

EXHIBIT B

Exhibit B – Materials from H.112 Bill File (2014)

The Vermont Legislative Bill Tracking System: “Committee Meetings where H.0112, An act relating to the labeling of food produced with genetic engineered, was considered” (June 4, 2014) 1

January 13, 2014 Letter from Laura Murphy, Environmental and Natural Resources Law Clinic (“ENRLC”), Vermont Law School, to Senate Committee on Agriculture..... 24

List of “studies, articles, reports, federal agency documents, and expert testimony discussing the health impacts and risks associated with foods produced through genetic engineering,” presented by ENRLC to House Committee on Agriculture (February 14, 2013) and Senate Committee on Agriculture (January 13, 2014)..... 25

List of “documents that discuss the environmental risks associated with genetically engineered crops,” presented by ENRLC to House Committee on Agriculture (February 14, 2013) and Senate Committee on Agriculture (January 13, 2014) 30

List of “Additional Materials for VT Legislature Spring 2014,” presented by ENRLC to Senate Committee on Agriculture (January 9, 2014) 31

List of “documents that explain religious concerns regarding genetically engineered foods,” presented by ENRLC to House Committee on Agriculture (February 14, 2013) and Senate Committee on Agriculture (January 13, 2014) 32

Monsanto, Definition of GMO, Glossary, included in materials presented by ENRLC to House Committee on Agriculture (February 14, 2013) and Senate Committee on Agriculture (January 13, 2014) 33

World Health Organization (WHO), 20 Questions on Genetically Modified (GM) Foods (2012), included in materials presented by ENRLC to House Committee on Agriculture (February 14, 2013) and Senate Committee on Agriculture (January 13, 2014)..... 41

The Vermont Legislative Bill Tracking System

Legislative History: Committee Meetings by Bill 2013 - 2014 Legislative Session

Committee Meetings where H.0112, An act relating to the labeling of food produced with genetic engineering, was considered:

Meeting Details:

Committee(s): House Committee on Agriculture and Forest Products
Hearing Date: 05/08/2014
Hearing Type: Standard
Comment:
Public Records ID:
CDs:

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Governor's Signing Ceremony on Front Steps

Complete Meeting Details

Meeting Details:

Committee(s): House Committee on Agriculture and Forest Products
Hearing Date: 04/22/2014
Hearing Type: Standard
Comment:
Public Records ID:
CDs: 14-142, 143, 144

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
testimony on the Fund established by H.112

Sen. Dick Sears, Sponsor
Rep. Martha Heath, Chair, Westford

H.112 - An act relating to the labeling of food produced with genetic engineering
Bridget Asay, Assistant Attorney General

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Judiciary**
 Hearing Date: **04/22/2014**
 Hearing Type: **Standard**
 Comment:
 Public Records ID:
 CDs: **14-117,118,119,120**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
 Hearing Date: **04/17/2014**
 Hearing Type: **Standard**
 Comment:
 Public Records ID:
 CDs: **14-136, 137, 138, 139**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
 Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
 Hearing Date: **04/16/2014**
 Hearing Type: **Standard**
 Comment:
 Public Records ID:
 CDs:

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
 Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Appropriations**
 Hearing Date: **04/10/2014**
 Hearing Type: **Standard**

Comment:
Public Records ID:
CDs: 14-076; 14-077

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Appropriations**
Hearing Date: **04/08/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: 14-070; 14-071

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Bridget Asay, Assistant Attorney General, Office of the Attorney General
Susanne Young, Deputy Attorney General, Office of the Attorney General
James Reardon, Commissioner, Department of Finance & Management
Stephen Klein, Chief Legislative Fiscal Officer, Joint Fiscal Office
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Judiciary**
Hearing Date: **04/03/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: 14-93, 94

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
~ Committee Discussion and Mark up
Michael O'Grady, Legislative Counsel, Office of Legislative Council
Bridget Asay, Assistant Attorney General

H.112 - An act relating to the labeling of food produced with genetic engineering
Vote
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details**Meeting Details:**

Committee(s): **Senate Committee on Judiciary**
Hearing Date: **03/26/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-82, 83**

Meeting Record:**H.112 - An act relating to the labeling of food produced with genetic engineering**
ROOM 11

Jim Harrison, President, Vermont Grocers' Association
Chris Miller, Director of Sustainability, Ben and Jerry's Homemade, Inc.
Steven Drucker, President and Executive Director, Alliance for Bio-Integrity
Bridget Asay, Assistant Attorney General

H.112 - An act relating to the labeling of food produced with genetic engineering

Diane Bothfeld, Deputy Secretary, Agency of Agriculture
Jane Clifford, Executive Director, Green Mountain Dairy Farmers Cooperative Federation, Inc.
Bill Moore, Legislative Director
Margaret Laggis, Lobbyist, United Dairy Farmers of Vermont

Complete Meeting Details**Meeting Details:**

Committee(s): **Senate Committee on Judiciary**
Hearing Date: **03/21/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-79**

Meeting Record:**H.112 - An act relating to the labeling of food produced with genetic engineering**

~ Committee Discussion of the bill

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details**Meeting Details:**

Committee(s): **Senate Committee on Judiciary**
Hearing Date: **03/19/2014**
Hearing Type: **Standard**

Comment:
Public Records ID:
CDs: 14-74,75,76

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

~ Constitutionality/Legal Issues

James H. Maroney Jr.
Dan Barlow, Policy Manager, Vermont Businesses for Social Responsibility
Bridget Asay, Assistant Attorney General
Stacey Chagnan

H.112 - An act relating to the labeling of food produced with genetic engineering

~ Constitutionality/Legal Issues

Laura Murphy, Associate Director, Environmental and Natural Resources Law Clinic, Vermont Law School
Andrew Homan, Student Clinician

H.112 - An act relating to the labeling of food produced with genetic engineering

~ Constitutionality/Legal Issues ~ Room 11

Dr. Michael Hansen, Senior Staff Scientist, Consumers Union, Yonkers, NY
Val Giddings, Senior Fellow, Information Technology and Innovation Foundation, Silver Springs, MD
Stanley H. Abramson, Attorney, Arent Fox PLLC, Washington, DC

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Judiciary**
Hearing Date: **03/13/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-70, 71**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Judiciary**
Hearing Date: **03/11/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-66, 67**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Walk thru the bill

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**

Hearing Date: **02/11/2014**

Hearing Type: **Standard**

Comment:

Public Records ID:

CDs: **14-43, 44**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

draft as passed

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**

Hearing Date: **02/07/2014**

Hearing Type: **Standard**

Comment:

Public Records ID:

CDs: **14-40, 41**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

William Sorrell, Vermont Attorney General, Attorney General's Office

Lucy Leriche, Deputy Secretary, Agency of Commerce and Community Development

Chuck Ross, Secretary, Agency of Agriculture, Food & Markets

Jim Harrison, President, Vermont Grocers' Association

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**

Hearing Date: **02/06/2014**

Hearing Type: **Standard**

Comment:

Public Records ID:

CDs: 14-36, 37, 38, 39

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Michael O'Grady, Legislative Counsel, Office of Legislative Council

H.112 - An act relating to the labeling of food produced with genetic engineering

Committee discussion

H.112 - An act relating to the labeling of food produced with genetic engineering

H.112 Public Hearing from 6-8 PM in House Chamber

Rich Conte, Stowe
Alton Smith, Wolcott
Nova Kim, Fairlee
Timothy O'Dell
Maureen Hurley, Topsham
Judith Persin, Bethel
Jim Minnich, Bethel
Grace Gershuny, Barnet
Paula Schramm, Enosburg
Claudia Rose, Enosburg
Kelly Cummings, Fletcher
Al Walskey, Berkshire
Sarita Khan, Montgomery
Jacques Berchten, Grand Isle
Sylvia Knight, , Charlotte
Sean Burke, Barre
Sylvia Smith, South Strafford
Kurt Armbrust, South Hartford
Falko Schilling, Consumer Advocate, Vermont Public Interest Research Group
Chris Jacobson, Hartland
Bradley Rauch, Stowe
Ben Scotch, Montpelier
Nancy Baron, Warren
Ben Eastwood, Montpelier
George Schenk, American Flatbread
Jesse Lovasco, Montpelier
Elizabeth Howard, Norwich
Li Shen, Thetford
Stuart Blood, Thetford Center
Richard Roderick, Wells River
Stephen Marx, Strafford
Stuart Smith, South Strafford
Mike Bald, Royalton
Gayle Brown, North Fayston
Helen Dicke, Hartland
Judy Bourque, Kirby
Matthew Ennis, Winooski
Michele Robbins, Williston

Fred Schwacke, Winhall
 Brian Stroffolino, Hartland
 Cat Buxton, Sharon
 Kye Cochran, , Hartford
 Sylvia Davatz, Hartford
 Shane Bowley, South Burlington
 Janice Russotti, South Burlington
 Steven Berry, Manchester
 Morgan MacIver, Plainfield
 David Fried, Elmore
 Susan Lloyd, Westford
 Stewart Savet, Brattleboro
 Amos Newton, Jamaica
 Rick Staht, Chester

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Judiciary**
 Hearing Date: **02/06/2014**
 Hearing Type: **Standard**
 Comment:
 Public Records ID:
 CDs: **14-40, 41 Public Hearing recorded by Sen Agriculture**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Public Hearing

Rich Conte, Stowe
 Alton Smith, Wolcott
 Nova Kim, Fairlee
 Timothy O'Dell
 Maureen Hurley, Topsham
 Judith Persin, Bethel
 Jim Minnich, Bethel
 Grace Gersheny, Barnet
 Paula Schramm, Enosburg
 Claudia Rose, Enosburg
 Kelly Cummings, Fletcher
 Al Walskey, Beshire
 Sarita Khan, Montgomery
 Jacques Berchten, Grand Isle
 Sylvia Knight, Charlotte
 Geraldine Burke, Barre
 Syvia Smith, So. Strafford
 Kurt Armbrust, So. Hartford
 Falko Schlilling, Montpelier
 Chris Jacobson, Hartland
 Bradley Rauch, Stowe

