From Southern Blight to Fusarium “falciforme” stem rot and decline (FRD): management of two persistent soil-borne diseases

CTGA Annual Grower Meeting/UCCE North San Joaquin Valley Processing Tomato Meeting

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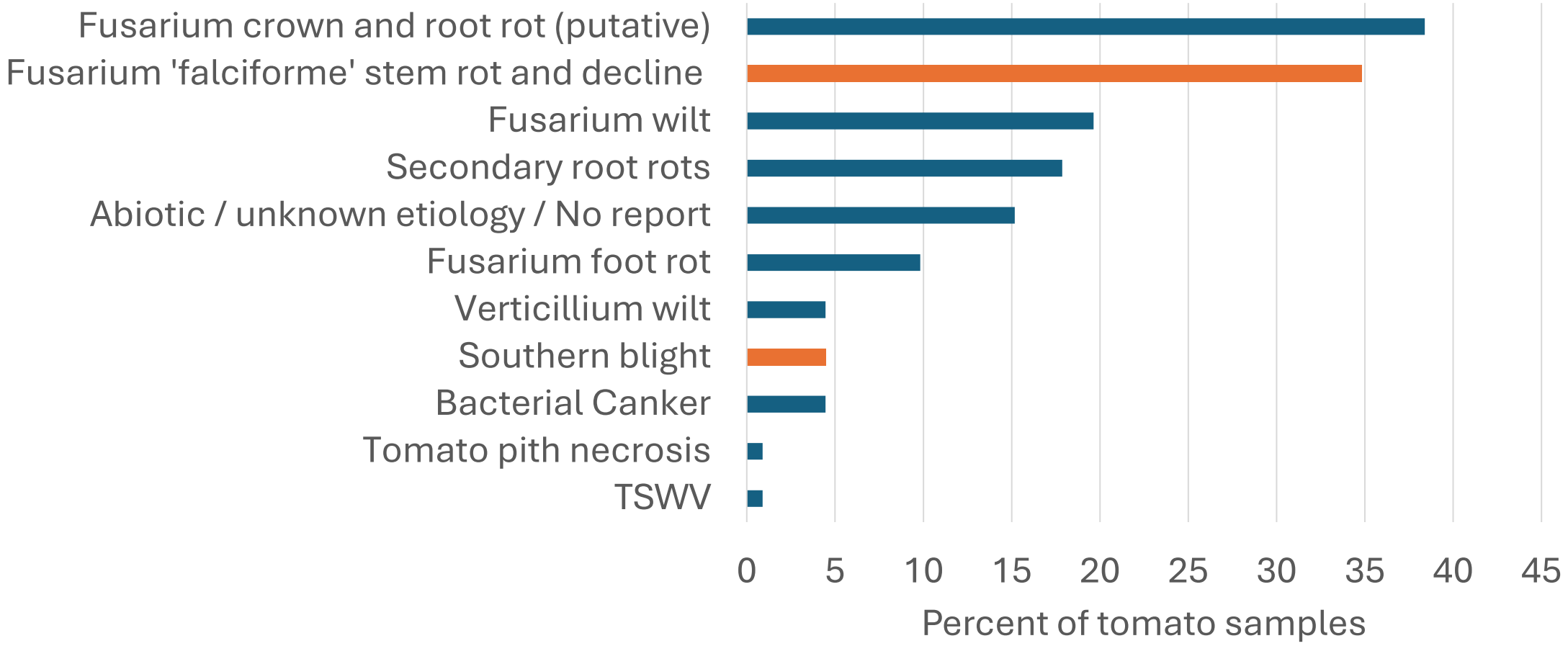
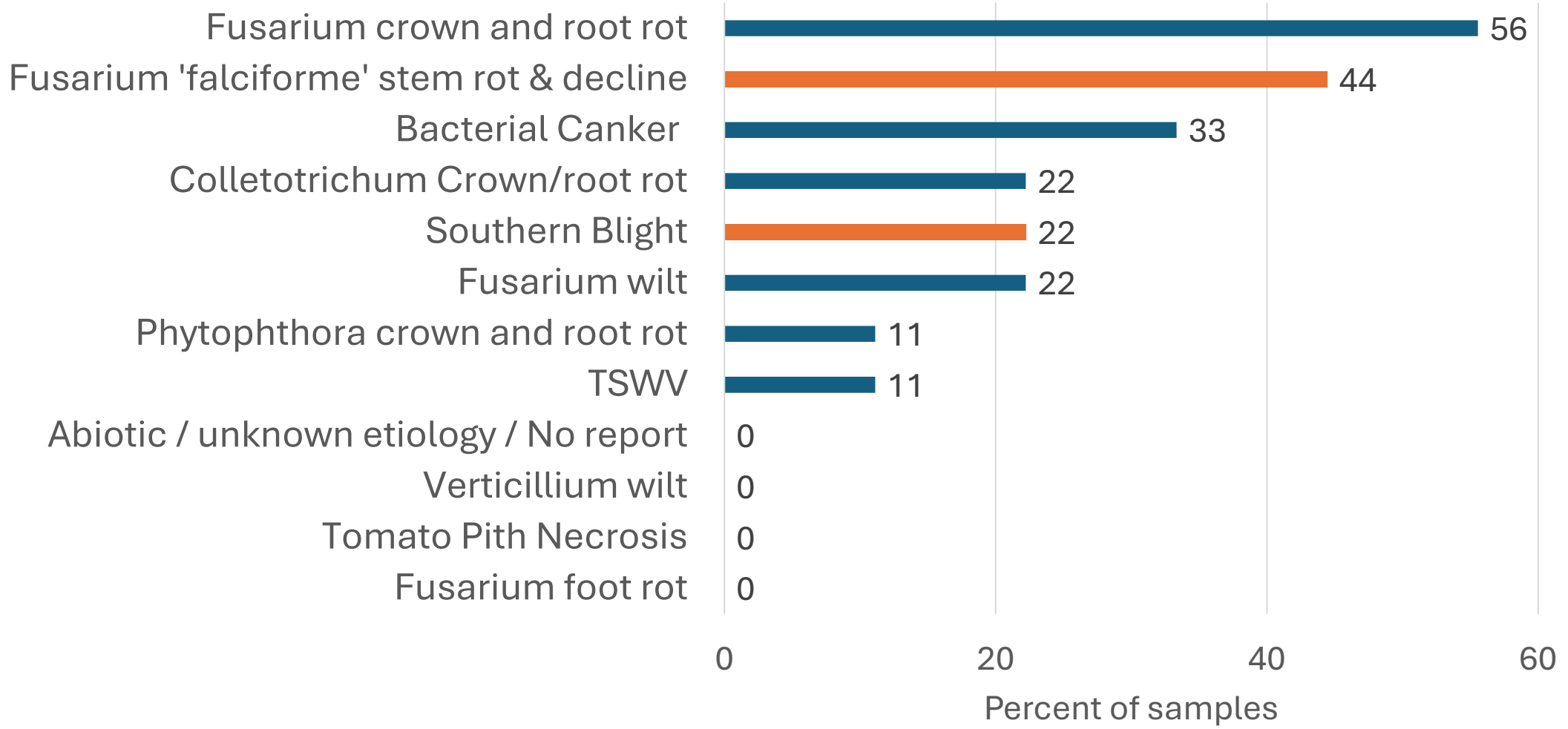
California Tomato Research Institute

NPDN National Plant Diagnostic Network

Statewide
FRD the most common disease of tomato
Southern blight with lower frequencies



In the North San Joaquin Valley
FRD still the most common
Southern blight at higher frequencies that statewide average



What was all previously called Fusarium falciforme
Is now known to be three species

Fusarium “falciforme” stem rot and decline (FRD) refresher

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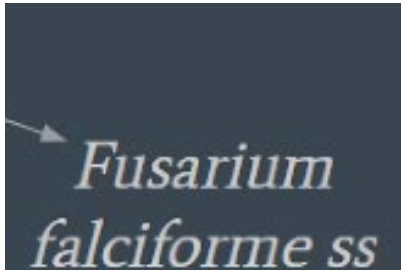

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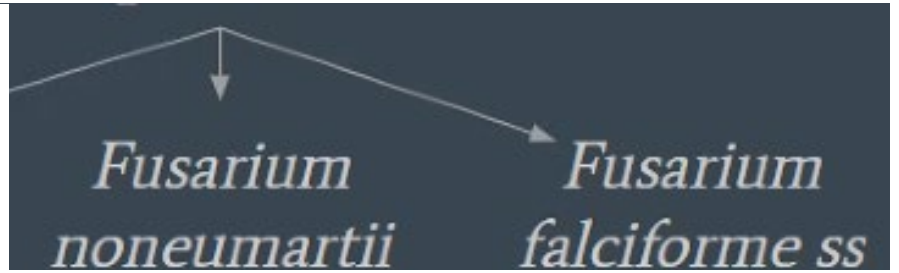

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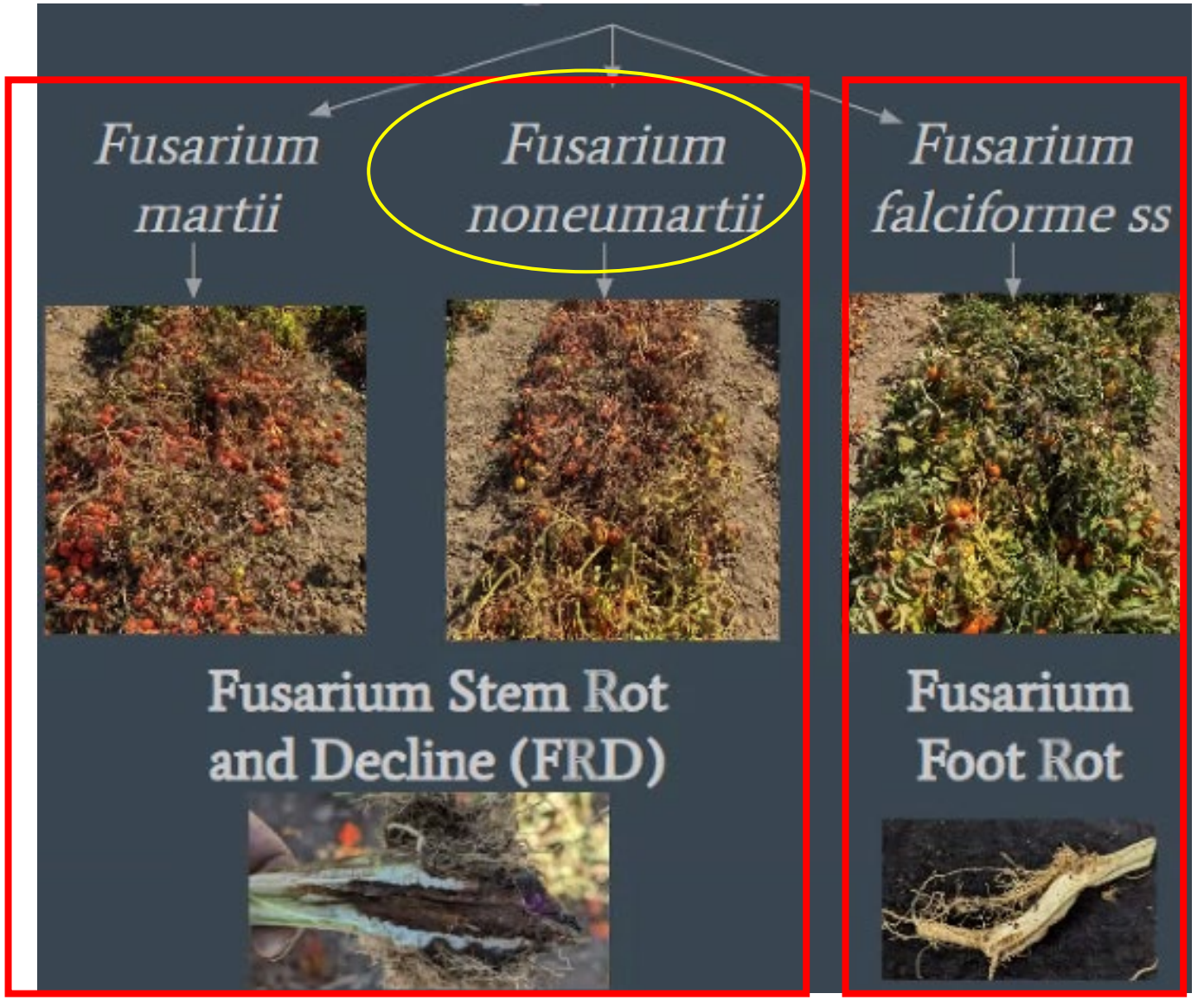
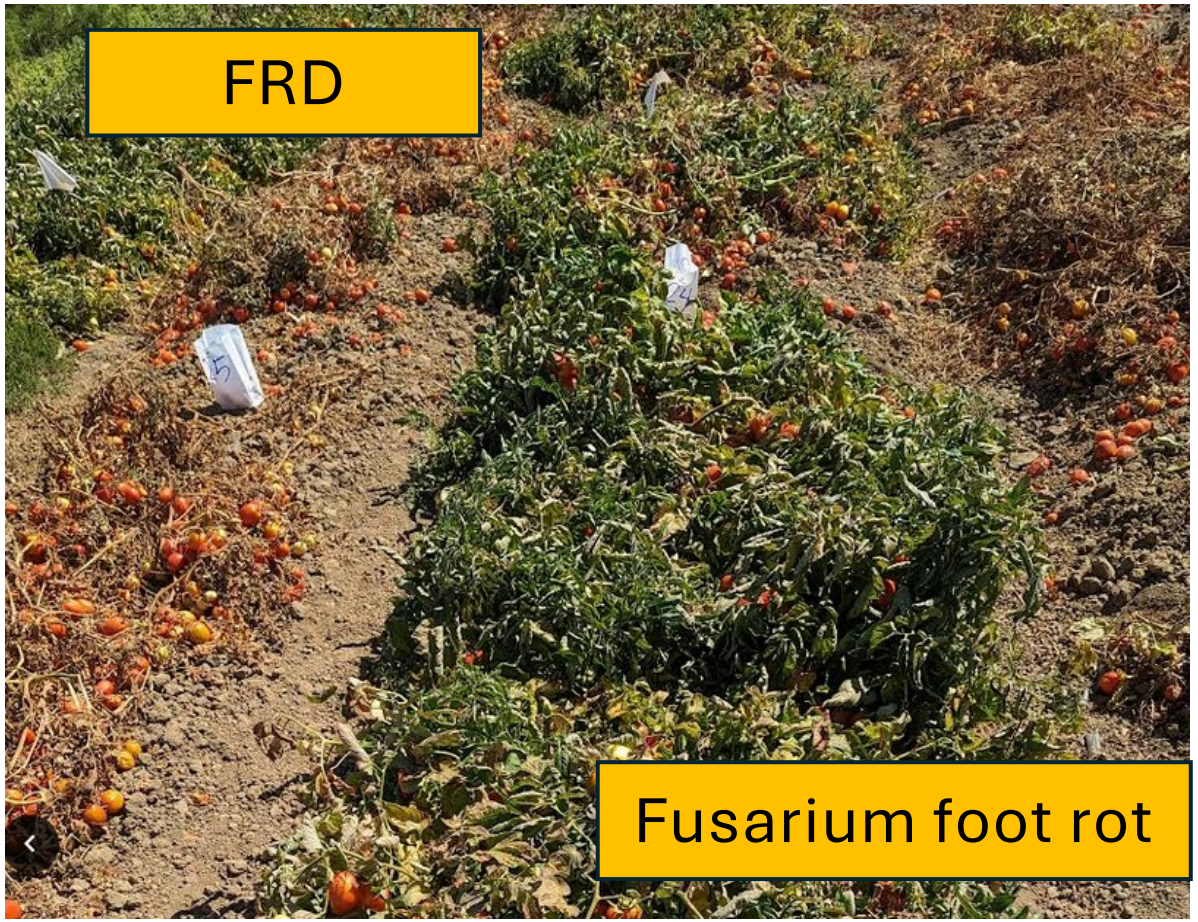


