to other crops or wild plants. The study discussed above (5.12.3) shows that the introduction of GM genes into crop plants could have consequences to organisms outside the plant kingdom, through the mechanism of infection by fungi carrying A. tumefaciens, which in turn carry GM genes.[177]

The consequences of such HGT for human and animal health and the environment are not predictable, but are potentially serious. The health and environmental risk assessment for any GM variety must demonstrate that the GM plants have been completely cleared of GM A. tumefaciens before they are approved for commercialisation.

5.12.4. Gene transfer by viruses

Viruses are efficient at transferring genes from one organism to another and in effect are able to carry out HGT. Scientists have made use of this capacity to create viral gene transfer vectors that are frequently used in research to introduce GM genes into other organisms. Such vectors based on plant viruses have also been developed to generate GM crops, though no crops produced with this approach have been commercialised to date.[182 183]

The viral vectors that are used to generate GM crops are designed to prevent the uncontrolled transfer of genetic material. However, because the long time period during which virally engineered crops would be propagated in the environment, and the large number of humans and livestock that would be exposed to this GM genetic material, there is a real, though small, risk that unintended modifications could occur that could lead to virus-mediated HGT – with unpredictable effects.

Another potential risk of virus-mediated HGT comes from GM crops engineered to contain a virus gene, in particular those carrying information for a viral "coat" protein. This is done in an attempt to confer resistance of the crop from actual infection and damage by the family of 'wild' virus from which the viral GM gene was derived. However, it has been suggested that if a GM crop containing a viral gene of this type was infected by the viruses, it may result in exchange of genetic material between the GM viral gene in the plant and the infecting virus, through a process known as recombination. This can potentially result in a new more potent ("virulent") strain of virus.[184,185]

The reasons for these concerns are as follows. The GM viral gene will be present in every single cell of the crop. As a result, the large-scale cultivation of such a viral GM gene-containing crop will result in an extremely high concentration of particular viral genes in fields. It has been suggested that this provides an unprecedented opportunity for genetic material recombination

events to take place between an infecting virus and GM viral genes in the crop, thereby increasing the risk of new, mutated, and potentially more virulent strains of virus being produced.[185]

Such viral mutation with increased virulence has been shown to occur under laboratory conditions.[186,187]

To date only two GM crops engineered with genes from viruses have been commercialised: a variety of squash grown in the USA and Mexico,[188 189] and papaya cultivated in Hawaii.[190] There are no reports of any investigations to see if any new viral strains have arisen by recombination in these two crops. Interestingly, and quite unexpectedly, although the GM squash was resistant to viral infection, it was found to be prone to bacterial wilt disease following attack by beetles.[191]

5.12.5. Overall assessment of the risks of HGT by the above methods

HGT events of all types are of very low probability of occurrence. The method with the highest probability of occurring is DNA uptake by bacteria in either the environment or the digestive tract. There is good evidence that this has already happened in the intestinal bacteria of humans who consume GM soy.

The other scenarios are of significantly lower probability. However, given the extremely wide distribution of GM crops and their intended use over decades, these low probabilities translate into the likelihood that HGT events could actually occur even via the mechanisms that are expected to take place at lower probabilities.

Therefore, the negative impacts and risks associated with HGT must be taken into account in considering the overall biosafety of any GM crop.

Conclusion to Section 5

Most of the benefits for farmers and the environment claimed for GM crops are either exaggerated or false. For example, contrary to frequent claims, GM crops have not increased intrinsic yield. Crop yields have increased over the past decades, but this is due to successes in conventional breeding, not GM traits.

Neither have GM crops decreased pesticide use. The adoption of GM Bt maize and cotton has resulted in a slight decrease in the volume of insecticide sprays, but this decrease is likely to be unsustainable as pests gain resistance to the Bt toxins and secondary pests take over. Also, the reduction in insecticidal sprays is dwarfed by the massive increase in herbicide use caused by the adoption of GM herbicide-tolerant crops. The adoption of these GM crops has caused farmers to spray 383 million more pounds (174 million kg) of herbicides than they would have done in the absence of GM herbicide-tolerant seeds.

This increase is largely due to the spread of weeds resistant to glyphosate, the herbicide most commonly used on GM crops. As a "solution" to the problem of glyphosate-resistant weeds, biotech companies have developed crops engineered to tolerate several different herbicides, including potentially even more toxic herbicides such as dicamba and 2,4-D (an extremely toxic ingredient of Agent Orange). The resulting chemical treadmill only benefits the GM seed companies, which profit from each failure of their technologies because the failure creates a new opportunity for them to sell more chemicals in increasingly complex mixtures. Claims for the environmental friendliness of the no-till farming system as practised with GM herbicide-tolerant crops are also unjustified.

Glyphosate over-use is also causing other problems for farmers, such as reducing crop vigour by making soil nutrients unavailable to crops and causing or exacerbating plant diseases that impact yield. Manufacturer claims that glyphosate/Roundup is an environmentally benign herbicide with low toxicity have proved to be false, with a growing number of studies showing that it persists in the environment and has toxic effects, in addition to studies showing that it is toxic to humans and causes birth defects and cancer.

Claims of reductions in insecticide use through Bt crops are suspect when it is considered that the entire GM plant is an insecticide. Also, Bt crop technology is being undermined by the

emergence of resistant and secondary pests, which force farmers to go back to spraying complex and expensive chemical cocktails. And the increased use of insecticidal seed treatments on GM and non-GM seed alike raises the possibility that insecticide use has not been reduced through Bt crops but that it is simply less visible to farmers and consumers.

Statements that the Bt toxin in Bt crops only affects insect pests have been shown to be false by studies showing negative effects on a wide range of organisms, including beneficial insects that help protect crops and beneficial soil organisms that enhance crop growth and health.

Economic impacts of GM crops on farmers appear to be variable. Reports have emerged of escalating prices for GM seeds and the chemicals they are engineered to depend on. This pattern is enabled by the consolidation of the seed market under the control of the GM and agrochemical industry and the absence of real competition.

At odds with claims that GM crops increase farmer choice, in reality their introduction marks the disappearance of farmer choice due to two mechanisms. First, as the GM industry gains control over the seed market in a region, desirable non-GM seed varieties are pulled from the market. Second, the biotech industry lobbies for "freedom of choice" for farmers, claiming that GM and non-GM crops (including organic) can "co-exist". This opens the door for GM crops, causing farmers who wish to grow non-GM or organic crops to lose their freedom of choice due to GM contamination. Time and again, this has resulted in lost markets and increased costs to farmers and the food and feed industry.

GM traits can spread to other crops, wild plants, and other unrelated species by horizontal gene transfer (HGT) through several mechanisms, some of which are more likely than others. The potential consequences of HGT have not been adequately considered by regulators.

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6. CLIMATE CHANGE AND ENERGY USE

climate change is often used as a reason to claim that we need GM crops.[1] But the evidence suggests that the solutions to climate change do not lie in GM. This is because tolerance to extreme weather conditions such as drought and flooding – and resistance to the pests and diseases that often accompany them – are complex traits that cannot be delivered through GM.

Where a GM crop is claimed to possess such complex traits, they have generally been achieved through conventional breeding, not GM. Simple GM traits such as pest resistance or herbicide tolerance are added to the conventionally bred crop so as to put the biotech company's "brand" on it after the complex trait is developed through conventional breeding.

While the resulting crop is often claimed as a GM success, this is untrue. It is a success of conventional breeding, with added GM traits. The GM traits do not contribute to the agronomic performance of the crop but make the crop the property of a biotech company and (in the case of herbicide tolerance) keep farmers dependent on chemical inputs sold by the same company.

Section at a glance

- GM will not solve the problems of climate change. Tolerance to extreme weather conditions involves complex, subtly regulated traits that genetic engineering is incapable of conferring on plants.
- Most GM crops depend on large amounts of herbicides, which in turn require large amounts of fossil fuels in manufacture.
- No GM nitrogen-use-efficient crops have been successfully commercialised even though promoters of the technology have been promising them for more than a decade.
- Conventional breeding is far ahead of GM in developing climate-ready and nitrogen-use-efficient crops.
- Additional means to cope with climate change include the many locally-adapted seeds conserved by farmers across the world and agroecological soil, water, and nitrogen management systems.

6.1 **Myth:** GM will deliver climate-ready crops **Truth:** Conventional breeding outstrips GM in delivering climate-ready crops

In December 2011 the US Department of Agriculture (USDA) deregulated Monsanto's drought-tolerant maize variety MON87460.[2] It was hailed as the first commercialised GM crop designed to resist stressful environmental conditions like drought. But the USDA, in its assessment of the crop, noted that many non-GM maize varieties on the market are at least as effective as Monsanto's engineered maize variety in managing water use. "The reduced yield [trait] does not exceed the natural variation observed in regionally-adapted varieties of conventional corn," USDA said, adding, "Equally comparable varieties produced through conventional breeding techniques are readily available in irrigated corn production regions."[3]

This is to be expected, given that GM crops are developed by adding GM traits to the best existing conventionally bred varieties.

Meanwhile, conventional breeding, sometimes helped by marker assisted selection, has outstripped GM in producing numerous climate-ready crops. Examples include:

- Maize varieties that yield well in drought conditions,[4] including some developed for farmers in Africa[5,6,7]
- Cassava that gives high yields in drought conditions and resists several diseases[8]
- Climate-adapted, high-yield sorghum varieties developed for farmers in Mali[9]
- Beans resistant to heat, drought, and disease[10,11]
- Pearl millet, sorghum, chickpea, pigeon pea and groundnut varieties that tolerate drought and high temperatures[12]
- Rice varieties bred to tolerate drought, flood, disease, and saline (salty) soils[13]
- Flood-tolerant rice varieties developed for Asia[14,15]
- Over 2,000 indigenous rice varieties that are adapted to environmental fluctuations, as well as varieties that resist pests and diseases, registered by Navdanya, a seed-keeping NGO based in India[16]
- Tomato varieties developed by Nepali farmers that tolerate extreme heat and resist disease.[17]

It should be borne in mind that only a part of the solution to climate change lies in plant genetics. Insofar as genetics is the solution, humanity will continue to rely on the same source that GM seed companies mine for their germplasm – the hundreds of thousands of locally adapted seed varieties developed and conserved over centuries by farmers worldwide. These varieties are our living germplasm bank.

The part of the solution that lies beyond plant genetics will be found in proven effective agroecological farm management techniques, such as building organic matter into the soil to conserve water, planting a diversity of crops, rotating crops, and choosing the right plant for the conditions.

6.2 **Myth:** No-till farming as practised with GM crops is climate-friendly as it sequesters more carbon
Truth: No-till farming does not sequester more carbon

Chemically-based agriculture is a major contributor to climate change, producing over 20% of greenhouse gas emissions.[18] GM proponents claim that GM crops can help reverse this trend by enabling the adoption of no-till farming, which avoids ploughing and relies on herbicide applications to control weeds. GM proponents argue that no-till sequesters (stores) more carbon in the soil than ploughing, preventing the carbon from being released into the atmosphere as the greenhouse gas carbon dioxide.

On the basis of this argument, Monsanto is lobbying for GM Roundup Ready crop cultivation to be made eligible for carbon credits under the United Nations' Clean Development Mechanism (CDM).[19] The CDM aims to promote technologies that mitigate climate change. Industrialized countries and companies in the Global North can continue to emit the same amount of greenhouse gases and still meet their required emissions reductions by funding CDM projects, most of which are in the Global South.

If Monsanto succeeds in its lobbying and farmers that grow Roundup Ready crops can access carbon credits for no-till, then sales of Monsanto's seeds and agrochemicals will increase, as governments will encourage farmers to plant Roundup Ready crops to qualify for carbon credits.

But industry claims of improved carbon sequestration for GM Roundup Ready crops with no-till are not supported by research. A comprehensive review of the scientific literature found that no-till fields sequester no more carbon than ploughed fields when carbon sequestration at soil depths greater than 30 cm is taken into account. Studies claiming to find carbon sequestration benefits from no-till only measure carbon sequestration down to a depth of about 30cm and so do not give an accurate picture.[20]

6.3 **Myth:** GM will solve the nitrogen crisis
Truth: GM has not delivered nitrogen-efficient crops

Synthetic nitrogen fertilizer is used in GM farming, as in all chemically-based agriculture. There are many problems associated with its production and use. The production process uses large amounts of natural gas, a non-renewable fossil fuel.[21] A UK study found that nitrogen fertilizer production can account for more than 50% of the total energy used in agriculture.[22]

Nitrogen fertilizer produces greenhouse gases at the time of manufacture and again when used on fields,[22] giving off nitrous oxide, a greenhouse gas 300 times more potent than carbon dioxide.[23] Fertilizer-intensive agriculture is the largest source of human-created nitrous oxide emissions in the US[24] and will be a major source in any country using chemically-based agriculture.

The profitability of farming is highly dependent on the cost of fertilizers, and the cost of nitrogen fertilizer is tied to natural gas prices.[21] In Canada, a major producer, the price of nitrogen fertilizer reached a record high in 2008.[25] According to some analysts, peak gas, the point at which the maximum rate of gas extraction is reached and supplies enter terminal decline is expected to arrive around 2020.[26] As this point gets closer, prices will rise. Already the industry is ramping up expensive and environmentally damaging strategies, like fracking, for natural gas extraction.

For these reasons, agriculture cannot continue to depend on synthetic nitrogen fertilizer. Other ways of managing nitrogen must be found.

Some plants, including most legumes (the bean family of plants, which includes soy and peanuts), fix nitrogen directly from the air with the help of nitrogen-fixing bacteria. But other crops, such as wheat and barley, cannot do this and need to be fed nitrogen through the soil.

Proponents claim that genetic engineering can produce crops with high nitrogen use efficiency (NUE) that require less nitrogen fertilizer.

But GM technology has not produced any commercially available NUE crops.[27] On the other hand, conventional breeding has successfully delivered improvements in NUE in a number of crops. Estimates for wheat from France show an increase in NUE of 29% over 35 years, and Mexico has improved wheat NUE by 42% over 35 years.[27]

Studies show that organic, low-input and sustainable farming methods are the key to nitrogen management. One study calculated the potential nitrogen production by such methods to be 154 million tonnes, a potential which far exceeds the nitrogen production from fossil fuel.[28]

Sustainable nitrogen management methods include the planting of legumes in rows between the main crop, or in a crop rotation. This makes growth-promoting nitrogen available to other plants growing nearby at the same time or planted in subsequent cropping seasons.

Study findings include:

- Planting legumes on degraded land in Brazil successfully fixed nitrogen in soil, restoring soil and ecosystem biodiversity in the process.[29]
- Maize/peanut intercropping (growing two or more crops in close proximity) increased soil nitrogen and nutrients, increased growth of beneficial soil bacteria, and was expected to promote plant growth, as compared with monoculture, in experiments in China.[30]
- Planting legume cover crops (crops planted to preserve soil) could fix enough nitrogen to replace the amount of synthetic fertilizer currently in use, according to data from temperate and tropical agroecosystems.[28]

Agroecological methods of managing nitrogen solve another major problem associated with the application of synthetic nitrogen fertilizer – loss of soil nitrogen though agricultural runoff. In the runoff process, nitrogen leaches from soil in the form of nitrate, polluting groundwater. It can get into drinking water, threatening human and livestock health.

Agroecological, organic, low-input, and sustainable farming practices have been found to reduce soil nitrogen losses in the form of nitrate by 59–62% compared with conventional farming practices.[31] The result is reduced nitrate pollution and better conservation of nitrogen in soil.

6.4 **Myth:** GM crops reduce energy use **Truth:** GM crops are energy-hungry

> *"We have tried to have more efficient farming, with fewer people, more machines and a greater dependency on pesticides, fertilizers, GM crops and energy, using 10 kilocalories to produce one kilocalorie [of food delivered to the consumer]. But that is only possible if there is cheap oil. The system basically is bankrupt, which is why we need to change it to a more modern, advanced system, which will create energy, rather than consume it, and is not dependent on fossil energy, but more on people and better science."*
>
> – Hans Herren, development expert and co-chair, International Assessment of Agricultural Knowledge, Science and Technology, (IAASTD), a three-year project on the future of farming involving more than 400 experts from across the world[32]

In the US food system, 10 kilocalories of fossil energy are required for every one kilocalorie of food delivered to the consumer.[33] Two-thirds of that energy goes into producing synthetic fertilizers and on-farm mechanisation.[34]

There is widespread agreement that the energy consumption of agriculture must be radically reduced. GM proponents claim that GM crops can help in that process. As evidence they cite a report by Graham Brookes and Peter Barfoot, directors of PG Economics, a consultancy firm to the agrochemical and biotech industry.[35,36]

Brookes and Barfoot offer as a major reason for this claimed reduction in energy use the no-till farming method that is used in the cultivation of GM Roundup Ready crops. The idea is that no-till reduces the number of tractor passes that farmers have to make across their fields in ploughing.

But data from Argentina comparing the energy used in growing GM Roundup Ready soy and non-GM soy showed that, while no-till did reduce farm operations (tractor passes across the field), the production of GM soy required more energy in both no-till and tillage systems. The reason for the increase was the large amount of energy consumed in the production of herbicides (mostly Roundup) used on GM soy.[37]

Proven methods of reducing the amount of fossil energy used in farming include minimising the use of synthetic pesticides and fertilizers, selecting farm machinery appropriate for each task, limiting irrigation, and using agroecological techniques to manage soil fertility and control pests.[33]

Organic farming systems use just 63% of the energy required by chemically-based farming systems, largely because they eliminate the energy required to produce nitrogen fertilizer and pesticides.[38]

Organic, low-input, and agroecological farming is well suited to the Global South. A study in Ethiopia, part-funded by the UN Food and Agriculture Organisation (FAO), showed that compost can replace chemical fertilizers and that it increased yields by more than 30%. The crops had better resistance to pests and disease and there were fewer difficult weeds.[39]

6.4.1. Peak oil and gas make GM crops redundant

According to some analysts, peak oil – the point when the maximum rate of extraction is reached, after which production goes into terminal decline – has already arrived. Peak gas is expected around 2020.26 Peak oil and gas mark the end of chemically-based agriculture because nitrogen fertilizers are synthesised using large amounts of natural gas, and pesticides (including herbicides) are made from oil.

GM firms constantly promise new crops that are not reliant on the chemical model of farming. But GM seeds are created by agrochemical companies and are heavily dependent on pesticides and fertilizers. According to industry data, two-thirds of GM crops worldwide are herbicide-tolerant[40] – in other words, they are designed to rely on high doses of herbicide. Many of the newest GM crops are engineered to tolerate several different herbicides (see section 5).

Agriculture cannot continue to depend on non-renewable and increasingly expensive external inputs. Future food production will reduce or eliminate pesticide use and rely on renewable biologically-based fertilizers – such as compost and animal manure – produced on the farm or locally.

Conclusion to Section 6

GM crops offer no effective or sustainable solutions to climate change. Tolerance to extreme weather conditions is a complex trait that cannot be inserted into plants through genetic engineering. Most GM crops planted worldwide depend on large amounts of herbicides, which in turn require large amounts of fossil fuels in manufacture. GM crops, like all chemically-farmed crops, also depend on energy-hungry and greenhouse-gas-emitting nitrogen fertilizer. No GM nitrogen-use-efficient crops are available on the market.

In contrast, conventional breeding, sometimes helped by marker assisted breeding, is far ahead of GM in developing climate-ready and nitrogen-use-efficient crops. Additional means to cope with climate change include the many locally-adapted seeds conserved by farmers across the world and agroecological soil, water, and nitrogen management systems.

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7. FEEDING THE WORLD

7.1 **Myth:** GM crops are needed to feed the world's growing population **Truth:** GM crops are irrelevant to feeding the world

"We strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly nor economically beneficial to us. We do not believe that such companies or gene technologies will help our farmers to produce the food that is needed in the 21st century. On the contrary, we think it will destroy the diversity, the local knowledge and the sustainable agricultural systems that our farmers have developed for millennia, and that it will thus undermine our capacity to feed ourselves."

– Statement signed by 24 delegates from 18 African countries to the United Nations Food and Agricultural Organization, 1998

"If anyone tells you that GM is going to feed the world, tell them that it is not… To feed the world takes political and financial will."

– Steve Smith, head of GM company Novartis Seeds UK (now Syngenta), public meeting on proposed local GM farm scale trial, Tittleshall, Norfolk, UK, 29 March 2000

Section at a glance

- GM crops are promoted as necessary to feed the world's growing population. But it seems unlikely that they could make a significant contribution as they do not deliver higher yields or produce more with less inputs than non-GM crops.
- Most GM crops are engineered to tolerate herbicides or to express a pesticide – properties that are irrelevant to solving hunger.
- Hunger is not caused by a lack of food in the world. It is a problem of distribution and poverty, which GM cannot solve.
- The IAASTD report, authored by over 400 international experts, concluded that the key to food security lay in agroecological farming methods. The report did not endorse GM, noting that yields were "variable" and that better solutions were available.
- Agroecological farming has resulted in significant yield and income benefits to farmers in the Global South, while preserving soil for future generations.
- GM is not needed to feed the world. Conventional plant breeding has already delivered crops that are high-yielding, disease- and pest-resistant, tolerant of drought and other climatic extremes, and nutritionally enhanced – at a fraction of the cost of GM.

GM crops are promoted as a way of solving world hunger at a time when the population is expected to increase. But it is difficult to see how GM can contribute to solving world hunger when there are no GM crops available that increase intrinsic yield (see Section 5). Nor are there any GM crops that are better than non-GM crops at tolerating poor soils or challenging climate conditions.

Instead, most currently available GM crops are engineered for herbicide tolerance or to contain a pesticide, or both. The two major GM crops, soy and maize, mostly go into animal feed, biofuels to power cars, and processed human food – products for developed nations that have nothing to do with meeting the basic food needs of the poor and hungry. GM corporations are answerable to their shareholders and thus are interested in profitable commodity markets, not in feeding the poor and hungry.

Even if a GM crop did appear that gave higher yields than non-GM crops, this would not impact

the problem of hunger. This is because the root cause of hunger is not a lack of food, but a lack of access to food. According to the UN Food and Agriculture Organisation, we already produce more than enough food to feed the world's population and could produce enough with existing agricultural methods to feed 12 billion people.[1] The problem is that the poor have no money to buy food and increasingly, no access to land on which to grow it. Hunger is a social, political, and economic problem, which GM technology cannot address. GM is a dangerous distraction from real solutions and claims that GM can help feed the world can be viewed as exploitation of the suffering of the hungry.

7.1.2. GM crops for Africa: Catalogue of failure

A handful of GM crops have been promoted as helping small-scale and poor farmers in Africa. However, the results were the opposite of what was promised.

