Grafting heirloom tomatoes for increased plant vigor and virus tolerance

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In organic and transitional vegetable production, there are few options currently available to growers for virus management. Tomato yellow leaf curl virus (TYLCV) is a particularly difficult problem for tomato growers and can completely devastate crops, reducing yields to zero when early infection occurs. Previous work in vegetable grafting has shown promise for control of a variety of pathogens using soilborne pathogen-resistant rootstocks. Few studies have shown potential for management of viruses through the use of resistant rootstocks (Jenns and Kuc, 1979; Rivard et al, 2008).

A field trial and a research farm-microplot trial were conducted to evaluate heirloom tomatoes used as scions grafted to the commercial cultivar 'Tygress'. Heirloom variety tomato scions evaluated were ‘Purple Calabash’, ‘Black Prince’, and ‘Moskvich’. These varieties are highly susceptible to tomato yellow leaf curl virus (TYLCV) and early-season infection with this virus can completely eliminate crop yields. A small-fruited tomato, 'Matt's Wild Cherry' has been observed to also have tolerance to TYLCV. For the on-farm field trial, all three heirloom varieties were grafted onto both of the tolerant varieties used as rootstocks. All heirloom varieties were assessed on their own roots as ungrafted controls, as were the two varieties used as rootstocks. Plants were produced in a commercial setting in protected, raised beds, according to USDA organic production standards typically utilized by the grower for tomato. Plants were infected by the native whitefly population. Virus infection was evaluated weekly for 12 weeks. Area under the disease progress curve (AUDPC) was calculated for each grafting treatment. Although there was a range of AUDPC values of 20.11 for Tygress alone to 60.55 for Moskvich ungrafted plants, the variability in the field resulted in no significant differences between treatments. However, in microplot studies conducted at the USDA-ARS farm, when plants were infected via viruliferous whiteflies prior to planting in the field, there were significant differences between final virus ratings for Black Prince ungrafted (87% of plants with visual symptoms) versus Black Prince grafted on Tygress (42% of plants with visual symptoms), and for Moskvich ungrafted (73%) and Moskvich grafted on Tygress (36%). Asymptomatic infection in some graft combinations was detected using tissue blot nucleic acid hybridization, which has been previously documented for TYLCV (Friedmann et al, 1998; Srinivasan et al, 2012) and interestingly, many grafted plants with severe symptoms showed virus infection of the tolerant Tygress used as the rootstock.

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