Fusarium diseases of tomato: updates on field diagnosis and management

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Fusarium wilt

Fusarium crown and root rot

Fusarium falciforme stem rot and vine decline

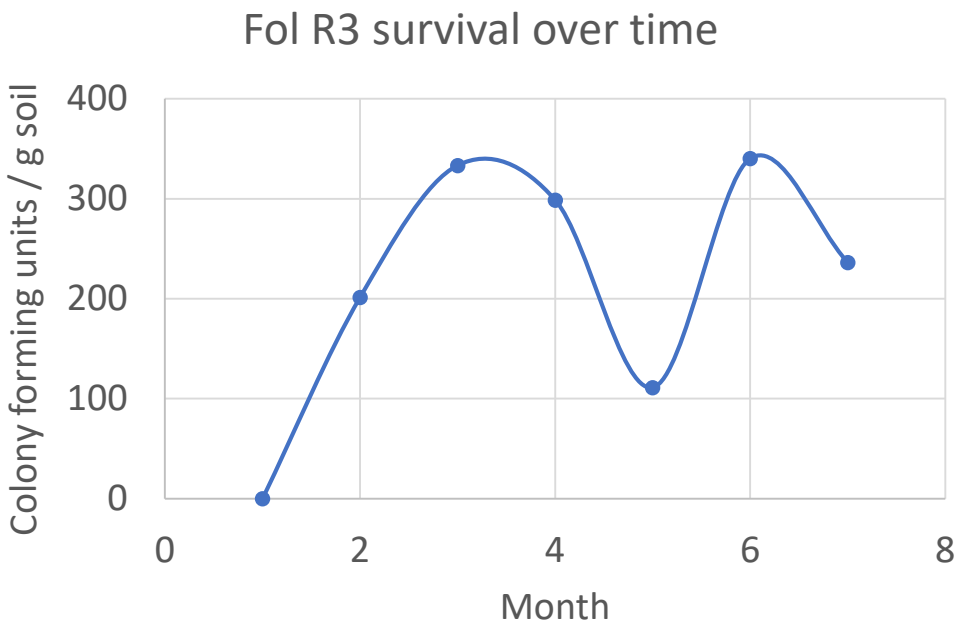
Fusarium wilt

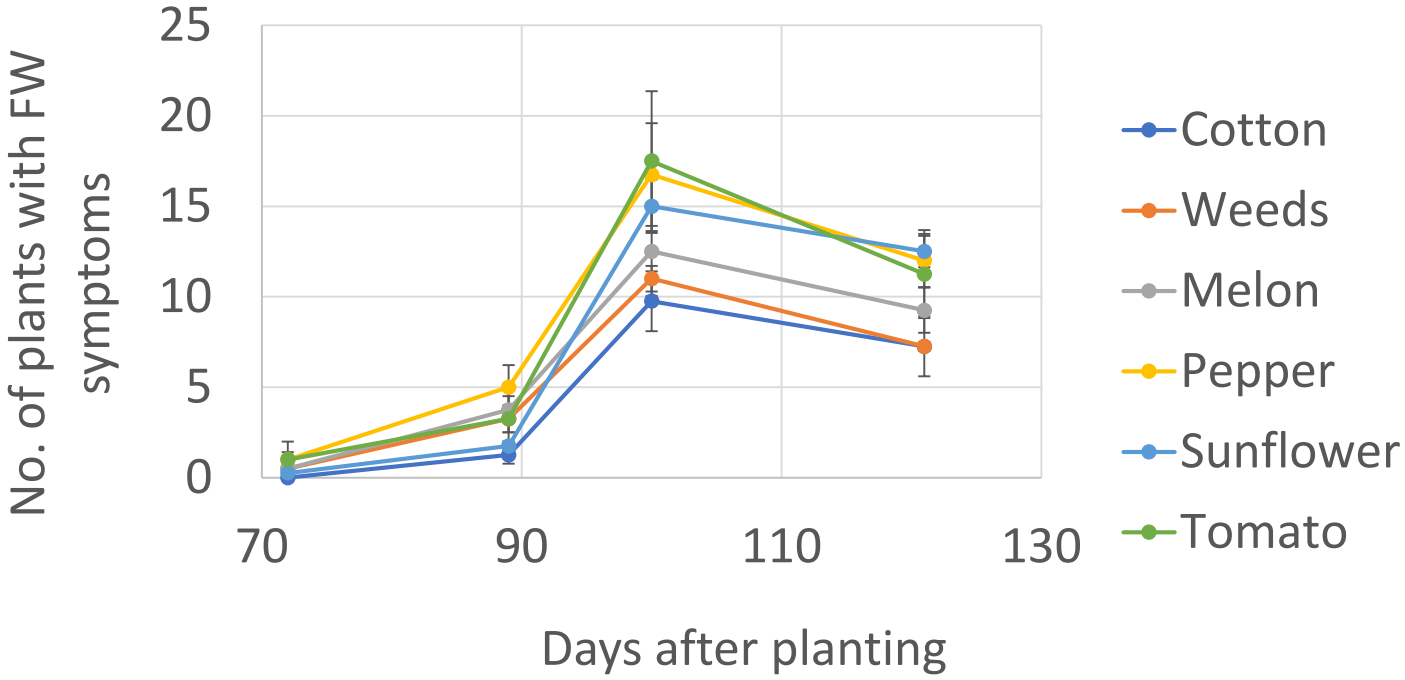
Caused by Fusarium oxysporum f. sp lycopersici (Fol), race 3

- Timing: symptoms begin to appear NO EARLIER than 45 days after planting
- Late season disease; favored by heat, drought stress, heavy fruit load
- Chlorosis of leaves
- Stem is green on the outside but with brown vascular discoloration
- If you cut green branches at 6” and 12” there is often still vascular discoloration

Methods for Fusarium wilt control

- Resistant cultivars: F3 cultivars
- Crop rotation
  - Fol race 3 can survive at least seven months in soil (ongoing)
  - Rotation crops are not all created equal (ongoing)
- Chemical management?—Brenna's talk

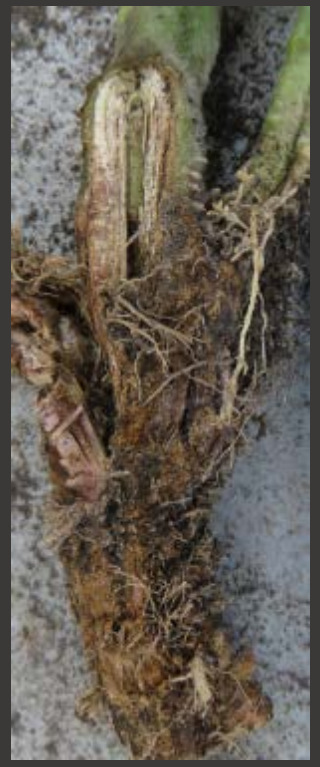


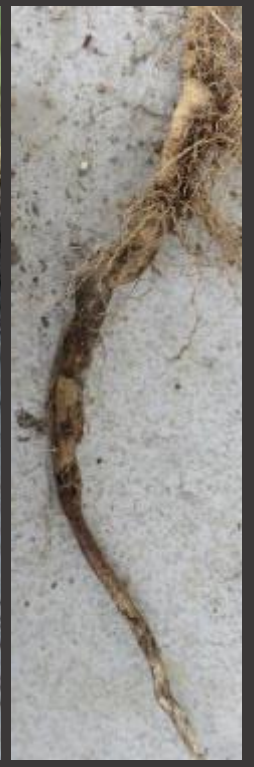


Fusarium crown and root rot

Caused by Fusarium oxysporum f. sp radicis lycopersici (Forl)

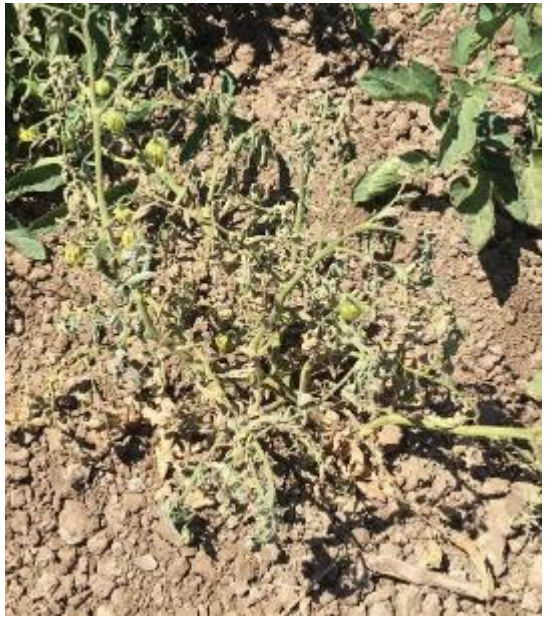
- Plant slowly declines over many weeks
- Crown rot is a LOCALIZED lesion
- Stem is brown on the outside and rotten on the inside
- IF you cut at 6” and 12” the stem will be healthy looking
- Roots will also often be decaying

