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Labeling Genetically Engineered Foods

The Food and Drug Administration (FDA) is “responsible for assuring that foods sold in the United States are safe, wholesome, and properly labeled.”¹ Although the FDA does not have the legal power to enforce labeling standards of commodities and food products “on consumer interest alone...producers are allowed to label their own food products as long as they meet conditions set by the FDA.”² Since labeling is done voluntarily, consumer interest has grown regarding the labeling of products that have been genetically engineered. This has prompted states to introduce legislation that would establish labeling standards on genetically engineered commodities such as food products, seed stock, etc.³

On January 23, 2013, the Vermont State Legislature introduced H-112: An Act Relating to the Labeling of Food Produced with Genetic Engineering.⁴ The central component of the bill is “to provide that food is misbranded if it is entirely or partially produced with genetic engineering and is not labeled as genetically engineered.”⁵ Similarly, on February 8th, 2013, Washington State Initiative 522, “The People’s Right to Know Genetically Engineered Food Act” was approved by Secretary of State Kim Wyman and submitted to Washington State Legislature, which may either pass it, allow it to be placed on the November ballot, or put a legislative

¹ United States Food and Drug Administration, “Food Labeling Guide,” U.S. Department of Health and Human Services, October 2009, accessed on February 20, 2013, <http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/FoodLabelingGuide/default.htm>.

² United States Food and Drug Administration, “Background Document: Public Hearing on the Labeling of Food Made from AquAdvantage Salmon,” U.S. Department of Health and Human Services, August 2010, accessed on February 14, 2013, <http://www.fda.gov/Food/LabelingNutrition/FoodLabelingGuidanceRegulatoryInformation/Topic-SpecificLabelingInformation/ucm222608.htm>.

³ Vermont General Assembly, *H.112: An Act Relating to the Labeling of Food produced with Genetic Engineering*, accessed on February 21, 2013, <http://www.leg.state.vt.us/docs/2014/bills/intro/H-112.pdf>, pp 5-7.

⁴ Vermont State Legislature, “Journal of the House,” January 23, 2013, accessed on February 10, 2013, <http://www.leg.state.vt.us/docs/2014/journal/HJ130129.pdf#page=6>, p. 78-79

⁵ Vermont General Assembly, *H-112: An Act Relating to the Labeling of Food Produced with Genetic Engineering*, January 29, 2013, accessed on February 8th 2013, <http://www.leg.state.vt.us/docs/2014/bills/intro/H-112.pdf>, p. 2.

alternative on the ballot.⁶ This report examines the fiscal, health and environmental issues associated with these proposed laws regarding genetic engineering of foods.

Definitions

In this report, Genetic Engineering (GE) is defined as “Food products produced through modern methods of biotechnology such as recombinant DNA techniques and cell fusion.”⁷ Transgenic Crops refers to “plants containing genetic material artificially transferred from another species.”⁸

Health Impacts

Bioengineered foods have been consumed for nearly 20 years. Under the Federal Food, Drug, and Cosmetic Act, the FDA is responsible to ensure that all genetically engineered animals, crops, and foods meet certain health requirements.⁹ Before a genetically engineered product gets circulated into the market, the producers of the product conduct mandatory safety assessments on them.¹⁰ If, “the transgenic crop possesses similar levels and variations of critical nutrients and toxicants as its conventional counterpart, it is considered to be substantially equivalent.”¹¹

Current studies examining the health impacts associated with the consumption of GE foods have found “no overt consequences [from the consumption of GE foods] on human health.”¹² However, “the small potential for adverse effects [such as] allergenicity and toxicity”¹³ has been discussed. The potential for allergens being present within a GE crop are still being questioned since the process of creating GE crops is relatively new. Therefore, scholars have

⁶ Adam Noble, “Secretary Wyman certifies I-522 to lawmakers,” Washington Secretary of State Blogs, February 1, 2013, accessed on February 15, 2013, <http://blogs.sos.wa.gov/FromOurCorner/index.php/2013/02/secretary-wyman-certifies-i-522-to-lawmakers/>.

