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Super Weeds, Mutant Salmon and Mice Guts

by Laura Hagar

Sometime this year, the voters of Sonoma County will be asked to vote on an issue that will affect every single farmer in the county. Farmers are a tiny percentage of the voting population, so their fate, for the most part, will be in the hands of people like me and you—city folk and suburbanites, most of whom wouldn't know what to do with the working end of a hoe if it were handed to them.

The issue at hand is whether genetically engineered, transgenic organisms should be grown in Sonoma County. Opponents of genetic engineering, based mostly in the area's robust organic farming community, have been organizing and gathering signatures since last summer to get an initiative on the ballot which would prohibit anyone from propagating, cultivating, raising or growing transgenic organisms in Sonoma County. That initiative, called the Sonoma County Ordinance to Prevent Agricultural and Environmental Contamination from Genetically Engineered (Transgenic) Organisms, is similar to other such bans that have been passed in California. Two years ago, voters in Mendocino County became the first in the nation to ban genetically modified organisms in farming. This last November, Marin County voted overwhelmingly to do the same. (Similar measures failed in the more agricultural counties of Yolo and Butte.)

Organizers from GE Free Sonoma County began gathering signatures in June 2004 for a special election in spring 2005. In fall, with their signature campaign going strong, they attempted to convince the board of supervisors to put the initiative on the November ballot in hopes of avoiding the expense of a special election, but the board declined to do so. GE Free Sonoma County campaign coordinator Daniel Solnit says the group is now looking again toward a special election sometime later this spring. Had the supervisors agreed to put the initiative on the ballot in November, it would have cost roughly $50,000-90,000. A special election will cost between $300,000-$500,000.

Both sides in this fight say that the debate over the use of transgenic organisms in agriculture is essentially about the right of farmers to be able to farm the way they want to. And oddly enough, both sides may be right. To understand why, you have to understand the controversial history of genetic engineering in agriculture.

A quick course in the basics

Fortunately, one of the country's foremost experts on the promise and dangers of genetically modified organisms now lives in the North Bay. Kim Waddell spent the last four years as a senior program officer for the Board of Agriculture and Natural Resources at the National Academy of Sciences in Washington, D.C. He now lives in the Napa Valley, where he works as executive director for the American Vineyard Foundation, a nonprofit educational foundation that supports scientific research in viticulture and enology. Waddell, a graduate of UC Santa Cruz, holds a Ph.D. in biological sciences from the University of South Carolina and did postdoc work as an insect ecologist at the University of Maryland. Waddell was the study director for three agricultural biotechnology-related reports from the National Academy of Sciences: Environmental Effects of Transgenic Plants: The Scope and Adequacy of Regulation, Animal Biotechnology: Science-Based Concerns, and Biological Confinement of Genetically Engineered Organisms.

The first thing Waddell wanted to do was nail down the terminology. "People often confuse the terms genetic engineering, genetic modification and biotechnology. When people think of genetically engineered products, like

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corn or soybeans, they're really talking about transgenic organisms which means that you've taken a gene from one species or organism and inserted it into the DNA of another species."

The wide world of transgenic crops

Like most GMO bans, the Sonoma initiative is specifically aimed at transgenic crops—the technology that, over the last several years, has transformed whole sectors of American agriculture. As of 2003, according to the FDA, 81% of the total soybean crop in the United States was genetically engineered using transgenic plants, as was 73% of the cotton crop and 40% of the corn crop. Although giant commodity crops like these were the first to use transgenic plants on a mass scale, a whole new generation of transgenic crops—including crops commonly grown in Sonoma County, such as lettuce, radicchio, tomatoes, squash, table grapes and sweet peppers—are about to become available commercially. There are no transgenic grapevines or yeasts available yet, but research is proceeding at a furious pace at major institutions like UC Davis.

Waddell says there are several major uses for transgenic crops. The first and far most common is pest-protected crops, such as BT corn which incorporates genes from the naturally occurring soil bacteria bacillus thuringiensis as a way of discouraging corn pests. (BT in a powdered form has been applied topically to plants as organic pesticide for years.) Another transgenic product, Roundup Ready soybeans, has been engineered to be tolerant of the weed-killer Roundup. Farmers appreciate the fact that Roundup Ready soybeans allow them to spray less often, earlier in the cycle, cutting back on the labor and energy involved in multiple trips into the field.

