



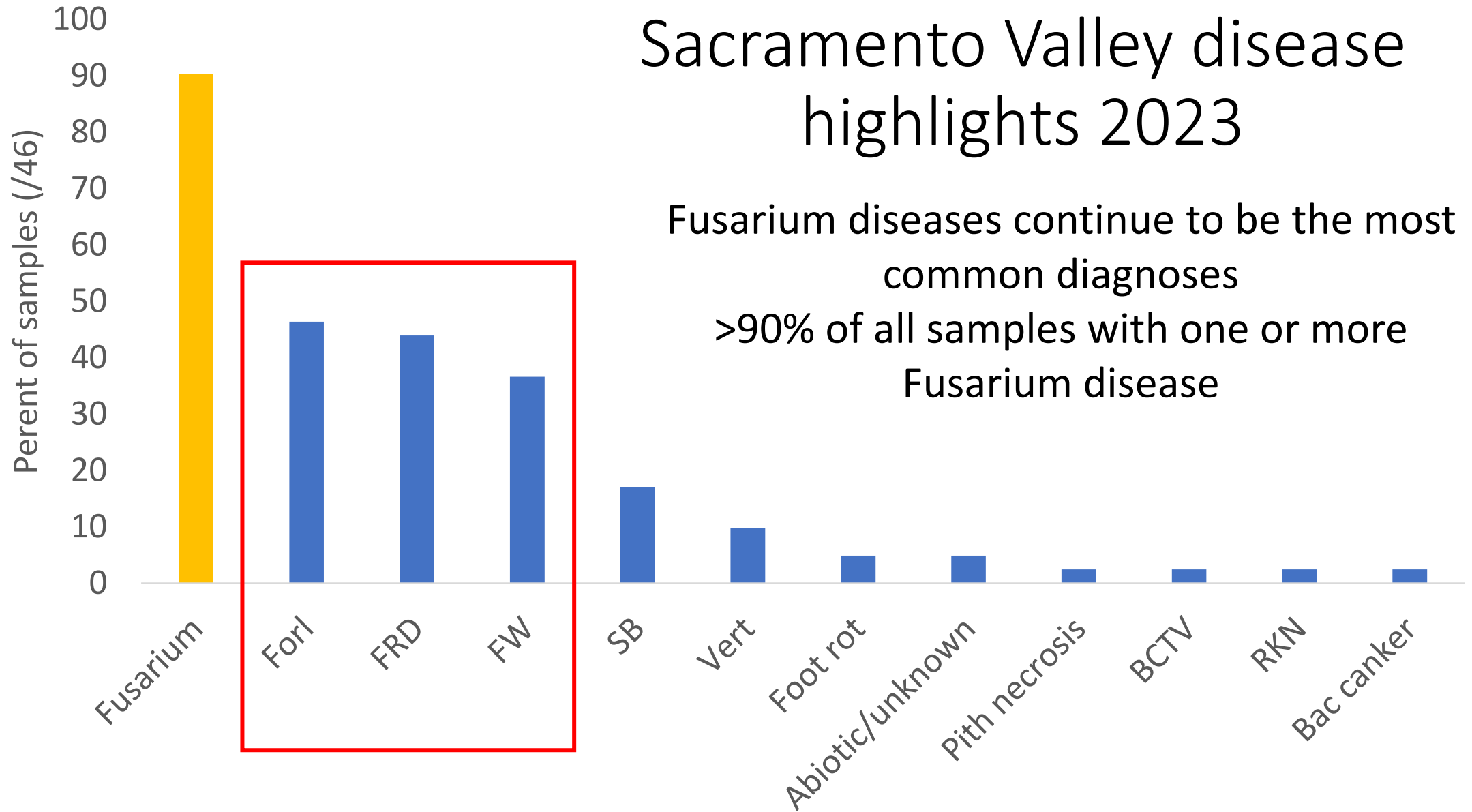
2023 Tomato disease updates for the Sacramento Valley

Cassandra Swett
UC Davis, Dept. of Plant Pathology

Sacramento Valley disease highlights 2023

Fusarium diseases continue to be the most common diagnoses

>90% of all samples with one or more Fusarium disease



Fusarium oxysporum

Fusarium wilt
f. sp. lycopersici
Fol (race 3)