GM sweet potato yielded poorly, lost virus resistance

The virus-resistant sweet potato has been a GM showcase project for Africa, generating global media coverage. Florence Wambugu, the Monsanto-trained scientist fronting the project, has been proclaimed an African heroine and the saviour of millions, based on her claims that the GM sweet potato doubled output in Kenya. Forbes magazine even declared her one of a tiny handful of people around the globe who would "reinvent the future".[2]

But it eventually emerged that the claims being made for the GM sweet potato were untrue, with field trial results showing it to be a failure. The GM sweet potato was out-yielded by the non-GM control and succumbed to the virus it was designed to resist.[3,4]

In contrast, a conventional breeding programme in Uganda produced a new high-yielding variety that was virus-resistant and raised yields by roughly 100%. The Ugandan project achieved its goal in a fraction of the time and cost of the GM project. The GM sweet potato project, over 12 years, consumed funding from Monsanto, the World Bank, and USAID to the tune of $6 million.[5]

GM cassava lost virus resistance

The potential of genetic engineering to boost the production of cassava – one of Africa's staple foods – by defeating a devastating virus has been heavily promoted since the mid-1990s. It was even claimed that GM cassava could solve hunger in Africa by increasing yields as much as tenfold.[6]

But almost nothing appears to have been achieved. Even after it became clear that the GM cassava had suffered a major technical failure, losing resistance to the virus,[7] media stories continued to appear about its curing hunger in Africa.[8,9]

Meanwhile, conventional (non-GM) plant breeding has quietly produced a virus resistant cassava that is already proving successful in farmers' field, even under drought conditions.[10]

Bt cotton failed in Makhatini

> *"The [GM cotton] seed itself is doing poorly. Without irrigation, and with increasingly unpredictable rain, it has been impossible to plant the cotton. In 2005 T. J. Buthelezi, the man whose progress was hymned by Monsanto's vice-president not three years before, had this to say: 'My head is full – I don't know what I'm going to do. I haven't planted a single seed this season. I have paid Rand 6,000 (USD 820, GBP 420) for ploughing, and I'm now in deep debt.' T. J. is one of the faces trucked around the world by Monsanto to prove that African farmers are benefiting from GM technology."*
>
> – Raj Patel, "Making up Makhatini", in Stuffed and Starved[11]

Makhatini in South Africa was home to a showcase GM Bt cotton project for small-scale farmers. The project began with 3000 smallholder farmers cultivating Monsanto's Bt cotton between 1998 and 2001,[12] with over 100,000 hectares planted. By 2002, the area planted had crashed to 22,500 hectares, an 80% reduction in four years.[13,11]

A 2003 report on the project calculated that crop failures left the farmers who had adopted the expensive Bt cotton with debts of $1.2 million.[5] A separate study concluded that the project did not generate sufficient income to generate a "tangible and sustainable socioeconomic improvement".[14]

By 2004, 85% of farmers who used to grow Bt cotton had given up. The farmers found pest problems and no increase in yield. Those farmers who still grew the crop did so at a loss. They continued only because the South African government subsidised the project from public funds; the company that sold the cottonseed and bought the cotton was their only source of credit; and there was a guaranteed market for the cotton.[13,11]

A 2012 review reported that by the 2010/11 growing season, the area planted to Bt cotton had shrunk to a minuscule 500 hectares – a decline of more than 90% from the area under cultivation during the period of Bt cotton's claimed success (1998–2000). Yields continued to vary widely according to rainfall levels, hovering within 10% of what they were before Bt cotton was introduced. Overall pest control costs remained significantly higher with Bt cotton (65% of total input costs) than with non-Bt cotton (42% of total input costs).

The review concluded that the main value of Makhatini project appears to have been as a public relations exercise for GM proponents, providing "crucial ammunition to help convince other African nations to adopt GM crops" and that there was a "disconnect" between how the project was represented and "the realities faced by its cotton growers".[12]

"To feed 9 billion people in 2050, we urgently need to adopt the most efficient farming techniques available. Today's scientific evidence demonstrates that agroecological methods outperform the use of chemical fertilizers in boosting food production where the hungry live – especially in unfavorable environments.

"To date, agroecological projects have shown an average crop yield increase of 80% in 57 developing countries, with an average increase of 116% for all African projects. Recent projects conducted in 20 African countries demonstrated a doubling of crop yields over a period of 3–10 years.

"Conventional farming relies on expensive inputs, fuels climate change and is not resilient to climatic shocks. It simply is not the best choice anymore today.

"Agriculture should be fundamentally redirected towards modes of production that are more environmentally sustainable and socially just."

– Olivier De Schutter, UN special rapporteur on the right to food and author of the report, "Agroecology and the right to food"[32,33]

GM soy and maize project ends in ruin for poor farmers

A GM soy and maize farming project ended in disaster for poor black farmers in South Africa. The Eastern Cape government was criticised for its support of this so-called "Green Revolution" project, which was launched in 2003–2004. A research study by the Masifunde Education and Development Project Trust, together with Rhodes University, found that the programme had disastrous results for farmers.

"We saw a deepening of poverty and people returning to the land for survival," said Masifunde researcher, Mercia Andrews. The study raised concerns about feeding schemes conducted on animals with "alarming results", including damage to internal organs. It presented evidence of weed and pest problems, contamination of crops with GM pollen, and the control exercised by big companies over local and global food systems as a result of patented seeds.[15]

We conclude from these examples that it is irresponsible to pressure poor farmers in the Global South into gambling their farms and livelihoods on risky GM crops when proven effective alternatives exist.

7.1.3. The biofuels boom and the food crisis

"The agribusiness giants who have developed and patented genetically modified crops have long argued that their mission is to feed the world, rarely

missing an opportunity to mention starving Africans. Their mission is, in fact, to make a profit.

"Land rights for small farmers, political stability, fairer markets, education and investment hold the key to feeding Africa but offer little prospect of increased profits.

"The climate crisis was used to boost biofuels, helping to create the food crisis; and now the food crisis is being used to revive the fortunes of the GM industry."

– Daniel Howden, Africa correspondent, The Independent (UK)[16]

"The cynic in me thinks that they're just using the current food crisis and the fuel crisis as a springboard to push GM crops back on to the public agenda. I understand why they're doing it, but the danger is that if they're making these claims about GM crops solving the problem of drought or feeding the world, that's bullshit."

– Denis Murphy, head of biotechnology, University of Glamorgan, Wales[17]

The 2007–2008 global food crisis led to food riots around the world, as the escalating price of staple crops pushed food out of reach of the poor and hungry. The crisis is ongoing – in early 2011 global food prices remained close to their 2008 peak.[18] They declined 8% between September and December 2011, though the World Bank reported that they were still high, with the 2011 annual food price index exceeding the 2010 annual index by 24%.[18]

GM proponents have used the food crisis to claim that anti-GM activists in the Global North are keeping the Global South hungry by creating unfounded fears about GM crops. These high-technology GM crops, they claimed, could help solve the hunger problem, if only the activists in affluent countries would stop interfering. But the World Bank and the United Nations Food and Agriculture Organisation identified the biofuels boom – not a lack of GM foods – as the main cause of the 2007–2008 food crisis.[19,20]

Biofuels are crops used for fuel. Vast tracts of cropland have been taken out of food production to grow biofuels for cars, funded by generous government subsidies. This has made food scarcer, pushing up costs.

An added factor is that the growth of the biofuels industry has created a link between agriculture and fuel that never existed before.

"A key question for our scientists, and politicians to address, and to have the courage to demand that industry addresses it too, is whether GM technology can and will co-exist in the global agricultural toolbox with other technologies, without destroying those other tools. Apart from more promise than delivery, and delivery of only private benefits like greater market share for their own chemical pesticides, GM has brought with it a marked narrowing of seed varieties available to farmers, a concentration of ownership of seed production and sales, and a concentration in ownership and control of the knowledge (intellectual property rights or IPRs) required for agricultural production.

"In 2002, the director of the Vietnamese government agricultural research centre told me at a conference in Asia that he could spend all of his annual R&D budget (US$20m, as I recall) just on lawyers, trying to sort out what materials his researchers could and could not use, and on licence fees for such IPRs, according to the intellectual property rights jungle which has grown on plant and crop materials and molecules. Is this kind of commercial restriction, and narrowing of diversity of agricultural innovation trajectories, helping such food-poor countries to gain food security?

"This concentration and narrowing, and the associated transformation of agriculture into industrialised monocrop production requiring more expensive and unsustainable inputs, which in turn ignores and externalises entirely predictable pest and weed resistance and thus short-term yield drops, cannot be a sustainable technology. Nor does it seem that it could co-exist with other technologies in the so-called toolbox."

– Professor Brian Wynne, ESRC Centre for Economic and Social Aspects of Genomics, Cesagen Lancaster University, UK[43]

Previously, agricultural markets were driven only by food demands and were not linked to petroleum markets. But now they are tightly linked, because agriculture provides the crops that are used to make the biofuels alternative to petrochemical fuels. Four major food and feed crops – sugarcane, maize, wheat, and soy – are now used for biofuels feedstock. So the biofuels boom has coupled food prices to fossil fuel prices,[18] with the result that food prices will continue to spiral as petroleum becomes scarcer and more expensive.

The same companies that produce GM seeds also produce feedstocks for biofuels. This shows that these companies are not motivated by a desire to feed the world but by a desire to make a profit.

7.1.4 Food speculation and hunger

An additional cause of the 2007–2008 food crisis (apart from the rush to biofuels) was financial speculation in food commodity markets. This ongoing trend drives up prices for the crops that are traded internationally on a large scale, namely maize, wheat, and soy. One report on the topic concluded, "Food markets should serve the interests of people and not those of financial investors… Given that hunger still exists in the world, even small price increases that are driven by financial investment are scandalous. We must not allow food to become a purely financial asset."[21]

GM crops do not provide a solution to the problem of financial speculation in food markets.

7.2 **Myth:** GM crops are vital to achieve food security
Truth: Agroecological farming is the key to food security

> *"Agroecology mimics nature not industrial processes. It replaces the external inputs like fertilizer with knowledge of how a combination of plants, trees and animals can enhance productivity of the land. Yields went up 214% in 44 projects in 20 countries in sub-Saharan Africa using agroecological farming techniques over a period of 3 to 10 years… far more than any GM crop has ever done."*
>
> – Olivier De Schutter, UN special rapporteur on the right to food[22]

In 2008 the World Bank and four United Nations agencies completed a four-year study on the future of farming. Conducted by over 400 scientists and experts from 80 countries and endorsed by 62 governments, the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) report did not endorse GM crops as a solution to world hunger. The report pointed out that yields of GM crops were "highly variable", providing "yield gains in some places and yield declines in others".[23]

The IAASTD identified agroecological farming as the key to future food security. The report called for more cooperation between farmers and interdisciplinary teams of scientists to build culturally acceptable and sustainable food production systems.[23] Examples of such systems documented in IAASTD and other sources include:

- Low-input, energy-saving practices that preserve and build soil, conserve water, and enhance natural pest resistance and resilience in crops
- Innovative farming methods that minimize or eliminate costly chemical pesticides and fertilizers
- Use of thousands of traditional varieties of major food crops which are naturally adapted to stresses such as drought, heat, harsh weather conditions, flooding, salinity, poor soil, and pests and diseases[24]
- Programmes that enable farmers to cooperatively preserve and improve traditional seeds
- Use of existing crops and their wild relatives in traditional breeding programmes to develop varieties with useful traits
- Use of safe techniques of modern biotechnology, such as marker assisted selection (MAS), to speed up traditional breeding. Unlike GM technology, MAS can produce new varieties of crops with valuable genetically complex properties such as enhanced nutrition, taste, high yield, resistance to pests and diseases, and tolerance to drought, heat, salinity, and flooding.[25]

Sustainable agriculture projects in the Global South have produced dramatic increases in yields and food security.[26,27,28,29,30,31] A 2008 United Nations report looked at 114 farming projects in 24 African countries and found that organic or near-organic practices resulted in yield increases averaging over 100%. In East Africa, a yield increase of 128% was found. The report concluded that organic agriculture can be more conducive to food security in Africa than chemically-based production systems, and that it is more likely to be sustainable in the long term.[29]

These results serve as a reminder that plant genetics are only a part of the answer to food security. The other part is how crops are grown. Sustainable farming methods that preserve soil and water and minimize external inputs not only ensure that there is enough food for the current population, but that the land stays productive for future generations.

7.2.1. Small farms are more efficient

Research confirms that future food security lies in the hands of small farmers. Small farms are more efficient than large ones, producing more crops per hectare of land.[34,35,36,37]

7.2.2. Sustainable agriculture can reduce poverty

Studies based in Asia, Africa, Latin America

and the Caribbean have found that organic and agroecological farming can combat poverty in an environmentally sustainable way:

- Farmers growing organic crops for export and domestic markets in Latin America and the Caribbean had higher incomes than a control group of farmers using chemically-based methods. Reasons included the lower cost of organic technologies; the substitution of labour and organic inputs for more expensive chemical inputs that often require access to credit; premiums paid for organic products; and the strong long-term relationships that organic farmers developed with buyers, which resulted in better prices. As a bonus, organic production was associated with positive effects on the health of farm workers. Concern about pesticide poisoning was an important factor in farmers' adoption of organic farming.[38]
- The income of farmers in China and India improved after they switched to organic systems and was greater than that of farmers using chemically-based methods. The study concluded that the promotion of organic agriculture among small farmers can contribute to poverty alleviation.[39]
- Certified organic farms in tropical Africa involved in production for export were more profitable than those involved in chemically-based export production. The result was decreased poverty and increased food security for farming communities, as people had more money to buy food. Also, organic conversion brought increases in yield.[40]
- Organic systems in Africa were found to raise farm incomes as well as agricultural productivity. Reasons for the higher incomes included lower input costs, as expensive synthetic pesticides and fertilizers were not used; and use of local, inexpensive, and readily available technologies.[29]
- The agroecological "integrated rice-duck" system of using ducks and fish to control pests in rice paddies in Japan, China, India, the Philippines, and Bangladesh has cut labour costs for weeding, reduced pesticide costs, increased yields by up to 20%, and boosted farm incomes by up to 80%.[41,42]

7.2.3. Who owns food?

Traditionally, most food crop seeds have not been owned by anyone. Farmers have been free to save seeds from one year's crop for the next year's crop. Around 1.4 billion farmers in the Global South rely on such farm-saved seed for their livelihoods.[44]

But this ancient practice is being undermined. The transgenes used in creating GM crops are patented and owned by GM companies. The patents forbid farmers from saving seed to plant the following year. They have to buy new seed each year.

While an increasing number of non-GM seeds are also being patented (in many cases by the big GM companies such as Monsanto, Dupont, and Syngenta), GM seeds are easier to patent as the artificial genetic constructs can be more clearly identified and there are fewer legal "grey areas".[45] So for the time being, at least, GM will remain the technology of choice for the seed multinationals.

In the United States and Canada, the presence of a company's patented GM genes in a farmer's harvest has been used by GM companies, particularly Monsanto, as the basis for litigation against the farmer. Contamination from cross-pollination happens readily, so the harvests of many farmers who have not planted Monsanto seed have tested positive for GM genes and Monsanto has sued them for patent infringement. This has pushed many farmers into switching to buying Monsanto's seed, because then they are safer from litigation. Farmers' claims that they have not intentionally planted GM crops have not protected them from having to pay large cash settlements or damages as a result of civil lawsuits.[46]

Patented GM seeds transfer control of food production from farmers to seed companies. GM companies co-opt centuries of farmer knowledge that went into creating locally adapted and genetically diverse seed stocks by adding one GM gene on top of the collective creation of generations of farmers.

Patents also transfer control of the food supply from the Global South to developed countries in the Global North. This is because most of the world's genetic resources for food crops are in the South, whereas most patents are held in

the North.[47] There is widespread concern in the Global South about the "biopiracy" of its genetic resources by the Global North, involving seed patenting and the loss of farmers' rights to save seed.

Some GM proponents have called for GM crops to be developed through public funds for the benefit of humanity.[48] But it is difficult to justify gambling taxpayer funds on speculative GM "solutions" to problems that can be solved using methods that are simpler, cheaper, and available now. Nor would any public or private entity have an incentive to fund the lengthy and expensive process of GM crop development unless they owned a patent that would enable them to recoup their expenses and make a profit.

Patents have no place in the agricultural system. To protect the security of the food supply and to ensure food sovereignty for each nation, governments must establish policies that ensure that the control of food production remains in the hands of farmers.

7.3 **Myth:** GM is needed to provide the crops that will enable us to survive the challenges ahead
Truth: Non-GM breeding methods are more effective at creating crops with useful traits

> *"The advantage of science is not in principle, for its own self – it's because it does something useful and valuable, that people want. If it is not supporting those particular objectives, I think we should take a much more sceptical view of it."*
>
> – Michael Meacher, UK environment minister 2001–2003[49]

When people hear about "supercrops" such as flood-tolerant rice, drought-tolerant maize, salt-tolerant wheat, pest-resistant chickpeas, low-allergen peanuts, iron-rich beans, beta-carotene-enriched cassava, and heart-healthy soybeans, many automatically think of GM.

But all these improved crops were created without GM. They are the products of conventional (natural) breeding, in some cases helped by marker assisted selection, or MAS. MAS, sometimes called precision breeding, is a largely uncontroversial branch of biotechnology that can speed up conventional breeding by identifying genes linked to important traits. MAS does not involve inserting foreign genes into the DNA of a host plant and avoids the risks and uncertainties of genetic engineering. It is widely supported by environmentalists and organic farming bodies.

Conventional breeding and MAS have succeeded where GM has failed in developing crops with useful traits such as tolerance to extreme weather conditions and poor soils, disease resistance, and enhanced nutritional value. Such traits are known as complex traits because they involve many genes working together in a precisely regulated way. Only conventional breeding methods, sometimes helped by MAS, are able to produce crops with the desired complex traits. In contrast, GM technology can only manipulate one or a few genes at a time and is unable to confer precise and integrated control of expression of GM genes. Therefore it is incapable of producing crops with desired complex traits that rely on multiple genes working together.

Conventional breeding and MAS use the many existing varieties of crops to create a diverse, flexible, and resilient crop base. GM technology offers the opposite – a narrowing of crop diversity and an inflexible technology that requires years and millions of dollars in investment for each new trait.[50,51]

Non-GM breeding successes usually gain minimal media coverage, in contrast with the often speculative claims of potential GM "miracles". Thanks to the huge public relations budgets of biotechnology companies, these claims are broadcast far and wide – but have little grounding in fact.

7.3.1. The GM successes that never were

Many crops developed through conventional breeding and marker-assisted selection (MAS) are wrongly claimed as GM successes. These fall into three broad categories:

Conventionally bred crop with GM tweak

> *"Biotech traits by themselves are absolutely useless unless they can be put into the very best germplasm."*
>
> – Brian Whan, spokesman for Monsanto subsidiary InterGrain[52]

Typically, GM firms use conventional breeding, not GM, to develop crops with traits such as drought tolerance or disease resistance. They first obtain germplasm from the best varieties developed over years by farmers and breeders. Then they use conventional breeding and MAS to achieve the desired complex trait. Finally, once they have developed a successful variety using conventional breeding, they use GM to engineer

in the company's proprietary genes, so that they can patent and own the crop. This GM tweak, often a herbicide-tolerant or insecticidal gene, adds nothing to the agronomic performance of the crop.

This process was mentioned in a news broadcast about Monsanto's 2010 buy-out of part of a Western Australia cereal breeding company, InterGrain. An InterGrain spokesman explained Monsanto's interest in his company: "A really important concept is that biotech traits by themselves are absolutely useless unless they can be put into the very best germplasm."[52]

An example of a GM product developed in this way is Monsanto's VISTIVE® soybean, which has been described as the first GM product with benefits for consumers. These low linolenic acid soybeans were designed to produce oil that would reduce unhealthy trans fats in processed food made from the oil. They were created by conventional breeding. But Monsanto turned them into a GM crop by adding a GM trait – tolerance to its Roundup herbicide.[53]

Interestingly, Iowa State University developed some even lower linolenic acid soybean varieties than the VISTIVE and did not add any GM traits to them.[54] Very little has been heard about them, compared with VISTIVE.

Another product of this type is Syngenta's Agrisure Artesian drought-tolerant maize. The crop was developed using non-GM breeding, but herbicide tolerant and insecticidal transgenes were subsequently added through genetic engineering.[55]

Conventionally bred crop without GM tweak – GM used as lab tool

In some cases, a crop is developed using GM as a lab research tool, but no GM genes are added. Nevertheless, such crops have been claimed to be GM successes. An example is flood-tolerant rice, which the UK government's former chief scientist, Sir David King, has wrongly claimed as a triumph of genetic engineering.[56,57]

In fact, the two best-known flood-tolerant rice varieties – one of which was almost certainly the one that King referred to – are not GM at all. One variety was developed by a research team led by GM proponent Pamela Ronald.[58] Ronald's team developed the rice through marker assisted selection (MAS).[58,59] They used genetic engineering as a laboratory research tool to identify the desired genes, but the resulting rice is not genetically engineered.[60]

However, the wording on the website of UC Davis, where Ronald's laboratory is based, misleadingly implied that her rice was genetically engineered, saying, "Her laboratory has genetically engineered rice for resistance to diseases and flooding, which are serious problems of rice crops in Asia and Africa."[61]

Another flood-tolerant rice created with "Snorkel" genes has also been claimed as a genetic engineering success. But the rice, which adapts to flooding by growing longer stems that prevent the crop from drowning, was bred by conventional methods and is entirely non-GM.

Laboratory-based genetic modification and modern gene mapping methods were used to study a deepwater rice variety and identify the genes responsible for its flood tolerance trait. Three gene regions were identified, including one where the two "Snorkel" genes are located. MAS was used to guide the conventional breeding process by which all three flood tolerance gene regions were successfully combined in a commercial rice variety.[62]

Only conventional breeding and MAS could be used to generate the resulting flood-tolerant rice line. This is because it is beyond the ability of current genetic modification methods to transfer the genes and control switches for the flood-tolerance trait in a way that enables them to work properly.

Crop that has nothing to do with GM

In one high-profile case, a crop that had nothing to do with GM at all was claimed as a GM success. In a BBC radio interview, the UK government's former chief scientist, Sir David King, said that a big increase in grain yields in Africa was due to GM, when in fact it did not involve the use of GM technology.[63] Instead, the yield increase was due to a "push-pull" management system, an agroecological method of companion planting that aims to divert pests away from crop plants.[64] King later admitted to what he called an "honest mistake".[65]

King produced this example when under pressure to provide compelling reasons why GM crops are needed. But far from showing why we need to embrace GM, it shows the exact opposite – that we need to stop being distracted by GM and put funding and support behind non-GM solutions to urgent problems.

7.3.2. Non-GM breeding successes show no need for GM

The following are just a few examples of conventionally bred crops with the types of traits that GM proponents claim can only be achieved through genetic engineering. Many are already commercially available and making a difference in farmers' fields.

