



Field Evaluations of Tomato Yellow Leaf Curl Virus-Resistant Varieties for Commercial Production

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Tomato is an economically important crop for many small- and large-scale producers in Hawai'i. Tomato yellow leaf curl, caused by Tomato yellow leaf curl virus (TYLCV), is a devastating disease of tomato worldwide and was first detected and identified in commercial tomato plantings around O'ahu and Maui in 2009 (Melzer et al. 2009). It has since been identified in the Kona area of Hawai'i. Susceptible varieties become chlorotic, with interveinal discoloring; they are stunted due to shortened internodes; leaflets curl or cup upwards at the leaf margins; and the plants suffer from reduced fruit set due to premature flower abortion.

TYLCV is transmitted by sweetpotato (*Bemisia tabaci*) and silverleaf (*Bemisia argentifolii*) whiteflies but is not transmitted by the greenhouse whitefly (*Trialeurodes vaporariorum*). TYLCV is not spread through mechanical means. Alternate hosts for the virus include solanaceous crops such as potato, pepper, tobacco, etc. Common beans and weeds are also known to harbor the virus. Alternate hosts do not typically exhibit virus-like symptoms.

TYLCV can completely devastate commercial tomato operations without proper control strategies statewide. It is important to screen and identify resistant varieties that can tolerate this virus. In 2010, a replicated field trial



Leaf curl and interveinal chlorosis. All photos by Michael Melzer and Jari Sugano.

was installed at the Poamoho Research station with 11 commercial varieties with putative resistance to TYLCV (Table 1). Kewalo was selected as a susceptible control. Four replications were installed, with twelve plants of each variety per replication. The varieties were evaluated based on total marketable yield, total marketable count, grade-A yield, grade-A count, and tolerance to TYLCV.

Plants were seeded in April and transplanted in May 2010. Harvest period was from June through September 2010. Varieties selected for this evaluation included determinate and indeterminate plant types and beefsteak, Roma, and cherry fruit types.

Harvest data were collected weekly. Fruits were sorted and graded based on the Hawaii Department of Agriculture's market standards for tomato. Data were analyzed with the computer software SigmaPlot. A tissue blot hybridization assay was used to identify the presence of TYLCV.

Results

Overall, data indicated varieties VT-62940 and VT-62966 had the highest marketable yields, followed by Adonis, Tygress, PIK Ripe 461, and Tovi Star (Figure 1). Indeterminate varieties such as Adonis, Tygress, and PIK Ripe 461 had the highest yield of grade-A fruit in



Close-up of leaf discoloration



Stunting effect due to shortened internodes.



Susceptible local variety with upward-cupping leaf margins

Table 1. Tomato varieties used in TYLCV-resistance field trial

Variety Name	Type	Seed Source
Adonis	Determinate	Seminis
Tygress	Determinate	Seminis
PIK Ripe 461	Determinate	Seminis
Sunchaser	Determinate	Seminis
Sunsugar (yellow cherry)	Indeterminate	Seminis
Yaqui	Determinate	Seminis
Tovi Roca	Indeterminate	Zeraim Gedera
VT-62966	Indeterminate	Zeraim Gedera
VT-62940	Indeterminate	Zeraim Gedera
Xaman (Roma type)	Determinate	Seminis
Kewalo	Determinate	UH CTAHR
Tovi Star	Indeterminate	Zeraim Gedera

