

Biotech

In focus



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Will We Still Have Bananas?

Google “no more bananas” and you’ll find national and international stories about a virulent race of Panama disease. This fungus has the potential to wipe out the global export market for bananas, which is centered in Latin America and based on the ‘Cavendish’ banana that can be found in every grocery store.

Bananas are the world’s most popular fruit, so it’s not surprising that news media covers the untreatable Panama disease and another fungal killer, Black Sigatoka, which is currently managed through frequent use of fungicides. In Africa, especially Uganda where banana are the number one staple, bacterial Xanthomonas wilt (BXW) has swept through small farmer plantations. All current bananas are susceptible to BXW disease.



Banana Aphid musarama.org



Closer to home, bananas face another threat. In Hawaii, the ‘Williams’ banana, a cousin to the ‘Cavendish’, is highly susceptible to Banana Bunchy Top Virus (BBTV). BBTV is spread by the banana

aphid and causes dramatic stunting of the banana plant. While less vulnerable than the ‘Williams’, the ‘Dwarf Brazilian’ cultivar—known locally as apple banana—is also susceptible to this virus. In a state that imports 90 percent of its food, bananas have been an exception. Hawaii doesn’t export bananas, but in most years we’ve consumed more locally farmed bananas than imports. By increasing costs and decreasing yields in Hawaii, BBTV can shift this balance, resulting in Hawaii depending on imports of bananas grown thousands of miles away.

BBTV was first observed on Oahu in 1989 and has since been found in Kauai, Maui, Molokai, and several regions of Hawaii Island, including Kailua-Kona, North Kohala, and much of Hilo and Puna. Current measures to combat BBTV rely on planting disease-free banana plantlets produced using tissue culture, spraying insecticides for aphid control, and using herbicides or mechanical methods to kill and remove infected banana plants. There is no known source of natural resistance to BBTV in bananas. Growers worry that as BBTV advances through East Hawaii, the virus will become established in steep ravines along the Hamakua Coast, where eliminating infected plants would be very difficult.



Ania Wiczorek, PhD

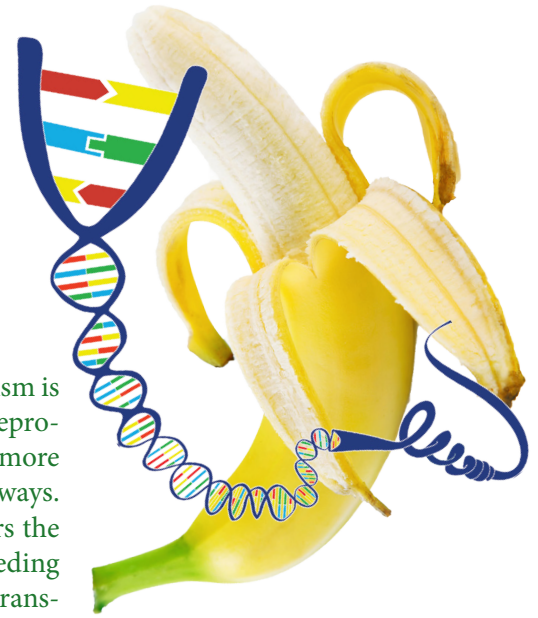
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Defending Against Virus

Dr. John Hu (Department of Plant and Environmental Protection Sciences, College of Tropical Agriculture and Human Resources, UH Manoa) is collaborating with Dr. Leena Tripathi of Kenya's International Institute of Tropical Agriculture to evaluate 'Williams' banana plants that have been genetically engineered to resist BBTV. These genetically modified (GM) bananas contain the gene for a BBTV protein called "Rep", which is involved in making copies of the virus.

When the engineered banana plants produce Rep protein, a plant defense mechanism is triggered. If BBTV is later transmitted to the plant by an aphid, the virus cannot reproduce inside the plant, because rather than following BBTV's instructions to make more viruses, the plant destroys the viral instructions. This approach fights BBTV two ways. First, it prevents the virus from infecting the GM banana plants. Second, it lowers the level of BBTV present in the banana aphid population, since uninfected aphids feeding on the GM plants become less likely to suck up virus particles that could later be transmitted to susceptible plants.



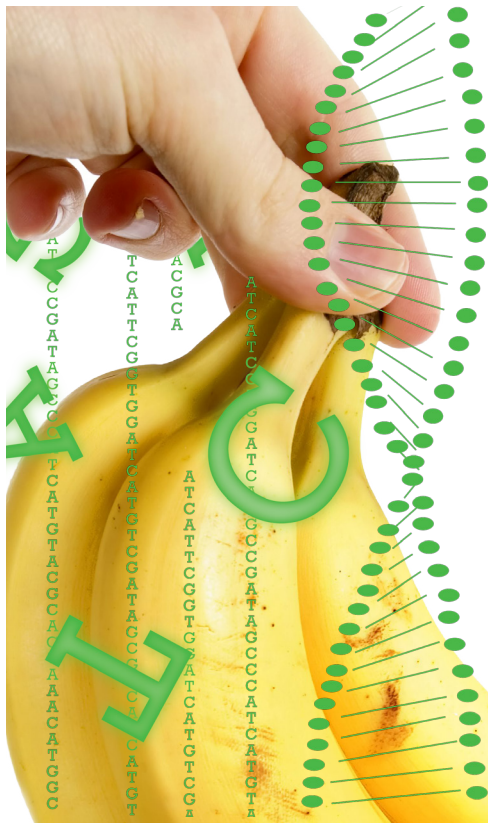
Field Testing



Greenhouse and field testing of GM banana plants for BBTV resistance will take place on Oahu. Bananas grown for fruit are reproduced from vegetative tissues; the female flowers of 'Williams' bananas are effectively sterile and do not set seeds. However, to guarantee that the Rep gene is not transferred to non-GM banana plants, male flowers will be removed before they can release any pollen.

Valuable Resistance

BBTV resistance could be a valuable trait for growers, limiting yield losses, saving on labor costs, and decreasing the application of insecticides and herbicides. As diseases threaten banana production in Hawaii and around the world, consumers may someday choose between GM bananas or none at all.



A Greater Impact



Next to BBTV, BXW has been the worst diseases to affect bananas in this century. Cultural control measures have been tried to control BXW, such as the quick removal of diseased plants, and these practices can reduce the impact but seem not to be sustainable. BXW is now wide-spread in Central and East Africa. Anti-GMO activists are preventing small-farmers from getting access to resistant transgenic bananas. The resistant bananas were developed by Ugandan Government and University scientists. In Africa, BXW has a greater impact as all varieties are susceptible and more importantly millions of people in these regions depend upon bananas as their staple food.