Still Life with Mass Hysteria: Are GMOs Really That Bad?

By Brian Barth on March 22, 2016

Photographs by Plamen Petkov; Styled by Richard Alfredo

On a recent Saturday afternoon in Chicago, a handful of vegans gathered for a potluck lunch. Between bites of soy nuggets, tofu steaks, and baked pasta blanketed in faux cheese, the friends

compared notes about a recent animal-rights demonstration and discussed the merits of a raw-food diet. For dessert, they chose among dairy-free brownies, eggless pumpkin pie, and two bowls of sliced apples—one labeled "Golden Delicious (conventional)"; the other, "Arctic Golden Delicious (non-browning GMO)."

David Sutherland, the 44-year-old video-game designer who organized the meal, had procured the Arctic apples, the most recent genetically modified crop to be approved in the United States, from Canada's Okanagan Specialty Fruits, which developed them. "I was worried people might get upset, that it might get political," admits Sutherland, who in 2011 founded a blog called Vegan GMO. "Culturally, the vegan community has a default anti-GMO position."

They aren't the only ones. Fully 72 percent of U.S. consumers say they don't want to eat food that contains genetically modified organisms, or GMOs, according to a 2014 survey published in *Consumer Reports*. Over the past few years, mainstream companies including General Mills, Chipotle, Target, and Safeway have moved to eliminate or reduce the number of GMOs in their supply chains. Nineteen European Union countries have banned GE (genetically engineered) crops outright, while Peru, Kenya, and numerous other developing nations have imposed bans or moratoriums on the marketing and importing of so-called Frankenfoods.

Fully 72 percent of U.S. consumers say they don't want to eat food that contains genetically modified organisms.

At the same time, a growing cadre of scientists, food-safety experts, and farmers—both conventional and organic—suggests that perhaps it isn't GMOs we should reject, but an industrial food system that employs them in irresponsible ways. The World Health Organization, the American Medical Association, the

National Academy of Sciences, the American Association for the Advancement of Science, and the U.S. Department of Agriculture, Food and Drug Administration, and Environmental Protection Agency all maintain that GE technology used for crop improvement is not fundamentally hazardous. Even radical British eco-activist Mark Lynas, famed for trashing GE testing facilities in the U.K. during the mid-1990s, now touts the benefits of genetic modification.

Why such a disconnect? For starters, most Americans probably couldn't tell you what genetically modifying a plant even means. Unlike conventional breeding, in which related plant species are hybridized in order to produce new varieties with desirable attributes, genetic engineering entails either the manipulation of a given organism's DNA or the insertion of one or more genes from one organism into those of another, which might belong to an unrelated species, genus, or even kingdom. Gene flow between unrelated organisms occurs in nature, and biotech advocates insist that genetic engineering is no less "natural" than old-fashioned hybridization. Certainly it is faster and more precise.

Another problem: Consumers tend to associate GMOs with Monsanto. Former manufacturer of Agent Orange, DDT, and recombinant bovine growth hormone (rBGH), the Missouri-based multinational now holds patents on traits present in nine-tenths of the genetically modified seeds sold in this country. The majority of them, dubbed "Roundup Ready," have been engineered to withstand glyphosate, the active ingredient in Monsanto's popular Roundup herbicide. Such herbicide-resistant seeds currently account for 89 percent of the corn and cotton, and 92 percent of the soybeans, grown on U.S. soil. Monsanto has drawn further ire by filing nearly 150 lawsuits against farmers the corporation claims have infringed upon its patents.

Anyone who objects to GMOs based solely on distrust of Monsanto, however, might consider the very real benefits they can impart. David Sutherland likes to remind his vegan pals about the potential of GE vegetables to deliver nutrients—like omega-3 fatty acids—that are typically lacking in plant-based diets. Insulin, he points out, is now routinely derived from engineered bacteria rather than cow pancreases. Do-it-yourself "biohackers" in San Francisco's Bay Area have rejiggered baker's yeast to produce milk proteins, which they plan to convert to curds using traditional cheese-making techniques. *(See "Do-It-Yourself GMOs,"*

below.)

