

A GUIDE TO GENETICALLY MODIFIED ALFALFA



WESTERN ORGANIZATION OF RESOURCE COUNCILS

WORC

WORC, the Western Organization of Resource Councils, is a regional network of seven grassroots community organizations that include 9,500 members and 45 local chapters. WORC helps its member groups succeed by providing training and coordinating regional issue campaigns.

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THE GUIDE

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QUEEN OF FORAGES

Think for a moment. Can you trace alfalfa—the forage crop you see in hay bales that dot America’s rural landscape—to your dinner plate? Alfalfa is food for dairy cows and beef cattle, for lambs, pigs, and even honeybees. So, even if we don’t see it on our dinner plates, it plays a crucial role in the food we eat. It’s a staple of the American farming diet.

Across the U.S., farmers value alfalfa as an important feed for livestock, especially dairy cows, and grow more than 20 million acres of it across the U.S. Because of its pervasiveness in our landscapes, alfalfa is an important habitat for wildlife, including more than 130 bird species.¹ It is the fourth most widely grown crop behind corn, soybeans, and wheat, and the third most valuable to agriculture. But a new genetically modified (GM) alfalfa variety poses unique agricultural, environmental, and economic risks—risks that didn’t exist with the alfalfa varieties farmers have grown for decades.



Photo Courtesy Agricultural Research Service, USDA

In June 2005, the U.S. Department of Agriculture (USDA) announced its approval of Roundup Ready (RR) alfalfa. This variety is herbicide-tolerant, meaning it is genetically engineered to survive applications of glyphosate, the main ingredient in the Monsanto Company’s trademark herbicide, Roundup. Monsanto produced RR alfalfa in partnership with the largest alfalfa seed company, Forage Genetics International (a subsidiary of Land O’Lakes).

Genetic engineering (recombinant DNA technology) differs tremendously from traditional breeding mechanisms. Unlike other breeding methods, genetic engineering operates at the cellular and molecular level, and makes it possible to select and transfer a single gene between cells of two organisms – sometimes between unrelated species. RR crops are engineered to express a gene derived from a soil bacterium, which allows these plants to tolerate applications of glyphosate. Other examples (not currently on the market) include tobacco and jellyfish genes inserted into tomato plants, and a soybean gene in lettuce.



RR alfalfa is considerably different from non-GM alfalfa varieties. For example, RR alfalfa encourages herbicide use by its very nature, but many farmers and ranchers currently produce alfalfa with minimal, if any, herbicides. USDA data indicates that the rapid adoption of RR crops (in 2006, 89 percent of soybeans planted in the U.S. were an herbicide-tolerant variety) increased herbicide use by more than 138 million pounds between 1996 (when herbicide-tolerant crops were introduced) and 2004. As a result, several weeds have developed resistance to glyphosate, becoming the bane of many farmers' operations, and requiring more toxic and expensive chemical controls. The National Center for Food and Agriculture Policy estimates that RR alfalfa could result in the application of 200,000 pounds more herbicides a year in California alone.

Because alfalfa is an open-pollinated crop, markets for alfalfa seed and hay that shun, or reject outright, GM material in seeds and feed (such as certified organic and some export markets) risk contamination by RR alfalfa. The USDA National Organic Program does not allow the use of agricultural biotechnology in certified organic farming systems, and cross-pollination of RR alfalfa with organic crops could increase production costs, reduce profits, or even eliminate markets for organic alfalfa producers.

In addition to environmental and market concerns, the increasing control that patented seed technologies afford transnational companies reduces the availability of affordable, public seed varieties, and further reduces the control American farmers and ranchers have over U.S. agriculture. Monsanto controls about 90 percent of the global GM seed market through



Alfalfa is the third most economically valuable crop to U.S. agriculture. It is an important fuel for dairy cows and beef cattle, for lambs, pigs, and honeybees. In the U.S., it is grown on more than 20 million acres and is the most important feed source for dairy cows. In agricultural vernacular, it is the "Queen of Forages."

ownership of patents and acquisition of other seed companies.² Adding alfalfa to the line of RR products increases Monsanto's grip on American farms and farmers, and allows a monopoly over a large segment of our food production system.

In February 2006, a coalition of alfalfa producers and family farm organizations, including the Western Organization of Resource Councils, filed a lawsuit against USDA, calling the department's approval of RR alfalfa a threat to farmers' livelihoods and a risk to the environment. It was the first lawsuit to be filed in response to the approval of a GM crop. A year later, the court ruled in favor of plaintiffs, and ordered USDA to rescind its approval of RR alfalfa and perform a full Environmental Impact Statement. This precedent-setting court decision, discussed on page 16, found that USDA failed to address concerns that RR alfalfa will contaminate conventional and organic alfalfa. In May 2007, the court issued a permanent injunction, barring any further planting of RR alfalfa, at least until an EIS is prepared. The court's decision gives alfalfa hay and seed growers, livestock and honey producers, and dairy farmers time to learn more about the effects of widespread planting of RR alfalfa on their operations. It gives consumers time to learn more about the effects of RR alfalfa on the food they choose to buy, and the cost of choosing organic or GM-free food. And it gives farmers, ranchers, and consumers a chance to be heard before USDA decides whether to approve further planting of RR alfalfa.

Monsanto and Forage Genetics believe that opposition to the technology by consumers is minimal, because alfalfa is one step removed from the plate, and many alfalfa growers see potential benefits to growing RR alfalfa in their operations. Other farmers and ranchers see the introduction of RR alfalfa as a threat to their choice of farming practices – even to their ability to make a living.

Many consumers see RR alfalfa as a threat to their right to affordable organic or GM-free food. Because GM food, and food derived from GM feed, are not labeled in the U.S., consumers are left to make the connection from field to plate – from those hay bales that dot the rural American landscape to their glasses of milk, slabs of butter and cheese, beef steaks, honey, and other livestock products.

A Guide to Genetically Modified Alfalfa is a toolkit for avoiding the environmental, agricultural, and economic risks Roundup Ready alfalfa poses to U.S. farmers, ranchers, and consumers. WORC hopes the *Guide* will aid discussions and activities surrounding Roundup Ready alfalfa by offering evidence and action steps to avoid the problems that would come with widespread adoption.

PROBLEMS WITH GM ALFALFA

AGRICULTURAL RISKS

Genetic Contamination

Alfalfa is a cross-pollinating crop, so genetically modified (GM) DNA from Roundup Ready (RR) fields is nearly certain to contaminate organic and other GM-free fields. Contamination could ruin organic alfalfa and alfalfa export markets, and other GM-free markets, including some in the natural beef, horse breeding, sprouting, and honey industries.

"It is difficult to certify that a non-GMO will not be contaminated if grown in an area where GMO alfalfa cultivars are produced."

— William T.W. Woodward,
Washington State University
Extension

No law or regulation requires farmers who plant RR seeds to create refuge or buffer areas to avoid cross-pollination with neighbors' crops or surrounding weeds. USDA says that farmers who want to be GM-free are responsible for preventing contamination of their crops.

Unfair Liability

Because Monsanto patents its GM seeds, farmers who purchase RR alfalfa seeds will have to sign Technology Agreements that shield Monsanto from liability for accidental contamination or any other problems its product may cause. The effect of these agreements is to pit farmer against farmer, and to let Monsanto off the hook for any economic damage caused by its product.



Photo Courtesy Agricultural Research Service, USDA

ENVIRONMENTAL RISKS

Increased Herbicide Use

Since 1996, herbicide use on herbicide-tolerant crops has increased by 138 million pounds.³ In California alone, the National Center for Food and Agriculture Policy estimates that RR alfalfa could result in the application of an additional 200,000 pounds of herbicides a year.⁴



Photo Courtesy USDA

Glyphosate Resistance

Not only is glyphosate weak on some important alfalfa weeds, several glyphosate-resistant weeds already exist, and evidence for others is mounting. Farmers who use glyphosate to kill alfalfa at the end of its stand life, who experience glyphosate resistance in weeds or volunteer crops, and who control wild alfalfa along roadsides will have to resort to less friendly and more costly chemicals.



Photo Courtesy Sarah Stokes

Non-Target Organisms

More than 130 species of birds visit alfalfa fields each year, including endangered species.⁵ The USDA did not analyze the possible impacts on birds, mammals, insects, and other beneficial organisms in its Environmental Assessment before approving RR alfalfa.

MARKETS AT RISK

Organic and Natural Foods

As the organic and natural dairy, beef, and honey markets continue to expand, so does the demand for organic alfalfa. The U.S. has experienced a chronic shortage of organic milk and grain for several years, and some producers have started to import organic feed to fill this demand. Some food retail stores already require name brand products to be free of GM ingredients, including Trader Joe's, Wild Oats, and Whole Foods.

Many organic and natural beef producers who feed their cattle non-GM feed are unable to purchase grain with a guarantee that it does not contain transgenic traits because of the rampant contamination of U.S. corn, soybeans, and canola. If alfalfa becomes as contaminated as other commodity feeds, non-GM feed sources will be increasingly expensive or impossible to find for dairy farmers and beef producers who are, or want to be, GM-free.

Alfalfa Hay Exports

Most U.S. alfalfa is used as domestic animal feed, while 5 percent is exported. Seventy-five percent of U.S. alfalfa exports go to Japan, and the rest is shipped to South Korea, Taiwan, Mexico, and Canada.⁶ Customers in these countries demand GM-free feed, and export companies continue to reject RR alfalfa. Of the alfalfa exported, 99 percent is produced in the West, including Washington, California, and Oregon.⁷

"Some of our Japanese hay customers are asking us to sign documents saying no genetically modified products will be coming over."

– Jeff Plourd of El Toro Export, El Centro, California

Honey

Honey bees are an important pollinator in alfalfa seed fields, and most U.S. honey is derived from alfalfa pollen (one-third of annual production).⁸ Honey bees can transfer pollen several miles, and can cross-pollinate RR alfalfa with conventional and organic varieties. Some honey producers fear their honey will acquire transgenic traits from GM crops. A study by Forage Genetics shows that honey bees transferred the RR alfalfa trait to non-RR alfalfa more than 2.5 miles away.⁹

TEN THINGS YOU SHOULD KNOW ABOUT ROUNDUP READY ALFALFA

Roundup Ready alfalfa will contaminate organic and other non-genetically modified alfalfa seed and hay

Roundup Ready (RR) alfalfa will decrease farmers' non-genetically modified (GM) feed options. Currently, beef producers who wish to feed non-GM grain have limited options because of the rampant spread of GM traits in corn and soybeans. For example, the Union of Concerned Scientists tested samples of conventional (non-GM) corn, soy, and canola seed and found that 50 percent of the corn and soybean samples, and more than 80 percent of the canola samples, contained a GM trait.¹⁰ Certified organic alfalfa growers risk losing premiums for their product and the genetic purity of their seed if GM traits transfer from RR fields to their own.

Roundup Ready alfalfa will increase the cost of organic milk and beef

The U.S. has experienced a chronic shortage of organic milk for several years. The dairy industry is the leading consumer of alfalfa. The demand for organic feed for beef cattle and dairy cows increases the need to protect organic and other non-GM alfalfa from RR alfalfa contamination. In the event that RR alfalfa is widely adopted, consumers can expect the prices of organic products derived from alfalfa, especially milk and beef products, to increase and be subject to shortages.

Roundup Ready alfalfa will increase herbicide use

Many alfalfa producers currently do not rely on herbicides. Herbicide use on herbicide-tolerant crops increased by more than 138 million pounds between 1996 and 2004. In California alone, the National Center for Food and Agriculture Policy estimates that RR alfalfa could result in the application of an additional 200,000 pounds of herbicides a year.

Roundup Ready alfalfa will exacerbate the problem of glyphosate-resistant weeds

As more and more glyphosate is used, weeds are developing resistance, making the popular herbicide less effective over time. Farmers must resort to less friendly and more costly chemicals to control glyphosate-resistant weeds, the very chemicals farmers were told RR technology would replace. Because the spread of glyphosate-resistant weeds has outpaced new tools for controlling them, farmers have few options to deal with thousands of acres of weeds that glyphosate cannot kill. The most problematic glyphosate-resistant weeds identified in the U.S. include pigweed (waterhemp), horseweed (marestail), common and giant ragweed, and ryegrass.¹¹

Roundup Ready alfalfa will ruin the hay export market for Pacific Northwest growers

Japan is the largest importer of U.S. alfalfa hay. Despite the Japanese government's approval of RR alfalfa for import, Japanese customers have told U.S. export companies they will not purchase GM hay. The leading export states are Washington, California, and Oregon. Although only 5 percent of U.S. alfalfa is exported, Pacific Northwest producers export a much higher percentage of their crop. They stand to lose everything if their markets abroad are eliminated.

Monsanto's patents on Roundup Ready technology transfer unfair liability risks to farmers

Many liability questions remain unanswered by our regulatory and judicial systems, including who should pay for damages caused by unwanted GM traits and who owns seed contaminated by patented traits. Unless laws governing patents and liability are reformed, farmers who don't plant GM crops are responsible for protecting their fields from GM contamination. USDA does not require RR alfalfa growers to plant buffer areas. Monsanto enforces a strict contract called a Technology Agreement that shields it from liability.

Roundup Ready alfalfa threatens the honey industry

Honey bees are important pollinators of alfalfa, and a large percentage of honey produced in the U.S. is derived from alfalfa pollen. Because GM material is detectable in honey products, honey producers—especially those who export—may be forced to test their products for GM traits.

The potential effects of Roundup Ready alfalfa feed on the health and productivity of livestock and wildlife have not been analyzed by independent scientists

No independent research exists on the potential effects of RR alfalfa (or any RR crop) on livestock health and productivity. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service did not analyze the effect of RR alfalfa on migratory birds and other non-target organisms before approving this new GM crop.



Photo Courtesy USDA

Roundup Ready alfalfa will increase farmers' seed and chemical costs

RR alfalfa costs twice as much as other proprietary seed varieties, because a technology fee is tacked onto the price of GM seed. Monsanto's Technology Agreement states that growers need to purchase its trademark glyphosate herbicide (Roundup), as opposed to cheaper generic brands of glyphosate, in order to receive warranties on seeds and other benefits. Farmers who adopt RR alfalfa will spend money on additional chemicals to control volunteer alfalfa and glyphosate-resistant weeds, as well as to kill RR alfalfa at the end of a stand's life.

Roundup Ready alfalfa increases the level of corporate control over American agriculture, and further reduces the availability of public alfalfa seed varieties

Monsanto controls about 90 percent of the global GM seed market through ownership of patents and acquisition of other seed companies. Adding alfalfa to the line of RR products increases Monsanto's grip on American farms and farmers, and allows a monopoly over a large segment of our food production system.

JIM MUNSCH - COON VALLEY, WISCONSIN

Jim Munsch runs a certified organic beef business, Deer Run Farm, in Coon Valley, Wisconsin. Some of his beef is sold under the name “Grazier’s Organic” by an area organic vegetable farm that operates mostly as a Community Supported Agriculture (CSA) program. Munsch also serves as a business consultant to a handful of organic vegetable and beef farms within a 150-mile radius of his farm.



Photo Courtesy Jim Munsch

Munsch says that organic alfalfa is a key forage in his production model, because it is the most cost-effective forage protein source for his cattle. All of his winter feed is mixed alfalfa and grass hay, and about a quarter of his pastures include alfalfa.

