Statewide tomato disease patterns 2023

Cassandra Swett

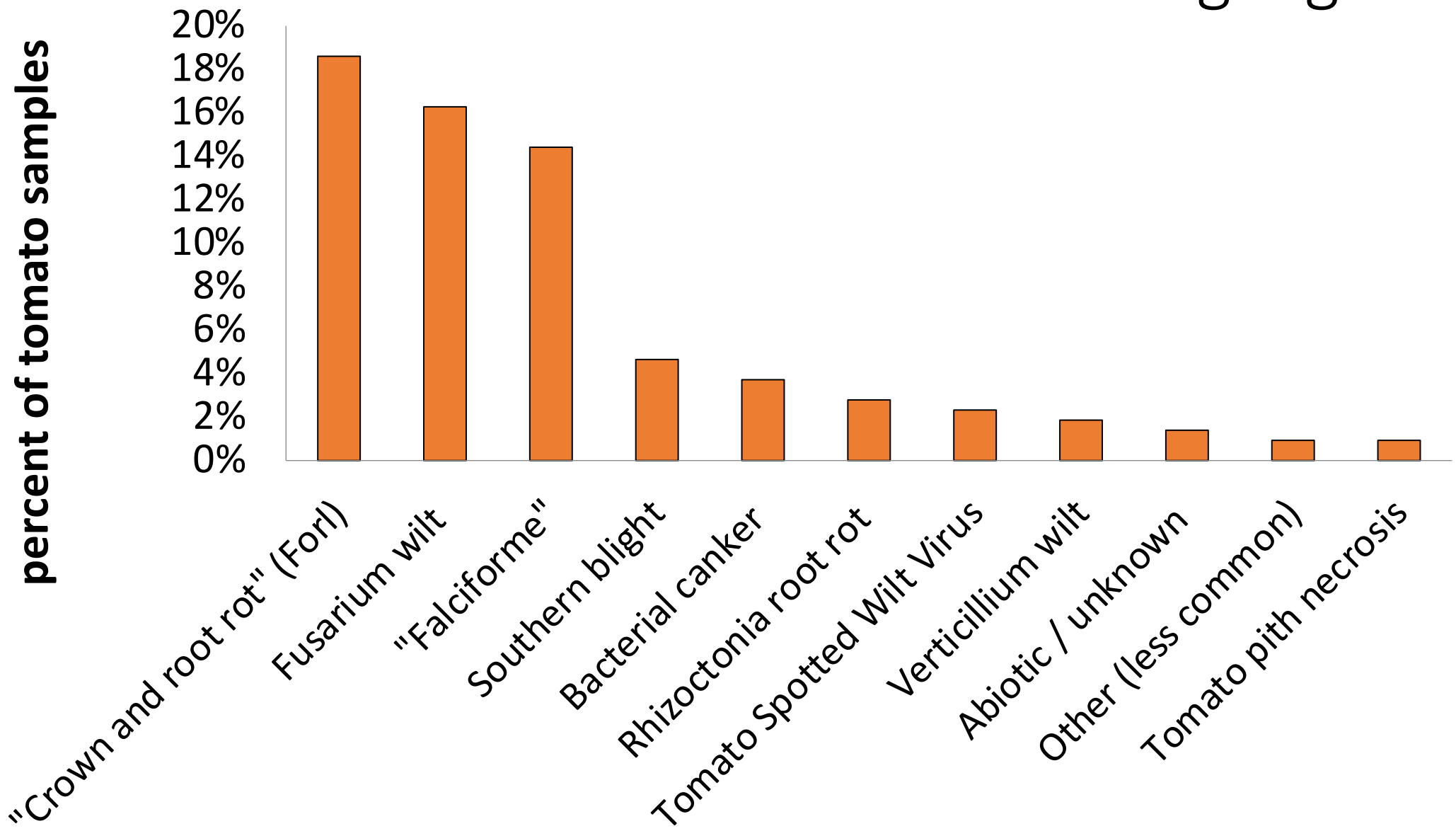
UC Davis, Dept. of Plant Pathology

UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources | UC Cooperative Extension

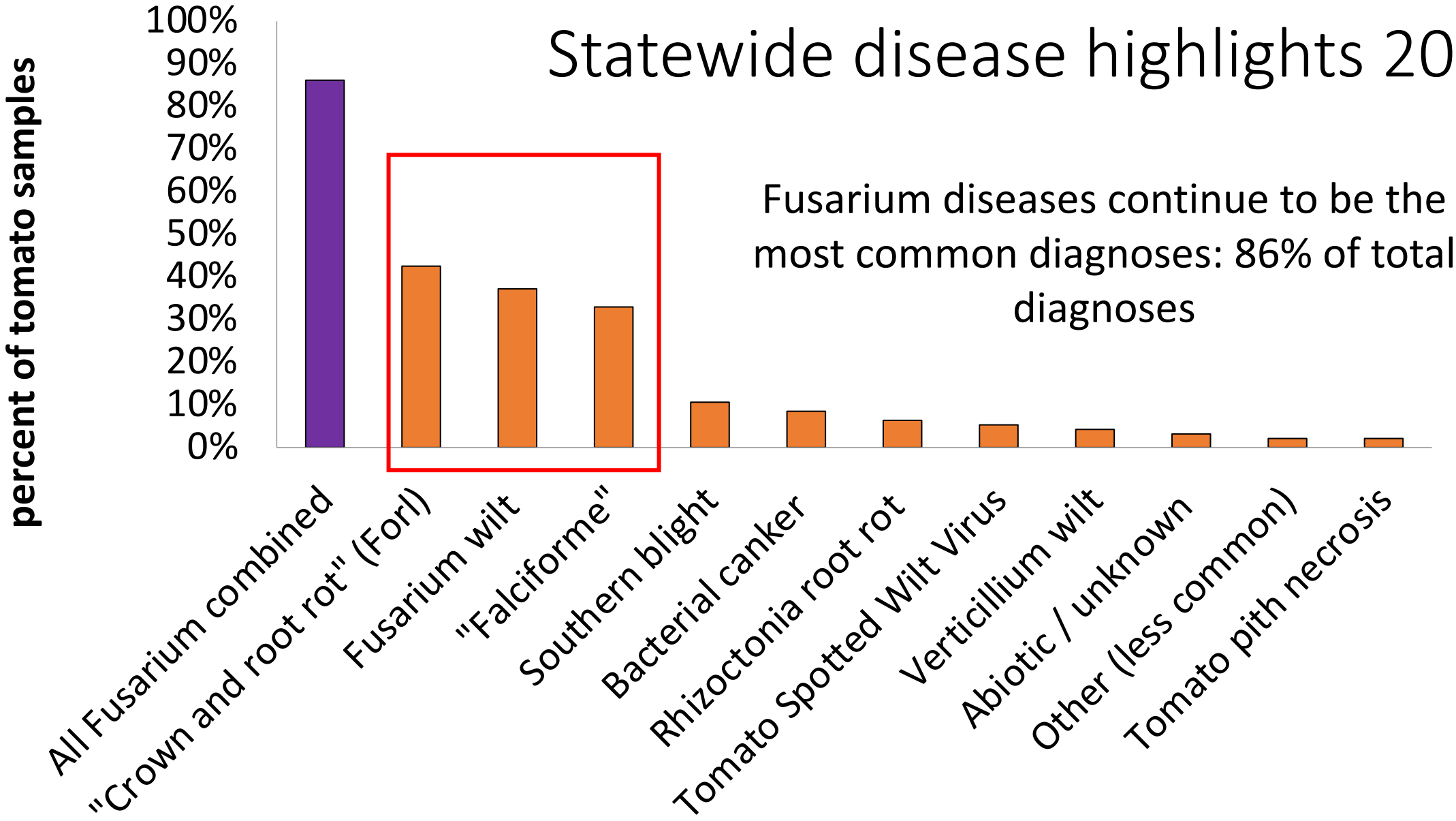
NPDN National Plant Diagnostic Network

California Tomato Research Institute

Statewide disease highlights 2023



Statewide disease highlights 2023



Fusarium diseases continue to be the most common diagnoses: 86% of total diagnoses

Fusarium oxysporum

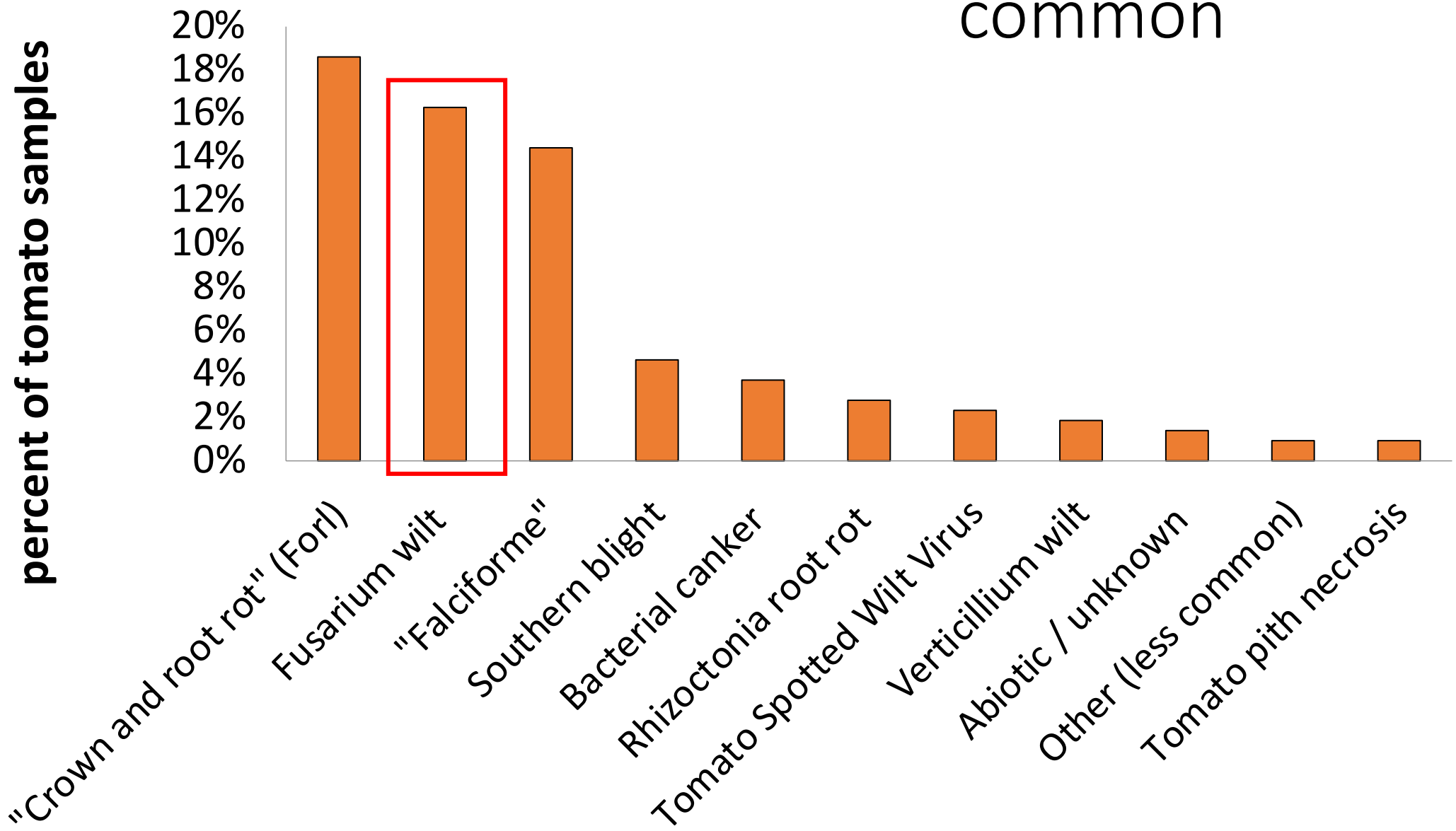
Fusarium wilt
f. sp. lycopersici
Fol (race 3)