> Anyone who objects to GMOs based solely on distrust of Monsanto might consider the very real benefits they can impart.

While vegan cheeses do "kind of suck," as Sutherland puts it, most genetic-engineering supporters have their sights set on more-pressing concerns. Anthony Shelton, a Cornell University entomologist inspired to pursue a career in integrated pest management by Rachel Carson's 1962 manifesto *Silent Spring*, has used GE techniques to engineer a diamondback moth whose female offspring don't live long enough to reproduce. Shelton's discovery, which is not yet approved for commercial use, would be a boon not only to farmers (diamondbacks cause an estimated $4 to $5 billion in global crop damage annually), but also to the planet, by reducing the use of harsh pesticides. Field tests in upstate New York have shown promising results, and Shelton envisions a future in which growers will order up a case of GE moths, as they do beneficial ladybugs today.

Already, crops containing genes from *Bacillus thuringiensis*—or Bt, a soil-dwelling bacterium that has been used by organic farmers and gardeners to thwart unwanted insects for decades—comprise more than 80 percent of the corn and cotton farmed domestically. As a result, pesticide use* in American cornfields has declined roughly 90 percent, and 56 percent for cotton, since the technology was approved in the mid-1990s. Globally, GE crops have reduced pesticide applications by 37 percent while boosting yields by 22 percent and farmer incomes by 68 percent, according to a 2014 meta-analysis conducted by Germany's University of Göttingen.

That's not to suggest that the outlook is completely rosy. With so much *Bacillus thuringiensis* present in the environment, five of 13 major pests normally targeted by Bt had developed some degree of tolerance by 2013. Similarly, the widespread use of glyphosate, which began with the introduction of Monsanto's Roundup in 1974, has led to "superweeds" resistant to the chemical, and to monocultures uninhabitable by butterflies and bees.

Others worry about as-yet-unknown repercussions from GMOs. In his 2005 book *Dangerous Liaisons?*, Norman Ellstrand, a professor of genetics at the University of California, Riverside, documented a case of glyphosate-tolerant genes showing up in the wild relatives of commercially cultivated canola. He also cited an instance when corn genetically modified to produce a pharmaceutical compound appeared to exchange genes with nearby corn plants destined for grocery-store shelves. Though Ellstrand says he "tilts anti-GMO," he admits that conventional breeding bears risks, too: "One of the worst weeds in European history, the weed beet, was the result of a naturally occurring hybridization between wild beets and sugar

beets."

Gregory Jaffe, who directs the Biotechnology Project at the Center for Science in the Public Interest, in Washington, D.C., takes a similarly measured view, placing GMOs along a continuum of potential risk based on their particular attributes. "If you introduce DNA from a foreign species," Jaffe says, "the risk profile is greater than if you were to introduce DNA from the same species." He offers the 1990s example of the company Pioneer Hi-Bred (now DuPont Pioneer), which attempted to improve the nutritional content of soybeans by introducing a gene from a Brazil nut. Pioneer abandoned the project after discovering that it had inadvertently inserted a gene that could trigger reactions in people with Brazil-nut allergies. The Arctic apple, on the other hand—in which the gene that causes browning has been "silenced" yet no new genes introduced—carries a relatively low risk. Jaffe refers to "a growing international consensus" that the GMO crops currently available are safe, but believes that the United States should institute a mandatory FDA-approval process *(see "Calling a GMO a GMO," below).*

While European and North American intellectuals debate such issues back and forth across the pond, developing nations struggle with basic nutritional needs. Incendiary politics have stalled progress on disease-resistant GE cassavas and bananas, which supply a significant number of calories to the planet's poorest people. German researchers developed beta-carotene–producing 'Golden' rice 15 years ago—in an attempt to address vitamin A deficiencies—that has yet to reach a single consumer. "If you're against Monsanto, fine," says Sarah Evanega, director of the Cornell Alliance for Science, a group founded to depolarize the GMO debate. "But don't stand in the way of public-sector scientists trying to deliver modern agricultural technology to farmers around the developing world who need it. That has nothing to do with Roundup Ready corn in Iowa."

