5. Viral Resistant Tomato

Whitefly transmitted geminiviruses have had major economic impacts on U.S. tomato production in the last decade, particularly in Florida. This is due to the introduction in 1987 of a new whitefly that feeds on tomatoes, followed by the development of two geminiviruses in 1989 and 1997 that infect tomatoes and that are spread by the new whitefly. Reduction in crop value of 1990-91 Florida tomatoes due to the first geminivirus, tomato mosaic virus (ToMoV), was conservatively estimated to be 20%, or $140 million. The second geminivirus, tomato yellow leaf curl virus (TYLCV), may reduce a tomato plant's production severely, or even eliminate it, depending on when in the season the plant is infected.

There are no commercially available cultivars with immunity or significant tolerance to geminiviruses. Geminivirus management therefore has been based on whitefly management. Multiple applications of various insecticides were used, with inconsistent results, until 1994 and the introduction of imidacloprid, a systemic insecticide with efficacy against all whitefly lifestages. Currently, growers use one soil application of imidacloprid at planting, followed eight weeks later by a rotation of foliar insecticides. Whitefly treatment programs are expensive, but losses due to ToMoV and TYLCV remain low as a result.

Research on transgenic, virus resistant tomatoes began at the University of Florida in the early 1990's. Studies on pathogen-derived resistance revealed that tomato plants transformed with a mutated copy of a symptom-inducing viral gene did not develop symptoms even when infected with the virus. This procedure for pathogen-derived resistance has been used to produce tomato lines with resistance to ToMoV and lines with resistance to TYLCV. Field tests show that in the absence of virus pressure yields of transformed varieties are equal to yields of untransformed varieties. In the presence of virus pressure, transgenic plants remain symptom free with yields 1.7 times greater than the non-transformed commercial hybrid.

**Potential Impacts of Viral Resistant Transgenic Tomatoes:**

| Change in Production: | none |
| Change in Pesticide Use: | 64,600 lbs/yr reduction in insecticides |
| Change in Production Costs: | $4.2 million/yr savings in insect control |

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**Full Report:** *Plant Biotechnology: Current and Potential Impact For Improving Pest Management In U.S. Agriculture An Analysis of 40 Case Studies* by Leonard P. Gianessi, Cressida S. Silvers, Sujatha Sankula and Janet Carpenter  
National Center for Food and Agricultural Policy, June 2002.  
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