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The Looming Trade War over Plant Biotechnology

by Ronald Bailey

Executive Summary

American farmers are caught in the middle of a battle between the United States and the European Union over genetically modified organisms (GMOs). The EU is one of the most important potential markets for those crops, two-thirds of which are grown in the United States, but impending EU regulations on biotech crops would seriously disrupt the flow of those exports to European markets.

Plant biotechnology has already dramatically boosted American farmers' productivity and lowered their costs and, at the same time, helped them to protect the natural environment by reducing their use of agricultural chemicals and preventing soil erosion. Consumers have also benefited from lower prices and a healthier environment. In developing countries, the deployment of plant biotechnology can spell the difference between life and death and between health and disease for hundreds of millions of the world's poorest people.

One scientific panel after another has concluded that biotech foods are safe to eat, and so has the U.S. Food and Drug Administration. Even an EU review issued in the fall of 2001 of 81 separate European studies of GMOs found no evidence that biotech foods posed any new risks to human health or the environment.

The EU has banned all foods containing GMOs on the basis of the "precautionary principle," under which regulators do not need to show scientifically that a biotech crop is unsafe before banning it; they need show only that it has not been proved harmless. Jettisoning scientific risk assessment and replacing it with a precautionary approach will open the entire trading system to interruptions based on arbitrary justifications. Capricious labeling requirements will also proliferate. Such labels are unjustifiably stigmatizing and costly and offer no consumer health or safety benefits.

Consequently, all U.S. negotiators involved with trade in biotech crops must make it unalterable U.S. policy to oppose the application of the precautionary principle and insist instead on scientifically based risk standards in all international trade forums.

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Introduction

The battle lines are being drawn. On one side stands the United States, the world's leading developer and exporter of genetically modified crops. On the other is the European Union, whose consumers, spooked by anti-biotechnology activists, are demanding that all biotech crops be labeled if not banned altogether.

Caught in the middle are American farmers, who plant more than two-thirds of all the world's acreage devoted to genetically enhanced crops. The U.S. Department of Agriculture estimates that genetically modified crops will represent nearly one-third of the 2002 corn harvest and nearly three-quarters of the 2002 U.S. cotton and soybean harvests. The EU is one of the most important potential markets for those crops. American farmers already export about 30 percent of their soybean harvest and 20 percent of their corn harvest to the EU. American farmers exported $6.3 billion in agricultural goods to the EU in 2000. Twenty-four percent of those exports were oilseed products, chiefly soybeans and soy products, and 16 percent were grains and feeds. Sixty-three percent of U.S. corn byproduct exports went to the EU.[1] U.S. corn growers alone have lost about $200 million per year since 1998 because of the EU ban on importing genetically enhanced crops.[2] Impending EU regulations on biotech crops would seriously disrupt the flow of those exports to European markets.

The Office of the U.S. Trade Representative has already threatened to bring the issue to the World Trade Organization in Geneva for adjudication. This transatlantic food fight has broader implications as well: If the U.S. position prevails, the poor of the world will have access to a safe technology that could dramatically reduce hunger and malnutrition. If the EU position prevails, research will slow, putting the world's poor at greater risk of starvation and setting a terrible precedent for the future of free trade.

This analysis will answer four questions: (1) What is plant biotechnology? (2) Who opposes it and why? (3) Where does the trade battle stand now? (4) What should U.S. policy be?

What Is Plant Biotechnology?

In the last decade, biologists and crop breeders have made enormous strides in their ability to select specific useful genes from various species and splice them into unrelated species. Previously, plant breeders were limited to introducing new genes through the time-consuming and inexact art of crossbreeding species that were fairly close relatives, for example, rye and wheat, plums and apricots. For each cross, thousands of unwanted genes would necessarily be introduced into a crop variety. Years of "backcrossing"—breeding each new generation of hybrids with the original commercial variety over several generations—were needed to eliminate the unwanted genes so chiefly useful genes and characteristics remained. The new biotech methods are far more precise and efficient. The plants they produce are variously described as "transgenic," "genetically modified," "genetically engineered," or "genetically enhanced."

Plant breeders using biotechnology have accomplished a great deal in only a few years. For example, they have created a class of highly successful insect-resistant crops by incorporating toxin genes from the soil bacterium *Bacillus thuringiensis*. Farmers have sprayed *B. thuringiensis* spores on crops as an effective insecticide for decades. Now, thanks to some clever biotechnology, breeders have produced varieties of corn, cotton, and potatoes that make their own insecticide. *B. thuringiensis* is toxic largely to destructive caterpillars such as the European corn borer and the cotton bollworm; it is not harmful to birds, fish, mammals, or people.[3]

Another popular class of biotech crops incorporates an herbicide-resistance gene that has been especially useful in soybeans. Farmers can spray herbicide on their fields to kill weeds without harming the crop plants. The most widely used herbicide is Monsanto's Roundup (glyphosate), which toxicologists regard as an environmentally benign chemical that degrades rapidly, only days after being applied. Farmers who use "Roundup Ready" crops don't have to plow for weed control, which means there is far less soil erosion.[4]

Biotech is the most rapidly adopted new farming technology in history. The International Institute for the Acquisition of Agri-Biotech Applications estimates that the global area planted in biotech crops in 2001 was 130 million acres (52.6 million hectares), up 19 percent from 2000. The area planted in biotech crop varieties is up 30-fold since 1996.[5]