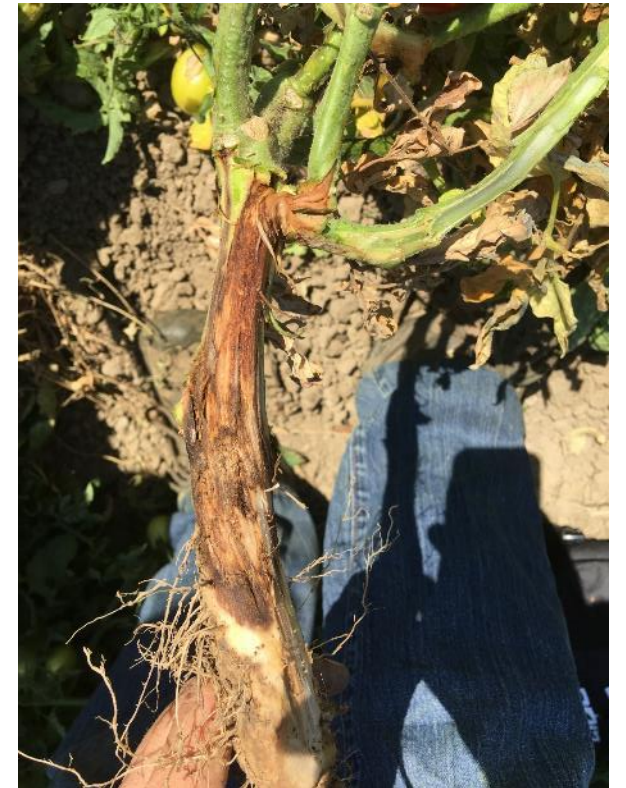


Fusarium crown and
root rot
f.sp. radicis-lycopersici
For1

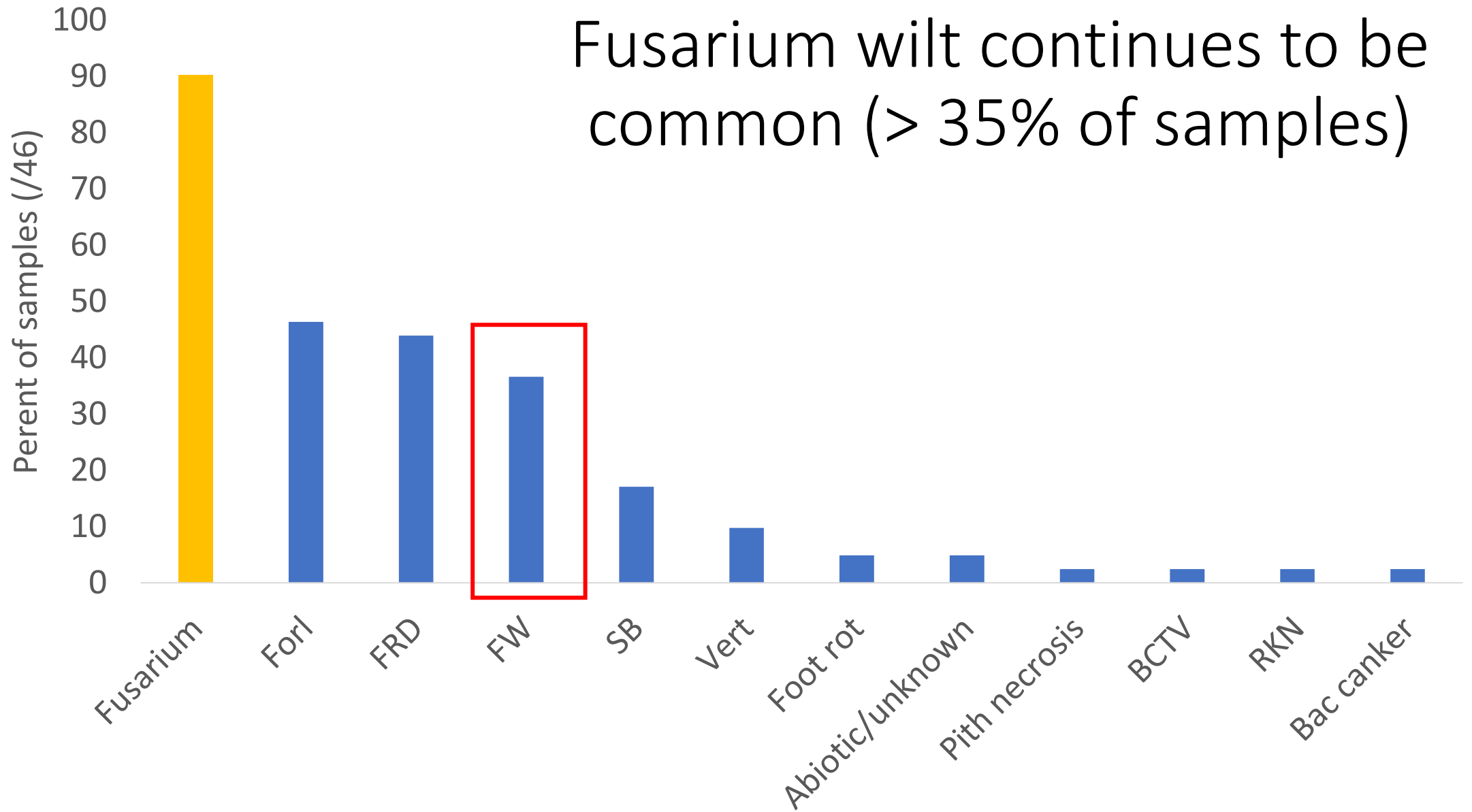


F. solani species complex

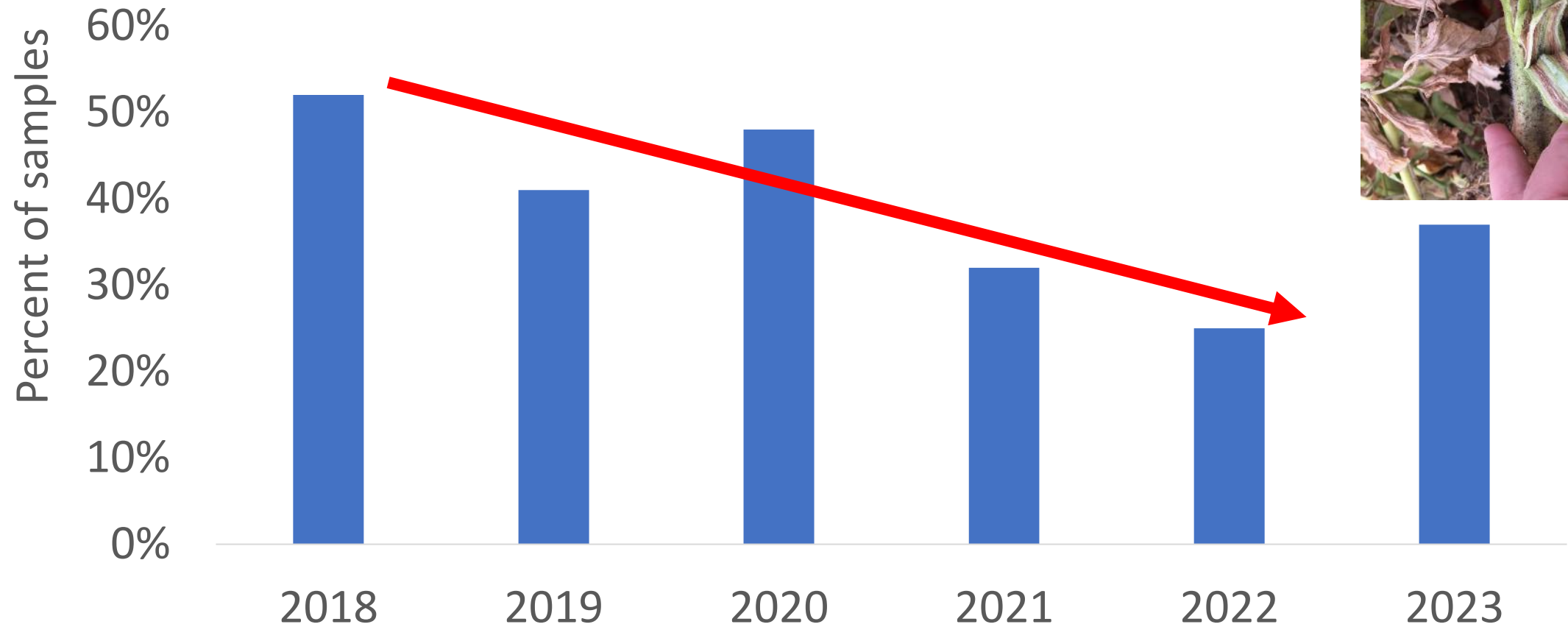
Foot/stem rot and
vine decline



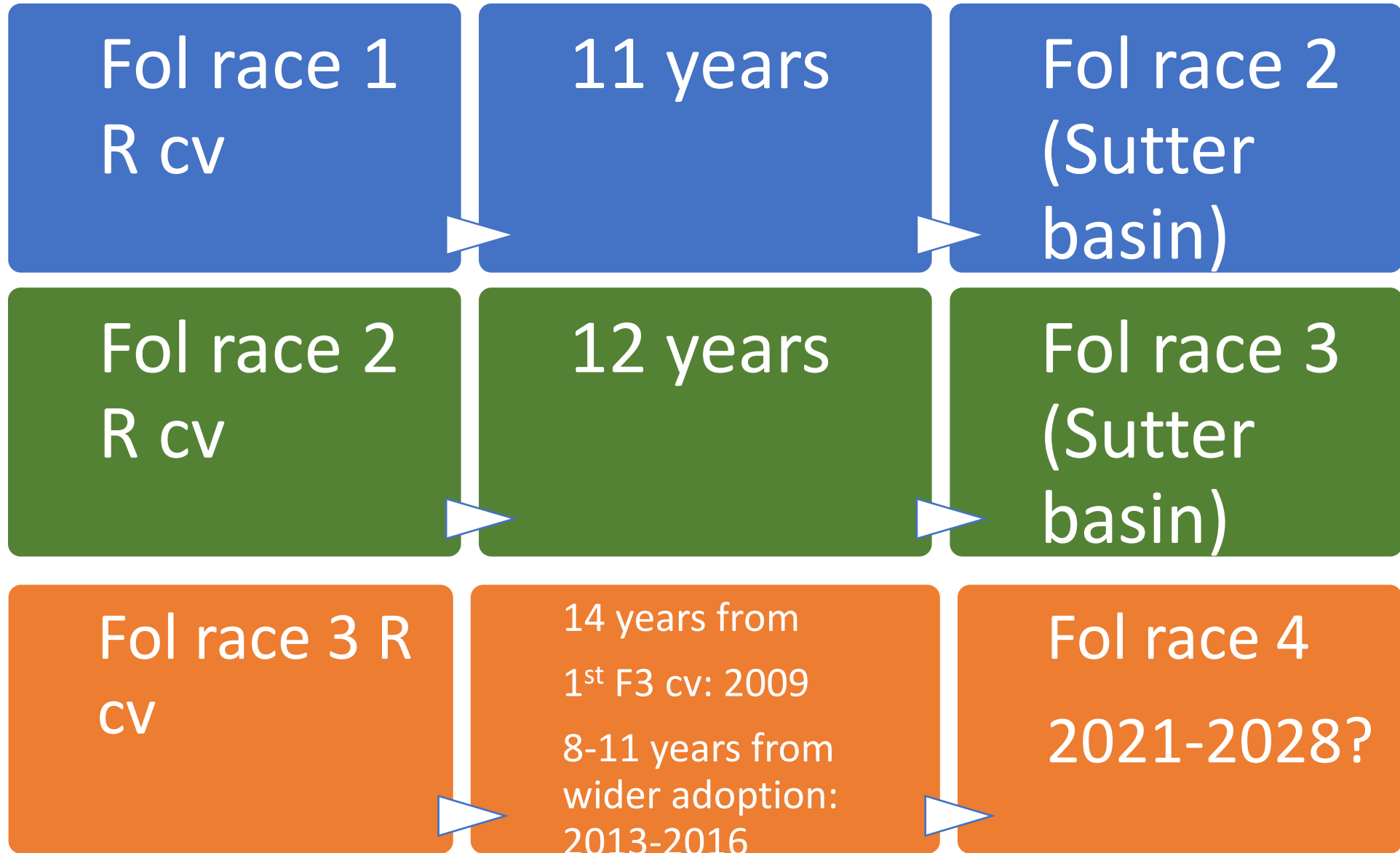
Fusarium wilt continues to be common (> 35% of samples)



Statewide, Fusarium wilt diagnoses have been decreasing as F3 use is increasing



Fusarium wilt resistance-breaking race timeline



Fusarium wilt in resistant cultivars

19 F3 fields in 6 years have had Fol
All were Fol race 3

	No fields (percent)							
			Fol					
Year	Total	Pot Fol	R1	R2	R3	R4	Forl	Non-Path
2017	2	2	0	0	2 (100%)	0	0	0
2018	11	11	0	0	11 (100%)	0	0	0
2019	0	0	0	0	0	0	0	0
2020	2	2	0	0	2 (100%)	0	0	0
2021	2	2	0	0	2 (100%)	0	0	0
2022	2	3	0	0	3 (100%)	0	0	0
Total	17	17	0	0	17 (71%)	0	0	0

If we get Fol race 4?

Aim is to slow spread while resistance is developed

1. Prevent movement into new fields: field equipment sanitation

-Physical cleaning + sanitizers

-BMPs for equipment sanitation:

<https://swetlab.faculty.ucdavis.edu/extension>

2. Chemical treatment of soil to reduce inoculum loads

-K-Pam spring, pre-planting 30 gal/A

-Miravis in-season

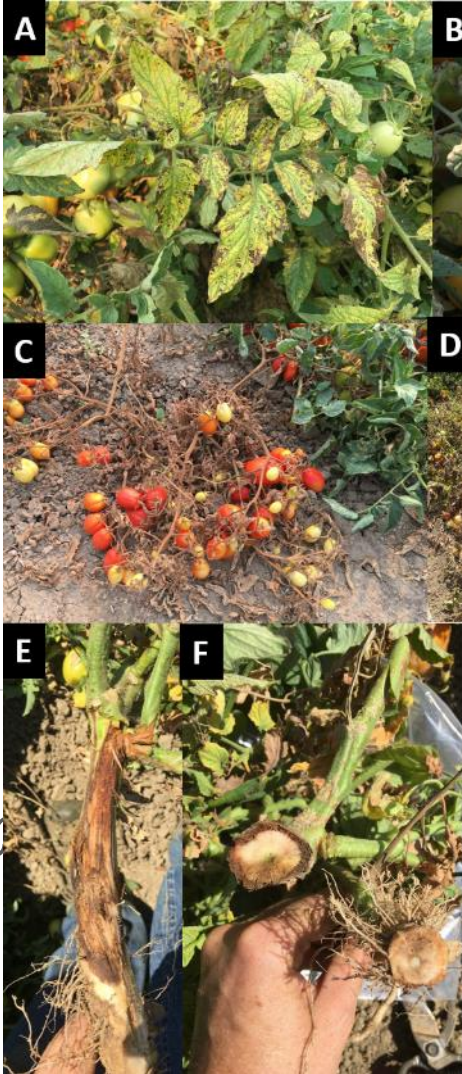
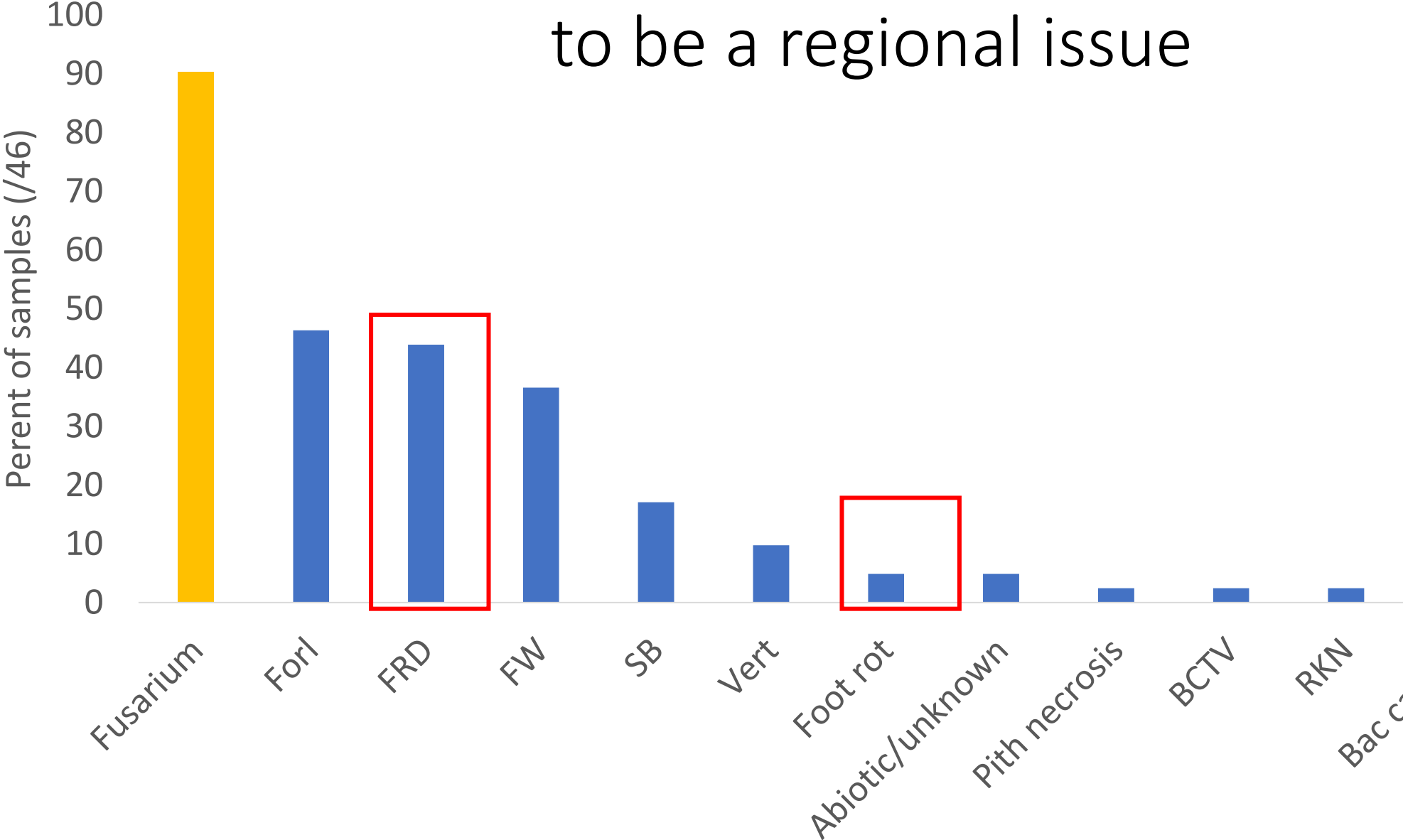
3. Don't plant tomatoes in a field with race 4



Treatment and rate/A	AUDPS ^a
Propulse 13.7 fl oz	661 ab ^u
Rhyme 7 fl oz	653 ab
K-Pam HL 15 gal	606 ab
K-Pam HL 30 gal	503 bc
Velum One 6.84 fl oz	498 bc
Miravis 8.55 fl oz	265 c
Untreated control	802 a

Paugh, Aegerter, Koivunen and Swett, 2020

Fusarium solani pathogens continue to be a regional issue



New paradigm for *Fusarium solani*-driven diseases California

When first observed in California in the 1980s

These symptoms



Disease name

Foot rot-as described first in Australia,
1988

Fusarium solani, the cause of foot rot of tomatoes in Central Queensland

L. L. Vawdrey^A and R. A. Peterson^B
Plant Pathology Branch, Queensland Department of Primary Industries,
^AP.O. Box 591, Ayr, Queensland 4807
^BP.O. Box 1054, Mareeba, Queensland 4880

Australasian Plant Pathology Vol. 17 (1) 1988

Identity of the pathogen

First *F. solani*, then *F. solani* f. sp.
eumartii



[Plant Dis. 2007 May;91\(5\):585-592. doi: 10.1094/PDIS-91-5-0585.](#)

Host Range and Phylogeny of *Fusarium solani* f. sp.
eumartii from Potato and Tomato in California

M K Romberg¹, R M Davis¹

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Starting in 2017

A mix of minor and severe symptoms



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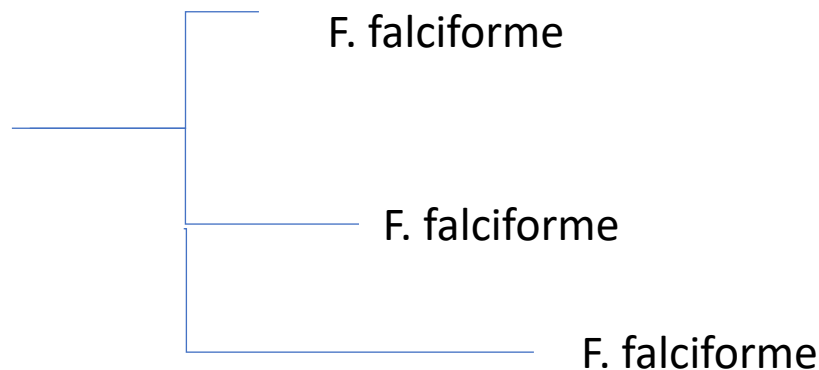
M K Romberg ¹, R M Davis ¹

Starting in 2017

A mix of minor and severe symptoms

But recent studies show there are actually three species in this
“*F. falciforme* species complex”

Initially identified the pathogen as *F. falciforme*



Fusarium Falciforme Species Complex (FFSC)

Fusarium martii



Fusarium Stem Rot and Decline (FRD)



