Fusarium wilt of strawberry

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Collaborators:

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Steve Koike

Fusarium wilt

Verticillium wilt

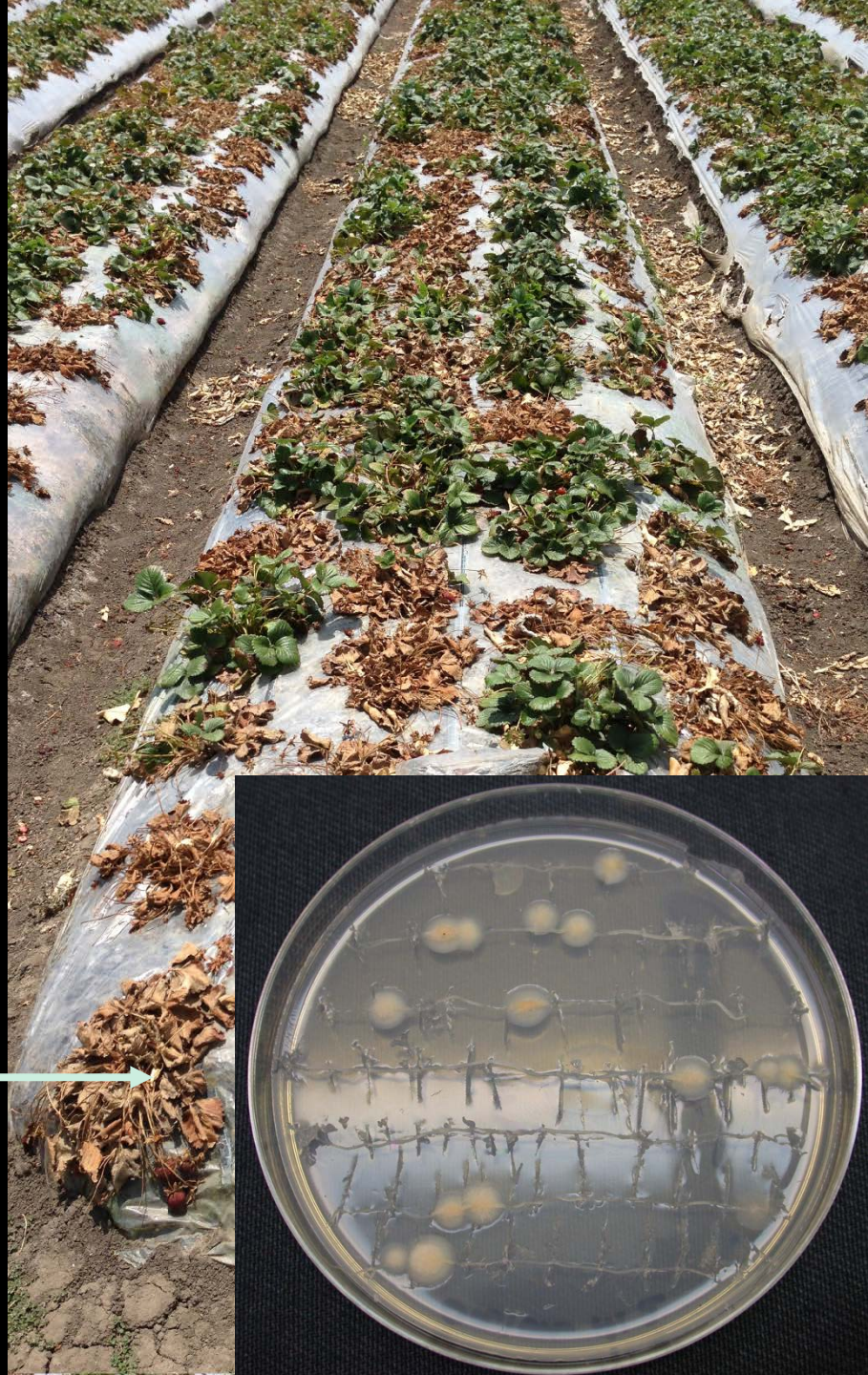
Macrophomina crown rot

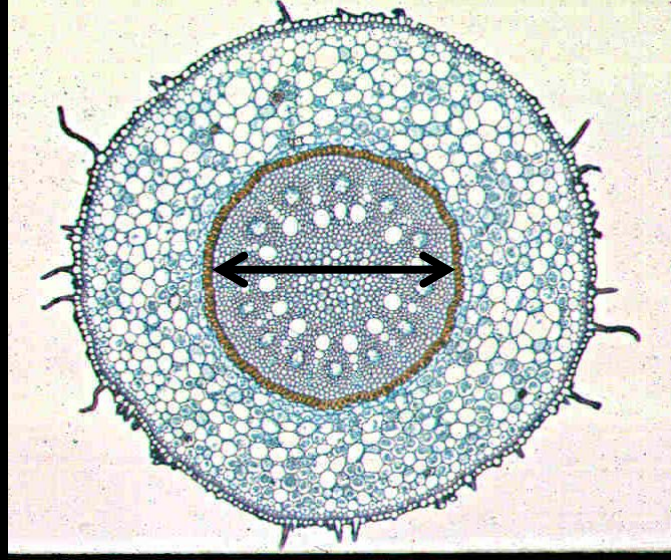
Fusarium wilt

Verticillium wilt

Macrophomina crown rot

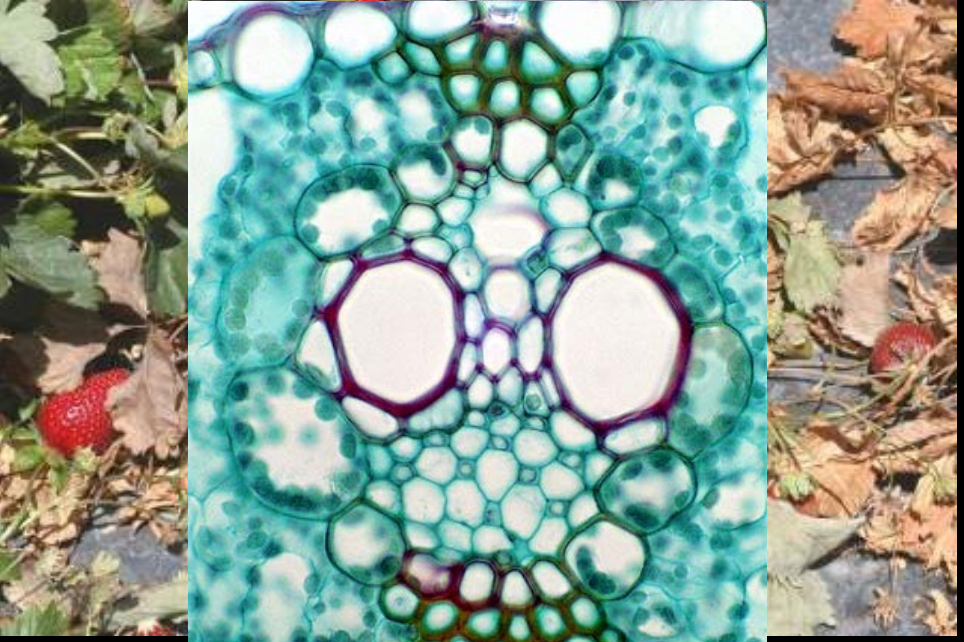
Fusarium oxysporum



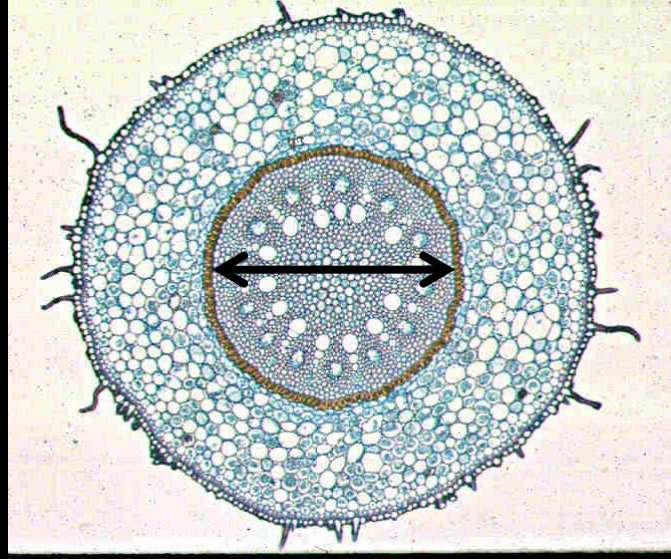


Fusarium wilt

