Biotech "Vaccine" Protects Peanuts

A biotech "vaccine" that protects peanut plants from deadly viruses could be just around the corner, a U.S. Department of Agriculture scientist reports.

Robert Jarret of USDA's Agricultural Research Service has taken the first steps toward developing such a vaccine. Using genetic engineering, Jarret and University of Georgia scientists Jim Demski, Zhijian Li, and Ming Cheng inserted virus genes into peanut cells.

The virus genes make proteins contained in the protective coating that surrounds the virus. The coat proteins themselves are harmless to the plant.

But inside the peanut plant, the coat proteins—at least in theory—apparently trigger a reaction similar to a vaccine in humans, Jarret says. The coat proteins alert the plant that an outside organism has invaded, and the plant is then better able to protect itself from the virus that the coat protein gene was isolated from.

"Peanut seedlings grown from the transformed cells retain the virus protein genes and are more virus-resistant than normal peanuts," adds Jarret. He is a geneticist in the agency's Plant Genetic Resources Conservation Research Unit in Griffin, Georgia.

Jarret says it's the first time scientists have been able to genetically engineer virus resistance into peanut plants that remain fertile and produce nuts. Until now, genetically engineering peanuts has been unsuccessful because the resulting plants are usually sterile.

Later this year, in greenhouse tests, Jarret will go a step further in testing the vaccine effect. He'll grow the seedlings into mature peanut plants and inoculate them with virus, to see if the plants continue to be resistant.

"We're confident that the grown plants will be vaccinated against the viruses, based on our work with peanut cells and seedlings," he says. "But we can't say for certain until our greenhouse studies are completed."

Human vaccines often contain a piece of the targeted germ—or a weakened strain of it—that alerts the body's immune system to produce antibodies and attack the invading organism. Such a strategy was used to eradicate smallpox and other diseases.

For the first time, scientists have been able to genetically engineer virus resistance into peanut plants that remain fertile and produce nuts.

Jarret says the plant virus proteins are similar to a human vaccine. But he cautions that scientists do not know the exact mechanism for this phenomenon in plants.

During the 1993-95 peanut study, the scientists used two genetic engineering procedures to move the virus protein genes into peanut cells called protoplasts. These cells have had their cell walls stripped so that foreign genes can be inserted.

In one genetic engineering method, called electroporation, an electrical charge moves the virus genes into the protoplasts. In another procedure, researchers put the virus protein gene into a special bacterium, *Agrobacterium tumefaciens*. The bacterium then infects the peanut cells, carrying the virus genes into the cells.

The researchers inserted virus protein genes from peanut stripe and tomato spotted wilt viruses, two serious threats to U.S. peanut production. Virus diseases cost growers an estimated $10 million a year. Twenty-four viruses infect peanuts worldwide, four in the United States. Peanut stripe and tomato spotted wilt are two of the worst.

"Very little genetic resistance to viruses has been found in peanut germplasm, so that's why we're interested in taking the vaccine approach," says Jarret, whose research is partly funded by a plant genome research grant under the USDA National Research Initiative.

Aside from virus resistance, Jarret says, scientists could also use genetic engineering to develop plants that are resistant to aflatoxin contamination and insect feeding.

"Once we've perfected this process for peanut viruses, the procedure can be used to transfer other genes into peanuts. There's a lot of potential to improve them," he says.—**Sean Adams,** ARS.

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