“Respected seed growers have warned that the introduction of genetically modified alfalfa will quickly lead to significant contamination of all alfalfa seed grown here in the U.S.,” Munsch says. He believes the compact geographic area of prime alfalfa seed producers coupled with the role of bees, which have a large natural range of activity, contribute to the likelihood that seeds will be contaminated by genetically modified (GM) alfalfa.

In order to continue with organic production after the introduction of GM alfalfa, Munsch believes he’s faced with two options, both with substantial financial impact.

The first is to find alfalfa seed from foreign sources, the cost of which would be high because of transportation. However, there is no guarantee, Munsch points out, that the same high-yielding varieties here in the U.S. will be available from other countries.

The second alternative is to switch from alfalfa to another legume, such as clovers. Alfalfa has twice the annual yield of clover, provides significantly better drought resistance, and only needs to be replanted every six to seven years compared to every two years for clover. Furthermore, producing low yielding forage like clover would increase the amount of land needed to feed his cattle by approximately 30 to 40 percent.

Munsch fears the economic strain that would come with transitioning out of alfalfa production. “An immediate problem,” he explains, “is that we do not have fallow land of our own ready to be used, so we would need to rent it.” Munsch has tried to rent organically certified land close to his operation in the past, but found it unavailable at any price.

Munsch says that rentable land is scarce because he is competing against grain producers who are subsidized by government programs, whereas his organic farm does not receive government payments.

“Renting uncertified land and undergoing the process of transition would mean keeping it out of an organic production system for three years – an extremely costly procedure, based on my previous experience,” Munsch adds.

“I am also very concerned about eating food grown with the use of Roundup herbicide,” Munsch explains. “There are residuals of glyphosate in conventionally raised grain, and there will be the same in sprayed genetically modified forage eaten by cattle. The public does not know the long-term effects of such herbicides.” Munsch believes there are unanswered questions regarding the legitimacy of science on the topic, and a dearth of data concerning long-term and multiple-generational studies. His family eats organic grain, and, given that the effects of GM feed are still unknown he says, “I would never feed forage to a cow if I knew it had residual glyphosate in it.”

Munsch is concerned about the implications of U.S. patent law on farmers, because the patenting of genetic material means the seeds are protected property of the patent holder, even in instances of contamination.

“Given that almost all alfalfa seed grown in North America is grown in very limited geographic areas, there is an absolute certainty that all alfalfa seed will eventually be contaminated with this genetically modified material,” Munsch explains. “The holder of the patent has claim over seed containing the patented genetic material regardless of how the material got there, allowing the patent holder to demand payment for the ‘use’ of the material.” The approval of the genetically modified seed, the biology and geography of seed production, and the patent all put the “owner” of this genetic material in a monopolistic position, Munsch adds.

THE CASE AGAINST ROUNDUP READY ALFALFA: GEERTSON SEED FARMS V. JOHANNNS

Roundup Ready (RR) crops entered the marketplace in 1996, beginning with soybeans and followed closely by canola, corn, and cotton. RR crops are grown on nearly 100 million acres across the United States.¹² Alfalfa is the most recent RR crop to be approved for commercial sale. The Monsanto Company produced RR alfalfa in partnership with the largest alfalfa seed producer, Forage Genetics International (a subsidiary of Land O'Lakes). Like all RR crops, RR alfalfa is engineered to tolerate glyphosate, the active ingredient in Monsanto's trademark herbicide, Roundup. To do this, Monsanto incorporated a gene sequence from a native soil microorganism, *Agrobacterium*, that confers resistance to glyphosate.¹³ RR alfalfa is the first genetically engineered perennial plant to be commercialized for widespread planting in the U.S.¹⁴ Unlike RR soybeans and corn, RR alfalfa will be harvested for several consecutive years without replanting.

Alfalfa (*Medicago sativa* L.) is the most important forage crop in the U.S., and was grown on more than 21 million acres in 2007.¹⁵ It is the third most economically valuable crop to U.S. agriculture and fourth most widely planted.¹⁶ Alfalfa is an important animal feed because of its high protein and low fiber content, and is a staple of most livestock diets, especially dairy cows.¹⁷ Because of alfalfa's pervasiveness, and because it is typically grown as a perennial crop, it provides important habitat for wildlife.¹⁸ For all these reasons, it is dubbed the "Queen of Forages."¹⁹

Dairy producers are more likely to use RR alfalfa, because they often depend on pure alfalfa stands free of weeds and grasses. Many beef cattle producers and horse owners typically feed their animals an alfalfa-grass mix hay.²⁰ RR alfalfa is not useful to mixed stand producers, as applications of glyphosate kill the desired grasses. The majority of U.S. alfalfa acreage is planted to pure stands; about a quarter is planted with grasses or another companion crop.²¹

APHIS, EPA, AND FDA: HOW REGULATORS APPROVED ROUNDUP READY ALFALFA

The path of RR alfalfa from field trials in 1998 to approval for commercial sale and planting in 2005 (see Table 1 on page 20) posed few serious hurdles along the way for Monsanto and Forage Genetics, and did not satisfy many growers or consumers.

Field Trials

The United States Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) must be notified of and acknowledge test plantings of genetically modified (GM) crops. APHIS considers each GM plant a "regulated article" and each DNA segment inserted using recombinant DNA methods an "event" until the plant is "deregulated" and allowed into the marketplace. Monsanto notified APHIS of more than 300 glyphosate-tolerant alfalfa field trials in the U.S. between 1998 and 2005.²² It is difficult to determine the amount of field trial acreage in individual states, because several states (sometimes more than a dozen) are often listed under a single notification.



Photo Courtesy USDA

Petition for Deregulation

Monsanto and Forage Genetics had to jump through several regulatory hoops to bring RR alfalfa to the marketplace. In 2002, the two companies began with the Environmental Protection Agency (EPA). Monsanto submitted glyphosate residue data and proposed labeling to increase the tolerance level of Roundup (or other glyphosate) herbicide on alfalfa pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).²³ Then Monsanto submitted a petition for "Reduced Risk" status for review of the data, which EPA granted on July 23, 2002, shortening the review time.²⁴

On April 17, 2002, EPA published a notice in the Federal Register that, pursuant to the Federal Food, Drug and Cosmetic Act (FFDCA), Monsanto had petitioned the agency to establish tolerances for glyphosate residues on alfalfa.²⁵ Pursuant to the FFDCA, EPA established a tolerance for residues of glyphosate “in or on animal feed, nongrass, group” at 400 parts per million (ppm), and “in or on grass forage, fodder and hay, group” at 300 ppm.²⁶ Because these tolerances did not extend to alfalfa seed, Monsanto petitioned EPA again to fill this regulatory gap.²⁷ Monsanto further proposed to delete the tolerances for alfalfa forage and hay, which it said were no longer needed.²⁸ These tolerances were to apply to both conventional and genetically engineered alfalfa.²⁹ Three months later, EPA denied Monsanto’s request to eliminate the tolerances for alfalfa forage and alfalfa hay.³⁰ Because EPA previously established an exemption for the CP4 EPSPS protein (which confers tolerance to glyphosate) and the genetic material necessary for the production of this protein in all raw agricultural commodities, it was unnecessary for Monsanto and Forage Genetics to acquire an exemption or tolerance for this protein.³¹ On February 16, 2005, EPA set a tolerance for glyphosate on alfalfa seed at 0.5 ppm.

The Food and Drug Administration’s (FDA) authority, laid out in a policy statement on the regulation of GM food and feed products, does not require the agency to make a food or feed safety finding.³² Instead, FDA encourages voluntary submission of safety information about new crops. Monsanto voluntarily submitted a food and feed safety and nutritional assessment summary for RR alfalfa “events” J101 and J163 in October 2003.³³ Although FDA published an overview of the data submitted by Monsanto, the data itself is only available to the public through a Freedom of Information Act (FOIA) request.³⁴ Monsanto applied for regulatory import and production approvals from several countries, including Canada, Japan, Korea, Mexico, and Taiwan.³⁵

On November 24, 2004, USDA published a notice in the Federal Register announcing that Monsanto and Forage Genetics had submitted their petition to deregulate (that is, allow uncontrolled commercial sale and planting of) RR alfalfa. The notice also said that APHIS’ preliminary Environmental Assessment (EA) was available for public comment.³⁶ The public comment period was set to end on January 24, 2005, but was later extended to February 17, 2005.³⁷

The next month, FDA issued a “Biotechnology Consultation Note” regarding RR alfalfa.³⁸ The Note summarized Monsanto’s food and feed safety and nutritional assessment documents. Because FDA neither conducted independent tests, nor required mandatory food or feed safety testing, its opinion on RR alfalfa is based on Monsanto’s own determination that RR alfalfa is not materially different from conventional alfalfa:

Monsanto and Forage Genetics have concluded that their glyphosate-tolerant alfalfa event J101 and event J163, and the feeds and foods derived from them, are not materially different in safety, composition, or any other relevant parameter from alfalfa now grown, marketed, and consumed. At this time, based on Monsanto’s and Forage Genetics’ description of its data and information, the Agency considers this consultation on alfalfa event J101 and event J163 to be complete.³⁹

USDA announced its decision to deregulate RR alfalfa in May 2005, paving the way for the crop to move into the marketplace. APHIS published its Finding of No Significant Impact (FONSI), which concluded that alfalfa events J101 and J163 “would not present a risk of plant pest introduction or dissemination,” and that the events “will not harm threatened or endangered species or organisms that are beneficial to agriculture; and...should not reduce the ability to control pests and weeds in alfalfa or other crops.”⁴⁰ The agency said it did not need to prepare a more thorough review in an Environmental Impact Statement (EIS).⁴¹ APHIS has never prepared an EIS for any of the GM crops on the market (although one is currently underway for a plant still in field trials, RR creeping bentgrass, a popular turf grass used for lawns and golf courses).



Photo Courtesy Kristina Hubbard

**TABLE 1.
REGULATORY TIMELINE FOR THE
APPROVAL OF ROUNDUP READY ALFALFA**

May 2, 1998	Roundup Ready (RR) alfalfa field trials begin.
April 17, 2002	EPA issues a notice in the Federal Register that Monsanto had petitioned EPA pursuant to the Federal Food, Drug and Cosmetic Act (FDCA) to establish tolerances for glyphosate residues related to alfalfa.
September 27, 2002	EPA establishes “tolerances for residues of glyphosate in or on animal feed, nongrass group; grass, forage, fodder and hay, group.”
October 1, 2003	Monsanto submits a food and feed safety and nutritional assessment summary for events J101 and J163 (RR alfalfa).
August 18, 2004	EPA issues a notice in the Federal Register that Monsanto had petitioned EPA pursuant to the FDCA to establish tolerances for residues of glyphosate on alfalfa seed. Monsanto also petitions to eliminate the tolerances set for alfalfa, forage, and alfalfa hay because it says they are no longer needed.
November 10, 2004	EPA denies Monsanto’s request to eliminate the tolerances for alfalfa forage and alfalfa hay.
November 24, 2004	USDA announces Monsanto & Forage Genetic’s petition to deregulate RR alfalfa in the Federal Register, the availability of APHIS’ Environmental Assessment, and a public comment deadline (January 24, 2005).
February 3, 2005	USDA extends comment period through February 17, 2005.
December 8, 2004	FDA issues a “Biotechnology Consultation Note regarding Glyphosate-tolerant Alfalfa Event J101 and Event J163.”
February 16, 2005	EPA sets a tolerance level for glyphosate on alfalfa seed at 0.5 ppm.
May 1, 2005	USDA issues an Environmental Assessment and Finding of No Significant Impact.
June 27, 2005	USDA publishes notice in Federal Register advising the public of its determination that glyphosate-tolerant alfalfa events J101 and J163 are no longer considered regulated articles.

PUBLIC RESPONSE

By the end of the public comment period, APHIS had received a strong response: 663 comments, from alfalfa growers and seed producers, organic growers, animal producers, growers associations, consumer groups, agriculture industries, university professionals, and private citizens.⁴² The vast majority of respondents (520) opposed deregulating RR alfalfa; 137 supported the petition.⁴³ The main concerns of opponents were potential problems with market acceptance and cross-pollination between RR alfalfa and conventional and organic alfalfa.⁴⁴ APHIS ignored or brushed aside these concerns.

FARMERS RESPOND

After USDA gave Monsanto and Forage Genetics a green light to commercialize RR alfalfa, a coalition of alfalfa producers and family farm, consumer, and environmental groups sued USDA on five claims, including violations of the National Environmental Policy Act (NEPA). It was the first lawsuit to be filed against USDA for the deregulation of a particular GM crop. The suit contends that RR alfalfa will affect the integrity of organic products, creating marketing problems; that it will introduce more herbicides into the environment and create glyphosate-resistant weeds; and that it will damage export markets. Importantly, the suit maintains that the potential environmental harm is interrelated with economic harm, and that USDA failed to consider the potential economic implications of introducing RR alfalfa when it deregulated the GM variety. The suit, filed in federal court in the Northern District of California, asked USDA to rescind its decision to deregulate RR alfalfa and perform a full EIS. It also asked for an EPA consultation with U.S. Fish and Wildlife about the potential for RR alfalfa to affect endangered or threatened species and their habitats.⁴⁵



LANDMARK COURT DECISION PROTECTS ALFALFA GROWERS

Judge Charles Breyer heard the case on January 19, 2007. He focused on whether an EIS should have been performed before RR alfalfa was released for commercial sale. On February 13, 2007, Judge Breyer ruled that USDA had failed to adequately evaluate the potential economic and environmental impacts of RR alfalfa.⁴⁶ He ordered USDA to perform a full EIS on RR alfalfa before a future decision regarding deregulation is made. In his ruling, the judge consistently found USDA's arguments unconvincing, without scientific basis, and/or contrary to the law. For example, the judge found that plaintiffs' concerns that RR alfalfa will contaminate conventional and organic alfalfa are valid, stating that USDA's opposing arguments were "not convincing" and do not demonstrate the "hard look" required by federal environmental laws. The ruling went on to note, "For those farmers who choose to grow non-genetically engineered alfalfa, the possibility that their crops will be infected with the engineered gene is tantamount to the elimination of all alfalfa; they cannot grow their chosen crop." The judge said:

APHIS did not conclude that gene transmission would not occur; indeed, an internal APHIS email acknowledges that '[i]t may be hard to guarantee that seeds or sprouts are GE free.' Instead, it in effect concluded that whatever the likelihood of gene transmission, such impact is not significant because it is the organic and conventional farmers' responsibility to ensure that such contamination does not occur. It rested its 'no significant impact' decision on this conclusion even though it made no inquiry into whether those farmers who do not want to grow genetically engineered alfalfa can, in fact, protect their crops from contamination, especially given the high geographic concentration of seed farms and the fact that alfalfa is pollinated by bees that can travel more than two miles.

The judge noted that "neither the EA nor the FONSI identify a single method" organic farmers can employ to protect their crops from pollen transported off RR alfalfa fields by pollinators, even if a "buffer zone" is established. Judge Breyer called APHIS' lack of inquiry into the extent of likely contamination of conventional and organic alfalfa by RR alfalfa "arbitrary and capricious." APHIS failed to consider that farmers cannot always harvest their fields at the "most optimal time" due to weather and other factors out of their control. His decision reads:

APHIS made no inquiry into how often farmers are actually able to harvest their forage crop before seeds mature and no inquiry into the likelihood of gene transmission when they cannot. Without such data, APHIS's conclusion is arbitrary.

