Dangers Abound
Protecting Connecticut Strawberries from Invasive Fungal Pathogens

Nate Westrick, PhD

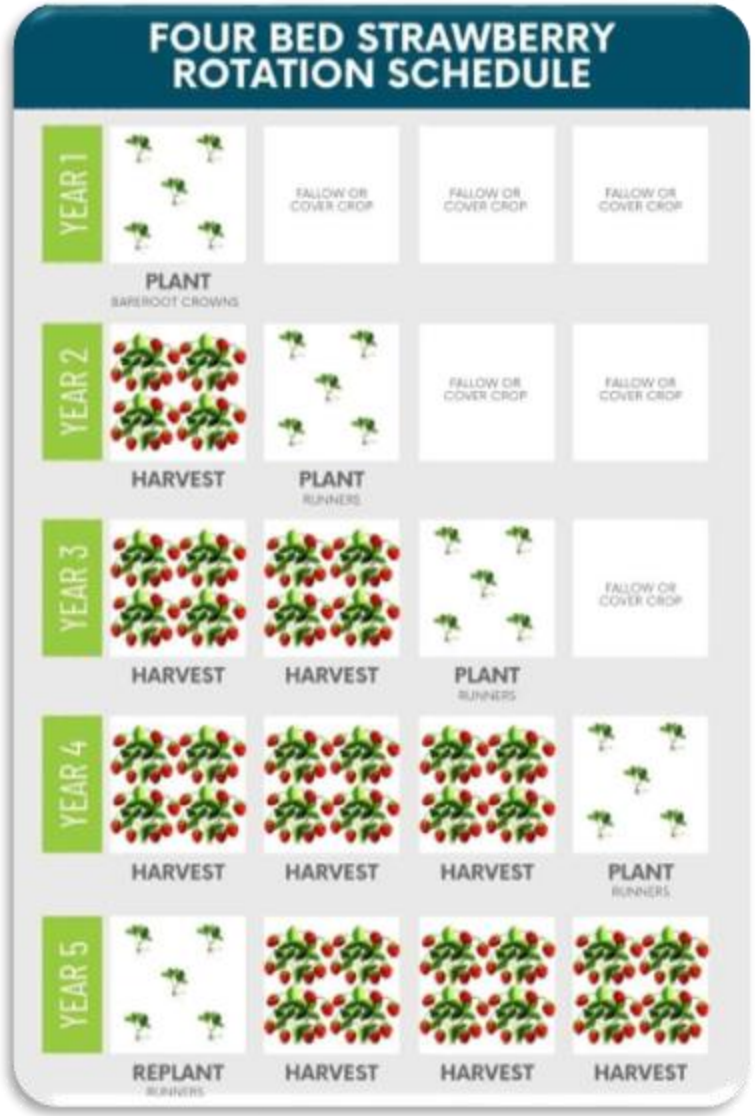
CT Fruit and Veg Seminar 01/07/2025

My Role as a Plant Pathologist with CAES (Connecticut Agricultural Experiment Station)

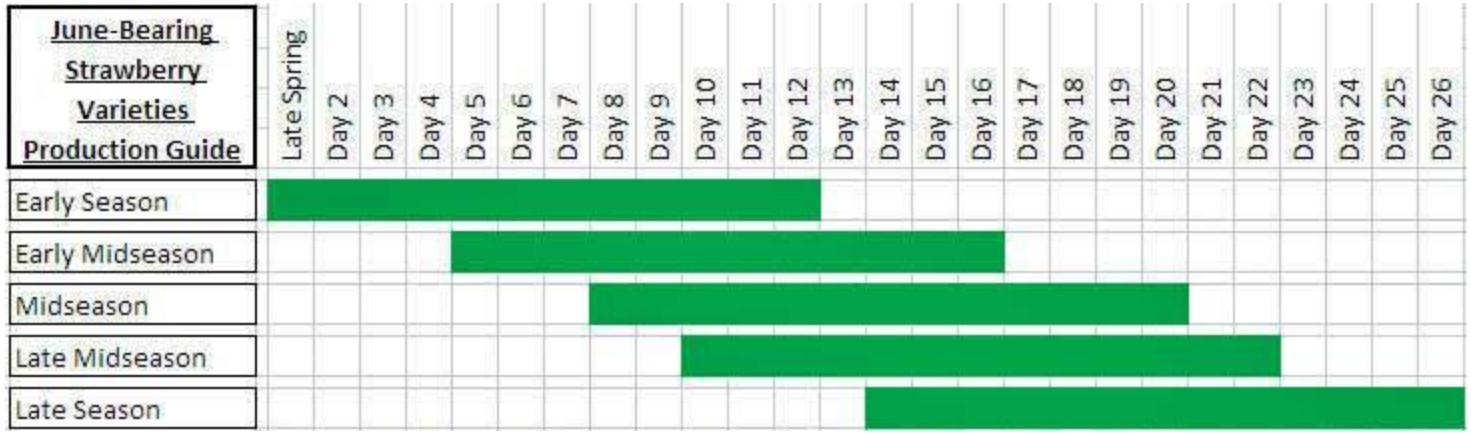
- Lab at the Valley Laboratory (Windsor, CT)
  - In-house soil and disease diagnostics
- Mixed appointment (Basic and Applied Research)
- Applied research on major crops in CT
  - Strawberry
  - Grapes
  - Tobacco

Strawberry School – How are they grown?

- Typically a multi-year, perennial crop in the Northeast
- Variety selection must be balanced to ensure consistent harvest



Strawberry Harvest Calendar



Strawberry School – How are they grown?

- Typically a multi-year, perennial crop in the Northeast
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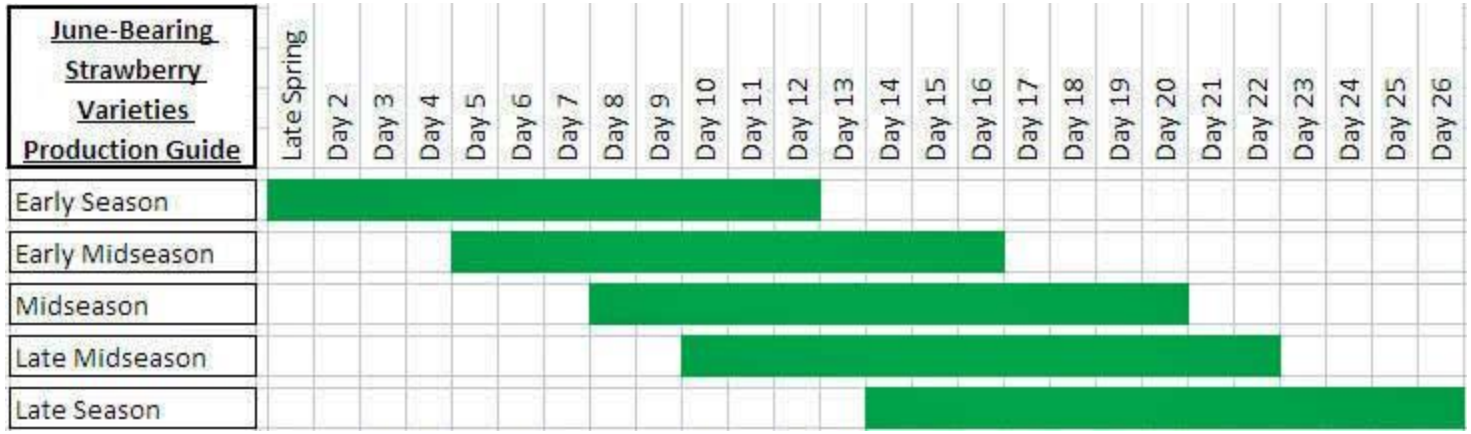
Types of Strawberry

Day Neutral
- Moderate production throughout the summer
- Uncommon in the Northeast

June-Bearing
- High yielding for ~2-weeks
- Large majority of the strawberries grown in our region

Strawberry Harvest Calendar



New Invasive Fungal Pathogens

Fusarium Crown Rot

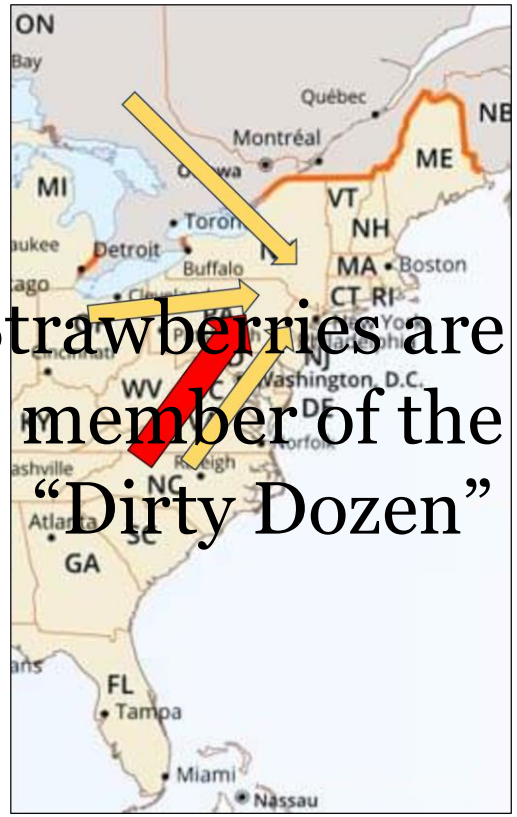
Fusarium oxysporum

Neopestalotiopsis Petiole Blight

Neopestalotiopsis spp.