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

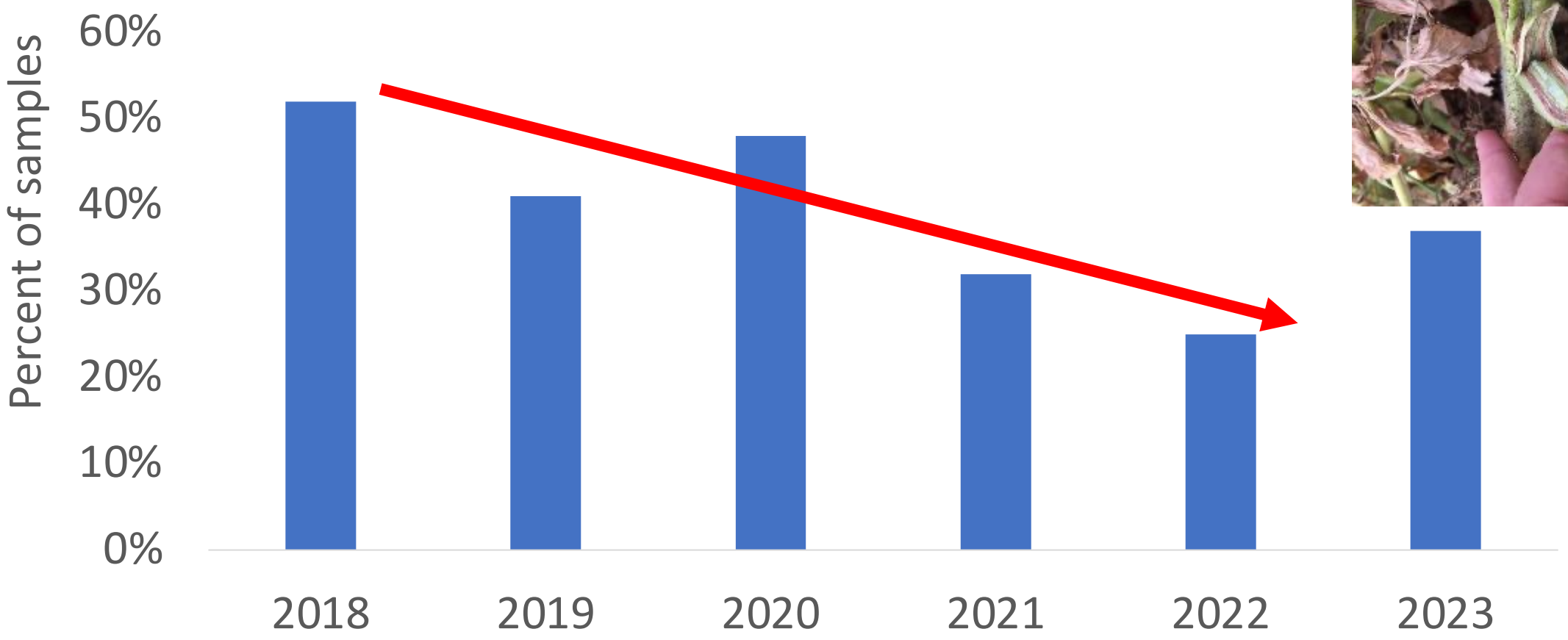
F. solani species complex

Foot/stem rot and vine decline

Fusarium wilt continues to be common

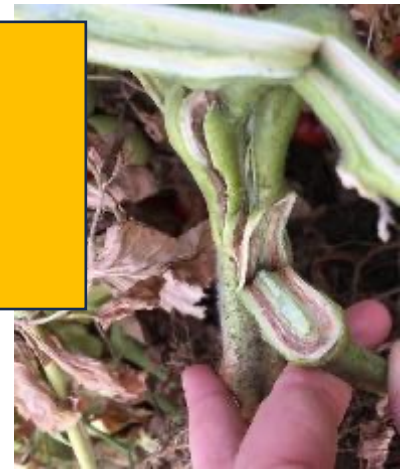


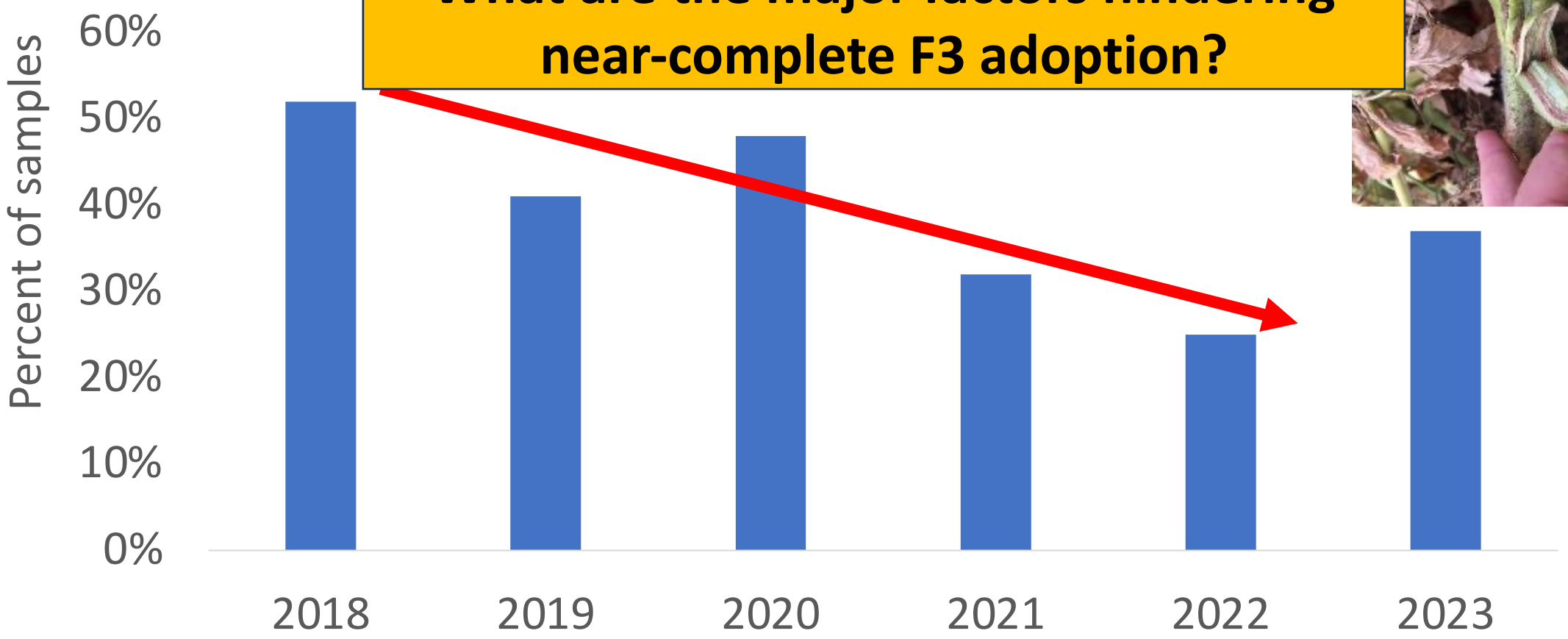
Fusarium wilt diagnoses have been decreasing as F3 use is increasing



Fusarium wilt diagnoses have been decreasing as F3 use is increasing

Reflects continued F2 cultivar use
What are the major factors hindering near-complete F3 adoption?





Fusarium wilt resistance-breaking race timeline

Fol race 1 R cv	11 years	Fol race 2 (Sutter basin)
Fol race 2 R cv	12 years	Fol race 3 (Sutter basin)
Fol race 3 R cv	14 years from 1st F3 cv: 2009 7-10 years from wider adoption: 2013-2016	Fol race 4 2021-2028?

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
2023	2	12	?	?	?	?	?	?
Total	17		0	0	17 (71%)	0	0	0

Fusarium wilt in resistant cultivars

2023: tentative Fol detected in a record number of F3 fields-12 total
Fol race 4 also tentatively detected in Florida

	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
2023	2	12	?	?	?	?	?	?
Total	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://swettlab.faculty.ucdavis.edu/extension

2. Chemical treatment of soil to reduce inoculum loads

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

-Miravis in-season

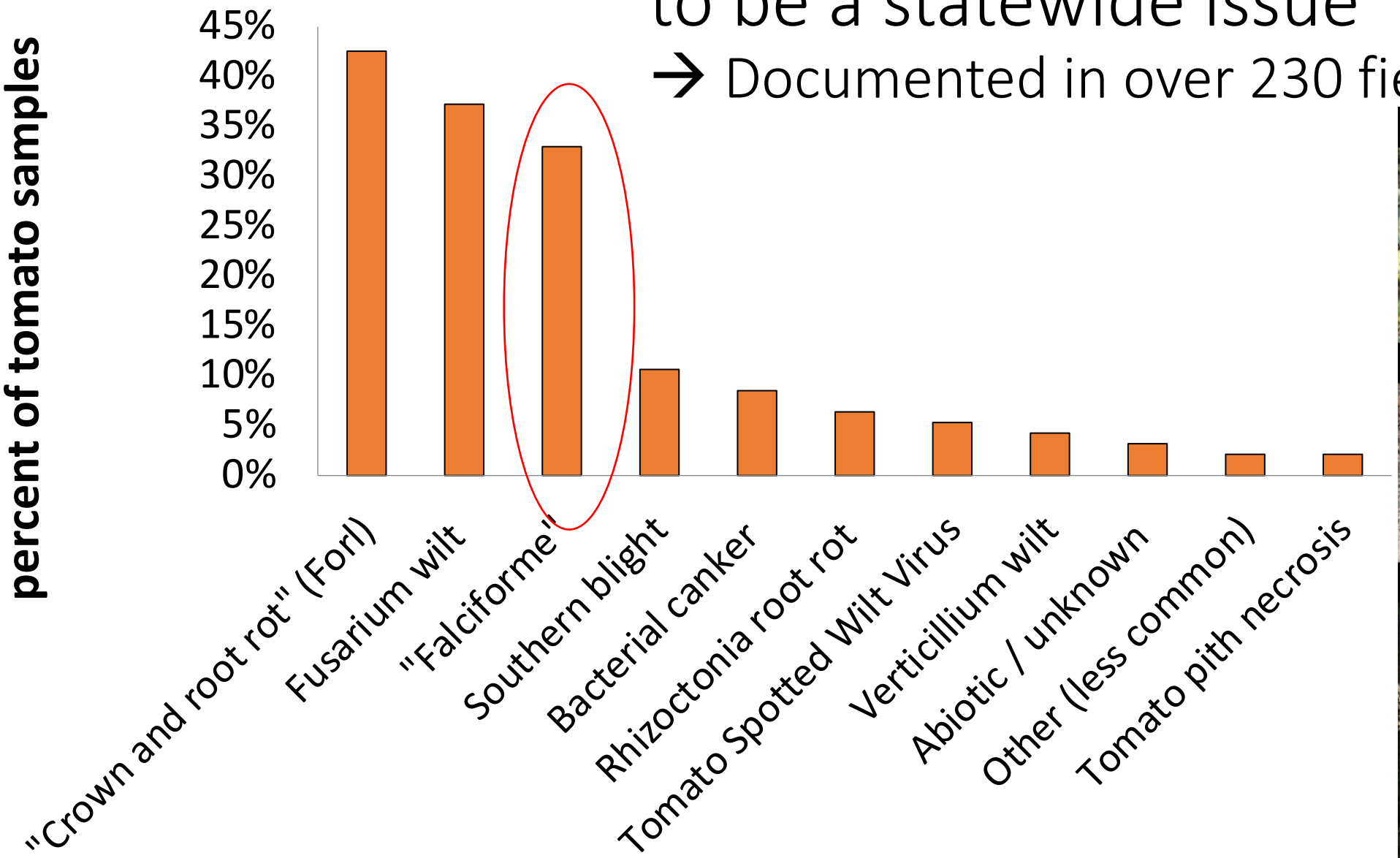
3. Don't plant tomatoes in a field with race 4

