Fusarium stem rot and decline (FRD): host range and rotation guidelines

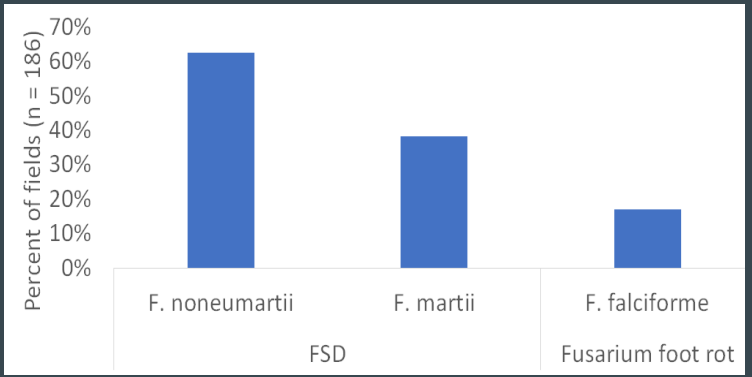
Myles Collinson
PhD Candidate
UC Davis, Department of Plant Pathology

Under the guidence of Cassandra Swett

Fusarium Stem Rot and Decline (FRD) in Processing tomato

- Soil borne Fusarium disease causing foot, crown, and stem rot, and severe canopy chlorosis, necrosis, and collapse
- Up to 30% plant decline at harvest in infested field surveys
- In controlled trials, over 25% reduction in marketable fruit (depending on cultivar)
- Management strategies needed

- FRD is driven by two pathogens: *F. noneumartii* and *F. martii*
- Closely realted to *F. falciforme ss* (causal agent of foot rot)



Fusarium Solani Species Complex (FSSC)