Drought-tolerant and climate-ready

- Maize varieties that yield well in drought conditions,[66] including some developed for farmers in Africa[67,68,69]
- Cassava that gives high yields in drought conditions and resists several diseases[10]
- Climate-adapted, high-yield sorghum varieties developed for farmers in Mali[70]
- Beans resistant to heat, drought, and disease[71,72]
- Pearl millet, sorghum, chickpea, pigeon pea and groundnut varieties that tolerate drought and high temperatures[73]
- Rice varieties bred to tolerate drought, flood, disease, and saline (salty) soils[74]
- Flood-tolerant rice varieties developed for Asia[75,76]
- Over 2,000 indigenous rice varieties that are adapted to environmental fluctuations, as well as varieties that resist pests and diseases, registered by Navdanya, a seed-keeping NGO based in India[77]
- Tomato varieties developed by Nepali farmers that tolerate extreme heat and resist disease.[78]

Salt-tolerant

- Rice varieties that tolerate saline soils and other problems[74]
- Durum wheat that yields 25% more in saline soils than a commonly used variety[79,80]
- Indigenous crop varieties from India that tolerate saline soils, stored by the Indian seed-keeping NGO, Navdanya. Navdanya reported that it gave some of these seeds to farmers in the wake of the 2004 tsunami, enabling them to continue farming in salt-saturated soils in spite of scientists' warnings that they would have to abandon the land temporarily.[81]
- High-yield, pest-resistant, and disease-resistant
- High-yield, multi-disease-resistant beans for farmers in Central and East Africa[82]
- High-yield, disease-resistant cassava for Africa[83]
- Australian high-yield maize varieties targeted at non-GM Asian markets[84]
- Maize that resists the Striga parasitic weed pest and tolerates drought, for African farmers[69]
- Maize that resists the grain borer pest[85]
- "Green Super-Rice" bred for high yield and disease resistance[74]
- High-yield soybeans that resist the cyst nematode pest[86]
- Aphid-resistant soybeans[87]
- High-yield tomato with sweeter fruit[88]
- High-yield, pest-resistant chickpeas[89]
- Sweet potato that is highly resistant to nematodes and moderately resistant to insect pests and Fusarium wilt, a fungal disease[90]
- High-yield, high-nutrition, and pest-resistant "superwheat"[91]
- Habanero peppers with resistance to root-knot nematodes.[92]
- Potatoes that resist late blight and other diseases[93,94,95,96]
- Potatoes that resist golden nematode and common scab – and appeal to food manufacturers due to good chipping and storage qualities[97]
- Potato that resists root-knot nematodes[98]
- Papayas that resist ringspot virus[99] – in spite of numerous claims from the GM lobby that only GM was able to produce a resistant papaya. Interestingly, there even seems to be doubt about the frequent claim that the GM virus-resistant papaya saved Hawaii's papaya industry. The GM papaya has dominated Hawaiian papaya production since the late 1990s, but Hawaii's Department of Agriculture reportedly said that the annual yield of papayas in 2009 was lower than when the ringspot virus was at its peak.[100]

An article in the Hawaii press said that GM has not saved Hawaii's papaya industry, which has been in decline since 2002. The article cites as a possible reason the market rejection that has plagued GM papayas from the beginning.[101]

Nutritionally fortified and health-promoting

- Soybeans containing high levels of oleic acid, reducing the need for hydrogenation, a process that leads to the formation of unhealthy trans fats[102]
- Beta-carotene-enriched orange maize, aimed at poor people suffering from vitamin A deficiency[103,104]
- Millet rich in iron, wheat abundant in zinc, and beta-carotene-enriched cassava[105]
- Iron-fortified maize, which has been shown in a study to decrease anaemia in children[106,107]
- Purple potatoes containing high levels of the cancer-fighting antioxidants, anthocyanins[108,109]
- A tomato containing high levels of the antioxidant, lycopene, which has been found in studies to have the potential to combat heart attacks, stroke, and cancer.[110]
- Low-allergy peanuts.[111] In a separate development, a process has been discovered to render ordinary peanuts allergen-free.[112]

7.3.3. Conventional breeding is quicker and cheaper than GM

"The overall cost to bring a new biotech trait to the market between 2008 and 2012 is on average $136 m[illion]."

– Phillips McDougall, "The cost and time involved in the discovery, development and authorisation of a new plant biotechnology derived trait: A consultancy study for Crop Life International"[113]

"Genetic engineering might be worth the extra cost if classical breeding were unable to impart such desirable traits as drought-, flood- and pest-resistance, and fertilizer efficiency. But in case after case, classical breeding is delivering the goods."

– Margaret Mellon and Doug Gurian-Sherman[51]

An industry consultancy study put the cost of developing a GM trait at $136 million.[113] Even Monsanto has admitted that non-GM plant breeding is quicker and "significantly cheaper" than GM. Monsanto said it takes ten years to develop a GM seed, in contrast with a conventionally bred variety, which takes only 5–8 years.[114] The plant breeder Major M. Goodman of North Carolina State University said the cost of developing a GM trait was fifty times as much as the cost of developing an equivalent conventionally bred plant variety. Goodman called the cost of GM breeding a "formidable barrier" to its expansion.[50]

Time and cost are vital considerations for the Global South, where the need for crop varieties adapted to local conditions is urgent, yet farmers cannot afford expensive seeds and inputs.

Conclusion to Section 7

GM crops are promoted as a way of solving world hunger. But this argument does not stand up to analysis, since there are no GM crops with a higher intrinsic yield or that cope better with challenging climate conditions than non-GM varieties.

Most GM crops are engineered to tolerate herbicides or to express a pesticide. They mostly go into biofuels, animal feed, and processed food – all products for affluent countries that have nothing to do with the food needs of the poor and hungry.

Hunger is in any case not caused by a lack of food in the world. It is a problem of distribution and poverty. Poor people have no money to buy food, and increasingly, no land on which to grow it.

A few GM crops have been developed to help poor farmers in Africa. But they have had disastrous results, leaving the farmers who adopted them worse off than before. In contrast, conventional breeding programs have developed non-GM crops far more cheaply and successfully.

Breeding improved crop varieties is part of the answer to food security – the other part is how crops are grown and land is managed. The

IAASTD report, commissioned by the World Bank and United Nations and authored by over 400 international experts and scientists, concluded that the key to food security lay in agroecological farming methods. The report did not endorse GM as a solution, noting that yields were "variable".

Other studies confirm that agroecological farming has resulted in significant yield and income benefits to farmers in the Global South, while preserving soil for future generations.

The expense of GM seeds and the chemical inputs on which they often rely make them irrelevant to solving the problem of hunger. GM seeds are patented and owned by multinational corporations and farmers are forbidden from saving seed to replant, shifting control of the food supply from farmers to corporations. While non-GM seed is also increasingly patented, the GM process lends itself more easily to patenting than conventional breeding.

Finally, GM is simply not needed to feed the world. Conventional plant breeding has successfully delivered crops that are high-yielding, disease- and pest-resistant, tolerant of drought and other climatic extremes, and nutritionally enhanced – at a fraction of the cost of GM.

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CONCLUSION

Genetically modified (GM) crops are promoted on the basis of far-reaching claims from the industry and its supporters, such as:

- Humans have been genetically modifying crops for centuries and genetic engineering is no different
- GM crops are safe for human and animal health and the environment
- GM crops increase yields and reduce pesticide use
- GM will produce supercrops that tolerate drought, resist pests and disease, and provide improved nutritional value
- GM crops are "an important tool in the toolbox" to feed the world.

However, based on the evidence presented in this report, these claims are misleading. The GM process is completely different from natural breeding and entails different risks. The GM transgene insertion and associated tissue culture processes are imprecise and highly mutagenic, causing unpredictable changes in the DNA, proteins, and biochemical composition of the resulting GM crop that can lead to unexpected toxic or allergenic effects and nutritional disturbances.

There is no scientific consensus that GM crops are safe, especially when the views of the scientific community independent of the GM crop development industry are taken into account. Toxicological studies in laboratory animals and livestock have revealed unexpected harmful effects from a diet containing GM crops, including some that are already in the human food and feed supply. Among the most marked effects are disturbances in liver and kidney function.

Many of these studies, including some conducted by the GM crop industry and others commissioned by the EU, have been incorrectly claimed by GM proponents to show that GM crops are safe when in fact, they show harmful effects. In some cases, advocates of GM crops have admitted that statistically significant differences were found between the GM and non-GM feeds under test but have dismissed them as "not biologically relevant/significant". However, these terms have not been defined and are scientifically meaningless.

Most animal feeding studies on GM crops have been relatively short – 30–90 days in length (technically called medium-term studies). What is needed are long-term and multi-generational studies to see if the worrying signs of toxicity observed in medium-term investigations develop into serious disease. Long-term studies of this type are not required for GM crops by government regulators anywhere in the world.

This and other inadequacies of the regulatory regime for GM crops and foods mean that it is too weak to protect consumers from the potential hazards posed by the technology. Regulation is weakest in the US and is inadequate in most regions of the world, including Europe.

GM crops have not delivered on their promises and, based on current evidence, it seems unlikely that they will provide sustainable solutions to the problems that face humanity, such as hunger and climate change.

Claims that GM technology will help feed the world are not credible in the light of the fact that GM technology has not increased the intrinsic yield of crops. While yields for major crops have increased in recent decades, this has been as a result of conventional breeding successes, not due to GM.

Also, the majority of GM crops are commodity crops grown on a large scale for affluent countries, such as soy and maize. A few GM crops have been developed for small-scale farmers in Africa, such as a sweet potato and cassava varieties that were intended to be virus-resistant, but these have failed miserably. In contrast, projects using conventional breeding have succeeded at a fraction of the cost of the GM projects.

GM crops have not decreased pesticide use, but have increased it. In particular, the widespread adoption of GM Roundup Ready crops has led to over-reliance on Roundup herbicide, leading to the spread of resistant weeds. This in turn has required farmers to spray more Roundup and

mixtures of chemicals in an attempt to control weeds.

Roundup is not safe or benign. It has been found to cause malformations in laboratory animals, to be toxic to human cells at very low doses, and to cause DNA damage in humans and animals. Epidemiological studies have found an association between Roundup exposure and cancer, premature births and miscarriages, and impaired neurological development in humans. In addition, Roundup applications can cause increases in plant diseases, including infection with Fusarium, a fungus that negatively impacts yields as well as producing toxins that can enter the food chain and affect the health of humans and livestock.

As Roundup fails under the onslaught of resistant weeds, the GM industry is developing multi-herbicide-tolerant crops that withstand being sprayed with potentially even more toxic herbicides, such as 2,4-D. These crops will lead to an immediate escalation in the use of these herbicides.

It is often claimed that GM Bt insecticidal crops reduce the need for chemical insecticide sprays. But these reductions, when they occur, are often temporary. Resistance has developed among target pests and even when control of the target pest has been successful, secondary pests have moved into the ecological niche. These developments demonstrate that GM Bt technology is not sustainable. In addition, Bt crops are themselves insecticide-containing plants, so even when they work as intended, they do not eliminate or reduce insecticides but simply change the way in which insecticides are used.

Advocates often claim that GM Bt crops are safe because Bt toxin has been safely used for decades as a spray to kill pests by chemical and organic farmers. But the Bt toxin expressed in GM plants is structurally very different from natural Bt used as a spray. The Bt toxin in GM plants is not always fully broken down in digestion and has been found to have toxic effects on laboratory animals and non-target organisms fed on such crops.

GM proponents have long promised climate-ready and drought-tolerant crops, but conventional breeding has been far more successful than GM technology in producing such crops. This is unsurprising, as these traits are genetically complex and cannot be produced by manipulating one or two genes.

GM herbicide-tolerant crops are often claimed to be climate-friendly because they are grown using the no-till farming method, which uses herbicides instead of ploughing to control weeds. No-till farming with GM crops is said to store carbon more effectively in the soil than ploughing, which releases carbon into the atmosphere as carbon dioxide. However, studies show that no-till fields do not store carbon more effectively than ploughed fields when deeper levels of soil are measured, throwing into question claims that no-till with GM crops offers a solution to climate change. In addition, the adoption of no-till with GM herbicide-tolerant crops has been found to increase the negative environmental impact of soy cultivation, because of the herbicides used.

Based on the evidence presented in this report, it is clear that GM technology has failed to deliver on its promises. GM technology is fundamentally unsound and poses scientifically proven risks to human and animal health, as well as the environment. The claims made for the benefits of GM crops are highly exaggerated and GM crop technology has been shown to be unsustainable.

It is not necessary to accept the risks posed by GM crops when conventional breeding – sometimes assisted by safe biotechnologies such as marker assisted selection – continues to successfully produce crops that are high-yielding, drought-tolerant, climate-ready, pest- and disease-resistant, and nutritious. Conventional breeding, the existing crop varieties developed by farmers worldwide, and agroecological farming methods, are proven effective methods of meeting our current and future food needs.

LABEL IT HAWAI'I
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www.labelithawaii.org

HOUSE COMMITTEE ON FINANCE
Friday February 21, 2013 3:00 p.m.
Re: HB174

Aloha Chair Luke, Vice Chair Nishimoto, Vice Chair Johanson and Committee Members:

On behalf of Label It Hawai'i, thank for the opportunity to offer testimony. We are in strong support of HB174. We are a grass roots organization dedicated to preserving sustainable, ethical and healthy food for Hawaii's people. The mission of Label It Hawai'i, through our educational outreach program, is to bring about awareness of GMOs (genetically modified organisms) in our food supply. Our goal is to urge elected officials to pass a bill protecting the consumers' right to know. To date we have collected over 2,000 signatures petitioning the legislature to label genetically modified organisms.

In light of the concerns from the Center for Food Safety, the Union of Concerned Scientists, the American Academy of Environmental Medicine, and the FDA's own scientists regarding the safety of these products, Hawai'i consumers are stepping forward to question GMOs in our food. Due to the economic, environmental and potential health risks associated with GMOs, consumers should have the power to decide whether to support such agricultural practices by the biotech industry.

GMO crops have the capacity to cross contaminate neighboring conventional and organic fields. This results in the loss of income and livelihood for farmers and undermines the quality of their products. Farmers have been sued for patent violations when GMO pollen has contaminated their fields. The idea that the GMO, conventional and organic industry can co-exist is a myth that threatens the very biodiversity that is needed to continue a sustainable food production system. The loss of organic produce alone jeopardizes the availability of such foods and consumer choice at the supermarket.

Contrary to claims of reduced herbicide usage, a peer reviewed study in Environmental Sciences Europe by Dr. Charles Benbrook, shows that herbicide usage is, in fact, increasing. This increase has created herbicide-resistant super weeds. These super weeds bolster the amount of chemicals being sprayed on crops and give way for more powerful chemicals. Label It Hawai'i views this as a dangerous cycle. Glyphosate, a component of RoundUp, has been found to be toxic to animals and amphibians. The US Geological Study shows that glyphosate is found in all waterways within the Mississippi Basin, which means it is not biodegradable. We are being exposed to this herbicide through our food consumption and water systems.

Label It Hawai'i supports the Food and Drug Administration's (FDA) policy in Section 402(a)(1) which states, "the act imposes a legal duty on those who introduce food into the market place, including food derived from new crop varieties, to ensure that the food satisfies the applicable safety standard." The FDA, United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA) do not test these products before being introduced in the market for human consumption. There are no long term studies provided by the biotech industry citing safety of GMO foods. The policy of "substantial equivalence" cannot apply to such products if patents have been obtained claiming novel and non-obvious traits.

GMOs are either banned or labeled in over 60 countries worldwide. According to the Hawai'i Department of Agriculture, the Rainbow papaya is already being labeled individually in our state prior to export to Japan. These same labels should be available here. Hawai'i consumers deserve to know the nature of ALL the food they eat.

We urge you to pass HB174.

Respectfully submitted,
Mary Oyama
Label It Hawaii

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kelly Stern	Goldielocks Grinds w/ Yogarden LLC	Support	Yes

Comments:

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As a health conscious individual, organic farmer, and chef living on the island of Oahu, I am extremely concerned about the health hazards caused by consuming genetically modified food and the severe chemicals that are sprayed upon the fruit and absorbed into the land for which we all live on.

For years now, humans have been researching the effects of genetically modified food. It has been proven over and over again that genetically modified food can led to many health problems such as infertility, allergies, tumors, and even cancer. It seems so clear to me as an individual that this is not something that I would like to put into my body or any of the bodies that I'm preparing food for as a chef. As a chef, I thrive to provide only the best for my consumers, which means the produce is grown organically and locally if possible. Unfortunately, so much of the land in Hawaii is being used to grow genetically modified food that pollutes our aina and then is shipped away. Instead of using this land for out sourcing a population that does not live on Hawaii, we should be growing food to sustain these islands. We are so blessed to live on an island with a tropical climate, where we can grow food year round. So why are we not doing this? We have the ability to provide food for these islands, yet we rely on boats and airplanes to bring 90% of the food to these islands. I choose to support local farmers who work hard to provide food for this island. I choose to by food that has not been in any way genetically modified for the health of myself, my family, my clients, and this aina.

As a farmer, I choose to only plant organic seeds. I choose to make organic soil mixes that are sustainable and add to the quality of this land. People who eat the food that my partner and I grow, taste the difference. There is love put into the land on our farm. We are not driven by the money, but by the love and commitment we have made to living a healthy lifestyle and supporting others who do. We all have the choice to know what we are putting into our bodies. We all have the right as citizens to know what we are purchasing.

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 5:32 PM
To: FINTestimony
Cc: lotuslover@hotmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Courtney Bruch	GMO Free Maui, GMO Free Oahu, GMO Free Big Island	Support	No

Comments:

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HOUSE HEARING
Committee on Finance
Friday, February 22, 2013
3:00PM, Conference Room 308
State Capitol, 415 South Beretania Street

Testimony OPPOSING HB174 HD2
Relating to Food Labeling

Aloha Chair Luke, Vice Chair Nishimoto, Vice Chair Johanson and Respected Committee Members:

I strongly oppose HB174 HD2.

It is logical to say that consumers would view *mandated* labeling of genetically modified products as a warning – as a "mandate" is most often associated with informing the consumer of something that could affect them.

When we identify what products the FDA *requires* to be labeled, we understand the purpose and intent of their labeling policy. The FDA requires a product to be labeled if there is a significant difference, the ingredient is a potential allergen, or somehow changes the nutritional properties of the food. The purpose is meant to bring attention to things that could affect the consumer, not for ideological differences.

The FDA is resolute in its finding, based on good peer reviewed scientific evidence, that genetically modified (GM) crops do not differ from non-GM crops, and that products containing them do not have to be labeled. This is because no approved biotech crop is an allergen, or has nutritional differences from non-GM counterparts. *Thus based on scientific evidence there is no reason to suggest that GM products cause harm or should be targeted and mandated to be labeled, according to FDA policy.*

The resultant consequences and reality of passing a bill to *mandate* the labeling of GM products would put a huge burden on our affected state regulatory agencies – one we can not afford. It will also put suppliers, retailers and freight carriers at risk of frivolous lawsuits, causing unfair hardship in defense litigation – in a time when businesses need economic stability. Lastly all of these increased costs to re-tool the majority of food products within this vast system that currently does not have the capabilities to separately manufacture, distribute and document this proposed new but unnecessary requirement – will inevitably fall on the shoulders of the consumer, who will burden these increased costs, many of which are unforeseeable.

Current voluntary labeling, for those who choose to label their product non-GM, is in wide spread use today and very successful in providing consumers a choice, as well as allow the producers to command a premium price point *without* burdening those that remain open to GM products.

Our time, money and energy would be better spent on educating the public on agricultural co-existence, which will help our State identify real solutions for greater economic self sufficiency.

I humbly ask that you oppose HB174 HD2.

Respectfully submitted,

Dawn Bicoy
Community Affairs Manager
Monsanto Molokai

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 11:25 AM
To: FINTestimony
Cc: bobs@times-supermarket.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Bob Stout	Times Supermarkets	Comments Only	No

Comments: This didn't work in California recently and for a reason. The national manufacturers are not going to bow to Hawaii and the associated expense of doing this. Someone down there really needs to do their homework with a lot less self serving emotion.

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MONSANTO CO.
94-520 KUNIA ROAD
KUNIA, HAWAII 96759

TESTIMONY BEFORE THE
HOUSE COMMITTEE ON FINANCE
Agenda #3; 3:00 p.m.
Room 308

FEBRUARY 22, 2013

TESTIMONY ON HB 174, HD 2
RELATING TO FOOD LABELING

Chair Luke and committee members:

My name is Fred Perlak, Vice President of Research and Business Operations for Monsanto Hawaii. We **strongly oppose** HB 174 primarily on the basis that there are Federal regulations for labeling that cover long-standing precedents in food regulation. The state does not have the funds, the expertise or the manpower to properly label our food. It will be difficult for State regulators to inspect and test all products being sold or distributed in the State for compliance with a genetically engineered labeling system. There is no evidence of safety concerns or nutritional differences. Any additional costs incurred by food manufactures would be passed on to Hawaii consumers. The USDA estimates that food costs will increase 3-4% in 2013 and we do not want additional costs added on to our already high food bills.

Federal law already requires accurate food labeling that provides information relevant to health, safety and nutrition of all food products sold in the United States. The FDA establishes uniform labeling requirements to be consistent with consumer protection and commerce on a nation wide basis. This agency requires labeling only to indicate that a food raises questions of safety, nutrition or proper usage. Federal research and regulatory agencies have conducted and reviewed years of studies that show no health or safety concerns. Research has found crops currently available from biotechnology to be as safe as those produced via other more conventional methods.

Current labeling regulations do allow for voluntary labeling. Food can be labeled non-gmo assuming that is a truthful statement. Food manufacturers will respond to public demand with products and labels if the demand were genuine and widespread.

Let the marketplace and the Federal guidelines dictate safety and labeling of our food. Please do not pass HB 174.

Thank you.

Fred Perlak, Ph.D.
Distinguished Monsanto Science Fellow
Vice President, business and Research Operations, Monsanto Hawaii

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 9:53 AM
To: FINTestimony
Cc: ChoonJamesHawaii@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Choon James	Country	Support	No

Comments: SUPPORT HB 174 to label GMO or non-GMO foods. This is a very issue that we need to address. There is a very acute controversy over the health and environment impacts on society. At the very least, Hawaii should provide the "Right to know" in what we eat. Contrary to what Monsanto lobbyists may say, labeling a product as GMO or Non-GMO should not cost or raise the price of food products. All foods have labeling already. All foods and for that matter, mattresses, have labels already. The public should have the right to know what it is buying.

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Love Life!

Down to Earth™
Organic & Natural

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Testimony to the House Finance Committee
Friday, February 22nd, 2013 3:00pm

To: Chair Luke, Vice Chairs Nishimoto & Ling Johanson, committee members
Re: HB 174 HD2 Relating to Food Labeling

Down to Earth Organic & Natural, a Hawaii company founded in 1977, has five (5) organic and natural foods stores throughout the state: four on Oahu and one on Maui.

Down to Earth supports HB 174 HD2 which currently requires all imported genetically engineered (GE) fresh produce sold in Hawaii to be labeled as "genetically engineered".

We strongly support this bill.

Consumers have the right to know whether the foods they eat are produced using genetic modification techniques. The overwhelming majority of consumers want to know whether the foods they consume are genetically modified or not (over 90% of consumers asked in recent surveys want labeling of GMOs).

As a food retailer with thousands of customers shopping in our stores on a daily basis, we are regularly asked by our customers whether the foods we sell contain GMOs or not.

As there is no requirement for labeling we are unable to provide accurate information to consumers in response to their questions. As a retailer, in many cases we are unable to obtain adequate information from our suppliers whether the products we buy from them contain GMOs or not. Without labeling, our suppliers don't know, we don't know, and our customers don't know; but we all want to know!

The biotech industry advocates that their products are good for people and good for the world. If they are so proud of their products and believe their claims then they should be happy to label their products, making it a strong marketing claim. So why are they opposed to providing that information?

The biotech industries position that there is no need for labeling because the foods are "nutritionally equivalent", or "substantially equivalent" is a hollow argument that does not help suppliers, retailers, and consumers get answers to their valid questions. The biotech industry is really taking a position of telling us what consumers need too or worse yet, are allowed to know.

The biotech industry argument that consumers can buy organic foods if they want to avoid GMOs is similarly irrelevant, while it is true that GMOs are not an approved process under the National Organic Program (NOP), many foodstuffs that are "conventionally" grown do not contain GMOs. Many consumers want to buy those foods, especially if an organic option is not available. Without knowing whether it is GMO or not consumers are unable to make informed choices on whether to buy what may or may not be a GMO item.

With regard to the current bill before your committee, it covers only imported produce items. The growers of GMO produce know that it is GMO as they buy the seed from the biotech companies, therefore no testing is required. It is also easy and inexpensive to label the GMO produce as it is hand-packed into boxes for shipping.

While consumers have the right, and are asking for and even demanding labeling of all foods containing GMO foods, HD174 HD2 is a compromise bill that, while not providing full labeling, at least provides some labeling and is therefore strongly supported by Down to Earth.

