USDA SPECIAL GRANT

Research Progress and Impact

PROTECTING ORCHARDS FROM FIRE BLIGHT BACTERIUM

January 2005

Summary of Research Accomplishments

- Enhanced the expression of an apple gene that switches on a tree's natural defenses when fire blight attacks.
- Adapted a new biological control — an otherwise harmless virus that kills the fire blight-causing bacteria.
- Identified genes in the bacteria that cause fire blight.
- Improved management strategies to control other phases of the disease, such as when the blight attacks plant shoots.
- Identified alternatives to a common and overused antibiotic control.

George Sundin/MSU

Fire blight infects the blossoms of fruit trees, causing blossom blight and infecting the emerging fruit. The disease also can spread from the blossoms into the twigs and limbs, eventually reaching the roots and killing the tree.

George Sundin/MSU

Fire blight can kill an apple tree in as little as 30 days. It's called fire blight because it can spread like wildfire under ideal conditions. And it takes only one infected blossom on a tree to kill it under those conditions.

Research for your future.

For questions about this or other MAES publications, contact Geoff Koch (kochg@msu.edu; 517-355-0123).

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PROTECTING ORCHARDS FROM FIRE BLIGHT BACTERIUM

Researchers at that Michigan Agricultural Experiment Station (MAES) and the New York Agricultural Experiment Station are cooperating to confront fire blight — a bacteria-caused disease that is a major threat to Michigan's apple trees.

RESEARCH ACCOMPLISHMENTS

Enhanced the expression of an apple gene that switches on a tree's natural defenses when fire blight attacks. MAES scientists cooperated with scientists from the New York Agricultural Experiment station to enhance the expression of the gene in apple seedlings. (Genes contain instructions for all traits, including immune systems, of plants and animals.) Trees harboring this boosted apple gene also show increased resistance to apple scab and cedar apple rust diseases.

A. Jones

Since the 1950s, growers have controlled fire blight by spraying the antibiotic streptomycin. In the 1990s, streptomycin-resistant strains of the blight-causing bacteria turned up in Michigan. MAES sicentists are identifying streptomycin alternatives — including bacteria-killing viruses — to help control the disease.

Adapted a new biological control — an otherwise harmless virus that kills the fire blight-causing bacteria. MAES scientists are working with an enzyme produced by a virus that infects the fire blight bacterium. (Enzymes are substances that turn biochemical reactions on and off.) The virus-produced enzyme breaks open fire blight cells and kills them. MAES scientists are attempting to adapt this enzyme to field conditions. Use of the enzyme is a novel form of biological control and another tool in the arsenal to reduce the reliance on antibiotic sprays.

Identified genes in the bacteria that cause fire blight. MAES scientists completed an initial study in which all of the genes used by the fire blight bacteria to infect fruit were identified. Having a list of genes makes it easier to focus the development of disease control. MSU researchers are aiming at two critical genes in the bacteria as targets for disease-fighting compounds.

Improved management strategies to control other phases of the disease, such as when the blight attacks plant shoots. After several consecutive years of field trials, MAES scientists, successfully incorporated prohexadione calcium into other blossom blight control activities. Prohexadione calcium is a growth inhibitor that helps trees control shoot blight. Using the integrated programs enables growers to defend trees against both critical disease phases (blossom and shoot) of fire blight.

Identified alternatives to a common and overused antibiotic. The presence of streptomycin-resistant strains of fire blight bacteria in apple orchards makes it harder to control disease. MAES scientists identified alternative chemical, biological and cultural control methods that can substitute for streptomycin to aid in the control of blossom blight.

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