Statewide tomato disease patterns with updates on resistance-breaking pathogens

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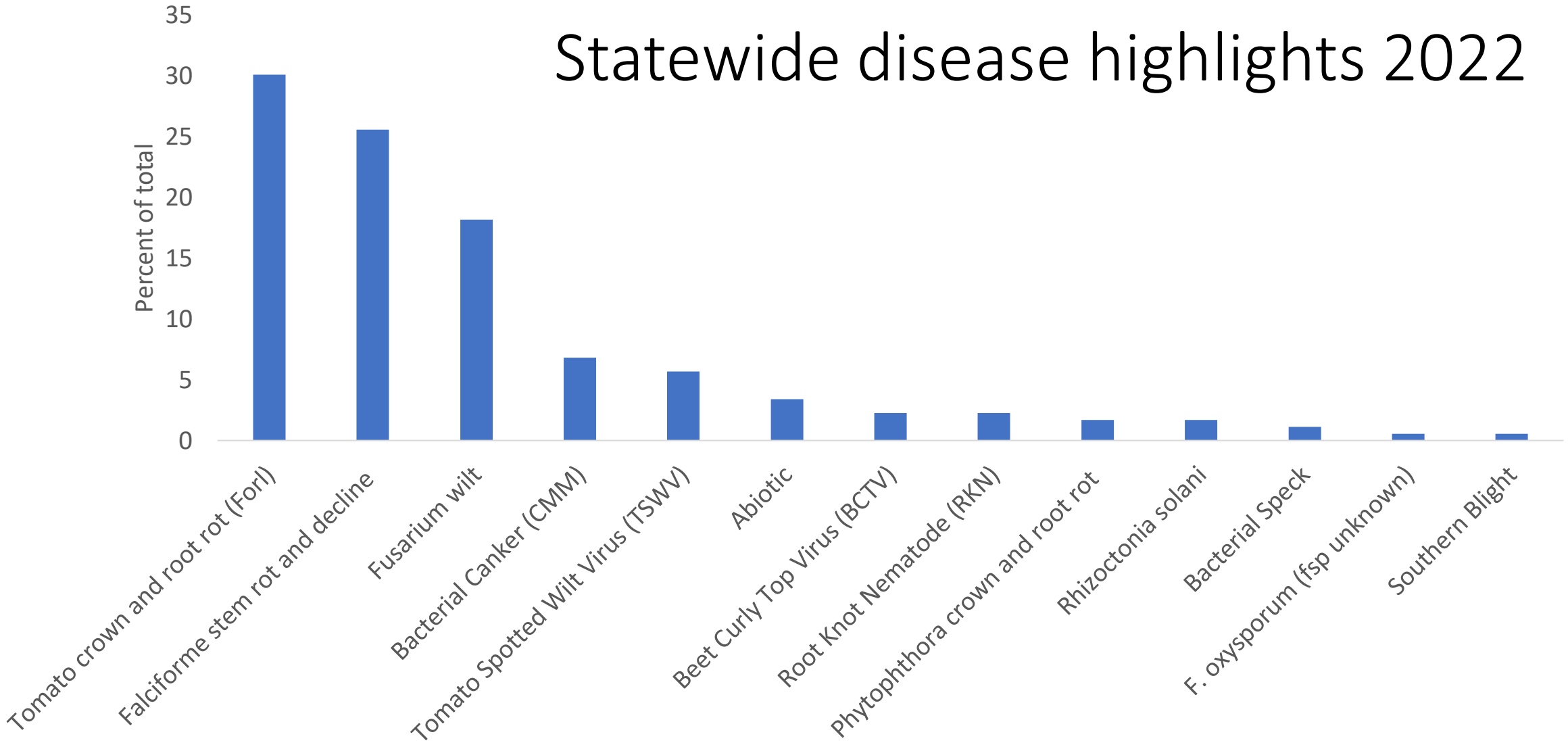
NPDN National Plant Diagnostic Network