There are of course many further reasons why GMOs should be labeled and why various individuals and organizations are asking for labeling. These include the adverse environmental impacts of GMOs (e.g. increased herbicide use, super-weeds, loss of biodiversity, etc.), and the unknown long-term health impacts (many independent studies showing cause for concern) of the consumption of GMO foods.

Down to Earth strongly supports HB 174 HD2 and urge you to pass the bill from your committee.

Down to Earth further advocates that the bill be amended to:

1. To ensure that the bill will be constitutional and not run afoul of the commerce clause, that all produce items, including produce items grown in Hawaii be labeled if they contain GMOs
2. To allow industry time to prepare for the required labeling, the implementation date be changed to January 1, 2015

Please vote in favor of H.B. No. 174 HD2 with the suggested amendments.

Respectfully submitted,

Mark Fergusson
Chief Organic Officer
Chief Executive & Chief Financial Officer

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 10:05 AM
To: FINTestimony
Cc: shannonkona@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Shannon Rudolph	Individual	Support	No

Comments:

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Cc: occupyhilomedia@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

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Submitted By	Organization	Testifier Position	Present at Hearing
Kerri Marks	Individual	Support	No

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Cc: namaka@interpac.net
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

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Submitted By	Organization	Testifier Position	Present at Hearing
Joan Lander	Individual	Support	No

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Cc: lmyang@hawaii.edu
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

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Submitted By	Organization	Testifier Position	Present at Hearing
Lisa Yang	Individual	Support	Yes

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Cc: nomie_34@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
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Submitted By	Organization	Testifier Position	Present at Hearing
Naomi Egami	Individual	Support	No

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Cc: daylinrose.gibson@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

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Submitted By	Organization	Testifier Position	Present at Hearing
Daylin-Rose Gibson	Individual	Support	Yes

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Cc: sundownertoni@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
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Submitted By	Organization	Testifier Position	Present at Hearing
Toni Withington	Individual	Support	No

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To: FINTestimony
Cc: jcbanna@hawaii.edu
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

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Submitted By	Organization	Testifier Position	Present at Hearing
Jinan Banna	Individual	Support	No

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Cc: mtpettit@hawaii.edu
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
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Submitted By	Organization	Testifier Position	Present at Hearing
Miyoko Pettit	Individual	Support	No

Comments:

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Sent: Thursday, February 21, 2013 2:41 AM
To: FINTestimony
Cc: devinisafoal@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
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Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Devin Dixon	Individual	Support	No

Comments:

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Cc: wybart4@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
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Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Wyatt Bartlett	Individual	Support	No

Comments:

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To: FINTestimony
Cc: sarah.hoer@live.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Sarah Hoer	Individual	Support	No

Comments:

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To: FINTestimony
Cc: maliadamon@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Malia Damon	Individual	Support	No

Comments:

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Cc: cravegreens@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Crystal Thornburg-Homcy	Individual	Support	No

Comments:

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To: FINTestimony
Cc: brimohi@msn.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Brian Emmons	Individual	Support	No

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FINTestimony

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To: FINTestimony
Cc: mauigirl.cari@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Cari Taylor	Individual	Support	No

Comments:

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To: FINTestimony
Cc: Kauaimichelle@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Michelle Clark	Individual	Support	No

Comments:

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To: FINTestimony
Cc: dobrin.dobrev@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Dobrin Dobrev	Individual	Support	No

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FINTestimony

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Sent: Wednesday, February 20, 2013 6:36 PM
To: FINTestimony
Cc: Kelseyoa@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kelsey molina	Individual	Support	No

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From: mailinglist@capitol.hawaii.gov
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To: FINTestimony
Cc: mauibrad@hotmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Brad Parsons	Individual	Support	No

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Sent: Wednesday, February 20, 2013 4:00 PM
To: FINTestimony
Cc: juliahorn1@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Julia Horn	Individual	Support	No

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Sent: Wednesday, February 20, 2013 3:45 PM
To: FINTestimony
Cc: davehomcy@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Dave Homcy	Individual	Support	No

Comments:

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From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 12:59 PM
To: FINTestimony
Cc: brilana@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Brilana Silva	Individual	Support	No

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 12:46 PM
To: FINTestimony
Cc: davidlhenkin@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
David Henkin	Individual	Support	No

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From: mailinglist@capitol.hawaii.gov
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To: FINTestimony
Cc: keani_nwr@msn.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Keani Rawlins-Fernandez	Individual	Support	No

Comments:

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From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 11:15 AM
To: FINTestimony
Cc: joyamarshall2003@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Joy Marshall	Individual	Support	Yes

Comments:

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To: FINTestimony
Cc: rollergregory@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
gregory roller	Individual	Support	No

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From: mailinglist@capitol.hawaii.gov
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To: FINTestimony
Cc: springmanju@earthlink.net
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Mary Manju	Individual	Support	No

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To: FINTestimony
Cc: adairf@hawaii.edu
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Adair Fincher	Individual	Support	Yes

Comments:

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From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 10:46 AM
To: FINTestimony
Cc: 8alana8@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Alana Bryant	Individual	Support	No

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From: mailinglist@capitol.hawaii.gov
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To: FINTestimony
Cc: zacaru1@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
carla daniels	Individual	Support	No

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Cc: cbilberg@hawaii.rr.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Cathrine Bilberg	Individual	Support	No

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To: FINTestimony
Cc: chrisalmida@outlook.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Chris	Individual	Support	No

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Cc: blyons@cca.edu
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HB174
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Submitted By	Organization	Testifier Position	Present at Hearing
Brittany Lyons	Individual	Support	No

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To: FINTestimony
Cc: partelow@hawaii.edu
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
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Submitted By	Organization	Testifier Position	Present at Hearing
Tim Partelow	Individual	Support	No

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Cc: saws123@myway.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Carl York	Individual	Support	No

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Cc: elwenfreitas@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Elwen Freitas	Individual	Support	No

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To: FINTestimony
Cc: hunakai5@aol.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kelly Perry	Individual	Support	No

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Cc: slpodish@yahoo.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Serena Podish	Individual	Support	No

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Sent: Thursday, February 21, 2013 2:05 PM
To: FINTestimony
Cc: kiyinlee@hotmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Katie Meadows	Individual	Support	No

Comments:

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FINTestimony

From: Hector Valenzuela [hectoruh@yahoo.com]
Sent: Thursday, February 21, 2013 3:02 PM
To: FINTestimony
Subject: Testimony for Bill HB174 HD 2 (Labeling) Support with AMENDMENTS

February 21, 2013

To: House Committee on Finance

From: Hector Valenzuela, Mililani

Re: Bill HB174 HD 2 Labeling: Testimony in STRONG SUPPORT with AMENDMENTS for labeling of BOTH local and imported produce

This testimony is in STRONG SUPPORT of labeling bill HB HB174 HD 2, requesting with AMENDMENTS for labeling of BOTH local and imported produce.

I have been a professor and specialist of ecological crop production for 22 years, but write this on a personal capacity.

As the bill currently stands, consumers won't be able to discern between locally grown GMO and non-GMO produce. However, consumers are demanding the labeling of ALL produce, not only the imported ones.

With respect to the science, there are simply too many unknowns about the potential unintended effects of GM food on human health (see notes and references below). Please allow the citizens of Hawaii to have the choice of making an educated personal decision about the type of products that they purchase.

In Hawaii, all counties, six (6) neighborhood boards in Oahu, and the democratic environmental caucus have all had resolutions in favor of GMO labeling.

I work and garden in Manoa and statewide, and the quality of the food I grow and eat, is as important to me as it is to many individuals, mothers, and care-takers in the state.

Thank-you for your consideration, in passing Bill HB174 with AMENDMENTS, requiring the labeling of GMO food for both locally grown and imported produce.

Sincerely,

Hector Valenzuela
Mililani
808-625-1277

/////

Reports on health risks from both GM crops and GM crops/pesticide combinations (as both the seed and pesticides are required for their production.

Impact of pesticide use in Hawaii by the GM Seed Industry
Available at:
https://dl.dropbox.com/u/ 33544971/Pesticides%20Report% 20HI13.pdf

Report on Health and Environmental Impacts from use of Roundup Herbicide
Available at:
http://dl.dropbox.com/u/ 33544971/Roundup%20report% 20HV12.pdf

Sample of citations showing adverse effects from consumption of gm crops:
Available at:
http://dl.dropbox.com/u/ 33544971/health%20articles% 20HV12.pdf

/////////

Factoids about GMO Labeling in the U.S. and in the World

- 63 countries around the world require labeling, including Europe, Russia, Japan, Australia, New Zealand, India, South Africa, and Pakistan
- Current GMO labeling bills or initiative in several states inc. Washington, Maryland, New Mexico, Vermont
- surveys show that over 90% of public in US and over 70% in Hawaii support labeling
- in the state all Hawaii Counties and six (6) Oahu neighborhood boards have issued resolutions in support of GMO labeling
- labeling has been endorsed by the Democratic Caucus in Hawaii, and by the Democratic Party in California
- calls for labeling were made in 2012 by 55 members of the U.S. Congress
- Wheat farmers in Washington State, support GM labeling

/////

References of recent refereed publications showing evidence of risk from GM food, and/or the pesticides needed to grow GM crops (herbicide resistant crops)

Birth-defects and skeletal malformations:
Antoniou M, Habib MEM, Howard CV, Jennings RC, Leifert C, et al. (2012) Teratogenic Effects of Glyphosate-Based Herbicides: Divergence of Regulatory Decisions from Scientific Evidence. J Environ Anal Toxicol S4:006. doi:10.4172/2161-0525.S4-00

Cell death from exposure to Roundup:
Martini, C.N. Matías Gabrielli, María del C. Vila. 2012. A commercial formulation of glyphosate inhibits proliferation and differentiation to adipocytes and induces apoptosis in 3T3-L1 fibroblasts. Toxicology in Vitro 26:1007–1013. http://dx.doi.org/10.1016/j. tiv.2012.04.017

Mesnage, R., B. Bernay, and G.-E. Séralini. 2013. Ethoxylated adjuvants of glyphosate-based herbicides are active principles of human cell toxicity Toxicology (In Press). http://dx.doi.org/10.1016/j.tox.2012.09.006.

Liver and kidney toxicity:
Séralini, G.-E., et al. Long term toxicity of a Roundup herbicide and a Roundup tolerant genetically modified maize. Food Chem. Toxicol. (2012), http://dx.doi.org/10.1016/j. fct.2012.08.005

Other Reviews showing evidence of risk:
American Academy of Environmental Medicine. 2009. Genetically Modified Foods. Testimony to Maui County Council, on September 29, 2009.

Antoniou, et al. 2011. Roundup and birth defects Is the public being kept in the dark? Earth Open Source. June 2011. 52 pp.

Dona, A., and Arvanitoyannis, IS. 2009. Critical Reviews in Food Science and Nutrition. Health Risks of Genetically Modified Foods. 49:164–175 (2009)

////

Further Analysis in Support of GMO Labeling
Hector Valenzuela, Ph.D.
Mililani, Hawaii

1) Surveys and public polls conducted at a national and at the state level in Hawaii show that the public overwhelmingly supports the labeling of GM food. According to a survey of Hawaii consumers "The majority of the respondents felt that labeling is **very important**" (Shehata and Cox, 2007).
2) After 25 years of following the crop biotechnology industry, via the scientific literature as described below, I still have serious concerns about potential unintended health and environmental effects from the consumption and planting of genetically modified crops.
3) A review of the most recent scientific literature (in the form of reviews or refereed publications published in international scientific journals) highlights the following disconcerting information about how little we know, and about potential and current real health and environmental risks:

- A recent review of the literature showed that the number of HEALTH studies to determine the safety of GM food continues to be "very limited" (Domingo and Bordonaba, 2011).

- Despite the lack of studies about the safety of GM food, the industry continues to claim, without providing any data or evidence, that GM food poses no health risks. As far as I know, not ONE refereed study has been conducted IN Hawaii to evaluate the health or environmental impact of the GM crops grown in the state. Certainly no 'post-marketing' health safety studies have been conducted in the United States, because GM crops are not labeled in the U.S.

- A recent review identified serious flaws with the current regulatory process to assess potential ENVIRONMENTAL risks (Hilbeck et al., 2011). Earlier reviews had shown that "key scientific studies" to assess potential environmental risks "are lacking" (Wolfenbarger and Phifer, 2000).

- **Conflict of Interest in safety assessment protocols** . Safety studies funded by industry, and published in science journals are riddled with a significant conflict of interest. Those studies that received industry funding had a 100% probability of showing results favorable to industry (Diels & Cunah et al. 2011).

- Recent reviews of the literature, published in science journals, show several health side effects from feeding experimental animals GM food (Seralini et al. 2011; Dona and Arvanitoyannis, 2009).

- A recent report documents considerable potential health effects from exposure to the direct application and residues of Roundup herbicide. Roundup herbicide is an integral component for the production of most of the GM crops grown today (i.e. growing RR crops requires the use of Roundup herbicide) (Antoniou et al, 2011).

- Three separate internal government audits conducted by the General Accountability Office (GAO, 2008), USDA (2006), and FDA (2007) concluded that current federal regulations are not doing an adequate job of protecting the public's health, nor the environment. These internal government audits concluded that "Increased oversight [is] needed", that regulations "do not go far enough to ensure the safe introduction of agricultural biotechnology," and that "FDA can't keep up with the science [of genomics, or biotechnology] to fulfill its mission"

- Based on a review of the available scientific literature, the well-respected American Academy of Environmental Medicine (AAEM) in 2009 called for the "labeling of GM foods, which is necessary for the health and safety of consumers". According to the AAEM "There is more than a casual association between GM foods and adverse health effects. There is causation as defined by Hill's Criteria in the areas of strength of

association, consistency, specificity, biological gradient, and biological plausibility," and the AAEM added that "The strength of association and consistency between GM foods and disease is confirmed in several animal studies." (AAEM, 2009).

References Cited

American Academy of Environmental Medicine. 2009. Genetically Modified Foods. Testimony to Maui County Council, on September 29, 2009.

Antoniou, et al. 2011. Roundup and birth defects Is the public being kept in the dark? Earth Open Source. June 2011. 52 pp.

Diels & Cunah et al. Food Policy Journal. 36:197(2011)

Domingo and Bordonaba. 2011. Environment International. 37:734–742

Dona, A., and Arvanitoyannis, IS. 2009. Critical Reviews in Food Science and Nutrition. Health Risks of Genegentically Modified Foods. 49:164–175 (2009)

Hilbeck et al. Environ. Sciences Europe 23:13(2011)

Seralini et al., Enviro Sci. Europe Journal. 23:10 (2011)

Shehata, S. and Linda J. Cox. 2007. Attitudes of Hawai'i Consumers. Toward Genetically Modified Fruit. Univ. Hawaii Coop. Ext. Serv. Ext. Bul. BIO-7, 8 pp.

Wolfenbarger and Phifer. 2000. The Ecological Risks and Benefits of Genetically Engineered Plants. Science. 290:2088-2093

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 2:52 PM
To: FINTestimony
Cc: eebrowni@hawaii.edu
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Elizabeth Browning	Individual	Support	No

Comments:

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 3:33 PM
To: FINTestimony
Cc: russell@dhgllc.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Russell Hirsch	Individual	Support	No

Comments: My daughters have soy and gluten allergies that my pediatrician says may have been caused by GMO foods. She recommends for us to stay away from all products containing GMOs, but this is extremely difficult without labeling, especially when my daughter is in social situations outside of our home. After learning more about GMOs as a result of her condition, I do not support the destruction and long-term costs that these crops cause to our environment, health or social structures. I would like to vote NO GMOs with my food purchases, but need labeling to be clear what is GMO and what is not. For example, Sugar is an ingredient that is often made from GMO beets but the labeling is unclear. Please pass this bill as a first step toward disclosing important food content and where our food comes from. Mahalo

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 3:52 PM
To: FINTestimony
Cc: finley_michele@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Michele Finley	Individual	Oppose	No

Comments: There are no reputable studies that point to any benefit from labeling GMO food products. Why? Because there aren't any adverse health concerns or issues associated with GMO foods.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 4:15 PM
To: FINTestimony
Cc: tylerandnani@hawaii.rr.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Tyler Paikuli-Campbell	Individual	Support	No

Comments:

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FINTestimony

From: James W. Macey [maceyj001@hawaii.rr.com]
Sent: Thursday, February 21, 2013 5:14 PM
To: FINTestimony
Subject: HB 174 RELATING TO FOOD LABELING

FIN Committee Members,

The European Food Safety Authority has discovered a hidden viral gene in 54 of 84 commercially approved genetically engineered crops—a finding that highlights deep flaws in the regulatory process.

Plant pathologists are speaking out about the potential dangers of the viral gene fragment in GE plants, stating it may confer "significant potential for harm," and call for a total recall of affected crops.

Plants expressing the viral gene fragment exhibit gene expression abnormalities, which indicate that the protein produced by gene functions as a toxin. The known targets of its activity are also found in human cells, so there is potential for this plant toxin to also have toxic effects on humans.

At present, the only way to avoid GE foods is to eliminate processed foods from your grocery list, and buy primarily whole foods grown according to organic standards. The need for labeling of GE foods is also becoming more apparent in order to allow for health monitoring. **The best way to protect our children is to label GE foods!**

Reference: Possible consequences of the overlap between the CaMV 35S promoter regions in plant transformation vectors used and the viral gene VI in transgenic plants
http://www.es.landesbioscience.com/journals/gmcrops/article/21406/?nocache=1759778285

Mahalo,
James W. Macey

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 3:49 PM
To: FINTestimony
Cc: OceanPixy@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Alice Switzer	Individual	Support	No

Comments: I would like to go on record that I am highly in support of labeling genetically engineered products imported or hawaii grown... The consuming public has the right to know when their food is being altered... There are to many unintended side effects... I limit the amount of these foods that are in my kitchen... I am please to see action being taken here, So we can protect our selfs from mass commercialization that does not have the human body as the highest factor rather the increase of revenue. Thank you for your time. Alice

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 12:44 PM
To: FINTestimony
Cc: melbefree@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Melissa Ebeling	Individual	Support	No

Comments: Please label GMO, There are no long term independent studies of the positive effects of GMO. Other countries have either completely banned GMO or they label it. Why Is the United States the Last to do so? Please protect our food from GMO by giving us the right to choose. Thank you Kindly for hearing my concerns. Melissa

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Testimony for HB147

Aloha,
My name is paul Izak and I am in Favor of HB147. I am a small business owner and steward of the land. I have been building back yard Organic Vegetable gardens in the communities for 6 years. I believe we must Label GMO's because it is our right to know if our food has been "Modified" on a molecular level. This awareness is for our health and for the health of the Hawaiian residents and will be a positive example for the other U.S states and the World.

As a organic grower I have developed a keen sense to chemicals and GMO's. I do not consume any GMO products and avoid chemicals at all costs. The times have been around the use of chemicals or eaten GMO food my body has physically respond in negative ways. I know the taste of organic food and the smell of soil that is alive and rich with living organisms. GMO crops and GMO foods do not have same taste, smell or vibration. In fact I don't feel safe anywhere near GMO crops and foods. When your body is healthy and in tune with nature you become very sensitive to this. However the majority of U.S Citizens are consuming GMO products on a regular basis and they don't even know it. They are developing cancers, ulcers, diabetes, gaining weight, migraines.....the list goes on and on. It's time we start acknowledging health starts with our food. By labeling GMO's the community at large will be more capable to make a positive decision for their own health.

Evidence has proven that GMO's are harmful to our health and are not natural. We have had the industrial green revolution and its's time we learn from it. We see now that the use of Pesticides and herbicides that GMO companies require and manufacture are destroying our environment. I do not want to support such destructive actions. What I do support is progressive and positive solutions that work with nature. Permaculture, which got a lot of it's idea's from the Hawaiians Ahupua'a system, is a positive solution that I will support and stand by till the end.

GMO companies have a strong hold on Hawaii's land and have financially invested a great amount. However it's time we look past these money issues. This is for our health our children's health and the health of all of hawaii. We will find other ways to become economically stable. We are starting to see that GMO companies agricultural practices no longer serve for the higher good of the people or this land. If it is not time for them to leave then so be it, the voices of the people will not stop till there is an end to GMO's. But it is time to label the products so that we can know. I think this is a justified, moral and humane request.
Once the awareness of the Harms of GMO's has spread you will be voting that GMO's have no place in hawaii. We must make way for new innovative, environmentally friendly, and health conscious ways of producing food. There is so much to learn from this land and it is time we listen to her cries. Closing the door to the harmful practices of GMO companies will open the doors to those people who truly want to Malama (take care of) this land with practices that are sustained to support future generations. I have faith that our self sustainable dreams are now manifesting and if we must take small steps our greatest solution now is the passing of HB174 and Labeling all GMO products. Mahalo.

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 1:27 PM
To: FINTestimony
Cc: 10kheartslove@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM
Attachments: GMOlabelingsupport.txt

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Amenala Nearhu	Individual	Support	No

Comments: Please listen to the people. We want this as a first step to getting it island wide so once and for all Monsanto will get off our islands! Mahalo

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February 21, 2013

To: House Committee on Finance

From: Hector Valenzuela, Mililani

Re: Bill HB174 HD 2 Labeling: Testimony in strong support with AMENDMENTS for labeling of BOTH local and imported produce

This testimony is in STRONG SUPPORT of labeling bill HB HB174 HD 2, requesting with AMENDMENTS for labeling of BOTH local and imported produce.

I have been a professor and specialist of ecological crop production for 22 years, but write this on a personal capacity.

As the bill currently stands, consumers won't be able to discern between locally grown GMO and non-GMO produce. However, consumers are demanding the labeling of ALL produce, not only the imported ones.

With respect to the science, there are simply too many unknowns about the potential unintended effects of GM food on human health (see notes and references below). Please allow the citizens of Hawaii to have the choice of making an educated personal decision about the type of products that they purchase.

In Hawaii, all counties, six (6) neighborhood boards in Oahu, and the democratic environmental caucus have all had resolutions in favor of GMO labeling.

I work and garden in Manoa and statewide, and the quality of the food I grow and eat, is as important to me as it is to many individuals, mothers, and care-takers in the state.

Thank-you for your consideration, in passing Bill HB174 with AMENDMENTS, requiring the labeling of GMO food for both locally grown and imported produce.

Sincerely,

Hector Valenzuela

Mililani

808-625-1277

/////

Reports on health risks from both GM crops and GM crops/pesticide combinations (as both the seed and pesticides are required for their production.

