

SPECIAL VIRUS ISSUE

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GROWER ALERT-2021

Resistance-breaking (RB) tomato spotted wilt virus (TSWV) has been identified in Northern Counties and Contra Costa and San Joaquin Counties

The resistance-breaking (RB) strain of TSWV (RB-TSWV) has been detected in the Northern Counties (Colusa, Sutter and Yolo) and Contra Costa and San Joaquin Counties based upon development of symptoms in Sw5 tomato varieties and detection of RB-TSWV with the molecular tests, RT-PCR and LAMP. At this point, the incidences of RB-TSWV are low and in mixed infection with non-RB wild-type (existing) strains). ***Thus, it is important to carefully monitor the situation and have an action plan in place.***

Background

- Tomato spotted wilt virus (TSWV) is one of the most damaging viruses of vegetables worldwide and is the most prevalent and damaging virus of processing tomatoes in California.
- In California, TSWV is transmitted by the Western flower thrips, but it is not passed through eggs, and larval forms must acquire the virus from TSWV-infected plants in order for adults to become viruliferous.
- Outbreaks of spotted wilt in the mid-2000s were managed by IPM, with the key tool being resistance (Sw5 varieties).
- Development of typical spotted wilt symptoms in resistant varieties in Fresno in 2016 led to the identification of RB-TSWV, which has become the dominant strain in Fresno, Kings and Merced Counties.
- Note that there also is a resistance gene for TSWV in pepper, the *Tsw* gene. This gene is unrelated to the Sw5 resistance gene in tomato and there are RB strains that break the *Tsw* gene.
- Detection of TSWV. We are fortunate to have the rapid immunostrip test for TSWV, which takes 10 minutes and can be performed in the field. However, this test will detect both the existing wild-type non-resistance breaking strains and the RB strains. RB-TSWV also infects lettuce, peppers (without the *Tsw* gene) and radicchio.
- RB-TSWV must be detected with 1) a molecular test, either RT-PCR or LAMP, and 2) by inoculating resistant varieties and observing development of typical spotted wilt symptoms.

- TSWV overwinters in weeds, in bridge crops and, possibly, in overwintering pupae of viruliferous larval thrips, as thrips pupae overwinter in soil.

RB-TSWV ACTION PLAN-2021-MONITOR/CONFIRM/MANAGE

Current season (now)

- Grower alerts on RB-TSWV and hold meetings where appropriate.
- Monitor for appearance of spotted wilt especially in fields with resistant (Sw5) cultivars.
 - Note: Very low levels of spotted wilt may be explained by a small proportion of plants not having the gene (incomplete penetrance) and infected with non-RB strains.
 - Levels of >3% are suggestive of RB-TSWV as is the appearance of extremely severe symptoms (extensive distortion, yellowing and necrosis of leaves) in certain genotypes when Sw5 is broken by RB-TSWV (e.g., some fresh market varieties).
- Confirm RB-TSWV with molecular tests and direct inoculation of Sw5 tomatoes.
- Carefully document locations of outbreaks to allow follow-up in 2022.
- Thrips monitoring and management. 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, which predicts when thrips generations will appear, based on temperature, but not actual populations.
[https://ucanr.edu/sites/TSWVfieldriskindex/Thrips Population Projections/](https://ucanr.edu/sites/TSWVfieldriskindex/Thrips%20Population%20Projections/)
 - For the DD model, thrips management is recommended when the 2nd and 3rd generations appear, with earlier sprays (within this window) if spotted wilt is observed in a field, and then as needed up to full canopy cover with well-sized early fruit set. This can slow the spread of TSWV.
 - For 2021, the peak of the third thrips generation just passed on the DD model. Thus, this is an appropriate time to spray for thrips, especially if spotted wilt has been seen in a field.
- 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. Note: check labels for preharvest intervals.

Insecticide options

- 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).

Current season-after harvest

- Effective sanitation of harvested tomato plants by destroying any unharvested plants, e.g., at headlands, and tilling under crop residue.
- Assess potential for bridge crops, especially fava beans, lettuce and radicchio in the areas as these can harbor the virus and the thrips vector.
- Consider not following fields with high incidences of spotted wilt with tomatoes the next season.