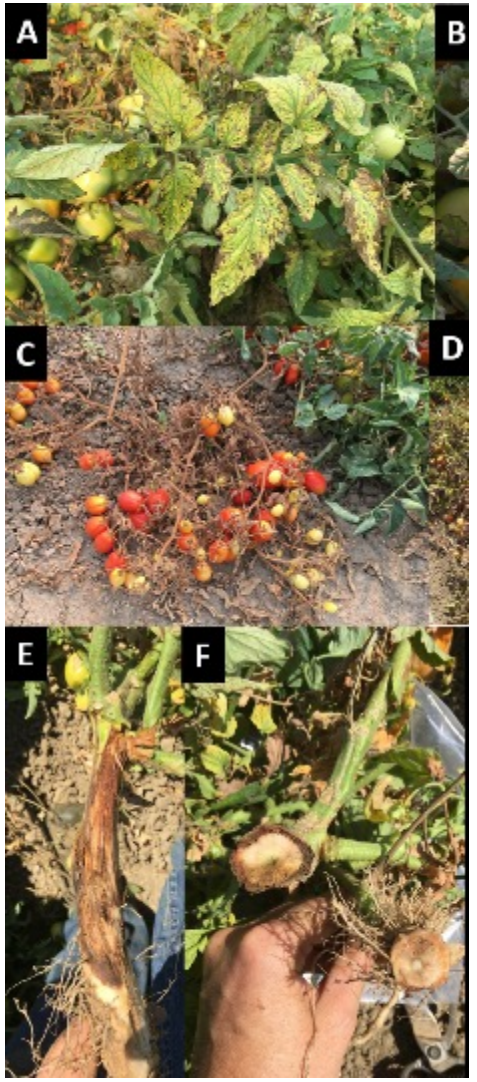
Treatment and rate/A	AUDPS[z]
Propulse 13.7 fl oz	661 *ab* [u]
Rhyme 7 fl oz	653 *ab*
K-Pam HL 15 gal	606 *ab*
K-Pam HL 30 gal	503 *bc*
Velum One 6.84 fl oz	498 *bc*
Miravis 8.55 fl oz	265 *c*
Untreated control	802 *a*

Paugh, Aegerter, Koivunen and Swett, 2020

Fusarium “falciforme” continues to be a statewide issue

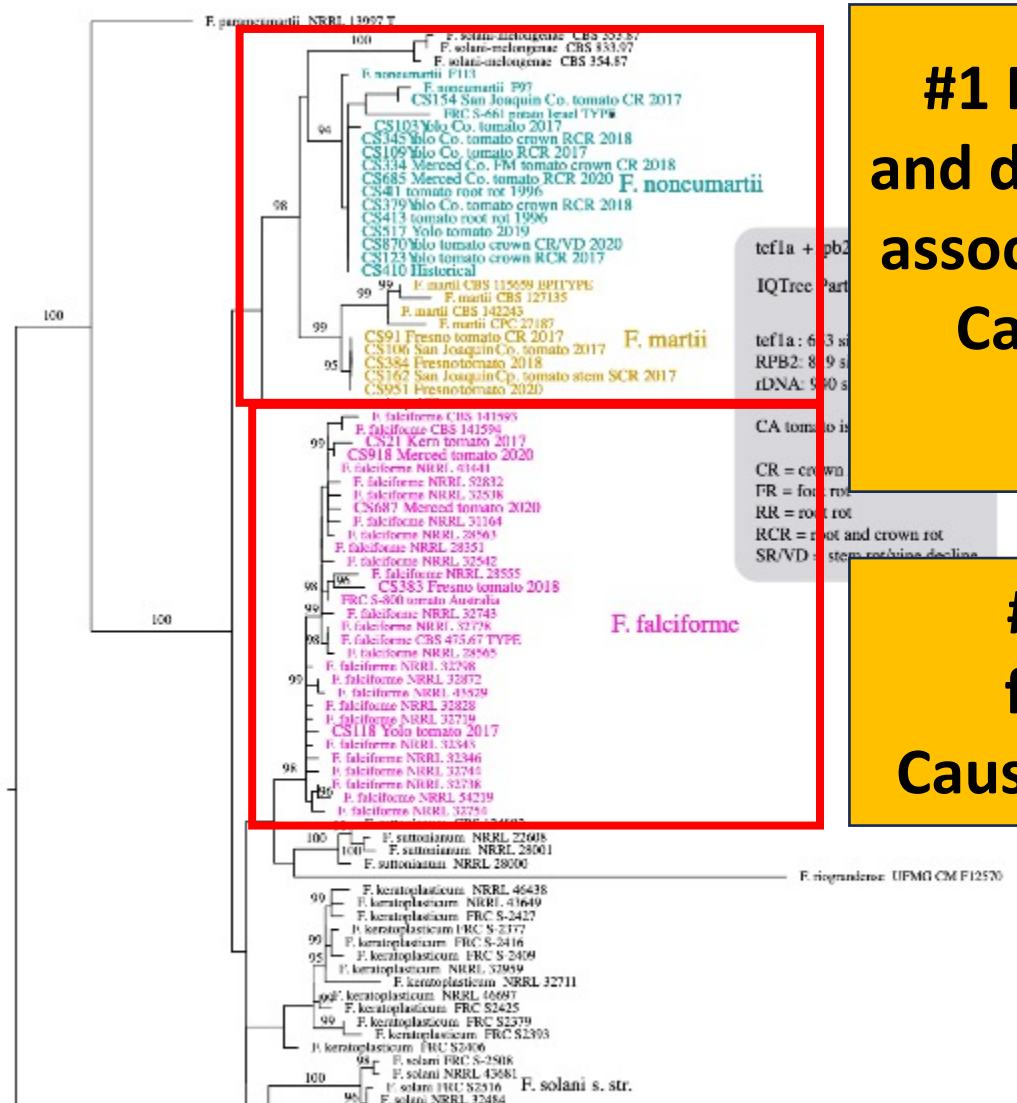
→ Documented in over 230 fields





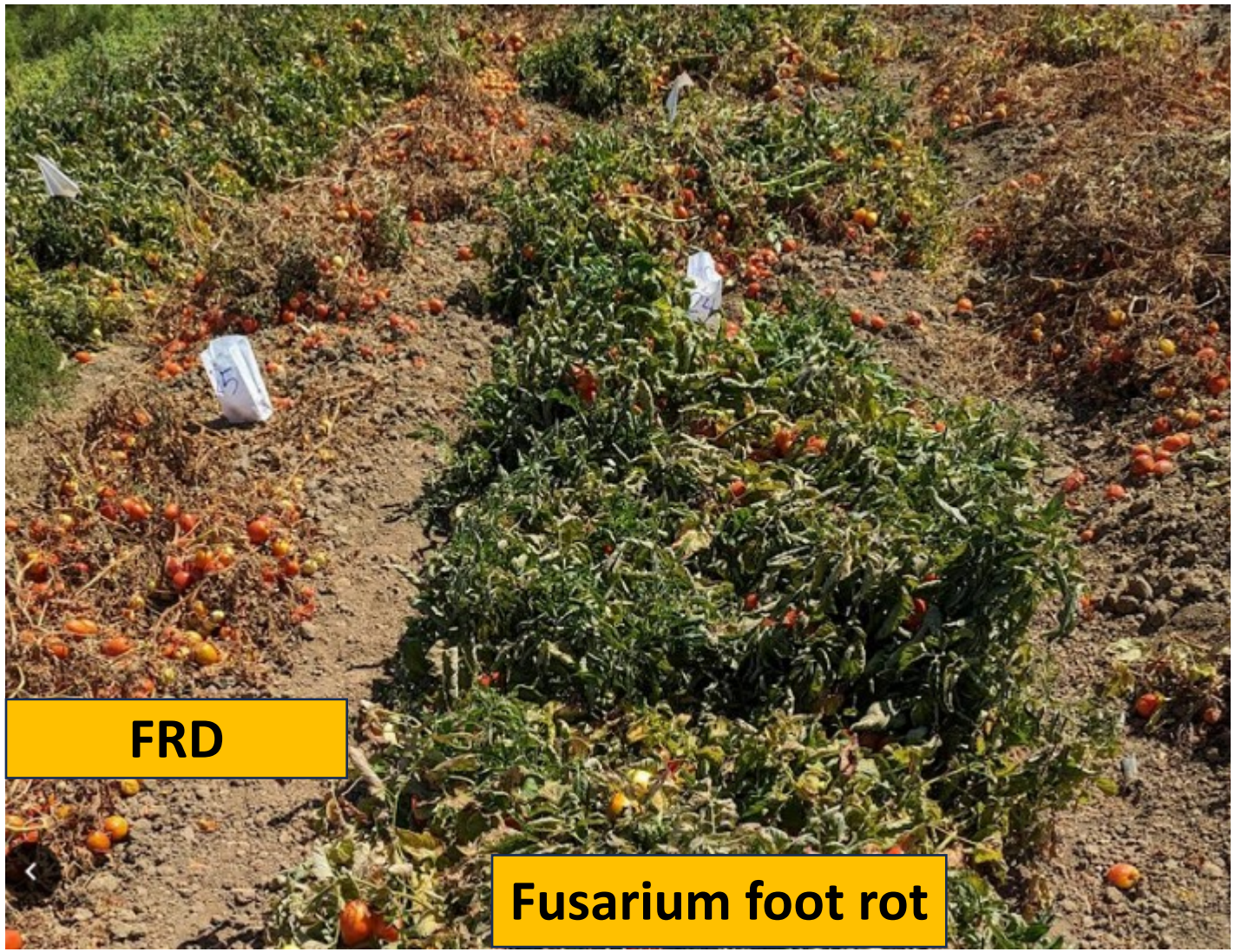
A new paradigm: Recent studies indicate there are THREE species in the F. falciforme species complex