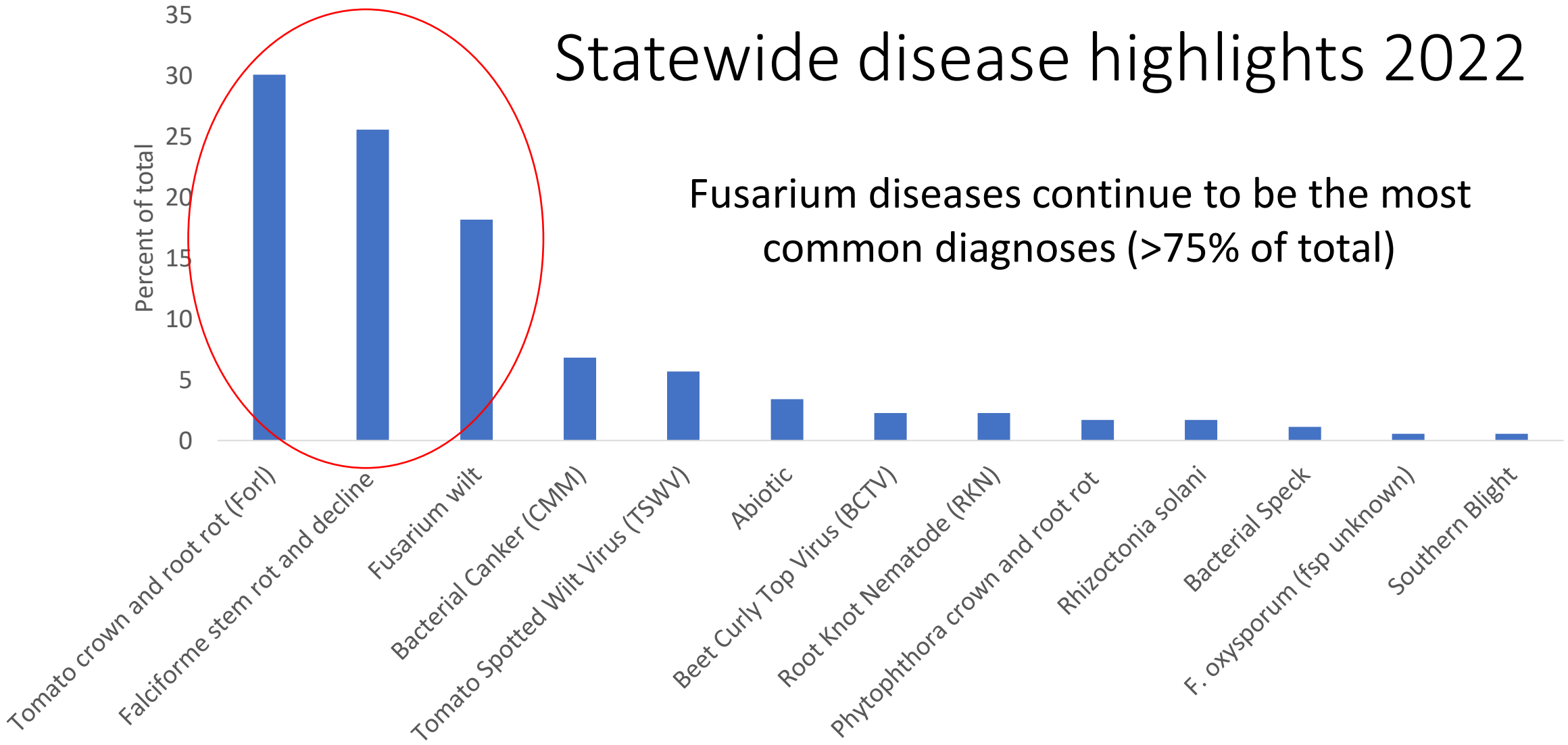
California Tomato Research Institute

Statewide disease highlights 2022



Statewide disease highlights 2022

Fusarium diseases continue to be the most common diagnoses (>75% of total)



Fusarium oxysporum

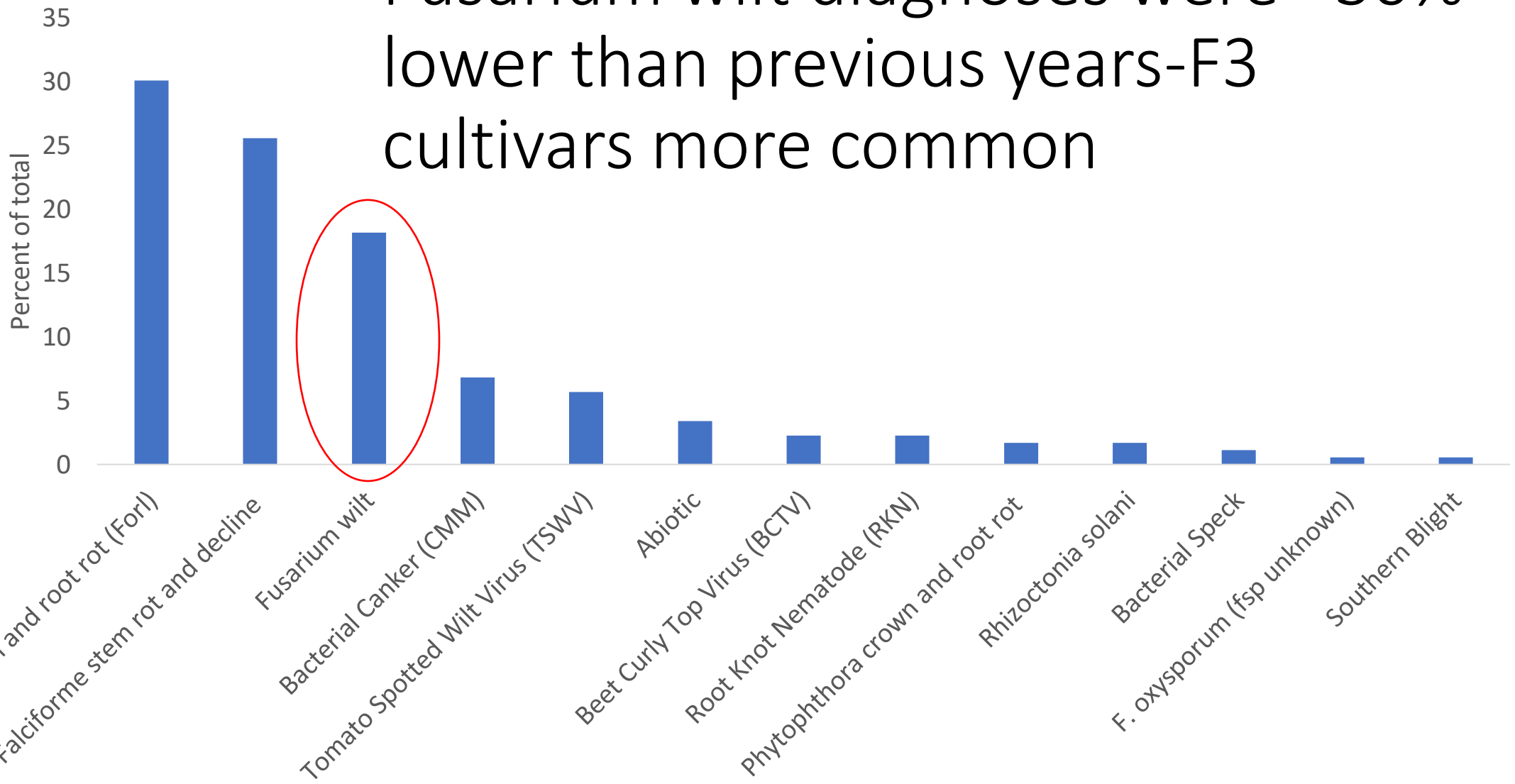
Fusarium wilt
f. sp. lycopersici
Fol (race 3)