⁷ James H. Maryanski, “Genetically Engineered Foods,” U.S. Food and Drug Administration, October 19, 1999, accessed on March 26, 2013, <http://www.fda.gov/newsevents/testimony/ucm115032.htm>.

⁸ Cholani Weebadde and Karim M. Mareida, “Environmental Biosafety Issues Associated with Genetically Engineered Crops,” in *Environmental Safety of Genetically Engineered Crops*, eds. Rebecca Grumet, James Hanacock, Karim Mareida, and Cholani Weebadde, East Lansing: Michigan State University Press, 2011, p. 21.

⁹ United States Food and Drug Administration, “General Question & Answer: Technology,” accessed on March 28, 2013, <http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/GeneticEngineering/GeneticallyEngineeredAnimals/ucm113605.htm>.

¹⁰ Lee R. Morisy, “Labeling of Bioengineered Foods,” Council on Science & Public Health, 2012, accessed on February 14, 2013, <http://www.ama-assn.org/resources/doc/csaph/a12-csaph2-bioengineeredfoods.pdf>, p. 4.

¹¹ Lee R. Morisy, “Labeling of Bioengineered Foods,” Council on Science & Public Health, p. 4.

¹² Jonathan A. Bernstein, Leonard Bernstein, Luca Bucchini, Lynn R. Goldman, Robert G. Hamilton, Samuel Lehrer, Carol Rubin, and Hugh A. Sampson, “Clinical and Laboratory Investigation of Allergy to Genetically Modified Foods,” Department of Medicine: University of Cincinnati, accessed on March 28, 2013, p. 1114. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241560/>.

¹³ Jonathan A. Bernstein, Leonard Bernstein, Luca Bucchini, Lynn R. Goldman, Robert G. Hamilton, Samuel Lehrer, Carol Rubin, and Hugh A. Sampson, “Clinical and Laboratory Investigation of Allergy to Genetically Modified Foods,” p. 1114.

cautioned that “the potential for occupational and consumer risks needs to be [properly] assessed.”¹⁴

The question of toxicity within GE crops was initially raised when a study emerged regarding the negative effect of a lectin transgene on rat’s intestines. This study was later deemed inconclusive; however, additional studies examining the dangers of lectin have been completed and the use of lectin in foods is currently prohibited.¹⁵ All studies on toxicity but those of lectins have proved to be inconclusive.

Genetically Engineered Animals

According to the Food & Drug Administration, there are currently no genetically engineered animals being used for food or as an ingredient in food. The FDA suggests that in the future there could be potential health benefits to genetically engineered animals. Some of these potential benefits include the production of medicinal substances in animals to be used on humans and the increase of omega-3 fatty acids in pigs to produce healthier meat products.¹⁶

Environmental Impacts of Genetically Engineered Crops

Transgenic crops, or plants containing genetic material artificially transferred from another species, are a topic of contention among scientists. The aim of GE crops is to maintain high yield levels of production. Crops can be engineered to have traits like insect resistance, herbicide tolerance, virus resistance, and nutritional enhancement.¹⁷ Of these, herbicide-resistant and insect-resistance crops are the most commonly discussed.

Herbicide Resistance

Glyphosate is the most common herbicide in which crops are genetically engineered to resist. It is a powerful plant killer but does not have significant adverse effects on animals or the environment.¹⁸ Most common glyphosate-resistant crops are cotton, corn, soybeans, and

¹⁴ Cholani Weebadde and Karim M. Maredia, “Environmental Biosafety Issues Associated with Genetically Engineered Crops,” in *Environmental Safety of Genetically Engineered Crops*, Rebecca Grumet, James F. Hancock, and Karim M. Maredia (editors), Michigan State University Press, 2011, pp. 25-26.

¹⁵ Lee R. Morisy, “Labeling of Bioengineered Foods,” Council on Science & Public Health, 2012, accessed on February 14, 2013, <http://www.ama-assn.org/resources/doc/csaph/a12-csaph2-bioengineeredfoods.pdf>, p. 4.

¹⁶ United States Food and Drug Administration, “Animal & Veterinary: General Question & Answer,” U.S. Department of Health & Human Services, November 2012, accessed on February 15, 2013, <http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/GeneticEngineering/GeneticallyEngineeredAnimals/ucm113605.htm>, p. 1.