Anthracnose Crown Rot

Colletotrichum spp.



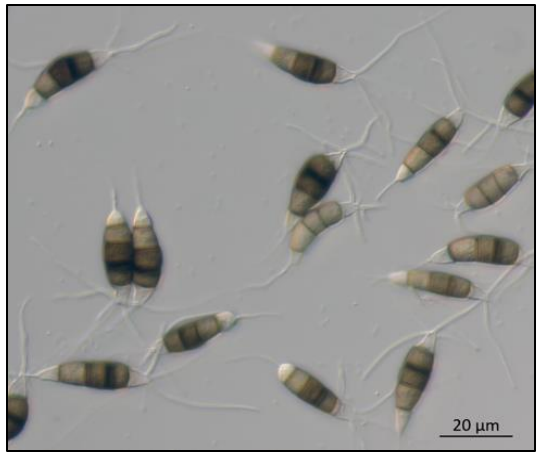
Strawberries are a member of the "Dirty Dozen"

Likely route of introduction for *C. siamense*

Possible routes of introduction for *N. rosae*

New Invasive Fungal Pathogens - *Neopestalotiopsis*

- Emerging fungal pathogen of strawberries (initially a problem in the south)
- **Lots of industry news coverage**
- Has been reported in growing regions from Mexico through Canada
- Causes noticeable foliar spots, but can progress to lesions on petioles and crowns which may lead to mortality

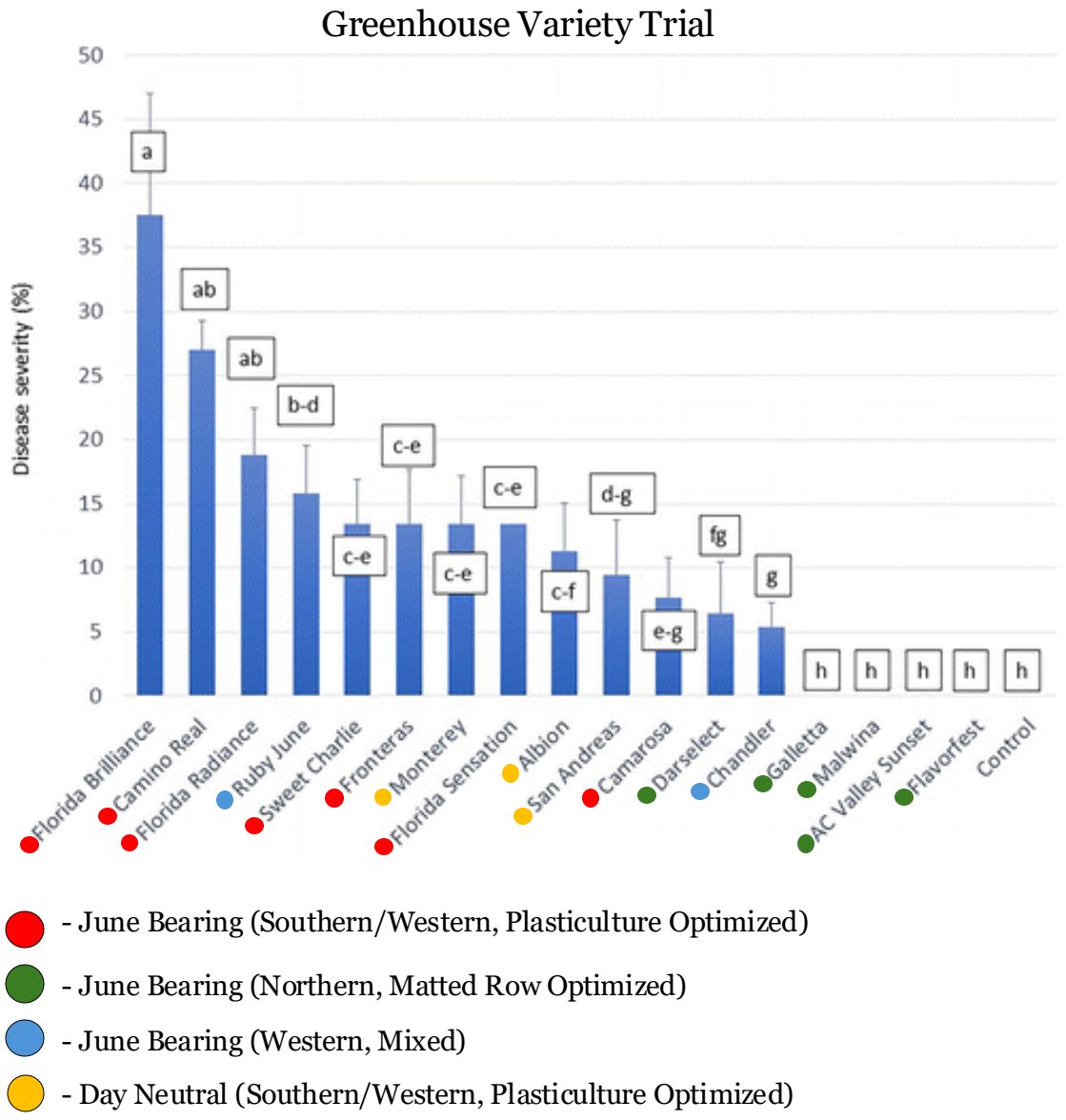


Neopestalotiopsis spores

Disease symptoms on CT strawberries

New Invasive Fungal Pathogens - *Neopestalotiopsis*

- Appears to be largely a problem on “Southern” varieties
- Major outbreaks in Connecticut and Michigan have been on Ruby June, an unusually susceptible variety for our region
- Most common “Northern” June Bearers appear quite tolerant to the disease



Guan et al. 2023

The Collapse of a Strawberry Field – Anthracnose Crown Rot (ACR)

- Fungal disease common to the Southeastern US
- First identified in Connecticut in 2022
- Very, very bad

Healthy

Early Infection

Late Infection

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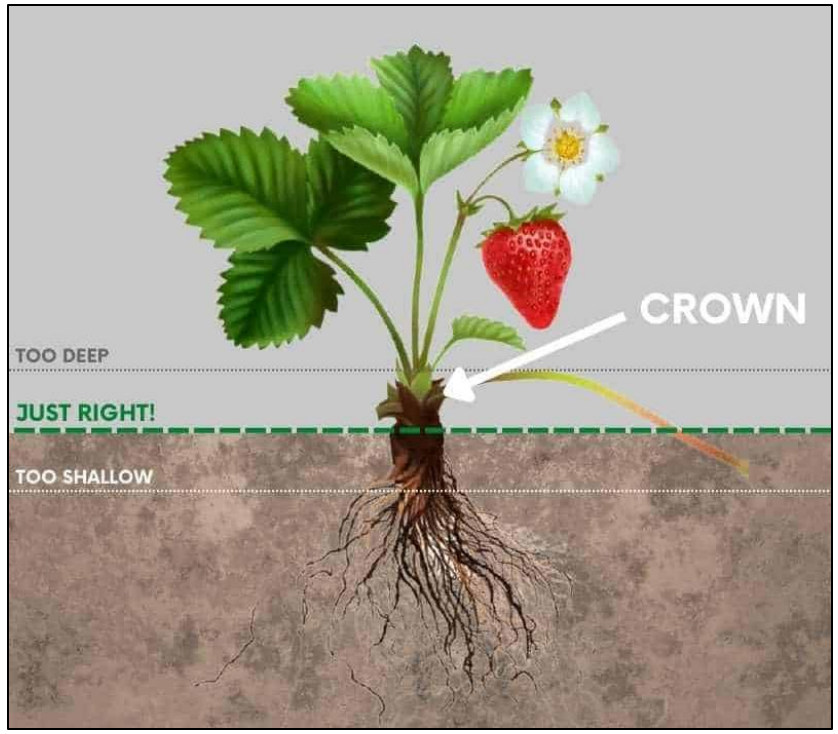


Healthy Crown

ACR Crown

Steps to Effective IPM

Identify

Proper identification of pests and monitoring their activity.

Prevent

Implement preventive measures to reduce pest incidence.

Control

Use environmentally sensitive control methods as needed.

