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Bridging the Genetic Divide: Confidence-Building Measures for Genetically Modified Crops

by

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BRIDGING THE GENETIC DIVIDE: CONFIDENCE-BUILDING MEASURES FOR GENETICALLY MODIFIED CROPS

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ABSTRACT: Genetically modified crops are now widely planted throughout the United States. To date, GM crops have not been modified for improved taste, appearance, or nutrition-benefits that would accrue directly to the public. Rather, ag-biotech companies have directed most of their energies toward developing crops that can be grown more profitably in Iowa. While growers have embraced GM crops, the public has been less sanguine about both the science underlying GM crops and about the trustworthiness of ag-biotech companies. In angry and divisive exchanges, the technology's proponents and opponents have been typecast and vilified. This inability to communicate has grown into a vicious cycle of misunderstanding and mistrust. Civil dialogue has become all but impossible.

This article proposes a series of confidence-building measures intended to break this cycle and permit GM advocates and opponents to move beyond empty rhetoric. These confidence-building measures focus on the environmental concerns that surround this technology and offer a way to create channels of trust and communication between the interested parties. Once communication is established, GM advocates and opponents should be able to begin a substantive dialogue about how GM technology can and should be exploited.

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Confidence-building measures (CBMs) are a common device in international law[1] and are part of the negotiator's stock in trade.[2] Used to diffuse tensions when the gulf between competing interests seems irreconcilable,[3] CBMs are intended to create the conditions necessary to restart a dialogue. They do not resolve the underlying conflict, but help the parties develop channels of trust and communication that will enable them to resume negotiations directed at an ultimate resolution of the conflict.

The adoption of CBMs to facilitate the GM crop debate seems promising, and perhaps necessary, in view of the highly polarized rhetoric swirling around their use. Biotechnology's proponents claim that GM crops will help feed the world's growing human population while preserving what is left of the natural ecosystem. Opponents counter that uncontrolled use of the technology is ecological roulette.[4] The rhetorical extremes of a "new green revolution"[5] and "Frankenfoods"[6] have polarized the participants in this critical public discussion. Where some see this technology as unalloyed progress, others see only disaster in the making. In angry and divisive exchanges, the technology's proponents and

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1. Confidence-building measures are frequently intended to ameliorate tensions and avert war. *See, e.g.*, Comprehensive Test Ban Treaty, *opened for signature* Sept. 10, 1996, art. IV, art. XVII, Confidence-Building Measures, Protocol and Annexes to the Protocol S. Treaty Doc. No. 105-28; 35 I.L.M. 1439; *see also* Organization for Security and Co-operation in Europe, Confidence- and Security-Building Measures, *at* http://www.osce.org/docs/english/csbme.htm (referencing the application of CBMs in the Helsinki Final Act regime (1975–86), the Stockholm Document regime (1986–90), and the Vienna Document regime (1990/1992/1994/1999)) (last visited Oct. 15, 2003). In this context, CBMs work to eliminate secrecy in military activity by helping states distinguish real adversary threats from unfounded fears regarding the threat posed by a real or potential adversary. For example, the Dayton Accords that ended the war in Yugoslavia were designed to procure a cease-fire between the warring parties and "provide for regional stabilization and confidence-building measures." General Framework Agreement for Peace in Bosnia and Herzegovina, Annex 1-A, Dec. 14, 1995, 35 I.L.M. 75 (1996). Although CBMs are commonly employed in the context of military hostilities, they can also serve a useful role in defusing civil tensions.

2. Thomas R. Colosi, *The Principles of Negotiation*, 57 DISP. RESOL. J. 28, 30 (2002).

3. *See* THE HENRIE L. STIMSON CENTER, A HANDBOOK OF CONFIDENCE-BUILDING MEASURES FOR REGIONAL SECURITY (Michael Krepon et al. eds., 3d ed. 1998) (including chapters on the use of CBMs to resolve tension in Bosnia-Herzegovina, the Korean Peninsula, Northern Ireland, and the Middle East).

4. Jeremy Rifkin, *The Biotech Century: Playing Ecological Roulette with Mother Nature's Designs*, E MAGAZINE, May-June 1998, *available at* http://www.emagazine.com/may-june_1998/0598feat2.html. *See also* Turning Point Project, Genetic Engineering Series, Ad #3: Genetic Roulette, *at* http://www.turnpoint.org/geneng.html (adapted from JEREMY RIFKIN, THE BIOTECH CENTURY: HARNESSING THE GENE AND REMAKING THE WORLD (1998)) (last visited Oct. 15, 2003).

5. *See, e.g.*, *GM Food v. Manure*, NAT'L POST, Aug. 2, 2001, at A17, *available at* 2001 WL 25978972; J. Madeleine Nash, *Grains of Hope*, TIME INT'L, Feb. 12, 2001, at 34, *available at* 2001 WL 5489428; RICHARD MANNING, FOOD FRONTIER: THE NEXT GREEN REVOLUTION (2000).

6. *See, e.g.*, Kevin Cullen, *Genetically Modified Food Fight Growing Unpalatable*, BOSTON GLOBE, Aug. 3, 1999, at A1, *available at* 1999 WL 6075068; Geoffrey Lean, *Frankenfoods: The Truth at Last*, DAILY MAIL, Feb. 6, 2002, at 12, *available at* 2002 WL 3310510; Turning Point Project, *Genetic Engineering Series*, *at* http://www.turnpoint.org/geneng.html (last visited Oct. 16, 2003).

opponents have been typecast and vilified. Civil dialogue has become all but impossible.

Before CBMs can play a role in restoring communication across the genetic divide, it is necessary to identify the nature of the concerns brought to the table by various stakeholders. Ag-biotech companies are naturally motivated by profits, but they also bring a deep belief in scientific progress and a sense of their own integrity to any discussion about GM crops. This perspective leads them to adamantly oppose increased regulation of GM crops. They argue that GM crops are no different from conventional crops and that regulation will impose billions of dollars of unnecessary costs on a developing industry.[7] Additionally, they claim that regulation will cause world food supplies to lag even further behind a burgeoning population.[8]

The public is less sanguine about both the science underlying GM crops and the trustworthiness of ag-biotech companies. Many consumer groups, environmental groups and other nongovernmental organizations (NGOs) articulate fears that regulatory standards are too lenient and that the scope of resultant environmental and human health harms might be staggering.[9] This fear of overly lenient standards, coupled with a mistrust of market forces and science, drives many of the most vocal GM opponents. The recent StarLink[10] and ProdiGene[11] fiascos

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7. *See, e.g.*, Kurt Lawton, *Seeds of Change*, FARM INDUSTRY NEWS, Jan. 1, 2003, at 1 (concluding that only lawyers benefit from the "costly legal battles over seeds engineered to resist insecticides"); Henry I. Miller, *Plants Are Not Pesticides*, NATIONAL POST, July 20, 2001, at C15 (decrying EPA regulations as costly and burdensome to commerce and the environment).

