Equipment cleaning and Regional disease updates for the Sacramento Valley-2025

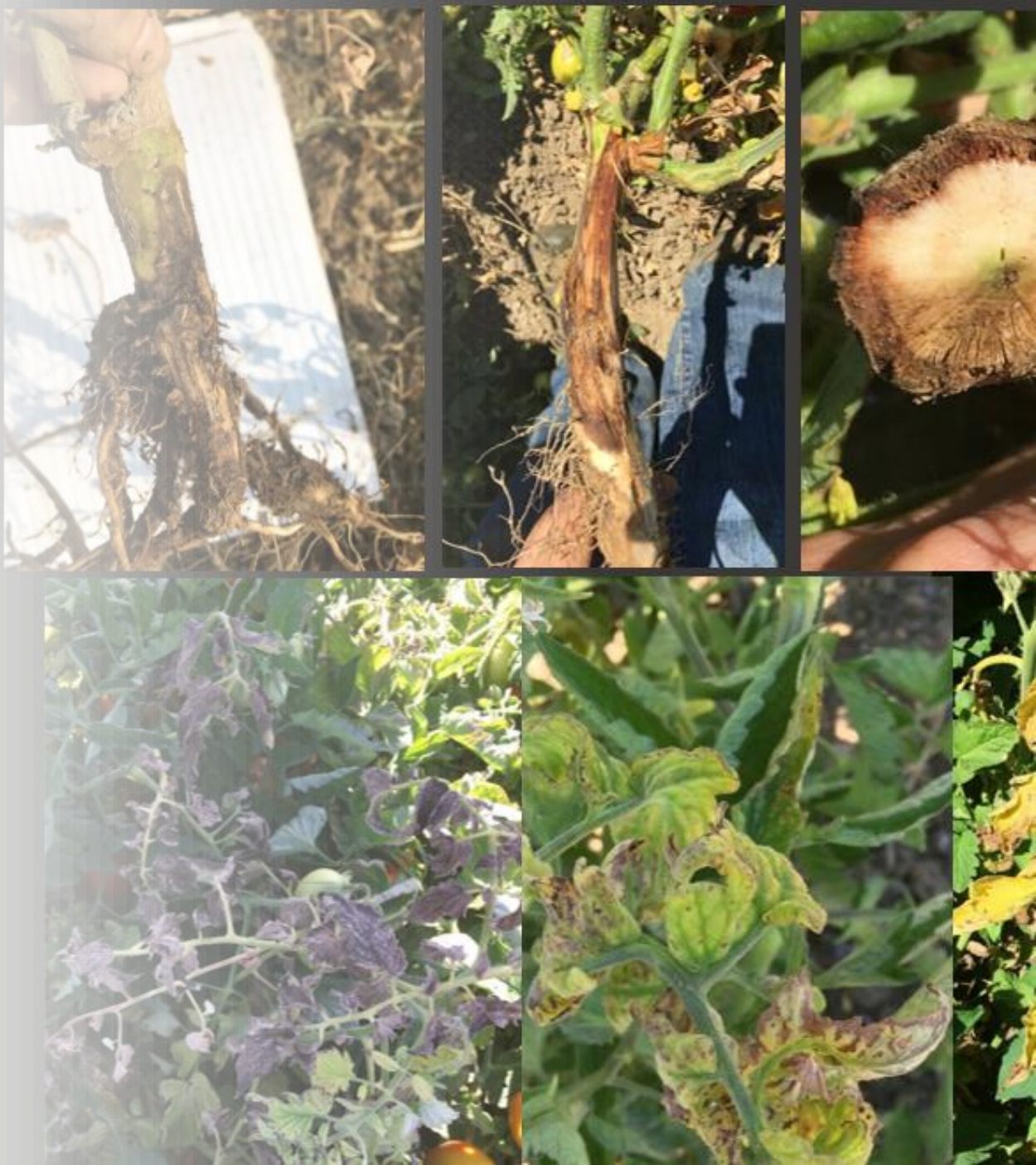
Cassandra Swett

UC Davis, Dept. of Plant Pathology

South Sacramento Valley

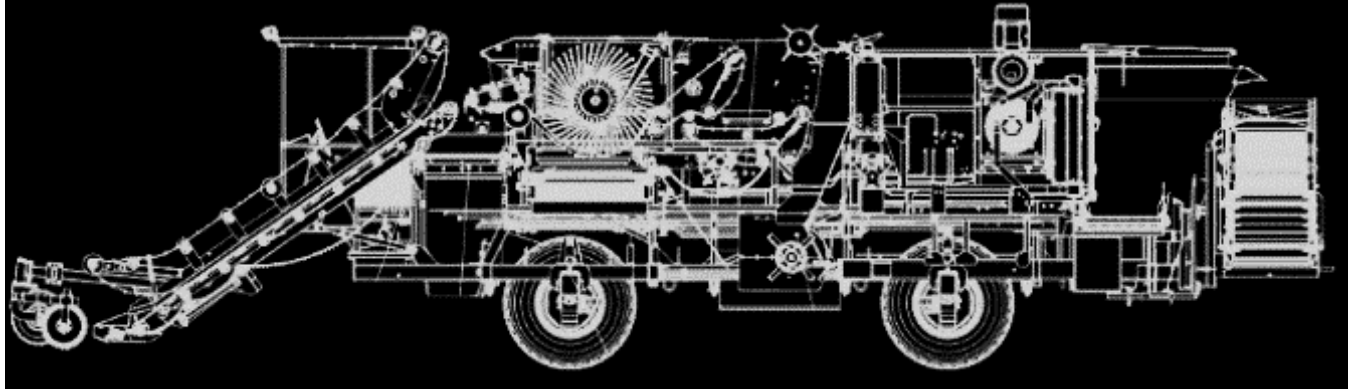
Processing Tomato Production Meeting

Jan 13, 2026



- Updates on equipment sanitation 10:50-11:05
- Diseases in the Sac Valley 11:05-11:20

Ask questions as we go along!



The Clean Machine: Where are we at in BMPs for equipment cleaning?

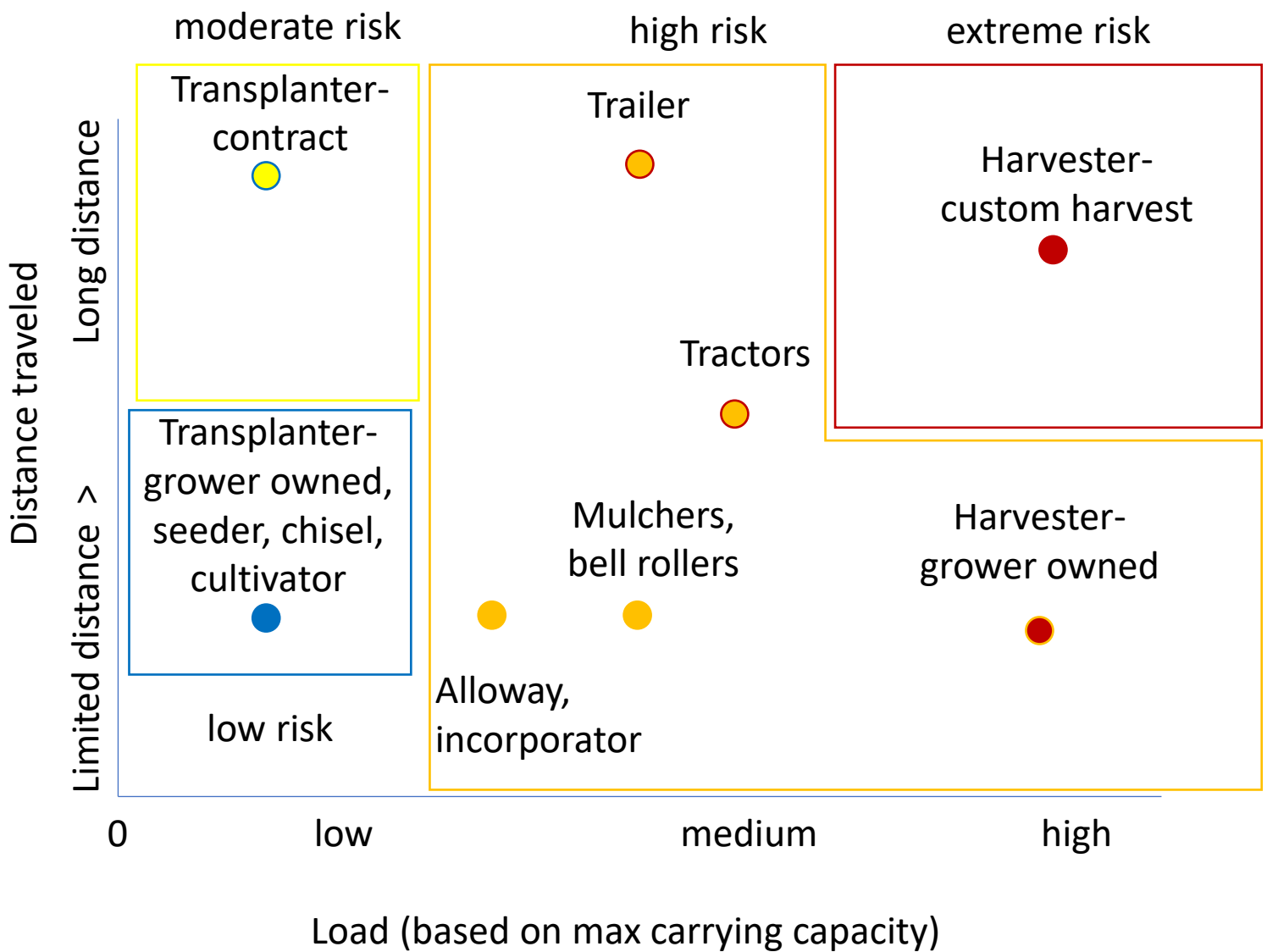
Cassandra Swett, Katie Ashley Brad Hanson, Pershang Hosseini, Patricia Lazicki, Dan Frank, Dave Viguie, Zach Bagley

California Food Producers

USDA

California Tomato Research Institute

Conceptualized risk matrix for equipment cleaning priorities

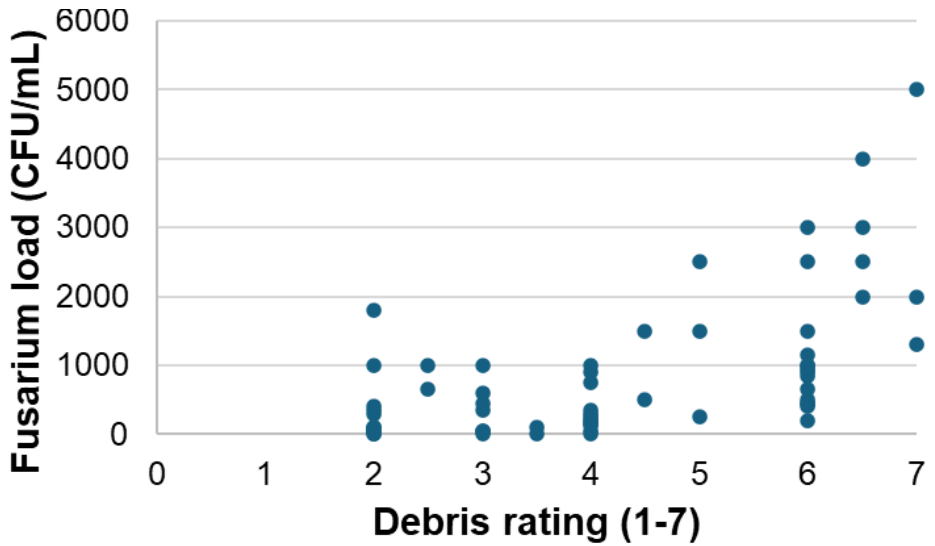


Expanding this to time of year when equipment is used

Pescadero silty clay loam, moisture content=0.22 g/g; sampled April 2

Yolo/Capay silty clay loam; moisture content=0.15 g/g; sampled April 10

- Risk of high loads throughout spring tillage
- Parts pushing against soil = highest contaminant loads
- High contaminant loads only occurred at high debris loads



Lazicki and Swett

Improving cleaning resources: on-board system to reach inaccessible areas

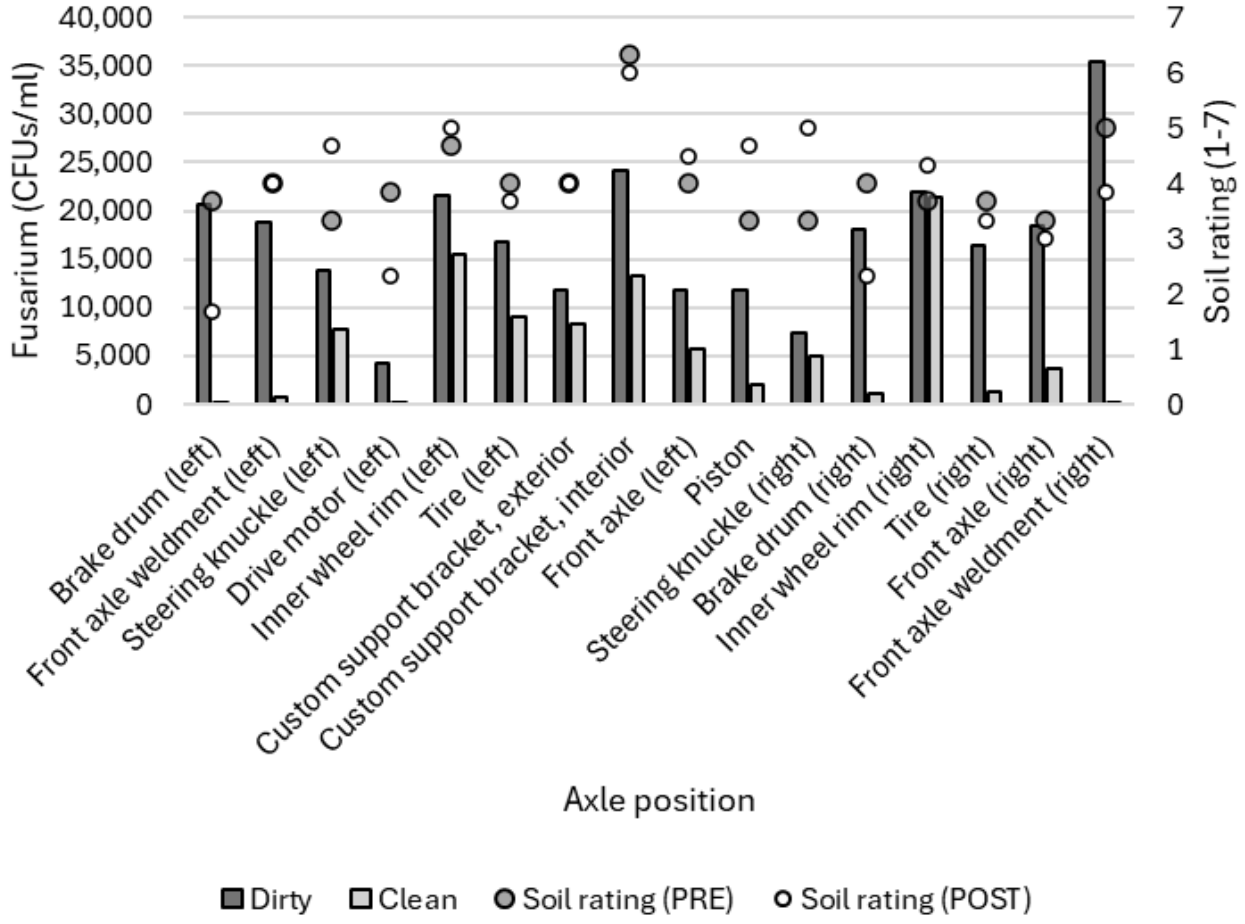
Lazicki, Frank and Swett

Improving cleaning resources: on-board system to reach inaccessible areas

Lessons learned

- Design is robust, fairly easy to use
- Cost ~$700
- Generally reduces but doesn't eliminate inoculum
- Needs to be individually tailored for each machine, fairly narrow target area