The first generation of biotech crops was approved by the Environmental Protection Agency, the Food and Drug Administration, and the U.S. Department of Agriculture in 1995. The USDA estimates that in 2002 transgenic varieties will account for 32 percent of corn acreage, 74 percent of soybean acreage, and 71 percent of cotton acreage in the United States.[6] With biotech soybeans, U.S. farmers save an estimated $216 million annually in weed control costs and make 19 million fewer herbicide applications per year.[7] In addition, using no-till farming made possible by herbicide-resistant biotech soybeans, farmers prevent 247 million tons of topsoil from eroding away.[8] It is estimated that herbicide-resistant biotech soybeans, canola, cotton, and corn varieties and insect-resistant biotech cotton reduced global pesticide use by 22.3 million kilograms of formulated product in 2000.[9] U.S. cotton farmers avoided spraying 2.7 million pounds of insecticides and made 15 million fewer pesticide applications per year by switching to biotech varieties. Their net revenues increased by $99 million.[10] Researchers estimate that *B. thuringiensis* corn, by preventing insect damage, increased yields by 66 million bushels in 1999.[11]

Documented Safety

One scientific panel after another has concluded that biotech foods are safe to eat, and so has the FDA. Since 1995, tens of millions of Americans have been eating biotech crops. Today it is estimated that 60 percent of the foods on American grocery shelves are produced using ingredients from transgenic crops.[12] In April 2000 a National Research Council panel issued a report that emphasized that the panel could not find "any evidence suggesting that foods on the market today are unsafe to eat as a result of genetic modification."[13] *Transgenic Plants and World Agriculture*, a 2000 report prepared under the auspices of seven scientific academies in the United States and other countries, strongly endorsed crop biotechnology, especially for poor farmers in the developing world. "To date," the report concluded, "over 30 million hectares of transgenic crops have been grown and no human health problems associated specifically with the ingestion of transgenic crops or their products have been identified."[14] Both reports concurred that genetic engineering poses no more risks to human health or to the natural environment than does conventional plant breeding.

As biologist Martina McGloughlin of the University of California at Davis remarked at a Congressional Hunger Center seminar in June 2000, the biotech foods "on our plates have been put through more thorough testing than conventional food ever has been subjected to."[15] According to a report issued in April 2000 by the House Subcommittee on Basic Research: "No product of conventional plant breeding . . . could meet the data requirements imposed on biotechnology products by U.S. regulatory agencies. . . . Yet, these foods are widely and properly regarded as safe and beneficial by plant developers, regulators, and consumers."[16] The report concluded that biotech crops are "at least as safe [as] and probably safer" than conventionally bred crops.[17] Even a 2001 review of 81 separate European scientific studies of genetically modified organisms funded by the European Union found no evidence that genetically modified foods posed any new risks to human health or the environment.[18]

Feeding the World's Hungry

Today, pest resistance and herbicide resistance, along with some disease resistance traits, are the chief improvements incorporated into biotech crops. And most of those enhancements have been made in leading commercial

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crops, such as corn, soybeans, and cotton, grown in developed countries. The next frontier will be applying genetic enhancements to crops that will feed the hungry in developing countries. However, progress could be halted if a full-fledged trade war breaks out between the United States and the EU, increasing the risk of starvation for millions. The International Food Policy Research Institute estimates that global food production must increase by 40 percent in the next 20 years to meet the goal of a better and more varied diet for a world population of some 8 billion people. As biologist Richard Flavell concluded in a 1999 report to the IFPRI, "It would be unethical to condemn future generations to hunger by refusing to develop and apply a technology that can build on what our forefathers provided and can help produce adequate food for a world with almost 2 billion more people by 2020."[19]

The good news is that researchers are already at work on improving crops that will help the poor in developing countries. For example, researchers have developed "golden rice," a crop that could prevent blindness in from .5 million to 3 million poor children a year and alleviate vitamin A deficiency in some 250 million people in the developing world. By inserting three genes, two from daffodils and one from a bacterium, scientists at the Swiss Federal Institute of Technology created a variety of rice that produces the nutrient beta carotene, the precursor to vitamin A. Agronomists at the International Rice Research Institute in the Philippines plan to crossbreed the variety, called "golden rice" because of the color produced by the beta carotene, with well-adapted local varieties and distribute the resulting plants to farmers all over the developing world.[20]

The International Food Policy Research Institute estimates that global food production must increase by 40 percent in the next 20 years to meet the goal of a better and more varied diet for a world population of some 8 billion people.

Technologies already well understood in the developed world are also valuable for farmers in the developing world. Thousands of poor Indian farmers nearly rioted in early 2002 when the Indian government, spurred by anti-biotech activists, seemed poised to destroy the biotech pest-resistant cotton the farmers had planted. Faced with a possible farmer revolt, the Indian government backed down and approved the biotech cotton for planting.[21]

Another way biotech crops can help poor farmers grow more food is by controlling parasitic weeds, an enormous problem in tropical countries. Cultivation cannot get rid of them, and farmers must abandon fields infested with them after a few growing seasons. Herbicide-resistant crops, which would make it possible to kill the weeds without damaging the cultivated plants, would be a great boon to such farmers. Kenyan biologist Florence Wambugu argues that crop biotechnology has great potential to increase agricultural productivity in Africa without demanding big changes in local practices.[22] A drought-tolerant seed will benefit farmers whether they live in Kansas or Kenya.

