Management updates for Fusarium diseases of tomato

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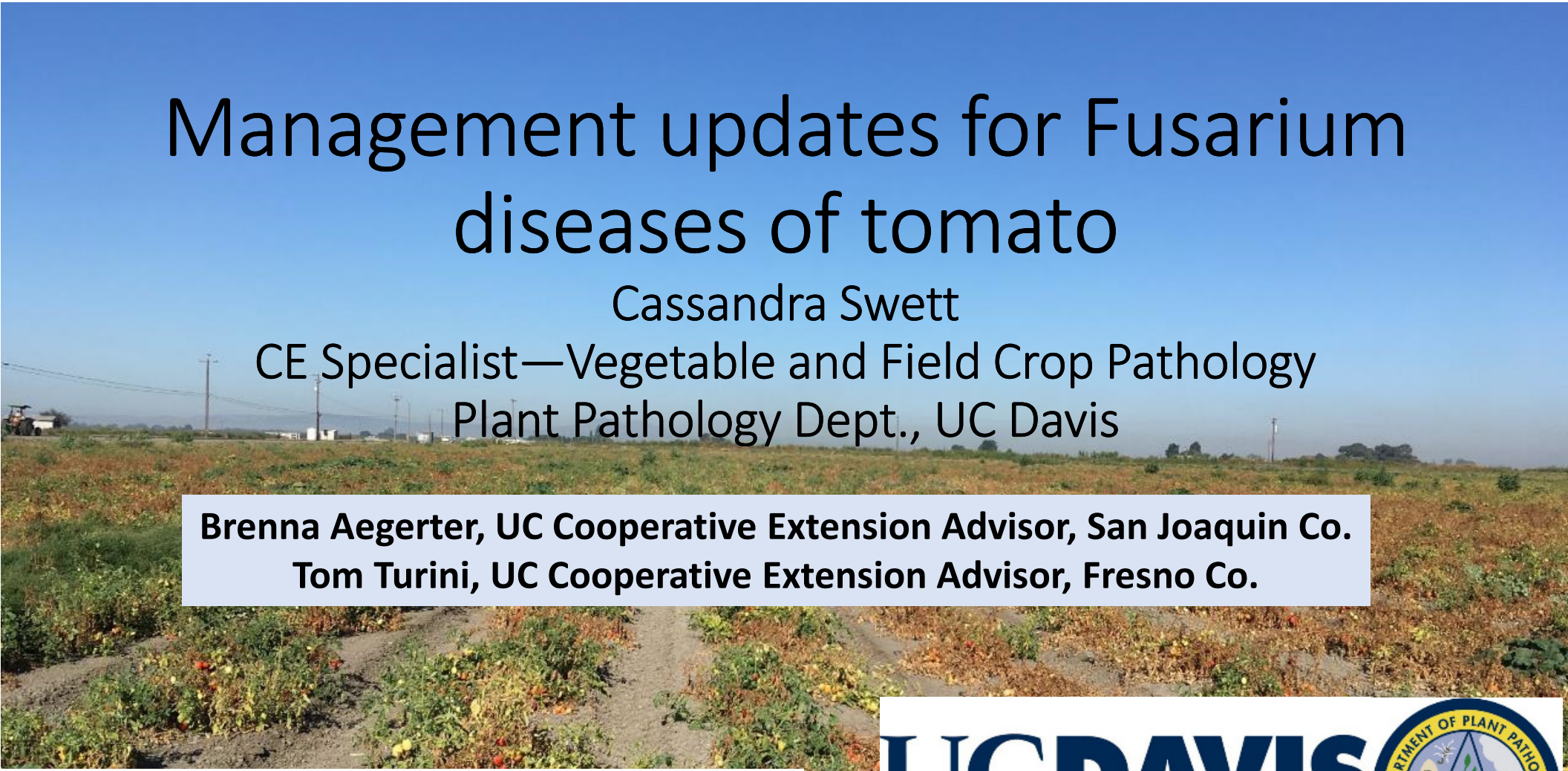

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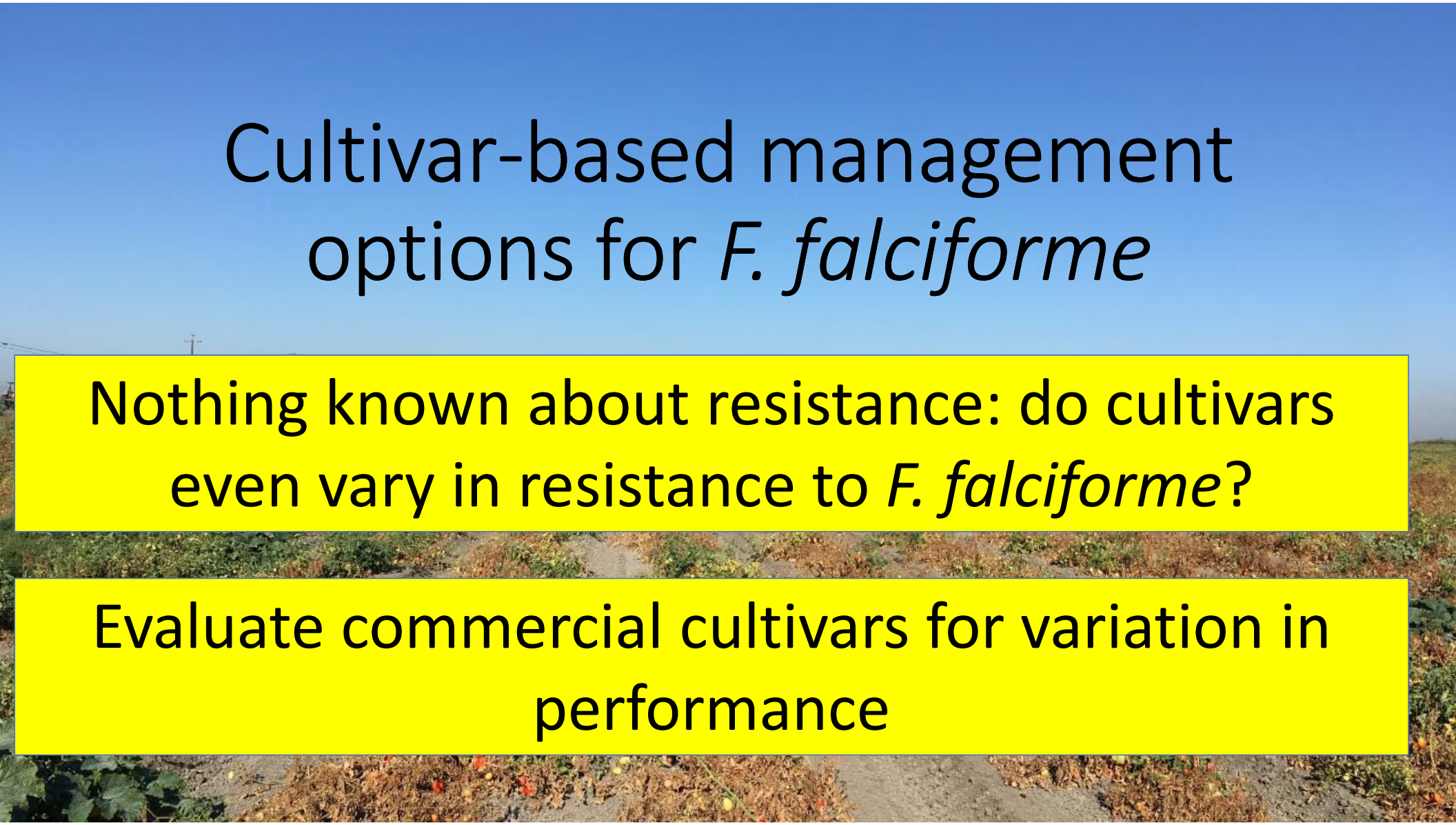
Fusarium falciforme stem rot and vine decline of tomato



Cultivar-based management options for *F. falciforme*

Nothing known about resistance: do cultivars even vary in resistance to *F. falciforme*?