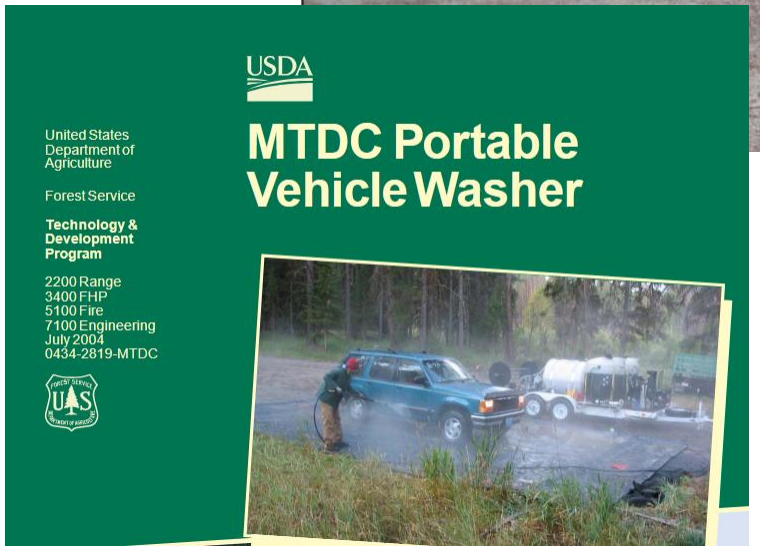
Recommended use case: very specific problem areas



Lazicki, Frank and Swett

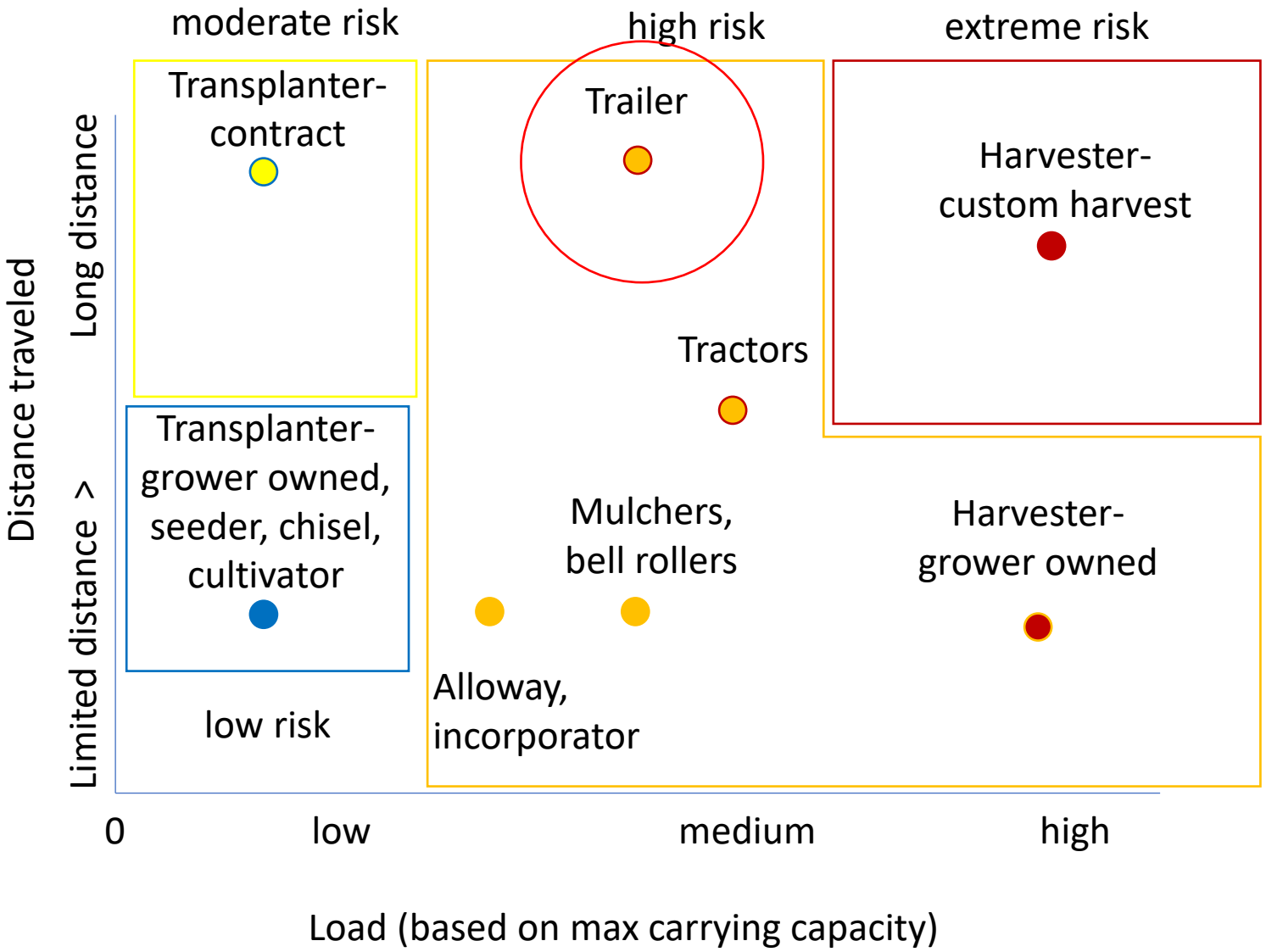
New developments planned for 2026

- Improving cleaning time and efficacy
- Drive over portable undercarriage wash adapted from systems developed for forest fire fighting equipment
  - https://www.govinfo.gov/content/pkg/GOVPUB-A13-PURL-gpo245281/pdf/GOVPUB-A13-PURL-gpo245281.pdf
- More dynamic spray wands
  - More ergonomic
  - Improve coverage



Lazicki, Frank and Swett
With Cal Fire

Trailers pose perhaps the highest risk for long distance movement of broomrape seed



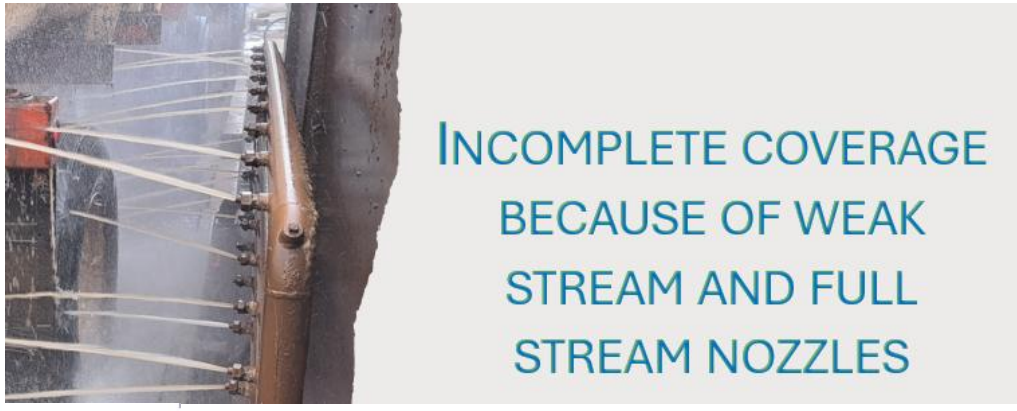
In responding to this risk-canneries are building wash stations

This is a new system

We are helping canneries to make sure this investment is reducing dispersal risk

Trailer wash station efficacy – some key challenge areas

2026: aim to expand consultations to a wider range of canneries
Help make simple changes to improve efficacy



CHALLENGES OF THE DESIGN

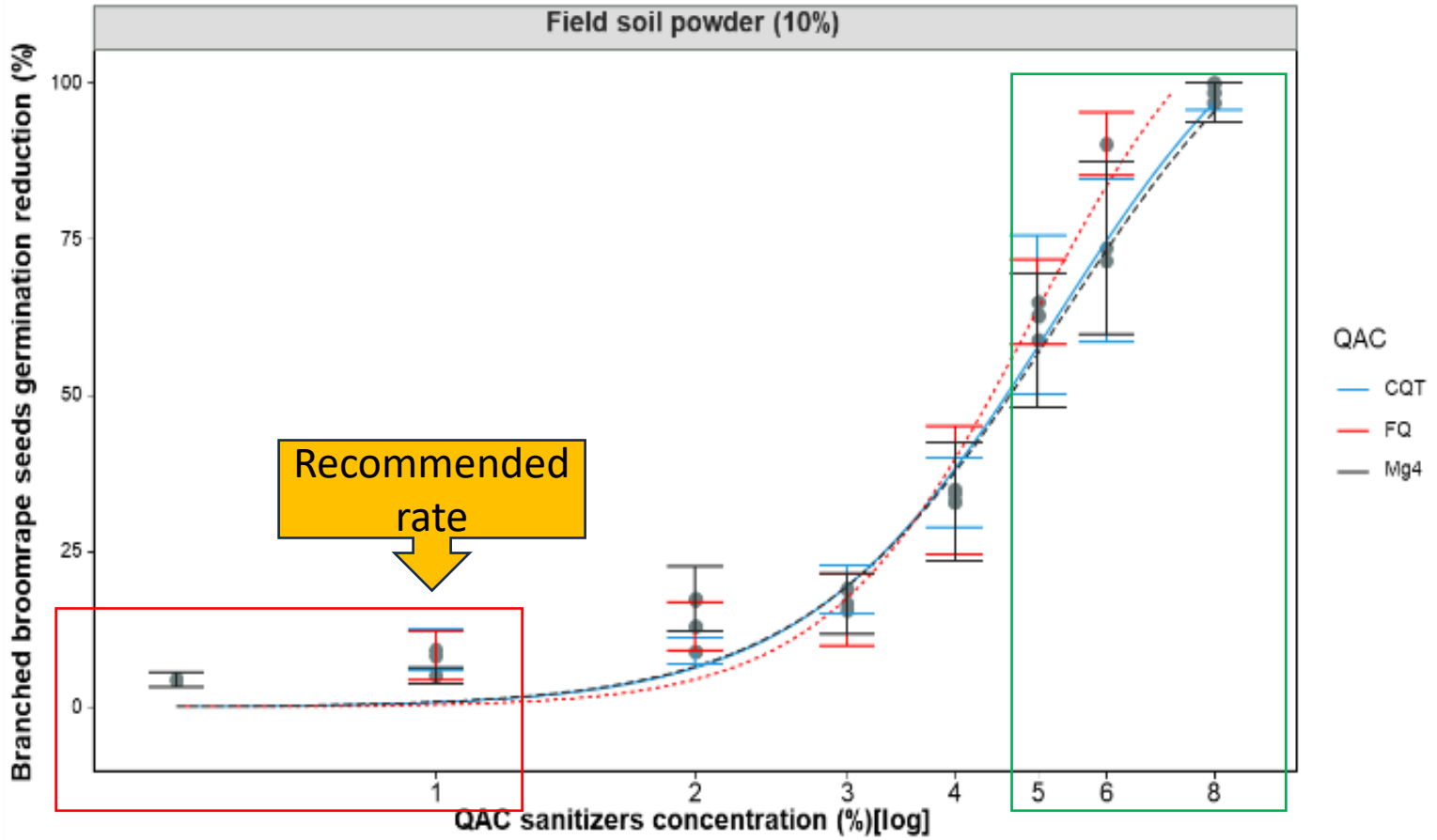
Sanitizer resources – includes efficacy against other pests
Quaternary ammonium compounds (QACs) are the only effective products for broomrape so far

Trade Name	Tested Conc.	Sanitizer type	Corrosive on metal	Managed Pathogens	Efficacy in presence of soil debris
Peracetic acid/Peroxyacetic acid (94865-2)	0.01% (100 ppm)	Oxidizer	Yes	None	TBD
QAC commercial products	1% (10,000 ppm)	Quaternary Ammonia	No	Branched broomrape, Fusarium wilt, bacterial canker	Low
Star San Acid Sanitizer (65001-1)	0.03% (300 ppm)	Organic Acid	Corrosive on soft metals	Fusarium wilt, bacterial canker	Moderate-low
Virkon S (71654-6)	1% (10,000 ppm)	Oxidizer	Corrosive on soft metals	Fusarium wilt, bacterial canker	Moderate-high
Jet-Ag	0.2-0.3% (2,000-3,000 ppm)	Oxidizer	Yes	TBD	TBD
Bleach (67619-32)		Oxidizer	Yes	TBD	Low

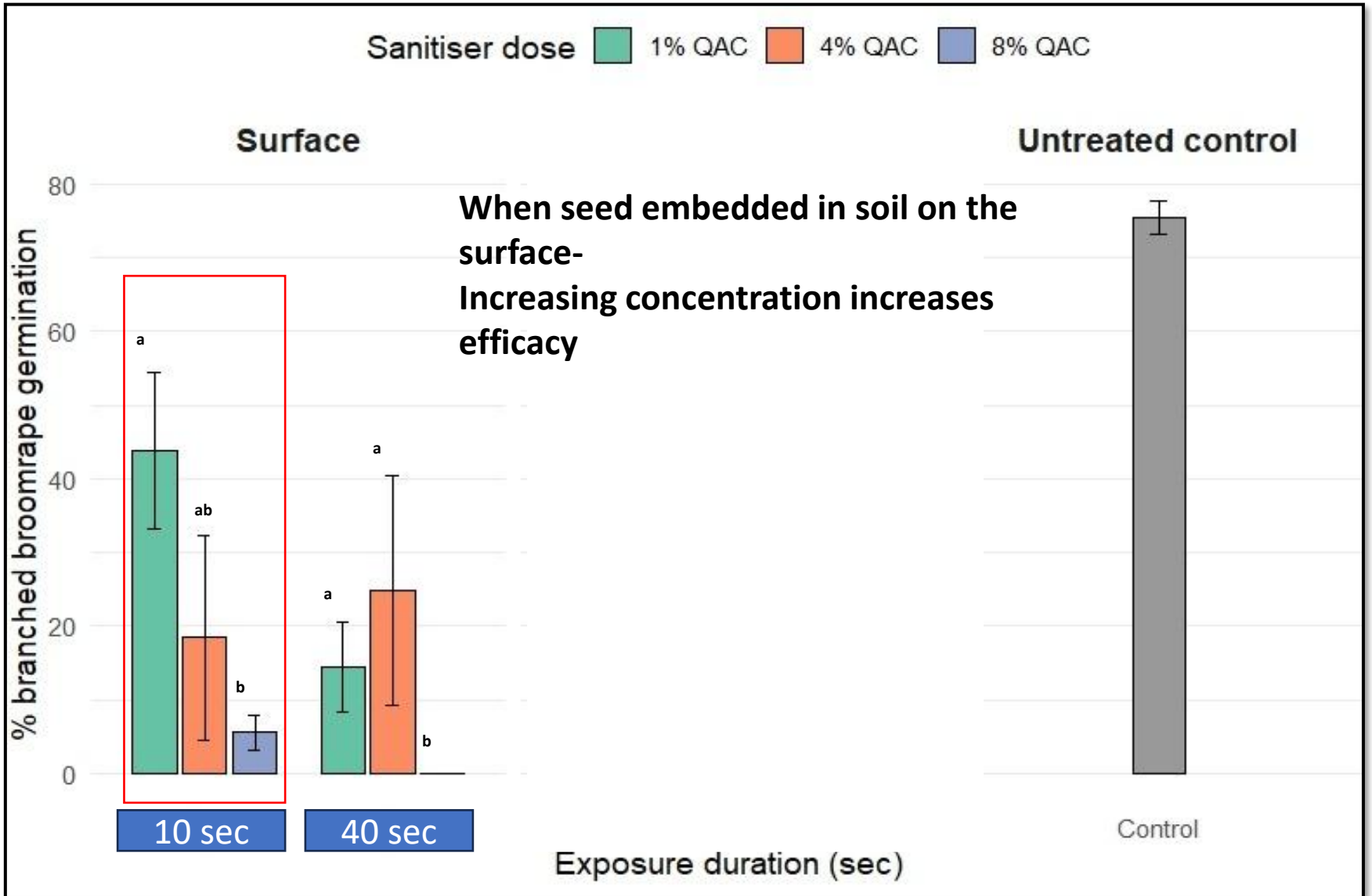
Commercial QACs with confirmed efficacy

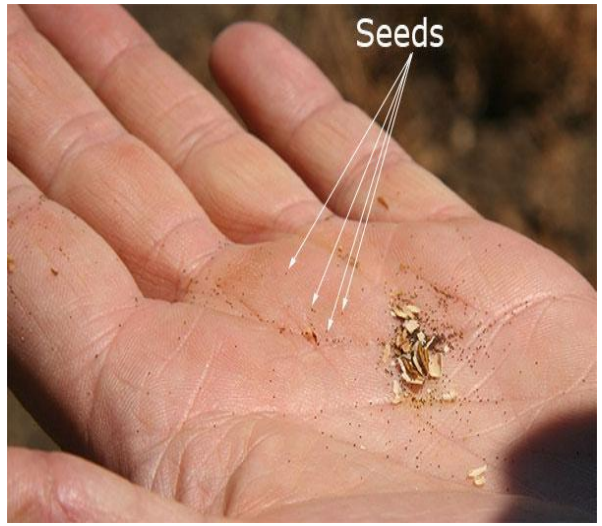
- MG4 Quat
- FloQuat
- Cleaner QT

We have established that QACs are inactive with debris at the 1% rate How to overcome soil inactivation?