8. *See, e.g.*, Norman Borlaug, *We Need Biotech to Feed the World*, WALL ST. J., Dec. 6, 2000, at A22; Robert L. Paalberg, *How the EU Made Africa's Famine Possible*, WALL ST. J. EUR., Aug. 26, 2002, at A10.

9. *See, e.g.*, Center for Science in the Public Interest, http://cspinet.org/biotech/ (last visited Oct. 7, 2003); Greenpeace, http://www.greenpeaceusa.org/bin/view.fpl/4794/cms_category/68.html (last visited Oct. 7, 2003); Sierra Club, http://www.sierraclub.org/biotech/ (last visited Oct. 7, 2003); Union of Concerned Scientists, http://www.ucsusa.org/food_and_environment/biotechnology/index.cfm (last modified Jan. 27, 2003).

10. On September 18, 2000, a coalition of environmental groups announced that it had found traces of StarLink corn in 23 common grocery products. Associated Press, *StarLink Corn: How It Reached the Food Supply*, Dec. 4, 2000, *available at* http://archive.showmenews.com/2000/dec/20001204busi011.asp. This was how the world discovered that StarLink corn, a GM crop not approved for human consumption because of unresolved allergenicity concerns, had found its way into various processed foods sold throughout the world. Marc Kaufman, *Biotech Critics Cite Unapproved Corn in Taco Shells; Gene-Modified Variety Allowed Only for Animal Feed Because of Allergy Concerns*, WASH. POST, Sept. 18, 2000, at A2. The discovery set off a frenzy of product recalls and a consumer panic. *See, e.g.*, Mark Kaufman, *Corn Woes Prompt Kellogg to Shut Down Plant*, WASH. POST, Oct. 21, 2000, at A2; *Biotech Corn Recall Expands in Stores, Restaurants*, WASH. POST, Nov. 3, 2000, at A5; *Fifty Percent of Corn May Be Impure; Problem Could Cost "Hundreds of Millions,"* DES MOINES REG., Oct. 28, 2000, at 1A; *Western Family Recalls Products with Altered Corn*, THE OREGONIAN, Oct. 26, 2000, at A2, *available at* 2000 WL 27103380. Ultimately, more than 300 types of processed foods were pulled from grocery shelves. FDA Enforcement Report, *available at* http://www.fda.gov/bbs/topics/ENFORCE/ENF00666.html (Nov. 1, 2000). Millions of bushels of StarLink corn had been commingled with food corn in at least 350 grain elevators. Kurt Eichenwald, *New Concerns Rise on Keeping Track of Modified Corn*, N.Y. TIMES, Oct. 14, 2000, at A1. Under heavy pressure from the United States Department of Agriculture

only underscored for GM opponents that ag-biotech companies are not to be trusted and that regulation is too lenient. Ag-biotech companies, for their part, have been slow to recognize that despite the inflammatory rhetoric, GM

(USDA), StarLink's manufacturer, Aventis, offered a 25-cent premium to repurchase the nation's supply of StarLink corn and to ensure that it did not enter the food chain. Fortunately, these efforts were relatively successful, and the Centers for Disease Control (CDC) concluded that so little StarLink corn ultimately entered the human food supply that allergic reactions were unlikely. *See* ENVTL. HEALTH DIV., CTRS. FOR DISEASE CONTROL & PREVENTION, INVESTIGATION OF HUMAN HEALTH EFFECTS ASSOCIATED WITH POTENTIAL EXPOSURE TO GENETICALLY MODIFIED CORN (2001), *available at* http://www.cdc.gov/nceh/ehhe/Cry9cReport (last modified Nov. 9, 2002). Even so, the StarLink fiasco had a devastating effect on United States grain exports. For a full exploration of the StarLink crisis, *see* Rebecca M. Bratspies, *Myths of Voluntary Compliance: Lessons from the StarLink Corn Fiasco*, 27 WM. & MARY ENVTL. L. & POL'Y REV. 593 (2003).

11. ProdiGene is a producer of a so-called "biopharm" crop. Biopharming involves inserting genes into crop plants, like corn, to make the plants manufacture drugs, vaccines, enzymes, antibodies, hormones or industrial chemicals. Essentially, biopharming converts plants into a living factory for chemical or pharmaceutical production. Although biopharming uses food crops as a production vehicle, biopharm crops are not food and are not intended for human consumption. Because biopharming is still experimental, fields planted with biopharm crops are currently subject to federal inspection.

In December 2002, USDA announced that ProdiGene corn, which had been genetically engineered to produce a swine vaccine, had been grown improperly in two separate locations, one in Nebraska and the other in Iowa. United States Department of Agriculture, USDA Investigates Biotech Company for Possible Permit Violations, *at* http://aphisweb.aphis.usda.gov/lpa/news/2002/11/prodigene.html (Nov. 13, 2002). At both sites, government inspectors discovered ProdiGene corn growing amidst soybeans. These growers had failed to remove volunteer ProdiGene corn before planting soybeans on the same land. *Feds Probe Biotech Firm for Crop Mixing*, *at* http:// www.cnn.com/2002/US/11/14/biotech.contamination/#1 (Nov. 12, 2002). Compounding the problem, these growers also failed to respond to post-discovery orders to destroy these volunteer corn plants before harvesting the soybean crops to prevent the possibility of contaminating human food. Philip Brasher, *Biotech Corn May Have Tainted Soybeans*, DES MOINES REG., Nov. 13, 2002, at 1A, *available at* 2002 WL 100690866. Instead, the growers simply harvested their fields and sent the soybeans to an elevator, where they were commingled with the soybeans already present in the elevator. Stalks and leaves from the bioengineered corn were discovered mixed with the soybeans. *Corn Near Gene-Altered Site to Be Destroyed*, N.Y. TIMES, Nov. 14, 2002, at C10. Because of contamination fears, regulators ordered the destruction, not only of all the soybeans in the elevator, but also of ordinary corn fields that had surrounded the biopharm corn. *Id.* ProdiGene was assessed a $250,000 fine and was ultimately required to pay more than $3 million to repurchase the soybeans and to clean the silo. *See* Christopher Doering, *ProdiGene to Spend Millions on Bio-Corn Tainting*, *at* http://www.planetark.org/avantgo/dailynewsstory.cfm?newsid=18935 (Sept. 12, 2002). The damage to public trust will be more difficult to repair. Neither the grower nor ProdiGene had taken seriously the need to prevent cross-contamination and to keep its swine vaccine corn out of the human food supply.

In 2002, there were at least two other incidents in which biopharming firms were fined for failure to properly manage biopharming crops. Justin Gillis, *EPA Fines Biotechs for Corn Violations*, WASH. POST, Dec. 13, 2002, at E3. Dow Agrosciences and Pioneer Hi-Bred were each fined for failure to take proper measures to prevent commercial crops intended for human consumption from being contaminated with experimental biopharmed corn. *Id.*

According to some predictions, at least 10% of United States agricultural lands will be devoted to biopharming by the end of the decade. Aaron Zitner, *Fields of Gene Factories*, L.A. TIMES, June 4, 2001, at A1; *see also* Scott Kilman, *Food, Biotech Industries Feud Over Plans for Bio-Pharming*, WALL ST. J., Nov. 5, 2002, at B7. Public trust will be critical to the successful exploitation of this new technology.

opponents have raised some real and valid concerns. As a result, there is a pervasive climate of mistrust that makes communication about expectations, problems, interests, wants and needs nearly impossible. The inability to communicate has grown into a vicious cycle of escalating misunderstanding and mistrust. CBMs might break this cycle and permit the interested parties to move beyond empty rhetoric.