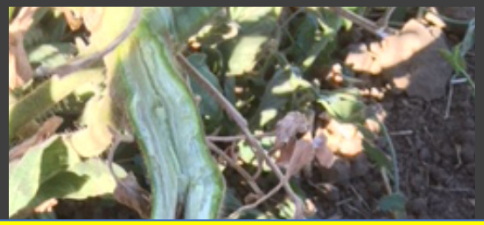
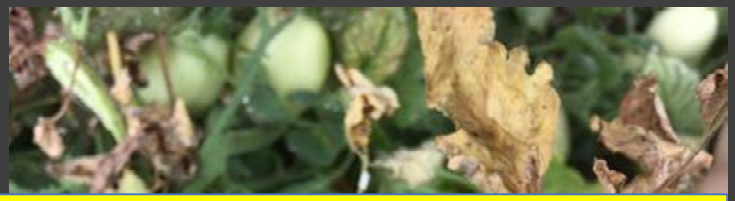
Evaluate commercial cultivars for variation in performance

Leaf speckles → leaflet blight → leaf death

Leaf death→ whole plant death

Cultivars vary in severity of foliar symptoms and decline development

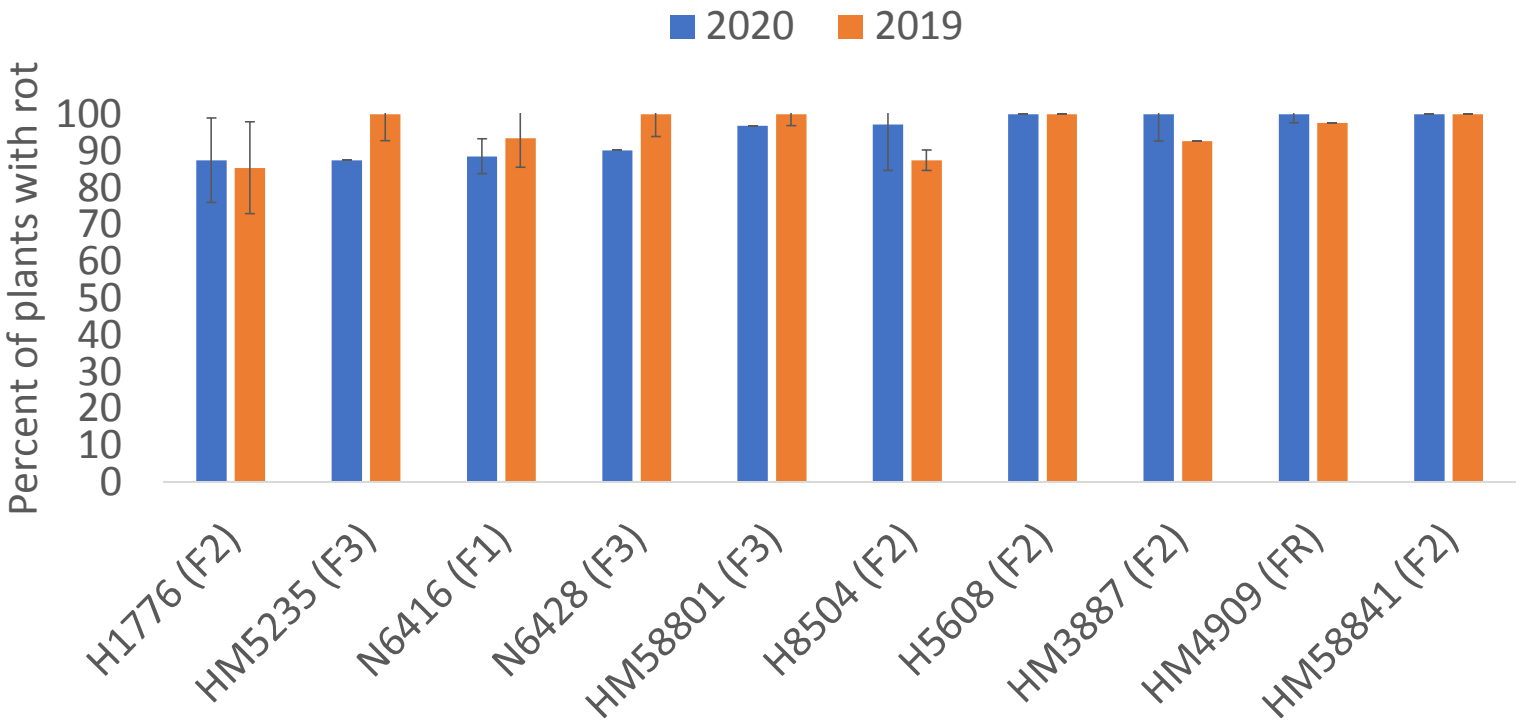
Stem rot below (foot) and above ground

Cultivars do not appear to vary in stem rot development: they all get at similar levels



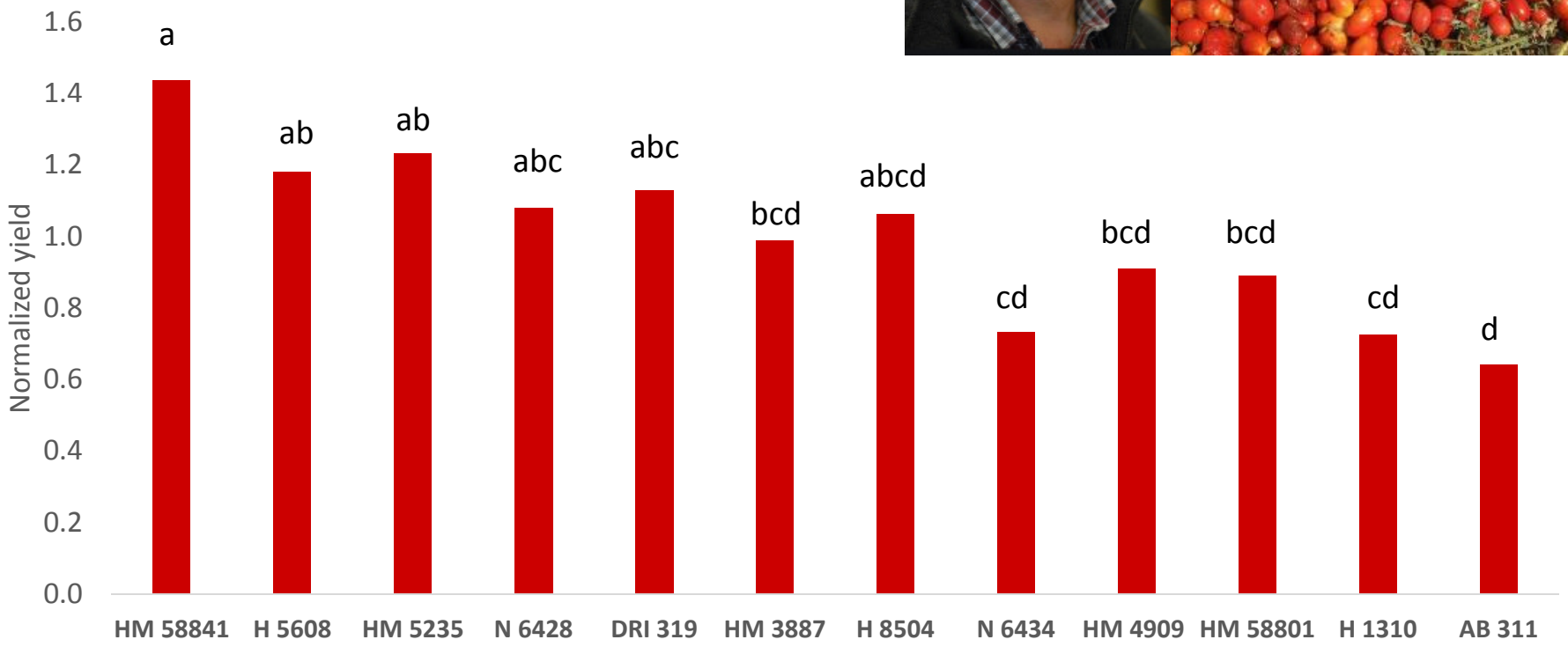
Stem rot is not a useful trait for resistance evaluations



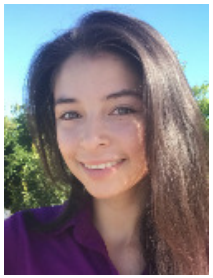
Cultivars also appear to vary in performance across years and sites

