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Can GMOs Help Feed a Hot and Hungry World?

Not if activists succeed in making the genetic modification of food politically unsustainable.

By *Madeline Ostrander*

AUGUST 13, 2014



(Illustration by Tim Robinson)

Eduardo Blumwald's genetically modified plants don't look much like "Frankenfood." Filling four modest greenhouses in a concrete lot behind Blumwald's laboratory at the University of California, Davis, the tiny seedlings, spiky grasses, alfalfa, and peanut and rice plants in plastic terracotta-colored pots look exactly like the ordinary varieties from which he and his fellow researchers created them. Blumwald's lab lies just ten miles from Monsanto's 90,000-square-foot vegetable seed building, a glassy edifice larger than the hangar for a 747. The Monsanto facility is one of the largest centers in the world for plant breeding and genetic engineering. But in the fourteen years that Blumwald, a professor of cell biology, has worked here studying the DNA of crop plants, he has hardly ever spoken to anyone from Monsanto.

Blue-eyed and round-faced, with a lilting Argentinian accent, Blumwald grows

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activists who've been challenging not only the Monsantos of the world but the entire field of genetic engineering.

“You want to penalize the multinationals; I have no problem with that,” he tells me in his office at the university’s plant biology building. “But because of your political stance against multinationals, you are going to condemn maybe the only viable solution we have for our future? It’s wrong—absolutely wrong.”

Blumwald means the hot future that we expect by 2050—when a world population of 9.5 billion people will scramble to put food on the table, while at least thirty-seven separate countries face extreme water crises. Blumwald thinks that part of the answer is to genetically engineer crops that can better withstand drought, and so he and his researchers are scouring the world for varieties of fruits, vegetables and some basic staples—rice, millet, wheat, maize—that grow well without much water. Then, using a device called a “gene gun,” which inserts DNA on microscopic gold particles, or a soil bacterium capable of changing plant genes, they alter or silence parts of the plant’s genome, adjusting how and when

the plant makes the hormones that let it know when to grow and when to wither. The researchers say the methods are more precise and much faster than developing new plant varieties by conventional breeding, which can take decades.

When I tour the rows of rice and peanuts with one of Blumwald's assistants, a postdoctoral researcher from Madrid, the air in the greenhouse is soupy. About two dozen researchers work in Blumwald's lab, many of them from hot parts of the world with swelling populations, including Brazil, China and the United Arab Emirates. In the greenhouse, the researchers force the rice to cope with heat and deprive it of water just as it's about to set seed. So far, the genetically altered rice is outperforming the natural kind—given less moisture, the non-engineered rice browns and wilts, but the new plant survives. Blumwald's goal is to create crops that won't keel over as quickly when things get hot, dry and stressful—plants that will improve the odds that a farmer can produce food even in a drought.

In about forty years, relentless dry spells may be more frequent across the Southwest, say climate scientists, and California may have more dry years like

this one, in which a drought has crippled the agricultural sector. But the state, one of the most fiercely contested battlegrounds in a worldwide fight over the use of genetically modified organisms (GMOs), isn't the most inviting home for research like Blumwald's. Since the 1980s, activists here have run a series of campaigns to require the labeling of GM products and an outright ban on GMO cultivation.

Blumwald says the controversy over GMOs has made it more difficult to pursue his research and obtain funding. And even if his GM plants could be an important part of the solution to climate change, they may never make their way into the hands of commercial farmers. Who will invest in his plants, test them in the field and market them if they attract boycotts, protests and lawsuits that make business difficult and consumers skittish?

Many biotech researchers and agronomists argue that a combination of bad will generated by Big Ag and misdirected public outrage is stifling important technological advances in agriculture—innovations that could help prevent famine, fight crop diseases and cope with climate change. But countless activists disagree. The Organic Consumers Association, a

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nonprofit agricultural watchdog group, says genetic engineering will never deliver on promises to feed a growing population and isn't a trustworthy technology. "The dirty secret of the biotech industry is, after thirty years, they haven't done anything for consumers," said Andrew Kimbrell, the founder and executive director of the Center for Food Safety, in a speech at a national heirloom-seed fair in Santa Rosa, California. "No better taste, no more nutrition, zero benefits," and a number of "potential risks."

Over the past several years, the political fight over GMOs has become supercharged, and much of the controversy has been driven by a distrust of big business—and of any of the novel biotechnologies it might produce.