These three species cause TWO different diseases



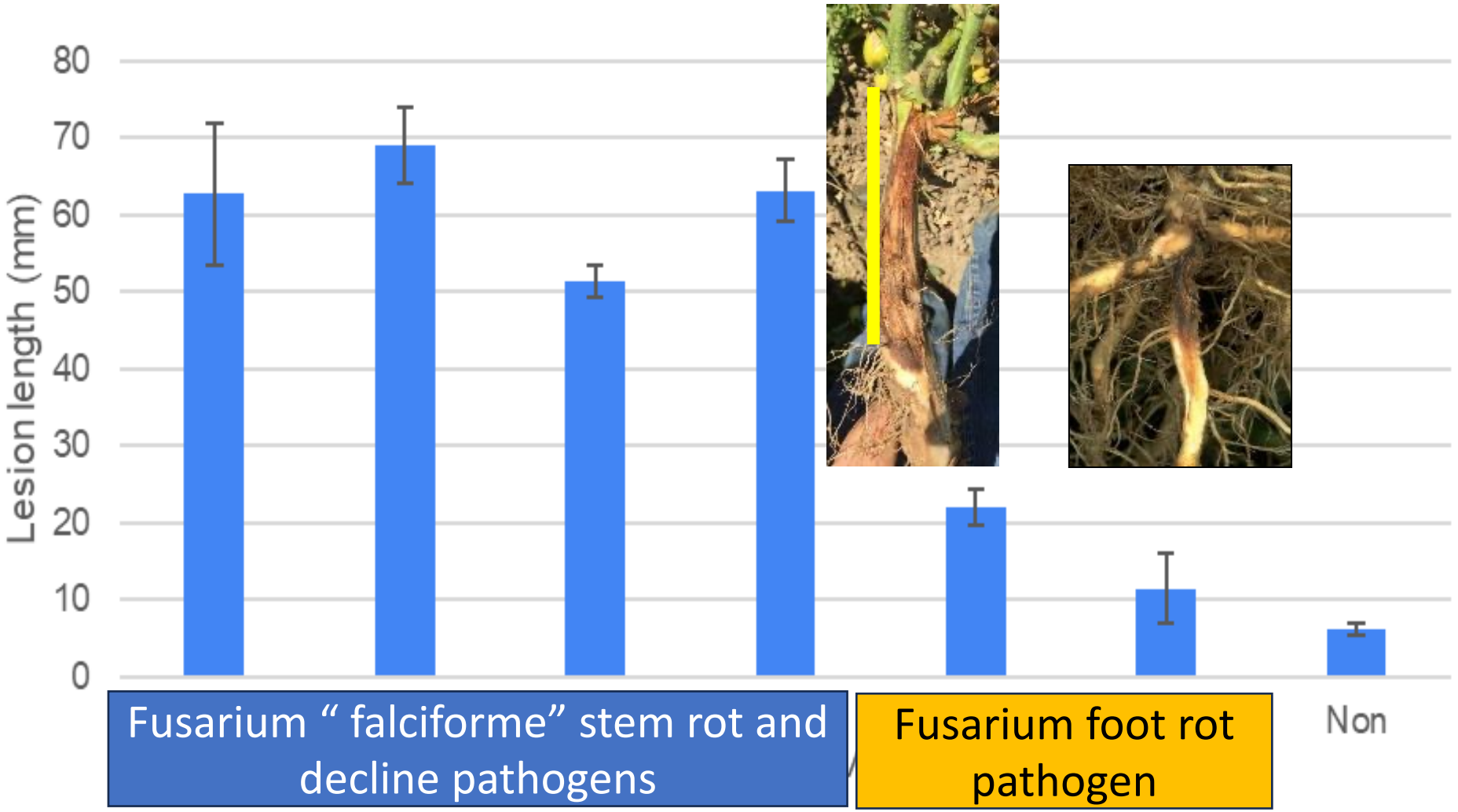
#1 Fusarium "falciforme" stem rot and decline (FRD) = severe disease we associate with the name "falciforme" Caused by F. noneumartii and F. martii

#2 Fusarium foot rot = minor foot/root and branch specks Caused by F. falciforme sensu stricto

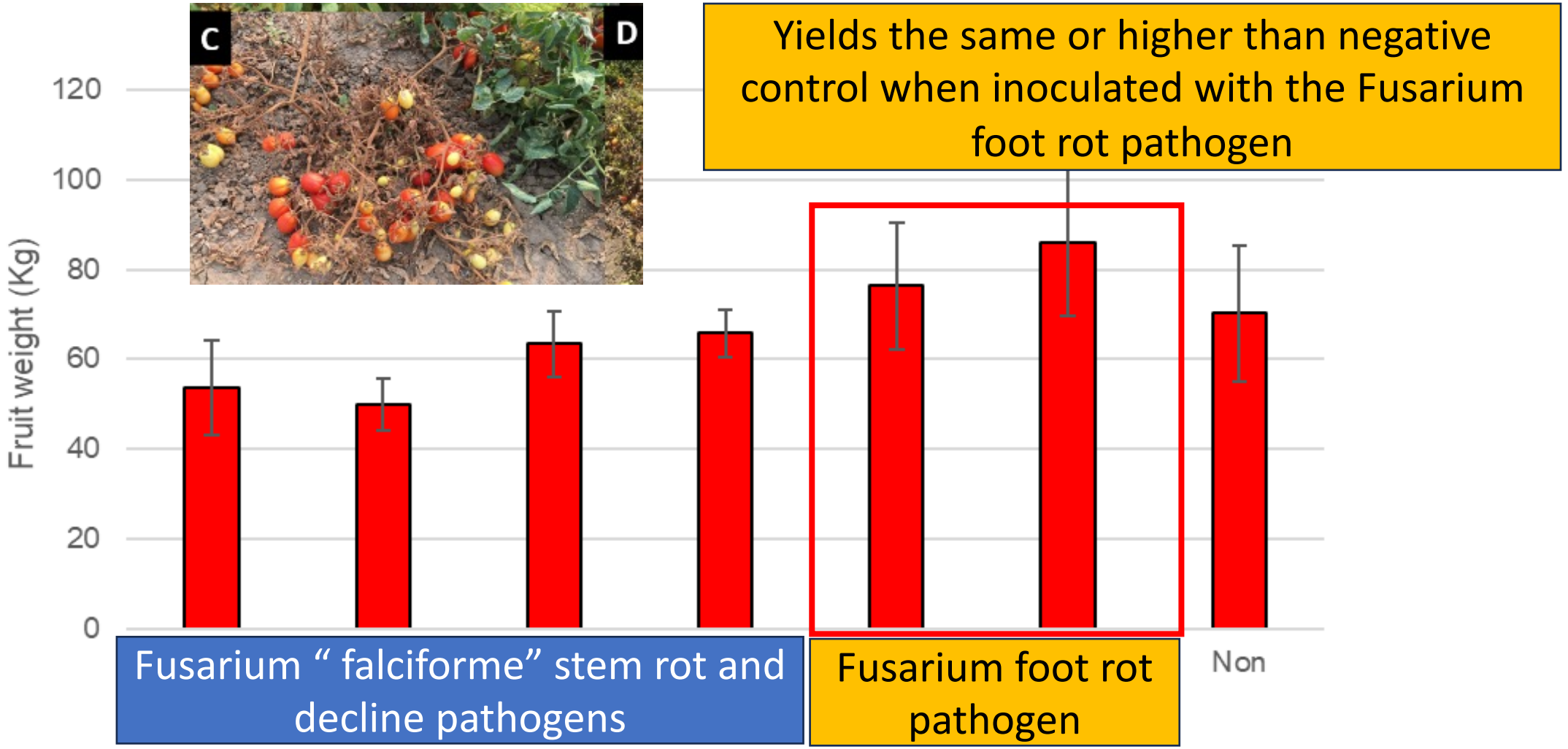


Fusarium foot rot

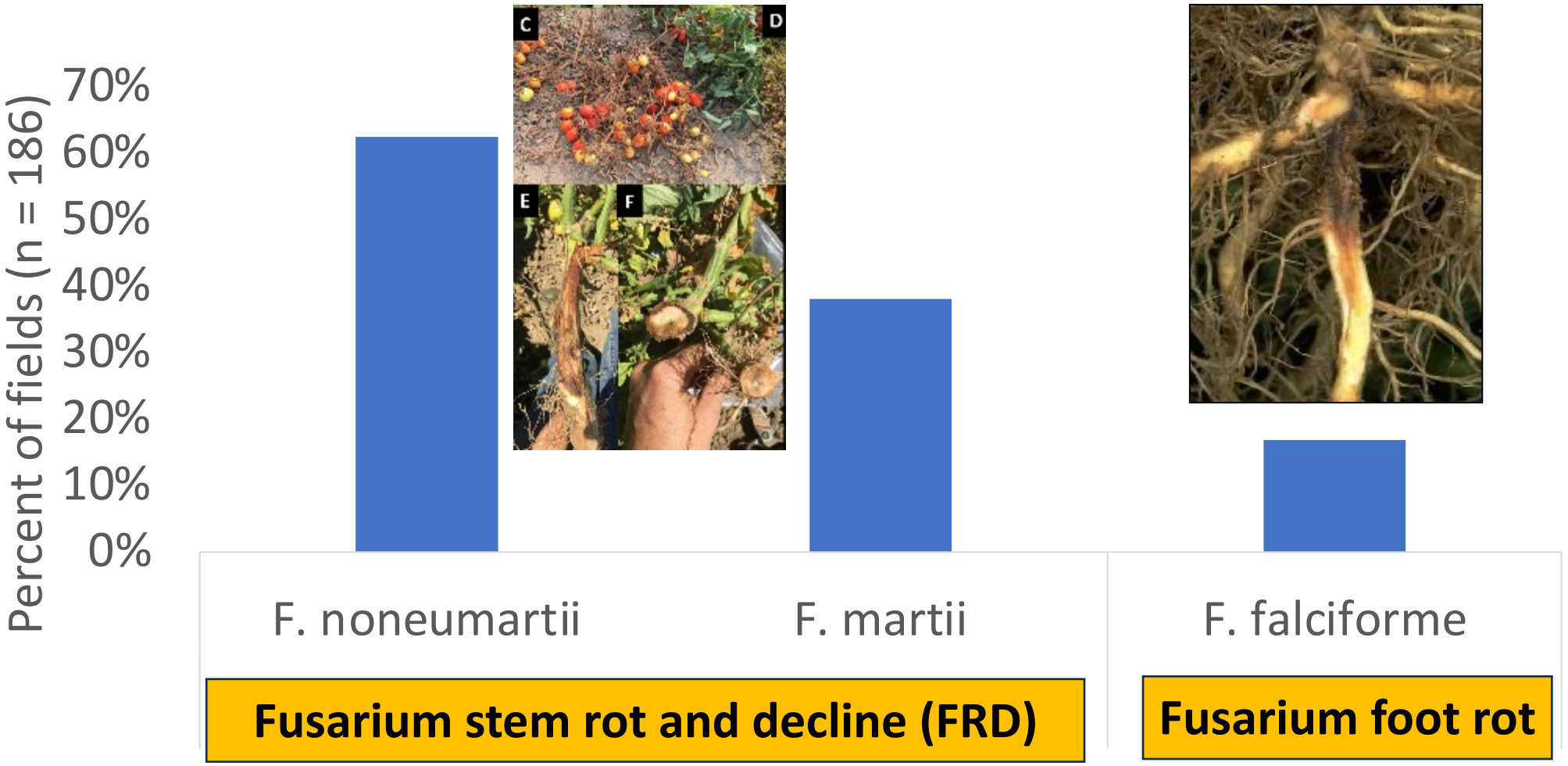
Fusarium foot rot isolates are barely cause stem rot = barely a pathogen



