Tomato Spotted Wilt Field Day-July 11, 2023

Robert L. Gilbertson, Distinguished Professor, Department of Plant Pathology, UC Davis

Situation: In 2021 and 2022, outbreaks of spotted wilt disease caused by tomato spotted wilt virus (TSWV) in processing tomato fields established with resistant varieties in the Northern Counties (Colusa, Glenn, Sutter and Yolo) and Sao Joaquin and Contra Costa Counties were **caused by resistance-breaking (RB) strains of TSWV (RB TSWV)**. **In 2023,** we are seeing spotted wilt in more fields, mostly at low incidences (1-3%), and it is caused by **two RB TSWV variants**: **Fresno RB TSWV**, the one that appeared in 2016 and a new one in California, **Colusa/Sutter RB TSWV.**

Background

-**Tomato spotted wilt disease** (TSWD) is caused by **tomato spotted wilt virus (TSWV),** an **unusual plant virus** composed of **three segments of RNA** (large [L], medium [M] and small [S]) enclosed in **membrane from the host plant**, which is embedded with glycoprotein spikes.

-TSWD is currently the **most common and damaging virus of processing tomatoes in California**.

-The disease is **typically most severe in Fresno, Kings and Merced Counties. It is becoming more important in the Northern counties.**

-Outbreaks in the mid-2000s caused economic losses in Fresno and were managed by an **integrated pest management (IPM) program** that features the **planting of resistant varieties**, i.e., with the *Sw-5b* gene from the wild species *L. peruvianum*.

The symptoms and impact of TSWV infection varies depending on the stage of growth plants are infected

-Seedlings-severe stunting, yellowing and necrosis-high yield loss potential

-Vegetative to flowering-distorted growth; curling, yellowing, necrosis of leaves-medium-high

-Fruit stage-fruits bumpy and have blotches and ringspots and shoot die-back-medium-low

How to confirm TSWV infection

-We are fortunate to have the **rapid immunostrip test for TSWV** infection, which takes **10 minutes and can be performed in the field.**

-However, **this test detects non-resistance breaking and RB strains**

-RB-TSWV must be detected with 1) a **molecular test**, either RT-PCR or RT-PCR and sequencing, and 2) by **inoculating resistant varieties** and observing development of typical spotted wilt symptoms

How is TSWV transmitted plant-to-plant?

-**Only by the thrips insect vector**, which is mostly the **Western flower thrips in California**

-**Not via seeds or by contact***

-TSWV replicates in cells of the thrips vector, but fortunately **is not passed to the offspring**

-**Importantly, for winged adults to spread TSWV they must acquire the virus as larvae**

How to monitor for thrips and decide when and what to spray?

-Thrips monitoring is done by 1) **yellow sticky cards** (a major effort) or by 2) **monitoring the 'Thrips Degree Day (DD) Predictive Model'** developed by Neil McRoberts and associates (https://ucanr.edu/sites/TSWVfieldriskindex/Thrips_Population_Projections/), which predicts when thrips generations will appear, based on temperature, but does not indicate actual populations

-For the DD model, **thrips management is recommended when the 2nd and 3rd generation adults are predicted to appear**, with earlier sprays if spotted wilt is observed in fields, and then as needed up to full canopy cover with well-sized early fruit set. This can slow the spread of TSWV.

-For **fields having high populations of thrips and RB TSWV infections**, a spray for thrips just before harvest (1-2 weeks) can substantially reduce the spread of the winged viruliferous adults to nearby fields.

Insecticide options for thrips management

-There are **limited options**

-These are currently the most effective materials for the Western flower thrips (the predominant vector in California): **dimethoate**, **Radiant** (spinetoram), **Success** (spinosad) and **Lannate** (methomyl)

-In general, the **effect of these material is relatively short-lived (~2 weeks)**

How does TSWV persist in the absence of tomato plants?

-In weeds (e.g., prickly lettuce and sowthistle), bridge crops (e.g., lettuce and radicchio) and in pupae of viruliferous larval thrips from the previous season.

-In general, the inoculum level early in the season is relatively low

IPM for RB TSWV

Before the season

-Assess weed and bridge crop potential to serve as inoculum sources

-Obtain TSWV-free and thrips-free transplants

-Varietal selection: plant Sw5 varieties with genetic backgrounds that provide some additional resistance/tolerance to the virus, making it less susceptible to RB-TSWV (work of Tom Turini)

-Field selection: avoid planting tomatoes back-to-back in fields with severe outbreaks in 2021 (due to potential for overwintering of viruliferous thrips) and known hot-spot areas for TSWV

During the growing season

-Early and comprehensive monitoring for symptoms of TSWV (with emphasis on hot-spots) and confirmation of RB TSWV as described above

-Early removal (within ~30 days after transplanting) of tomato plants with spotted wilt symptoms (this may not be practical, but it is effective). Alternatively, simply pulling symptomatic plants without bagging and removing will reduce potential risk.

-Thrips monitoring and management

After harvest

-Effective sanitation of harvested tomato plants

-Assess potential for bridge crops, especially fava beans, lettuce and radicchio in the areas as these can harbor RB-TSWV and the thrips vector

-Consider not following fields with high incidences of spotted wilt with another tomato crop

Grower wish list:

-Varieties with robust resistance to the California strain of RB-TSWV

-More effective and safe insecticides for thrips management

Additional resource management tools

TSWV informational brochure

http://ipm.ucanr.edu/PDF/PMG/Tomato_Spotted_Wilt_Print.pdf

Thrips population predictions (by regions/counties)

https://ucanr.edu/sites/TSWVfieldriskindex/Thrips_Population_Projections/

Variety susceptibility/tolerance to TSWV (Tom Turini's field research)

https://ucanr.edu/sites/veg_crop_sjc/files/343457.pdf

(key frames are #9, 11 and 12)