¹⁷ Cholani Weebadde and Karim M. Maredia, “Environmental Biosafety Issues Associated with Genetically Engineered Crops,” p. 21.

¹⁸ The National Academy of Sciences, “The Impact of Genetically Engineered Crops on Farm Sustainability in the United States,” 2010, accessed on February 17, 2013, http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/genetically_engineered_crops_report_brief_final.pdf.

canola. Crops that are resistant can withstand applications of the herbicide, which in turn, kills weeds that do not have the transgene.¹⁹

Insect Resistance

Insect-resistant crops most often contain the bacteria called *Bacillus thuringiensis* (Bt), which is lethal to the larvae stage of many insects. Traditionally without this bacterium, insects such as moths, butterflies, flies, and beetles would reduce yields by damaging or destroying crops. However when these insects ingest transgenic crops, they are killed.²⁰

Potential Environmental Impacts of Transgenic Crops

There are four major areas of impact with respect to transgenic crops: invasiveness, gene and pollen flow, impacts on non-target organisms, and pest resistance.²¹

Invasiveness

Genetically modified crops themselves may be difficult to control inside and outside of an agricultural environment. Transgenic crops would have a higher success rate compared to conventional crops²² due to the fact that they are specifically engineered to possess traits such as herbicide-resistance, which allows them to survive when exposed to various agricultural practices. Higher reproductive success through genetic engineering can allow them to become invasive, meaning they could become competitors among native plants.²³

Gene and Pollen Flow

The spread of gene and pollen flow may happen to other non-GE entities like conventional crops, landraces, and wild relatives.²⁴ Landraces are defined as traditional, open-pollinated varieties of plants that have developed with natural processes.²⁵ The introduction of GE genes to other nearby species could be detrimental because of the potential towards invasiveness.

¹⁹The United States Environmental Protection Agency, "EPA's Regulation of Biotechnology for Use in Pest Management," January 2011, accessed on February 17, 2013, http://www.epa.gov/oppbppd1/biopesticides/reg_of_biotech/eparegofbiotech.htm.

²⁰The National Academy of Sciences, "The Impact of Genetically Engineered Crops on Farm Sustainability in the United States."

²¹Cholani Weebadde and Karim M. Mareida, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

²²Conventional farming is described as any "system without the application of alternative methods or genetic engineering." From Coextra, "Conventional farming," 2006, accessed on February 21, 2013 <http://www.coextra.eu/glossary/word672.html>.

²³Cholani Weebadde and Karim M. Mareida, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

²⁴Cholani Weebadde and Karim M. Mareida, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

²⁵Kristin L. Mercer and Joel D. Wainwright, "Gene flow from transgenic maize to landraces in Mexico: An analysis," *Agriculture, Ecosystems & Environment* 123 (2008): 109, accessed February 22, 2013, <http://www.sciencedirect.com/science/article/pii/S0167880907001624>.

Additionally, a wild plant that is not desired in an agricultural environment, defined as a weed, can receive a gene and therefore takes on the same herbicide-resistant traits as the original.²⁶ Weeds with glyphosate resistance have been emerging and there are six known species in the United States. Therefore, weed control near GE crops may be a problem in the future.²⁷ Maintaining isolation distances between GE to non-GE plants has been used as a solution to some unwanted gene and pollen flow cases.²⁸ However, other new weed control practices will need to be introduced in addition to applying glyphosate in order to adequately manage the resistant weeds.²⁹

Impact of non-target organisms

Insects that come in contact with or eat a transgenic crop which have a pesticidal component are expected to be affected by the toxins. In this case, soil dwellers, pollinators, natural enemies or predators of the targeted insect, threatened or endangered insect species, or insects of cultural or aesthetic value, like the monarch butterfly, are all susceptible.³⁰ Bt crops are the only genetically engineered crops that have been extensively studied with regards to their effects on non-target organisms. The findings were negligible. However, other genetically engineered crops have not been as widely studied so effects on non-targets are unknown. It is important to point out, however, that there are large amounts of pesticides used in conventional cropping so the detrimental effects of GE crops to insects may be less than traditional methods. Additionally, pesticide/insecticide levels in genetically engineered crops compared to conventional have seen major reductions.³¹