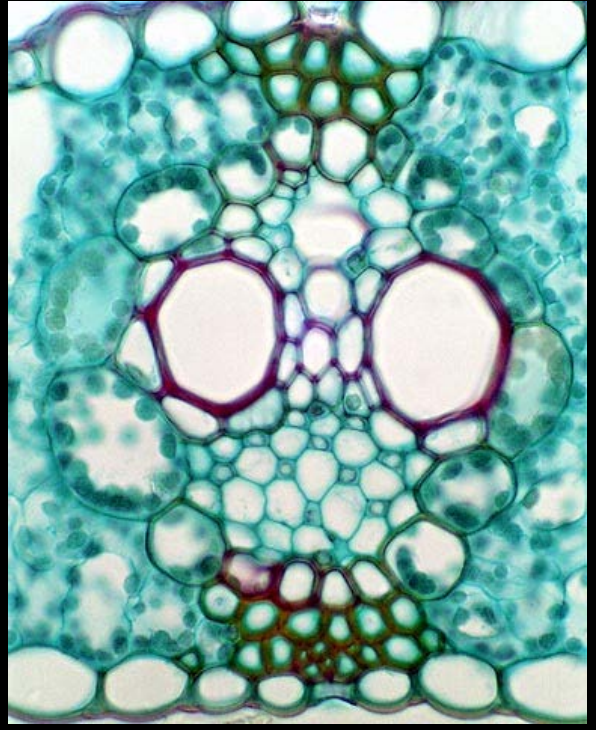
Fusarium oxysporum

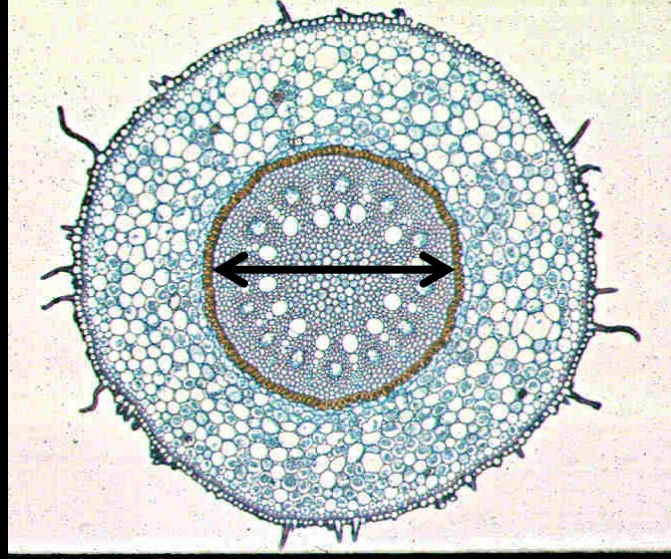


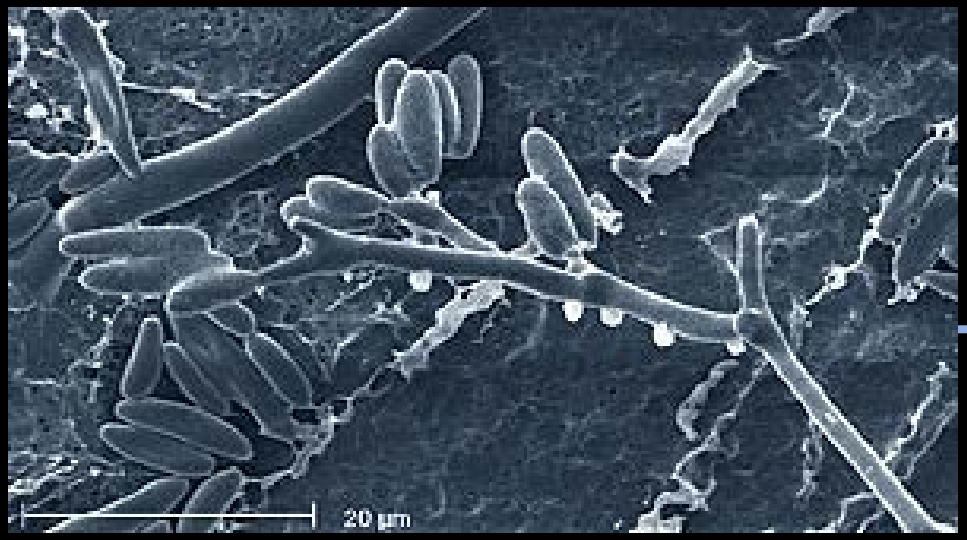
Fusarium wilt



Fusarium oxysporum

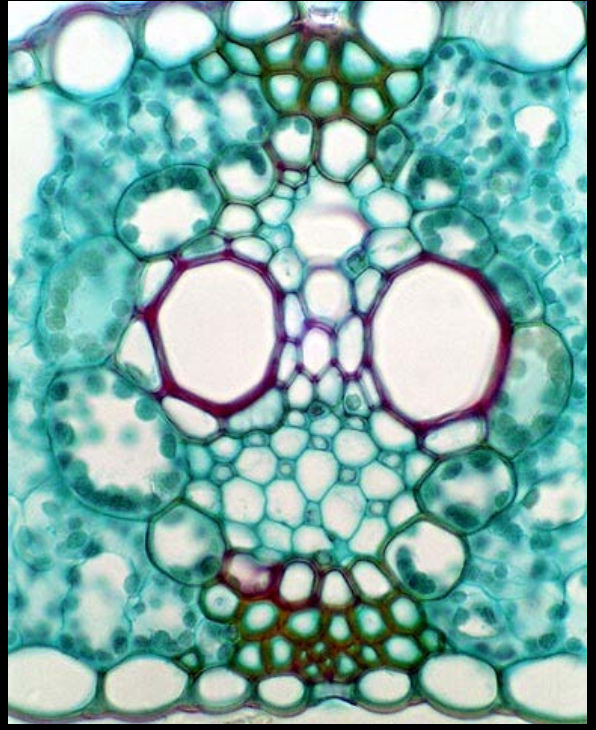


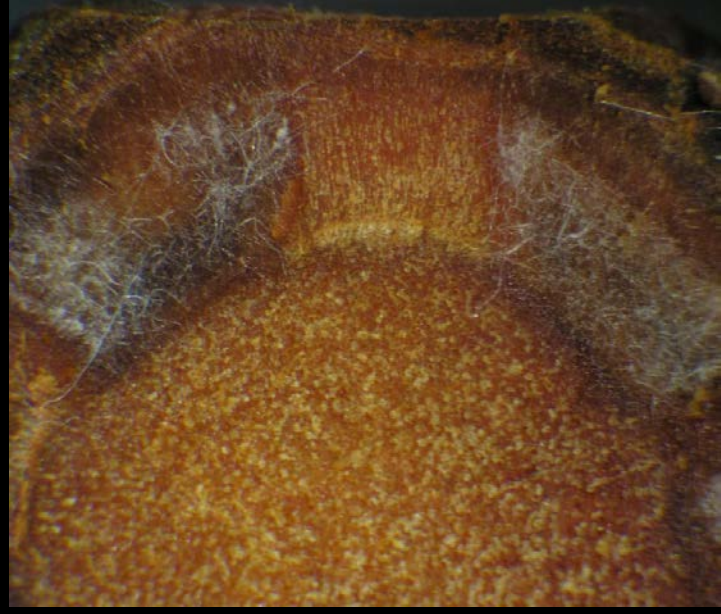




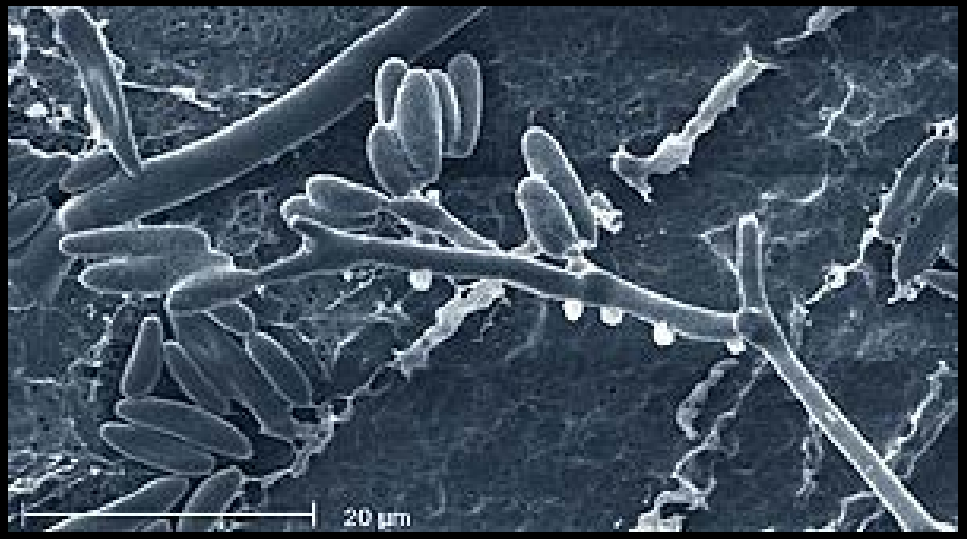
Fusarium oxysporum

Microconidia carried upward in xylem vessels

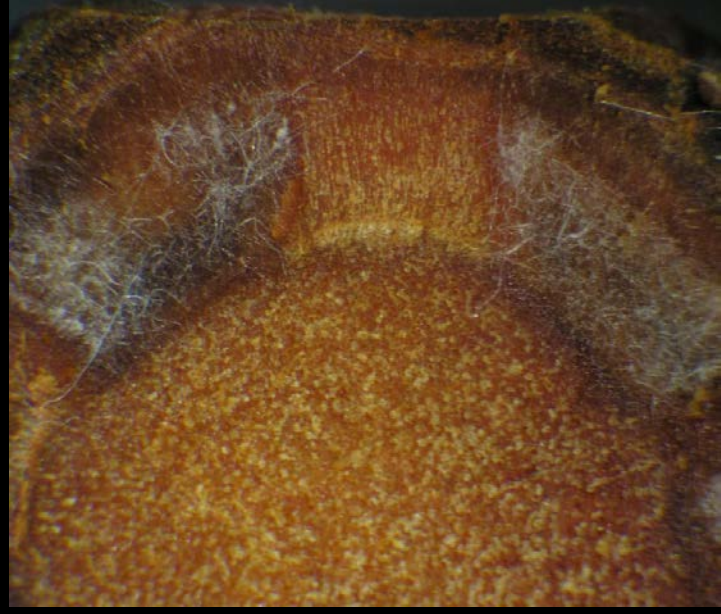




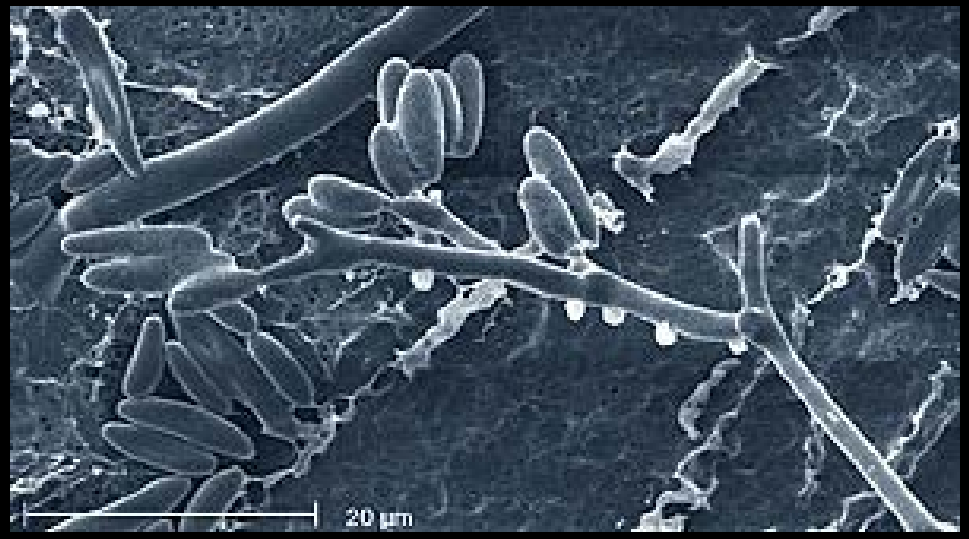
Colonized
vascular tissue



Microconidia carried