Fighting Drought and Plant Diseases

By incorporating genes for proteins from viruses and bacteria, crops can be immunized against infectious diseases. The papaya mosaic virus had wiped out papaya farmers in Hawaii, but a new biotech variety of papaya incorporating a protein from the virus is immune to the disease. As a result, Hawaiian papaya orchards are producing again, and the virus-resistant variety is being made available to developing countries.[23] Similarly, scientists at the Donald Danforth Plant Science Center in St. Louis are at work on a cassava variety that is immune to cassava mosaic virus, which killed half of Africa's cassava crop two years ago. Biotech companies are granting to international and academic research institutes broad licenses to use their patents. That will enable the development of genetically enhanced crops, such as cassava and rice, that are especially important to poor farmers in the developing world.[24]

Another recent advance with enormous potential is the development of biotech crops that can thrive in acidic soils, a large proportion of which are located in the tropics. Aluminum toxicity in acidic soils reduces crop productivity by as much as 80 percent.[25] Progress is even being made toward the Holy Grail of plant breeding, transferring the ability to fix nitrogen from legumes to grains. (Legumes such as soybeans and alfalfa house microorganisms in their roots that allow them to absorb nitrogen from the atmosphere and transform it into biologically useful forms—that is, literally make nitrogen fertilizer, which all plants need, using their roots.) That achievement would greatly reduce the need for fertilizer. Biotech crops with genes for drought and salinity tolerance are also being developed. Researchers at the University of California at San Diego have already identified techniques that could make plants more drought resistant.[26]

McGloughlin predicts that, further down the road, "We will be able to use biotechnology to enhance nutritional content of crops such as protein, vitamins, minerals, and antioxidants, remove anti-nutrients, remove allergens, and remove toxins. We will also be able to enhance other characteristics such as growing seasons, stress tolerance, yields, geographic distribution, disease resistance, shelf life and other properties of production of crops. The ability to manipulate plant nutritional content heralds an exciting new area and has the potential to directly benefit developing countries."[27]

Biotech crops can provide medicine as well as food. Biologists at the Boyce Thompson Institute for Plant Research at Cornell University recently reported success in preliminary tests with biotech potatoes that would immunize people against diseases.[28] One modification protects against Norwalk virus, which causes diarrhea, and another might protect against the hepatitis B virus, which afflicts 2 billion people. Plant-based vaccines would be especially useful for poor countries, which could manufacture and distribute medicines grown by local farmers.

Plant biotechnology has already dramatically boosted American farmers' productivity and lowered their costs and, at the same time, helped them to protect the natural environment by reducing their use of agricultural chemicals and preventing soil erosion. Consumers also benefit from lower prices and a healthier environment. In the future consumers will benefit even more as biotechnologists develop fresher and more nutritious foods along with crop- and plant-derived medicines and vaccines. A robust plant biotechnology industry coupled with American farming prowess will also ensure that our country remains the granary to the world. In developing countries, the deployment of plant biotechnology can spell the difference between life and death and between health and disease for hundreds of millions of the world's poorest people.

Who Opposes Plant Biotechnology and Why?

There is a growing global war against crop biotechnology. Gangs of anti-biotech vandals with cute monikers such as Cropatistas and Seeds of Resistance have ripped up scores of research plots in Europe and the United States. The so-called Earth Liberation Front burned down a crop biotech lab at Michigan State University on New Year's Eve in 1999, destroying years of work and causing $400,000 in property damage. Overall, the Federal Bureau of Investigation estimates that ELF has perpetrated more than 600 attacks and caused $43 million in damage since 1996.[29] Anti-biotech lobbying groups have proliferated and now include Greenpeace, the Union of Concerned Scientists, the Institute for Agriculture and Trade Policy, the Institute of Science in Society, the ETC (Action Group on Erosion, Technology and Concentration) Group, the Ralph Nader–founded Public Citizen, the Council for Responsible Genetics, the Institute for Food and Development Policy, and that venerable opponent of technological change, Jeremy Rifkin's Foundation on Economic Trends.

False Alarms

Despite the wide agreement among scientific and medical organizations on the safety of biotech crops, activists still insist that those crops are not safe. For example, they point to a study by Arpad Pusztai, a researcher at Scotland's Rowett Research Institute, that was published in the British medical journal the *Lancet* in October 1999. Pusztai found that rats fed one type of genetically modified potatoes (not a variety created for commercial use) developed immune system disorders and organ damage. The *Lancet*'s editors, who published the study even though two of six reviewers rejected it, apparently were anxious to avoid the charge that they were muzzling a prominent biotech critic. But the *Lancet* also

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published a thorough critique, which concluded that Pusztai's experiments "were incomplete, included too few animals per diet group, and lacked controls such as a standard rodent diet. . . . Therefore the results are difficult to interpret and do not allow the conclusion that the genetic modification of potatoes accounts for adverse effects in animals." The Rowett Institute, which does mainly nutritional research, fired Pusztai on the grounds that he had publicized his results before they had been peer reviewed.[30]

Activists are also fond of noting that the seed company Pioneer Hi-Bred produced a soybean variety that incorporated a gene—from a protein in Brazil nuts—that causes reactions in people who are allergic to nuts. The activists fail to mention that the soybean never got close to commercial release because Pioneer Hi-Bred checked it for allergenicity as part of its regular safety testing and immediately dropped the variety. The other side of the allergy coin is that biotech can remove allergens that naturally occur in foods such as nuts, potatoes, and tomatoes, making those foods safer.