"The same corporations that brought us DDT and Agent Orange now want to deny us our right to know what's in our food," argued California Right to Know during a 2012 campaign that brought together a coalition of organic farmers, environmental organizations, grassroots groups like Moms Advocating Sustainability, and companies like Clif Bar and Dr. Bronner's Magic

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Soaps. Two years ago, this coalition attempted to pass a statewide referendum that would have required the labeling of food containing GMOs. The anti-GMO activists were vastly outspent: Monsanto alone invested \$8 million in efforts to defeat the measure. But the pro-labeling campaign helped launch a movement. This year alone, a series of similar initiatives have been proposed in twenty states, according to the Center for Food Safety; this past April, Vermont became the first state to pass a GMO labeling law. The Grocery Manufacturers Association and several other trade groups have filed a lawsuit to overturn it.

The California campaign's messages were a jab at Monsanto, in part. Since the 1940s, the company has been manufacturing and selling chemicals, including DDT, the now-banned herbicide that contributed to the near-extinction of bald eagles in the twentieth century. In the 1960s, the company distributed a brochure mocking Rachel Carson's seminal work, *Silent Spring*, the book that first brought widespread public attention to the dangers of pesticides and launched the modern environmental movement. Around the same time, Monsanto was producing Agent

Orange, the chemical weapon used to strip vegetation in Vietnam war zones—and later linked to birth defects and cancers there and in the United States.

In 1997, Monsanto partly reinvented itself, transferring most of its chemical business to a company called Pharmacia, which later became part of Pfizer. Today, the only chemicals that Monsanto produces are agricultural, including Roundup, an herbicide that the company invented in 1970. It has marketed genetically modified seed since the 1990s; its premier products, among the most common GM crops on the market, are “Roundup Ready”—varieties of soybeans, corn, alfalfa, cotton, canola and sugar beets whose DNA has been modified to keep them from dying when doused with Roundup. In the big grain-growing regions of the United States, such as the Midwest, Roundup Ready is the industry standard. As a result, Roundup, which also goes by the chemical name glyphosate, is the most commonly used herbicide in the country.

Because the DNA of Monsanto’s GM plants is patented, the company has enormous control over the US food system. It has brought 145 suits against American farmers for patent infringement—i.e., for

intentionally or, according to at least one farmer, accidentally (since grain DNA travels along with pollen in the wind) growing Monsanto's GM varieties without paying for them.

The explosion of the Roundup Ready market may have environmental upsides. One biotech researcher I spoke with noted that the use of Roundup Ready seed has reduced reliance on even more toxic agricultural chemicals, and US Department of Agriculture data concur. Roundup is considered more benign than many herbicides: it tends not to linger in the soil and is sometimes used even in places like nature preserves to beat back aggressive weeds. But few chemicals intended to poison plants or pests are entirely harm-free, and new research indicates that Roundup could be more damaging than previously thought: it may contribute to miscarriages and interfere with fetal development. And around the country, weeds that are resistant to Roundup are proliferating. Dow Agrosiences, a division of Dow Chemical and another major player in agribusiness, is about to release a new generation of genetically modified crops that tolerate a more powerful and persistent herbicide—2,4-D, a potential neurotoxin.

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According to Robert Fraley, Monsanto's chief technology officer and executive vice president, his company has been studying the impacts of climate change since 2006. But it has created only one line of GM plants designed to deal with environmental stress—a type of corn called DroughtGard. Like Blumwald's plants, DroughtGard doesn't die back as quickly when the weather is dry, though the mechanism driving this trait is different: it relies on inserting bacterial DNA into the plant. In field trials in the Great Plains, DroughtGard performed modestly better than other varieties of corn. Monsanto has now made it available commercially to farmers, and China has approved the seed for import.

But even if such technologies prove useful in mitigating the impacts of climate change, Monsanto's tarnished history, heavy-handed dealings with the public, lawsuits, and sheer size and might have made it a favorite villain. To a certain segment of the public, everything that Monsanto does is suspect, and genetic engineering looks like a strategy for pushing the company's brand of herbicides and manipulating the food economy—not a way to feed a world in crisis.

It can be easy to forget that genetic engineering has an existence and a history beyond Big Ag. Monsanto's website credits Robert Fraley, then a researcher for the company, with producing the first GM plant in 1982, but there were at least three other institutions working simultaneously—two universities in the United States and one in Belgium—to grow the first plants with spliced genes that year. In the decades since, scores of university researchers, small research and development ventures and even a few nonprofits have used genetic engineering to try to stop diseases from decimating citrus plants, create mustard plants that can clean up toxins from mining and industrial sites, and grow food that can better survive in heat, drought, flooding, freezing and other extreme weather conditions that may get worse in the next several decades.