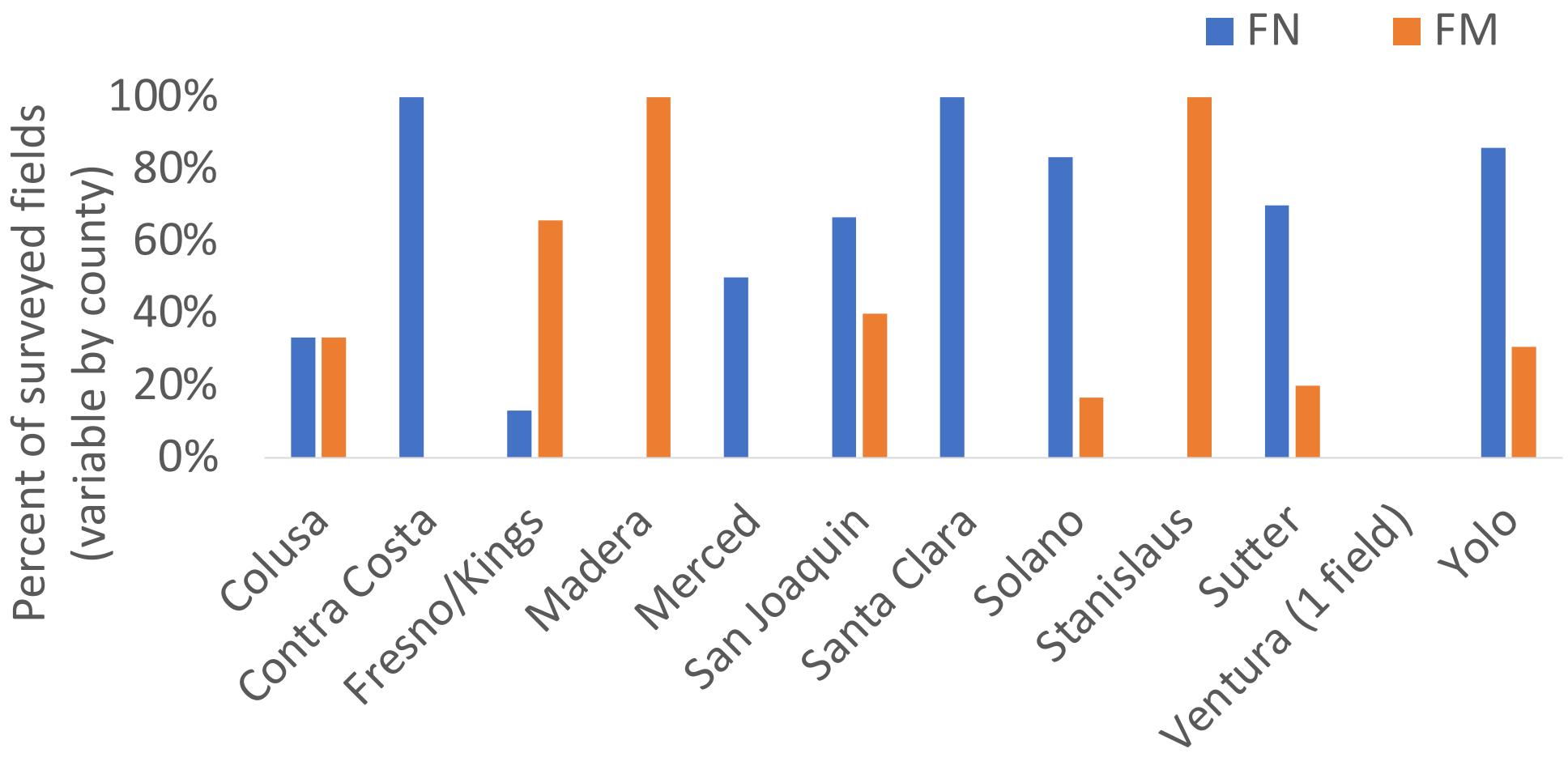
ONLY Fusarium “falciforme” stem rot and decline (F. noneumartii and F. martii) appears to cause yield loss



Fusarium stem rot and decline pathogens are much more common than foot rot statewide



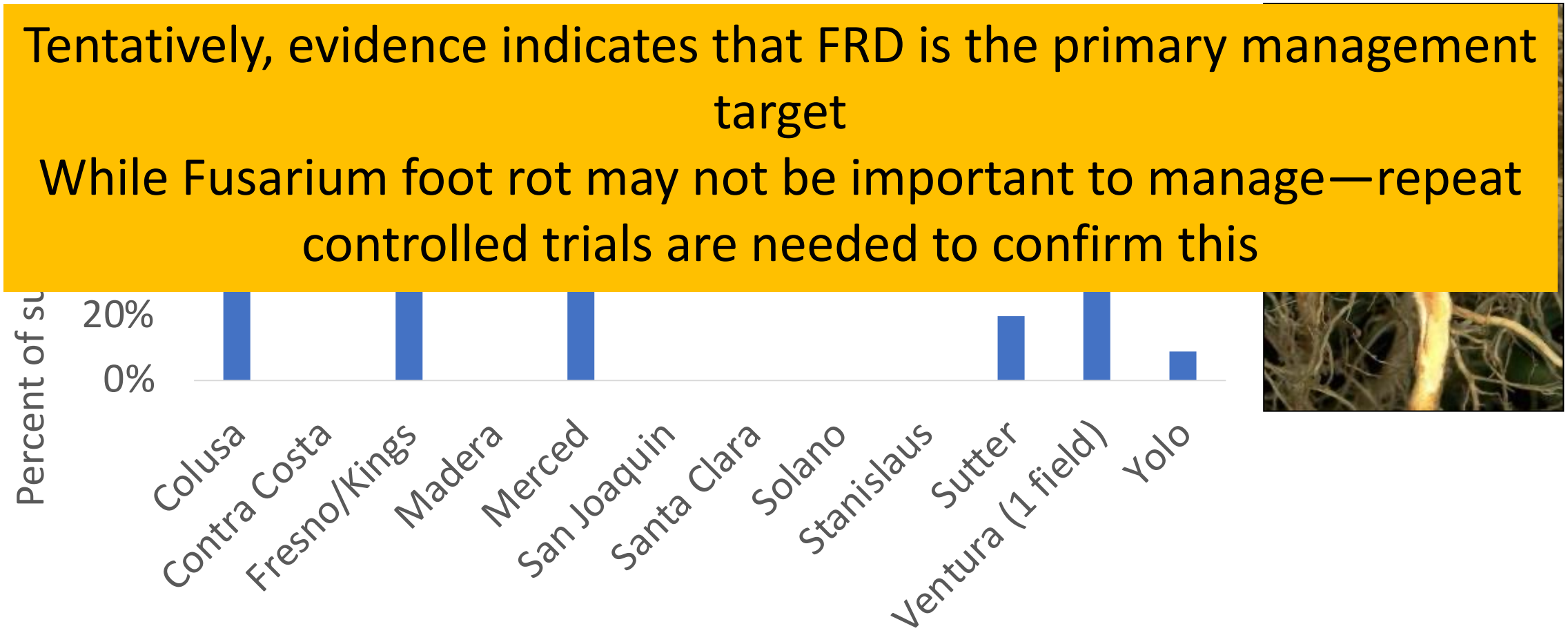
Fusarium stem rot and decline is in all counties



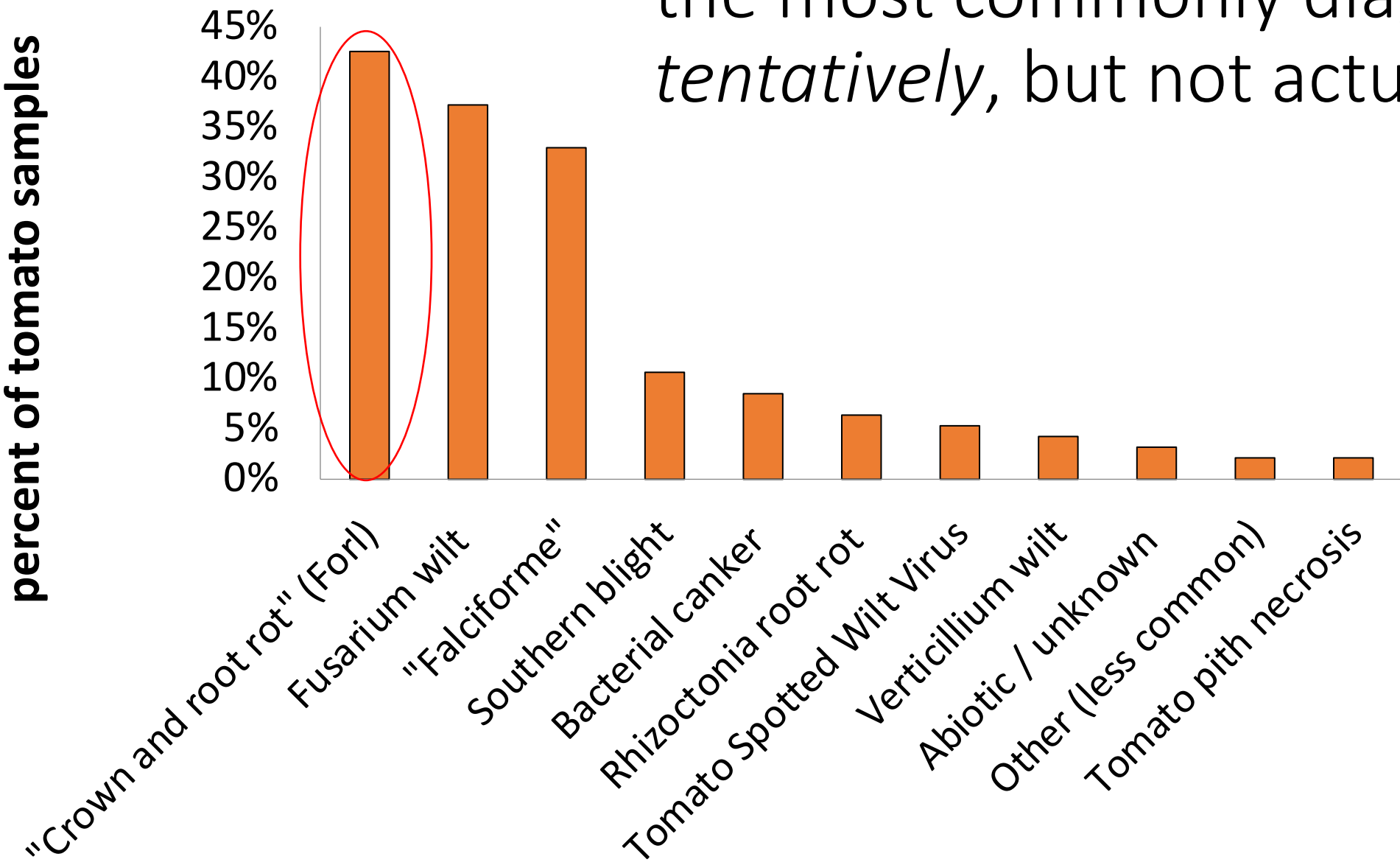
Fusarium foot rot has only been detected in a few counties

Tentatively, evidence indicates that FRD is the primary management target

While Fusarium foot rot may not be important to manage—repeat controlled trials are needed to confirm this

