

# Site-specific management of soil pests in California strawberry production

Steve Fennimore	<i>UC Davis, Salinas, CA</i>
Alexander Putman	<i>UC Riverside, Riverside, CA</i>
Frank Martin and Michael Matson	<i>USDA-ARS, Salinas, CA</i>
Oleg Daugovish and Andre Biscaro	<i>UC Cooperative Extension, Ventura, CA</i>
Rachael Goodhue and Tom Gordon	<i>UC Davis, Davis, CA</i>
Forrest Melton and Lee Johnson	<i>CSU Monterey Bay/NASA Ames, Mountain View, CA</i>
Michael Stanghellini	<i>TriCal, Hollister, CA</i>
Nathan Dorn	<i>FoodOrigins, Salinas, CA</i>
Chris Greer	<i>UC Cooperative Extension, San Luis Obispo, CA</i>

# Acknowledgements



## Grower Cooperators

Matt Conroy and Dave Murray *Andrew and Williamson*

Henry Ito *Ito Bros.*

Jaime Lopez *Mixtekz Berries*

# Fumigation

- Often applied uniformly at the high label rate when perceived risk is high
  - Broadcast/flat
  - Drip
- Soilborne diseases usually occur in clusters or hot spots

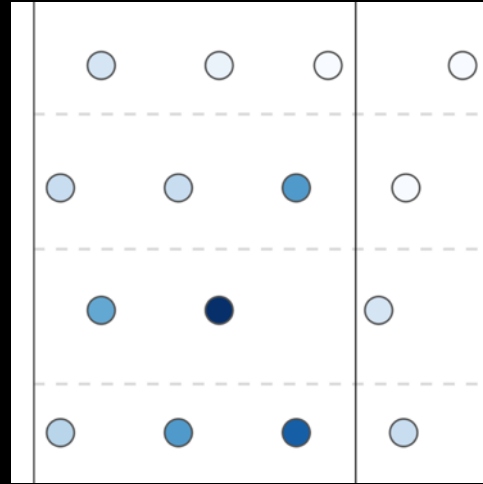


# Clustered distribution of disease



How to provide knowledge to growers about the spatial distribution of disease?

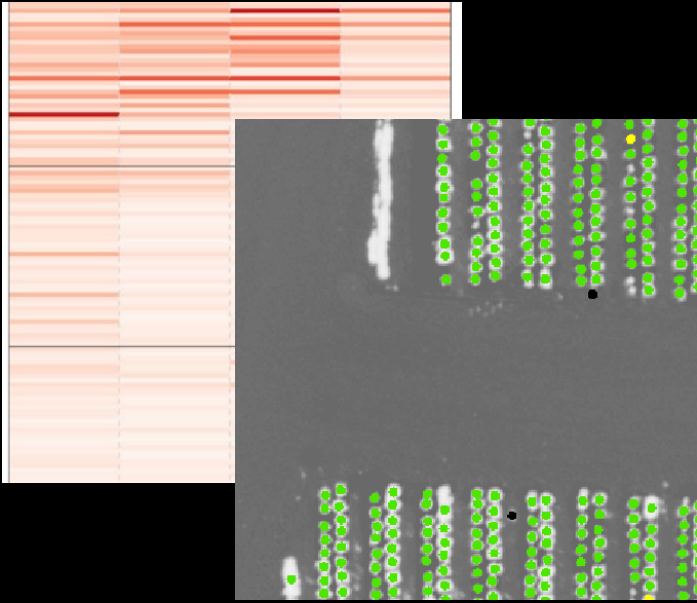
# Determine spatial distribution



Pathogen counts in soil

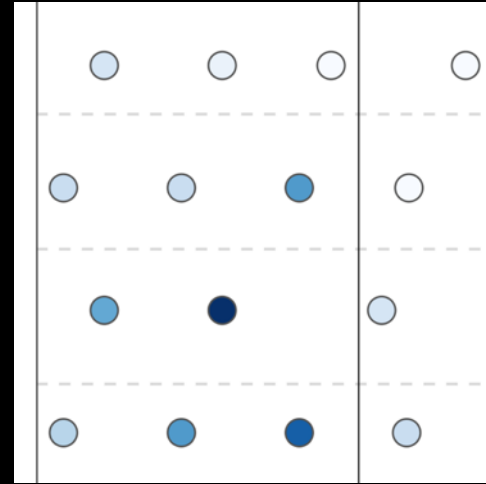
Amount of pathogen in soil  
is the biggest factor  
affecting disease severity

# Determine spatial distribution



Mortality and plant health

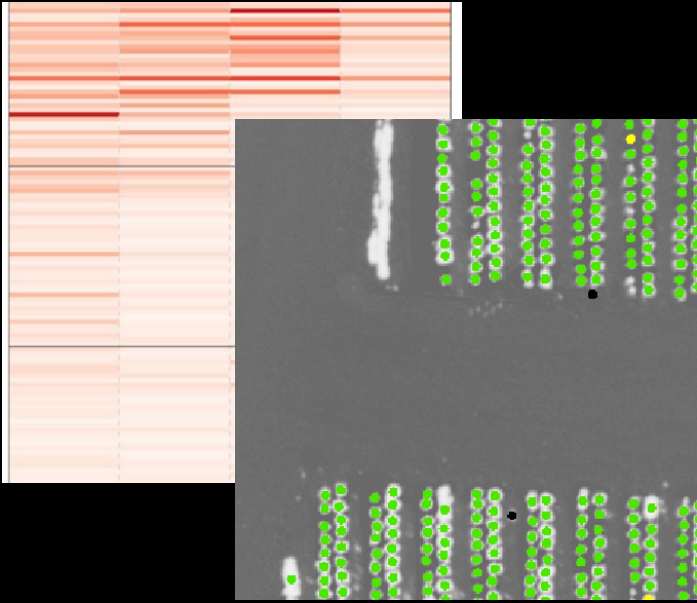
Disease is likely to recur in the same area