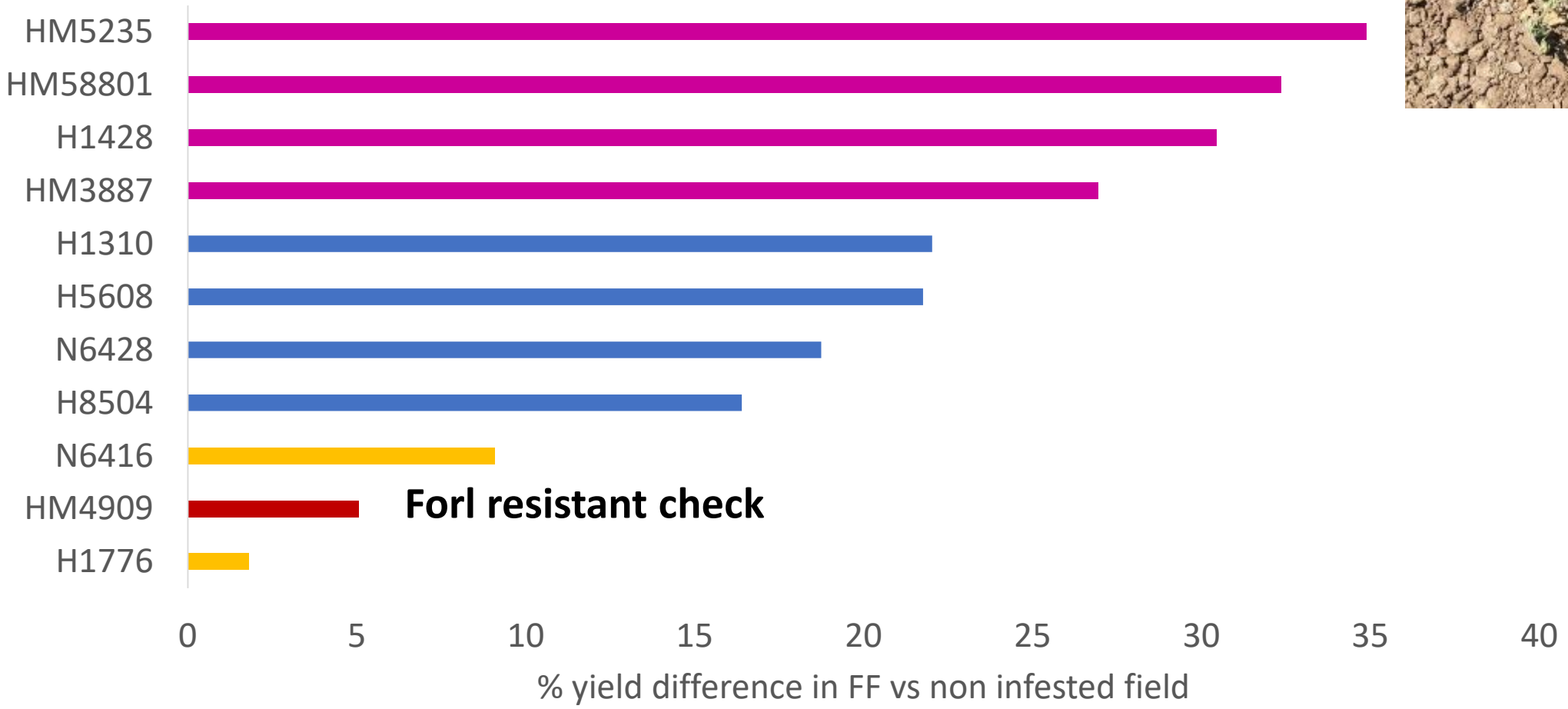




Methods for managing Forl

- Some commercial cultivars with resistance (FR) (few)
- Several cultivars appear tolerant to Forl





Fusarium falciforme

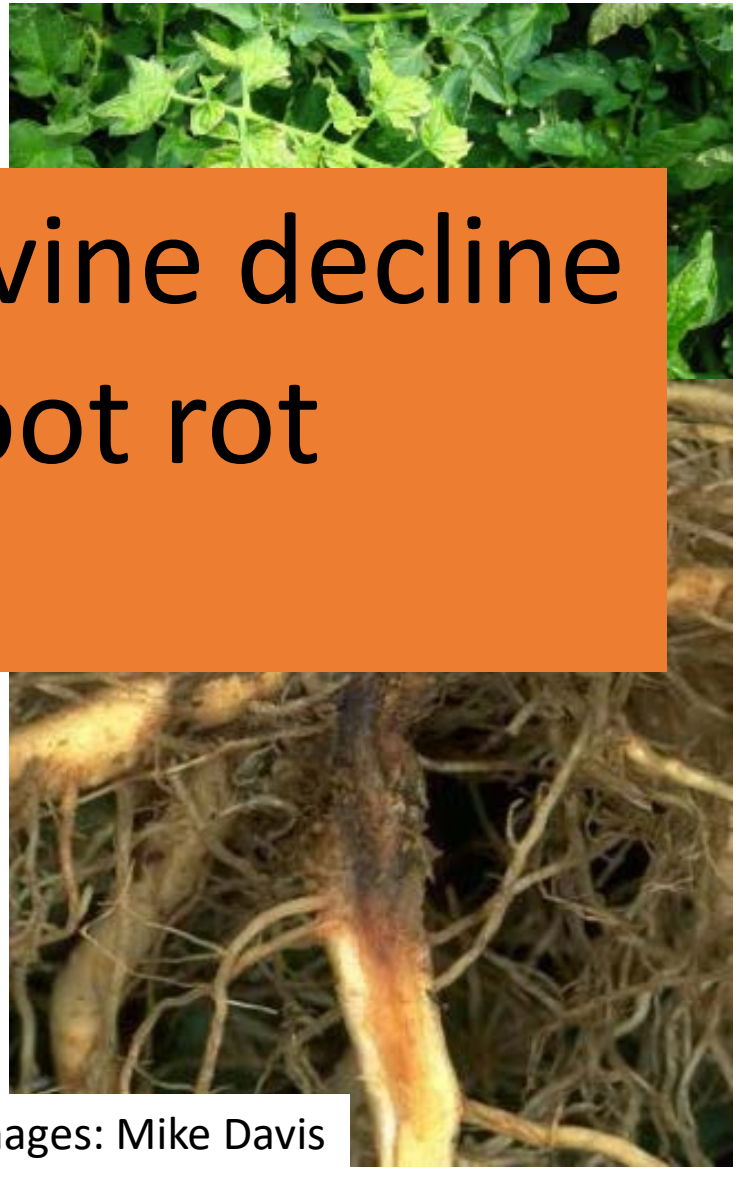
A poorly understood stem rot and vine decline pathogen with emerging significant impacts on tomato

Understanding disease(s) caused by fungi in the *Fusarium solani* species complex in tomato

- First described in as a pathogen of fresh market

Stem rot and severe premature vine decline are not part of Fusarium foot rot symptomology