upward in xylem vessels



Colonized vascular tissue



Microconidia carried upward in xylem vessels

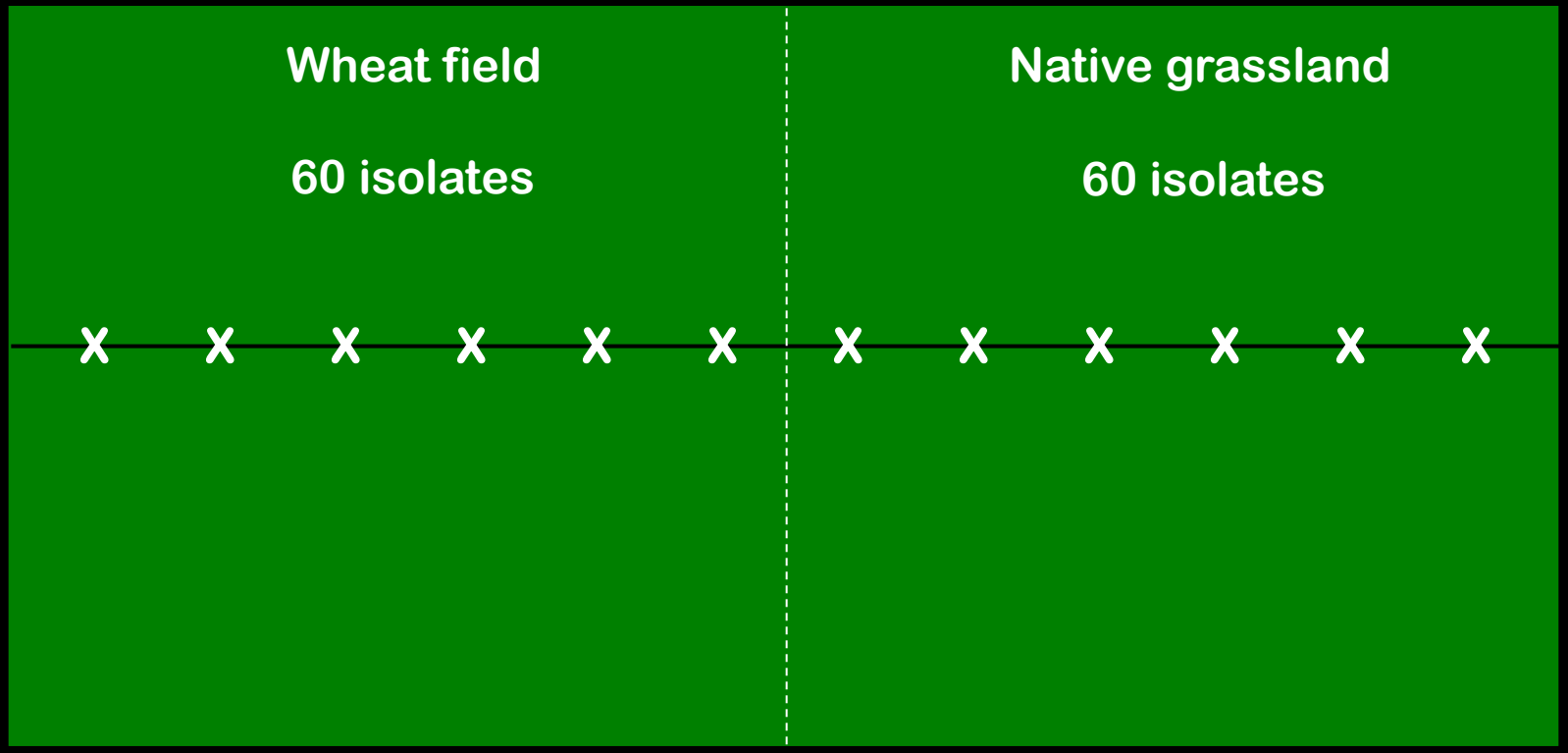
Origin of Fusarium wilt

Fusarium oxysporum **is common in arable soils**

Grasslands

Populations of *Fusarium oxysporum*

Native and cultivated soils



Same population in both soils

Most are non-pathogenic

No visible damage to roots

Pathogens arise through chance encounters

Strain * crop combination

> 120 host-specific strains

Pathogens arise through chance encounters