2020 trials: two sites, repeating 2019 cultivars

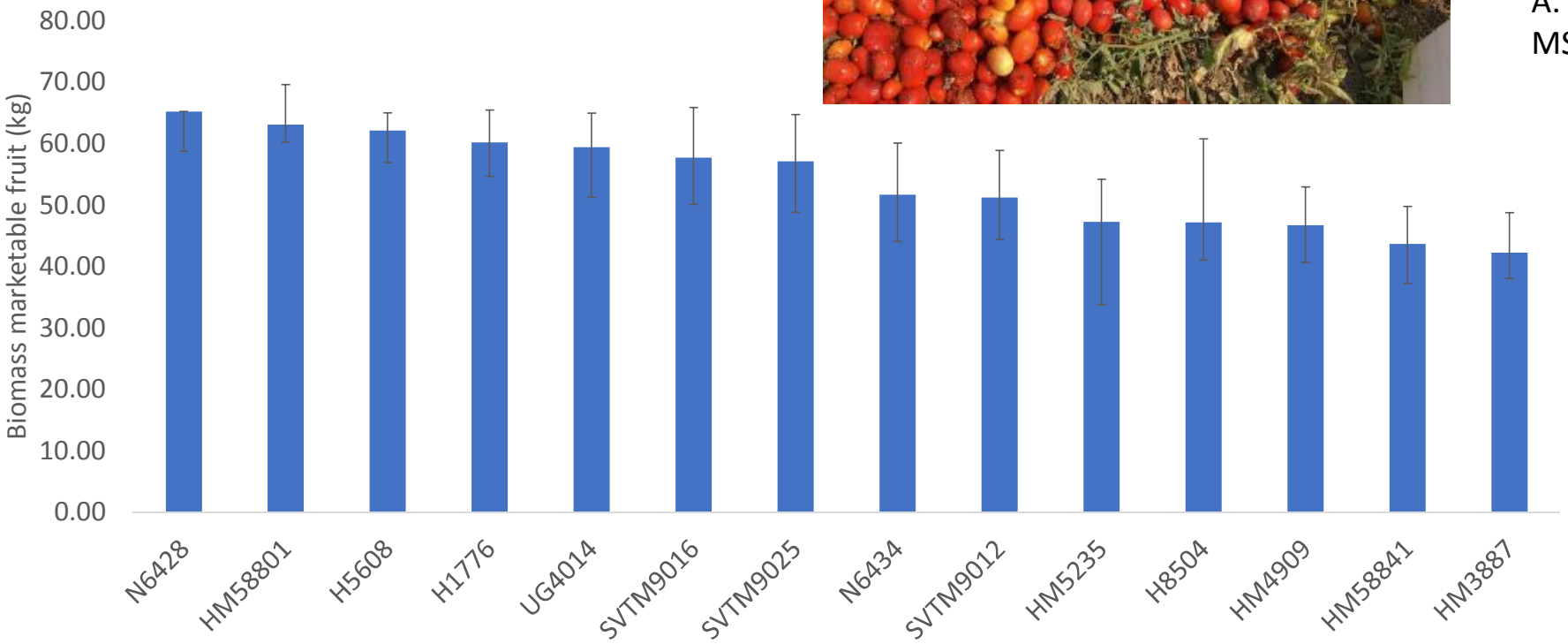
Fresno trial (Turini): yields

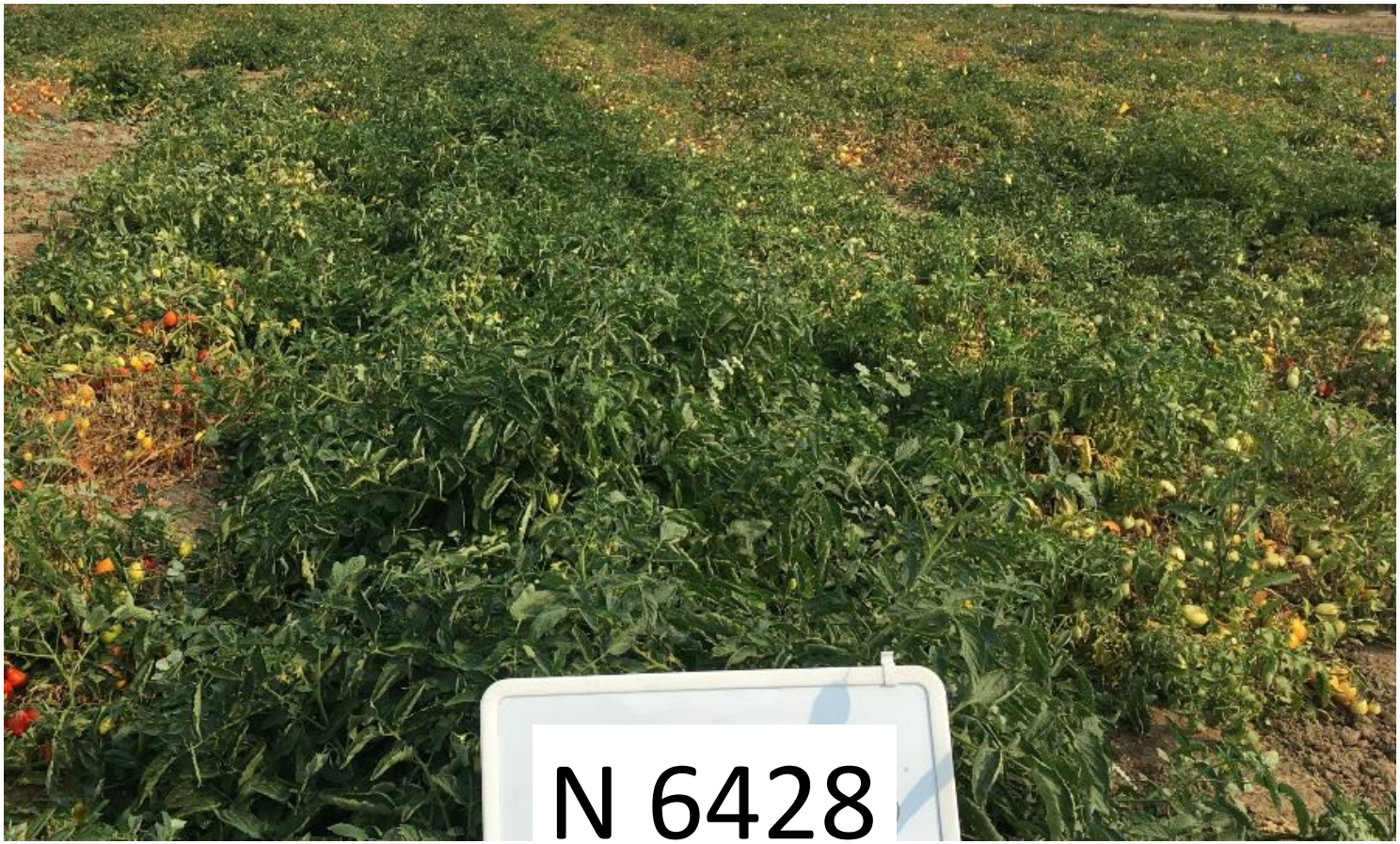


UC Davis trial: yields



A. Brackrog
MS student




N 6428

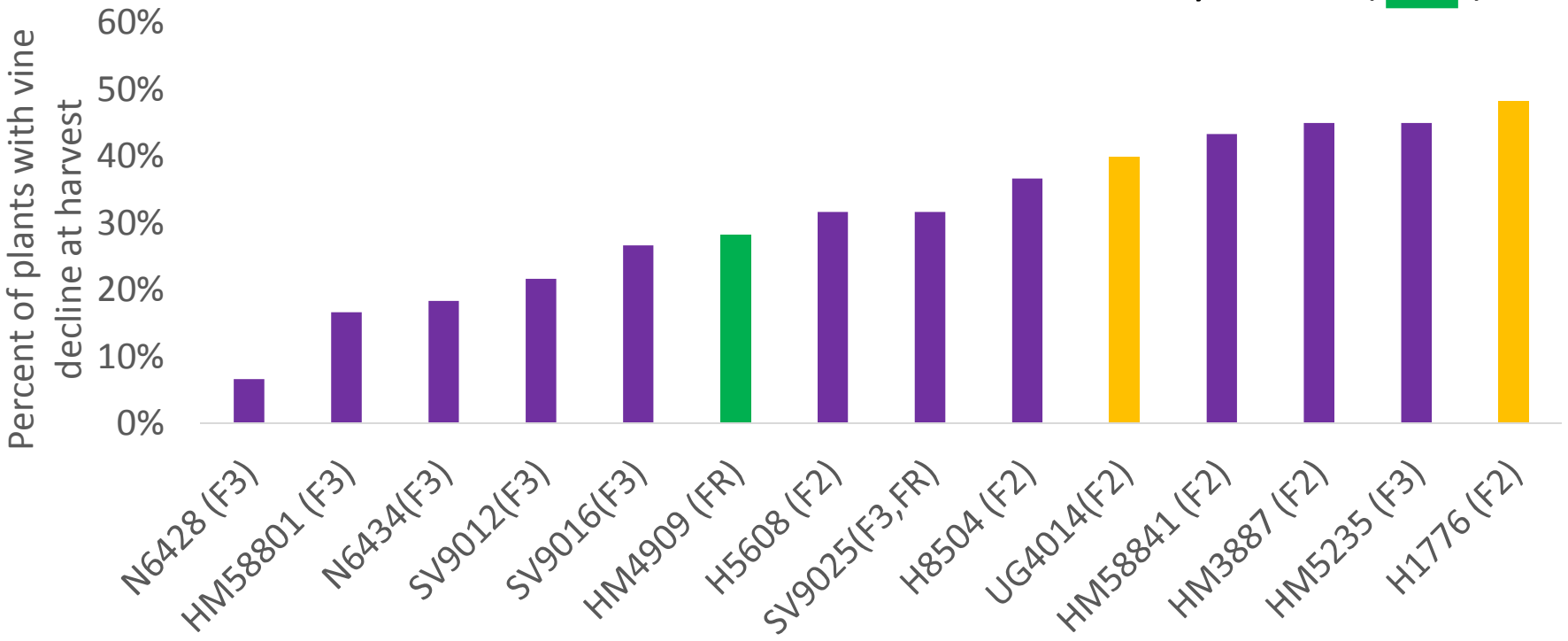
HM 4909 HM 58841

UC Davis trials:

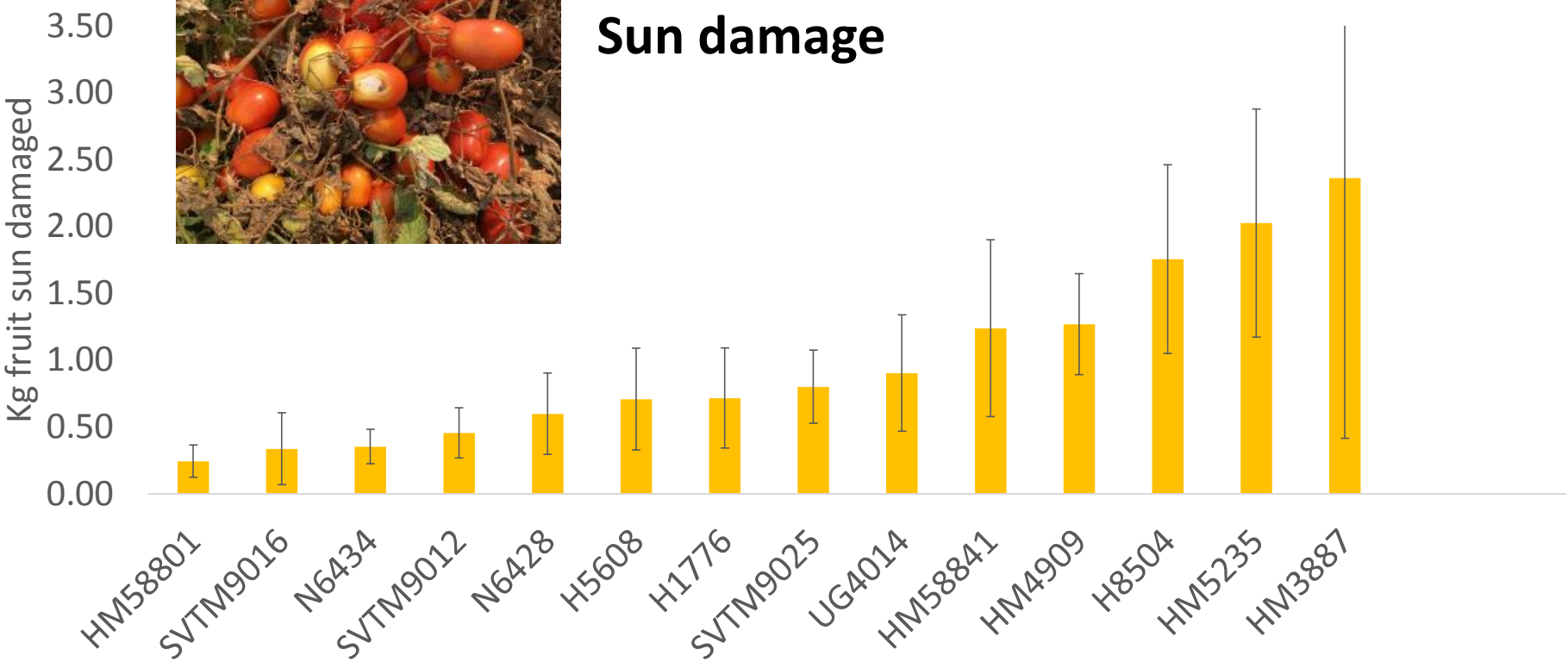
Yield performance often paralleled vine decline ( )

Some cultivars with high yields had high vine decline ( )

Some cultivars with low vine decline had low yields ( )

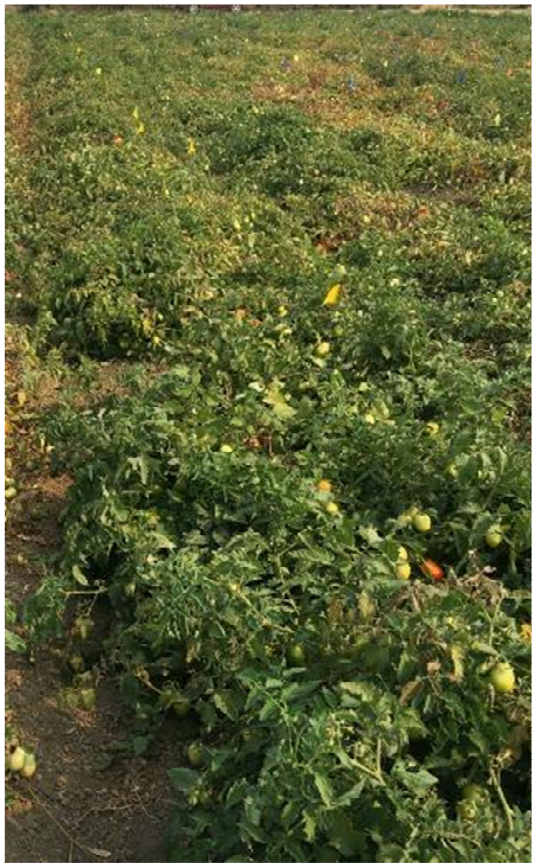


Differences in performance reflect impacts of plant decline on fruit damage



Top yielders under *F. falciforme* pressure based on 2020 trials

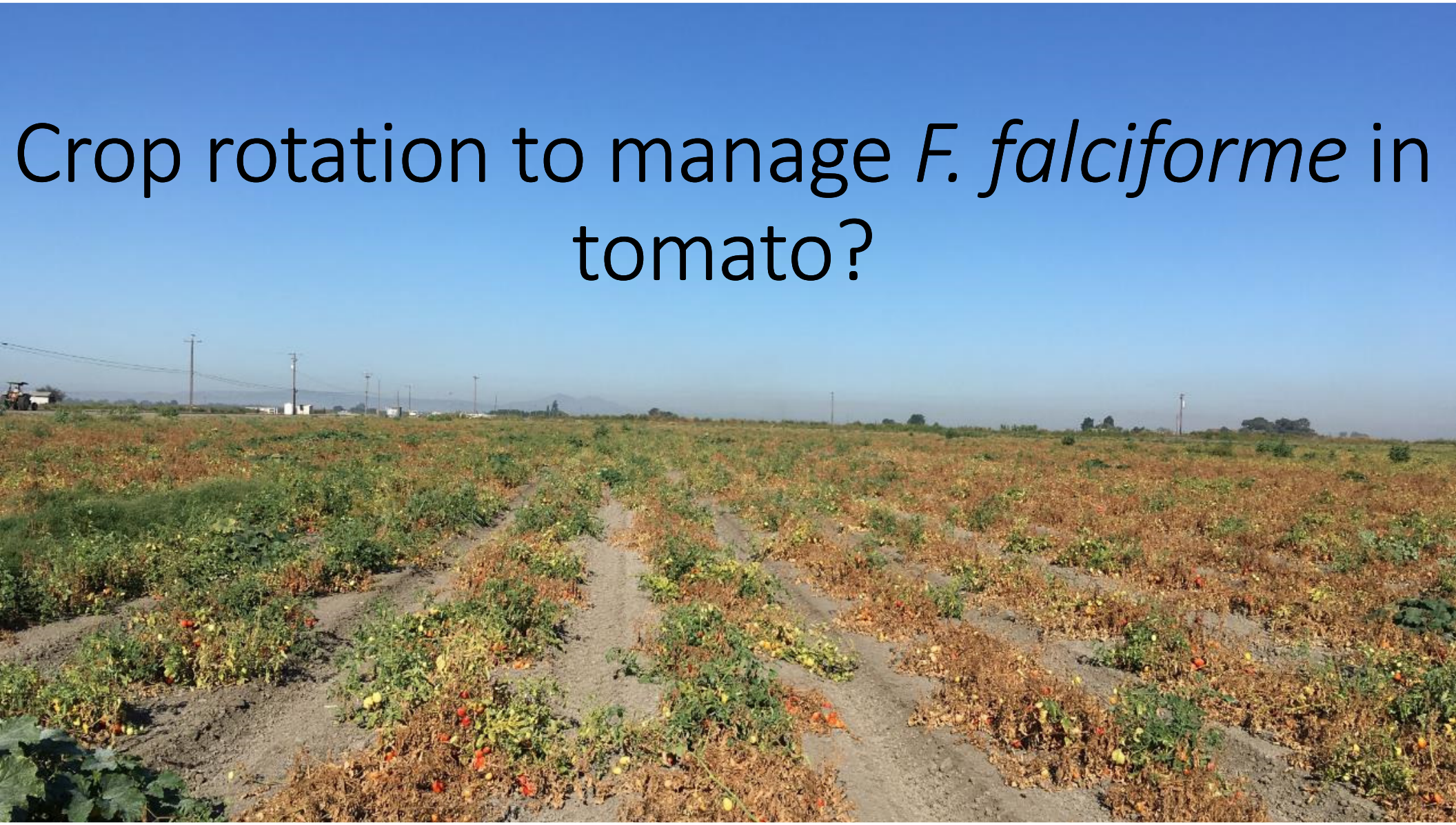
- Consistently top performers in 2020:
  - N6428, H5608
- Cultivars which performed well in one site but not the other:
  - HM58841, HM5235, HM58801
- Cultivars which performed well in the first trial year
  - H1779, UG4014, DRI 319, SVTM 9016
- Intermediate performers
  - H8504



Poor performers based on 2019 and 2020 trials

- Consistently poor performers in 2020:
  - HM 3887
- Cultivars which performed poorly in one site but not the other:
  - HM58841, HM5235
- Poor performers only tested at a single site:
  - 2020: AB 311, HM4909, N6434
  - 2019: H1310, H9663, N6416, H1428?