Because the United States is the primary adopter of agricultural biotechnology, and the American public is more accepting of the technology than many other populations, we have a unique opportunity to develop CBMs. By encouraging openness and transparency, CBMs can help GM advocates and opponents establish some common ground based on shared goals. Once a dialogue has been established, the parties can work towards creating a framework for safe and effective implementation of this new technology. Failure to successfully address these issues in the United States may result in permanent polarization on the issue and might ultimately result in the loss of this promising technology altogether.

I. OVERVIEW OF THE PROBLEM

The contours of the debate about agricultural biotechnology must be viewed against the fact that every year the world's population continues to grow. The United Nations Food and Agriculture Organization (FAO) projects that world population will reach 9–10 billion individuals by 2050, a 60% increase from 2000.[12] Given that a large percentage of the population in developing countries currently suffers from chronic malnutrition, adequately feeding those new mouths will require a more than 60% increase in the food supply.[13] To accommodate this growth, more land will have to be converted to farm use or existing farmland will have to be made more productive. The former option raises serious environmental concerns. The sheer scope of rainforest and other wild lands lost to farming every year (with an attendant loss of habitat and biodiversity) seriously threatens conservation efforts and may exacerbate global warming.[14] Other things being

12. U.S. Census Bureau, Total Midyear Population for the World: 1950–2050, *available at* http://www.census.gov/ipc/www/worldpop.html (last modified July 17, 2003); *see also* FAOSTAT, *available at* http://apps.fao.org (last visited Nov. 11, 2003); FOOD & AGRIC. ORG. OF THE U.N., THE STATE OF FOOD INSECURITY IN THE WORLD (2001), *available at* http://www.fao.org/docrep/003/y1500e/y1500e00.htm (last visited Nov. 11, 2003).

13. *See* FOOD & AGRIC. ORG. OF THE U.N., *supra* note 12; *see also* Dr. Norman Borlaug, *Is There Enough Food?*, *at* http://www.whybiotech.com/html/con399mid17.html (July 10, 2000) (the Nobel laureate agronomist explains that among the more serious of these nutritional deficiencies is vitamin A deficiency which causes one-half million children to lose their eyesight each year).

14. *See* ROBERT T. WATSON, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, A REPORT ON THE KEY FINDINGS FROM THE IPCC SPECIAL REPORT ON LAND-USE, LAND-USE CHANGE AND FORESTRY, *at* http://www.ipcc.ch/present/sp-lulucf.htm (June 13, 2000). For a cogent explanation of the role that deforestation plays in global warming, geared towards the nonscientist, see Union of Concerned Scientists, *Recognizing Forests' Role in Climate Change*, *at* http://www.ucsusa.org/global_environment/biodiversity/page.cfm?pageID=526 (last modified Oct. 25, 2002).

equal, increased crop yields would therefore be a more environmentally desirable solution to the population problem.

GM crops are offered as a solution to the intractable problem of human population growth. The crops are touted as a means to feed the hungry,[15] provide nutrients to undernourished children (particularly golden rice which has been promoted as the way to prevent Vitamin A deficiency blindness)[16] and to reclaim farmlands lost to desertification or heavy metal contamination.[17] These claims are not uncontested, especially with regard to golden rice. At their best, GM crops can offer the promise of increased yields and more nutritious crops while reducing dependence on pesticides and fertilizers.[18]

Why then do large numbers of people react so negatively to the very idea of GM crops?[19] Part of the answer lies in the disconnect between the ag-biotech industry's "save the world" rhetoric and its actual conduct. GM technology may have all of the potential to feed the hungry that its most fervid promoters claim. Unfortunately, these "save the world" crops are not the ones being heavily researched and marketed.[20] Despite the golden rice hyperbole, the focus has not

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15. *See, e.g.*, Gregory Conko & C.S. Prakash, *Battling Hunger with Biotechnology*, *at* http://usinfo.state.gov/journals/ites/0502/ijee/conko.htm (last visited Oct. 9, 2003).

16. J. Madaleine Nash, *Grains of Hope*, TIME ASIA, Oct. 29, 2003, *available at* http://www.time.com/time/asia/biz/printout/0,9788,98034,00.html; *c.f.* Michael Pollan, *The Great Yellow Hype*, N.Y. TIMES MAG., Mar. 4, 2001, at 15. For a report critical of the hyperbolic claims for golden rice, see Vandana Shiva, *The "Golden Rice" Hoax—When Public Relations Replaces Science*, *at* http://online.sfsu.edu/~rone/GEessays/goldenricehoax.html (last visited Oct. 9, 2003). For a response from the Rockefeller Foundation, sponsor of much of the golden rice research, acknowledging that the claims for golden rice have been overblown by biotech advocates but emphasizing that golden rice can be a useful tool in an integrated campaign against Vitamin A blindness, see *A Letter from Prof. Gordon Conway to Greenpeace on the Issue of "Golden Rice," at* http://www.rockfound.org/display.asp?context=1&Collection=4&DocID=422&Preview=0&ARCurrent=1 (last visited Oct. 9, 2003).

17. FOOD & AGRIC. ORG. OF THE U.N., STATEMENT ON BIOTECHNOLOGY (2002), *at* http://www.fao.org/biotech/stat.asp (last visited Oct. 16, 2003); Anahad O'Connor, *Altered Tomato Thrives in Salty Soil*, N.Y. TIMES, Aug. 14, 2001, at F3; Marcia Wood, *New, Salt-Tolerant Plants Developed, at* http://www.ars.usda.gov/is/pr/2003/030129.htm (Jan. 29, 2003).

18. *See* Biotechnology Industry Organization (BIO), Guide to Biotechnology: Agricultural Production Applications, *at* http://www.bio.org/er/agriculture.asp (last visited Oct. 9, 2003).