De novo origin is a rare event

Strain * crop combination

> 120 host-specific strains

De novo origin is a rare event

Most new occurrences are introductions of existing strains

> 120 host-specific strains

De novo origin is a rare event

Most new occurrences are introductions of existing strains

Moved with infested soil

or plants

Introduction to California

Infected plants can be symptomless

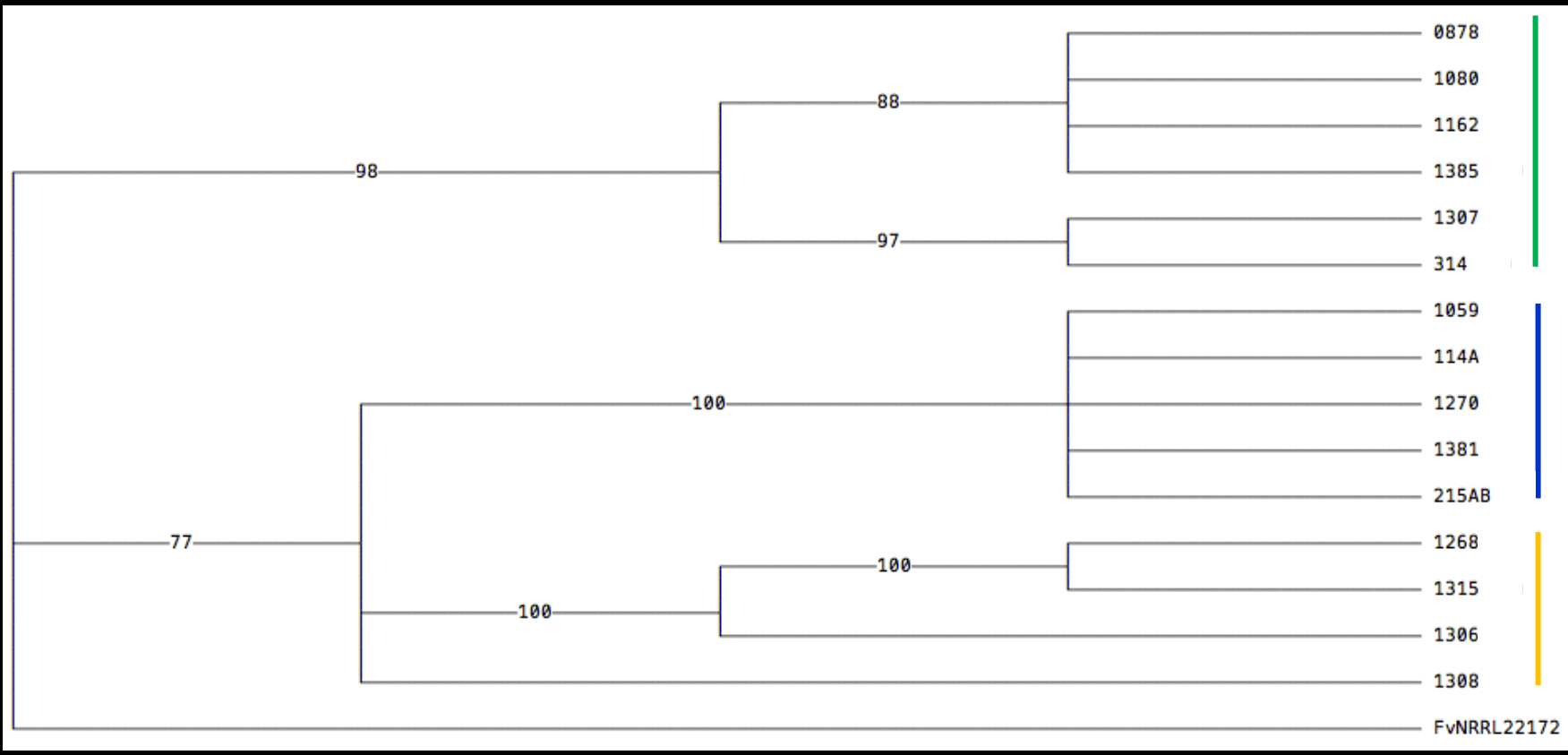
Discovered in Australia in 1962

?