Evaluate

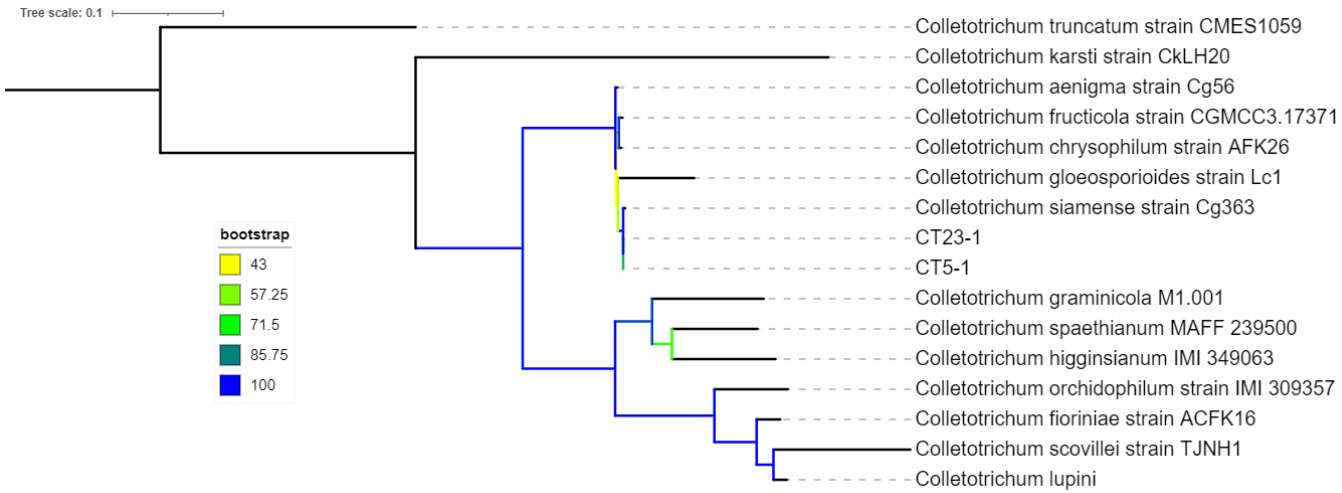
Regularly assess the effectiveness of the IPM strategies.

Educate

Inform and train staff and the public about IPM practices.

Characterizing the ACR Pathogen

- Identified through sequence and morphology as *Colletotrichum siamense*
- *C. siamense* is the dominant source of ACR in the southern United States
- First report of this pathogen in New England



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Waltham Pest Control
https://www.walthampestcontrol.com

Preventing ACR – Preplant Fungicide Dips

Control

Inoculated

1) Dormant, bare root strawberries inoculated with *C. siamense* spores

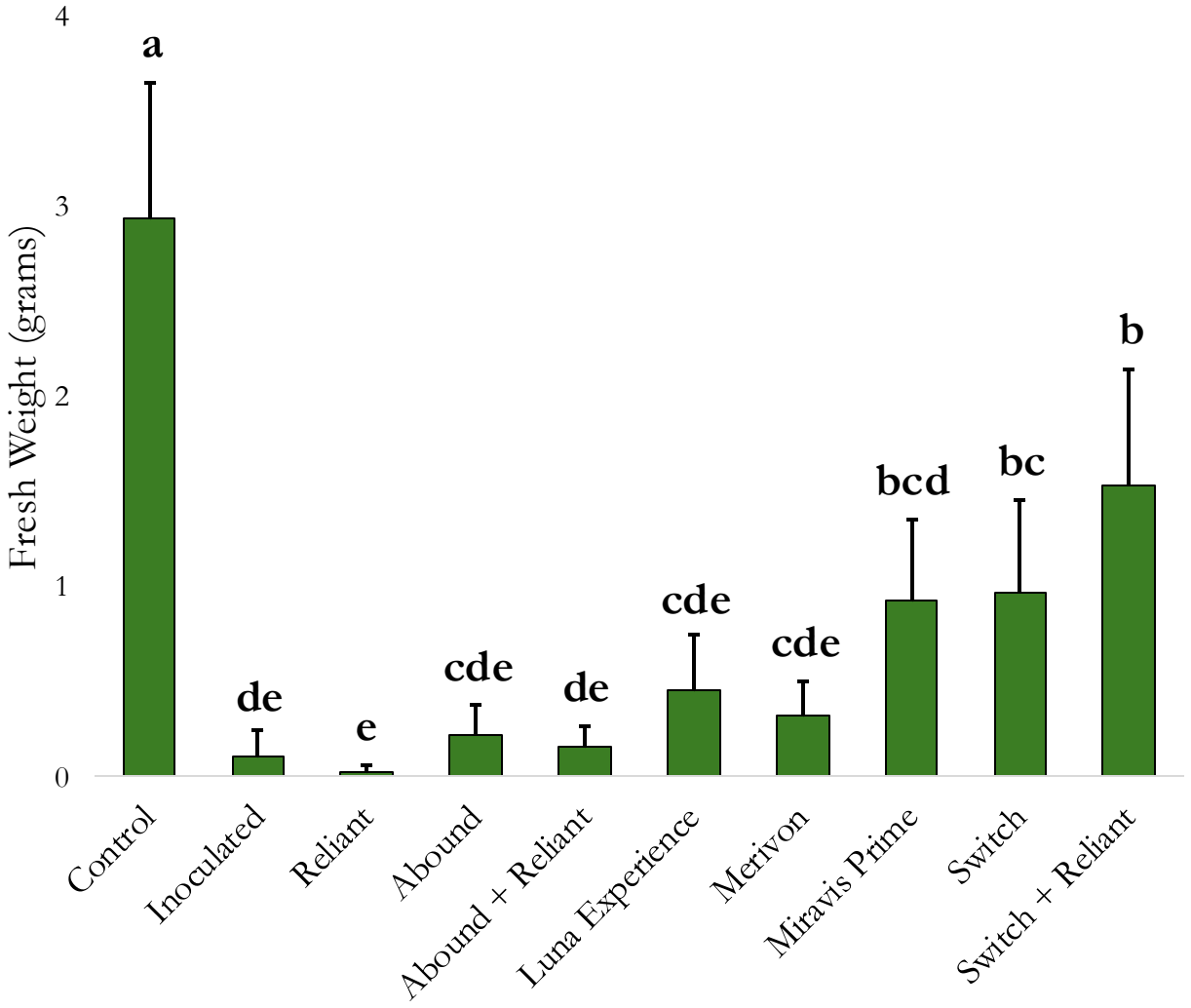
2) Incubated for 48 hours to allow for colonization

3) Treated with commercially available fungicides and grown out for 1 month

Preventing ACR – Preplant Fungicide Dips

Fungicide	FRAC
Reliant	P07
Abound	11
Abound + Reliant	11 + P07
Luna Experience	7/3
Merivon	7/11
Miravis Prime	7/12
Switch	9/12
Switch + Reliant	9/12 + P07