Judge Breyer also found APHIS' reasoning that farmers will not "necessarily" be prohibited from labeling their products as organic as "wholly inadequate." He acknowledged that many farmers and consumers have higher standards than the federal government:

...to these farmers and consumers organic means not genetically engineered... most importantly, APHIS's comment simply ignores that these farmers do not want to grow or feed to their livestock genetically engineered alfalfa, regardless of how such alfalfa can be marketed.

USDA argued that, based on a legal technicality, the agency did not have to address the economic risks to organic and conventional growers whose alfalfa crop could be contaminated by Monsanto's GM variety. But the judge found that USDA "overstates the law...Economic effects are relevant when they are 'interrelated' with 'natural or physical environmental effects'.. Here, the economic effects on the organic and conventional farmers of the government's deregulation decision are interrelated with, and, indeed, a direct result of, the effect on the physical environment." The judge explained the importance of maintaining the integrity of non-GM seed:

A federal action that eliminates a farmer's choice to grow non-genetically engineered crops, or a consumer's choice to eat non-genetically engineered food, is an undesirable consequence: another NEPA goal is to 'maintain, wherever possible, an environment which supports diversity and variety of individual choice.'

About a month after his decision, Judge Breyer ordered a preliminary injunction halting RR alfalfa seed planting. This marked the first-ever moratorium on the planting of a GM seed. His decision allowed growers who had already purchased RR alfalfa to plant it before March 30, 2007, and prohibited all planting of GM alfalfa after this date.

In May 2007, Judge Breyer issued a permanent injunction, which banned the planting of RR alfalfa, and stated that RR alfalfa was once again a regulated article, requiring Monsanto and Forage Genetics to notify APHIS of future plantings. RR alfalfa already planted could be harvested and sold under certain conditions, which USDA was ordered to communicate to growers through an Administrative Order. RR alfalfa sold or planted after March 30, 2007, was deemed illegal. The Judge also ordered Forage Genetics to supply all known RR alfalfa production locations for public disclosure.

In July 2007, USDA issued an Administrative Order requiring mandatory production measures for growers who planted RR alfalfa between June 14, 2005 and March 30, 2007. (A December 2007 supplemental Administrative Order clarified and replaced the July 2007 Order.)⁴⁷ These requirements remain in effect as long as RR alfalfa is an unapproved GM crop:

Pollinators: Pollinators cannot be introduced to RR alfalfa fields grown for hay production.

Equipment:¹ Equipment used exclusively for the production of RR alfalfa hay or seed must be marked with a sign or label stating, “This equipment shall be used only with RR alfalfa.”

Equipment used for both RR and non-RR alfalfa fields must be cleaned while it is in the RR alfalfa field prior to use in non-RR alfalfa fields.

Transportation: Any trucks, wagons, or other transporters used to move RR alfalfa to a storage site must be swept clean after unloading before being used for transport of non-RR alfalfa. Flatbed trucks used to haul RR alfalfa hay must be covered with a secured cover if viable seed is present in the hay. Buyers must be notified if hay they purchase contains RR alfalfa, and that the hay must be used for feed purposes only. RR alfalfa hay must be clearly labeled with a sign measuring no less than 8.5 x 11 inches and marked “Roundup Ready Alfalfa.”



Hay: Commingling of RR and non-RR hay is allowed for use on farms where the hay is produced and/or by end-users, and for animal feed.

All RR alfalfa and/or commingled alfalfa hay that leaves the farm on which it was produced or leaves a re-seller’s location must be clearly labeled by one of the following methods:

Bale Tags

Bales of RR alfalfa and/or commingled alfalfa hay must be identified as “Roundup Ready Alfalfa” by bale tags securely attached to the binding twine or wire.

Lot Identification and Documentation

The following documentation must accompany RR alfalfa and/or commingled alfalfa hay during transportation. Vehicles transporting RR alfalfa must display a sign no less than 8.5 x 11 inches and marked “Roundup Ready Alfalfa.”

1. RR alfalfa designation
2. Name, signature, and address of buyer
3. Name, signature, and address of seller
4. Name and address of hauler
5. Lot number
6. Unit count (number of bales)
7. Weight
8. Scale and ticket number
9. Shipment date

Storage: All RR hay may be transported to contained areas for storage, but must be segregated from non-RR hay.

Bales of RR alfalfa leaving the farm where it was produced must be identified as “Roundup Ready Alfalfa” by bale tags securely attached to the binding twine or wire.

Seed: All RR alfalfa seed must be harvested, handled, transported, and stored to prevent physical mixing with non-RR alfalfa seed. Bags of RR alfalfa seed must be segregated from non-RR alfalfa seed. Storage containers must be labeled “Roundup Ready Alfalfa.”

¹ The Administrative Order outlines instructions for cleaning specific pieces of equipment, including balers, wagons, choppers, combines, and seed conditioning equipment.

COURT SETS RULES TO STOP SPREAD OF ROUNDUP READY ALFALFA

In 2007, more than 200,000 acres of RR alfalfa were planted in the U.S. for forage, and 20,000 acres for seed. Before the court decision halted further planting of RR alfalfa, Monsanto expected the acreage to jump to 570,000 in 2007, and then to more than one million acres in 2008.⁴⁸

The plaintiffs did not ask the court to order the destruction of GM alfalfa already planted, but did ask that Monsanto and USDA disclose the location of these fields. As a result, the injunction also ordered Monsanto and Forage Genetics to provide USDA with Global Positioning System (GPS) locations of all RR alfalfa production acreage.

Two months later this order was amended to require that notice be provided only to alfalfa growers who live within the same county or adjacent county to RR alfalfa farms. Judge Breyer ordered USDA to disclose the counties in 17 western states where RR alfalfa was planted, set a timeline for disclosure of the counties in eastern states where RR alfalfa was planted, and establish a toll-free hotline so farmers can find out if RR alfalfa is growing near their non-GM fields, to evaluate the potential for contamination and take steps to protect their alfalfa.

USDA established this hotline in August 2007 with a set of criteria for callers.⁴⁹ First, the agency requires that callers be current conventional or organic alfalfa growers (or a grower who plans to plant conventional or organic alfalfa). Second, callers must provide the USDA operator with the exact location of their farm or field where alfalfa is or will be grown – either latitude and longitude coordinates or the mailing address of the farm.

Is Roundup Ready Alfalfa Growing Near You?

Alfalfa growers can find out if Roundup Ready alfalfa is growing near their fields by calling USDA's hotline, **(866) 724-6408**. A list of counties where Roundup Ready alfalfa was planted before March 30, 2007, is posted on USDA's website, at http://www.aphis.usda.gov/biotechnology/alfalfa_locations.shtml.

MONSANTO APPEALS COURT ORDER BANNING ROUNDUP READY ALFALFA

On July 23, 2007, Monsanto and Forage Genetics appealed Judge Breyer's decision to vacate USDA's approval of RR alfalfa to the Ninth Circuit Court of Appeals. Monsanto asserts that the injunction against RR alfalfa seed sales imposes unnecessary restrictions and costs on growers, seed dealers, Forage Genetics, and Monsanto. Monsanto did not seek to lift the injunction during its appeal. It did ask the court to expedite the appeal, which was partially granted. During the appeal, the injunction against planting RR alfalfa remains in effect.

PLAINTIFFS

Nine individuals and organizations filed the case against USDA and EPA:

Geertson Seed Farms is a family-owned seed farm near Adrian, Oregon that has produced alfalfa seed since 1942. Phillip Geertson still farms the original 80 acres that was homesteaded by his family in 1939. Geertson Farms sells six varieties of alfalfa seed in both domestic and international markets. Geertson Farms' seed varieties are university tested and have proven yield records. The contamination of Geertson Farms' seeds by RR alfalfa will affect its ability to export seed, as well as its domestic market. Weed resistance to glyphosate will hinder Geertson Farms' ability to control weeds and feral alfalfa with glyphosate.

Trask Family Seeds ranches on the edge of the Black Hills of South Dakota and has been a family business for four generations. Trask Family Seeds harvests alfalfa seed and hay from old, public varieties commonly known as South Dakota Commons. Trask Family Seeds provides high quality seed nationwide, including to organic producers, and believes the contamination of its seed supply is inevitable with the introduction of RR alfalfa. Both conventional and organic farmers may demand testing to certify the purity of Trask Family Seeds, which will raise the company's costs.

Center for Food Safety (CFS) seeks to address the impacts of industrial farming and food production systems on human health, animal welfare, and the environment. CFS is a national non-profit membership organization with members in almost every state across the nation. Some of these members grow alfalfa, use it as feed for their livestock, and sell non-GM products. CFS' members also regularly eat organic foods and desire foods that are free of GM material. CFS fears that RR alfalfa will reduce the supply of non-GM feed and food, as well as negatively impact the environment.

Beyond Pesticides promotes safe air, water, land, and food and works to protect public health and the environment by encouraging a transition away from the use of toxic pesticides. Beyond Pesticides and its members aim to reduce the proliferation of GM crops designed to tolerate pesticides because these crops will continue the pesticide treadmill that threatens the health of Beyond Pesticides' members.

The Cornucopia Institute is a non-profit organization based in Cornucopia, Wisconsin. Through research, advocacy, and economic development, Cornucopia's goal is to empower farmers both politically and through marketplace initiatives. Among the interests of The Cornucopia Institute is protecting the credibility of organic farming methods. Its members include alfalfa farmers who grow and use non-GM alfalfa and who own certified organic farms that they wish to maintain as free of GM crops.

The Dakota Resource Council (DRC) is a North Dakota non-profit organization that is headquartered in Dickinson with other offices in Bismarck and Fargo, North Dakota. DRC was formed in 1978 to protect North Dakota's land, air, water, rural communities, and agricultural economy. Among the interests of DRC are consumers' right to know whether their food is genetically engineered; placing liability on biotechnology corporations for damages caused by their products; and disclosure of research sponsorship on GM products. DRC's members include alfalfa farmers who grow and use non-GM alfalfa; who desire to maintain their farms free of GM crops; and who regularly eat organic foods and desire foods that are free of GM material.

The National Family Farm Coalition (NFFC) is a coalition representing family farm and rural groups working to secure a sustainable, economically just, healthy, safe, and secure food and farm system. NFFC was founded in 1986, and was among the first farm groups in the nation to call into question the agronomic, economic, environmental, and public health impacts of GM crops. NFFC and its member organizations coordinated and sponsored the Farmer to Farmer Campaign on Genetic Engineering in 1999 to provide a national voice for farmers on agricultural biotechnology issues. Farmer to Farmer is comprised of 34 farm and rural groups who have endorsed the Farmer Declaration on Genetic Engineering, which demands that no new GM crops be deregulated and commercialized until a thorough, objective, independent, and publicly transparent assessment of the impacts is conducted.

The Sierra Club is a national non-profit organization of approximately 750,000 members dedicated to exploring, enjoying, and protecting the wild places of the earth. The Sierra Club is a California non-profit headquartered in San Francisco, California. The Sierra Club's concerns encompass endangered species, habitat protection, pollution, genetic engineering, and industrial agriculture. The Sierra Club's Genetic Engineering Committee educates the public and advocates for regulatory reform to protect the natural environment and human health from the threats posed by the release of novel GM organisms.

The **Western Organization of Resource Councils** is a regional network of seven grassroots community organizations with 9,500 members and 50 local chapters. WORC's mission is to advance the vision of a democratic, sustainable and just society through community action. WORC wants to ensure consumers' right to know by requiring the clear and accurate labeling of genetically modified foods; protecting the interests of farmers and ranchers who want to grow GM-free alfalfa or feed uncontaminated alfalfa to livestock or dairy cattle; and protecting the interests of consumers who want GM-free foods.



Alfalfa hay fields in full bloom south of Billings, Montana, August 2005. Harvesting was delayed due to rain. Monsanto and Forage Genetics assert that cross-pollination between hay fields is not a threat, even though weather and other factors dictate when hay can be harvested.

TABLE 2.
TIMELINE OF LAWSUIT FILED AGAINST USDA FOR ITS
APPROVAL OF ROUNDUP READY ALFALFA

June 27, 2005	USDA publishes notice in Federal Register advising the public that glyphosate-tolerant alfalfa events J101 and J163 are no longer considered regulated articles.
February 16, 2006	Center for Food Safety, WORC, and seven other plaintiffs file lawsuit challenging USDA's commercial release of Roundup Ready (RR) alfalfa.
February 13, 2007	Court finds USDA violated the law by failing to conduct an Environmental Impact Statement (EIS) before approving the commercial release of RR alfalfa.
March 12, 2007	Judge orders preliminary injunction, halting RR seed sales and planting.
March 23, 2007	APHIS publishes notice in Federal Register announcing that RR alfalfa is once again a regulated article, and that a future decision regarding the deregulation of RR alfalfa will be issued only after the completion of a full EIS.
May 3, 2007	Judge orders permanent injunction until USDA does a full EIS on RR alfalfa.
July 23, 2007	Judge publishes amended judgment.
July 23, 2007	Monsanto and Forage Genetics appeal the Court's decision.
August 1, 2007	USDA publishes notice in Federal Register announcing a toll-free hotline for farmers to call and find out if RR alfalfa is growing close to their fields.
September 18, 2007	APHIS appeals the Court's decision.

BLAINE SCHMALTZ - RUGBY, NORTH DAKOTA

Blaine Schmaltz owns and operates Blaine's Best Seeds, an organic seed farm that has been in business for more than ten years. In addition to organic seed production, he produces sprouting alfalfa for human consumption and alfalfa forage for organic dairy livestock. He began farming organically after his health was negatively impacted by systemic exposure to chemicals and fertilizers used in conventional farming. "Organic farming has allowed me to continue in my livelihood," Schmaltz says.



Blaine's Best Seeds

Due to liability concerns regarding both alfalfa seed and sprouting alfalfa, Schmaltz's sales of organic alfalfa are threatened by RR alfalfa that may come in contact with his fields. "There is zero tolerance for contaminated seed among my customers who demand organic products," Schmaltz explains. "I have attempted to find an insurer who would cover my liability in case of such an event, but every company I have contacted has said it is impossible to issue coverage for such a liability."

Schmaltz provides organic alfalfa forage to organic dairies. While the dairies do not presently test the feed to ensure it is free of GM material, it is likely such testing will follow the introduction of GM alfalfa. On one hand, he may incur additional testing costs to assure his customers that the alfalfa feed is organic. On the other hand, if this testing reveals that his feed is contaminated, he would be forced to discontinue forage production.

“My primary concern as a food producer regarding the genetic engineering of crops is the unknown risk to consumer health,” Schmaltz explains. “Becoming an organic farmer has allowed me to preserve my own health and to ensure that my customers do not face unknown risks in consuming the alfalfa I grow.”

“My family and I eat organic foods. We also eat honey produced by our own honey bees that pollinate our fields. Bees will venture out about two miles, and if there were GM alfalfa fields nearby, my organic alfalfa crop might be contaminated by cross-pollination with the GM alfalfa.”

