Dec. 2016

# Vegetable Crops Newsletter

University of California
Agriculture and Natural Resources
Cooperative Extension

UC CE


**Field Observations and Year Review 2016**

*Processing Tomatoes*

Small areas of Beet Curly Top Virus, transmitted by the beet leafhopper, were observed and confirmed in mid-June in Colusa county.


I tested one tomato field for southern blight at end of July before harvest and the results were positive. Tomato plants with southern blight have lesions on the stem at or near the soil line. White mats of mycelia are produced on the stem and in the adjacent soil. In a few days, tan to brown spherical sclerotia about 0.06 inch (0.5 mm) in diameter appear on the mycelial mat and these sclerotia are a good diagnostic feature (see photo). The disease is favored by high temperatures (>85°F), and attacks a wide range of plants, surviving for long periods in the soil as sclerotia. Disease incidence and severity are dependent on the number of sclerotia in the soil. To manage southern blight, rotate to non-host crops, such as corn, sorghum, rice, or small grains, for at least two years to reduce the inoculum. Deep plowing to bury plant debris may help to destroy sclerotia (http://ipm.ucanr.edu/PMG/r783100711.html. UC-IPM).

In mid-September, I collected tomato samples from Sutter county fields that were close to harvest to test for Fusarium wilt, but the samples came back from the diagnostic lab as Fusarium crown and root rot. The different Fusariums that occur in tomato can be difficult to distinguish late in the season after vines die. Foliar symptoms on plants with Fusarium crown and root rot include yellowing followed by browning along the margin of older leaves. Dry brown lesions develop on main lateral roots. Internally, a brown

discoloration extends no more than 6 to 12 inches above the soil line. Infected plants may be stunted and wilted, and older plants may die (http://ipm.ucanr.edu/PMG/r783101211.html. UC-IPM). This can be confused with Fusarium wilt because of the leaf yellowing, necrotic stem lesions, and plant collapse.

In my observations, root-knot nematode was the most common and widespread issue in tomato fields. Tomato root samples from four root-knot nematode resistant varieties that were exhibiting vine collapse and root galling were sent to UC-Riverside to determine the root-knot nematode species and the mode of resistance. Results are still pending.

All in all, 2016 was a good year for tomatoes in Colusa and Sutter Counties. Organic tonnage was up for both counties from 2015.

*Cucurbits*

Spider mites, melon aphid, and *Alternaria* were common issues in 2016 for melon crops, though *Alternaria* is generally a secondary pathogen and does not warrant control in most situations.

For melon aphid control, silver reflective mulches have successfully been used to repel aphids from plants. Biological control can also have a significant impact on aphid population so be sure to evaluate predator and parasite populations when making treatment decisions. Melon aphid is very difficult to control with insecticides.

**Fusarium wilt, Race 3 tomato variety trial**

As mentioned previously in my June newsletter, I conducted a variety trial in processing tomatoes this past season in Sutter County in collaboration with other UCCE Vegetable Crop Advisors spanning five counties. Fifteen varieties were evaluated for their resistance to Fusarium wilt, Race 3 in commercial fields with a history of the disease. This work was supported by the California Tomato Research Institute with cooperation by seed dealers and growers.

*Fusarium oxysporum* f. sp. *lycopersici*, or Fusarium wilt, is an important soilborne fungal pathogen in our area. The only known control method is resistant tomato varieties. Fusarium wilt can greatly reduce yields in fields with a high incidence of the fungus. Fusarium can survive for many years in the soil as spores and on the outer surface of other plants (weeds and other crops) without causing them harm. Long distance spread is by seed, transplants, and soil on farm machinery. The disease is favored by warm weather.


Vine necrosis in Fusarium wilt, race 3 variety trial. August 2016.

The spread of infested soil can be limited by cleaning farm equipment. Avoid root knot nematode infestations because nematode feeding can overcome plant resistance to Fusarium wilt. Rotation out of tomatoes for several years reduces inoculum level, although Fusarium is long-lived (http://ipm.ucanr.edu/PMG/r783101011.html. UC-IPM).

Fifteen (15) varieties were compared which included a susceptible (H 8504) and 2 tolerant (HM 3887 and DRI 319) varieties among the Fusarium wilt, Race 3 resistant lines (12). Varieties are listed in Table 1. Consultation on variety list, seed collection and greenhouse support provided by AgSeeds and TS&L.