Fusarium martii

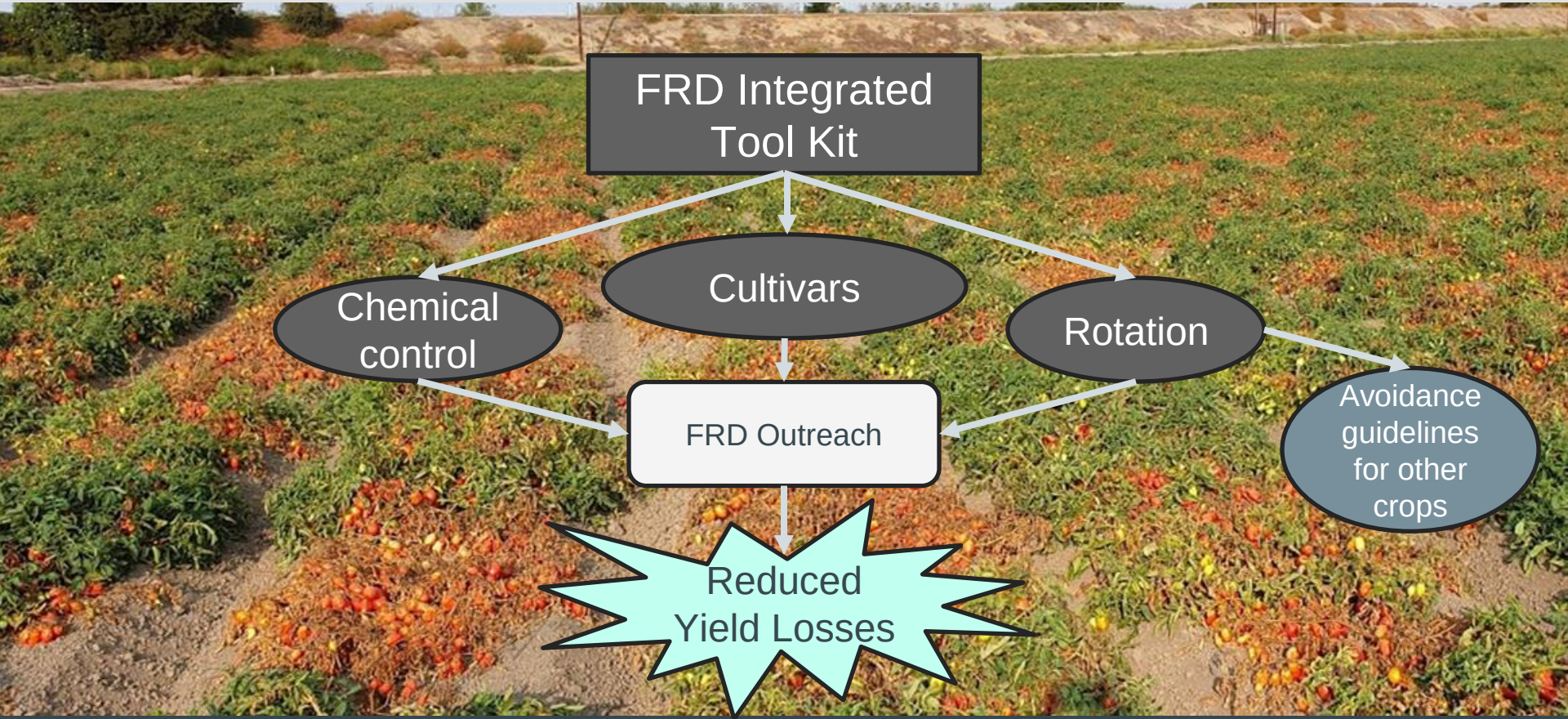
Fusarium noneumartii

Fusarium falciforme ss

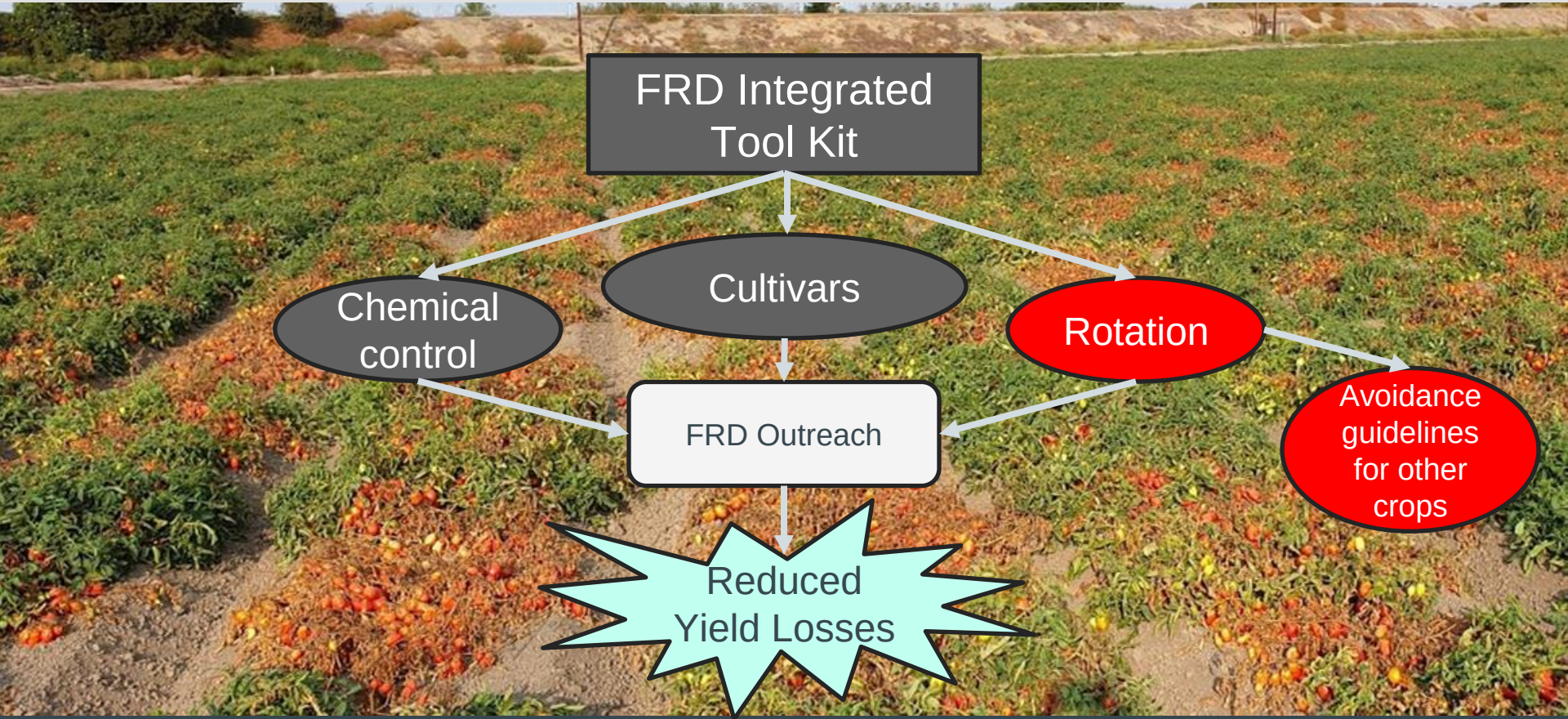
Fusarium Stem Rot and Decline (FRD)