Other categories of transgenic crops include crops that have been engineered to increase their nutritive value as well as those that have been engineered to produce industrial or pharmaceutical compounds. Transgenic techniques can also be used to create crops that grow outside their normal habitats (they need less water, for example, or can tolerate higher levels of salinity in the soil) or that combat major viruses or diseases. The transgenic variety of papaya that is resistant to the ringspot virus is generally credited with saving the Hawaiian papaya industry.

As a scientist, Waddell is excited by the possibilities of transgenic plants. Looking at the papaya, for example, Waddell says, "Imagine if we can do that for cassava or yams or sweet potatoes, which are some of the staple crops of Africa. Right now, in the developing world, farmers can easily lose 30-40% of their crops from farm gate to market through funguses or viruses that rot the vegetables. I'm talking now about farmers and whole nations that are faced with ongoing food insecurity. If we could stabilize food availability and increase the income for small- to medium-sized farmers, that would just completely change the whole landscape down there."

The risks of GE

Defenders of genetic engineering often use idealistic arguments like these—the ability to produce new crops that might feed the developing world—but activists like Daniel Solnit of GE Free Sonoma aren't buying it. Solnit says he's not an opponent of genetic engineering per se, but he believes there are serious problems with transgenic crops, ranging from potentially wide-ranging health and environmental effects to the economic and political

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crops, ranging from potentially wide-ranging health and environmental effects to the economic and political dangers involved in the increasing corporate ownership of the world's genetic resources. He also says the science of genetic engineering is just too new, too untested and too poorly regulated to risk introduction on a mass scale.

"We're not against genetic engineering," he says. "We're against making the entire planet into a field test for untested organisms that could have potentially dire consequences for the environment and human health. That's just not rational. Good science is about finding out what makes sense and what doesn't, but the science coming out of the industry is an embarrassment. Most of their patents are based on the concept of one-gene/one-trait, but genetics is much more complex. Most genes code for different traits, and it's all about position in relation to the gene sequence. Yet these companies are suggesting they can drop in a gene and not affect anything else. Any honest scientist will tell you that that is bunk."

I asked Kim Waddell how genetic scientists could be so sure that the alteration of a single gene won't have other, unintended effects. His answer was surprisingly simple and not particularly reassuring.

"We don't have any guarantee, but usually, when you have cascading effects, they're usually lethal to the plant. You'll make a change in one place and somewhere else, the metabolism changes and that's that for that plant. It's the same thing with natural mutations. Few mutations are beneficial. So one of our standard tests is, What happens to the plant? Does it grow just as tall? Does it grow just as fast? Is it the same color?" If it is, Waddell says, and scientists can't detect any other differences in the field tests, it's assumed to be safe.

Might there be subtler changes? "There might be," says Waddell, "but just how much testing are you going to require?"

He notes that there are currently no tests required of conventionally bred plants. "Every year, plant breeders produce new hybrids, which involve the swapping of tens of thousands of genes altered in ways no one understands. But no one worries about this because we have a history of new crop varieties being developed without incident.

"So, suddenly we go from that sort of blasé attitude to the level of scrutiny and concern we have over genetic engineering, which involves inserting one gene out of millions. I mean, unless you're introducing snake venom as the protein of choice you want to express, I think the level of scrutiny is a bit out of whack. The people who are designing these things for commercialization for human consumption aren't interested in producing toxins, allergens or poisons. That's exactly what they don't want. Invariably, whatever they're inserting is something that they're very familiar with because they know where it is, they know what it is, they know what it does in its target species and to other species that might ingest it. It's not like they say, 'Gee, let's see what's on the shelf today' and insert that. So I think there's a level of concern that, from a scientific standpoint, is difficult to justify."

Food scare or reality check?

