

# Effect of *Fusarium oxysporum* f.sp. *fragariae* and *Macrophomina phaseolina* inoculum density on strawberry cultivar performance



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# Ability to produce fruit in presence of pathogens

- Cultivar resistance
- Fumigation optimization
- Environmental considerations (cool soils slow disease development)
- Non-fumigant approaches (ASD, steam, solarization, biocides)
- Crop rotations
- Soilless culture/hydroponics

How much **Fusarium** in soil can strawberry handle?

Can susceptible cultivars perform at low pathogen levels?



Can resistant resistant cultivars perform at high pathogen level?

# Treatments

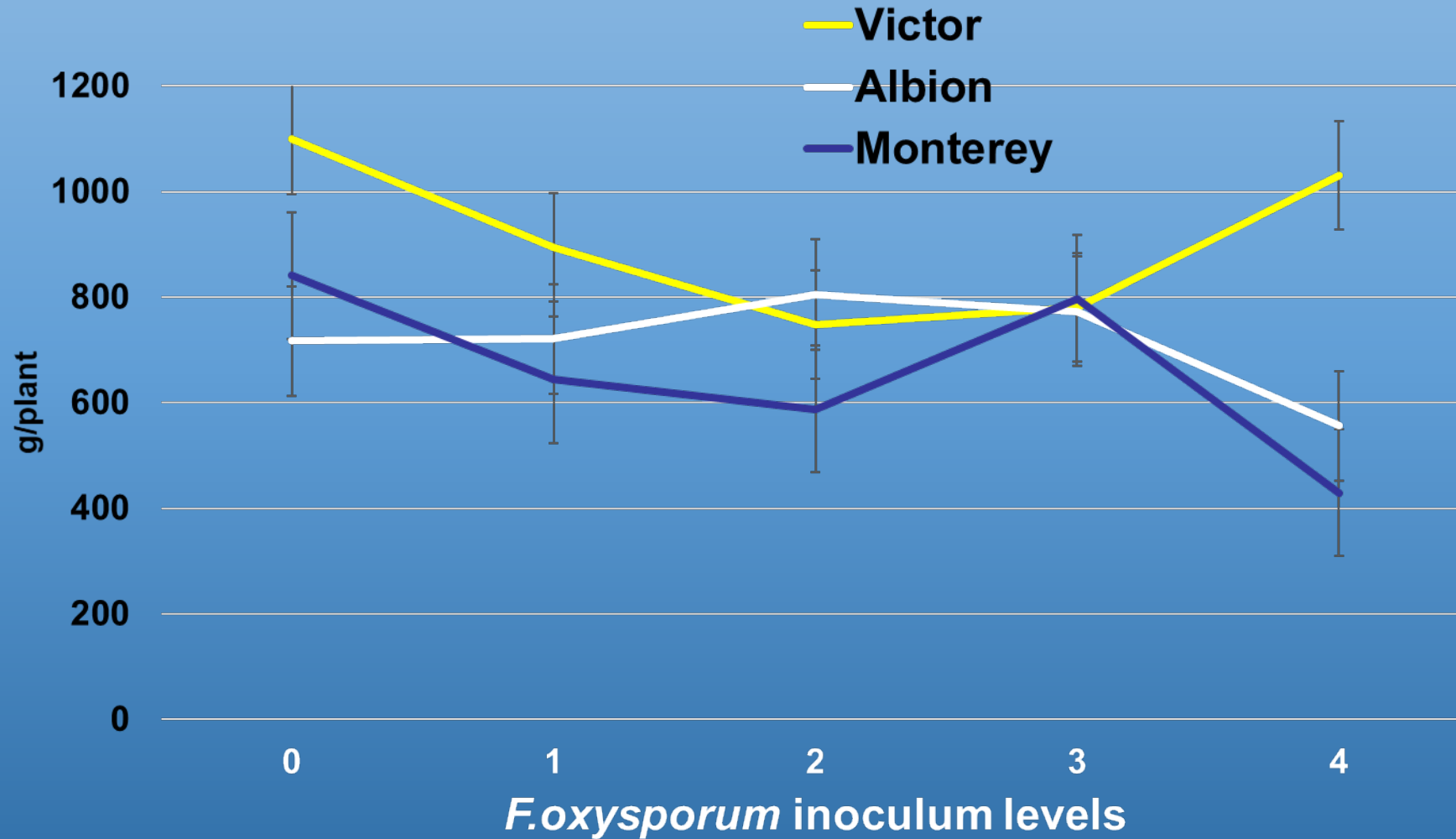
- Soil flat fumigated with Chloropicrin at 300 lbs/A, beds made with black TIF , holes cut
- Soil excavated from planting holes (1L) is mixed with **Fusarium-inoculated** or **Macrophomina-inoculated** sand (0.1L) and returned to planting holes
- 3 cultivars Planted in RCBD plots with 4 reps

2000 CFUs per gram (4),  
1000 CFUs per gram (3),  
500 CFUs per gram (2),  
100 CFUs per gram (1),  
0 CFU (just sand) (0).





