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The Potential Impacts of Mandatory Labeling for Genetically Engineered Food in the United States

No label is currently required for genetically engineered food in the United States. This Issue Paper discusses the potential legal and economic implications of mandatory GE labeling. (Source photo and artwork from Shutterstock.)

Abstract

Although genetically engineered (GE) products are used around the world, their use in food products has become a contentious issue for some consumers. A key point in the resulting debate centers on proposals regarding the mandatory labeling of GE food.

Many U.S. states are considering legislation to mandate such labels. This publication examines arguments for and against labels, the costs involved with labeling, and experiences in countries that use mandatory labeling. The authors start from the premise that hundreds of independent studies have determined that foods made using GE ingredients are safe. They gather factual information to produce a peer-reviewed publication that clarifies the potential impacts of mandatory labeling.

Proponents of mandatory GE labeling cite the right to know what is in their food as an important attribute of a democratic society. Opponents think that such a label will increase the cost of food and confuse consumers with no corresponding improvement in human health or food safety. Seemingly contradictory studies are cited to support opposing views—informed discourse about this emotional issue is hard to find. The authors examine key aspects of the arguments:

- Public opinion, polls, and methods used
- Consumer choice and interpretations that support both sides in this respect
- Right-to-know issues—and the complications inherent with the right to know "what" and "at what cost"
- Food safety and testing—and the lack of any evidence that GE foods have harmful effects

Many state labeling initiatives suggest there are remaining food safety concerns about GE organisms and, therefore, mandatory labeling

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should be implemented. Some say these products are intrinsically different because they would not have occurred in nature through natural processes. To date, no material differences in composition or safety of commercialized GE crops have been identified that would justify a label based on the GE nature of the product. Whereas this conclusion will not satisfy those who consider the insertion or manipulation of genes in a laboratory a material difference per se, the science of food safety does not support mandatory process-based labeling of GE food and, by extension, neither does the Food and Drug Administration.

This paper examines legal issues—the Commerce Clause, the First Amendment, label location, state versus national jurisdictions—and economic impacts. The authors conclude the following:

1. There is no science-based reason to single out GE foods and feeds for mandatory process-based labeling.
2. Mandatory labeling based on process abandons the traditional U.S. practice of providing for consumer food preferences through voluntary product differentiation and labeling.
3. Market-driven voluntary labeling measures are currently providing consumers with non-GE choices.
4. Mandatory labeling could have negative implications for First Amendment rights and trade issues.
5. Mandatory labeling will increase food costs.

The authors finish with a call for better communication about this issue: "Independent objective information on the scientific issues and the possible legal and economic consequences of mandatory GE food labels need to be provided to legislators and consumers, especially in states with labeling initiatives on the ballot, to help move the national discussion from contentious claims to a more fact-based and informed dialog." All legislative references in this document were current as of March 1, 2014, at the completion of writing.

Introduction

Genetic engineering (GE) can be defined as the manipulation of an organism's genes by introducing, eliminating, or rearranging specific genes using the methods of modern molecular biology, particularly those techniques referred to as recombinant deoxyribonucleic acid (rDNA) techniques. Genetically engineered microorganisms, and products derived from them, have found widespread use in the pharmaceutical (e.g., human insulin used by diabetics), chemical, and food (e.g., rennin used to produce cheese) industries with no documented reports of adverse impacts. In general, GE labels are not required on these products, or the foods resulting from their use in food processing, in any part of the world (Mansour and Key 2004).

The use of GE in the production of these widely used products is relatively noncontroversial; however, the application of rDNA technology to produce GE or transgenic plants and animals that are used as food has proved to be highly contentious for some consumers. The purposes of this paper are to (1) explore the scientific, legal, and economic aspects of requiring food labeling in the United States based on the use of a process (i.e., GE) rather than on some attribute of the food product itself, and (2) clearly discuss the complex considerations that come into play when contemplating mandatory GE food labeling in the United States.

Genetically engineered organisms and products made from them go by many names, including genetically modified (GM), genetically modified organism (GMO), transgenic, biotech, bioengineered, or products made with modern biotechnology. Given that traditional breeding techniques also result in genetic modifications and hence this term is not specific for the use of rDNA, in this document the term GE is used rather than the more common and pervasive, but less precise, term GM. Typically, food produced using GE food processing aids or enzymes, and the meat, milk, and egg products derived from animals that have eaten GE feed or been treated with GE therapeutics or vaccines, have not been considered to be GE foods.

A total of 165 GE crop events in 19 plant species (alfalfa [2], canola [20], chicory [3], corn [38], cotton

[27], creeping bentgrass [1], flax [1], melon [2], papaya [3], plum [1], potato [28], rice [3], rose [2], soybean [19], squash [2], sugar beet [3], tobacco [1], tomato [8], and wheat [1]) have been approved in the United States (ISAAA 2013), although not all of these events are being grown commercially, and no GE animals have yet been approved for food purposes as of the time of this writing.

The first GE food product to come to the U.S. market in 1994, the MacGregor's brand of tomato grown from GE seeds, bore a voluntary GE label. It was branded with the Flavr Savr® name and was accompanied by in-store information about the delayed-softening characteristic. Since that time, growers have adopted approved GE crops extensively. For example, in 2013 GE varieties were planted on 95% of sugar beet, 93% of soy, and 90% of all cotton and corn hectares in the United States (USDA–NASS 2013a), and similar rates of adoption were observed in other major agricultural producing countries such as Argentina, Brazil, Canada, and South Africa.

In 2013, approximately 175.2 million hectares (433 million acres) of GE crops were cultivated worldwide (James 2014) by 18 million farmers. More than 90% (>16.5 million) were small-scale resource-poor farmers in developing countries. This planting was greater than a 100-fold increase from the 1.7 million hectares that were planted in 1996, making GE the fastest-adopted crop technology in recent history. Farmers have planted these GE varieties to enable the adoption of improved agronomic practices (e.g., no-till agriculture, decreased insecticide applications, use of less toxic herbicides) providing environmental, economic, and food security benefits (Ali and Abdulai 2010; Burachik 2010; Carpenter 2013; Fernandez-Cornejo et al. 2014; Huang et al. 2010; Kathage and Qaim 2012; Qaim and Kouser 2013). For the period 1996–2011, it has been estimated that the cumulative economic benefits from cost savings and added income derived from planting GE crops was US$49.6 billion in developing countries and US$48.6 billion in industrial countries (Brookes and Barfoot 2013).

As a result of the widespread use of this technology in agriculture (Figure 1), many food products in the United States include ingredients such as corn oil, soy protein, or beet sugar that might have been derived from a GE crop variety. It has been estimated that at least 70% of processed food items in the supermarket contain at least one ingredient derived from a GE crop, often the additive soy lecithin or various oils (Cornell Cooperative Extension 2003).