The level of concern in some parts of the community, however, is very high indeed, and GE Sonoma County is doing its best to keep it that way. As a part of the initiative campaign, Daniel Solnit has been showing a film called the "Future of Food," by documentary filmmaker Deborah Koons Garcia. (Koons is also the widow of

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Grateful Dead guitarist Jerry Garcia.) The film is, at times, an almost laughably heavy-handed piece of propaganda, but it does raise several important questions about the safety of genetic engineering and the adequacy of regulation.

The film lays out the most common objections to GE crops. Concerns about GE and food safety range from the introduction of allergens to antibiotic resistance to as-yet-unproved allegations about the effect of GE food on various parts of the human body. A peanut gene inserted into a soybean plant, for example, could cause a fatal reaction in people with severe peanut allergies. Transgenic salmon, engineered to produce their own antibiotics, could lead to antibiotic resistance in people who consume them. Some as-yet-unreplicated British studies have suggested that some GE crops have lower nutrient values or cause lesions in the guts of laboratory animals.

Koons film is particularly effective at demonstrating the revolving door between the chemical industry (primarily Monsanto, which holds the largest number of GE patents) and the government agencies which are supposed to regulate GE organisms.

Regulation of transgenic organisms is shared by three agencies—the Environmental Protection Agency, the Food and Drug Administration and the U.S. Department of Agriculture—and affected by more than a dozen major federal statutes. That sounds like a lot of regulation, and there are, in fact, a lot of bureaucratic hoops to jump through before you can take a genetically modified organism from the laboratory to the grocery shelf. Company scientists do have to submit lots of reports to various governmental agencies. The level of regulatory oversight, according to Waddell, varies tremendously depending on the gene in question, its expression and the host. The more novel the combination, the more tests (ranging from field tests to biochemical analyses) the company is required to do. What isn't required is any actual independent testing—such as animal testing for food safety or nutritive value. That's because the government, in a bow to industry, has declared genetically modified crops to be "substantially equivalent" to conventionally produced crops. This exempts GE foods and crops from the kind of rigorous independent safety testing which might otherwise be required. This same argument of "substantial equivalence" is used by industry groups to oppose mandatory labeling of genetically modified foods. After all, according to the industry, if it's substantially the same, why bother to label it?

The hot-button issue at the heart of the current initiative, however, is the so-called "right to farm" question. Proponents of the initiative argue that GE crops would spread their genes through the environment, contaminating conventional and organic crops through a well-known phenomenon known as gene flow.

"Our initiative is about protecting the freedom of farmers to choose what they grow and how they grow it," says Dave Henson, executive director of the Occidental Arts and Ecology Center and one of the authors of the initiative. "The real question here is, What is the future of ag going to look like in Sonoma County? Who's going to make the decision about what we can grow and whether we're even going to have an organic agricultural sector or not? If we don't do anything, that decision is going to be made by a handful of giant chemical corporations."

Solnit agrees and adds that organic farmers aren't the only ones who should be worried. "If you are a conventional farmer growing conventional crops, and your neighbor is growing transgenic crops which cross-pollinate and interbreed with your crops, then your right to farm the way you want has just been taken

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cross-pollinate and interbreed with your crops, then your right to farm the way you want has just been taken away. It's no different than poisoning your neighbor's well."

The dangers of gene flow in agriculture are real, according to Kim Waddell. "The plight of organic corn growers in the Midwest is a serious one," he says. "It would be quite challenging to find a place in Iowa that wouldn't, over time, be exposed to the corn pollen flow from all the genetically engineered corn grown by neighbors."

The consequences of this kind of gene flow in Sonoma County would be twofold. The first is economic. Organic farmers, who currently get premium prices for their products, fear that they would lose their organic certifications if their crops were contaminated by cross-pollination with transgenic crops. Others say that Sonoma's reputation as a source for "pure and healthy" agricultural produce would be damaged both domestically and abroad and would limit farmers' ability to sell to consumers in other countries that are wary of GE foods. (GE foods are illegal in Japan, for example, and tightly regulated in Europe.)

That's why Mike Benziger of Benziger Family Winery on Sonoma Mountain signed on to the initiative early on. "In Sonoma County, we have to be extra careful. We can really only separate ourselves from everyone else based on quality. In terms of grapes, at least, we can't compete as a commodity, and we can't compete on price. We have to compete on uniqueness, purity and quality.