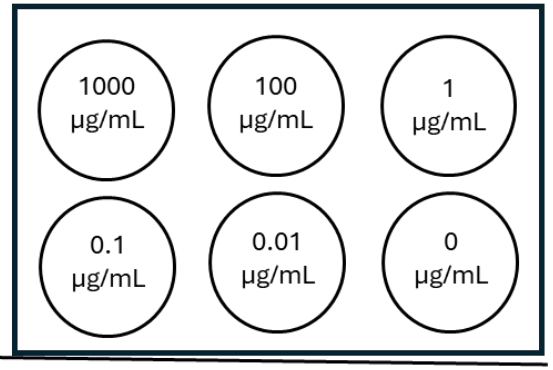
Treated Plants



Preventing ACR –Fungicide Resistance

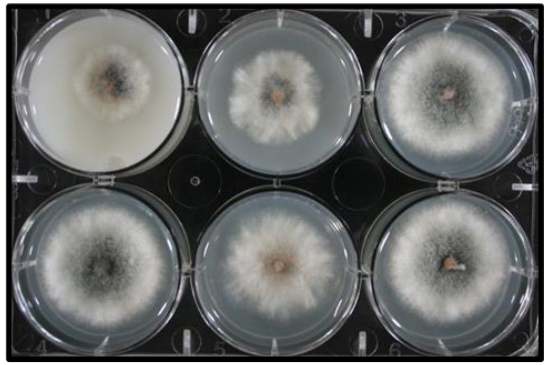
A

x µg/mL Azoxystrobin
+ 0.5 mM SHAM



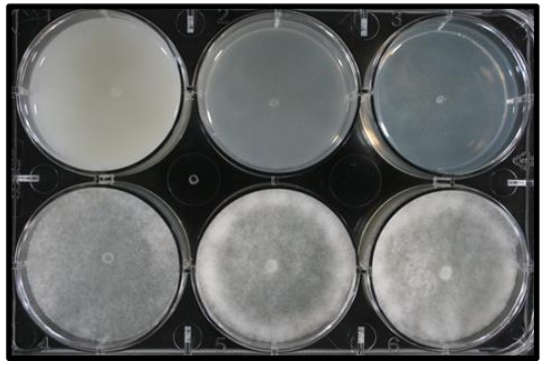
B

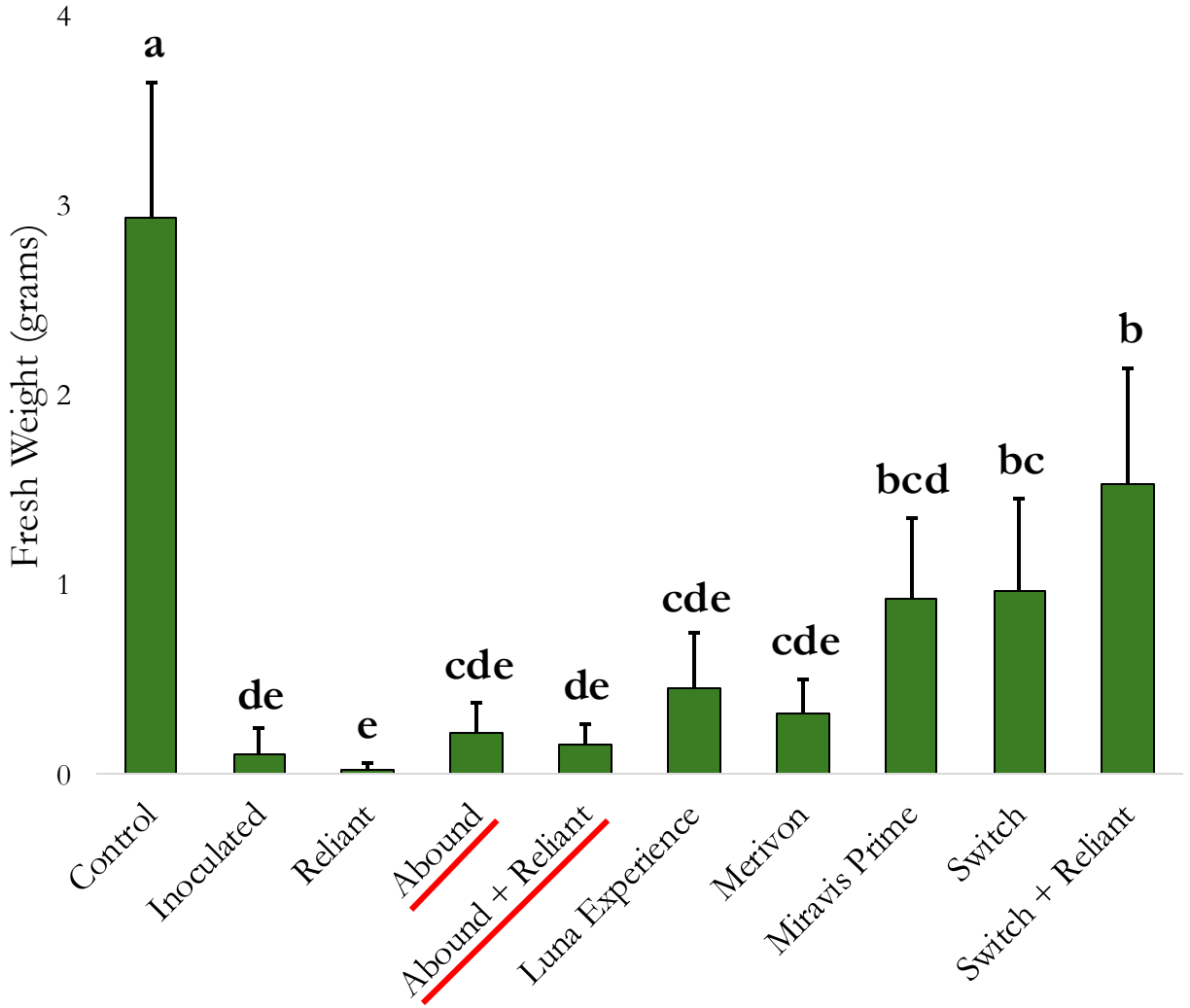
Colletotrichum siamense



C

Sclerotinia sclerotiorum





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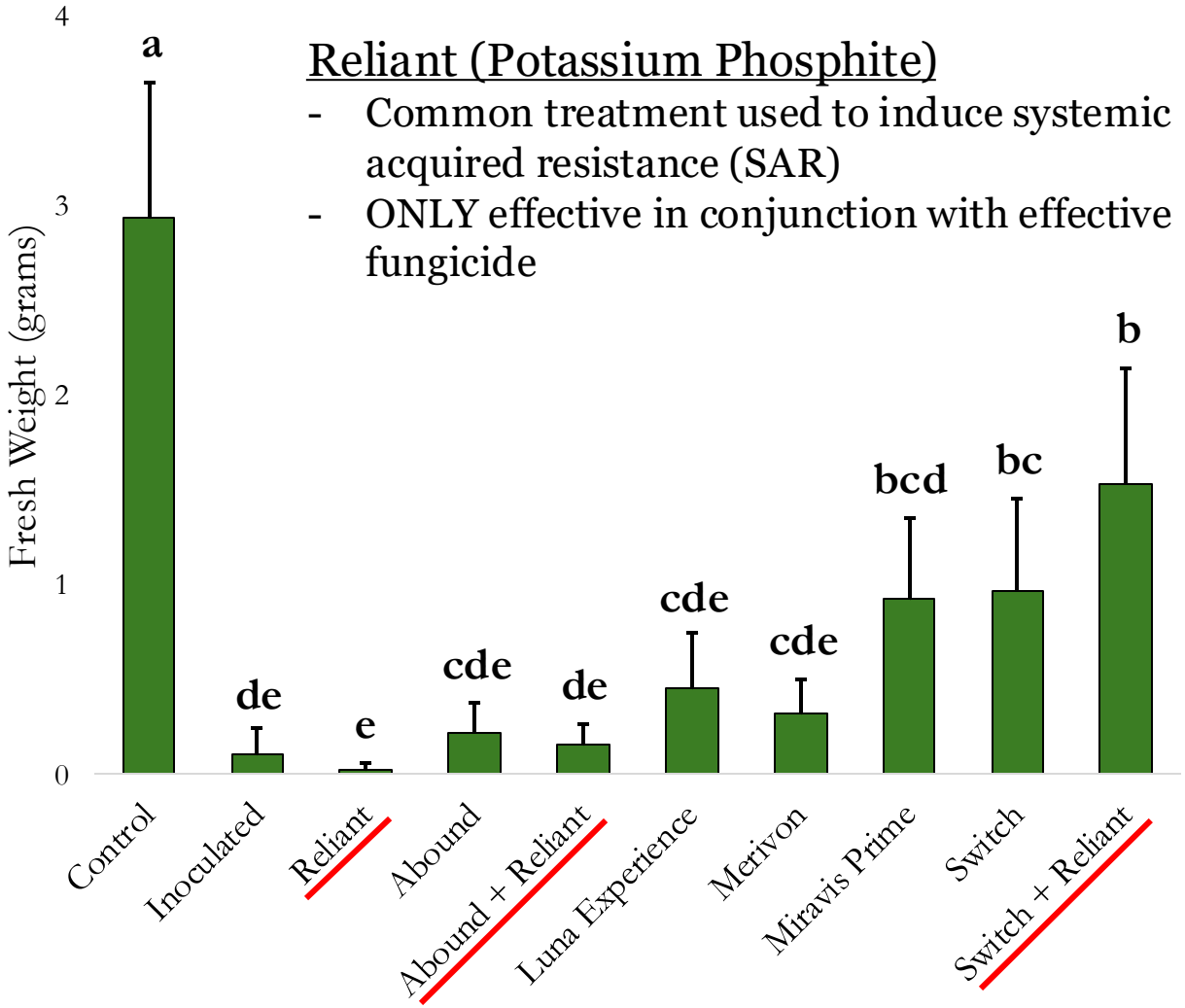

Reliant (Potassium Phosphite)

- Common treatment used to induce systemic acquired resistance (SAR)
- ONLY effective in conjunction with effective fungicide