Fusarium noneumartii



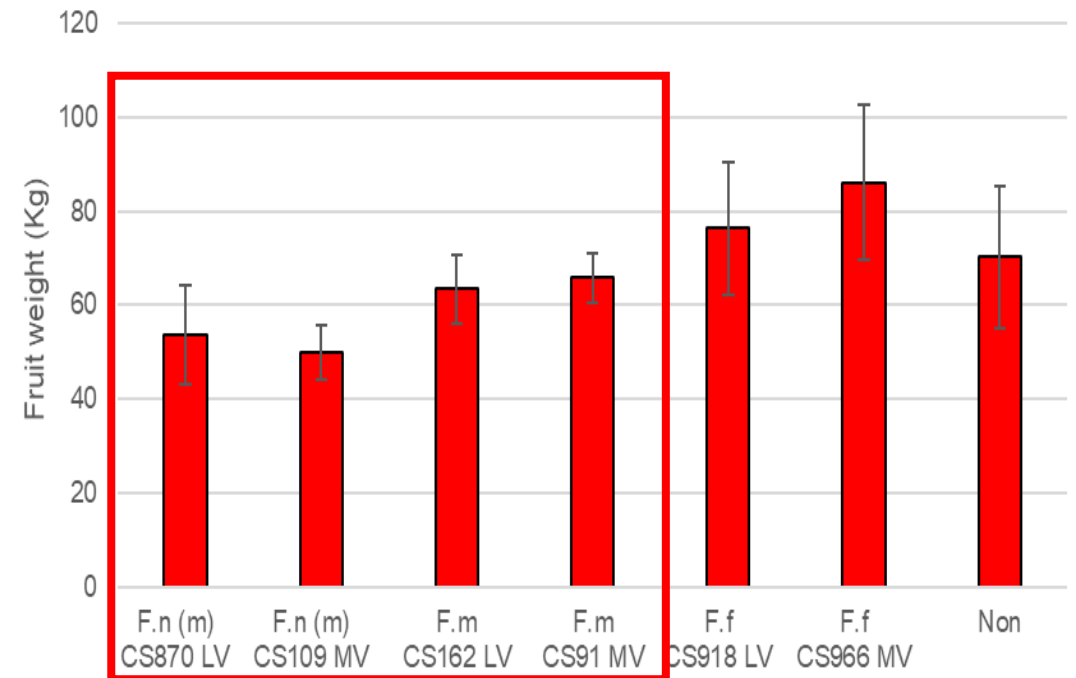
Fusarium falciforme ss



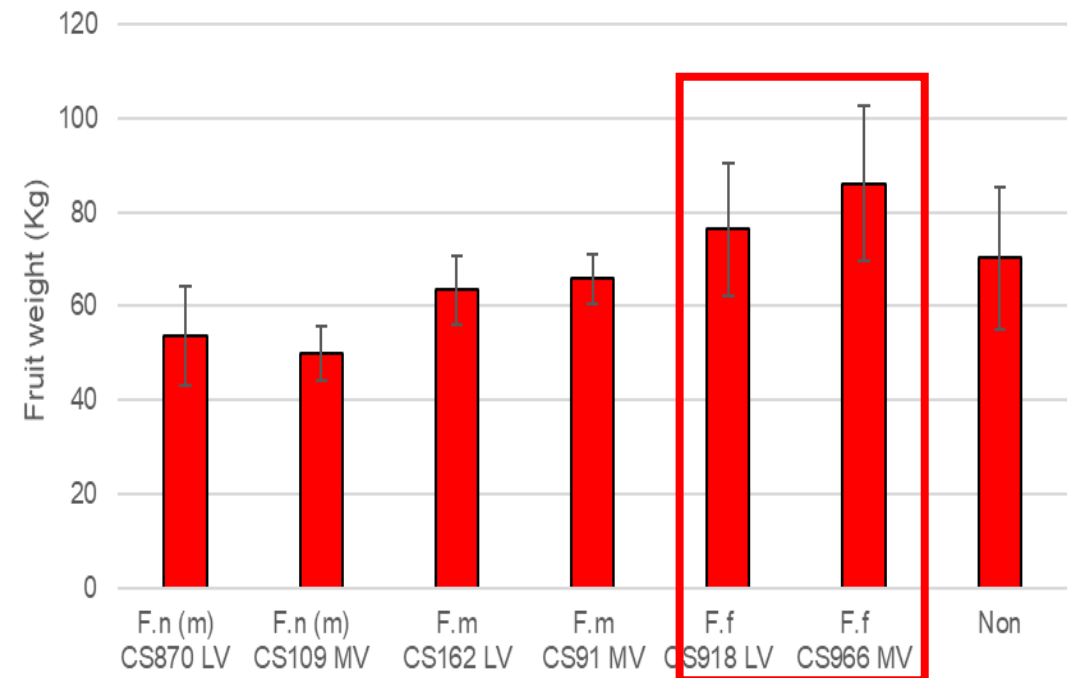
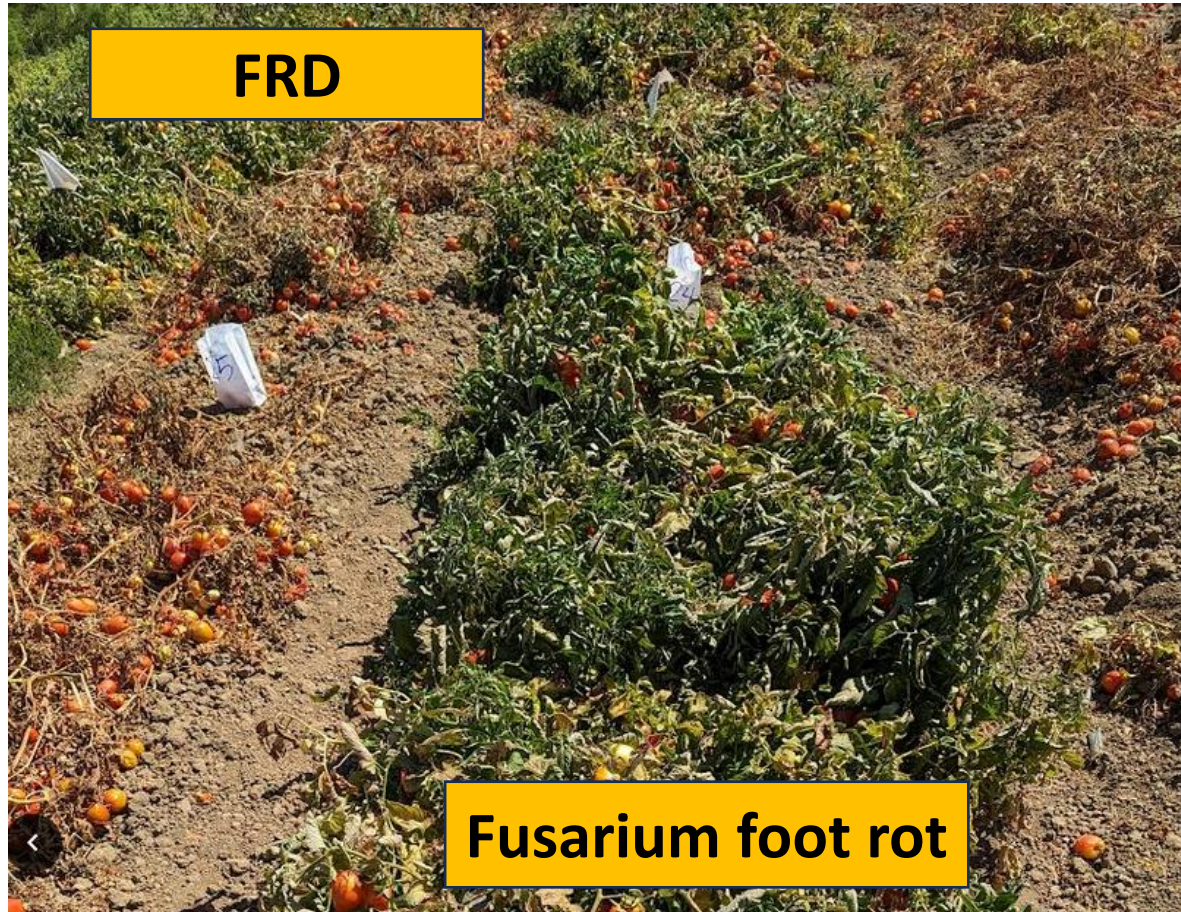
Fusarium Foot Rot



Fusarium stem rot and decline causes yield loss and is a management target
F. noneumartii is the most virulent



Foot rot does not appear to cause yield loss and thus may not require management



Understanding connections between historical and modern *F. solani* diseases

Modern disease: Fusarium stem rot and decline

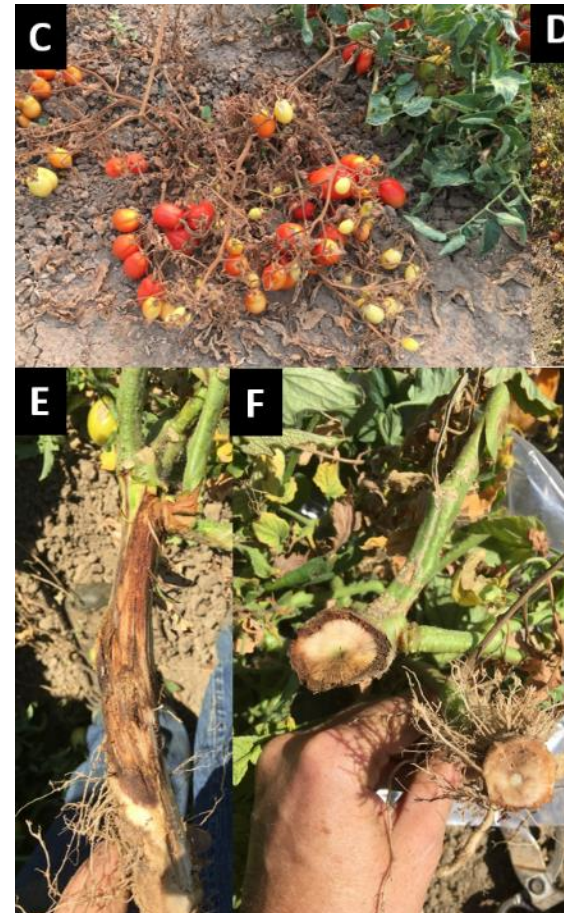
Disease in the 1980's



=

***F. noneumartii*, the cause of FRD, was causing these symptoms in the 1980's**

This was not actually foot rot
It was the FRD pathogen, causing less severe symptoms



**Caused by both
*F. noneumartii***

AND

***F. martii*
A new pathogen to CA**

Why is it more severe now?
Likely inoculum pressure increases have made symptoms more severe

Understanding connections between historical and modern *F. solani* diseases

The disease in the 1980's



WAS NOT

Foot rot

Caused by *F. falciforme sensu stricto*



Foot rot is present in CA as a recent introduction

Likely became established in the last
~20 years

Fusarium Falciforme Species Complex (FFSC)

Fusarium martii



Fusarium Stem Rot and Decline (FRD)

Major yield impacts
Manage me!

Fusarium noneumartii



Fusarium falciforme ss



Fusarium Foot Rot

No yield impacts?
No management?

Very hard to separate diseases in the field
Less FRD susceptible cultivars can have symptoms similar to foot rot

Diagnosis requires laboratory analysis

martii



Fusarium Stem Rot
and Decline (FRD)



noneumartii



falciforme ss



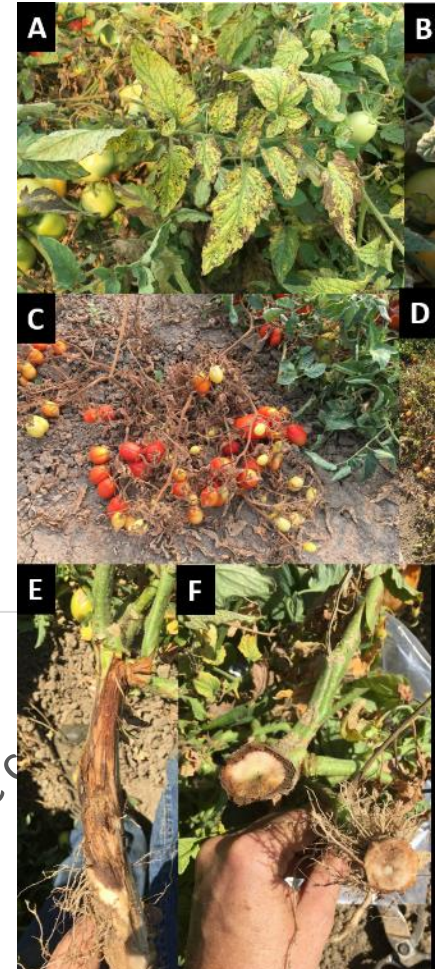
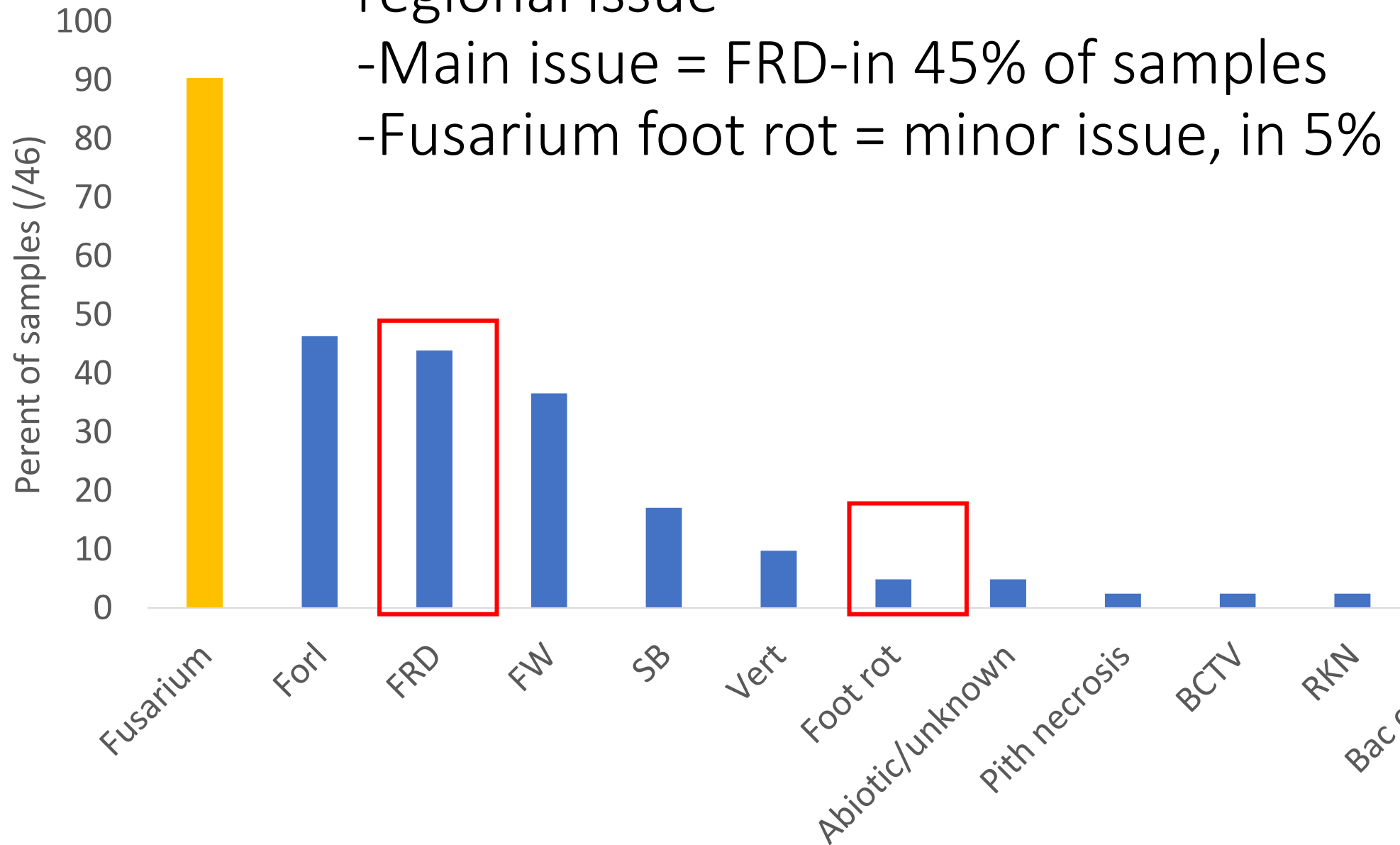
Fusarium
Foot Rot