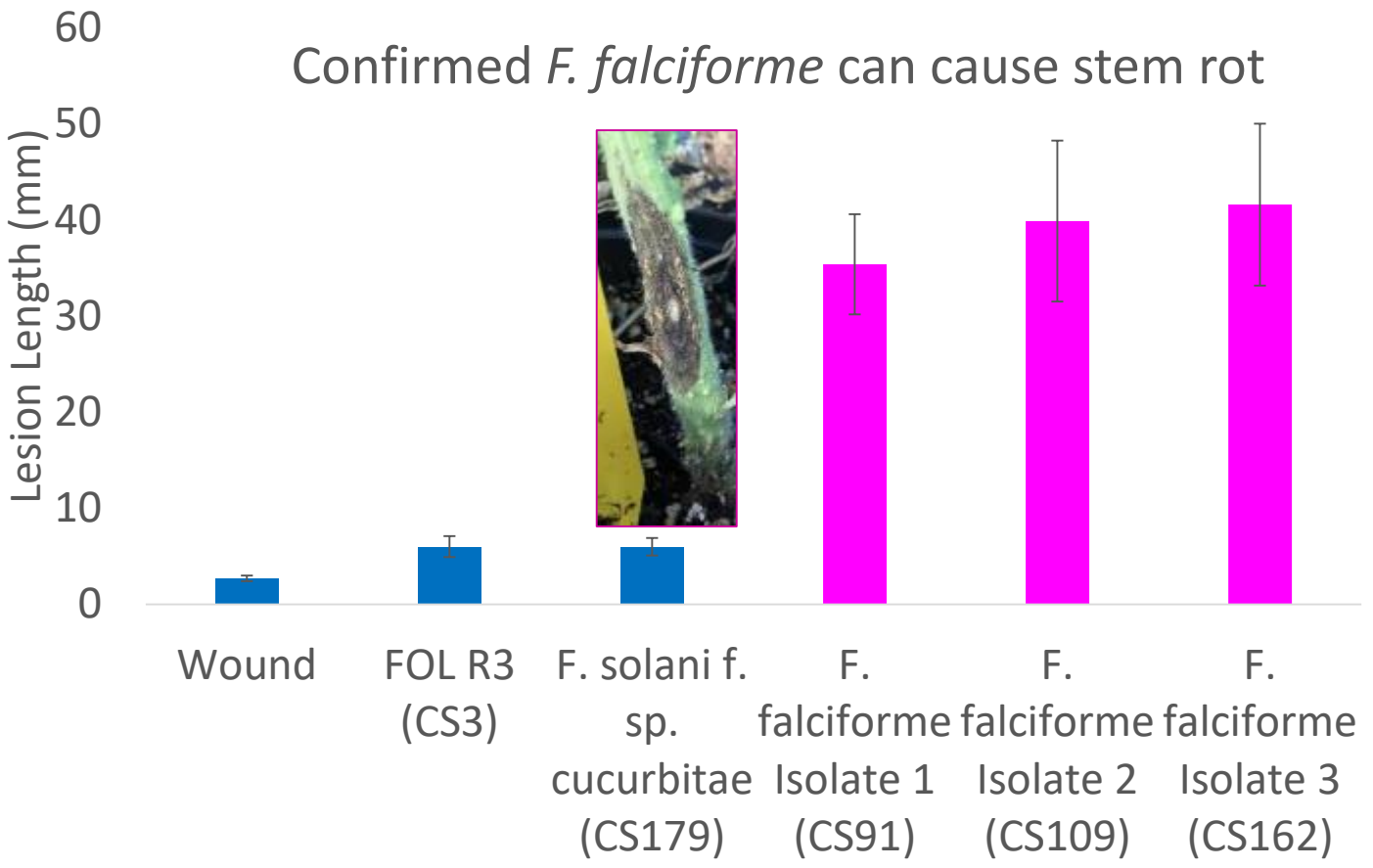
- Pathogen name:
  - 1975: Fusarium solani
  - 2007: *F. solani* f. sp. *eumartii*
  - 2019: *F. noneumartii*



Images: Mike Davis

Fast forward: Plants with severe stem rot samples identified by Gene Miyao in 2017

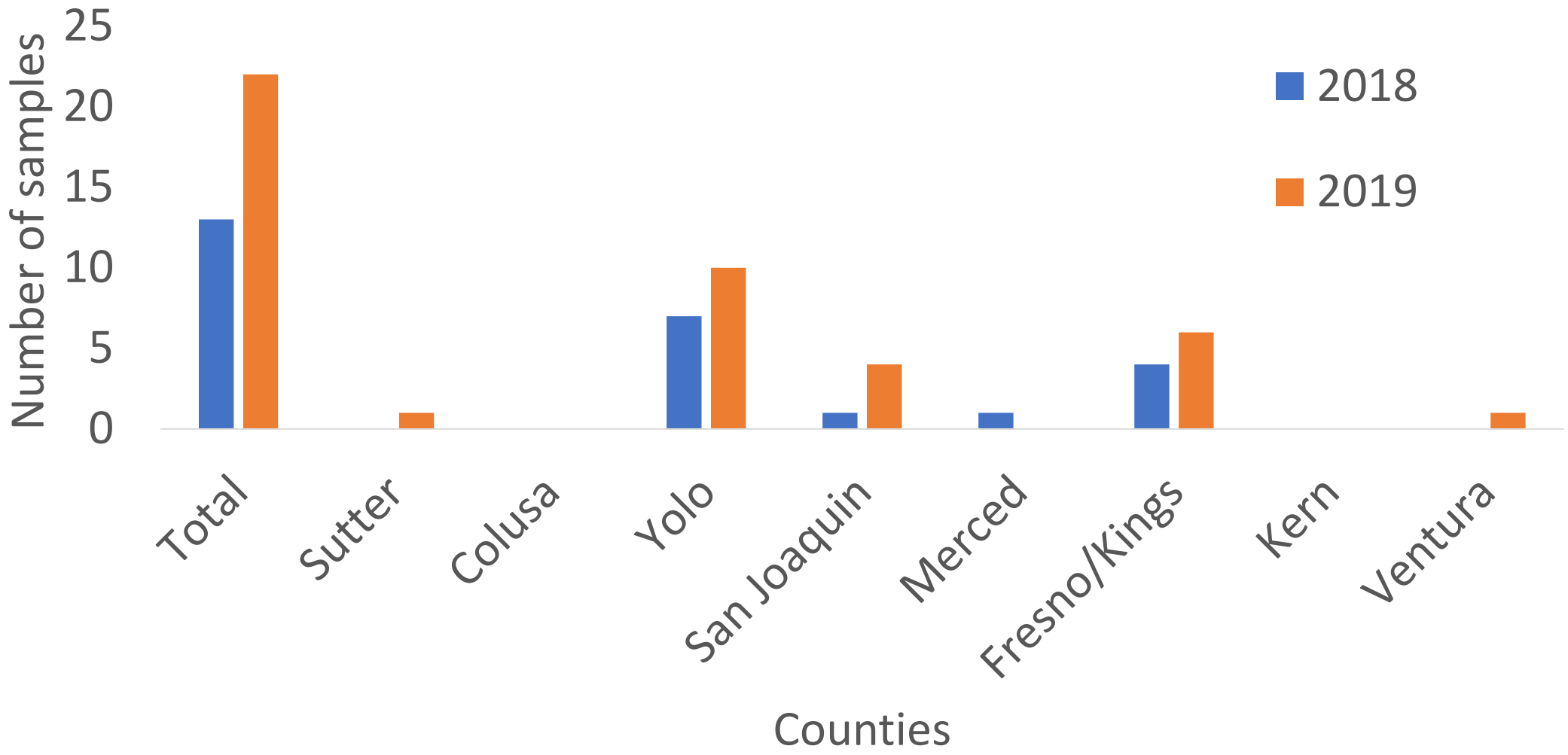
Identified as *Fusarium falciforme*-closely related to *F. noneumartii* ***but able to cause stem rot***



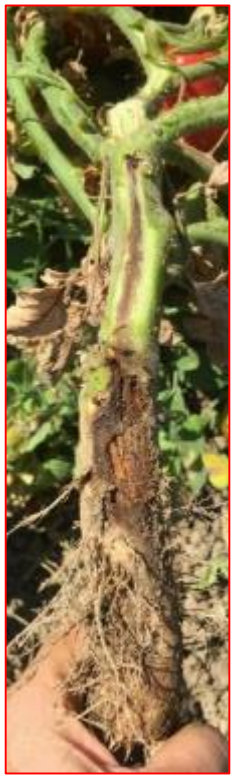
In 2019: Concern was elevated with multiple *F. falciforme* fields exhibiting severe losses

