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First Genetically Engineered Papaya Released to Growers in Hawaii

See the APSnet* featured article of the September '98: Transgenic Virus Resistant Papaya
*American Phytopathological Society Plant Pathology On-Line Webzine

by John Zakour and Linda McCandless

Hilo, HI - Growers are depending on the virus-resistant 'SunUp' and 'Rainbow' to restore the pot of gold to the Hawaiian papaya industry, which has been decimated by the deadly papaya ringspot virus in recent years. Seeds from the genetically engineered fruit will be distributed free of charge on May 1 - an historic occasion that marks the coronation of over 20 years of work.

"Commercialization of 'SunUp' and 'Rainbow' could save the entire Hawaiian papaya industry," said Cornell University plant pathologist Dennis Gonsalves, who helped genetically engineer resistance for papaya ringspot virus into the plants."

"This is the first commercialization of a genetically engineered virus resistant perennial fruit crop," said Dennis Gonsalves, plant pathologist with Cornell University's Agricultural Experiment Station at Geneva, NY. Gonsalves cooperated with researchers from the University of Hawaii, the USDA, and Upjohn to develop the new varieties. "As researchers, we are always very happy to see some of our efforts become practical reality."

Papaya - Hawaii's fifth largest crop - generates $45 million in annual revenues, but yields have been dropping steadily. The virus reduces fruit quality and quantity and eventually kills the trees. From 1993 to 1997, papaya production fell from 58 million pounds to 36 million pounds.

"These seeds give the papaya industry in Hawaii a second chance," said Emerson F. Llantero, manager of the Papaya Administrative Committee (PAC), of Hilo, HI, whose beleaguered growers helped finance much of the research.

"This genetically engineered, disease-resistant papaya is an excellent example of improving agricultural productivity through partnership," said Michael V. Dunn, assistant secretary for USDA's marketing and regulatory programs. "In this case, the partnership between USDA, Cornell, and the University of Hawaii has resulted in a papaya that is environmentally safe, will lower input costs for producers, provide a better product for consumers, and improve export potential."

In addition to Gonsalves, the research team that developed the improved papaya lines includes horticulturist Richard Manshardt of the University of Hawaii, Honolulu-based USDA plant physiologist Maureen Fitch, Upjohn Company scientist Jerry Slightom, and the Papaya Administrative Committee.

The team used recombinant DNA techniques to isolate and clone a gene in the virus that encodes for production of the coat protein of the virus. The gene was "shot" into cells of the papaya plant using a special gene gun developed by John Sanford at the Geneva Experiment Station, where Gonsalves works. Expression of the gene in the resulting papaya line renders the plants resistant to the virus, thus producing more fruit of higher quality. Scientists have dramatic photographs of test plots where genetically engineered papaya trees are thriving next to virus-riddled non-genetically engineered trees.

The transgenic papaya will have no harmful effects on humans because the virus already infects fruit that consumers eat. Gonsalves noted: "The only way we have affected papaya quality is to make it resistant to the virus and improve its survivability." The first fruit from the genetically engineered seeds should be available in stores in about a year.

Jim Hunter, director of the Geneva Station, compares the process of conferring resistance using a gene from the virus to "molecular immunization." "The techniques used to develop the resistant papaya are a 'model system' to investigate the practicality of cross protection to control other plant viruses," he said.

"Using a mild strain of a virus to protect plants against infection by a severe strain of the same virus is a potentially practical way to control virus diseases of crops important in New York - especially the tomato ringspot virus infecting peaches, and viruses infecting cucurbits," said Gonsalves. The Liberty Hyde Bailey professor envisions a worldwide network of scientists transferring knowledge and technology as well as cooperating in the sharing of genes to solve food problems in a global village of hungry people.

Genetic engineering of fruits and vegetables can increase yields while decreasing

the amount of chemical fungicides required to grow them. Bio-engineering desired traits can often reduce the time it takes plant breeders to alter a plant by traditional methods, perhaps by a factor of about five, saving millions in crop development.

The virus-resistant papaya were deregulated by APHIS, EPA, and FDA in 1997. The Cornell Research Foundation and PAC pursued licensing, which was successfully obtained in April 1998. In anticipation of commercialization, PAC funded seed production over a year ago, and the seed from 1,000 acres is now being released.

Note to Editors: Click on photograph to download a 300 ppi version. If you prefer an electronic file or a hard copy of the photo, contact Rob Way at 315-787-2357, rfw2@cornell.edu.

Suggested caption: "Commercialization of 'SunUp' and 'Rainbow' could save the entire Hawaiian papaya industry," said Cornell University plant pathologist Dennis Gonsalves, who helped genetically engineer resistance for papaya ringspot virus into the plants.

FOR FURTHER INFORMATION, contact:
Dennis Gonsalves (Cornell Univ., NYSAES): 315-787-2334, dg12@cornell.edu
Richard Manshardt (Univ. of Hawaii): 808-956-6093, manshard@hawaii.edu
Emerson F. Llantero (Papaya Administrative Committee): 808-969-1160, papayas@aloha.net

See also Practical Control of Plant Viruses through Pathogen-Derived Resistance, a seminar presented at the Cornell Community Conference on Biological Control, April 11-13, 1996.

Contact: Linda McCandless, Communications Services
Telephone: (315) 787-2417
e-mail: llm3@cornell.edu

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