Impact of pesticide use in Hawaii by the GM Seed Industry
Available at:

https://dl.dropbox.com/u/ 33544971/Pesticides%20Report% 20HI13.pdf

Report on Health and Environmental Impacts from use of Roundup Herbicide
Available at:

http://dl.dropbox.com/u/ 33544971/Roundup%20report% 20HV12.pdf

Sample of citations showing adverse effects from consumption of gm crops:
Available at:

http://dl.dropbox.com/u/ 33544971/health%20articles% 20HV12.pdf

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Factoids about GMO Labeling in the U.S. and in the World

- 63 countries around the world require labeling, including Europe, Russia, Japan, Australia, New Zealand, India, South Africa, and Pakistan
- Current GMO labeling bills or initiative in several states inc. Washington, Maryland, New Mexico, Vermont
- Surveys show that over 90% of public in US and over 70% in Hawaii support labeling
- In the state all Hawaii Counties and six (6) Oahu neighborhood boards have issued resolutions in support of GMO labeling
- Labeling has been endorsed by the Democratic Caucus in Hawaii, and by the Democratic Party in California
- Calls for labeling were made in 2012 by 55 members of the U.S. Congress
- Wheat farmers in Washington State, support GM labeling

/////

References of recent refereed publications showing evidence of risk from GM food, and/or the pesticides needed to grow GM crops (herbicide resistant crops)

Birth-defects and skeletal malformations:

Antoniou M, Habib MEM, Howard CV, Jennings RC, Leifert C, et al. (2012) Teratogenic Effects of Glyphosate-Based Herbicides: Divergence of Regulatory Decisions from Scientific Evidence. J Environ Anal Toxicol S4:006. doi:10.4172/2161-0525.S4-00

Cell death from exposure to Roundup:

Martini, C.N. Matías Gabrielli, María del C. Vila. 2012. A commercial formulation of glyphosate inhibits proliferation and differentiation to adipocytes and induces apoptosis in 3T3-L1 fibroblasts. Toxicology in Vitro 26:1007–1013. http://dx.doi.org/10.1016/j. tiv.2012.04.017

Mesnage, R., B. Bernay, and G.-E. Séralini. 2013. Ethoxylated adjuvants of glyphosate-based herbicides are active principles of human cell toxicity Toxicology (In Press). http://dx.doi.org/10.1016/j.tox.2012.09.006.

Liver and kidney toxicity:

Séralini, G.-E., et al. Long term toxicity of a Roundup herbicide and a Roundup tolerant genetically modified maize. Food Chem. Toxicol. (2012), http://dx.doi.org/10.1016/j. fct.2012.08.005

Other Reviews showing evidence of risk:

American Academy of Environmental Medicine. 2009. Genetically Modified Foods. Testimony to Maui County Council, on September 29, 2009.

Antoniou, et al. 2011. Roundup and birth defects Is the public being kept in the dark? Earth Open Source. June 2011. 52 pp.

Dona, A., and Arvanitoyannis, IS. 2009. Critical Reviews in Food Science and Nutrition. Health Risks of Genetically Modified Foods. 49:164–175 (2009)

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Further Analysis in Support of GMO Labeling

Hector Valenzuela, Ph.D.
Mililani, Hawaii

1) Surveys and public polls conducted at a national and at the state level in Hawaii show that the public overwhelmingly supports the labeling of GM food. According to a survey of Hawaii consumers "The majority of the respondents felt that labeling is very important" (Shehata and Cox, 2007).

2) After 25 years of following the crop biotechnology industry, via the scientific literature as described below, I still have serious concerns about potential unintended health and environmental effects from the consumption and planting of genetically modified crops.

3) A review of the most recent scientific literature (in the form of reviews or refereed publications published in international scientific journals) highlights the following disconcerting information about how little we know, and about potential and current real health and environmental risks:

- A recent review of the literature showed that the number of HEALTH studies to determine the safety of GM food continues to be "very limited" (Domingo and Bordonaba, 2011).

- Despite the lack of studies about the safety of GM food, the industry continues to claim, without providing any data or evidence, that GM food poses no health risks. As far as I know, not ONE refereed study has been conducted IN Hawaii to evaluate the health or environmental impact of the GM crops grown in the state. Certainly no 'post-marketing' health safety studies have been conducted in the United States, because GM crops are not labeled in the U.S.

- A recent review identified serious flaws with the current regulatory process to assess potential ENVIRONMENTAL risks (Hilbeck et al., 2011). Earlier reviews had shown that "key scientific studies" to assess potential environmental risks "are lacking" (Wolfenbarger and Phifer, 2000).

- Conflict of Interest in safety assessment protocols. Safety studies funded by industry, and published in science journals are riddled with a significant conflict of interest. Those studies that received industry funding had a 100% probability of showing results favorable to industry (Diels & Cunah et al. 2011).

- Recent reviews of the literature, published in science journals, show several health side effects from feeding experimental animals GM food (Seralini et al. 2011; Dona and Arvanitoyannis, 2009).

· A recent report documents considerable potential health effects from exposure to the direct application and residues of Roundup herbicide. Roundup herbicide is an integral component for the production of most of the GM crops grown today (i.e. growing RR crops requires the use of Roundup herbicide) (Antoniou et al, 2011).

· Three separate internal government audits conducted by the General Accountability Office (GAO, 2008), USDA (2006), and FDA (2007) concluded that current federal regulations are not doing an adequate job of protecting the public's health, nor the environment. These internal government audits concluded that "Increased oversight [is] needed", that regulations "do not go far enough to ensure the safe introduction of agricultural biotechnology," and that "FDA can't keep up with the science [of genomics, or biotechnology] to fulfill its mission"

· Based on a review of the available scientific literature, the well-respected American Academy of Environmental Medicine (AAEM) in 2009 called for the "labeling of GM foods, which is necessary for the health and safety of consumers". According to the AAEM "There is more than a casual association between GM foods and adverse health effects. There is causation as defined by Hill's Criteria in the areas of strength of association, consistency, specificity, biological gradient, and biological plausibility," and the AAEM added that "The strength of association and consistency between GM foods and disease is confirmed in several animal studies." (AAEM, 2009).

References Cited

American Academy of Environmental Medicine. 2009. Genetically Modified Foods. Testimony to Maui County Council, on September 29, 2009.

Antoniou, et al. 2011. Roundup and birth defects Is the public being kept in the dark? Earth Open Source. June 2011. 52 pp.

Diels & Cunah et al. Food Policy Journal. 36:197(2011)

Domingo and Bordonaba. 2011. Environment International. 37:734–742

Dona, A., and Arvanitoyannis, IS. 2009. Critical Reviews in Food Science and Nutrition. Health Risks of Genegentically Modified Foods. 49:164–175 (2009)

Hilbeck et al. Environ. Sciences Europe 23:13(2011)

Seralini et al., Enviro Sci. Europe Journal. 23:10 (2011)

Shehata, S. and Linda J. Cox. 2007. Attitudes of Hawai'i Consumers. Toward Genetically Modified Fruit. Univ. Hawaii Coop. Ext. Serv. Ext. Bul. BIO-7, 8 pp.

Wolfenbarger and Phifer. 2000. The Ecological Risks and Benefits of Genetically Engineered Plants. Science. 290:2088-2093

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FIN Committee on Friday, 02-22-13 3:00PM in House conference room 308.

RE: COSTS OF LABELING OF GENETICALLY ENGINEERED FOOD 2/21/2013

Honorable Finance Chairman and Committee Members,

Producers and distributors frequently argue that requiring GE labeling will increase the cost of food for consumers. What this controversy is really about is that the interests in GE crops will most likely lose market share and profits if consumers know what they are getting. I believe that government should protect the public's interest in the right of informed choice in the operation of a free market rather than protecting the continuing profits and market share of special interests propped up by withholding information from the consumer.

1) I have seen no real evidence of actual significant price increases in the nearly **50** countries where GE labeling has been required. No significant increase in food prices were observed in the EU after passage of the initial labeling requirement. Mr. David Byrne, European Commissioner for Health and Consumer Protection indicated in 2001 that ". . . when the labeling regime (based on DNA/protein) was introduced in 1997, it did not result in increased costs, despite the horrifying (double-digit) prediction of some interests. Similarly, when Norway introduced its current labeling regime (similar to the one now proposed), it did not provoke any price increase or disruption in trade." (Speech/01/378, European Parliament, Brussels, 11 September 2001).

2) In regard to the actual evidence for the United States, law Professor Joanna M. Shepherd-Bailey wrote an assessment of the cost of GE labeling based, in large part, on FDA cost analysis of the impact of changes in labeling requirements. She concluded that if Prop 37 were adopted in California last year, "At most, the average California household will see total annual food expenditures increase by a one-time cost of $1.27 to offset these labeling expenses." .(Economic Assessment: Proposed California Right to Know Genetically Engineered Food Act (Prop 37) Likely to Cause No Change in Food Prices, Minor Litigation Costs, and Negligible Administrative Costs. Prepared for Emory University School of Law, 2012). Furthermore, she cited an FDA estimate that three-quarters of package labels are normally scheduled to be changed during any 30 month period (Food and Drug Adminstration, *Food Labeling: Trans Fatty Acids in Nutrition Labeling, Nutrition Content Claims, and Health Claims,* 68 Federal Register 41477(2003)). Costs and

contents are regularly being tracked, and labels periodically updated all the time. With a reasonable compliance period the proposed labeling changes can be part of the normal update process.

3) But many GE labeling opponents argue that the larger impact will be in more expensive cost of the food itself and its processing for the average consumer. In California, opponents of the Right to Know conducted a massive PR campaign in the final days before the vote claiming that requiring labeling would cost the average household $350-$400 annually. (Genetic Engineering & Biotechnology News, October 11, 2012). This, or course, was based on a 'worst case' assumptions where producers substituted all non-GMO foods for the GMO food products. And even for the 'worst case' this estimate has been challenged by multiple sources as being quite unrealistic (e.g, Shepherd-Bailey, and Genetic Engineering & Biotechnology News, *supra*).

   But the argument that producers and suppliers would have to change out most of their products if they had to be labeled is for me one of the strongest arguments for requiring GE labeling! The producers and distributors are clearly acknowledging that they are not supplying the consumer what we want, and that if we actually knew what we are getting many of us would not buy what they now are putting on the shelves.

   And even if non-GMO conventional food, and especially certified organic food, were a bit more expensive, whether to purchase GMO or non-GMO products should be a consumer choice. Likely still a significant percentage of families won't want to spend a possible few extra dollars each week to buy organic and/or non-GMO produce. I have great confidence that innovative producers will continue to be happy to supply them with GMO foods at no significant increase in cost. Let the market respond to consumer demand.

   A basic tenant of the free market system is that producers and suppliers give the consumer what we want, as determined by what we buy. So if producers and suppliers don't sell us what we want, they lose sales and profit, and they either adapt to what is demanded, or they go out of business. Producers and suppliers who give us what we want thrive. Most of us don't take lightly to businesses either getting government subsidies to keep producing what people don't want, or effectively getting a green light from the government to continue to sell us what we don't want.

4) GE labeling opponents strongly argue that GE foods 'do not differ from' the non-GE foods that they are derived from, and 'do not pose a health issue' (see, for example Maui Chamber of Commerce testimony to the Agriculture Committee on February 4, 2012). While I have seen hundreds of studies and documentation from around the world that call these assumptions into question, and am aware of the legal restrictions against unapproved research that Monsanto, Syngenta, *et. al*. have tried to impose on all purchasers of their seeds (see *Seed Giants vs. U.S. Farmers*, A Report By the Center For Food Safety & Save Our Seeds, 2013) , the issue here is more about the right of consumers to know what we are getting and make our own decisions about what is important to us. The recent outrage in Europe about beef products containing some horsemeat is instructive in this regard. It can be argued that horsemeat may be even more nutritious in many regards than beef (*Nutritional Characteristics of Horsemeat in Comparison to those of Beef and Pork*, Journal of Nutritional Research and Practice, 2007 Spring: 1(1):70-72). Yet consumers, especially in the British Isles, are demanding not to eat horsemeat, and the government regulatory agencies and justice departments are taking prompt and decisive action to make sure consumer demand is satisfied, prompting massive recalls and extensive genetic testing of products.

I believe it is one purpose of government is to help insure transparency of information that the public considers important in our decision-making. I strongly urge you to mandate full labeling of products that are, or come from seed that are, genetically engineered, not only because of potential health issues that need more independent research, but right now because of extensive consumer demand.

Gene Groves
Kihei, HI
Retired research sociologist, computer systems engineer, real estate investor, and teacher.

Sited Sources Included:

David Byrne, European Commissioner for Health and Consumer Protection, Proposal for a regulation on GM Food and Feed European Parliament, Brussels, 11 September 200, Speech/01/378 p. 4 on "Costs" http://ec.europa.eu/dgs/health_consumer/library/speeches/speech114_en.pdf

Alex Phillippidis, Weighing the Costs of GMO Labeling 2012.
http://www.genengnews.com/keywordsnadtools/print/3/29090/

Joanna M. Shepherd Bailey, Ph.D., Emory University School of Law, Economic-Assessment: Proposed California Right to Know Genetically Engineered Food Act (Prop 37) Likely to Cause No Change in Food Prices, Minor Litigation Costs, and Negliglbe Administrative Costs, 49 pages
http://www.anh-usa.org/wp-content/uploads/2012/08/GE-Food-Act-Costs-Assessment.pdf

Food and Drug Adminstration, *Food Labeling: Trans Fatty Acids in Nutrition Labeling, Nutrition Content Claims, and Health Claims,* 68 Federal Register 41477(2003))
http://www.fda.gov/ohrms/dockets/98fr/03-17525.htm

Chong-Eon Lee,corresponding author Pil-Nam Seong,Woon-Young Oh, Moon-Suck Ko, Kyu-Il Kim, and Jae-Hong Jeong *Nutritional Characteristics of Horsemeat in Comparison to those of Beef and Pork*, Journal of Nutritional Research and Practice, 2007 Spring: 1(1):70-72).
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2882581/

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 2:41 PM
To: FINTestimony
Cc: kanoe_p@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kanoelani Puuohau	Individual	Support	No

Comments: I am from the Island of Hawai'i and currently reside in Nu'uanu on O'ahu and I support the labeling of GMO food products including imported produce. Although citizens have the option of buying food that is labeled as certified organic, I believe that they are also entitled to know which foods incorporate genetically modified organisms in their product. Those in opposition to GMO labeling note that GMO foods have not been scientifically proven to be harmful. In that same vein, they have not been proven safe either. In a recent panel on GMO issues in Hawai'i at the UH Manoa Richardson School of Law, Uncle Walter Ritte spoke about the negative impacts of GMO production that are plainly visible on the island of Moloka'i. In his description of bare lands, bulldozed topsoil, wind swept dirt clouds and runoff into the ocean, the cost to the environment and the community seems to greatly outweigh any supposed benefits of developing GMO's for increased drought and insect resistance. Another benefit of GMOs that was mentioned in the panel is use for nutritional enhancement, but people can always adjust their diet to incorporate more vegetables in order to address vitamin deficiencies. Lastly, those who oppose labeling claim that the cost will pass to the consumer making our food more expensive, however, the companies who voluntarily choose to label their products as GMO-free provide proof that labeling does not necessarily prevent companies from continuing to sell products at a profitable price. The issue of GMOs is hotly contested and labeling provides a solution to the controversy by giving the public the information they deserve and the power to decide whether to purchase these products. Thank you for the opportunity to submit testimony in support of HB174.

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Jay W Duquette	Individual	Support	No

Comments: First allow me to thank you folks for having the courage to introduce a bill like HB 174. It is long overdue. The people have spoken and we want to be given a choice about the food we put in our bodies. This choice begins with the labeling of our food. This bill is a bold step in the right direction. If GMO foods are as safe and healthy as the major seed companies would have us believe then they should have no problem backing up their claims by labeling the food they are responsible for creating. The bottom line is label it and let the consumer decide. Mahalo for your time.

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
janice palma-glenie	Individual	Support	No

Comments: the public has a right to know what's in their food. please support. mahalo.

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Lars Lind	Individual	Support	No

Comments: Aloha Representatives, My wife and I own a small organic farm on the island of Maui. It is so important that the food we eat and feed to the community be healthy and non-genetically modified. Requiring genetically engineered foods to be labeled will allow the consumer to make a decision as to what they are putting into their bodies. Mahalo for your support of this bill requiring GMO labeling! Lars Lind Olinda Organic Farm Makawao, HI

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Cc: mauimartha@hawaiiantel.net
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Martha Lind	Individual	Support	No

Comments: Aloha Representatives, I urge you to support HB174 HD2 to require specific labeling for any food or raw agricultural commodity sold in the State of HI that contains or was produced with a genetically engineered material. The terrible health effects of consuming GMO foods is just coming to light. We, the consumer, have a right to know what is in the food that we eat and feed to our families and GMO foods should thus be labeled as such. Mahalo for your support of this bill, Martha Lind Makawao, HI

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To: FINTestimony
Cc: kevinlash@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kevin Lash	Individual	Support	No

Comments: Maui Resident: Thank you all for getting the bill this far! It has been a real struggle to pass this type of bill anywhere due to outside political pressures. Personally, I won't consume any food that is not labeled GMO free but most people with not and will assume that many of the packaged food they trust are GMO free when they very well may not be. This bill is no different than requiring food to list ingredients. We as consumers have a right to know if are food is created in a lab (and therefore possibly unsafe) or as nature intended. PLEASE SUPPORT this bill. It is not a radical idea and we ALL have the right to know what we are eating. Thank you!

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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Linn Nishikawa	Individual	Oppose	No

Comments: I highly oppose HB174. Should this GM foods labeling bill be passed, THERE WILL be costs incurred for all tax payers. Why should we pay for a minority of people's "right to know" when there are programs already in place for volunteer labeling of GM foods?! One only has to search online to read what will happen should this type of legislation go through. Estimates range from a few dollars per person per year to 10 percent of consumer's food bill. For a family of 5, I already pay $1,500 - $2,000 per month on groceries ALONE, why should I pay more? In 2012, a legislative analysis of California Proposition 37, a state initiative calling for mandatory labeling of GM foods, concluded that the measure would have a fiscal impact to the state ranging from a few hundred thousand dollars to more than $1 million per year. The analysis also noted a potential increase in costs associated with lawsuits filed by individuals claiming violation of the labeling measure. Another report examining the potential impact of California Proposition 37 concluded that the measure would raise the average California household's annual food bill by $350 to $400. Can Hawaii sustain these types of costs? Who will enforce this type of legislation? Will we have less choice in food products in grocery stores because farmers, food manufacturers, etc. decide it's too expensive to make a special food label just for Hawaii? Majority of Hawaii's residents don't have the time to come out and testify because we have to work to make a living - I'm no exception. I'm hoping those we put in office have the strength to fight against these types of burdensome legislation that hurt the majority of our residents.

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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Casey Sexton	Individual	Support	No

Comments: I think it is outrageous that we do not already have a mandated transparent food labels for GMO's. There is plenty of scientific research & information on the toxic effects GMO's have on the body and living cells. Even China, Russia AND Saudia Arabia labels GMO's!! GMO's are not only toxic and promote the growth of tumors and cancer but they are completely unsustainable! They ravage the land and soil. They are destroying our land and will only further our reliance on imported foods and goods. LABEL OUR FOOD (we all know who's been receiving contributions from Monsanto, Syngenta, Bayer, etc. did they elect you into office? Aren't you supposed to serve the people???)

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Elizabeth McDermott	Individual	Support	No

Comments: I strongly support this bill. It is essential that Hawaii families have the ability to determine for themselves what risks they want to take with their health when purchasing their food. Labeling gives them a choice. It also tells us something about the way such foods were grown, often with far greater amounts of pesticide given that the vast majority of GMO foods are engineered to endure higher and higher amounts of pesticides. The vast majority of Americans and Hawaii residents want their food labeled. Most don't realize how much of what they consume is genetically engineered. It's time to end the secrecy. 63 countries around the world already require the labeling of GMO products. So claims that costs to label will be economically burdensome are really unfounded. It's already being done. It's time Hawaii got on board and rode this wave. It's a movement with enormous public support behind it. It will not go away.

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02/21/2013
The House of the twenty-seventh Legislature, Rep. Jessica Wooley, Chairperson
Hearing Date: 02/22/13
RE: HB 174 relating to labeling of Genetically Engineered Food

1. TESTIMONY IN SUPPORT OF HB 174 GMO Labeling

To the Honorable Chairperson Jessica Wooley and Hawaii State Legislature.

As you are well aware, Genetically Modified Organisms, or GMOs, are present in a majority of our food. It is a new and novel technology created only in the last 20-30 years. Despite claims by the industry, there is no way to guarantee they are safe for humans or the ecosystems they have been released into. Any geneticist will agree we are just scratching the surface in understanding DNA. To claim mastery of this science using GMOs is arrogant and foolish. We know very little about what will happen down the road with this technology.

GMOs are manipulated at the genetic level to either produce a pesticide in every cell of the plant, or to be resistant to roundup, so unlimited applications will not harm the plant. Both flavors do not have direct consumer benefit but do offer a slew of health, environmental and ecological concerns. Due to the uncertainty of this technology we need to know when these organisms are put into our food. Over sixty countries world wide label GMOs. With Hawaii being the epicenter of GMO research, it is logical to follow that we would also be transparent in our labeling. This is not the first time you are hearing of GMOs as I know many people have made a lot of information available to you, so I will not go into all the reasons GMOs deserve a label. Look at the volume of people in support of a labeling law. In addition to the many scientists including the FDA's own who question the safety of GMOs, another important reason to label is that people want and deserve them. So please allow us the freedom to opt. out and avoid GMOs if we so choose.

Thank you for allowing me to present testimony today regarding this resolution.

Thank you for your consideration.

Respectfully submitted,

Lanson A. Cosh PE

432 Kihapai St.

Kailua, HI

917 548 9676

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Cc: Imabreeze@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Crystal breeze	Individual	Support	No

Comments: Let Hawaii lead the way! Give us the power and knowledge to decide if we want to put GMO's into our growing children's bodies. Ua mau ke ea o ka aina i ka pono, “the life of the land is perpetuated in righteousness"

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HOUSE HEARING
Committee on Finance
Friday, February 22, 2013
3:00PM, Conference Rm 308
State Capitol, 415 South Beretania Street

Testimony OPPOSING HB174 HD2
Relating to Food Labeling

Aloha Chair Sylvia Luke, Vice Chair Scott Nishimoto, Vice Chair Aaron Ling Johanson and Respected Committee Members:

I strongly oppose HB174 HD2.

More than 16 years of research by some of the most credible scientific organizations in the world - The American Medical Association, the European Union Commission, the Swiss National Science Foundation, and the World Health Organization - have all confirmed that there is "no danger" to human health or the environment in the use of genetically engineered crops.

Since government mandated labeling by the US Food and Drug Administration is based solely on the health and safety of the product, there is simply no scientific justification to label GMO foods.

Appropriately – the FDA retains responsibility for labeling because they have the resources and expertise to properly implement costly changes in US food labeling policies.

During these tough economic times with competing priorities and budget restrictions, it is fiscally irresponsible for the counties or even states to duplicate what is already regulated by the federal government.

According to a recent study by Colorado State University, the cost of mandatory labeling could be as high as 10 percent of a consumer's annual food bill.

For the people who oppose GMO foods - for lifestyle, ideological or even religious beliefs - they can continue to purchase premium priced organically labeled or all-natural foods found at most grocery stores today which affirmatively addresses their "right to know" concerns.

Ironically - after analyzing forty years of data to determine whether organic foods provide additional health benefits, Stanford University scientists recently concluded that organic fruits and vegetables are generally no more nutritious or healthy than their conventionally-grown counterparts despite claims by proponents and growers.

For those of us who are struggling to put food on the table, we can be assured that the majority of food grown conventionally or genetically engineered will remain affordable because the unnecessary and costly labeling mandates whose only purpose is to stigmatize our food choices will be avoided.

Labeling GM foods would mean added costs for Hawaii's consumers. Our state already leads the nation in the price of food – up to 40 percent higher on some products. Labeling will drive up costs even further.

Sincerely,

Joan F. Lasua
P.O. Box 544
Kaunakakai, HI 96748

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From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 12:04 PM
To: FINTestimony
Cc: Abensley80@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Adam Bensley	Individual	Support	No

Comments: I strongly support this bill. GMO's need to be labeled

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February 21, 2013

To: The Honorable Sylvia Lake, Chair
Members of the House Committee on Finance

From: Marirai C. Maui Tauotaha
mauinko@gmail.com

Re: **HB174 HD2 – STRONG SUPPORT**
Hearing on Friday, February 22, State Capitol, Conf. Rm. 308, 3:00pm

Aloha Chair Lake, and Members of the Committee:

I am writing in strong support of HB357 relating to the labeling of genetically engineered produce (imported into the islands). I praise you for finally addressing an issue that much of the world has already dealt with. I mahalo you for taking the time to read my brief, yet strong, mana□ o. Please forgive me if I do not agree with all elements of the current bill but I do believe it is a step in the right direction, I sincerely applaud your efforts.