# Fruit yield (total) in response to Fusarium



# Albion without Fusarium - May





# Albion in response to Fusarium - May



1



2



# Albion in response to Fusarium - May



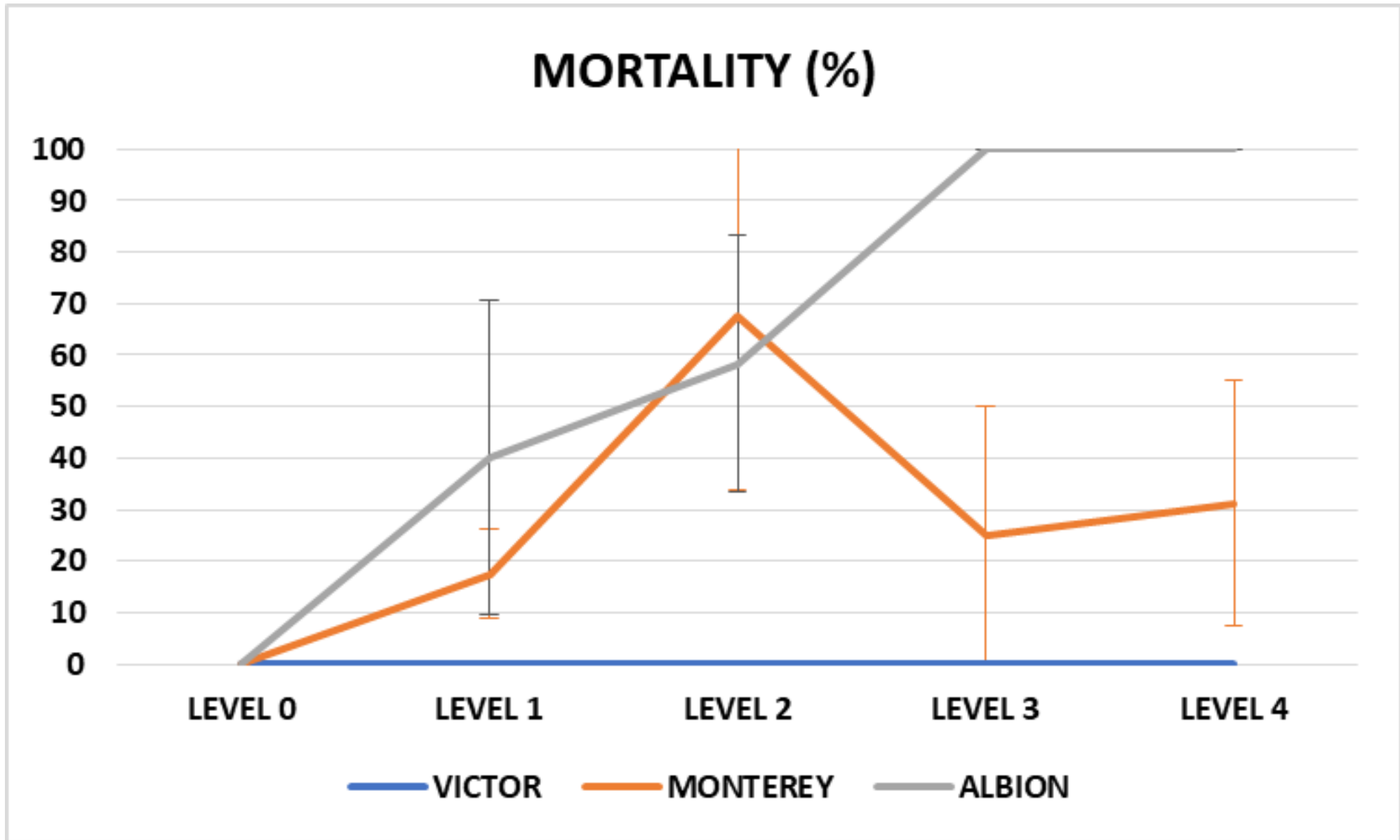
3



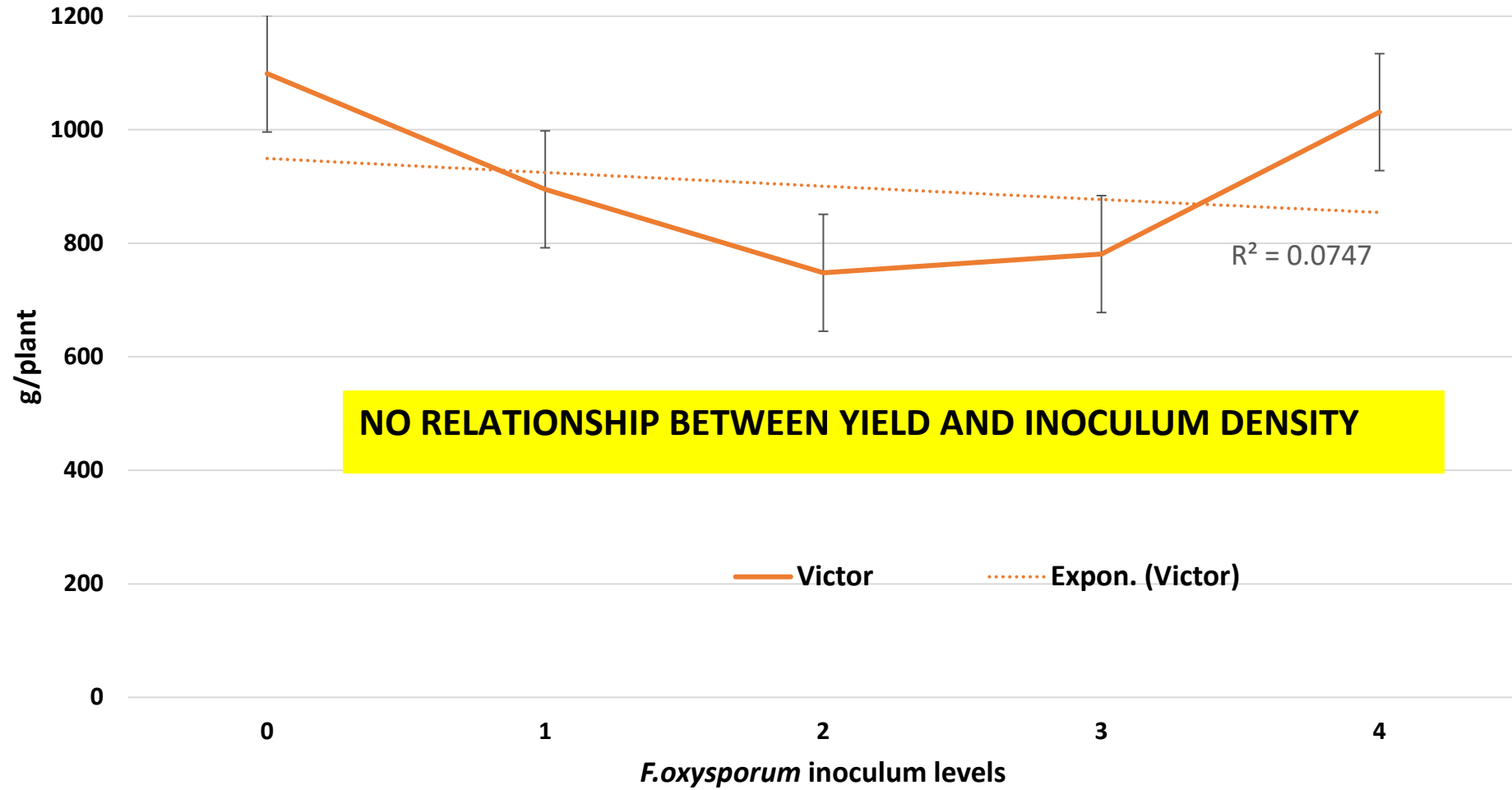
4



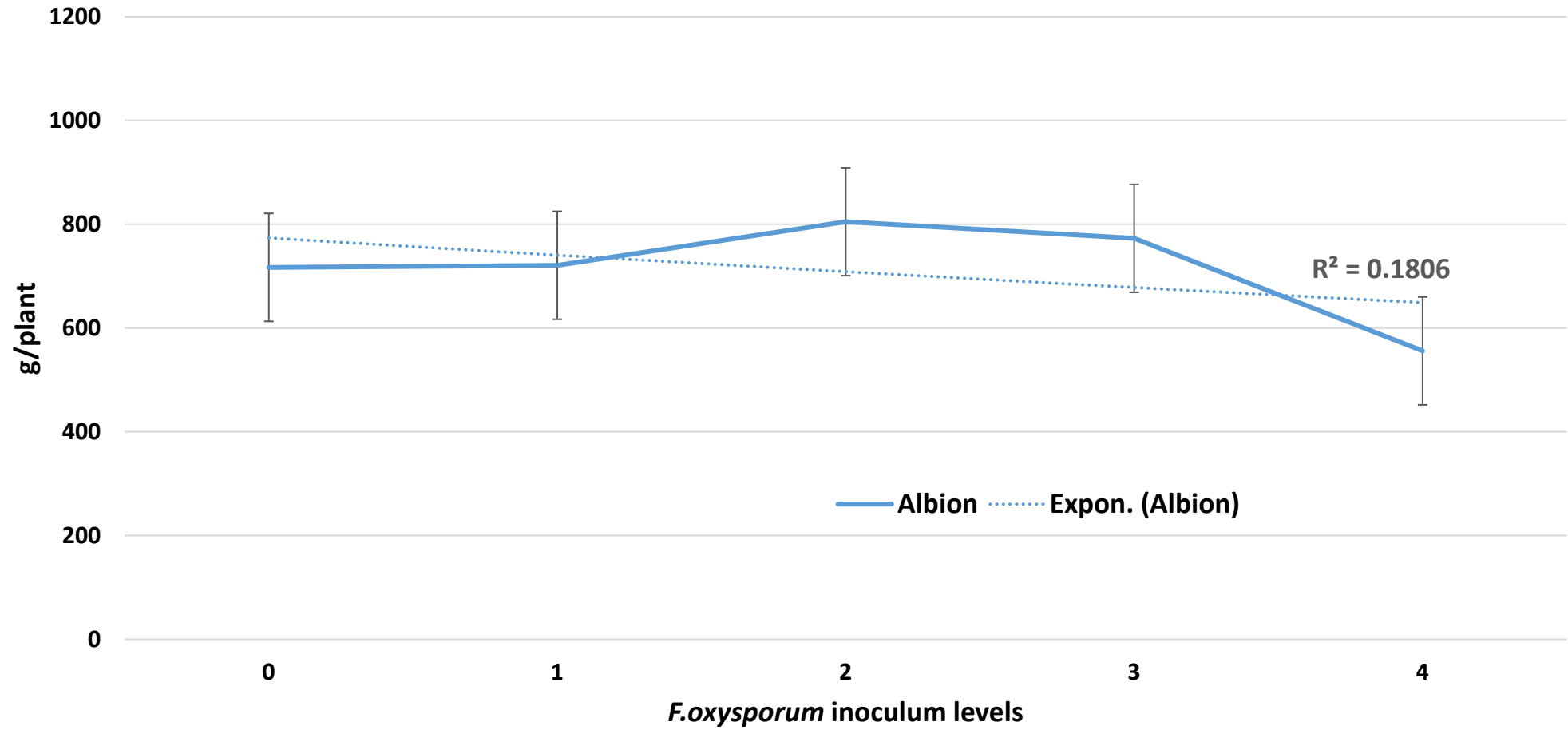
**MORTALITY CAUSED BY *F. OXYSPORUM* F. SP. FRAGARIAE AT THE END OF THE EXPERIMENT**