More From Modern Farmer

Will "Contains GMO" Labels Scare Off Customers?

Evanega's doctoral research focused on the 'Rainbow' papaya, a GE variety codeveloped by Cornell (with the University of Hawaii) in the 1990s to combat ring spot, a


The Outsize Importance of the Tiny Organic Seed


The Great GMO Debate Goes to Washington

virus on the verge of wiping out the cash crop in Hawaii. Rainbow contains genetic material from the virus itself, essentially vaccinating the fruit against infection. Developed entirely in the public sector and distributed free to Hawaiian farmers, the papaya has become a poster child for benevolent biotechnology. *(See "Genetic Engineering for the People," below.)* Scientists in other countries where ring spot had become entrenched began developing strains for their particular needs. "But this was before GMOs became heavily politicized," says Evanega. By the mid-2000s, many developing nations had instituted bans or moratoriums. "Since then, the public sector has not been able to develop this technology," she adds. "Those pushing for excessive regulations have actually done the Monsantos of the world a favor by eliminating the competition."

"I've lost count of the number of projects that have been abandoned because the country has a prohibitionary approach or activists have blocked the project in court," says Mark Lynas, who has been traveling through Africa and Southeast Asia to speak with farmers about their needs and how GMOs might help. "These people don't have romantic illusions about farming," he says. "I don't think subsistence agriculture is a great place to be."

One of the few success stories involves the impoverished nation of Bangladesh. In 2014, the government began distributing seeds for genetically engineered Bt eggplants, or *brinjal* (Bangladesh's third most commonly grown vegetable crop), after field tests revealed that damage from fruit and shoot borers was reduced to less than 1 percent. Before the introduction of Bt eggplants, the *brinjal* farmers were spraying pesticides 80 to 100 times a season, says Arif Hossain of the Bangladesh Alliance for Science. A 2005 World Bank survey found that 70 percent of the pesticides used by Bangladeshis included chemicals classified as either "very" or

"extremely" hazardous, yet more than 87 percent of farmers there took few or no safety precautions when applying them.

If the Bt eggplant project changes those stats, it could be a litmus test for the future of global biotechnology. Other than papaya, the only genetically modified plants grown on a large scale have been commodity crops destined for industrial use and processed foods, as opposed to something consumers can bite into, like an apple. The vast scales associated with commodity crops have made them attractive to corporations seeking a return on investment, but 160 million Bangladeshis embracing a Bt eggplant could send the message that there's a deeper well to tap. By that time, however, the business of genetic engineering may have escaped the clutches of companies like Monsanto and DuPont. As the technology becomes less expensive and more accessible, university plant-breeding programs, small seed companies, and even kitchen-table hackers could begin engineering fruits and vegetables in beneficial ways. It's a little harder to find a villain in that.

DO-IT-YOURSELF GMOS

Mail-order kits and libraries of genetic "parts" promise to change the face of the industry.

"We are as gods and might as well get good at it." So wrote self-described "environmental heretic" Stewart Brand in the original *Whole Earth Catalog* nearly 50 years ago. Brand was an early advocate of genetic engineering and among the first to envision a day when the average person would have the ability to tinker with the very fundamentals of life. In the 2008 book *Tomorrow's Table: Organic Farming, Genetics, and the Future of Food*, fellow Californians Pamela Ronald, a UC–Davis geneticist, and her husband, organic farmer Raoul Adamchak, carry on Brand's tradition of encouraging private citizens to embrace technology in ways that benefit the planet. The couple intersperses family recipes and organic gardening tips with lessons like how to isolate DNA from organic strawberries—an approach that serves to demystify genetics and cast GMOs in a friendly, approachable light.

