FORUM

Premier Papaya Plantations Rescued Through Science and Teamwork

Hawaii's papayas are among the world's finest. But only a few years ago, the state's papaya industry was in crisis.

In 1995, at the height of the disaster, Hawaii's most extensive and most productive papaya-growing district, the Puna region on the eastern coast of the Big Island of Hawaii, was besieged by papaya ringspot virus. The virus causes unsightly ring-shaped blemishes and drastically reduces the amount of fruit that a tree would otherwise produce. Though the fruit remains safe to eat, the unattractive appearance makes it unmarketable.

Before the virus hit Puna, farmers in that district often grew more than 50 million pounds of papaya a year. Their harvests of this popular and flavorful fruit constituted more than 90 percent of the state's papaya crop.

But soon after the virus struck, Puna district's production plummeted, hitting a financially devastating low of about 26 million pounds in 1998.

Papaya ringspot virus, discovered and named in Hawaii in the 1940s on the Island of Oahu, is carried from plant to plant by aphids. It is the cause of the worst viral disease of papaya worldwide, and there is no cure. At the time it showed up in Puna, there was no effective strategy for its prevention, though work on biotech-based tactics had been the subject of experiments beginning in the mid-1980s.

ARS scientists here at the U.S. Pacific Basin Agricultural Research Center in Hawaii teamed up with papaya growers and with colleagues from the University of Hawaii, Cornell University, and Pharmacia-Upjohn to bring the best available knowledge to bear on how to battle the viral disease. Within 6 years after the virus first emerged in Puna, they were able to provide distraught growers with two remarkable new varieties of papaya—the yellow-fleshed Rainbow and the red-fleshed SunUp. These papaya trees were highly resistant to the pathogen and produced tasty fruit that shipped and stored well.

Instantly popular with growers, packers, and consumers, Rainbow and SunUp today constitute about 60 percent of all papayas grown in Hawaii. Puna district production has continued to recover, reaching a respectable 40 million pounds of fresh fruit in 2001, for instance.

This team effort, credited with rescuing Hawaii's $47 million papaya industry, is a notable example of the speed at which science can provide workable solutions.

Today, the story of how people worked together to help save Hawaii's papaya orchards has spread beyond the shores of this state. Researchers and government agricultural officials in other countries where papaya orchards have been infected by papaya ringspot virus—including Brazil, Venezuela, Jamaica, Thailand, and Bangladesh—are interested in learning all they can from the Hawaii model. They are working to bring this practical strategy for disease prevention to the farmers of their nations. That is significant because, in these countries and others, people eat papaya nearly every day.

The lasting protection for Rainbow and SunUp is based on a biotech strategy in which a gene from the virus itself becomes the key to its undoing. Rainbow and SunUp trees contain the gene for a protein that would normally coat, or enclose, the virus. The presence, inside a papaya tree, of the coat protein gene is a powerful deterrent. The gene triggers a defense response in the trees, providing strong resistance in the event of attack by the ringspot virus. The results are somewhat analogous to those obtained with vaccines that protect people from disease.

Though Rainbow and SunUp are very successful, scientists at the U.S. Pacific Basin Agricultural Research Center intend to accomplish even more. The scientific discoveries coming from this program will benefit everyone who grows, ships, or enjoys eating papayas.

Scientists at the center have expanded the family of ringspot-resistant papayas to include a new specialty papaya called Laie Gold. Developed by our ARS team, Laie Gold is a delectable, yellow-fleshed papaya especially suited for growing on the Island of Oahu. Our researchers are investigating a newer and faster way to accomplish the costly, unavoidable chore of replanting papaya orchards and are pursuing leading-edge strategies to foil *Phytophthora,* another destructive papaya foe. (See story, p. 4.)

Papaya specimens needed for these studies, and for other papaya research worldwide, are provided from parent plants preserved and safeguarded for perpetuity at an ARS-managed repository in Hilo, Hawaii. (See story, p. 7.)

More and more Americans are becoming acquainted with the delightful tastes and textures of papaya and other tropical fruits. ARS scientists and the growers, university and industry researchers, and others with whom we work will continue to provide new, useful, and intriguing findings to meet the growing demand for appetizing and nutritious tropical fruits.

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