Ben Scotch, Montpelier
Nancy Baron, Warren
Ben Eastwood, Montpelier
George Schenk, Warren
Jesse Lovasco, Montpelier
Elizabeth Howard, Norwich
Li Shen, Thetford
Stuart Blood, Thetford Center
Richard Roderick, Wells River
Stephen Marx, Strafford
Stuart Smith, South Strafford
Mike Bald, Royalton
Gayle Brown, North Fayston
Helen Dicke, Hartland
Judy Bourque, Kirby
Matthew Ennis, Winooski
Michele Robbins, Williston
Fred Schwacke, Winhall
Brian Stroffolino, Hartland
Cat Buxton, Sharon
Kye Cochran, Hartford
Sylvia Davatz, Hartford
Shane Bowley, South Burlington
Janice Russotti, S. Burlington
Steven Berry, Manchester
Morgan MacIver, Plainfield
David Fried, Elmore
Susan Lloyd, Westford
Stewart Savel, Brattleboro
Amos Newton, Jamaica
Rick Staht, Chester
Pete Newton, Windham

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **02/05/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-34, 35**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Rep. Teo Zagar, House Committee on Agriculture
Rep. Tristan Toleno, Representative, House Committee on Agriculture
Rep. Kristina Michelsen, Representative, House Committee on Agriculture
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **02/04/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-32, 33**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/31/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-30, 31**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Jane Kolodinsky, Director, Center for Rural Studies, Community Development and Applied Economics Department
UVM
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/29/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-28, 29, 29A**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Dr. Michael Hansen, Senior Staff Scientist, Consumers Union

H.112 - An act relating to the labeling of food produced with genetic engineering

Steven Druker, Executive Director, Alliance for Bio-Integrity
Michael O'Grady, Legislative Counsel, Office of Legislative Council
Martin Donohoe, Member, Board of Advisers, Oregon Physicians for Social Responsibility

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/28/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-26, 27**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Michael O'Grady, Legislative Counsel, Office of Legislative Council
Dyeanne Racette, General Surgeon, Copley Hospital

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/24/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-25**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/23/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-24**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Jerry Greenfield, Co-Founder, Ben and Jerry's Homemade, Inc.

Chris Miller, Director of Sustainability, Ben and Jerry's Homemade, Inc.

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**

Hearing Date: **01/22/2014**

Hearing Type: **Standard**

Comment:

Public Records ID:

CDs: **Cd 14-21, 22, 23**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Janet Anderson, Former Director, Biopesticides Division, EPA

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**

Hearing Date: **01/21/2014**

Hearing Type: **Standard**

Comment:

Public Records ID:

CDs: **14-19, 20**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Andrea Stander, Executive Director, Rural Vermont

Rep. Harvey Smith

Jane Clifford, Lobbyist, Green Mountain Dairy Farmers

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**

Hearing Date: **01/17/2014**

Hearing Type: **Standard**

Comment:

Public Records ID:

CDs: 14-17, 18

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Bridget Asay, Assistant Attorney General

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/16/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-14, 15, 16**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Mike Tetreault, President, Vermont Feed Dealers and Manufacturers Association
Bridget Asay, Assistant Attorney General
Val Giddings, Senior Fellow, Information Technology and Innovation Foundation

H.112 - An act relating to the labeling of food produced with genetic engineering
Martin Donohoe, Member, Board of Advisers, Oregon Physicians for Social Responsibility

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/15/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-12, 13**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Gary Hirshberg, Founder and former CEO, Stonyfield Farm

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/14/2014**

Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-9, 10, 11**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
continuation of initial introduction of bill

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/10/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-7, 8**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

David Rogers, Policy Advisor, NOFA VT

Margaret Laggis, Lobbyist, Laggistics

Dan Barlow, Policy Manager, Vermont Businesses for Social Responsibility

James Maroney, Owner

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/09/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-3, 4, 5, 6**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Laura Murphy, Associate Director, Environmental and Natural Resources Law Clinic, Vermont Law School

Falko Schilling, Consumer Advocate, Vermont Public Interest Research Group

H.112 - An act relating to the labeling of food produced with genetic engineering

Lucy Leriche, Deputy Secretary, Agency of Commerce and Community Development

Jim Harrison, President, Vermont Grocers' Association

Complete Meeting Details

Meeting Details:

Committee(s): **Senate Committee on Agriculture**
Hearing Date: **01/08/2014**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **14-1, 2**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **05/10/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-152**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Consideration of amendments
Rep. Paul Ralston, Middlebury
Rep. Anne B. Donahue, , Northfield
Rep. William F. Johnson, Canaan
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Commerce and Economic Development**
Hearing Date: **05/08/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-177, 178**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Rep. Teo Zagar, Member, House Committee on Agriculture

Rep. Tristan Toleno, Member, House Committee on Agriculture
Rep. Kristina Michelsen, Member, House Committee on Agriculture

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Judiciary**
Hearing Date: **05/07/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-149, 150**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Final committee discussion and vote.

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Judiciary**
Hearing Date: **05/06/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-147, 148**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Committee discussion and possible vote.
Karin Moore, Vice President and General Counsel, Grocery Manufacturers Asso.
Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Judiciary**
Hearing Date: **05/03/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-14145, 146**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Committee discussion

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Judiciary**
Hearing Date: **05/02/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-141, 142, 143**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Committee discussion

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Laura Murphy, Associate Director, Environmental and Natural Resources Law Clinic, Vermont Law School

H.112 - An act relating to the labeling of food produced with genetic engineering

Continued Committee Discussion

Wendy Morgan, Assistant Attorney General, Attorney General's Office

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Judiciary**
Hearing Date: **04/18/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-124, 125, 126, 127**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Introduction by sponsors and initial walk through

Rep. Kate Webb, Sponsor

Rep. Carolyn W. Partridge, Windham

Rep. Teo Zagar, Barnard

Rep. John L. Bartholomew

Michael O'Grady, Legislative Counsel, Office of Legislative Council

Bridget Asay, Assistant Attorney General

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **03/01/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-82, 84 (83 bad disc)**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

H.112 - An act relating to the labeling of food produced with genetic engineering
Committee vote

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/28/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-78, 79, 80, 81**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Committee mark-up of bill

H.112 - An act relating to the labeling of food produced with genetic engineering

H.112 - An act relating to the labeling of food produced with genetic engineering

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/27/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-72, 73, 74, 75, 76, 77**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Stephen Pintauro, Associate Professor, Nutrition and Food Sciences, University of Vermont

H.112 - An act relating to the labeling of food produced with genetic engineering

H.112 - An act relating to the labeling of food produced with genetic engineering

Rabbi Elihu Gevirtz, Council of Netiya

Rev. Daniel Buford, Allen Temple Baptist Church, Oakland, CA

H.112 - An act relating to the labeling of food produced with genetic engineering
bill mark-up

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/26/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-67, 68, 69, 70, 71**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Committee discussion

H.112 - An act relating to the labeling of food produced with genetic engineering
Dyeanne Racette, General Surgeon, Copley Hospital

H.112 - An act relating to the labeling of food produced with genetic engineering
Conrad Brunk, Editor, "Acceptable Genes?: Religious Traditions and Genetically Modified Foods"

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/22/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-64, 65, 66**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Jeffrey Smith, Author and Founder, Institute for Responsible Technology

H.112 - An act relating to the labeling of food produced with genetic engineering
Committee discussion.

Michael O'Grady, Legislative Counsel, Office of Legislative Council
Jordan Gonda, Law Clerk, Office of Legislative Council

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/21/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-62, 63**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Committee discussion.

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/20/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-60, 61**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Kari Bradley, General Manager, Hunger Mountain Coop
Cathy Bacon, Owner, Freedom Foods
George Schenk, American Flatbread

H.112 - An act relating to the labeling of food produced with genetic engineering
Mel Fields, Birnn Chocolates of Vermont

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/19/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-57, 58, 59**

Meeting Record:

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Rep. Duncan F. Kilmartin, , Newport
Jane Clifford, Lobbyist, Green Mountain Dairy Farmers Cooperative Federation, Inc.

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Robert Merker, Supervisory Consumer Safety Officer, Food and Drug Administration

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Michelle Kropp, Gringo Jack's

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/15/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-51, 52, 53, 54, 55, 56**

Meeting Record:

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Dale Johnson, Divisional Vice President, State Government Affairs, Abbott Labs
Val Giddings, Senior Fellow, Information Technology and Innovation Foundation

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/14/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-46, 47, 48, 49, 50**

Meeting Record:

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Margaret Laggis, Lobbyist, Laggistics

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Jerry Greenfield, Co-Founder, Ben and Jerry's Homemade, Inc.
Rob Michalak, Social Mission Director, Ben and Jerry's Homemade, Inc.