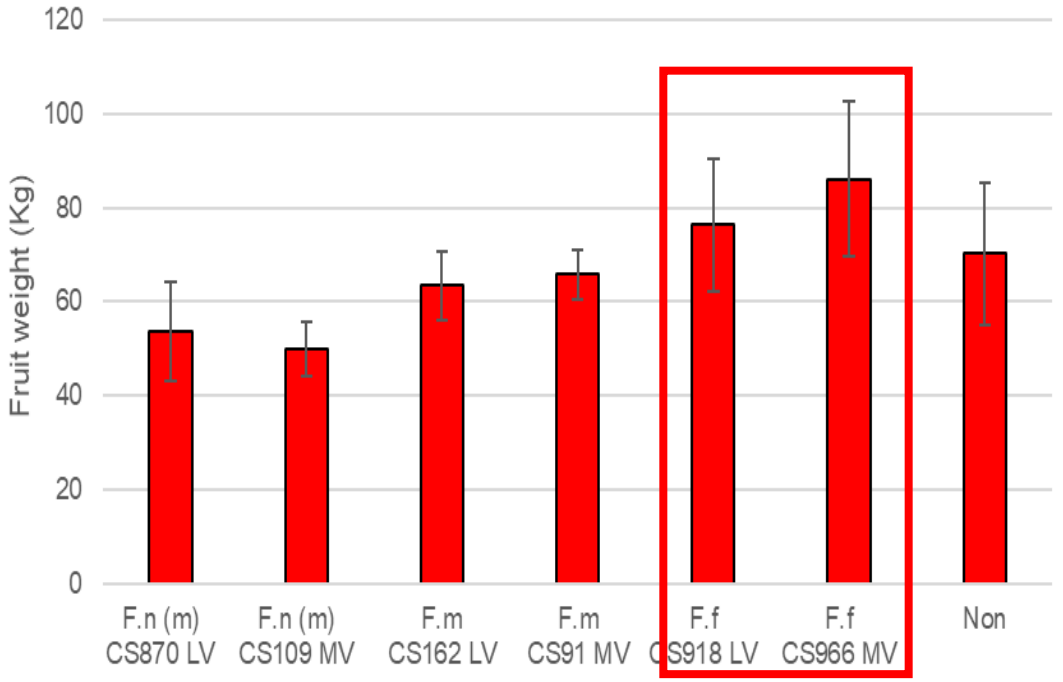
Fusarium “falciforme” stem rot and decline (FRD) refresher

Fusarium stem rot and vine decline (FRD)
F. noneumartii and F. martii

Fusarium foot rot
F. falciforme

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





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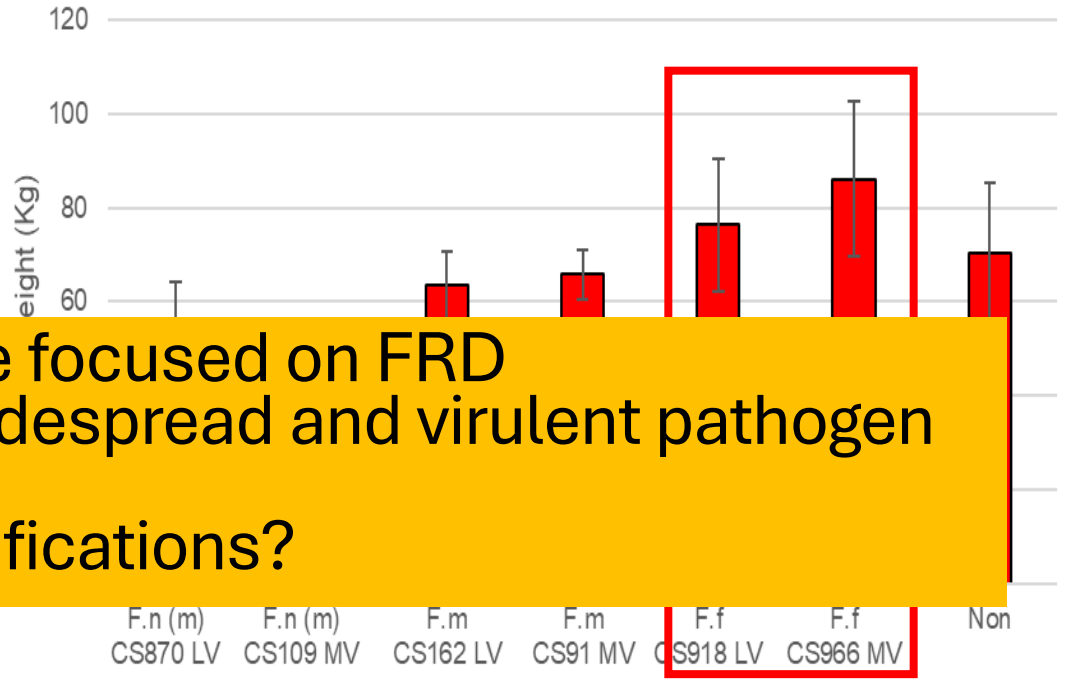
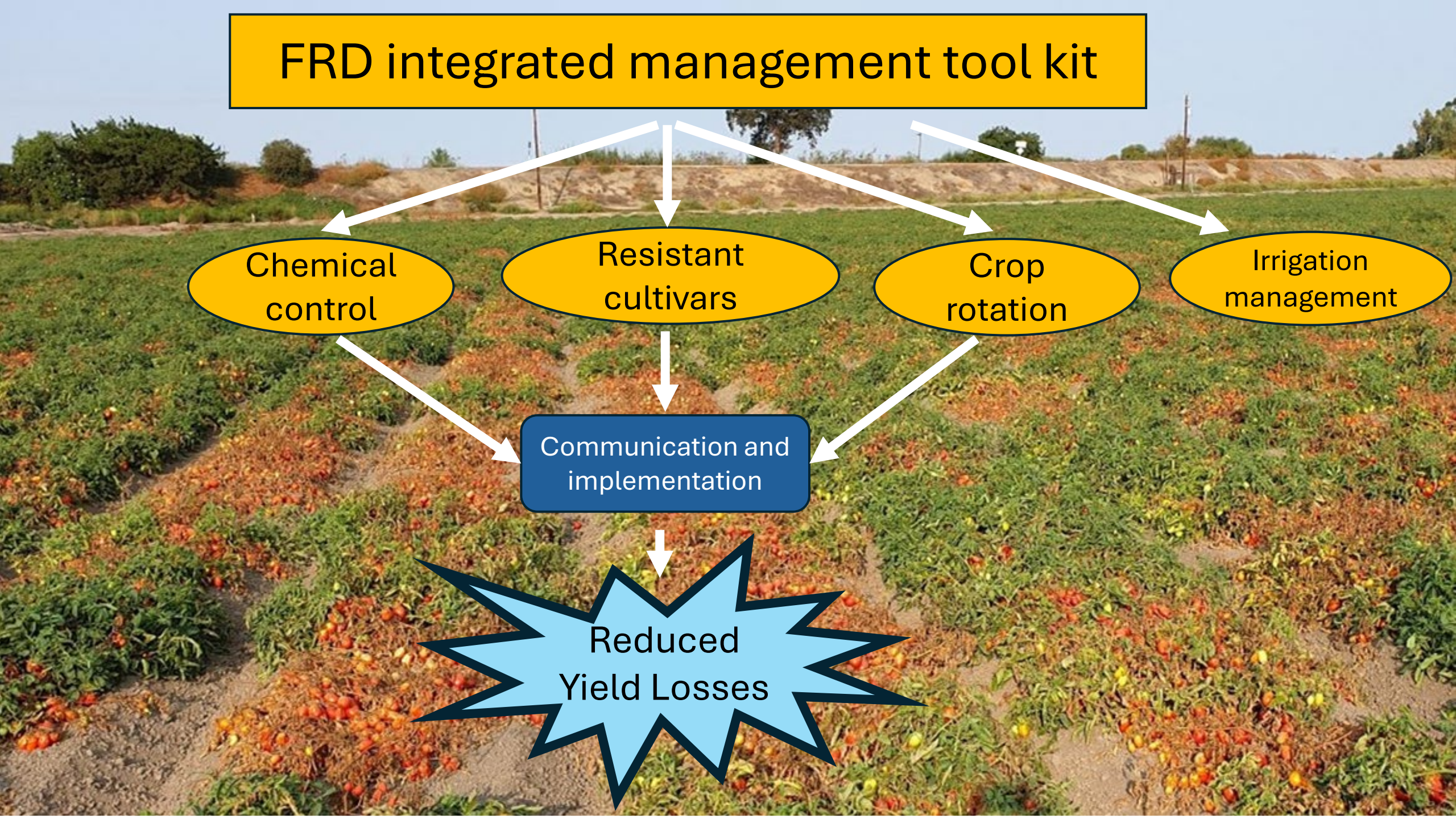


Management efforts are focused on FRD
Primarily F. noneumartii—the most widespread and virulent pathogen

Questions / clarifications?