Pathogen counts in soil

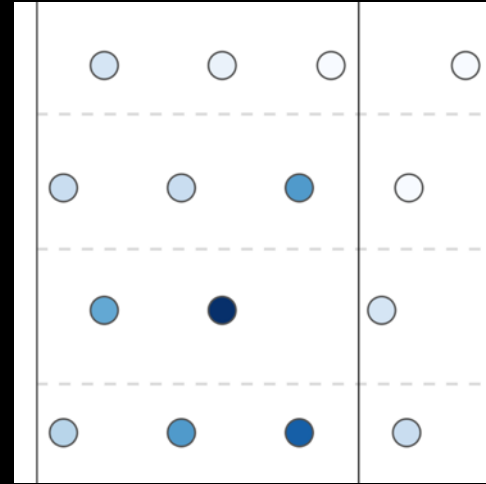
Amount of pathogen in soil is the biggest factor affecting disease severity

# Determine spatial distribution



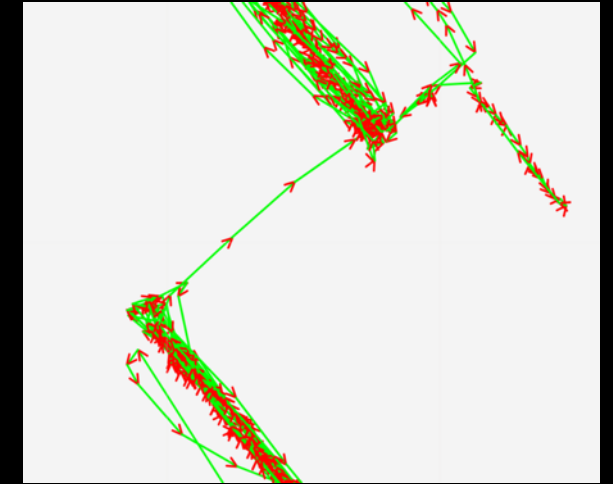
Mortality and plant health

Disease is likely to recur in the same area



Pathogen counts in soil

Amount of pathogen in soil is the biggest factor affecting disease severity

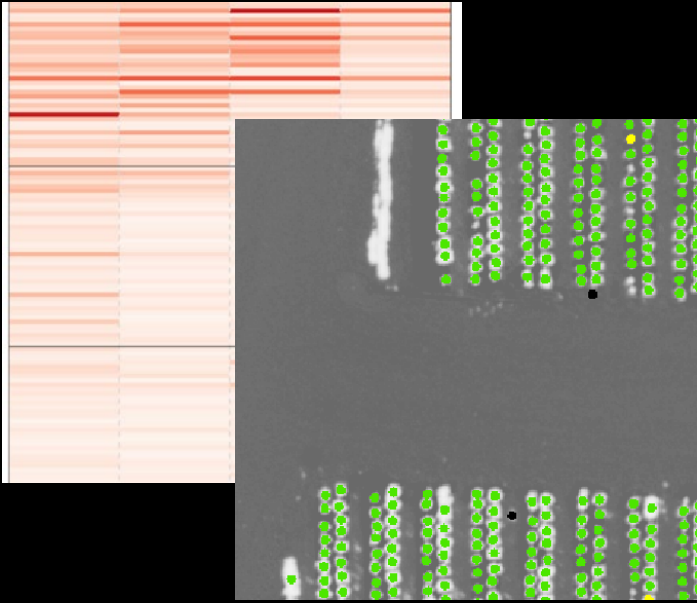


High-resolution yield

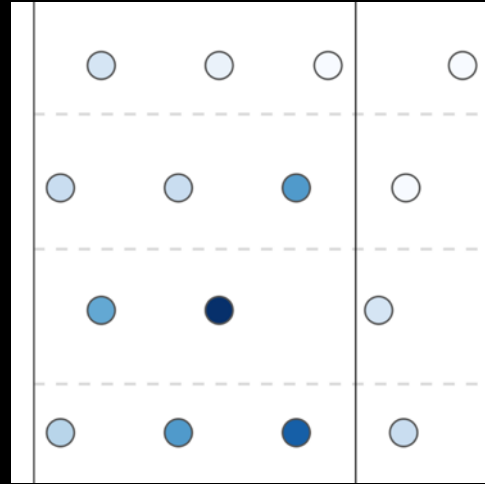
Determine how yield is influenced by plant health, pathogen