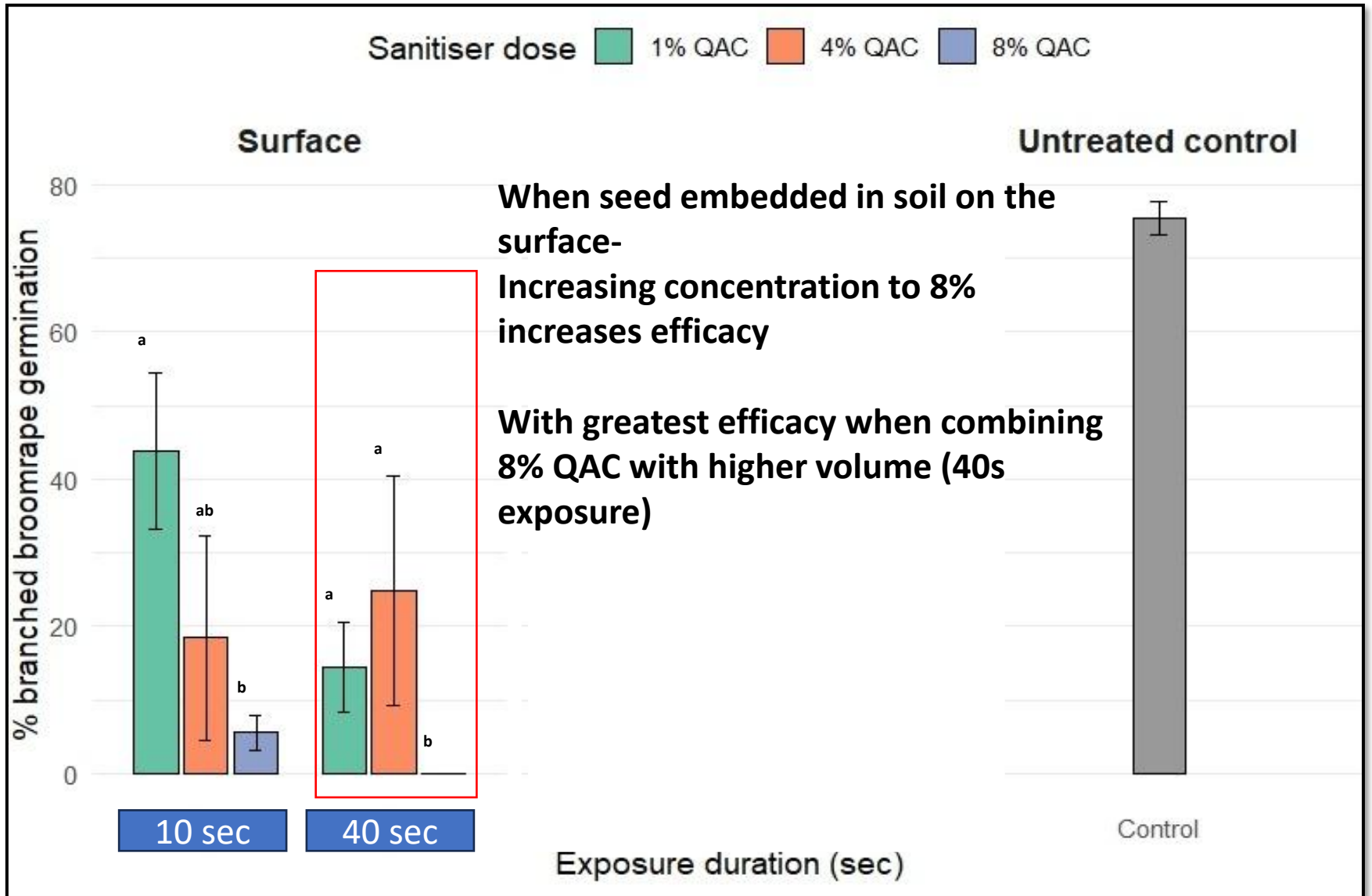
Increasing QAC concentration and application volume / exposure duration





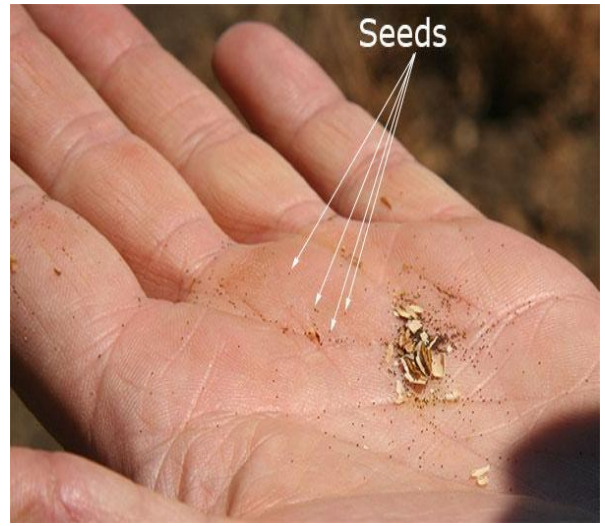
Hosseini, Vulchi, Hanson

Increasing QAC concentration and application volume / exposure duration can improve QAC efficacy



When seed embedded in soil on the surface-
Increasing concentration to 8% increases efficacy

With greatest efficacy when combining 8% QAC with higher volume (40s exposure)



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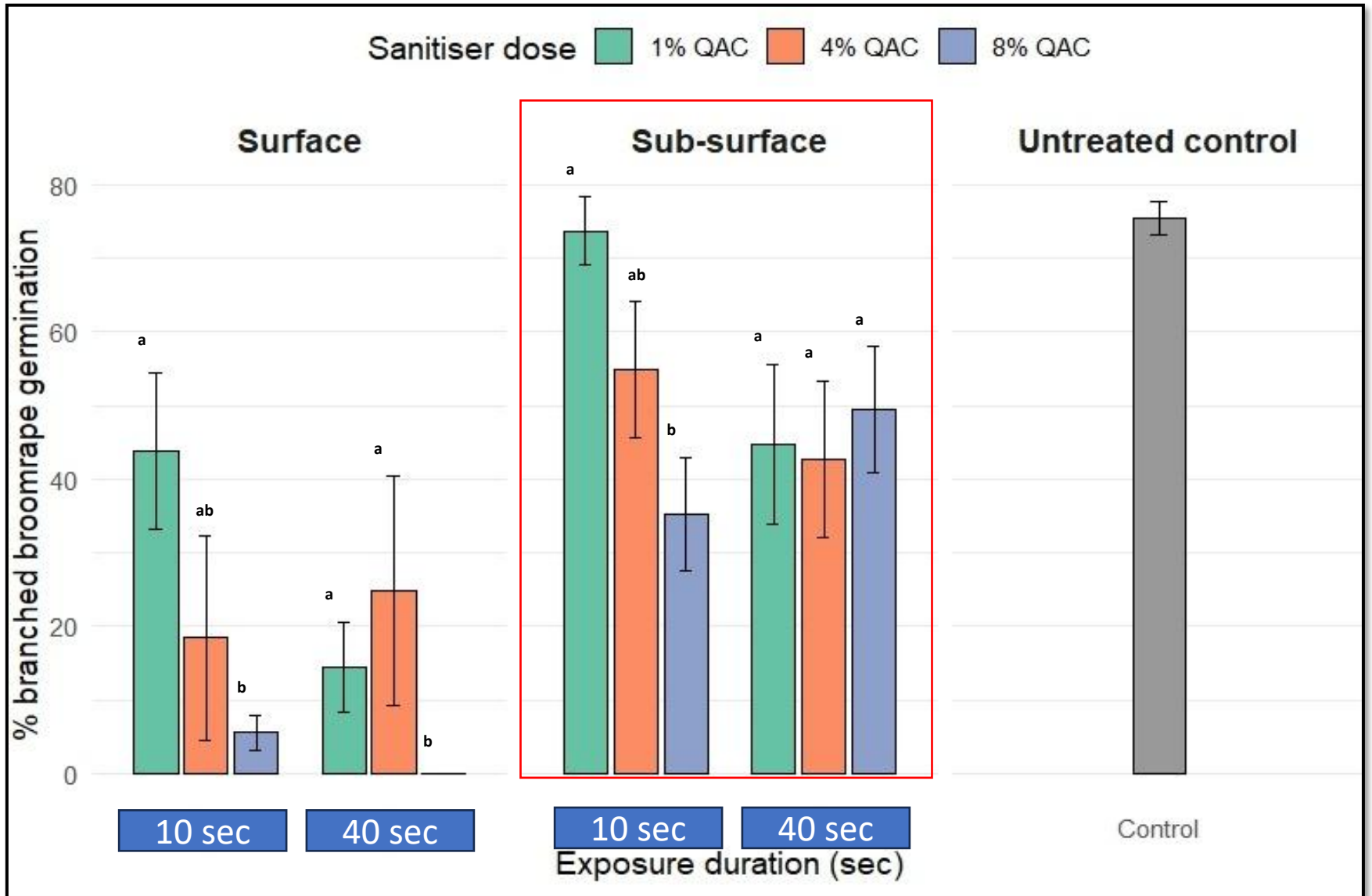

When buried in thick mud, QAC was not able to penetrate as well

There was still some effect of QAC compared to untreated

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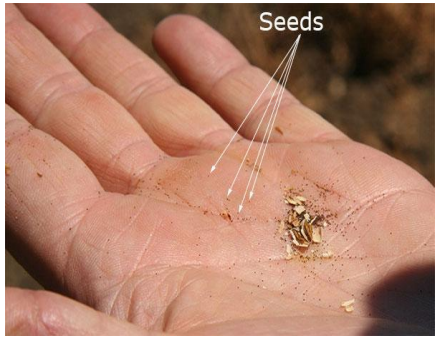
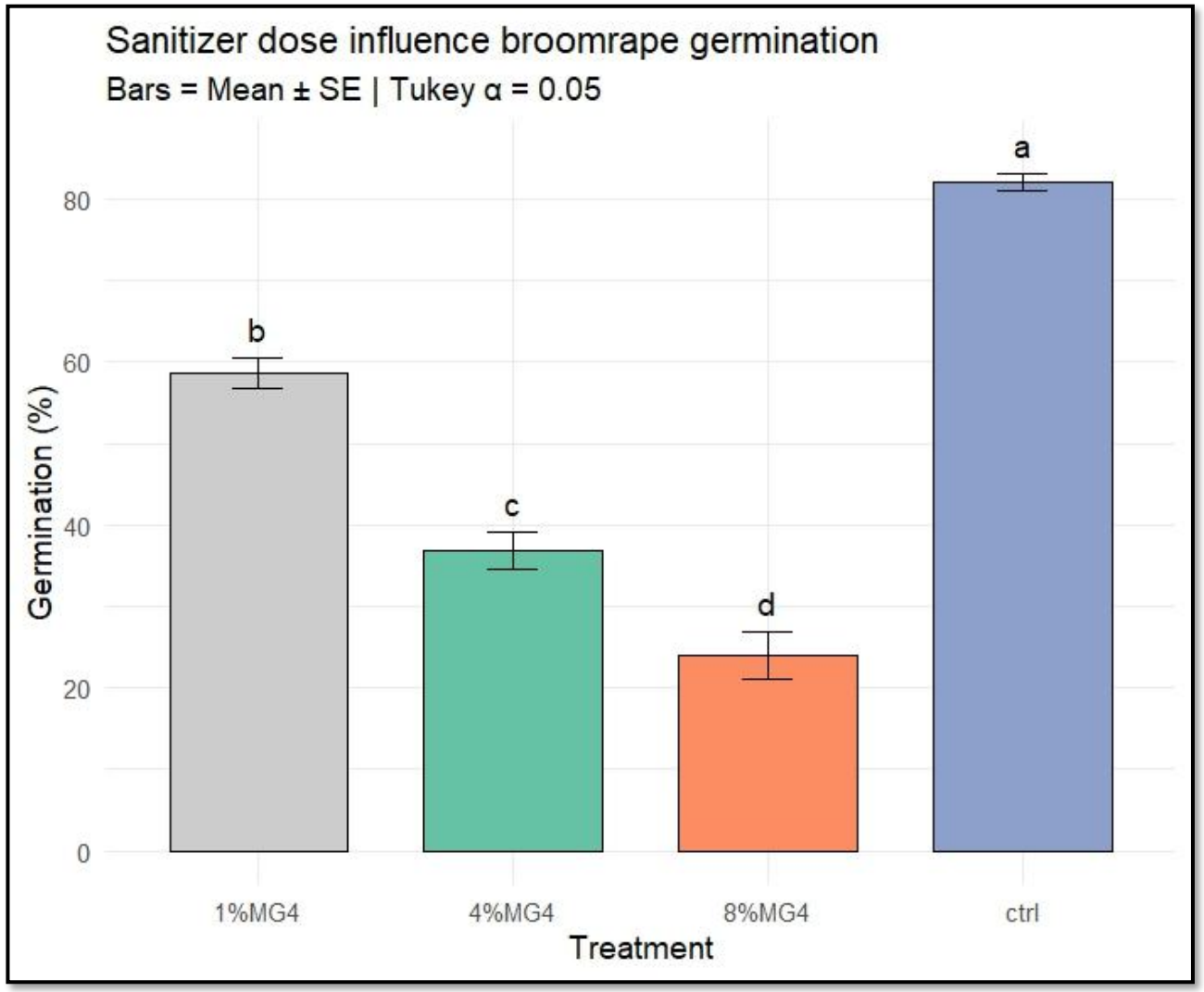
Further understanding-can QAC kill broomrape seed if embedded in soil? The “mud ball” experiment

QAC can reduce seed viability when embedded in mud by up to 75%

But even at 8% QAC, 20% of seed still alive





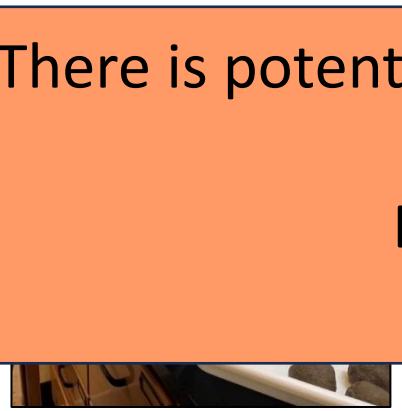
Hosseini, Vulchi, Hanson

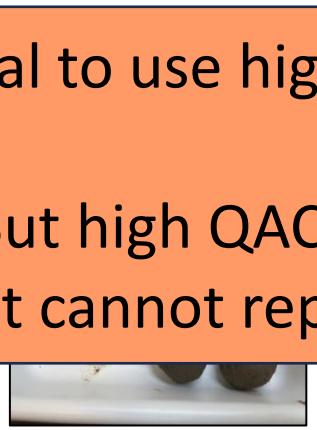
Further understanding-can QAC kill broomrape seed if embedded in soil? The “mud ball” experiment

There is potential to use higher concentrations and volumes to overcome debris inhibition

But high QAC and high volume is not a silver bullet

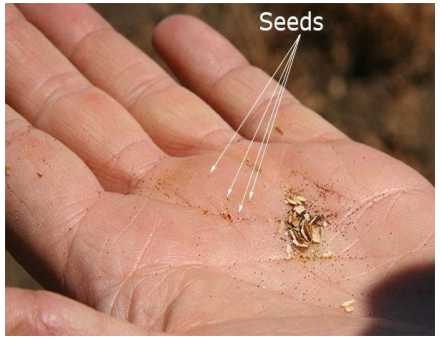
It cannot replace some baseline physical cleaning