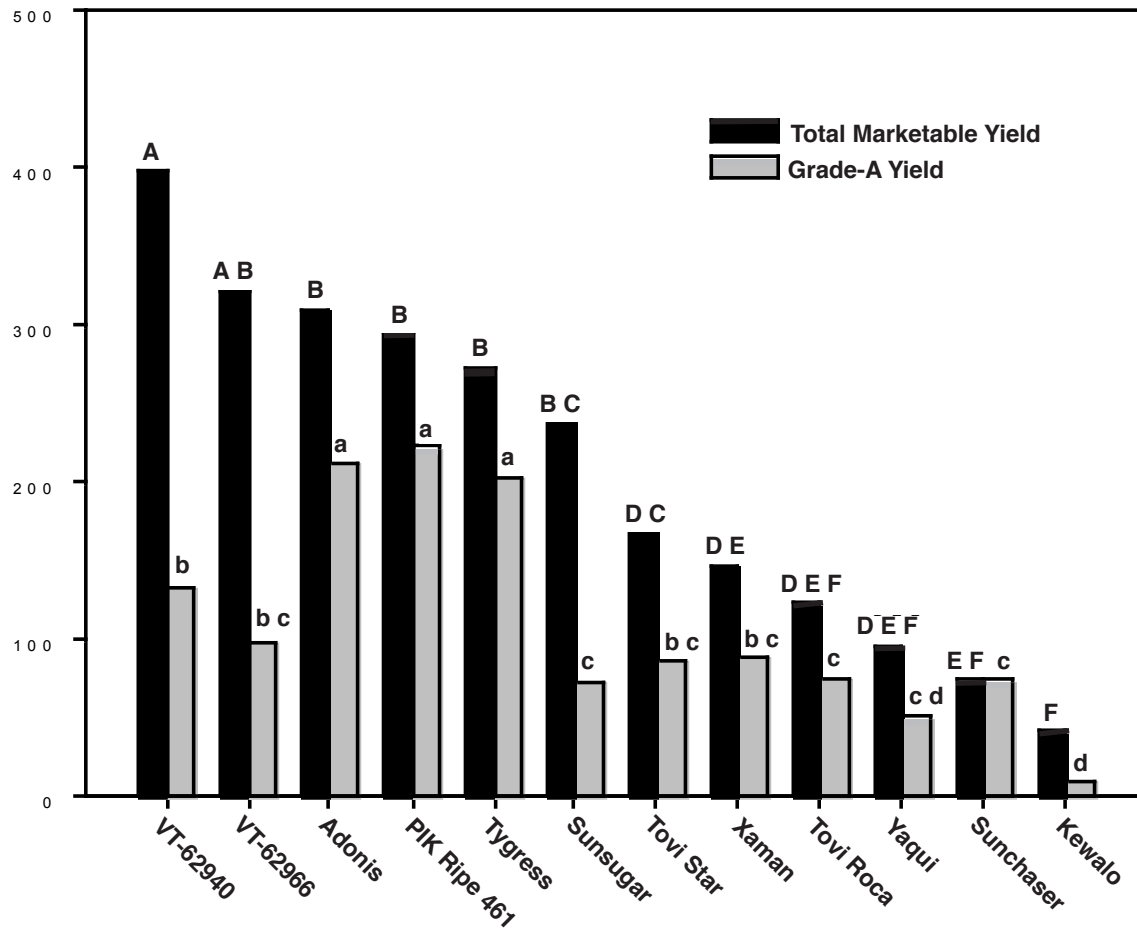
comparison to other varieties. A single VT-62940 plant developed symptoms of tomato yellow leaf curl and tested positive for the virus. A mix-up in seed may account for this result, although it is possible that this high-yielding variety is not entirely resistant to the virus. Further field evaluations may be needed to assess VT-62940 resistance to TYLCV.

Screening Process for TYLCV

For each variety, two plants were sampled from each of the four replications ($2 \times 4 = 8$). These samples were evaluated for the presence of TYLCV using a tissue blot immunoassay. The dark spots indicate the presence of the virus (Figure 2). All Sunchaser, Sunsugar, and Kewalo (susceptible control) plants evaluated were strongly positive for TYLCV. A single VT-62940 plant was also found to be strongly positive for TYLCV. Plants that tested strongly positive for TYLCV also had severe disease symptoms. The remaining varieties (Adonis, Tovi Star, Tovi Roca, VT-62966, Yaqui, PIK Ripe 461, Xaman, and Tygress) tested negative or weakly positive for TYLCV and had no observable disease symptoms.

A field day was conducted to showcase the different varieties to interested stakeholders. Growers evaluated

Figure 1. Total marketable and grade-A yield of different varieties. Means followed by the same letter are not statistically significant ($p < 0.05$). Capital letters separate the means of total marketable yield, and small letters separate the means of grade-A yield.