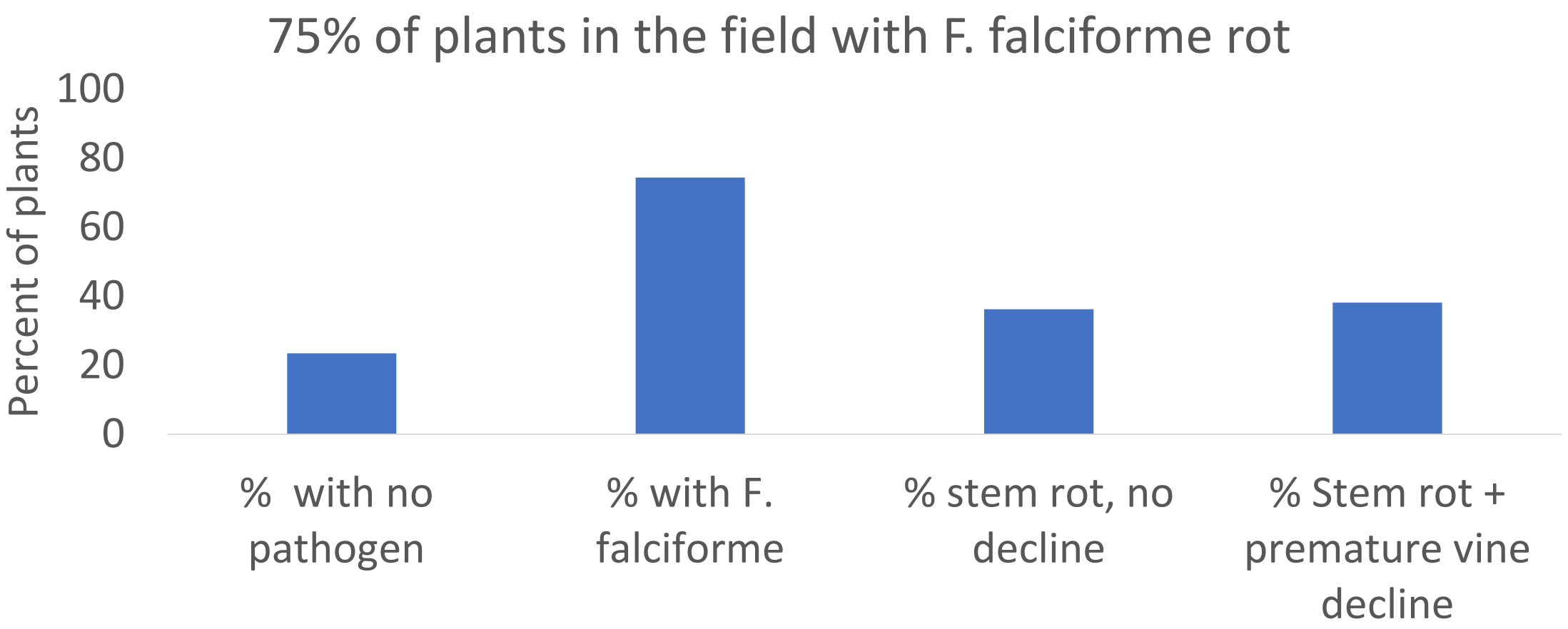
High incidence of plants dying early in the season

Can find *F. falciforme* in most tomato-producing counties in California

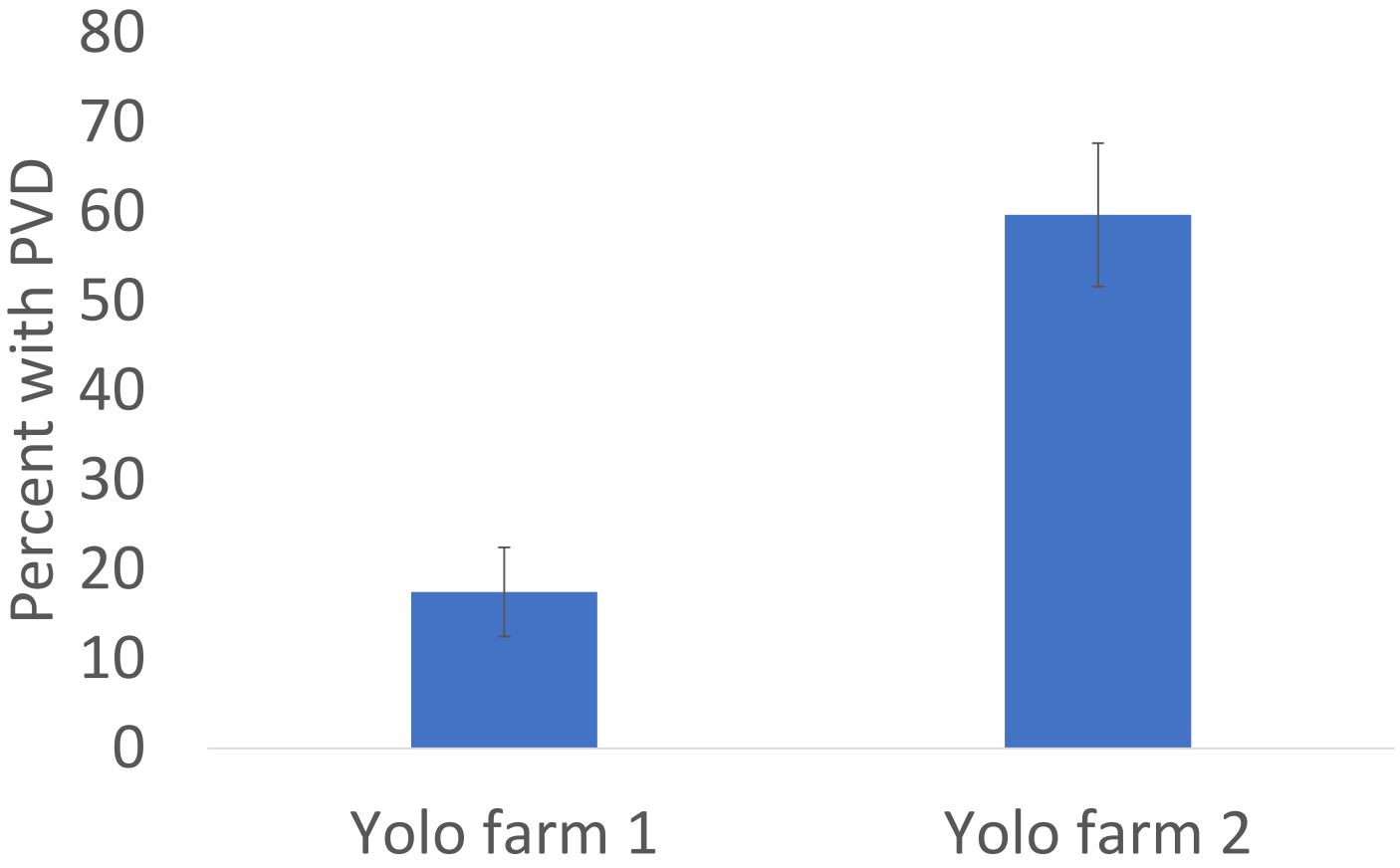


Over 75% of plants can be infected in a field



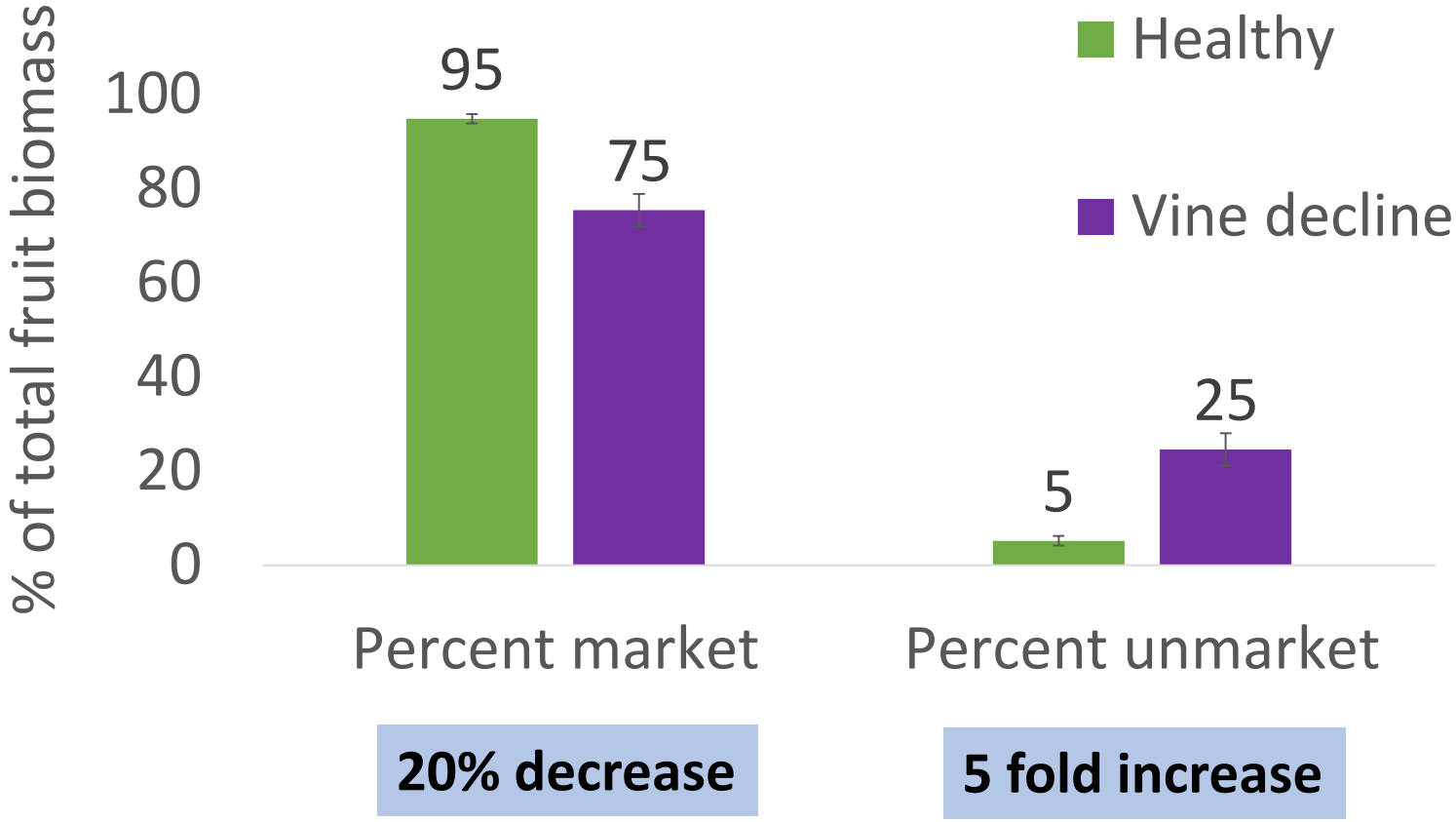


With 20-60% of plants developing premature decline in commercial fields



Premature vine decline causes sunburn and fruit rot

…significantly reducing yields and increasing unmarketable fruit in some cultivars