The book keeps things pretty basic, but in basements and ad hoc labs from Berkeley to Tel Aviv, "biohackers" bent over micro-centrifuges and ultrasonic baths are upping the DIY ante every day. Thousands of high

school and college students participate in iGEM, an annual genetic-engineering competition that originated at the Massachusetts Institute of Technology. Provided access to some 20,000 mail-order genetic "parts," students from around the world will work all summer to splice together useful creations—like bacteria engineered to detect arsenic in drinking water or to biodegrade plastic in landfills—before gathering in Boston to review the projects in the fall. In 2013, iGEM alumni started the Toronto-based company Synbiota, which sells $395 genetic-engineering kits that kitchen-table gods can use to render bacteria fluorescent and otherwise fiddle with rudimentary life forms. Can do-it-yourself dog breeds be far behind?

GENETIC ENGINEERING FOR THE PEOPLE

Let's face it: Roundup Ready corn and fast-maturing salmon will do more for the private corporations holding their patents than for any of us. But

public researchers around the world are employing the technology toward nobler ends. Here are a few of the challenges they're currently tackling:

The near extinction of the American chestnut. At the State University of New York, scientists have successfully inserted a gene from wheat into the American chestnut, making it resistant to the blight that nearly decimated the tree's population in the early 20th century.

Methane emissions from rice paddies. Geneticists and biologists at universities in China and Sweden, in conjunction with the U.S. Department of Energy, have discovered that inserting a gene from the barley plant into rice has the effect of largely eliminating the crop's methane emissions, which account for as much as 17 percent of global totals.

Micronutrient deficiency in East Africa. Researchers in Uganda are engineering bananas to carry amped-up levels of vitamin A and iron to address nutritional deficiencies contributing to anemia-related deaths among pregnant women and stunted growth in children.

Inhumane de-horning of dairy calves. Applying the gene-editing technology TALENs, scientists at the University of Minnesota have deleted the DNA sequences in Holsteins that cause the cows to grow horns, replacing those sequences with ones from hornless Angus beef cattle. As a result, the Holsteins' offspring will avoid the painful removal process (burning or cutting) used as a means of improving farmworker safety and protecting the animals from one another.

CALLING A GMO A GMO

Behind the food fight over labeling.

Unlike 64 other nations around the world, the United States does not require that foods containing genetically modified organisms be labeled as such. And if Mike Pompeo gets his way, that's how things will stay. Last March, the Republican senator from Kansas introduced H.R. 1599, the Safe and Accurate Food Labeling Act, which would override state laws mandating labels on GMO products. (Vermont, Connecticut, and Maine have already passed such measures, and nearly 20 more states are