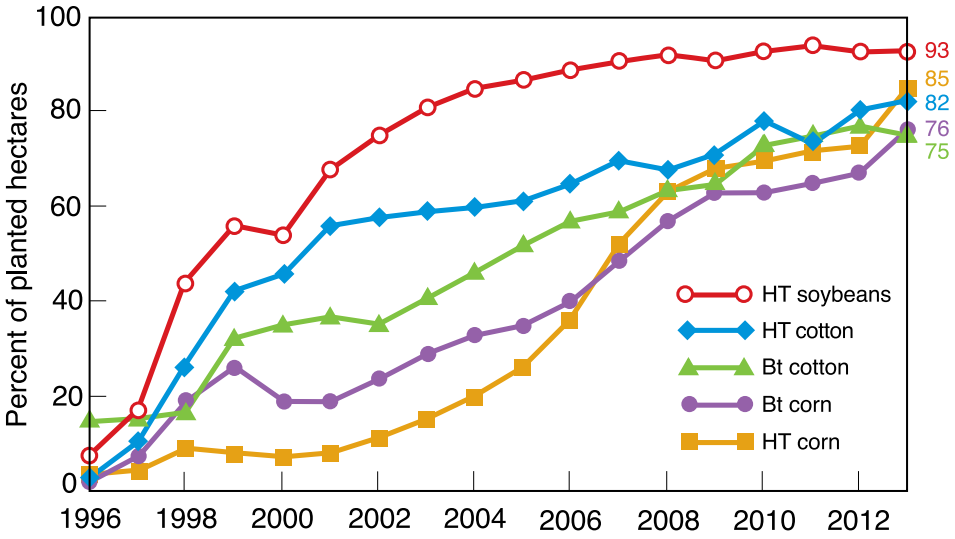

Figure 1. Adoption of GE crop varieties in the United States, 1996–2013 (HT = herbicide-tolerant; Bt = *Bacillus thuringiensis*). Data for each crop category include varieties with both HT and Bt (stacked) traits. Sources: USDA–Economic Research Service using data from Fernandez-Cornejo and McBride (2002) for the years 1996–1999; USDA–National Agricultural Statistics Service, June Agricultural Survey for the years 2000–2013. (Figure adapted from USDA–ERS [2013a].)

At least 25 states have considered proposed legislation to require GE labeling (see Figure 2). Many of these were bills that progressed through the legislative process to hearings, or even committee or floor votes in some cases, but were eventually defeated, withdrawn, or held. Three statewide initiatives requiring labeling—one in Oregon in 2002 (Measure 27), one in

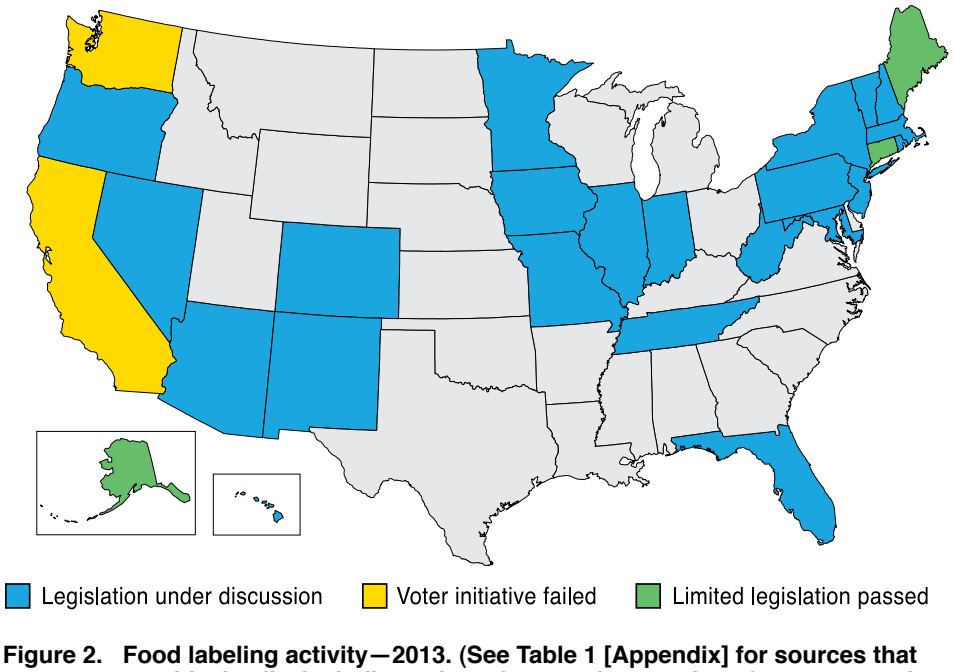

Figure 2. Food labeling activity—2013. (See Table 1 [Appendix] for sources that provide details, including selected text and exemptions from proposed and defeated legislation.)

California in 2012 (Proposition 37), and one in Washington in 2013 (Initiative 522)—were not supported by a majority of the voters. The only mandatory labeling law enacted to date is an Alaskan law that requires labeling of GE fish (none of which has yet been approved for food purposes by the Food and Drug Administration [FDA]) sold in the state. Connecticut and Maine have passed bills with limitations (e.g., one bordering state and three other states with a total population collectively exceeding 20 million people must enact similar labeling rules), and several others are still pending (Wattles 2013).

Proponents of mandatory GE labeling cite the right to know what is in their food as an important attribute of a democratic society. Opponents have countered that such a label will increase the cost of food and confuse consumers with no corresponding improvement in human health or food safety. Various seemingly contradictory studies are frequently cited to support opposing views, and civil, informed discourse about this important and frequently emotional issue is hard to find. There are three main themes that are associated with mandatory GE labeling, with the following arguments for and against it:

Public Opinion

- PRO: Polls show an overwhelming majority of people support mandatory labeling of GE foods when specifically asked if "the federal government should require labels on food saying whether it's been genetically modified, or 'bioengineered'" (Langer 2013).
- CON: In unprompted polls in which participants are asked what additional labeling they would like to see on food, more than 99% of respondents do not volunteer a desire to see mandatory labeling of GE foods (IFIC 2012).

Consumer Choice

- PRO: People should have a choice regarding what types of products they purchase and consume. Many believe that this should include the choice to "vote with their wallets" about how the food was produced even if it does not result in any change or consequence for the food product itself.
- CON: Consumers in the United States who want to avoid GE products already have that choice available through voluntary non-GE and organic labeling. In countries that have implemented mandatory GE labeling, GE products have generally been removed from the market; so choice has decreased (Marchant, Cardineau, and Redick 2010).

Right to Know

- PRO: People have the right to know what is in their food (Raab and Grobe 2003). Mandated calorie and nutritional content panels on packaged foods are examples of labels to inform consumers about food composition.
- CON: The right to know what is in food is different from the right to know how it was produced. Furthermore, this uniquely singles out GE technology—not other production methods and processes—for right to know.

Polls suggest consumers would like to see label information about many production methods and processes (e.g., sprayed with pesticides) (CSPI 2001). There is, however, no prima facie case that consumers have the right to know everything through mandated labels or that labels be required at any cost (Kalaitzandonakes 2004). Mandating process-based food labeling is a very complex topic with nuanced marketing, economic, and trade implications depending on how the labeling laws are written and how the market responds.

Food Safety

The premarket food safety assessment of GE foods and feeds evaluates risks that might be associated with newly introduced nucleic acids, novel proteins encoded by the inserted genetic material, and both intended and unintended changes in composition that might be associated with the development process (CAST 2001; Chassy 2010; Chassy et al. 2004). There is general agreement that novel components introduced through GE, as well as any changes in endogenous metabolites, must be demonstrated to be safe for humans and animals to consume.