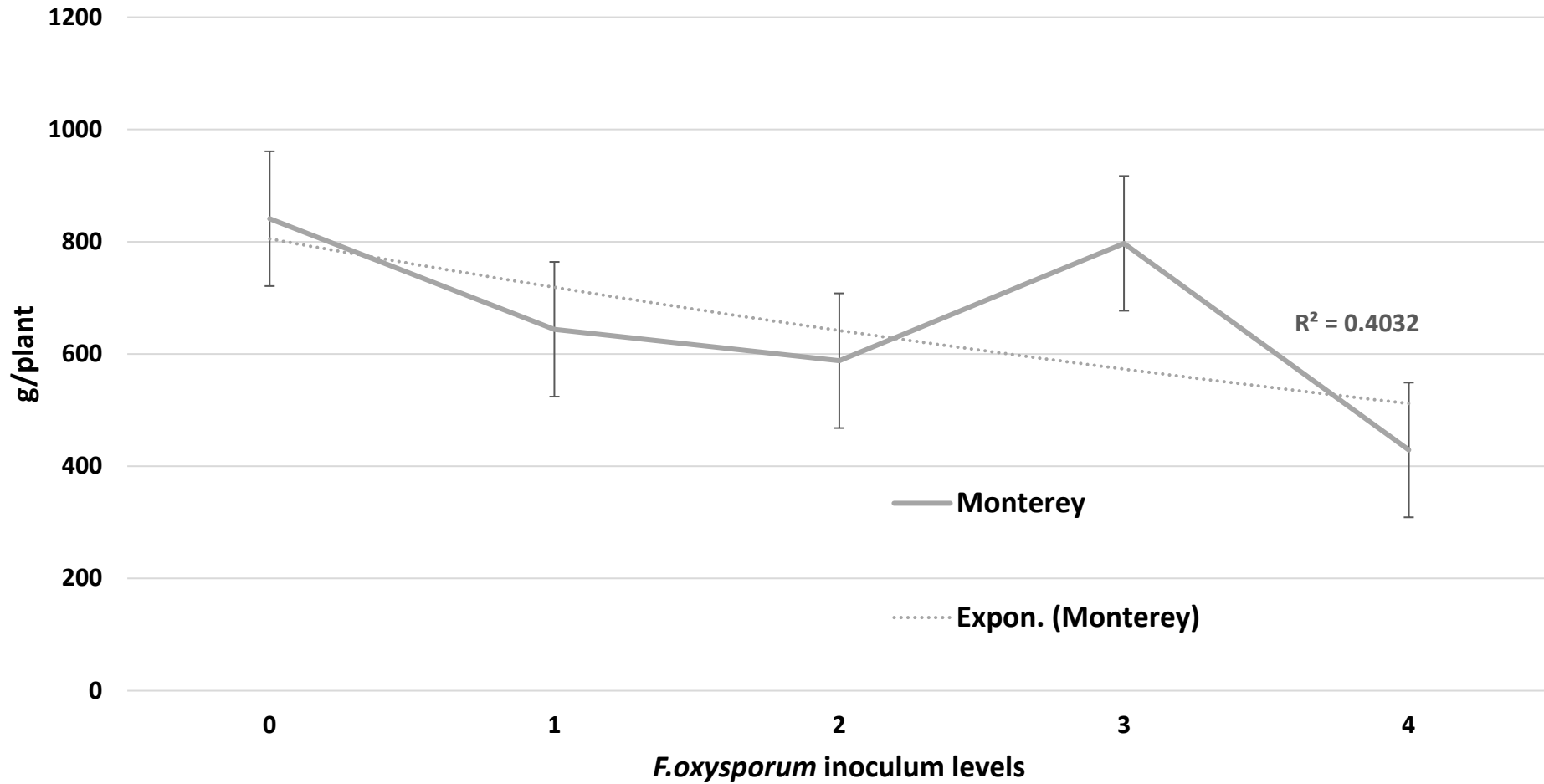
### Total Fruit Yield, 2019- Victor



### Total Fruit Yield, Albion, 2019

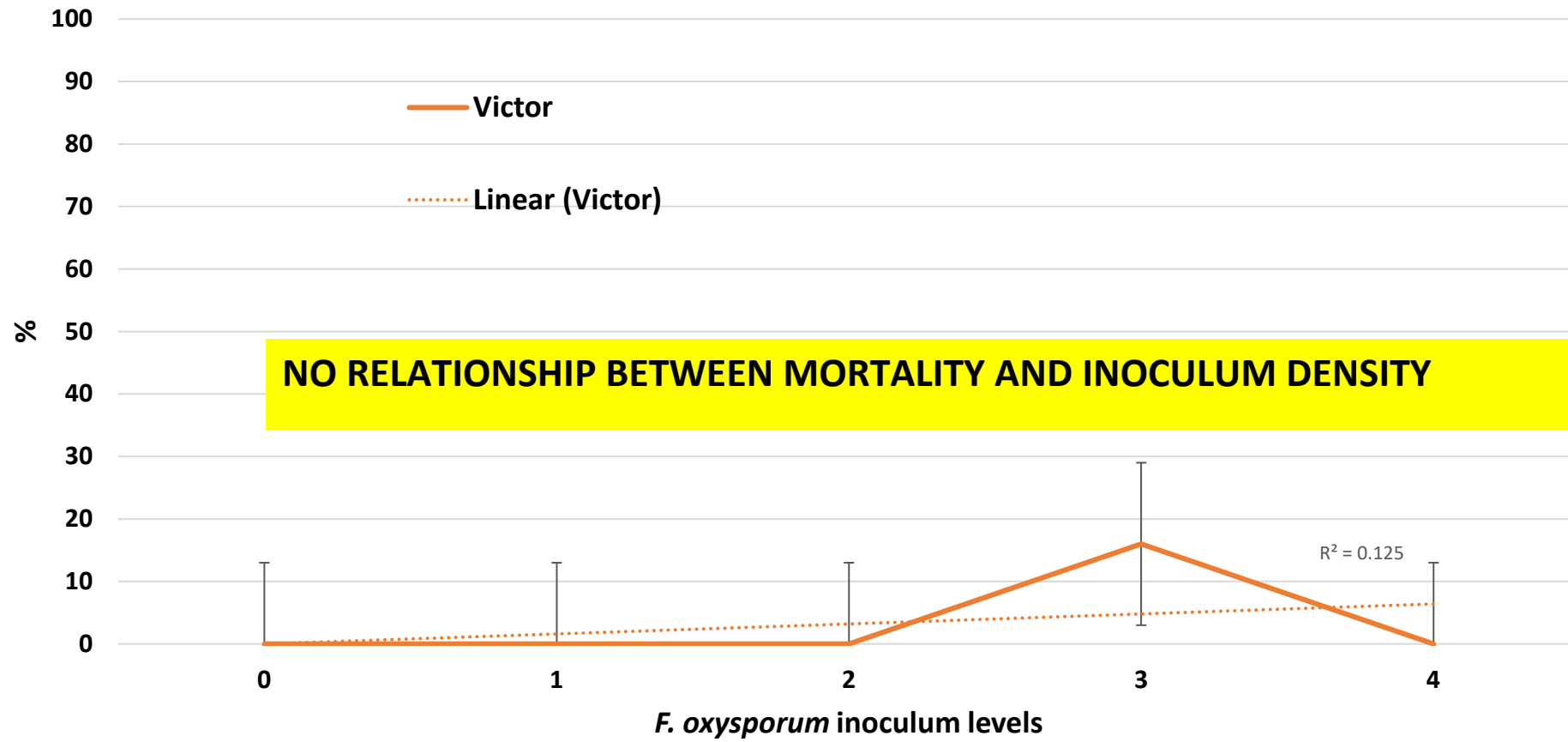


# Total Fruit Yield, Monterey, 2019

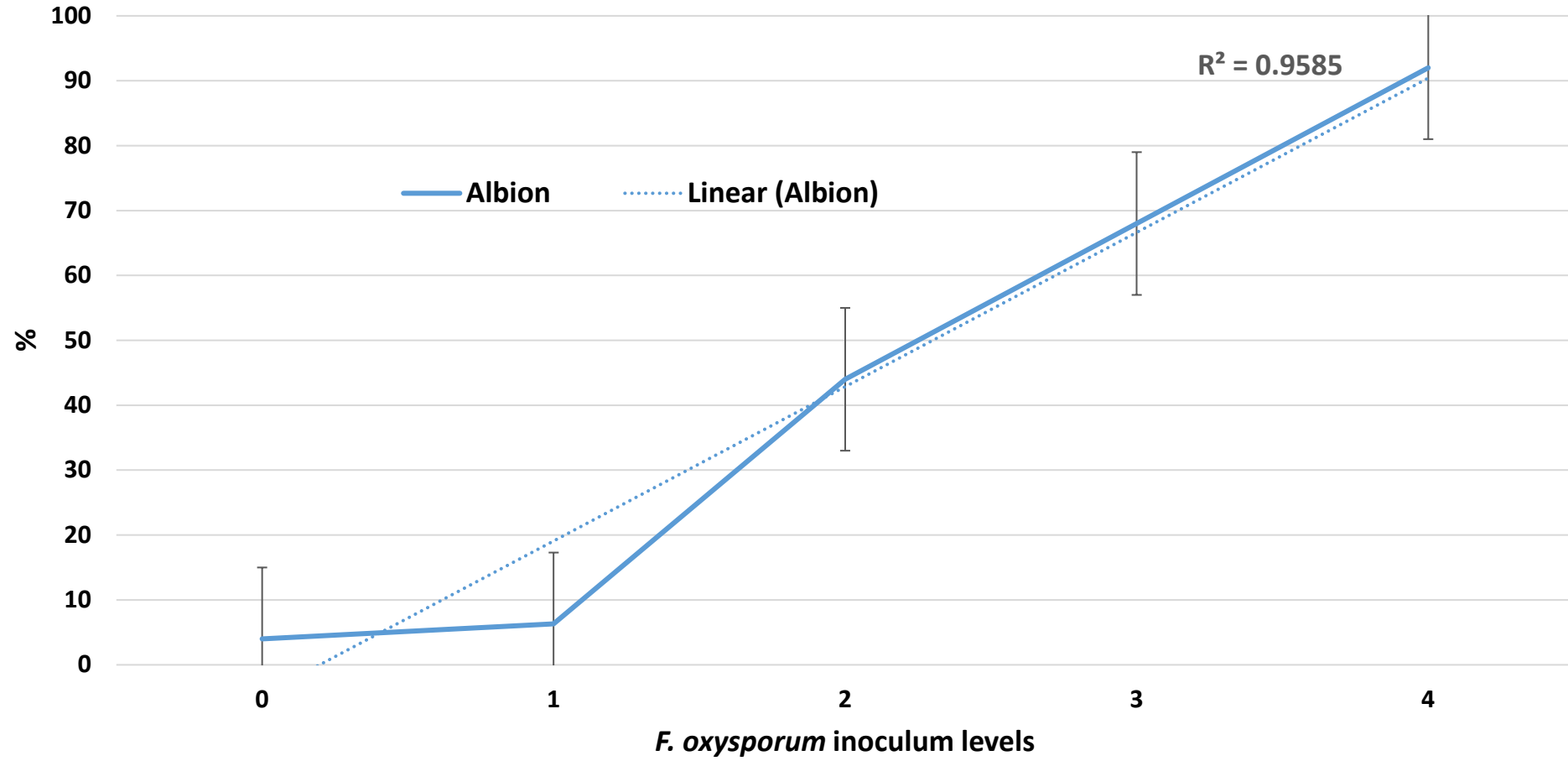




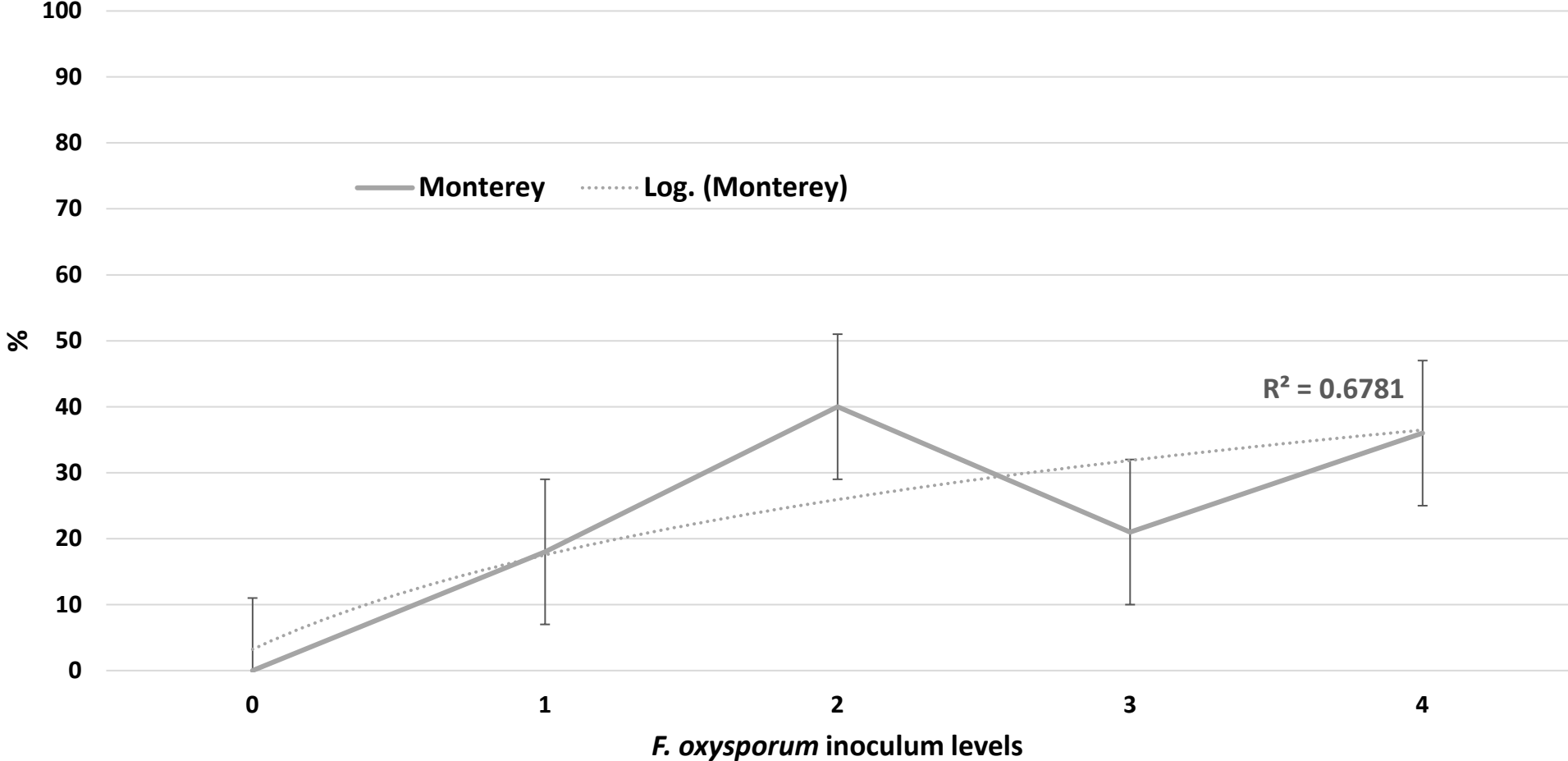
### Percent mortality, Victor, July 2019



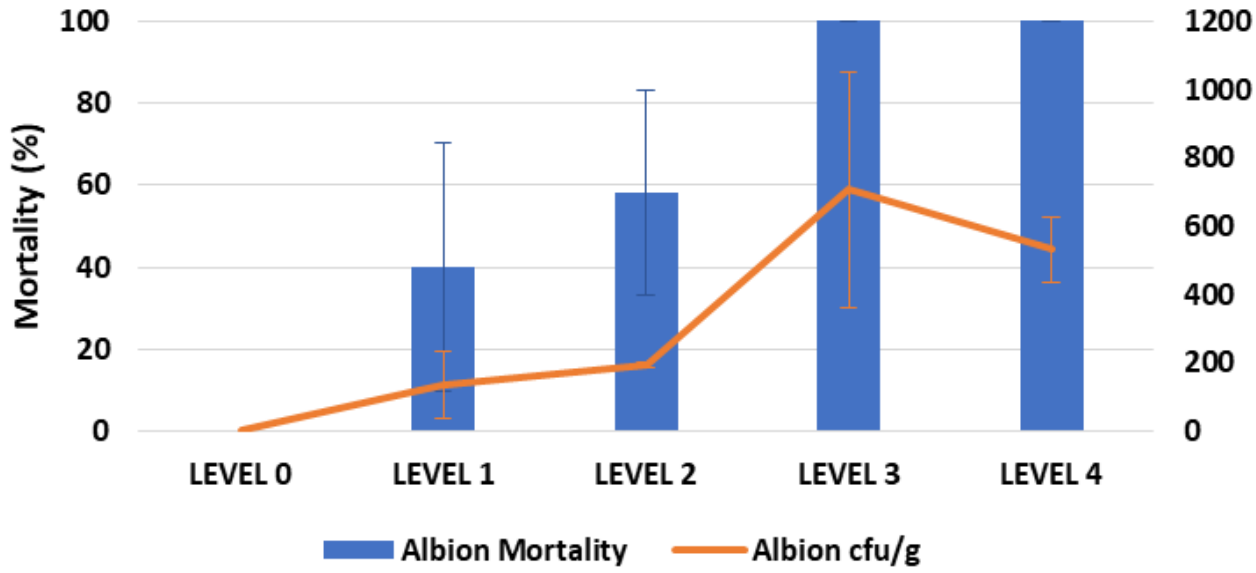