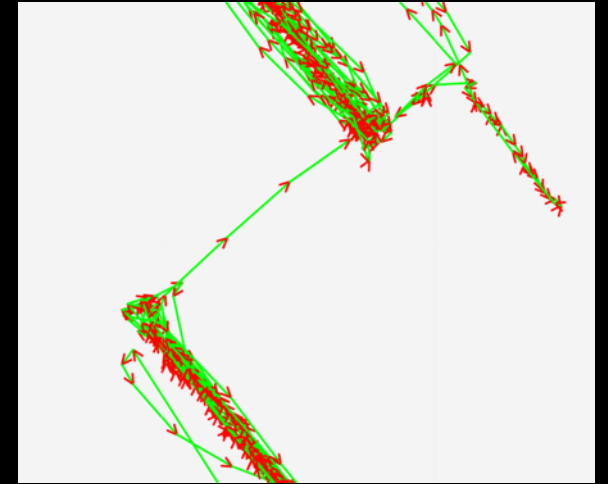
# Determine spatial distribution



Mortality and plant health



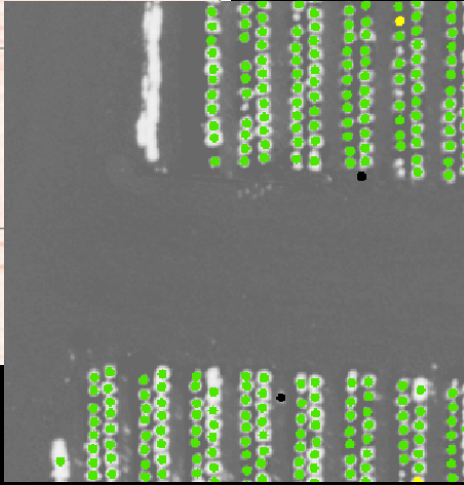
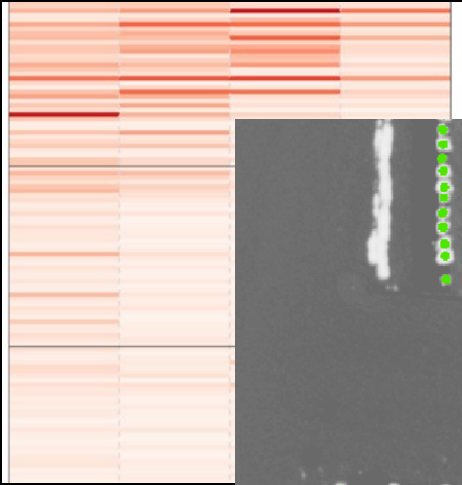
Pathogen counts in soil



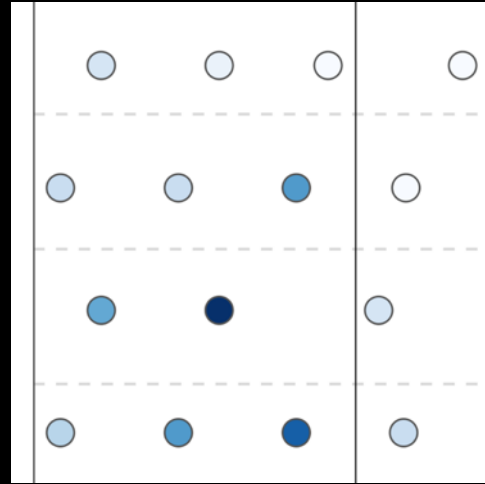
High-resolution yield



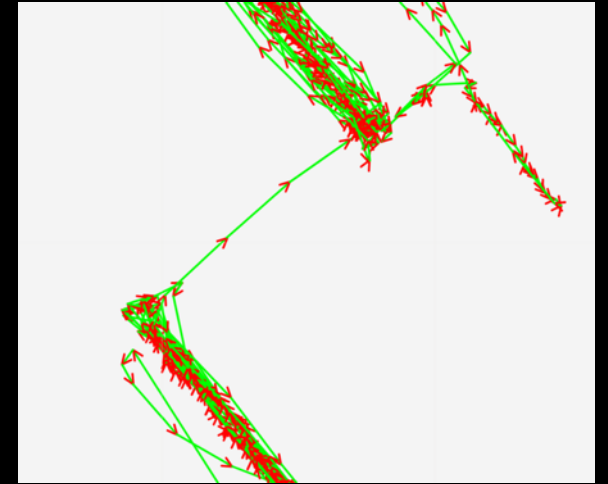
## Determine spatial distribution



Mortality and plant health



Pathogen counts in soil



High-resolution yield

Can this information be used to reduce fumigation rate in low disease pressure areas without sacrificing yield?