Fusarium Foot Rot

Overall Goal: Developing an effective integrated toolkit for FRD *(F. noneumartii, F. martii)* in processing tomato



Overall Goal: Developing an effective integrated toolkit for FRD *(F. noneumartii, F. martii)* in processing tomato



FRD Host range studies

- Over the last 3 years, tested 26 crops in greenhouse and field host range trials
- Focused on *F. noneumartii*
- Identified crops that are severely affected (plant decline, death), mildly affected (mild rot, no canopy symptoms), and non-hosts

Family	Crop	Season
Amaryllidaceae	Garlic	Cool
	Onion	Cool
Apiaceae	Carrots	Cool
	Cilantro	Cool
	Parsley	Cool
Asteraceae	Safflower	Warm
	Sunflower	Warm
Brassicaceae	Broccoli	Cool
	Cabbage	Cool
Cannabaceae	Hemp	Warm
Convolvulaceae	Sweet Potato	Warm
Cucurbitaceae	Melon	Warm
	Pumpkin	Warm
Fabaceae	Alfalfa	Cool
	Fava bean	Cool
	Garbanzo	Cool
	Kidney bean	Warm
	Vetch	Cool
Malvaceae	Cotton	Warm
Poaceae	Barley	Cool
	Corn (field)	Warm
	Rice	Warm
	Wheat	Cool
Solanaceae	Bell pepper	Warm
	Potato	Warm
	Tomato	Warm

F. noneumartii host range studies

Cilantro

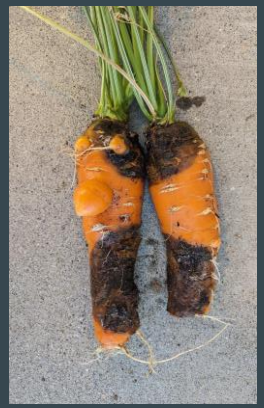
Carrot

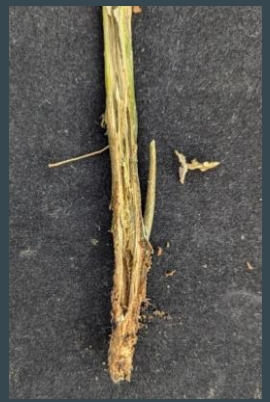
Potato

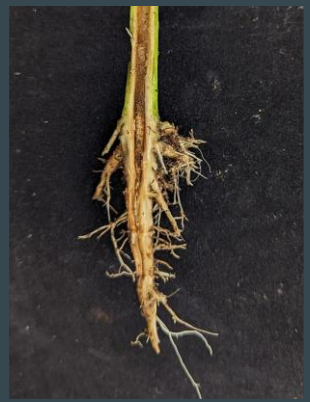
Sunflower

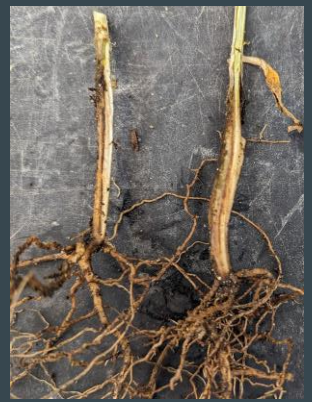
Safflower

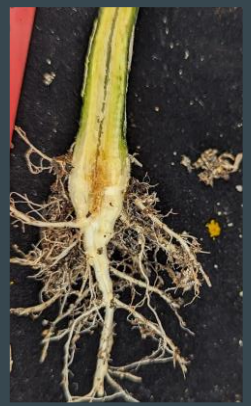
Pumpkin





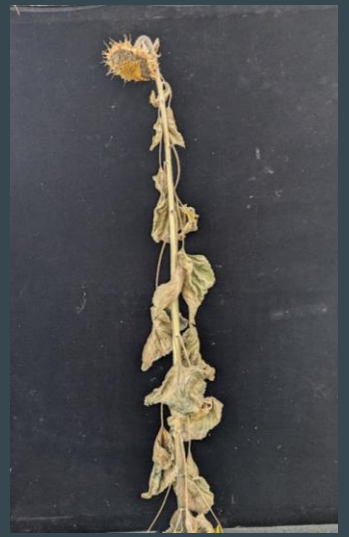






F. noneumartii host range – Avoidance recommendations

- Severe hosts (may develop economic losses)
  - Potato, pepper, cilantro, carrot, sunflower (depends)
- Mild hosts (no losses, but could still increase soil inoculum)
  - Sunflower (depends), 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