For Next Season (2022)

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, UCCE Advisor in Fresno County).
- 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 in 2021) 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 as for 2021.

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](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/](https://ucanr.edu/sites/TSWVfieldriskindex/Thrips_Population_Projections/)
 - Variety susceptibility/tolerance to TSWV (Tom Turini's field research)
 - https://ucanr.edu/sites/veg_crop_sic/files/343457.pdf
(key frames are #9, 11 and 12)
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Disease Highlight: Beet Curly Top Virus

In 2021, we had an outbreak of beet curly top virus (BCTV) which is not generally a major issue for processing tomatoes in the northern growing region. The prevalence of the disease this year may be due to the hot dry winds in March/April that caused a dry down of weeds in the foothills and resulted in atypical timing or patterns of beet leafhopper migration. In addition, the virus confirmed in the northern counties is an unusual strain of BCTV called BCTV-SpCT, which is different from what is found in Fresno and Kern counties. BCTV is also being detected in cucurbits this year.



Beet curly top virus symptoms

Plants infected with BCTV show stunting, dull green/yellow coloring, and leaves curled upward with swollen purple veins. Fields with prevalent virus (5-10%) were located near the foothills in Colusa County. Plants with these symptoms were also detected in the Grimes and Sutter Basin area, though incidence was lower.

Bob Gilbertson's lab at UC Davis was able to identify the strain of BCTV because of research supported by the California Tomato Research Institute (CTRI) and CDFA. The identified BCTV strain is very different from what is found in Fresno and Kern Counties, where curly top virus is most severe. According to Dr. Gilbertson, this particular strain has been previously identified in California, but was considered minimal to curly top incidence and severity in the state. Therefore, the detection of this strain from the northern region this year is likely a localized issue, and not because leafhoppers are migrating north from Fresno.

Beet leafhopper is the only vector of the disease, other insects cannot transmit the virus to tomatoes. The virus is also not transmitted or spread by seed, touch or machinery. Beet leafhoppers do not like tomatoes and do not complete their life cycle within a tomato field. They taste tomatoes as they migrate into the valley and while tasting, they transmit the virus to the plant. But then they move on to find plants in the sugarbeet family, their preferred hosts. Due to

this behavior, it is unlikely you will find beet leafhoppers in your tomato field and there will be no tomato-to-tomato spread of BCTV in the field. Once the beet leafhopper flights are finished, the infection you see is what you will end up with, with early infected plants dying. Often, there will be a mix of different aged plants with symptoms reflecting different times of infection from multiple leafhopper flights. We are seeing this now in some of the later planted fields.

So, where are the leafhoppers coming from? Most of the affected fields are closer to the western foothills, which is likely where the leafhoppers came from, since females spend the winter in the foothills. Dr. Gilbertson speculates that the unusual weather in the spring (hot temperatures and strong winds) may have impacted leafhopper migration resulting in this emergence of curly top diseases.

He also suggested that since ideal conditions are needed for a curly top outbreak, especially this far North, it is likely that we will not see it like this next year. For example, with the 2013 outbreaks in Fresno/Kern, growers were worried there would be a repeat in 2014, but there was hardly any curly top in 2014. So, having it one year does not mean you will have it the next year.

What to do?

Nothing can be done for the current crop except confirming the problem and analyzing for any patterns (like proximity to foothills areas). Again, since there is no tomato-to-tomato transmission, there will be no more infections. For next season, Dr. Gilbertson suggests treating transplants in the greenhouse for fields that will be established near the foothills and monitoring for beet leafhoppers with yellow sticky cards in selected fields with curly top issues. Insecticides are not usually effective at controlling beet leafhoppers or reducing BCTV in crop fields due to the biology of the pest, but managing surrounding weed hosts may be helpful in reducing sources of the virus.



Please feel free to contact me with any vegetable crop issues in the field, questions or comments, or to subscribe to this newsletter electronically.

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