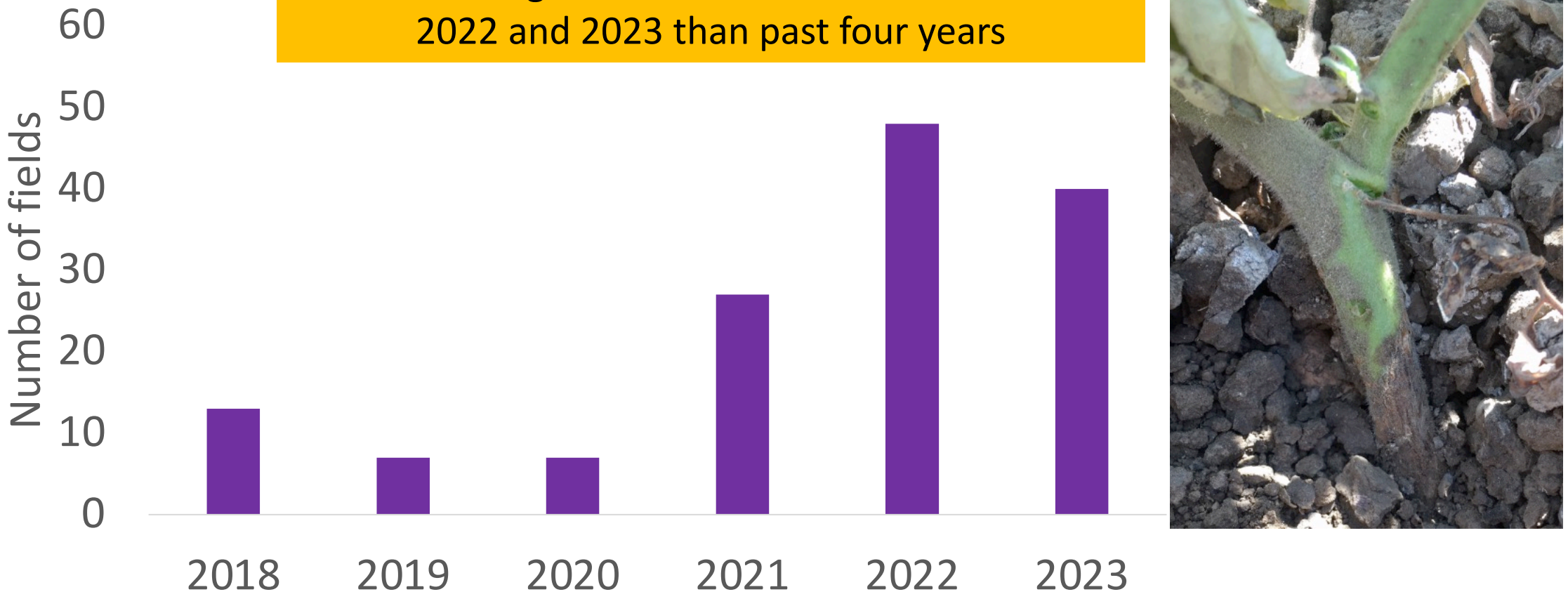


Fusarium crown and root rot: the most commonly diagnosed *tentatively*, but not actually



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

Tentative diagnoses are 2-4x's more common in 2022 and 2023 than past four years

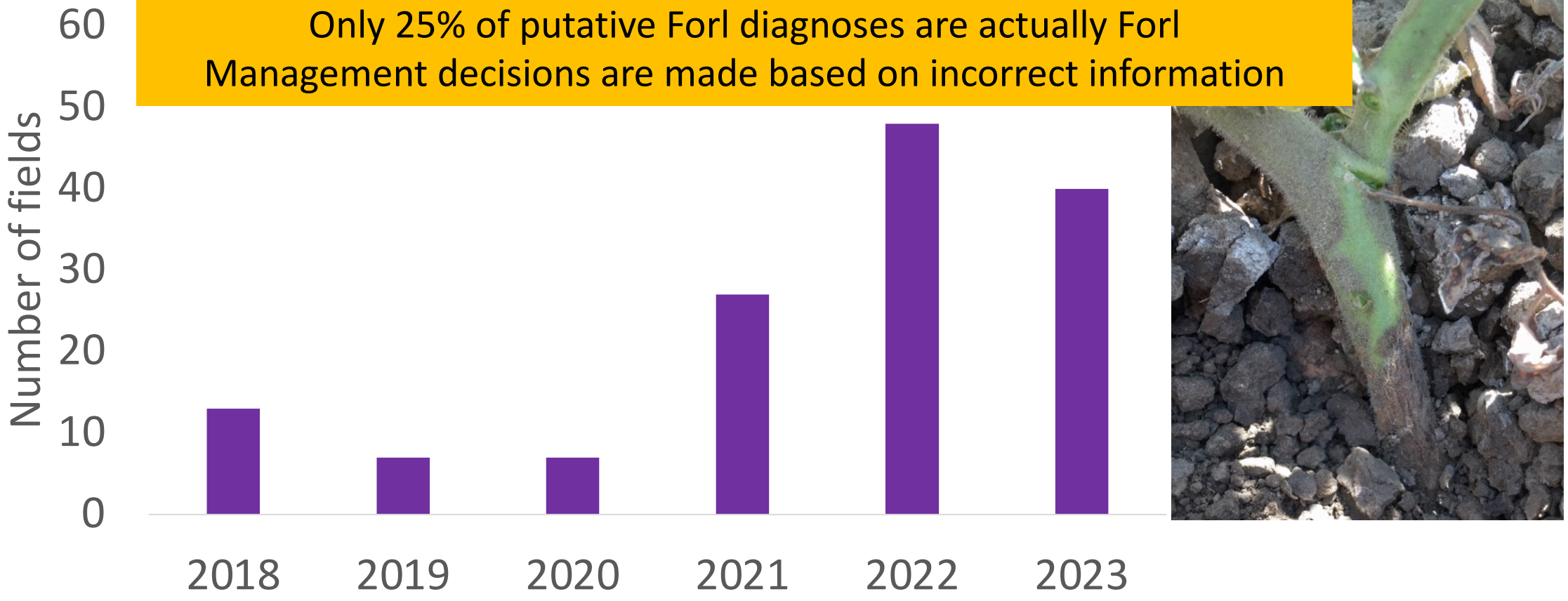


Fusarium crown and root rot: an increasing statewide issue

Current challenge

Only 25% of putative Forl diagnoses are actually Forl

Management decisions are made based on incorrect information



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

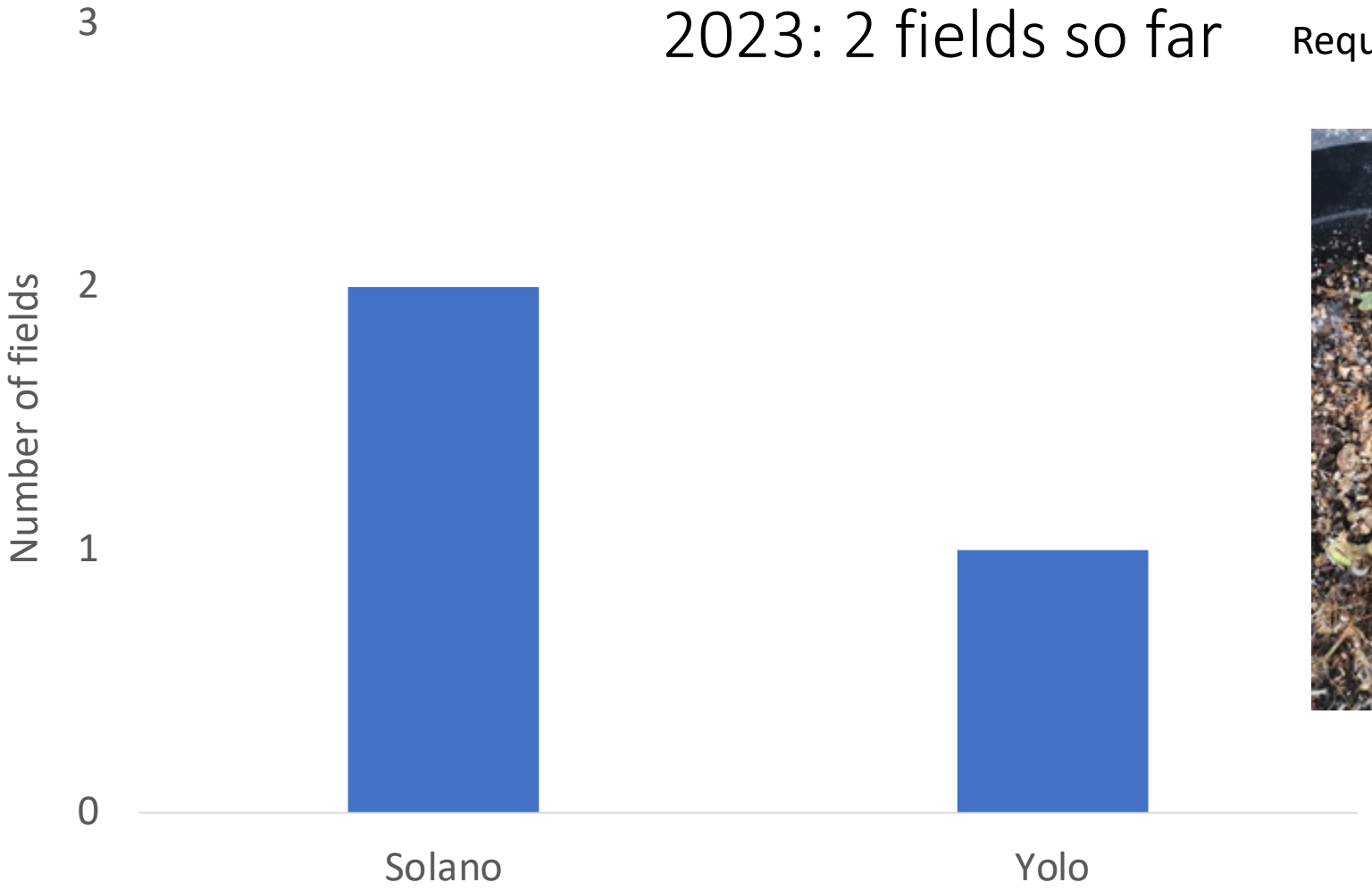
				Molecular diagnosis				Haplotpye #	Lineage
Date	Sample number	Isolate number	status	Confirmed Forl	Confirmed Nonpath	Forl or Nonpath	Ambiguous		
7/6/2023	162023	0162023-6				X		Five_191	3D
7/6/2023	162023	0162023-8				X		Five_191	3D
7/6/2023	172023	0172023-1		X				Five_242	3D
7/14/2023	422023	0422023-1-p1					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 Forl in resistant (Fr) cultivars

Resistance-breaking?

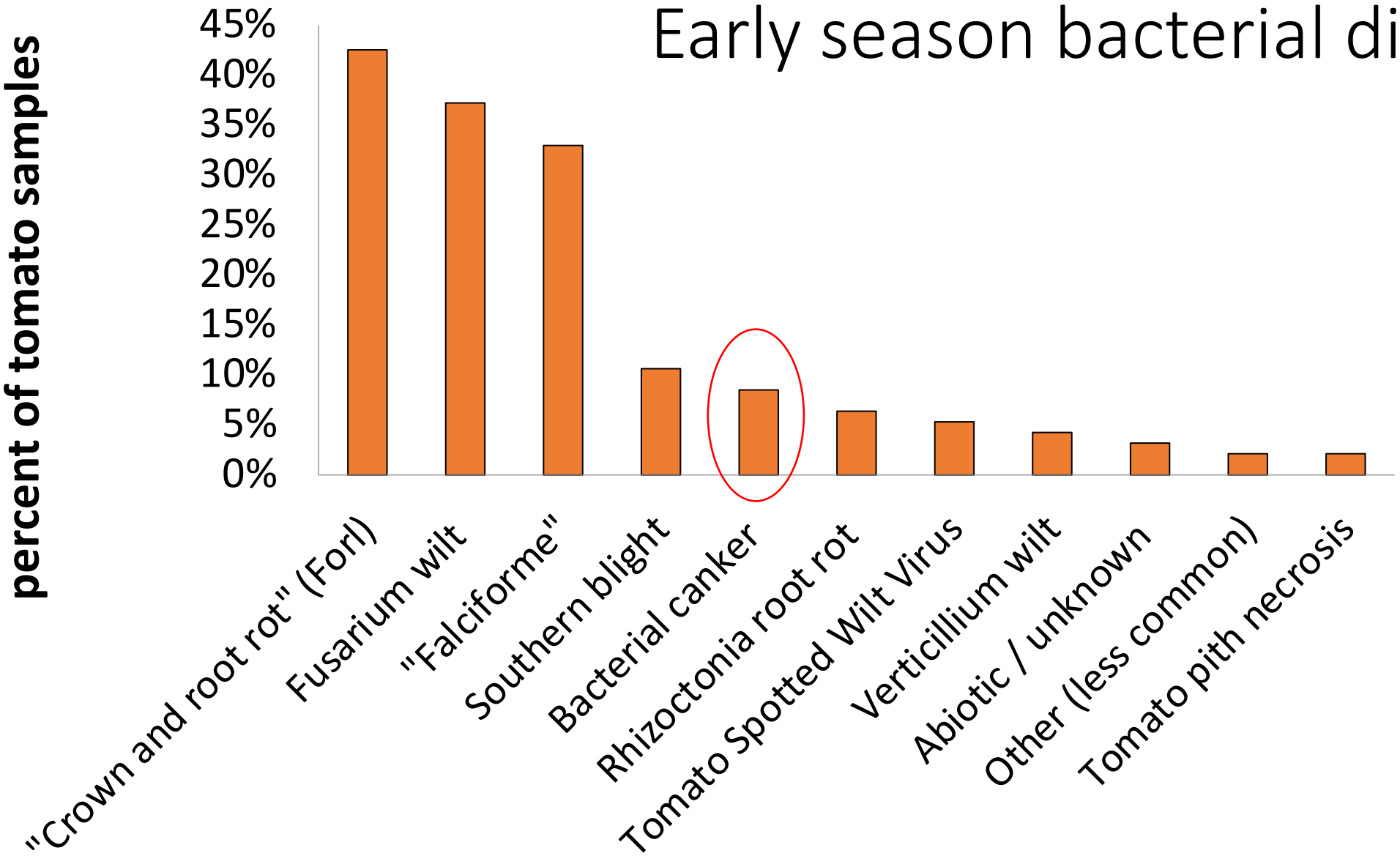
2022: 3 fields, all were NOT resistance breaking