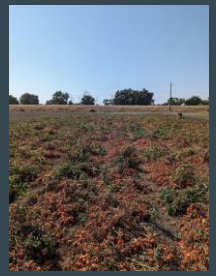
FRD Rotation Guidelines

- Controlled rotation studies to develop rotation guidelines for FRD management
- Ran warm (summer) and cool (winter) trials testing a selection of host and non host crops
- Compared to chemical fallow as a baseline
- Also ran multi-year commercial rotation surveys in grower fields

Summer rotation

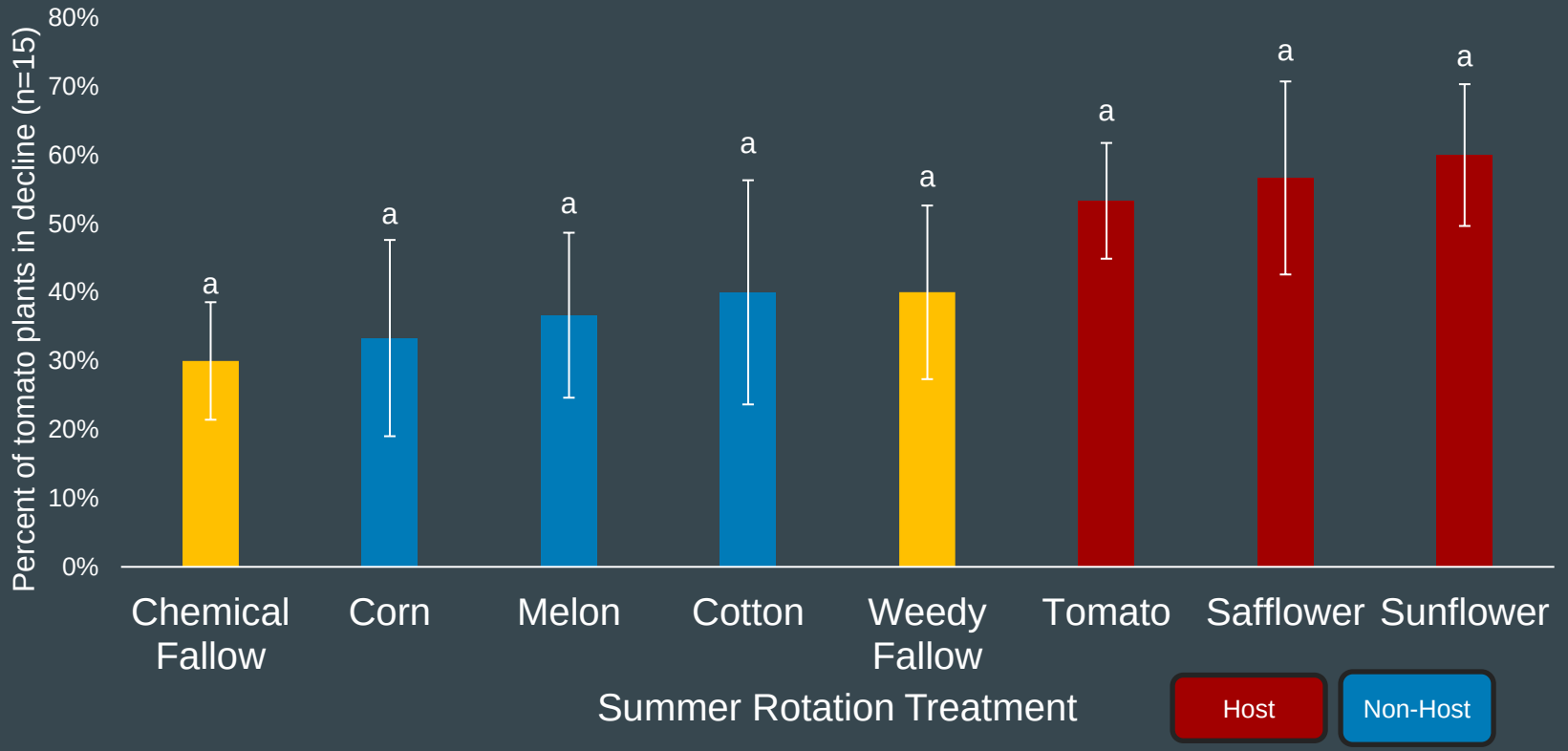
Winter rotation

Controlled warm season rotation trials - 2022 and 2023

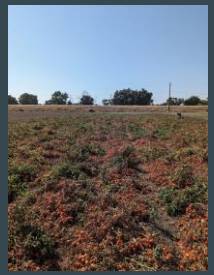