- H.112 - An act relating to the labeling of food produced with genetic engineering**
Tim Schmalz, Plant Pathologist, Agency of Agriculture, Food & Markets

Chelsea Lewis, Agricultural Development Coordinator, Agency of Agriculture, Food & Markets
Jim Leland, Director, Agency of Agriculture, Food & Markets

H.112 - An act relating to the labeling of food produced with genetic engineering

Jim Harrison, President, Vermont Grocers' Association

H.112 - An act relating to the labeling of food produced with genetic engineering

Laura Murphy, Associate Director, Environmental and Natural Resources Law Clinic, Vermont Law School
Falko Schilling, Consumer Advocate, VPIRG
Alex Funk, Student Clinician, Vermont Law School
Jillian Bernstein, Student Clinician, Vermont Law School

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/13/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-44, 45**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Andrea Stander, Executive Director, Rural Vermont

H.112 - An act relating to the labeling of food produced with genetic engineering

Dan Barlow, Policy Manager, Vermont Businesses for Social Responsibility

H.112 - An act relating to the labeling of food produced with genetic engineering

Steven Druker, Executive Director, Alliance for Bio-Integrity

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/07/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-38, 39**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering

Dr. Michael Hansen, Senior Staff Scientist, Consumers Union

Complete Meeting Details

Meeting Details:

Committee(s): **House Committee on Agriculture and Forest Products**
Hearing Date: **02/06/2013**
Hearing Type: **Standard**
Comment:
Public Records ID:
CDs: **13-34, 35, 36, 37**

Meeting Record:

H.112 - An act relating to the labeling of food produced with genetic engineering
Rep. Kate Webb, Sponsor of Bill
Michael O'Grady, Legislative Counsel, Office of Legislative Council
Bridget Asay, Assistant Attorney General

Complete Meeting Details

VERMONT LAW SCHOOL



**Environmental and Natural Resources Law Clinic
Vermont Law School
PO Box 96, 164 Chelsea Street
South Royalton, VT 05068-0096
802-831-1630 (phone) • 802-831-1631 (fax)**

January 13, 2014

Linda Leehman
Committee Assistant
Senate Committee on Agriculture
Vermont State House
Montpelier, Vermont 05633-5301

Dear Linda:

When I testified last week, the Senate Committee on Agriculture expressed interest in receiving the materials that we provided to the House committees last year. I am enclosing a CD that contains those materials, which were submitted by the Environmental and Natural Resources Law Clinic on behalf of the Vermont Public Interest Research Group. The materials also include a follow-up communication from Michael Hansen to the House Committee on Agriculture and Forest Products.

Please let me know if there are any questions or if I can provide further assistance.

Sincerely,

A handwritten signature in black ink, appearing to be 'Laura Murphy', written over a light blue horizontal line.

Laura Murphy
Associate Director & Assistant Professor
(802) 831-1123
lmurphy@vermontlaw.edu

Cc (via email):Falko Schilling, VPIRG

This binder compiles several scientific studies, articles, reports, federal agency documents, and expert testimony discussing the health impacts and risks associated with foods produced through genetic engineering. The binder is divided into two volumes and four sections. The four sections include: general health risks, food allergies and sensitivity, toxicity, and uncertainty. The general health section contains several scientific studies and reports linking major health problems with the consumption of genetically modified foods. These studies and reports conclude that genetically modified foods do pose some health risks. The food allergies section also contains several scientific studies and reports finding that altering the DNA of organisms can create new proteins that can cause allergic reactions. This section also discusses demonstrated risks to immune systems as a result of consuming genetically modified foods. The toxicity section contains several scientific studies and reports discussing the health impacts associated with increased herbicide use as a result of introducing crops genetically engineered to be resistant to these chemicals. Furthermore, this section discusses several studies that examined the health impacts and risks associated with crops genetically modified to produce certain insecticides and pesticides. Finally, the uncertainty section contains agency and expert comments concluding that genetically modifying certain organisms could have unintended consequences and pose uncertain health risks to consumers.

Please note that the materials in this binder are not intended as an exhaustive compilation of studies pertaining to health risks associated with foods produced through genetic engineering.

Table of Contents: Health Risks of GE Foods, Volume I**Section I: General Health Impacts**

1. G. Séralini et al., *Genetically modified crops safety assessments: present limits and possible improvements*. Environmental Sciences Europe (2011).
2. American Academy of Environmental Medicine, *Genetically Modified Foods Position Paper* (2009).
3. Kilic, M. Akay. *A three generation study with genetically modified Bt corn in rats: Biochemical and histopathological investigation*. Food and Chemical Toxicology. 46(3): 1164–1170 (2008).
4. Artemis Dona, Ioannis S. Arvanitoyannis. *Health risks of genetically modified foods*. Critical Reviews in Food Science and Nutrition. 49(2): 164–175 (2009).
5. F. Brasil, L. Soares, T. Faria, G. Boaventura, F. Sampaio, C. Ramos. *The impact of dietary organic and transgenic soy on the reproductive system of female adult rat*. The Anatomical Record; 292(4): 587–594 (2009).
6. Michael Antoniou, *GM Soy, Sustainable? Responsible?: A Summary of Scientific Evidence Showing that Genetically Modified (GM) Soy and the Glyphosate Herbicide it is Engineered to Tolerate are Unsustainable From the Point of View of Farming, the Environment, Rural Communities, Animal and Human Health, and Economies*, GLS Bank (2010).
7. M. Malatesta, et al. *A long-term study on female mice fed on a genetically modified soybean: effects on liver ageing*. Histochem Cell Biology. 130: 967–977 (2008).
8. M. Poulsen, S. Kroghsbo, M. Schrøder, et al. *A 90-day safety study in Wistar rats fed genetically modified rice expressing snowdrop lectin Galanthus nivalis (GNA)*. Food and Chemical Toxicology. 45(3): 350-363 (2007).
9. M. Schrøder, M. Poulsen, A. Wilcks, et al. *A 90-day safety study of genetically modified rice expressing CryIAb protein (Bacillus thuringiensis toxin) in Wistar rats*. Food and Chemical Toxicology. 45(3): 339-349 (2007).
10. M. Trabalza-Marinucci, G. Brandi, C. Rondini, et al. *A three-year longitudinal study on the effects of a diet containing genetically modified Bt176 maize on the health status and performance of sheep*. Livestock Science. 113(2): 178–190 (2008).
11. R. Tudisco, P. Lombardi, F. Bovera, et al. *Genetically modified soya bean in rabbit feeding: Detection of DNA fragments and evaluation of metabolic effects by enzymatic analysis*. Animal Science. 82: 193–199 (2006).
12. Institute for Responsible Technology, *State-of-the-Science on the Health Risks of GM Food* (2010).

13. Jean Halloran and Michael Hansen, *Why We Need Labeling of Genetically Engineered Food*, Consumers International (1998).

Section II: Food Allergies and Food Intolerance/Sensitivity

1. Michael Antoniou, Claire Robinson, and John Fagan, *GMO Myths and Truths: An Evidence-Based Examination of the Claims Made for the Safety and Efficacy of Genetically Modified Crops*, Earth Open Source, Chapter 5 (2012).
2. Michael Antoniou, *GM Soy, Sustainable? Responsible?: A Summary of Scientific Evidence Showing that Genetically Modified (GM) Soy and the Glyphosate Herbicide it is Engineered to Tolerate are Unsustainable From the Point of View of Farming, the Environment, Rural Communities, Animal and Human Health, and Economies*, GLS Bank (2010).
3. *Statement of Policy-Foods Derived from New Plant Varieties*, U.S. Food and Drug Administration (1992).
4. Institute for Responsible Technology, *State-of-the-Science on the Health Risks of GM Food*, 8-9 (2010).
5. V. Prescott, P. Campbell, A. Moore, et al. *Transgenic expression of bean alpha-amylase inhibitor in peas results in altered structure and immunogenicity*. *Journal of Agricultural and Food Chemistry*. 53(23): 9023–9030 (2005).
6. Roberto I. Vázquez-Padrón, *CryIAc Protoxin from Bacillus Thuringiensis sp. Kurstaki HD73 Binds to Surface Proteins in the Mouse Small Intestine*, *Biochemical and Biophysical Research Communications* (2000).
7. Finamore, M. Roselli, S. Britti, et al. *Intestinal and peripheral immune response to MON810 maize ingestion in weaning and old mice*. *The Journal of Agricultural and Food Chemistry*. 56: 11533–11539 (2008).
8. S. Ewen and A. Pusztai, *Effect of diets containing genetically modified potatoes expressing Galanthus nivalis lectin on rat small intestine*, *The Lancet* (1999).
9. N. Fares and A. El-Sayed, *Fine Structural Changes in the Ileum of Mice Fed on [X] Endotoxin-Treated Potatoes and Transgenic Potatoes*, *Natural Toxins* (1998).

Table of Contents: Health Risks of GE Foods, Volume II

Section 3: Toxicity

1. Jose L. Domingo, *Toxicity Studies of Genetically Modified Plants: A Review of the Published Literature*, Critical Review in Food Science and Nutrition (2007).
2. G. Séralini et al., *Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize*, Journal of Food and Chemical Toxicology (2012).
3. G. Séralini et al., *Answers to critics: why there is a long term toxicity due to a Roundup-tolerant genetically modified maize and to a Roundup herbicide*, Journal of Food and Chemical Toxicology (2012).
4. Alberto Finamore, et al., *Intestinal and Peripheral Immune Response to MON810 Maize Ingestion in Weaning and Old Mice*, Journal of Agricultural and Food Chemistry (2008).
5. Alejandra Paganelli, et al., *Glyphosate-Based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling*, Chemical Resources Toxicology (2010).
6. Dr. A. Velimirov, et al., *Biological Effects of Transgenic Maize NK603xMON810 Fed in Long Term Reproduction Studies in Mice* (2008).
7. Aziz Aris and Samuel Leblanc, *Maternal and Fetal Exposure to Pesticides Associated to Genetically Modified Foods in Eastern Townships of Quebec, Canada*, Reproductive Toxicology (2011).
8. César Paz-y-Miño, et al., *Evaluations of DNA Damage in an Ecuadorian Population Exposed to Glyphosate*, Brazilian Society of Genetics (2007).
9. G. Séralini, D. Cellier, J. Spiroux de Vendomois. *New analysis of a rat feeding study with a genetically modified maize reveals signs of hepatorenal toxicity*. Archives of Environmental Contamination and Toxicology. 52(4): 596–602 (2007).
10. Memorandum from Dr. Edwin J. Matthews to the Toxicology Section of the Biotechnology Working Group. Subject: "Analysis of the Major Plant Toxicants." Dated Oct. 28, 1991.
11. Memorandum from Dr. Samuel I. Shibko to Dr. James Maryanski, FDA Biotechnology Coordinator. Subject: "Revision of Toxicology Section of the *Statement of Policy: Foods Derived from Genetically Modified Plants*." Dated January 31, 1992.
12. Mikael Eriksson, et al., *Pesticide Exposure as Risk Factor for Non-Hodgkin Lymphoma Including Histopathological Subgroup Analysis*, International Journal of Cancer (2008).