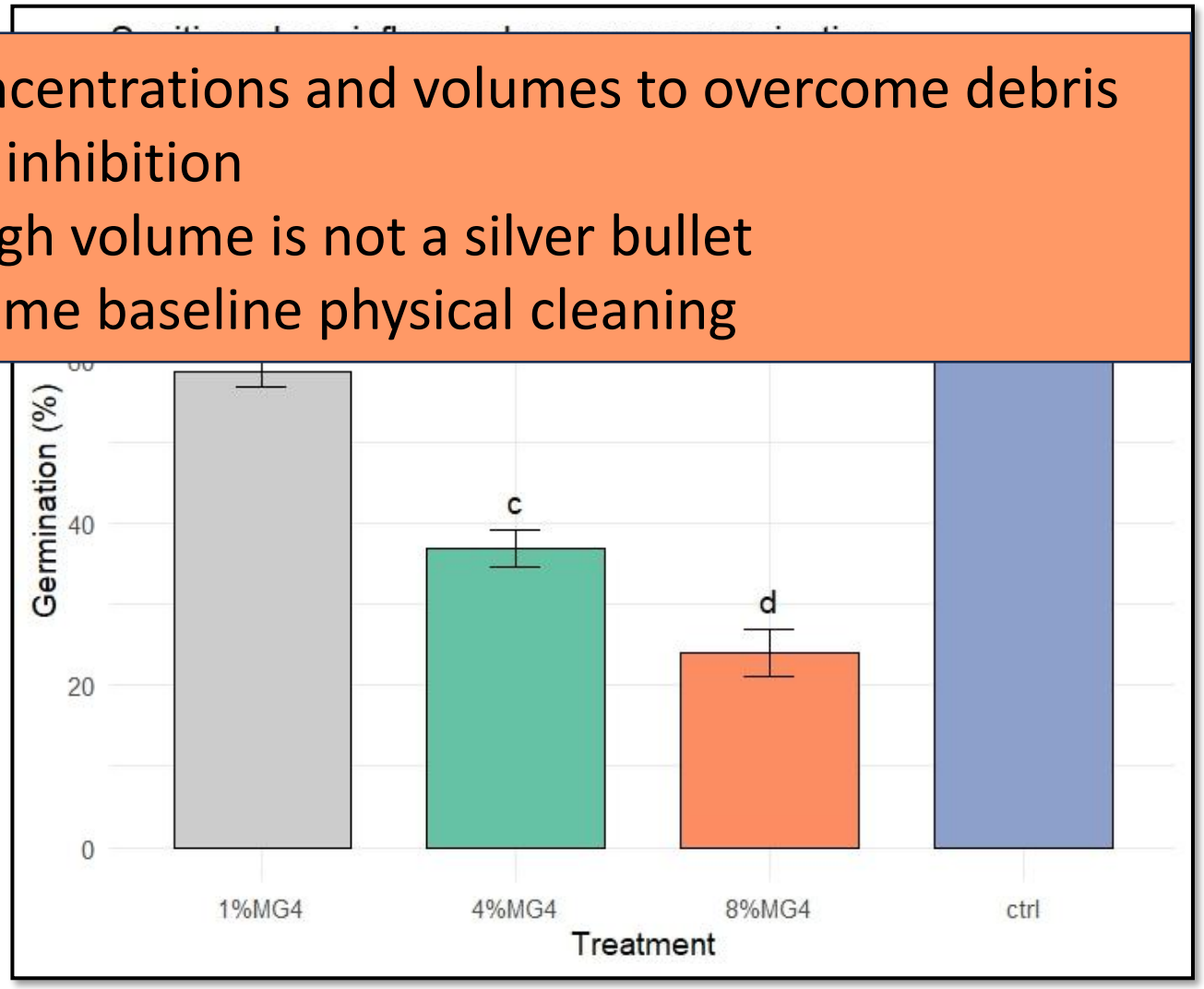




QAC can reduce seed viability when embedded in mud by up to 75%

But even at 8% QAC, 20% of seed still alive





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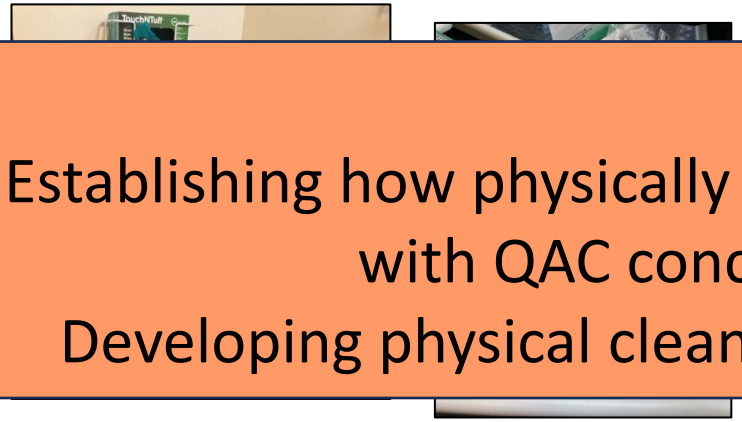
Further understanding-can QAC kill broomrape seed if embedded in soil? The “mud ball” experiment

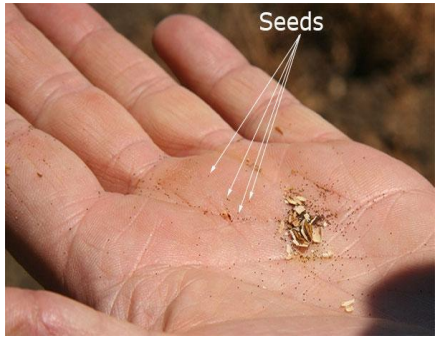


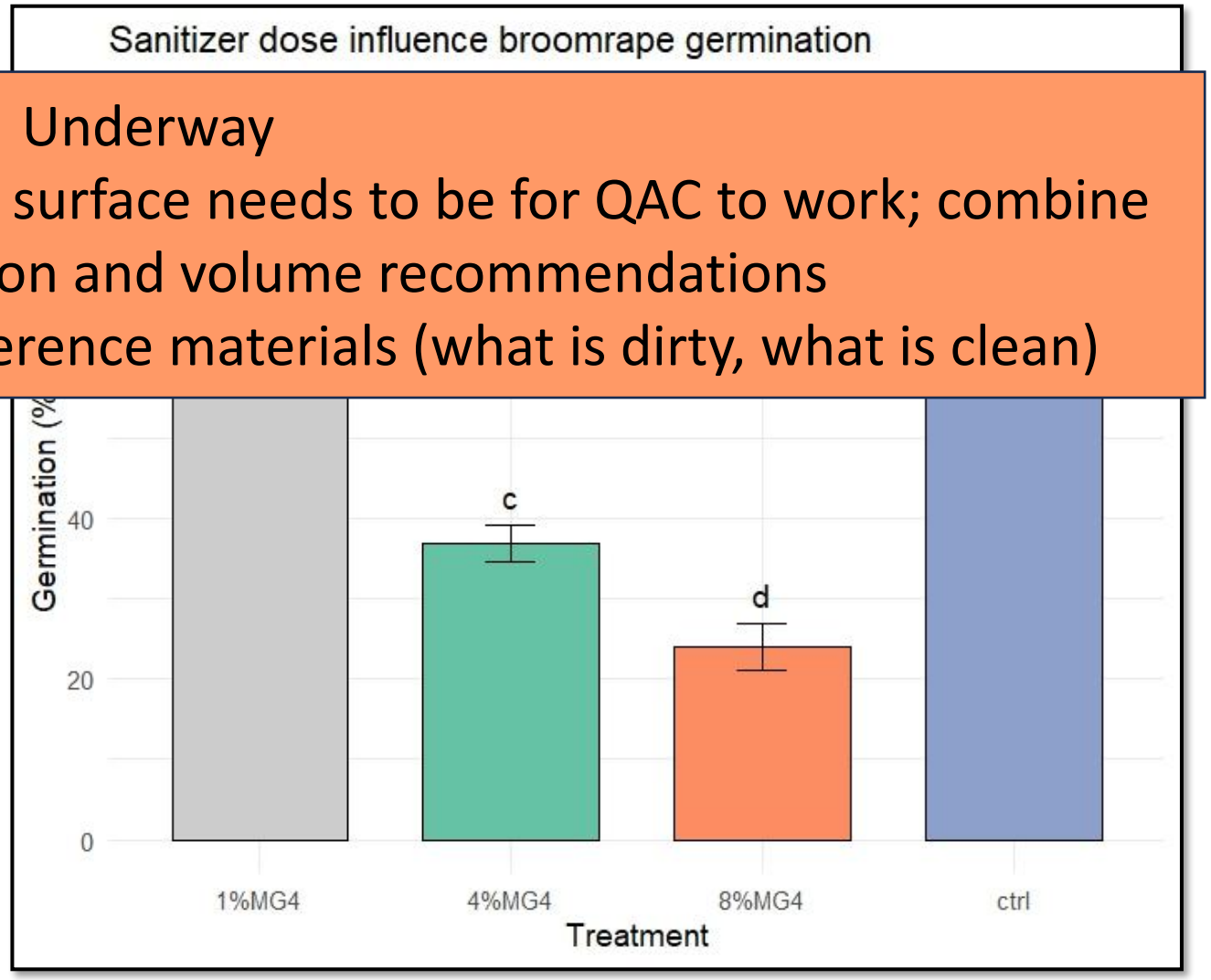
Underway

Establishing how physically clean a surface needs to be for QAC to work; combine with QAC concentration and volume recommendations

Developing physical cleaning reference materials (what is dirty, what is clean)

QAC can reduce seed viability when embedded in mud by up to 75%
But even at 8% QAC, 20% of seed still alive





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Goals for early 2026

- Video trainings on You Tube
- Outreach events to help affiliated personnel navigate the compliance agreement
- BMPs cited in the compliance agreement are online
  - How clean is clean guidelines distributed
  - Shoe washing method validated
  - QAC application method improved

Resources summary

- Swett lab extension website
  https://swettlab.faculty.ucdavis.edu/extension/

- Current BMP for field equipment sanitation:
  https://swettlab.faculty.ucdavis.edu/wp-content/uploads/sites/434/2024/11/Field-Equipment-Sanitation-Best-Management-Guidelines_Updated-May-2024.pdf

- CTRI broomrape management resources
  https://tomatonet.org/grower-resources/broomrape-resources/

- Broomrape website: forthcoming

Questions?

Cassandra Swett
clswett@ucdavis.edu

Regional disease updates for the Sacramento Valley-2025

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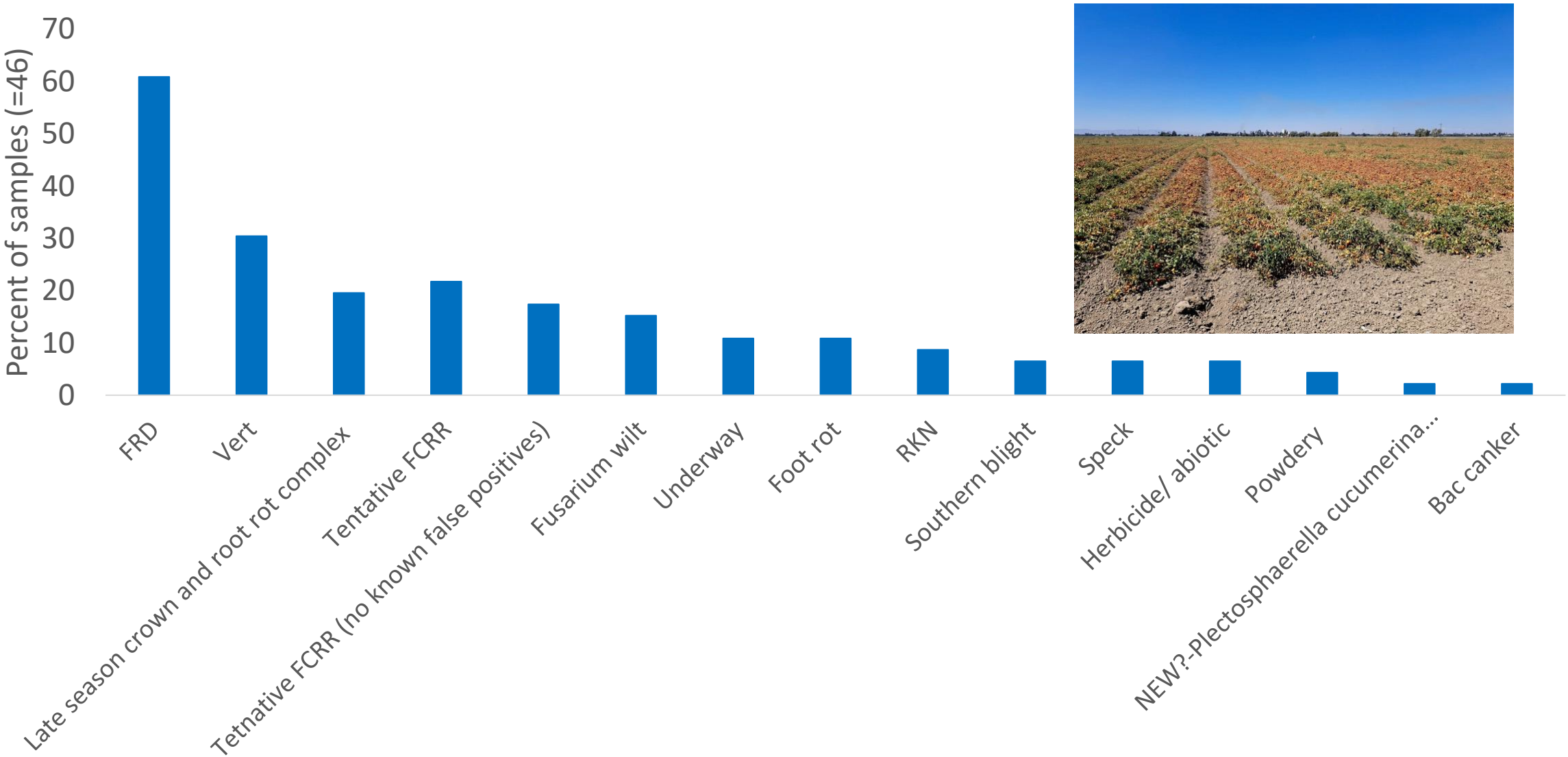
California Tomato Research Institute