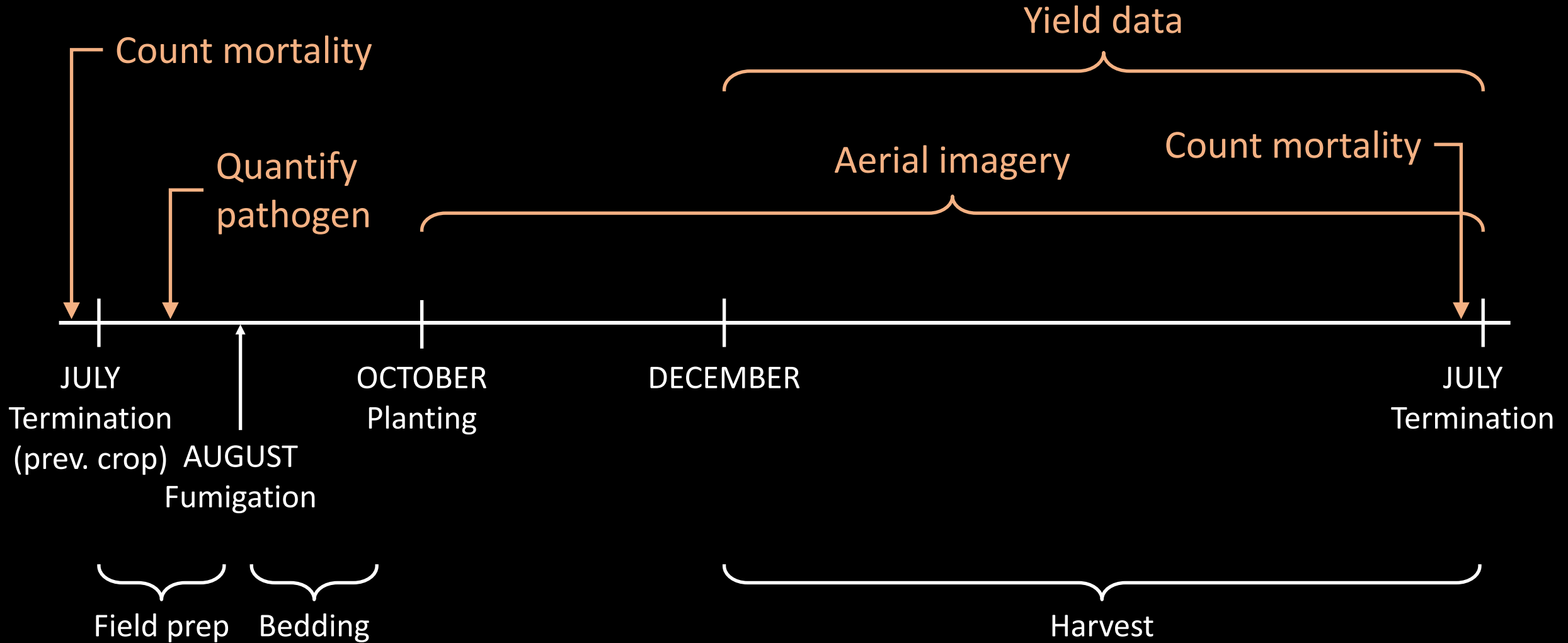
# Methods

- Treatments
  - Standard: broadcast/flat fumigation
  - Precision: establish zones and apply fumigant at rate proportional to pressure
- Tri-Chlor (chloropicrin)
  - 250, 300, 350 lbs/acre
- Fields: ~10 acres
- Randomized complete block with 3 or 4 replications