In October 2000 activists seized on the news that a genetically modified corn variety called StarLink that was approved only for animal feed in the United States had been inadvertently used in two brands of taco shells, prompting recalls and front-page headlines. Ultimately, compensating food companies and growers for the recall cost Aventis, the creator of Starlink, $1 billion.[31] Lost in the furor was the fact that there was little reason to believe the corn was unsafe for human consumption—only an implausible, unsubstantiated fear that it might cause allergic reactions. The U.S. Centers for Disease Control found that there was no evidence that anyone had suffered any adverse reaction to eating foods containing Starlink corn.[32]

Butterfly Friendly

Activists also cite environmental concerns as a reason to oppose plant biotechnology. Most notoriously, activists worry about how biotech corn pollen affects the monarch butterfly. The global campaign against green biotech received a public relations windfall on May 20, 1999, when *Nature* published a study by Cornell University researcher John Losey that found that monarch butterfly caterpillars died when force-fed milkweed dusted with pollen from *B. thuringiensis* corn. Since then, at every anti-biotech demonstration, the public has been treated to flocks of activist women dressed as monarch butterflies. But when more-realistic field studies were conducted, researchers found that "there is no significant risk to monarch butterflies from environmental exposure to Bt corn."[33] Corn pollen is heavy and doesn't spread very far, and milkweed grows in many places in addition to the margins of cornfields. In the wild, monarch caterpillars apparently know better than to eat corn pollen on milkweed leaves.

Furthermore, *B. thuringiensis* crops mean that farmers don't have to indiscriminately spray their fields with insecticides, which kill beneficial as well as harmful insects. In fact, studies show that *B. thuringiensis* cornfields harbor higher numbers of beneficial insects such as lacewings and ladybugs than do conventional cornfields.[34] James Cook, a biologist at Washington State University, points out that the population of monarch butterflies has been increasing in recent years, precisely the time period in which *B. thuringiensis* corn has been widely planted.[35] The fact is that pest-resistant crops are harmful mainly to target species—that is, exactly those insects that insist on eating them.

Never mind; we will see monarchs on parade for a long time to come. Meanwhile, a spooked Environmental Protection Agency has changed its rules governing the planting of *B. thuringiensis* corn, requiring farmers to plant non–*B. thuringiensis* corn near the borders of their fields so that *B. thuringiensis* pollen doesn't fall on any milkweed growing there. But even the EPA firmly rejects activist claims about the alleged harms caused by *B. thuringiensis* crops. "Prior to registration of the first *B.t.* plant pesticides in 1995," it said in response to a Greenpeace lawsuit, "EPA evaluated studies of potential effects on a wide variety of non-target organisms that might be exposed to the *B.t.* toxin, e.g., birds, fish, honeybees, ladybugs, lacewings, and earthworms." The EPA concluded, "These risk assessments demonstrated that Bt endotoxins expressed in transgenic plants do not exhibit detrimental effects to non-target organisms in populations exposed to the levels of endotoxin found in plant tissue." In other words, those species were not harmed by transgenic plants.[36] In a review article in *Nature Biotechnology*, researchers strongly concurred: "In most cases, no adverse effects were observed even when test populations were exposed to [bt] toxin concentrations over 500-1,000-fold greater than those they would be expected to encounter under field conditions."[37]

Runaway Crossbreeding and Superpests?

Another danger highlighted by anti-biotech activists is the possibility that transgenic crops will crossbreed with other plants. At the Congressional Hunger Center seminar, British activist Mae-Wan Ho claimed that genetically modified constructs "are designed to invade genomes and to overcome natural species barriers." And that's not all. "Because of their highly mixed origins," she added, "GM constructs tend to be unstable as well as invasive, and may be more likely to spread by horizontal gene transfer."[38] In other words, genetically modified organisms (GMOs) could supposedly spawn new and harmful breeds unintended by their creators.

"Nonsense," says Tuskegee University biologist C. S. Prakash. "There is no scientific evidence at all for Ho's claims." Prakash points out that plant breeders specifically choose transgenic varieties that are highly stable since they want the genes that they've gone to the trouble and expense of introducing into a crop to stay there and do their work.[39]

Ho also charges that "GM genetic material," when eaten, is far more likely to be taken up by human cells and bacteria than is "natural genetic material." Again, there is no scientific evidence for this claim. All genes from whatever food sources are made up of the same four DNA bases, and all undergo digestive degradation when eaten. Britain's chief scientific organization, the Royal Society, issued a report in February 2002 that pointed out this elementary fact of biology when it concluded, "Given the very long history of DNA consumption from a wide variety of sources, it is likely that such consumption poses no significant risk to human health, and that additional ingestion of GM DNA has no effect."[40]

Opponents of biotech also sketch scenarios in which transgenic crops foster "superpests": weeds bolstered by transgenes for herbicide resistance or pesticide-proof bugs that proliferate in response to crops with enhanced chemical defenses. As McGloughlin notes: "The risk of gene flow is not specific to biotechnology. It applies equally well to herbicide-resistant plants that have been developed through traditional breeding techniques."[41] Even if an herbicide-resistance gene did get into a weed species, most researchers agree that it would be unlikely to persist unless the weed were subjected to significant and continuing selection pressure—that is, was sprayed regularly with a specific herbicide. And if a weed becomes resistant to one herbicide, it can be killed by another.