Diseases in the Sacramento Valley region 2025



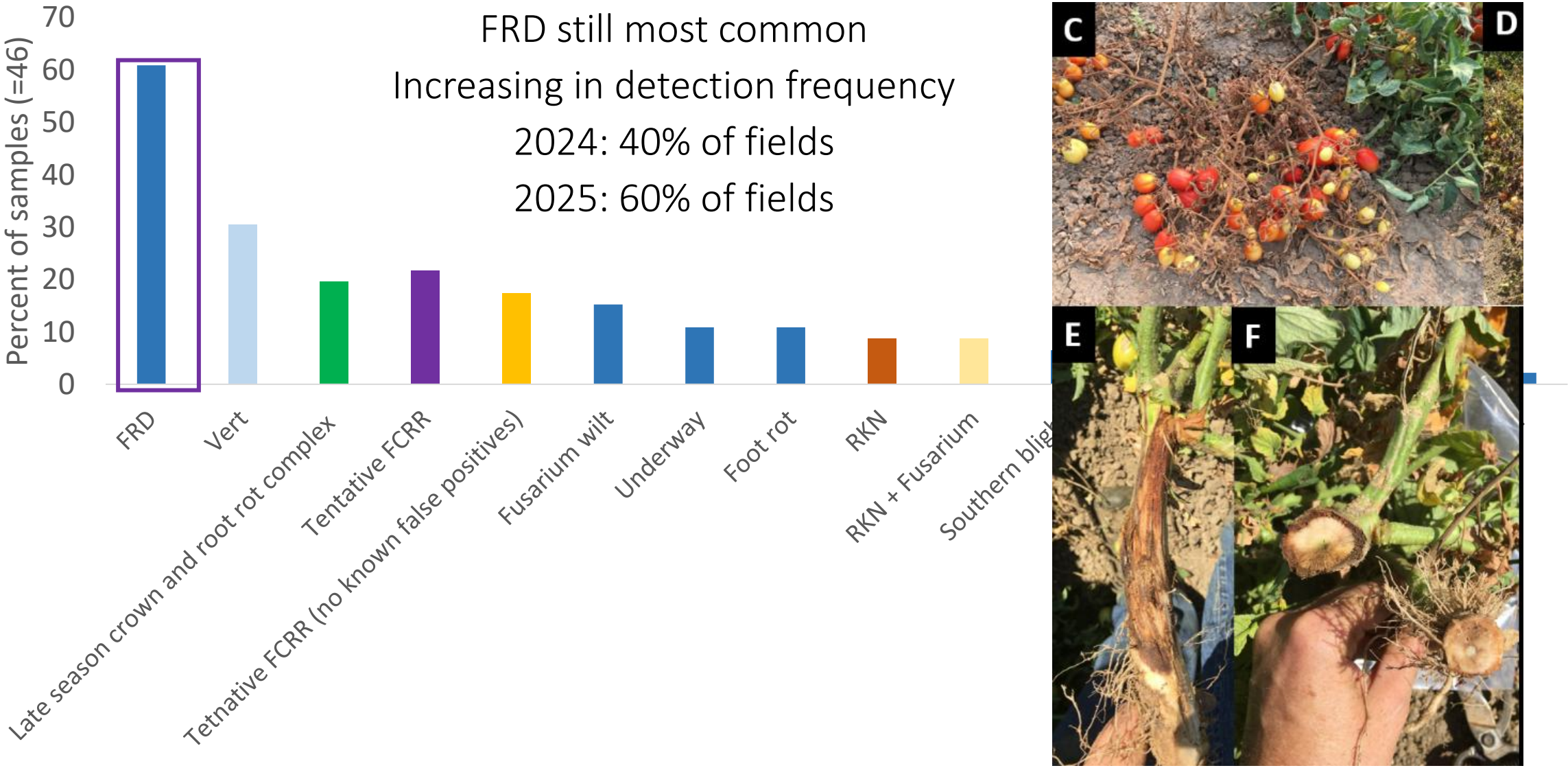
Field notes 2025

- Spring: mild, no major frosts or winds
- Summer: cool temperatures
  - Low stress
- Fields looked good
- Diseases not a major issue
- Fusarium wilt way down (15% of fields)
  - Combination of more F3 fields
  - And cooler temps
- Monitoring efforts are improving as we develop better diagnostic tools

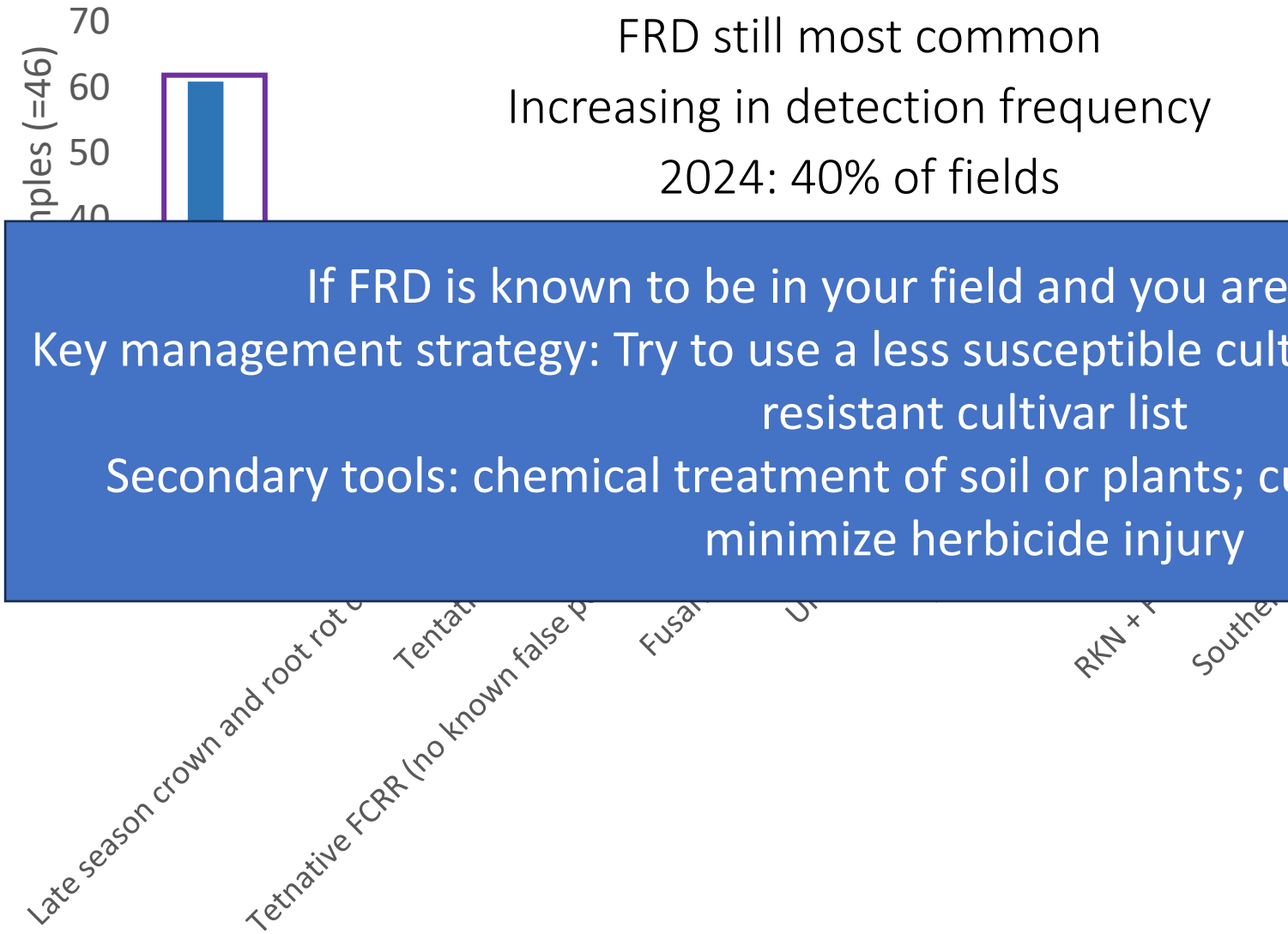




Notes


Percent of samples (=46)
70
60
50
40
30
20
10
0
FRD still most common
Increasing in detection frequency
2024: 40% of fields
2025: 60% of fields
FRD
Vert
Late season crown and root rot complex
Tentative FCRR
Tetnative FCRR (no known false positives)
Fusarium wilt
Underway
Foot rot
RKN
RKN + Fusarium
C
D
E
F

Notes



FRD still most common

Increasing in detection frequency

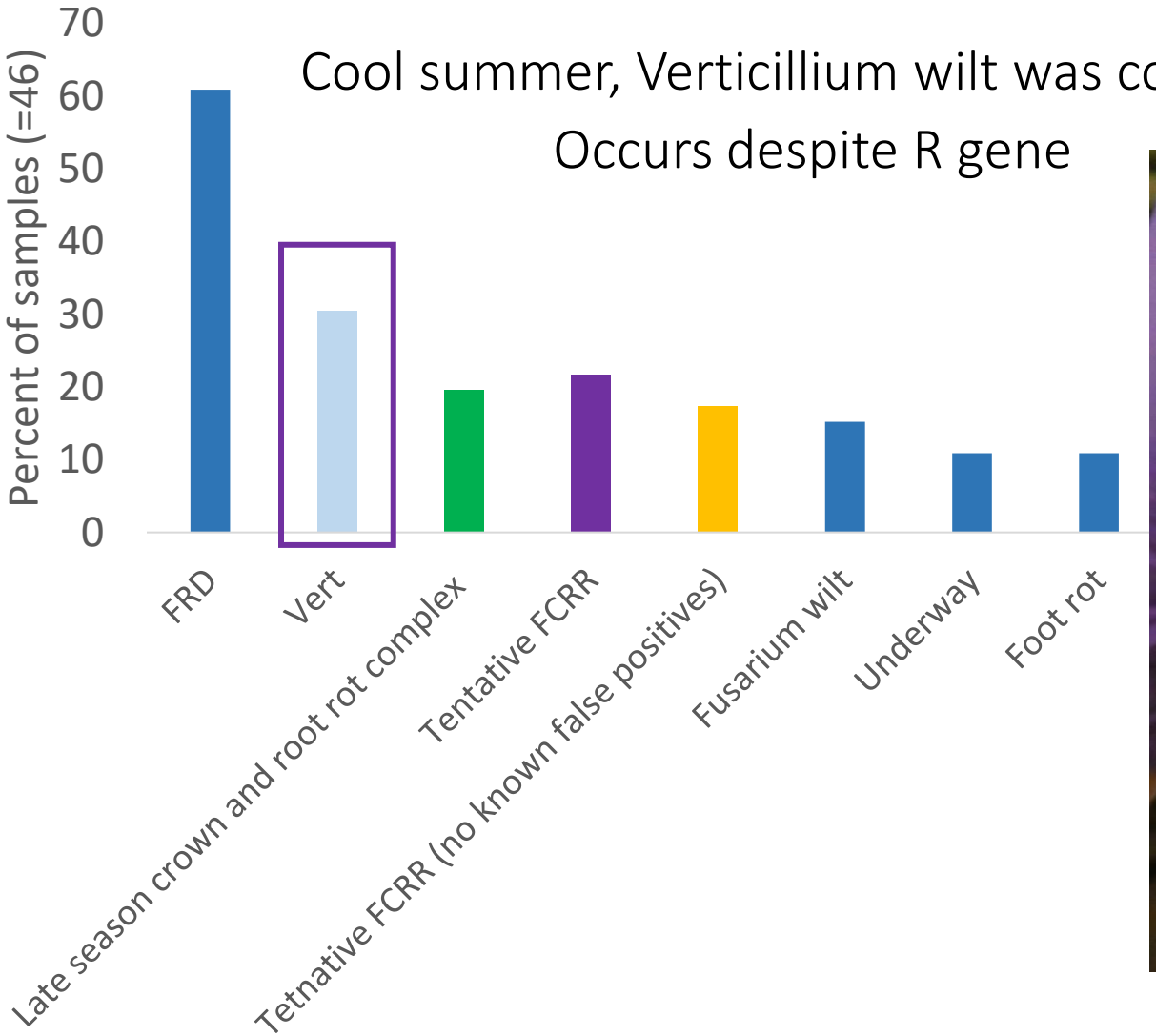
2024: 40% of fields

If FRD is known to be in your field and you are planting tomato

Key management strategy: Try to use a less susceptible cultivar; Ideally select from more resistant cultivar list

Secondary tools: chemical treatment of soil or plants; cut water closer to harvest; minimize herbicide injury

Notes


Cool summer, Verticillium wilt was common
Occurs despite R gene
Percent of samples (=46)
70
60
50
40
30
20
10
0
FRD
Vert
Late season crown and root rot complex
Tentative FCRR
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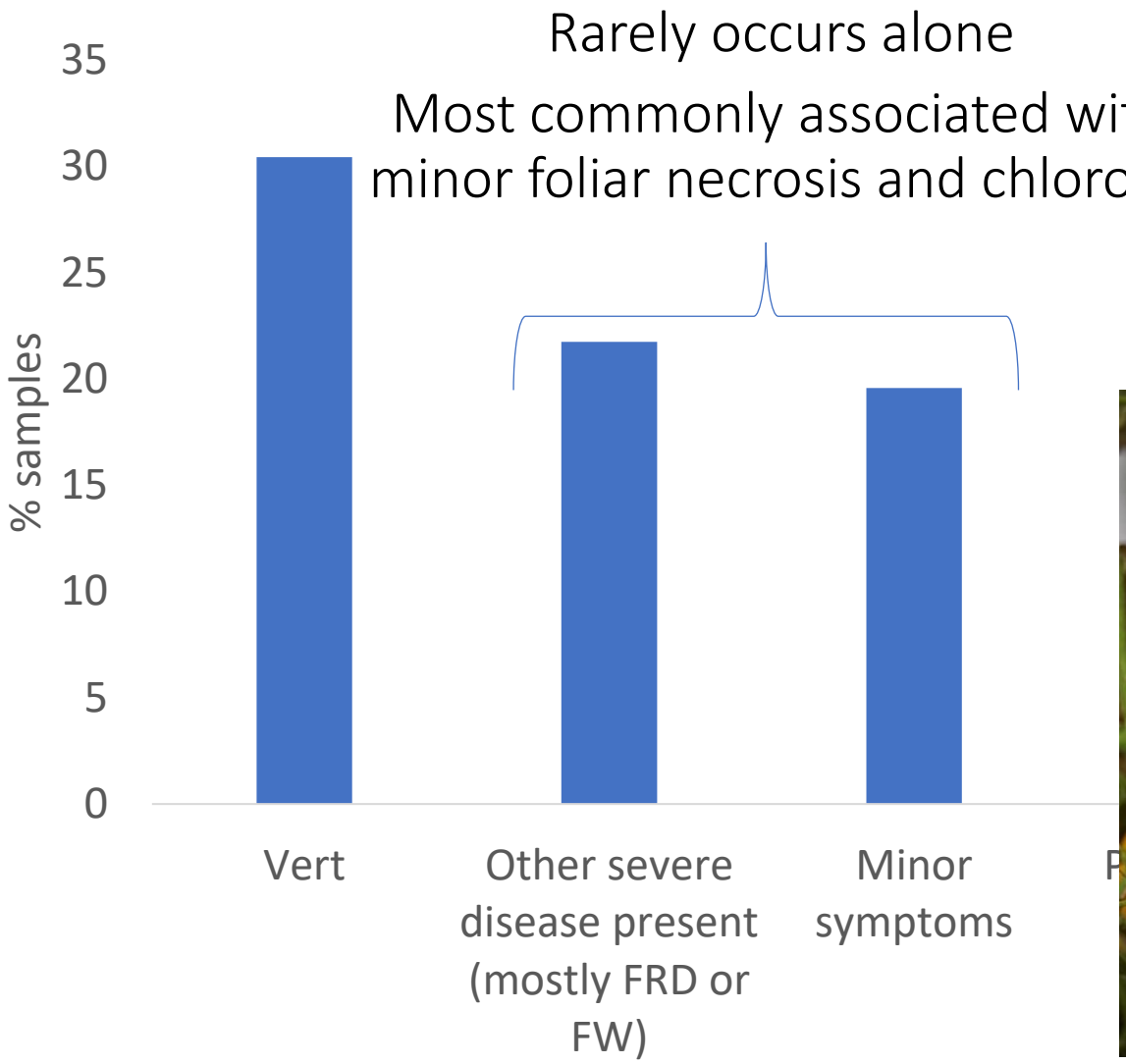
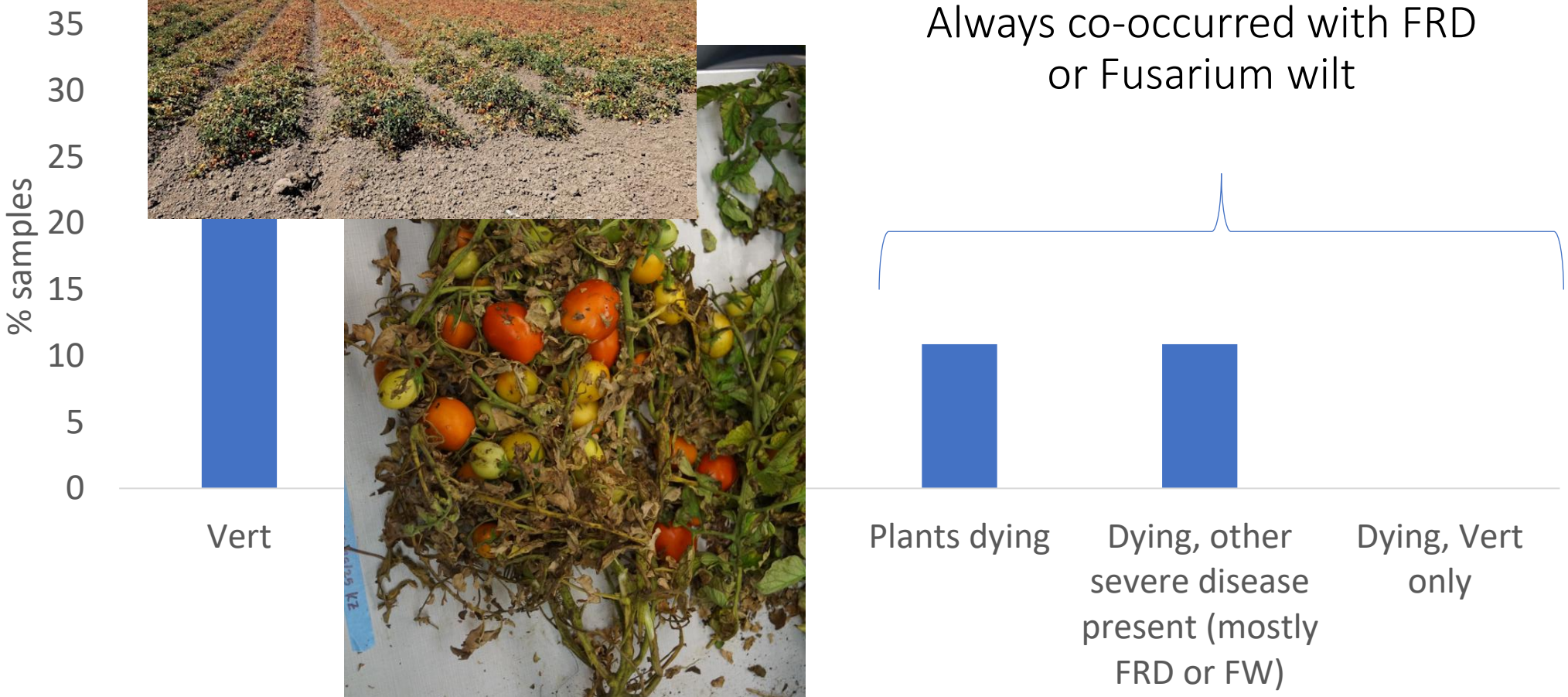
Fusarium wilt
Underway
Foot rot