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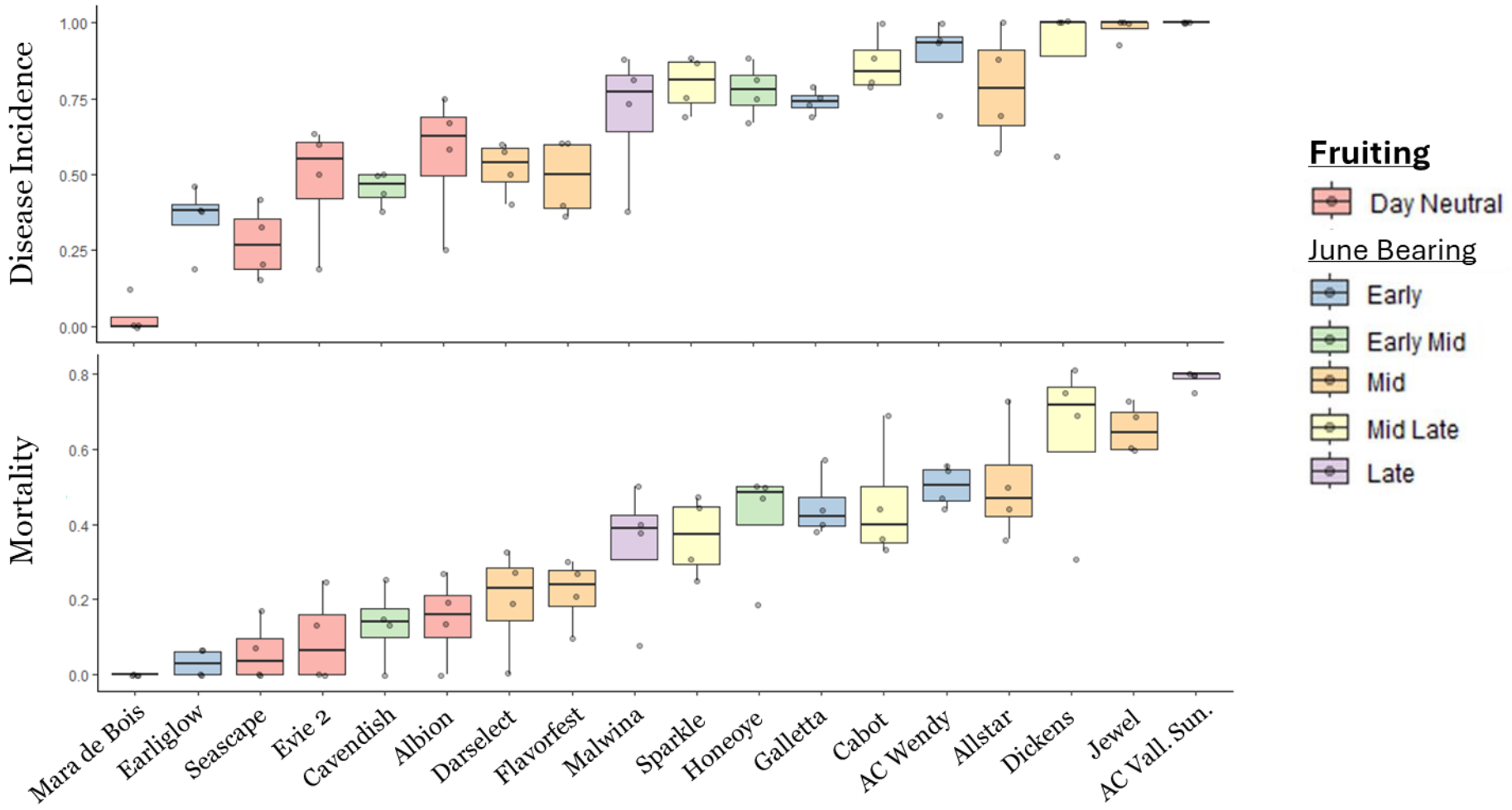
Varietal Susceptibility to ACR

- What do we know about ACR resistance in northern strawberry varieties?
  - Zero
  - Zip
  - Zilch
  - Nada

- Field trials at Lockwood and the Valley Lab containing 18 varieties across a variety of fruiting styles

	Row 1	Row 2	Row 3	Row 4
Block 18	5	18	9	10
Block 17	13	6	18	17
Block 16	1	1	4	13
Block 15	17	8	11	15
Block 14	16	3	14	7
Block 13	3	5	13	11
Block 12	14	4	12	9
Block 11	2	14	6	6
Block 10	6	12	8	12
Block 9	7	15	3	1
Block 8	12	7	7	4
Block 7	18	13	15	14
Block 6	9	11	17	3
Block 5	10	17	10	2
Block 4	4	16	1	18
Block 3	8	2	16	8
Block 2	15	10	2	5
Block 1	11	9	5	16

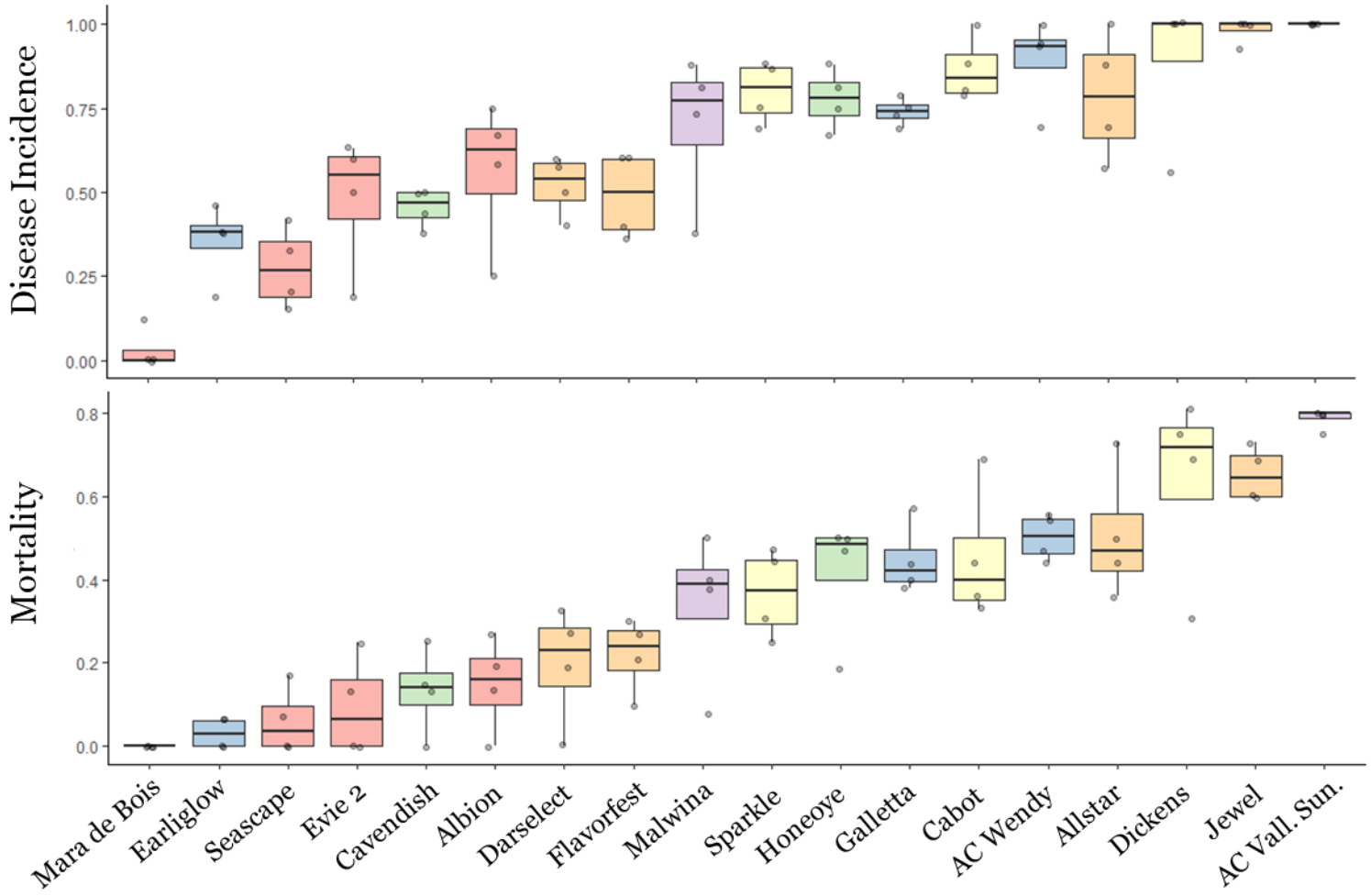
Varietal Susceptibility to ACR



Wilting

Mortality

Varietal Susceptibility to ACR



Fruiting

Day Neutral — Broadly "resistant"