Safety assessment focuses on the safety of newly introduced components and any intended changes in composition as well as evaluating if any potentially harmful unintended changes have occurred. It is accepted that all breeding produces unintended changes; however, the great majority of these are without safety implications. Thus, changes per se are not considered to pose new risks. Questions that must be addressed in such regulatory evaluations include the following:

- Does the GE food, and/or the newly introduced substance, have a traditional counterpart that has a history of safe use?
- Have any toxins or allergens been introduced and has the concentration of any naturally occurring toxins or allergens in the food changed?
- Have biologically significant compositional changes occurred and, in particular, have levels of key nutrients changed?

According to the American Association for the Advancement of Science, GE crops are "the most extensively tested crops ever added to our food supply" (AAAS 2012). During the past 20 years, the FDA has found that all 148 transgenic gene/crop combinations evaluated by the agency (including all biotech crops commercialized to date, despite the fact that this premarket safety review is technically voluntary) are equivalent to their conventional counterparts. Japanese regulators independently reached the same conclusions for 189 submissions they reviewed. These submissions spanned biotech corn, soybean, cotton, canola, wheat, potato, alfalfa, rice, papaya, tomato, cabbage, pepper, raspberry, and mushroom, and they included traits of herbicide, drought and cold tolerance, insect and virus resistance, nutrient enhancement, and expression of protease inhibitors (Herman and Price 2013).

There is also an extensive body of scientific research performed by independent scientists from around the globe on this topic (Nicolia et al. 2013). Hundreds of peer-reviewed publications involve GE feeding studies on a wide variety of species—including laboratory rodents, chickens, quail, pigs, sheep, dairy cows, beef cattle, goats, rabbits, buffalo, and fish—measuring feed intake, nutrient digestion, performance,

and health (Flachowsky, Shafft, and Meyer 2012). These studies, including some long-term research spanning multiple generations and many years, generally support the conclusion that there are no detrimental effects from the consumption of the currently available biotech crops (Snell et al. 2012).

Additionally, no differences in the composition of animal products—including meat, milk, and eggs—have been observed between animals fed conventional or biotech crops or their products (CAST 2006). A 2011 summary report from the European Commission, covering a decade of publicly funded research, 130 research projects, and 500 research groups, similarly concluded that there is no scientific evidence of higher risks from GE crops to the environment or for food and feed safety (European Commission 2011). This report found no evidence that GE foods have any harmful or long-term effects over multiple generations. Although a handful of widely publicized small studies have claimed to find some adverse health impacts of GE foods on animals, these studies have been retracted and/or severely criticized by government and mainstream scientific organizations as poorly designed and unreliable.

The U.S. National Academy of Sciences concluded in 1987, and reaffirmed in 2000 and 2004, that GE poses no new or different risks to food safety (NAS 2004). Likewise, the American Medical Association wrote the following in 2012: "There is no evidence that unique hazards exist either in the use of rDNA techniques or in the movement of genes between unrelated organisms.… The risks associated with the introduction of rDNA-engineered organisms are the same in kind as those associated with the introduction of unmodified organisms." The association then went on to conclude that "... there is no scientific justification for special labeling of bioengineered foods, as a class" (American Medical Association 2012).

Food Labeling

Despite these scientific assessments by independent and authoritative scientific organizations globally, many of the state labeling initiatives have included text suggesting that there are remaining food safety concerns about GE food and, therefore, mandatory labeling should be required. In the United States, the Food, Drug, and Cosmetic Act (FDCA) grants authority for food labeling to the FDA. The FDCA Section 403(a)(1) states that a food is misbranded if its labeling is untrue or misleading, whereas Section 201(n) states that a label is misleading if it fails to reveal "material facts" about a product. Material facts have been interpreted by the FDA to mean (1) changes in health or environmental safety posed by the product, (2) statements that might mislead the consumer in light of other information on the label, and (3) a food label that might cause a consumer to expect that the product closely resembles a food product from which it differs in one or more significant characteristics. The FDA would require labels on products that demonstrably pose novel hazards that might affect safety or have significant unexpected differences in composition. These are material facts. In contrast, production methods that create no material difference in products require no special labeling.

The FDA has stated that it has no basis for finding that GE foods "differ from other foods in any meaningful or uniform way, or that, as a class, foods developed by the new techniques present any different or greater safety concern than foods developed by traditional plant breeding" (USFDA 1992). Therefore, since GE production methods create no material difference in products, no label is required for GE foods. In the two decades since this initial finding, the FDA has not encountered any evidence or data that have caused it to change its position despite having reviewed regulatory packages on more than one hundred GE events (Herman and Price 2013).

If a new GE process changed a product such that it differed significantly from its conventional counterpart, the FDA could require labeling for those specific qualities. For instance, since high omega-3 and high oleic vegetable oils differ significantly in composition from their conventional counterparts, the FDA could require that these oils be labeled—not because they were produced using GE, but because there is a material difference in the oil products.

The FDA could also require labeling for potential allergenicity if the food contained a novel allergen that a consumer would not expect to be present in a specific type of food. As an example, if a peanut protein was inserted into a tomato, the product would need to be labeled to warn individuals allergic to peanuts that the GE tomato may present an allergenic risk unless the developer could demonstrate that there was no allergy risk from that peanut gene. To date, no GE products have required such a specific label.

It should be noted that the FDA allows voluntary process-based labeling as long as it is not false or misleading. In 2001, the FDA put out a draft guidance that set forth requirements for industry as to acceptable language for voluntary labels on products not containing any GE ingredients (USFDA 2001). The guidance stated that it is not possible to demonstrate a zero level of GE ingredients and therefore prohibits claims that a food is GE "free." It also advised that "a label statement that expresses or implies that a food is superior (e.g., safer or of higher quality) because it is not bioengineered would be misleading" given the lack of evidence that GE foods are materially different from non-GE foods. It was also considered that it would be misleading to label a food or ingredient as being non-GE, when in fact no commercialized GE varieties of that food or ingredient exist on the market.

Although the food safety of GE crops and animals, and ingredients derived from them, has been reviewed by the FDA prior to introduction of all new GE varieties commercialized to date, some have expressed concerns that GE crops are inherently less safe than those produced by other plant-breeding techniques. Their major safety contention is that the process of GE per se can produce unintended changes resulting in long-term adverse consequences. Advocates of mandatory labeling have argued that GE foods are by definition altered in composition by virtue of the presence of genetic material introduced through rDNA methods. A key driver of concern about GE food safety is that these products are intrinsically different because they would not have occurred in nature through natural processes.

Charles Darwin observed that very few of the world's cultivated crops arise from nature; most have been extensively genetically modified by human intervention. First, genetic modifications

resulting from spontaneous mutations were selected by breeders based on their effect on phenotype; then, in more recent times, genetic modifications were created through mutagenesis breeding techniques (exposing seeds to chemicals or radiation in order to generate mutations). New genes have been acquired by plants through horizontal gene transfer throughout evolution and more recently have been introduced through plant breeding among related species. New genes have arisen spontaneously—at least three new plant genes in the last century (Weber et al. 2012). Domesticated plants are thus not unchanged, nor would they exist today without extensive human intervention. There are no published scientific studies providing evidence that passive or natural genetic and phenotypic changes pose fewer hazards than those introduced by in vitro rDNA methods. In fact, some studies have found that plant mutagenesis induces more changes than rDNA GE technologies (Batista et al. 2008; Ricroch, Bergé, and Kuntz 2011).