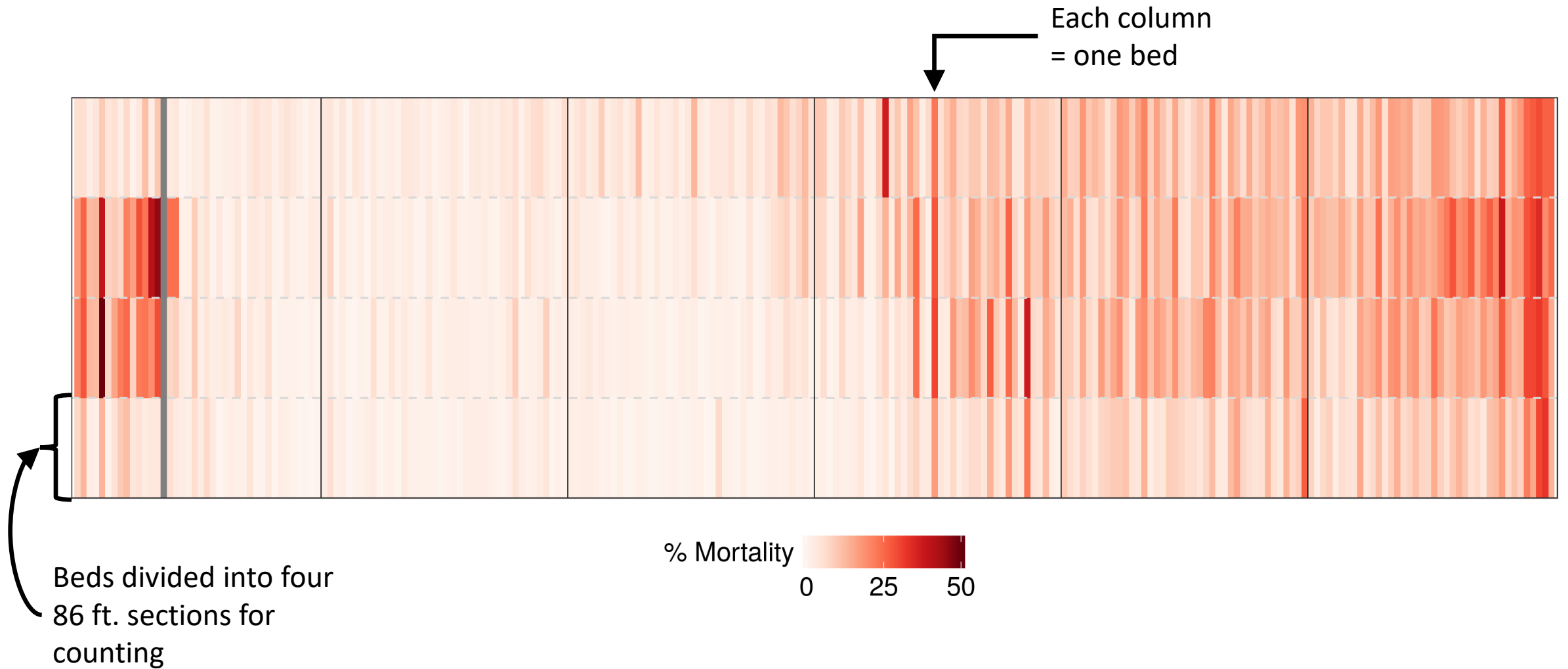
# Study Locations

- Oxnard
  - Field A (2017-2018): Fall planting, history of Fusarium wilt and Macrophomina charcoal rot
  - Field B (2019-2020): Fall planting, history of Fusarium wilt
  - Field C (2019-2020): Summer planting, recent history of Macrophomina charcoal rot
- Salinas-Watsonville
  - 2018-2019: Fall planting, history of Verticillium wilt