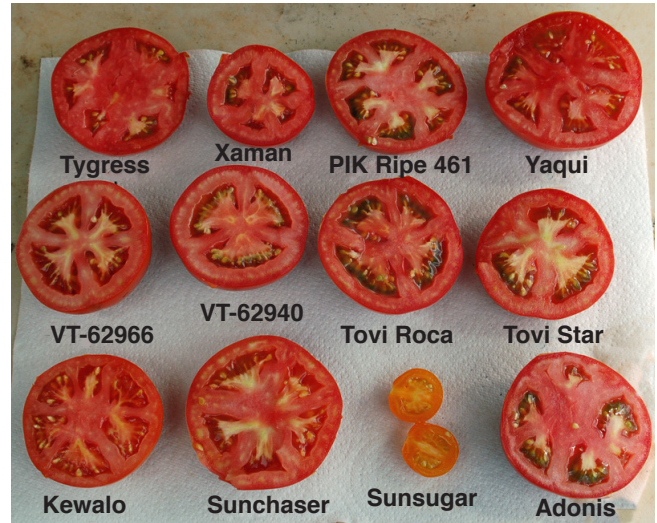
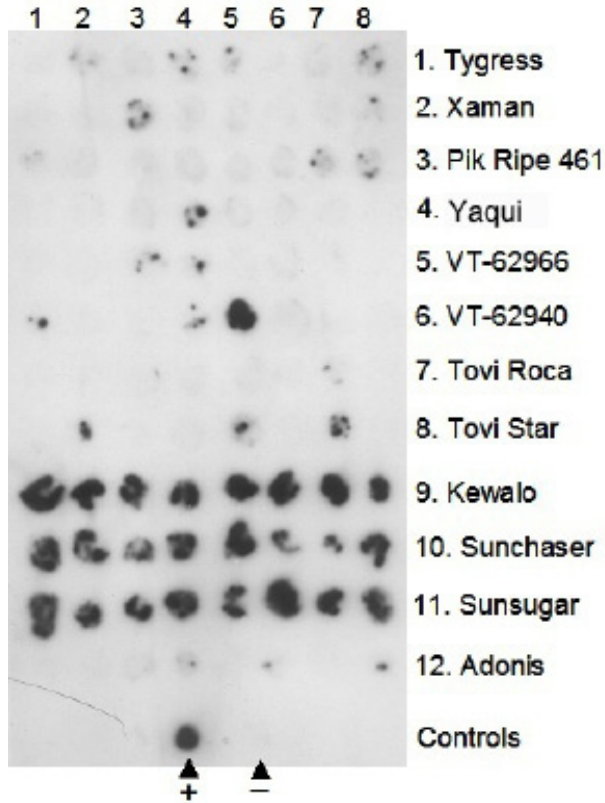
the horticultural characteristics of tolerant hybrids and are in the process of assessing their suitability to their localized field operations via seeds obtained through various seed companies. A further consideration is tomato spotted wilt virus (TSWV), another important virus that can severely hinder tomato production in Hawai'i. The varieties evaluated in this study were putatively resistant to TYLCV but were susceptible to TSWV. As such, many plants were lost to TSWV infection. Currently there are only a few commercial tomato varieties that have putative resistance to both TYLCV and TSWV. We have obtained seeds of these varieties, and they are currently under evaluation. The results of this study will

be released in a subsequent CTAHR publication. Applied field testing by CTAHR and adoption of tolerant varieties by producers may lead to increased productivity and long-term sustainability of Hawai'i's tomato industry.

Acknowledgements

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Figure 2: Tissue blot immunoassay results for the 12 different tomato varieties. A black dot indicates the presence of TYLCV.



References

Melzer, M. et al. 2009. Tomato Leaf Curl. University of Hawai'i at Mānoa, College of Tropical Agriculture and Human Resources, Plant Disease publication PD-70.

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Mention of company names does not imply endorsement by UH CTAHR.