Pest Resistance

Insects that are overly exposed to GE Transgenic crops are expected to adopt a tolerance against the transgene. Thereby a cycle emerges where the effectiveness of the transgene decreases as the emergence of insects with higher tolerance become more difficult to control. This could potentially lead to a return to the use of broad chemical pesticide control and therefore the death of non-target species. Pest resistance can be thwarted by use of insect resistance management (IRM) where non-GE crops are placed near GE crops so that insects

²⁶ Cholani Weebadde and Karim M. Maredia, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

²⁷ Chris Boerboom and Micheal Owen, "Facts about Glyphosate-Resistant Weeds," *The Glyphosate, Weeds, and Crops Series*, December 2006, accessed on February 22, 2013, <http://www.extension.purdue.edu/extmedia/gwc/gwc-1.pdf>.

²⁸ Cholani Weebadde and Karim M. Maredia, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

²⁹ Jane E. Carpenter, "Impact of GM Crops on Biodiversity," *Landes Bioscience* 2 (2011): 1, accessed April 18, 2013, <http://www.landesbioscience.com/journals/gmcrops/article/15086/CarpenterGMC2-1.pdf>.

³⁰ Cholani Weebadde and Karim M. Maredia, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

³¹ Jane E. Carpenter, "Impact of GM Crops on Biodiversity."

have a choice of which to consume and ideally dilute their exposure.³²

Conclusion on Environment Effects

This section has provided information for the potential effects associated with the use of genetically engineered crops, but due to their relatively recent use, there is not much research on the long-term environmental impacts. In conclusion, weed control has been demonstrated to be a problem, while reduced use of pesticides is an advantage. Evidence to support the rest of the concerns regarding the impact of GE crops on the environment will not be available until additional research is completed.

Current State Legislation Regarding the Labeling of Genetically Engineered Products

Washington

On February 8th, 2013, Washington's Secretary of State certified Initiative 522, known as "The People's Right to Know Genetically Engineered Food Act."³³ This initiative "would require most raw agricultural commodities, processed foods, seeds and seed stocks, if produced using genetic engineering ...to be labeled as genetically engineered when offered for retail sale."³⁴ The Department of Health would be in charge of enforcing state regulations. In addition, the Attorney General, through the Department of Health, would be in charge of overseeing claims and cases against those who violate I-522.³⁵ If the measure passes through the legislature or through a general public vote, it would go into effect on July 1, 2015.³⁶

In Initiative 522, the labeling of seed or seed stock that has been "genetically engineered" or "produced with genetic engineering" must be "clearly and conspicuously [labeled on] ... the seed, stock container, sales receipt, or any other reference to identification, ownership, or possession."³⁷ Until July 1, 2019, the initiative would exempt "any processed food that would be subject to [Initiative 522] solely because it includes one or more materials produced by genetic engineering, provided that "The materials in the aggregate do not account for more than 9/10ths of one percent of the total weight of the processed food."³⁸

³² Cholani Weebadde and Karim M. Maredia, "Environmental Biosafety Issues Associated with Genetically Engineered Crops."

³³ Adam Noble, "Secretary Wyman certifies I-522 to lawmakers," Washington Secretary of State Blogs, February 1, 2013, accessed on February 15, 2013, <http://blogs.sos.wa.gov/FromOurCorner/index.php/2013/02/secretary-wyman-certifies-i-522-to-lawmakers/>.

³⁴ Washington General Assembly, *Initiative Measure No. 522: An Act Relating to Disclosure of Foods Produced through Genetic Engineering*, June 29, 2012, accessed on February 13, 2013, http://sos.wa.gov/assets/elections/initiatives/FinalText_285.pdf, p.6.

³⁵ Washington General Assembly, *Initiative Measure No. 522*, p. 7.

³⁶ Washington General Assembly, *Initiative Measure No. 522*, p. 6.

³⁷ Washington General Assembly, *Initiative Measure No. 522*, p. 6.