Schmaltz is also concerned that the likelihood of cross-pollination between GM alfalfa and his own fields is even greater due to the open, windswept prairie landscape that he farms. He explains that each week he encounters four or more days with a wind speed of 10 to 15 miles per hour or higher. “The traveling distance of pollen and seed would be enormous in this region due to persistent wind,” Schmaltz says.

Seeds can also be transported from field-to-field by wildlife, which Schmaltz describes as “abundant,” in addition to people’s clothing and boots, such as hunters who frequent agricultural fields during hunting season.

GLYPHOSATE-RESISTANT WEEDS

A GROWING THREAT TO AMERICAN FARMERS

Those who follow the debate on genetically modified (GM) crops are familiar with the term “superweed:” a weed that survives a normal dose of a chemical application that previously would have killed it. Weeds develop resistance for several reasons: frequent exposure to a particular chemical, the spread of naturally resistant weed seeds, and the outcrossing of herbicide-tolerant genes to weedy relatives. Some of the most challenging weeds are also prolific seed producers, capable of dispersing hundreds of thousands of seeds per plant. These seeds can remain dormant in the soil for years, leaving the opportunity for germination years down the road, complicating farmers’ containment efforts.

Roundup Ready (RR) alfalfa entered the marketplace at a time when several cases of glyphosate-resistant weeds were reported in the press, including glyphosate-resistant horseweed and pigweed. Already, glyphosate-resistant weeds infest more than two million acres of U.S. farmland.⁵⁰ Because leading weed scientists agree that many of these weeds develop in fields where farmers consistently grow RR crops, introducing another RR crop into field rotations, especially a widely grown perennial, will encourage even more weed resistance to glyphosate. To contend with resistant weeds, farmers must increase and diversify their herbicide use, meaning higher input costs and more chemicals in our environment and food.

HOW DID WE GET HERE?

Since the introduction of RR crops, herbicide use in the U.S. has increased dramatically. USDA data shows that herbicide use on herbicide-tolerant crops increased by more than 60,000 tons in less than a decade.⁵¹ Glyphosate use alone has increased by more than 700 percent.⁵² For example, glyphosate use on cotton increased 753 percent from 1997 to 2003 as RR cotton increased from 4 percent to 74 percent of total U.S. cotton acreage. The same pattern is seen in corn, where glyphosate use increased more than seven-fold from 2002 to 2005 (as acreage of RR corn steadily increased).⁵³

While some crops are naturally resistant to particular herbicides (for example, corn is resistant to 2,4-D), some of our most widely grown crops – corn, soybeans, and cotton – are now genetically engineered to resist glyphosate, the most widely used herbicide in the world. The extent of RR crop plantings in the U.S. – more than 100 million acres in 2006 – has increased the development of resistant weeds substantially.

Of course, glyphosate-resistant weeds occur in conventional crop production, too. Still, glyphosate-resistant weeds in RR crops now infest more acres than prominent resistant weeds, such as ryegrass, that commonly develop in conventional fields.⁵⁴ At least one study confirms that glyphosate-resistant horseweed develops after use of glyphosate alone for several years.⁵⁵

COMBATING RESISTANCE IS COSTLY

The rapid adoption of RR crops has been coupled with a 50 to 200 percent increase in suggested rates of glyphosate use, largely attributed to the growing resistance in weeds.⁵⁶ Now farmers must resort to more toxic and costly chemicals to control resistant weeds—the very chemicals biotechnology companies claimed RR technology would replace. Farmers are often forced to double their chemical costs to control resistant weeds.⁵⁷

Glyphosate-Resistant Horseweed

In 2005, glyphosate-resistant horseweed (*Conyza canadensis*), or marestalk, may have cost Arkansas farmers as much as \$500 million in inputs.⁵⁸ An Arkansas extension agent reported: “If you’re in the Arkansas Delta, and you don’t have a resistant horseweed problem now, you soon will...We can’t stop the spread of this weed. It will spread over the entire Arkansas Delta. We have to live with it and adjust to it.”⁵⁹ The resistant weed has infested a half-million acres since it first showed up in 2003.⁶⁰ Though a normal rate of glyphosate will kill a susceptible horseweed, eight times the suggested rate often fails to kill a resistant weed. One Arkansas



producer with a severe infestation of glyphosate-resistant horseweed saw his yields reduced by more than 50 percent, and lost more than \$35,000 in input costs.⁶¹ Tennessee lost 50 percent of its no-till acreage in one year due to glyphosate-resistant horseweed infestations.⁶² The weed is spreading rapidly, and has been documented in fourteen states, most recently in Nebraska.⁶³

Glyphosate-Resistant Pigweed

Some weed scientists believe glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*), or pigweed, is a greater threat to American farmers than horseweed. The world’s first population of glyphosate-resistant pigweed was discovered in Georgia in 2005. The weeds survived a dosage of glyphosate almost 10 times the recommended rate. Since 2005, scientists in Georgia, Missouri, South Carolina, and North Carolina have all reported high levels of resistance to glyphosate (8 to 12 times the suggested rate). One weed specialist calls glyphosate-resistant pigweed “catastrophic,” because the weed was difficult to control even before resistance surfaced.⁶⁴ On average, resistant pigweed costs cotton producers an extra \$40 or more per acre.⁶⁵

“We can’t stop the spread of this weed.”

—Arkansas Extension Agent

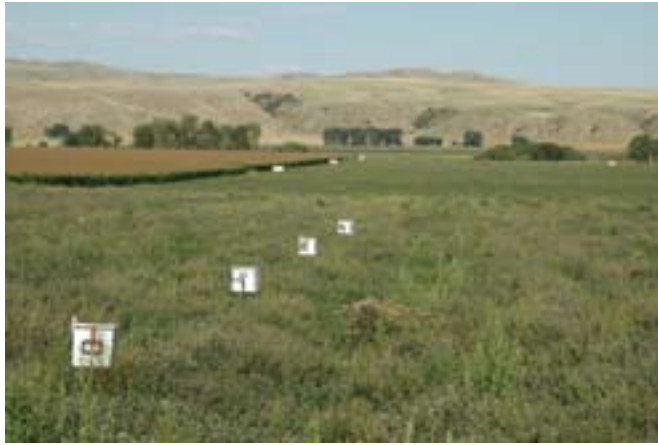
The List Keeps Growing

Each year, as more and more farmers contend with glyphosate-resistant weeds, it is clear that resistance is very difficult, if not impossible, to eliminate once established. Horseweed and pigweed are only two of many weeds developing resistance to glyphosate. Others include ryegrass, already a problem in California, and common ragweed, which has survived 10 times the normal rate of glyphosate in Missouri.⁶⁶ And the list keeps growing. Evidence for resistance in waterhemp, velvetleaf, ivyleaf, morning glory, cocklebur, and lambsquarter is growing.

Roundup Ready Alfalfa and Weed Resistance

Many alfalfa producers use few if any herbicides. In 1998, a University of Wisconsin weed specialist reported that herbicides were applied to less than 17 percent of U.S. alfalfa hay acreage.⁶⁷ Though more recent figures are not available, farmers’ best approach to managing weeds, still appears to be maintaining a healthy alfalfa stand, not relying on herbicides. Providing the option of spraying herbicides directly over alfalfa is likely to increase the amount of chemicals used in alfalfa production. In fact, the National Center for Food and Agriculture Policy estimates that RR alfalfa could result in the application of an additional 200,000 pounds of herbicides per year in California alone.⁶⁸

In 2007, 91 percent of soybeans and 52 percent of corn planted in the U.S. were herbicide-tolerant varieties.⁶⁹ Alfalfa is a major acreage crop, so adding it to the RR line of crops is certain to exacerbate the problem of already existing, as well as unidentified, glyphosate-resistant weeds. Common crop rotations – alfalfa with corn, corn with soybeans – mean some growers will rotate one RR crop with another. Leading weed scientists are confident that RR alfalfa will add to the rotation selection for resistant weeds.



Alfalfa is grown throughout the U.S., in regions relatively free of RR crop cultivation, as well as where other RR crops are produced. The risks don't only concern RR crop rotations, but non-RR crops too. In the West, RR alfalfa poses risks to conventional wheat producers who rely on glyphosate to control some important weeds (notably, some of these weeds are also important in alfalfa).⁷⁰

Weed specialists identified weed resistance in RR alfalfa field trials years before the variety was approved for commercial sale. A University of California-Davis weed specialist observed a shift in the prevalence of stinging nettles in experimental plots where RR alfalfa had been grown for three years: “When we started this study, there were four or five stinging nettle plants on [one] end of the field...Now you can see nettle all along the field. We’re seeing more and more nettle each year.”⁷¹

There is also evidence that glyphosate may not kill Bermuda grass at the proposed labeled rates for weed control in RR alfalfa.⁷² Additional weeds found in alfalfa stands appear to be developing resistance, too, including lambsquarter and barnyardgrass.⁷³ Farmers who adopt RR alfalfa will rely on additional herbicides whether glyphosate-resistant weeds surface or not, because glyphosate is weak on some of the most important alfalfa weeds, including malva, nettle, henbit, cheeseweed, marestail, hairy fleabane, and filaree.⁷⁴

Volunteer Roundup Ready Alfalfa

At the end of an alfalfa stand's life (anywhere from three to twelve years), many farmers use glyphosate to kill remaining plants in order to proceed with crop rotations.⁷⁵ Alternatives for taking out RR alfalfa stands are often more toxic than glyphosate herbicides, such as 2,4-D and Dicamba.⁷⁶ According to Cornell University's Environmental Impact Quotient (EIQ), a system that rates pesticides' effect on the environment, Dicamba has an EIQ of approximately 28, almost twice that of glyphosate.⁷⁷ This is expected to pose problems in California where certain herbicides (phenoxy herbicides, such as Dicamba) are banned in some regions at certain times of the year.⁷⁸

RR alfalfa could become a problematic weed itself, especially when rotated with other RR crops, such as corn. If RR alfalfa becomes as pervasive in the American landscape as RR corn and soybeans, farmers will have trouble managing volunteer alfalfa and its weedy relatives. Glyphosate is also used to control feral alfalfa along roadsides and in ditches, and may lose its effectiveness if RR alfalfa outcrosses with feral alfalfa or takes root outside cultivated fields.

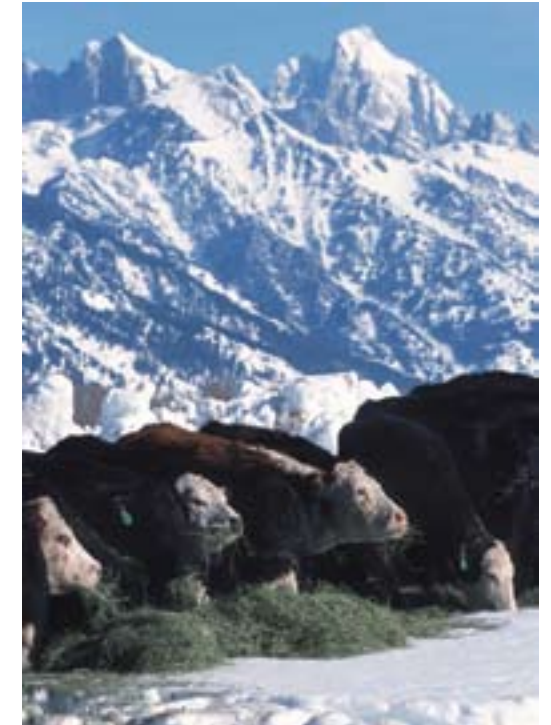


Photo Courtesy USDA

“Human error, random events, sub-standard stewardship practices, and the forces of nature make it impossible to guarantee that a ‘zero tolerance’ threshold for transgenic seeds or plants can be achieved after the release of RR alfalfa, even within specially designated areas.”

—Allison Snow, Ph.D., Gene flow expert at Ohio State University

CONTAMINATION BY GM CROPS

Organic farmers have long been concerned with pesticide drift, where residues of chemicals applied in their area show up in their organic products. Now, in addition to chemicals transported across field borders, organic producers are experiencing a new drift – “genetic drift” – from neighboring fields. The transfer of genes from genetically modified (GM) crops to organic crops poses many problems to organic farmers, including losing premium prices afforded by non-GM markets. Farmers also risk losing the genetic integrity of seeds that took years to develop through careful breeding. The issue of liability associated with patented genetic traits is of great concern, as biotechnology and seed companies effectively own crops that contain their patented traits, even if those traits entered the crop through inadvertent cross-pollination. Of course, conventional farmers share many of the same concerns, and stand to lose as much – if not more – than organic producers in some situations.

“The GM pollution of American commodities is now so pervasive, we believe it is not possible for farmers in North America to source seed free from it.”
—Farm Verified Organic, organic certification service in North Dakota

Biological factors and human error can both contribute to the unwanted spread of transgenic pollen and seed. Such contamination is problematic not only ecologically, but also in terms of differentiation in the marketplace. Although biotechnology companies argue that GM seed and conventional seed can co-exist without harming the growers of either, keeping transgenic and conventional products separate throughout the food supply chain has proven more than difficult. Some argue it is impossible.⁷⁹ Scientists from Santa Clara University and the University of Manitoba concluded that the movement of transgenes beyond their intended destination is a “virtual certainty.”⁸⁰

In 2000, 54 percent of soybeans planted in the U.S. were GM varieties; by 2007, 91 percent were GM.⁸¹ More GM plantings are taking place abroad, too. In 2006, 22 countries planted GM crops on more than 250 million acres, a 13 percent increase from 2005 (or 30 million acres).⁸²

At the same time that adoption of GM crops has increased, the organic market has become one of the fastest growing sectors of the American food industry. The United States Department of Agriculture (USDA) estimates the organic market is growing by 20 percent or more each year, with some individual sectors, such as organic dairy, growing by 60 percent in some parts of the country.⁸³ In just decades, the organic food industry grew from a grassroots movement into a \$14 billion industry.⁸⁴ Because the USDA National Organic Program (NOP) does not allow the use of GM seed and feed in certified organic systems, consumers rely on organic products as alternatives to food products that contain GM ingredients. Still, GM material continues to turn up in crops and food intended for non-GM markets, including organic products.

GM CONTAMINATION ON THE RISE

In 2005, two international non-governmental organizations launched a GM Contamination Register, an initiative to record incidents of contamination by intentional or accidental releases of GM crops.⁸⁵ The Register currently lists 142 cases of GM contamination in 43 countries on five continents since GM crops were introduced in 1996. More contamination incidents were recorded in 2006 than any other year (24 events). Although many of these cases are not fully investigated, cross-pollination appears to be the cause of contamination in most of them.

Not only can GM seeds mix with non-GM seeds at any stage of production, farmers often unknowingly plant seeds that, while not a GM variety, contain GM material – ensuring a contaminated harvest from the beginning. The Union of Concerned Scientists tested samples of certified (i.e., produced under strict conditions to ensure purity) conventional varieties of corn, soybeans, and canola, and concluded that the varieties are pervasively contaminated with low levels of DNA sequences derived from GM varieties.⁸⁶ Interestingly, the soybean samples (a mostly self-pollinated crop) were contaminated at rates and levels similar to corn (an open-pollinated crop), proving that inadvertent mixing and other forms of human error have greatly contributed to contamination. The report notes that foundation seed of traditional crop varieties used for breeding—seeds with no detectable level of GM contamination—is in need of protection for future research needs and market demands.⁸⁷

But seed companies have done little to slow contamination or educate their farming customers. Genetic ID, a reputable genetically modified organism (GMO) testing facility based in Fairfield, Iowa, tested five different conventional seed varieties from four major seed companies and found that all the varieties of non-GM seeds from each company tested positive for a small percentage of transgenic material. As a result, GM crops continue to turn up in fields that farmers believe are completely free of GM crops, and, consequently, in markets that don't want GM food.

