'Rewilding' Draws on the Past to Modify Plants

By Gina Kolata

What's in a name?

A lot, if the name is genetically modified organism, or G.M.O., which many people are dead set against. But what if scientists used the precise techniques of today's molecular biology to give back to plants genes that had long ago been bred out of them? And what if that process were called "rewilding?"

That is the idea being floated by a group at the University of Copenhagen, which is proposing the name for the process that would result if scientists took a gene or two from an ancient plant variety and melded it with more modern species to promote greater resistant to drought, for example.

"I consider this something worth discussing," said Michael B. Palmgren, a plant biologist at the Danish university who headed a group, including scientists, ethicists and lawyers, that is funded by the university and the Danish National Research Foundation.

They pondered the problem of fragile plants in organic farming, came up with the rewilding idea, and published their proposal Thursday in the journal Trends in Plant Science.

The best way to improve plants, they say, is with "precision breeding," using well-known modern methods for inserting and deleting genes in cells.

The researchers wrote that in the United States and Canada, non-G.M.O. foods are prohibited from having genes that could not have occurred in nature in that plant. So adding a fish gene to a plant, for example, is forbidden if the food is to be labeled non-G.M.O. But adding a gene from an ancient variety of the same plant using precision breeding would be allowed, Dr. Palmgren said.

In Europe, the rules are different, they report. There, G.M.O. is defined by the process, not the product. The methods of genetic engineering are forbidden, even if the gene that is added is from the same plant. That means "rewilded" foods created with precision breeding could be labeled non-G.M.O. in the United States, but not in Europe, they conclude.

Rebecca M. Bratspies, a law professor at the City University of New York who has no public position on the G.M.O. or organics debate, said the issue is not the definition of G.M.O. in the United States -- there is no legal definition of G.M.O., she noted. Instead, it is the definition of "organic" that matters.

To be labeled organic, food cannot have a foreign gene that was introduced with today's genetic engineering methods. For rewilding with precision breeding, the question of whether the food was organic would hinge on whether the gene that was introduced was considered "foreign."

"There's definitely an argument to be made there," on each side of the issue, she said.

Brise Tencer, executive director of the Organic Farming Research Foundation in Santa Cruz, Calif., said she is skeptical of the idea that proponents of G.M.O.-free foods would accept precision breeding.

"They take a term that sounds really wonderful, but genetic engineering is genetic engineering is genetic engineering," Ms. Tencer said. "It is not something farmers want. It is not something consumers want. I don't think it is a very viable concept."

Charles Benbrook, an adjunct professor of crops and soils at Washington State University, said he worries about the precision part of precision breeding. There can be unexpected effects on other genes when a new gene is added or an existing one is silenced, he said. Other scientists acknowledge that point, but add that researchers typically test the plants, just as they do with crossbreeding, and select those with the desired characteristics.

The Danish group may not get the response it expects from people already skeptical of genetic engineering, Dr. Benbrook said, adding, "I think they will be frustrated" by the reaction.

Dr. Benbrook is an expert witness in five class-action lawsuits against food companies who labeled foods as natural...
when they included soybeans, wheat or corn that had been genetically modified.

The idea of restoring long-lost genes to plants is not new, said Julian I. Schroeder, a plant researcher at the University of California, Davis. But, wary of the taint of genetic engineering, scientists have used traditional breeding methods to cross modern plants with ancient ones until they have the gene they want in a crop plant that needs it. The tedious process inevitably drags other genes along with the one that is targeted. But the older process is “natural,” Dr. Schroeder said.

For example, in 2006, scientists discovered an ancient variety of rice that produces meager yields but resists flooding. Rice plants in Southeast Asia were dying every year when monsoons flooded rice paddies, keeping the plants submerged for more than a week at a time.

Scientists found the gene that makes the rice resistant to flooding; after a couple of years of crossbreeding, researchers were able to grow rice plants with the flood resistance gene of the ancient rice. Now, Dr. Schroeder says, flood-resistant rice is grown by more than four million farmers in Southeast Asia.

Many of the plants grown today by both conventional and organic farmers were created with brute force and imprecise methods, scientists said. Researchers deliberately mutated plants with chemicals and radiation, altering thousands of genes at once, and then searched the resulting plants to find ones with traits they wanted. Though the plants were created using unnatural methods, they can be grown using organic farming techniques.

Nina Fedoroff, a plant researcher and emerita professor at Pennsylvania State University, said it seems nonsensical to say a plant is natural when it is mutated by chemicals and radiation, but not when a gene from an ancient variety of the same plant is added with methods of molecular biology.

And sometimes the old-fashioned crossbreeding methods just will not suffice, she said.

As an example, she noted that Chinese scientists recently made bread wheat that is resistant to a devastating fungal disease called rust. Bread wheat plants, she said, are “genetic monstrosities created 3,000 years ago” with three different genomes. Scientists knew which gene they had to knock out to make wheat rust-resistant. But because wheat has three genomes, it is impossible to use crossbreeding to knock out that gene in all three at once. So the researchers used Crispr, a gene-editing technique, to surgically remove the gene.

“They did not create a transgenic plant,” Dr. Federoff said. "They knocked out a gene that makes a plant susceptible to rust."

Researchers have previously crossbred wheat plants with traits found in ancient varieties, noted Maarten Van Ginkel, who headed such a program in Mexico at the International Maize and Wheat Improvement Center.

“We selected for disease resistance, drought tolerance,” he said. "This method works but it has drawbacks. You prefer to move only the genes you want.”

When Dr. Van Ginkel crossbred for traits, he did not look for the specific genes conferring those traits. But with the flood-resistant rice plants, researchers knew exactly which gene they wanted. Nonetheless, they crossbred and did not use precision breeding to alter the plants.

Asked why not, Dr. Schroeder had a simple answer -- a complex maze of regulations governing genetically engineered crops. With crossbreeding, he said, "the first varieties hit the fields in a couple of years."

And if the researchers had used precision breeding to get the gene into the rice?

“They would still be stuck in the regulatory process,” Dr. Schroeder said.

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