Conventional spray pesticides encourage the evolution of pesticide-resistant insects, so there is no scientific reason for singling out biotech plants. Cook points out that crop scientists could handle growing pesticide resistance the same way they deal with resistance to infectious rusts in grains: using conventional breeding techniques, they stack genes for resistance to a wide variety of evolving rusts. Similarly, he says, "It will be possible to deploy different B.t. genes or stack genes and thereby stay ahead of the ever-evolving pest populations."[42]

Given their concerns about the spread of transgenes, you might think opponents of biotech would welcome innovations designed to keep transgenes confined. Yet opponents became apoplectic when Delta Pine Land Co. and the U.S. Department of Agriculture announced the development of the Technology Protection System, a complex of three genes that makes seeds sterile by interfering with the development of plant embryos. TPS also gives biotech developers a way to protect their intellectual property: since farmers couldn't save seeds for replanting, they would have to buy new seeds each year.[43]

Because high-yielding hybrid seeds don't "breed true"—that is, the progeny of the crossbred hybrids will exhibit an unpredictable and

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undesirable mixture of the parental stocks' characteristics—corn growers in the United States and western Europe have been buying seed annually for decades. Thus TPS seeds wouldn't cause a big change in the way many American and European farmers do business. If farmers didn't want the advantages offered in the enhanced crops protected by TPS, they would be free to buy seeds without TPS. Similarly, seed companies could offer seeds with transgenic traits that would be expressed only in the presence of chemical activators that farmers could choose to buy if they thought they were worth the extra money. Ultimately, the market would decide whether those innovations were valuable.

If anti-biotech activists really are concerned about gene flow, they should welcome such technologies. The pollen from crop plants incorporating TPS would create sterile seeds in any weed with which the crop plant happened to crossbreed, so that genes for traits such as herbicide resistance or drought tolerance couldn't be passed on. That point escapes some opponents of biotech. "The possibility that [TPS] may spread to surrounding food crops or to the natural environment is a serious one," writes Indian anti-biotech activist Vandana Shiva in her recent book *Stolen Harvest*. "The gradual spread of sterility in seeding plants would result in a global catastrophe that could eventually wipe out higher life forms, including humans, from the planet."[44] That dire scenario is not just implausible but biologically impossible: *TPS is a gene technology that causes sterility; that means, by definition, that it can't spread*.

Despite the clear advantages that TPS offers in preventing the gene flow that activists claim to be worried about, the Rural Advancement Foundation International, now the ETC Group, quickly demonized TPS by dubbing it "Terminator Technology." RAFI warned that "if the Terminator Technology is widely utilized, it will give the multinational seed and agrochemical industry an unprecedented and extremely dangerous capacity to control the world's food supply."[45] Responding to activist protests, Monsanto, which had acquired the technology when it bought Delta Pine Land Co., declared that it would not develop TPS.

Even so, researchers have developed another clever technique to prevent transgenes from getting into weeds through crossbreeding. Chloroplasts (the little factories in plant cells that use sunlight to produce energy) have their own small sets of genes. Researchers can introduce the desired genes into chloroplasts instead of into cell nuclei where the majority of a plant's genes reside. The trick is that the pollen of most crop plants doesn't have chloroplasts; therefore it is impossible for a transgene confined to chloroplasts to be transferred through crossbreeding.[46]

Public Opinion vs. Sound Science

To date, the American public and policymakers have not generally succumbed to the scares and bogus concerns being peddled by anti-biotech activists. Europe, however, is another matter entirely. A recent poll in the United Kingdom found that 51 percent of British consumers would avoid eating genetically enhanced foods, while 40 percent would not. However, 76 percent of respondents favored labeling biotech foods, while only 6 percent agreed with the U.S. view that such foods should not be labeled.[47]

Since it is widely agreed by scientific experts around the world and U.S. regulatory authorities that food produced using biotech crops is safe, why are European regulators, who know that the technology is safe, trying to ban it or stigmatize it using labels that the public would likely misconstrue as warning labels?

Concern about competition is certainly one often-unstated reason European governments have been so quick to oppose crop biotechnology. "EU countries, with their heavily subsidized farming, view foreign agribusinesses as a competitive threat," Frances Smith, director of Consumer Alert, has written. "With heavy subsidies and price supports, EU farmers see no need to improve productivity."[48] In fact, biotech-boosted European agricultural productivity would be a fiscal disaster for the EU, since it would increase already astronomical subsidy payments to European farmers. Currently, the EU's Common Agricultural Policy subsidy payments make up half of the

EU's entire budget. Eighty percent of the EU subsidies go to just 20 percent of European farmers, generally those with the largest farms.[49] EU agricultural policy is hostage to member-state concerns, much as U.S. farm policy is hostage to the demands of senators from sparsely populated farming states.

Where Does the Trade Battle Stand?

The battle over biotech crops is now being joined in virtually all of the institutions that govern the world's food trade system, including the World Trade Organization, the new Biosafety Protocol, and the Codex Alimentarius Commission.

European resistance to genetically enhanced crops is generally traced to the concerns about food safety that erupted with the outbreak of mad cow disease in Britain and food contamination problems in Belgium in the 1990s. But there is a longer history to the EU's hostility to biotech. Starting in 1990, EU regulators used specious health concerns to fight against the importation of American beef and milk produced using biotech bovine growth hormone. The EU suffered a string of losses in international arbitration, first under the General Agreement on Tariffs and Trade and then in the WTO, which finally ruled in 1999 that the United States could impose countervailing duties on more than $100 million in European exports in retaliation.[50]

Precautionary Principle Paralysis

The EU is justifying its ban of and import restrictions on biotech crops on the basis of the "precautionary principle." Under that principle, regulators do not need to show scientifically that a biotech crop is unsafe before banning it; they need only assert that it has not been proved harmless. "They want to err on the side of caution not only when the evidence is not conclusive but when no evidence exists that would indicate harm is possible," observes Smith.[51] The precautionary principle is best summed up as "regulate first, ask questions later."