2023: 2 fields so far



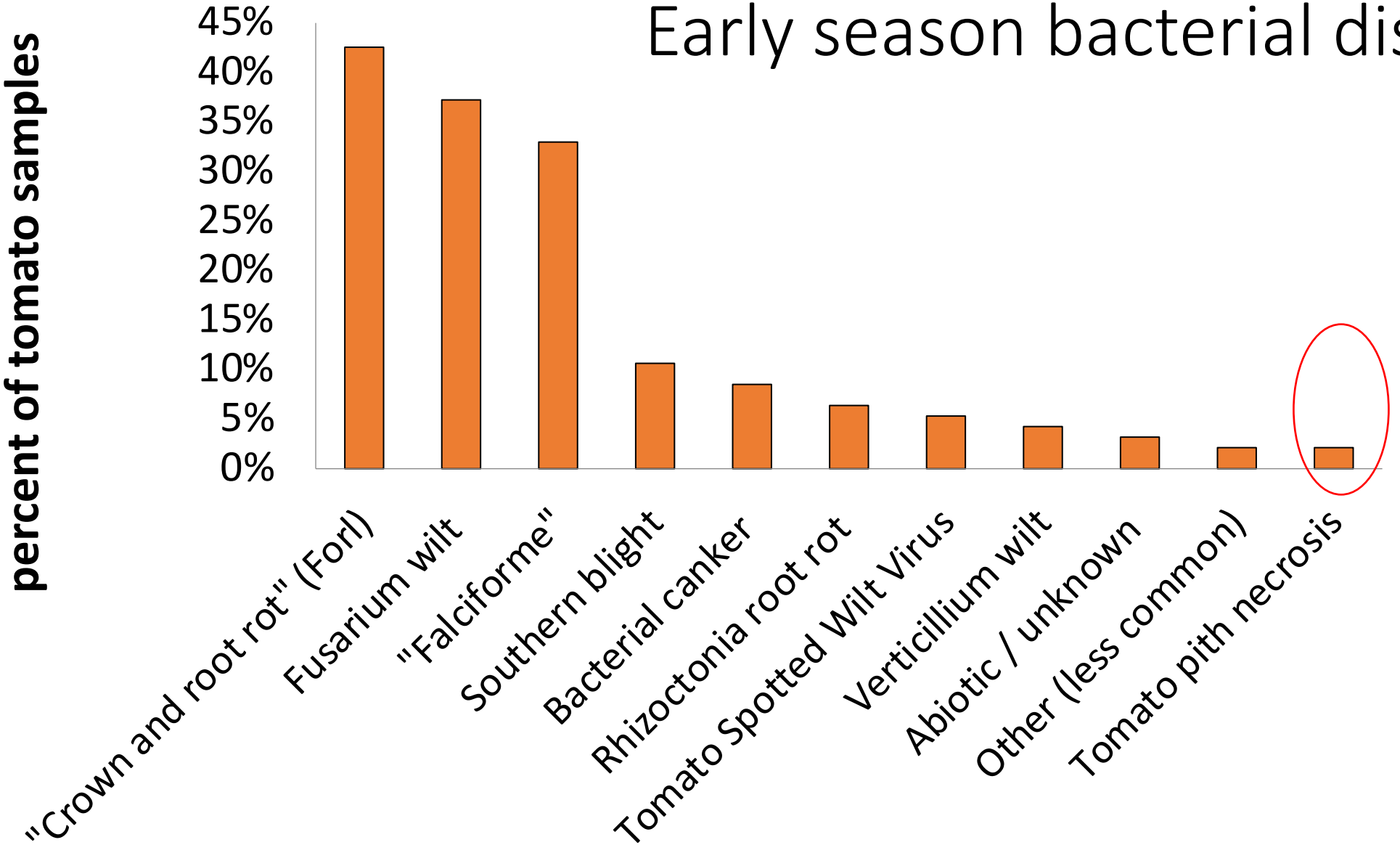
Requires in-planta phenotyping to confirm resistance breaking