**Table 1. Variety evaluation, Fusarium wilt, race 3 resistance, 2016**

| | Variety | Disease Resistance | Fol, race 3 | Company |
|---|---|---|---|---|
| 1 | H 8504 | VFFNP | Susceptible | Heinz |
| 2 | HM 3887 | VFFNsw | Tolerant | HM Clause |
| 3 | DRI 319 | VFFNPsw | Tolerant | Monsanto |
| 4 | BQ 141 | VFFF3NPsw | Resistant | Woodbridge |
| 5 | BQ 142 | VFFF3NPsw | Resistant | Woodbridge |
| 6 | BP 16 | VFFF3NPsw | Resistant | BHN |
| 7 | BP 2 | VFFF3NPsw | Resistant | BHN |
| 8 | SVS 8232 | VFFF3NPsw | Resistant | Monsanto |
| 9 | SVS 2493 | VFFF3NPsw | Resistant | Monsanto |
| 10 | H 1310 | VFFF3NPsw | Resistant | Heinz |
| 11 | BQ 406 | VFFF3NPsw | Resistant | Woodbridge |
| 12 | HM 58801 | VFFF3Nsw | Resistant | HM Clause |
| 13 | H 1539 | VFFF3Nsw | Resistant | Heinz |
| 14 | N 6428 | VFFF3Nsw | Resistant | Nunhems |
| 15 | N6429 | VFFF3NswLv | Resistant | Nunhems |

Code: Disease Resistance
V = Verticillium wilt
F = Fusarium wilt, race 1
FF = Fusarium wilt, race 2
**FFF = Fusarium wilt, race 3**
N = Root Knot Nematode (some species)
P = Bacterial speck
sw = Tomato Spotted Wilt Virus
Lv = Tomato Powdery Mildew

Tests were initiated in Knights Landing (Sutter), Woodland (Yolo), Stockton (San Joaquin), Dos Palos (Merced) and Huron (Fresno) by the local vegetable crop advisor. Results presented are from the Sutter Co. trial (Table 2), which was conducted in one of the original Fusarium wilt, Race 3 fields. Bed configuration was single lines on 60-inch centered beds and was sprinkler irrigated season long. Previous tomato crop was 2010.

The trial was mechanically transplanted and harvested. Fruit yield was measured using a portable cart with weigh sensors to collect fruit off the mechanical harvester. The trial included a subsample of fruit to sort and measure culls by weight. Small, bagged samples from all sites were delivered to a local Processing Tomato Advisory Board (PTAB) inspection station to determine fruit color, Brix and pH.

Research trailer with weigh sensors dumping harvested tomatoes. September 2016.

Plant stands were counted in each plot to later calculate % infected plants from multiple visits to visually tally the total number of symptomatically diseased Fusarium wilt plants. Lab confirmation at UC Davis was made from these tests. About a month before harvest, because of an onset of unrelated vine death, plants with late Fusarium infections could not be easily determined. The late growth stage assessment shifted to visually rate vine necrosis.

Overall yield was 57 tons/acre. The top yielding varieties were H 3887 (tolerant) at 64 tons/acre, and SVS 2493, HM 38801, and N 6428, all above 60 tons/acre. Lowest yielding varieties were BQ 142, DRI 319, BP 16, and BQ 406 though all were between 49-52 tons/acre. Different letters in the column next to yield denote whether there are significant differences between yield (Table 2). Fusarium infection (Fol plants) averaged 24% for H 8504 and remained at 0-3% for all resistant varieties. Tolerant varieties had 16-24% infection of Fusarium before vine necrosis (death) made it too difficult to determine the cause of plant collapse. Vine necrosis climbed from 22% to 55% in one week after Ethrel application.

Cull samples were taken off of the harvester for each plot during harvest and sorted for green fruit, pink fruit, sunburn, blossom end rot (BER), and mold. Pink and green fruit was <1%, which was expected with the Ethrel application on September 7. Average % sunburn was <4%, but up to 8% in SVS 2493 and DRI 319. Average % mold was <2%. Blossom end rot was prevalent, up to 6% in H 1310 and BQ 406.

Brix was highest (6.28) for DRI 319 (tolerant) but yield was lower, though still 50 tons/acre. Average Brix was 5.4.