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

Fusarium falciforme

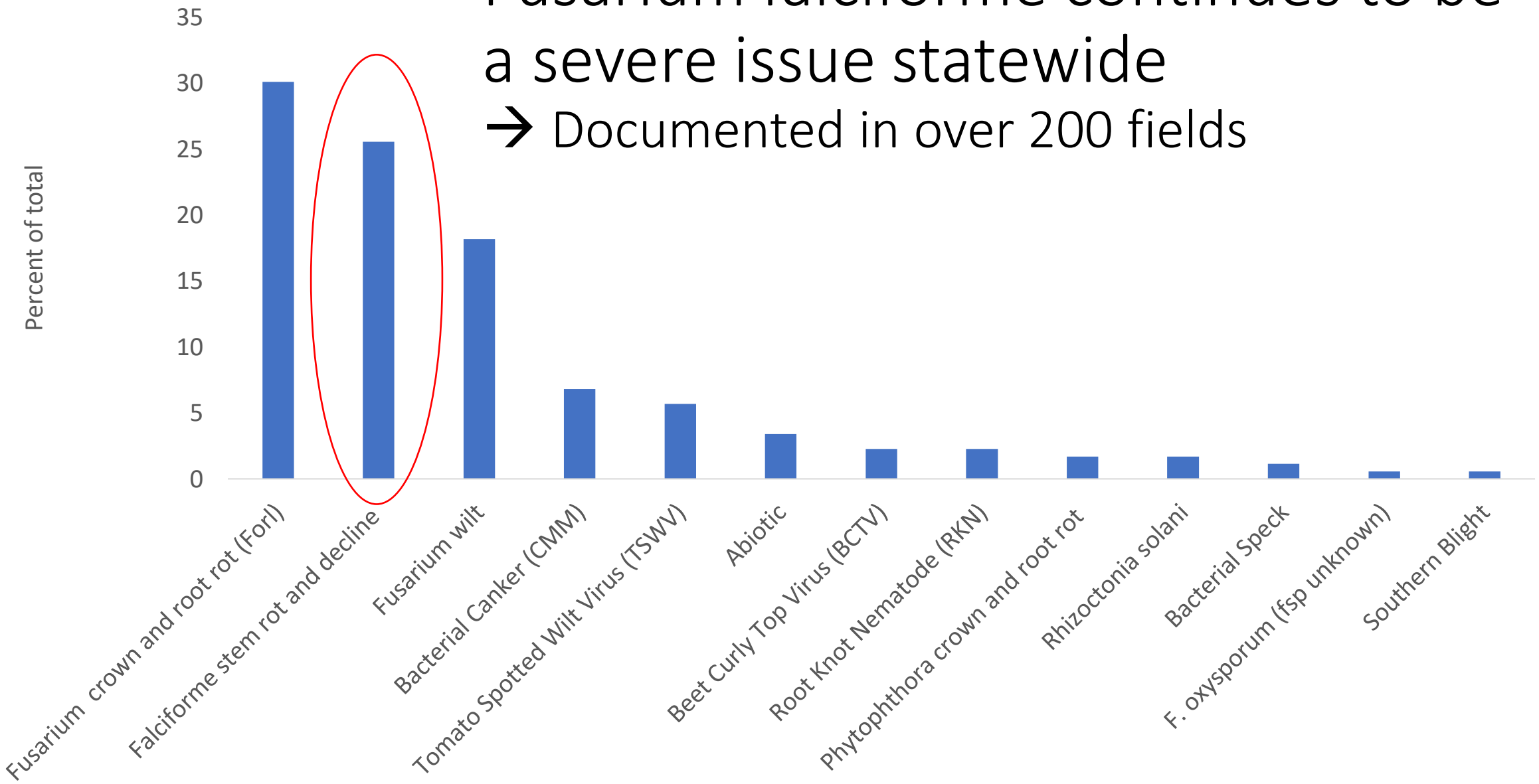
Stem rot and vine decline

Fusarium wilt diagnoses were ~30% lower than previous years-F3 cultivars more common