We can debate the science and economics at the core of this bill for the next few generations but what it really comes down to is the consumer's right to choose. In a society where we pride ourselves in our right to choose, the right to choose what foods we put into our own bodies ***should*** be paramount. Any economically based argument that you may succumb to will demonstrate to the voting public that you value money over a citizen's right to be in control of his or her own health-related choices. I cannot stress enough the negative view our people will have for those legislators who value money over our right to make our own health choices. Therefore **ALL** foods should be labeled, plain and simple.

In addition, I must present my strong concerns about GMO being grown in Hawai□ i,using our □ āina as a laboratory. The science of GMO is too new to fully understand the long-term effects and I fear we may be poisoning our □ āina for future generations. This matter will hopefully be addressed in future bills. I pray the "Penny-wise, Pound-foolish" perspective of today's leaders will grow into a more enlightened state, before it's too late.

Mahalo for your time and your service,
maui

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From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 10:31 AM
To: FINTestimony
Cc: Annie2002@live.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Annie	Individual	Comments Only	No

Comments: Please, please, PLEASE let us know what we are feeding our children!

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Cc: bmurphy420@mail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Brian Murphy	Individual	Comments Only	No

Comments: We have the right to know! Its We the People! Not We the Corporation!

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February 21, 2013

To the Honorable Members of the Finance Committee:

HD174 HD2

I support this bill, however, to exclude labeling any Hawaii grown genetically engineered produce defeats the purpose of a labeling bill. To have imported GE corn labeled and sold alongside Hawaii grown GE corn does not provide consumer protection intended in the bill.

Mahalo.

Merle Inouye Hayward

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From: mailinglist@capitol.hawaii.gov
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Cc: skylarsteranko@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
skylar steranko	Individual	Support	No

Comments: i support labeling and restriction on gmo food in the state of hawaii

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Cc: johnandlisa100@hotmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
lisa favreaux	Individual	Support	No

Comments: I support the labeling of GMO products. Thank you, Lisa Favreaux

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Cc: dani_lfrisco@hotmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Danielle Guion-Swenson	Individual	Support	No

Comments: Please hear and pass HB 174 to have labeling requirements for the food we consume. It is only sensible and fair since most things including packaged foods, textiles and many other consumables are mandatorily labeled as to their contents and origins.

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Cc: lkukona@hawaii.edu
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Lindsay Kukona	Individual	Support	Yes

Comments: This bill is essential to allowing consumers to make informed decisions about what they are eating. Labeling is an easy way to allow consumers to be aware of what is in their food. I adamantly support HB 174!

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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Stephen Luksic	Individual	Support	No

Comments: Properly informing the consumer is long overdue. In fact, we should relentlessly strive to eliminate Genetically Engineered Food products completely. Information about what we consume should be mandated. Of course the biotech industries are going to say it is safe. I believe they are more concerned with making profit than the well being of the consumer. Please inform the consumer.

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Don V. Lax	Individual	Comments Only	No

Comments: Please Label GMO's!!! Please protect our keiki and our aina! Thank you, and aloha.

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HB174
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Submitted By	Organization	Testifier Position	Present at Hearing
Keone Nakoa	Individual	Support	No

Comments: I support this measure as amended as HB 174 HD 2.

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Cc: audrey262@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Audrey Alvarez	Individual	Support	No

Comments: Dear Sir/Madam: I am writing in regards to HB174 and would like to voice my support for labeling legislation in Hawaii and urge our local leaders to take action on this important issue for our community's health. I have a right to know about the food I eat and what I feed my family. In the U.S., we pride ourselves on having choices and making informed decisions. Under current FDA regulations, we don't have that choice when it comes to GE ingredients in the foods we purchase and feed our families. Labeling is essential for me to choose whether or not I want to consume or feed my family genetically engineered foods. Genetically engineered foods are required to be labeled in the 15 European Union nations, Russia, Japan, China, Australia, New Zealand, and many other countries around the world. As an American, I firmly believe I should also have the right to know if my foods have been genetically engineered. A recent poll released by ABC News found that 93 percent of the American public wants the federal government to require mandatory labeling of genetically engineered foods. As ABC News stated, "Such near-unanimity in public opinion is rare." I hope you will listen to me and the other 93 percent of the American public who want mandatory labeling. Please show your support for the interests of the American people by labeling genetically engineered foods. Sincerely, Audrey Alvarez

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Cc: sisheldjones@comcast.net
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Sylwia Jones	Individual	Comments Only	No

Comments: I support food labeling re: GMO food labeling in USA. Regards, Sylwia Jones

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 10:14 AM
To: FINTestimony
Cc: italkitchen808@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Trisha Gonsalves	Individual	Support	Yes

Comments: To: House committee on Finance; Rep. Sylvia Luke, Chair, Rep. Scott Y. Nishimoto, Vice Chair, Rep. Aaron Ling Johanson, Vice Chair Re: HB 174 HD 2; Testimony in strong support DATE: Friday, February 22, 2013 TIME: 3:00 P.M. PLACE: Conference Room 308 State Capitol 415 South Beretania Street Aloha my name is Trisha Gonsalves and I am testifying as a very concerned mother in strong support of this bill. Everyday in the media, from somewhere around the world there is alarming new information regarding GMOs. This is great reason to be concerned. The biotech argibusinesses assure us that this technology is solving world hunger, uses less pesticides, tells us labeling would increase food by 40%, and that poor farmers would be put out of business. The truth is: Studies show that GMOs are proving to be ineffective in solving world hunger, Pesticides are on the rise because of new super weeds and super bugs- damage to the environment (especially in Hawaii) is incomprehensible(http://www.bbc.co.uk/news/#sa-ns_mchannel=rss&ns_source=PublicRSS20-sa). There have been no proven rise in cost of food documented in countries that require labeling- Kellogg already labels GMO foods shipped to Europe, and Hawaii labels all GM papaya shipped to Japan. Farmers would be put out of business? What about the 263,000 farmers in India who committed suicide because they could not pay debt to GM corporations. Worldwide we are seeing more and more farmers who say this way of farming is not working and protesting the use of GMOs. These companies behind GMOs have a track record for some of the most devastating environmental tragedies in history. I would like to have the right to know if the food I am eating and feeding to my family is GMO. It is of great concern to me that many policy makers, insuring that my right to know is denied, and telling me that the food is safe to consume, are former biotech employees. It is suspect to me that the biotech industry launched a 46 million dollar campaign in California to deny the right for people to know. Many come before you to testify bringing late breaking news from around the world about the havoc that GMOs are causing. Please be our hero's today and give us this right to know what is in our food. I urge you to take a stand for the people to do what is right and just, please support this bill.

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Cc: alohalways@gmail.com
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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Tanja Miller	Individual	Support	No

Comments: Aloha Ke Akua. We have a right to know if our food is GMO. Almost every country in the world has GMO labeling, except America. Please support this bill and lead the way to a healthier Hawaii. Mahalo Nui Loa.

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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Deek Martin	Individual	Support	No

Comments: please give us the information to decide.

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Sent: Thursday, February 21, 2013 9:46 AM
To: FINTestimony
Cc: kshishido02@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Karen Shishido	Individual	Support	No

Comments: Dear Chair Luke, Vice-Chairs Nishimoto and Johansen and Members of the Committee: I would like to add my voice in strong support of mandatory labeling for genetically modified foods and urge that you pass this measure. For many years, international agribusiness corporations have used their considerable clout to obscure debate and block scientific scrutiny regarding the environmental and human health impacts of GMO food consumption. As a Hawaii resident and a consumer, I strongly urge you to send a strong signal to GMO companies operating in our fragile ecosystems. Additionally, I believe we need to label local agricultural products which are genetically modified, in addition to imports. I also disagree with the removal of punitive measures for noncompliance. I want to know and choose what my family and I are putting into our bodies. This is a basic consumer issue. We demand more fundamental transparency in our food system, and this is a strong start. Environmental and human health are too important to allow industry pushback to trump public safety. Many other countries have required labeling, as you know, and their food pricing systems have not suffered collapse. We should operate under the precautionary principle now, rather than regret our short-sightedness in the future. Thank you very much for your consideration. Respectfully yours, Karen Shishido Honolulu

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Cc: JOTKAY@GMAIL.COM
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
jodi kuhnmuench	Individual	Support	No

Comments: no gmo...we should know what is in our food, if it IS food, and the right to refuse what's not real.

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Cc: killertiller@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Brady Townsend	Individual	Support	No

Comments: this is only the first step. I WANT TO KNOW WHAT IS IN MY FOOD!!!

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To: FINTestimony
Cc: debancha@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Debra Green	Individual	Support	No

Comments: We have a right to know what is in our food that goes into our bodies and into our unborn children. Please label it!

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To: FINTestimony
Cc: xion_ok@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Todd Young	Individual	Comments Only	Yes

Comments: label GMOs! we have a right to know without having to do cart wheels AND read the fine print. thank you

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Cc: dreamitdoitproductions@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Helen Babalis	Individual	Comments Only	No

Comments: For residents and guests of Hawai'i, it would be paramount that food is labelled accordingly. If something is genetically modified, I do not want it in my body. The crops wreak havoc with nature as well. Humans and ecology suffer alike. The effects are so slow to notice perhaps and so not enough people are alarmed. It's a tiny 'aina, let's protect it....and us. Mahalo!

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Sent: Thursday, February 21, 2013 8:15 AM
To: FINTestimony
Cc: jonicarroll@earthlink.net
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Joni Sadler	Individual	Support	No

Comments: Please support. We all have a right to be healthy. It is a God given right. Labeling will help support this right.

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To: FINTestimony
Cc: puhipaue001@hawaii.rr.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Eleu Puhipau	Individual	Support	No

Comments: Please label GMO food. I am now allergic to Neo-Sporin after eating pounds of GMO papaya. I found out after the fact that GMO papaya uses a Neo-Sporin marker to kill the ring spot virus. Eating GMO papaya is eating a antibiotic. Consumers have a right to know what we are eating. Label GMO products would be a fine first step in the open information of these food products that have been altered.

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To: FINTestimony
Cc: nredfeather@kohalacenter.org
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Nancy Redfeather	Individual	Oppose	No

Comments: This bill has been turned on it's head. We need to label whole foods grown in Hawai'i and not be afraid. Papaya towers have very successfully grown non-gmo papayas for the Japanese market for 15 years. We should not punish our organic growers by a back door labeling scheme that does not get to the heart of the matter. People want to know what they are eating and they have a right to know. It seems so simple but it becomes complex when the interests of big business interfere with logic.

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Melani Spielman

I was born and raised here before GMO was ever a reality and I have seen significant changes in the health of plants people and the environment because of things like GMO. I want to see the government taking steps to protect our rights to know what is in the things we are eating. If it is a GMO product we should be able to find out in the same way that we get to know if it is organic or grown locally. I go to the University of Hawaii at Manoa and I know what GMO means. I am in favor of this bill because as consumers we have a right to know what our money funds. Records show that GMO crops are linked with the death of bees (out ever important pollinators), loss of biodiversity and cancer among other diseases in laboratory animals. I think that the effects of these modifications have not been nearly well studied enough. Changing these plants through genetic modification has created compounds and complex changes in plants, there needs to be labels to inform the public of this risk.

Aloha Legislatures,

I would like to ask that all of you please support HB 174 in regards to labeling foods. As a mother I do my best to teach my children about eating healthfully, exercising etc, not having food labeled that contain GMO undermines my decisions as a parent to do what's best for my keiki. In no way shape or form would I want my children eating GMO's knowing the adverse effects it has not only on our bodies but the environment to grow these crops, the greed of the companies and individuals who support these practices and the unknown of what the long term effects are allowing these crops to continue. Therefore, I hope all of you will vote in favor of HB174

Mahalo,

Summer Faria

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From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 11:44 PM
To: FINTestimony
Cc: ivy@cococat.us
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Ivy	Individual	Support	No

Comments: Aloha, I support HB 174 I am a concerned parent of 3 keiki. They are growing and developing in a time when our foods are being altered and NO ONE knows the long term effects. In this country I am noticing we are having issues with infertility, allergies, diseases, and other health issues. I feel it s related to what we are putting in our bodies, collecting in our tissues, and in the womb of mothers. I deserve to know what my children are consuming and not spend countless hours in the store googleing each product/company to find out if they are non-GMO. I was raised on Kaua i and wasn t raised eating GMO foods... I don t want my keiki eating GMO foods either. Please assist me and others like me to make our own choices for our keiki because my keiki ARE my greatest investments. Mahalo.

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Cc: konaconnection@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
April Lee	Individual	Support	No

Comments: I strongly support this bill and affirm that you consider the consequences...many we do not even have a full grasp of yet. Mahalo, April Lee

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Feb. 22, 2013

Testimony of Wynnie Hee in SUPPORT of HB174 HD 2 RELATING TO FOOD LABELING

Imposes labeling requirements and import restrictions on imported genetically engineered produce. Authorizes labeling of non-genetically engineered food….

Chair Luke, Vice-Chairs and Members of the House Committee on FINANCE:

Allow me to give you an analogy: There was a big scandal in Europe recently when consumers found out they were eating HORSE meat, instead of BEEF. There was no health risk. Horse meat is probably the protein equivalent of beef; in fact, being lower in fat and cheaper, it is probably better than beef. So why were European consumers so outraged? Because they didn't know! They objected to eating horse meat for whatever reason. If it had been labeled "contains horse meat," they would NOT have bought it and eaten it! They had the right to know what they were eating.

I object to eating genetically modified foods for many reasons. I believe that what you don't know CAN hurt you, and I prefer to err on the side of caution. I try to be an informed consumer. I read labels. How can I choose not to eat genetically modified foods if you do not require them to be labeled, one way or the other, genetically modified or NOT genetically modified?

So HB174 HD2 is a small step in advancing the right to know. I support this small step: "A journey of a thousand miles begins with the first step."

Right now, did you know that at Hawaii Farm Bureau Federation farmers' markets -- KCC, Blaisdell, Mililani, and Kailua -- the farmers are NOT allowed to label their produce "NON-GMO"? Why is that? Farm Bureau doesn't want to label GMOs but they don't allow farmers to advertise NON-GMO's either? That's ridiculous! What is GMO lobbyist and HFBF president Dean Okimoto, owner of Nalo Farms, trying to hide?

I understand that you, our legislators, want to protect local farmers from finicky consumers like me, so you will only allow <u>imported</u> produce to be labeled genetically modified.

GMO lobbyists have persuaded the Honolulu City Council and many state legislators to oppose any law requiring the labeling of genetically engineered food products because that would "increase the COST to consumers." If that's true, how much does it increase the cost to consumers to label local produce "Hawaii Grown" or "Island Fresh"?

Raising the cost to consumers is NOT the real reason labeling of GE food is so vigorously opposed. The real reason is that they are afraid of the YUCK factor. A recent example is "pink slime." When it got picked up by the media and consumers learned that Lean Finely Textured Beef was beef scraps with the fat melted off, then pureed and sterilized with ammonia --YUCK! Nobody wanted to eat it anymore. Another example was an ingredient in Gatorade, "brominated vegetable oil," a patented flame retardant -- YUCK! Gatorade responded immediately by changing the formula, even though it still claimed BVO was safe for human consumption.

But I say to you legislators and all the lobbyists for Biotech companies, Monsanto et al: DON'T WORRY about the YUCK factor. Hawaii consumers are not like that. They love SPAM, and SPAM is pink pork slime steamed in a can. In Hawaii you have nothing to fear by labeling.

Legislators, please have the courage to take this small step and allow consumers the right to know. Pass HB174 HD2. Thank you for hearing my plea.

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From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 10:23 PM
To: FINTestimony
Cc: panther_dave@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Dave Kisor	Individual	Support	No

Comments: Their poisons are systemic and can't be washed off. We were lied to about agent orange and now that is being applied to the root system of what you may call food, but I most certainly do not. I do not want that garbage in me, and most certainly not in my cat.

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To: FINTestimony
Cc: Mumma.sarah@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Sarah Mumma	Individual	Support	No

Comments: We should have the option to choose our produce by knowing how it was developed and grown.

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Cc: Morse@hawaii.rr.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Dorothy Morse	Individual	Support	No

Comments: Dear Sir/Madam: I am writing to voice my support for labeling legislation in Hawaii and urge our local leaders to take action on this important issue for our community's health. I have a right to know about the food I eat and what I feed my family. In the U.S., we pride ourselves on having choices and making informed decisions. Under current FDA regulations, we don't have that choice when it comes to GE ingredients in the foods we purchase and feed our families. Labeling is essential for me to choose whether or not I want to consume or feed my family genetically engineered foods. Genetically engineered foods are required to be labeled in the 15 European Union nations, Russia, Japan, China, Australia, New Zealand, and many other countries around the world. As an American, I firmly believe I should also have the right to know if my foods have been genetically engineered. I hope you will listen to me and the the American public who want mandatory labeling. Please show your support for the interests of the American people by labeling genetically engineered foods. Sincerely, Dorothy Morse

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Re: GMO labeling HB 174

From: Dr. Jana Bogs
P. O. Box 198900, PMB 203
Hawi, Hawai'i 96719
info@BeyondOrganicResearch.com
808-938-9888

Aloha Representatives,

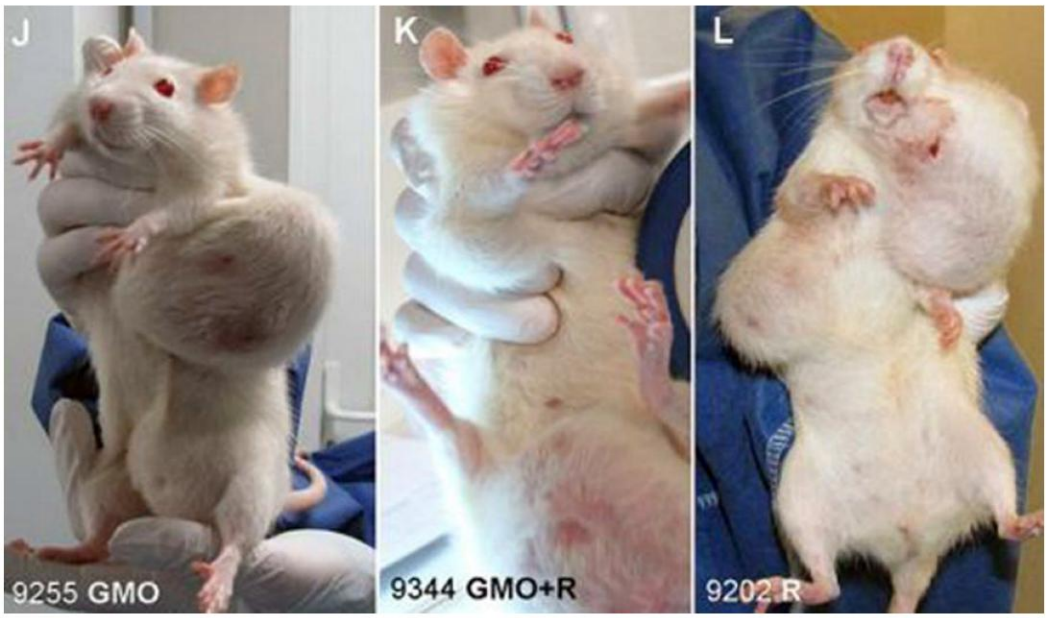
I hail from the Big Island where I serve on the North Kohala Community Development Plan Agriculture Subcommittee. It is the position of this subcommittee that genetically engineered crops should not be allowed to be grown in this district and that any genetically engineered foods brought into this district should be labeled as such.

I work as an agricultural crop consultant to farmers and gardeners, as well as a researcher focused on improving crop quality. I am a nutritionist (BS/MS) turned horticulturist (PhD) with the aim of growing the most nutritionally-rich foods possible. Genetically engineered foods are the antithesis of this goal. Not only are genetically engineered foods less nutritious, they are dangerous to the health of humans and animals. They should be labeled so that people can make an informed choice.

Because I care, I work to inform my community about the dangers of GMOs. Many people have signed petitions for GMO labeling. You have a duty to protect the people of this state. Please have the bravery to pass a GMO labeling bill. Besides doing right by the people, you will probably even become famous!

Mahalo for listening and caring,

Dr. Jana Bogs



Laboratory rats fed genetically-engineered (GMO) feed and/or Roundup ®(R)

The following section is an excerpt about GMOs from a book I am currently writing.

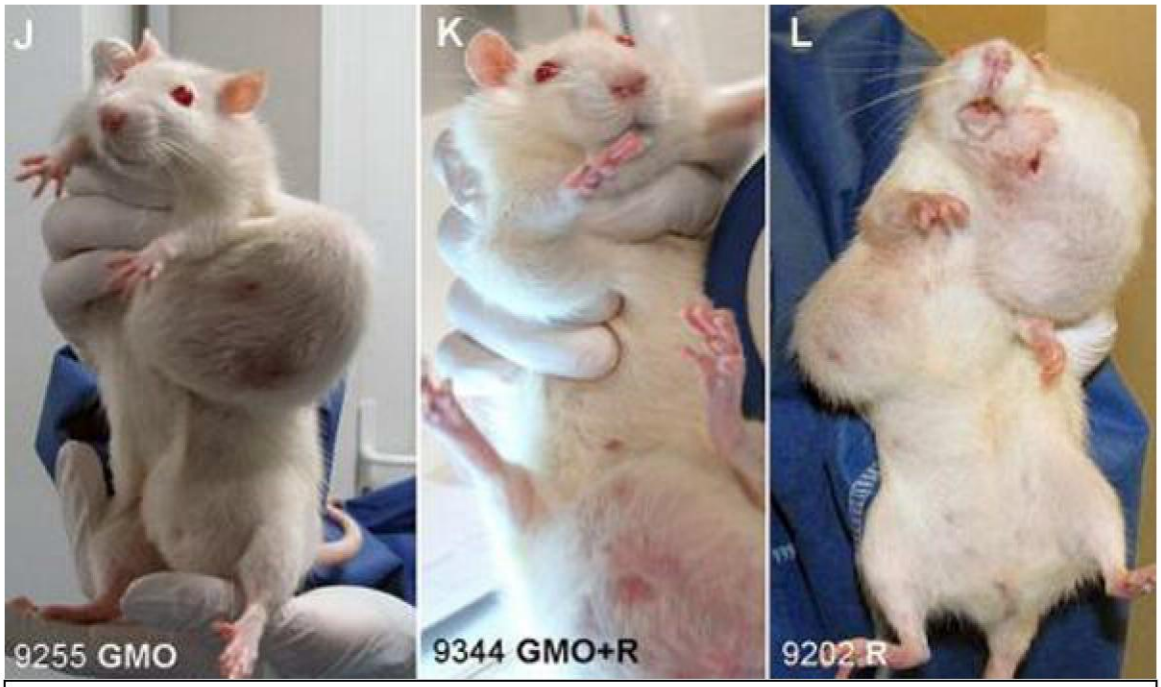
Something (Bad) has Happened to our Food

Corn and soybeans are used to produce many food products and food additives. Approximately 70% of processed foods in your grocery store contain corn- and/or soy-derived ingredients, some hidden by deceptive labeling. What's so bad about that? Most of this corn and soy is transgenic. Transgenic organisms are also known as genetically-engineered (GE), genetically-modified (GM) or genetically-modified organisms (GMOs). These plants have been genetically engineered in a laboratory by the unnatural process of inserting genes from one type of organism, such as bacteria, into another organism, such as corn. This would never happen in nature.