13. R.C. Lajmanovich, et al., *Induction of Mortality and Malformation in Scinax nasicus Tadpoles Exposed to Glyphosate Formulations*, Bulletin of Environmental Contamination and Toxicology (2003).
14. R. Mesnage, et al., *Cytotoxicity on Human Cells of CryIAb and CryIAc Bt Insecticidal Toxins Alone or With a Glyphosate-Based Herbicide*, Journal of Applied Toxicology (2011).

Section 4: Uncertainty

1. Arpad Pusztai, *Can Science Give Us the Tools for Recognizing Possible Health Risks of GM Food?*, Nutrition and Health, pp.73-84 (2002).
2. Comments from Division of Food Chemistry and Technology and Division of Contaminants Chemistry. "Points to Consider for Safety Evaluation of Genetically Modified Foods. Supplemental Information." Dated Nov. 1, 1991.
3. Comments from Dr. Carl B. Johnson on the "draft statement of policy 12/12/91." Dated Jan. 8, 1992.
4. Comments from Dr. Linda Kahl, FDA Compliance Officer, to Dr. James Maryanski, FDA Biotechnology Coordinator, on the "Statement of Policy: Foods from Genetically Modified Plants." Dated Jan. 8, 1992.
5. Kaiser Permanente, "What you need to know about GMOs," Partners in Health Newsletter Fall 2012.

This binder includes documents that discuss the environmental risks associated with genetically engineered crops.

This binder includes:

- *Gone to Seed, Transgenic Contaminants in the Traditional Seed Supply* by the Union of Concerned Scientists
- *Pollen-and-Seed-Mediated Transgene Flow in Commercial Cotton Seed Production Fields* by S. Heuberger, C. Ellers-Kirk, B. Tabashnik, and Y. Carrière
- *GM Soy, Sustainable? Responsible? A Summary of Scientific Evidence Showing that Genetically Modified (GM) Soy and the Glyphosate Herbicide it is Engineered to Tolerate are Unsustainable from the Point of View of Farming, the Environment, Rural Communities, Animal and Human Health, and Economies* by Michael Antoniou
- *Recent Long-Distance Transgene Flow into Wild Populations Conforms to Historical Patterns of Gene Flow in Cotton (*Gossypium hirsutum*) at its Centre of Origin* by A. Wegier, et al.
- *GMO Myths and Truths: An Evidence-Based Examination of the Claims Made for the Safety and Efficacy of Genetically Modified Crops* by Michael Antoniou, Claire Robinson, and John Fagan
- *The Establishment of Genetically Engineered Canola Populations in the U.S.* by M. Schafer, A. Ross, J. Londo, et al.
- *Environmental Concerns with the Development of Herbicide-Tolerant Plants* by Rebecca J. Goldberg
- *Evidence of Reduced Arbuscular Mycorrhizal Fungal Colonization in Multiple Lines of BT Maize* by Tanya Cheeke, Todd N. Rosentiel, and Mitchell B. Cruzan
- *Milkweed Loss in Agricultural Fields Because of Herbicide Use: Effect on the Monarch Butterfly Population* by John M. Pleasants and Karen S. Oberhauser
- *Increasing Cropping System Diversity Balances Productivity, Profitability and Environmental Health* by Adam S. Davis, Jason D. Hill, Craig A. Chase, Ann M. Johanns, and Matt Liebman
- *Impacts of Genetically Engineered Crops on Pesticide Use in the U.S.-the First Sixteen Years* by Charles M. Benbrook

GE Labeling – Additional Materials for VT Legislature Spring 2014

TABLE OF CONTENTS

Tab A Summaries 2014

- GE Labeling – Legal Summary
- GE Labeling – Summary of Materials
- GE Labeling – Legal One-Pager
- GE Labeling – Summary New Materials 2014

Tab B Health 2014

- European Network of Scientists for Social & Environmental Responsibility, *No Scientific Consensus on GMO Safety* (Oct. 21, 2013)
- Mezzomo et al., *Hematotoxicity of Bacillus thuringiensis as Spore-crystal Strains Cry1Aa, Cry1Ab, Cry1Ac or Cry2Aa in Swiss Albino Mice*, *Journal of Hematology & Thromboembolic Diseases* (2013)
- Judy A. Carman et al., *A Long-term Toxicology Study on Pigs Fed a Combined Genetically Modified (GM) Soy & GM Maize Diet*, *Journal of Organic Systems* (2013)
- Hans-Wolfgang Hoppe, *Determination of Glyphosate Residues in Human Urine Samples from 18 European Countries*, Report from the Medical Laboratory Bremen (June 6, 2013)
- S. Thongprakaisang et al., *Glyphosate Induces Human Breast Cancer Cells Growth via Estrogen Receptors*, *Journal of Food & Chemical Toxicology* (June 10, 2013)
- Jose L. Domingo & Jordi Gine Bordonaba, *A Literature Review on the Safety of Genetically Modified Plants*, *Environment International* (May 2011)
- Michael Antoniou, *Sources & Mechanisms of Health Risks from Genetically Modified Crops & Foods* (Third World Network Sept. 2013)
- David Schubert & William Freese, *Safety Testing & Regulation of Genetically Engineered Foods*, *Biotechnology & Genetic Engineering Reviews* (Nov. 2004)

Tab C Consumer Confusion & Deception 2014

- New York Times poll, reported by Alison Kopicki, *Strong Support for Labeling Modified Foods* (July 27, 2013)
- Statement, *Vermont Consumer Food Cooperatives Support GMO Labeling* (2013)
- Hartman Group, *Organic & Natural 2012*
- ABC News poll, reported by Gary Langer, *Poll: Skepticism of Genetically Modified Foods* (June 19, 2013)
- HuffPost/YouGov, *Omnibus Poll* (2013)
- Thomson Reuters, *National Survey of Healthcare Consumers: Genetically Engineered Food* (Oct. 2010)
- Consumer Reports National Research Center, *Food-Labeling Poll 2008*, NRC #2008.18 (Nov. 11, 2008)

Tab D Costs 2014

- Kai Robertson, *Independent Study: Why Label Changes Don't Affect Food Prices* (Sept. 11, 2013)
- Joanna M. Shepherd-Bailey, Ph.D., *Economic Assessment of Washington Initiative 522*

Tab E Legal 2014


- *American Meat Institute v. USDA* (D.D.C., Sept. 2013)
- State of Oregon Legislative Counsel Committee, Letter to Representative Brad Witt (April 19, 2013)

This binder includes documents that explain religious concerns regarding genetically engineered foods.

This binder includes:

- *Caring for Life: Genetics, Agriculture and Human Life* by the World Council of Churches
- *Book of Resolutions and Advocacy Issues* of the United Methodist Church
- *2011 Statement of Conscience* of the Unitarian Universalist Association of Congregations
- *Faith and GMOs: Christian, Jewish and Hindu Congregations Urged to Vote Yes on 37* by Faith & GMOs
- *Christian Faith Leaders, GMOs, and Prop 37/Labeling* by Faith & GMOs
- *Why the Venture to Genetically Engineer our Food Offends Science, Religion, and the Bill of Rights* by the Alliance for Bio-Integrity
- *The Three Main Monotheistic Religions and GM Food Technology: An Overview of Perspectives* by Emmanuel B. Omobowale, Peter A. Singer, and Abdallah S. Daar
- *Vermont Religions* available at city-data.com

MONSANTO

Careers ... Investors ... Select a Country 

News & Views

Monsanto in the News

Newsroom

Issues & Answers

Executive Speeches
& PresentationsHome / [News & Views](#) / Glossary

Glossary

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#)
[N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)

A

[Acetanilide](#) - The active ingredient in a class of selective herbicides used predominantly in corn. Acetanilides are pre-emergent herbicides; pre-emergent herbicides are applied to prevent the germination of weeds.

[Adaptation](#) - Changes in an organism's structure or habits that help it adjust to its surroundings

[Adventitious Presence](#) - In modern plant biotechnology, adventitious presence refers to the unintended, trace levels of traits developed through modern plant biotechnology in seed, grain, or feed and food products.

[Agrobacterium Tumefaciens](#)- A genus of bacteria that researchers can use to transfer DNA to plants. *Agrobacterium tumefaciens* can infect plants and cause crown gall disease – a tumorous growth at the base of plants. The DNA transfer occurs naturally during the crown gall disease, and can be used as a method of transformation.

[Agronomics](#) - Agronomic practices are steps farmers incorporate into their farm management systems to improve soil quality, enhance water use, manage crop residue and improve the environment through better fertilizer management. These steps not only improve a farmer's bottom line by decreasing input costs, but also improve the environment by decreasing water use and over-fertilization. Agronomic practices encompass many areas of conservation from practicing reduced-tillage methods

B

[Bacillus thuringiensis \(Bt\)](#) - A naturally occurring bacterium present in soil and used successfully by home gardeners and organic farmers to control certain insects for more than 40 years. When ingested by a target insect, the protein produced by *Bt* destroys the insect by disturbing the digestive system. The *Bt* protein is harmless to other insects, people and animals.

[Biodiesel](#) - Renewable fuel created by combining methanol or ethanol (the base) with vegetable oil, such as canola or soybean oil, or animal fat. It can be used in any diesel engine, either by itself or blended with petroleum diesel.

