Green Genes

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I cover science and medicine, and believe this is biology's century.

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Plant geneticist Pamela Ronald was just tagging along on a kayaking trip with a girlfriend when she met Raoul Adamchak 15 years ago. She spent her days in the lab, trying to figure out how to genetically engineer plants. He was an organic farmer--and genetically engineered crops cannot be organic. They fell in love and got married.

Despite the giant gap in the public mind between organic farming, which bans artificial pesticides and fertilizers, and gene modification, the couple was never exactly star-crossed. From the beginning, Ronald says, they shared this goal: figuring out how to grow crops in a way that could feed the Earth without destroying the environment. Shortly after she met Adamchak, Ronald began looking for a variety of rice that could resist the floods that annually destroy 4 million tons of crops in India and Bangladesh. She produced one, and in 2009 the rice was released to farmers.

Now Ronald, 49, and Adamchak, 55, have become proselytizers for the marriage of genetically modified foods and organic farming. Their goal: crops that limit the use of pesticides and fertilizers while

delivering more food per acre planted. They wrote a book together, *Tomorrow's Table*. An opinion piece she wrote for the *Boston Globe* won a 2009 National Association of Science Writers prize. They give lectures. They are leading a chorus of young scientists and forward thinkers who see genetic modification not as a threat to sustainable farming but as a new way to make it better. They are not fans of corporate agriculture but think genetically modified organisms represent a missed opportunity to make things better.

These true believers come as a flood of new gene crops approaches. The European Union estimates the number of GM traits in crops will quadruple to 120 by 2015. Only half will be made by for-profit companies. Stewart Brand, one of the founders of the back-to-the-land movement, has been arguing fiercely that environmentalists need to drop their anti-GM stance. So has Karl Haro von Mogel, a 27-year-old plant sciences graduate student at the University of Wisconsin at Madison, whose blog promotes the technology. "There's so much stuff going on that nobody even knows about," says Von Mogel. "There is this huge potential if we use the science to pursue those things that are possible."

Then there are farmers like Jose Baer, a California grower of organic walnuts. He knows that big companies will probably never want to make GM versions of a minor crop like walnuts, but he bemoans the fact that protecting his trees without pesticides is expensive (he uses pheromones to lure the insects into mating with everything but one another). Transgenic plants, engineered with an antipest gene, could kill the bugs. "I believe it's probably going to be a very valuable technology in the future," he says.

For Ronald the most powerful argument is that lives are at stake. A genetically engineered rice that contains vitamin A was created by academic researchers and the seed company Syngenta . It could

save the lives of 40,000 children a year--more, if people don't reject it just because it's genetically modified. "Greenpeace is against that," she says. Why? "People just really cannot imagine their child dying from any kind of vitamin deficiency."

Most naysayers have little understanding of agricultural genetics, Ronald says, and are under the impression that the food they eat is far more natural than it really is.

"You can never develop anything with no risk," she says. "Every single thing you eat every day has been genetically manipulated, unless you're eating wild Alaskan salmon or Maine blueberries." Plant and animal breeding go back maybe 14,000 years.

Foods created through a process called mutagenesis, in which seeds are exposed to chemicals or radioactivity until their traits change, can be certified organic, Ronald says. Yet, as the National Academy of Sciences has noted, this method is far more unpredictable than inserting a single gene from another species, as was done to produce insect-resistant corn, soybeans and cotton.

Ronald's flood-resistant rice is also certified organic through another loophole. The gene that lets the rice plant survive after being submerged in water comes from an archaic rice strain from before the dawn of agriculture, discovered by geneticists 50 years

ago. Initially she inserted the gene using bacteria, but then her colleagues managed to breed the ancient rice with modern varieties using genetics-assisted breeding technologies, which transferred the flood-resistance gene and not much else. That meant fewer regulatory hurdles.

Ronald says that genetically modified crops have proved remarkably safe for both people and the environment. When genetically modified corn not made for human consumption got into the food supply in 2001, there were many reports of allergies. But the Centers for Disease Control & Prevention found that none of them panned out. Insect-resistant corn containing the BT toxin, derived from a bacterium and used in organic farming, does kill butterflies and other good insects but far less than 1% of them. Traditional pesticides kill them all. A row of bt cotton has more diversity in insect species than the regular stuff. Besides, pesticides kill people, too: 300,000 a year, most of them impoverished farm workers.

In the eyes of these revisionist enviros, even Monsanto 's Roundup Ready crops, which are genetically modified to be resistant to the company's herbicide, have a good side. Roundup is not as toxic to animals or people as other herbicides, and the crops have allowed farmers to do less tilling. That means fewer tractors and the carbon-sparing equivalent of taking 6 million cars off the road.

Adamchak emphasizes that genetically modified crops can't overcome the lack of biodiversity in the farm system. But with organic farming representing 3% of U.S. crop production, there is certainly room for GM crops to help.

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