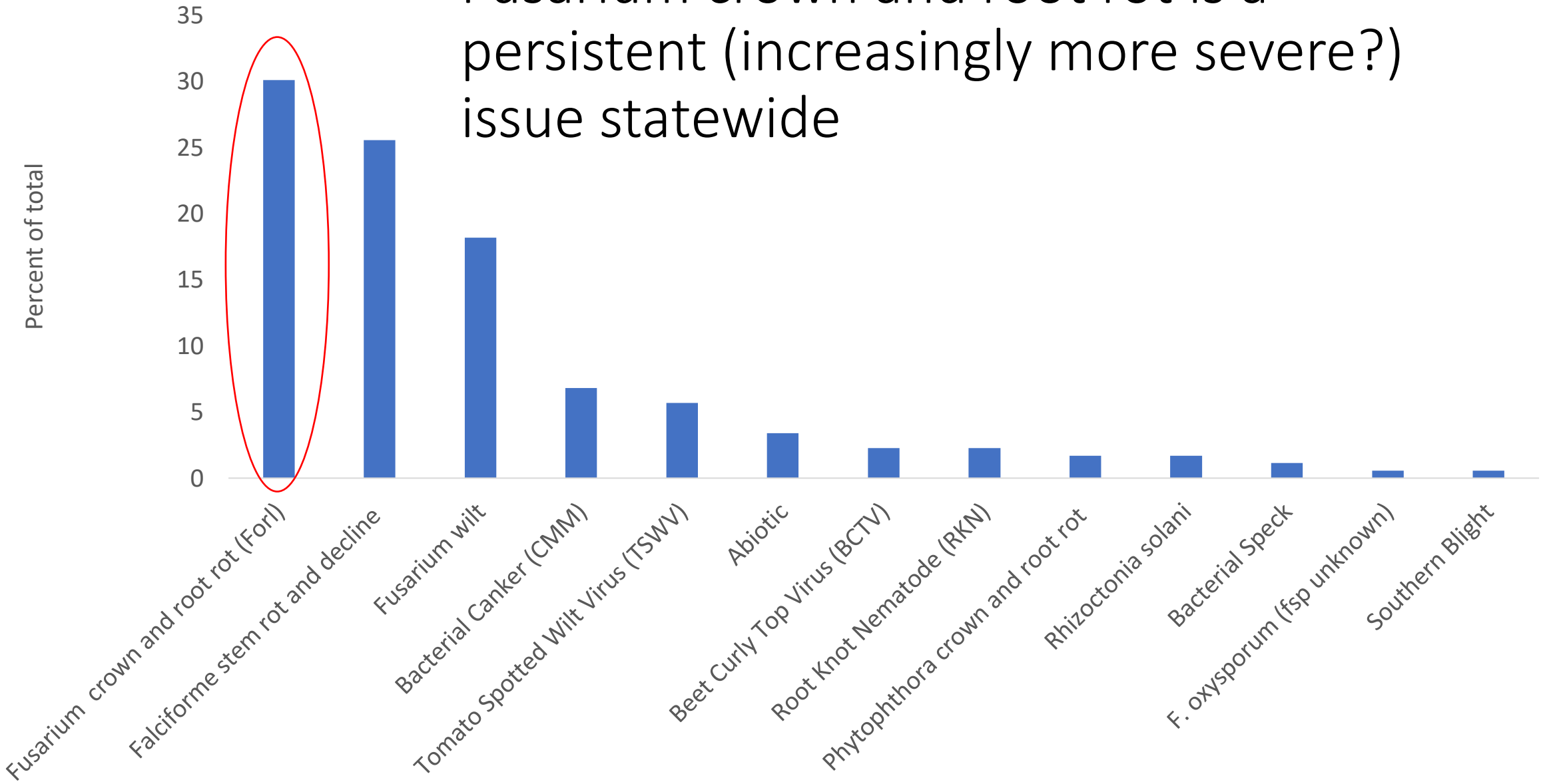


Fusarium falciforme continues to be a severe issue statewide

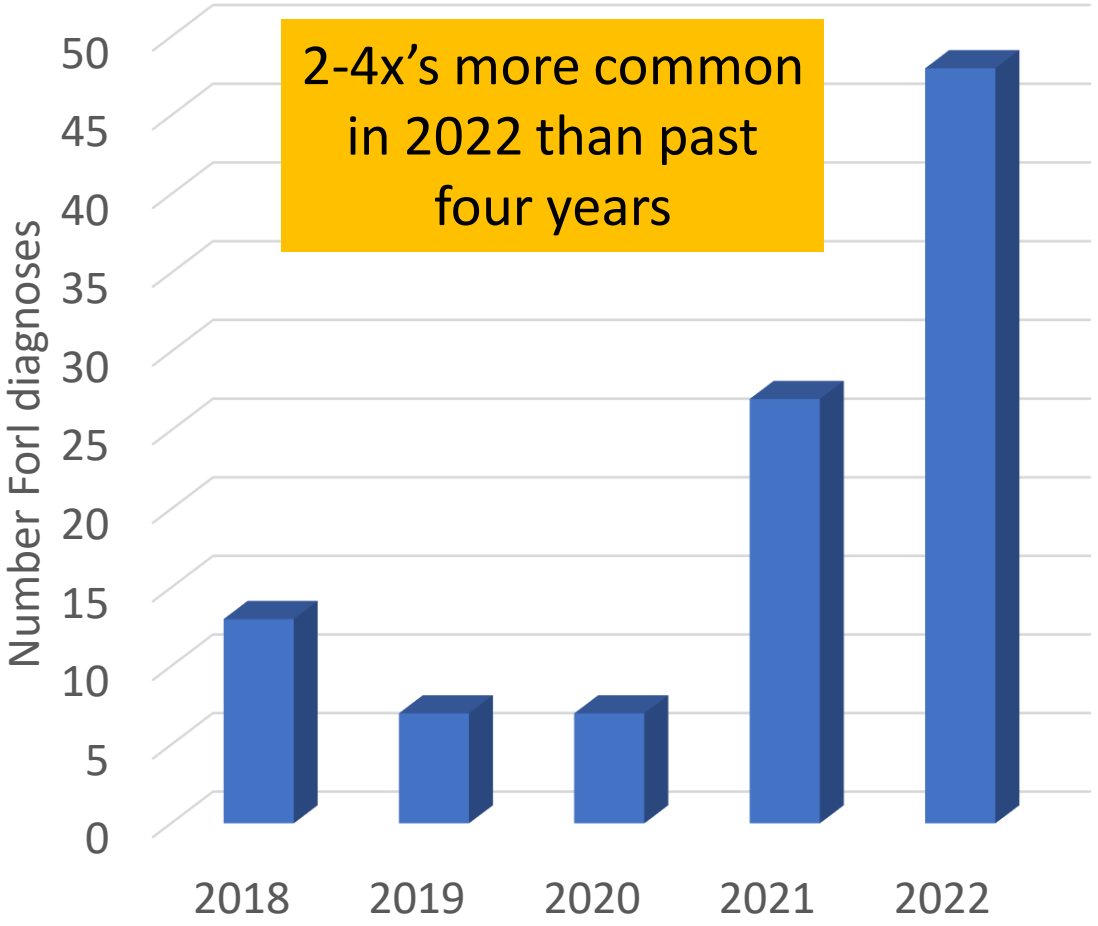