Crop rotation to manage *F. falciforme* in tomato?



2020 studies: *F. falciforme* that is pathogenic on tomato may infect and cause rot in other crops

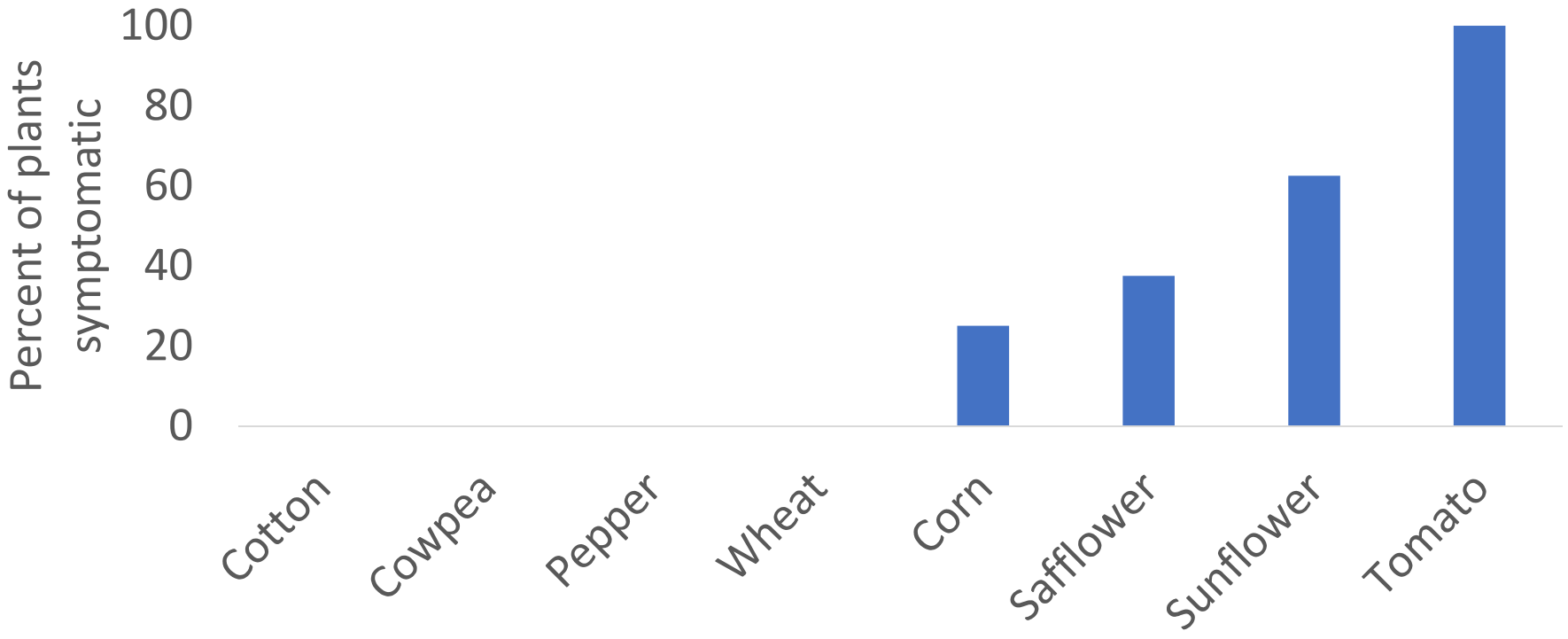
Dr. K. Paugh
Post-doc

Safflower

Sunflower

Corn

2020 studies: *F. falciforme* pathogenic on tomato may infect and cause rot in other crops



2021: Initiate controlled field studies to evaluate effects of different rotation crops on *F. falciforme* losses

Fusarium wilt

Caused by *Fusarium oxysporum* f. sp *lycopersici*, FO**L , 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
- One-sided 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

Managing Fusarium wilt: updates

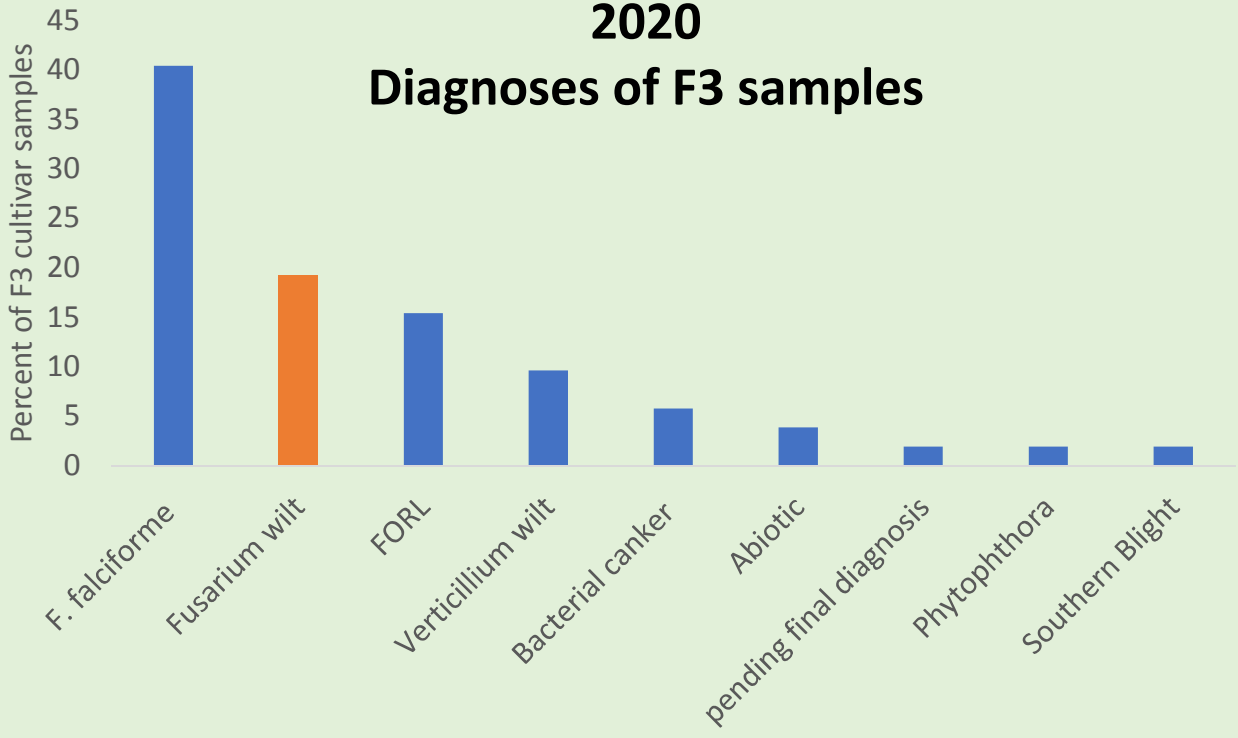
Cultivar resistance (F3) is our best tool

Managing Fusarium wilt: updates

B. Hellman

2020 F3 cultivar efficacy and race 4 monitoring

FW R status	No samples
F1	2
F2	62
F3	42
unknown	66
Total	**172**



Fusarium wilt and *F. falciforme* symptoms are very similar: easily confused in the field