Verticillum wilt is often associated with minor canopy symptoms



Verticillum wilt does not appear as a sole driver of plant death

In fields with canopy decline-
Always co-occurred with FRD
or Fusarium wilt



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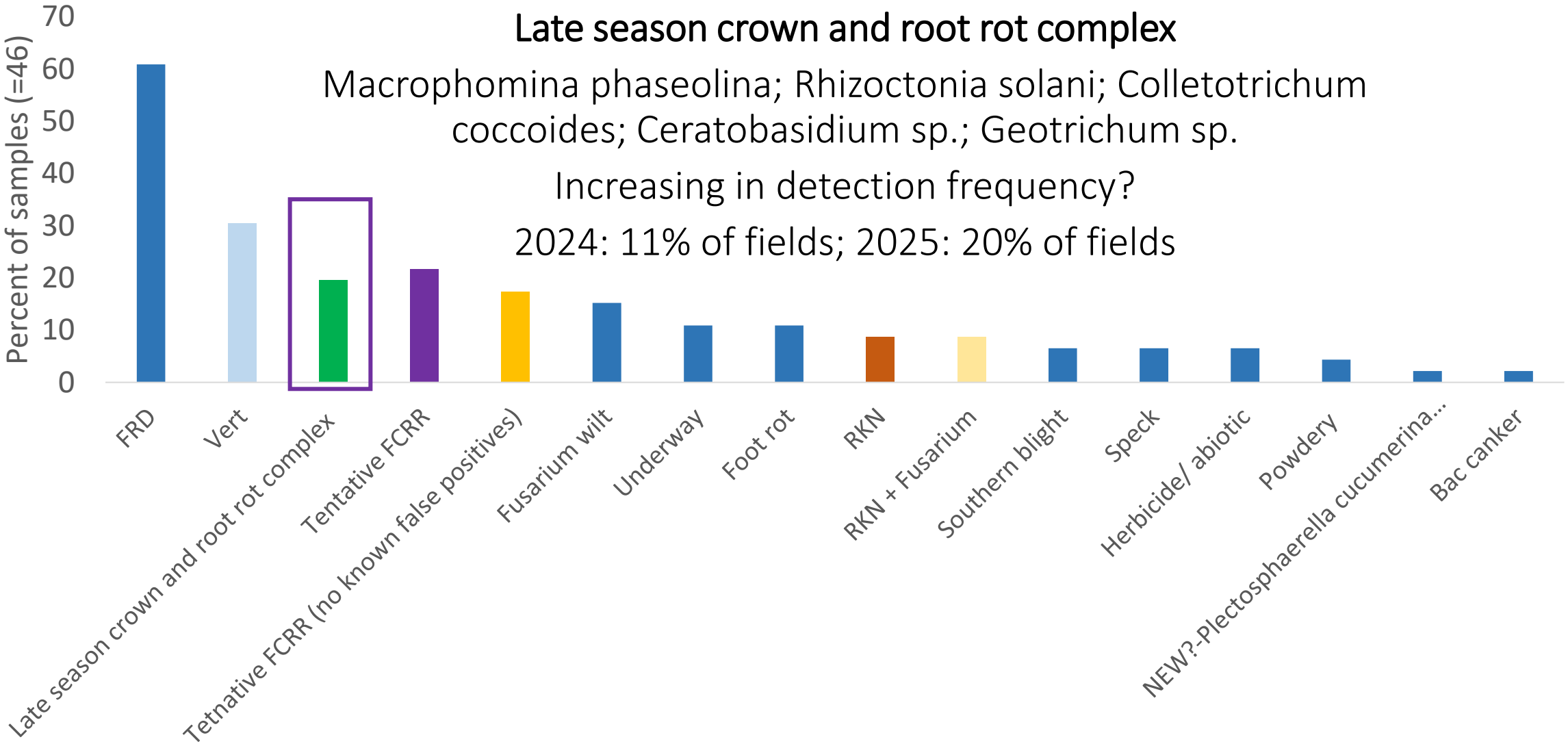
Late season crown and root rot complex
Macrophomina phaseolina; Rhizoctonia solani; Colletotrichum coccoides; Ceratobasidium sp.; Geotrichum sp.
Increasing in detection frequency?
2024: 11% of fields; 2025: 20% of fields
Percent of samples (=46)
70
60
50
40
30
20
10
0
FRD
Vert
Late season crown and root rot complex
Tentative FCRR
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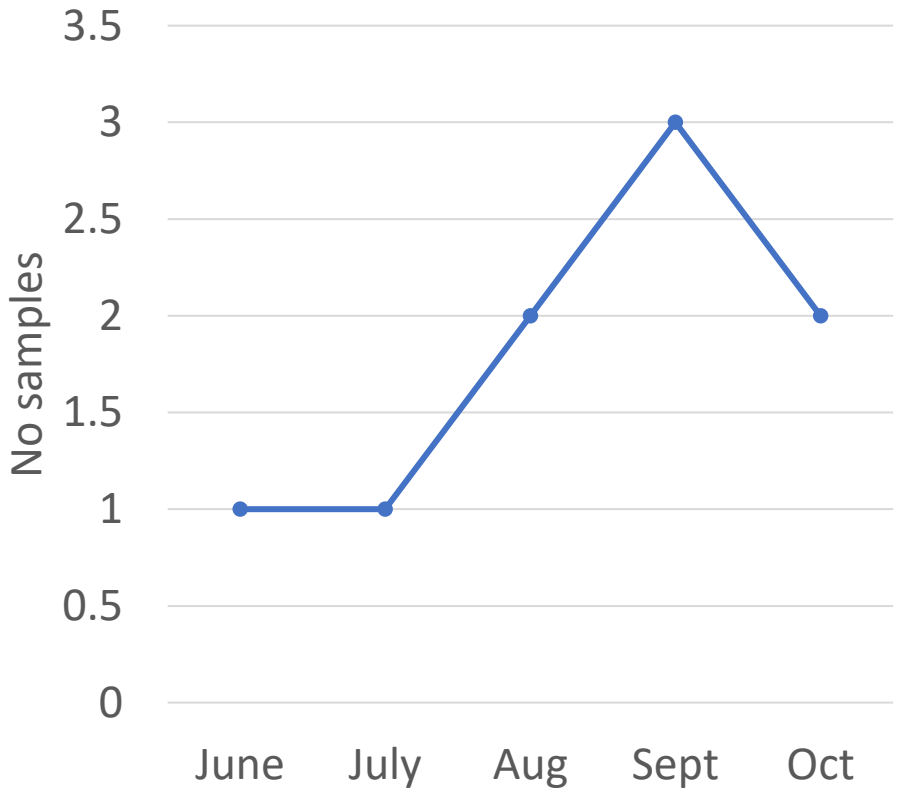
Fusarium wilt
Underway
Foot rot
RKN
RKN + Fusarium
Southern blight
Speck
Herbicide/ abiotic
Powdery
NEW?-Plectosphaerella cucumerina...
Bac canker

Late season crown and root rot complex found in plants with minor to severe canopy and stem rot symptoms

Late season crown and root rot complex

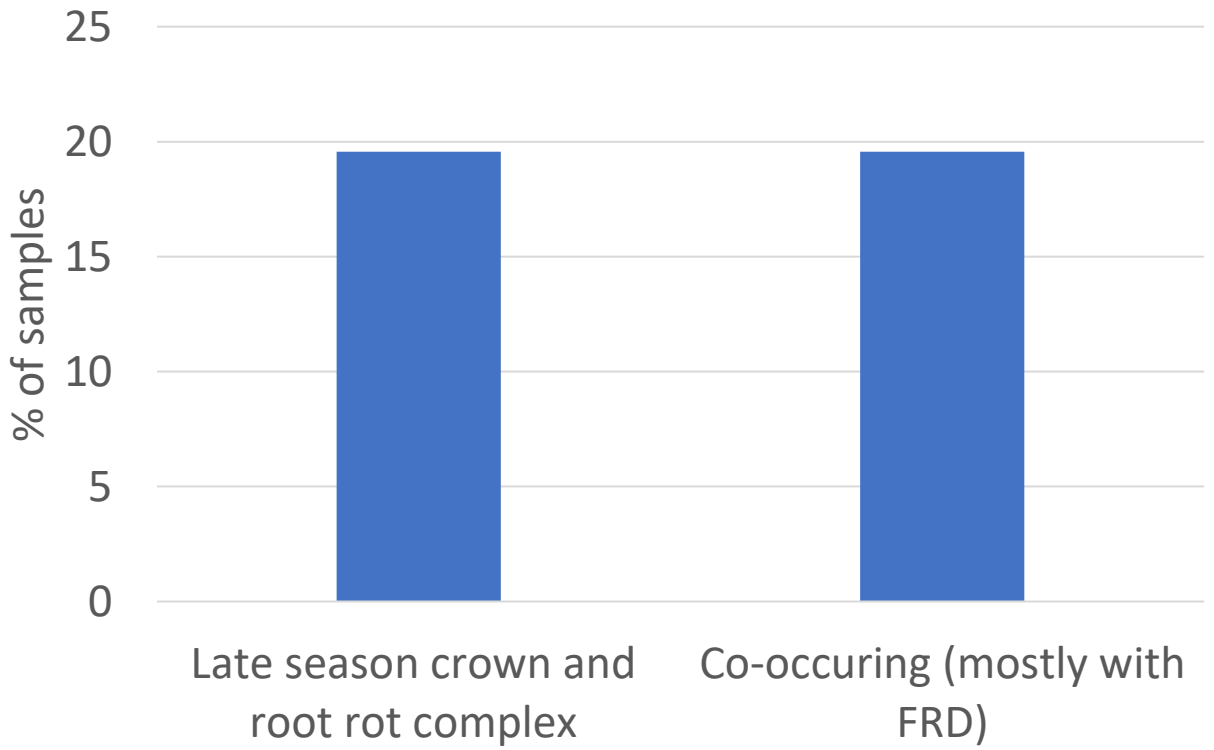
Most detections are in August to October, near harvest