To date, no material differences in composition or safety of commercialized GE crops have been identified that would justify a label based on the GE nature of the product. While this conclusion will not satisfy those who consider the insertion or manipulation of genes in a laboratory a material difference per se, the science of food safety does not support mandatory process-based labeling of GE food and, by extension, neither does the FDA.

Legal Issues

No comprehensive GE labeling law has yet passed in any state. Alaska's law requires labeling of any GE food made from a GE fish—although none is yet available on the market in the absence of a regulatory decision from the FDA regarding the approval or otherwise of the fast-growing GE AquaBounty Salmon (Anthes 2013). In Connecticut and Maine, conditional legislation has been passed stipulating that GE labels would be required to appear on products in the state's supermarkets only after two conditions are met: (1) four other states, including a bordering state, must enact similar labeling rules; and (2) the aggregate population of any Northeast states (Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, or Vermont) that enacts such a law must collectively have a total population of more than 20 million people. In passing such conditional laws, states likely recognized the potential threat of litigation to overturn a single state GE labeling law and perhaps also the difficulty companies might face complying with food labeling laws that differ among states.

Whatever the scope, the passage of state-based GE labeling laws is likely to be associated with legal challenges. There are three major legal issues associated with state laws mandating process-based GE labeling.

Commerce Clause of the U.S. Constitution

The Commerce Clause of the U.S. Constitution grants Congress the power to regulate interstate commerce and forbids individual states from unduly burdening interstate commerce (U.S. Const. art. 1, sec. 8, cl. 3). So even if consumers in a given state vote to support mandatory GE labeling legislation, federal law may not allow it. In general, a U.S. state violates rules on interstate commerce if it passes laws mandating that food manufacturers who create products for national and international markets must label them for a single state. Pending cases are defining the boundaries—generally, a state law may not discriminate against out-of-state products or unduly burden interstate commerce. Courts will limit a state law that impedes trade and forces companies to label their products to comply with only a few U.S. states' laws. Although the oldest of the legal barriers, this one may be weaker than those that follow in light of recent decisions (e.g., a California federal court recently allowed Alameda County to maintain a drug take-back program) [Karst 2013], and a similar challenge to California's low carbon fuel standard may be surviving legal debate [Griffin 2014; *Rocky Mountain Farmers Union v. California Air Resources Board* 2014]).

Supremacy Clause of the U.S. Constitution and FDCA Preemption

Under the Supremacy Clause of the U.S. Constitution, federal law prevails in any conflict with state law. As discussed earlier, the federal FDCA grants the FDA authority over food labeling and expressly prohibits states from imposing labeling requirements that are different from the FDA's requirements. The FDA has taken the position that process-based labels would not be required for GE food products that are comparable in composition to similar food products. At a 2010 hearing to reconsider GE labeling, FDA officials suggested doing so would open the door to any number of processes that interest consumers. It is likely that state GE food labeling requirements would be preempted by the FDCA because the FDA has explicitly decided not to require labeling of GE foods. In recent court cases, the potential preemptive effect of the FDCA has also been discussed. Most notably, the Ninth Circuit, which covers the West Coast (California, Oregon, Washington, etc.), has recently ruled that the FDCA preempts unfair competition claims (*Pom Wonderful LLC v. Coca-Cola Co*. 2012) in a decision that could be applied to a state's attempt to label GE food.

The First Amendment Protection of Commercial Speech

This legal barrier was actually used to stop a state (Vermont) from imposing mandatory labeling for a process used on dairies in the production of milk in 1996 (administration of recombinant bovine somatotropin [rBST], a type of growth hormone). The First Amendment prohibits government compulsion of commercial speech unless the speech is factual, uncontroversial, and reasonably related to a legitimate government interest. Although commercial speech is accorded less protection than political expression under the First Amendment, "the right not to speak inheres in political and commercial speech alike, and extends to statements of fact as well as statements of opinion" (*International Dairy Foods Association v. Amestoy* 1996).

As noted earlier, Vermont's mandatory process-based labeling of a product produced using a GE protein was found to violate the First Amendment. Dairy manufacturers contested a law that read "if rBST has been used in the production of milk or a milk product for retail sale in this state, the retail milk or milk product shall be labeled as such."

They demonstrated a likelihood of prevailing on a First Amendment challenge to a law requiring them "to identify products which were, or might have been, derived from dairy cows treated with a synthetic growth hormone used to increase milk production," arguing that the compelled speech violated their First Amendment rights and that the state had not advanced a governmental interest sufficient to require the speech. The state did not argue that the requirements were to raise public health, but it instead argued that Vermont citizens had a right to know whether or not the milk products were produced using rBST. The court held that gratifying "customer curiosity" by mandatory labeling of an accurate factual statement was insufficient to compel speech if it "involves neither health concerns nor other substantial interests" and thus failed to demonstrate a substantial government interest (*International Dairy Foods Association v. Amestoy* 1996).

Genetic modification labeling advocates argue that the FDA has previously mandated labeling for a production process, irradiation. This mandate was based not on safety concerns about irradiated food, but rather on the fact that the irradiation process can cause changes in flavor or shelf life of finished foods. These changes could be significant and material in light of the consumer's perception of such foods as unprocessed. This distinction explains the differential FDA policies toward the use of mandatory labels for irradiation and GE processes.

National GE Labeling Law

An alternative to state-by-state laws would be the implementation of a national GE labeling law. In 2013, a proposed federal labeling bill entitled The Genetically Engineered Food Right-to-Know Act was introduced simultaneously in the Senate (S 809) and House (HR 1699) to require the FDA to mandate GE labeling. The bills have 9 cosponsors in the Senate and 22 cosponsors in the House.

There are some international trade implications that would result from the passage of such a law. If the United States were to mandate labeling of GE food, the United States would have to show a scientific health threat in order to be in compliance with international trade law. Many of the GE labeling laws in the 64 countries around the world that require GE labeling likely violate the World Trade Organization (WTO) and its 1994 Sanitary and Phytosanitary Agreement, which frowns on process-based labels mandating disclosure of information on production-process issues that do not relate to food safety (CSPI 2000).

Indeed, the United States has lost two recent WTO decisions that ruled against U.S. laws requiring production-process labeling on dolphin-safe products and country-of-origin labeling (COOL). Both laws were designed to inform consumers about process or origin information not impacting the food itself. These interests could have been better served by voluntary international standards, if the market justified them. These WTO decisions point toward potential future challenges of GE labeling laws that disrupt trade (Jurenas and Greene 2013).

The United States has not challenged a GE labeling law at the WTO, despite calls from major U.S. commodity trade associations to do so and the fact that it is estimated that European Union (EU) labeling laws prevent billions of dollars in U.S. trade to the EU (Bernauer 2003). Canada and Mexico could similarly assert that a U.S. GE labeling law violates the WTO, just as they challenged U.S. laws on dolphin-safe and COOL. Both the WTO and U.S. interstate commerce laws favor voluntary standards, and the existing voluntary Non-GMO Project (www.nongmoproject.org) and other similar certification and labeling programs provide a "less burdensome" alternative to mandatory labeling.