# Timeline (fall, Oxnard)

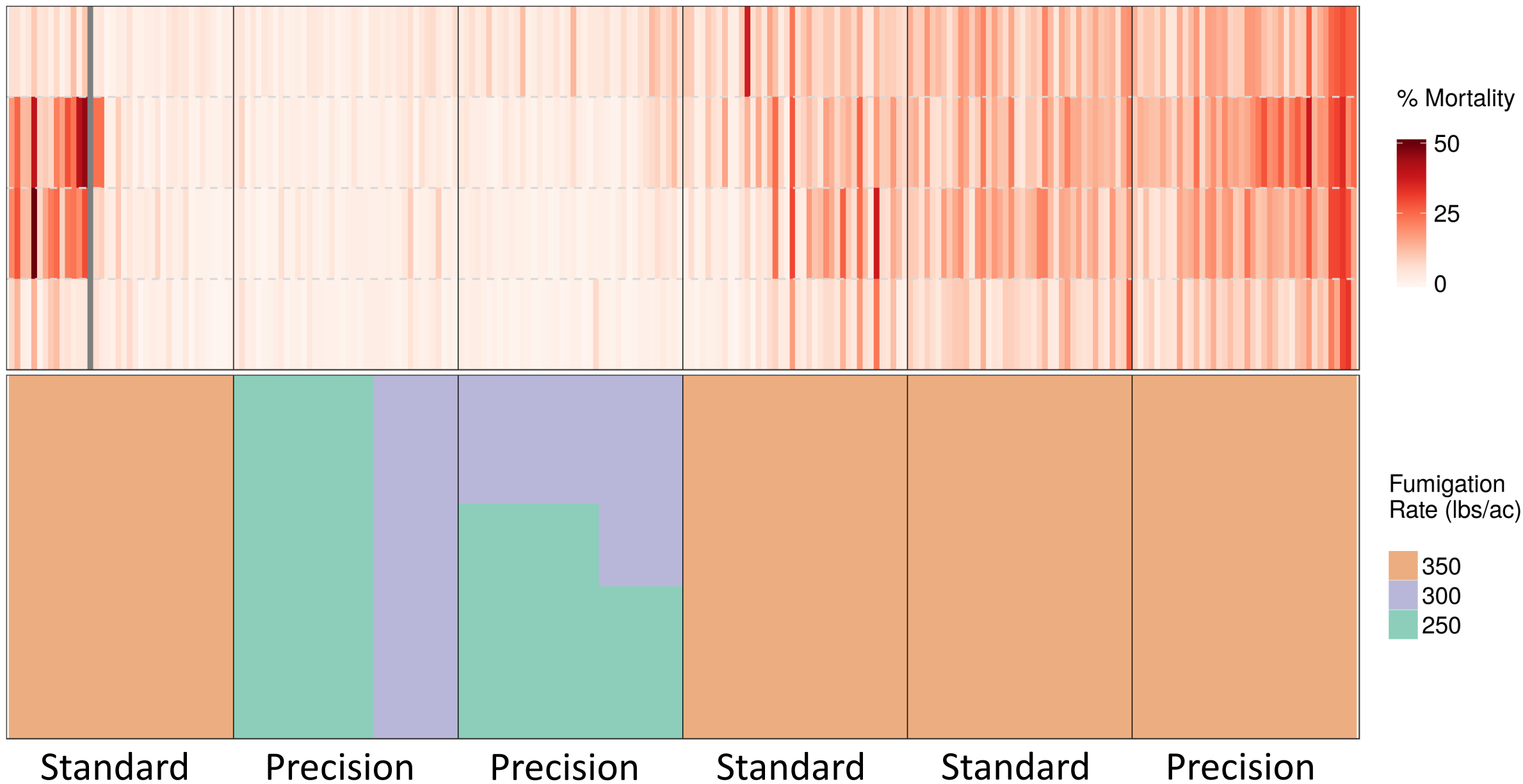


# Mortality (previous crop)



# Fumigant Rate Zones

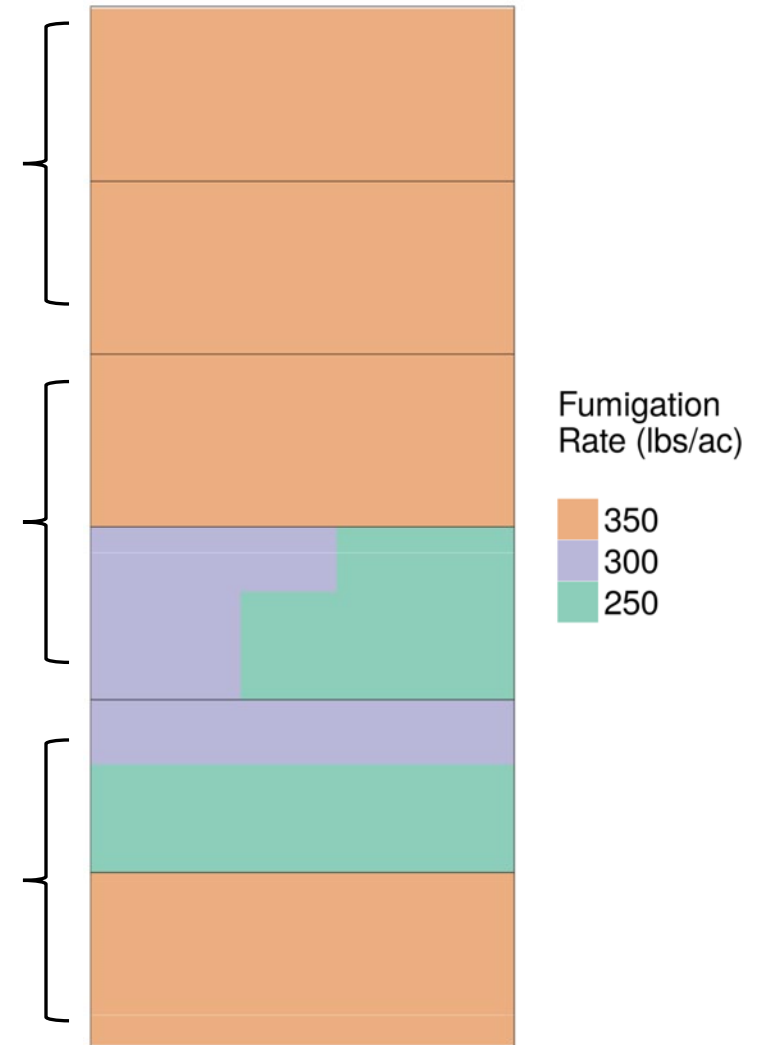
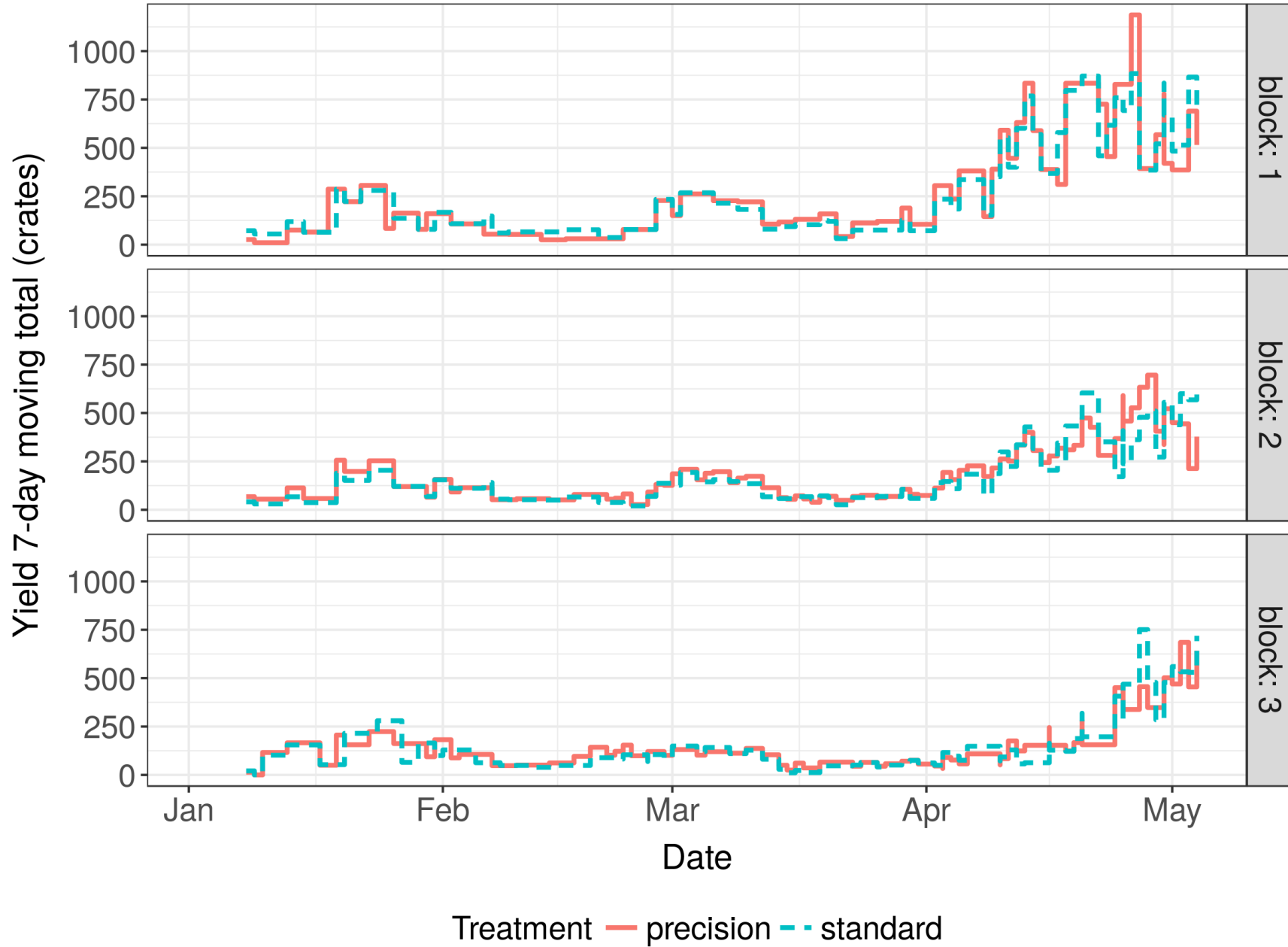
Oxnard Field A (2017)