FRD integrated management tool kit
Chemical control
Resistant cultivars
Crop rotation
Irrigation management
Communication and implementation
Reduced Yield Losses

FRD integrated management tool kit

Chemical control

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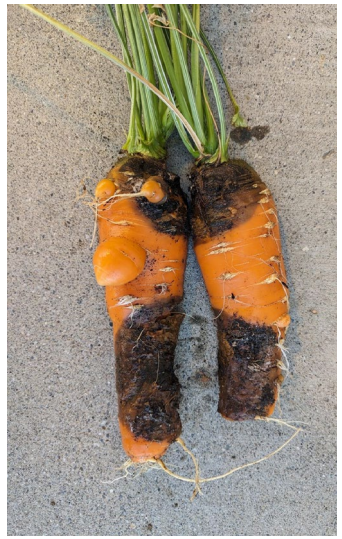
Rotation avoidance guidelines to reduce losses in other affected crops

Reduced Yield Losses

Cilantro Carrot Potato








Other crops where FRD causes yield impacts

Avoid growing in rotation with each other or tomato

Some crops host the FRD pathogens with no apparent yield impacts

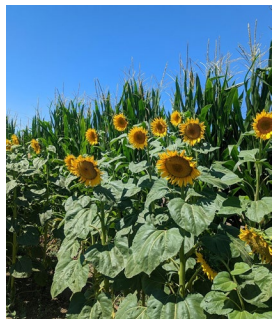
Sunflower

Safflower

Host range summary

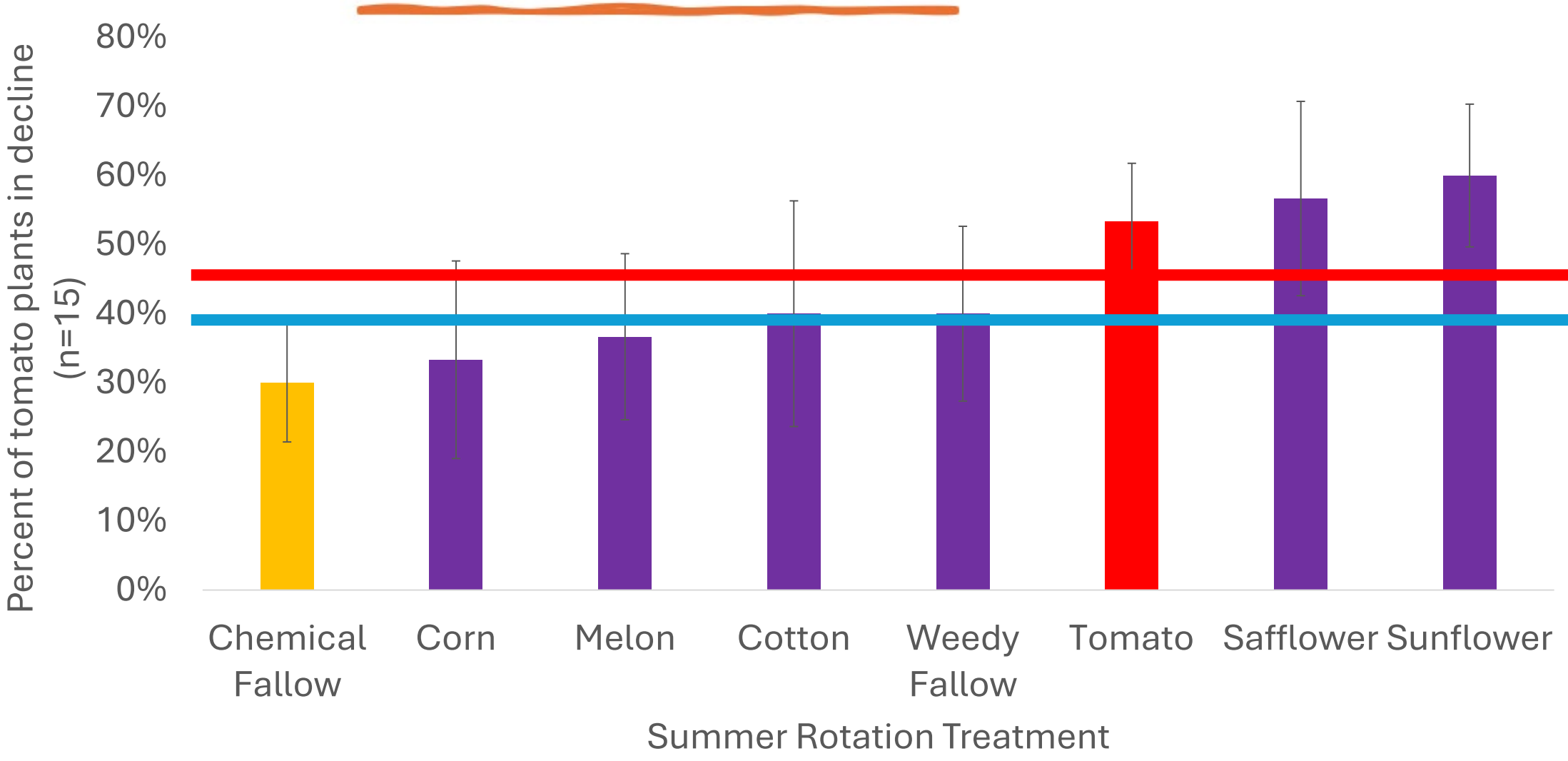
- Severely affected hosts
    - Potato, pepper, cilantro, carrot, sunflower (rare)
- Unaffected hosts
    - Sunflower (usually), safflower, pumpkin, hemp, lettuce, broccoli, garbanzo, kidney bean
- Non-hosts
    - Common rotations: Garlic, onion, alfalfa, corn, cotton, melon, wheat, barley
    - Less common rotations: Spinach, cabbage, vetch, parsley, fava bean, sweet potato

Tomato disease development following one year rotation with chemical fallow and other crops



Data taken pre harvest

Averaged across the two years we ran this etrial



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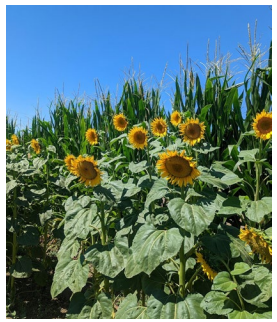

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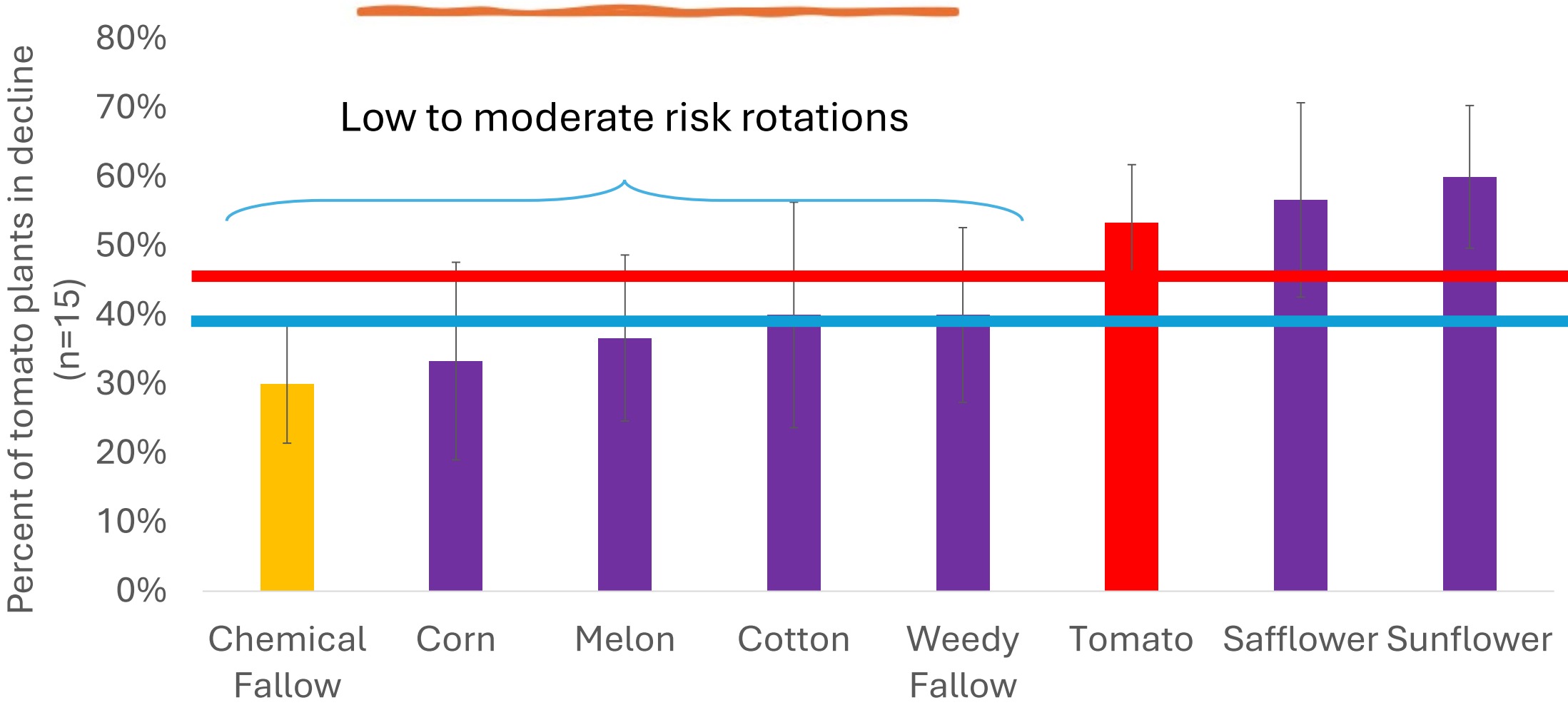

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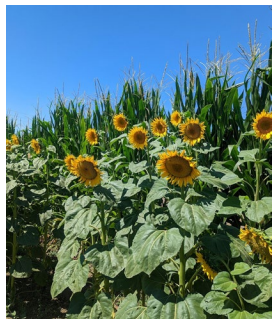

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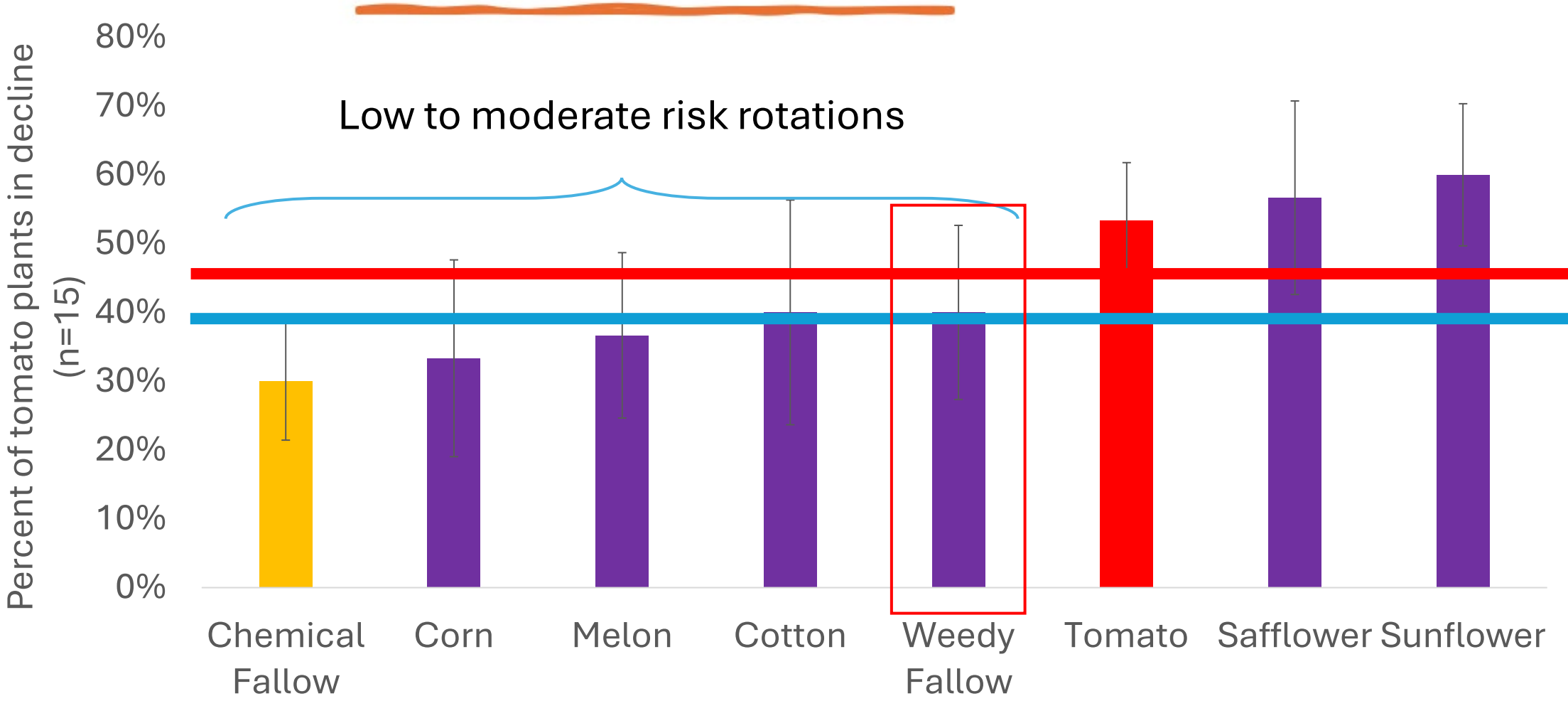
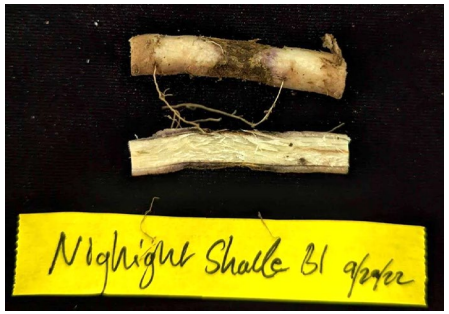