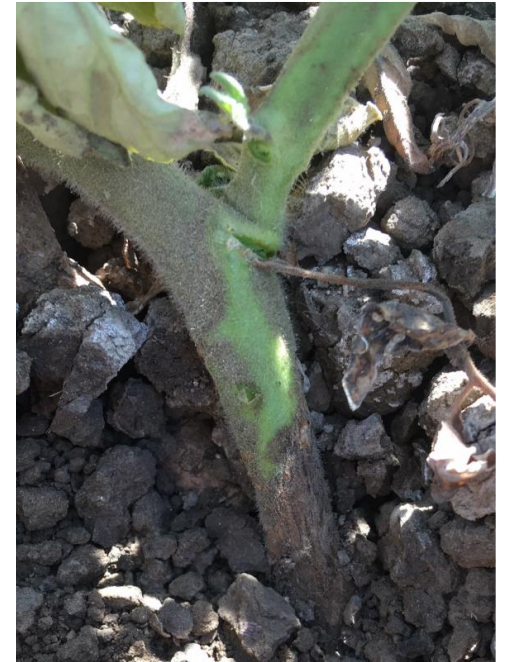
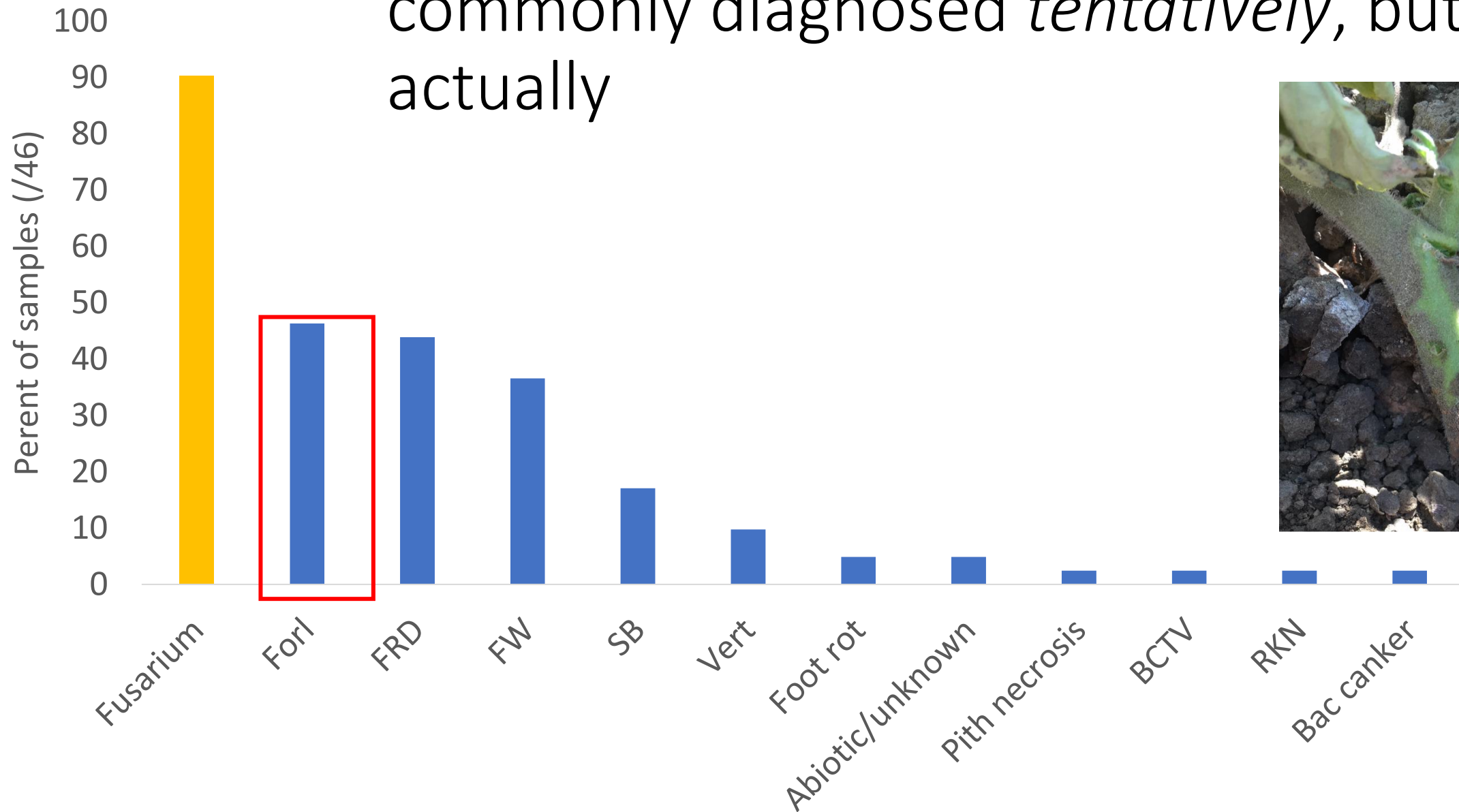
Fusarium solani pathogens continue to be a regional issue

-Main issue = FRD-in 45% of samples

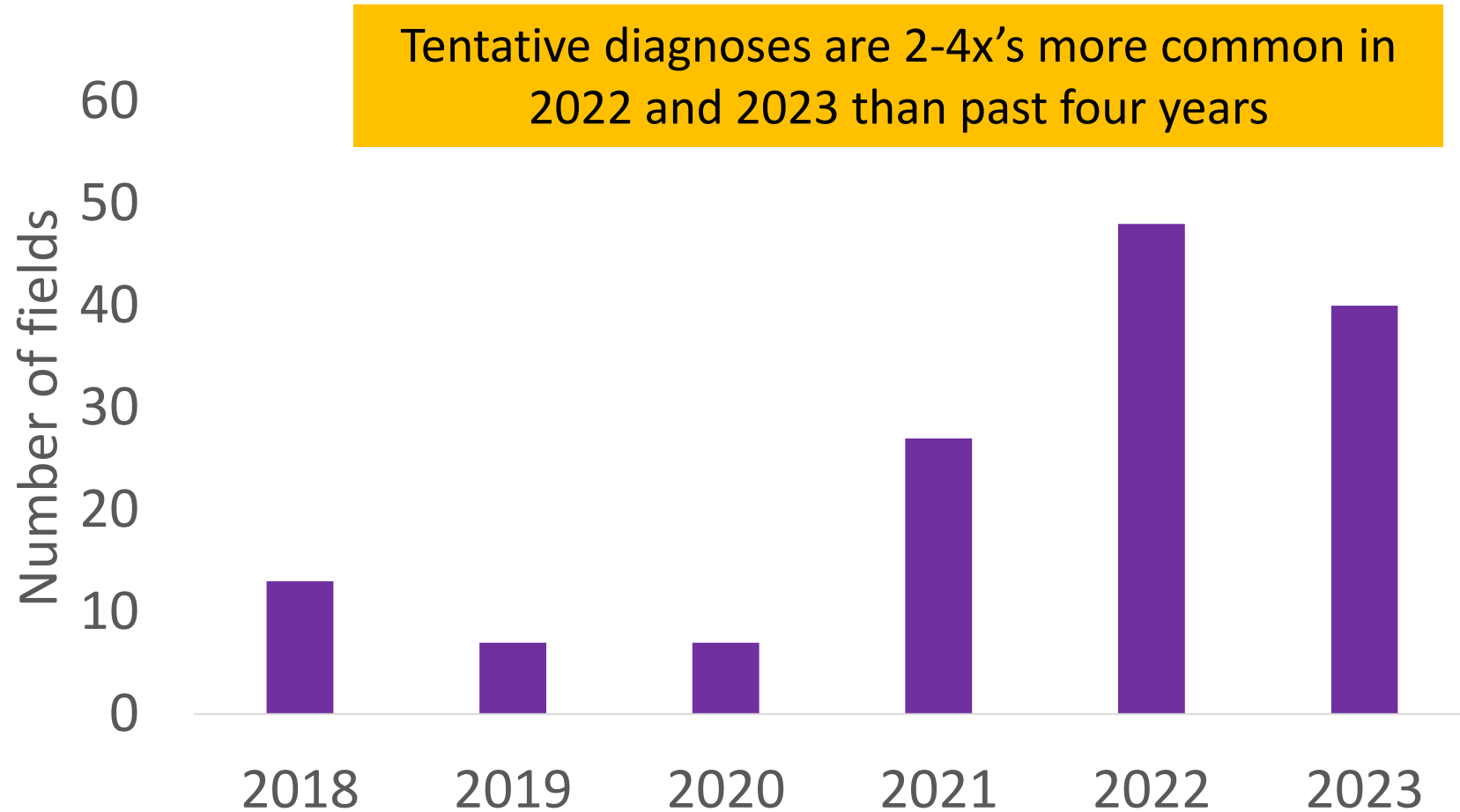
-Fusarium foot rot = minor issue, in 5% of samples