[Biodiversity](#) - The word – a contraction of 'biological diversity' – refers to the number, variety and variability of living organisms. It encompasses three basic levels of organization in living systems: the genetic, species and ecosystem levels. Plant and animal species are the most commonly recognized units of biodiversity.

[Biofertilizers](#) - Microorganisms that increase the amount of nutrients available to plants.

[Biofuel](#) - Any fuel derived from an organic material that is not fossilized like coal or petroleum. Common sources of biofuel grown for the U.S. and European markets are corn, soybeans, flaxseed and rapeseed. Biofuel can appear in solid, liquid, or gas form.

[Biomass](#) - Organic, non-fossil material available on a renewable basis. Biomass includes all biological organisms, dead or alive, and their metabolic by-products that haven't been transformed by geological processes into substances such as coal or petroleum.

[Biopesticides](#) - Microorganisms that increase the amount of nutrients available to plants.

[Biosphere](#) - That part of a planet's outer shell -- including air, land, and water -- within which life occurs, and which biotic processes alter or transform.

[Biotechnology](#) - A broad term used to describe any technique that uses living organisms or parts of organisms to solve problems or develop new products. Biotechnology is used in a wide range of applications including the production of foods and medicines, testing for disease, removing wastes in the environment, and improving agricultural plants. Modern biotechnology includes the tools of genetic engineering, although it is only one of many applications. See [Plant Biotechnology](#)

Biotech Crop - A crop grown from seed that has been modified using biotechnology. Often biotech crops provide benefits through reduced need for plowing soil, reduction in pesticides, and added crop qualities and vigor.

Breeding - See [Plant Breeding](#)

Bt crops - Crops that are genetically engineered to carry a gene from the soil bacterium *Bacillus thuringiensis* (Bt). The bacterium produces proteins that are toxic to target pests but non-toxic to humans and other mammals. Crops containing the Bt gene are able to produce this toxin, thereby providing protection for the plant.

C

Carbon (or climate) neutral - When activities that reduce or capture carbon are paired successfully with those that produce it, they are said to be carbon neutral or climate neutral.

Carbon dioxide (CO₂) - A colorless, odorless, unreactive gas that is a normal part of the atmosphere. It is produced during the combustion of fossil fuels when the carbon in the fuels reacts with oxygen. It is also produced when living organisms respire. It is essential for plant nutrition. While relatively innocuous in itself, carbon dioxide and other greenhouse gases can trap the sun's heat in the atmosphere and contribute to Global Warming.

Carbon footprint - The total amount of greenhouse gases emitted directly and indirectly to support human activities, usually expressed in equivalent tons of either carbon or carbon dioxide.

Chromosome - Tightly coiled strands of genes (DNA) located in the nucleus of every cell that determines the inheritance of traits. Each chromosome has a fixed number of genes, and every species has a characteristic number of chromosome pairs – humans have 23 pairs, mice have 19 and pea plants have 7.

Climate change - Any long-term significant change in the "average weather" that a given region experiences. Average weather may include average temperature, precipitation and wind patterns. It involves changes in the variability or average state of the atmosphere over durations ranging from decades to millions of years. (see also Global Warming)

Conservation tillage - Crop production methods that de-emphasize use of the plow for weed removal and encompass a range of new farming production practices like reduced tillage, or no tillage. In general, these methods all include reduced use of the plow and increased use of crop mulch and cover on the fields.

Conventional Crop - A non-biotech hybrid or inbred crop grown with inputs, such as fertilizer, herbicides, and insecticides.

CSR (Corporate Social Responsibility) - A business outlook that acknowledges responsibilities to stakeholders -- including suppliers, customers, and employees as well as local and international communities in which it operates -- and the natural environment.

D

Diversity - In nature, a source of ecosystem strength since failures are unlikely to eliminate all species. Therefore, the ecosystem will recover in some form and continue.

DNA (deoxyribonucleic acid) - A complex molecule that contains, in chemically coded form, all the information needed to build, control and maintain a living organism. DNA is a ladder-like double-stranded nucleic acid that forms the basis of genetic inheritance in all organisms except for a few viruses. In organisms other than bacteria, it is organized into chromosomes and contained in the cell nucleus.

Double cropping - Consecutively producing two crops that are either the same or of different varieties on the same land in a single year.

E

Ecological footprint - A term to describe the total ecological impact (the amount of land, food, water, and other resources needed) to sustain a person or organization. This is usually measured in acres or hectares of productive land. It is used to determine relative consumption.

Ecology - A science that studies the Earth and its systems, including the interrelationships of all living things and all elements of their environment. The science was further developed from the work of Ernest Haeckel when investigating 'the study of living things within their environmental context.'

Ecosystem - A dynamic and interdependent living community of people, parts or mechanisms that interact with one another. The term was coined by Arthur Tansley, a British Ecologist, who said that "ecosystems have the capacity to respond to change without altering the basic characteristics of the system."

Environmental Impact Quotient (EIQ) - A universal indicator that integrates the various environmental impacts of individual pesticides into a single field value per acre (hectare). EIQ incorporates the impact of the key toxicity and environmental exposure data on farm workers, consumers and ecology, providing a consistent and comprehensive measure of the non-

intentional impact of different pesticides on the environment. EIQ is not universally accepted and is an indicator only; it does not take into account all environmental issues and impacts.

Erosion - A process by which rock particles and soil are detached from their original site, transported and deposited in a new location. The main agents of erosion are water and wind.

Extension (Agricultural) - Agricultural extension is the function of providing need- and demand-based knowledge in agronomic techniques and skills to rural communities in a systematic, participatory manner, with the objective of improving their production, income and (by implication) quality of life. Extension is essentially education and it aims at bringing about positive behavioral changes among farmers.

F

Farm inputs - The resources that are used (e.g. seeds, chemicals, equipment) in farm production.

Feed - A mixture or preparation of food for feeding livestock.

Fertigation - The application of fertilizers, soil amendments, or other water-soluble products through an irrigation system.

FFA - Formerly Future Farmers of America, The National FFA Organization is an organization focused on helping to prepare future generations for the challenges of feeding a growing population. It also helps helping them explore their interests in a broad range of career pathways.

Field trial - A test of a new technology or variety, including biotech-derived varieties, done outside the laboratory but with specific limitations and requirements on location, plot size, methodology, etc.

Food security - Having access at all times to ample food for leading a healthy and active life.

G

Gene - A specific segment of DNA in a chromosome that produces a specific product or has an assigned

Genetic modification (genetic engineering) - The technique of removing, modifying or adding genes to a living organism via genetic engineering or other more traditional methods. Also referred to as gene splicing, recombinant DNA (rDNA) technology or genetic engineering.

Genetically engineered organism (GEO) - See genetically modified organism (GMO).

Genetically Modified Organisms (GMO) - Plants or animals that have had their genetic makeup altered to exhibit traits that are not naturally theirs. In general, genes are taken (copied) from one organism that shows a desired trait and transferred into the genetic code of another organism.

Genetics - The study of the patterns of inheritance of specific traits.

Genome - All the genetic material in all the chromosomes of a particular organism. It is the master blueprint for the total set of an organism's genes.

Genomics - The science that identifies crop traits and accelerate plant breeding. It is one of the tools used to "mine" germplasm, finding the best combinations of characteristics that can be bred or introduced into plants for better products. Genomics allows the "mapping" of a plant's genes to understand its structure and the role it plays in the plant's function.

Genotyping - This is the process of determining the genes (genotype) of an individual by examining the individual's DNA sequence by using biological assays.

Germplasm - The basic genetic material for any plant, used to develop new seed varieties. Within the germplasm are the basic characteristics that make plants what they are.

Global warming - An aspect of climate change, it is the gradual, average increase of temperature of the Earth's atmosphere and oceans. Global warming is accelerated by the greenhouse gases expelled into the atmosphere from man-made sources.

Glyphosate - The active ingredient in Roundup herbicide. Roundup is a post-emergent herbicide, and is the world's leading nonselective herbicide brand, used primarily in agricultural settings.

Glyphosate tolerant (Roundup Ready) crops - A common herbicide-tolerant crop, which provide tolerance to glyphosate, an herbicide effective on many species of grasses, broadleaf weeds and sedges. Roundup Ready crops (cotton, corn, soybeans, and canola) contain the Roundup Ready gene, which allows glyphosate to be applied to the crop to provide effective weed control without damaging the crop itself.

Green - A common metaphor referring to environmental association based on the shared secondary color of many plants. It is often used to associate products, organizations, political parties, or policies with environmental sensitivity.

[Greenhouse effect](#) - Process whereby greenhouse gases released into the atmosphere cause heat to be trapped in the atmosphere rather than escaping into space. The greenhouse gases form an insulating blanket around the planet. This blanket allows light and heat from the sun through, but prevents some of the heat, which radiates back from the earth from escaping. The same effect occurs in greenhouses, hence the name. The effect is natural and vital to current life forms on earth. Without it, the planet would be frozen.

[Greenhouse Gas](#) - Gases produced from human activities that trap solar radiation and thus contribute to climate change and the destruction of the ozone layer. These include carbon dioxide (CO₂), methane (CH₄) and Hydrofluorocarbons (HFCs).

H

[Habitat](#) - The area in which a given population lives, which is distinguished by its physical features and/or main plants.

[Hectare](#) - A unit of surface, or land, measure equal to 100 ares, or 10,000 square meters: equivalent to 2.471 acres.

[Herbicide](#) - A substance used to kill plants, especially weeds.

[Herbicide-tolerant crops](#) - Crops that have been developed to survive application(s) of particular herbicides by the incorporation of certain gene(s) either through genetic engineering or traditional breeding methods. The genes allow the herbicides to be applied to the crop to provide effective weed control without damaging the crop itself.

[Hybrid](#) - A plant that is heterogeneous; the offspring of two plants of the same species but different varieties.