Indeed, in recent years a large number of food products indicating the absence of GE ingredients through non-GE or organic labels have also been offered in the U.S. market. Food manufacturers and retailers have voluntarily labeled such products, and often third-party organizations have certified the accuracy of the claims and labels. More than 14,800 food products and 800 brands are reported to have been certified as meeting the Non-GMO Project standard alone (Brown 2013). Another option consumers have is to buy organic products, because the use of GE is not allowed in certified organic production systems. Additionally, some manufacturers are doubly verifying their certified organic products with the Non-GMO Project Verified and other non-GE certification programs (Gallo 2013).

Some U.S. food merchants have gone even further. In March 2013, the retail chain Whole Foods Market set a deadline that all products sold in its U.S. and Canadian stores must be labeled to indicate if they contain GE ingredients (using a $\geq 0.9\%$ GE content threshold for labeling) by 2018 (Robb and Gallo 2013; *The Organic and Non-GMO Report* 2009). Altogether, these voluntary measures provide consumers with non-GE choices in the U.S. marketplace at commercially achievable standards (*The Organic and Non-GMO Report* 2007).

In February 2014, the Grocery Manufacturers Association announced the creation of a 33-member group called The Coalition for Safe Affordable Food (www.CFSAF.org), which is calling for federal legislation that would require mandatory premarket approval of GE food ingredients by the FDA and grant authority to the agency to label products that raise safety concerns, set up a voluntary program for food companies to label foods for the absence or presence of GE ingredients, and define the term "natural" for its use on food and beverage products.

Location of the Label

A final issue is that of the GE label placement. Some of the proposed legislation requires the GE designation to be conspicuously present on the front of the package or retailer's display (for raw produce). For example, the failed Washington State initiative (Washington Initiative Measure No. 522 2012) required the following:

> In the case of a raw agricultural commodity, on the package offered for retail sale, with the words "genetically engineered" stated clearly and conspicuously on the front of the package of such a commodity, or in the case of such a commodity that is not separately packaged or labeled, on a label appearing on the retail store shelf or bin where such a commodity is displayed for sale;
> In the case of any processed food, on the front of the package of such food produced by a manufacturer, with the words "partially produced

with genetic engineering" or "may be partially produced with genetic engineering" stated clearly and conspicuously.

No rationale or justification has been advanced for this label placement, which would separate the GE label from preexisting nutritional and ingredient information. Consumers tend to overstate the importance of labels that are placed only on the front of a package and separated from nutritional and health information (Costanigro, Deselnicu, and Kroll 2012). Mandating producers and retailers to prominently display such a label implies that consumer knowledge about GE is more important than nutritional content or ingredients. In the absence of an identified material difference in GE products, such prescriptive compelled speech would likely increase the chance of a Constitutional First Amendment objection.

Economics

The Costs of Non-GE Foods

Adequate information that allows consumers to make choices consistent with their preferences is an essential feature of well-functioning food markets. Food labels can contribute useful information and can assist in consumer decision making. Organic and non-GE foods provide interested consumers information and choices, but they are more costly than conventional foods. Non-GE and organic products are more expensive in part because of lower yields (Seufert, Ramankutty, and Foley 2012); higher average production costs; segregation costs incurred in order to keep such products from commingling with GE or conventional products across the food supply chain; and various testing, certification, and traceability costs that must be paid to demonstrate the authenticity of such products when they are bought and sold (Kalaitzandonakes, Maltsbarger, and Barnes 2001). Suppliers of non-GE and organic products are compensated for their higher costs through price premiums they receive from buyers. For instance, the prices received by U.S. non-GE corn and soybean producers in recent years have averaged 15% more than the prices received by conventional commodity producers. Likewise, the prices received by U.S. organic corn and soybean growers have at times been more than twice the prices received by the nonorganic growers (Figure 3).

Premiums paid to suppliers of non-GE and organic agricultural products along with certification costs are carried all the way to the final processed, prepared, and ready-to-eat foods that make use of such ingredients and are paid by consumers in the form of higher prices. For example, according to analysis of scanner data, the prices U.S. consumers paid for organic ice cream, margarine spreads, and eggs were, respectively, 120%, 100%, and 80% higher than the U.S. average prices of conventional products for the 2008–2011 period (Vickner, S. 2013. Personal communication). Likewise, organic fruit and vegetable prices averaged 50 and 100% higher than conventional prices, respectively, in 2012–2013 (USDA–ERS 2014).

The Costs of Alternative Purity Standards and Tolerances

The incremental costs associated with the production and distribution of non-GE foods are not fixed and are heavily dependent on the GE purity standards and tolerances used (Giannakas et al. 2011). Purity thresholds and tolerances are used to recognize that perfect avoidance (or zero tolerance) of GE material is difficult to achieve in practice. Agricultural land, transport, storage, and processing facilities are broadly shared in the food sector, and perfect segregation of any agricultural product is typically not possible. Tolerances set for the presence of GE material are determined with best industry practices in mind and permit small unintended GE amounts that can be present in non-GE or organic foods.

When GE tolerances are set to be very low, segregation methods must become more stringent. When that occurs, the incremental production, segregation, and certification costs of non-GE products increase disproportionally, however, because the relative effectiveness of more stringent segregation methods diminishes with lower tolerances (Huygen, Veeman, and Lerohl 2004; Kalaitzandonakes, Maltsbarger, and Barnes 2001). Increasingly higher production and segregation costs are therefore applied to a progressively lower volume of non-GE products that can meet the stricter tolerances and purity standards. Production and segregation costs for non-GE corn, for instance, are estimated to increase by as much as 20% by lowering the tolerance for any unintended GE

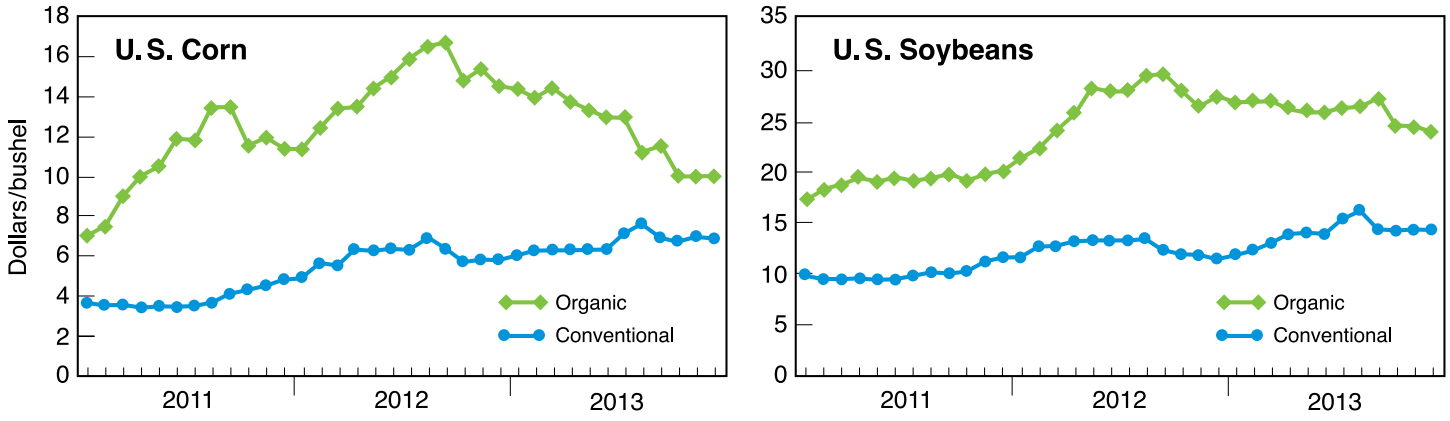

Figure 3. Prices received for conventional and organic corn and soybean (dollars/bushel), 2011–2013 (USDA–LPS 2013; USDA–NASS 2013b).

content from a maximum of 1% to 0.5% (Kalaitzandonakes, N. 2013. Personal communication) and much more than that for tolerances below 0.5%.

