News & Opinion

The Beginning of the End for Bananas?

Already reeling from a 20-year losing battle with a devastating disease, the banana variety eaten in the United States is now threatened by a new—but old—enemy.

By Dan Koeppel | July 22, 2011

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Our standard supermarket banana, a variety called Cavendish, may be at the brink of disaster. Chosen for its resistance to a fungal pathogen that wiped out its predecessor, the Gros Michel banana, the popular fruit has long battled a related fungus, which has all but devastated the banana industry in certain parts of the world. Now, it appears the Cavendish variety is facing a new threat—the very same fungal disease that drove Gros Michels off the market.

Cavendish bananas account for about 45 percent of the fruit's global crop, with an annual export value of US$8.5 billion, according to the United Nations Food and Agriculture Organization. It was chosen to replace the original Gros Michel banana after a deadly fungal infection, known as Panama disease (*Fusarium oxysporum f. sp. Cubense*), wiped out much of the world's banana crop in the first half of the 20th century.

Farmers adopted the Cavendish variety because it appeared to resist the blight, as well as about a dozen other banana diseases that also threaten the worldwide crop. But it wasn't long before it too started suffering from disease. In the late 1980s, a mysterious malady began to wipe out Asian Cavendish plantations. Soil samples were sent to plant pathologist Randy Ploetz of the University of Florida's Tropical Research and Education Center, who made the shocking identification: Panama disease was back, in the form of a new strain, which he dubbed Tropical Race 4.

Race 4 is just as virulent to Cavendish as Race 1 was to Gros Michel. The fungus enters the plant via its roots through infected soil or water and spreads via the plant's vascular system. Once exposed, the plant yellows, and begins to look obviously sick—dried-out, sunken, and sagging. As the disease progresses, brown and purple stripes appear on the trunk, and the plant eventually dies. The disease, however, lives on, spreading via infected soil from plant to plant, plantation to plantation.

Today the disease has spread across Asia, into the Pacific, and to Australia, where it has devastated the island country's banana industry. Though Race 4 has yet to hit Latin America, where bananas imported to the United States are grown, there's little doubt it will, said Ploetz.

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But it turns out that Race 4 is not the only threat to Cavendish bananas. As banana growers have fled from Race 4, replanting their Cavendish trees in areas only known to harbor Race 1, they quickly learned that Gros Michel's old foe was now tormenting Cavendish bananas as well.

In 2010, scientists conducting a survey of plants infected in India, which grows and consumes more bananas than any other country in the world, were the first to conclusively identify the presence of Race 1 in the Cavendish banana. They published their findings in *Plant Disease* that November, and this March, Bioversity International—the global umbrella group for banana research—released a report confirming the finding: Race 1 had begun killing Cavendish plants in plantations around the Theni District of Tamil Nadu, India.

Banana scientists are still trying to determine why some Cavendish are no longer immune to Race 1. Altus Viljoenm, a researcher with the University of Stellenbosch in South Africa, speculates that this new strain of Race 1 may have evolved over time so that it could attack Cavendish.

Other researchers are skeptical of the finding. Ploetz notes that there have been rare cases in which Race 1 has killed individual Cavendish plants when they were already stressed—due to drought conditions, for example, or flooding. "I suspect that this is the same thing," he said.

But the authors of the *Plant Disease* paper reported that they had confirmed the finding with laboratory tests on sterile, potted Cavendish. "To our knowledge," the researchers wrote, "this is the first report of [such] a virulent strain."

Today, there are no cures, treatments, or even reliable molecular diagnostic tests for either Race, partly due to lack of detailed information on the banana genome, according to Bioversity. Currently, the best available strategy is containment. Ploetz has developed a plan to fight Race 4 if it appears in Latin American plantations, involving the use of strict quarantines on affected plantations to prevent, at least temporarily, the spread of the disease.

But isolating infected plantations is more a stopgap than a solution, Ploetz knows. "It buys time," he said, but barring any new discoveries, the spread of Panama disease remains inevitable. Ploetz

said it's important that similar agricultural practices be instituted in already affected countries to help prevent the spread to Latin America in the first place.

In the meantime, scientists are working to develop new approaches to quell disaster. Last year, for example, University of Queensland researcher James Dale began the first field tests of a genetically modified Cavendish, which he hopes will provide long-term resistance against Race 4.

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Banana companies such as Chiquita and Dole are also reportedly working to develop new varieties. Though genetic modification has long been considered the only way to breed Cavendish, since the variety is completely sterile, recent research conducted in Honduras has revealed that a few Cavendish plants do produce viable seeds. Researchers at the Fundacíon Hondureña de Investigación Agrícola (FHIA) say these non-sterile fruit form the basis of a series of promising hybrids, that can be bred for resistance to the fungi. It will still be at least six years before the new breeds are ready to be brought to market, however, according to a source familiar with the project, or may never appear at all, now that the banana companies are no longer funding the research.

Most banana researchers agree that the real answer—as has been the case with crops like potatoes, apples, and grapes—is to abandon the monoculture that makes the emergence of a disease so devastating. A more diverse banana harvest would allow farmers to isolate susceptible bananas, surrounding them with more resistant varieties. If the solution ends up being a Cavendish stand-in that is resistant to both strains, on the other hand, the predicament of the banana monoculture—with its vulnerability to old, new, and yet-to-be discovered pathogens—would continue.

Dan Koeppel is the author of "Banana: The Fate of the Fruit that Changed the World." His account of a search, conducted in the Democratic Republic of Congo, for potentially diversifying banana breeds will appear in National Geographic in 2011.