I

[Infiltration](#) - The downward movement of water into soil. The higher the infiltration rate, the higher level of moisture in the soil for crops.

[Input](#) - Resources used in agriculture to produce a crop, including seed, fertilizer, herbicide, and insecticide.

[Insecticide](#) - A substance used to control certain populations of insect pests. In agriculture, insecticides are used to control insect pests that feed on crops or carry plant disease.

[Insect-resistant crops](#) - Plants with the ability to withstand, deter or repel insects and thereby prevent them from feeding on the plant. The traits (genes) determining resistance may be selected by plant breeders through cross-pollination with other varieties of this crop or through the introduction of novel genes such as Bt genes through genetic engineering.

[Invasive species](#) - An alien species of animals, plants or pests that, when introduced, will likely produce harm to the environment and/or human health.

[Irrigation](#) - Irrigation is an artificial application of water to the soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and re-vegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

L

[Land treatment](#) - Any project that both enhances production and improves the conservation of natural resources such as water and soil.

[Land trust](#) - A nonprofit 501 (c)3 organization that may receive donations of money, property or development rights. These organizations may use their assets to purchase property or development rights.

[Leaching](#) - Leaching refers to the loss of water-soluble plant nutrients from the soil, due to rain and irrigation.

[Legumes](#) - A family of plants, including many valuable food, forage and cover species, such as peas, beans, soybeans, peanuts, alfalfas, sweet clovers, and kudzu. Legumes are an important rotation crop because of their nitrogen-fixing property.

[Low-flow irrigation system](#) - These systems-- which include drip, trickle, and micro sprinklers-- provide water in small volumes and generally provide water to plants with less waste than furrow irrigation.

[Low-input sustainable agriculture \(LISA\)](#) - A collection of agricultural methods such as crop rotation that lessen the need for farmers to apply fertilizers, pesticides and herbicides.

M

[Marginal / Small Holder Farmer](#) - This term, including similar terms such as "resource-poor" and "subsistence farmers," refers to a farmer who grows just enough food for his family's own needs with little, if anything, left over to sell.

[Marker genes](#) - Genes coding for particular traits that allow a microorganism to be tracked.

[Marker-assisted breeding](#) (also Molecular Breeding) - An enhanced tool that involves the use of DNA markers for genes in combination with physical measurement of traits to accelerate selection in plant breeding programs. Also called molecular breeding.

Molecular breeding - See [Marker-assisted breeding](#)

N

[No-till farming](#) - A method of farming that eliminates plowing to prepare the land for planting seeds and weed control. Instead, crop residue is left on fields, and seed and nutrients are placed in narrow rows or in drilled holes. Weed control is accomplished with suitable herbicides. Because the soil is not disturbed or exposed through plowing, it is much less susceptible to erosion from both water and wind.

O

[Organic \(Chemical\)](#) - A compound containing carbon bound to hydrogen.

[Organic \(Food and Agriculture\)](#) - Organic is a term used to describe products or processes that are developed without the use of 'man-made' or synthetic products or processes. In organic farming natural fertilizers, cultivation methods, and pesticides derived from natural sources are used as an alternative to synthetic chemicals.

[Overshoot](#) - The amount that any value exceeds its intended measure. In sustainability terms, overshoot is often the amount a variable (such as a measure of environmental impact) exceeds what is thought to be acceptable. Overshoots can be positive but are usually used to convey negative impacts of activity.

P

[Patent](#) - A license, issued by the government, granting the patent holder rights to a process, design, or new invention for a designated period of time. Since the passage of the Plant Patent Act of 1930, it has been possible to patent to control new varieties of plants in the United States.

[Pesticide](#) - A substance used pests, such as harmful insects, weeds or microorganisms.

[Pest-resistant crops](#) - Plants with the ability to withstand, deter or repel pests and thereby prevent them from damaging the plants. Plant pests may include insects, nematodes, fungi, viruses, bacteria, and weeds, among others.

[Phytostimulators](#) - Microorganisms that stimulate plant growth through the production of compounds such as hormones.

[Plant Biotechnology](#) - Plant biotechnology allows for the transfer of a greater variety of genetic information in a more precise, controlled manner. It allows for the transfer of one, or a few, genes that can introduce traits such as better insect and weed control.

[Plant breeding](#) - The act of bringing together two specific parent plants to produce a new offspring plant. Plant breeders use cross-pollination, selection and other techniques to produce plant varieties with particular desired characteristics (genes) that can be passed on to future plant generations.

[Plant pests](#) - Organisms that may directly or indirectly cause disease, spoilage or damage to plants, plant parts or processed plant materials. Common examples include certain insects, mites, nematodes, fungi, molds, viruses and bacteria.

[Plant Rooting Zone](#) - This is the entire area where roots are growing below the plant. Root zones are important for future plantings.

[Plow](#) - A tool used in farming for initial cultivation of soil in preparation for sowing seed or planting.

[Post-emergent herbicide](#) - A herbicide that controls weeds after they emerge from the ground.

[Pre-emergent herbicide](#) - A herbicide that controls weeds before they emerge from the ground.

[Protein](#) - A molecule composed of one or more chains of amino acids in a specific order. Proteins are required for the structure, function and regulation of an organism's cells and tissues, and each protein has a unique function.

Q

[Quarantine](#) - A restraint on importation of certain animals or plants from areas where pests or contagious diseases are endemic - or isolation of animals or plants suspected of carrying pests or diseases - to prevent the spread of those pests and diseases.

R

[Recombinant DNA \(rDNA\)](#) - Procedures used to join DNA segments in a cell-free system (e.g. in a test tube outside living cells or organisms). Under appropriate conditions, a recombinant DNA molecule can be introduced into a cell and copy itself

(replicate), either as an independent entity (autonomously) or as an integral part of a cellular chromosome.

Reduced Tillage – A method of farming that reduces plowing to prepare the land for planting seeds and weed control. In reduced tillage typically 15%-30% of the previous crop residue is left on fields.

Renewable - Any material or energy that can be replenished in full without loss or degradation in quality

S

Seed Chipping - Seed chipping is technology that allows the analysis of each seed before planting and advancement of only seeds with product potential.

Seed Drill - A seed drill is a sowing device that precisely positions seeds in the soil and then covers them.

Seed Production - The process of growing crops to be sold as seed, instead of growing crops to sell as food or feed. Because each seed will become a crop plant, seed production requires high standards for quality and germination.

Seeding Rates - The amount of seeding material released per unit time, per unit distance traveled, or per amount of air.

Selective breeding - Making deliberate crosses or matings of organisms so the offspring will have particular desired characteristics derived from one or both of the parents.

Solar energy - Direct radiant energy from the sun. It also includes indirect forms of energy such as wind, falling or flowing water (hydropower), ocean thermal gradients, and biomass, which are produced when direct solar energy interact with the earth.

Soil Profile - The vertical display of soil horizons or layers.

Stacking – See trait stacking

Stewardship - Responsible caretaking; based on the premise that we do not own resources but only manage them, and are responsible to future generations for their condition.

Subsistence - The means of living; obtaining food and shelter necessary to support life; everything that is done to "make a living."

Subsistence farmer - A farmer who grows just enough food for his family's own needs with little, if anything, left over to sell.

Substantial Equivalence - Substantial equivalence means that a GM crop has similar components and nutritional characteristics as its conventional (non-GM) counterpart. Specifically that the range of concentrations for components and nutritional characteristics of the GM crop falls within the typical range for the non-GM counterpart. Substantial equivalence is accepted and utilized by most regulatory agencies worldwide.

Sustainability - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable agriculture- Farming methods that allow the production of crops or livestock without damage to the farm as an ecosystem, including effects on soil, water supplies, biodiversity or other surrounding natural resources. The concept of sustainable agriculture is an "intergenerational" one in which we pass on a conserved or improved natural resource base instead of one which has been depleted or polluted.

Sustainable development - A pattern of resource use that seeks to meet human needs while preserving the natural environment so these needs can be met in the present and in the indefinite future.

Sustainable management - The ability to direct the course of a company, community, organization, country or any activity that restore and enhance all forms of capital (human, natural, manufactured, and financial) to generate stakeholder value and contribute to the well-being of current and future generations.

T

Tillage - Cultivation, including hoeing and plowing. In agriculture, tillage is used to fight weeds.

Traditional breeding - Modification of plants and animals through selective breeding. Practices used in traditional plant breeding may include aspects of biotechnology such as tissue culture and mutational breeding (mutagenesis).

Trait - An important characteristic of a crop (such as drought tolerance or insect resistance) that is determined by a specific gene or set of genes.

Trait stacking - The combination or "stacking" of traits allows the farmer to have the value of multiple traits, instead of having to choose between them. Within each respective crop, farmers can choose to combine different traits in a single seed, including insect-protection and herbicide tolerance. These product offerings are commonly referred to as "stacked" traits.

[Transgene](#) - A gene from one organism inserted into another organism by recombinant DNA techniques.

[Transgenic organism](#) - A plant, animal, bacterium or other living organism, which has had one or more transgenes added to it by means of genetic engineering.

U

[Upland cotton](#) - The most common variety of cotton grown in the United States.

V

[Value-added products](#) - Products that have increased in value because of processing, including wheat flour and soybean oil.

[Variety](#) - A group of individual plants that is uniform, stable and distinct genetically from other groups of individuals in the same species.

W

[Watershed](#) - The area that drains to a common waterway, such as a stream, lake, estuary, wetland, aquifer, or even the ocean.

[Wetlands](#) - Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs.

X

[Xeriscaping](#) - Landscaping based on native, water-efficient plants to minimize the need for irrigation.

Y

[Yield](#) - The number of bushels (or pounds or hundredweight) that a farmer harvests per acre.