It is unclear what tolerance levels are being used in the various non-GE products that are currently on the market because they are not always reported. Some have argued that a zero tolerance is appropriate. A zero or near-zero tolerance for GE content would be commercially challenging, if not impossible, to achieve at a large scale and would greatly complicate the procurement of food ingredients. The legal doctrine of commercial impossibility could be used to render contracts unenforceable, and such legal challenges could further increase the costs of non-GE products. These issues are recognized where mandatory GE labeling has been implemented in practice. Although a number of countries have laws requiring GE food labeling (Just Label It 2012), none has tried to enforce a zero tolerance (the strictest is the EU at a maximum of 0.9%, whereas many Asian nations use 5%).

The Costs of Mandatory GE Labels

The potential economic impact of state and other initiatives that would mandate labeling for the presence of GE ingredients in foods has also been of much interest. Opponents of mandatory GE labeling schemes have argued that they would be very costly and that their costs would be paid by all consumers, including those who do not wish to avoid GE. Proponents have argued that the implied costs would be minimal. Indeed, a handful of studies has sketched out the potential costs of the mandatory labeling initiatives in California and Washington. The results have varied from more than $1 billion per year to a few thousands of dollars (Alston and Sumner 2012; Robertson 2013).

The widely differing calculations in the estimated costs of the proposed mandatory labeling schemes are explained by fundamentally different conjectures about the responses of key players in the food supply chain and the changes they could bring about in the U.S. food market. Much depends on how food manufacturers, food retailers, and other food merchants would choose to act if mandatory GE labeling was put in place. On the one hand, they could choose to maintain the current composition of their products, placing GE labels on them when necessary. On the other hand, they could choose to change the composition of their products in order to avoid the use of GE labels.

The reactions of food manufacturers and retailers could be shaped by expectations of negative consumer response toward GE labels (Marchant, Cardineau, and Redick 2010), targeting of their products by activists (Gruère and Rao 2007), exploitation of GE labels by competitors (Kalaitzandonakes and Bijman 2003), and concern that a mandated label might be mistakenly interpreted by consumers to confer a food safety warning (Marchant, Cardineau, and Redick 2010). If manufacturers choose to maintain their products and place labels on them, the cost impact of mandatory labeling would be the relatively minor cost of the ink to print new labels and the more significant costs associated with tracking and monitoring to ensure compliance. If manufacturers choose to substitute GE ingredients with non-GE ingredients to avoid labels, the cost impact of mandatory labeling would be substantial and associated with new product formulation and sourcing non-GE ingredients. [1]

Changing the composition of foods sold in the market today in order to avoid the use of GE labels would involve the replacement of GE ingredients with others derived from commodities that have not yet been genetically engineered (e.g., wheat or rice) or with non-GE and organic ingredients. Such changes are both difficult to implement and costly. Changes in ingredients may alter the final product as it is not always possible to achieve identical appearance and functionality when reformulating and redeveloping a product using alternative ingredients (e.g., changing from corn starch to tapioca or potato starch).[2] Moreover, as discussed previously, non-GE ingredients tend to be more expensive and may have more uncertain and inconsistent supplies. The added costs of avoiding mandatory GE labels are therefore more or less the same as those incurred by products voluntarily labeled non-GE, as described earlier. In effect then, appraisal of the added costs for mandatory labeling involves (1) an estimation of the share of the food market that might become non-GE, and (2) an estimation of the costs that would be incurred to procure non-GE ingredients and reformulate products.

If a significant share of the prepared and ready-to-eat foods sold in supermarkets today were to require non-GE ingredients, the demand for certified non-GE and organic products would increase well beyond its current levels.[3] The markets of non-GE and organic food ingredients are, in effect, specialty markets, and as such they can exhibit noticeable price jumps even under modest changes in their demand and supply conditions. Hence, under expanded markets and increased demand conditions, price premiums for such ingredients could well exceed their current levels.

It is unclear how much U.S. consumers are willing to pay for mandatory GE labeling, although if a mandatory GE labeling law is enacted there will be little choice but to pay the resulting costs, especially if products containing GE ingredients are removed from the market. At the beginning of the decade, 77% of the public indicated that they would not be willing to pay more than

[1] It is worth noting that although mandatory GE labeling is often assumed to enable consumer choice, mandatory GE labeling laws in other countries have had the opposite effect in that they resulted in the virtual disappearance of any labeled GE product from the shelves, thereby decreasing choice and increasing price for those consumers unconcerned about GE food (Marchant, Cardineau, and Redick 2010). In the EU, Greenpeace and other anti-GE organizations quickly launched negative campaigns targeting GE-labeled products and publicized supermarkets or food brands carrying GE labels. In response, retailers decided not to stock brands with GE labels to avoid the risk of losing sales because of such campaigns and boycotts, and food processors avoided using GE ingredients to decrease their risk of loss in market share (Gruère and Rao 2007).

[2] Processed foods often contain a number of ingredients that are derived from different commodities such as corn, soybean, canola, and sugar beets. Ensuring that all ingredients used in any given processed product come from non-GE commodities can complicate their supply chains. For example, chicken bouillon today might include sugar from GE sugar beets, maltodextrin and hydrolyzed protein from GE corn, and tocopherol (vitamin E) from GE soybean, whereas peanut butter might contain sugar from GE sugar beets, molasses from GE corn, and vegetable oils from GE canola and corn varieties. If food manufacturers were to reformulate such products, they would have to ensure that all individual ingredients are certified non-GE. Many highly processed ingredients and oils contain no detectable traces of their GE origin (e.g., no DNA is present in oil), which further complicates certification of non-GE ingredients.

[3] For instance, organic production of corn and soy constitute 0.26% and 0.17% of total U.S. production, respectively (USDA–ERS 2013b).

$50 per year per household for GE labeling, with 44% of respondents not willing to pay anything extra for GE labeling (CSPI 2001). Furthermore, analysis of the unsuccessful California and Washington GE labeling initiatives indicates that the concern about potential food price increases figured in their defeat (*The Elway Poll* 2013).

Potential Changes in the Costs of Mandatory Labeling

The cost consequences of any mandatory GE labeling scheme could change over time. The state labeling laws that have passed in Connecticut and Maine, as well as the proposed 2014 Oregon ballot measure, include time-limited exemption language that originated in the failed California Proposition 37, which can change the labeling standards and their cost implications over time. Specifically, they state the following:

> Until July 1, 2019, any processed food that would be subject to this section solely because it includes one or more materials produced by GE, provided that the engineered materials in the aggregate do not account for more than nine-tenths of one percent of the total weight of the processed food.