June Bearing

Early

Early Mid

Mid

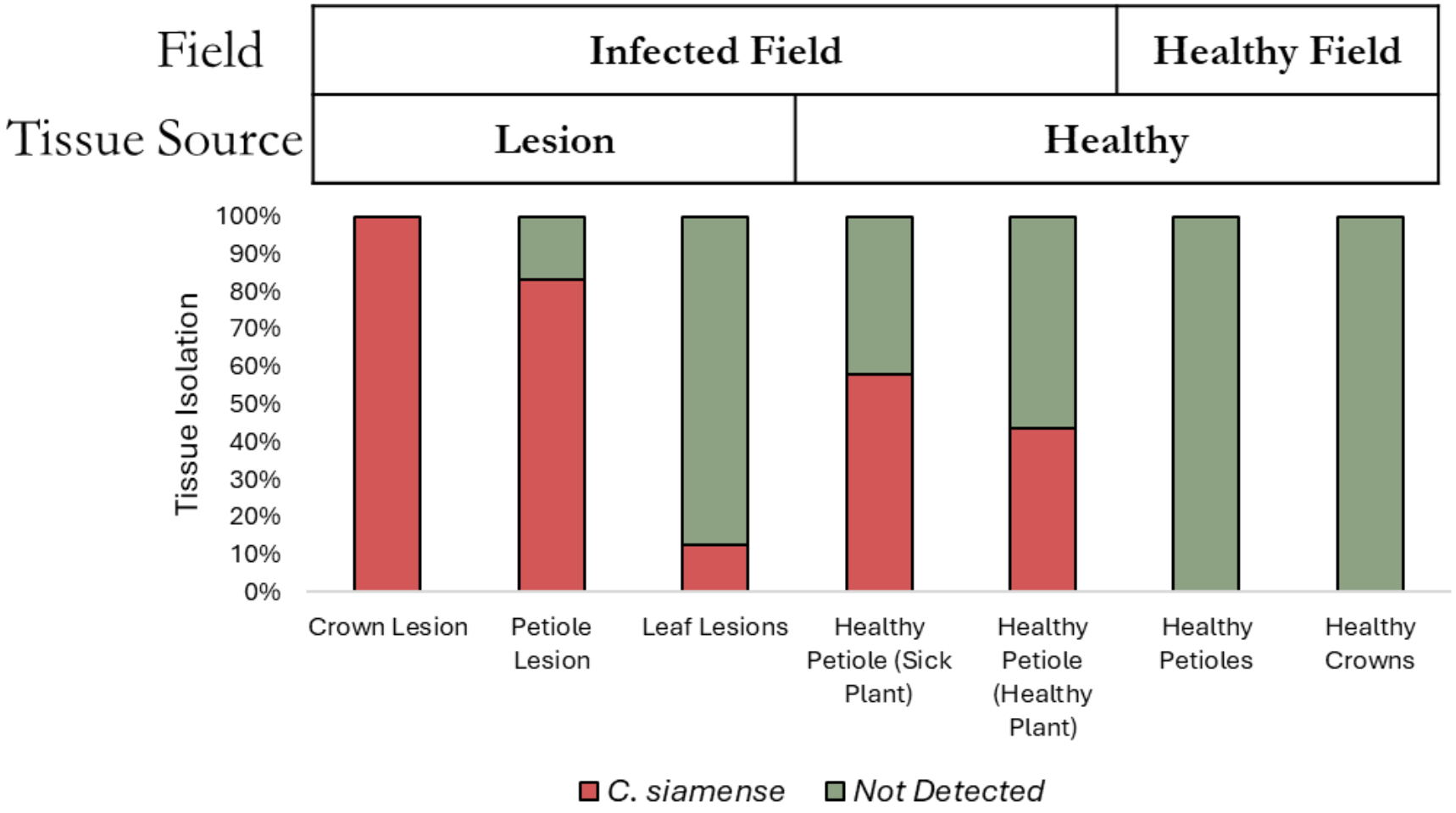
Mid Late

Late

— No clear relationship with resistance

<u>Why are day neutrals resistant?</u>
Could be physiological, but more likely due to geography

ACR – Finding it in the field



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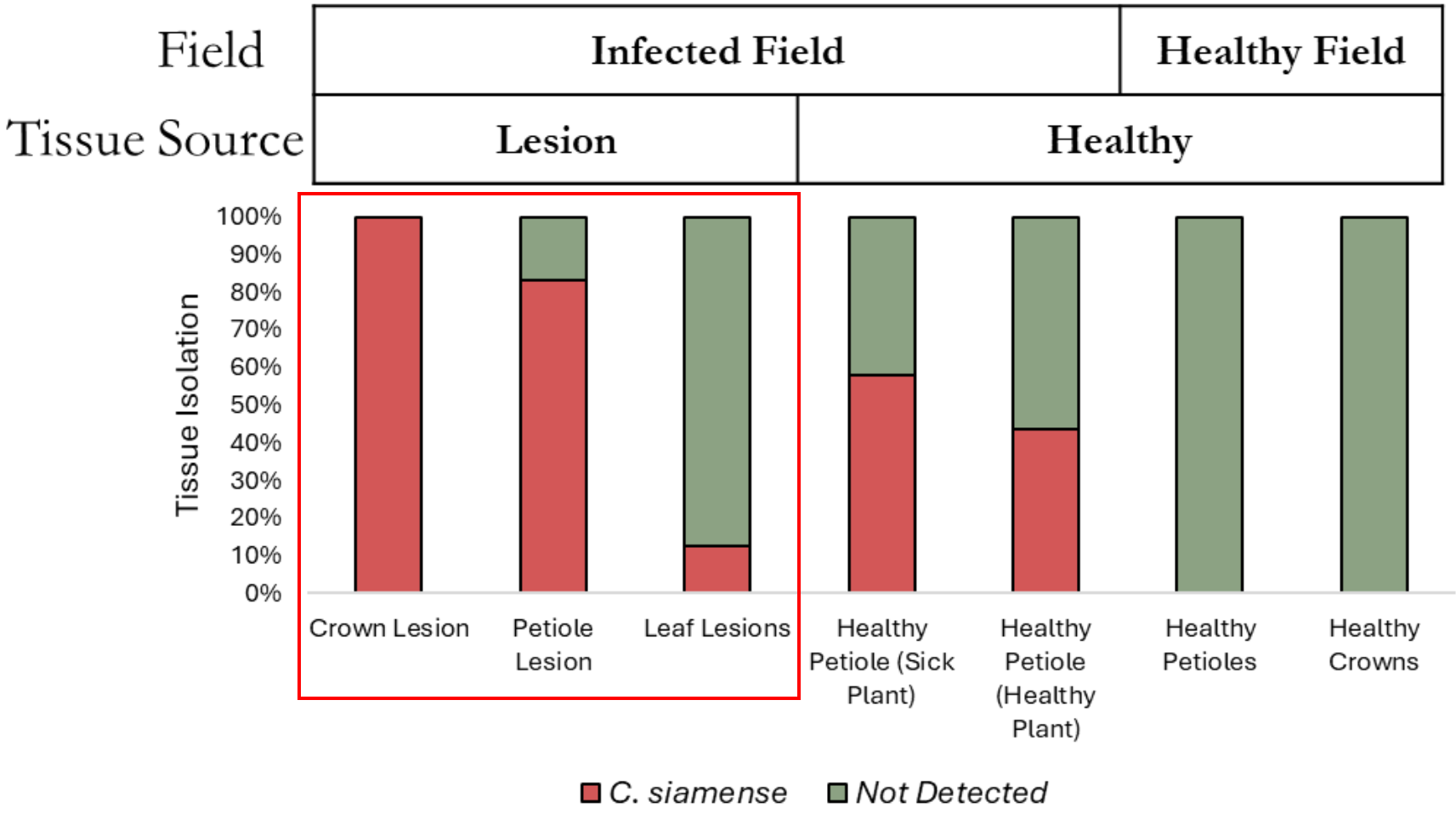

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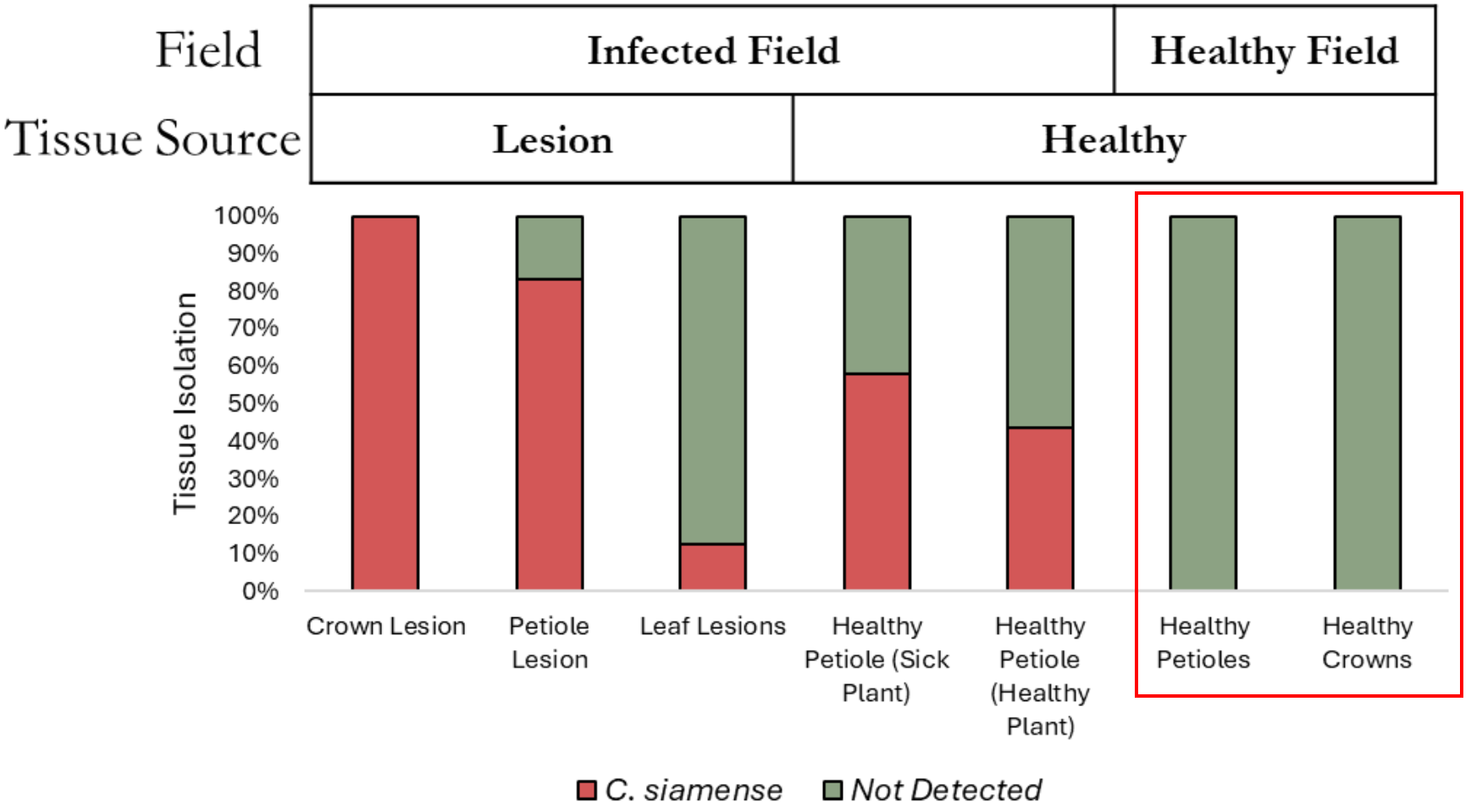