Z

[Zero waste](#) - The goal of developing products and services, managing their use and deployment, and creating recycling systems and markets to eliminate the volume and toxicity of waste and materials, and to conserve and recover all resources.

Monsanto Homepage

Who We Are

Monsanto at a Glance
Our Commitments
Company Leadership
Corporate Governance
Company History
Partnering & Licensing
Our Locations
Contact Us

Products

Product Overview
Brands
Agricultural Seeds
Traits & Technologies
Vegetable Seeds
Weed Control Products
Research & Development
Product Stewardship
Weed Management
Product Safety

Careers

Search Jobs

News & Views

Monsanto in the News
Newsroom
Issues & Answers
Executive Speeches

Investors

Corporate Profile
Presentations & Reports
SEC Filings

Improving Agriculture

Why Does Agriculture Need to be Improved?
What Is Monsanto Doing to Help?
How Are We Doing It?

Visit Our Other Sites

Monsanto Gift Store
Monsanto Fund
America's Farmers
Improve Agriculture
Genuity
Asgrow & DEKALB
Deltapine
Channel
Roundup Ready PLUS
Monsanto Vegetable Seeds



[Advanced search](#)

Food safety

- [Food Safety](#)
- [Zoonoses](#)
- [Microbiological risks](#)
- [Chemical risks](#)
- [Biotechnology and nanotechnology](#)
- [Food standards \(Codex Alimentarius\)](#)
- [Foodborne disease](#)
- [Food production to consumption](#)
- [Capacity building](#)
- [Consumer education](#)

20 questions on genetically modified foods

20 QUESTIONS ON GENETICALLY MODIFIED (GM) FOODS

Q1. What are genetically modified (GM) organisms and GM foods?

These questions and answers have been prepared by WHO in response to questions and concerns by a number of WHO Member State Governments with regard to the nature and safety of genetically modified food.

Genetically modified organisms (GMOs) can be defined as organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally. The technology is often called “modern biotechnology” or “gene technology”, sometimes also “recombinant DNA technology” or “genetic engineering”. It allows selected individual genes to be transferred from one organism into another, also between non-related species.

Such methods are used to create GM plants – which are then used to grow GM food crops.

Q2. Why are GM foods produced?

GM foods are developed – and marketed – because there is some perceived advantage either to the producer or consumer of these foods. This is meant to translate into a product with a lower price, greater benefit (in terms of durability or nutritional value) or both. Initially GM seed developers wanted their products to be accepted by producers so have concentrated on innovations that farmers (and the food industry more generally) would appreciate.

The initial objective for developing plants based on GM organisms was to improve crop protection. The GM crops currently on the market are mainly aimed at an increased level of crop protection through the introduction of resistance against plant diseases caused by insects or viruses or through increased tolerance towards herbicides.

Insect resistance is achieved by incorporating into the food plant the gene for toxin production from the bacterium *Bacillus thuringiensis* (BT). This toxin is currently used as a conventional insecticide in agriculture and is safe for human consumption. GM crops that permanently produce this toxin have been shown to require lower quantities of insecticides in specific situations, e.g. where pest pressure is high.

Virus resistance is achieved through the introduction of a gene from certain viruses which cause disease in plants. Virus resistance makes plants less susceptible to diseases caused by such viruses, resulting in higher crop yields.

Herbicide tolerance is achieved through the introduction of a gene from a bacterium conveying resistance to some herbicides. In situations where weed pressure is high, the use of such crops has resulted in a reduction in the quantity of the herbicides used.

Q3. Are GM foods assessed differently from traditional foods?

Generally consumers consider that traditional foods (that have often been eaten


[Share](#)

[Print](#)

- [English](#)
pdf, 112kb
- [French](#)
pdf, 106kb
- [Spanish](#)
pdf, 117kb
- [Russian](#)
pdf, 258kb
- [Chinese](#)
pdf, 212kb
- [Arabic](#)
pdf, 587kb
- [Estonian](#)
pdf, 75kb

for thousands of years) are safe. When new foods are developed by natural methods, some of the existing characteristics of foods can be altered, either in a positive or a negative way. National food authorities may be called upon to examine traditional foods, but this is not always the case. Indeed, new plants developed through traditional breeding techniques may not be evaluated rigorously using risk assessment techniques.

With GM foods most national authorities consider that specific assessments are necessary. Specific systems have been set up for the rigorous evaluation of GM organisms and GM foods relative to both human health and the environment. Similar evaluations are generally not performed for traditional foods. Hence there is a significant difference in the evaluation process prior to marketing for these two groups of food.

One of the objectives of the WHO Food Safety Programme is to assist national authorities in the identification of foods that should be subject to risk assessment, including GM foods, and to recommend the correct assessments.

Q4. How are the potential risks to human health determined?

The safety assessment of GM foods generally investigates: (a) direct health effects (toxicity), (b) tendencies to provoke allergic reaction (allergenicity); (c) specific components thought to have nutritional or toxic properties; (d) the stability of the inserted gene; (e) nutritional effects associated with genetic modification; and (f) any unintended effects which could result from the gene insertion.

Q5. What are the main issues of concern for human health?

While theoretical discussions have covered a broad range of aspects, the three main issues debated are tendencies to provoke allergic reaction (allergenicity), gene transfer and outcrossing.

Allergenicity. As a matter of principle, the transfer of genes from commonly allergenic foods is discouraged unless it can be demonstrated that the protein product of the transferred gene is not allergenic. While traditionally developed foods are not generally tested for allergenicity, protocols for tests for GM foods have been evaluated by the Food and Agriculture Organization of the United Nations (FAO) and WHO. No allergic effects have been found relative to GM foods currently on the market.

Gene transfer. Gene transfer from GM foods to cells of the body or to bacteria in the gastrointestinal tract would cause concern if the transferred genetic material adversely affects human health. This would be particularly relevant if antibiotic resistance genes, used in creating GMOs, were to be transferred. Although the probability of transfer is low, the use of technology without antibiotic resistance genes has been encouraged by a recent FAO/WHO expert panel.

Outcrossing. The movement of genes from GM plants into conventional crops or related species in the wild (referred to as "outcrossing"), as well as the mixing of crops derived from conventional seeds with those grown using GM crops, may have an indirect effect on food safety and food security. This risk is real, as was shown when traces of a maize type which was only approved for feed use appeared in maize products for human consumption in the United States of America. Several countries have adopted strategies to reduce mixing, including a clear separation of the fields within which GM crops and conventional crops are grown.

Feasibility and methods for post-marketing monitoring of GM food products, for the continued surveillance of the safety of GM food products, are under discussion.

Q6. How is a risk assessment for the environment performed?

Environmental risk assessments cover both the GMO concerned and the potential receiving environment. The assessment process includes evaluation of the characteristics of the GMO and its effect and stability in the environment, combined with ecological characteristics of the environment in which the

introduction will take place. The assessment also includes unintended effects which could result from the insertion of the new gene.

Q7. What are the issues of concern for the environment?

Issues of concern include: the capability of the GMO to escape and potentially introduce the engineered genes into wild populations; the persistence of the gene after the GMO has been harvested; the susceptibility of non-target organisms (e.g. insects which are not pests) to the gene product; the stability of the gene; the reduction in the spectrum of other plants including loss of biodiversity; and increased use of chemicals in agriculture. The environmental safety aspects of GM crops vary considerably according to local conditions.

Current investigations focus on: the potentially detrimental effect on beneficial insects or a faster induction of resistant insects; the potential generation of new plant pathogens; the potential detrimental consequences for plant biodiversity and wildlife, and a decreased use of the important practice of crop rotation in certain local situations; and the movement of herbicide resistance genes to other plants.

Q8. Are GM foods safe?

Different GM organisms include different genes inserted in different ways. This means that individual GM foods and their safety should be assessed on a case-by-case basis and that it is not possible to make general statements on the safety of all GM foods.

GM foods currently available on the international market have passed risk assessments and are not likely to present risks for human health. In addition, no effects on human health have been shown as a result of the consumption of such foods by the general population in the countries where they have been approved. Continuous use of risk assessments based on the Codex principles and, where appropriate, including post market monitoring, should form the basis for evaluating the safety of GM foods.

Q9. How are GM foods regulated nationally?

The way governments have regulated GM foods varies. In some countries GM foods are not yet regulated. Countries which have legislation in place focus primarily on assessment of risks for consumer health. Countries which have provisions for GM foods usually also regulate GMOs in general, taking into account health and environmental risks, as well as control- and trade-related issues (such as potential testing and labelling regimes). In view of the dynamics of the debate on GM foods, legislation is likely to continue to evolve.

Q10. What kind of GM foods are on the market internationally?

All GM crops available on the international market today have been designed using one of three basic traits: resistance to insect damage; resistance to viral infections; and tolerance towards certain herbicides. All the genes used to modify crops are derived from microorganisms.

Q11. What happens when GM foods are traded internationally?

No specific international regulatory systems are currently in place. However, several international organizations are involved in developing protocols for GMOs.

The Codex Alimentarius Commission (Codex) is the joint FAO/WHO body responsible for compiling the standards, codes of practice, guidelines and recommendations that constitute the Codex Alimentarius: the international food code. Codex is developing principles for the human health risk analysis of GM foods. The premise of these principles dictates a premarket assessment, performed on a case-by-case basis and including an evaluation of both direct effects (from the inserted gene) and unintended effects (that may arise as a consequence of insertion of the new gene). The principles are at an advanced stage of development and are expected to be adopted in July 2003. Codex principles do not have a binding effect on national legislation, but are referred to specifically in the Sanitary and Phytosanitary Agreement of the World Trade

Organization (SPS Agreement), and can be used as a reference in case of trade disputes.