California
2008

Not a single, recent introduction to California

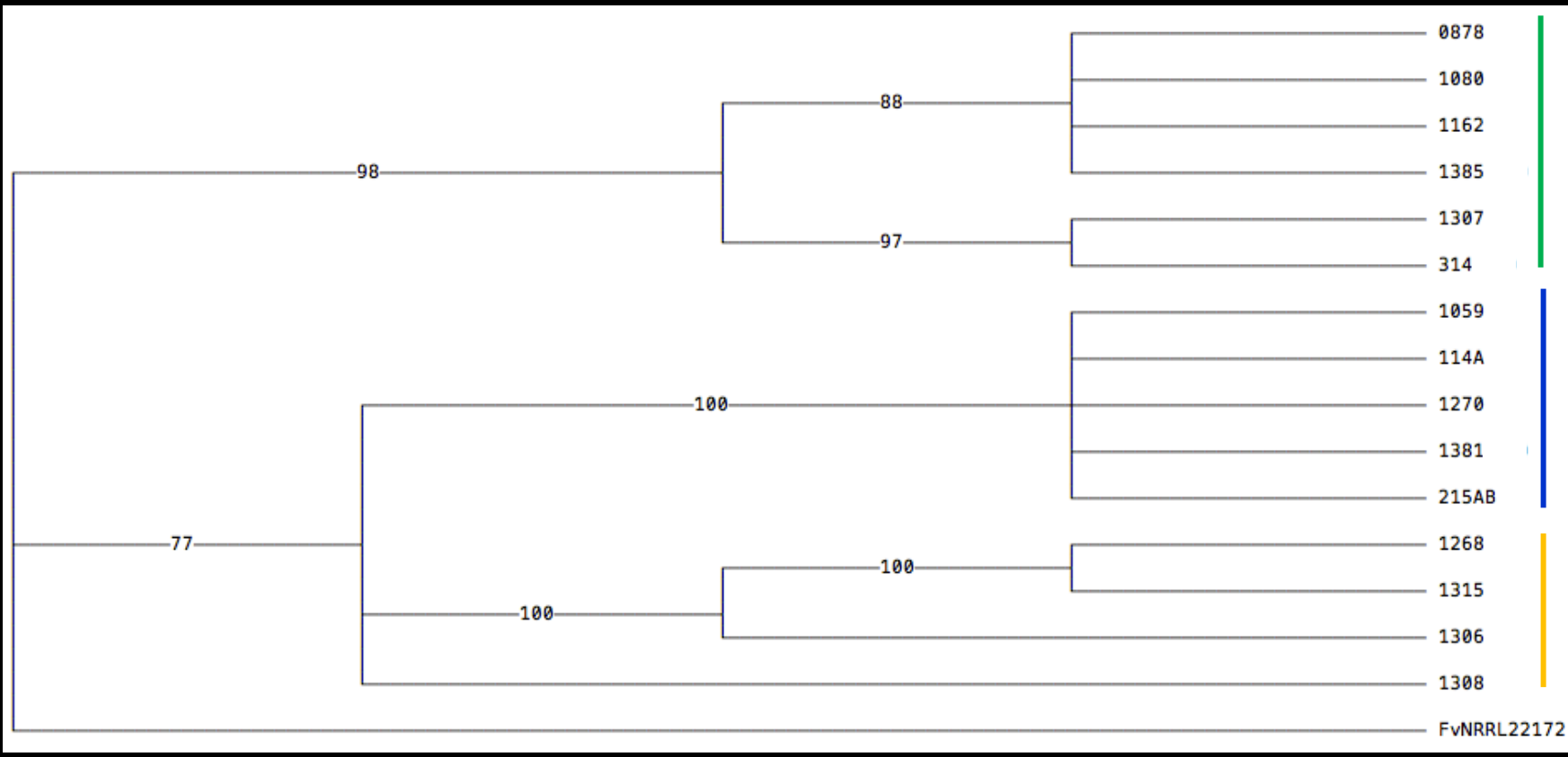
Population of *F. o. fragariae* in CA



DNA sequence comparisons

Population of *F. oxysporum* in CA

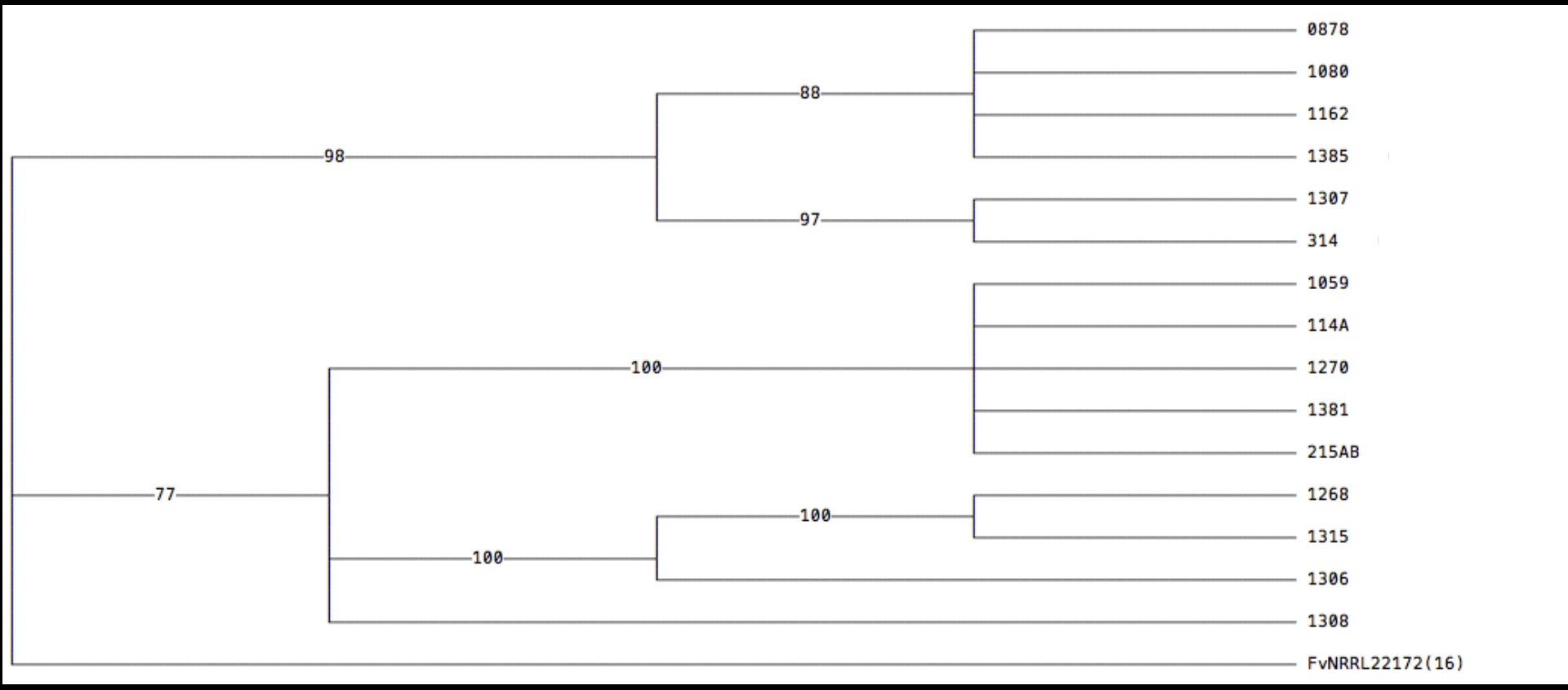
Breeding for resistance



Three strains of the pathogen

Multiple introductions to California

Breeding for resistance



Three strains of the pathogen

Multiple introductions to California

Management

Avoid introduction

Soil on equipment