Vascular discoloration

Yellow flagging of branches

Managing Fusarium wilt: updates

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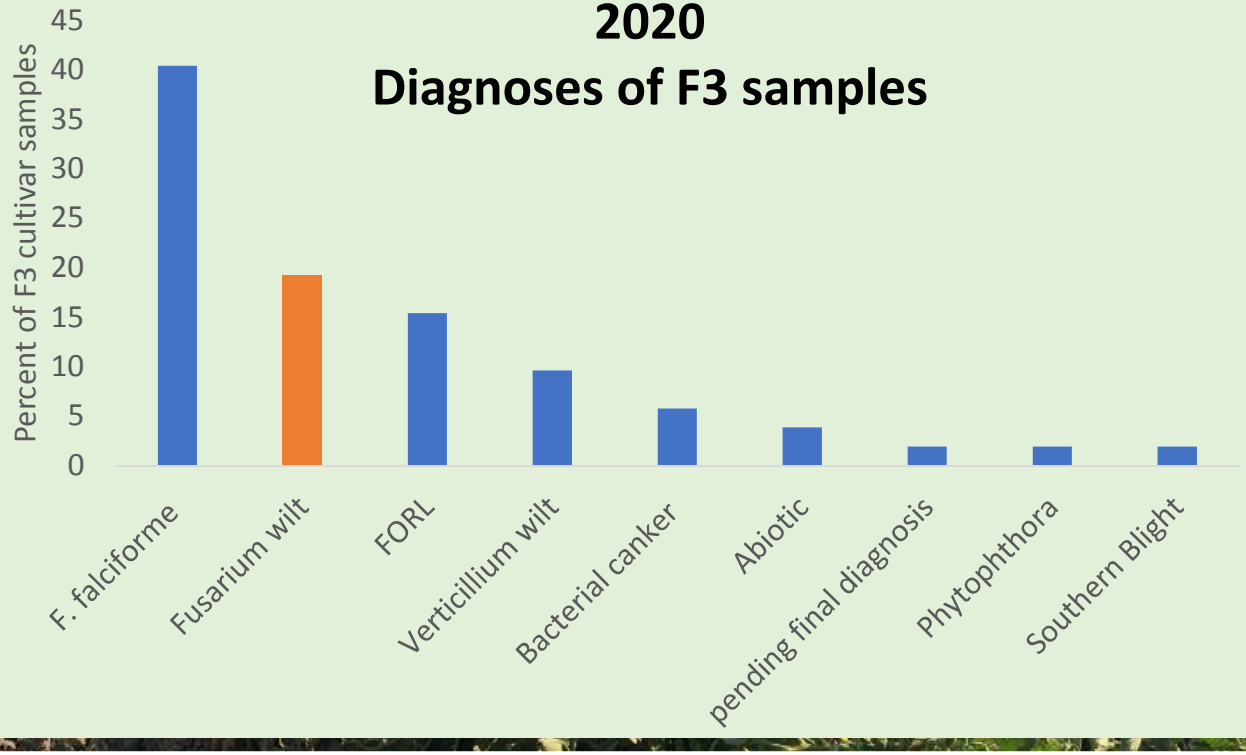
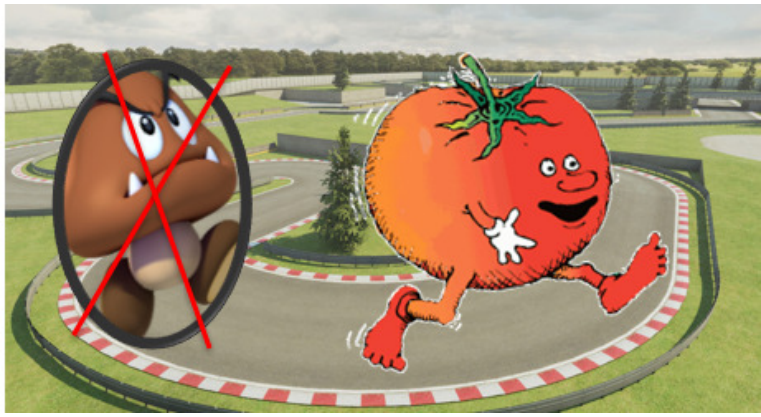


F3 cultivars are maintaining efficacy: no resistance breaking detected

- **NO RACE 4 DETECTED**
- Fol Race 4 not reported worldwide
- **2018:** Tested NINE Fol recovered from F3 plants
  → All were Fol race 3
- **2019**: Recovered Fol from TWO F3 fields
  → All were Fol race 3



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- **2018:** Tested NINE Fol recovered from F3 plants
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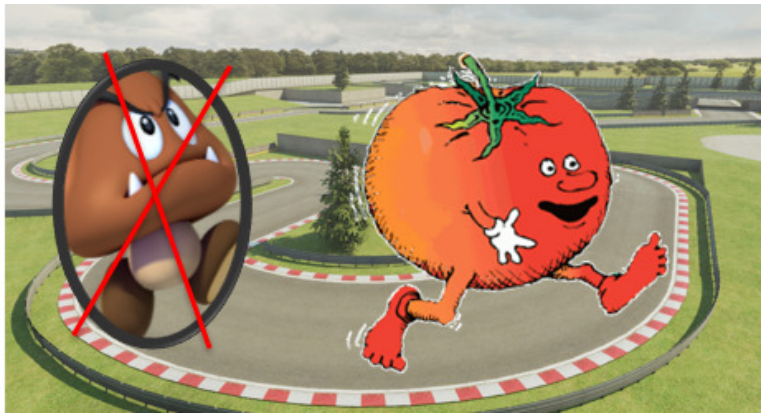
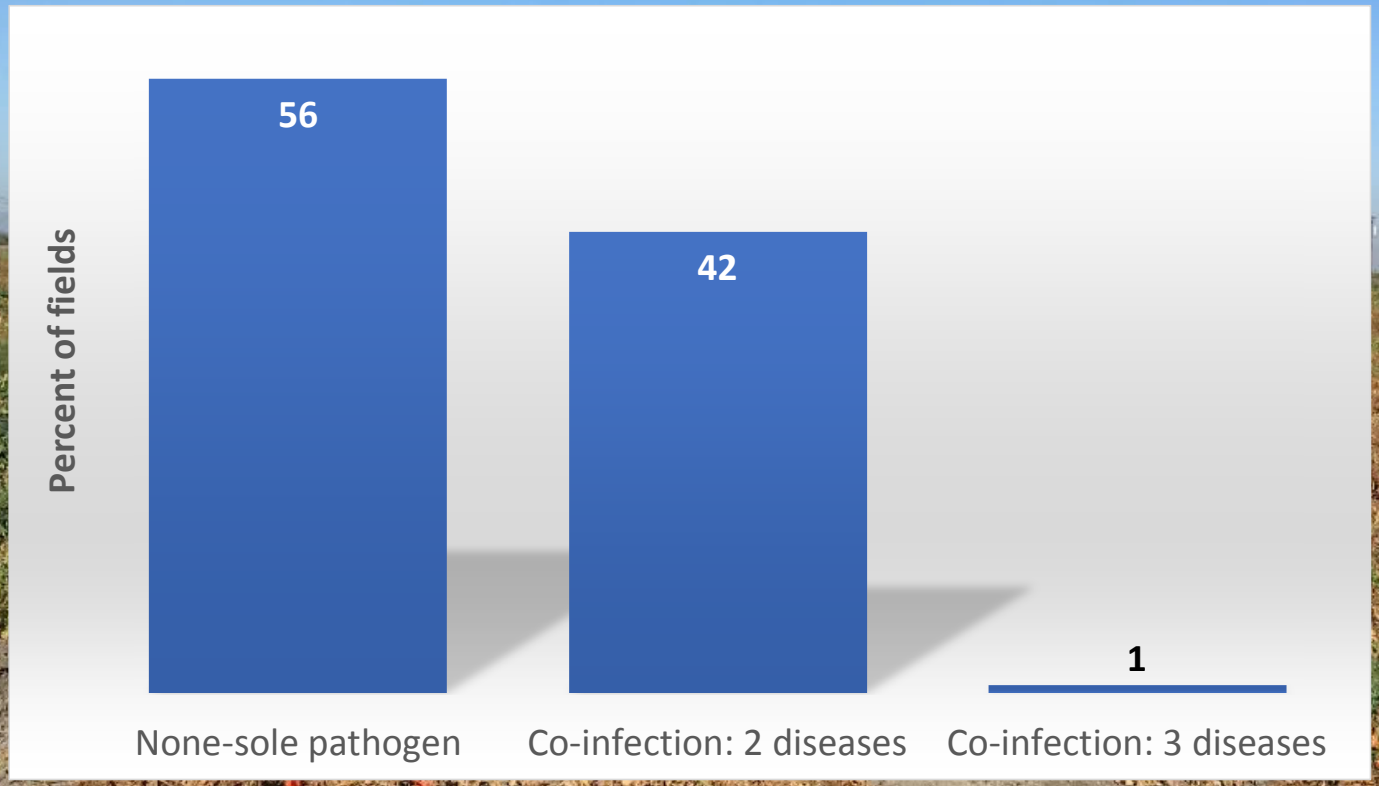
- **2019**: Recovered Fol from TWO F3 fields
  → All were Fol race 3
- **2020**: Recovered Fol from TWELVE F3 fields
  → In testing