This clause, a version of which has commonly been included in the text of other states' proposed GE labeling legislation (see Table 1 [Appendix]), effectively introduces a time limit allowing products containing less than 0.9% GE content to be exempt from labeling for a few years. This tolerance would have expired on July 1, 2019, after which presumably all covered food products containing any level of GE content (i.e., zero tolerance) would have required GE labeling. As explained previously, trying to achieve a zero tolerance would lead to greater costs from mandatory labeling and would be difficult, if not impossible, to achieve in practice (Kalaitzandonakes, Kaufman, and Miller, in press).

Zero tolerances would also increase uncertainty in the food supply chain. When food manufacturers and retailers choose to use non-GE ingredients in order to avoid GE labeling, they depend on testing and certification to guarantee the authenticity of such ingredients. Sampling, testing, and certification depend on statistical processes, however, and hence all are subject to some error, which increases at very low tolerances (Lamb and Booker 2011). Under some state GE labeling laws, this type of error could open up firms to potential liabilities for misbranded products. To the extent that such state laws provide for citizens to file suit—seeking restitution, attorneys' fees, and potentially punitive damages—they could add to the segregation, testing, and certification costs borne by the food supply chain. State laws enacting such consumer fraud approaches to enforcing GE content in the food supply could therefore further increase the economic impact of mandatory GE labeling through litigation on food producers and manufacturers. Such an effect was seen following the passage of Proposition 65 in California.[4]

The Cost Implications of Labeling Exemptions

Some of the state labeling bills contain labeling exemptions for different categories of food, and these would affect the cost of mandatory labels (see Table 1 [Appendix]). One exemption includes food products obtained from animals raised on feed derived from GE crops. This is an especially large category because virtually all conventional livestock industries in the United States (and most other countries) use predominantly GE feed. Approximately 40% of total U.S. corn production and more than 80% of total soy production is used for animal feed. Corn grain, silage, gluten feed, gluten meal, soybean meal, cottonseed, alfalfa, and sugar beet pulp are common GE components of animal feed. Including and tracking products such as meat, milk, and eggs from animals that might have consumed GE feed at some time in their lives would add a significant level of complexity and expense to mandatory GE labeling of these animal products.

Other exemptions have variously included alcoholic beverages, foods sold in restaurants, and/or certified organically produced foods. The last exemption is particularly important because it might inadvertently lead to further increases in the cost of food. If certified organic products do not require GE labeling irrespective of whether or not they contain trace amounts of GE content (whereas nonorganic non-GE products have to be tested and may still be subject to liability if testing reveals misbranding), then food manufacturers and retailers may favor more expensive organic ingredients to avoid any potential liabilities associated with misbranding, thereby further increasing the overall cost impact of mandatory labeling.[5]

Who Pays?

Over time, food prices would rise to cover the incremental costs of any mandatory GE labeling regime in the U.S. market. An important question then is who would be most affected by such price hikes. So far, state initiatives have called for mandatory GE labeling of foods bought at the grocery store and consumed at home but do not generally require the same for foods consumed in restaurants, cafeterias, catered events, schools, and the like. And, as explained earlier, they also invariably exclude all organic foods from mandatory GE labeling, irrespective of where they are consumed or their potential GE content. Given these exemptions and the proposed rules on what foods would actually need the GE labels, the proposed mandatory labeling schemes would have a greater impact on low-income households.

Specifically, data from the 2012

[4] Proposition 65 (California's Safe Drinking Water and Toxic Enforcement Act of 1986) requires the State of California to promulgate a list of chemicals known to be carcinogens of reproductive toxins. It provides a financial incentive for private enforcers to bring lawsuits because it allows them to recover the litigation costs and retain for their own personal benefit 25% of the money obtained in each lawsuit. Between 1988 and 2006, more than 1,550 lawsuits were filed and companies paid approximately $406 million settling Proposition 65 cases (Walsh and Sanford 2008).

[5] It should be noted that there may be other costs associated with mandatory GE labeling that have not been discussed in this document. For example, there could be costs associated with the use of natural resources and the environment if American agriculture reverts to using conventional non-GE varieties of corn, cotton, canola, sugar beet, and soybeans to meet an expanded non-GE market. The adoption of insect-resistant and herbicide-tolerant GE crops by U.S. farmers has resulted in decreased insecticide use and has enabled the substitution of more effective and less persistent herbicides, respectively (Fernandez-Cornejo et al. 2014). Alston and Sumner (2012) discuss these issues in some detail, including how the reversion to non-GE varieties could also impact private and public investment into biotechnology and other agricultural research and development, and U.S. agricultural competitiveness—especially if major contenders such as Brazil and China continue to adopt and develop GE technologies.

Bureau of Labor Statistics Consumer Expenditure Survey (USDL–BLS 2012) show that low-income households across the United States spend a larger portion of their income on food than high-income households and spend most of these dollars for food at home. High-income individuals spend more at restaurants and eateries. For example, U.S. households with an annual income of $10,000–$20,000 spend between 21 and 26% of this income for food. Two out of three such dollars are spent at the grocery store for food cooked and consumed at home. By contrast, affluent households with an annual income of more than $70,000 spend less than 8% of their income for food and only about half of that at the grocery store.

Similar trends exist for older relative to younger consumers. For instance, U.S. households headed by consumers 65 or older have, on average, less than $40,000 in annual income and spend more than 12% of that for food, and two out of three such dollars are spent for food at home. Younger households headed by consumers 35–54 years old have, on average, 50% more income and spend about 10% of it for food, and almost half of such food dollars are spent away from home. Finally, research shows that younger, more affluent consumers spend more on organic food than older, poorer ones.

Given the proposed rules and exemptions, younger and more affluent consumers who spend more on organics and food away from home would be least affected by the costs resulting from mandatory GE labeling. Poorer and older consumers would instead pay more of the added costs associated with mandatory GE labeling while spending a larger portion of their limited income in doing so. Indeed, regardless of the reason for price increases, elevating food cost has a greater impact on the poor as a proportion of their income.

Summary and Conclusion

- All domesticated crops and animals have been genetically modified in some way; there is no science-based reason to single out GE foods and feeds for mandatory process-based labeling. Wide-ranging evidence shows that GE technology is equally safe to conventional breeding.
- Mandatory labeling based on process abandons the traditional U.S. practice of providing for consumer food preferences through voluntary product differentiation and labeling (i.e., marketing and promotion of products with specific attributes).
- Market-driven voluntary labeling measures (e.g., organic, Non-GMO Project, Whole Foods initiative) currently provide consumers with non-GE choices in the U.S. marketplace.
- Current labeling authority is federal; state mandatory labeling laws may be invalidated for conflicting with preemptive federal authority and may also violate First Amendment rights. If courts invalidate such locally imposed laws, it may be seen that courts are thwarting consumer will. Litigation seems a likely outcome if states pass mandatory labeling laws.
- Labeling at the national level has trade implications and needs to be harmonized with international trade agreements that frown on mandatory labeling for a production process when there is no scientific evidence that the process relates to food safety.
- Mandatory GE labeling would increase U.S. food costs. The size of this increase will depend on choices made in the marketplace by suppliers and marketers, and what products are included in labeling requirements. If, as in other countries, sellers move to non-GE offerings in response to mandatory labeling, food costs could rise significantly and these increased costs would exact a greater burden on low-income families. If, on the other hand, food suppliers choose to label virtually all products as containing GE without testing or segregation, increases in costs might be minimal.
- Independent objective information on the scientific issues and the possible legal ramifications and economic consequences of mandatory GE food labels needs to be provided to legislators and consumers, especially in states with labeling initiatives on the ballot, to help move the national discussion from contentious claims and counterclaims to a more fact-based and informed dialog.