Field diagnosis of *F. falciforme*-look alike problems and tips

FF symptoms share similarities to other disorders, leading to misdiagnosis

Foot and crown rot

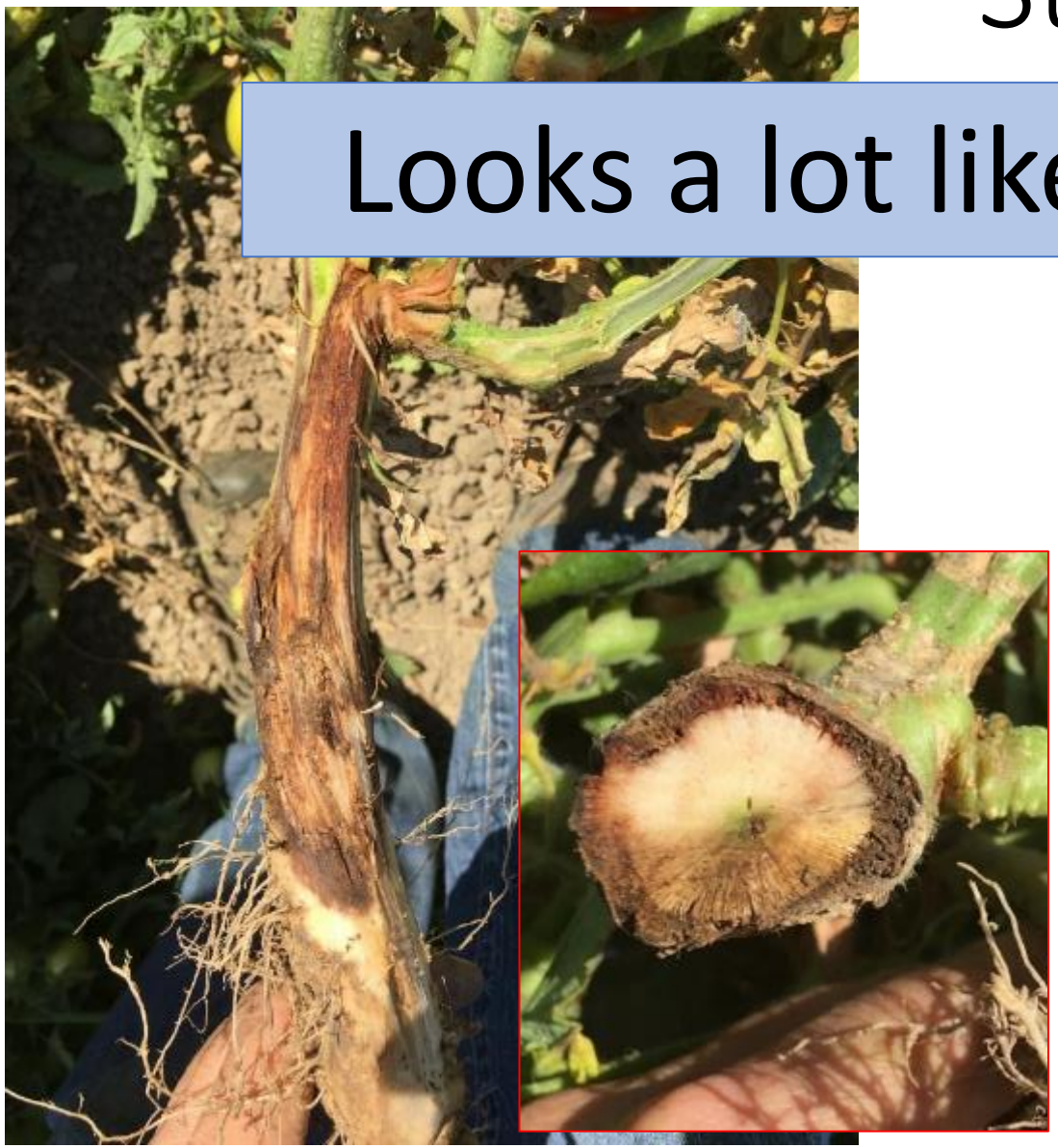
Looks a lot like

Fusarium crown and root rot
Southern blight

Stem rot

Stem rot

Looks a lot like



Fusarium wilt or Verticillium wilt

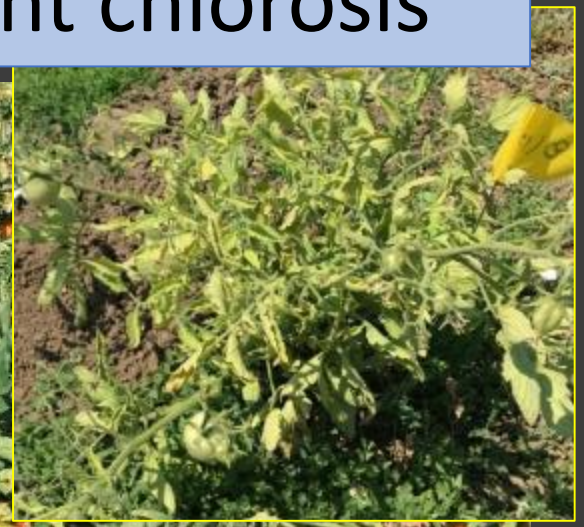
Foliar yellowing / bleaching symptoms

Branch chlorosis

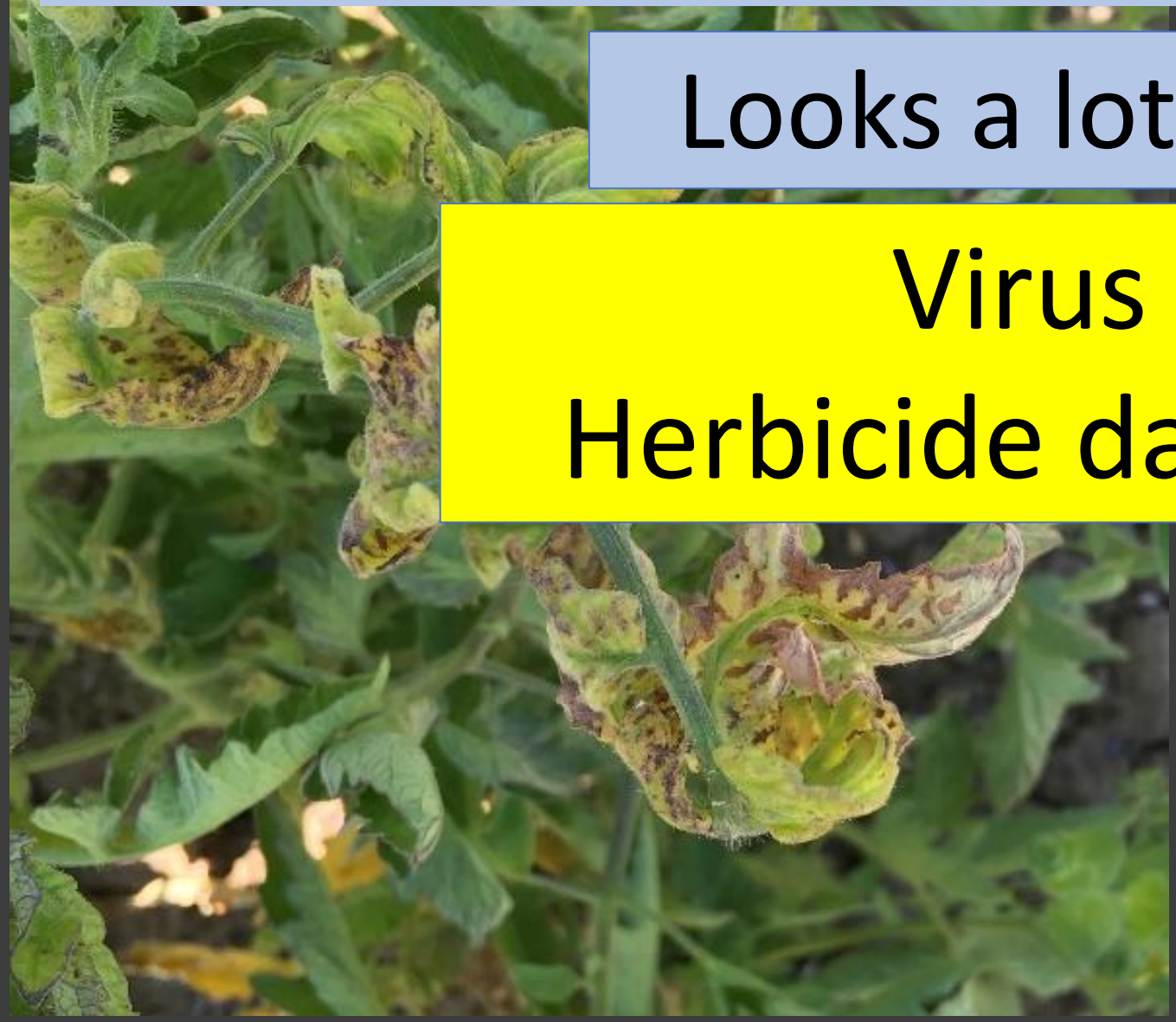
Whole plant chlorosis

Looks a lot like?

Fusarium wilt



Deep leaf curling, deformity, little leaf



Looks a lot like

Virus
Herbicide damage

Leaf speckles → leaflet blight → leaf death

Leaf death→ whole plant death
Whole process ~3-5 weeks

Leaf death→ whole plant death

Boron toxicity
Salt damage

Diagnosing plants with similar symptoms to other wilt and rot pathogens requires LABORATORY diagnosis



In development: easy to use, cost effective, rapid molecular-based tools that rapidly differentiate *Fusarium* pathogens of tomato



Diagnosing plants with foliar symptoms similar to abiotic disorders and viruses IS POSSIBLE in the field (to an extent)

Look for a discrete rot in the foot, crown and/or stem

+

Likely
F. falciforme