GM material can enter a farmer's field through several routes, unlike pesticide drift, which is largely attributed to wind. Transgenic pollen can travel from a neighboring farm via wind or pollinating insects (i.e. bees); transgenic and conventional seed can get mixed through shared harvesting and storage equipment; and volunteer plants – crops that persist without deliberate cultivation – can show up in fields a year or more after the original crop was grown as a result of seed being shed from the crop and remaining dormant in the soil. Some volunteer plants germinate several years after the original seed was shed.⁸⁸

Yet cross-pollination, contaminated seed sources, and the convoluted path seeds travel—from farm fields to grain elevators and transport trucks, to ocean barges and food companies—aren't the only routes of contamination. At times, it's the companies' own mismanagement of genetic resources. In 2004, Syngenta reported an error in GM corn breeding to U.S. authorities. For four years, Syngenta inadvertently produced and distributed a GM corn variety that did not have regulatory approval. As a result, several hundred tons were grown and distributed in the U.S., inadvertently exported to other countries, and used in field trials in Spain. Syngenta believes that the unapproved GM corn variety was mistakenly used in breeding.⁸⁹

Similarly, in 2003, University of California-Davis scientists mistakenly sent GM tomato seeds to researchers at twelve institutions in the U.S. and to researchers in 14 countries.⁹⁰ Apparently, the UC-Davis scientists were unaware the seeds contained genes derived from genetic engineering. Seminis Seed, the company from which UC-Davis scientists originally obtained the seeds, was fined for sending the seeds without correct documentation.⁹¹

“They’ve introduced technology that they can’t manage and now I have to pay the bills.”

—David Vetter,
Organic Farmer in Nebraska



THE STARLINK FIASCO LIVES ON

While numerous contamination events have been documented around the world, no event has received more public attention than the 2000 discovery of Aventis' GM StarLink corn in the human food supply—a variety only approved for livestock consumption. In 1999, Iowa farmers planted less than 0.4 percent of their corn to StarLink.⁹² By harvest time, half the harvests registered positive for the GM variety.⁹³

After this discovery, seed companies, farmers, processors, and food makers spent more than \$1 billion trying to eradicate Starlink.⁹⁴ Three years after StarLink was found in the food supply and pulled from the market, contaminated grain still pervaded the nation's corn supply.⁹⁵ In 2003, Aventis agreed to pay \$110 million to settle claims from corn growers who did not grow StarLink but were hurt by the declining market for U.S. corn caused by the contamination.⁹⁶ Neil E. Harl, a professor of economics at Iowa State University, estimated that Aventis paid more than \$500 million to farmers, food processors, and grain handlers.⁹⁷ Experts agree that it will take years to remove StarLink from the human food supply.⁹⁸

GM RICE FIELD TRIALS DEVASTATE U.S. EXPORTS

In 2006, a GM rice variety not approved for commercial sale showed up in the U.S. long-grain rice supply, half of which is exported.⁹⁹ Approved for experimental field trials but not human consumption, LL601 rice (which tolerates glufosinate herbicides, trademark name Liberty) found its way into the commercial rice supply in five Southern states where long-grain rice is grown, and in 29 countries receiving long-grain rice exports from the U.S. Shockingly, this discovery was made five years after the manufacturer stopped growing the variety in experimental plots. (Bayer CropScience of Germany abandoned research on LL601 in 2001.) According to Greg Yielding, executive director of the Arkansas Rice Growers Association, the rice industry lost nearly \$2 billion in 2006 as a result of the contamination.¹⁰⁰ Almost 200 hundred lawsuits have been filed against Bayer CropScience, including a class-action lawsuit involving more than 450 rice producers.¹⁰¹ Total compensatory damages for the plaintiffs may reach or exceed \$1 billion.¹⁰² The losses ruined many farmers' enterprises, and some reported going out of business as a result of the contamination.¹⁰³ Margaret Mellon of the Union of Concerned Scientists' said the situation offers “more evidence...that all of these things that have been getting tested ultimately have a route to the food supply.”¹⁰⁴

TESTS REVEAL WIDESPREAD CONTAMINATION IN ORGANIC FOOD PRODUCTS

The USDA's National Organic Program sets production standards, but not standards for inadvertent contamination of crops and food, so testing for unwanted genetic material is not required to certify crops as organic. However, the inability to keep GM material out of conventional seed varieties is reducing the integrity of organic food products, and makes it unrealistic for consumers to expect a guarantee that all organic foods are free of GM material. Organic farmers depend on access to GM-free conventional seed varieties to meet organic standards and consumer demand. Seed contamination places an unfair burden on organic food producers by hindering their ability to find GM-free seed. Some U.S. organic farmers now import seeds from as far away as China to ensure seed purity.

Because the government has never required testing, many farmers and consumer and environmental groups have investigated the extent of GM contamination in conventional seeds and food products. For example, StarLink was discovered in the food supply after a coalition of non-governmental organizations tested corn taco shells for GM material.¹⁰⁵ Since this finding, several contamination events have been revealed across the country. (See Genetic Contamination Across the United States, pages 44 and 45.)

Nebraska grower David Vetter has tested his seeds regularly since 1997. He discovered GM contamination of his 2000 corn harvest. Because he confirmed the purity of his seeds before planting, Vetter attributes the contamination to cross-pollination with GM corn in neighbors' fields. Vetter tests his seeds because seed dealers won't guarantee their purity—some refuse to test their seeds. Farmers must shoulder the cost of testing if they want to guarantee their crops as GM-free. These tests add about 25 percent to Vetter's corn seed bill. He spent \$1,500 to test a load of corn worth \$4,000.¹⁰⁶

Illinois-based Clarkson Grain Company takes strict identity preservation measures to ensure its crops are non-GM, and uses an optical scanner to sort through organic blue and white corn varieties. Despite these precautions, GM material still contaminates about 6 percent of Clarkson's grain. President Lynn Clarkson describes GM crops as a "leaky technology" and says contamination limits his market, especially abroad, where some countries have zero tolerance for GM material in organic products.¹⁰⁷

GOVERNMENT OVERSIGHT OF FIELD TRIALS

A GM crop undergoes years of field trials in experimental plots before it is commercialized. These plots require oversight by USDA's Animal and Plant Health Inspection Service (APHIS). After field trials are conducted, manufacturers of GM crops may petition APHIS to deregulate their varieties, to allow their commercial release without further regulation by APHIS.

Most field trials are conducted under APHIS' notification system, a streamlined process that replaced a permit process for more than 85 percent of the crops in field trials beginning in 1993.¹⁰⁸ Under the notification system, APHIS simply acknowledges an applicant's notification for conducting field trials (within 30 days of receiving the notification). APHIS does not perform an Environmental Assessment before a field trial begins. One notification can include an unlimited amount of acreage and may cover any number of states. In 2004, about 97 percent of the GM plants in field trials were regulated under notifications, not permits.¹⁰⁹

"Promises were made about containment and segregation, and they weren't kept, and you might say they could never be kept."

— Philip Regal, Biologist,
University of Minnesota

APHIS provides growing recommendations for plants in field trials, including containment measures, but the guidelines are not legally enforceable. The recommendations are also very general in nature and may not appropriately address each new GM plant, including RR alfalfa. APHIS can request additional information from applicants, but it cannot require that the requested information be submitted.¹¹⁰ Even if APHIS' recommendations are followed, they are often inadequate to stop the movement of pollen. For example, Louisiana State



University scientists who conducted LL601 (GM rice) field trials claim they exceeded APHIS' confinement recommendation considerably, and implemented other segregation measures to prevent contamination.¹¹¹ Yet the field trials led to contamination of the entire U.S. long-grain rice crop, potentially costing billions in damages.¹¹²

APHIS' oversight of these field trials has received much criticism. In 2005, the U.S. Public Interest Research Group documented more than 18,000 authorized field releases between 1987 and 2004, and criticized APHIS for rejecting only 3.6 percent of field trial applications. The field trials involved 47,000 test sites spanning more than 480,000 acres.¹¹³

The majority of field trials involve genes considered proprietary, allowing manufacturers to withhold information as "Confidential Business Information." In these cases, the public has no access to information about experiments that may be happening in their own community. And farmers don't have access to the location of field trials, so unapproved GM crops can contaminate their crops without their knowledge.

In 2005, the USDA Office of Inspector General published an Audit Report on APHIS' approval process and monitoring of GM crop field trials. The study concluded that APHIS "lacks basic information about the field test sites it approves and is responsible for monitoring, including where and how the crops are being grown, and what becomes of them at the end of the field test."¹¹⁴ Specifically, the report notes that:

- ❑ The exact locations of all GM field trails planted in the U.S. are not always known.
- ❑ After authorizing field trials, APHIS does not follow up with all permit and notification holders to find out exactly where the fields have been planted or if they have been planted at all.
- ❑ APHIS does not review notification applicants' containment protocols, which describe how applicants plan to contain the GM crop within the field trial and prevent it from persisting in the environment, before acknowledging notifications and allowing field trials to proceed.
- ❑ APHIS does not require permit holders to report on the final disposition of GM pharmaceutical and industrial crops, which are modified for nonfood purposes and may pose a threat to the food supply if unintentionally released. The Inspector General found that two large harvests of GM pharmaceutical crops remained in storage at field test sites for over a year, without APHIS' knowledge or approval.

THE PUBLIC HEALTH RISK OF PHARMACEUTICAL CROPS

The lack of field trial information available to the public is especially alarming in the face of experimental crops unintended for the human food supply, such as pharmaceutical crops—plants engineered to produce pharmaceutical drugs or industrial chemicals. USDA authorized pharmaceutical and industrial crop field trials on more than 1,600 acres in 2007 alone.¹¹⁵ The production of drugs or other industrial chemicals in food crops, such as corn, is a threat to human health should pharmaceutical substances find their way into the food chain. Many of these crops are produced in open-air environments, and could create a catastrophic situation similar to, but more serious than, the StarLink incident. According to experts, there is a "very high probability" that "plants engineered to produce pharmaceuticals, enzymes [and] industrial chemicals" will contaminate the human food supply.¹¹⁶



Evidence for the problem already exists. In 2002, USDA ordered the destruction of 500,000 bushels of soybeans that were mistakenly mixed with corn engineered to produce an experimental pig vaccine. Prodigene, a Texas-based biotechnology company, planted the experimental corn only to plow it under after it failed. Soybeans were later planted in the same field, and some of the corn from the previous harvest grew among the soybeans, contaminating soybeans headed for human consumption. Prodigene paid a \$250,000 fine and agreed to reimburse the USDA for the \$3 million it cost the agency to destroy the contaminated soybeans.¹¹⁷

USDA authorized pharmaceutical and industrial crop field trials on more than 1,600 acres in 2007.

ROUNDUP READY ALFALFA:

GENETIC CONTAMINATION

ACROSS THE UNITED STATES

Oregon

In 2004, pollen from Roundup Ready (RR) creeping bentgrass, a GM turf grass developed by The Scotts Company and Monsanto, traveled 13 miles from field trials in Jefferson County, Oregon. USDA ordered The Scotts Company to pay a \$500,000 fine for failing to prevent RR bentgrass from persisting in the environment in November 2007. GM creeping bentgrass is still undergoing review by USDA, and is the first GM crop to undergo an Environmental Impact Statement (EIS). Critics, including the U.S. Forest Service, worry the grass will spread to areas where it is not wanted or pass its resistance to glyphosate on to weedy relatives.

California

In 2003, University of California-Davis scientists mistakenly sent GM tomato seeds to researchers at twelve institutions in the U.S. and to researchers in 14 countries. Apparently, the UC-Davis scientists were unaware the seeds contained genes derived from genetic engineering. Seminis Seed, the company from which UC-Davis scientists originally obtained the seeds, was fined for sending the seeds without correct documentation.

Idaho, Montana, Wyoming

In December 2006, the Idaho Alfalfa and Seed Clover Association reported that RR alfalfa traits were found in conventional alfalfa seed in Montana, Wyoming, and Idaho, including foundation seed, which contained enough transgenic material to deem it useless as seed stock. The foundation seed was planted two miles from the nearest RR field. At the time of these tests, segregation distances were set at 900 feet.

Colorado

Colorado State University Extension tested feral alfalfa plants at 23 sites in Mesa County, Colorado along roadsides, abandoned fields, and edges of active hay fields within two miles of RR alfalfa seed fields. Transgenic gene flow was found at 83 percent of the collection sites.

Texas

In 1998, Terra Prima recalled and destroyed more than 87,000 bags of organic tortilla chips after European and UK distributors revealed transgenic material in the chips. The contamination event cost Terra Prima \$200,000.

Hawaii

Virus-resistant papaya, the first GM tree to be commercialized, has contaminated conventional and organic papaya trees on three Hawaiian islands: Oahu, the Big Island, and Kauai. Non-GM seeds sold by the University of Hawaii also showed levels of contamination. On the Big Island, nearly 20,000 papaya seeds—80 percent from organic farms, the balance from backyard gardens or wild trees—showed contamination levels of 50 percent.

North Dakota

In 2002, the Northern Plains Sustainable Agriculture Society discovered contamination of a North Dakota State University foundation soybean seed variety. Some of the contaminated seed was distributed to growers of registered certified seed who sell to organic and conventional farmers.

Iowa

In 1999, StarLink corn – a GM variety not approved for human consumption – contaminated 50 percent of the Iowa corn harvest. Seed companies, farmers, processors, and food marketers spent more than \$1 billion trying to eradicate StarLink from the food supply. In 2003, Aventis agreed to pay \$110 million to settle claims from corn growers hurt by the declining market for U.S. corn caused by the contamination.

Nebraska

Nebraska grower David Vetter has tested his seeds regularly since 1997, and discovered Bt contamination of his 2000 corn harvest. Because he confirmed the purity of his seeds before planting, Vetter attributes the contamination to cross-pollination with GM corn in neighbors' fields. Vetter tests his seeds because seed dealers won't guarantee the purity—some refuse to test their seeds.

Louisiana, Arkansas, Missouri, Mississippi, and Texas

In 2006, the U.S. identified an unapproved rice variety in the commercial rice supply, including all five Southern long-grain rice producing states. Bayer CropScience abandoned field trials of LL601 rice in 2001, yet the variety pervasively contaminated the seed and food supply, including exports to nearly 30 countries. The rice industry lost nearly \$2 billion in damages.

Vermont

The Vermont Public Interest Research Group tested corn from 12 farms in Vermont for genetic contamination and discovered transgenic material in one of the samples. According to the report, the low level of contamination indicates that pollen drift is responsible for the presence of the trait, rather than contaminated seed.

Illinois

In 2003, the *New York Times* reported that 365 GM pigs may have entered the food supply. According to the U.S. Food and Drug Administration, the pigs were offspring of GM pigs engineered to produce more milk and a protein that improves digestion in piglets. The University of Illinois at Urbana/Champaign released the pigs to a livestock dealer, instead of destroying them.