Data taken pre harvest

Averaged across the two years we ran this etrial



Controlled cool season rotation trials



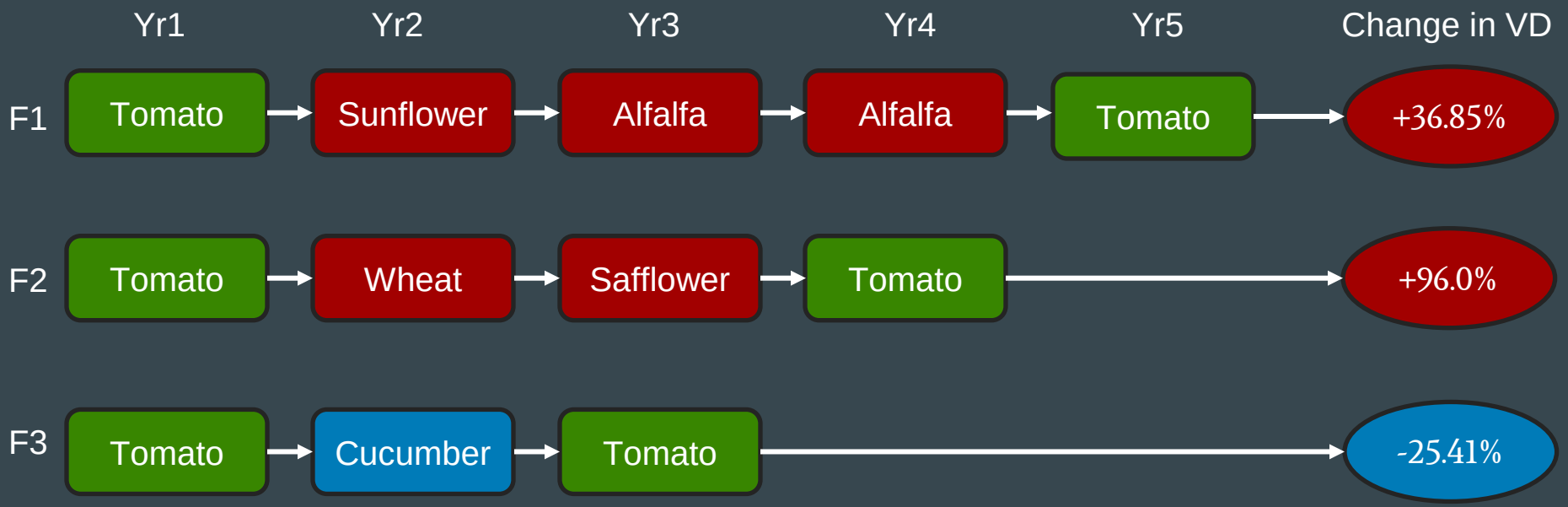
Data taken at harvest

Tukey's Test, P<0.05

Multi-year rotations in commercial survey

High Disease Risk Rotation

Low Disease Risk Rotation



Studies have focused on *F. noneumartii*

Thus far studies have focused on *F. noneumartii* but *F. martii* is also an economically important pathogen

Investegating *F. martii* host range

Fusarium Falciforme Species Complex (FFSC)