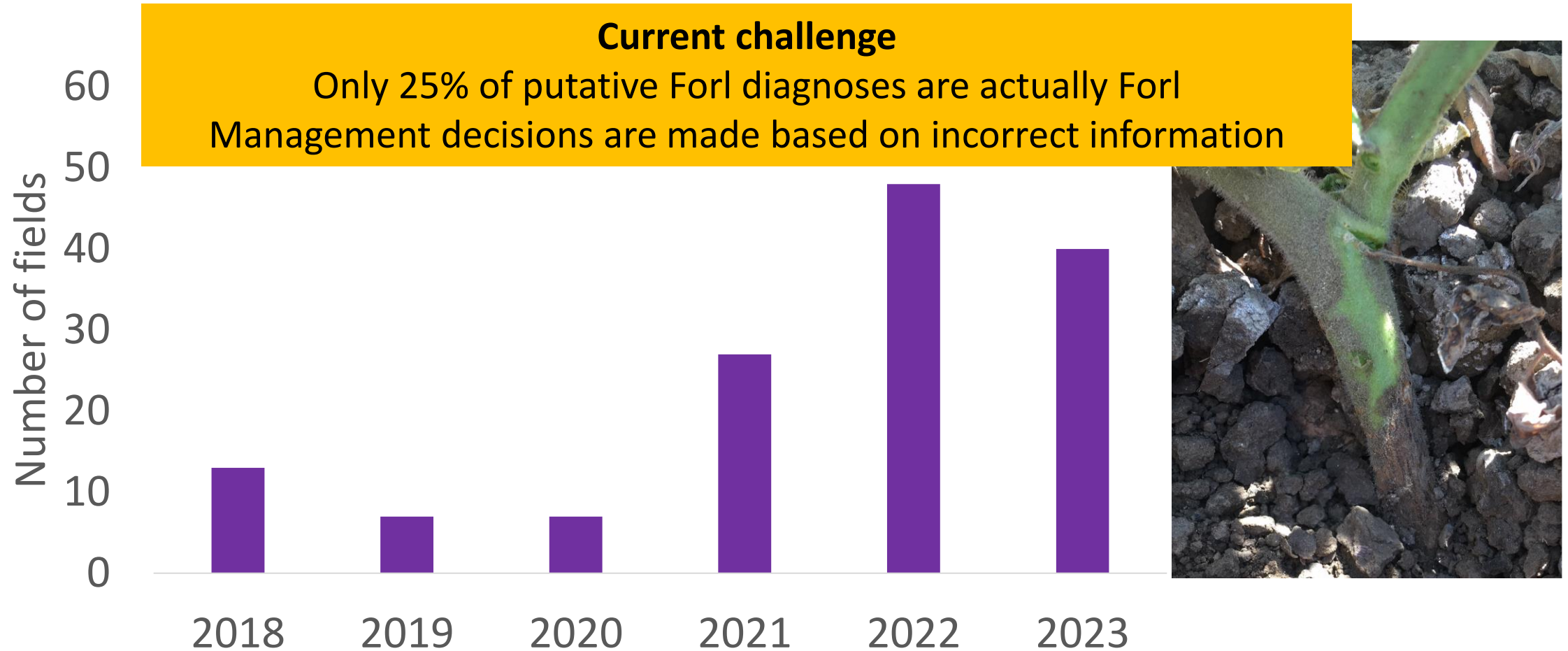
Fusarium crown and root rot: the most commonly diagnosed *tentatively*, but not actually



Fusarium crown and root rot (Forl): an increasing statewide issue



Fusarium crown and root rot: an increasing statewide issue



New molecular-based diagnostic Forl method:
 Have been able to clearly identify 15% of isolates as non-pathogens
 Diagnosis of 50% of isolates narrows down to likely Forl

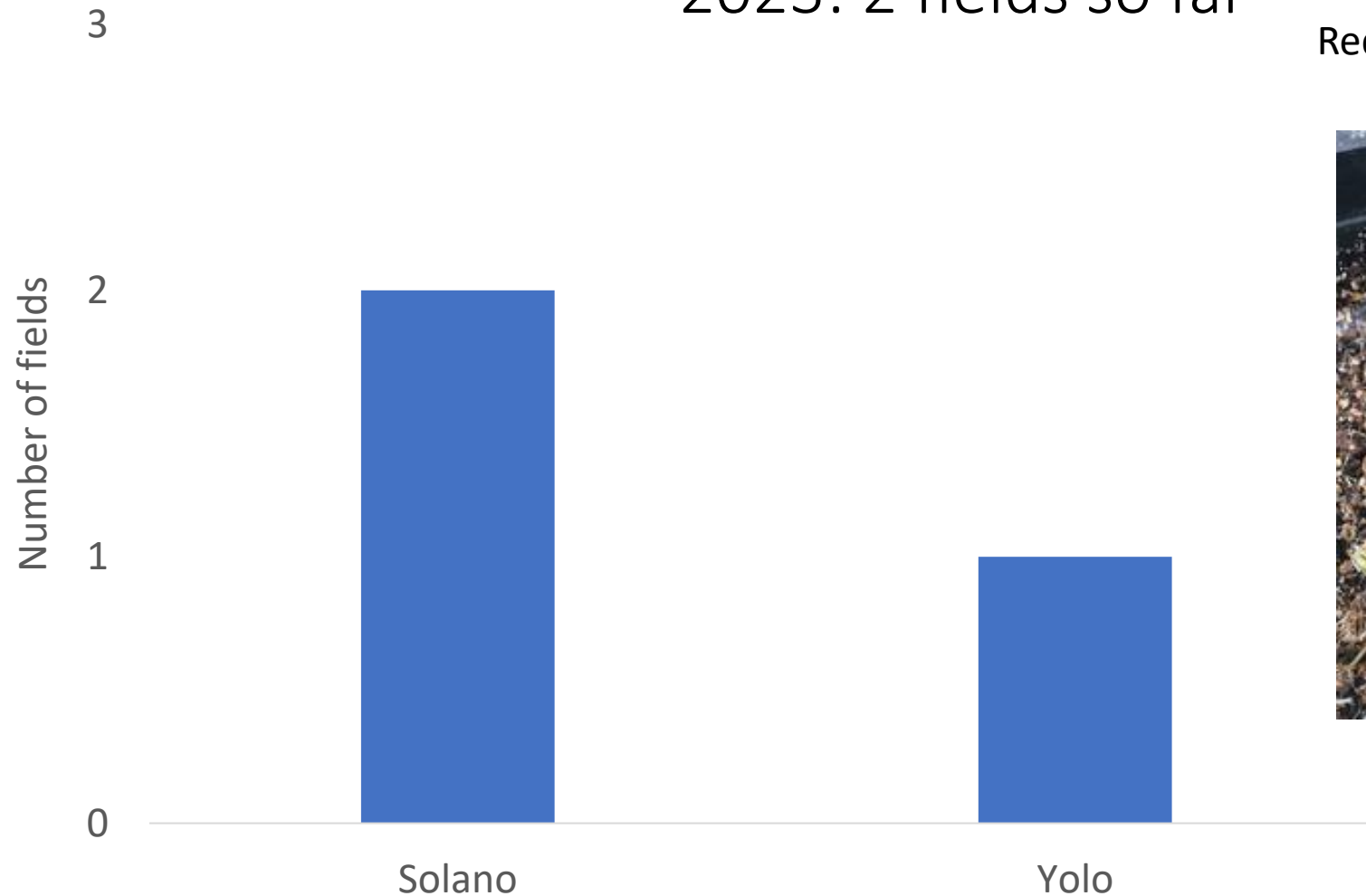
Date	Sample number	Isolate number	status	Molecular diagnosis				Haplotpye #	Lineage
				Confirmed Forl	Confirmed Nonpath	Forl or Nonpath	Ambiguous		
7/6/2023	162023	0162023-6				X		Five_191	3D
7/6/2023	162023	0162023-8				X		Five_191	3D
7/6/2023	172023	0172023-1		X				Five_242	3D
7/14/2023	422023	0422023-1-p1					X	Five_191 (FORL or Nonpath) Five_58 (FOL)	3D 3D
7/14/2023	422023	0422023-2-p3					X	Five_191 (FORL or Nonpath) Five_58 (FOL) Five_63 (Nonpath) Five_2 (Nonpath)	3D 3D 3D 3D
7/14/2023	482023	0482023-2			X			Five_200	3G
7/14/2023	482023	0482023-5				X		Five_128	3G
9/14/23	902023	0902023-5			X			Five_141	3G
9/14/23	902023	0902023-9	FAILED						
8/22/2023	902023	0902023-3				X		Five_170	3G
8/22/2023	1002023	1002023-2				X		Five_191	3D
8/22/2023	1002023	1002023-5				X		Five_191	3D
8/22/2023	1002023	1002023-8				X		Five_191	3D
9/14/23	692023	0692923-6	FAILED						
9/14/23	692023	0692923-7	FAILED						
9/14/23	712023	712023-2				X		Five_191	3D
9/14/23	712023	712023-6	FAILED						
9/14/23	712023	712023-9	FAILED						
9/14/23	922023	0922023-3			X			Five_141	3G
9/14/23	922023	0922023-4					X	Five_128 (FORL or Nonpath) Five_61 (Nonpath)	3D 3G
9/14/23	1042023	1042023-4				X		Five_128	3G
9/14/23	1042023	1042023-7				X		Five_128	3G

An additional issue: Detecting For1 in resistant (Fr) cultivars

Resistance-breaking?

