12. Bacterial Resistant Citrus

Citrus canker, caused by a bacterial pathogen, is one of the most devastating diseases to affect citrus crops. Severe infections lead to defoliation, dieback and premature fruit drop, reducing yields by as much as 50%. The lesions canker produces on infected fruit makes the fruit unsalable in the fresh market. In addition, possible quarantines on citrus-producing regions where canker has been detected threaten to eliminate sales to canker-free citrus-producing regions.

Approximately 75-80% of all citrus produced in the U. S. is grown in Florida (26 billion pounds), including 100% of domestic limes and approximately 65% of domestic fresh grapefruit. Total annual citrus production in Florida is worth approximately $1.2 billion. Citrus canker is an ongoing threat to Florida's citrus industry. In the first half of the 20th Century, Florida spent $6 million, removed 258,000 trees and destroyed three million nursery plants to eradicate the disease. Citrus canker reappeared in 1986, and from 1986 to 1994 Florida spent $27 million and removed 89,000 trees to eradicate it a second time. Since 1995, Florida has implemented a third citrus eradication program, so far destroying more than half a million residential trees and more than a million orchard trees. The eradication program costs have escalated from $10 million per year when it was implemented in 1996, to $50 million in 1999, to $145 million in 2000.

Citrus canker is spread over short distances by wind and rain, on farm equipment and orchard workers, and over long distances by the transport of infected plant material. Management of citrus canker spread includes decontamination of equipment and workers between fields, and inspection of nursery stock and fresh fruit harvests. Orchard practices include installing windbreaks around fields and applying copper, the only material available for use in citrus for canker management. Copper applications may reduce incidence of the disease by protecting leaves and fruit, but copper will not eliminate infections already present. As with many plant diseases, the ideal management tool would be resistant cultivars, of which none are available.

Through biotechnology, transgenic citrus plants have been developed through the insertion of synthetic genes which produce antibodies. The antibodies specifically bind to and deactivate pathogenic proteins produced by the citrus canker bacterium. Preliminary trials indicate these transgenic citrus plants have moderate canker resistance, and research continues toward the goal of full immunity to canker.

Potential Impacts of Bacterial Resistant Transgenic Citrus

Changes in Production: 1.56 billion pounds per year yield loss prevented ($72 million/yr.)
Changes in Pesticide Use: 1.6 million pound per year increase in copper prevented
Changes in Production Costs: $56.7 million per year savings in management costs

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