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# Vegetable Crops Facts

UCCE

Merced & Madera Counties Vol. 1, May 2022

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- ✓ **UCCE/CTGA meeting recap**
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- ✓ Fusarium management summary

***Special Note:***

CA Processing Tomato Production (million tons):
2017: 10.46
2018: 12.28
2019: 11.18
2020: 11.31
2021: 10.76

Merced rainfall:
2017 - 18: 6.84”
2018 - 19: 15.93”
2019 - 20: 9.70”
2020 - 21: 7.65”
2021 - 22: 7.18

Scott Stoddard

## RECAP: UC Cooperative Extension Northern San Joaquin Valley Processing Tomato Meeting

*normally held in conjunction with*
**The California Tomato Growers Association (CTGA) Annual Meeting**
on Thursday, February 3, 2022, 8:00 - 11:00 am

The meeting this year was held via Zoom because at the time, the Omicron variant of COVID was still at very high levels. Though all online, attendance was still fairly good with about 80 logged on at any one time. The presentations are posted and available for viewing at https://ucanr.edu/sites/veg_crop_sjc/Presentations/

Presentation files

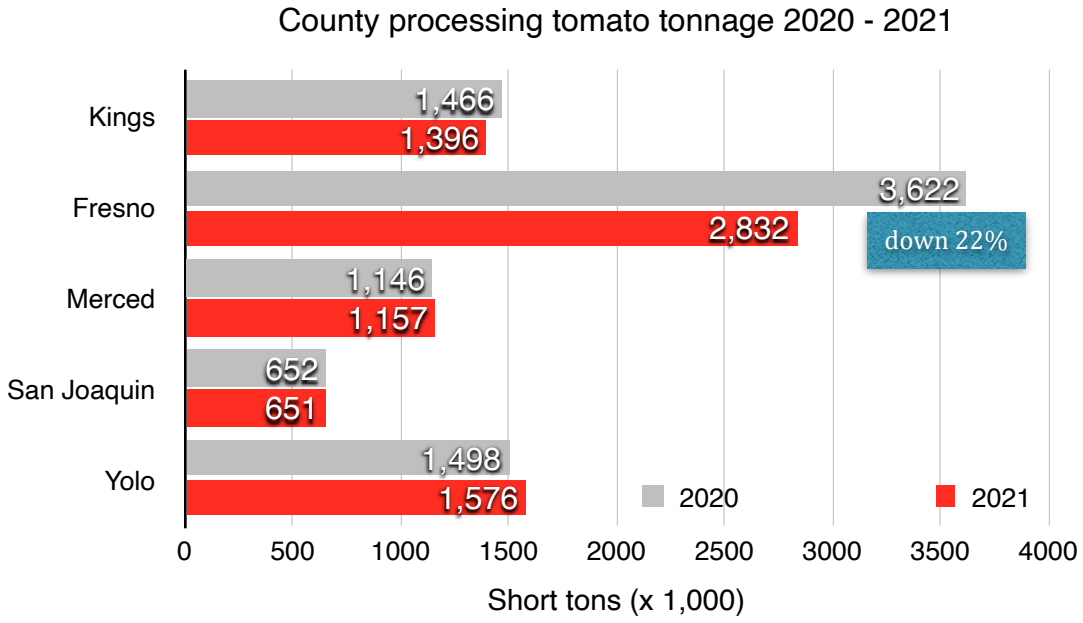
- Management of Tomato spotted wilt virus - Tom Turini
- Broomrape update - Zach Bagley
- Beet leafhopper and curly top in Stanislaus County - Zheng Wang
- Management of Fusarium diseases - Cassandra Swett
- Resistance breaking nemtodes and Fusarium interactions - Amanda Hodson
- In-row cultivators - Amber Vinchesi-Vahl
- 2021 Tomato Season Review - Scott Picanso

### General Notes:

For processing tomatoes, the 2021 production year was fairly good in Merced County and to the north, but was a big challenge for the southern production areas (mainly Fresno and Kings counties). In the south, lack of water, TSWV, and split sets because of extreme heat likely combined to cause the significantly lower than average yields for the region. In Stanislaus County and north, Curly Top virus was a problem for some. In Merced County, Curly Top was low to average in our production area, Fusarium race 3 infests nearly every field but is being managed through variety resistance, and resistance-breaking root knot nematodes (RKN) may be on the radar.