# Percent mortality, Albion, July 2019



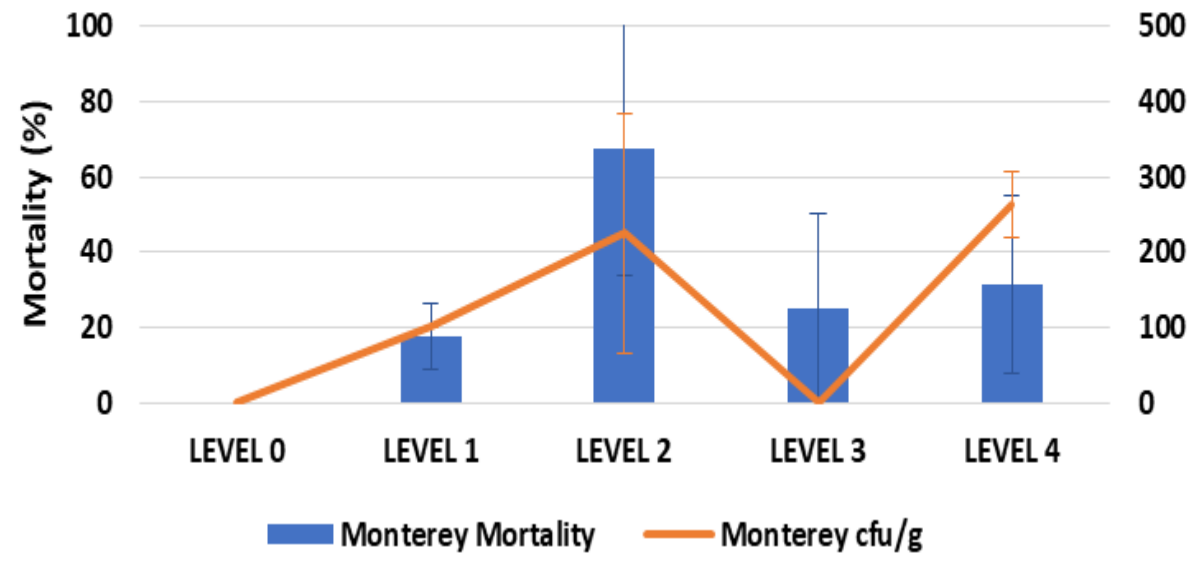
### Percent mortality, Monterey, July 2019



### ALBION - END POINT



### MONTEREY - END POINT





# 2019-2020 Season: short day cultivars

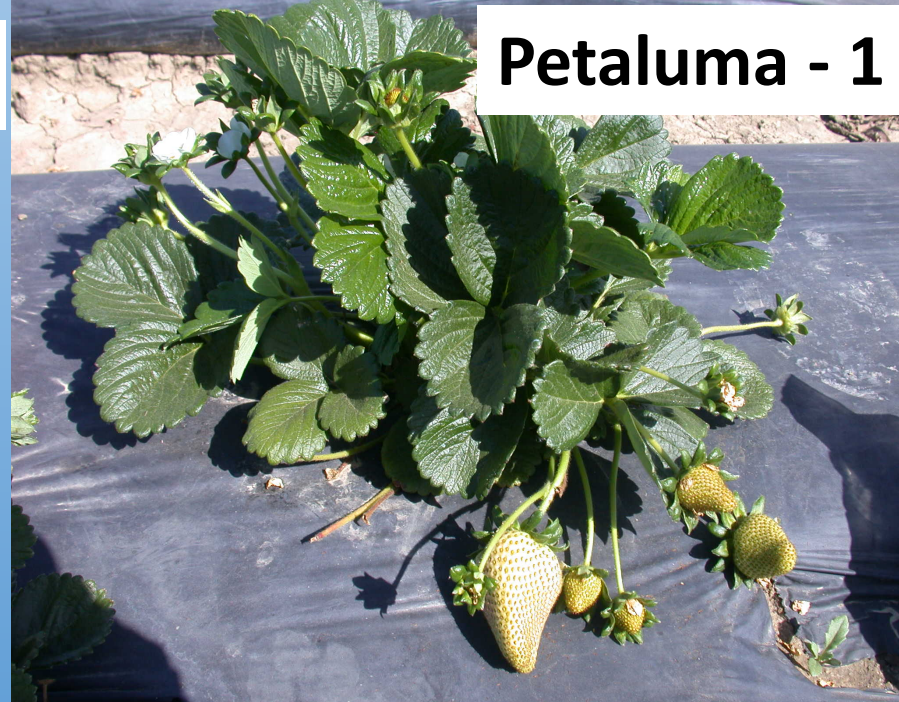
- Petaluma (Fusarium susceptible)
- Victor (Fusarium resistant)
- Warrior (Fusarium resistant)