**Table 2. Fusarium wilt, race 3 reisstant processing tomato variety trial results, Sutter County 2016**

| | Disease | Yield | | % | %Vine Necrosis | | | | | % | % | % sun | % | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety | Resistance | Tons/A | | Fol plants | 9/7/2016 | 9/16/2016 | Brix | Color | pH | pink | green | burn | mold | BER |
| HM 3887 | VFFNsw | 64.8 | A | 16.3 | 32 | 43 | 5.20 | 23.5 | 4.42 | 0 | 1 | 4 | 2 | 1.1 |
| SVS 2493 | VFFF3NPsw | 62.2 | AB | 0.9 | 25 | 72 | 5.10 | 21.5 | 4.44 | 0 | 0 | 8 | 2 | 1.3 |
| HM 58801 | VFFF3Nsw | 61.8 | ABC | 0.3 | 16 | 35 | 5.73 | 23.8 | 4.37 | 0 | 0 | 3 | 2 | 1.7 |
| N 6428 | VFFF3Nsw | 60.3 | ABCD | 0.3 | 22 | 54 | 5.40 | 22.0 | 4.34 | 1 | 0 | 2 | 1 | 3.1 |
| BQ 141 | VFFF3NPsw | 59.2 | BCD | 0.3 | 14 | 57 | 5.05 | 21.3 | 4.38 | 0 | 0 | 4 | 1 | 1.1 |
| N 6429 | VFFF3NswLv | 58.8 | BCD | 0.0 | 18 | 65 | 5.55 | 22.5 | 4.39 | 0 | 0 | 2 | 2 | 2.9 |
| BP 2 | VFFF3NPsw | 57.3 | BCDE | 0.0 | 16 | 57 | 5.43 | 21.0 | 4.47 | 0 | 0 | 3 | 2 | 1.0 |
| H 1310 | VFFF3NPsw | 57.9 | BCDE | 0.3 | 8 | 35 | 5.38 | 21.3 | 4.40 | 1 | 1 | 3 | 1 | 5.8 |
| H 8504 | VFFNP | 56.9 | CDE | 23.7 | 50 | 61 | 5.03 | 22.0 | 4.28 | 1 | 0 | 4 | 1 | 1.5 |
| SVS 8232 | VFFF3NPsw | 55.5 | DEF | 0.0 | 21 | 61 | 5.50 | 20.5 | 4.33 | 0 | 0 | 5 | 4 | 1.8 |
| H 1539 | VFFF3Nsw | 55.9 | DEF | 0.3 | 19 | 43 | 5.03 | 20.5 | 4.41 | 0 | 0 | 1 | 0 | 1.0 |
| BQ 406 | VFFF3NPsw | 52.9 | EFG | 0.0 | 18 | 54 | 5.50 | 20.8 | 4.44 | 0 | 0 | 3 | 1 | 6.3 |
| BP 16 | VFFF3NPsw | 51.3 | FG | 3.2 | 25 | 65 | 5.68 | 22.8 | 4.33 | 1 | 0 | 2 | 2 | 1.6 |
| DRI 319 | VFFNPsw | 50.4 | G | 23.7 | 35 | 72 | 6.28 | 22.8 | 4.35 | 1 | 0 | 8 | 3 | 0.7 |
| BQ 142 | VFFF3NPsw | 49.1 | G | 0.0 | 22 | 50 | 5.68 | 21.3 | 4.40 | 0 | 0 | 5 | 2 | 2.2 |
| LSD 5% | | 5.1 | | 6.3 | 10.9 | 13.6 | 0.5 | 0.9 | 0.1 | NS | 0.4 | 3.0 | 1.3 | 1.9 |
| % CV | | 6 | | 95.5 | 33.8 | 17.4 | 5.8 | 2.8 | 1.2 | 110.7 | 96.2 | 56.0 | 57.8 | 60.6 |
| Average | | 57.0 | | 4.6* | 22.6 | 54.9 | 5.4 | 21.8 | 4.4 | 0.5 | 0.3 | 3.7* | 1.6 | 2.2 |

*significant non-additivity issue

BER= blossom end rot

Overall, resistant varieties performed well against Fusarium wilt, Race 3. There was less incidence in the field than expected in susceptible and tolerant varieties (16-24%). It is possible more Fusarium was present but as mentioned previously, a month before harvest, vine necrosis set in and plants with late Fusarium infections could not be easily identified.

The trial results suggest that some specific varieties with only tolerance to Fusarium wilt, Race 3 perform well, for example, HM 3887. The Race 3 resistant variety, N 6428, was also in the highest yielding group among the statewide trials. The range of results across the states implies that variety performance tends to be greatly influenced by environmental factors, thus suggesting that no single variety will likely be the top performer under a wide range of conditions. Genetically, these Race 3 resistant varieties performed well under disease pressure, especially compared to the susceptible control, H 8504. The risk of continuing to rely on a tolerant variety when disease pressure reaches high levels is not recommended.

*Acknowledgements*

I would especially like to thank my grower cooperators, Mark and Dave Richter. Harvest was done with Morningstar equipment and a grower crew. AgSeeds provided variety consultation, collection of seed and greenhouse support for the Sutter Co. trial. The Processing Tomato Advisory Board analyzed fruit quality.

Finally, I would like to thank the California Tomato Research Institute and its contributing growers for the funding support.

Please feel free to contact me if you would like more information or have questions about the variety trial.


Happy Holidays!

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