Science

*Monocultures of the Cavendish banana variety are highly susceptible to Fusarium.*

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# Devastating banana disease may have reached Latin America, could drive up global prices

By Erik StokstadJul. 17, 2019 , 2:20 PM

In a long-feared development, an extremely damaging banana disease has apparently reached Latin America. Late last week, the Colombian Agricultural Institute (ICA) in Bogotá confirmed that four plantations in northern Colombia have been quarantined because of suspected infection with Fusarium wilt tropical race 4 (TR4), a fungus that kills plants by clogging their vascular system. Already widespread in Asia, the disease can wipe out entire plantations.

The finding has yet to be confirmed, but countries in the region are on high alert. Neighboring Ecuador is the largest banana exporter in the world; Colombia, Costa Rica, and Guatemala are big producers as well. A major outbreak of TR4 could ruin many farmers and drive up banana prices globally. "It poses a big threat," says Rob Reeder, a plant pathologist at CABI, a nonprofit research and outreach center for plant diseases in the developing world, based in Egham, U.K. "This should really start raising alarm bells." "We should take this extremely seriously," adds Gert Kema, a plant pathologist at Wageningen University in the Netherlands.

TR4 is a variant of Panama disease, which wiped out banana plantations across Latin America in the mid-20th century. The industry recovered after it replaced the most widely cultivated banana variety at the time, Gros Michel—also known as the Big Mike—with a new one, the Cavendish, that is resistant to Panama disease and now dominates the export industry.

TR4, which easily overcomes the defenses of the Cavendish and many other banana varieties, emerged in Indonesia in the 1960s and has spread to many other countries since then. It surfaced in Jordan in 2013, in Mozambique 2 years later, and also in India, the world's largest banana producer. Scientists dreaded its jump to the Americas, suspecting it was only a matter of time: "I wasn't surprised, but I was shocked," Kema says.

In June, staff at a large Colombian banana plantation spotted suspicious symptoms on trees and alerted ICA. After an initial polymerase chain reaction test for the fungus DNA came back positive, ICA launched its contingency plan, closing four farms and destroying all plants within 10 meters of samples that tested positive. ICA officials also established checkpoints to disinfect vehicles and boots and expanded disease surveillance in another 1100 hectares. So far, samples from the wider area have come back negative.

To confirm the presence of TR4, samples from the four farms will be analyzed by Wageningen University and KeyGene, a plant breeding company also in Wageningen; they expect to have the strain's genome sequence in early August. "We are trying to do this as fast as possible, but it takes time," says Fernando Garcia Bastidas, a Colombian researcher at KeyGene.

The sequence may also shed light on the origins of the fungus and how it arrived in Colombia. *Fusarium* is spread largely by contaminated soil and infected plant materials. It's possible that the strain arrived with farm machinery from abroad, or was carried by traveling farm workers or tourists. Banana leaves, used for wrapping food in many countries, are another potential infection route. (Bananas themselves do not spread the disease.)

Fungicides can't save plants that are already infected with TR4, and the fungus's spores persist in soil for decades. The only way to contain the pathogen, once a plantation is infested, is to destroy all of the plants and take the farm out of production for many years—while trying to prevent the spores from escaping in runoff.

Data on TR4's economic toll are scarce, but one estimate puts the damage for Indonesian farmers at $120 million annually, and for farmers in Taiwan at double that amount. After TR4 was detected in Queensland in Australia in 2015, "most farmers implemented extensive biosecurity measures which are very expensive and very restrictive," says James Dale of the Queensland University of Technology in Brisbane. Meanwhile, he says, "Areas in which there is TR4 are quarantined and therefore out of production. There is a double economic hit." Filipino farmers have tried to cope with the disease by abandoning infested plantations and planting on clean soil elsewhere. But that strategy only lasts until clean land runs out—and often, farmers have contaminated the new fields in the process.

TR4 may be harder to control in Central and South America than in Australia, Dale says, because many more hectares are in production and many smallholder farmers don't know about, or can't afford, control measures.

New ways to battle the scourge are on the horizon. Adding certain types of biomass to the soil and covering it in plastic can kill the spores, as the material decomposes and releases gas toxic to bacteria and fungi. In trials conducted by Kema and his colleagues in the Philippines, the technique significantly reduced the number of spores, suggesting it might help contain the disease.

The longer-term solution is the same one that saved plantations decades ago: replacing the vulnerable plants with a resistant variety. The Honduras Foundation for Agricultural Research in La Lima has spent decades breeding TR4-resistant bananas, but so far the results have not lived up to the Cavendish in properties such as taste and resistance to blemishes. A genetically

modified Cavendish produced in Dale's lab has shown resistance to the fungus in early field trials. Dale says that banana is now in larger trials; he hopes it can be commercialized in 2023. But whether consumers will buy transgenic bananas remains a question. "It's down to public perception," Reeder says.

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What's already clear from TR4's apparent arrival in Latin America, Kema says, is that banana cultivation cannot continue without major changes. "This is a turning point for the industry," he says.