# Yield



Oxnard Field A (2017)

# Economic Performance (per plot)

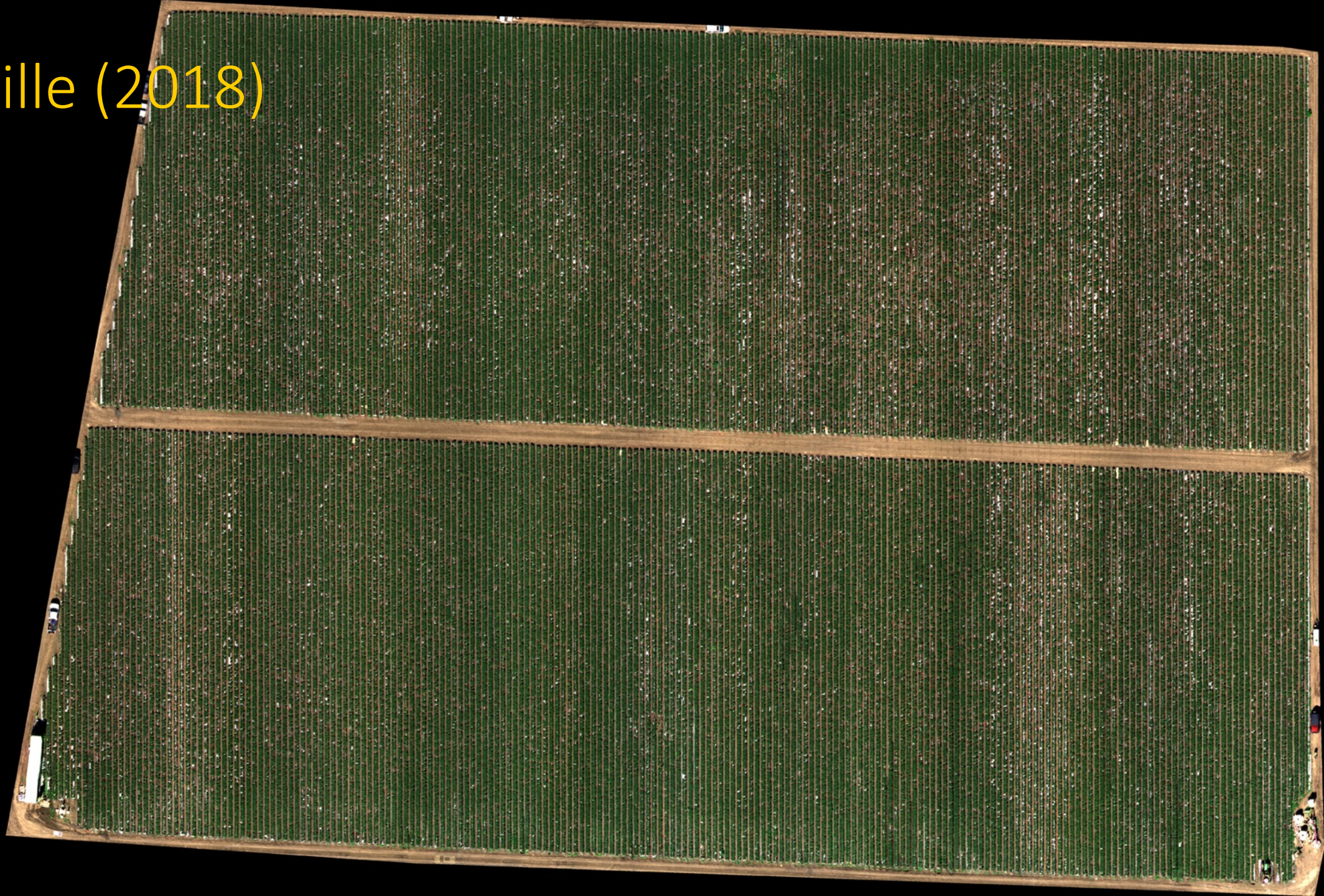
<b>Treatment</b>	<b>Plots</b>	<b>Yield</b>	<b>Gross revenues</b>	<b>Net returns</b>
Precision	1,4,5	4,709	\$53,751	\$47,475
Standard	2,3,6	4,580	\$51,750	\$44,939