Weather had the biggest impact on early planted fields from Fresno south, with average yield down nearly 22% from the prior year. At one point in the season, forecasted production was the lowest in 20 years, but late season fields in Merced, San Joaquin,

Colusa, and Yolo counties had strong yields and the state finished at about 10.8 million tons, about 0.8 million tons less than contract intentions. This is similar to 2020, when state production was about 1 million tons short. As a result, contract intentions for 2022 are 12.2 million tons.




*Source: https://www.nass.usda.gov/Statistics_by_State/California/Publications/County_Estimates/2022/PTOMCounty_0322.pdf*

Merced county is one of 4 California counties with processing tomato production greater than one million tons annually. In 2021, production was 1.157 million tons from 24,900 contracted acres, which is 46.5. tons per acre on average. Soluble solids were 5.33, and color (Hue) was 21.2 using the new system. Harvest tonnage was skewed towards late season, with more than 237,000 tons picked in late September and October.

Resistant-breaking RKN, or Rb-RKN, does not seem to be a production issue, *yet*, in Merced County. This may be because our production area is dominated by heavy clay loam and loamy clay soils that are not conducive for root knot nematodes (this pest prefers sandy soils, and is a major issue in the Atwater and Livingston area). Or it could simply be that the pest is here, but just hasn't infested many fields. If so, this would be similar as to what happened with Fusarium wilt race 3, when I first confirmed this in the Dos Palos area around 2008. By 2011, it was popping up all over the place.

Fusarium wilt race 3 (*Fusarium oxysporum f. sp. lycopersici*) [F3] continues to be a problem for tomato growers. This soil fungus has been spreading both in scope and severity for more than 10 years in Merced County. There are numerous F3 resistant cultivars now available that provide very good control of this disease, however, demand outstrips supply. According to Scott Picanso with TS&L Seeds, about 45% of the production area was planted to F3 resistant cultivars in 2021. N6428 and H1662 were the #1 and #2 varieties grown in the state last year, and both have resistance to F3. Furthermore, every new variety being released has F3 resistance. Based on my fungicide evaluations on F3 control in an infested field, resistant varieties have yielded on average 24.7% more than susceptible varieties (Table 1).

***Left: Fusarium wilt race 3 produces a characteristic bright yellow "flagging" of leaves, typically about 30 to 45 days after transplanting.***

**Table 1. Yield difference between F3 resistant processing tomatoes and untreated susceptible varieties in a Fusarium wilt race 3 infested field, Merced County 2016 - 2021.**

| Date | F3 Variety, susceptible | F3 yield, Tons/A | Susceptible yield Tons/A | difference, Tons/A | F3 variety, % yield increase |
|---|---|---|---|---|---|
| **2016** | BQ141, H8504 | 58.77 | 54.59 | 4.18 | 7.7% |
| **2017** | BP19, H5608 | 56.81 | 49.79 | 7.09 | 12.5% |
| **2018** | N6428, H2401 | 64.21 | 50.62 | 13.59 | 27.0% |
| **2019** | N6428, DRI319 | 50.26 | 34.13 | 16.13 | 47.0% |
| **2020** | N6428, H2401 | 70.6 | 56.3 | 14.3 | 25.4% |
| **2021** | H1662, H1498 | 59.7 | 46.4 | 13.3 | 28.7% |
| | | | | **AVERAGE** | **24.7%** |

**FUSARIUM AND FUNGICIDE RESEARCH UPDATE**

I have conducted trials since 2016 evaluating the impact on fungicides and biofungicides applied at planting on the suppression of F3 in both resistant and susceptible varieties in a commercial field severely infested with F3. In 2021 tested fungicides included Velum (fluopyram, Bayer Crop Science), Miravis (pydiflumetofen, Syngenta), Rhyme (flutriafol, FMC), and Maxim (fludioxonil, Syngenta Crop Protection). Two coded fungicides by Syngenta, A23156 SC and A19649 SC were also tested with and without Injector soil penetrant. Products were applied to transplants immediately after planting as a plant drench using 230 ml of water per plant (about 520 gallons per acre), and again 3 & 5 weeks after planting using 230 & 270 ml per plant, respectively. The amount of product used was based on a plant population of 8700 plants/A and calculated such that delivered rates were at the recommended volume per acre on the label. The varieties used were H1498 VFFN (susceptible) and N6416 VFN (susceptible), transplanted with commercial equipment at 12" in-row spacing on 60" beds.

