Evaluation of TYLCV-resistant Tomato Cultivars under Commercial Conditions in Southwest Florida Spring 2009

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The trial was conducted in a commercial farm near Immokalee, FL. Twelve TYLCV-resistant varieties were evaluated and compared to two susceptible grower standards in a completely randomized experimental design with three replications, respectively (Table 1). Two additional treatments included grafted plants: (1) resistant TYLCV (root-stock)/susceptible TYLCV (scion), and (2) susceptible TYLCV (root-stock)/resistant TYLCV (scion).

**Cultural Practices**

Seed were planted in flats and grown by Redi Plants, Corp. The field was rototilled, and the pre-plant fertilizer (bottom mix and top “hot” mix) was applied following the modified broadcast method to supply 300-60-462 lb.acre⁻¹ of N-P₂O₅-K₂O. Beds 36-inch wide and 9-inch tall and formed on 6-ft centers (1 acre = 7,260 linear bed feet). Beds were then fumigated with methyl bromide and chloropicrin (50:50, w:w) at the rate of 200 lb.acre⁻¹. All beds were immediately covered with aluminized VIF polyethylene mulch. On 9 Jan 2009, transplants were established in the field at a within-row spacing of 22 inches, which created a stand of approx. 4,035 plants/acre. Plots were 36-ft long in 2008 (20 plants). On 28 days after transplanting (DAT), each tomato variety was pruned following the seed company’s specifications (Table 1). The field was seepage irrigated and tomato plants staked and tied. Pesticide applications were made as needed in response to regular scouting reports according to UF/IFAS recommendations (Olson et al., 2006). Ten tomatoes plants were harvested three times on 21 April, 6 and 20 May 2009 (102, 117 and 132 DAT).

**Data collection**

The whitefly (Bemisia argentifolii) population was monitored using a leaf-turn method and TYLCV symptomatic plants were counted at the third harvest 20 May 2009. The number of plants showing symptoms of fusarium crown rot (caused by Fusarium oxysporum f.sp. radicis-lycopersici) in each plot was also noted at third harvest 20 May 2009. Bacterial spot (caused by Xanthomonas campestris) was rated as percentage foliar cover at the third harvest 20 May 2009. Tomatoes were graded in the field using a potable grading table according to USDA specifications for extra-large (5x6), large (6x6), and medium (6x7) fruit categories (USDA, 1997). Total unmarketable tomato fruit numbers were recorded and categorized into odd shape (OS) blossom end scar (BES), discoloration (DISC), and scaring (SC), as described by Gilreath et al. (2000).
Tomatoes were harvested at breaker stage on 21 April 2009 (harvest 1) and 6 May 2009 (harvest 2). After harvest, tomatoes were placed in 25-lb boxes and transported to the Garguilo, Inc. packinghouse (Immokalee, FL). After 6 days of ethylene ripening treatment, a subsample of tomatoes from each variety and replication were transported to the UF Postharvest Horticulture Laboratory in Gainesville, FL for quality evaluation. These fruits were stored at 68°F until they reached table-ripe stage defined as “the point at which red-ripe tomatoes became noticeably softer when pressure was applied with thumb and fingertips to the equatorial region of each fruit”. All postharvest quality parameters were evaluated once the tomatoes reached table-ripe stage. Firmness was tested using a deformation meter (1 kg-force applied for 5 sec) with an 11-mm convex probe at the fruit equator. Higher values indicate softer fruit. Color was measured by reflectance using a chromameter (Minolta Chroma Meter CR-2000). One color measurement was taken per fruit at the equatorial region. Color data is expressed as follows: L value: zero = black, 100 = white, Hue angle: 0° = red; 90°= yellow; 180° = green, Chroma value: Color intensity; the higher the value, the more intense the color. Three fruit from each cultivar were placed in a plastic bag and frozen for later chemical analysis. Frozen pulp samples were thawed and homogenized then centrifuged at 15,000 RPM for 20 min at 41 °F. The supernatant was filtered through cheesecloth and the tomato juice was used to determine soluble solids content (SSC), pH, and total titratable acidity (TTA). TTA and pH were determined using an automatic titrimeter (Titrino 719S, Metrohm, Switzerland). Aliquots 6g (0.013 lb) of tomato juice were diluted with 50ml deionized water then titrated with 0.1N NaOH to an end point of pH 8.2. TTA is expressed as percent citric acid. The SSC was determined with a Mark Abbe II digital refractometer (Reichert-Jung, Model 10480, Depew, NY) and expressed as °Brix.

A field day was conducted at first harvest 21 April 2009. Participants using a 1-to-5 scale (1= very poor; 5=very good) in a blind test evaluated the varieties in earliness, plant vigor, fruit size, firmness, fruit quality, potential yield and an overall plant rating at first harvest 21 April, 2009. Data yield components, SSC, pH, TTA, firmness, and field evaluation to TYLCV variety responses were analyzed using ANOVA and Duncan’s Multiple Range Test at 5%. Amount of fruit defects by TYLCV, fusarium crown rot, and bacterial spot percentage by variety were transformed by Arcsin distribution before the ANOVA and Duncan’s Multiple Range Test (SAS, 2002).