"I believe personally that people are going to be more and more aware of the purity and wholesomeness of the food and beverages that they consume. We need to consider very closely anything that we might do that would put that purity and wholesomeness into question."

Watch out for those wild relatives

Initiative supporters also have concerns about the environmental effects of GE crops. No one knows, for example, what would be the effect if transgenic genes escaped into the wild in either plants or animals. Transgenic salmon, for example, could easily transport their engineered genes into the wild population. Herbicide-resistant plants could interbreed with wild relatives and pass on their engineered traits.

It's a concern Waddell shares. "My biggest concern with genetic engineering has to do with the environmental effects. Canola is a perfect example. It's related to wild radish and wild mustard, and they hybridize like crazy so you've got gene flow problems. So the trait you wanted in canola, which is herbicide tolerance, has now moved into the weed population, and you've now got herbicide-tolerant weeds, which are kind of like super weeds."

The danger of gene flow varies with the species—whether it's an annual or a perennial, or open- or closed-pollinated. Open-pollinated crops, such as corn, soybeans and grasses, which are pollinated by wind, insects or animals, have more problems with gene flow than closed-pollinated species, such as grapes or apples. Waddell is particularly concerned about the development of genetically engineered turf grasses, which have a lot of weedy relatives. "You could start introducing traits that are really good for use on golf courses (the grass stays green, or it stays short), but the potential risk of those genes getting into the wild grass population is really high."

There are also the secondary environmental effects of genetic engineering on the animals that eat GE plants or GE-contaminated plants. Most people have heard, for example, of the problem of transgenic corn pollen

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poisoning monarch butterfly caterpillars that were munching on nearby milkweed plants. There has been a major effort by the chemical industry to discredit this study and raise questions about whether the poisoning ever happened, but according to Kim Waddell, it actually did. That's the part of the story that anti–GE activists like to tell. The part they don't tell, Waddell says, is that the most lethal varieties of corn were pulled from the market by the next growing season and never saw wide-scale introduction. That particular incident, he said, led both researchers and government regulators to look more carefully at the effects of GE on non-target species.

The front lines of an ag war

By the beginning of January, the GE Free Sonoma County campaign had gathered over 45,000 signatures, more than the number required for a special election. Solnit says he expects the special election to be held in May or June. Why the need for a special election? Why not just wait for the next regularly scheduled election? According to Solnit, the issue is simply too urgent to wait.

"Over the next year, several engineered varieties of fruits and vegetables will become available, and there will be a real push for the commercial planting of GE crops, not just in Sonoma County but throughout California. That's why there's a real sense of political urgency around this issue. We also have reason to believe Monsanto will attempt to preempt local ordinances by regulation on the state level. We believe that we'll be in a stronger position to argue for responsible regulation and perhaps a statewide ban if the counties act first. If we can stop this in Sonoma County, we can stop it in California," he says. "If we can stop it in California, we can stop it in the rest of the world. The campaign in Sonoma is part of a broader strategy."

How is the local agricultural community reacting to the initiative? The reaction seems to be split. None of the major agricultural organizations, including the Farm Bureau and the Sonoma County Grape Growers, has endorsed the initiative, but they haven't opposed it either. Nick Frey of the Sonoma County Grape Growers says that the organizers of the initiative met with his group several times and incorporated several of their objections into the final draft of the initiative, including a 10-year sunset clause and an escape clause that would allow the board of supervisors to override the initiative in case of an agricultural emergency. "We agree that there are concerns about GE crops," Frey says. "On the other hand, if someone develops a vine that's resistant to something as potentially devastating to the industry as Pierce's disease, we want to have the flexibility to look into that."

Lex McCorvey of the Farm Bureau says that his organization hasn't taken a position on the initiative either. Personally, though, you can tell that he's leaning against it. He put together an educational trip for the board of the Farm Bureau to visit farmers in the Central Valley that currently use GE crops. "We spoke with a farmer who's been growing genetically engineered corn, and he's seen a significant reduction in the amount of herbicides and pesticides that he's had to use, as well as a decrease in the amount of fossil fuels for farm equipment. It's a complex issue, and I don't think most people understand all the dynamics of it. That's why

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