The appearance of Fusarium wilt was first observed in the plants in early July, which was confirmed to be caused by Fusarium oxysporum race 3 by UCCE Plant Pathology Specialist Cassandra Swett. However, there was no significant difference between any of the fungicide treatments on the observed number of infected plants for either variety at this time. At the 8-week evaluation, all of the fungicide treatments had significantly fewer infected plants than the untreated control (5.8% vs 12.5%) in cv N6416, but only Rhyme and Syngenta A23156 SC had significantly fewer infected plants at 8 weeks for cv H1498. Infection rates were less than previous years at this location, about 20% in H1498, but some plots were as high as 44%. N6416 had less infection than H1498. F3 was not observed in resistant cultivar H1662 throughout the experiment.

Except for Velum with N6416, none of the fungicide treatments significantly improved yield over the untreated control for either variety, though there was a trend for slightly improved yield (about 2 – 7 tons/A) from the fungicide treatments (Figure 1). Average yield was about 50 tons per acre. PTAB scores, rot%, and green% were essentially the same across treatments.

For comparison, resistant H1662 yields were 59.7 tons/A with soluble solids of 4.9.

In summary, fungicides have shown consistent short-term suppression of this disease, usually 60 days or less, but impacts on yield have been mixed. In 2017, 2019, and 2021 there were yield increases in the susceptible varieties when fungicides were used at or near transplanting, but in 2016, 2018, 2020, and 2021 there were no significant yield improvements (Table 2). Averaged across all years, the fungicides fludioxonil (Maxim) and fluopyram (Velum) have shown an ~ 10.8% yield increase as compared to untreated plots.

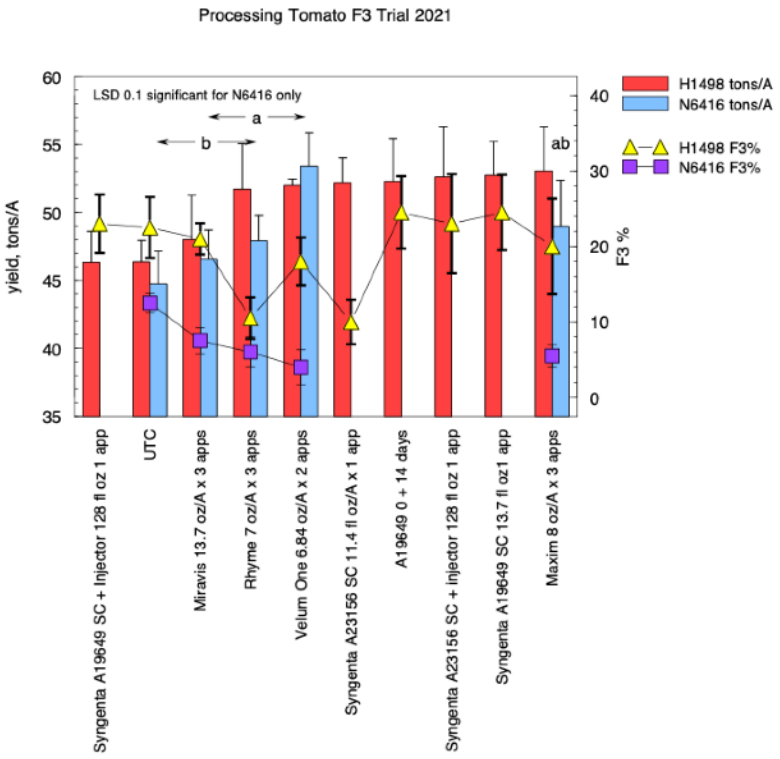



**Figure 1. Processing tomato yield and %F3 at 8 weeks after transplanting in susceptible varieties H1498 and N6416 as affected by fungicide treatment. Yields are estimated from 50 ft² harvest area within each plot for N6416 and whole plot (250 ft²) for H1498.**