Other issues of note
Early season bacterial diseases



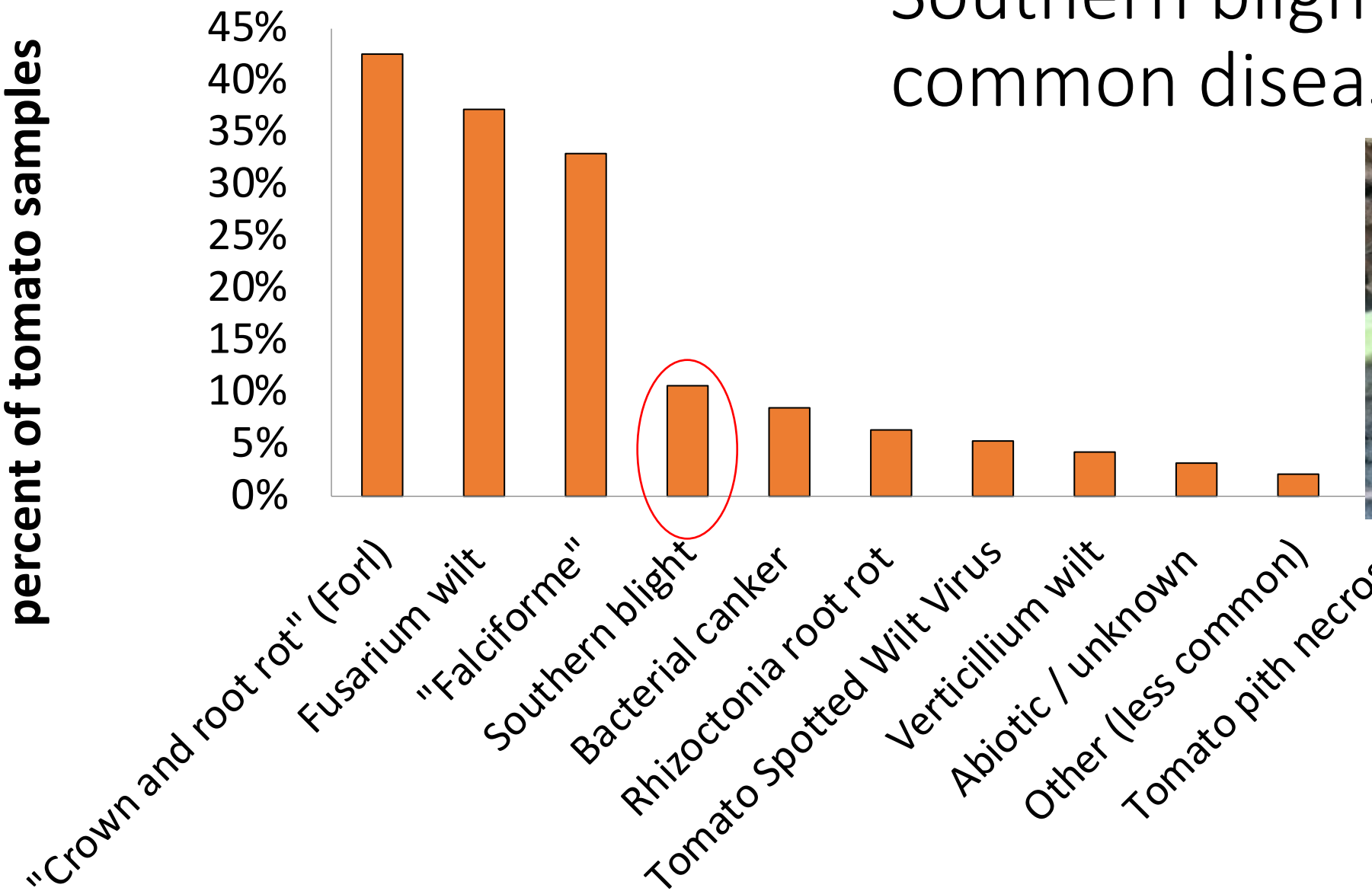
S. Stoddard

Other issues of note
Early season bacterial diseases



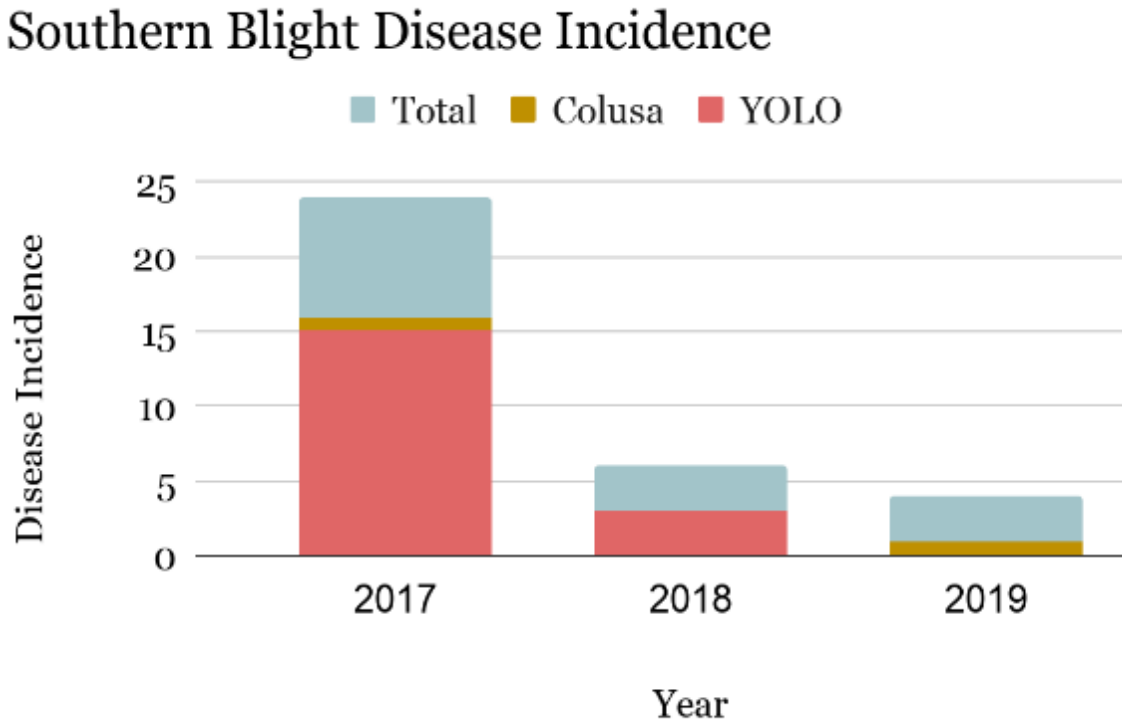
Pseudomonas corrugata

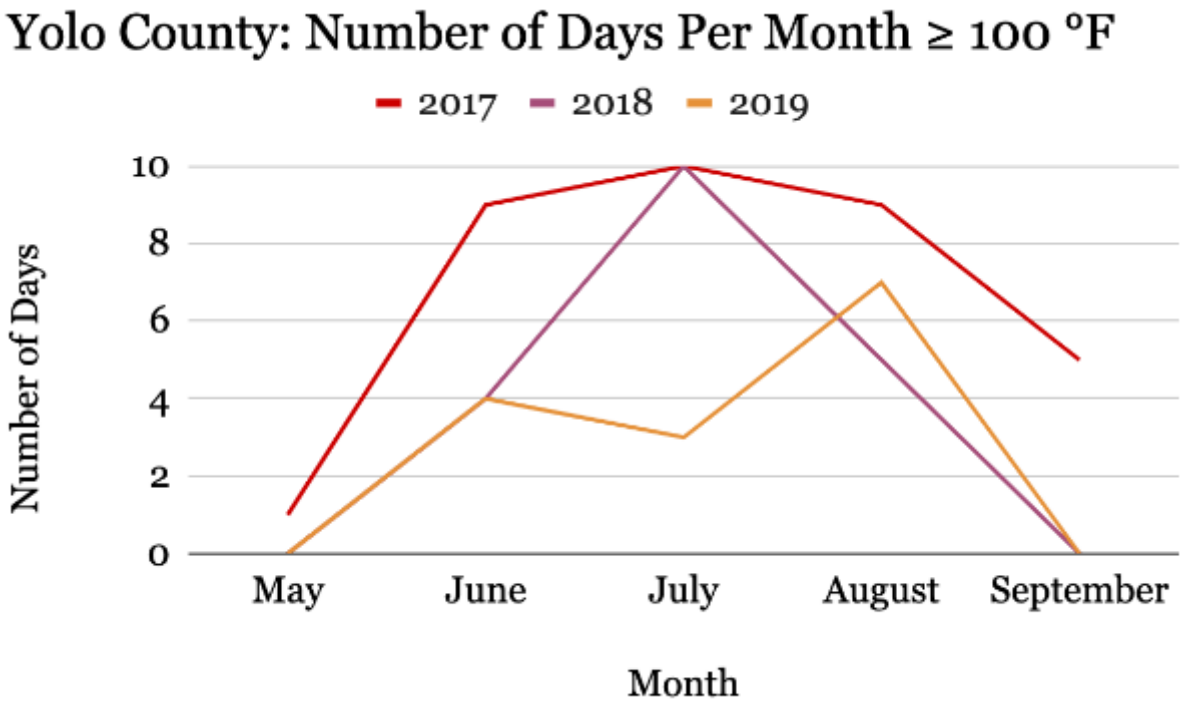
Other issues of note
Southern blight was 4th most common disease this year



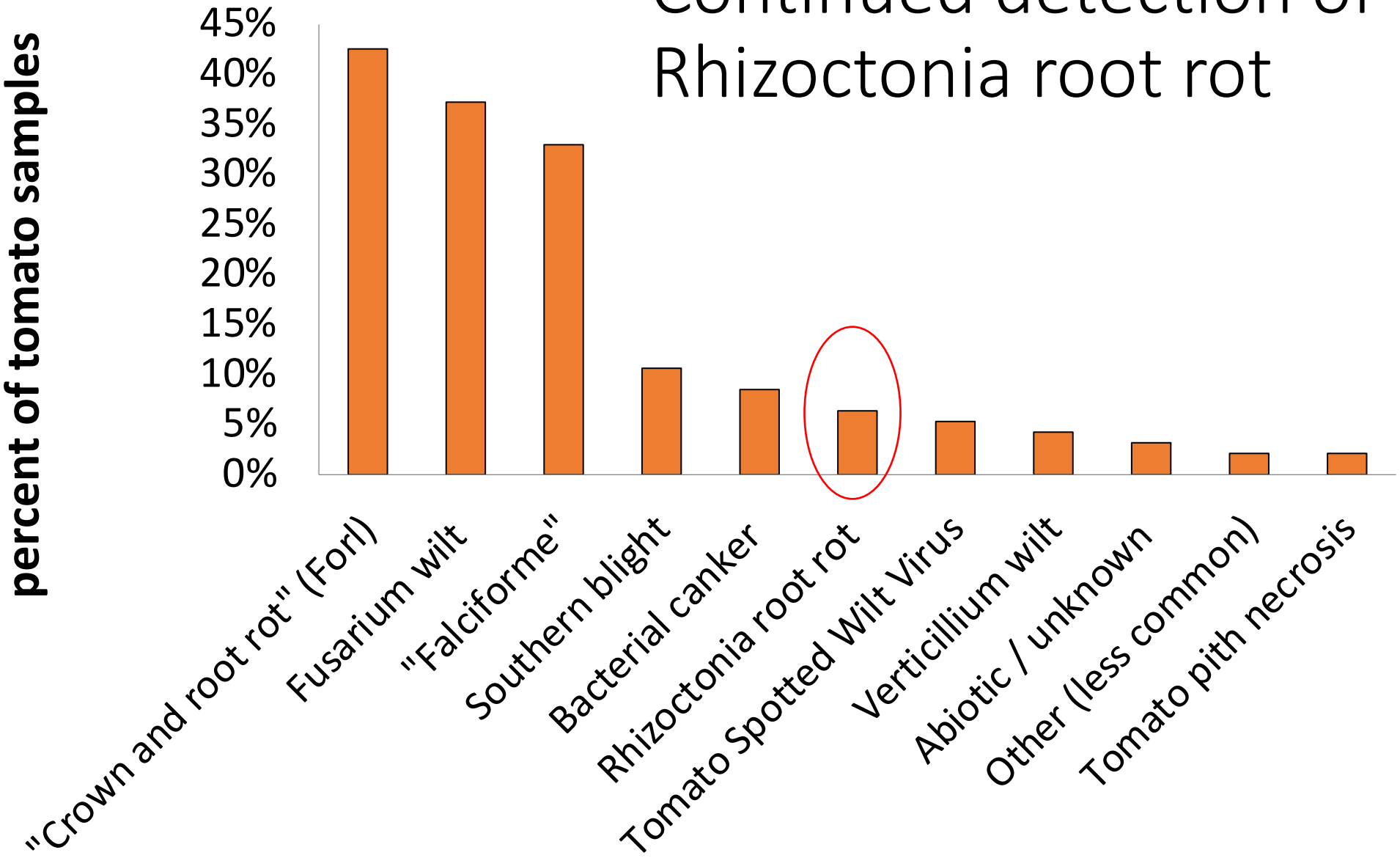
Southern blight is present by often not active
This year-during heat spells, plants sat in hot mud
Heat and moisture likely triggered disease

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





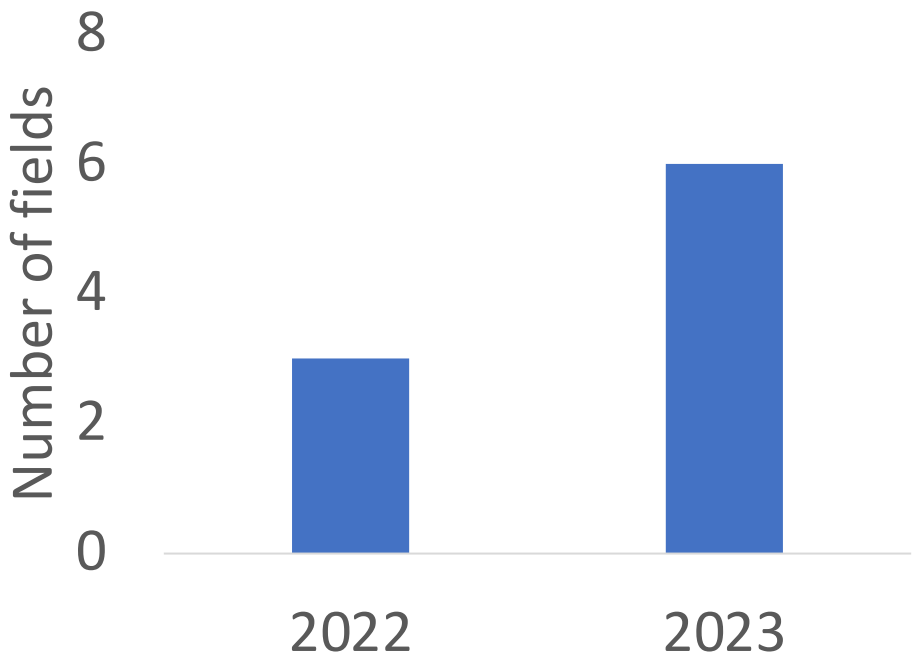
Other issues of note
Continued detection of Rhizoctonia root rot



?

Rhizoctonia root rot is poorly understood as a tomato pathogen-better studied in other crops

Rhizoctonia root rot detections are increasing



Root knot nematode resistance breaking common statewide-2021 survey (Hodson, Swett)

Statewide:

- RKN reco
  fields pla
  cultivars
- 100% of tested isolates (18) were resistance-breaking (controlled temp)

Is there anything we can do to facilitate development of new RKN-resistance resources?

			% Root galling	
	Yolo	145	19	28
	Yolo	146	30	37
	Yolo	213	6	7
	Yolo	R-R	43	44
	Solano	212	4.6	12
	Fresno	157	30	32
	Fresno	158	26	28
	Fresno	208	24	20
	Fresno	207	28	44
	Fresno	151	34	44
	Merced	183	28	38
	Sutter	A-S	46	37
M. javanica	Yolo	184	19	29
	Stanislaus	C-L	0	1
Controls				
M. incognita		Hr3	36	29
M. incognita		I3	0	47
M. javanica		VW5	33	25
M. javanica		VW4	5	42

Upcoming: new 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
Depart

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

urly top disease (CTD)-beet
urly top virus (BCTV)
ector: beet leafhopper
ymptoms
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
TD is sporadic but can cause economic oss in bad years; no resistant varieties ut known risk factors

Tomato necrotic spot disease-tomato necrotic spot (ToNSV)

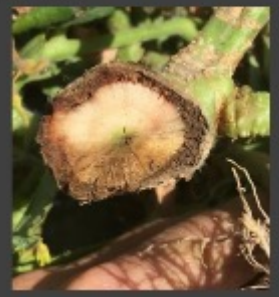
A windborne pollen-transmitted virus introduced to tomato via thrips feeding

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 crop field day, UC Davis
Open to all
Date: TBD

Support for this work comes from:

California Tomato Research Institute

USDA NIFA

NPDN National Plant Diagnostic Network

cdfa

California Food Producers

dpr California Department of Pesticide Regulation

Questions?

Cassandra Swett
clswett@ucdavis.edu
https://swettlab.faculty.ucdavis.edu/