<b>PLANT SIZES, DEC 11</b>	<b>CM<sup>2</sup></b>
• Petaluma	<b>168 a</b>
• Victor	<b>113 b</b>
• Warrior	<b>138 b</b>





**Petaluma - 0**



**Petaluma - 1**

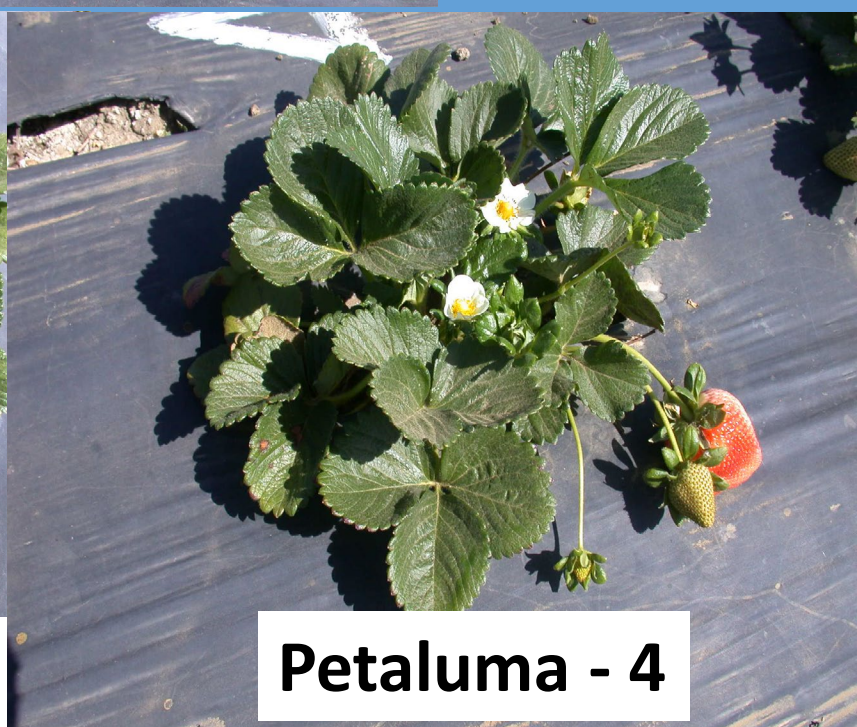
**4/28/2020**



**Petaluma - 2**



**Petaluma - 3**



**Petaluma - 4**





4/28/2020







**Warrior - 0**



**Warrior - 1**

**4/28/2020**



**Warrior - 2**



**Warrior - 3**

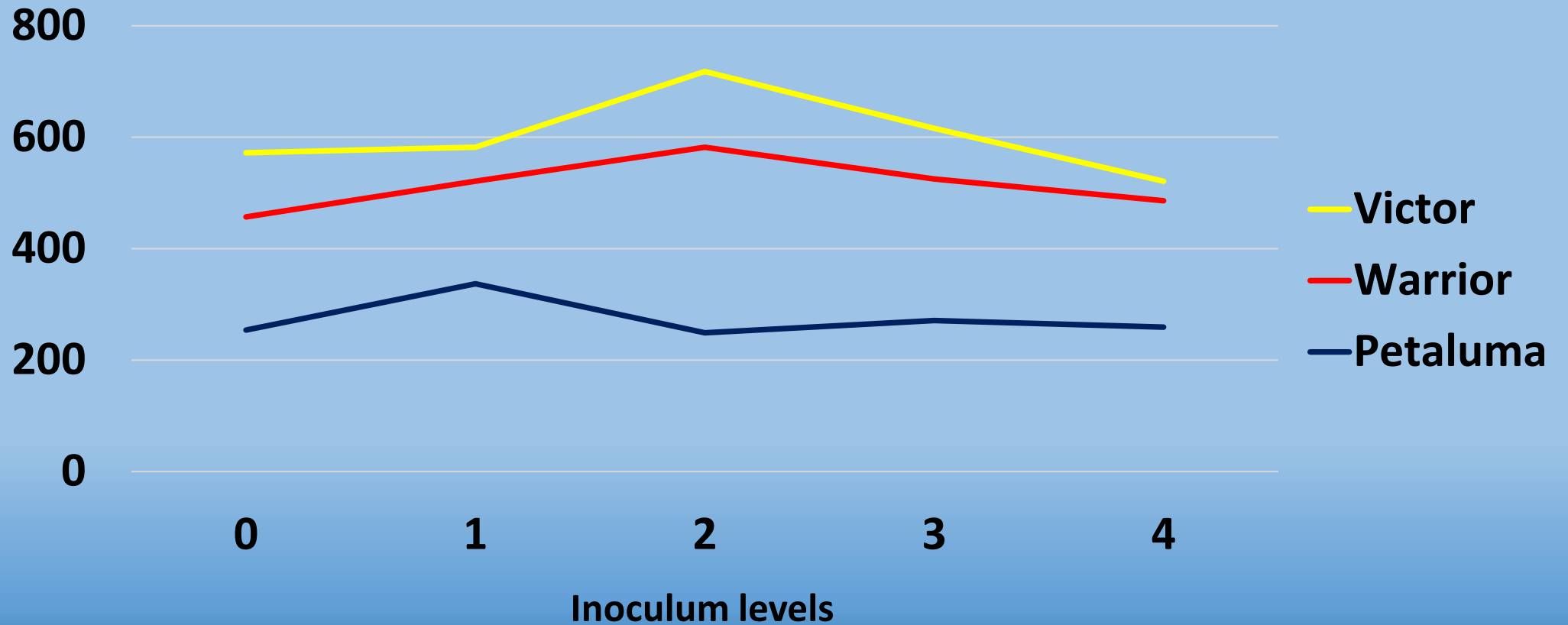


**Warrior - 4**



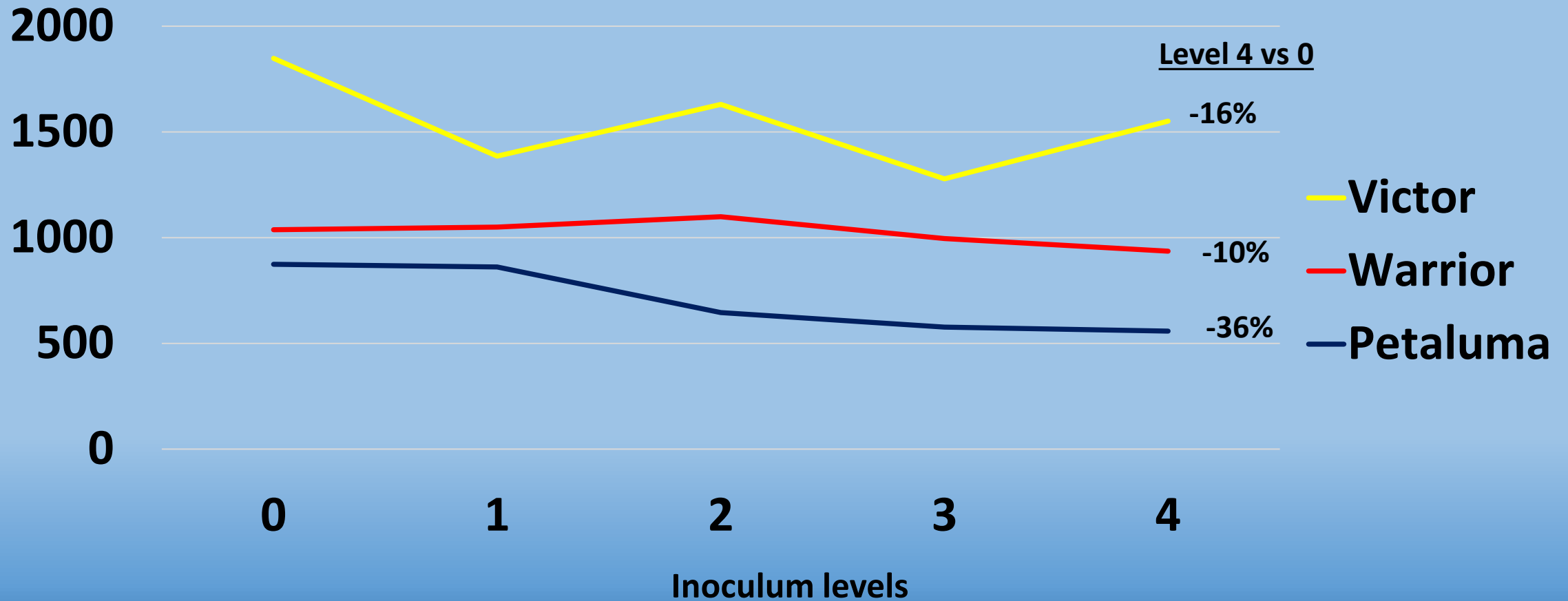
# Fruit yields Jan-April 2020

Yield, g/plant through April 2020



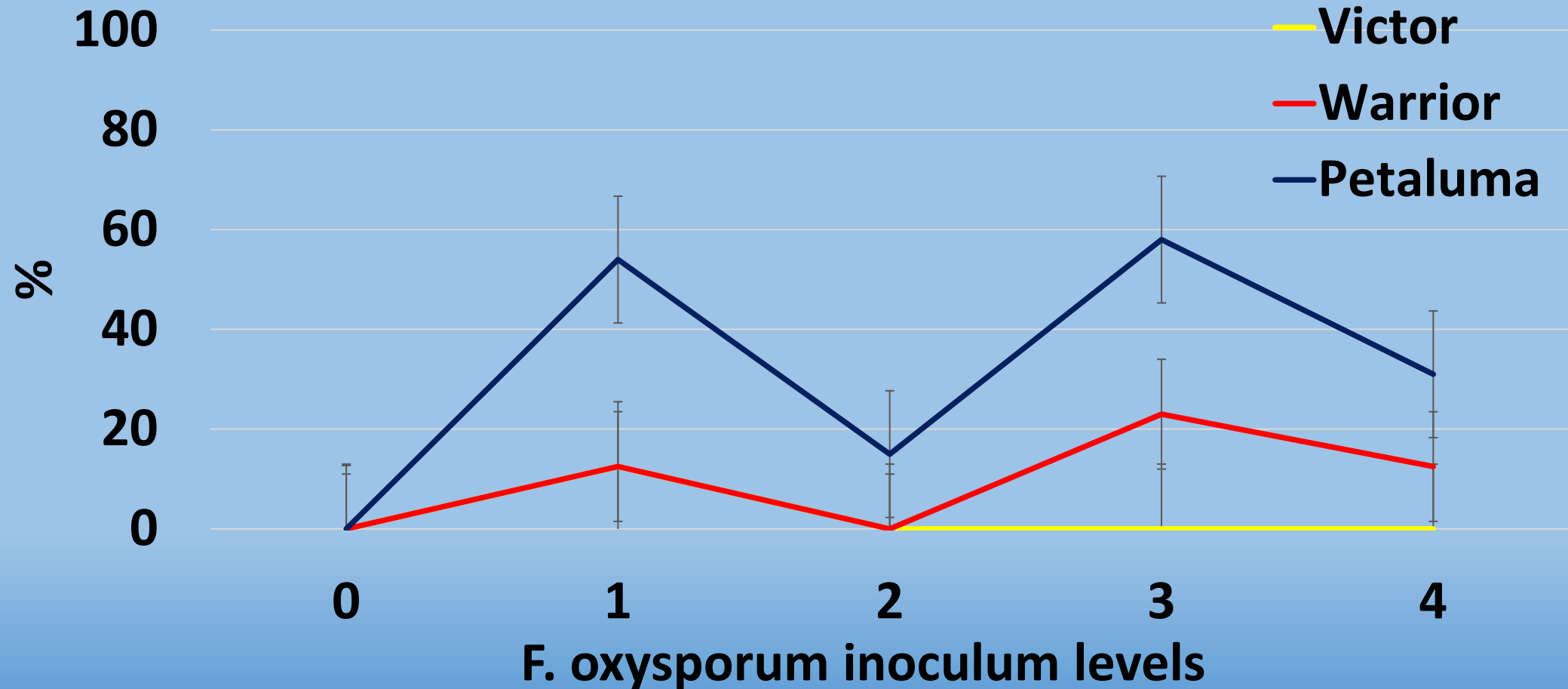
# Fruit yields Jan-July 2020

## Yield, g/plant Jan - July 2020



# Percent mortality, July 2020

Level 4 vs 0