B. Hellman



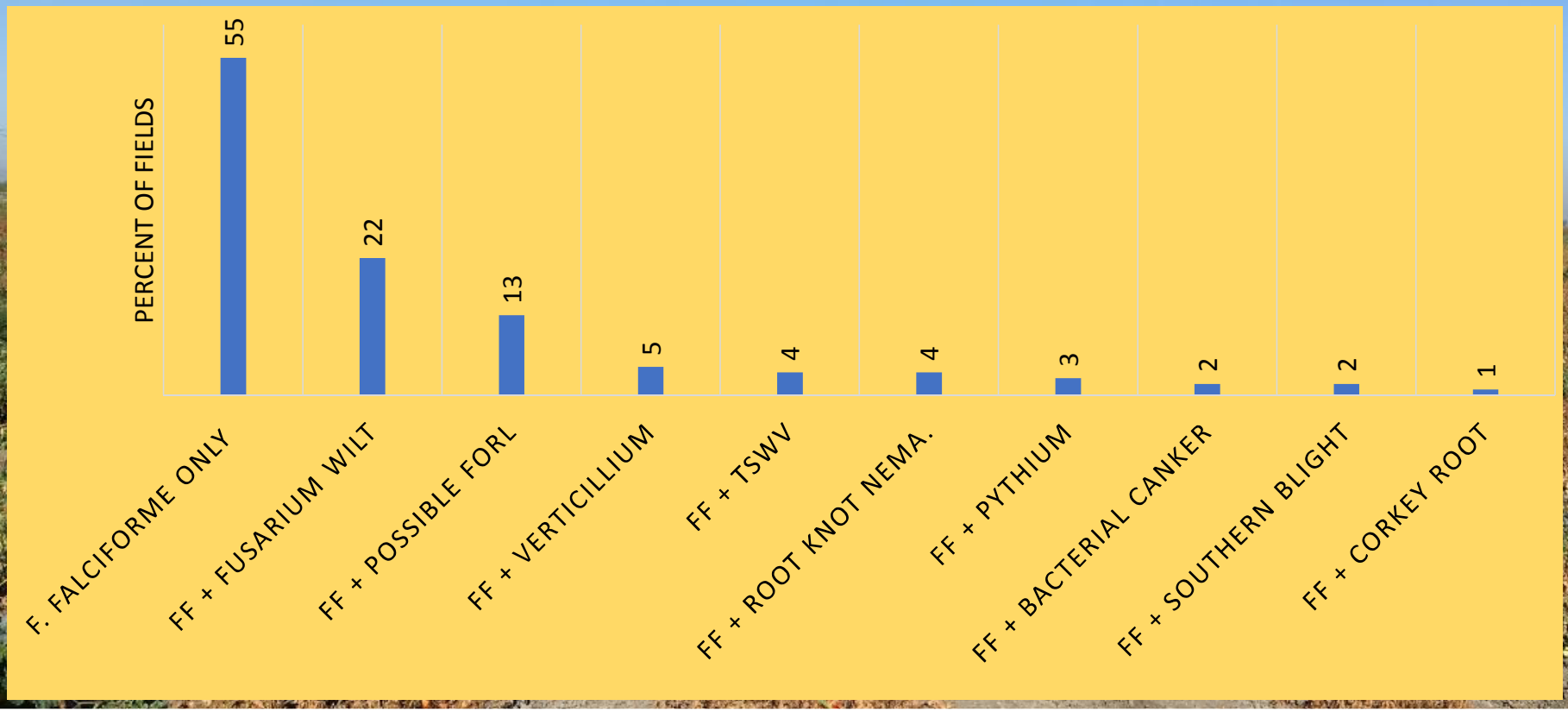
Co-managing Fusarium wilt and *F. falciforme*

~50% of fields have two or more pathogens



Co-managing Fusarium wilt and F. falciforme

Over 20% of fields with F. falciforme also have Fusarium wilt

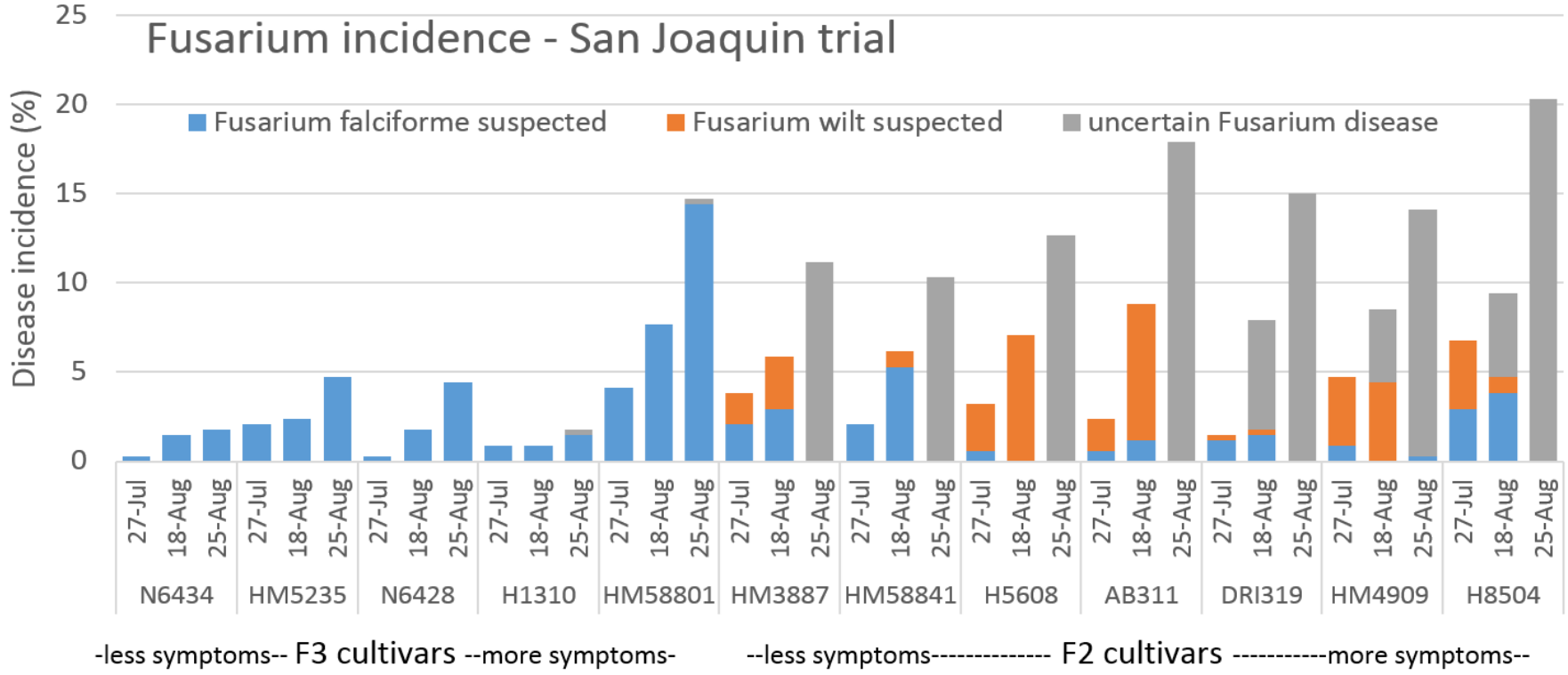


Co-managing Fusarium wilt and F. falciforme

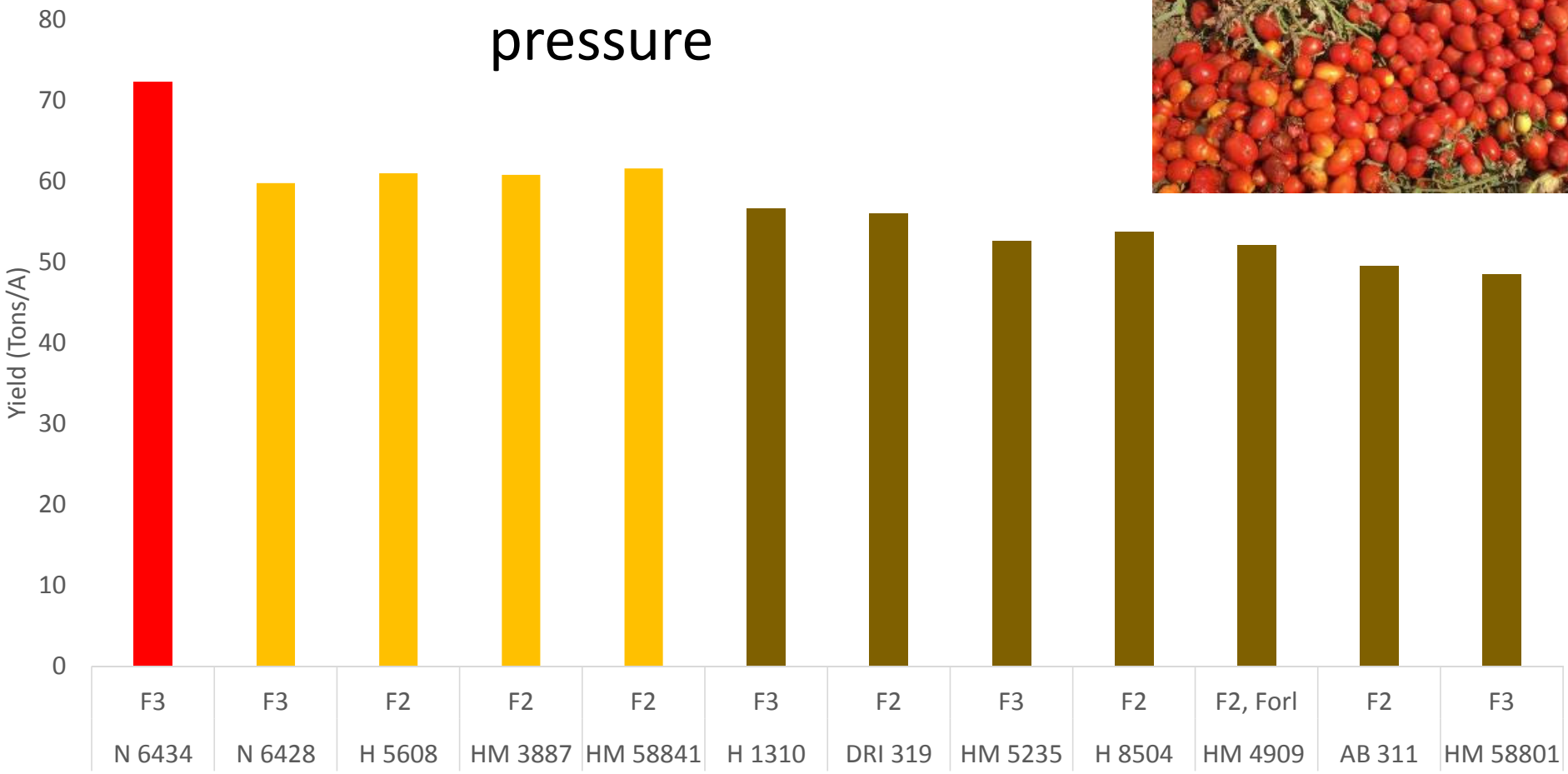
Can we use cultivars with multi-pathogen resistance to co-manage these pathogens in fields where both occur?