Associated with a range from minor to severe symptoms

Always co-occurring with other more severe diseases

May be enhancing effects of these diseases



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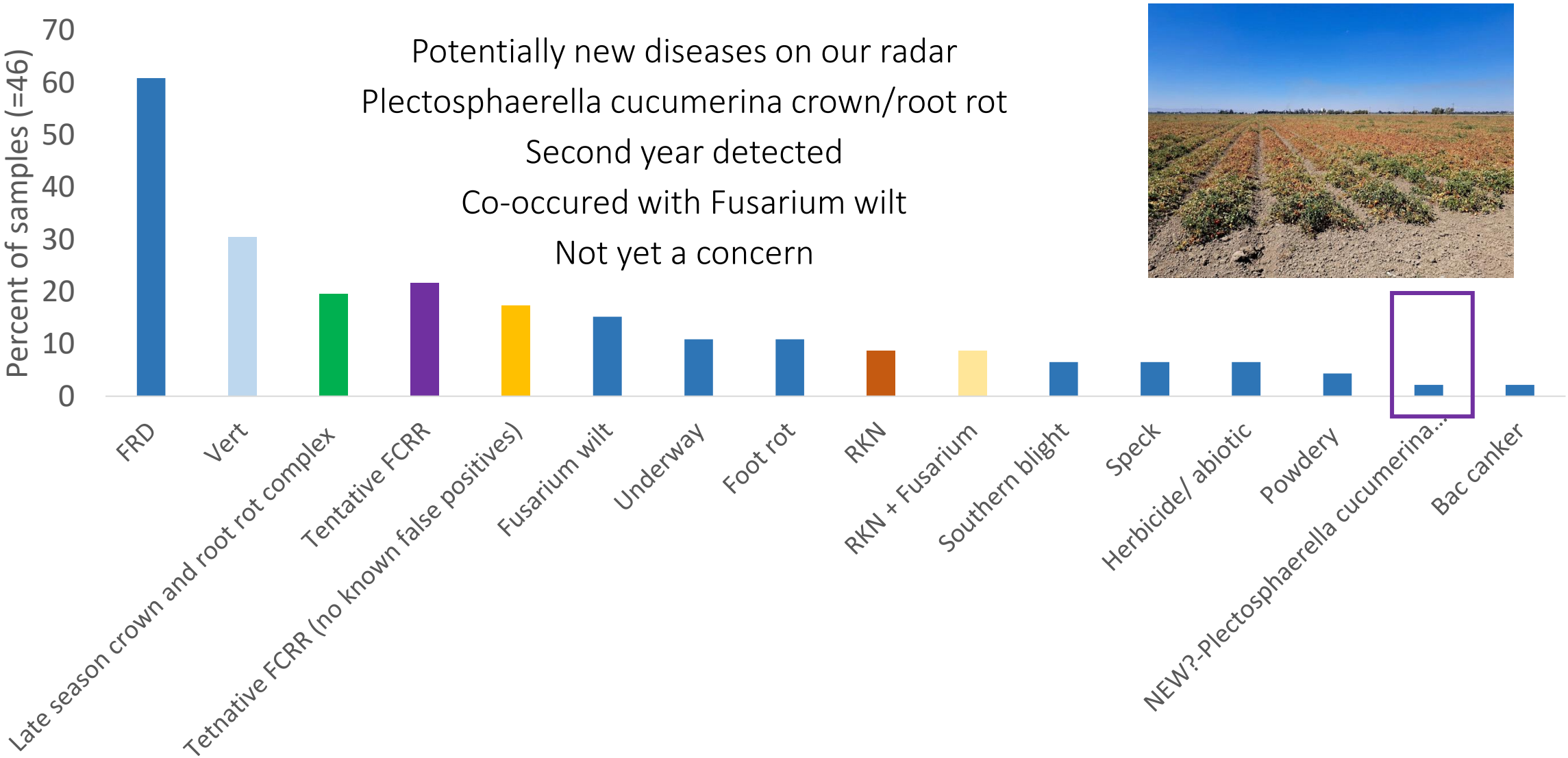
Potentially new diseases on our radar
Plectosphaerella cucumerina crown/root rot
Second year detected
Co-occured with Fusarium wilt
Not yet a concern
Percent of samples (=46)
70
60
50
40
30
20
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0
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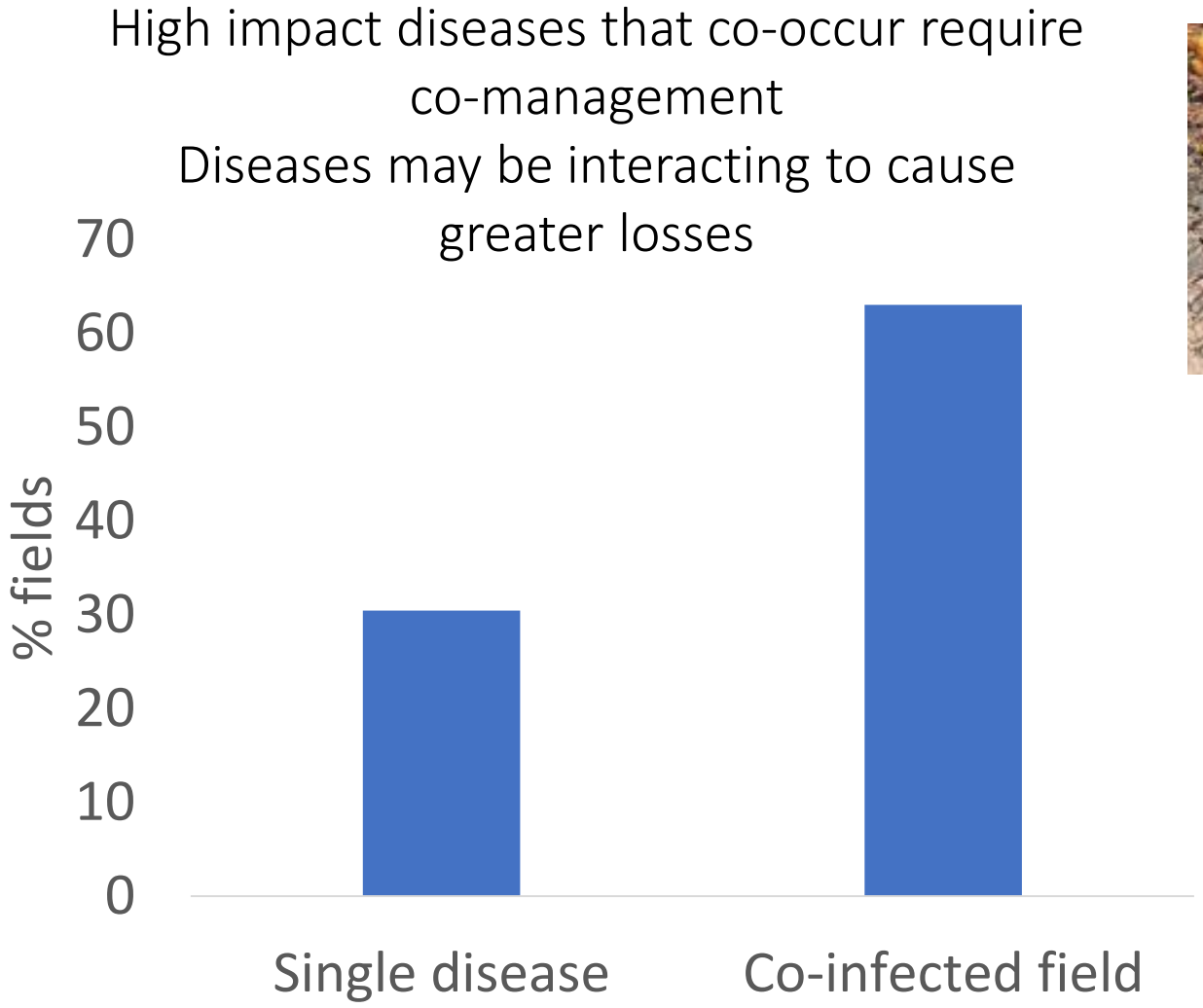
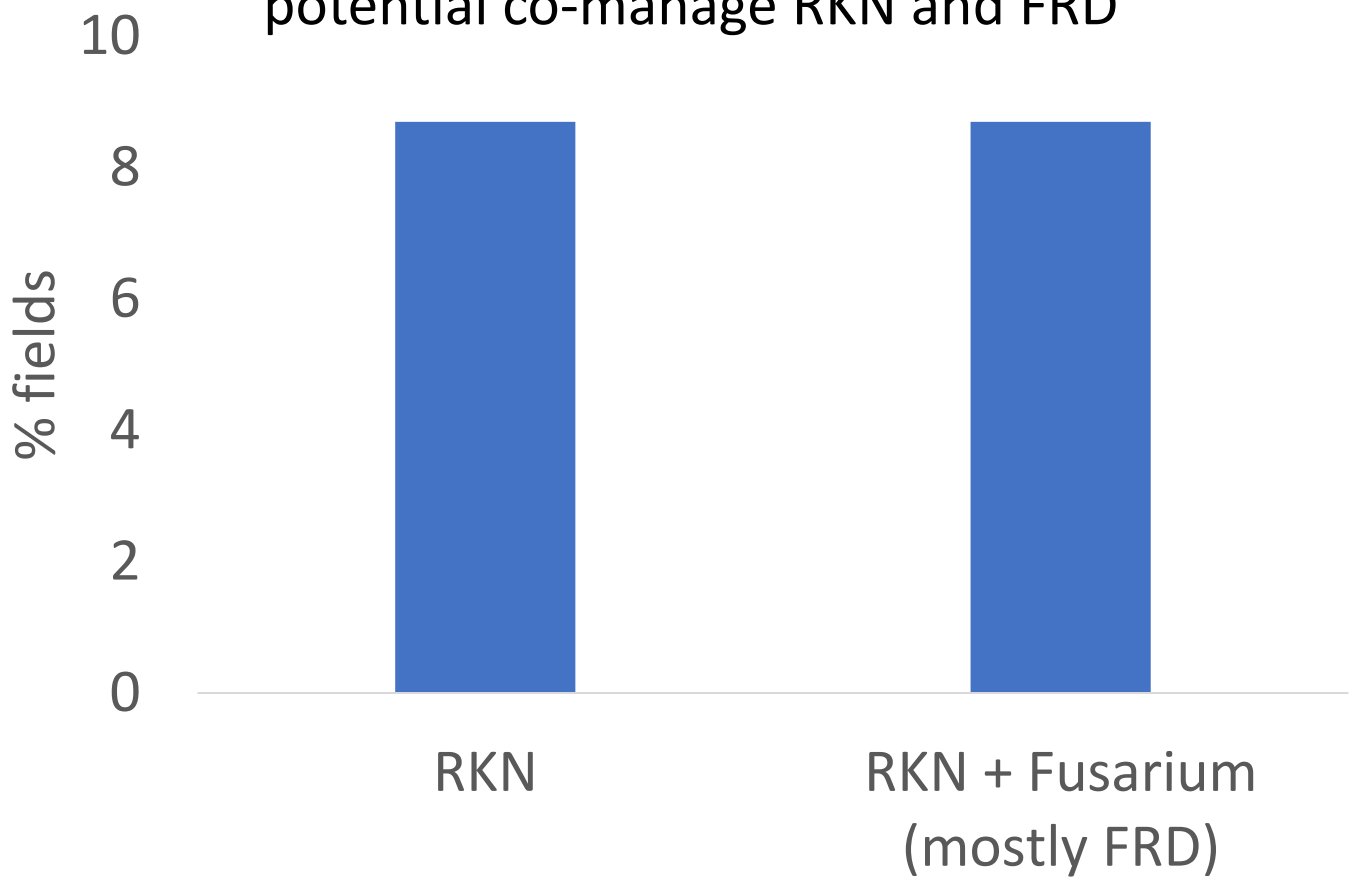
NEW?-Plectosphaerella cucumerina...
Bac canker

Most fields have multiple management targets in this region



For example-all fields with root knot nematode also have a Fusarium disease (mostly FRD)

Chemical studies underway indicate some potential co-manage RKN and FRD



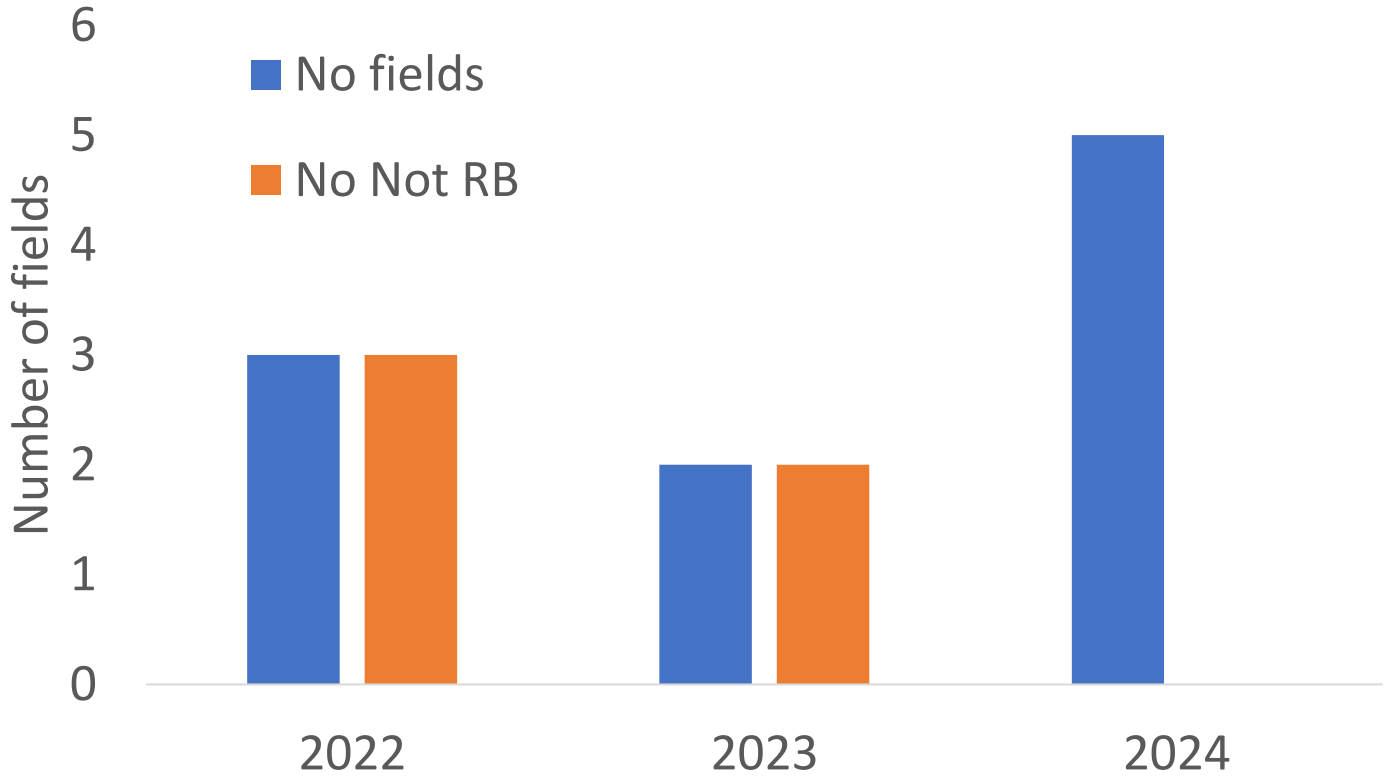
Resistance breaking status for Fusarium wilt / Fol race 4 in F3 cultivars (Fol race 4 monitoring)

- Not detected anywhere in the world (FL report not confirmed)
- 33 tentative Fol recoveries from CA F3 fields since 2024
- 80% were Fol race 3
- The rest represented false positives in diagnostics

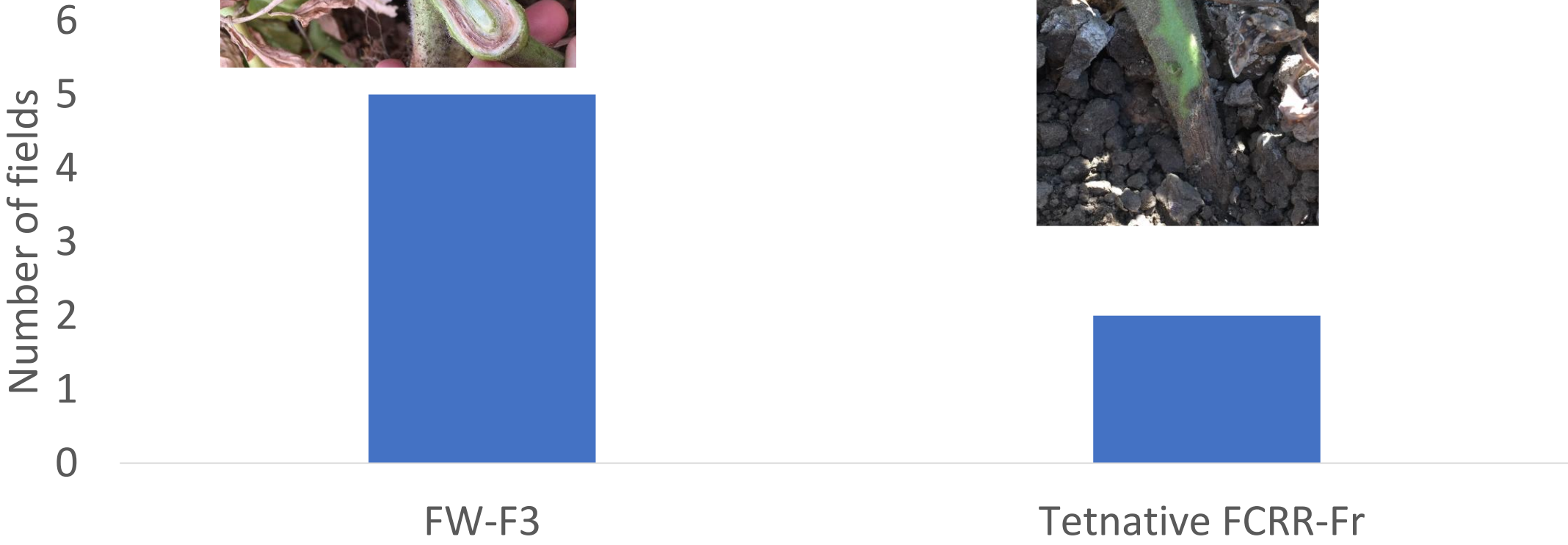
		No fields (percent)					
Year	Total	Fol R1	Fol R2	Fol R3	Fol R4	Forl	Non-Path
2017	2	0	0	2 (100%)	0	0	0
2018	11	0	0	11 (100%)	0	0	0
2019	0	0	0	0	0	0	0
2020	2	0	0	2 (100%)	0	0	0
2021	2	0	0	2 (100%)	0	0	0
2022	3	0	0	3 (100%)	0	0	0
2023	9	0	0	3 (33%)	0	2	4
2024	4	0	0	3 (75%)	0	0	1
Total	33	0	0	26 (79%)	0	2 (6%)	5 (15%)
2025	5				TBD		

Resistance breaking status for Fusarium crown and root rot in Fr cultivars (Forl race 2 monitoring)