The Cartagena Protocol on Biosafety (CPB), an environmental treaty legally binding for its Parties, regulates transboundary movements of living modified organisms (LMOs). GM foods are within the scope of the Protocol only if they contain LMOs that are capable of transferring or replicating genetic material. The cornerstone of the CPB is a requirement that exporters seek consent from importers before the first shipment of LMOs intended for release into the environment. The Protocol will enter into force 90 days after the 50th country has ratified it, which may be in early 2003 in view of the accelerated depositions registered since June 2002.

Q12. Have GM products on the international market passed a risk assessment?

The GM products that are currently on the international market have all passed risk assessments conducted by national authorities. These different assessments in general follow the same basic principles, including an assessment of environmental and human health risk. These assessments are thorough, they have not indicated any risk to human health.

Q13. Why has there been concern about GM foods among some politicians, public interest groups and consumers, especially in Europe?

Since the first introduction on the market in the mid-1990s of a major GM food (herbicide-resistant soybeans), there has been increasing concern about such food among politicians, activists and consumers, especially in Europe. Several factors are involved.

In the late 1980s – early 1990s, the results of decades of molecular research reached the public domain. Until that time, consumers were generally not very aware of the potential of this research. In the case of food, consumers started to wonder about safety because they perceive that modern biotechnology is leading to the creation of new species.

Consumers frequently ask, “what is in it for me?”. Where medicines are concerned, many consumers more readily accept biotechnology as beneficial for their health (e.g. medicines with improved treatment potential). In the case of the first GM foods introduced onto the European market, the products were of no apparent direct benefit to consumers (not cheaper, no increased shelf-life, no better taste). The potential for GM seeds to result in bigger yields per cultivated area should lead to lower prices. However, public attention has focused on the risk side of the risk-benefit equation.

Consumer confidence in the safety of food supplies in Europe has decreased significantly as a result of a number of food scares that took place in the second half of the 1990s that are unrelated to GM foods. This has also had an impact on discussions about the acceptability of GM foods. Consumers have questioned the validity of risk assessments, both with regard to consumer health and environmental risks, focusing in particular on long-term effects. Other topics for debate by consumer organizations have included allergenicity and antimicrobial resistance. Consumer concerns have triggered a discussion on the desirability of labelling GM foods, allowing an informed choice. At the same time, it has proved difficult to detect traces of GMOs in foods: this means that very low concentrations often cannot be detected.

Q14. How has this concern affected the marketing of GM foods in the European Union?

The public concerns about GM food and GMOs in general have had a significant impact on the marketing of GM products in the European Union (EU). In fact, they have resulted in the so-called moratorium on approval of GM products to be placed on the market. Marketing of GM food and GMOs in general are the subject of extensive legislation. Community legislation has been in place since the early 1990s. The procedure for approval of the release of GMOs into the environment is rather complex and basically requires agreement between the

Member States and the European Commission. Between 1991 and 1998, the marketing of 18 GMOs was authorized in the EU by a Commission decision.

As of October 1998, no further authorizations have been granted and there are currently 12 applications pending. Some Member States have invoked a safeguard clause to temporarily ban the placing on the market in their country of GM maize and oilseed rape products. There are currently nine ongoing cases. Eight of these have been examined by the Scientific Committee on Plants, which in all cases deemed that the information submitted by Member States did not justify their bans.

During the 1990s, the regulatory framework was further extended and refined in response to the legitimate concerns of citizens, consumer organizations and economic operators (described under Question 13). A revised directive will come into force in October 2002. It will update and strengthen the existing rules concerning the process of risk assessment, risk management and decision-making with regard to the release of GMOs into the environment. The new directive also foresees mandatory monitoring of long-term effects associated with the interaction between GMOs and the environment.

Labelling in the EU is mandatory for products derived from modern biotechnology or products containing GM organisms. Legislation also addresses the problem of accidental contamination of conventional food by GM material. It introduces a 1% minimum threshold for DNA or protein resulting from genetic modification, below which labelling is not required.

In 2001, the European Commission adopted two new legislative proposals on GMOs concerning traceability, reinforcing current labelling rules and streamlining the authorization procedure for GMOs in food and feed and for their deliberate release into the environment.

The European Commission is of the opinion that these new proposals, building on existing legislation, aim to address the concerns of Member States and to build consumer confidence in the authorization of GM products. The Commission expects that adoption of these proposals will pave the way for resuming the authorization of new GM products in the EU.

Q15. What is the state of public debate on GM foods in other regions of the world?

The release of GMOs into the environment and the marketing of GM foods have resulted in a public debate in many parts of the world. This debate is likely to continue, probably in the broader context of other uses of biotechnology (e.g. in human medicine) and their consequences for human societies. Even though the issues under debate are usually very similar (costs and benefits, safety issues), the outcome of the debate differs from country to country. On issues such as labelling and traceability of GM foods as a way to address consumer concerns, there is no consensus to date. This has become apparent during discussions within the Codex Alimentarius Commission over the past few years. Despite the lack of consensus on these topics, significant progress has been made on the harmonization of views concerning risk assessment. The Codex Alimentarius Commission is about to adopt principles on premarket risk assessment, and the provisions of the Cartagena Protocol on Biosafety also reveal a growing understanding at the international level.

Most recently, the humanitarian crisis in southern Africa has drawn attention to the use of GM food as food aid in emergency situations. A number of governments in the region raised concerns relating to environmental and food safety fears. Although workable solutions have been found for distribution of milled grain in some countries, others have restricted the use of GM food aid and obtained commodities which do not contain GMOs.

Q16. Are people's reactions related to the different attitudes to food in various regions of the world?

Depending on the region of the world, people often have different attitudes to food. In addition to nutritional value, food often has societal and historical connotations, and in some instances may have religious importance.

Technological modification of food and food production can evoke a negative response among consumers, especially in the absence of good communication on risk assessment efforts and cost/benefit evaluations.

Q17. Are there implications for the rights of farmers to own their crops?

Yes, intellectual property rights are likely to be an element in the debate on GM foods, with an impact on the rights of farmers. Intellectual property rights (IPRs), especially patenting obligations of the TRIPS Agreement (an agreement under the World Trade Organization concerning trade-related aspects of intellectual property rights) have been discussed in the light of their consequences on the further availability of a diversity of crops. In the context of the related subject of the use of gene technology in medicine, WHO has reviewed the conflict between IPRs and an equal access to genetic resources and the sharing of benefits. The review has considered potential problems of monopolization and doubts about new patent regulations in the field of genetic sequences in human medicine. Such considerations are likely to also affect the debate on GM foods.

Q18. Why are certain groups concerned about the growing influence of the chemical industry on agriculture?

Certain groups are concerned about what they consider to be an undesirable level of control of seed markets by a few chemical companies. Sustainable agriculture and biodiversity benefit most from the use of a rich variety of crops, both in terms of good crop protection practices as well as from the perspective of society at large and the values attached to food. These groups fear that as a result of the interest of the chemical industry in seed markets, the range of varieties used by farmers may be reduced mainly to GM crops. This would impact on the food basket of a society as well as in the long run on crop protection (for example, with the development of resistance against insect pests and tolerance of certain herbicides). The exclusive use of herbicide-tolerant GM crops would also make the farmer dependent on these chemicals. These groups fear a dominant position of the chemical industry in agricultural development, a trend which they do not consider to be sustainable.

Q19. What further developments can be expected in the area of GMOs?

Future GM organisms are likely to include plants with improved disease or drought resistance, crops with increased nutrient levels, fish species with enhanced growth characteristics and plants or animals producing pharmaceutically important proteins such as vaccines. At the international level, the response to new developments can be found in the expert consultations organized by FAO and WHO in 2000 and 2001, and the subsequent work of the Codex ad hoc Task Force on Foods Derived from Biotechnology. This work has resulted in an improved and harmonized framework for the risk assessment of GM foods in general. Specific questions, such as the evaluation of allergenicity of GM foods or the safety of foods derived from GM microorganisms, have been covered and an expert consultation organized by FAO and WHO will focus on foods derived from GM animals in 2003.

Q20. What is WHO doing to improve the evaluation of GM foods?

WHO will take an active role in relation to GM foods, primarily for two reasons:

(1) on the grounds that public health could benefit enormously from the potential of biotechnology, for example, from an increase in the nutrient content of foods, decreased allergenicity and more efficient food production; and (2) based on the need to examine the potential negative effects on human health of the consumption of food produced through genetic modification, also at the global level. It is clear that modern technologies must be thoroughly evaluated if they are to constitute a true improvement in the way food is produced. Such evaluations must be holistic and all-inclusive, and cannot stop at the previously separated, non-coherent systems of evaluation focusing solely on human health or environmental effects in isolation.

Work is therefore under way in WHO to present a broader view of the evaluation of GM foods in order to enable the consideration of other important factors. This

more holistic evaluation of GM organisms and GM products will consider not only safety but also food security, social and ethical aspects, access and capacity building. International work in this new direction presupposes the involvement of other key international organizations in this area. As a first step, the WHO Executive Board will discuss the content of a WHO report covering this subject in January 2003. The report is being developed in collaboration with other key organizations, notably FAO and the United Nations Environment Programme (UNEP). It is hoped that this report could form the basis for a future initiative towards a more systematic, coordinated, multi-organizational and international evaluation of certain GM foods.

Food safety > Publications related to food safety > Biotechnology (GM foods) publications



Sitemap

Home
 Health topics
 Data and statistics
 Media centre
 Publications
 Countries
 Programmes and projects
 About WHO

Help and Services

Contacts
 FAQs
 Employment
 Feedback
 Privacy
 E-mail scams

WHO Regional Offices

WHO African Region
 WHO Region of the Americas
 WHO South-East Asia Region
 WHO European Region
 WHO Eastern Mediterranean Region
 WHO Western Pacific Region

Connect with WHO

RSS Feeds
 WHO YouTube channel
 Follow WHO on Twitter
 WHO Facebook page
 WHO Google+ page

© WHO 2012