→ Documented in over 200 fields

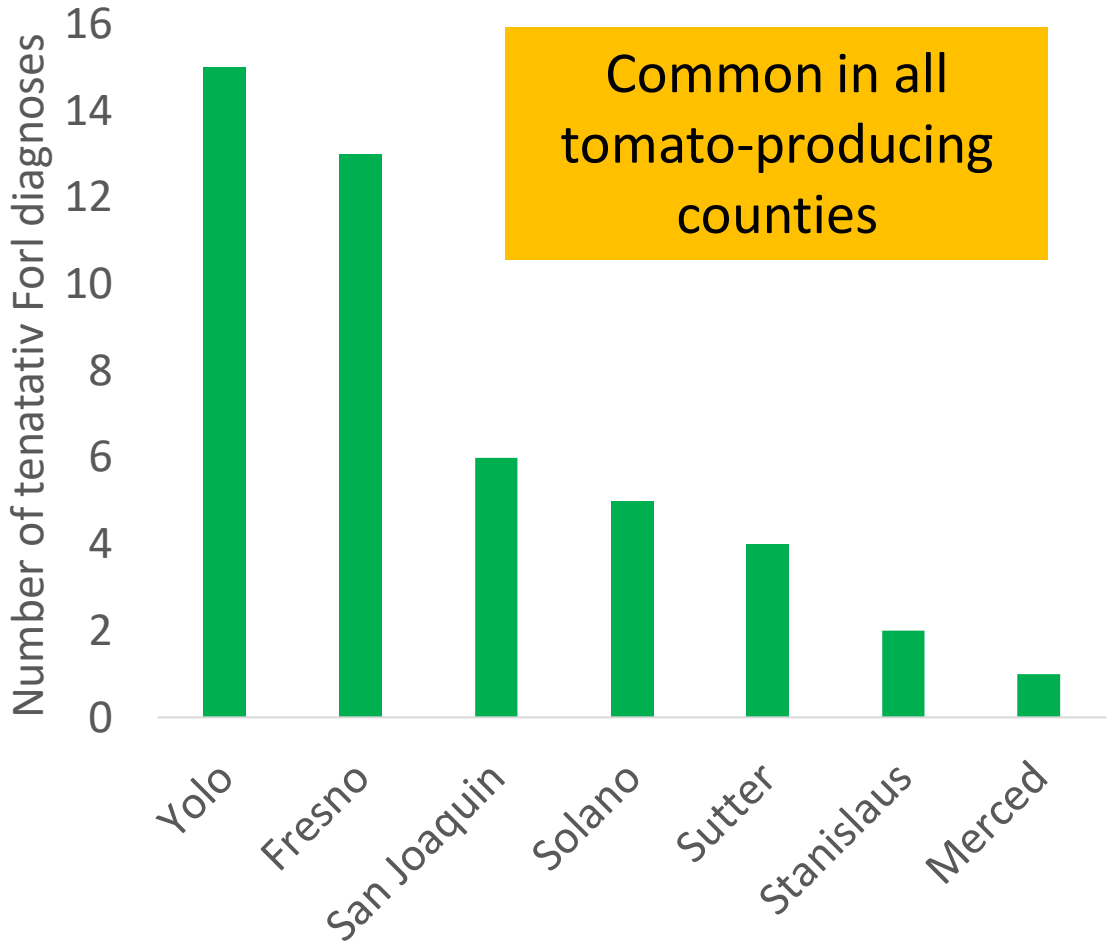


Fusarium crown and root rot is a persistent (increasingly more severe?) issue statewide