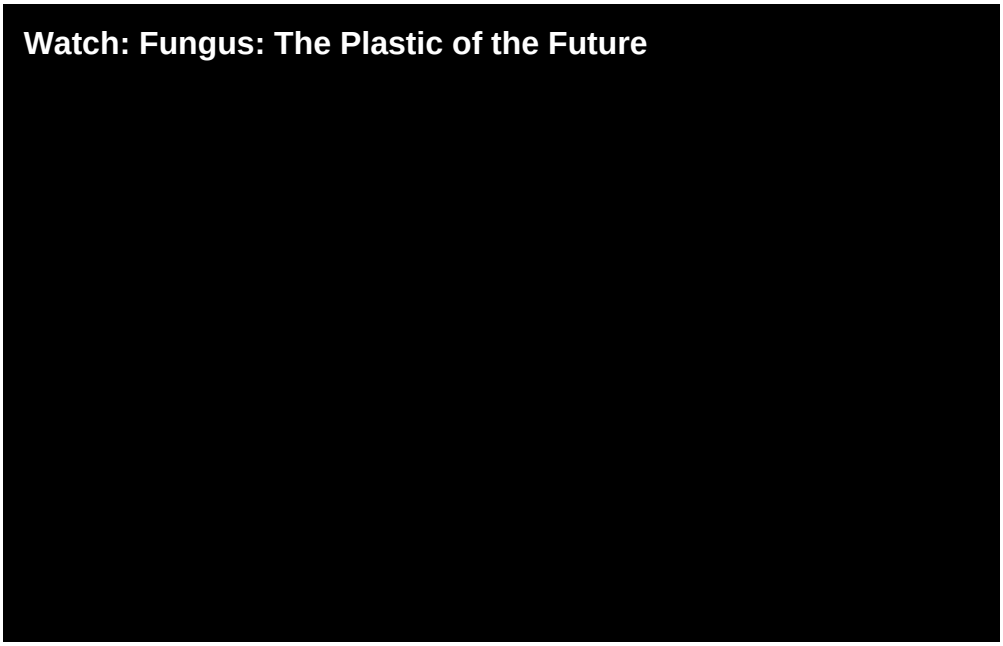
considering them.) Proponents of the so-called SAFE Act—among them the food industry's main trade and lobbying arm, the Grocery Manufacturers Association (GMA)—say that a federal framework will help avoid today's "patchwork quilt" of labeling requirements, as Pompeo puts it.

The bill would establish a voluntary federal "non-GMO" labeling program and would alter the existing approval process—making it mandatory, rather than voluntary, for instance, for biotech companies to consult with the Food and Drug Administration before bringing new products to market. (Nothing more than a consultation is required.) The legislation would also require labeling in situations where GMO foods pose potential risks not associated with their non-GMO counterparts, such as carrying genes from a species associated with allergies.

As an alternative to mandatory on-product labeling, the GMA has introduced a "transparency initiative" called SmartLabel, in which consumers could scan QR codes with smart phones, or search by product name online, to access information on some 350 "product attributes" (the presence of allergens, for example, or whether birds have been raised in a cage-free environment). "Companies expect to disclose through SmartLabel whether food products do, may, or do not contain GMOs on more than 20,000 products by the end of 2017," Pam Bailey, president and chief executive of the GMA, wrote in a December 2015 letter to the *New York Times*. Proponents of a mandatory national labeling law, who refer to Pompeo's bill as the DARK ("Deny Americans the Right to Know") Act, argue that the SmartLabel initiative favors the wealthy—nearly a third of Americans don't own smart phones—and that its QR-code technology threatens consumer privacy. H.R. 1599 passed the House of Representatives last July. No companion bill has been introduced in the Senate as of press time. To read the House of Representatives bill, go to govtrack.us/congress/bills/114/hr1599.

** Clarification: In this instance, we relied on Webster's definition of "pesticide" as "a chemical that is used to kill animals or insects that damage plants or crops," instead of as a catch-all term that includes herbicides and fungicides. The word "insecticide" would have been clearer. The figures regarding corn and cotton crops in this paragraph refer to insecticide reduction only, and not the reduction of herbicides and fungicides.*

From our partners at



HIDE COMMENTS

What's Trending

Have You Bought Milk Since 2003? Today Is Your Last Day To Collect Your Settleme...

FOOD

Take Three Zucchinis And Call Me In The Morning: The Power Of Produce Prescripti...

FOOD

Never Buy A Teacup Pig

ANIMALS

How To Prune Your Fruit Trees

PLANTS AND ANIMALS

How To Incubate Chicken Eggs

PLANTS AND ANIMALS

Opinions And Reactions

Previous

Next

Related

The First GMO Field Tests

GMO Labeling Legislation: Modern Farmer's Guide to the Mayhem

Food Waste: The Next Food Revolution

Caught in the Middle: Farmers Seek a New and Improved GMO Debate

Popular

Raising Backyard Chickens for Dummies

6 Differences Between Llamas and Alpacas

Will a Sheep's Wool Grow Forever?

How To Prune Your Fruit Trees