But almost none of these plants have ever made it beyond a field-testing stage. As of 2010, though 260 genetically engineered traits have been tested in seventy-seven different “specialty crops” (foods that are less profitable and produced on a smaller scale than field corn, cotton, soy, wheat and rice), just four varieties—including

insecticide-resistant sweet corn, disease-resistant papaya and squash, and an ornamental purple carnation—are on the market, according to a review by Jamie Miller and Kent Bradford, researchers with the Seed Biotechnology Center at UC Davis. That’s nothing near the scope of innovation one would need to confront a problem as vast as climate change or famine.

When I spoke with Bradford, he blamed anti-GMO activists, in part, for making R&D difficult: “Those groups have driven all of the biotechnology work into the companies they hate,” he said. “They’ve made it impossible for anybody else by raising a stink. Even if the regulatory bars don’t seem so high, [activist groups] will sue.” Only big companies like Monsanto can afford the legal and regulatory costs to test GM varieties and bring them to market, Bradford argues.

Neither biotech researchers nor GMO opponents think the current regulatory process is working well. Anti-GMO groups insist that the Food and Drug Administration’s approval process is too opaque and leaves GMO testing in the hands of food companies. Biotech

researchers counter that, in practice, the FDA insists on exhaustive and expensive testing far beyond what has been required for any other kind of food crop, even though years of research suggest that the technology of genetic engineering is safe. The American Association for the Advancement of Science, for example, has announced that “foods containing ingredients from [GM] crops pose no greater risk than the same foods made from crops modified by conventional plant breeding.” Bradford and others insist that it doesn’t make scientific sense to single out GM crops for special testing when other, far less precise methods of crop development—including blasting plants with radiation—aren’t subject to such rigorous scrutiny.

The high cost of GMO field-testing may explain why the only genetically modified crops that have made it to market are, in the words of environmental scientist Jonathan Foley, “very disappointing” and “come with some big problems.”

“GMO efforts may have started off with good intentions to improve food security,” Foley wrote in a column in the science magazine *Ensisia* in February, “but they

ended up in crops that were better at improving profits.”

* * *

Whether Blumwald’s plants—or the hundreds of other GM crops designed to be disease- or climate-change-resistant or otherwise useful in feeding the world—ever make it to farm fields may depend a lot on whether food activists, the public and policy-makers can be persuaded that the technology is able to produce worthwhile results.

The heart of one GMO battle is roughly fifty miles west of Blumwald’s lab, in Sonoma County—a land of wineries, towering redwood groves poised at the edge of rocky coastal cliffs, and some of the most innovative organic agriculture in the country.

Much of the opposition to GMOs here has come from organic farmers, partly out of fear that their crops will be tainted by cross-pollination by GM varieties. Under organic certification rules, farmers aren’t allowed to grow GMOs, and their customers often refuse to eat GM food. In March 2004, Mendocino County, just north of Sonoma, became the first jurisdiction in

the nation to pass a law regulating GM plants, making it illegal to “propagate, cultivate, raise, or grow” them, in order to stop what it called “genetic pollution”; Marin County, to the south, passed a similar ordinance the following November. A grassroots group in Sonoma County is now actively pushing for a countywide ban on GMOs.

Here, on a plot of forest in the tiny unincorporated town of Occidental, several longtime environmental activists run a center for sustainable agriculture research in a cluster of yurts and wood cabins that form an intentional community called the Occidental Arts and Ecology Center (OAEC). Its leader, Dave Henson, co-founded Californians for GE-Free Agriculture, a coalition that ran campaigns against GMOs between 2002 and 2008. But when I asked him how he felt about genetic engineering, his answer surprised me. “If this is public research at a university, I think we will see some really interesting potential solutions with recombinant DNA that could show all kinds of benefits in health and agriculture and other things,” he said. “So baby and bathwater are separate.” Henson added that he’s even guest-lectured to classrooms of biotechnology graduate

students at UC Berkeley.

When I described Blumwald's research, however, Henson was skeptical. "The biotech solution is to change out one variety of one crop with another single variety that's somehow more adapted by genetic engineering," he said, while the approach to climate change, drought and other related issues "should be about the whole farm system."

And that's the major area of disagreement between food activists and the farm industry: people like Henson believe the entire system of modern agriculture needs a radical makeover to rely less on fossil fuels, irrigation, and the chemical fertilizers and weed killers that are fouling water sources from the Great Lakes to the Mississippi. Tweaking a gene won't fix all that, Henson argues: "The solution has got to be a return to a more sustainable, soil-focused agriculture."