Ongoing: Is *F. falciforme* a new pathogen causing a new disease or a more severe manifestation of Fusarium foot rot?

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DISEASE NOTES

OPEN

Foot Rot and Wilt in Tomato Caused by *Fusarium falciforme* (FSSC 3 + 4) in Mexico

T. A. Vega-Gutiérrez, C. A. López-Orona, G. A. López-Urquídez, S. Velarde-Félix, L. A. Amarillas-Bueno, A. R. Martínez-Campos, and R. Allende-Molar

Affiliations

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January 2019

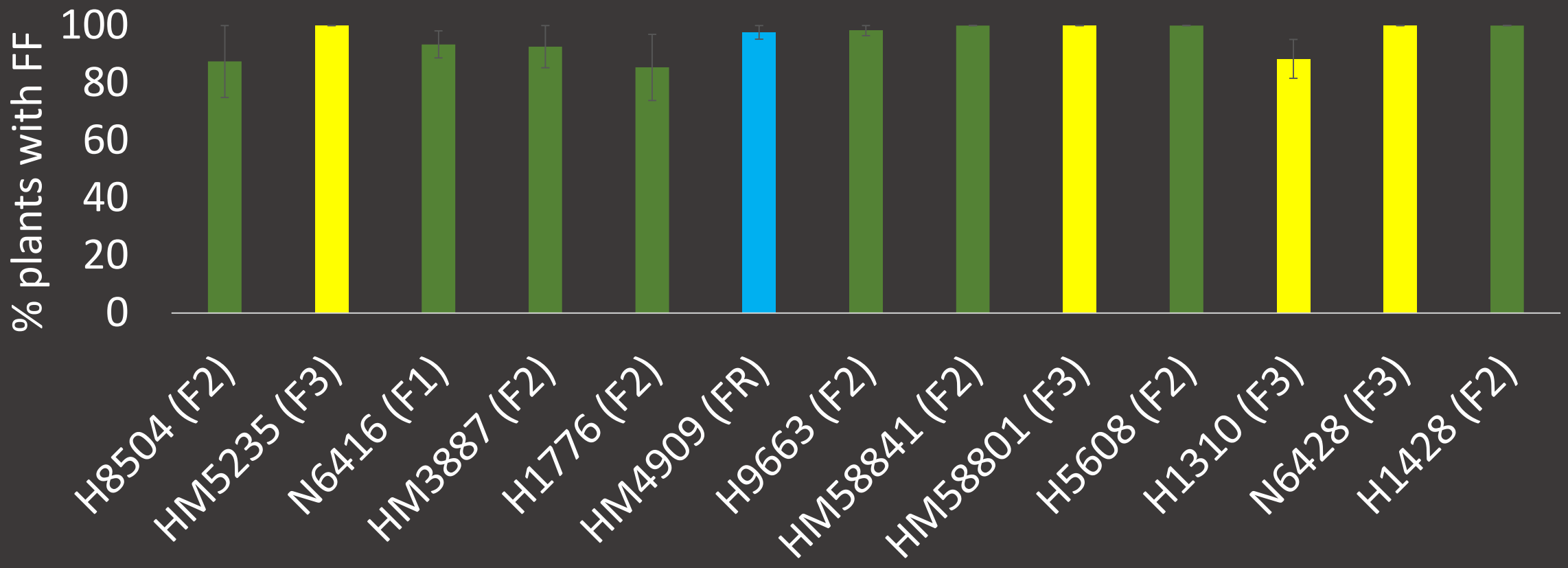
tomato crops in the state of Sinaloa (Mexico). The symptoms included wilting, leaf yellowing, defoliation vascular tissue darkening, and drying and death of branches and the entire plant. Plant crowns exhibited necrosis (visible in the interior) that advanced through the main root, along with slight root

Managing *Fusarium falciforme*
No management options known

Commercial cultivar resistance
Chemical management (Brenna-next)

Management methods for *Fusarium falciforme* will be different than Fusarium wilt and Fusarium crown and root rot

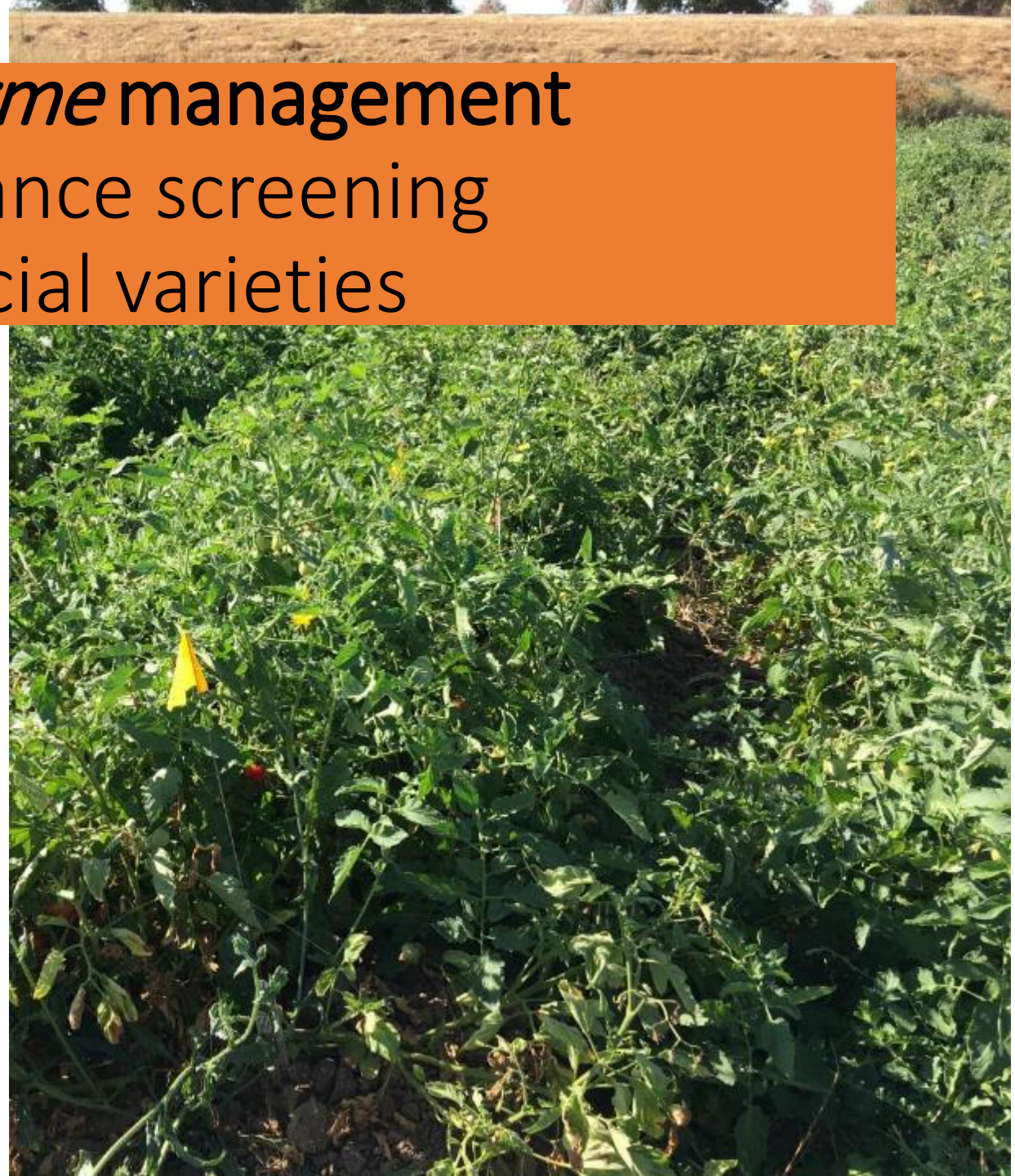
Since this is a completely different species, F3 and Forl resistance do not work to control *F. falciforme*