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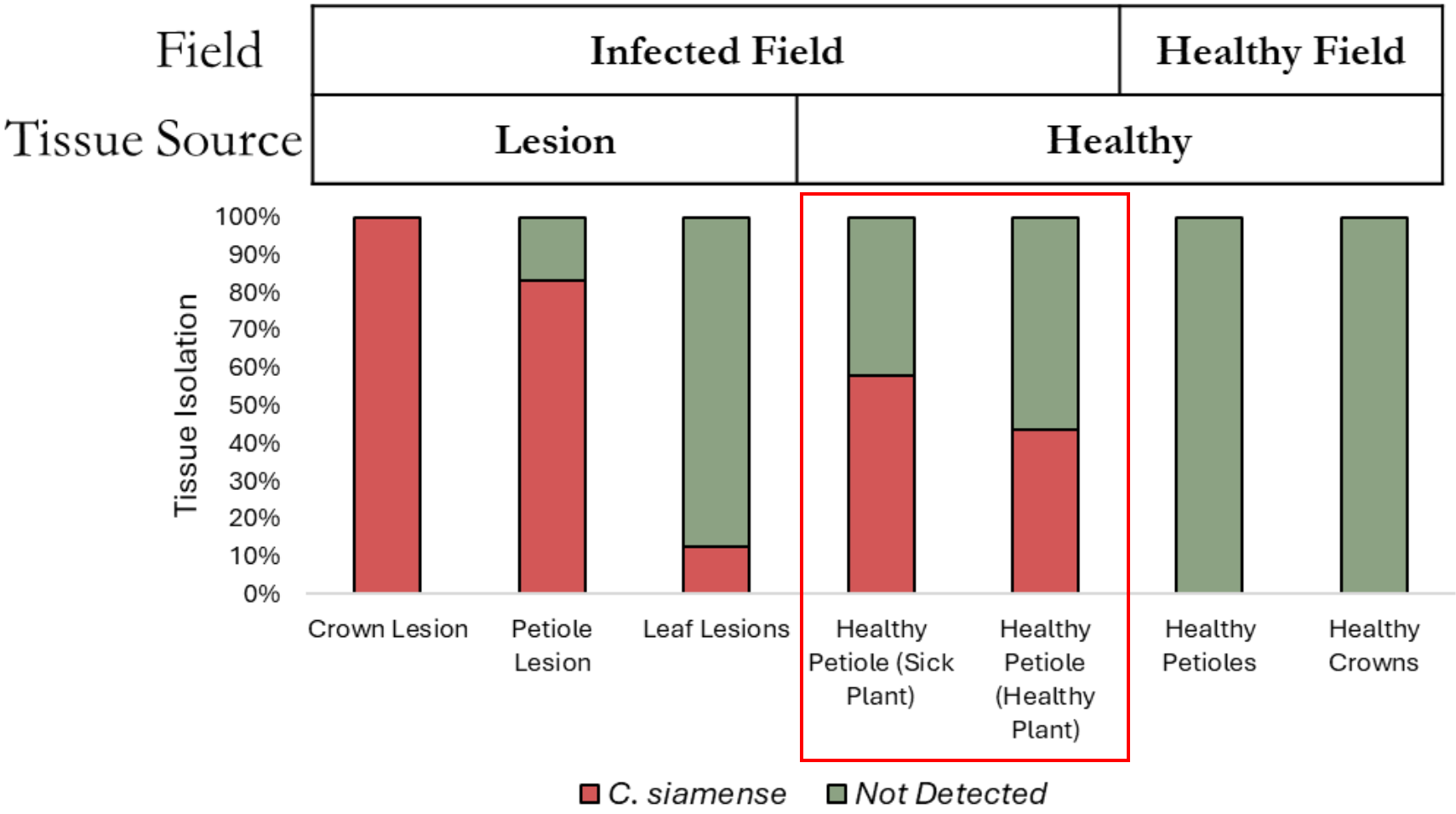

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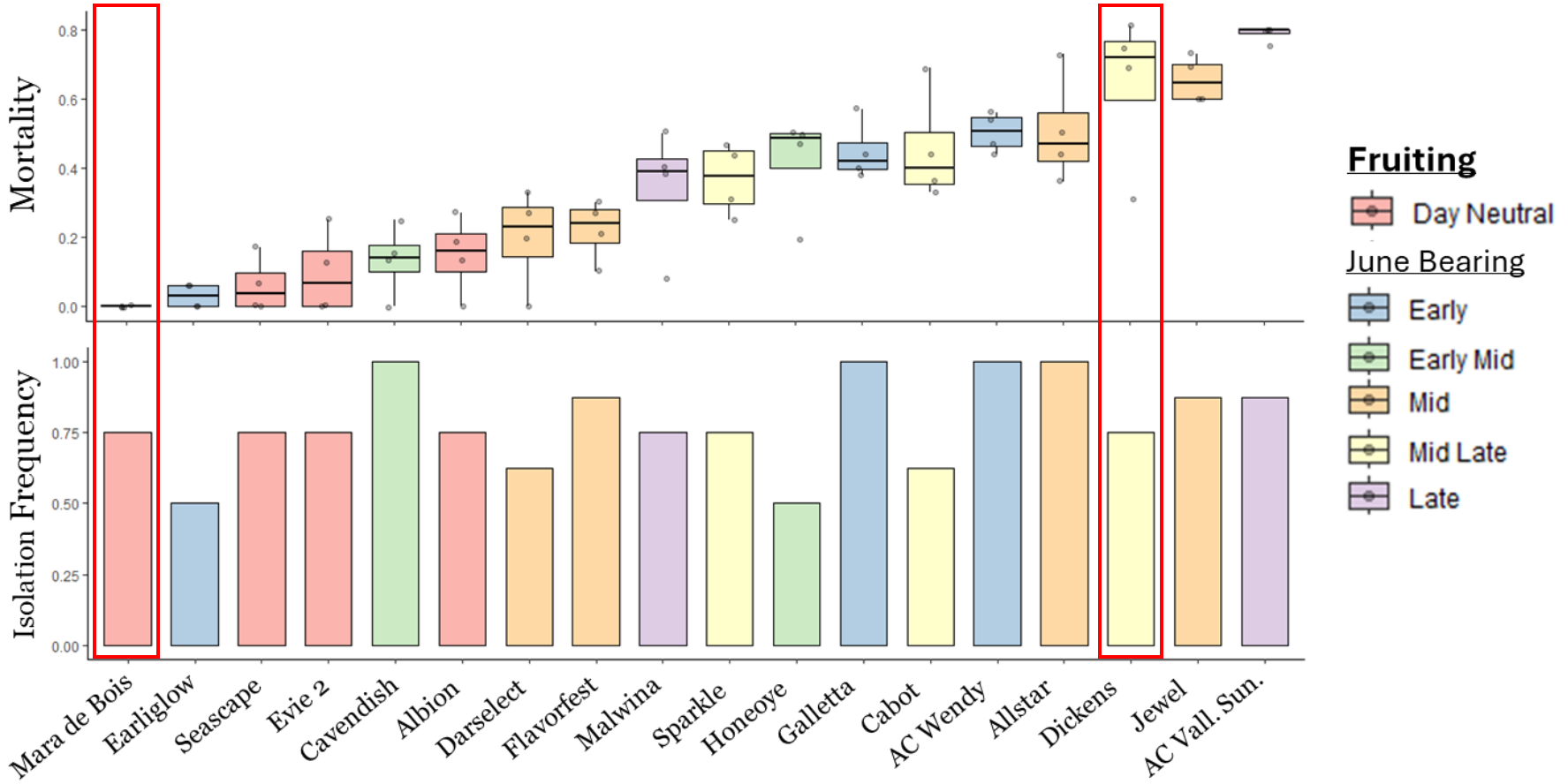
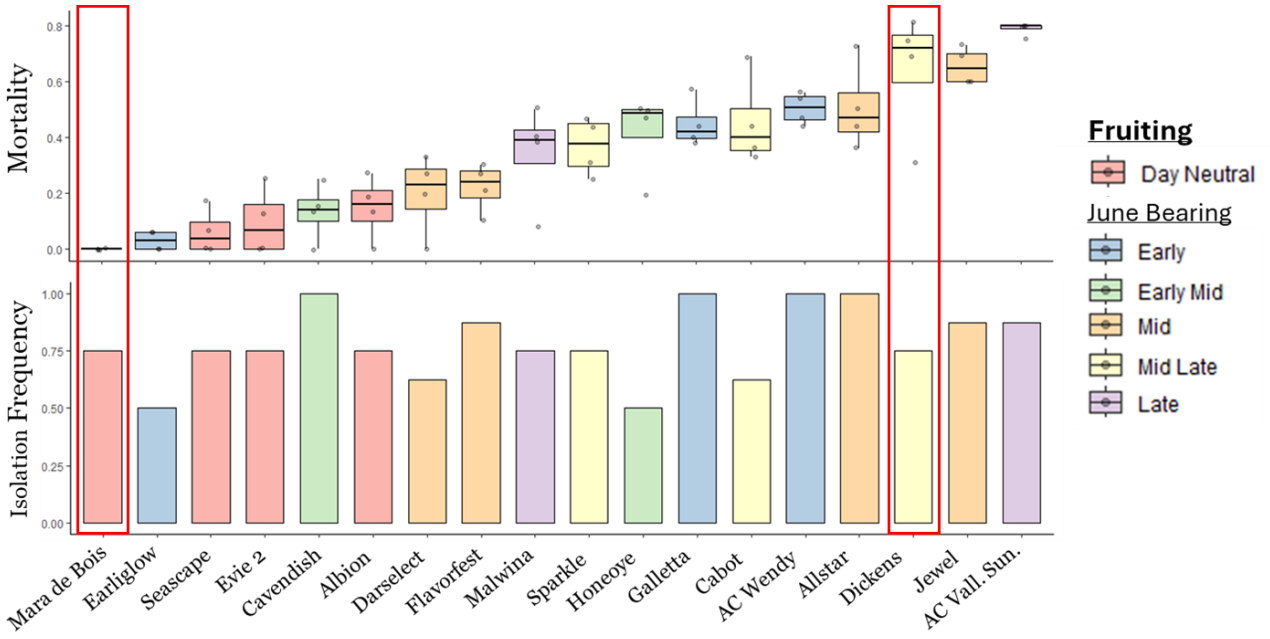