Weeds can be pathogen hosts

Crop/weed	Number of plants isolated	Number of isolations with solani morphology	Number ID to FSCC 3+4	Number matched to CS 109
Amaranthus	11	2	1	1
Pig weed	1	1	0	0
Prickly Lettuce	2	0	0	0
Barnyard Grass	2	0	0	0
Nightshade	8	8	7	1
Bindweed	15	2	1	0
Alkali mallow	4	3	1	1



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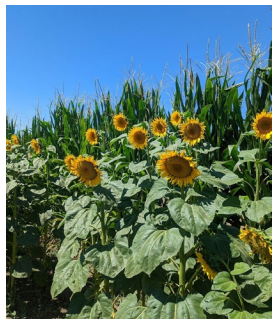

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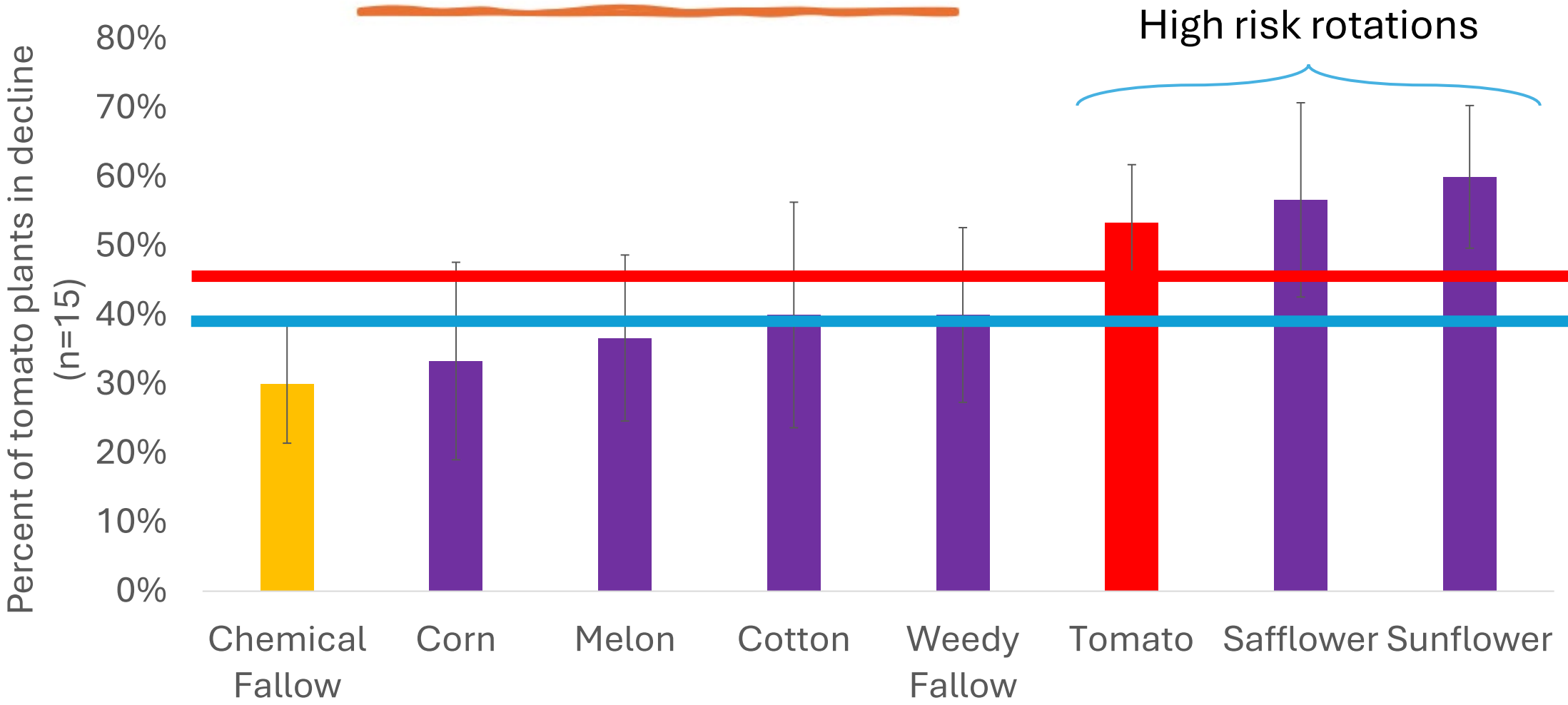
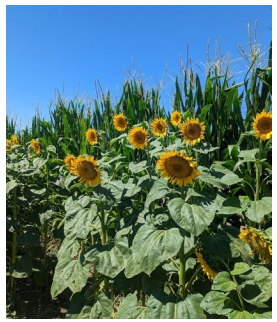


Host crops are associated with higher risk of disease development in tomato



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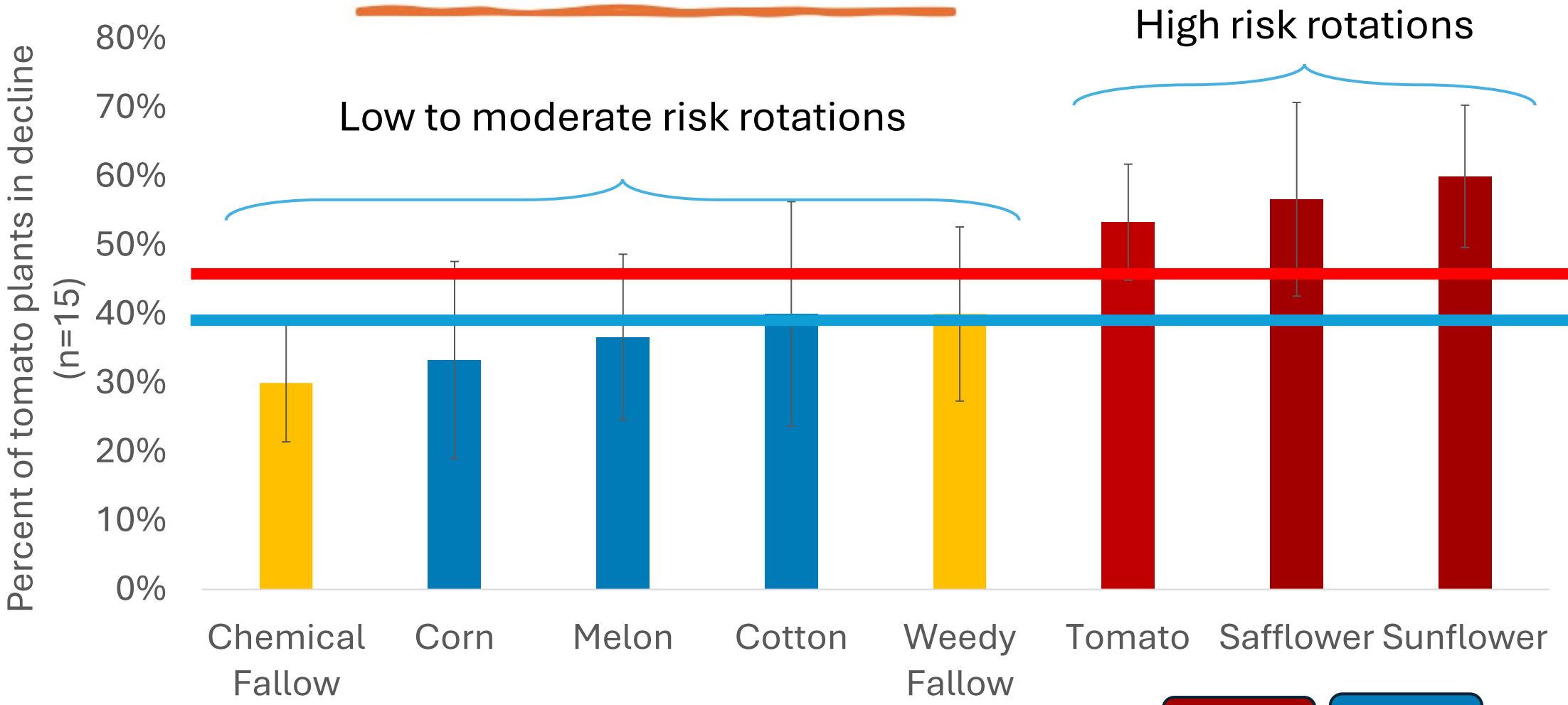

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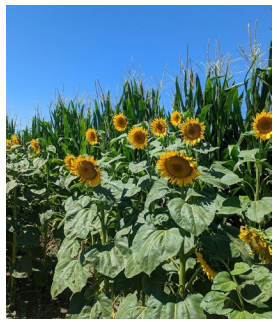

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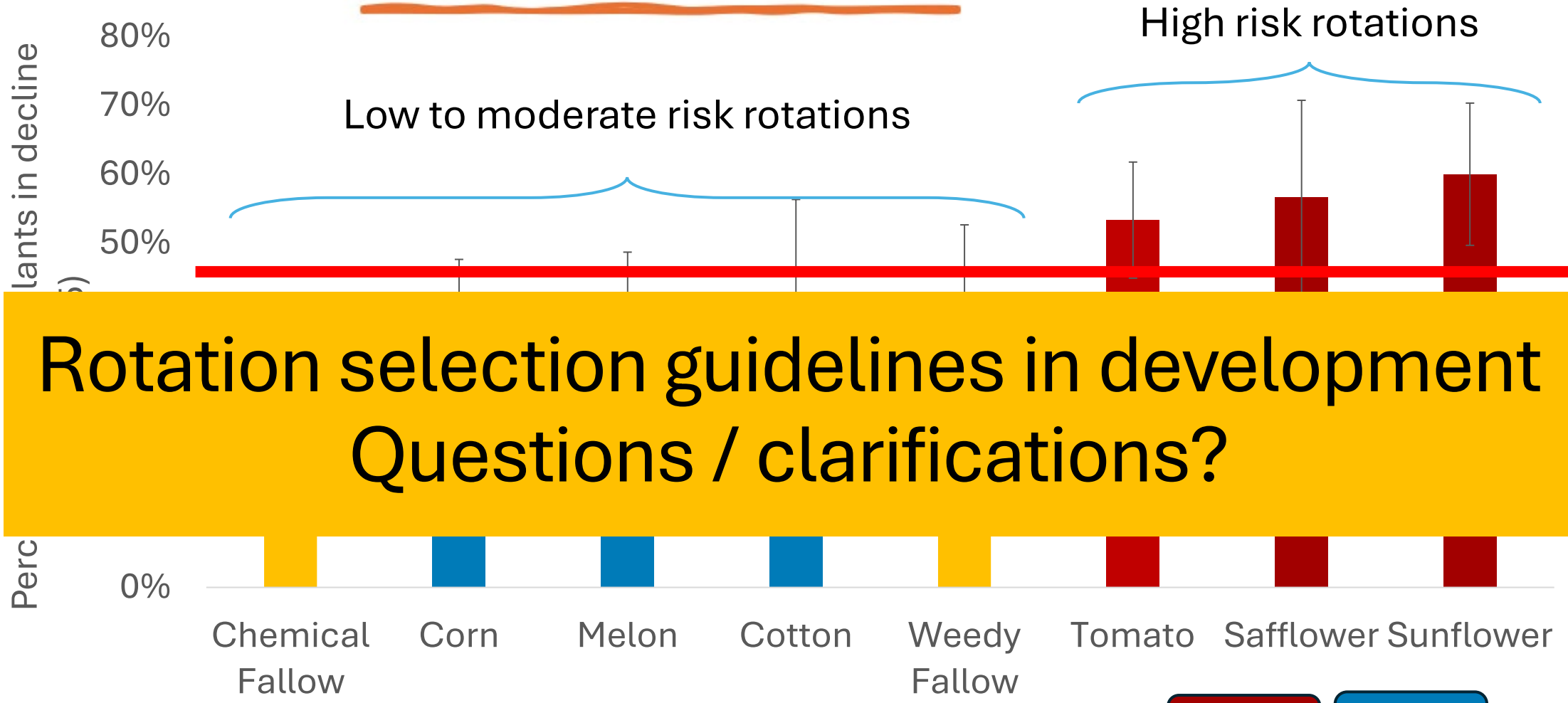


Rotation selection guidelines in development

Questions / clarifications?