Five years ago, Henson, OAEC, and several other groups and individuals involved with the GE-Free coalition partnered with organic and family farmers to form a new organization, the California Climate and Agriculture Network (CalCAN). Their

intent was to involve farmers in California's new climate-change law, the most comprehensive policy on global warming in the country. At the time, the group was also responding to Monsanto. "It was informed by the advertising campaign that Monsanto was doing...around its development of GMO crops that they claimed would respond to a number of [environmental] issues," says Renata Brillinger, who now heads the group. In 2008 and 2009, Monsanto placed ads in publications like *The New Yorker* and *The Atlantic Monthly* and on the radio program *Marketplace* arguing that its biotech seeds would be necessary to feed the world's burgeoning population. "We saw a need for other solutions," Brillinger adds.

Today, CalCAN has no formal position on GMOs, but simply says that it wants, in Brillinger's words, "shovel-ready" solutions to deal with the drought right now. Most of these are about managing soil. Rich, organic soil—the kind that can be developed by using manure and compost more and tilling less—holds water better than poor soil. In a drought, plants grown in rich soil are less thirsty; in a deluge, such soil absorbs and slows the flow of water, thereby decreasing flooding and erosion.

Organic matter is also high in carbon, and storing it in the soil keeps it out of the atmosphere, helping to address the problem of climate change itself. CalCAN has focused on statewide policy, including efforts to wring funding from the California budget to promote soil- and water-conservation practices and climate-change strategies for farmers. To Brillinger, GMO research looks costly and difficult; managing the soil is immediate, cheap and much easier.

Down the road, in Sebastapol, I found a small organic farm that made this convincing. Paul Kaiser drove up to meet me in front of his barn in a small green tractor, then walked me through the densely planted rows spanning his two acres of crop fields, filled with roughly 150 varieties of vegetables. “We earn over \$100,000 per crop acre per year,” he says. (By contrast, the average revenue from an acre of California cabbages or cucumbers in 2012 was about \$6,000 to \$8,000, according to the state’s Department of Food and Agriculture.) Kaiser credits his soil-management practices for his financial success.

Before farming, he worked in agroforestry,

restoring fields in the tropics that were so overgrazed they could barely grow grass. To Kaiser, the question of engineering any single plant is unimportant compared with a larger picture involving soil, water, bees, and the various other insects and birds that can thrive on an organic farm and provide natural pest control. Kaiser supports the ban in Sonoma County: “Unless we can prove that a GMO crop is fully safe and beneficial to everything that it touches—the pollinators, the soil it’s grown in, the watershed and our body—we shouldn’t be using it,” he says.

* * *

At its core, nothing about the science of gene splicing precludes good soil management and other sustainable practices. Pamela Ronald, a UC Davis plant pathology professor, and her husband Raoul Adamchak, a farmer and former board president of the group California Certified Organic Farmers, insist that it’s not only possible but necessary to combine techniques like soil conservation with genetic engineering. They’ve also written a book on the subject called *Tomorrow’s Table*.

Ronald argues that those who object to GMOs are focused on the wrong questions: “It would make a lot more sense to evaluate all crops and all farming practices based on whether they are sustainable, not on the process of developing the seed. We know that the process itself is no more risky than any other kind of genetic process.” GM crops will never be a silver bullet, she adds, and we can’t confront a food crisis without also dealing with the other shortcomings of large-scale agriculture. Even so, genetic modification does offer help, and in a crisis, even a small fix can be worth a lot. Ronald and her colleague, David MacKill, used a combination of genetic engineering and plant breeding to create a variety of rice that can withstand the flooding that has inundated much of Bangladesh and India and devastated the rice fields, a disaster made worse by climate change. Last year, the rice was grown by 4 million farmers.

Ronald doesn’t point fingers at any one party for the public relations difficulties faced by biotech researchers. But she does note that the solution to a world food crisis won’t emerge only in the lab: “There seems to be a communication gap between organic and conventional farmers, as well as between consumers and scientists. It is

time to close that gap,” she and Adamchak conclude in *Tomorrow’s Table*. “Science and good farming alone will not be sufficient.”