The strictest interpretations of the precautionary principle jettison entirely the notion of tradeoffs, requiring that any new technology never cause any harm to the environment or human health. Of course, accurately predicting in advance the benefits and harms that a technology may one day produce is an impossible task. This inherent uncertainty means that opponents of a new technology can always stall its introduction by endlessly demanding that more research be done to rule out even their most farfetched fears.

As researchers Soren Holm and John Harris explained in *Nature*:

> As a principle of rational choice, the PP will leave us paralyzed. In the case of genetically modified (GM) plants, for example, the greatest uncertainty about their possible harmfulness existed before anybody had yet produced one. The PP would have instructed us not to proceed any further, and the data to show whether there are real risks would never have been produced. The same is true for every subsequent step in the process of producing GM plants. The PP will tell us not to proceed, because there is some threat of harm that cannot be conclusively ruled out, based on the evidence from the preceding step. The PP will block the development of any technology if there is the slightest theoretical possibility of harm. So it cannot be a valid rule for rational decisions.[52]

In other words, the only way to protect completely against unknown risks is never to do anything for the first time.

The precautionary principle certainly is irrational in scientific terms, but it is, unfortunately, all too rational in terms of satisfying the political needs of regulators. Under the WTO, the Sanitary and Phytosanitary Agreement allows countries to set their own health and environmental standards. But in Article 2.2, the SPS says regulations must be "based on scientific principles" and that they should not be "maintained without sufficient scientific evidence."[53] Therefore, it would seem that the

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SPS requirement that regulations be justified by scientific assessments would rule out the precautionary principle.

Similarly, under the WTO, the Technical Barriers to Trade agreement requires that countries avoid unnecessary obstacles to trade in adopting regulations aimed at protecting human health and safety or the environment. Regulators may set general standards but not specify how a product should be made. For example, a country could adopt a safety regulation that says that a door must resist fire for 30 minutes but not one that says the door must be made of steel.[54] Clearly, a rule requiring that food be safe is acceptable, but one banning foods made from genetically modified crops is not, since all relevant scientific authorities agree that all approved genetically modified crops are healthy and safe for human consumption. It is vital that the U.S. negotiators resist European efforts to undermine WTO agreements by reinterpreting them to include consumer desire for more information as a legitimate goal under the TBT.

Protectionist Labels

In any case, the EU is trying to make an end run around the relatively clear standards set out by the WTO through two other international forums, the Cartagena Biosafety Protocol and the Codex Alimentarius Commission. The Biosafety Protocol was drafted under the Convention on Biological Diversity (never ratified by the United States) and completed in 2000. The protocol, largely negotiated by environment ministers rather than trade ministers, focuses almost entirely on international trade in "living genetically modified organisms" (LMOs). Specifically, that means trade in genetically enhanced crops and livestock.

The EU is trying to make an end run around the relatively clear standards set out by the WTO through two other international forums, the Cartagena Biosafety Protocol and the Codex Alimentarius Commission.

The Biosafety Protocol specifically incorporates the precautionary principle in its preamble and in Articles 10 and 11 as justification for signatories to limit the importation of LMOs such as grains and livestock.[55] Article 18 of the protocol also allows importing countries to require that shipments containing LMOs, say genetically enhanced corn or soybeans, be labeled "may contain" LMOs. Furthermore, the Biosafety Protocol ambiguously states that it should "not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements," but also that it is not "subordinate . . . to other international agreements."[56]

The Biosafety Protocol requires that all shipments of biotech crops, including grains and fresh foods, carry a label saying they "may contain living modified organisms." This international labeling requirement is clearly intended to force the segregation of conventional and biotech crops. The protocol was hailed by Greenpeace's Benedikt Haerlin as "a historic step towards protecting the environment and consumers from the dangers of genetic engineering."[57]

Shortly after the Biosafety Protocol negotiations were completed in 2000, the European Commission issued a "Communication from the Commission on the Precautionary Principle," explaining how the EU would incorporate the principle in its regulatory systems. The communication explicitly noted, "The concept of risk in the SPS leaves leeway for interpretation of what could be used as a basis for a precautionary approach" and further noted that international standards recognized under the SPS were being negotiated at the Codex Alimentarius Commission.[58]

Using the Biosafety Protocol and the Codex Commission's interpretation of the precautionary principle, in July 2001 the European Commission issued a set of draft regulations regarding biotech crops. Those regulations, which will come into effect in October 2002, impose "traceability" and labeling requirements on all foods made using biotech crops, including imports. Traceability means that farmers and the food industry must create, retain, and transmit information about the origin of foods made using genetically enhanced crops at each stage of production and distribution (from dirt to fork). Industry must create systems that identify to whom and from whom products using biotech crops are made available. That information must be transmitted throughout the commercial chain and must be retained for five years.[59]

In addition, all foods produced using ingredients derived from biotech crops and livestock, irrespective of whether they actually contain genetically modified DNA or proteins in the final product, must bear the following label: "This product contains genetically modified organisms."[60] Even corn syrup and soybean oil, which contain no detectable levels of DNA or biotech-derived proteins, will have to be labeled, in this case, erroneously, as containing genetically modified organisms. Similar requirements are proposed for feed grains that human beings will not eat.