Cultivar-based management

- More from Patricia
- Many cultivars are more resistant to FRD
- And there are several highly suceptible cultivars to avoid

Chemical-based management

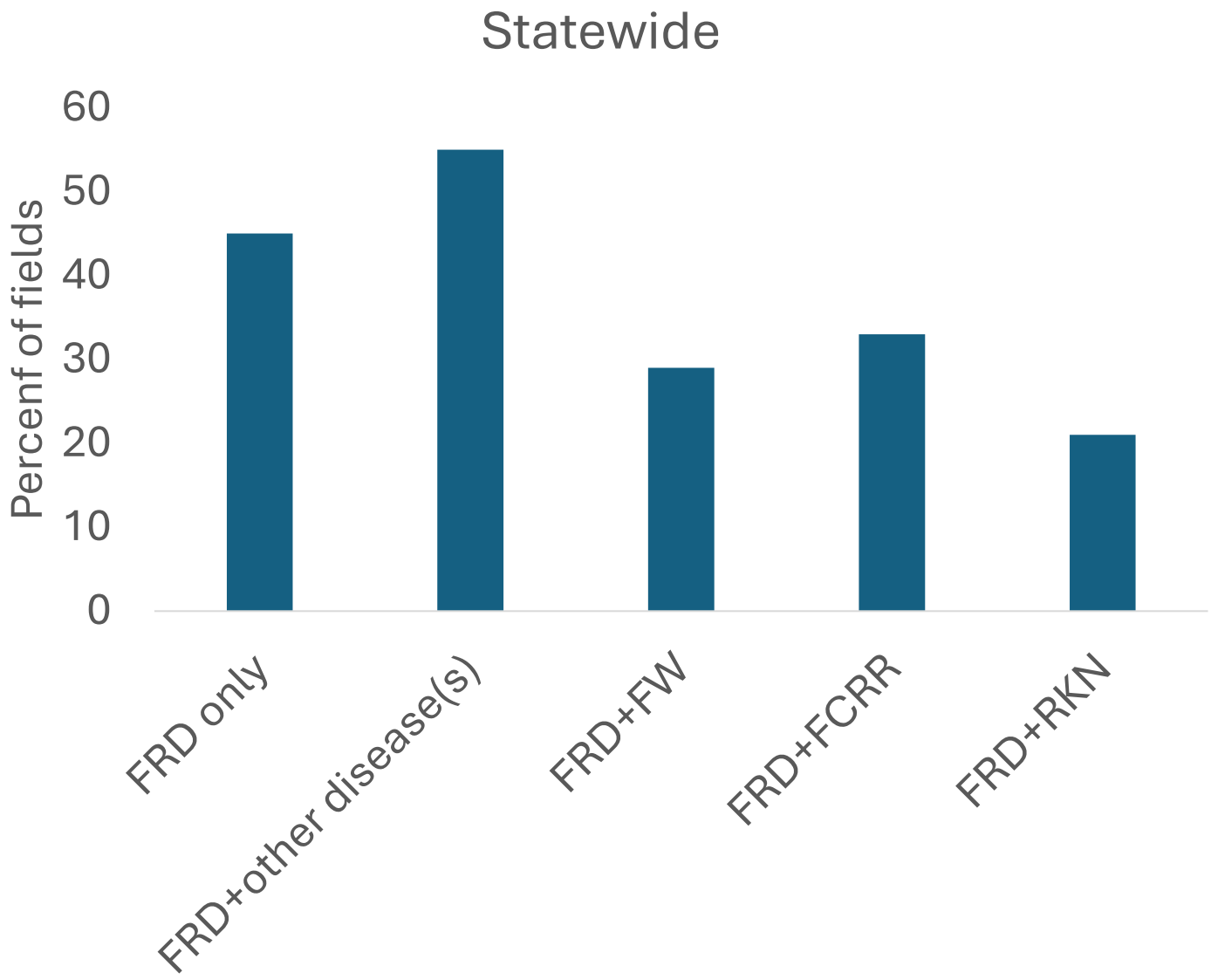
- More from Patricia
- Pre-plant management: spring fumigation
- In-season chemigation via drip
  - 3 applications starting at planting, every 2-3 weeks
  - By the time you see the disease it's too late

Treatment and rate /A	Total rot incidence (%) [z]	Crown rot incidence (%)	AG stem rot incidence (%) [y]	Total fruit (t/A)	Marketable red fruit (%) [x]	Damaged fruit (%) [w]	Microbial activity (µg/g soil) [v]
K-Pam HL 10 gal	72.5 *a* [u]	40.0 *a*	2.5 *a*	46.6 *ab*	95.2 *a*	2.3 *a*	0.82 *a*
K-Pam HL 15 gal	80.0 *a*	31.3 *a*	10.0 *a*	51.0 *a*	93.7 *a*	2.0 *a*	0.90 *a*
K-Pam HL 20 gal	78.8 *a*	36.3 *a*	10.0 *a*	46.7 *ab*	95.3 *a*	2.7 *a*	0.99 *a*
Untreated control (water)	72.5 *a*	50.0 *a*	1.3 *a*	38.0 *b*	94.4 *a*	1.9 *a*	0.76 *a*

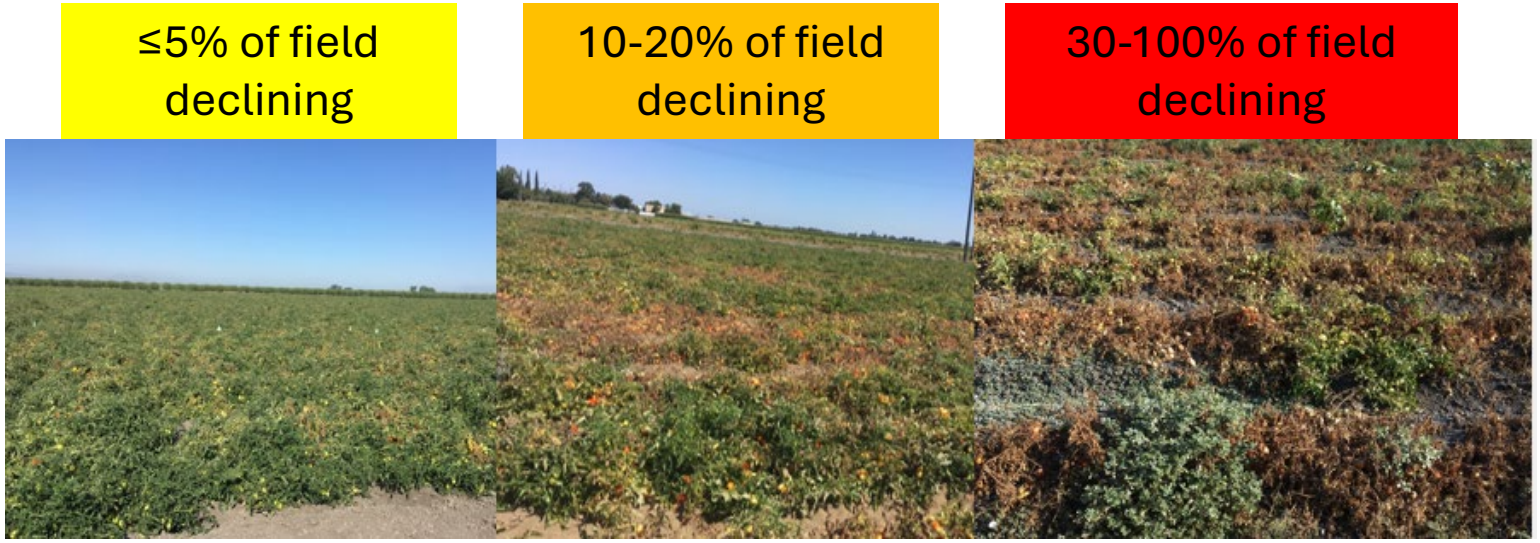
Treatment and amount/A	Total rot incidence (%)[z]	Crown rot incidence (%)	AG stem rot incidence (%)[y]	Total fruit (t/A)	Marketable red fruit (%)[x]	Damaged fruit (%)[w]
Miravis 13.7 fl oz	43.9 *negl*[v]	5.9 *med*	2.2 *small*	46.9 *small*	60.5 *negl*	29.1 *negl*
Propulse 13.7 fl oz	35.1 *small*	6.7 *med*	0.0 *large*	44.9 *negl*	53.8 *large*	29.4 *small*
Velum One 6.84 fl oz[u]	16.2 *large*	5.3 *med*	0.0 *large*	41.8 *small*	60.6 *negl*	29.5 *small*
Untreated control (water)[u]	46.9	23.3	10.0	43.8	61.8	26.8

FRD is not occurring in isolation

- The majority of fields with FRD have one or more additional disease
- Most commonly co-occurs with:
  - Fusarium wilt (FW)
  - Fusarium crown and root rot (FCRR)
  - Root knot nematode (RKN)



Higher rates of decline are more common in co-infested fields



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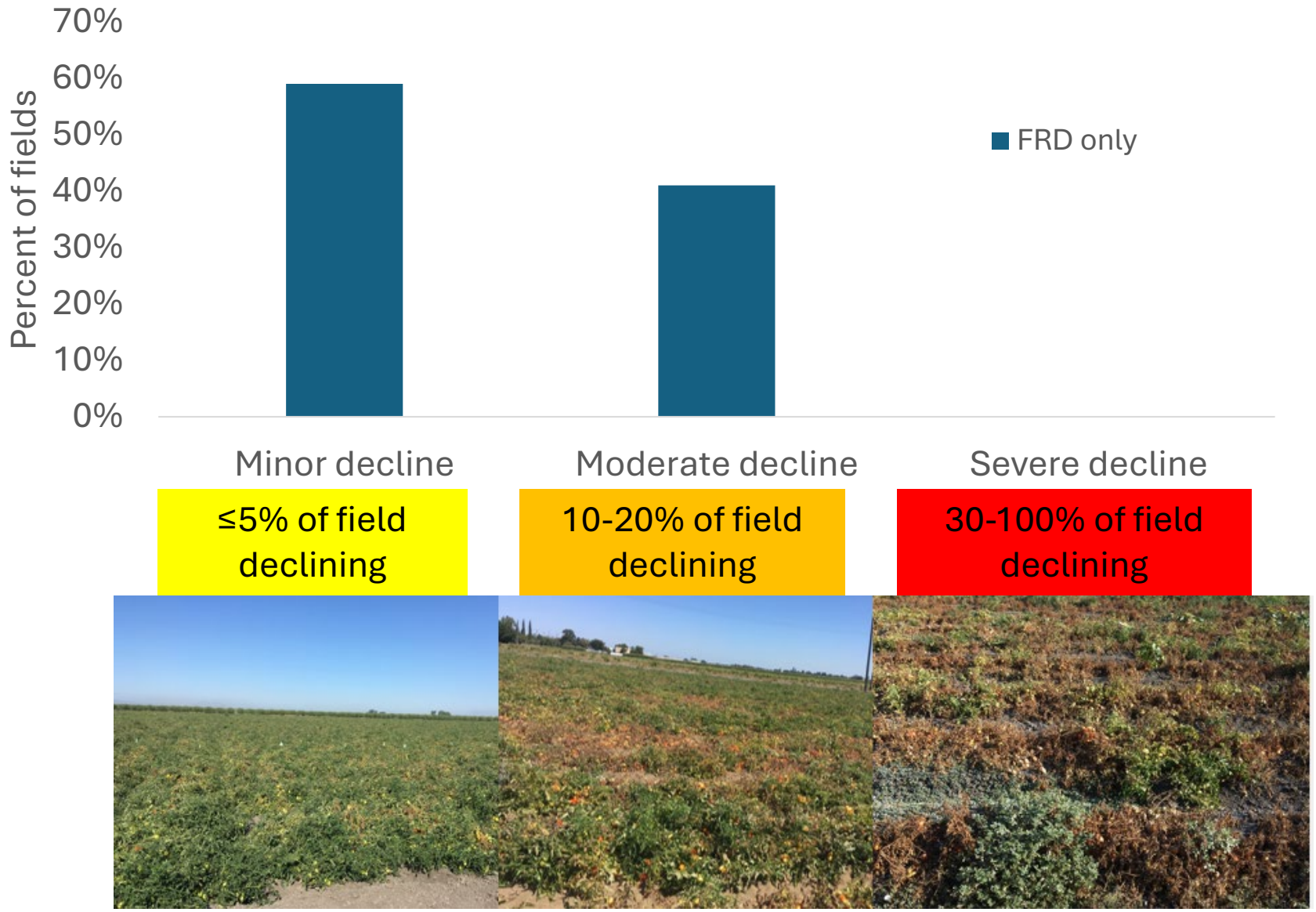