2022: 3 fields, all were NOT resistance breaking

2023: 2 fields so far

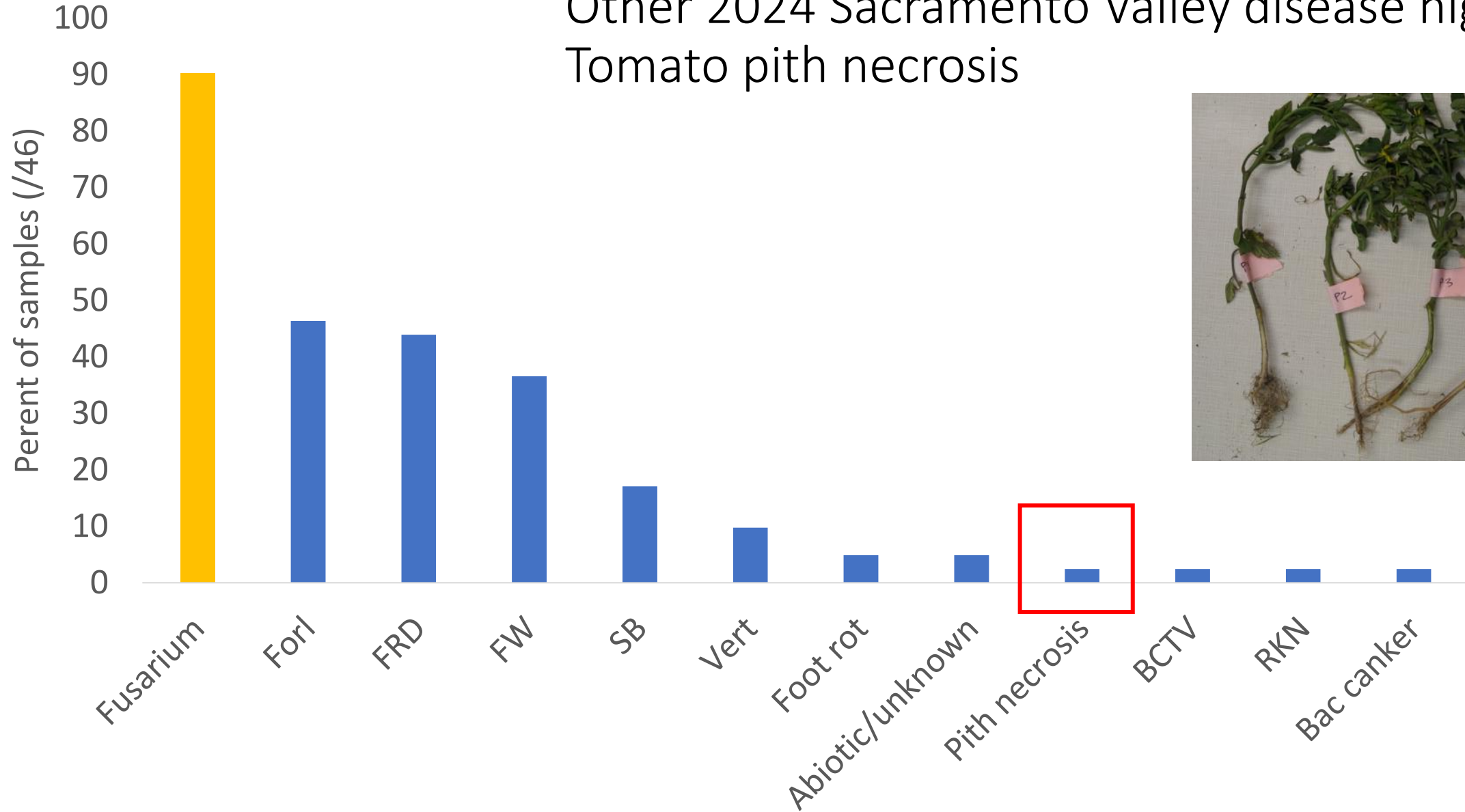


Requires in-planta phenotyping to confirm resistance breaking



Other 2024 Sacramento Valley disease highlights

Tomato pith necrosis



Tomato pith necrosis

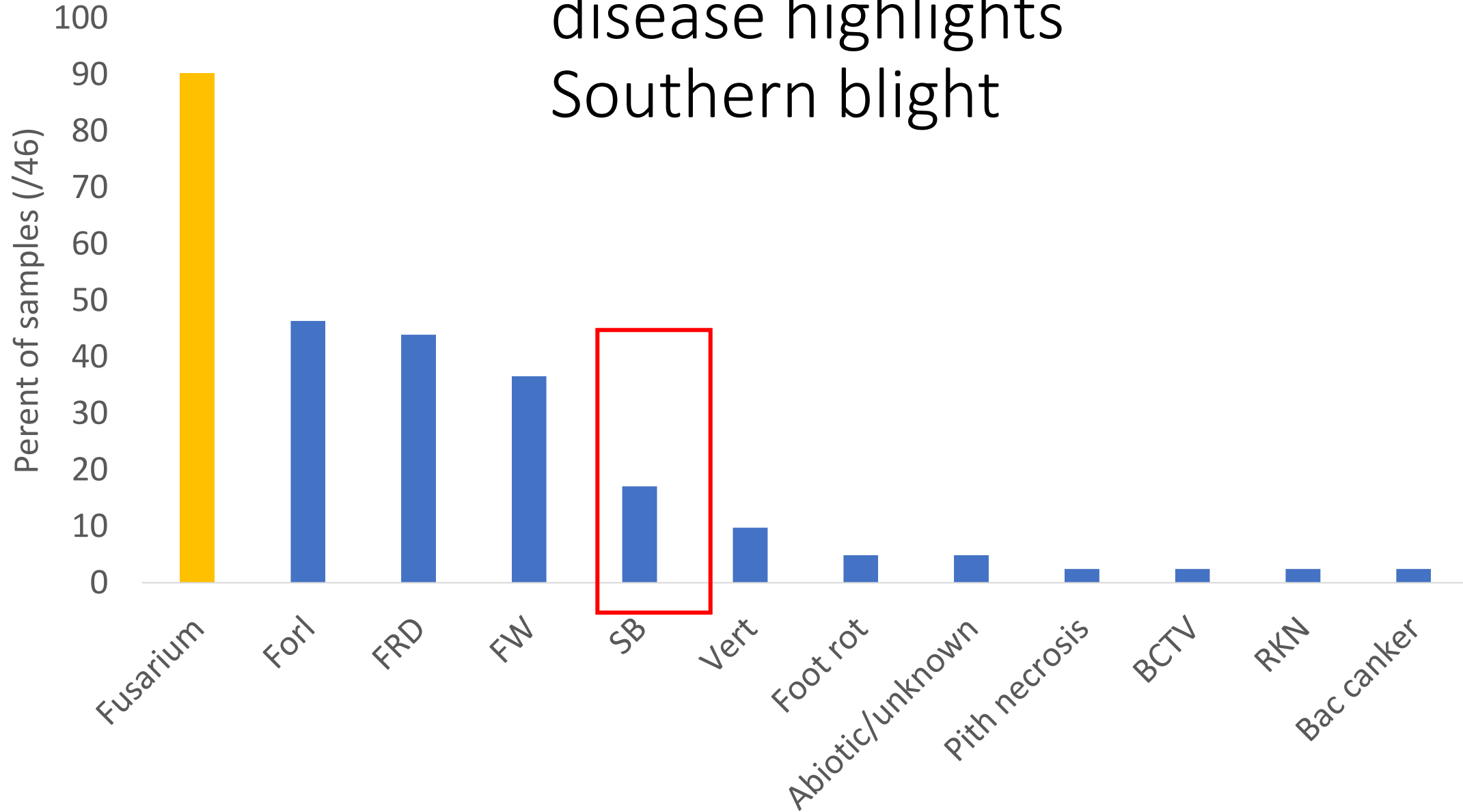
Pseudomonas corrugata

-Looks like Phytophthora but no root rot

-Looks like bac canker but is Cm negative with strip test



Other 2024 Sacramento Valley disease highlights Southern blight

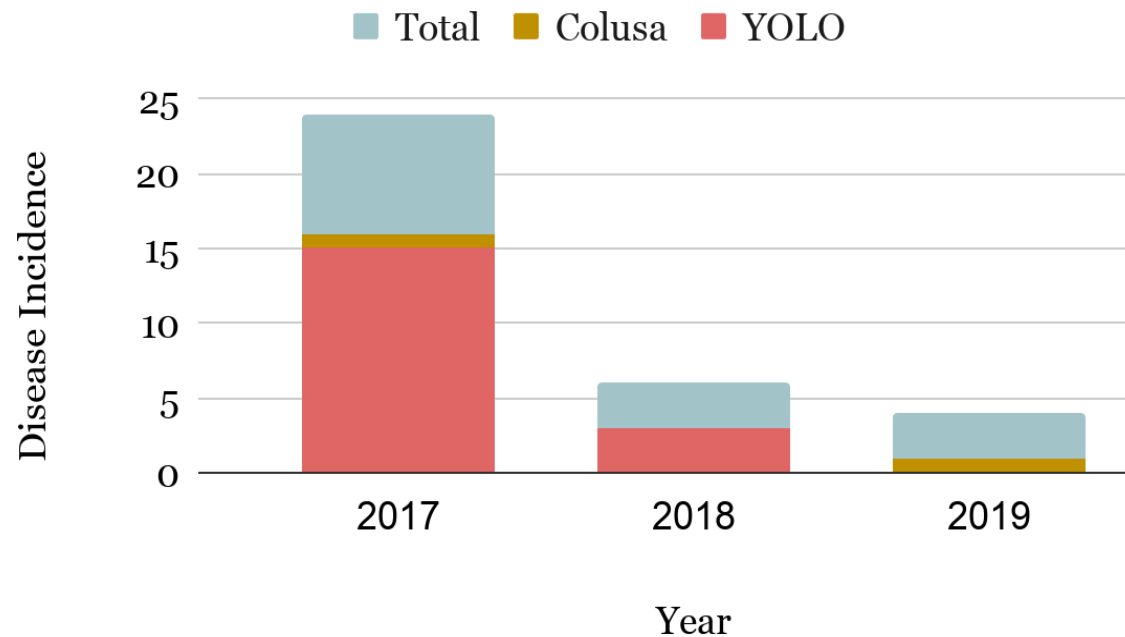


Southern blight is present by often not active
This year-during heat spells, plants sat in hot mud
Heat and moisture likely triggered disease