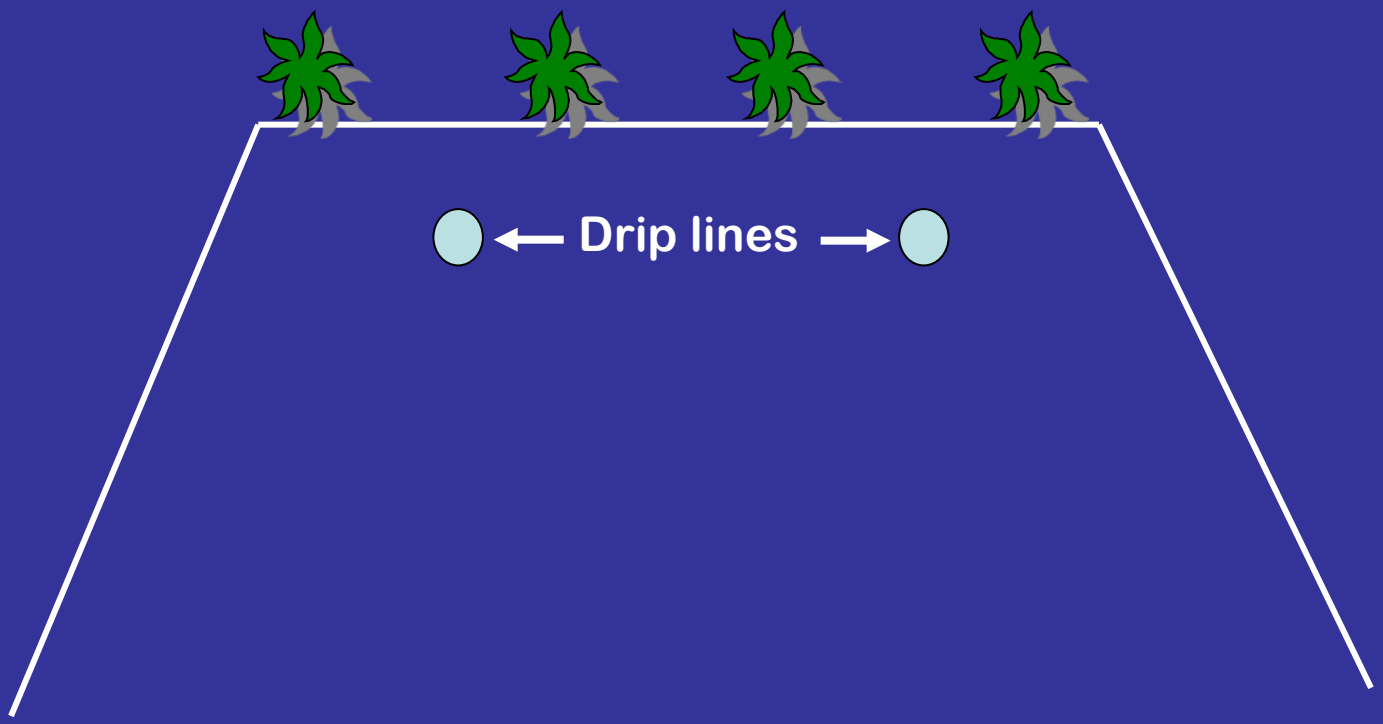
Management

Reduce inoculum levels in soil

Pre-plant fumigation

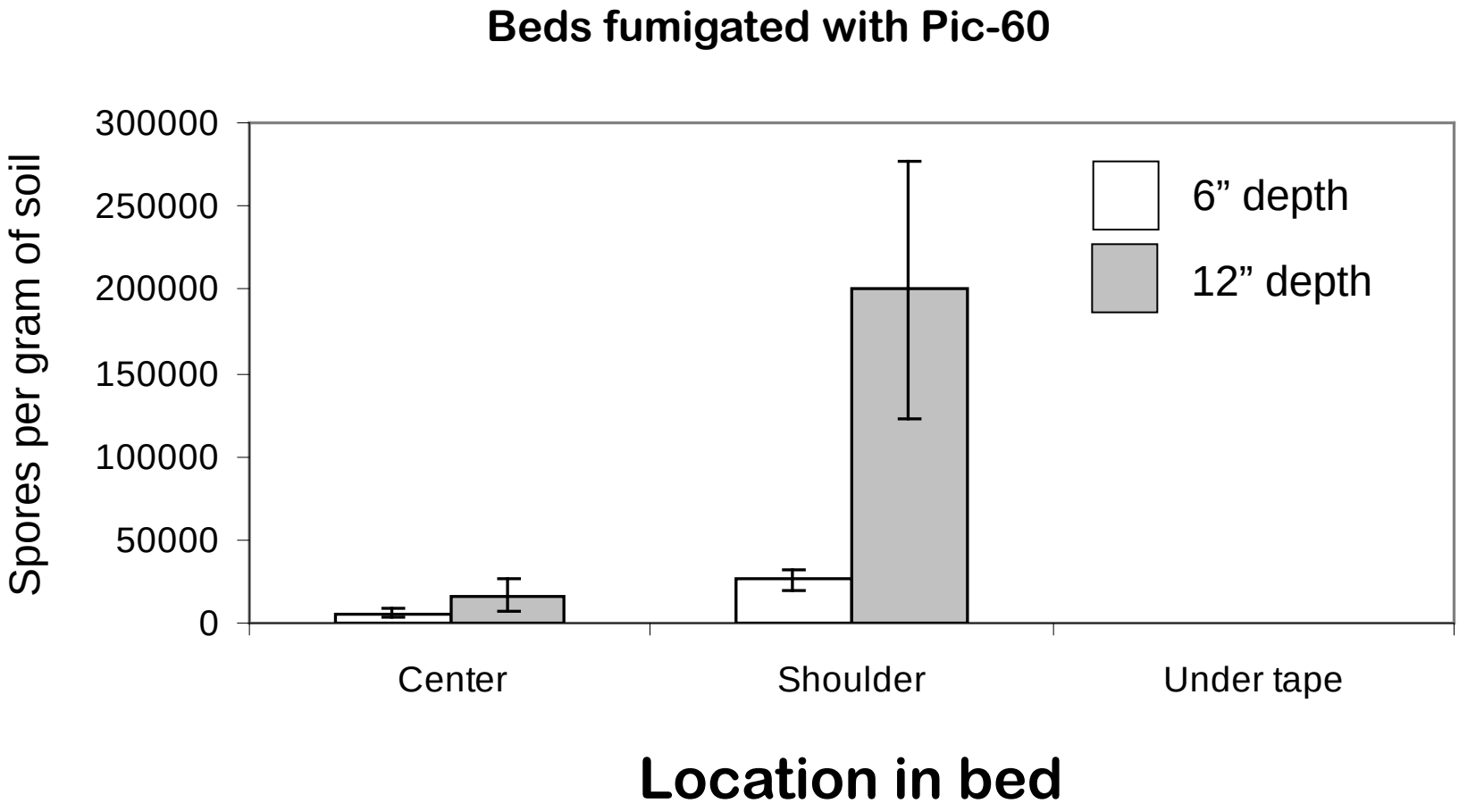
Flat fumigation to treat the entire field

Bed fumigation



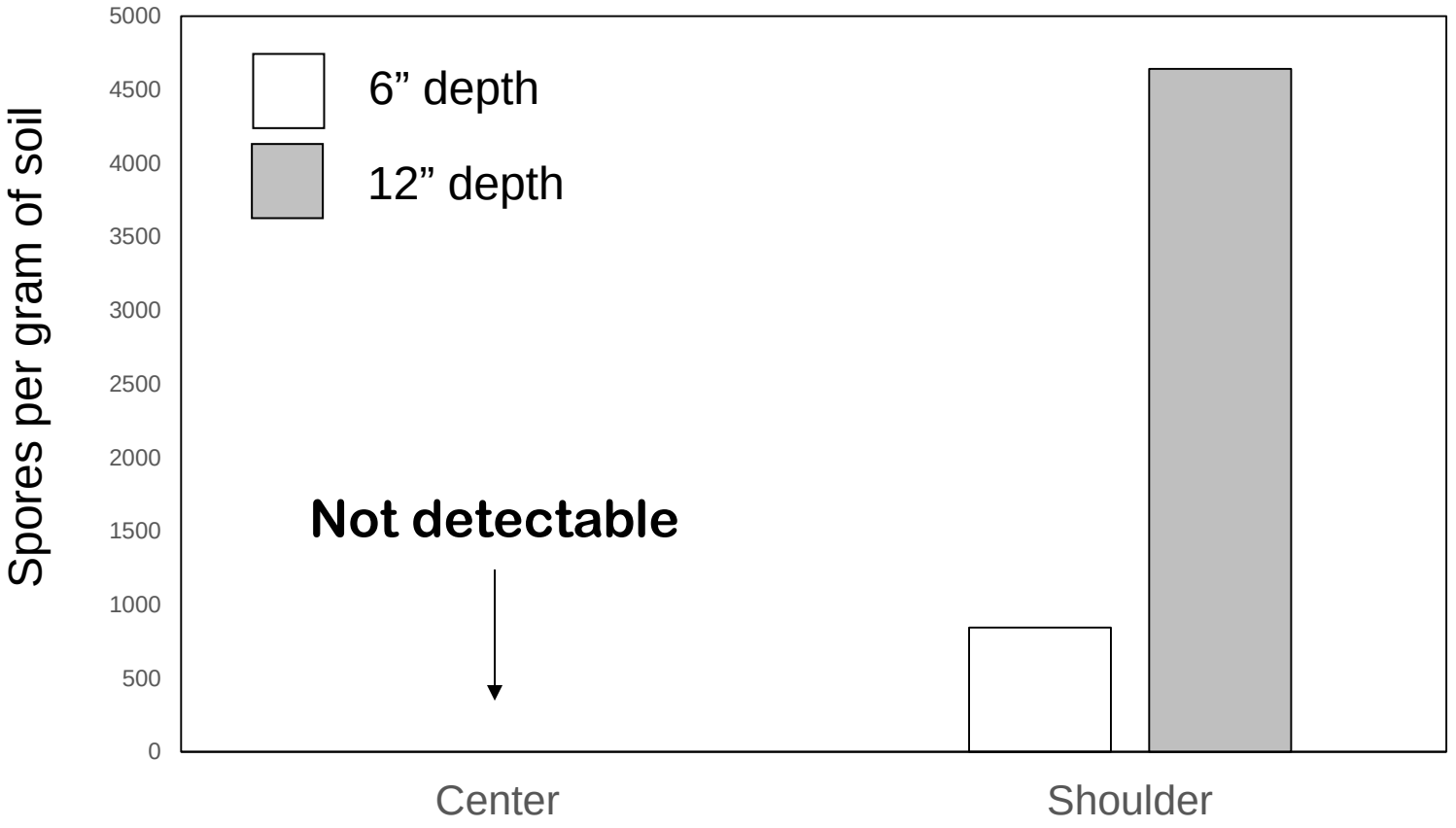
The soil is not uniformly exposed to the fumigant

Mortality is not evenly distributed across beds


Beds fumigated with Pic-60
Spores per gram of soil
300000
250000
200000
150000
100000
50000
0
6” depth
12” depth
Center
Shoulder
Under tape
Location in bed