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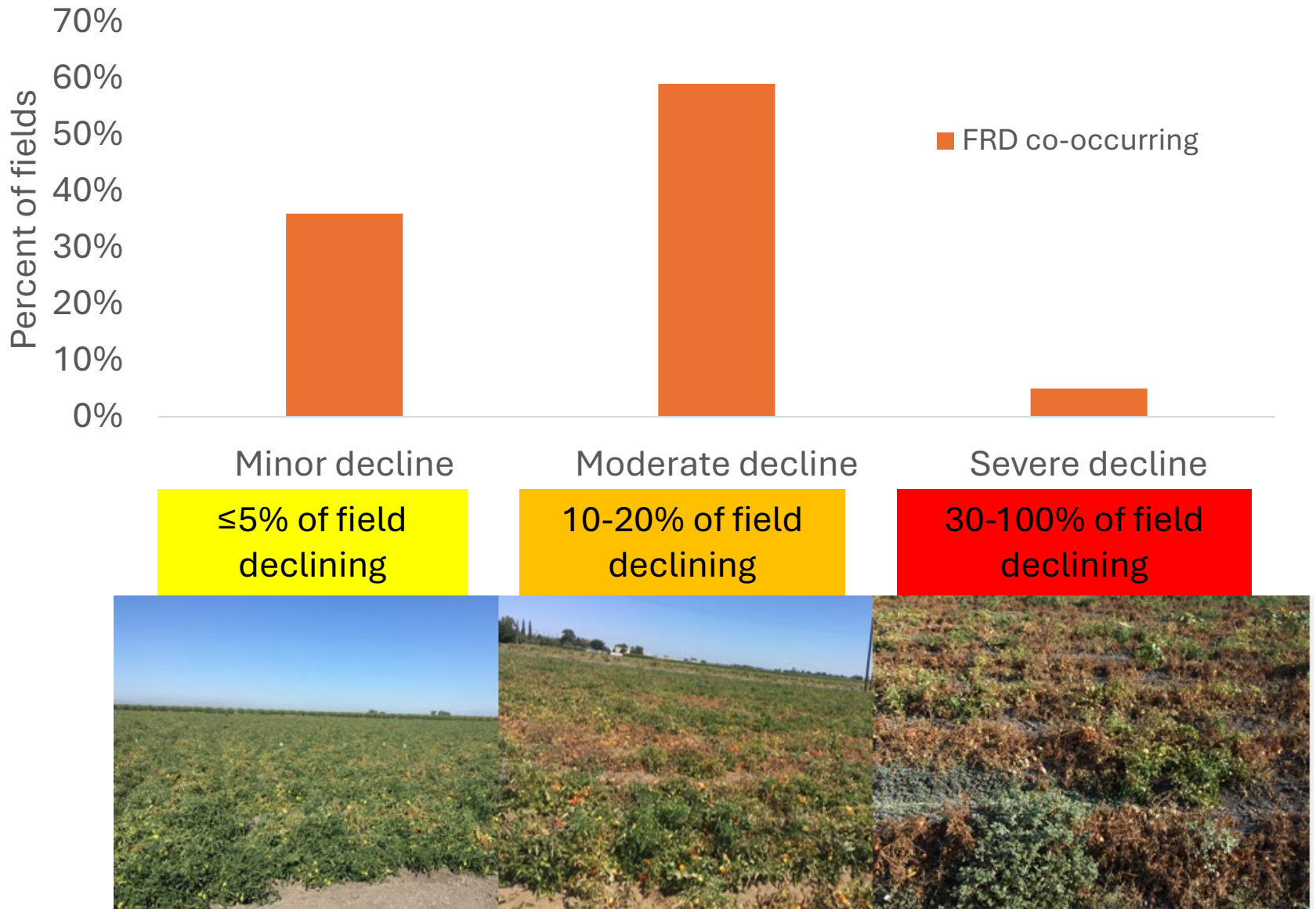
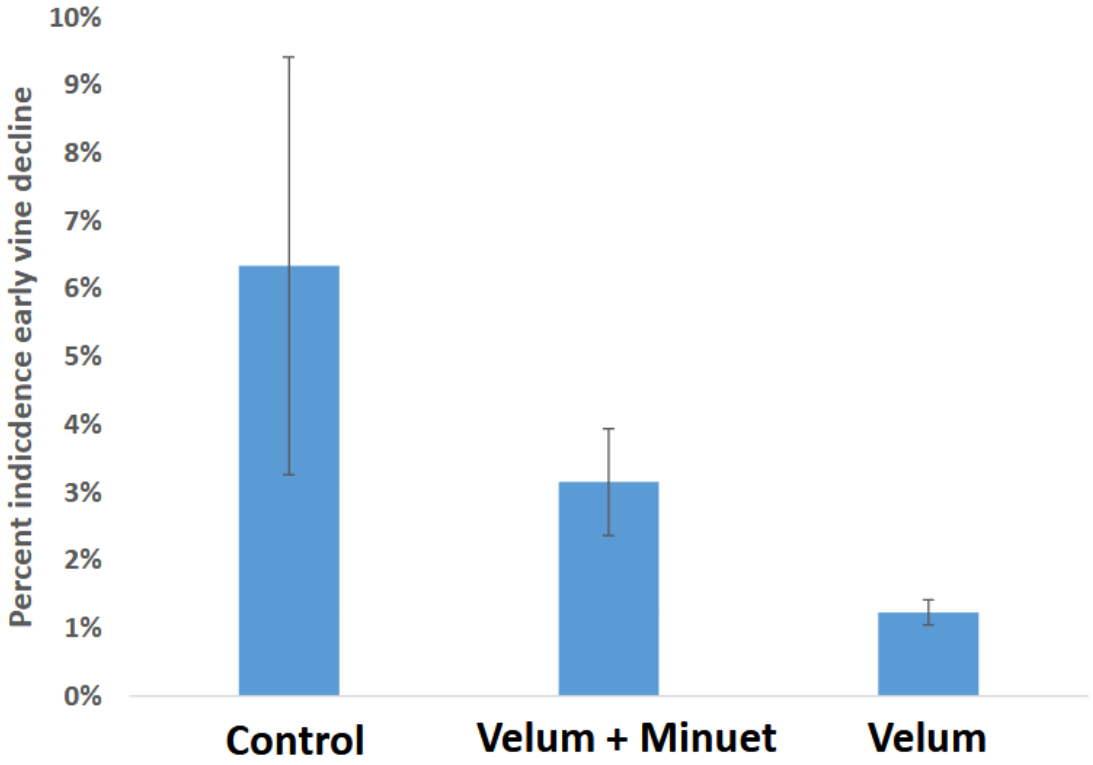


Co-management opportunities: FRD-RKN complex

Velum highly effective against FRD + root knot nematode

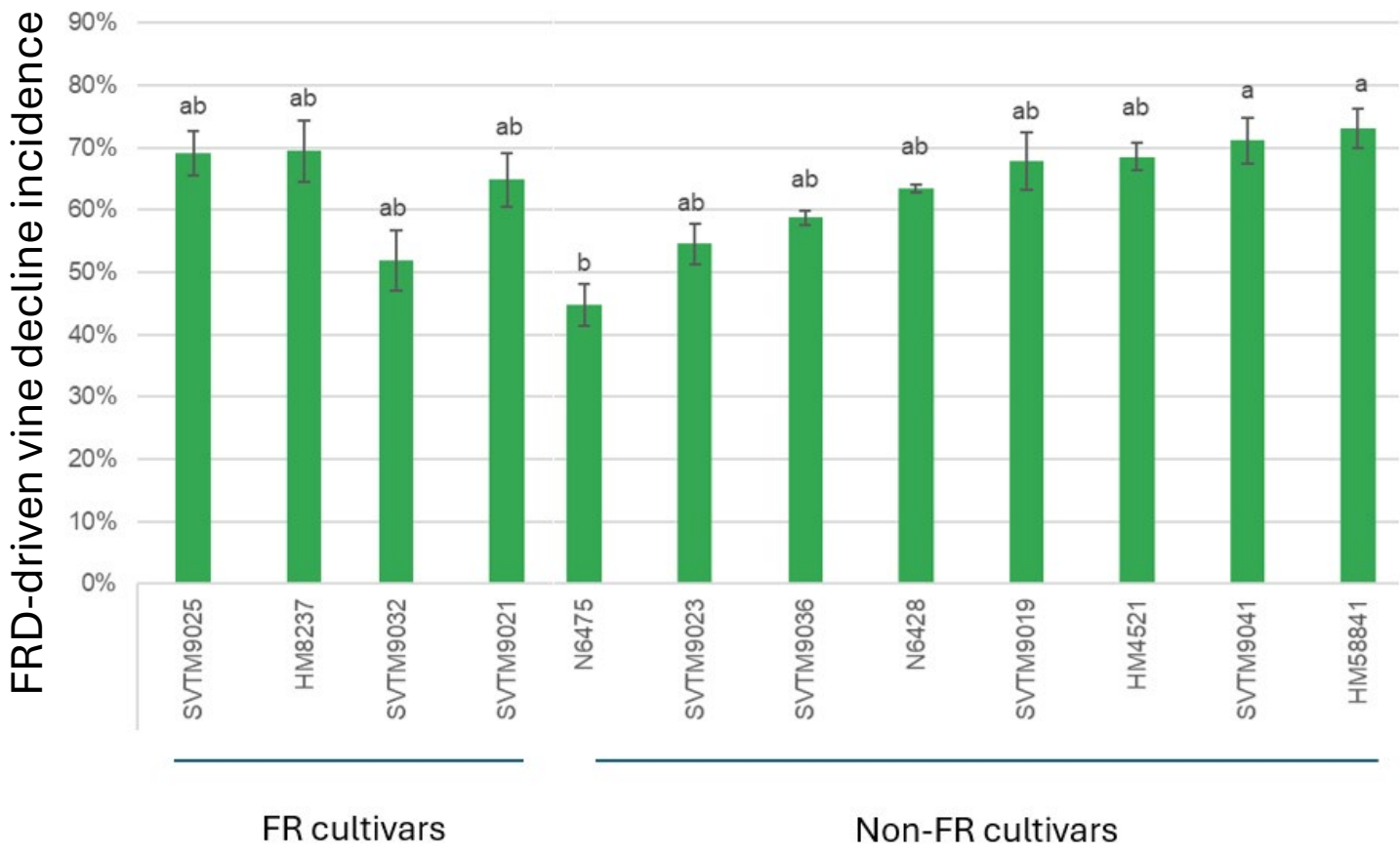
- 75% reduction in vine decline compared to controls (P= 0.06)
- 10 tons/acre yield increase with Velum (69.7 t/ac)