Florida

GM pigs were stolen from the University of Florida by a lab technician, turned into sausage, and then served at a funeral. The pigs were engineered to develop a disorder similar to diabetic blindness.

PHILLIP GEERTSON - ADRIAN, OREGON

Phillip Geertson owns and operates Geertson Seed Farms, an Oregon business that produces six varieties of alfalfa seed for both domestic and international markets. His father grew alfalfa seed beginning in 1939 and his brother still farms the land that his family homesteaded. Geertson Seed Farms has sold seed directly to alfalfa forage growers for more than 30 years, and has worked with a plant breeding program for more than 20 years. As part of Geertson's work, he talks to alfalfa forage farmers across the U.S. He has been concerned about the development of Roundup Ready (RR) alfalfa for several years, and fears the genetically modified (GM) variety will make it impossible for conventional farmers to grow a non-GM crop.



“Once [Roundup Ready alfalfa] is in the environment, it's there—it will get in everything,” Geertson explains. “Alfalfa as we know it will be gone forever.”

“Not only is alfalfa a perennial crop that grows for up to eight years or more, alfalfa has a high percentage of hard seed – up to 50 percent of alfalfa seed is hard seed,” Geertson says, explaining that hard seed can remain in the ground without germinating for many years. If RR seed is plowed deep into the ground, the hard seed could remain dormant for years, and, if that hard seed is brought back to the surface through plowing, the RR hard seed could germinate and begin growing again. “It's a survival mechanism for the species.”

“Based on my experience as an alfalfa grower for more than 20 years, I am confident that RR alfalfa will contaminate all non-RR alfalfa in just a few short years.”

Geertson explains that the first cutting of alfalfa has no seed, but that there will always be some seed—though hard to find—with second and third cuttings. He believes there are always plants farmers miss or that are in the hedgerow. If these are RR alfalfa plants (even just one plant), the seeds they produce will spread the GM trait. And the perennial nature of alfalfa makes containing the GM trait even more difficult.

“If the Roundup Ready gene spreads to feral alfalfa along roads, the gene will eventually transfer to conventional alfalfa seed fields. Raising alfalfa seed in the U.S. that is free of contamination will be nearly impossible,” Geertson says, adding, “It will make it so it's the only alfalfa plant grown.”

He fears that planting RR alfalfa in the U.S. will destroy the foreign seed market for American seed growers. “Most foreign buyers of alfalfa seed will not accept alfalfa contaminated with the RR gene,” Geertson explains.

In fact, Geertson decided not to sell alfalfa seed to his New Zealand customers this year, due to contamination concerns. “I don't feel comfortable sending alfalfa seed from the U.S. to a country that has zero tolerance for GM seed,” he says.

“I'm not against the technology, but you have to use it carefully – it has to be contained,” Geertson explains. “They're putting something out there that you can't recall, and that's grievous in my opinion.”



IS CONVENTIONAL & ORGANIC ALFALFA AT RISK?

Alfalfa is an essential component in the organic livestock industry. Milk cows accounted for more than half of the total number of certified organic animals in 2001. The total number of certified organic livestock, including beef cattle, pigs, sheep and lambs, increased by 572 percent between 1997 and 2003.¹¹⁸ And the demand for alfalfa-derived organic products is growing. California currently imports organic feed from China and South America to meet its rapidly growing demand for organic livestock and poultry markets, and is looking to North Dakota to increase production of organic corn, soybeans, barley, peas, and alfalfa.¹¹⁹ In 2005, the U.S. experienced a shortage of organic milk, one of the fastest growing segments of the organic market.¹²⁰ While the shortage is attributed primarily to a lack of certified organic cows, this demand is implicitly coupled with a need for more organic alfalfa hay.¹²¹ According to Lynn Clarkson, board member of the Organic Trade Association, the demand for organic feed is growing 20 percent each year, while U.S. production of organic crops, including corn and other feed, is only growing by about 4 percent.¹²²

Alfalfa seed producers rely on pollinators, especially leafcutter and honey bees, to pollinate their alfalfa plants. Cross-pollination occurs when bees collect pollen for food and transfer pollen from the flowers of one alfalfa plant to the flowers of another, a process necessary for setting seed in alfalfa. When bees transfer pollen from one crop to the next, genetic material is sometimes transported as well. Both commercial and wild pollinators contribute to gene flow in agricultural fields, and bumble bees, a common wild pollinator, are reported to travel five miles or more.

If Roundup Ready (RR) alfalfa makes its way into the organic alfalfa market, organic alfalfa producers risk serious consequences: costly eradication efforts and potential loss of markets; loss of consumer confidence and higher prices for consumers; and loss of genetic resources used in organic and conventional alfalfa seed breeding.

Because the National Organic Program (NOP) does not allow the use of genetically modified (GM) seed and feed in certified organic farming systems, cross-pollination of RR alfalfa with

conventional and organic crops could increase production costs and reduce profits for non-GM farmers. Organic alfalfa markets afford producers a 10 to 50 percent premium for their hay compared to conventional producers.¹²³ USDA does not require farmers who plant RR seeds to create buffer areas to avoid cross-pollination with neighbors' crops. So, the burden of keeping transgenic material out of certified organic and conventional fields is entirely on producers of non-GM crops, not on neighbors who plant GM crops, or on the patent owners of GM traits (in this case, Monsanto).



Crop-to-Wild Gene Flow

Alfalfa persists in the environment outside human cultivation, often times as a weed, unlike other crops that only survive through human care, such as corn. Pollinators can transfer the RR trait to these feral alfalfa plants established on the edges of fields, along roads, and in ditches. County crews that use glyphosate to control feral alfalfa in these areas will find the herbicide ineffective if RR alfalfa outcrosses with feral alfalfa.¹²⁴ Feral alfalfa plants that acquire the RR trait also become vehicles for gene flow by spreading pollen into nearby conventional or organic fields.

Volunteer alfalfa may present serious problems in managing unwanted alfalfa plants, including limiting yields of crops succeeding an alfalfa stand.¹²⁵ All alfalfa has a certain percentage of “hard seed” content. “Hard seeds” are viable but have an impervious seed coat that keeps water from entering the seed to start germination.¹²⁶ Hard seeds may germinate late in the season or even years later, leading to unwanted volunteer alfalfa plants. These volunteer alfalfa populations are potential sources for the reintroduction of transgenic traits, complicating control measures for pollen flow to surrounding alfalfa fields and feral alfalfa.¹²⁷ Hard seed makes up a significant portion of the total seed produced in an alfalfa field. In fact, some RR alfalfa field trials averaged 43 to 71 percent hard seed content.¹²⁸ According to Oregon State University scientist Clinton Shock, it is “simply unfeasible to use a field that has had RR alfalfa grown as a seed crop in the recent past to grow completely uncontaminated conventional alfalfa.”¹²⁹

Crop-to-Crop Gene Flow

Because alfalfa is insect-pollinated, markets for alfalfa seed and hay that shun or reject outright GM material in seeds and feed risk contamination by RR alfalfa. Considering alfalfa's importance to the organic livestock industry, contamination between RR and organic and conventional alfalfa cannot be overlooked.

Canada's experience with transgenic canola (another insect-pollinated crop) shows how extensive cross-pollination between crops can be. After planting three different varieties of herbicide-tolerant canola, Canadian growers now find that canola plants volunteering in subsequent seasons are resistant to three herbicides (including glyphosate), owned by different companies, and associated with three different GM varieties of canola.¹³⁰ This rampant spread of transgenic canola traits makes controlling volunteer canola extremely difficult. It has also negatively impacted markets that reject genetic engineering, as nearly 75 percent of Canadian canola is exported each year.¹³¹ For example, the European Union (EU) export market for Canadian canola was \$425 million in 1994, but is now "virtually zero" because of the EU's opposition to GM products (Canada began growing GM canola in 1995), according to a report by the Standing Committee on Agriculture and Forestry in Canada.¹³² Many farmers argue that GM canola has destroyed the organic canola market in Canada.¹³³

Scientists recorded cross-pollination between RR alfalfa and conventional alfalfa in field trials years before the new forage hit the market. Researchers at Kansas State University studied alfalfa pollen drift and found that complete containment of transgenic traits within alfalfa seed or hay production fields would be unlikely using current production practices.¹³⁴ Field trials conducted by Forage Genetics found that honey bees transferred the RR trait more than 2.5 miles.¹³⁵ And a Washington State University agronomist said it would be difficult to certify that a non-GM plant would not be contaminated if grown in an area where GM alfalfa cultivars are produced.¹³⁶

Cross-pollination concerns are compounded by the absence of RR alfalfa planting restrictions and containment measures. Monsanto's Technology Use Guide (TUG) outlines factors that contribute to cross-pollination, but does not require growers to implement containment strategies to limit the transfer of the RR trait to conventional and organic alfalfa. The TUG simply recommends that RR alfalfa hay be harvested "at or before 10 percent bloom to minimize potential pollen flow from hay to common alfalfa seed production."¹³⁷ While hay producers typically harvest before alfalfa blooms or at a very small percentage bloom, they cannot control weather or other factors affecting their harvest schedule. Even if a farmer signs a contract acknowledging recommended growing practices, there is no legal requirement for farmers to harvest hay at a certain time, or to ensure that their fields are isolated from alfalfa fields grown for seed production. Furthermore, opponents of RR alfalfa insist that most alfalfa hay is cut after flowers have already produced viable pollen.¹³⁸ So, while cross-pollination

between hay fields is less of a risk than between alfalfa seed production fields, it is still a serious concern for alfalfa producers who want to avoid RR alfalfa.

Isolation distances in alfalfa seed production have already proved inadequate. According to one expert, the "most likely contamination could be in purchased seed because of seed production practices that may not allow adequate isolation distances."¹³⁹ A University of California extension agent agrees, and notes that even if growing "standards are revised to modify isolation and control pollination, movement of pollen beyond the borders of an individual field cannot be prevented entirely."¹⁴⁰

In fact, RR alfalfa contaminated conventional alfalfa the first year the GM variety was commercially available. In December 2006, the Idaho Alfalfa and Seed Clover Association (IASCA) reported that the RR alfalfa trait was found in conventional alfalfa seed in Montana, Wyoming, and Idaho, including foundation seed, which contained enough transgenic material to deem it useless as seed stock. The foundation seed was planted two miles from the nearest RR field. At the time of these tests, segregation distances were set at 900 feet – a distance Idaho specifically mandated for RR alfalfa plantings. Of eleven sites, ten showed contamination ranging from 0.2 percent to 0.4 percent at distances of 900 feet to 1.5 miles.

The same year, Colorado State University (CSU) Extension tested feral alfalfa plants at 23 sites in Mesa County, Colorado, along roadsides, abandoned fields, and edges of active hay fields within two miles of RR alfalfa seed fields. Transgenic gene flow was found at 83 percent of the collection sites.¹⁴¹

The commercial release of RR alfalfa has shown that isolation distances do not prevent contamination. Both the IASCA and CSU data demonstrate a poor correspondence between distances and contamination levels.¹⁴² That is, contamination levels did not always decline with distance. Dr. Allison Snow, an expert on gene flow, concluded that even with very clear stewardship guidelines and voluntary precautions, it's likely that the RR alfalfa trait would infiltrate non-RR seed sources over time.¹⁴³ As the data above indicates, this "infiltration" took less than one year.

Monsanto notified APHIS of more than 300 RR alfalfa field trials between 1998 and 2005. (According to the Information Systems for Biotechnology database, only seven of these notifications were either withdrawn or denied.) The average acreage of these field trials was 435 acres.¹⁴⁴ It is difficult to determine the total acreage and locations of these field trials, because Monsanto lists the total proposed acreage for several states combined under a single notification. Alfalfa is currently among the top ten crops in field trials, planted in at least 35 states. Pollen drift may have occurred (and may still occur) during RR alfalfa field trials, and

certainly could have entered organic and conventional alfalfa fields during this time, depending on where the field trials were conducted. For example, Idaho boasts the most acreage for certified organic alfalfa hay, as well as the second most RR alfalfa field trials (more than 40, which potentially cover thousands of acres). Because farmers are not notified of experimental field trials in their communities, RR alfalfa likely entered organic or other conventional alfalfa fields unbeknownst to affected farmers. In 2007, Forage Genetics notified APHIS of 25 new RR alfalfa field trials, five of which are pending.¹⁴⁵

“There is no possible way that the Japanese customer will accept it...We stand the chance of losing all of our export market.”

—Chep Gauntt, President, Washington State Hay Growers Association

Sprout Industry

Alfalfa sprouts are a popular item in health food stores because of their many nutritional benefits.¹⁴⁶ Monsanto’s 2007 Technology Use Guide says that RR alfalfa seed cannot be planted for the production of sprouts. However, RR alfalfa seed could affect the sprouting industry without being marketed directly to sprout growers, because introducing RR alfalfa into the environment and marketplace could eventually limit GM-free seed sources. Sprout producers who wish to stay GM-free will find it extremely difficult, if not impossible, to locate pure seed sources should RR alfalfa be widely adopted. This is especially alarming for producers who market or are considering marketing their sprouts as organic or GM-free. Many large food retail chains, including Trader Joe’s, Wild Oats, and Whole Foods, are committed to keeping GM ingredients off their shelves. As these markets continue to grow, sprout growers should be aware of the difficulty and added costs of providing GM-free sprouts (such as testing for transgenic material in their products). According to one expert, “it is questionable if the health or sprout market knows that an alfalfa GMO will be on the market and that they might have to test for its presence.”¹⁴⁷

Export Industry

Both organic farmers and conventional farmers who export to sensitive markets rely on seeds and harvests that are free of transgenic material. Farmers who export to countries that shun GM crops and food are just as concerned as organic farmers about their ability to provide a GM-free product. Growing RR alfalfa in areas where alfalfa is largely produced for export is very controversial, because both alfalfa farmers and export businesses know that alfalfa’s ability to cross-pollinate does not bode well for an industry that depends on foreign customers wary of GM products.

Nearly all alfalfa exported from the U.S. is grown in the western U.S. Most U.S. alfalfa is used domestically as animal feed, while 5 percent is exported, mostly to Japan, which accounts for 75 percent of the alfalfa export market (around \$500 million a year).¹⁴⁸ Other alfalfa export countries include South Korea, Taiwan, Mexico, and Canada.¹⁴⁹ Even though Monsanto and Forage Genetics have received import approval for RR alfalfa from these governments, many U.S. export companies and producers insist their customers do not want GM forage.¹⁵⁰ As one expert put it, “the issues are more of a concern with the customer than with government approval. Most of the alfalfa hay customers have indicated a low tolerance for GMOs in hay products.”¹⁵¹ Several alfalfa export companies submitted public comments to APHIS in opposition to RR alfalfa for this reason.¹⁵²



Mark Anderson of Anderson Hay and Grain Inc., one of the largest hay exporting companies in the U.S., told reporters that he did not want RR alfalfa because of the politics and problems that go with it.¹⁵³ “Some of our Japanese hay customers are asking us to sign documents saying no genetically modified products will be coming over,” said Jeff Plourd of El Toro Export in El Centro, California.¹⁵⁴ Many other alfalfa processors and exporters have indicated that their Japanese customers do not want GM material in their forage products.¹⁵⁵ So, regardless of any tolerance level set by foreign governments (Japan has a 5 percent tolerance for GM material in non-GM products), foreign customers continue to demand zero tolerance for RR alfalfa.