"Resistant" varieties are holding *C. siamense* as an endophyte

Why does being an endophyte matter?



"Resistant" varieties are holding *C. siamense* as an endophyte

1. Exclusion and tolerance are different. "Resistant" plants may succumb to ACR because of:
   a) Other diseases
   b) Physical damage (renovation)
   c) Environmental Stress?

2. The disease may enter your field on asymptomatic cultivars (pre-plant dips on resistant cultivars still have value)

Major Takeaways - ACR

- Preplant dips are a cheap and effective first line of defense to fungal pathogens, but pick your chemistry wisely
    - Switch and Miravis Prime (both contain FRAC 12) have shown efficacy against most major strawberry pathogens in Connecticut
    - Combining a plant defense elicitor (Reliant, Actigard, etc.) can be beneficial in combination with other fungicides
- If ACR is a concern, avoid highly susceptible varieties such as AC Valley Sunset, Dickens, and Jewel
- If you suspect ACR is on your farm, carefully consider post-harvest renovation protocols (damage may spread the pathogen and induce the transition to disease)

Questions?

Dr. Nathaniel (Nate) Westrick
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(860) 687-4763

Jasper (Assistant to the Farm Manager)

Valley Laboratory, Windsor, CT

Final Notes – What else am I seeing in CT Strawberries?

<u>Strawberry Black Root Rot</u>

- Disease complex with multiple possible culprits
  - In CT most often caused by a combination of fungi and nematodes (both relatively ubiquitous)

- Common contributors:
  - Overwatering (especially in plasticulture)
  - Continuous strawberry production

- Recommendations:
  - Not all rotation crops are the same, avoid rye and prioritize Saia oats or Sorghum Sudangrass
  - Optimize drainage
  - Preplant fungicide dips

Strawberry Black Root Rot Symptoms

Final Notes – What else am I seeing in CT Strawberries?

<u>Anthracnose Fruit Rot</u>

- Caused by a different species of *Colletotrichum* than the ACR pathogen; specifically infects fruit
- Primarily an issue on Day Neutral varieties (pathogen becomes an issue after June Bearers have stopped producing)
- Low tunnels which block rain are incredibly effective at reducing pathogen spread
- DON'T DROP INFECTED FRUIT IN YOUR ALLEYS
- Strobilurin resistance is common (I don't recommend Abound)

Anthracnose Fruit Rot Symptoms

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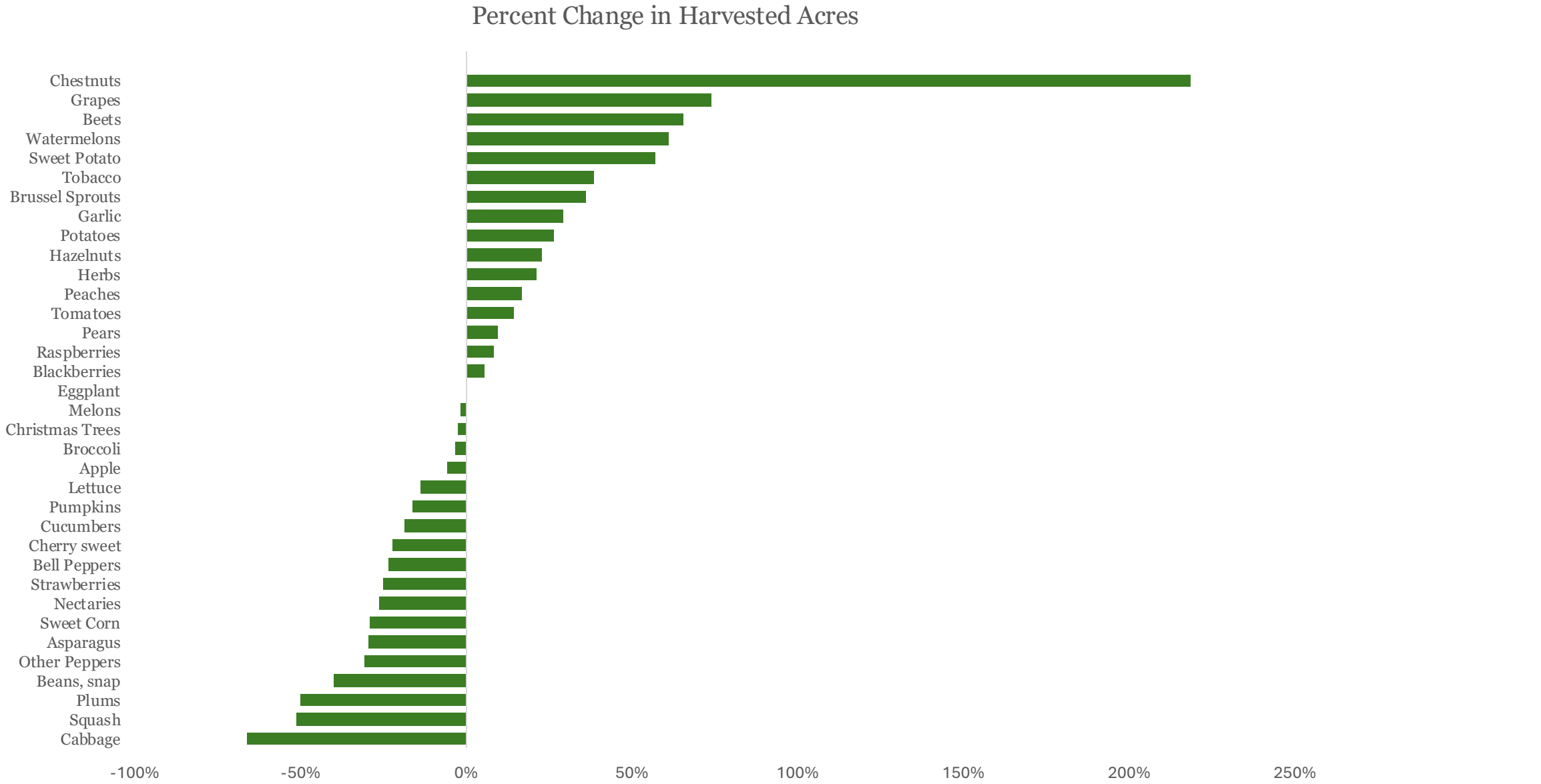
Changing Crop Acreage in CT (2017 - 2022)



USDA National Agriculture Statistics Service (NASS)