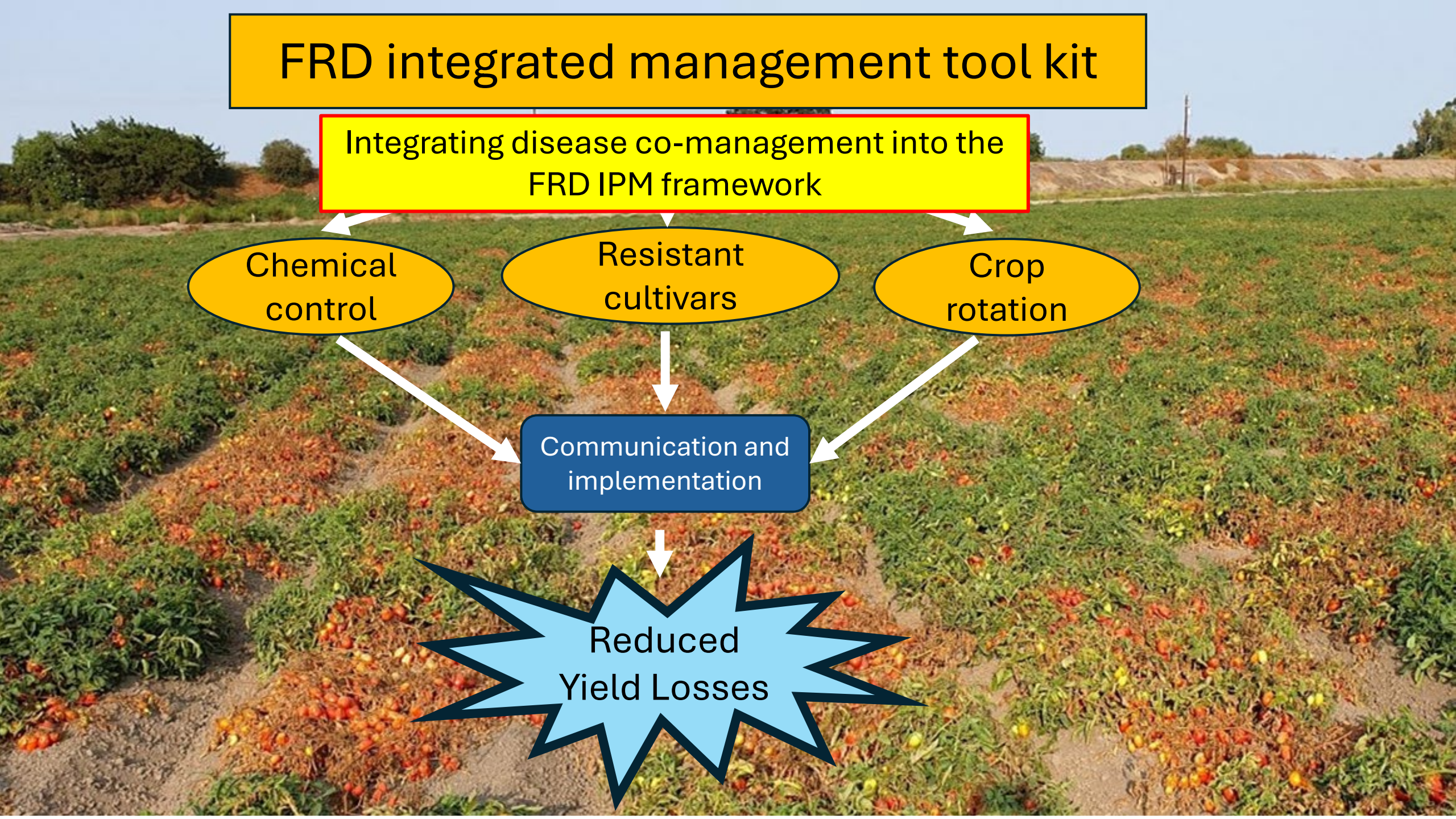


Swett, Hodson and Cook

Co-management opportunities: FRD-FW/FCRR complexs

- Evaluating FRD resistance in cultivars with single gene resistance to other pathogens
  - FW: F3 cultivars
  - FCRR: FR cultivar
- Evaluating performance of Fr and F3 cvs against FRD alone
- And in fields co-infested with both pathogens

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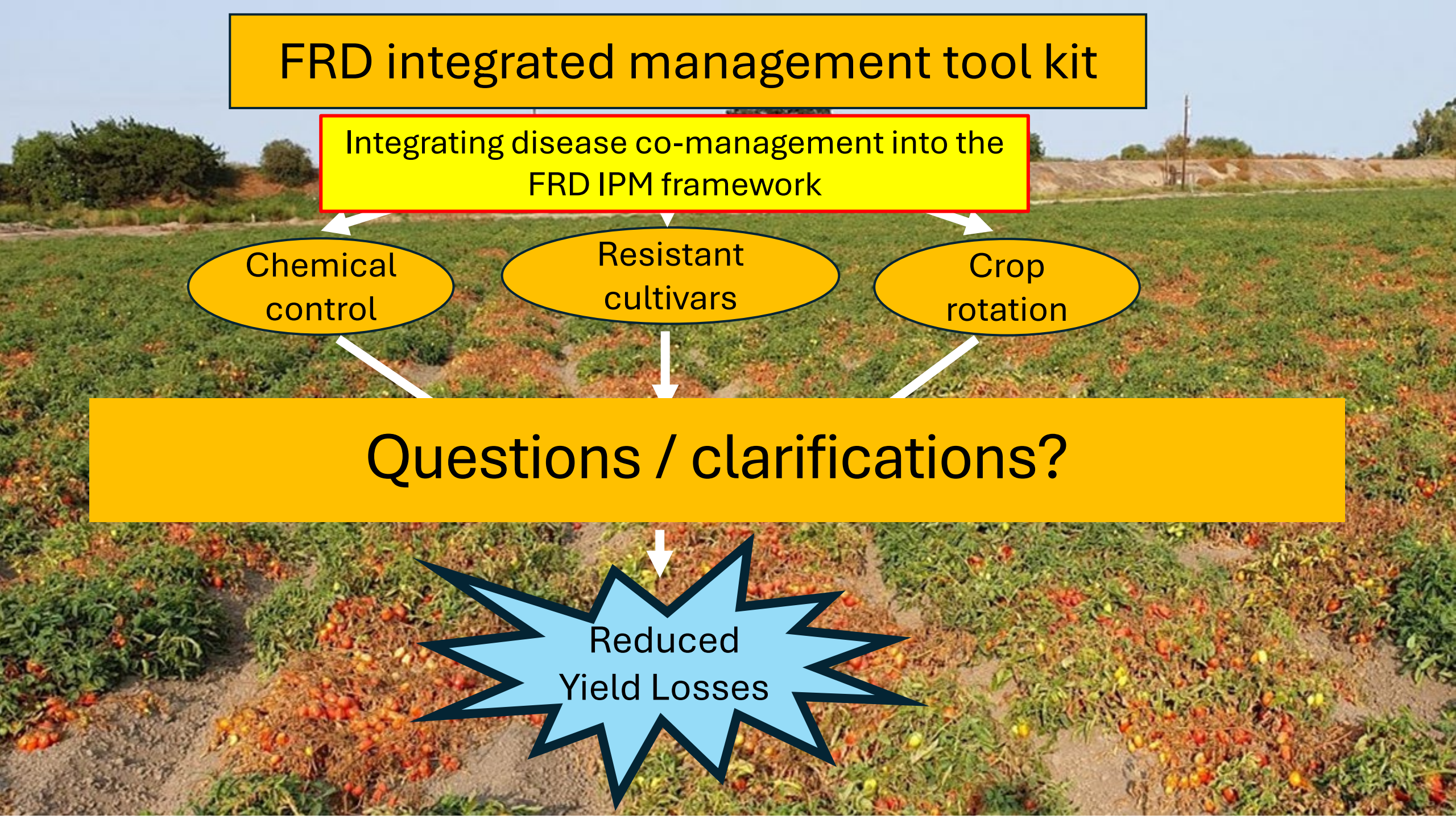
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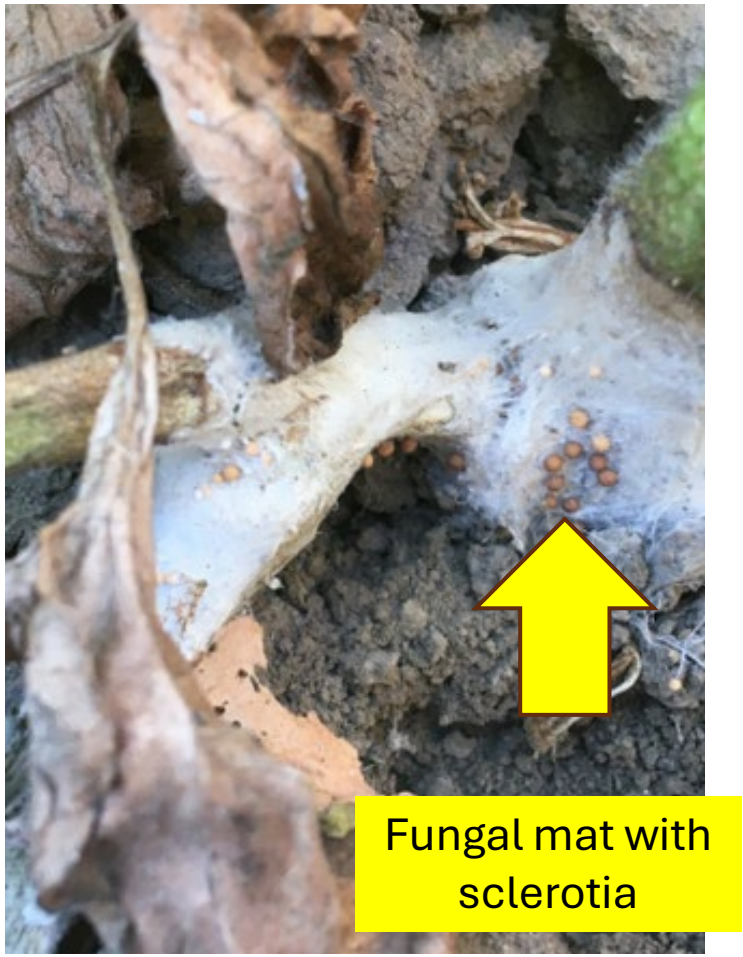
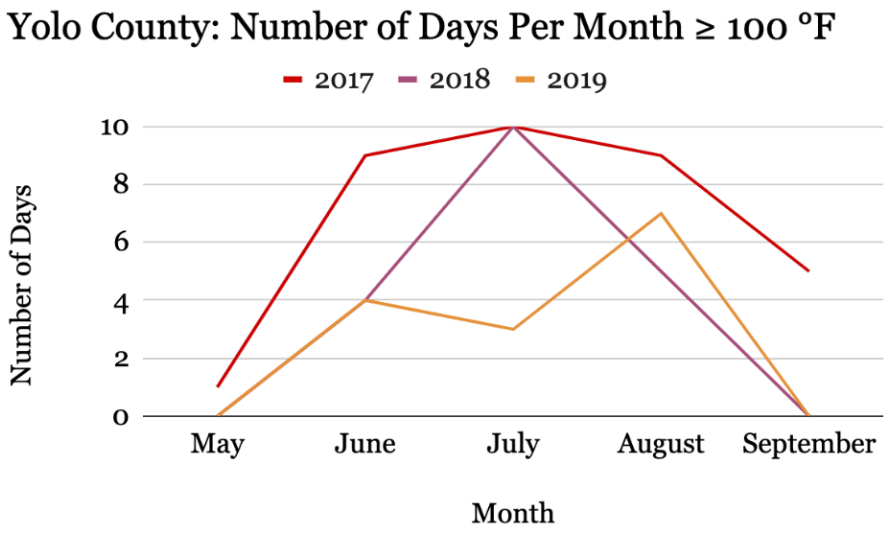
Southern blight in tomato

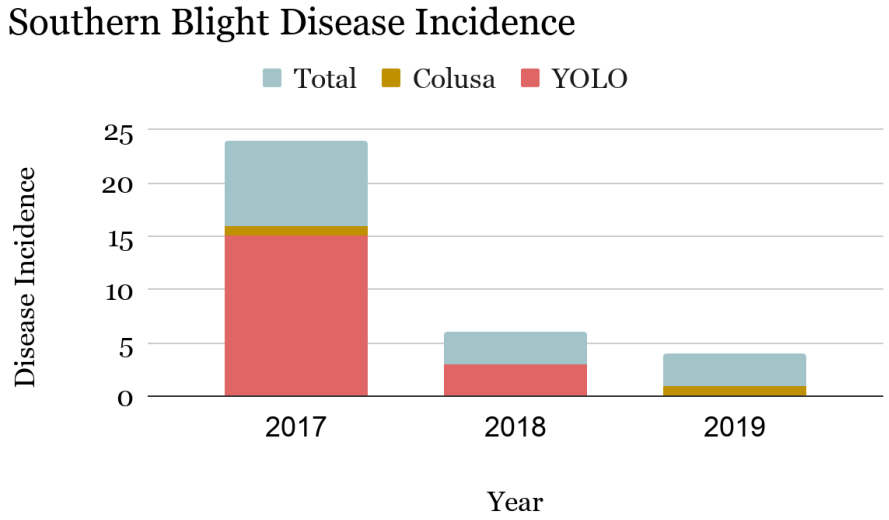
- Southern blight is present in many fields in this region
- Statewide: all counties except Fresno
- Cause stem rot and vine decline
- Commonly see crown covered in white fungal mat (fan)
- Occasionally produce sclerotia (rare)