19. For an interesting snapshot of United States public opinion on the safety of GM crops, see The Pew Initiative on Food and Biotechnology, *Environmental Savior or Saboteur? Debating the Impacts of Genetic Engineering*, *available at* http://pewagbiotech.org/research/survey1-02.pdf (Feb. 4, 2002). This survey reported that the American public is deeply divided on the safety and desirability of GM crops. *Id.*

20. That is not to say that existing GM crops do not offer the potential for significant environmental benefits. Indeed, as Thomas Redick points out, Roundup Ready soybeans (soybeans that have been genetically engineered to be glyphosate-resistant) and other herbicide resistant (HR) soy have a soil-conserving effect that is clearly an ecological benefit. Thomas R. Redick, *Stewardship for Biotech Crops: Strategies for Improving Global Consumer Confidence*, 44 Jurimetrics J. 5, 22 n.39 (2003). Additionally, some data suggest that Bt crops have enabled growers to significantly reduce pesticide applications. JANET E. CARPENTER & LEONARD P. GIANESSI, NAT'L CTR. FOR FOOD & AGRIC. POLICY, AGRICULTURAL BIOTECHNOLOGY: UPDATED BENEFIT ESTIMATES 1 (2001), *available at* http://www.ncfap.org/reports/biotech/updatedbenefits.pdf (last visited Nov. 11, 2003).

been on creating GM crops to meet the nutritional needs of subsistence farmers in poorer developing countries.[21] Rather, ag-biotech companies have directed most of their energies toward developing crops that can be grown more profitably in Iowa.

The first round of GM crops have been engineered for pest resistance and herbicide tolerance—traits that enable growers to reduce costly pesticide and fertilizer inputs while expanding yields. If these crops reduce pesticide inputs, the environment as a whole might benefit, but the lion's share of benefits from existing GM crops redounds to the grower or the ag-biotech company in the form of increased profits. Because commodity costs are a fraction of the price of most processed foods, consumers do not see the benefit of reduced costs.[22] To date, ag-biotech companies have not marketed crops with improved taste, appearance or nutrition—benefits that would more directly accrue to the public. With such a profound disconnect between rhetoric and implementation, it is perhaps inevitable that opponents mistrust these representations of "a new green revolution."[23]

Public fears about the use of GM crops can be loosely grouped into two separate concerns: (1) human safety and consumer choice concerns and (2) environmental concerns. The human safety and consumer choice concerns center on whether genetically modified foods are safe to eat. Coupled with this basic safety question is an ongoing debate about whether GM products should be labeled so that consumers can make informed choices about purchasing and eating GM products.[24] The environmental concerns focus on the possible ecological

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21. For example, crops like plantain, cassava, cowpeas, lentil, millet, and sweet potato are an essential part of diets in the developing world. Improvements in yield or nutritional content would dramatically increase the health of the world's poorest citizens. Unfortunately, these so-called "orphan crops" do not provide a high profit potential and thus do not get the private research attention that their importance as a food source would suggest. Research on these essential staple crops is thus left to underfunded public sector researchers. For a good description of this problem, see Sarom Bahk, *Food for Thought,* THE PEAK, Jan. 22, 2001, *available at* http://www.peak.sfu.ca/the-peak/2001-1/issue3/fe-gmf.html.

22. For example, the price of corn flakes has increased more than 450% per box from 1975 to 1998, while the price of the corn used to manufacture that box of cornflakes has only increased $0.03 per box. DIANE J. F. MARTZ & WENDY MOELLENBECK, CTR. FOR RURAL STUDIES & ENRICHMENT, ST. PETER'S COLLEGE, THE FAMILY FARM IN QUESTION: COMPARE THE SHARE REVISITED 9 (2002). Similarly, the cost of wheat was only 8% of the consumer cost of a loaf of bread in 1998, down from 17% in 1975. *Id.* According to a 1999 USDA survey, farm inputs contributed only 5% to the cost of a box of cornflakes, and marketing and transportation costs were far more likely to affect ultimate consumer food prices than were fluctuations in the price paid to farmers. *See* HOWARD ELITZAK, FOOD & RURAL ECON. DIV., U.S. DEP'T OF AGRIC., FOOD COST REVIEW 1950–1997, at iii, 5 (1999), *available at* http://ers.usda.gov/publications/aer780/aer780.pdf.

23. *See* MANNING, *supra* note 5.

24. For a balanced articulation of this issue, see Gregory A. Jaffe, Labeling Genetically Modified Foods: Communicating or Creating Confusion?, statement presented at the Pew Initiative on Food and Biotechnology's Public Form, *available at* http://cspinet.org/biotech/pew-forum.html (June 27, 2002). For a thorough exploration of the international law questions surrounding labeling, albeit with a strong point of view, see MATTHEW STILWELL & BRENNAN VAN DYKE, CENTER FOR INTERNATIONAL ENVIRONMENTAL LAW, AN ACTIVIST'S HANDBOOK ON GENETICALLY MODIFIED ORGANISMS AND THE WTO (1999), *available at* http://www.consumerscouncil.org/policy/handbk

hazards that these crops might pose if cultivated. The possible environmental hazards include: transfer of genetic material to wild relatives,[25] disruption of natural ecosystems,[26] contamination of conventional crops through cross-breeding,[27] and evolution of resistance in pest populations.[28]

799.htm. The debate over the labeling of GM crops has caused tremendous trans-Atlantic tensions. On May 13, 2003, the Bush Administration formally requested consultations in the World Trade Organization (WTO) over the European Union's (EU) informal moratorium on new GM crops and challenging the EU's new labeling rules.

The request is a first step in a challenge alleging that the ban violates fundamental free-trade principles. The WTO's dispute resolution provisions can be found at http://www.wto.org/english/tratop_e/dispu_e/rc_e.htm (last visited Oct. 9, 2003). The United States' Request for Consultation is available at http://www.wto.org/english/tratop_e/dispu_e/dispu_subjects_index_e.htm#gmos (last visited Oct. 9, 2003). The EU's new directive for deliberate release of genetically modified organisms, EU Directive 2001/18/EEC, can be found at http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=32001L0018&model=guicheti (last visited Oct. 9, 2003.

25. Ralph Haygood et al., *Consequences of Recurrent Gene Flow from Crops to Wild Relatives*, PROC. ROYAL SOC'Y LONDON, Series B (2003) (modeling negative outcomes of transgenic gene flow from GM crops to wild relatives); Marc Fuchs & Dennis Gonsalves, *Risk Assessment of Gene Flow from a Virus-resistant Transgenic Squash into a Wild Relative*, *in* METHODS FOR RISK ASSESSMENT OF TRANSGENIC PLANTS 141–43 (1999). The possibility of genetic exchange between cultivated plants and their wild relatives is not unique to GM crops. Rather, it is this ability for genetic exchange that has permitted the development and enhancement of all cultivated crops. What is unique with GM crops is the array of genes that could possibly be transferred to wild relatives and the possible repercussions from such a transfer. One frightening report of GM contamination involved a wild relative of corn in Mexico—a country that had not even approved the GM variety detected. Carol Kaesuk Yoon, *Genetic Modification Taints Corn in Mexico*, N.Y. TIMES, Oct. 2, 2001, at F7. David Quist & Ignacio H. Chapela, *Transgenic DNA Introgressed into Traditional Maize Landraces in Oaxaca, Mexico*, 414 NATURE 541, 541–42 (2001). In April 2002, however, the editors of *Nature* concluded that "the evidence available was not sufficient to justify the publication of the original paper." Editorial Note, 416 NATURE 600, 600 (2002). Further Mexican research confirmed the Quist & Chapela reports of contamination. Kelsey Demmon & Amanda Paul, *Mexican Study Validates GE Corn Contamination*, DAILY CALIFORNIAN, Aug. 20, 2002, *available at* http://www.organicconsumers.org/gefood/chapela082802.cfm; Fred Pearce, *Mexican Study Confirms GM Contamination of Maize*, SCIENTIST DAILY NEWS, May 1, 2002, *available at* http://www.biomedcentral.com/news/20020501/04.