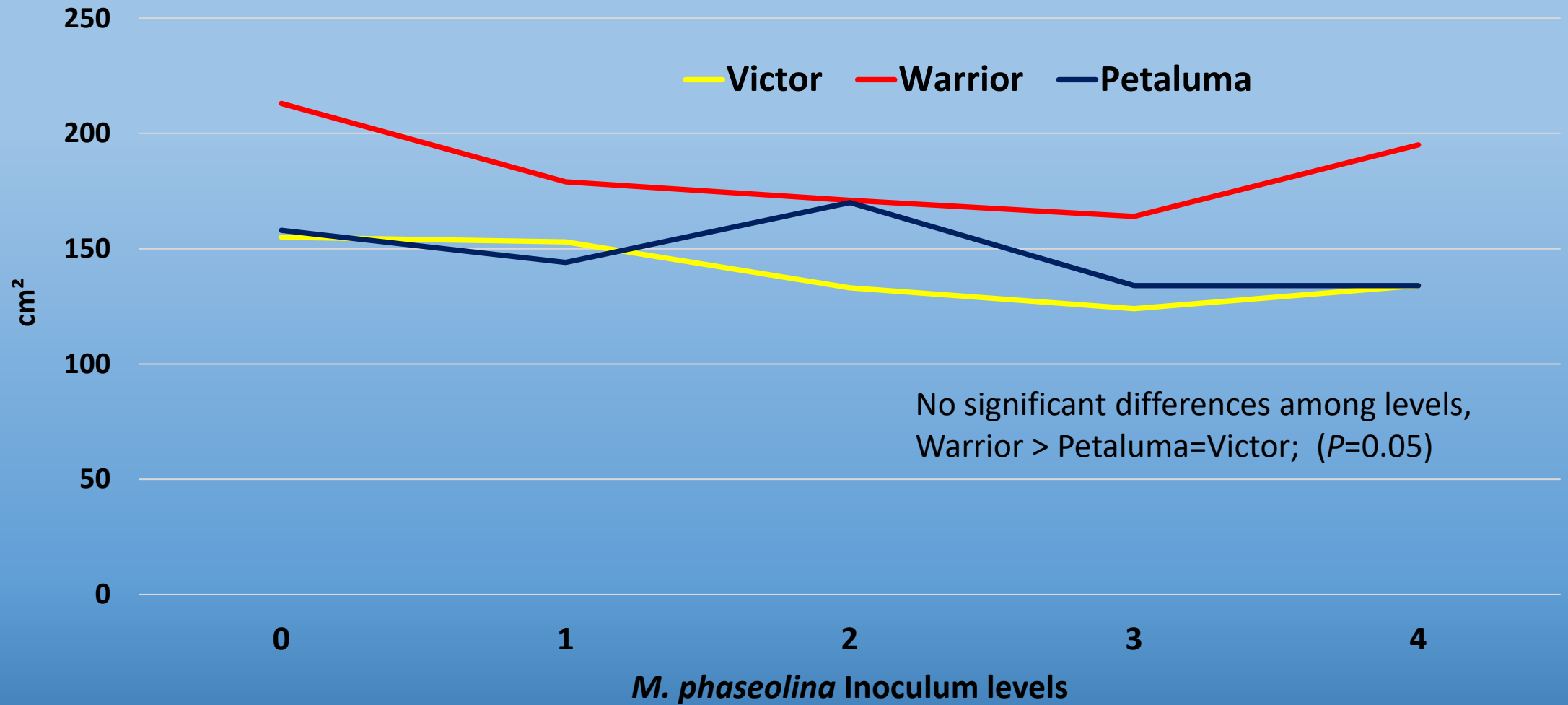


# How much **Macrophomina** in soil can strawberry handle?

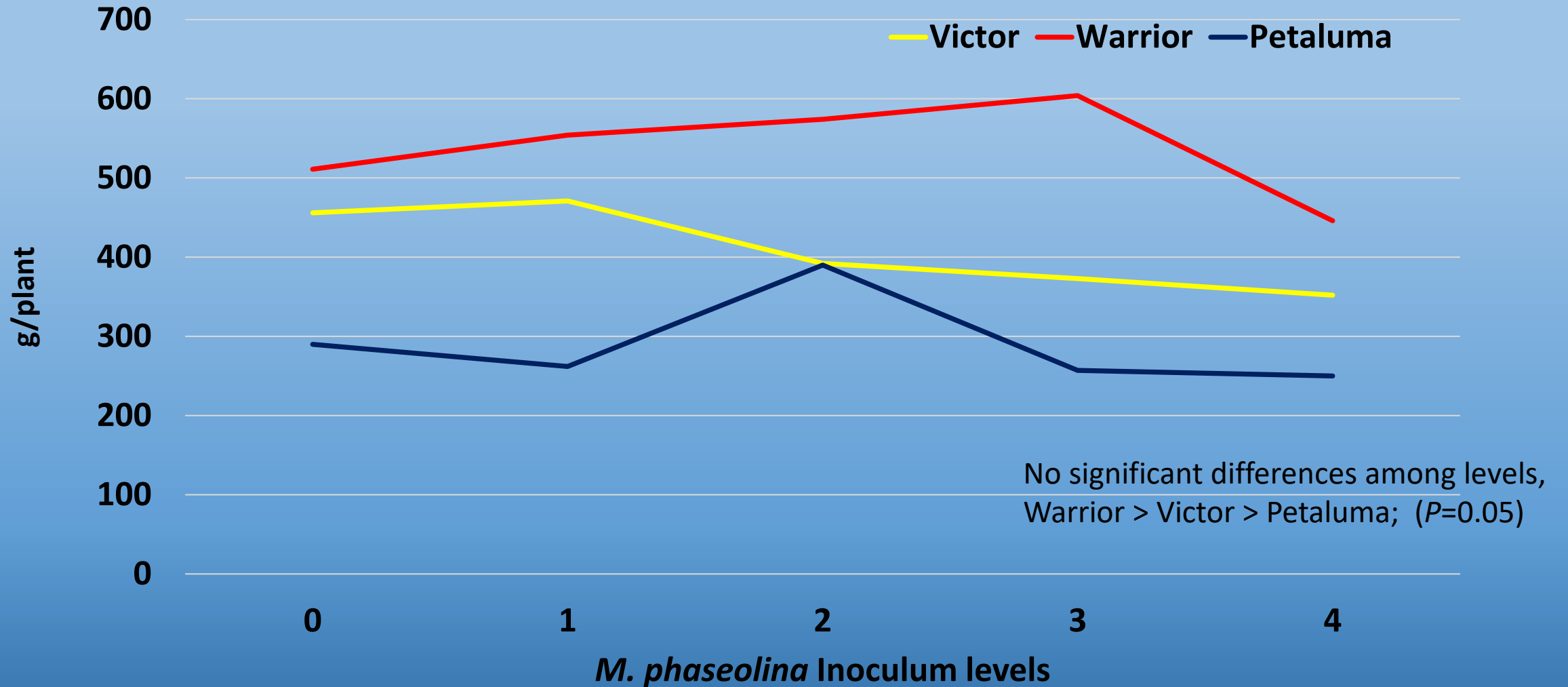
**2000 CFUs per gram (4),  
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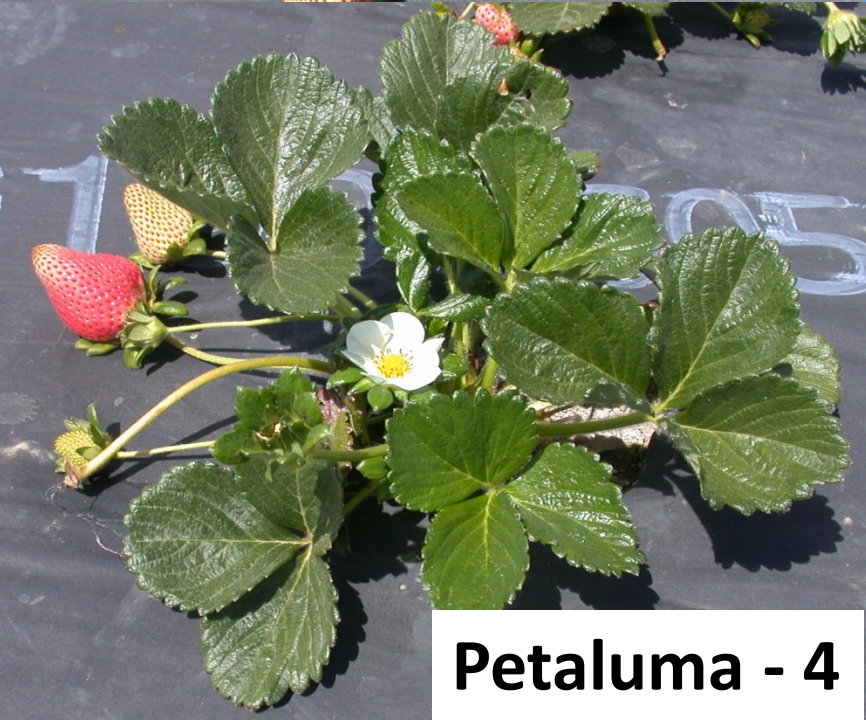
## Plant size (avg.) on 12/11/2020



# Fruit yields Jan-March 2021









# Cultivar resistance

- Victor and Warrior resistance at high Fusarium density in soil (no yielded losses or mortality)
- Susceptible cultivars (Albion, Monterey , Petaluma) can produce most of the season in low-level Fusarium infested soils. Mortality increases rapidly with pathogen density late in the season
- Macrophomina?
- ALL CULTIVARS SUPPORT PATHOGENS