Fusarium falciforme management

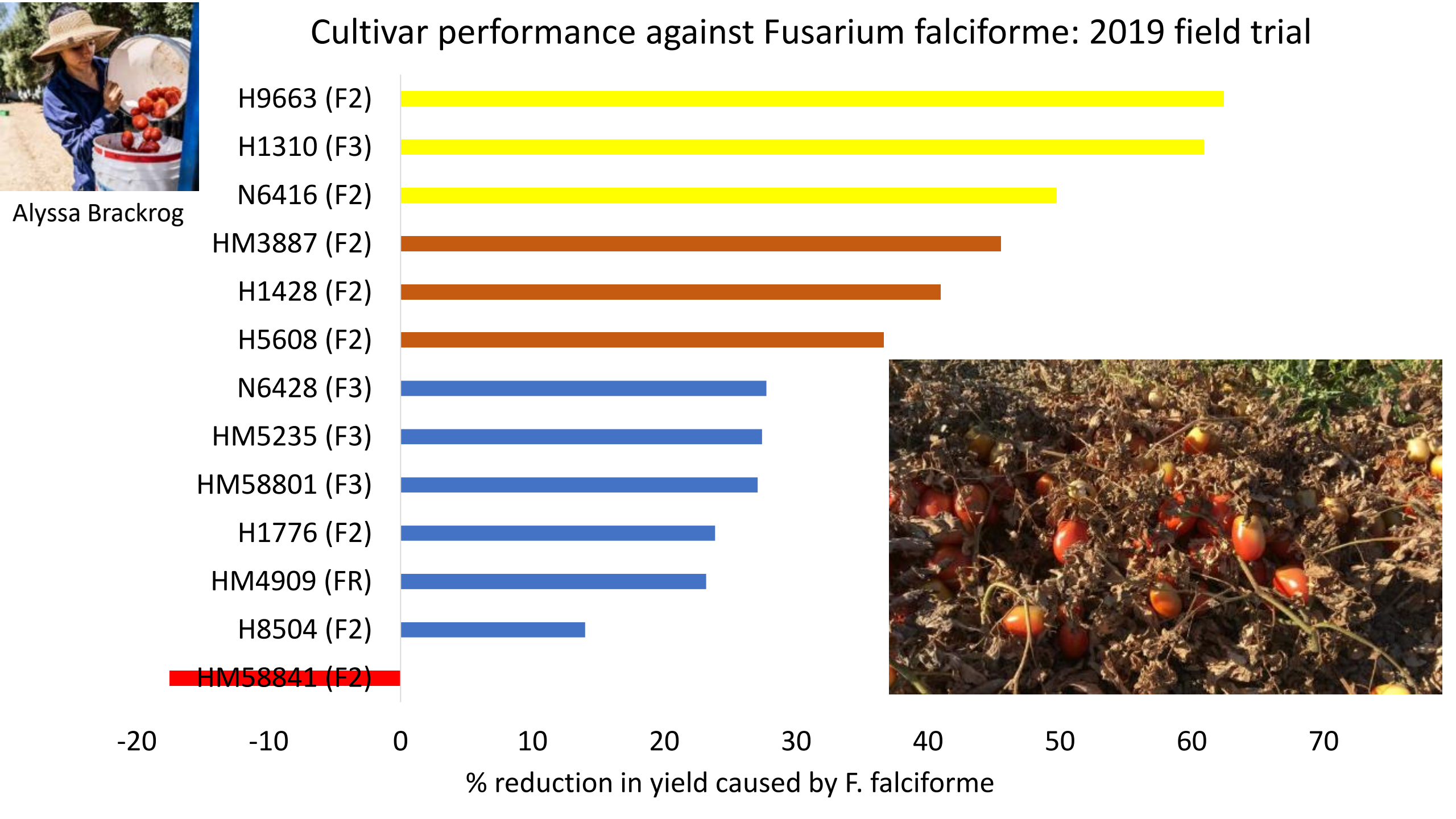
Cultivar resistance screening

16 commercial varieties



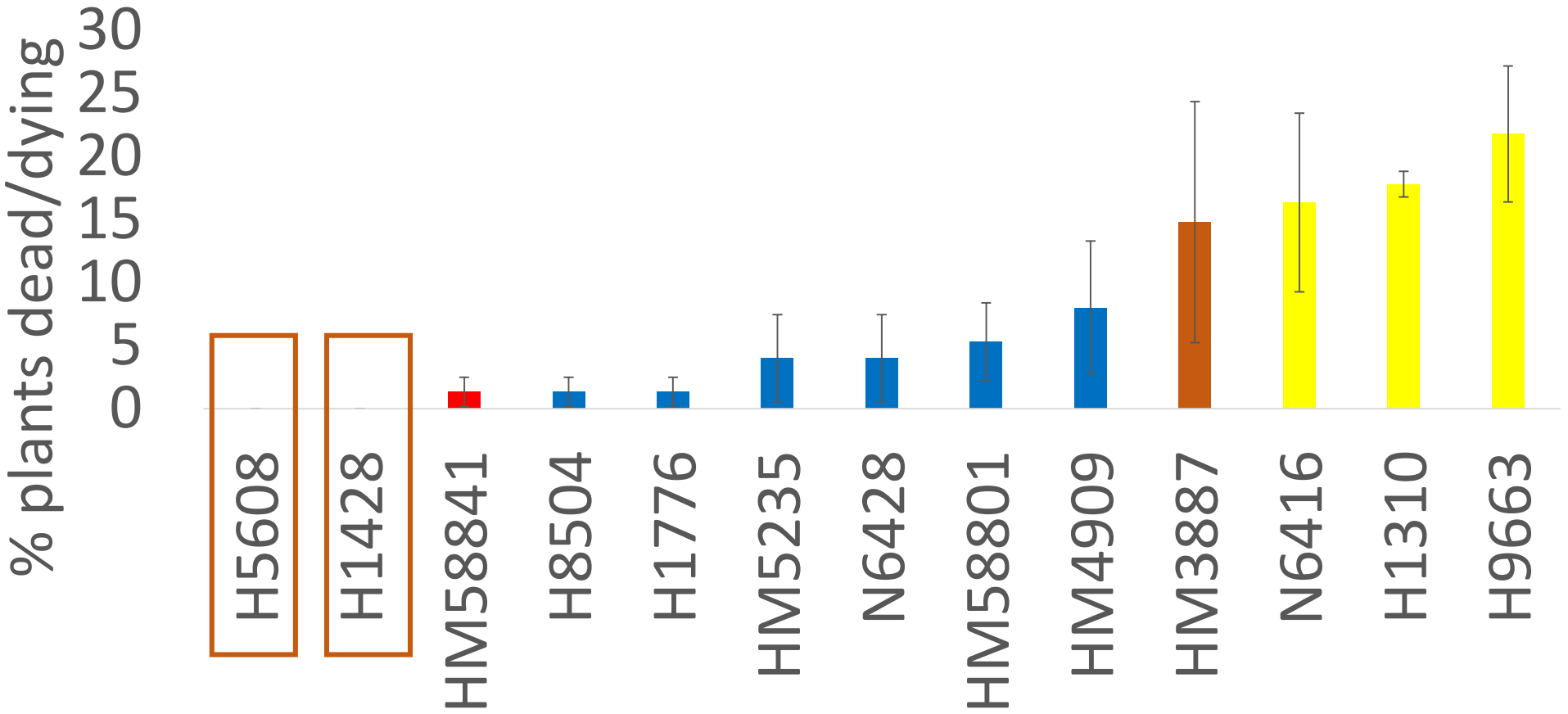
Alyssa Brackrog

Cultivar performance against Fusarium falciforme: 2019 field trial



Alyssa Brackrog

Better yield performance associated with lower premature vine decline incidence



Alyssa Brackrog

All cultivars: 85-100% of all plants developed rot

No COMPLETE resistance

Progress on *F. falciforme* IPM

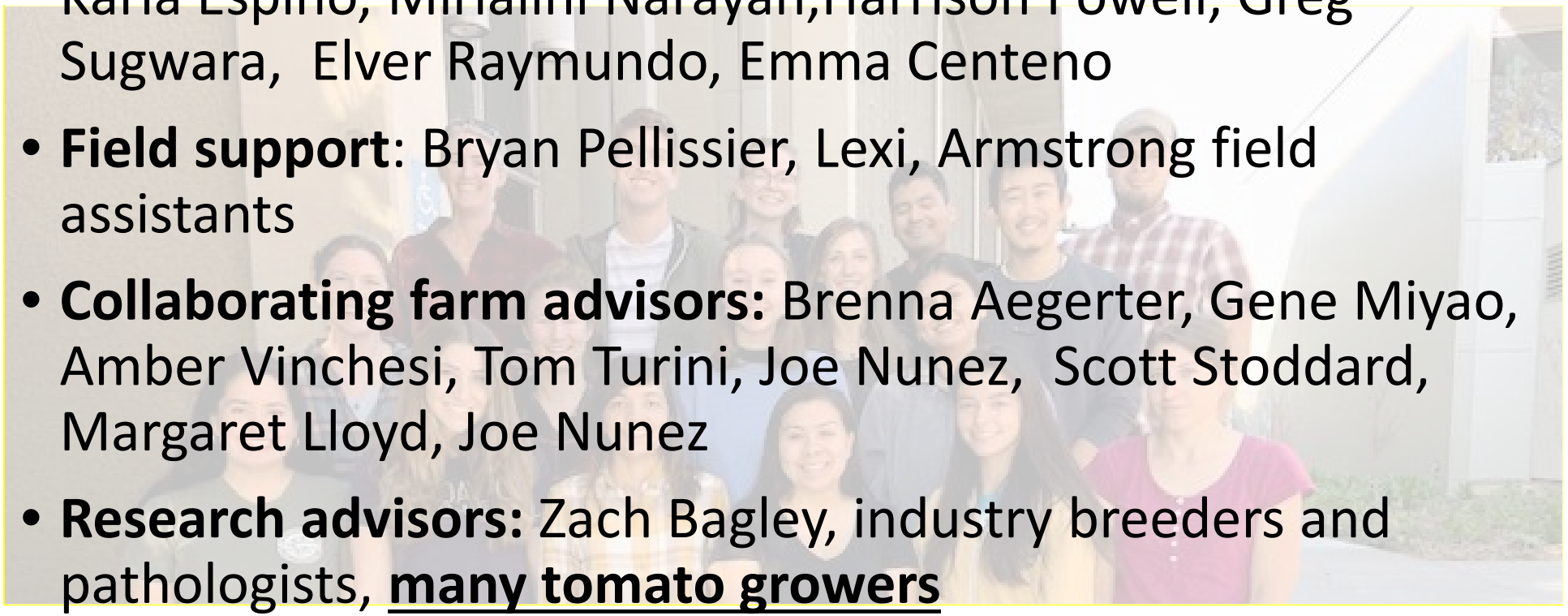
- **Developing field diagnosis guide**
- **Cultivars with FR and F3 genes ARE NOT resistant to FF**
- **Commercial cultivars have field tolerance to *Fusarium falciforme***
  - HM58841
  - H1776, HM 4909, H8504?, HM58801, HM5235, N6428
- **Some cultivars are highly susceptible to *F. falciforme*--avoid if possible in heavily infested fields**
  - H9663, H1310, N6416 and HM3887
- **Fungicide and fumigants may fit into IPM programming for *F. falciforme*—Brenna's talk**
- **Crop rotations / alternate hosts?**

To see this in action:
Biennial Tomato Disease Field Day-UC Davis

Next field day: 2021
1:1 available by appointment

The amazing Swettonians!

- **People who conducted/assisted with these projects**: **Alyssa Brackrog, Kelley Paugh, Johanna Del Castillo, Erin Helpio,** Beth Hellman, Justine Beaulieu, Megan Kozel, Andrea Paulk, Karla Espino, Mirialini Narayan,Harrison Powell, Greg Sugwara, Elver Raymundo, Emma Centeno
- **Field support**: Bryan Pellissier, Lexi, Armstrong field assistants
- **Collaborating farm advisors:** Brenna Aegerter, Gene Miyao, Amber Vinchesi, Tom Turini, Joe Nunez, Scott Stoddard, Margaret Lloyd, Joe Nunez
- **Research advisors:** Zach Bagley, industry breeders and pathologists, **many tomato growers**



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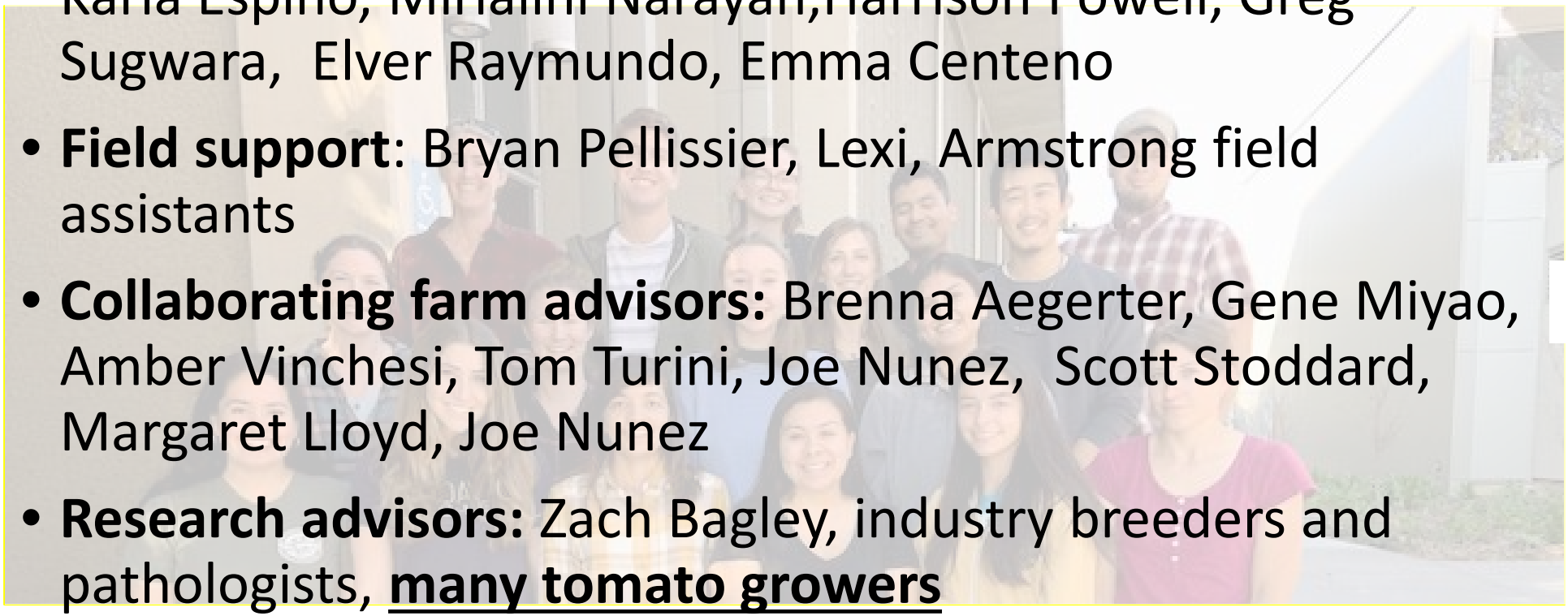

California Tomato Research Institute

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CMRB
stands for
California Melon Research Board
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Thank you!
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