The Codex Alimentarius Commission is an intergovernmental body created in 1962 to set food standards under the auspices of the UN's Food and Agriculture Organization and the World Health Organization. In 1995 the SPS agreement conferred on the Codex Commission the responsibility for setting international food safety standards that would be recognized by the WTO.

EU negotiators are well on their way to persuading the Codex Commission to adopt standards that would require that foods that have genetically modified crops as ingredients carry mandatory labels and be able to be traced. U.S. negotiators from the FDA and the USDA have already given away the store by conceding to EU demands in the Codex Ad-Hoc Intergovernmental Task Force on Foods Derived from Biotechnology's most recent meeting in Yokohama, Japan, in March. Paragraph 19 of the Draft Principles for the Risk Analysis of Foods Derived from Modern Biotechnology states, "Risk management measures may include, as appropriate, food labeling, conditions for marketing approvals and post-market monitoring." The EU's long-sought traceability provision is incorporated in Paragraphs 20 and 21 of the draft principles. Under the guise of risk management procedures, those articles permit regulators to set up mechanisms for "the tracing of products for the purpose of facilitating withdrawal from the market when a risk to human health has been identified or to support post-market monitoring in circumstances as indicated in paragraph 20."[61] These draft principles are being submitted for consideration of the commission in July 2003.

Furthermore, the EU negotiators have managed to incorporate the precautionary principle in the codex deliberations by persuading the Codex Committee on General Principles to forward Proposed Draft Working Principles for Risk Analysis in the Framework of the Codex Alimentarius to the commission's executive committee for adoption as draft principles. This risk analysis draft specifically acknowledges, "Precaution is an inherent element of risk."[62]

Environmental groups such as the International Union for the Conservation of Nature and the International Centre for Trade and Sustainable Development are already hailing the draft principles as a European victory in the attempt to limit trade in genetically enhanced crops. "Some observers believe that the agreement reached at the Codex Commission meeting might mark a breakthrough in international negotiations on the use of traceability systems and at least partially vindicates the EU's insistence on introducing a labelling and traceability system for GM foods," notes ICTSD's *Bridges* report on trade.[63] Clearly, U.S. trade interests are not being well served by allowing the FDA and the USDA to take the lead in the codex negotiations.

Despite the fact that the European Commissioner for Health and Consumer Protection, David Byrne, admitted last October that "there is an irrational fear of GM food in the EU," he justified these proposed regulations on consumer choice and protection grounds.[64] Indeed, even if no hazards from genetically improved crops have been demonstrated, don't consumers have a right to know what they're eating? This seductive appeal to consumer rights has been a very effective public relations gambit for anti-biotech activists and European bureaucrats eager to expand their jurisdictions. If there's nothing wrong with biotech products, they ask, why shouldn't seed companies, farmers, and food manufacturers agree to label them?

The activists are being more than a bit disingenuous here. Their scare tactics, including the use of ominous words such as *Frankenfoods*, have created a climate in which many consumers would interpret labels on biotech products to mean that they were somehow more dangerous or less healthy than old-style foods. Opponents of biotech hope labels

Opponents of biotech hope labels will drive frightened consumers away from genetically modified foods and thus doom them.

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will drive frightened consumers away from genetically modified foods and thus doom them. Then the activists could sit back and smugly declare that biotech products had failed the market test.

An Organic Alternative to GMO Labels

In the United States, the biotech labeling campaign is a red herring, because the USDA, at the insistence of organic farmers, has issued some 554 pages of regulations outlining which foods qualify as "organic."[65] Among other things, the definition requires that organic foods not be produced using genetically modified crops. Thus U.S. consumers who want to avoid biotech products need only look for the "organic" label. Furthermore, there is no reason why conventional growers who believe they can sell more by avoiding genetically enhanced crops should not label their products accordingly, so long as they do not imply any health claims. The FDA has begun to solicit public comments on ways to label foods that are not genetically enhanced without implying that they are superior to biotech foods. The European Union could adopt this approach instead of imposing new regulations on genetically enhanced crops and foods.

In any case, labeling nonbiotech foods as such will not satisfy the activists whose goal is to force farmers, grain companies, and food manufacturers to segregate biotech crops from conventional crops. Such segregation would require a great deal of duplication in infrastructure, including separate grain silos, rail cars, ships, and production lines at factories and mills. It has been estimated that constructing the parallel infrastructure needed to comply with these regulations could cost the American farm sector as much $4 billion. The StarLink corn problem is just a small taste of how costly and troublesome segregating conventional from biotech crops would be. Some analysts estimate that segregation would add 12 percent to grain prices without any increase in safety.[66]

Activists are also clearly hoping that mandatory crop segregation will lead to novel legal nightmares: If a soybean shipment is inadvertently "contaminated" with biotech soybeans, who is liable? If biotech corn pollen falls on an organic cornfield, can the organic farmer sue the biotech farmer?[67]

Consider the Catch-22 situation that organic farmers have created for themselves. As the editors of *Nature Biotechnology* note: "Organic certification is a form of self-regulation imposed, in essence, by organic farmers on organic farmers. The rules have been established so that all organic farmers play on a level field. 'No GM' is one of these rules. Having established themselves as rule-makers, law enforcement agencies, and juries, organic certification bodies are now endeavoring to obtain judgments from legislative bodies that had no part in establishing the rules in the first place."[68]

Even worse than the proposed EU regulations are model biosafety laws proposed by the activist group Third World Network. Under the model legislation, "the absence of scientific evidence or certainty does not preclude the decision makers from denying approval of the introduction of the GMO or derived products." Worse, under the model regulations, "any adverse socio-economic effects must also be considered."[69] In April 2001 the EC issued a directive covering genetically enhanced foods, which also directs regulators to take into account the socioeconomic effects of introducing biotech crops and foods.[70] If provisions like these are adopted, they could give traditional producers a veto over innovative competitors, the moral equivalent of letting candle makers prevent the introduction of electric lighting.