Fusarium martii

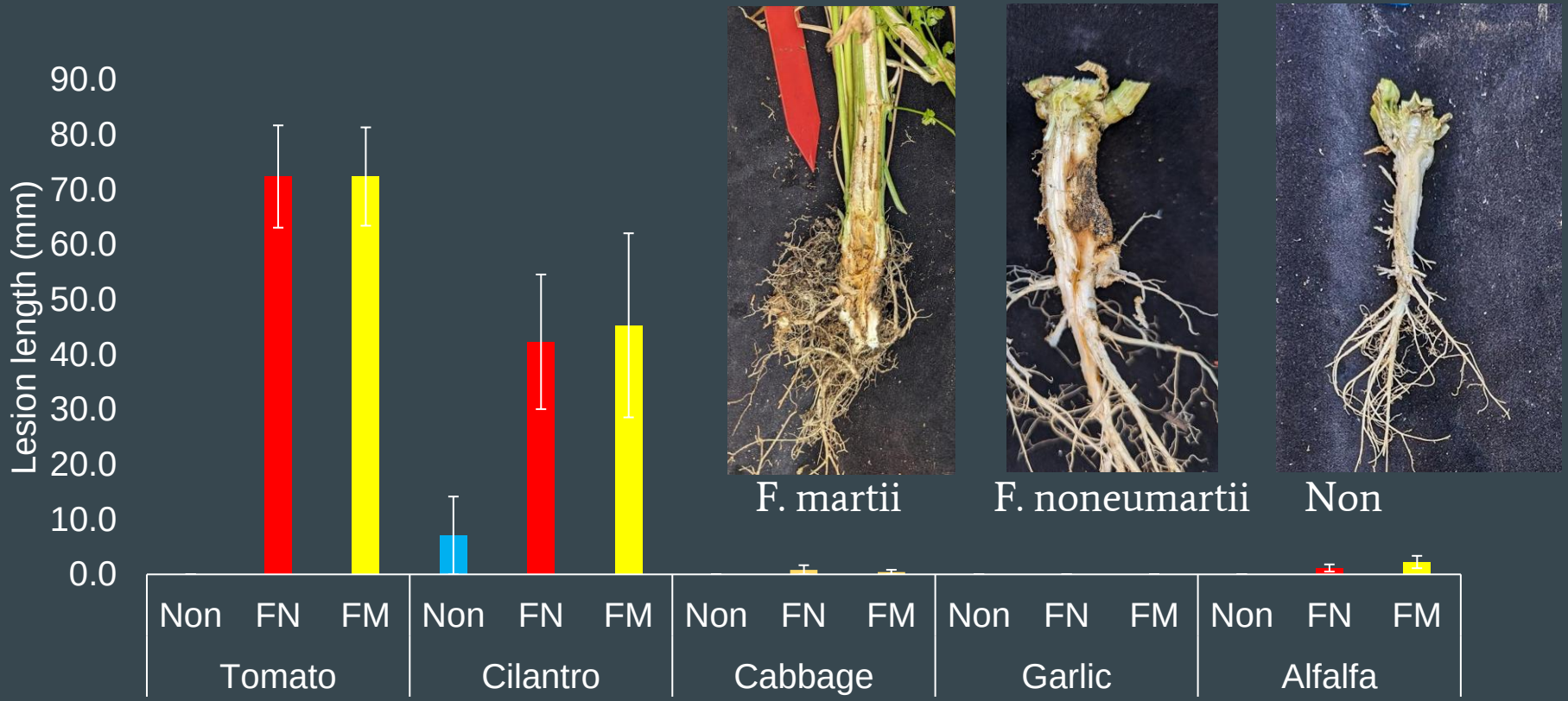
Fusarium Stem Rot and Decline (FRD)

Fusarium noneumartii

Fusarium falciforme ss

Fusarium Foot Rot

F. noneumartii vs *F. martii* host range



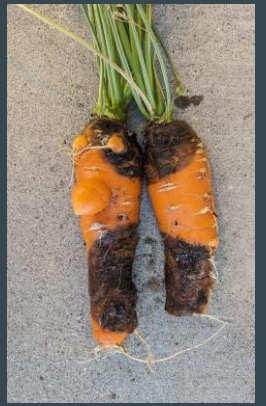
F. noneumartii vs *F. martii* host range

Non *F. martii* *F. noneumartii*

Non *F. martii* *F. noneumartii*

Take Homes

- Crop choice **is** important under FRD pressure
  - FRD affects crops other than tomato
  - There are crops (cilantro, carrot, potato..) that should **not** be planted in a field with FRD – could experience an economic loss
  - Crop choice influences disease level in tomato in subsequent years (ie rotation)
    - In warm season crops, host status is predictive of rotation risk
    - In cool season crops, host status is less predictive, indicating other factors at play
    - Studies on going to investigate other factors influencing rotation risk



- So far, *F. martii* and *F. noneumartii* appear to have similar host ranges and could be managed with the same rotation strategies
  - Work needs to be repeated and expanded to wider range of crops to confirm this

Thank you! Questions?

DEPARTMENT OF PLANT PATHOLOGY
UC DAVIS

WESTERN SARE
Sustainable Agriculture Research & Education

AgSeeds UNLIMITED

California Tomato Research Institute