26. John Harte, Editorial Note, *Land Use, Biodiversity, and Ecosystem Integrity: The Challenge of Preserving Earth's Life Support System*, 27 ECOLOGY L.Q. 929, 958 (2001) (worrying that a released GMO might alter the natural ecosystem and have enormous effects on natural biodiversity).

27. Norman C. Ellstrand, *When Transgenes Wander, Should We Worry?*, 125 PLANT PHYSIOLOGY 1543, 1544–45 (2001), *available at* http://www.plantphysiol.org/cgi/content/full/124/4/1543; Neil E. Harl, Genetically Modified Food Crops: Guidelines for Producers, *at* http://www.extension.iastate.edu/Pages/grain/publications/buspub/0010harl1.pdf (last visited Oct. 16, 2003); *See generally* CAROL NORRIS & JEREMY SWEET, MONITORING LARGE SCALE RELEASES OF GENETICALLY MODIFIED CROPS (EPG 1/5/84) INCORPORATING REPORT ON PROJECT EPG 1/5/30: MONITORING RELEASES OF GENETICALLY MODIFIED CROP PLANTS (2002) (final report of monitoring studies of fieldscale releases of GM oilseed rape crops in England from 1994–2000), *at* http://www.defra.gov.uk/environment/gm/ research/epg-1-5-84.htm (Dec. 24, 2002).

28. *See generally* International Survey of Herbicide Resistant Weeds, *at* http://www.weedscience.org/in.asp (last visited Oct. 5, 2003); Union of Concerned Scientists, *supra* note 9; *see also* Herbicide Tolerance in RR Crops Seen By Farmers to Reduce Land Values, *at* http://www.syngentacropprotection-us.com/media/article.asp? article_id=216 (Apr. 4, 2002).

At this stage, the human safety concerns are much less amenable to CBMs. Although there have been no documented adverse public health effects from GM crops, the issue is an extremely emotional one for GM opponents, and proponents can offer little solid evidence to support their claims of product safety. The environmental concerns, though thorny, are not nearly as intractable. Therefore, I propose to focus first on the environmental concerns associated with GM crops and to develop CBMs around environmental protection. My hope is that successful agreement and cooperation on one front will lay groundwork for cooperation on the other.

II. ENVIRONMENTAL CONCERNS RAISED BY USE OF GM CROPS

Over the past five years, genetically modified (GM) crops—particularly Bt corn and cotton[29]—have been widely planted in the United States.[30] Indeed, the United States' policies toward adoption of GM technology are more favorable than any other industrialized countries, and the United States accounts for more than two-thirds of the total GM harvest worldwide.[31] In 2001, for example, GM corn was planted in every state in the continental United States.[32] South Dakota led in adopting GM crops, with 47% of corn acreage and 80% of soybean acres planted with GM crops.[33] By 2003, those numbers had leapt to 75% of corn acres and 91% of soybean acres in South Dakota planted with GM crops.[34] Kansas, Indiana, Nebraska, and Minnesota were not far behind.[35] In some counties, Bt crops represent more than 50% of crops planted.[36] Overall, GM crops in 2003

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29. Bt stands for *Bacillus thurengiensis*, a species of commonly found soil bacteria. This bacteria produces a series of proteins with pesticidal properties. For many years, these proteins were isolated and used as a spray on pesticide. Because these naturally occurring proteins are toxic to certain lepidopteran pests, but have almost no effect on mammals or other nontarget animals, Bt toxins are unique among pesticides. With the advent of biotechnology, it became possible to transfer genes coding for these various Bt toxins from bacteria to plant genomes. Thus, the GM plant would endogenously produce the bacterial Bt toxin.

30. *See* NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T OF AGRIC., CROP PRODUCTION-ACREAGE-SUPPLEMENT, *at* http://usda.mannlib.cornell.edu/reports/nassr/field/pcp-bba (June 30, 2003) [hereinafter 2003 ACREAGE REPORT].

31. *See* Economic Research Service, USDA, *Agricultural Biotechnology: Adoption of Biotechnology and Its Production Impacts*, *at* http://www.ers.usda.gov/briefing/biotechnology/chapter1.htm (last modified Sept. 17, 2003); Pew Initiative on Food and Biotechnology, Fact Sheet: Genetically Modified Crops in the United States, *at* http://www.pewagbiotech.org/resources/factsheets/display.php3?FactsheetID=1 (Aug. 2001).

32. Pew Initiative on Food and Biotechnology, *supra* note 31.

33. *See* 2003 ACREAGE REPORT, *supra* note 30. *See also* NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T OF AGRIC., CROP PRODUCTION-ACREAGE-SUPPLEMENT, *at* http://usda.mannlib.cornell.edu/reports/nassr/field/pcp-bba (June 29, 2001).

34. 2003 ACREAGE REPORT, *supra* note 30, at 24–26.

35. *Id.*

36. *See generally* National Corn Growers Association, *at* http://www.ncga.com (last visited Nov. 11, 2003).

accounted for 73% of the cotton, 81% of the soybeans, and 34% of the corn grown in the United States,[37] and these numbers will likely continue to increase.

While growers have embraced GM crops,[38] the general public has been more hesitant. In fact, widespread use of GM crops has generated growing concerns about human health and environmental safety. Unexpectedly high rates of adoption have exceeded all agency estimates for use of these crops.[39] This stronger-than-expected market penetration of GM crops raises the possibility that agency-imposed safeguards may not be adequate to protect the environment.[40] Though the American public has expressed nowhere near the level of alarm seen in Europe and elsewhere, even in the United States rhetoric about Frankenfoods,[41] ecological roulette,[42] and playing god[43] is not uncommon.

To date, most GM crops are Plant-Incorporated Protectorants (plants that have been modified to endogenously produce Bt pesticidal proteins).[44] As such, they are subject to the same EPA regulations that govern pesticides.[45] In particular, EPA can register a pesticide for sale and use in the United States only if the agency is satisfied that the pesticide does not pose "an unreasonable risk of

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37. 2003 ACREAGE REPORT, *supra* note 30, at 24–26.

38. There is also a great deal of pressure on a grower to adopt Bt crops if a neighbor does. *See, e.g.*, EPA Office of Pesticide Programs, EPA/USDA Workshop on Bt Crop Resistance Management ("If my neighbor is planting Bt, I'd better plant it too, otherwise I get the corn borers"), *available at* http://www.epa.gov/oppbppd1/biopesticides/pips/old/x_btcornproceedings.htm (June 18, 1999).