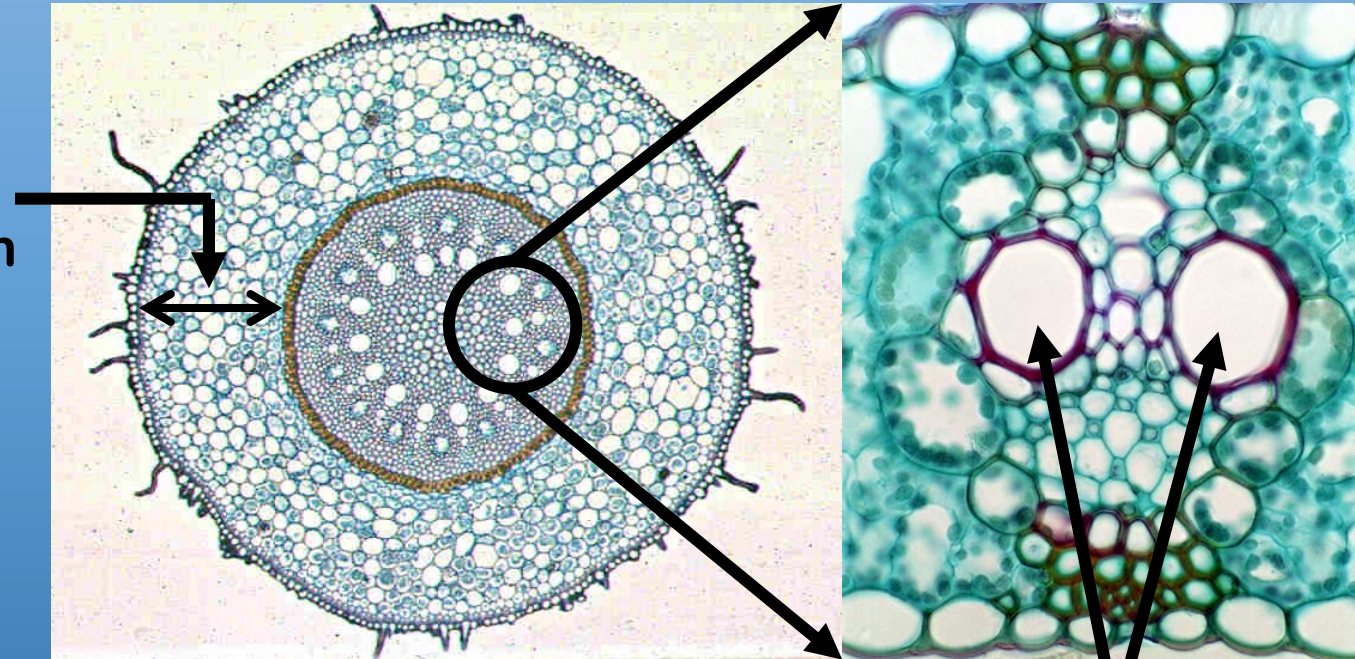


Non-pathogenic  
fungi colonize the  
root cortex

*Fusarium  
oxysporum*  
f. sp. *fragariae*

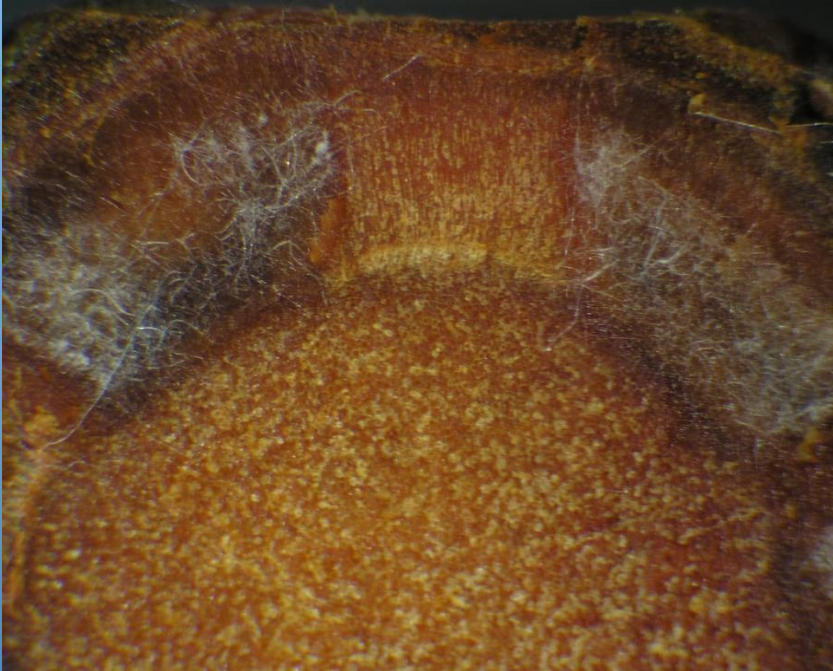


Region of  
fungal growth



Xylem vessels

The Pathogen Moves Into The Shoot With **Water**



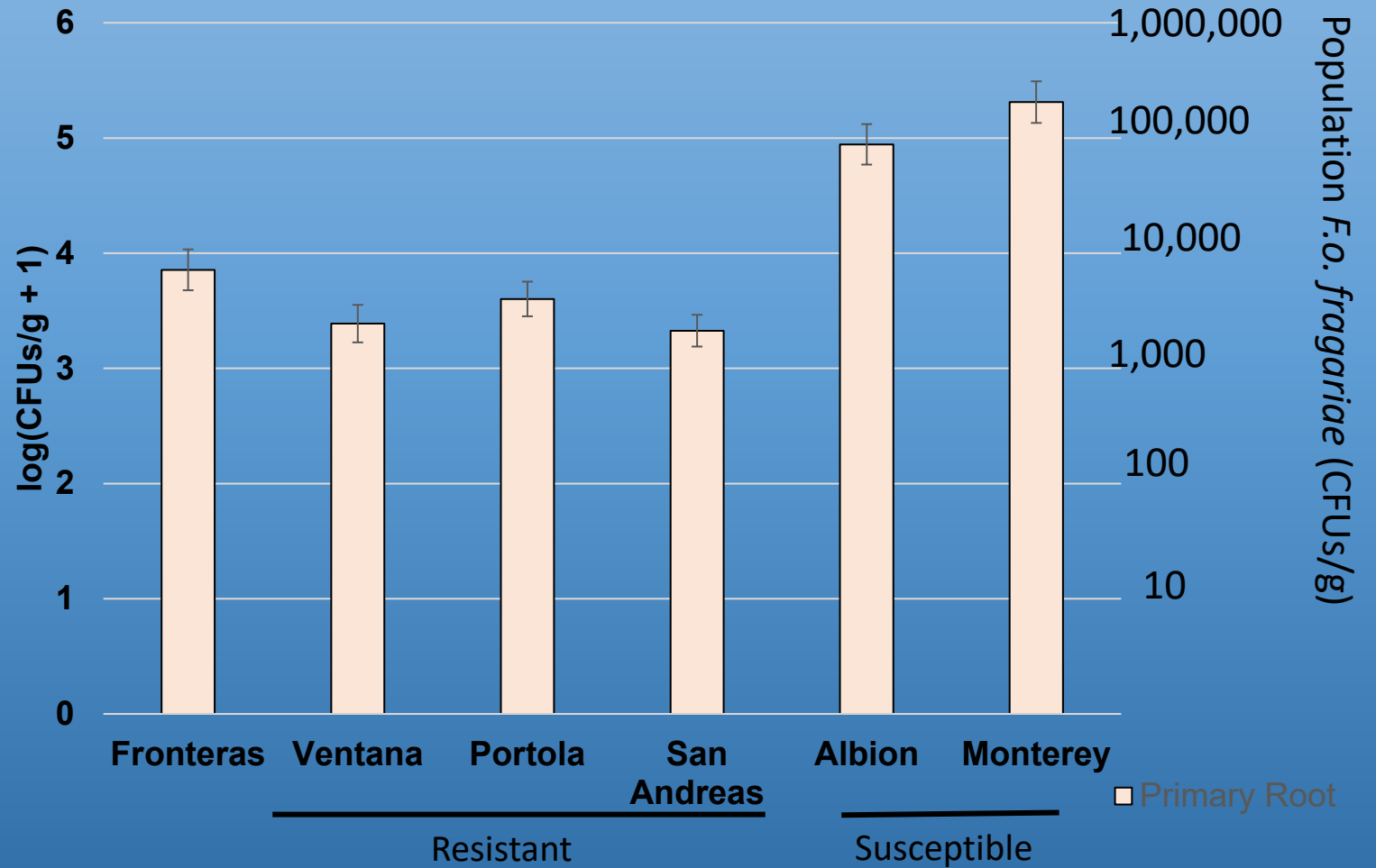
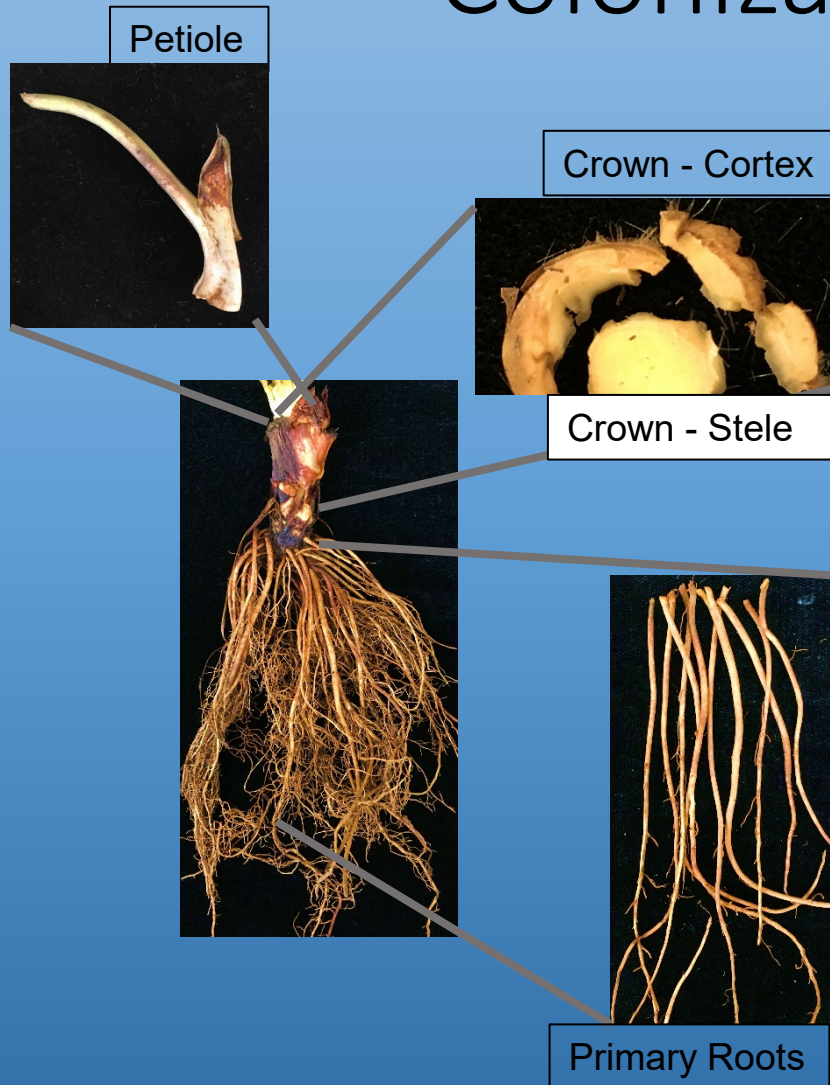
**Colonized vascular tissue**



**Obstruction of water flow**

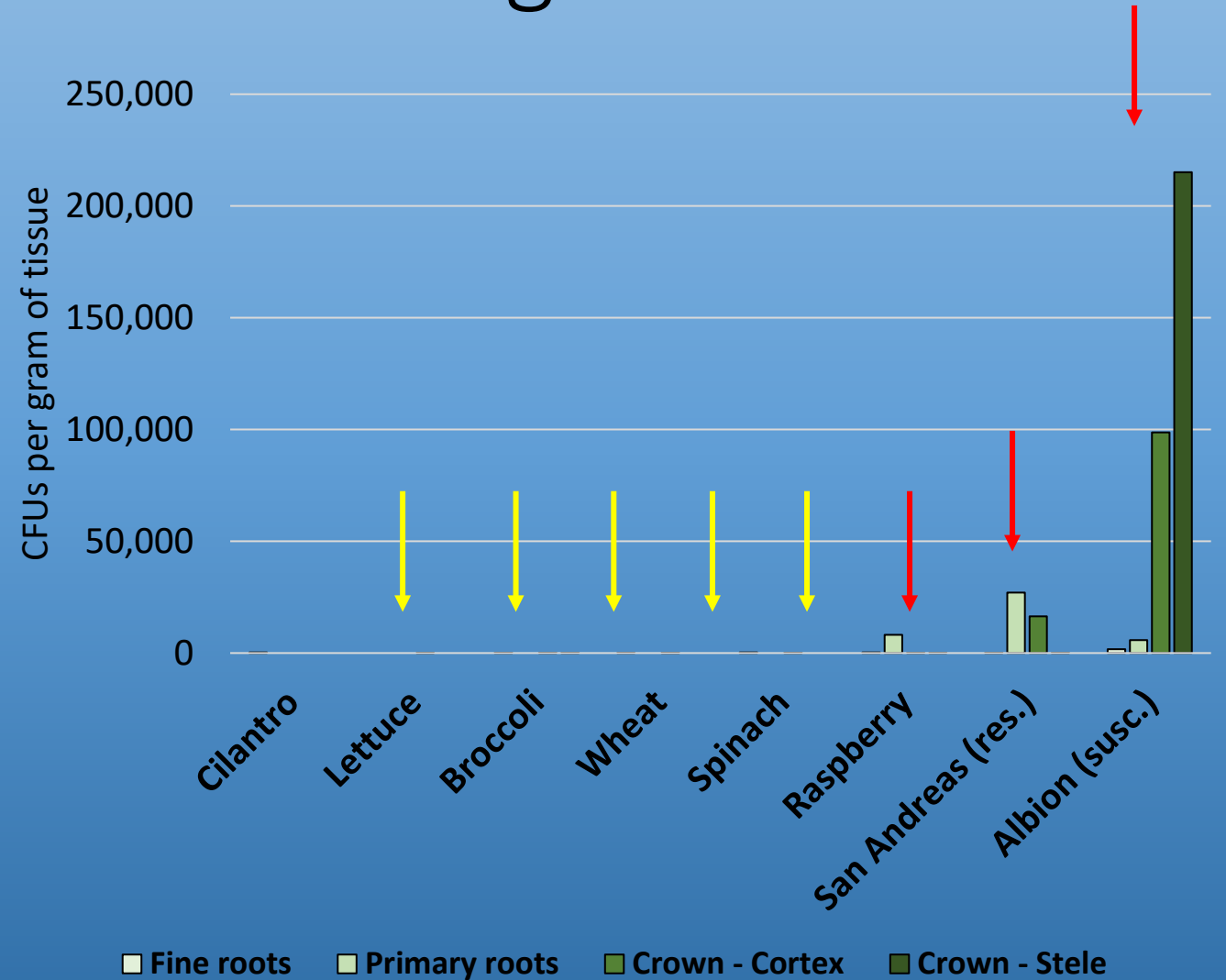


# Colonization of resistant cultivars



# Population growth on living tissues

- Soil: high *F.o. fragariae* population
- Very low population growth detected on tissues of rotation crops
- Exception: Raspberry primary roots



# Acknowledgements

- UCD breeding Program
- Cedar Point Nursery and Lassen Canyon Nursery
- Hansen REC and UCCE staff
- NIFA grant funding