According to Jeffrey Smith, founder of the Institute for Responsible Technology, a scientifically published human feeding study involving GMO soybeans resulted in genetically modified material from these soybeans transferring into the intestinal bacteria and remaining active. Mr. Smith also relates that animal studies show transference of DNA (genetic material) from foods to organs in the body.

Top researchers who have studied the effects of these genetically-engineered "foods" on laboratory animals found serious health risks associated with the consumption of these foods, such as tumors, lung damage, inability to reproduce, altered DNA function, immune responses commonly associated with diseases, significant organ disruptions, autistic-like behavior and early death. Humans are also reported to have had serious negative consequences from GMOs. Some people have allergic reactions to GMO soybeans, but not to non-GMO soybeans. The American Academy of Environmental Medicine asks physicians to advise patients to avoid GMOs due to associated health risks.

The scientific article, *A Comparison of the Effects of Three GM Corn Varieties on Mammalian Health*, was published by Professor Gilles-Eric Seralini and associates in the International Journal of Biological Sciences in 2009. The corn varieties used in the study are commonly available in the marketplace in food and feed. Besides causing massive tumors, the GMO corn damaged organ tissues, including liver, kidney, heart, adrenal gland, and spleen.



Laboratory rats fed genetically-engineered feed (GMO), genetically-engineered feed cultivated with Roundup® (GMO+R), or Roundup® alone in water (R); showing large tumors. These photos are from the study, *Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize*, performed by Seralini and associates, published in the scientific journal, Food and Chemical Toxicology, in 2012. For more information see http://www.criigen.org (Photos used by permission.)

Why is this type of production allowed? Why aren't these foods labeled as genetically engineered? Follow the money. You will find corporate money infiltrating politics in the greedy attempt to control food production, and hence, the people. A number of key players in GMO biotech companies, such as Monsanto, have gone on to hold influential governmental positions. For example, Michael Taylor was an attorney for Monsanto, and then worked for the FDA. While at the FDA, he created a policy allowing GM foods to be marketed without any safety studies. Subsequently, Michael returned to the ranks of Monsanto as vice president.

You may find it interesting to know that, in at least one cafeteria for employees at a Monsanto factory, GM soy and corn have such a bad reputation that they are not served.

The corporate whitewashing used to "sell" GMO to governmental authorities and the public claims that genetic modification is a good and necessary action to produce more and/or higher quality foods to feed a hungry world. Often the genetic modifications are an attempt to circumvent a disease condition in the plants. Unfortunately, what has been seen is other plant disease conditions, which used to be minor concerns, becoming more serious due to the plants' overall diminished cellular integrity. I contend there is nothing wrong with the natural plant genetics; it is the soils which have not been properly managed to supply the plants with nutrients they need to be healthy and resist diseases. These same nutrients are needed in the plants for humans to be able to consume them and be healthy as well. The

bottom line is we do not need genetically engineered foods to feed the world; we need well grown food.

According to the Organic Consumers Association (OCA), genetic modification of crops has not increased yields. They cite a report sponsored by the United Nations (UN) and the World Bank, compiled by 400 scientists and endorsed by 58 countries which concluded, "GM crops have little to offer to the challenges of poverty, hunger, and climate change". Furthermore, the OCA states that scientists warn of potential dangers from the use of GMOs such as:

- harming beneficial insects, i.e. honeybees
- producing dangerous toxins
- increasing the use of toxic pesticides and herbicides
- creating super-pests, super-weeds, and new plant viruses
- producing antibiotic-resistant pathogens
- damaging soil fertility
- contaminating organic and non-GMO crops

Due to the inherent dangers, more than 40 countries require labeling of GMOs, including European Union countries, Japan and Australia. Some countries, including Japan, New Zealand, Ireland, France and Switzerland, ban production of GMO crops. In the USA, the home of genetic engineering, all attempts at getting the foods labeled as GMO have been quashed. The companies that produce this "Franken food" know that labeling would be their death knell. Corporations claim that the GMO foods should not be required to have labels because the crops are "not significantly different" from non-GMO crops. On the other hand, the corporations have received patents for their seeds because they *are significantly different.* It can't be both ways. An examination of the laboratory animal research studies indicates that the crops certainly are different in their ability to support health.

What foods are genetically engineered?
Soybeans—including edamame, soy milk, soy protein, soy protein isolate, soy oil, soy sauce, shoyu, tamari, soy lecithin, soy flour, tofu, tempeh, more items
Corn—corn meal (i.e. tortillas, tortilla chips, corn chips, corn muffins, cornbread), corn flour (i.e. corn flakes), fructose, high fructose corn syrup (often in soft drinks and fruit juice blends), corn oil (may be hidden as "vegetable oil"), corn starch, modified food starch, dextrose, glucose, many more items
Cottonseed oil--a commonly used food oil, i.e. for salad dressing
Canola oil—another very commonly used cooking and salad oil
Sugar—from sugar beets
Papayas—some commercial varieties from Hawaii
Squashes—some varieties of zucchini and crookneck squash
Animal foods—Unless animals are raised organically, most beef, pork, chicken and eggs come from animals that are fed GMO corn and soybeans. Besides being feed GMOs, many dairy cows are given recombinant bovine growth hormone (rBGH), which is GMO-derived, to increase their milk production. Most horse feeds also contain GM ingredients.
Alfalfa—In 2011, genetically-engineered alfalfa was allowed on the market. Alfalfa constitutes a large portion of feed for horses, cattle, and other farm animals. It is also used for humans in nutritional supplements and as alfalfa sprouts in salads or on sandwiches.
Nutritional supplements—i.e. vitamin B-12 (cobalamin), vitamin E (tocopherols), many amino acids (made with GM microorganisms). Did you hear the story about people dying from GMO

tryptophan? In 1989, 37 people died and 1500 more became chronically ill due to poisoning from GMO-derived tryptophan.
Sugar alcohols—erythritol, maltitol, mannitol, sorbitol
Artificial sweeteners—(These are not really foods, but since people eat them, I will list some here.) Aspartame, also known as NutraSweet®, Equal®, AminoSweet®, Equal Spoonful®, Canderel®, E951, BeneVia® (named as if it is beneficial for life). Dr. Joseph Mercola, a very well-known holistic physician, states that aspartame is the most dangerous substance in the food market. It accounts for most of the reportings of adverse food reactions received by the FDA; yet the "powers that be" keep it on the market. It is used in 6000 food products.

Back in the 1980's when aspartame first appeared on the market, I tried it in a variety of food products. I started having gastrointestinal upsets and did not know why, so I kept a food diary. It took a while, but I came to clearly realize I was reacting adversely to aspartame. I contacted G. D. Searle company, the manufacturer at the time. (The company was since bought out by Monsanto.) When I asked the representative if they had had any complaints about their product causing gastrointestinal upset, she said, "No." I told her I would like to register a complaint about the product causing gastrointestinal problems. She then stated that they didn't take complaints. *So, they had no product complaints because they didn't take complaints!*

Where else do genetically engineered items show up in our lives?
Cotton—clothing, ropes, bedding. Many GM cotton farmers have skin, eye, and respiratory tract reactions. Thousands of grazing animals have died after grazing on GM cotton fields.
Gasoline containing ethanol—This is touted as renewable energy, but abusing good farmland is an inefficient and environmentally-unsound way to provide energy. Besides, this fuel is bad for engines. It breaks down over time and gums up the works.
Pharmaceuticals—Examples include insulin, vaccines, interferon, spermicidal antibodies, and antithrombin (blood plasma protein). The latter is produced by goats that have been genetically engineered. This is called "pharming". Is it getting spooky yet? A number of people have died due to problems encountered in GMO pharmaceutical trials.

One of the major genetic modifications was performed to increase the tolerance of plants to doses of herbicide (weed killer) that would otherwise kill the food-producing plants. This herbicide, glyphosate, also commonly known as Roundup®, is manufactured by Monsanto. It is the largest-selling agricultural chemical in the world. "Roundup Ready®" genetically-engineered seeds are also manufactured by Monsanto. The Roundup Ready® plants allow the use of more glyphosate than would be possible without the genetic modification, so we have much more glyphosate in our environment and in our foods. The use of large amounts of glyphosate is resulting in "super-weeds", which are no longer suppressed by glyphosate and have become much harder to manage.

The feeding of these glyphosate-treated, GM crops is associated with high rates of infertility and spontaneous abortions in farm animals and, most likely, in humans as well. It has also caused abnormal aging in beef cattle. The carcass of a two-year old, which should be prime beef, appears like that of a 10-year old cow. What does this imply for humans?

Glyphosate is not just on the outside of a plant. It cannot be washed off. It is absorbed into the plant tissues, so it is eaten by the plant's consumer. The method of action of glyphosate to kill weeds is that of chelation of needed mineral elements. The glyphosate is absorbed by the weed and complexes with minerals, making these minerals unavailable to the weed's enzyme systems. Then the weed dies. The problem is that similar action also happens in the genetically-engineered food plants. The glyphosate-chelated mineral elements are not available for use by the plant or the consumer of the plant. The minerals still appear on a food analysis, but they are not usable by consumers. Here we have the opposite of good nutrition!

How pervasive is the GMO food problem in the USA? Unfortunately, it is extremely pervasive, for example, 93% of soybeans are transgenically modified, 86% of corn, 93% of cotton, and 93% of canola.

How does one avoid these foods? Consume certified organic foods. Organic certification guidelines still disallow the use of transgenic materials, though some in authoritative positions would like to change that. You can also look for food labels which state, "non-GMO", "not genetically modified", "we source ingredients which are not genetically altered", or some similar language.

GMO is not only pervasive, it is invasive. When the wind blows, GMO pollen is blown onto neighboring farms contaminating their crops. This is particularly troublesome if one is trying to grow organically, or just non-GMO. Monsanto has even prosecuted farmers for "using their GMO technology without paying for it" when it was due to pollen drift contamination, not because the farmer wanted to use it! Allowing these GM crops out into the environment is like opening Pandora's Box—once loose, how does one recapture the GM pollen and prevent it from contaminating the entire world?

For more information on transgenics, also known as genetically-engineered (GE), genetically-modified (GM) or genetically-modified organisms (GMO), see http://www.criigen.org, www.OrganicConsumers.org, www.ResponsibleTechnology.org and www.SeedsOfDeception.org.

Toxic agricultural pesticides, herbicides and other chemicals are also produced by large corporate interests. These toxic chemicals have no rightful place in our foods or on our planet. There are much better ways to manage our food production.

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Toxic agricultural pesticides, herbicides and other chemicals are also produced by large corporate interests. These toxic chemicals have no rightful place in our foods or on our planet. There are much better ways to manage our food production.

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 9:11 PM
To: FINTestimony
Cc: charlottep@hawaii.rr.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
charlotte casey	Individual	Comments Only	No

Comments: HB174, HD1 - GMO Labeling is desperately needed. We have the RIGHT to know what is in our food, and WHERE it originated. Just like the nutritional contents, and how many calories it contains, we DESERVE to know WHAT we are purchasing with our hard earned dollars. This is no brainer. Please do this for our keiki (as Europe did for theirs), and restore our beliefs that what is JUST will win over 'big money'. Aloha. Charlotte Casey, Waimea.

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Cc: jeannine@hawaii.rr.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Jeannine Johnson	Individual	Support	No

Comments: Genetically modified organisms (GMOs), are produced by genetic engineering, the splicing of genes from one species into those of another. These are not combinations that can happen in nature are and are experimental. There is a growing concern that introducing foreign genes into food plants has an unexpected and negative impact on human health. Many children in the US and Europe have developed life-threatening allergies to peanuts and other foods. There is a possibility that introducing a gene into a plant may create a new allergen or cause an allergic reaction in susceptible individuals. Labeling of genetically engineered foods and food products is essential to Hawai‘i’s population, just as nutritional labels are. Proposed amendment: Please amend the language to apply to all fresh produce sold in Hawai‘i. Mahalo.

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To: FINTestimony
Cc: Maliaadams6@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Malia adams	Individual	Support	No

Comments: GMO's are POISON. Test rats that have been fed GMO's have either DIED or developed cancerous tumors. Do you have children? Do you want your children eating poison? Do you want them to grow up and suffer with cancer? No? Then say NO to GMO's! No matter how much money Monsanto is paying you to say YES! What is really more important to you?? MONEY? Or the health and well being of your fellow HUMAN BEING? Your children, your children's children, even your parents and grandparents. If you really can't say yes to a bill which is merely asking to label GMO poison, I have lost all faith in society. GMO IS POISON. I don't understand why people have to FIGHT for this. It should be common sense not to allow poison in our food, or at least LABEL IT! Come on! Wake up!! Please!! Do it for the human race!!!

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Janet Murray	Individual	Support	No

Comments: I support HB174. I wonder why we keep having to let our leaders know over and over again that Hawaiians do NOT want GMO non foods on our island. ALL GMO products should be labeled to that people can easily identify and stop purchasing these products. The companies that brought GMO here should have to pay for the removal of all GMO products. This is nearly an impossible task, so it would be very expensive to accomplish. But accountability is vital.... Mahalo for supporting the people.

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To: FINTestimony
Cc: mealaaloha@aol.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Daniel Bishop	Individual	Support	No

Comments: Common sense dictates that we should, nay, have the right to know what we eat.

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Cc: marilynmick@pobox.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Marilyn Mick	Individual	Support	No

Comments: I support labeling of all gmo food. We have the right to know what we are eating and the time has come for this nation to join what most of the developed world. Much of our food is now labeled for various reasons including ingredients, country of origin etc. This will not increase the price of food by $400 as claimed by Monsanto lobbyists.

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Caki Kennedy	Individual	Support	No

Comments: Corporations are getting entirely TOO MUCH power over our quality of life. They will NOT regulate themselves, we must do it.

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To: FINTestimony
Cc: luly.unemori2@hawaiiantel.net
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Luly Unemori	Individual	Oppose	No

Comments: Aloha Honorable Representatives, Please do not pass this bill. I think mandatory labeling for GMOs is unnecessary and possibly very costly. I can already buy foods that say on their containers they don't have GMOs (like my soy milk and yogurt),so there's no need to require more labeling. I'm also concerned about the cost - how much will it cost to enforce this labeling? How much will it cost to test the foods coming into Hawaii to make sure they're complying with this law? Will it make it more expensive for me to buy food? Or will the food suppliers stop sending their products to Hawaii because they won't want to pay for special labeling? Thank you very much for letting me testify.

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To: FINTestimony
Cc: 808jackie@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Jackie Reynolds	Individual	Support	No

Comments: Aloha Legislature: I support HB174. Please employ your power as my representative and pass this bill. Sincerely, Jackie Reynolds

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Sent: Wednesday, February 20, 2013 7:40 PM
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Cc: Robertscelia1@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Celia Roberts	Individual	Support	No

Comments: I would just like to voice my thoughts about GMO's. Though I have not done extensive research on the subject, I do not think that is gravely required on this subject. How about we refer to common sense. Allowing the population at large including ALL OF YOUR LOVED ONES, to ingest foods that have been manipulated, changed, modified from natures original version, is not only unsafe but irresponsible. How about we keep these experiments in a lab somewhere. Lets join together and say no to GMO'S. It's just common sense. Please allow us the option to know what kind of food we are eating. Label the GMO foods boldly so we have a choice. Mahalo Nui Loa for your time. -Celia Roberts Lahaina, Maui

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
James Friedman	Individual	Support	No

Comments: Lets not let the Corporate Agro industry rule the day. The majority does not have the resource$$ that these huge corporations use to sway legislation and politicians. For the future of our health and food resources we should let them know that people have a right to know that what they eat has or has not been genetically altered by what ultimately amounts to corporate greed.

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Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Cori Gift	Individual	Support	No

Comments: Label GMO, we deserve to know!

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Cc: carnet@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
carnet williams	Individual	Support	No

Comments: Please lable GMO foods for our health, for our kids, and for our environment.

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Cc: tinkersg@hotmail.com
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HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Tyler Westhoff	Individual	Support	Yes

Comments: Those who support this bill want for their families and communities to stay healthy. Those who oppose it want only to stay wealthy. The chemical and biotech companies want to claim their inventions with patents in order to capitalize on profit and control the food source of the world, yet they don't want anyone to know that what they're eating is their GMO invention. Please ask yourselves why this is. Make them label it. Let those who have been effectively deceived finally gain some awareness about these products. Tyler Westhoff

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Cc: MSMatson@hawaii.rr.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
MS Matson	Individual	Support	No

Comments: Strongly support.

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Cc: evelyndebuhr@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Evelyn de Buhr	Individual	Comments Only	No

Comments: Every person has a right to know what is in the food we are eating. Period. All food should be labeled, GMO food included.

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Cc: juliankauai@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Julian Miller	Individual	Support	No

Comments: I support labeling of GE foods. Besides the fact that we have a right to know its crazy to say that GE corn with built in pesticides or pharmaceuticals is the same as ordinary corn. It also makes no sense that Monsanto can both patent their GE corn because its different from ordinary corn and yet oppose labeling because they say its no different.

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Cc: Keaevangelista@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kea Evangelista	Individual	Support	No

Comments: I believe we have a right to know what we are putting in our bodies. GMO foods should in the very least be labeled, so that I as the consumer am given what I believe to be the bare minimum of information with regard to makin healthy choices for my children and I.

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Cc: joncole@gmail.com
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HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Jonathan R Cole	Individual	Support	No

Comments: Yes!! I support this!! Take back the food supply from the giant chemical and biotech corporations who do not care if we live or die!!

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 12:11 PM
To: FINTestimony
Cc: foodsovereigntynow@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Mitsuko Hayakawa	Individual	Support	No

Comments: As a mother of three, I am concerned about the health of my children and future generations. I would appreciate GMOs to be labeled so that mothers like me can know what we are feeding our families. It is our fundamental right to know if our food has been genetically altered and we should have the right to choose if we want to take the health risks associated with GMOs. Every month there are new findings about genes and gene technology. Scientists admit they still don't know much about them. How do the new proteins from gene splicing affect our health? How can a pesticide-producing EPA-registered crop be absolutely safe for small people to consume? What about horizontal gene transfer and how does that affect our bodies? I am opposed to having any GMOs in our food supply until it has been proven SAFE, but the evidence that has been exposed thus far has been quite the contrary for both our health and the environment. I really find the FDA and USDA are being irresponsible for allowing them in our food supply. Opponents of GMO labeling argue that if we want to avoid GMOs we should eat organic. That reasoning does not help the hundreds of thousands of mothers in Hawaii who are not aware that the food they feed their children are GMOs. GMOs should be labeled for what they are so the public would know. Please help protect the residents of Hawaii by supporting this bill and label GMOs. Thank you.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 1:27 PM
To: FINTestimony
Cc: omgmariah@ymail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Mariah Martino	Individual	Support	No

Comments: A label should be required for goods with GE ingredients to allow people to make their own decisions on what they buy. So consumers KNOW what they will be consuming. The label should not be used for warning purposes but just so us kamaaina KNOW what we are getting. It would be such a miracle for this to happen!

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 6:17 PM
To: FINTestimony
Cc: alohamelissag@hotmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Melissa Anderson	Individual	Comments Only	No

Comments: Please support this bill. We need to know what we are eating. Our health depends on it. Mahalo

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 5:42 PM
To: FINTestimony
Cc: msaporter@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Amanda Porter	Individual	Support	No

Comments: Support this bill! We cannot remain ignorant with food anymore.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 2:52 PM
To: FINTestimony
Cc: mercy@molokaimom.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Mercy Ritte	Individual	Support	No

Comments: As a mother, I support the human right to know how our food is grown, especially if it is has been altered in an unnatural way or heavily sprayed with pesticides or other toxic chemicals. I would like to know if the whole foods I purchase on the market has been genetically engineered, not only for the sake of my health, but primarily for the sake of my young, growing children. You see, I work very diligently to provide my family with the safest, healthiest food I know is available on Molokai; most of which are locally grown, comes right out of our home garden, or is labeled organic. Their health is my top priority; it is my kuleana as a mother to protect my children and ensure that their health is always my top priority. Overall, I feel this is a very reasonable bill for Hawai i! It is my hope that the approval of this bill will pave the way for the future of labeling all processed foods with GE ingredients.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 1:36 PM
To: FINTestimony
Cc: michaelbroady@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Michael Broady Jr.	Individual	Support	Yes

Comments: Aloha, my name is Michael Broady Jr., I am a life long resident of O'ahu, a student at Leeward Community College, and a small organic farmer practicing biodiverse permaculture on limited land. I do support HB 174 as a step towards the consumer's right to know what they are buying, but I ask that you strike the HD1 and HD2 amendments, and pass HB 174 with it's original language. I would like to know if the locally grown papayas I buy at Foodland are GMO or not. As a small farmer, it becomes nearly impossible to grow healthy organic food next to a field which has been genetically engineered to resist heavy routine spraying of war chemicals. Possible contamination from cross pollination has forced me into the difficult decision of not growing corn, although as a Native American, corn is my ancestor. The simple act of growing papaya trees becomes a time-intensive science of researching and testing to ensure the trees are non-GMO. Fruit trees are not pollinated and do not fruit when the GMO corporations spray heavily with their war chemicals. The simple lifestyle of malama 'aina has become nearly impossible with these bad neighbors around. Vandana Shiva has described the effects of the GMO corporations as the genocide of farmers; the systematic destruction of a group of people: the stewards of the land. If we choose to allow these corporations to poison our communities, we choose to sacrifice our farmers. The problem is that most consumers do not realize they are choosing to support the GMO corporations because GMOs are not labeled, even though they are in most processed foods found in stores. Please allow consumers to consciously decide whether they would like to support this method of agriculture, growing "food" engineered with chemicals designed to kill.

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 12:54 PM
To: FINTestimony
Cc: krkparker@aol.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kira Parker	Individual	Support	No

Comments: It's very important for the public to know what's in their food. Please support the labeling of GMO's in Hawaii. PLEASE!

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 11:40 AM
To: FINTestimony
Cc: mkelley323@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Mary Lu Kelley	Individual	Support	No

Comments: Aloha. I request a hearing on HB174 HD2 to label imported GMO produce. This pesticide registry bill was introduced by Kaua`i Rep Dee Morikawa and is backed by many of us on Kauai. Please hear HB174. Thank you.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 12:09 PM
To: FINTestimony
Cc: kristicotton@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kristin Cotton	Individual	Support	No

Comments: It's very important that the people of Hawaii be informed about GMO's that are in the food that we consume. I urge you to support the labeling of GMO's in Hawaii.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 6:22 PM
To: FINTestimony
Cc: creekertodd@hotmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Todd	Individual	Support	No

Comments: Please allow the general public to be able to make an educated choice about what they choose to consommé.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 11:28 AM
To: FINTestimony
Cc: hunafive@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Bill Howes	Individual	Support	No

Comments: Dear Honorable Elected officials, Please support this bill. This will make a brighter future for the citizens of Hawaii, and our new generations to come. This measure will also set an example for other states to follow. Mahalo for your time and consideration. Best Regards

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 1:39 PM
To: FINTestimony
Cc: kcotton222@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kevin Cotton	Individual	Support	No

Comments: We have the right to know if food has been genetically modified.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 6:34 PM
To: FINTestimony
Cc: rasmussen144000@yahoo.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Nalani Sato	Individual	Support	No

Comments: Please, with all my heart, please make it mandatory to label all GMO foods. It is our right to know what we are feeding our children and ourselves. Soaking and washing produce with insecticides and chemicals sprayed is one thing; But, we are not able to wash the insecticides and chemicals out of GMO foods. That is straight up eating chemicals in sheeps clothing. That is straight up your child eating chemicals encased in sheeps clothing. That is straight up your grand child eating chemicals robed in sheeps clothing. Please show me you do not have it within you to allow that!? What are Monsanto and other GMO companies so scared of? Is it really the ectra 1/10 of a penny it will cost to label their foods as GMO? Seriously. They're huge and can take it. Please stand up for our rights to know what we eat. Please Malama Aina and our Keiki!!