Appendix

See Table 1.

Table 1. States with food labeling legislation, selected exemptions from the proposed legislation text, status, and source of text.

State	Legislation Citation	Selected Text and Exemptions	Status
Alaska	Alaska Legislature 2013	Labeling of GE fish	Passed 2005
Arizona	Arizona Senate 2013	Exempts food consisting entirely of, or derived entirely from, animals that have been fed with any GE feed or treated with any drug that has been produced through means of GE	
		Exempts GE processing aids or enzymes	
California	California 2012	SB 1381 exempts food derived entirely from animals that are not themselves GE, regardless of whether they have been fed or injected with any feed or drug that has been produced through means of GE	11/6/12—Proposition 37 defeated
	California 2014		2/21/14—Senate Bill 1381 introduced
		Exempts "packaged food in which the materials produced through GE account for nine-tenths of 1 percent" and "food lawfully certified to be labeled, marketed, and offered for sale as 'organic'" pursuant to the federal Organic Foods Production Act of 1990	
Colorado	Colorado General Assembly n.d.	Exempts food that contains less than 1% of GE material	
		Exempts food certified as "organic"	

Table 1. (continued)

State	Legislation Citation	Selected Text and Exemptions	Status
Connecticut	Connecticut General Assembly 2013a,b,c	Exempts food products derived from animals fed GE feed Exempts GE processing aids or enzymes Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.9% of the total weight of the processed food	6/25/13—Signed by governor; requires four other contiguous states with a combined population of more than 20 million to enact similar legislation before it can be implemented
Florida	Florida House 2013; Florida Senate 2013	Exempts food consisting entirely of, or derived entirely from, animals that have been fed with any GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Until January 1, 2015, exempts any single ingredient that accounts for no more than 0.5% of the total weight of any processed food and the food does not contain more than 10 GE ingredients	1/10/14 (Senate)—Introduced and referred to the Committees on Agriculture, Commerce and Tourism, Regulated Industries, and Community Affairs 3/4/14 (House)—Introduced
Hawaii	Hawaii House 2013a,b,c; Hawaii Senate 2013a,b,c	Exempts animal or any animal product, milk or any milk product	1/13—Referred to committees 1/30/13—House Bill 733 hearing held by the Committee on Agriculture February 4, 2013 4/12/13—Report from Committee on Finance recommending adoption; adopted in final form
Illinois	Illinois House 2013; Illinois Senate 2013	Identical bills exempt food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE	3/22/13—House Committee Amendment No. 1 Rule 19(a) and re-referred to Committee on Rules 3/22/13—Senate Rule 3-9(a) and re-referred to Committee on Assignments
Indiana	Indiana House 2013	Exempts food consisting entirely of, or derived entirely from, animals that have been fed with any GE feed or treated with any drug that has been produced through means of GE Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.5% of the total weight of the processed food	
Iowa	Iowa Senate n.d.	Exempts meat, fish, or poultry that originated from an animal that consumed GE feed	
Maine	Maine House 2013a,b	Exempts food products derived from animals fed GE feed Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.9% of the total weight of the processed food	1/9/14—Signed by governor; requires four other contiguous states with a combined population of more than 20 million to enact similar legislation before it can be implemented
Maryland	Maryland House 2013	Exempts food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.5% of the total weight of the processed food and it does not contain more than 10 ingredients that have been produced with GE	2/26/13—Unfavorable report from committee; withdrawn
Massachusetts	Massachusetts House 2013a,b,c,d	Multiple bills: HB 808 specifically requires labeling of food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE; whereas 1936 and 2037 allow these exemptions Until July 1, 2019, exempts any processed food provided that no single GE ingredient accounts for more than 0.5% of the total weight of the processed food and that the processed food does not contain more than 10 GE ingredients	1/22/13—Referred to Joint Committee on Environment, Natural Resources and Agriculture; concurred in committee referral
Minnesota	Minnesota House 2013; Minnesota Senate 2013	Exempts GE processing aids or enzymes Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.9% of the total weight of the processed food	2/21/13 (House)—Introduction, first reading, and referred to Committee on Agriculture Policy 2/28/13 (Senate)—Introduction, first reading, and referred to Committee on Jobs, Agriculture and Rural Development

Table 1. (continued)

State	Legislation Citation	Selected Text and Exemptions	Status
Missouri	Missouri House n.d.; Missouri Senate 2013	Specifically requires labeling if milk comes from cows that have been fed GE feed or treated with GE hormones or drugs	2/14/13—Both bills withdrawn
Nevada	Nevada Assembly 2013	Exempts food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Exempts processed foods in which ingredients or materials produced with GE in the aggregate do not account for more than 0.9% of the total weight of the processed food	4/13/13—Pursuant to Joint Standing Rule No. 14.3.1, no further action allowed
New Hampshire	New Hampshire House 2013; New Hampshire Senate 2014	Does not include exemptions and requires the Commissioner of the Department of Agriculture to develop a list of GE products and best practices for labeling	4/30/13—Committee retained the bill 1/8/14—Senate bill introduced 1/23/14—House killed the bill
New Jersey	New Jersey Assembly 2012a,b; New Jersey Senate 2012	Exempts food composed of less than 1% of GE material	
New Mexico	New Mexico Senate 2013	Specifically requires labeling of animal feed that contains GE material Exempts food that is composed of less than 1% GE material No specific exemption for certified organic food products	2/1/13—Withdrawn
New York	New York Assembly 2013a,b; New York Senate 2013a,b	Exempts food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Exempts any single ingredient that accounts for less than 0.9% of the total weight of any processed food	2/21/13—Senate Bill 3835 referred to Committee
Oregon	Oregon House 2013a,b,c; Oregon Office of the Secretary of State 2013	Specifically requires labeling of food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.9% of the total weight of the processed food	7/8/13—Left in Committee upon adjournment
Pennsylvania	Pennsylvania Senate 2013	Exempts food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than 0.9% of the total weight of the processed food	4/3/13—Referred to Committee on Agriculture and Rural Affairs
Rhode Island	Rhode Island House 2013a,b	Exempts food composed of less than 1% of GE material	
Tennessee	Tennessee House 2013; Tennessee Senate 2013	Specifically requires labeling of food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE	3/13/13—House bill placed on Committee calendar for March 20 3/19/13—Senate bill assigned to General Subcommittee
Vermont	Vermont House 2013; Vermont Senate 2013	Exempts food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Until July 1, 2019, exempts packaged processed food if the total weight of the processed food that was GE is less than one half of 0.9% of the total weight of the processed food and the food contains less than 10 such ingredients	2/8/13—Senate bill filed, read first time, and referred to Committee on Agriculture 5/10/13—House bill amendments offered and disagreed to, read third time, and passed
Washington	Washington Initiative Measure No. 522 2012; Washington Senate 2013	Exempts food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE Exempts GE processing aids or enzymes Exempts any single ingredient that accounts for no more than 0.9% of the total weight of any processed food	11/5/13—Initiative defeated
West Virginia	West Virginia House 2013	Specifically requires labeling of food products derived from animals fed GE feed or treated with any drug that has been produced through means of GE	2/13/13—Introduced and referred to Committee on Agriculture

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