Cultivar	FW Res.	FF tolerant
N 6428	F3	Yes
N 6434	F3	No
H 1310	F3	No
HM 5235	F3	Maybe
HM 58801	F3	Maybe
H 5608	F2	Yes
HM 4909	F2	No
AB 311	F2	No
HM 3887	F2, R3 tolerant	No
DRI 319	F2	No
HM 58841	F2	Maybe
H 8504	F2	Maybe

2020: San Joaquin cultivar trial: *F. falciforme*-Fusarium wilt co-infected fields (Aegerter)



Yield performance under dual pathogen pressure



Top two performing cultivars were F3's (Fol race 3 resistant)-known high yielding F3s

Cultivar	FW Res.	FF tolerant	Yield (t/ac)	Separation
N 6434	F3	No	72.3	a
N 6428	F3	Yes	59.8	bcd
H 5608	F2	Yes	61	bc
HM 3887	F2, R3 tolerant	No	60.8	bc
HM 58841	F2	Maybe	61.6	b
H 1310	F3	No	56.7	cde
DRI 319	F2	No	56.1	def
HM 5235	F3	Maybe	52.6	efgh
H 8504	F2	Maybe	53.8	efg
HM 4909	F2, Forl	No	52.1	fgh
AB 311	F2	No	49.6	gh
HM 58801	F3	Maybe	48.5	h

HM 3887 also did well—considered tolerant to Fusarium wilt, and high yielding

Cultivar	FW Res.	FF tolerant	Yield (t/ac)	Separation
N 6434	F3	No	72.3	a
N 6428	F3	Yes	59.8	bcd
H 5608	F2	Yes	61	bc
HM 3887	F2, R3 tolerant	No	60.8	bc
HM 58841	F2	Maybe	61.6	b
H 1310	F3	No	56.7	cde
DRI 319	F2	No	56.1	def
HM 5235	F3	Maybe	52.6	efgh
H 8504	F2	Maybe	53.8	efg
HM 4909	F2, Forl	No	52.1	fgh
AB 311	F2	No	49.6	gh
HM 58801	F3	Maybe	48.5	h

But several poor performers were also F3—may reflect yield performance, rather than resistance

Cultivar	FW Res.	FF tolerant	Yield (t/ac)	Separation
N 6434	F3	No	72.3	a
N 6428	F3	Yes	59.8	bcd
H 5608	F2	Yes	61	bc
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HM 4909	F2, Forl	No	52.1	fgh
AB 311	F2	No	49.6	gh
HM 58801	F3	Maybe	48.5	h

Fusarium wilt resistance is important for co-management, when varieties are high yielding

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N 6428	F3	Yes	59.8	bcd
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AB 311	F2	No	49.6	gh
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Our two strong *F. falciforme*-tolerant lines also did well

Cultivar	FW Res.	FF tolerant	Yield (t/ac)	Separation
N 6434	F3	No	72.3	a
N 6428	F3	Yes	59.8	bcd
H 5608	F2	Yes	61	bc
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HM 4909	F2, Forl	No	52.1	fgh
AB 311	F2	No	49.6	gh
HM 58801	F3	Maybe	48.5	h

The more intermediate performers against *F. falciforme* (maybe's) ranged from good to poor

Cultivar	FW Res.	FF tolerant	Yield (t/ac)	Separation
N 6434	F3	No	72.3	a
N 6428	F3	Yes	59.8	bcd
H 5608	F2	Yes	61	bc
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HM 4909	F2, Forl	No	52.1	fgh
AB 311	F2	No	49.6	gh
HM 58801	F3	Maybe	48.5	h

F. falciforme tolerance is important for co-management—need more cultivar options

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N 6428	F3	Yes	59.8	bcd
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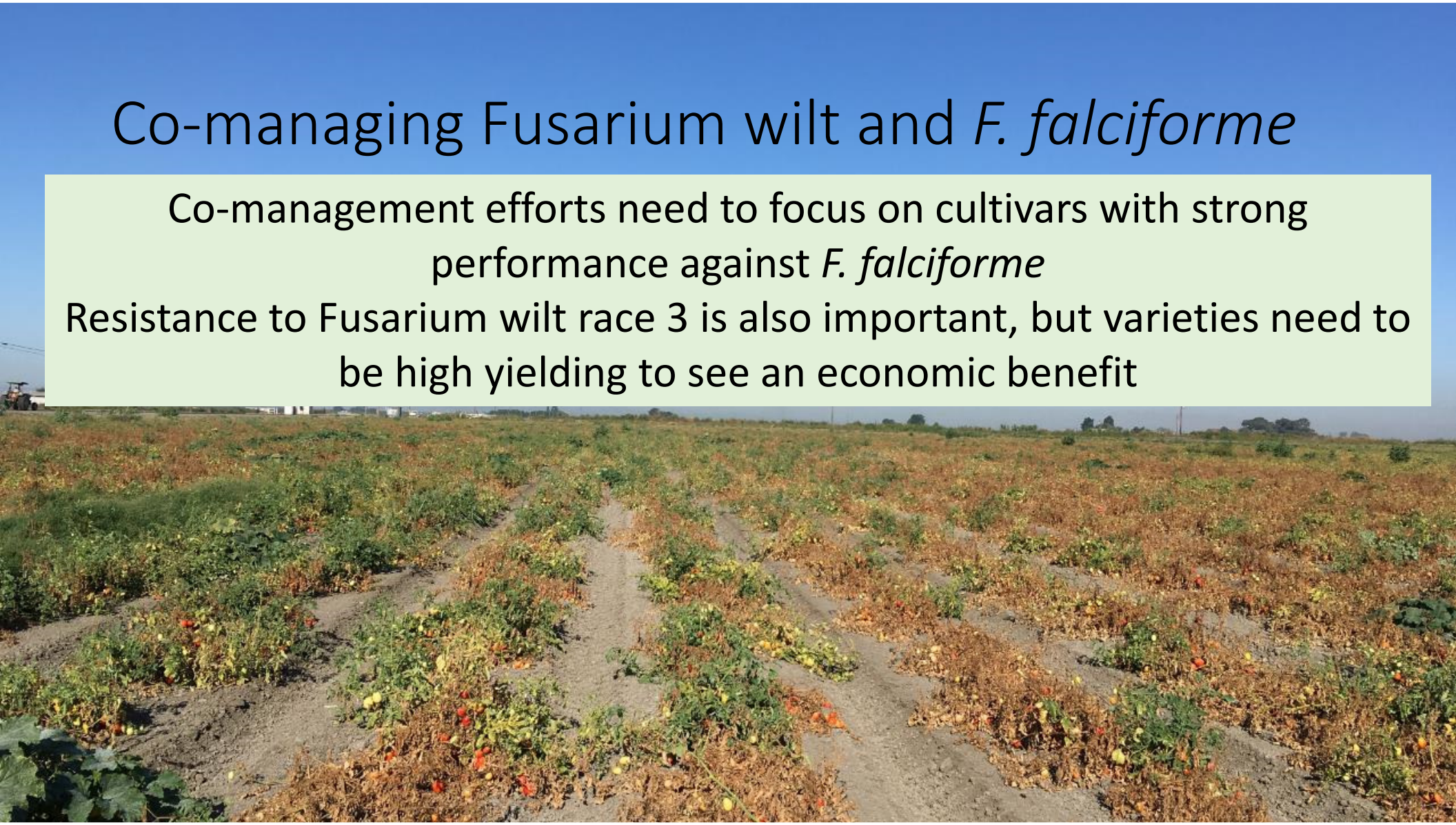
Co-managing Fusarium wilt and *F. falciforme*

Co-management efforts need to focus on cultivars with strong performance against *F. falciforme*

Resistance to Fusarium wilt race 3 is also important, but varieties need to be high yielding to see an economic benefit



Co-managing Fusarium wilt and *F. falciforme*

Further trials planned to evaluate a wider range of cultivars for Fusarium wilt-*F. falciforme* management at one to two sites in 2021

The amazing Swettonians!

- **People who conducted/assisted with these projects**: Kelley Paugh, Alyssa Brackrog, Emma Centeno, Justine Beaulieu, Forrest Wilcox, Cooper Calvin, Aimee Hopkins, Hanna Josifek, Rachel Hallmark
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California Department of Pesticide Regulation

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Questions?
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