MADELINE OSTRANDER

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Super Bowl Winners Like Martellus Bennett Are Refusing to Go to the White House

*Four Patriots players have declined Trump's
invitation—so far.*

By *Dave Zirin*

TODAY 11:35 AM





New England Patriots player Martellus Bennett speaks with a reporter after Super Bowl 51. (AP Photo / Gregory Payan)

The champagne had not even dried in the Patriots locker room last Sunday when New England tight end Martellus Bennett restated that there was no way he would be visiting Trump’s White House to celebrate the Super Bowl victory with his teammates. He said this even though no team in sports is as identified with Trump as the Patriots, because of the president’s friendship with owner Bob Kraft, coach Bill Belichick, and quarterback Tom Brady. When asked if he was concerned about the response from Kraft, Bennett said, “I’m not really worried about that. I’m not worried about it at all.... It is what it is. People know how I feel about it. Just follow me on Twitter.”

Sure enough, on the lacerating, loopy, and at times relentless Twitter feed of Martellus

Bennett, his feelings have been crystal clear. On January 28, he said of Trump, “Surprised the president dude didn’t ban celebrating Chinese New Year in America!!”

When Kanye West went through his short-lived infatuation with Trump, Bennett tweeted, “So Kanye didn’t take the time to vote. And now he holding on to Trump’s coattail like Peter Pettigrew to Lord Voldemort. Kanye Pettigrew.” (Bennett, who also writes acclaimed children’s books and is a proud Harry Potter fan, is comfortable with a good Hogwarts burn.)

As uproar over his decision to not visit the White House bubbled, he tweeted, “Media makes me seem like I’m Katniss Everdeen. Lol.” (Katniss Everdeen, is of course the protagonist of the young-adult Hunger Games series, who leads a people’s revolution against a despotic, swinish, bizarrely coiffed despot).

Now his teammate Devin McCourty has also come forward to say that he will not attend any kind of ceremony with Trump. “I’m not going to the White House,” he told *Time* in a text message. “Basic reason for me is I don’t feel accepted in the White

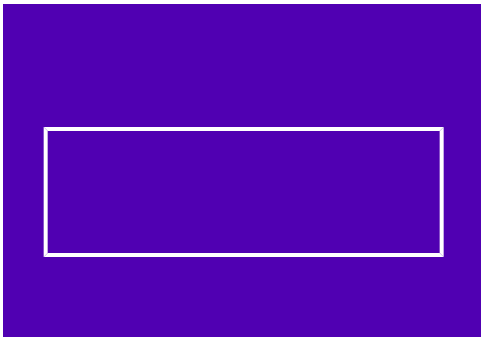
House. With the president having so many strong opinions and prejudices I believe certain people might feel accepted there while others won't." Patriots linebacker Dont'a Hightower has also said he will not go to the White House, saying, "Been there, done that."

They won't be the only Patriots players to skip, but it's not surprising that they are the first. Bennett and McCourty also raised their fists during the anthem during the opening game of the season, as part of the group of NFL players who took part in pre-game protests against racism and for Black Lives.



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It would
be
difficult
for
anyone
in the



provincial world of Boston sports radio to make some kind of argument that skipping the White House is objectionable, since quarterback Tom Brady didn't show up at the White House with the team to meet President Obama two years ago, although it wasn't what anyone would call a principled political decision. As *Deadspin* remembered, “[Bennett and McCourty] appear willing to own their decision, unlike Tom Brady, who two years ago claimed a ‘prior family commitment’ when he skipped the Patriots’ White House visit with Barack Obama, and instead spent his day working out and shopping at the Apple Store.”

While the team is a favorite of infamous white-supremacist Richard Spencer because of its identification with Trump and “great number of white wide receivers,” the fact is that this is still a team that is 67 percent African American. It is also a team with white players like Chris Long who spoke sympathetically about the Black Lives

Matter protests during the season and just announced that he will not be attending the reception at the White House.

That puts the number of players committed to skipping up to four. The question might end up being who, other than Kraft, Belichick, and Brady, shows up at all. This is a president who keeps a white supremacist as his “strategic adviser” and appointed an attorney general who was too racist to become a federal judge. He mocks civil-rights leaders of the past, and seems to think that Frederick Douglass is some guy living in the United States who “is an example of somebody who’s done an amazing job and is being recognized more and more.”

The Patriots will end up showing two definitions of patriotism on the day of their visit: one defined by fealty to the White House, and another that stands up to all enemies foreign and domestic. But let the last word go to Martellus Bennett, who tweeted earlier this week, “I’m going to speak my mind because guess what...for a looonng time my ancestors didn’t have a voice.... Your favorite athlete stands on his platform to be seen. I stand on my platform to shout. To be heard.”



4 COMMENTS



DAVE ZIRIN _____ Dave Zirin is the sports editor of *The Nation*.

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By Michelle Chen

TODAY 10:00 AM

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