Each year, the U.S. exports alfalfa seed worth \$40 million to more than 30 countries across the globe. Most of these countries have also indicated a zero tolerance for GM material or have no current regulatory framework in place.

When RR alfalfa was first approved for commercial sale and planting, some of the most important export countries had not yet approved the GM forage for import. Monsanto implemented a “Limited Domestic Launch,” an additional contract that RR alfalfa growers had to sign (in addition to the Technology Agreement). The contract said that RR alfalfa could be grown for domestic use only, pending international regulatory approval. In February 2006, Monsanto and Forage Genetics removed the domestic use requirements after receiving final import approval from some important export markets.¹⁵⁶

Even with government approvals, however, customers abroad continued to reject GM alfalfa imports. The Washington State Hay Growers Association took a strong stance against the immediate release of RR alfalfa and asked that Monsanto and Forage Genetics hold off on selling the GM variety in Washington until its customers overseas accepted the technology.¹⁵⁷ But Monsanto and Forage Genetics insisted on moving forward with sales in some parts of the state, causing tension between the two companies and hay growers, and increasing fears among hay exporters that their markets in the Pacific Rim would be lost.¹⁵⁸ Hay is the largest export commodity by volume in the Pacific Northwest, and Columbia Basin growers export about \$140 million in alfalfa to Japan each year.¹⁵⁹ Growers fear that Japanese customers will stop purchasing all U.S. alfalfa out of contamination fears. Similar cases of market rejection, including the beef embargos imposed by Japan in 2003 and 2006 in response to bovine spongiform encephalopathy (BSE), or mad cow disease, and Japan's response to the prospect of GM wheat, which ultimately forced Monsanto to drop its efforts to develop and market RR wheat, lend support to hay growers' concerns.¹⁶⁰ Losing the alfalfa export market could cost Washington State thousands of jobs.

Non-GM Shortages

Certified organic producers and hay exporters may not be the only farmers and ranchers avoiding RR alfalfa. Some "natural" beef producers who prefer non-GM feed are currently unable to purchase grain with any guarantee that it does not contain transgenic traits.¹⁶¹ If RR alfalfa is widely adopted and follows the precedent of RR soybeans, corn, and canola, non-GM feed supplies will be limited or impossible to find.¹⁶² In the event of organic alfalfa hay shortages, consumers can expect prices of organic dairy and meat products to increase.

FIVE THINGS



Eckenberg Farms, the largest exporter of alfalfa in the U.S.
Photo Courtesy Eckenberg Farms

ECKENBERG FARMS - MATTAWA, WASHINGTON

Eckenberg Farms is the largest exporter of alfalfa hay in the nation, employing nearly 100 people and purchasing hay from hundreds of farmers in the Pacific Northwest. The company buys more than 150,000 tons of hay annually and exports more than 5,500 40-ft containers – \$25 million in business – each year. On a volume basis, hay from farms in Eastern Washington is the largest export from the state, totaling more than 50,000 40-ft containers per year.

Japan accounts for 70 percent of Eckenberg Farms' export volume, and South Korea and Taiwan consume the balance.

Exports make up about 40 percent of the income from hay produced in Washington, valued at nearly \$150 million. Thousands of agricultural workers, truck drivers, and laborers at the ports of Seattle and Tacoma directly depend on these exports for jobs.

According to Brent Evans, international sales manager for Eckenberg Farms, genetically modified (GM) alfalfa raises serious concerns in the alfalfa export industry. "While the Japanese government has approved the sale of Roundup Ready alfalfa," Evans says, "Japan's marketplace, including importers, agricultural cooperatives, and dairymen, does not want to buy Roundup Ready alfalfa."



Eckenberg Farms exports alfalfa in the form of hay cubes used in the compound feed industry in Japan and as double-compressed bales in a variety of sizes. Production of hay cubes requires large, complex production, bagging and storage facilities. Making double-compressed bales requires large compressing machines that resize and compress hay to achieve maximum density in ocean-going containers. Photo Courtesy Eckenberg Farms

“The companies to which we export alfalfa have all indicated that they will not import Roundup Ready alfalfa from Eckenberg Farms or other American exporters. These companies collectively easily constitute the vast majority of the alfalfa and other hays imported into Japan,” Evans explains. “Some of these companies have even required us to provide guarantees and certificates that we will not buy or ship Roundup Ready alfalfa,” he adds, emphasizing that his industry should not have to bear the costs of testing for contamination.

Eckenberg Farms risks losing its largest market even if its farmers don’t plant GM alfalfa. Contaminated alfalfa alone may send Japan looking to other countries for hay, such as Canada or Australia. “The issues with propagation are very real,” Evans makes clear. “There is a need for an [Environmental Impact Statement] to assess containment of Roundup Ready alfalfa, as pollinators can transfer the GM gene into feral alfalfa and other populations where it is not wanted.”

Evans fears a reaction to Roundup Ready alfalfa similar to Japan’s beef embargo following the discovery of bovine spongiform encephalopathy (BSE), or mad cow disease, in the U.S. In his words, “Our industry fears a severe reaction to the introduction of Roundup Ready alfalfa that could cripple or, in the worst case, entirely stop exports of all Washington State alfalfa to Japan.”

“The consequences of such a reaction will fall primarily on the shoulders of the Washington State hay industry and on the state’s economy, not Monsanto.”

Evans, who worked in Japan for six years, understands the power of Japanese customers in the marketplace. He believes Monsanto’s statements that Japanese customers will accept its GM alfalfa variety are unfounded.

“We asked Monsanto to delay the sale of Roundup Ready alfalfa in Washington State until our Asian markets accepted it. We even asked Monsanto to accompany us to Japan to help address our customers’ concerns,” Evans explains. “But Monsanto ignored the concerns of the Washington State hay industry and seems unwilling to listen to us.”

Evans says that his company welcomes further research on the science and environmental safety of Roundup Ready alfalfa, if for no other reason than to give its Japanese customers time to study and perhaps accept its introduction into Japan. “As things now stand, however,” Evans begins, “Roundup Ready alfalfa constitutes a real threat to our business and to thousands of jobs in Washington State.”

A FARMER CAN DO ABOUT THE RISKS OF ROUNDUP READY ALFALFA

1. Call USDA’s toll-free number, 866-724-6408, to find out where Roundup Ready alfalfa is being grown in your area.
2. Talk to your neighbors, seed and hay customers, and your seed dealer or suppliers about the risks of adopting Roundup Ready alfalfa. Tell them about USDA’s toll-free number for locating Roundup Ready alfalfa fields in their county. Ask your seed dealer to guarantee the seed you buy is GM-free.
3. Write a letter to your state Agriculture Commissioner, and ask the state to protect alfalfa growers from genetic contamination that might result from Roundup Ready alfalfa field trials.
4. Ask your local and state representatives to support policies that protect farmers from genetic contamination.
5. Write letters to the editor of your local papers and farm and ranch publications about the risks of Roundup Ready alfalfa.

FIVE THINGS

A CONSUMER CAN DO ABOUT THE RISKS OF ROUNDUP READY ALFALFA

1. Tell your co-op or supermarket you don't want products derived from GM alfalfa. Support markets that pledge to avoid GM ingredients.
2. Write letters or talk to dairy, beef, and honey producers and food processors, and tell them you do not want products derived from GM alfalfa.
3. Write letters to your local and state representatives. Ask them to support policies that protect farmers from genetic contamination and protect your right to choose GM-free food.
4. Write letters to the editor of your local papers and consumer publications about the risks of Roundup Ready alfalfa.
5. A court-ordered Environmental Impact Statement (EIS) for RR alfalfa will begin soon, and there will be opportunities for public comment. Sign up to receive updates at www.worc.org.

KATHY COX, BLOOMFIELD BEES HONEY - SEBASTOPOL, CALIFORNIA



Kathy Cox has owned Bloomfield Bees Honey for five years. In addition to raising bees for honey, Cox breeds and sells queen bees for both pollination and backyard hives. Cox also sells honey at three area farmers' markets and her farm stand.

"We keep the bees in twenty different locations," Cox explains. "Because they forage up to five square miles away from their hives, I am concerned that my bees may forage on or in the vicinity of GM alfalfa. If my bees forage on Roundup Ready alfalfa, pollen or nectar containing GM material could contaminate my honey and weaken or kill my bees."

In addition to cross-pollination concerns, Cox is afraid that GM alfalfa will cause more glyphosate herbicides to enter the environment, increasing exposure to her and her bees.

"We produce honey in a manner that I call 'Beyond Organic,'" Cox says. "As part of this method, we do not use any chemicals in the bee hives. The use of Roundup Ready alfalfa in the area could contaminate my bees and hives, especially if glyphosate gets into the water that my bees drink. My customers demand natural raw honey and they do not want any chemicals, so I will lose business with the spread of GM alfalfa."

Cox is a past president and vice president of the Sonoma County Beekeepers' Association and a member of the California State Beekeeping Association. She actively opposes GM crop cultivation in Sonoma County, as she believes there are environmental and health concerns that remain unaddressed by the U.S. government. "I cannot believe that the USDA and EPA are allowing GM alfalfa to be released into the environment without restrictions," she says.

Cox also notes the absence of labeling for GM food ingredients. "I cannot tell if the foods I eat are derived from GM alfalfa," she explains. "I could buy milk or meat from animals fed GM alfalfa and I have no way to tell."

WHAT IF MY NEIGHBOR PLANTED ROUNDUP READY ALFALFA?

If you are a conventional or organic alfalfa producer who discovers that Roundup Ready (RR) alfalfa is growing in your area, there are steps you can take to minimize risks to your non-GM alfalfa.



- Talk to the farmer or rancher growing RR alfalfa. Communicate how important it is for your alfalfa to remain GM-free. Ask these growers if they planted buffer areas or took other measures to prevent cross-pollination with neighboring fields.
- If you share equipment for harvesting, seed conditioning, or trucking, or share storage units, be sure the equipment and space was not used for RR alfalfa.
- If you are an alfalfa seed producer, consider testing your harvest to ensure genetic purity.
- Alfalfa seed and hay growers should consider testing their alfalfa seed before planting to verify seed purity.

Testing Alfalfa

- Conventional alfalfa may be contaminated by RR alfalfa at low levels. Always save a sample of your seed and hay for your records. If you purchase seed, save the tag, which lists the manufacturer, germination rate, weed seed content, and other information about the variety.
- If you use glyphosate in your operation, test your alfalfa seed by planting a small plot (a quarter- or half-acre) and spraying it with glyphosate. If one or two plants survive, it is likely they contain at least a small percentage of the RR trait. You can use one of the tests below to confirm.
- Forage Genetics and Monsanto selected two companies to develop test kits for determining the presence of RR alfalfa in haystacks, hay fields, and seed. The tests can identify the RR gene in conventional alfalfa at a level of 5 percent or more. For ordering information and instructions, visit these two links:

EnviroLogix – <http://www.envirologix.com/library/AS045AHE.pdf>

Strategic Diagnostics Inc. – <http://www.sdix.com/ProductSpecs.asp?nProductID=19>

- Keep careful records of your sampling, testing, and any measures you take to protect your alfalfa from cross-pollinating with neighboring plants. Should contamination occur, your documents will help pinpoint the cause or point of contamination, and help protect you from liability risks.
- Make sure your customers are aware of your efforts to maintain GM-free products. Talk to them about the issues involved in adopting RR alfalfa.
- Know your customers and understand any contracts you sign. Be careful when signing documents that classify your product as “GM-free,” especially if the product has not been tested.
- Be vocal in RR alfalfa discussions. Talk to your neighbors and other community members about the economic and environmental risks of GM alfalfa.
- Watch for glyphosate-resistant weeds that migrate from neighboring fields. Ask your neighbors if they’ve identified weed resistance in their fields.
- A court-ordered Environmental Impact Statement (EIS) for RR alfalfa will begin soon, and there will be opportunities for public comment. Sign up to receive updates at www.worc.org.

UNDERSTANDING MONSANTO'S TECHNOLOGY USE GUIDE

Liability for the spread of Monsanto's genetically modified (GM) seeds is a serious threat to all farmers, whether they grow GM seeds or not. Patents afford Monsanto ownership of its GM seeds even after a farmer purchases and plants the seeds. To protect its patent rights, Monsanto enforces a "limited use license" called a Technology Agreement. This contract subjects farmers to invasions of their private property and personal records, and shields Monsanto from liability associated with contamination events and market rejection involving GM crops.

Because Roundup Ready (RR) alfalfa is a perennial crop, farmers face even greater challenges in containing the GM trait. Below is a list of obligations and legal limitations farmers accept when signing Monsanto's Technology Agreement.²

- ❑ Farmers accept all the terms of the Technology Agreement by signing it or simply opening a bag of Monsanto's seed. Farmers have no opportunity or rights to negotiate the terms of the contract.
- ❑ Farmers who sign the Technology Agreement waive all of their rights under the Federal Privacy Act.
- ❑ Farmers may be required to settle all legal disputes concerning Monsanto in St. Louis, Missouri (Monsanto's headquarters), regardless of where they live.
- ❑ Farmers cannot save any seed grown from Monsanto's seeds or provide any seed to others.

² Thanks to Farmers' Legal Action Group and Rural Advancement Foundation International for this overview of Monsanto's Technology Agreement, which is drawn from their Farmers' Guide to GMOs, available at www.rafiusa.org/pubs/Farmers_Guide_to_GMOs.pdf

- ❑ Farmers must allow Monsanto full access to their records, including USDA, Farm Service Agency (FSA), and Risk Management Agency (RMA) records, and invoices for all seed and chemical purchases, and allow Monsanto to copy any relevant receipts and documents.
- ❑ There is no time limit to this contract—Monsanto can review a farmer's documents, fields, and crops even after the farmer has stopped growing Monsanto's seeds.
- ❑ Monsanto will not honor any warranties if the farmer does not use the company's chemicals with its GM seeds.
- ❑ All Monsanto cotton seed disputes are resolved through binding arbitration.
- ❑ If farmers are caught violating the contract, Monsanto will seek to collect damages and attorneys' fees and costs from farmers.
- ❑ Farmers accept all liability and responsibility for keeping GM crops out of markets, elevators, or other farmers' fields that do not want or allow GM crops.



MONSANTO'S TECHNOLOGY USE GUIDE & ROUNDUP READY ALFALFA

In addition to the Technology Agreement, farmers are responsible for understanding and following the Agreement's supplementary publication, the Technology Use Guide (TUG), more than 50 pages of guidelines for growing Monsanto's GM crops. Because Roundup Ready (RR) alfalfa was approved in the U.S. for planting before it was approved for export, growers who purchased RR alfalfa seed had to sign a Seed and Feed Use Agreement—a "domestic use contract"—in addition to the Technology Agreement. Following export approval, growers were still bound to the Technology Agreement, and for some California growers, an additional Imperial Valley Use Agreement. Even though planting RR alfalfa is currently illegal, alfalfa producers should still be aware of the following rules and procedures included in the TUG. A copy of the Technology Agreement and TUG can be downloaded from the online version of this Guide at www.worc.org or from Monsanto's website, www.monsanto.com.

Seed and Feed Use Agreement

Monsanto called the initial release of RR alfalfa a "Limited Domestic Launch." Producers were expected to sign this domestic use contract to ensure RR alfalfa was not exported.