39. *See* BIOPESTICIDES & POLLUTION PREVENTION DIV., ENVTL. PROT. AGENCY, BIOPESTICIDES REGISTRATION ACTION DOCUMENT: *BACILLUS THURINGIENSIS* (BT) PLANT-INCORPORATED PROTECTANTS II.B.5 [hereinafter ACTION DOCUMENT], *available at* http://www.epa.gov/pesticides/biopesticides/pips/old/x_brad_bt_pip2.htm2 (Oct. 16, 2001). Unfortunately, these rate of adoption projections were used to develop a whole series of safety calculations, designed to prevent pest resistance. Because the projections were so inaccurate, questions about the validity of the safety claims must be entertained.

40. For an exploration of these safeguards and their weaknesses, see Rebecca Bratspies, *The Illusion of Care*, 10 N.Y.U. ENVTL. L.J. 297 (2002).

41. *See, e.g.*, Turning Point Project, *supra* note 6; Ethical Investing, Genetically-Engineered "Frankenfoods," *at* http://www.ethicalinvesting.com/monsanto/ge.shtml (last visited Oct. 15, 2003); Grist Magazine, Fight Frankenfoods, *at* http://www.gristmagazine.com/dogood/food.asp (last visited Oct. 15, 2003); Organic Consumers Association, Summary of Current Lawsuits on the Frankenfoods Front, *at* http://www.organicconsumers.org/ge/gelawsuits.cfm (last modified Dec. 20, 2000); *see also* Sharon Schmickle, *Missing from the Cloning Roundup; Food Companies Are Staying on the Fence*, MINNEAPOLIS STAR TRIB., Oct. 14, 2002, at 1D (describing Frankenfood protests); Margaret Wertheim, *PharmPhresh: The Latest in Frankenfoods*, LA WEEKLY, Oct. 7, 2002, *available at* http://www.alternet.org/story.html?StoryID=14241.

42. RIFKIN, *supra* note 4; Turning Point Project, *supra* note 6.

43. Turning Point Project, *supra* note 6, *at* Ad #1. Prince Charles famously claimed that "[g]enetic modification takes mankind into realms that belong to God and God alone." *See* Cullen, *supra* note 6, ¶ 10.

44. Another large group of GM crops has been genetically engineered for herbicide resistance. These CBMs could also be applied to herbicide resistant GM crops.

45. Biopesticides are exempt from the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) requirements only if they are derived through the conventional breeding of sexually compatible plants. *See* Plant-incorporated Protectant from Sexually Compatible Plant, 40 C.F.R. § 174.25 (2002). *See also* General Qualifications for Exemptions, 40 C.F.R. § 174.21 (2002).

harm."[46] Responding to significant scientific concerns about the possibility that unrestricted use of Bt crops will likely lead to rapid evolution of Bt resistance among the target insect populations,[47] EPA imposed a series of restrictions on Bt crops designed to prevent this "unreasonable risk of harm." These restrictions are the preconditions for lawful sale and use of the products.

However, government regulators have been reluctant to interfere with market development of these products. As a result, the regulatory system is full of holes. Most particularly, the regulatory scheme lacks any monitoring and enforcement mechanisms to ensure compliance with environmental protection measures imposed as a condition of crop registration. All Bt crop registrations contain an identical condition designed to prevent the evolution of insect resistance to Bt toxins—the requirement that all growers planting Bt corn plant at least 20% of their acreage with a non-Bt variety.[48] This requirement is intended to ensure that every Bt field will have many insects susceptible to Bt nearby. The idea is to make it overwhelmingly likely that any Bt resistant insect that survives the Bt crop will mate with a Bt susceptible partner from the refuge area, thus producing offspring that are susceptible to Bt.[49] In the absence of a 20% non-Bt refuge, the insect population is likely to rapidly evolve resistance to Bt toxins, thus rendering the pesticide worthless.[50] It is this refuge requirement that will be the focus of my proposed CBMs.

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46. 7 U.S.C. § 136a(c)(5) (2000). To determine whether an adverse effect is unreasonable, EPA must consider "the economic, social and environmental costs and benefits of the use of any pesticide." 7 U.S.C. § 136(bb) (2000). EPA may, by regulation, exempt any pesticide from some or all of the requirements of FIFRA if the pesticide is "of a character which is unnecessary to be subject to" FIFRA in order to carry out the purposes of the Act. 7 U.S.C. § 136w(b) (2000). EPA generally exempts pesticides that pose low probabilities of risk to the environment in the absence of regulatory oversight. *See* Regulations Under the Federal Insecticide, Fungicide, and Rodenticide Act for Plant-Incorporated Protectants (Formerly Plant-Pesticides), 66 Fed. Reg. 37,772 (July 19, 2001) (codified at 40 C.F.R. pts. 152, 174) (allowing pesticides that do not qualify for exemption to still be approved for specific uses, but only if they do not "cause unreasonable adverse effects").

47. TERRANCE M. HURLEY ET AL., BIOTECHNOLOGY AND PEST RESISTANCE: AN ECONOMIC ASSESSMENT OF REFUGES (Ctr. For Agric. & Rural Dev., Working Paper 97-WP 183, 1997), *available at* http://www.card.iastate.edu/publications/DBS/PDFFiles/97wp183.pdf (last visited Oct. 15, 2003).

48. *See* ACTION DOCUMENT, *supra* note 39, at IID14. The refuge requirement is slightly different for Bt cotton. For Bt crops planted in certain identified corn and cotton growing regions, the minimum refuge is 50%. *Id.*

49. For a more comprehensive explanation of how refugia are intended to function and the details of the regulatory scheme, see Bratspies, *supra* note 40.

50. R.T. Roush, *Can We Slow Adaptation by Pests to Insect Transgenic Crops?*, *in* BIOTECHNOLOGY & INTEGRATED PEST MANAGEMENT 242–63 (G.J. Persly ed., 1996); Richard Roush, *Managing Pests and Their Resistance to Bacillus thuringiensis: Can Transgenic Crops Be Better than Sprays?*, 4 BIOCONTROL SCI. & TECH. 501 (1994); D.N. Alstad & D.A. Andow, *Managing the Evolution of Insect Resistance to Transgenic Plants*, 268 SCI. 1894–96 (1995); James Mallet & Patrick Porter, *Preventing Insect Adaptation to Insect Resistant-Crops: Are Seed Mixtures or Refugia the Best Strategy?*, 250 PROC. ROYAL SOC'Y LONDON, Series B, Biological Sciences 165–69 (1992).

III. CONFIDENCE-BUILDING MEASURES

In 2001, EPA re-registered Bt crops on the condition the crops be planted with a 20% non-Bt refuge to prevent or delay the evolution of insect resistance to Bt. However, there is no regulatory mechanism in place to enforce this registration condition.[51] Because of the unique nature of the regulatory scheme governing GM crops, EPA has regulatory authority over only the ag-biotech company that manufactures the crops, not over the growers.[52] It is these ag-biotech companies that are bound by the registration restrictions rather than the growers who actually plant and cultivate the crops. In theory, the ag-biotech companies then impose those restrictions on growers through contractual conditions of the license agreements.[53] Unfortunately, not all companies have been diligent about imposing these contractual conditions.[54] Moreover, even when the ag-biotech companies have followed through on their legal obligation to contractually impose these conditions on growers, the contracts provide no penalties for failure to comply. Since the growers have no independent obligations to the government, a grower suffers no regulatory consequences for failing to fulfill these important environmental measures.