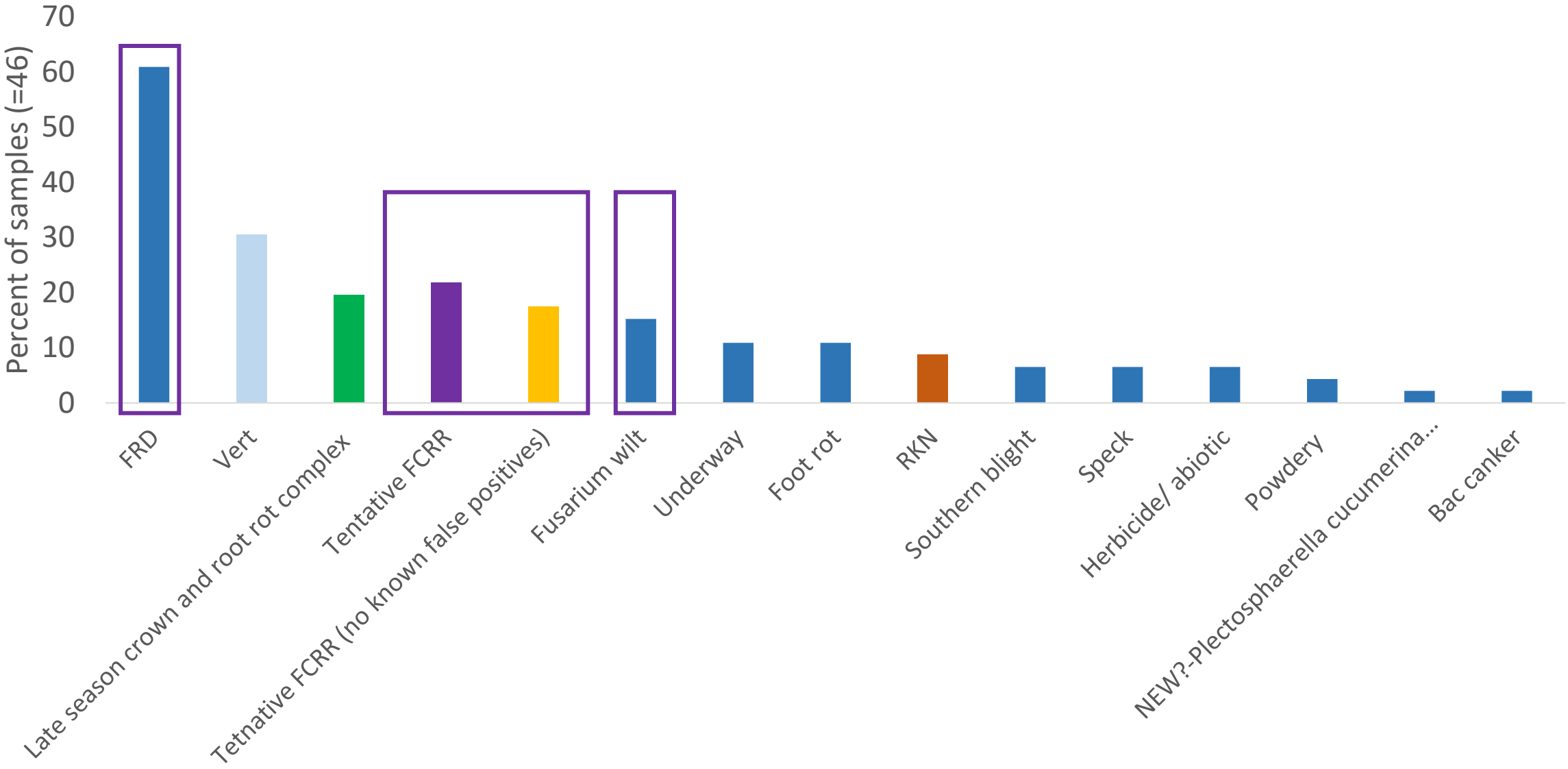
- 10 fields since 2022
- No RB Forl detected
- 1 case where Forl was confirmed-but Fr resistance worked
- 2 different sources of Forl resistance-one thought to be less effective



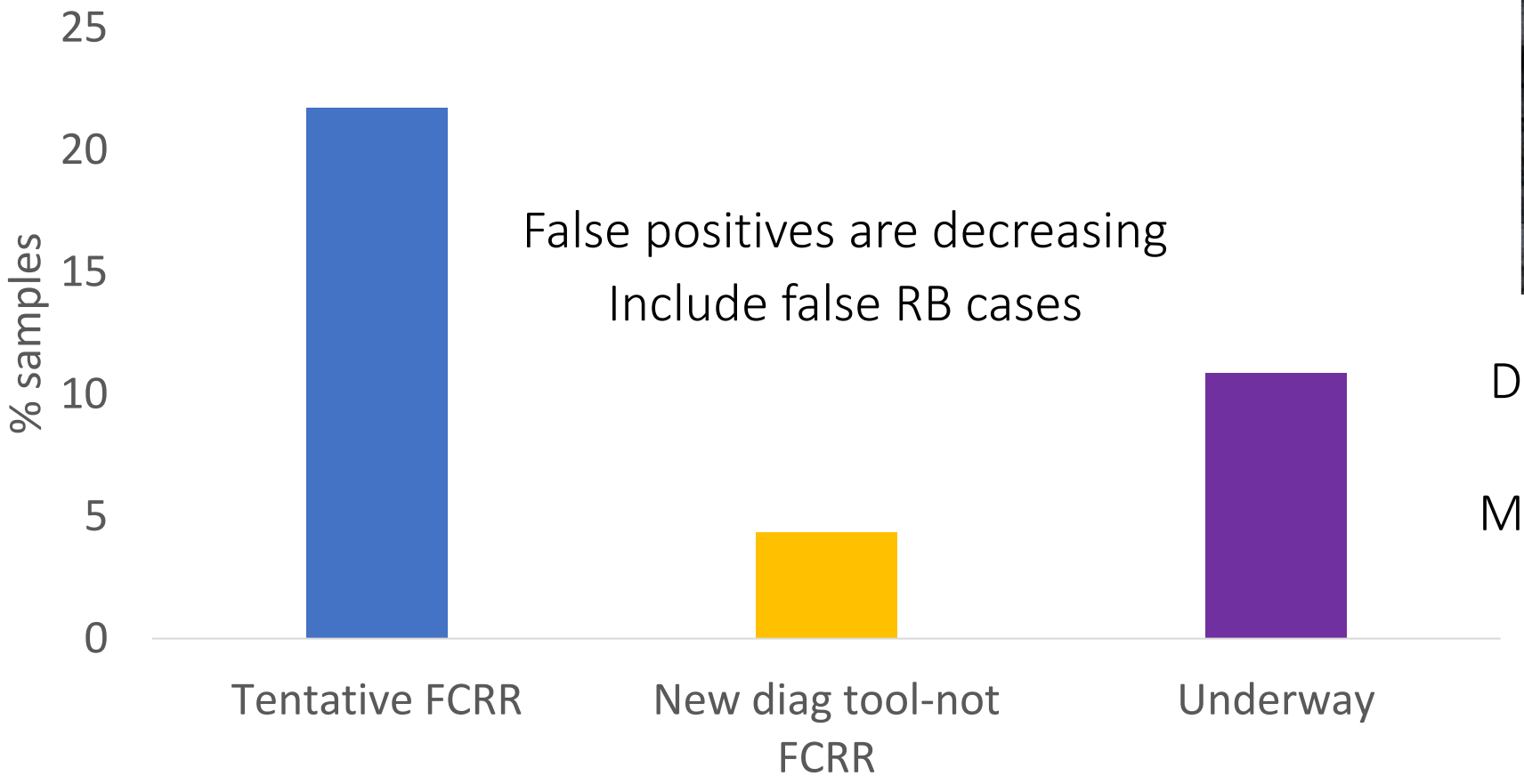
Resistance breaking monitoring 2025



New diagnostic tools used in 2025 or in development



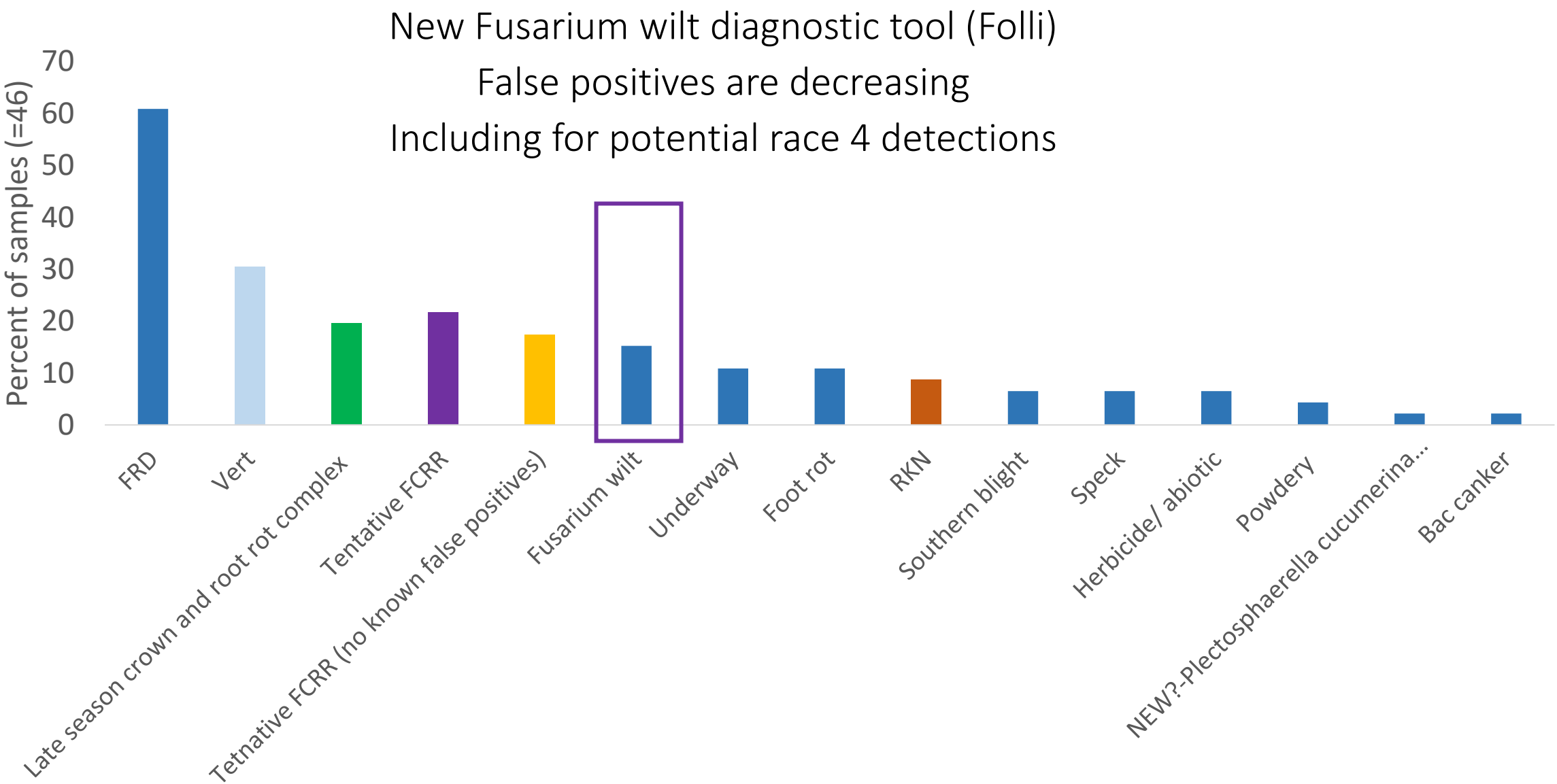
New Fusarium crown and root rot diagnostic tool (multi locus haplotyping)



Downside-too intensive to do in-season

Most updated diagnoses going out in winter

New diagnostic tools used in 2025



Upcoming diagnostic tool

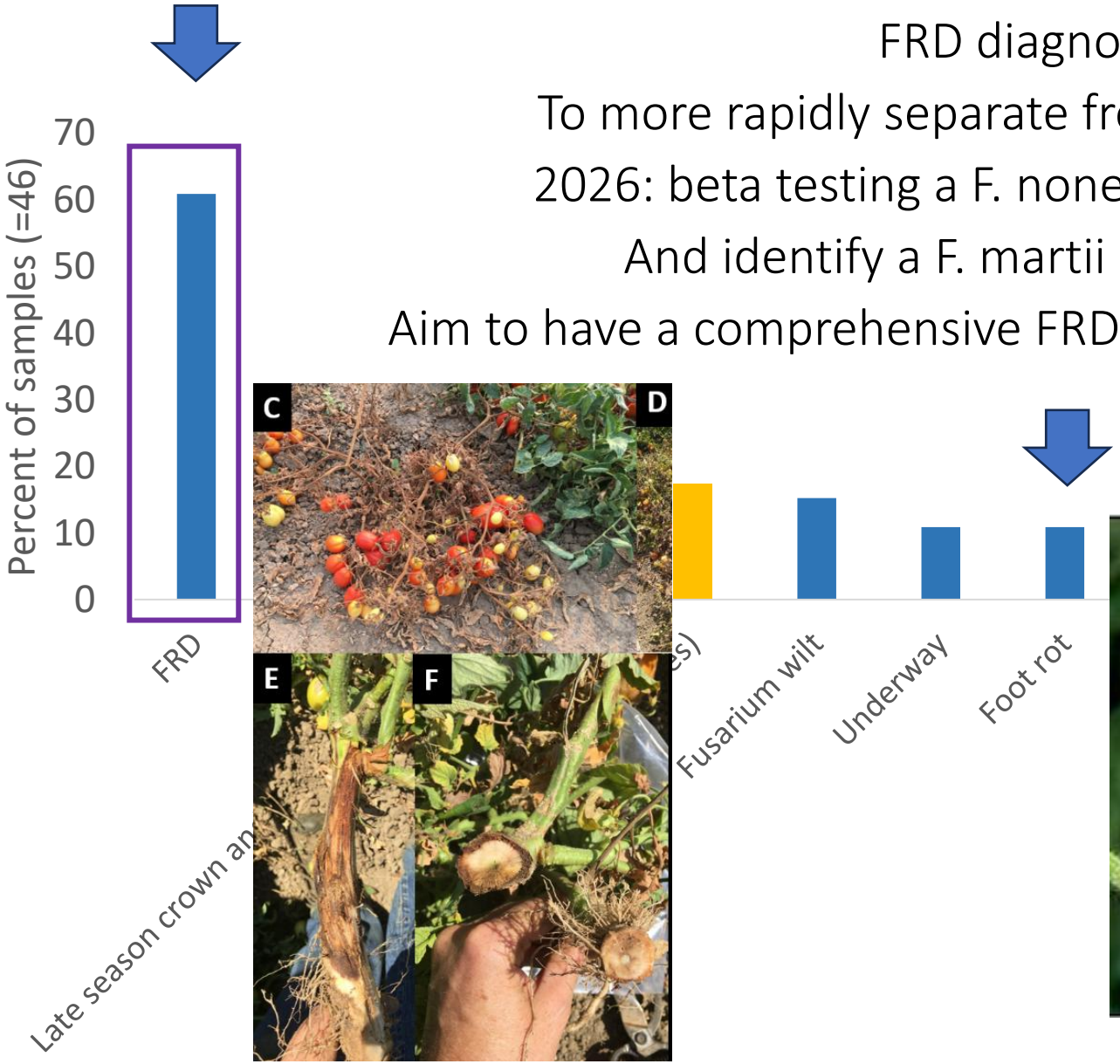
FRD diagnostics!

To more rapidly separate from Fusarium foot rot

2026: beta testing a F. noneumartii region (FN-1)

And identify a F. martii diagnostic region

Aim to have a comprehensive FRD diagnostic package by 2027



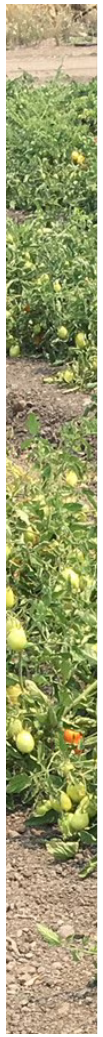
Diagnostic labs-resources we can provide to you

- Forl diagnostic protocol and sequence library
  - Or we can run our haplotyping analysis on your cultures
- Folli primers and thermocycler conditions

Fusarium diagnostic workshop 2026-date TBD

Current and forthcoming resources

- Swett lab extension resources: https://swettlab.faculty.ucdavis.edu/extension/
  - Fusarium stem rot and decline cultivar performance table here
- Fusarium stem rot and decline UC IPM Pest Note
- Fusarium wilt management UC IPM 8000 series article
- Diagnostic guide as hard copy pocket book
- Training in new diagnostic methods for Fusarium diseases—late 2025 to early 2026



OUTREACH RESOURCES

Diagnostic field guides

Diagnosing vine decline and rot diseases of tomatoes in the field

Equipment Sanitation working BMPs

Field Equpiment Sanitation Best Management Guidelines (V1.3 May 2024)

UCD_Harvester Sanitation Best Management GuidelinesV1

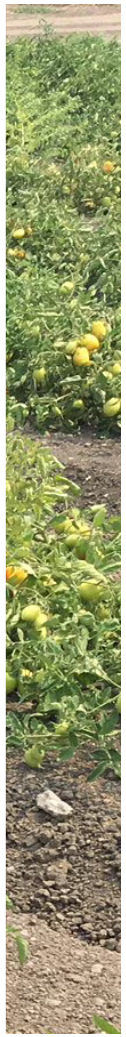
Tomato cultivar trial results

Tomato cultivar performance against Fusarium stem rot and vine decline (FRD / "falciforme")

Newsletter Articles

Fusarium wilt of tomato: diagnosis, distribution and management

Southern Blight Cliff Notes 2017



Questions?

Cassandra Swett

clswett@ucdavis.edu