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FINTestimony

From: James W. Macey [maceyj001@hawaii.rr.com]
Sent: Thursday, February 21, 2013 5:13 PM
To: FINTestimony
Subject: HB 174 RELATING TO FOOD LABELING - 72 Studies Showing Evidence of Harm From GE Foods

FIN Committee Members,

The Safe Food Foundation is concerned by the large volume of scientific material showing evidence of harm from GM foods.

The papers below relate only to the direct and indirect effects of the consumption of GM food and feed -- ie evidence of (1) GM plant toxicity (this would include all animal feeding, immuntoxicity, inhalation etc trials) and (2) evidence of potential harm from the indirect effects of GM plants through inseparable or unavoidable production methods (e.g. the effects of added Roundup residues which are unique to Roundup Ready plants or possibly other HT plants). Some papers discuss the survival of DNA from GM plants in the mammal digestive system, since there are obvious health implications.

We do not include papers which show environmental damage, relating to GM plant toxicity to animals in the food web (these may result in environmental harm or increase the evidence of potential human toxicities) and relating to potential harm to the food web from the indirect effects of GM plants through inseparable or unavoidable production methods (this could include the rise in glyphosate resistant weeds that also increase the chance of their toxins contaminating human food supplies).

The papers towards the end of the list are recommended reviews which summarizes earlier published raw data -- and look for cause and effect relationships -- but which do not necessarily report new experimental data.

Papers published in 2011

(1) Aris, A and Leblanc, S. (2011) "Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada" Reproductive Toxicology, 2011 May; 31(4):528-33. Epub 2011 Feb 18.

(2) Antoniou, M et al. (2011) "Roundup and birth defects: Is the public being kept in the dark?" Earth Open Source.

Papers published prior to 2011

(1) Agodi, A. et al. (2006) "Detection of genetically modified DNA sequences in milk from The Italian market". International Journal of Hygiene and Environmental Health, 209, 81-88.

(2) Benachour N, Sipahutar H, Moslemi S. et al. "Time- and dose- dependent effects of roundup on human embryonic and placental cells". Arch Environ Contam Toxicol. 2007;53:126-133

(3) Benachour, N. and Seralini, G-E. 2008, "Glyphosate Formulations Induce Apoptosis and Necrosis in Human Umbilical, Embryonic, and Placental Cells", Chemical Research in Toxicology, DOI: 10.1021/ tx800218n. Publication Date (Web): December 23, 2008

(4) Bernstein, I.L., Bernstein, J.A., Miller, M., Tierzieva, S., Bernstein, D.I., Lummus, Z., Selgrade, M.K., Doerfler, D.L. and Seligy, V.L. (1999). "Immune responses in farm workers after exposure to Bacillus thuringiensis pesticides", Environmental Health Perspectives 107, 575-582

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(12) Fares NH, El-Sayed AK. 1998 "Fine structural changes in the ileum of mice fed on delta-endotoxin-treated potatoes and transgenic potatoes". Nat Toxins. 6: 219-33.

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(14) Fu, TJ. et al. (2002) "Digestibility of food allergens and nonallergenic proteins in simulated gastric fluid and simulated intestinal fluid – A comparative study". Journal of Agricultural Food Chemistry, 50, 7154-7160.

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Mahalo,
James W. Macey

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Wednesday, February 20, 2013 8:46 PM
To: FINTestimony
Cc: makanavertido@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/20/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
MakanaKealoha Vertido	Individual	Oppose	No

Comments: well for the fact that GMO pretty much creates GENOCIDE TO HUMAN KIND yeah i think honestly that much right there is a common sense of a BIG NO NO. we need to stop this illegal poisoning of our human race any way possible and i believe by labeling GMO products is a first step of creating a healthy society because people will start to understand that they have to eat better and choose the right choices

Please note that testimony submitted less than 24 hours prior to the hearing , improperly identified, or directed to the incorrect office, may not be posted online or distributed to the committee prior to the convening of the public hearing.

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FINTestimony

From: bbbtutu@gmail.com
Sent: Thursday, February 21, 2013 7:41 PM
To: FINTestimony
Subject: *****SPAM***** HB174 HD 2

To: House Finance Committee
From: Bonnie Bonse

Thank you for this opportunity to submit testimony.
I am a resident of Makawao on Maui and a concerned citizen over the right to know how the food I purchase and eat is being grown. I am in strong support of HB174 HD2 with amendments, which will provide the labeling of genetically engineered local and imported produce.

I urge you to support this bill, thereby giving the people of Hawaii (70% at minimum) what they want and have been asking for for years. Not only is it unjust that the U.S. has not seen fit to label GMOs in our food when they do so for Japan and many European countries, it is shameful. It is time for Hawaii to step up and do the right thing; it is what we, the people, want and deserve.

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 7:46 PM
To: FINTestimony
Cc: realmaui@aloha.net
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Jane Sperr	Individual	Support	No

Comments: Labeling of GMO ingredients is very important to me as I have food alergies. The citizens of Hawaii have a right to know what is in their food.

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SUPPORT

HB174- HD2
(GMO LABELING)
Friday, February 22, 2013, 11:00 a.m.
State Capitol, Rm. 308

FINANCE COMMITTEE (FIN)
Rep. Sylvia Luke, Chair
Rep. Scott Y. Nishimoto, Vice Chair
Rep. Aaron Ling Johanson, Vice Chair

Dear Representatives:

This is an important grassroot movement in our community regarding food safety & the public's right to know.

Please support **HB174**!

Mahalo nui,

Anjie Pham
Honolulu, Hawaii

FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 7:06 PM
To: FINTestimony
Cc: mnakahata@gmail.com
Subject: *Submitted testimony for HB174 on Feb 22, 2013 15:00PM*

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Mae Nakahata	Individual	Oppose	No

Comments:

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 7:51 PM
To: FINTestimony
Cc: kyle.kajihiro@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Kyle Kajihiro	Individual	Support	No

Comments: The public has a right to know what is in the food we are eating. Thank you.

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FINTestimony

From: mailinglist@capitol.hawaii.gov
Sent: Thursday, February 21, 2013 7:15 PM
To: FINTestimony
Cc: Mauifaith@gmail.com
Subject: Submitted testimony for HB174 on Feb 22, 2013 15:00PM

HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Faith Chase	Individual	Support	No

Comments: HB174 GMO labeling is imperative to the health of my family. There are some who have specific blood types wherein GMOs in the diet pose critical critical consequences. I strongly urge you to listen seriously to the high numbers of those testifying IN FAVOR of GMO labeling. It is a matter of life and death. Thank you for taking this plee seriously and advocating on the public and YOUR OWN behalf. Anxiously Awaiting your corrective measures, Faith Ewbank

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HB174
Submitted on: 2/21/2013
Testimony for FIN on Feb 22, 2013 15:00PM in Conference Room 308

Submitted By	Organization	Testifier Position	Present at Hearing
Unmani Cynthia Groves	Individual	Support	No

Comments: ENCLOSED DOCUMENT

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FIN Committee
Friday, 02-22-13 3:00PM in House conference room 308.

Aloha Honorable Chairman and Finance Committee,

I've seen GMO labeling cost studies my husband reviewed and documented in his written testimony, and I concur with his assessments on the overblown claims of industry and the actual data of negligible impacts of labeling costs to consumers and industry. You will no doubt see other studies and claims. Please consider that many countries have labeling requirements already on GE products, numbers of them have implemented them, including American companies who already label GMOs for other countries--and even removed GMO ingredients-- but have not done the same for us in the US. They seem to have accommodated the market. We should be given the same right of choice.

Further, I spoke extensively with scientist Jason Bietz at the FDA Wed. Jan 20, 2013. He stated the FDA only currently allows voluntary labeling on fresh produce. The FDA does not see any need for human studies and there are agreements by industry that attempt to prevent studying their products as sited below.. That is a major concern.

I have reviewed countless animal studies and effects on human farmers. 29 countries ban GE foods and 64 restrict and/or label them. I personally don't want to eat produce or any "genetically engineered product" that

has not been studied on humans and not labeled--even though I want to support local! Genetic engineering is a young science and already, some of the precepts have been proven wrong. Further, there is real question how GE interacts not only with the human gut, but in relationship to other organs with gene promoters that affect networks—not just one gene-one trait.

Further, the argument sited below on wikipedia are precisely WHY we should have GMO labeling--for the safety of our population not just myself and my family. Market dynamics considerations are another aspect--particular control of our food supply, pricing, control over people's lives in the hands of a few corporatioins.

Jason Bietz stated: ". Taking action on human reporting adverse effects from GMO foods only considers in their guidelines two options: adverse effects from a single ingredient and dire hazards to safety such as death on the other end with nothing in between." We must have GE labeling to protect ourselves from the opposite extremes. The last I saw from his walking me through the FDA website re: consultations with industry on the products was approvals in 1995--with no updates on the FDA website. That is a concern. What are they not assessing? And how safe, is safe? If they assess genetically engineered plants and products individually, they may be safe in small amounts. However, it does not consider the 70-80% of our foods that have genetically engineered ingredients in them without our knowledge or consent and the "accumulative effects" or toxic burden. Labeling gives us choice.

Articles on health show that when you combine high fructose corn syrup in coke, canola oil in baked goods, salads and many canned and packaged goods people can build up accumulative effects with allergies, food intolerances, insulin resistance, diabetes and other conditions.Until human studies are done, presented to the FDA, and the dots are connected that these are not just the named foods themselves, we know they are predominantly GE foods, and we can come to terms with toxic burden, the precautionary principle should be applied, and labels provided us -whether on imported produce, GE foods or not. We have many more GE crops and produce coming down the pipe line already without any moratoriums to prevent a take over our bodies, let alone our island, or considerations to what it does to the environment in Hawaii.

Human studies and obstacles

We are not protected by the below thinking on human studies which is why we must individually and for our families protect ourselves by at least having GMO labeling. Both the US General Accounting Office (in a review of FDA procedures requested by Congress) and the FAO/WHO

believe that long term studies of the effect of GM food on humans are not feasible, for reasons including: there is no plausible hypothesis to test; very little is known about the potential long-term effects of any foods; identification of such effects is further confounded by the great variability in the way people react to foods; and epidemiological studies are not likely to differentiate the health effects of GM foods from the many undesirable effects of conventional foods.[82][83] Additionally, there are strong ethics that guide the conduct of research on human subjects, which mandate that the intervention being tested must have a potential benefit for the human subjects, such as treatment for a disease or nutritional benefit (ruling out toxicity testing on humans).[84] In this context, scientists and regulators discussing clinical studies of GM food have written that the "ethical and technical constraints of conducting human trials, and the necessity of doing so, is a subject that requires considerable attention."[85]

Market dynamics

The seed industry is dominated by several seed and biotechnology firms. Firms have engaged in vertical integration, causing structural changes in the seed industry.[246][247] It is reported that in 2011, 73% of the global market is controlled by 10 companies.[248]

Market power gives seed and biotechnology firms the ability to set or influence price, dictate terms, and act as a barrier to entry into the industry. It also gives firms the bargaining power over governments in policy making.[252][253] In March 2010, the US Justice Department and the U.S. Department of Agriculture held a meeting in Ankeny, Iowa to look at the competitive dynamics in the seed industry. Christine Varney, who heads the antitrust division in the Justice Department, said that her team was investigating whether biotech-seed patents are being abused to extend or maintain companies' dominance in the industry.[254] A key issue is how Monsanto sells and licenses its patented trait that allows farmers to kill weeds with Roundup herbicide while leaving crops unharmed - the gene was in 93 percent of U.S. soybeans grown in 2009.[255] About 250 family farmers, consumers and other critics of corporate agriculture held a town meeting prior to the governmental meeting to protest Monsanto for what they see as manipulation of the market by buying up independent seed companies, patenting the seeds and then raising seed prices.[254]

What about what is in our drinking water and labeling or warnings for our protection? Glyphosate has been studied on the effects of humans and showed up on human urine in every person studied in the town. Glyphosate is the main active substance used in most commercial herbicides. It poisons not only plants, but also animals and humans.

When testing for glyphosate contamination in an urban population, a German university found significant contamination in all urine samples with levels 5 to 20 times above the legal limit for drinking water. http://www.ithaka-journal.net/herbizide-im-urin?lang=en Are we willing to allow our lands and our bodies to be usurped without our having such protections over our lives?

To not deal with the issue of labeling is putting off the inevitable. The direction we are heading is consuming the earth and her people by industry practices of chemicalization. By the time frame you have in the HB174 "to have further a discussion"—2112, 99 years from now, we will have a chemicalized world. Consider what has happened in 20 years. There is an urgency to pass a labeling bill at a very minimum. Give us the choice for transparency nondiscriminately--both with foods on the islands and imports and show you respect our right to choose what we put into our bodies, the protection of our genetic lineages, and our aina-- If other countries can get their labeling together in a year or two we should be able to--or something is radically amiss!
Respectfully submitted. Mahalo nui loa for the opportunity to testify.
Unmani Cynthia Groves
Health Care Practice Mgmt. Consultant to Professionals since 1985
Member:
Kihei Community Association Planning Committee
Alliance of Maui Community Associations
SW Maui Watershed Advisory, Halau Ke'alaokamaile

ARTICLE ENCLOSED

Significant Health Hazards of Genetically Engineered Foods
http://articles.mercola.com/sites/articles/archive/2012/08/07/genetically-engineered-foods-hazards.aspx?e_cid=20120807_DNL_artNew_1
August 07 2012 | 188,709 views |

By Dr. Mercola
Scientists in Norway have released results from experimental feeding studies carried out over a 10-year period, and the verdict is in: If you want to avoid obesity, then avoid eating genetically engineered (GE) corn, corn-based products, and animals that are fed a diet of GE grain.

As reported by Cornucopia.org1, the project also looked at the effects on organ changes, and researchers found significant changes that affected weight gain, eating behaviors, and immune function.

How Genetically Engineered Corn and Soy Can Wreak Havoc on Your Health According to the featured article

2:*"The results show a positive link between GE corn and obesity. Animals fed a GE corn diet got fatter quicker and retained the weight compared to animals fed a non-GE grain diet. The studies were performed on rats, mice, pigs and salmon, achieving the same results.*

... Researchers found distinct changes to the intestines of animals fed GMOs compared to those fed non-GMOs. This confirms other studies done by US researchers. Significant changes occurred in the digestive systems of the test animals' major organs including the liver, kidneys, pancreas, genitals and more."

Their findings (which were published July 11, 2012 in Norway by Forskning.no, an online news source devoted to Norwegian and international research3) showed that animals fed genetically engineered Bt corn ate more, got fatter, and were less able to digest proteins due to alterations in the micro-structure of their intestines.

They also suffered immune system alterations. The impaired ability to digest proteins may be of particular concern as this can have far-reaching implications for your health. If your body cannot digest proteins, your body will be less able to produce amino acids, which are necessary building blocks for proper cell growth and function.

As noted by Cornucopia.org:

"This not only may relate to a rise in obesity, but to increases in many modern diseases. These diseases include diabetes, digestive disorders, inflammatory bowel disease, colitis, autism spectrum disorders (ASD) (ADD), autoimmune diseases, sexual dysfunction, sterility, asthma, COPD and many more.

...[Lead author] Professor Krogdahl explains: "It has often been claimed that the new genes in genetically modified foods can't do any damage because all genes are broken down beyond recognition in the gut. Our results show the contrary; that genes can be taken up across the intestinal wall, is transferred to the blood and is left in the blood, muscle and liver in large chunks so that they can be easily recognized... The biological impact of this gene transfer is unknown."

Bt Toxin Found in Blood of Women and Fetuses

This is not the first time scientists have revealed significant biological impacts and related health problems as a result of eating a diet of genetically engineered foods. More often than not, unless the research is

tainted by industry ties, studies into the effects of genetically engineered foods demonstrate that it is anything but safe. This isn't so surprising when you consider that simple logic will tell you it's probably not wise to consume a plant designed to produce its own pesticide, for example.

So-called "Bt corn" is equipped with a gene from the soil bacteria *Bacillus thuringiensis* (Bt), which produces Bt-toxin—a pesticide that breaks open the stomach of certain insects and kills them. This pesticide-producing corn entered the food supply in the late 1990's, and over the past decade, the horror stories have started piling up.

Monsanto and the US Environmental Protection Agency (EPA) swore that the toxin would only affect insects munching on the crop. The Bt-toxin, they claimed, would be completely destroyed in the human digestive system and would not have *any* impact on animals and humans. The biotech companies have doggedly insisted that Bt-toxin doesn't bind or interact with the intestinal walls of mammals, and therefore humans.

The featured research proves all such claims *false*.

Prior findings have already shown that Bt corn is anything but innocuous to the human system. Just last year, doctors at Sherbrooke University Hospital in Quebec found Bt-toxin in the blood[4] of:

- 93 percent of pregnant women tested
- 80 percent of umbilical blood in their babies, and
- 67 percent of non-pregnant women

Bt-toxin breaks open the stomach of insects. Could it similarly be damaging the integrity of your digestive tract? If Bt-toxins can damage the intestinal walls of newborns and young children, the passage of undigested foods and toxins into the blood from the digestive tract could be devastating to their future health. Scientists speculate that it may lead to autoimmune diseases and food allergies. Furthermore, since the blood-brain barrier is not developed in newborns, toxins may enter the brain causing serious cognitive problems. Some healthcare practitioners and scientists are convinced that this one mechanism for autism.

If Bt genes are colonizing the bacteria living in the digestive tract of North Americans, we might expect to see an increase in gastrointestinal problems, autoimmune diseases, food allergies, and childhood learning disorders since the advent of Bt crops in 1996, and that's exactly what's being reported. For example, between 1997 and 2002 the number of hospitalizations related to allergic reactions to food increased by a whopping 265 percent. One out of 17 children now has some form of food allergy and allergy rates are rising.

Genetically Engineered Foods Trigger Adverse Immune System Responses

There's plenty of evidence showing that the Bt-toxin produced in genetically modified Bt crops like corn and cotton plants is toxic to humans and mammals *and* triggers immune system responses. For example, in government-sponsored research in Italy[5], mice fed Monsanto's Bt corn showed a wide range of immune responses, such as:

- Elevated IgE and IgG antibodies, which are typically associated with allergies and infections
- An increase in cytokines, which are associated with allergic and inflammatory responses. The specific cytokines (interleukins) that were found to be elevated are also higher in humans who suffer from a wide range of disorders, from arthritis and inflammatory bowel disease, to MS and cancer
- Elevated T cells (gamma delta), which are increased in people with asthma, and in children with food allergies, juvenile arthritis, and connective tissue diseases.

Rats fed another of Monsanto's Bt corn varieties called MON 863, also experienced an activation of their immune systems, showing higher numbers of basophils, lymphocytes, and white blood cells[6]. These can indicate possible allergies, infections, toxins, and various disease states including cancer. There were also signs of liver and kidney toxicity.

USDA Clears Roundup Ready Sugar Beets

So-called "Roundup Ready" crops are another type of genetically engineered crops. While Bt crops contain a gene that produces a pesticide inside the plant itself, Roundup Ready crops are designed to withstand otherwise lethal topical doses of glyphosate—a broad spectrum herbicide, and the active ingredient in Monsanto's herbicide Roundup as well as hundreds of other products.

This way, the crop survives while all weeds are theoretically eliminated from the field. I say 'theoretically' because the overuse of the herbicide has led to the rapid development of glyphosate-resistant superweeds. It's estimated that more than 130 types of weeds spanning 40 U.S. states are now herbicide-resistant, and the superweeds are showing no signs of stopping.

Roundup Ready crops have also been linked to serious health problems—particularly relating to fertility and birth defects—as has glyphosate itself, which is why the latest news regarding the deregulation of Roundup Ready sugar beets is all the more disappointing.

A number of organizations challenged the USDA approval of Roundup Ready (RR) sugar beets in 2008, arguing that the beets would contaminate related organic and non-GE crops such as table beets and chard. Further, they said that the pesticide-resistant beets would increase pesticide impacts on the environment and worsen the current epidemic of pesticide-resistant superweeds.

A lawsuit was filed against the USDA in 2009 for failure to complete an Environmental Impact Study. A federal judge agreed, temporarily suspending all planting of RR sugar beets. The suspension was later overridden by the USDA, ostensibly to prevent a sugar shortage. After a number of additional legal twists and turns, the USDA has now announced its decision to deregulate Monsanto's Roundup Ready genetically modified sugar beets[7]. According to a July 19 press release by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS)[8]:

"After completing both a thorough environmental impact statement and plant pest risk assessment, holding three public meetings and considering and analyzing thousands of comments regarding its analyses, APHIS has determined that, from the standpoint of plant pest risk, Roundup Ready sugarbeets are as safe as traditionally bred sugarbeets."

GM Companies Threaten Food Security and Sovereignty

A landmark speech delivered during the 2011 SEMEAR conference in Sao Paulo, Brazil, on how genetically modified (GM) seed companies threaten food security and food sovereignty has resulted in a call to action by an unlikely source who is a key player in the soy industry. Pierre Patriat, President of APROSMAT, the association of seed producers of Mato Grosso, Brazil, does not oppose genetically engineered (GE) crops, but he does recognize the unprecedented threat to food security that GM seeds pose.

Saying that the GM industry is rapidly taking away Brazilian farmers' freedom of choice, he asked for "immediate mobilization and action on the part of concerned industry members, government, lawmakers, farmers, and civil society to avert the threat to food sovereignty posed by the GM industry's control of markets through their patented seeds," according to a recent report by GM Watch[9].

In his speech, which I recommend reading in its entirety to learn more, Patriat wisely says:

"... [T]oday, people think everything can be resolved through the seed. If soybean rust occurs they say, "Just wait, this can be resolved with genetic engineering!" A problem with nematodes? - "We'll change the seed directly!" They want to solve all problems that way... But as long as we have alternative solutions we don't need genetic engineering to get rid of all problems.

Today we have a big problem with nematodes for a simple reason, not least because of the lack of a medium-term agricultural policy. There is a solution known to every agronomist: Crop rotation! That is how weeds and pests are weakened. It is so simple! Another way is soil management and measures to correct the soil - fundamental things nobody pays attention to anymore because everything has to be resolved through the seed.

No one does rotation any more - everyone does succession [planting same crop in succession]. These are problems that are not resolved by biotechnology. The man who is going to spend 150-200 Brazilian dollars per hectare would do much better to invest it in the [quality of the] land. The profitability in the medium term will be much better for sure. This does not mean that constant seed improvement will not bring solutions. But we ought to cooperate and define the base for new regulations, so that everyone may collaborate harmoniously without abusing their economic power.

Because today there are no brakes on the abuse of economic power over seed, and even worse, this affects the sovereignty of a country, because it is a matter of food security and food security is national security."

The issue of food sovereignty is certainly not restricted to Brazil. It's becoming a serious threat to every nation on this planet as genetically engineered crops spread. These seeds are owned by private companies, and it's imperative to understand that once a country allows GE crops to monopolize their agricultural sector, it becomes completely beholden to and dependent upon a corporation for the ability to grow food and feed its citizens!