Highly publicized industry failures like StarLink and ProdiGene, coupled with the absence of any direct regulatory authority over the growers, have created a big credibility problem. Redressing this credibility problem could be ripe ground for employing CBMs in order to build trust and communication between proponents and opponents of GM technology. As things now stand, EPA's 20% refuge requirement can be enforced only through industry self-monitoring. If ag-biotech companies can work with GM opponents to develop education and monitoring programs that achieve high rates of voluntary compliance with the 20% refuge requirement, that success can become a platform for further communication. These groups can then use the good will and trust built up through a successful education and monitoring program to tackle the human health and consumer choice issues in a more thoughtful manner.

The proposed CBMs target the exchange and verification of information as a key means to promote cooperation among the various stakeholders. These CBMs aim to promote mutual trust and to dispel some of the environmental concerns that surround GM crops by encouraging openness and transparency. The proposal involves two stages: First, ag-biotech companies would immediately and unilaterally broaden the scope of information that they provide to the public. Second, these companies can take measures in conjunction with interested NGOs

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51. *See* Bratspies, *supra* note 40.

52. *Id.* at 351–52.

53. One such agreement, Monsanto's 2003 Technology/Stewardship Agreement, is *available at* http://www.monsanto.com/monsanto/us_ag/content/tools_dir/mta2003.pdf (last visited Oct. 16, 2003).

54. For example, when the StarLink news broke, Aventis was unable to produce grower agreements for much of the StarLink corn it had sold. Matt Crenson, *Rules for Genetically Modified Corn Broke Down Between Seed Plant, Farm*, ST. LOUIS POST-DISPATCH, Dec. 15, 2000, at A10.

(like Center for Science in the Public Interest or Union of Concerned Scientists) to create new educational programs for growers. This collaboration will produce three vital CBM initiatives: (1) a curriculum for grower education, (2) a series of independent compliance verification measures, and (3) a communications network to air and address concerns about growing practices.

IV. IMMEDIATE AND UNILATERAL AG-BIOTECH INDUSTRY MEASURES

Ag-biotech companies already provide a great deal of useful information about GM crops on their corporate websites[55] as well as through various industry trade groups like BIO[56] or commodity groups like ASTA.[57] Unfortunately, quite a bit of the most relevant information about GM crops either is not available on these websites, is buried so deep in the site as to be virtually inaccessible, or is extremely difficult to understand. The websites themselves are frequently difficult to navigate. Only the most determined researcher can track down the multitude of documents, studies and representations that are the informational basis for regulatory approvals.

As an immediate, unilateral CBM, the ag-biotech companies should make their websites more accessible and user-friendly—with easy-to-follow links leading to both technical and lay information about the various GM crops. In revising their websites, the ag-biotech companies should prominently display all public filings about their GM crops and should feature cross-links to federal agency websites[58] and independent biotechnology information sources. Such an action would cost little, could be implemented immediately, and would inform the interested public about peer-reviewed and agency vetted research and testing that has already been conducted by the companies. This action would convey the unmistakable message that the ag-biotech industry welcomes public scrutiny and is eager to communicate with those interested in biotechnology. By ensuring wide public access to information about GM crops, the ag-biotech industry will set the stage for collaboration and will have taken positive, concrete steps aimed at making real dialogue possible.

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55. *See, e.g.*, Syngenta, http://www.syngenta.com/en/index.aspx (last visited Oct. 9, 2003); Monsanto, http://www.monsantoag.com/monsanto/layout/default.asp (last visited Oct. 9, 2003); Dow Agrosciences, http://www.dowagro.com/homepage/index.htm (last visited Oct. 9, 2003); Pioneer Hi-Bred International, http://www.pioneer.com (last visited Oct. 10, 2003); Eden Bioscience, http://www.edenbio.com (last visited Oct. 9, 2003); Prodigene, http://www.prodigene.com (last visited Oct. 9, 2003).

56. Biotechnology Industry Organization (BIO), http://www.bio.org/index.asp (last visited Oct. 9, 2003).

57. American Seed Trade Association (ASTA), http://asta.farmprogress.com (last visited Oct. 9, 2003).

58. USDA Agricultural Biotechnology, http://www.usda.gov/agencies/biotech/index.html (last visited Oct. 9, 2003); EPA Biotechnology, http://www.epa.gov/oscpmont/oscpbiotech.htm (last modified Mar. 25, 2003); FDA Biotechnology, http://vm.cfsan.fda.gov/~lrd/biotechm.html (last modified Feb. 3, 2003).

V. SECOND STAGE COLLABORATIVE CONFIDENCE-BUILDING MEASURES

Acting together, possibly through BIO or another trade group, the ag-biotech companies should draft a Declaration of Environmental Principles to be prominently displayed on their various websites. Without delving into specific details, this Declaration should acknowledge the ag-biotech companies' oft-repeated corporate commitment to ensuring that the new technology is used in a responsible and sustainable manner.[59] This Declaration will then lay the groundwork for collaboration with NGOs and growers to develop the educational programs needed to promote responsible use of GM crops.

A. Educational Programs

Beginning in 2001, EPA made the funding of grower education programs a mandatory condition of Bt crop registration.[60] EPA did not, however, require that growers attend educational programs before purchasing GM seeds. By voluntarily adopting grower education programs as a mandatory precondition for seed purchase, ag-biotech companies can create an opportunity to build a bridge of cooperation with GM opponents. The ag-biotech companies, again through an industry trade group like BIO, could voluntarily implement measures to achieve the clear purpose of this EPA restriction by requiring that all purchasers of GM seeds attend educational programs on how to safely grow these crops. The companies could create a uniform education and certification process and could require that a grower obtain certification of attendance before purchasing GM seeds. By imposing this requirement, the ag-biotech companies will be doing their part to ensure that the new technology is used in a responsible manner. Although the requirement might initially depress adoption of Bt crops, any decrease in sales is likely to be temporary. As non-adopters see how the Bt crops increase their neighbors' profits by raising yields while reducing inputs, the demand for the crops will likely rebound to its original levels or beyond. The new demand will be qualitatively different, because it will be from growers educated in the proper use of the new technology and thus more aware of the need and means to comply with the important federal restrictions designed to preserve insect susceptibility to Bt.

Adopting an education requirement as a CBM would not only be an act of good faith on the part of the ag-biotech companies, it would also be a sensible

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59. *See, e.g.*, Monsanto, Commitment to Stewardship: Efforts Focus on Product Safety, *available at* http://www.monsanto.com/monsanto/layout/our_pledge/benefits/biotech_benefits.asp#02 (last visited Oct. 9, 2003); Pioneer, Biotechnology—Open Letter on Biotechnology, *available at* http://www.pioneer.com/biotech/open_letter/default.htm (last modified July 23, 2003); DowAgro, Sustainable Development Guiding Principles, *available at* http://www.dow.com/about/corp/sustain.htm (last visited Oct. 9, 2003); Syngenta, Health Safety and Environmental Policy, *available at* http://www.syngenta.com/en/downloads/HSE_policy.pdf (last visited Oct. 9, 2003).