³⁸ Washington General Assembly, *Initiative Measure No. 522*, p.7.

Vermont

On January 29th, 2013, H-112, “An Act Relating to the Labeling of Food Produced with Genetic Engineering,” was introduced to the Vermont state legislature.³⁹ Sponsors of the bill argue that since the FDA and U.S. Congress do not require genetically engineered food to be produced, state mandated labeling laws will “prevent inadvertent consumer deception, promote food safety, respect religious beliefs, protect the environment, and promote economic development.”⁴⁰ The Commissioner of Health would be in charge of ensuring state GE labeling standards are being adhered to.⁴¹ If H-112 passes, it would go into effect on July 1, 2014.⁴² Highlights of H-112 state that any processed food that contains “one or more ingredients that have been produced with genetic engineering” is exempt from H-112 until July 1, 2019, as long as “[n]o single such ingredient accounts for more than half of 0.9 percent of the total weight of the processed food; and the processed food does not contain more than 10 such ingredients.”⁴³ In addition, food or seed that has been determined by an independent organization to not be produced with genetic engineering will be also exempt.⁴⁴

Components and Exemptions regarding “Right to Know” Legislation

Since there are so many similarities between the components and exemptions surrounding Right to Know legislation, this report has compiled two tables to better examine right to know legislation in Vermont and Washington. See Appendix A and B. Table 1 lists the components associated with state legislation and Table 2 lists its exemptions. In both tables, Y is defined as Yes, meaning that this component/exemption is a part of the State’s “Right to Know” legislation.

As seen in Appendix A, Vermont does not require genetically engineered seed stock to be labeled. Vermont prohibits the use of terms such as “natural,” “naturally made,” “naturally grown,” and “all natural” on food products that have been “produced entirely or in part from genetic engineering.”⁴⁵

In Appendix B, Vermont and Washington exempt the labeling of food products administered for the treatment of medical conditions. Washington exempts food products that are “consistent with the most recent guidelines on performance criteria and validation of methods for detection, identification, and quantification of specific DNA sequences and specific proteins in foods and does not on testing of processed foods in which no DNA is detectable.” Vermont does not require the following to be labeled: alcoholic beverages and the identification of any ingredient(s) that were genetically engineered. Washington exempt animals fed or injected with GE material as long as animals themselves are not produced through genetic engineering.

³⁹ Vermont State Legislature, “Journal of the House,” p. 78-79

⁴⁰ Vermont General Assembly, *H-112*, p. 8.

⁴¹ Vermont General Assembly, *H-112*, pp. 16-17.

⁴² Vermont General Assembly, *H-112*, p. 19.

⁴³ Vermont General Assembly, *H-112*, p. 19.

⁴⁴ Vermont General assembly, *H-112*, p. 14.

⁴⁵ Vermont General Assembly, *H-112*, p.13.

Potential Fiscal Impacts of Implementing “Right to Know” Legislation

Since there have been few states that have introduced “Right to Know” Legislation, this report will be referring to the fiscal impact concerns raised in Connecticut’s HB-522 since they have explicitly stated and addressed them.

Connecticut and HB-5117

Regarding the fiscal costs surrounding HB-5117, the Connecticut Office of Fiscal Analysis cited a potential cost regarding the State’s General Fund. The requirements surrounding Section 3 “may result in significant costs to [the] Department of Agriculture as the agency would need to hire a consultant with the scientific knowledge required to draft the regulations.”⁴⁶ However, there would be no municipal impact. In addition, the Department of Consumer Protection “currently has information available to publish the online list required under [Section 5] of the bill.”⁴⁷

Conclusion

Due to the recent nature of genetic engineering, additional research is recommended in order to properly observe the health and environmental effects in the long run.

Unlike genetically engineered animals, GE crops are used in some foods currently on the market, which scholars and the scientific community argue is a cause for public health concern. Few scientific tests have been conducted, but so far little to no harmful effects have been detected. Some scholars argue that continued research needs to be done in regards to the long-term effects regarding allergenicity and toxicity of GE foods.

Potential environmental effects regarding the production of genetically engineered crops include resistance, contamination, and invasiveness in genetically engineered crops and their neighbors.