- Partial budgeting analysis: only treatment costs considered
  - Precision treatment includes pathogen sampling costs
- Daily prices from USDA Agricultural Marketing Service

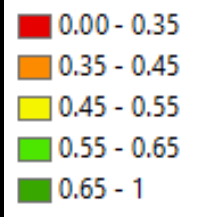
# Summary – Oxnard Field A (2017)

- Precision treatment: 6% higher net returns
  - First 4 months of yield
- Precision treatment used 15% less fumigant
- Low disease pressure
  - Mild weather
  - *Fusarium*-resistant cultivar planted during study season

Watsonville (2018)



# Plant Health Imagery



May 31, 2019

July 11, 2019

August 09, 2019

August 20, 2019

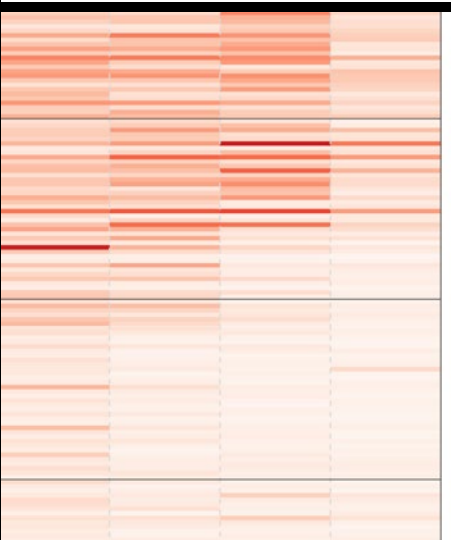
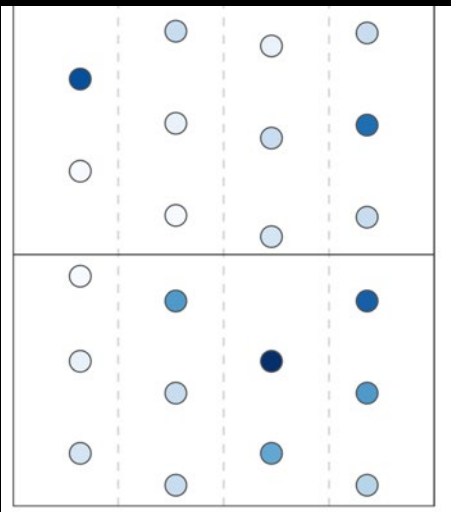
September 19, 2019

October 04, 2019

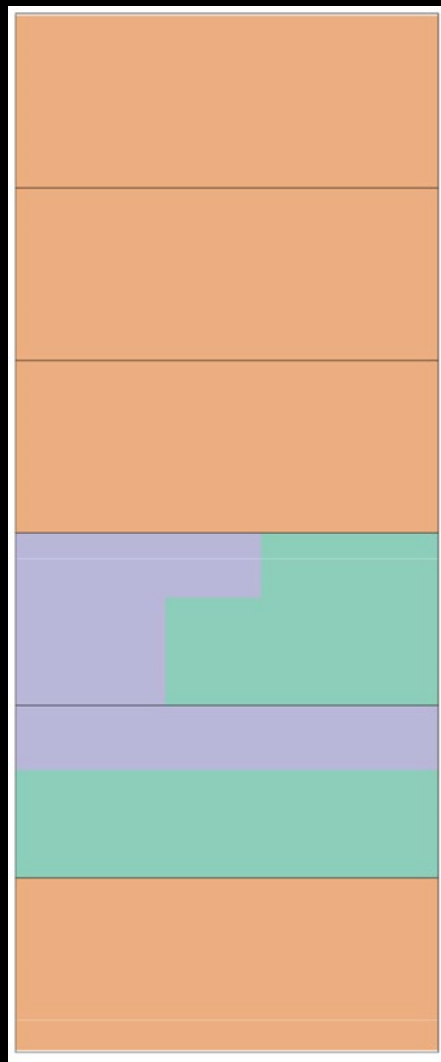


## Tracking Individual Plants

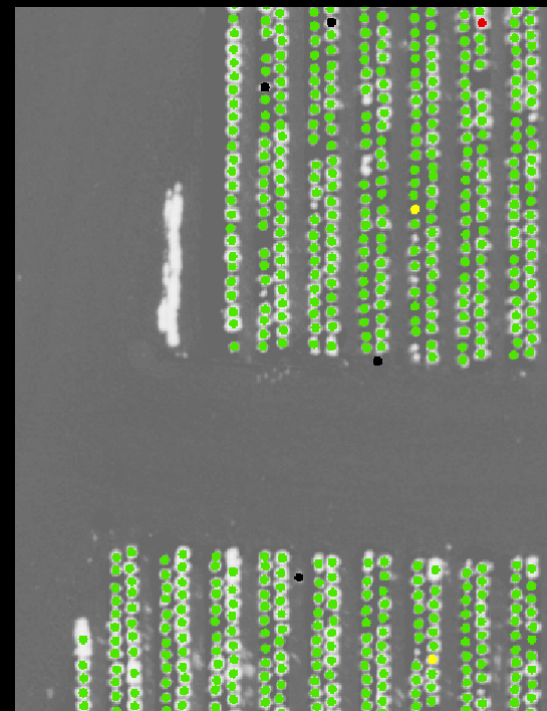
- Stand and mortality counts
- Plant health over time



Assess



Treat



Monitor