**Extension Activities**

The extension activities: A field day held at the grower’s cooperator in Immokalee was well-attended (65 attendees). According to 23 responses from participants in the blind test, best overall TYLCV varieties for the spring 2009 were ‘Tygress’, ‘SVR 200’ and ‘HM 8845’ based in earliness, plant vigor, fruit size, firmness, fruit quality, potential yield and an overall plant rating (Table 7).

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Field Day Photos

Previously, no clear advantage or disadvantage has been demonstrated by using TYLCV resistant varieties under conditions of low or no virus pressure during springs TYLCV variety evaluation (Cushman and Stansly, 2006; Ozores et al., 2008). In contrast, this year ‘Tygress’ demonstrated a better performance in the extra-large fruit category over the standard susceptible ‘FL 47’ and ‘Sebring’.

Results and Discussion

Overall weather conditions during the trials in South Florida recorded by the Florida Automated Weather Network (FAWN) was cool and dry with five (21-23, Jan., 5 Feb. and 3 Mar.) freeze events during the spring of 2009. Rainfall during the season showed accumulations of 3.0 inches.

Whitefly population, TYLCV incidence, bacterial spot, and fusarium crown rot rating: Whitefly pressure was low in spring 2009, with an average whitefly count of 0.5 to 1 ± 1.0 and 2 to 5 ± 1.0 adult per leaf at the beginning and end of the season, respectively. The were no TYLCV symptomatic plants among varieties (Table 1). There were no significant differences in bacterial spot or fusarium crown rot among TYLCV varieties at third harvest (Table 1). The incidence of bacterial spot range from 25 to 37% and fusarium crown rot was 0 to 47% (P ≤ 0.05).

Fruit yields

First harvest extra-large ranges from 336 to 1,733 boxes/acre, total extra-large (all harvest combined) 462 to 2,165 and total harvest (all sizes and harvest combined) 1,549 to 3,210 boxes/acre (Table 2, Table 3, Table 4).

First harvest of extra-large fruit yields and total first harvest (all sizes combined) are given in Table 2. First and second combined extra-large, total first and second harvest (all sizes combined) are given in Table 3. Total extra-large and total harvest (all sizes and harvest combined) are given in Table 4. By all measures, yields were greater for ‘Tygress’, ‘Tygress on FL47’ grafted plants and ‘Sur 200’ than the rest of the varieties (P<0.05). However, ‘Tygress’, Tygress on FL47’ grafted plants and ‘Sur 200’ total first harvest (all sizes combined), first and second harvest combined (all sizes combined), total harvest (all sizes and harvest combined) were not significantly different than ‘BHN 765’, HM 8845, FL 47 on Tygress’ grafted plants, FL 47 (control) and Sebring (control).

Total unmarketable tomato categories for first harvest, first and second harvest combined (all sizes combined) and total harvest (all sizes and harvest combined) were lowest with ‘Tygress’, ‘Tygress on FL47’ grafted plants, ‘FL 47’ on ‘Tygress’ grafted plants, ‘Sur 200’, ‘FL 47’ and ‘Sebring’ and the highest ‘BHN 765’, ‘FLA 8577’ and ‘8578’, ‘HA 3096’, and ‘Sak 5230’ (Table 5). The large number of unmarketable (odd shape, blossom end scar, discoloration, and scar) fruit found with TYLCV-resistant cultivars was consistent with
results from spring 2007 and 2008 (Ozones et al., 2008), but in contrast to other studies (Gilreath et al., 2000; Scott, 2004 and Cushman and Stansly, 2006).

The most common defect types as percentage of the total unmarketable yields harvested per TYLCV variety were scaring (SC) and odd shape (OS) followed by blossom end scar (BES) and discoloration (DISC) (Table 5). TYLCV varieties with the highest percentage of odd shaped fruit were ‘Tycoon’, ‘FL 47’, and ‘FL 47’ on ‘Tygress’. Those with the lowest percentage were ‘BNH 765’, ‘HA 3075’ (‘Ofri’), ‘HA 3095’, and ‘Sak 5230’. Highest percentage of blossom end scar were ‘FL 8578’ and ‘Sak 5230’ and lowest with ‘SVR 200’, ‘Tygress’, ‘FL 47’ on ‘Tygress’, ‘FL 47’ and ‘Sebring’. The highest percentage of scaring occurred with ‘SUR 200’, ‘Tygress’ and ‘HM 8845’ and the lowest with ‘FL 8578’.

**Post-harvest Evaluation**

There were no significant differences in firmness, pH, SSC, and TTA among TYLCV varieties (Table 6). The authors would like to thank Southwest Vegetable Growers Association, Sakata, Hazera, Harris Moran, Seminis, BHN and Six’L Farms for providing monetary or in-kind support for this project.

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