Fusarium crown and root rot: an increasing statewide issue

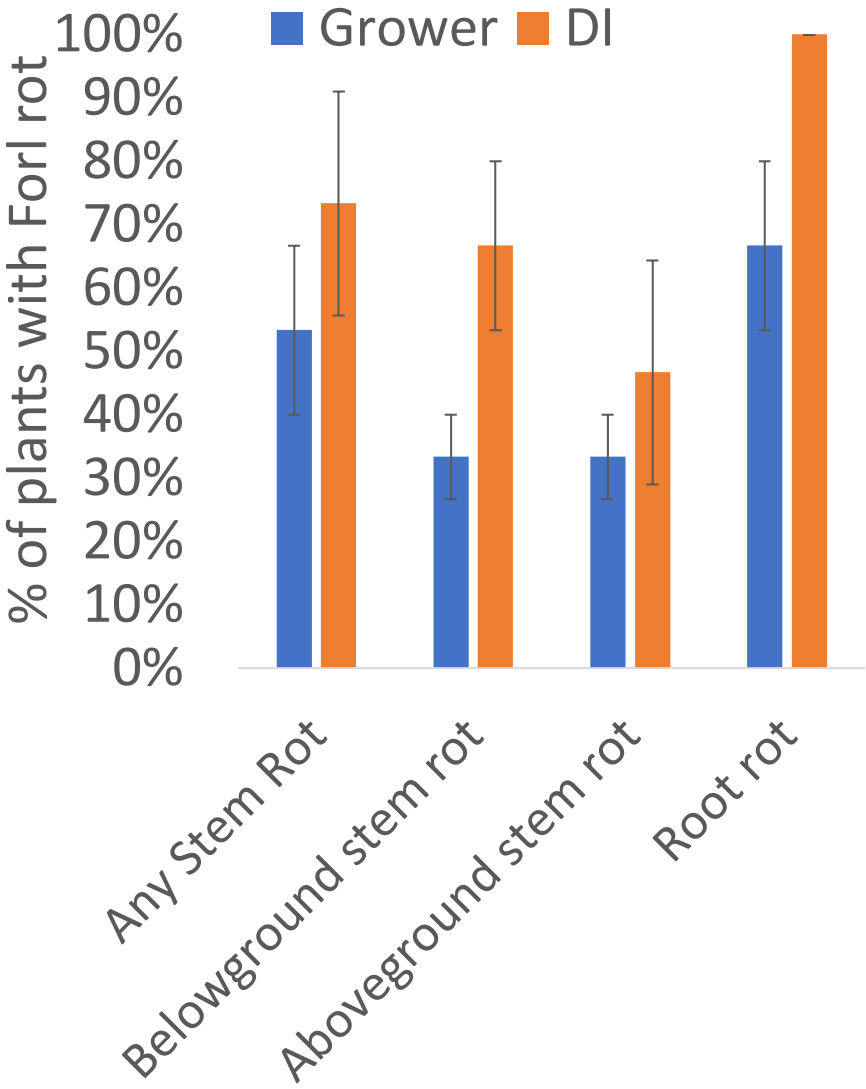




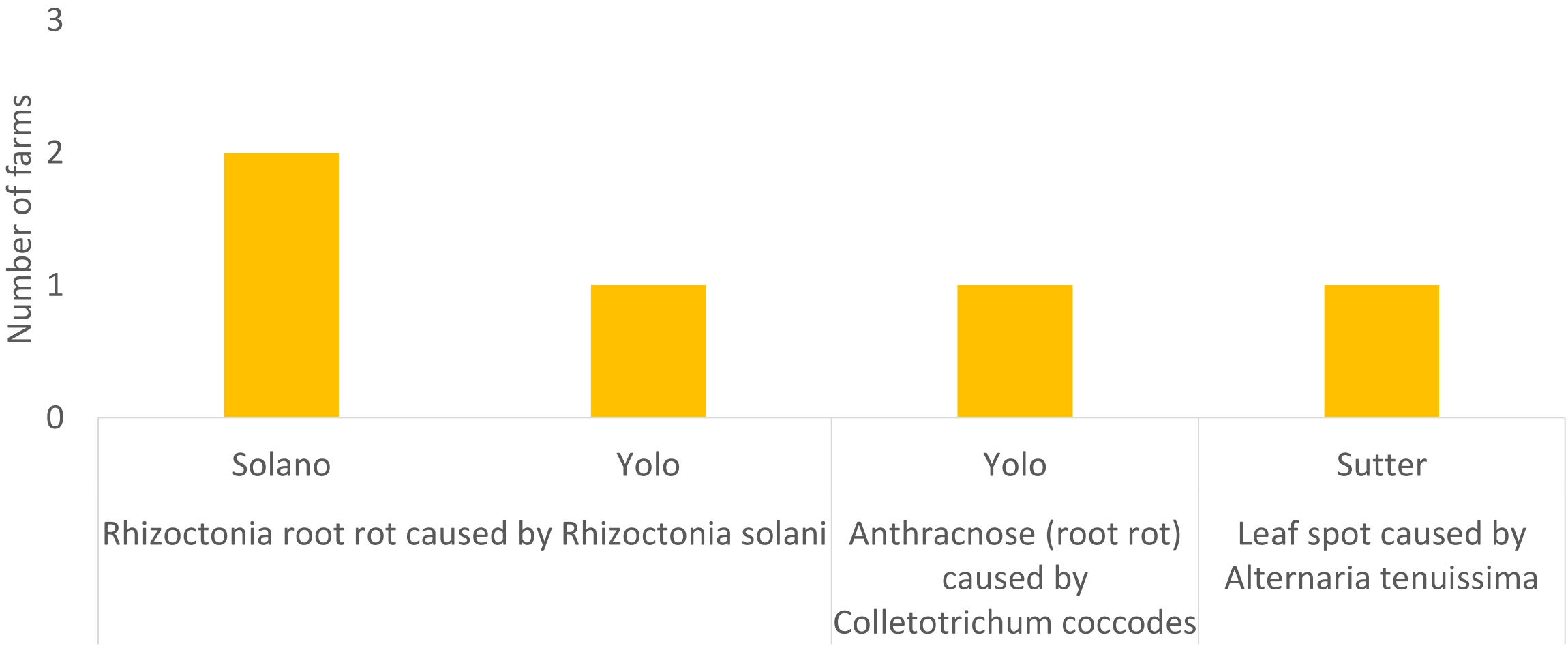
Irrigation shifts may in part underly increased occurrence

Grower standard-well watered (at least 100% ET)

Deficit irrigated at 60%ET



Putative new diseases detected in 2022



Upcoming: new UC IPM tomato disease diagnosis field guide

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Diagnosing vine decline and rot diseases of tomatoes in the field

UC Davis 2022 Vegetable Disease Field Day
Cassandra Swett, Bob Gilbertson
Depart[illegible]

University of California
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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

[illegible]urly top disease (CTD)-beet [illegible]urly top virus (BCTV)

[illegible]ector: beet leafhopper

[illegible]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

[illegible]TD is sporadic but can cause economic [illegible]oss in bad years; no resistant varieties [illegible]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

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

Se ve como

Marchitamiento por Fusarium

Igual en: Toxicidad de boron y salinidad

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (Sw5 gene)
  - Known to have resistance breaking strains (Gilbertson, Turini)

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)

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

Statewide:

- RKN recovered from 27 fields planted to resistant cultivars
- 100% of tested isolates (18) were resistance-breaking (controlled temp)

			% Root galling	
	County	**Isolate**	**Celebrity' (*Mi*+)**	**Rutgers' (*Mi*-)**
M. incognita	Yolo	139	33	31
	Yolo	140	44	32
	Yolo	143	23	27
	Yolo	144	35	33
	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

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)
  - Resistance breaking is widespread
  - This is not a temperature-related issue-GH studies controlled for temperature
  - 60% of RB-RKN-infested fields also had one or more Fusarium disease
    - There are likely RKN interactions with Fusarium diseases

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)
- Fusarium wilt-race 3 (I3 gene, F3 cultivars)
  - No resistance-breaking race 4 known to be present in the state
  - Monitoring efforts aim to detect early emergence of race 4

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

17 F3 fields in 5 years had Fol

All were Fol race 3

Efforts are opportunistic: lack rigorous surveys

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

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)
- Fusarium wilt race 3 (I3 gene, F3 cultivars)
  - No resistance breaking race 4 detected; have maybe five years.
  - Early detection critical to mitigate spread, preserving efficacy of F3 cultivars and providing time for development of new resistant cultivars