**FUSARIUM MANAGEMENT**

A lot of work has been done since 2015 on understanding the factors that contribute to Fusarium wilt in tomatoes and evaluating management options by UC Farm Advisors Gene Miyao, Tom Turini, and Brenna Aegerter, and Vegetable Crops Disease Specialist Cassandra Swett. Some of the important findings include the impact of variety resistance, rotation crops, soil salinity, soil temperature, root knot nematodes, and even other Fusarium species, such as *Fusarium falciforme*. Research sponsored by the California Tomato Research Institute (CTRI) clearly shows the role that equipment plays in moving plant pathogens around in infested soil and plant debris. However, at this point I doubt equipment sanitation will have any significant reduction on the prevalence of Fusarium race 3 in Merced County. As noted above, Merced is a late production area, which means harvesting equipment has been in been in many fields before getting here, and most fields were infested long ago. However, if you are farming a new field with no tomato production in the last 10 years, sanitation is very effective. It takes just 3 years for Fusarium to take hold and cause significant yield reductions, and therefore you should implement a clean equipment protocol for new fields with no known history of Fusarium problems.

See Table 3 for a summary of management techniques to help manage Fusarium wilt in tomatoes. These apply to fresh market production as well.

**Fusarium is spread field to field by soil and plant debris on harvesting equipment, including trailers.**

Scott Stoddard, Farm Advisor

**Table 2. Yield differences between an untreated control (UTC) and fungicide treatments in susceptible processing tomato varieties in a Fusarium wilt race 3 infested field, Merced County 2016 - 2021.**

| Date | F3 susceptible variety | UTC yield, Tons/A | fludioxynil yield Tons/A | fluopyram yield Tons/A | significance test (p = 0.05) | increase, % |
|---|---|---|---|---|---|---|
| **2016** | H8504 | 54.60 | 53.72 | —- | NS | -1.6% |
| **2017** | H5608 | 49.79 | 56.81 | 55.75 | * | 12.0% |
| **2018** | H2401 | 44.53 | 50.22 | 49.31 | NS | 12.4% |
| **2019** | DRI319 | 34.13 | 38.53 | 41.25 | * | 16.9% |
| **2020** | H2401 | 56.3 | 57.0 | 56.5 | NS | 1.8% |
| **2021** | H1498 | 46.3 | 53.1 | 52.0 | NS | 14.7 |
| | | | | | **AVERAGE** | **10.8%** |

**Table 3. Tomato Fusarium management guidelines summary.**

| F3 management option | | Notes |
|---|---|---|
| **Variety resistance** | SV8232TM, CXD282, BQ141, BQ142, N6412, H1310, BP2, H1662, N6428, SVTM9014, HM58801, and many others | Most new varieties are resistant, but demand>supply<br>Stoddard and Turini |
| **Rotation** | Rotating out of tomatoes for several years will reduce but not eliminate the pathogen, some alternate crops can host, including lettuce, melons, and cotton. | Cassandra Swett |
| **Compost/manure/salinty** | Heavy rates (>10 tons/A) have improved yield but not reduced disease incidence. High salinity increases disease severity. | Gene Miyao, 2015.<br>Cassandra Swett |
| **Fumigation** | Research in drip tomatoes has shown reduction of Fusarium and improved yield with Vapam/K-Pam | Brenna Aegerter, 2019-20<br>Kelly Paugh, 2021 |
| **Fungicides/biologicals** | Transplant and in-furrow drench fungicides usually delay onset of symptoms but yield impacts have been mixed. | Scott Stoddard, 2016 -21<br>Kelly Paugh, 2021 |
| **Root knot nematodes** | 2020-21: 63% of F3 - Fusarium wilt diagnoses were co-infected with root knot nematodes. Controlling nematodes decreases disease severity. | Swett, Hodson, Turini, 2021 |