This report was completed on April 23, 2013 by Ann Nguyen, Claire Crisman, and Lauren Morlino under the supervision of Assistant Director Kate Fournier and Professor Anthony Gierzynski in response to a request from Representative Katie Webb.

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Disclaimer: This report has been compiled by undergraduate students at the University of Vermont under the supervision of Professor Anthony Gierzynski. The material contained in the report does not reflect the official policy of the University of Vermont.

⁴⁶ Office of Fiscal Analysis, *HB-5117: An Act Concerning Genetically Engineered Foods*, State of Connecticut General Assembly, 2012, accessed on February 12, 2013, <http://www.cga.ct.gov/2012/FN/2012HB-05117-R000307-FN.htm>.

⁴⁷ Office of Fiscal Analysis, *HB-5117*, 2012.

Appendix A: Components of “Right to Know” Legislation regarding the Labeling of GE Foods

| Components | VT: H.112 | WA: I-522 |
|--|-----------|-----------|
| Raw Agricultural Commodity Sold in Retail: Front of the package must be clearly labeled as “Genetically Engineered” | Y | Y |
| “Genetically Engineered” Label of Retail store shelf or bin of commodity is displayed for sale | Y | Y |
| <i>Processed Food</i> : Labeling of “Partially Engineered” or “Produced with Genetic Engineering” stated clearly and conspicuously | Y | Y |
| <i>Seed Stock</i> : labeled as “Genetically Engineered” or “Produced with Genetic Engineering” stated clearly and conspicuously | | Y |
| Prohibits the use of terms such as “natural,” “naturally made,” “naturally grown,” and “all natural” in the labeling and advertising of GE foods | Y | |

Sources: Vermont General Assembly, H-112, p. 12-13, Washington General Assembly, I-522, p. 4, 6

Appendix B: Exemptions to “Right to Know” Legislation Regarding the Labeling of GE Foods

| Exemptions | VT: H.112 | WA: I- 522 |
|---|--------------|---------------|
| Food that is Certified Organic | Y | Y |
| Unintentionally produced with GE material* | Y | Y |
| Animals fed/injected with GE material but are not produced by genetic engineering themselves | Y | |
| Processed/contain a small amount of GE ingredients ** | Y | Y |
| Administered for Treatment of Medical Conditions | | |
| Medical Food | Y | Y |
| Food that is not packaged for retail sale and is either: a processed food that is prepared and intended for immediate human consumption or; served, sold, or otherwise provided in a food establishment that is primarily engaged in the sale of food prepared and intended for immediate human consumption | Y | Y |
| Alcoholic Beverages | | Y |
| Listing of Identification of any ingredient(s) that were Genetically Engineered | | Y |
| Any processed foods which includes one or more processing aids or enzymes that were produced with Genetic Engineering | Y | Y |
| Food that an independent organization determined was not knowingly/intentionally produced from or comingled with GE seed or GE food | Y | Y |
| Consistent with the most recent “Guidelines on Performance Criteria and Validation of Methods for Detection, Identification, and Quantification of Specific DNA Sequences and Specific Proteins in Foods”; and does not on testing of processed foods in which no DNA is detectable. | Y | |

Sources: Vermont General Assembly, H-112, p. 13-16, Washington General Assembly, I-522, p. 6-8

*To be unintentionally produced with GE material: “A raw agricultural commodity or food derived from it that has been grown, raised, or produced without the knowing and intentional use of food or seed produced with genetic engineering. Food will be deemed to be as described in this subdivision only if the person otherwise responsible for complying with [these] requirements with respect to the commodity or food that person, a sworn statement that the commodity or food has not been knowingly or intentionally produced with genetic engineering and has been segregated from and has not been knowingly or intentionally comingled with food that may have been produced with genetic engineering at any time. In providing such a sworn statement, any person may rely on a sworn statement from his or her own supplier that contains the affirmation set forth in this subdivision.”⁴⁸

** Each State has different requirements regarding the amount of genetic engineered material food/commodities may contain. These differences are further explained in the state sections.

⁴⁸ Vermont General Assembly, H-112, p.13-14.