TECHNOLOGY

DOES ORANGE JUICE HAVE TO GENETICALLY MODIFY OR DIE?

CITRUS GREENING, A BACTERIAL DISEASE THAT'S RAVAGING ORCHARDS, HAS BROUGHT THE OJ INDUSTRY TO A CROSSROADS.

BY SATTA SARMAH

Everybody loves Florida orange juice. Since its emergence in the late 1940s, the sunny beverage has survived hurricanes and anti-sugar diet crazes to become as common on American breakfast tables as scrambled eggs.

But Florida's citrus industry is facing a new existential threat: Citrus greening, a bacterial disease spread by an insect called the Asian citrus psyllid, is killing Florida's citrus trees. The disease emerged in 2005 and since then citrus production has slowed. Last year Florida produced only 104.4 million boxes of oranges—its lowest in about 30 years.

Researchers and industry experts say they have a potential solution: genetic engineering. Texas A&M University and University of Florida researchers are separately testing GMO citrus. Erik Mirkov, a plant pathologist at Texas A&M AgriLife Research and Extension Center who has been working on solutions to citrus greening for nine years, has developed an approach that uses spinach defensins to strengthen oranges' resistance to greening.

Mirkov says if Americans want to keep orange juice on their tables, genetic engineering is the best option. "Greening is in Florida and Brazil, so the two biggest producers of oranges in the world could potentially not be able to grow them anymore," Mirkov says. "In a case like this, it's not a nice-to-have, it's a must-have."

Dr. Erik Mirkov
Photo: courtesy of Texas A&M AgriLife Research & Extension Center

But will Americans want their OJ with a side of spinach? That's still up for debate, especially as questions about the safety of GMO foods continue. Opponents say those who want to save the citrus industry need to look elsewhere and explore non-GMO options—such as organic growing and using parasites to the kill the citrus psyllid—which promote sustainable control of the disease. Genetic engineering could be a game-changer for the citrus industry, but it also could be an uphill battle to get GMO oranges from research labs to supermarket shelves to kitchen tables.

Immature young orange showing aborted seeds and lopsidedness.
Photo: courtesy of Ron Brlansky, Plant Pathologist, IFAS, University of Florida, Lake Alfred

FROM LAB TO FARM TO TABLE

Citrus greening is a blow to an already-ailing industry. Orange juice consumption hit an 18-year low this year, and consumers increasingly have more exotic fruit juice options such as acai berry, but lower production also has affected sales.

Citrus greening is undoubtedly part of the problem. Most of the world's citrus-producing regions, including several Asian countries, Brazil, Florida, Texas and California, have experienced greening. The disease begins in a citrus tree's roots, infecting a tree before a grower can do anything to stop it, making an otherwise healthy fruit resemble a weird hybrid of a lime and orange.

"Greening disease has been in the world for a long time. It's been around for as long as it has and we haven't found a non-GE cure to date," says Rick Kress, president of Southern Gardens Citrus, the world's largest supplier of pure Florida orange juice. "Every researcher that is aware of this disease has said the ultimate solution is going to be genetic engineering."

Mirkov and Jude Grosser, a researcher at the University of Florida, agree. Mirkov is working closely with Southern Gardens Citrus, and his approach has been used on the most commonly grown oranges,

grapefruits and popular lemon varieties in Texas and Florida. So far, spinach defensins have made many trees resistant to greening and others more tolerant to it, meaning they have the bacteria at lower levels than a conventional citrus tree and can still bear fruit.

Grosser's research explores both GMO and conventional breeding approaches. On the GMO side, Grosser's team has scoured the plant kingdom to find genes that can be introduced to citrus trees to improve their resistance. Though researchers will need to go through a thorough regulatory process to ensure GMO citrus meets the same standard as the normal fruits, Grosser says only one foreign gene is being added to the plant, so there shouldn't be a significant difference between the two. Whether consumers agree is another issue.

"The consumer base in the U.S. is a bit more accepting than other places in the world, but the two major orange juice companies—PepsiCo. and Coca-Cola—are international companies, so that complicates the issue," Grosser says. "Orange juice companies are going to want this to be salable worldwide before they try to commercialize this."

Even still, the citrus industry has a lot of educating to do. Recent surveys show that Americans are skeptical of GMO foods—only a third of people believe they're safe to eat. Another survey finds 93% of American consumers want labels for GMO foods so they can avoid them.

Any GMO solution would require regulatory approval by the USDA, FDA, and EPA, but opponents say so far these agencies have rubber stamped other GMO foods.

"People are concerned that this is a new technology and that it's not being well-regulated," says Bill Freese, a science policy analyst at the Center for Food Safety.

"Whenever you transfer a foreign gene into a crop where it hasn't existed before, you create potential food safety risks because it creates a new protein that people haven't been exposed to."

Lopsided pumelo fruit infected with Asian Citrus Greening disease.
Photo: courtesy of Division of Plant Industry, Florida Department of Agriculture and Consumer Services

Freese says it could take about 30 years to build resistant citrus trees through genetic engineering and commercialize them, which he says would be too late. He says there are better approaches the industry can explore, including a nutritional approach that involves treating infected trees with a mix of micro- and macronutrients; biocontrol methods involving parasitic wasps and fungus that kill the citrus psyllid; and heat treatments that use PVC tents over smaller trees and seedlings to trap heat that suppresses the disease and stimulates healthy growth.

"There have been a lot of experiments with using GMOs for disease resistance, but the majority of them have failed and never resulted in viable crops," Freese says. "To develop a typical biotech crop costs a $135 million, and that's a huge investment of resources when there's a good chance of it failing."

But Mirkov says proposed non-GMO solutions aren't viable or sustainable. He is continuing his research and is hopeful there will be small-scale commercialization of GMO citrus trees within the next four years, which could pave the way for more production. If and when this happens, consumers will have to choose whether to put that carton of GMO-labeled orange juice in their grocery basket or simply leave it on the shelf.

[Photo: Flickr user Basheer Tome]

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