The Office of the U.S. Trade Representative has suggested several times that it might ask the WTO to adjudicate these issues, but so far it has not taken any concrete steps to do so despite the obvious dangers posed to U.S. agricultural exports.

Farm Trade and Scientific Standards at Risk

The brewing U.S.-EU trade war over biotech crops could imperil the whole WTO system of international trade, especially if socioeconomic considerations are incorporated into any trade rule negotiations in the guise of implementing the precautionary principle. As the U.S.-EU dispute over importing U.S. beef produced using growth hormone indicates, the EU seems willing to accept the imposition of countervailing duties rather than comply with WTO rulings.

Time is of the essence. U.S. trade negotiators who are relying on the WTO and SPS provisions to challenge European efforts to limit trade in genetically enhanced crops are about to be blindsided by European negotiators' efforts to subvert the SPS Agreement's scientific standards through the codex negotiations. How? The SPS Agreement recognizes the Codex Commission as the international organization responsible for setting standards related to food safety. According to the SPS Agreement, WTO members "shall base" their measures related to human and plant health on codex standards, guidelines, or recommendations. Codex measures "shall be deemed to be necessary to protect human, animal or plant life or health, and presumed to be consistent with the relevant provisions" of the SPS Agreement.[71]

As noted above, the Codex Commission will meet in Rome in July 2003 to consider approving the draft principles governing foods derived from modern biotechnology. If the commission at that time accepts the draft standards, that would provide the EU a rationale for imposing labeling and tracing requirements of biotech foods under the guise of meeting international health and safety standards under the SPS. In that case, the United States would likely lose any future WTO challenge to EU labeling and traceability requirements imposed on imports of U.S. biotech crops. That must not be allowed to happen.

Fortunately, the U.S. trade negotiators can stop the codex process in its tracks. All codex standards must be agreed to by consensus of all the parties. U.S. negotiators must simply call a halt at the Rome meeting to inclusion of the precautionary principle, biotech labeling, and traceability requirements. Any language incorporating notions of the precautionary principle must be ripped out of codex principles root and branch. U.S. negotiators must make it clear that only science-based risk standards will be acceptable in protecting human health and food safety.

It is vital that the Office of the U.S. Trade Representative recognize that the Europeans are clearly no longer treating the Codex Commission as a forum for setting international food safety and health standards. They are treating it as an alternative forum for international trade negotiations. This means that the USTR must take the lead over the FDA and the USDA in negotiations of the Codex Commission beginning at the July meeting.

The EU has made it clear that it intends to use the Biosafety Protocol's recognition of the precautionary principle as a justification for imposing labeling and traceability requirements on biotech crop imports. The Biosafety Protocol will come into effect internationally only if it is ratified by 50 nations. So far it has been ratified by 11 nations. This gives U.S. negotiators an opportunity to make concerted efforts to persuade developing nations not to ratify the Biosafety Protocol and to approve biotech crops for domestic production and consumption, thus isolating the EU. This effort could perhaps be coordinated by the U.S. Department of State's Bureau of Economic and Business Affairs and the USTR.

By stopping the adoption of codex draft principles and making a concerted effort to prevent the Biosafety Protocol from coming into effect, the United States will make it clear to EU officials that their proposed biotech regulations will be challenged. In the face of this challenge, EU officials may be persuaded to rethink and revise their proposed regulations before putting them into effect this October.

One final possibility is that the USTR could bring the EU labeling and traceability regulations for adjudication by the WTO. However, if the Codex Commission adopts the draft principles discussed above, the United States could well lose at the WTO. Even if the USTR does derail the codex draft principles and does win at the WTO, such a victory could turn into a public relations disaster as European governments tell their citizens that American corporations are forcing genetically

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Jettisoning scientific risk assessment and replacing it with a precautionary approach will open the entire trading system to interruptions based on arbitrary justifications.

enhanced foods down their throats. Still, the USTR must be willing to take this step if all else fails.

Conclusion

It is essential to preserve and insist upon standards based on scientific risk assessment in order to maintain and expand a freer international trading system. Jettisoning scientific risk assessment and replacing it with a precautionary approach will open the entire trading system to interruptions based on arbitrary justifications. Capricious labeling requirements will also proliferate. Such labels are unjustifiably stigmatizing and costly and offer no consumer health or safety benefits. Only objective scientific standards should be used because regulations that are based on "societal values" alone can never be agreed upon internationally and will restrict trade without protecting public safety.

Consequently, all U.S. negotiators involved with trade in biotech crops must make it unalterable U.S. policy to oppose the application of the precautionary principle and instead insist on scientifically based risk standards in all international trade forums. Among other things, this means that all U.S. trade negotiators in whatever forums must insist that no labeling or traceability requirements be imposed on biotech food products that are substantially equivalent to nonbiotech crops.

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