60. ACTION DOCUMENT, *supra* note 39, at IID25.

way to implement their obligations to ensure that the crops are used only in accordance with the registration restrictions. First, grower education will increase the likelihood that growers comply with refuge requirements. Because the companies are bound by the registration restrictions, they have a legal duty to obtain this grower compliance, and failure to meet this obligation could ultimately result in loss of the registration. In addition to increasing grower compliance, such a program will build public trust in growers and ag-biotech companies, repairing some of the damage caused by the StarLink and Prodigene fiascos. As trust in growers and ag-biotech companies' ability and willingness to protect the environment grows, so will trust in the safety of GM products. Finally, increased grower education works to benefit the ag-biotech companies by delaying or preventing the onset of insect resistance to Bt, thereby prolonging the life of existing GM products.

The curriculum of these grower education programs should be a joint project between EPA, the ag-biotech companies, university extension programs, and NGOs involved in the GM debate. Involving GM opponents and independent third parties would give these grower education programs added credibility, and the curriculum development process would itself provide a new forum for discussion directed at the shared goal of grower education.

To make the attendance requirement palatable to growers, certification could entitle a grower to discounts on non-GM seed purchased for the refuge portion of the grower's fields. Such a measure would have the additional benefit of providing growers with some compensation for the perceived crop losses involved with maintaining an adequate refuge, which could make compliance more likely. The cost of the discount to the ag-biotech companies is likely to be minimal because such a process would encourage growers to purchase all their seed from one company in order to maximize the discount.

B. Compliance Verification Measures

At present, GM crop regulations in the United States rely entirely on registrant self-reporting to determine grower compliance with refuge and resistance sampling requirements. Given this regulatory framework, the process of creating a verification mechanism offers unique opportunities for confidence building that will encourage public trust in GM crops. By creating, funding, and implementing a transparent and effective third-party monitoring and verification system, ag-biotech companies and growers will ally their interests with those of the general public and will make a significant demonstration of their ability to deliver on promises made when seeking regulatory approval.

In the wake of StarLink and ProdiGene, there has been a growing chorus of voices calling for tighter regulation of GM crops. Voluntary industry steps, however, could make such regulation unnecessary. To the extent that GM proponents understand that an efficient and transparent third-party verification system is the only way to avoid direct and expensive governmental regulation, such a system will be of interest to growers and ag-biotech companies as a less

expensive and more efficient means of achieving the same end. A voluntarily adopted, comprehensively implemented verification program would certainly fit within the Bush administration's oft-repeated emphasis on voluntary compliance and self-regulation.[61] Nevertheless, a verification process would be costly and more intrusive than the *laissez-faire* status quo and therefore may be a hard sell to an industry focused on short-term profits rather than long-term sustainability. Such a verification system would, however, have significant advantages, and its costs must be measured against the compliance costs the companies would incur under a stringent government regulatory scheme.

For the verification system to succeed in building public confidence, it must be independent of industry control and accountable to the public for the accuracy of information provided. Additionally, such a program would be palatable to ag-biotech companies and to individual growers only if it is based on a consistent and open compliance protocol and if the verification inspectors are perceived as neutrals. Similarly, NGOs and consumer advocacy groups are unlikely to trust company inspectors.

So the first step will be to identify a neutral and mutually trusted third party to fulfil the role of independent auditor. The various stakeholders must jointly select the neutral auditors who will conduct verification inspections. To be successful, an independent auditing scheme must include two separate components: (1) a reporting requirement and (2) an inspection protocol.

To implement the reporting requirement, the ag-biotech industry should compile and provide the auditors with information about the purchasers of GM seeds, such as who they are, what educational programs they attended, where they plant their GM crop, how they configure their refuges, and whether the refuges have been treated with pesticides. Collecting these data will lay a baseline of information about how GM crops are being planted and will provide a useful check on the real world effectiveness of the grower education curriculum. In particular, the auditors will be able to use this information to assess whether refuge requirements are being met. For such a plan to work, however, the ag-biotech industry must act as a unit and must adopt an integrated, industry-wide reporting system.

This information will also permit the auditors to identify growers whose paperwork suggests the need for an on-site inspection. In addition to having

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61. In regulatory areas as diverse as OSHA ergonomic standards, cybersecurity, and the reduction of greenhouse gases, the Bush administration has consistently rejected concrete regulatory standards in favor of voluntary compliance programs. *See, e.g.*, John L. Henshaw, Assistant Secretary of Labor for Occupational Health and Safety, Statement Before the Subcommittee on Workforce Protections Committee on Education and the Workforce, U.S. House of Representatives (April 25, 2002), *available at* http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=TESTIMONIES&p_id=306 (explaining the administration's reliance on voluntary compliance after rejecting the ergonomic standards established during Clinton Administration); *Bush Cybersecurity Proposal Stresses Voluntary Compliance*, TELECOMM. REP., Sept. 30, 2002, *available at* 2002 WL 20134690. Unlike some of these areas, ensuring responsible use of GM technology is a concern that lends itself to voluntary compliance measures.

independent auditors in the role of inspector, the following ground rules will build trust in and cooperation with the verification process:

- On-site inspections must not interfere with legitimate commercial operations.
- There must be a publicly available protocol for on-site inspections designed to insure a standard inspection process that avoids placing undue burden on individual growers.
- Selection of on-site inspection sites must be through a statistically valid, randomized process.
- Other than those randomly selected sites, only challenge inspections—short-notice inspections based on specific allegations of noncompliance with refuge requirements, or evidence of resistance—would be permitted, and only if based on strong evidence that noncompliance has occurred.
- Growers must receive a copy of the inspection report and must have the right to respond in writing to conclusions and assessments contained in the report.

For any grower found to be out of compliance, the ag-biotech companies should cooperate with the independent auditor and the grower to develop an individualized plan for further education and compliance assistance, coupled with follow-up monitoring. Willful or repeated violations should be reported to EPA. Acting as a unit, the ag-biotech companies should create eligibility standards that will prevent sale of GM crops to any grower found to be willfully or repeatedly out of compliance.

The process of developing an educational curriculum, teaching the growers, and then verifying grower compliance will build bridges of trust and communication that will enable more fruitful discussions on the human health and consumer choice issues. Moreover, these confidence-building measures can serve as a model for public and industry cooperation wherever and whenever GM crops are planted. As more nations adopt GM technologies in their agricultural sectors, they will face the same environmental challenges the CBMs are designed to overcome. Frequently, these nations will not have well-developed regulatory agencies, and environmental protection will fall solely to the ag-biotech companies and the individual growers. Success of these CBMs in the United States will be a model for how the industry can ensure that its crops are safely grown elsewhere.