Heat and moisture triggered disease

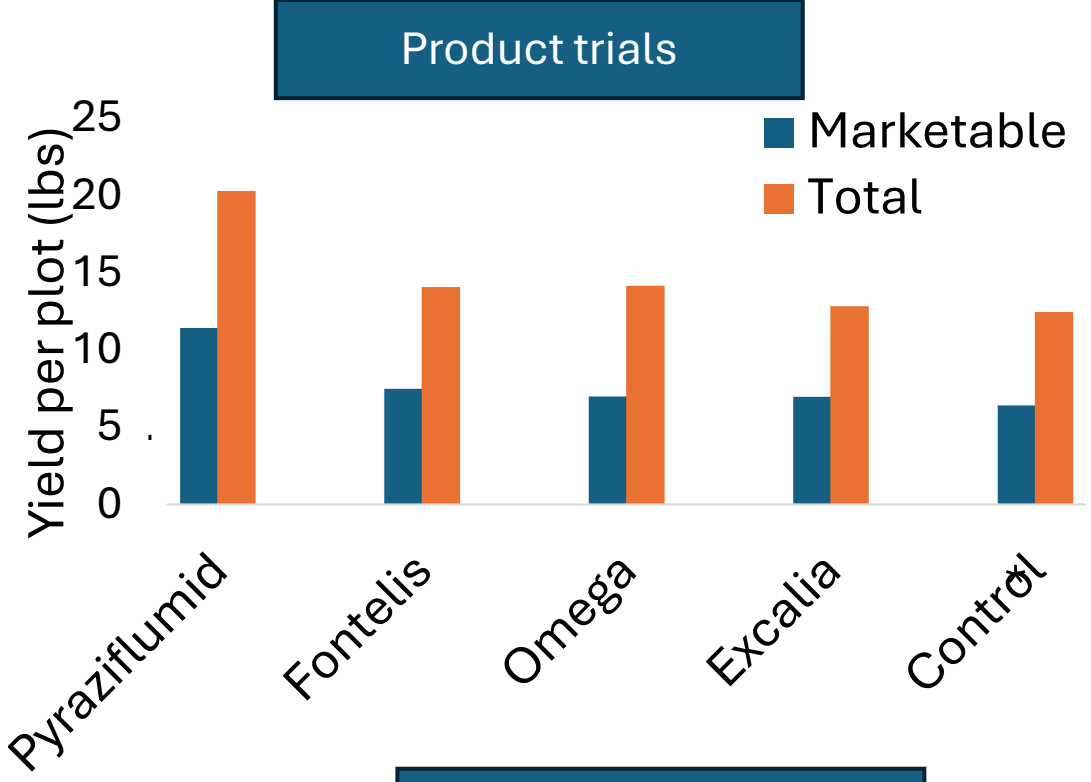
- Bad years correspond with a greater number of days over 100˚F
  - Used to occur rarely in the north (once every ten years)
  - Now seeing every year to every three year
- During heat waves plants are irrigated but can’t take up water
  - Hot mud around the crown
  - Highly conducive to southern blight development

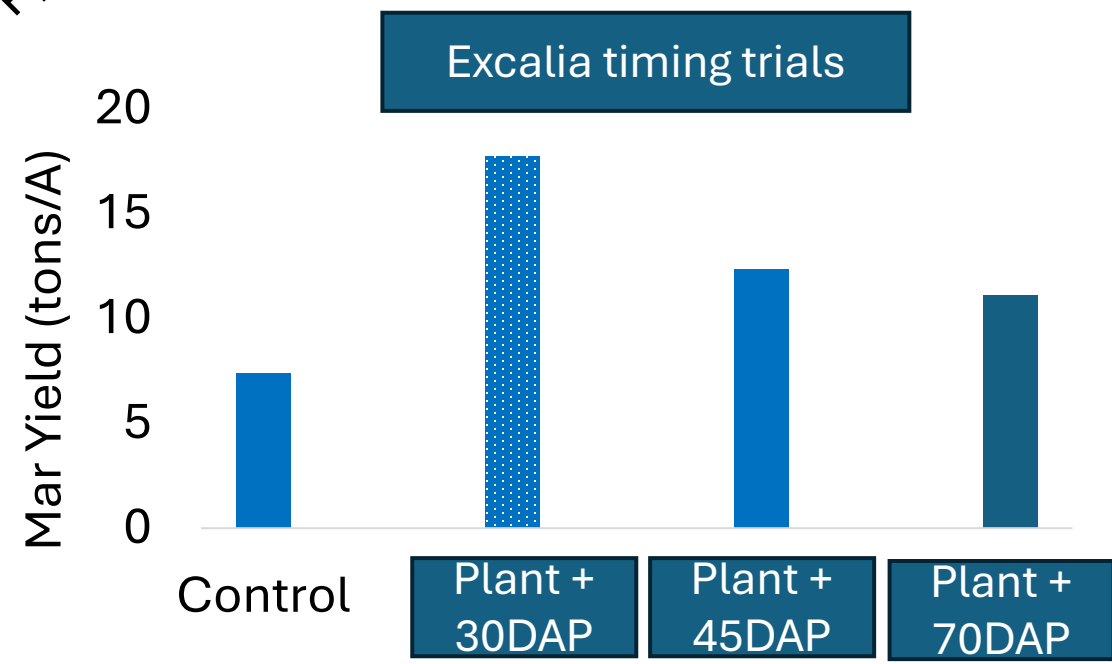




Management options for southern blight in tomato

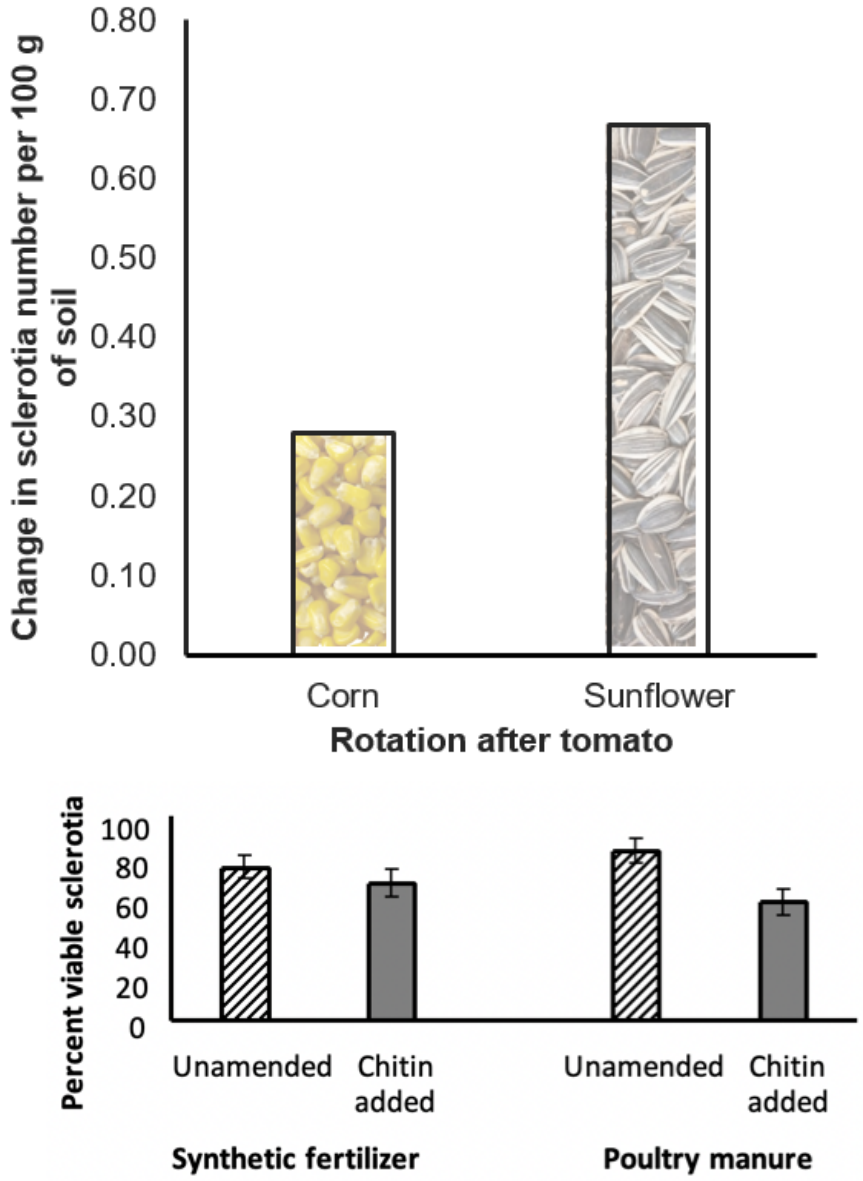
- Crown protection critical
- Chemical treatments pre plant and during the season- Jaspreet Sidhu
  - Chemicals need to canopy to contact the crown
    - Overhead: penetrate canopy
    - Buried drip: apply until surface wetting occurs
  - Applications at planting
    - and 30 days post-planting more effective than later applications
  - Effective product screenings underway
    - Excalia has some promise





Management options for southern blight in tomato

- Irrigation management
  - Drip irrigation reduces disease severity compared to furrow
  - Avoid surface moisture around the crown during heat waves- monitor soil moisture
- Crop rotation with poor hosts like corn
  - Avoid highly susceptible hosts like sunflower
- Soil amendments: chitin (organic)

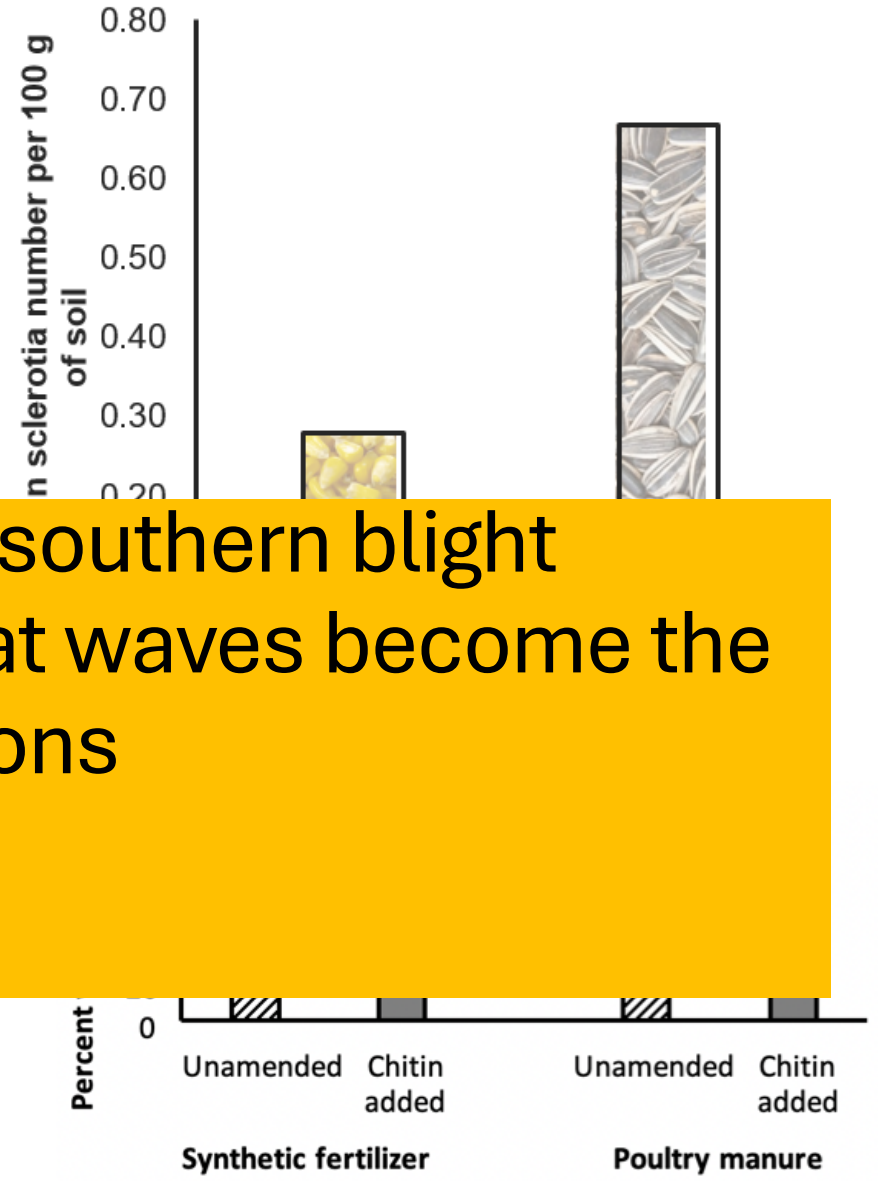


Management options for southern blight in tomato

- Irrigation management

More work is needed to optimize southern blight management in tomato as summer heat waves become the norm in northern regions

Questions?



Management resources

- FRD diagnosis and management
  - UC IMP Pest note in prep + UC IPM tomato disease website
  - Cultivar resources:
  - https://swettlab.faculty.ucdavis.edu/wp-content/uploads/sites/434/2023/07/Falciforme-cultivar-table-2022.pdf

- Southern blight management
  - http://swettlab.faculty.ucdavis.edu/wp-content/uploads/sites/434/2017/09/Southern-Blight-Cliff-Notes-2017.pdf
  - https://swettlab.faculty.ucdavis.edu/wp-content/uploads/sites/434/2024/08/SB-Newsletter-Research-Summary-2020.pdf

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Questions?