Four drip tapes

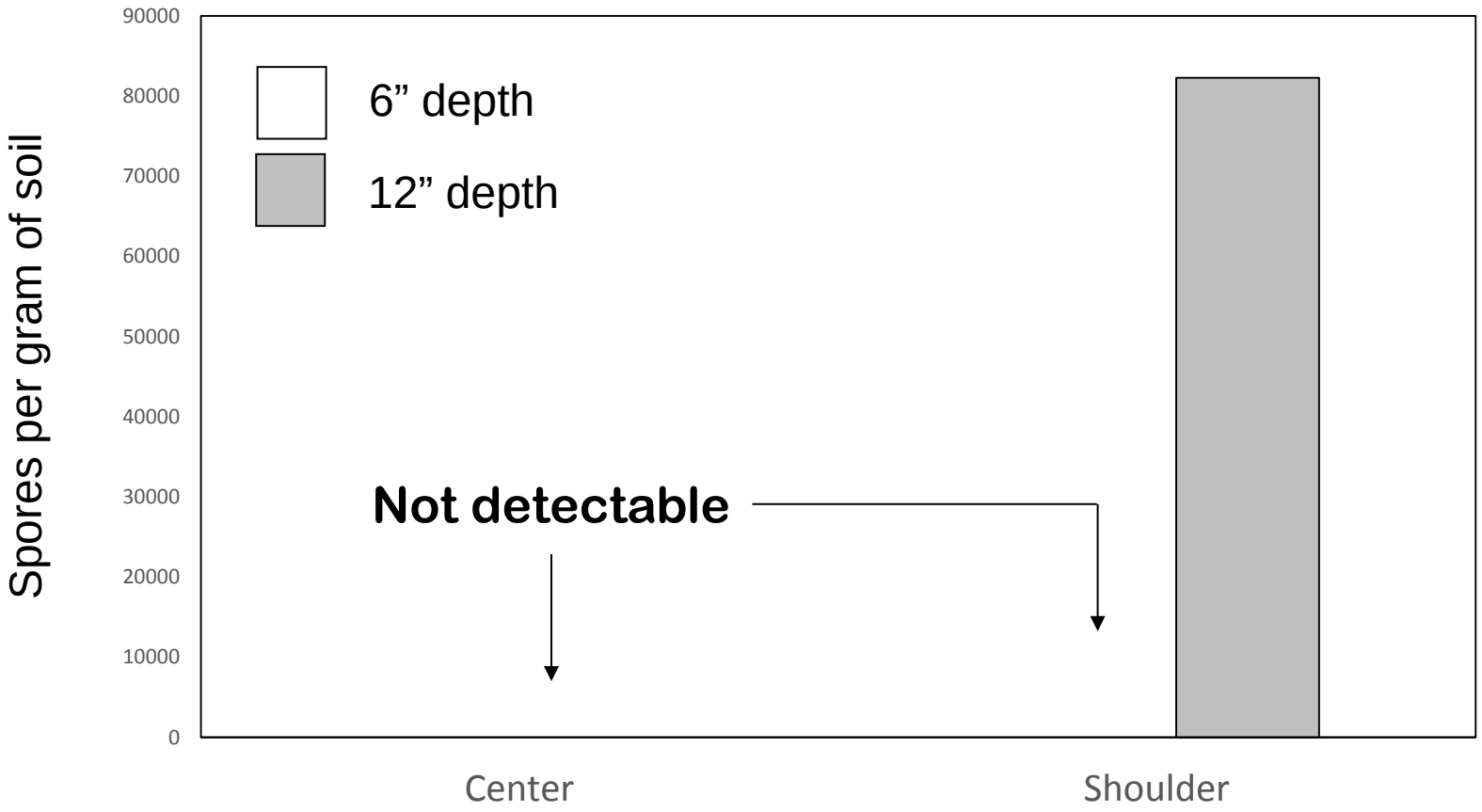
Shallow depth



Location in bed

Four drip tapes

two shallow + two deep



Location in bed

Effect of inoculum depth on disease

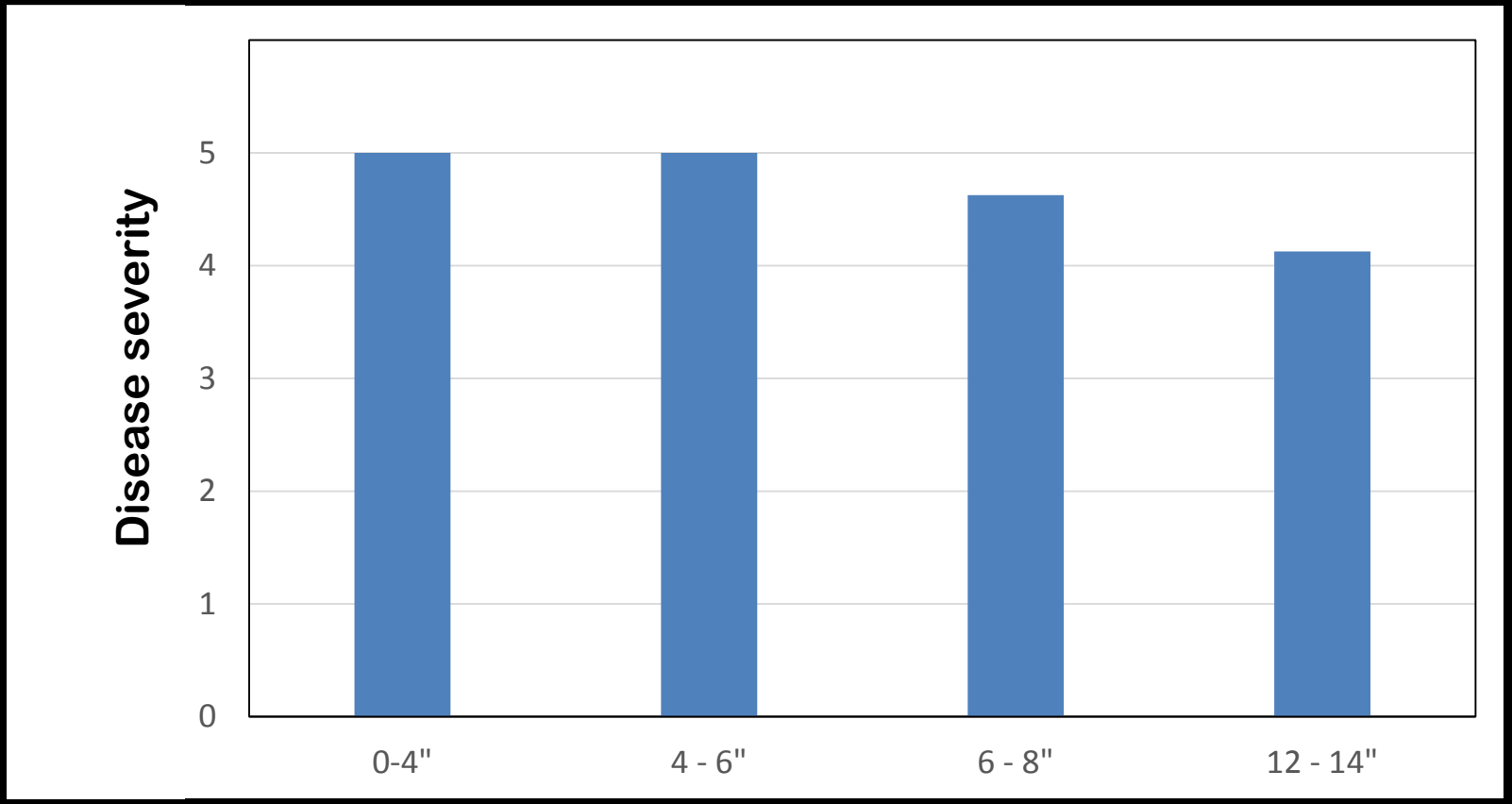
Nine weeks after planting

Inoculum below 12”