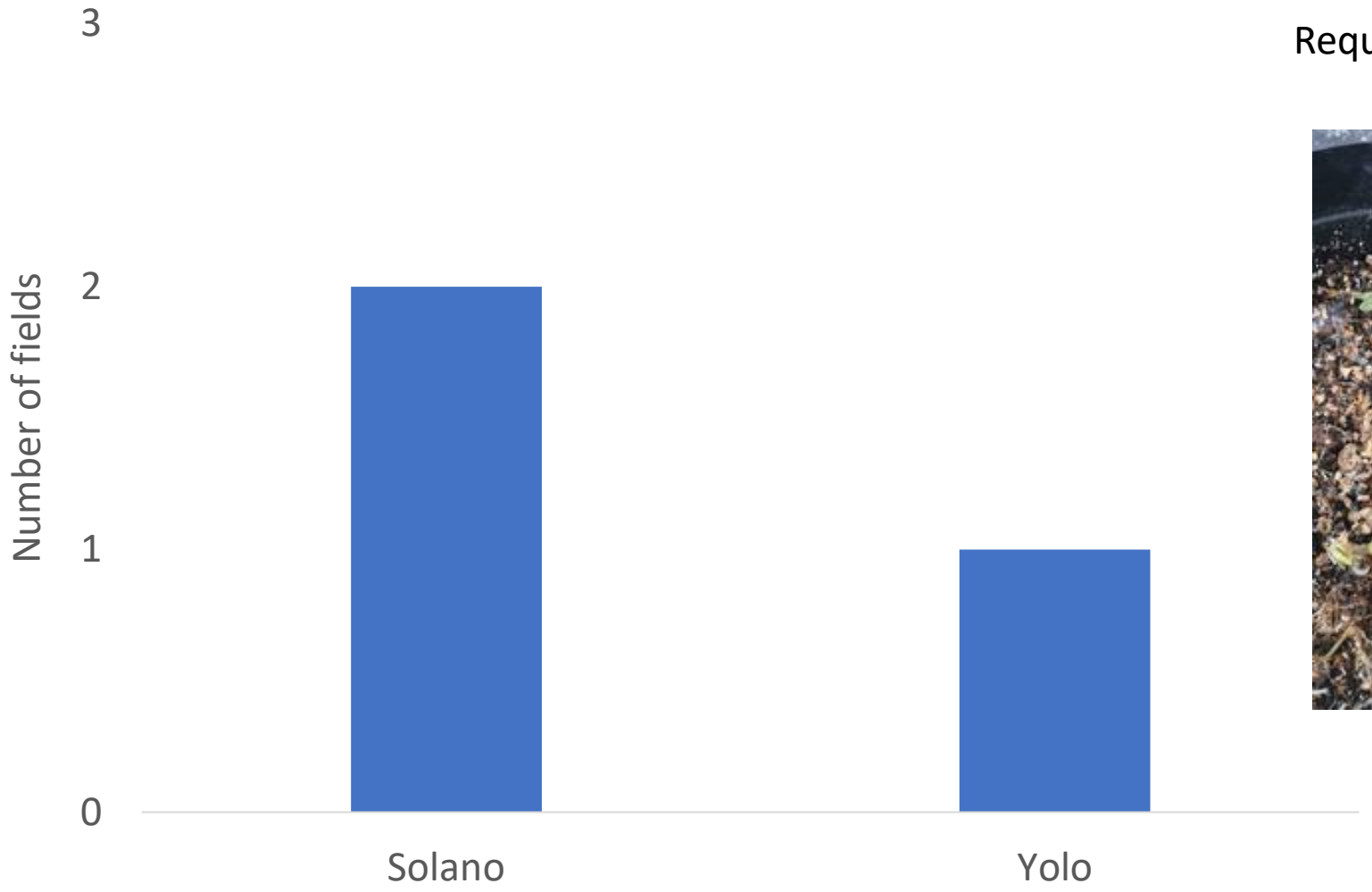
Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)
- Fusarium wilt race 3 (I3 gene, F3 cultivars)
- Fusarium crown and root rot (Frl gene, Fr cultivars)

Potential Forl resistance-breaking detected for the first time

3 fields, H5522: the primary Fr CV in 2022



Requires in-planta phenotyping to confirm resistance breaking

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)
- Fusarium wilt race 3 (I3 gene F3 cultivars)
- Fusarium crown and root rot (Frl gene, Fr cultivars)
  - Might have possible Forl race 2 (Frl resistance breaking race)
  - Testing is needed-may be non-pathogenic F. oxysporum

Statewide monitoring of resistance-breaking strains

Diseases managed by single gene resistance

- TSWV (SW5 gene)
- Root knot nematode (Mi gene)
- Fusarium wilt race 3 (I3 gene F3 cultivars)
- Fusarium crown and root rot (Frl gene, Fr cultivars)

Early identification of resistance breaking is critical
Use of sanitation and other management methods will be important to slow spread statewide
Enabling the breeding industry to develop new resistant materials

Questions?

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