Imperial Valley Use Agreement

Alfalfa growers in the Imperial Valley of California, an area that exports a significant amount of alfalfa, had to sign an Imperial Valley Use Agreement with special stewardship commitments.

Stand Takeout, Volunteers, and Weed Resistance

The TUG outlines the management of RR alfalfa volunteers and stand takeout. Farmers must consult their "regional technical guides" to learn proper stand takeout methods. The TUG does not recommend specific herbicides for stand takeout. It only refers to "appropriate commercially available herbicide treatments." Monsanto's TUG acknowledges that glyphosate-resistant weeds exist, and provides a few websites for dealing with this potentially expensive problem.

Pollen Flow

Monsanto acknowledges that RR alfalfa cross-pollinates with other alfalfa crops. The TUG outlines factors that contribute to cross-pollination but does not require preventative measures for mitigating the transfer of the GM trait, except to suggest that RR alfalfa growers should harvest their hay fields at or before 10 percent bloom. Cross-pollination of GM crops with organic and other non-GM crops, and the presence of volunteer GM seeds (seeds that germinate late, are inadvertently planted, or are dropped by the plant), could increase production costs, reduce profits, or even eliminate markets for non-GM farmers and ranchers.

Roundup Rewards

As with all of Monsanto's GM seed, in order to benefit from the company's "Roundup Rewards" program, a farmer must use a Roundup product. This means RR alfalfa producers who experience poor stand performance or other problems with RR alfalfa seed are not eligible for warranties or other compensation if they used generic glyphosate instead of Monsanto's trademark brand.

Yield

RR Alfalfa is different from RR soybeans in that not every plant will have the gene for tolerating glyphosate. Some field trials experienced stand losses of 12 to 25 percent after being sprayed with glyphosate. The TUG acknowledges this potential loss, but provides no remedy. It reads:

Due to the genetic diversity of alfalfa, up to 10% of the seedlings are susceptible and will not survive the first application of Roundup WeatherMAX or Roundup UltraMAX II. The initial application is necessary to eliminate the effects of stand gap created by loss of non-Roundup Ready plants and to ensure adequate spray coverage of emerging weeds before crop canopy interference.

Seed & Sprout Production

The TUG prohibits growers from harvesting RR alfalfa seed without an additional Monsanto contract. It also prohibits growers from using RR alfalfa seeds for sprout production.

WHAT'S NEXT IN THE PIPELINE?

Nearly all GM crops currently on the market fall under the “first generation” category of plants, which provide farmer-oriented traits, such as herbicide-tolerance, virus-resistance, and insect-resistance. The vast majority of these varieties involve corn, soybean, canola, and cotton plants. Few GM fruits and vegetables have been approved for commercial sale, and many that have regulatory approval are no longer on the market.

The majority of new GM crops continue to enter the food system in a processed form (soybean oil accounts for 80 percent of oils used in food, and almost 90 percent of soybeans are GM). The biotechnology industry has abandoned several research and development projects involving herbicide-tolerant traits in popular foods eaten directly by people (wheat, lettuce, and strawberries), evidence that consumer opposition to GM foods is influencing the direction of research and development. According to a 2004 *New York Times* article, “lettuce growers in California balked at the introduction of Roundup Ready lettuce.”¹⁶³

Instead, companies continue to pour money into different varieties of existing first generation traits. For example, Monsanto has provided “stacked” varieties of crops for years. These are GM crops that include two or more engineered traits, usually one for herbicide-tolerance and one for insect-resistance – for years. Monsanto has convinced the Federal Crop Insurance Corporation to provide up to a 20 percent discount on crop insurance for farmers using the company’s triple stack corn hybrids in Iowa, Illinois, Indiana, and Minnesota. The program, which debuts in 2008, essentially subsidizes Monsanto by requiring corn growers who take advantage of the insurance program to plant 75 to 80 percent of their corn acreage to the company’s stacked varieties.¹⁶⁴

Most recently, the company announced a partnership with Dow AgroSciences to introduce an unprecedented number of stacked genes in a single variety of corn called “SmartStax,” a combination of eight herbicide-tolerance and insect-resistance traits, due out by the end of the decade.¹⁶⁵

The biotechnology industry’s burgeoning interest in consumer-oriented, or “second generation,” traits points toward an effort to win public approval through products that would benefit human health. The first of these products to enter the marketplace, low linolenic soybeans, are already grown on a large scale in the U.S., and are intended to reduce or eliminate trans fatty acid in a variety of food products. Though the low linolenic trait was not developed through genetic engineering, manufacturers tacked on the RR trait to these new, allegedly more nutritious varieties.

Still, as of December 2007, ten of the twelve petitions now pending approval by USDA for new GM crop varieties involve “first generation” traits – plant varieties engineered to tolerate herbicides or resist insects and viruses, just like existing GM crops on the market. However, two petitions involve plants for which there are no engineered varieties already on the market: creeping bentgrass (glyphosate-tolerant) and carnations (altered flower color). There is only one “second generation” crop pending approval. Pioneer Hi-Bred International, Inc. has petitioned for its own variety of soybean to reduce or eliminate trans fats in foods, a soybean with “high oleic oil” content.¹⁶⁶ Unlike low linolenic soybeans, the high oleic content in Pioneer’s soybean is a genetically modified trait.



ROUNDUP READY SUGAR BEETS TO DEBUT IN 2008

The USDA first approved Monsanto's Roundup Ready (RR) sugar beets in 1999, but due to concern about consumer rejection, including from candy-makers Hershey and Mars, and reportedly poor field trial performance, RR sugar beets came to a standstill. Now, it appears the sugar industry and at least some food companies are willing to take a chance on GM sugar. In 2005, USDA approved a new RR sugar beet variety that farmers are poised to plant in 2008. Food companies report no consumer resistance, though not many have taken a public position on the issue.

The U.S. depends on sugar beets for half of its sugar supply, with the rest coming from cane sugar. Only 3 percent of U.S. sugar is exported. While the European Union (EU) has approved RR sugar for import (but not planting), some U.S. food companies may decide to use cane sugar in export products to avoid consumer rejection, which is common in countries where GM ingredients are labeled.

Opponents have similar concerns about RR sugar beets as they do other RR crops, including weed resistance and the contamination of conventional seed sources. They believe the new herbicide-tolerant variety will only encourage the problem of glyphosate-resistant weeds, turning a short-term solution into a long-term problem.

Sugar beets produce seed in their second year, so for most sugar beet growers (who harvest their sugar beets each fall), cross-pollination and contamination issues may not be a concern. Still, California has weeds capable of crossing with sugar beets, and the warmer climate means sugar beets stay in the ground through winter, providing an opportunity for seeds to develop and transfer transgenic material to wild and domestic relatives.

"We have to make sure we don't cause ourselves more problems than we're curing," said Ben Goodwin, executive manager of the California Beet Growers Association.

Sugar beets are grown on more than 1.2 million acres in the U.S., largely in Minnesota, North Dakota, Idaho, and Michigan. Most sugar beet seed is produced in Oregon. If RR sugar beets are widely planted in 2008, they will be the newest GM food crop to be adopted on a scale similar to GM soybeans and corn in the late 1990s.¹⁶⁷

GEORGE SIEMON, ORGANIC VALLEY - LAFARGE, WISCONSIN

George Siemon is CEO for the Cooperative Regions of Organic Producer Pools (CROPP Cooperative), an agricultural cooperative located in LaFarge, Wisconsin. CROPP Cooperative is comprised of 1,170 organic family farms located in 32 states and one Canadian province. All members are USDA certified organic farmers, and as such are required to operate their farms in accordance with the Organic Food Production Act of 1990 and the USDA's National Organic Standards. Of the member farms, 919 are organic dairy farms and 177 are organic beef, pork and/or poultry producers.

CROPP Cooperative markets the products of its members throughout the United States and internationally under the brand name "Organic Valley." Siemon says that consumers look to the Organic Valley label as a signature brand that represents the integrity of the USDA organic seal. "This integrity is paramount to the continued success of the organic industry and CROPP Cooperative," he explains.

Organic Valley is the number one selling organic brand in the Natural Food Retail Channel. In 2006, CROPP Cooperative had a total of \$333 million in sales, which represented a 38 percent growth over 2005 sales. Of this total, \$287 million involved sales of organic dairy products, and \$7.8 million involved sales of organic meat products. CROPP Cooperative is projecting a 35 percent growth in 2007, with total sales expected to reach \$450 million.

"Our dairy farmers receive a premium for their organic milk, above conventional prices," Siemon explains. In 2006, the average price received by CROPP Cooperative farmers for a



hundred pounds of milk (cwt) was \$24.87, compared to a conventional average price of \$13.04 (a difference of \$11.83). These farmers collectively received \$68 million in organic premiums in 2006.

CROPP Cooperative's dairy membership represents approximately 35 percent of the total national organic milk supply, and its total membership represents approximately 10 percent of all organic operations in the United States.

The Economic Impact of the Loss of Organic Alfalfa

CROPP Cooperative's membership collectively own approximately 58,000 cows. Certified organic livestock may only be fed a diet of 100 percent certified organic feed. CROPP's members feed their animals a combination of a high forage diet, comprised of approximately 60 percent certified organic alfalfa, and pasture their animals for the remainder of their diet. CROPP Cooperative's members grow and produce their own animals' feed, or they purchase 100 percent certified organic feed from other producers or feed mills.

Each cow eats approximately 32.5 pounds of organic alfalfa per day. This equates to approximately 205,000 tons of certified organic alfalfa per year for CROPP members' animals alone.

Sourcing adequate organic feed in the United States is a very difficult and expensive issue for CROPP's membership. Organic feed for livestock has been, and continues to be, in very short supply, causing increased prices and supply difficulties for all organic farmers. CROPP has had to initiate a feed program in the past year to assist its members in sourcing adequate certified organic feed at reasonable prices. Many farmers have reported severe economic impacts due to the lack of certified organic feed.

Siemon says that if Roundup Ready alfalfa is sold commercially, and this causes the contamination of certified organic alfalfa stands, or seed stock, this will devastate the organic farmers who market their milk through CROPP Cooperative.

"The purchase of non-certified organic alfalfa is not an option," Siemon explains. "In order for milk and dairy products to be marketed as organic, certified organic alfalfa must be used as forage."

One of the reasons members of CROPP Cooperative have chosen to be organic producers is because they do not desire to raise genetically modified crops. They have chosen to raise non-GM crops, and they will lose this choice if the national crop of alfalfa becomes contaminated with Roundup Ready alfalfa. If certified organic seed is not available, farmers who seek non-

GM seed will be forced to test at a great expense. The cost of testing can range from \$179 to \$259 per sample, depending upon the species and complexity of the test. Farmers will be forced to test seed or hay lots simply to ensure that they are planting a crop that does not have GM contamination, or to ensure that hay they are purchasing has not been contaminated. If the farmers are unable to source adequate organic feed, they will not be able to produce organic milk. CROPP Cooperative does not market conventional milk, and relies on its farmers' consistent production to take the "Organic Valley" brand to market. A shortage of feed will affect this production and affect Organic Valley's ability to compete in the retail channels. If the brand is not able to maintain its presence in the retail channels, the farmers will lose their market, and lose their chosen livelihood of organic farming.



The Consumers' Reliance on Organic Representing Non-GMO

The impact of Roundup Ready permeating into the organic food industry could potentially devastate consumer trust in the USDA organic seal. For consumers, the seal represents, among other things, a statement that the product is free from genetically modified organisms. If consumers come to believe that the USDA organic seal no longer represents a GM-free product, the integrity of the seal will be greatly compromised. Consumers may no longer choose organic products, and our market will be greatly reduced.

"If the national alfalfa seed stocks become contaminated with Roundup Ready genes, it

will become impossible to feed dairy cattle GM-free alfalfa, and therefore impossible to market GM-free dairy products," Siemon says. "This issue is fast becoming a major issue for organic integrity."

"Roundup Ready seed production and planting should be stopped, to prevent contamination of the nation's organic alfalfa stocks, until the USDA can ensure that the GM alfalfa can be grown in a manner that ensures other alfalfa crops are safe from cross-contamination," Siemon adds.

REPORTS

For more information on genetically modified plants and foods and the rights of farmers and consumers, see these reports, or visit our website, www.worc.org.

Gone to Seed: Transgenic Contaminants in the Traditional Supply

The Union of Concerned Scientists examines how GM crop varieties threaten the quality of the seed supply and concludes that traditional seed varieties of corn, soybeans, and canola are pervasively contaminated with low levels of DNA sequences derived from GM varieties.

To order write to: The Union of Concerned Scientists,
2 Brattle Square, Cambridge, MA 02238

Download at: www.ucsusa.org/food_and_environment/genetic_engineering/gone-to-seed.html

Genetically Engineered Crops and Pesticide Use in the United States: The First Nine Years

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The Soil Association presents evidence challenging commonly claimed benefits of GM technology: higher yields, lower chemical use, food security, and profitability for farmers.

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In this comprehensive article, the Farmers' Legal Action Group (FLAG) examines requirements to avoid the use of genetic engineering that affect crop and livestock farmers who are certified organic or who wish to become certified organic. The article also addresses handling requirements as they apply to organic farmers, as well as a brief discussion of the ways in which sales contracts may impose responsibilities upon farmers that differ from the requirements for organic certification.

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Harvest at Risk

Dr. Charles Benbrook describes the probable consequences of Roundup Ready wheat adoption and projects economic impacts on growers and industry, including the cost of adoption and the impacts on farmers who do not adopt Roundup Ready wheat.

Download at: www.worc.org/issues/benbrook.html

Contaminating the Wild: Gene Flow from Experimental Field Trials of Genetically Engineered Crops to Related Wild Plants

The Center for Food Safety reports on gene flow from experimental field trials of genetically engineered crops to related wild species.

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Transgenic Crops

ATTRA, a sustainable agriculture information service of the National Center for Appropriate Technology, provides farmers a comprehensive overview of GM crops in the U.S., including the unintended effects, regulations, liability concerns, and impact on organic producers.

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Market Risks of Roundup Ready Hard Red Spring Wheat

Dr. Robert Wisner, University Professor of Economics at Iowa State University, examines the potential impacts on export markets and prices from commercializing GM hard red spring wheat in the U.S. within the next two to six years.

Download at: www.worc.org/issues/benbrook.html

A Growing Concern: Protecting the Food Supply in an Era of Pharmaceutical and Industrial Crops

A Growing Concern addresses the challenge of protecting the U.S. food supply from contamination by crops genetically engineered to produce drugs and industrial substances. Six experts commissioned by the Union of Concerned Scientists to analyze this problem concluded that corn and soybean cannot be used as pharmaceutical crops while preventing contamination of the food supply – unless substantial changes are made to the commodity production and management practices applied to these crops.

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A Grain of Caution: A Critical Assessment of Pharmaceutical Rice

The Center for Food Safety details the potential human health impacts of Ventria's pharmaceutical rice and the FDA's refusal to approve Ventria's rice-grown drugs. The report also disputes the need for Ventria's pharmaceutical rice, discussing cheap and effective solutions for prevention and treatment of diarrhea recommended by the World Health Organization and other public health experts.

To order write to: Center for Food Safety, 660 Pennsylvania Ave, SE, Suite 302, Washington, DC 20003

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