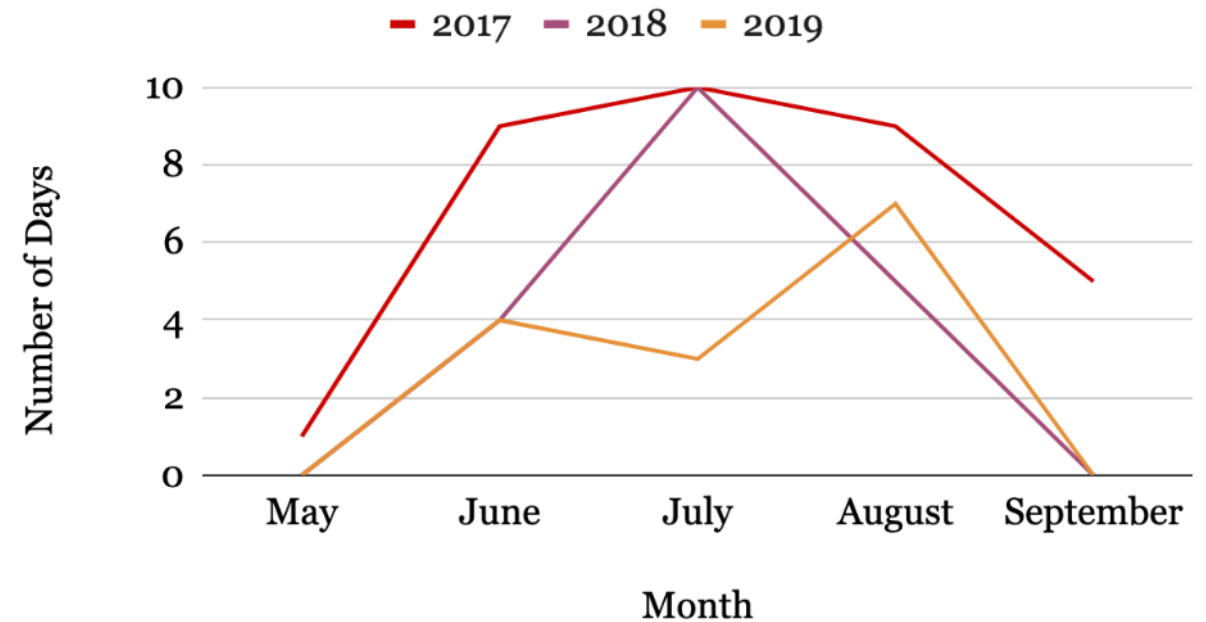


Previous bad years correspond with a greater number of days over 100°F

Southern Blight Disease Incidence

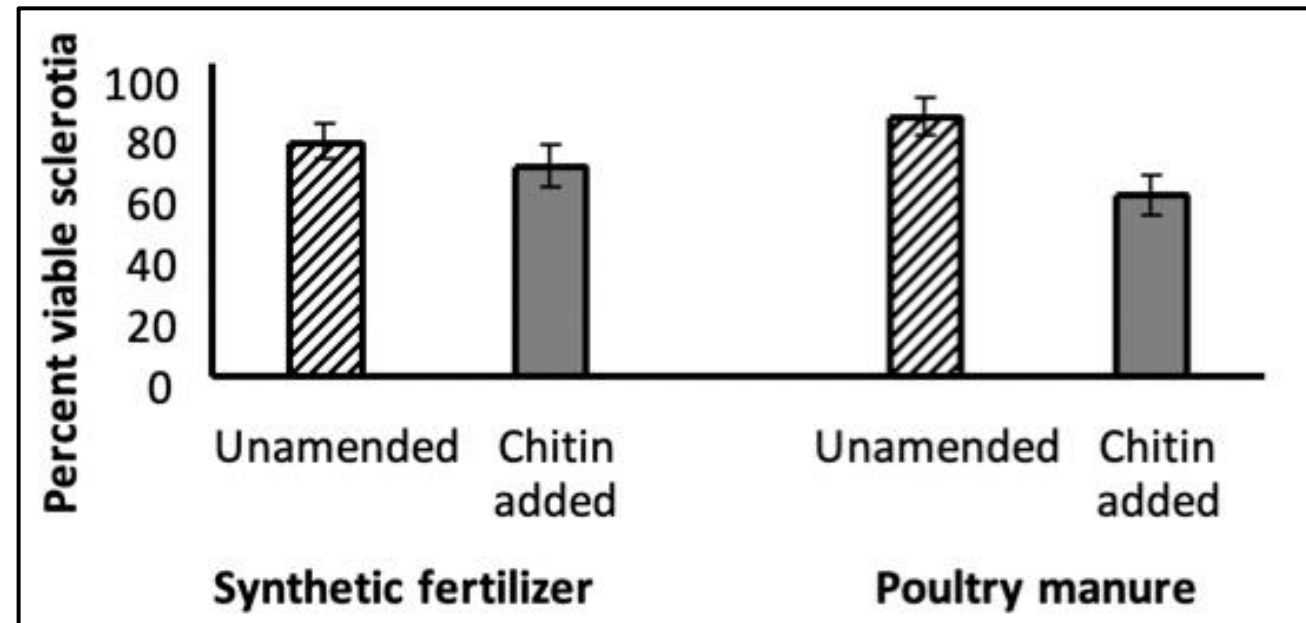
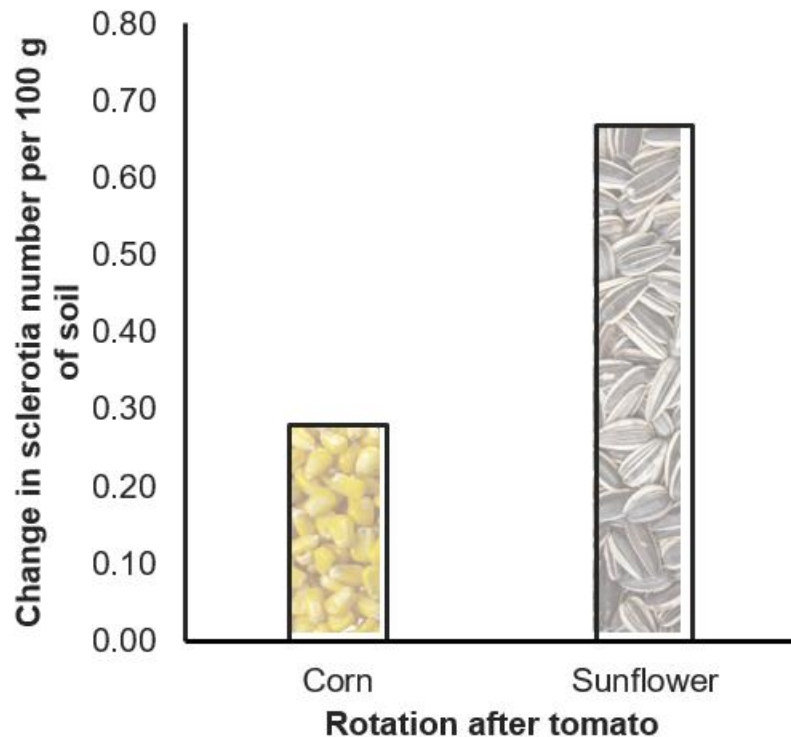


Yolo County: Number of Days Per Month $\geq 100^\circ\text{F}$



Management options for southern blight in tomato

- Crop rotation with poor hosts like corn; avoid highly susceptible hosts like sunflower
- Chemical treatments pre plant and during the season
- Soil amendments
- Irrigation management--Less severe with drip



New in 2024

UC IPM tomato disease diagnosis field guide

Diagnosing vine decline and rot diseases of tomatoes in the field

UC Davis 2022 Vegetable Disease Field Day
Cassandra Swett, Bob Gilbertson
Department of Plant Pathology

Diagnóstico de decaimiento foliar y enfermedades de pudrición de tomates en el campo

UC Davis 2022 Vegetable Disease Field Day
Cassandra Swett, Bob Gilbertson
Traducido por: Johanna Del Castillo Múnera
Department of Plant Pathology
UC Davis



Curly top disease (CTD)-beet curly top virus (BCTV)

Vector: beet leafhopper

Symptoms

Observed early in the season
often in fields near foothills

Plants are stunted and dull-green

Leaves: dull-green to yellow, crumple, curl upward or even roll, and swollen purple veins

Fruits: small and ripen prematurely

CTD is sporadic but can cause economic loss in bad years; no resistant varieties but known risk factors

Tomato necrotic spot disease-tomato necrotic spot (ToNSV)

A windborne pollen-transmitted virus introduced to tomato via thrips feeding

Symptoms

- Generally seen early in the season
- Leaves are distorted and show brown necrotic spots and stems are necrotic
- Not economically important: tomato plants recover (defense response) and there is little within field spread
- More common in Northern Counties in 2022
- Detected with RT-PCR test

Fusarium falciforme en cultivares con pudrición de pie severa, sin moteado



Se ve como



Marchitamiento por Fusarium



Igual en:
Toxicidad de boron y salinidad

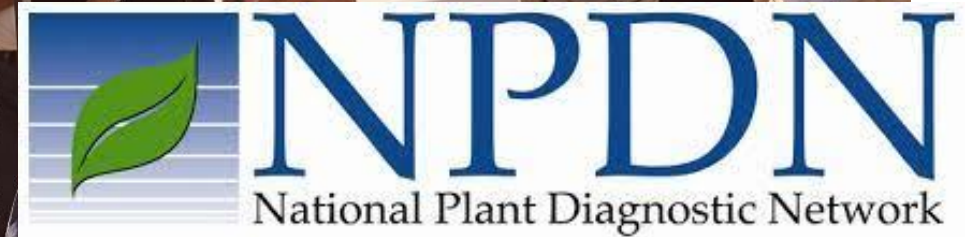
Upcoming:

Summer 2024: Vegetable disease field day, UC Davis

Open to all

Date: TBD

Support for this work comes from:



Questions?

Cassandra Swett

clswett@ucdavis.edu

<https://swetlab.faculty.ucdavis.edu/>