14 weeks after planting

Disease severity

16 weeks after planting



Inoculum depth

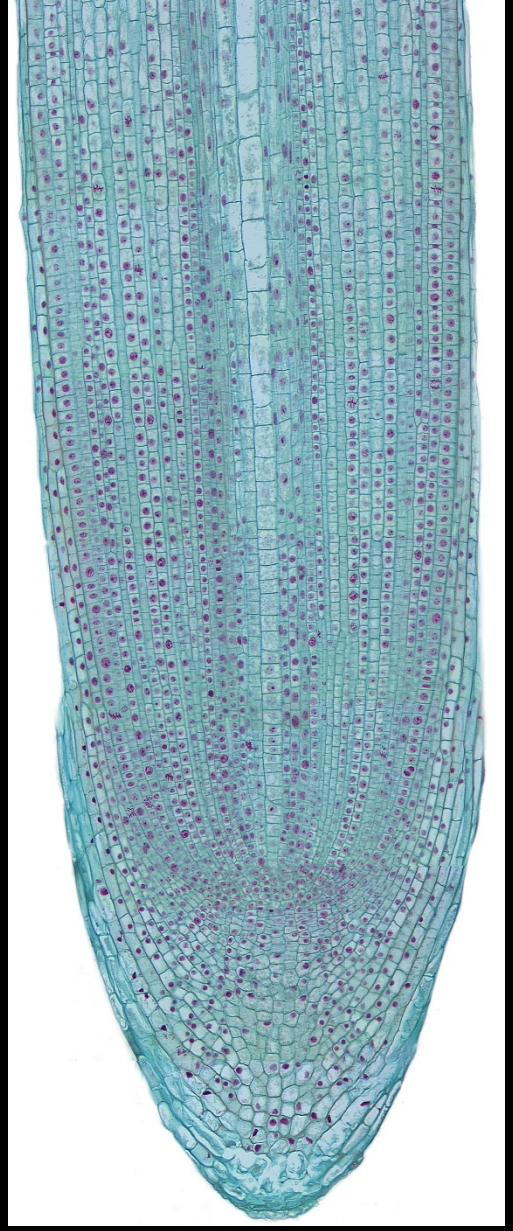
Crop rotation

Inoculum levels decline when other crops are grown

Fusarium wilt

Specific to strawberry

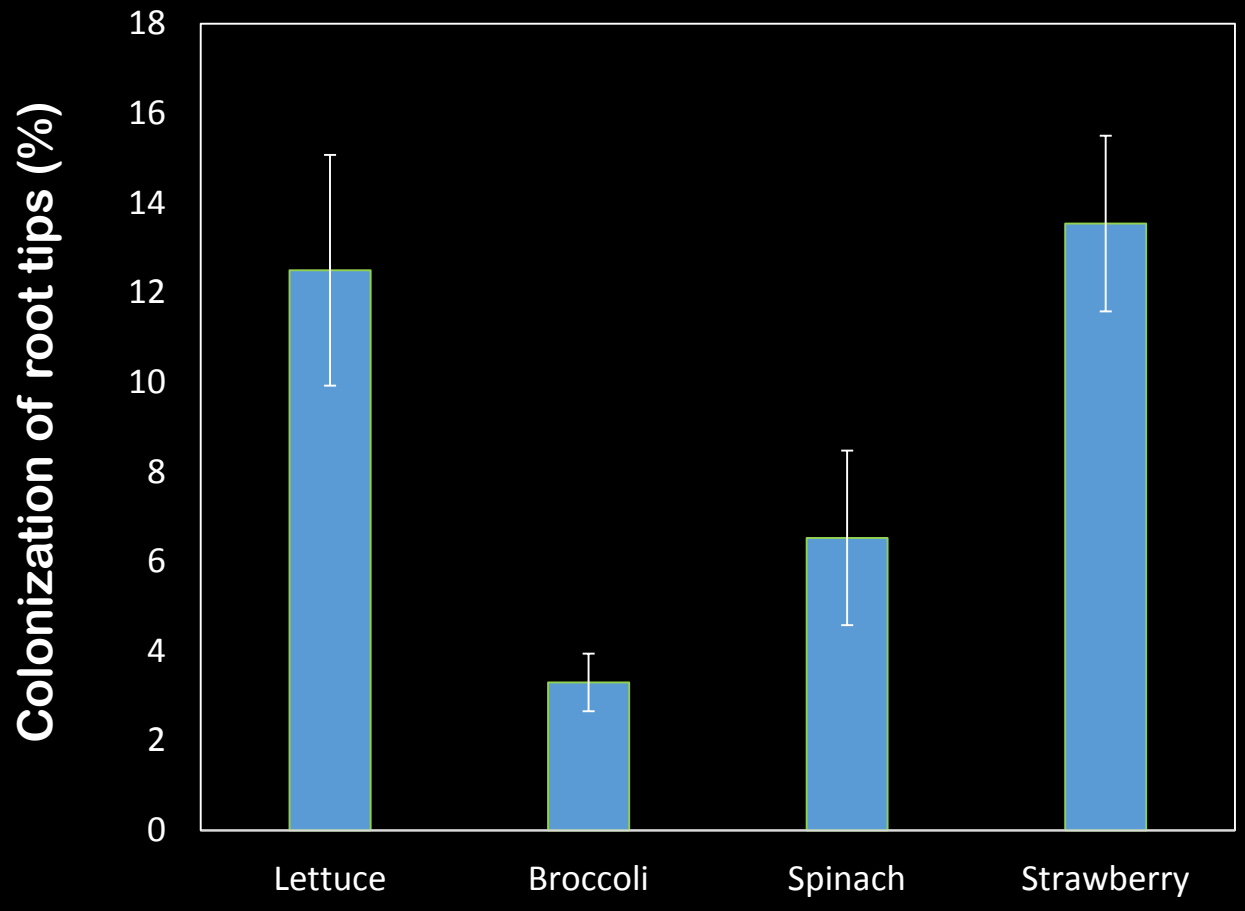
Colonization of rotation crops



Root tip

Proportion of root tips infected

Colonization of rotation crops

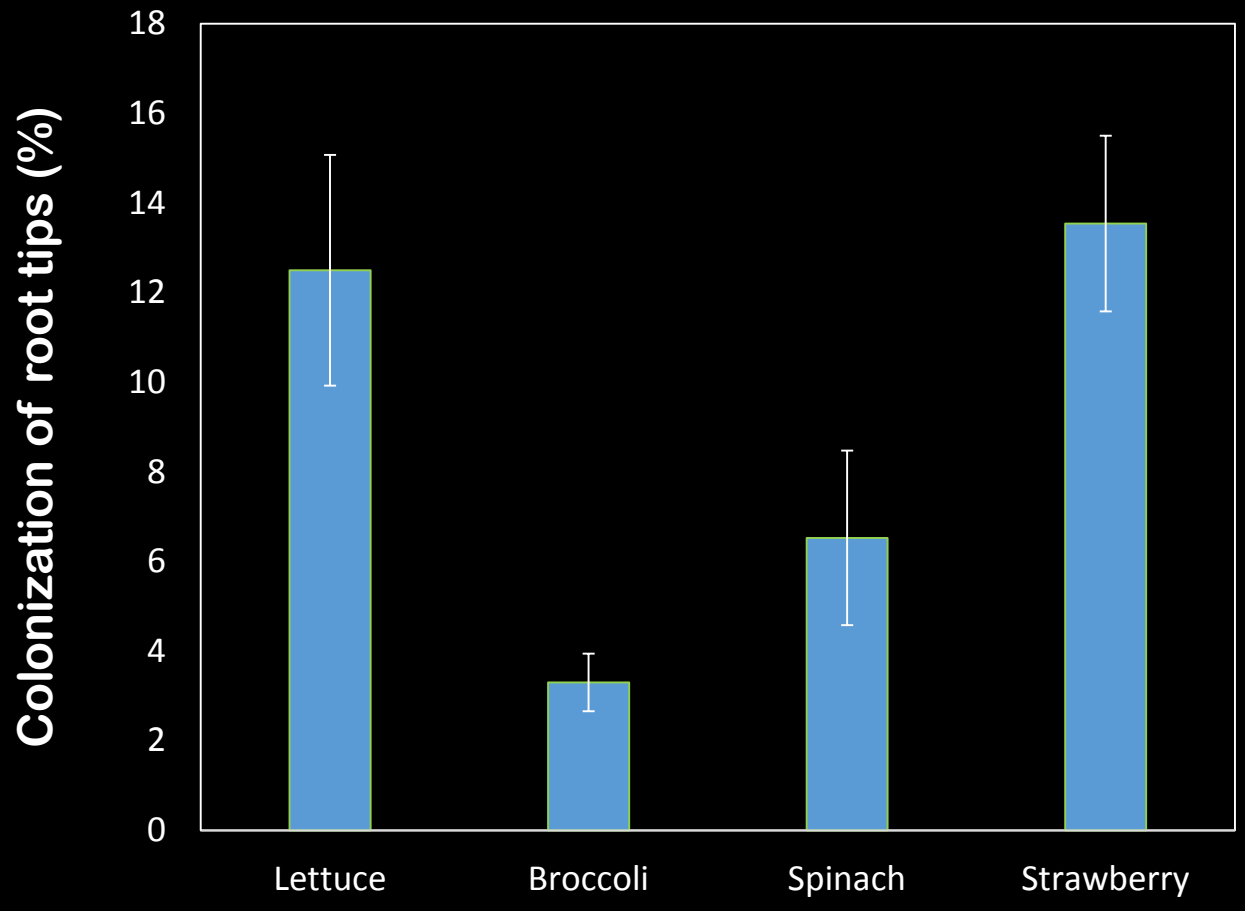


Pathogen population will decline

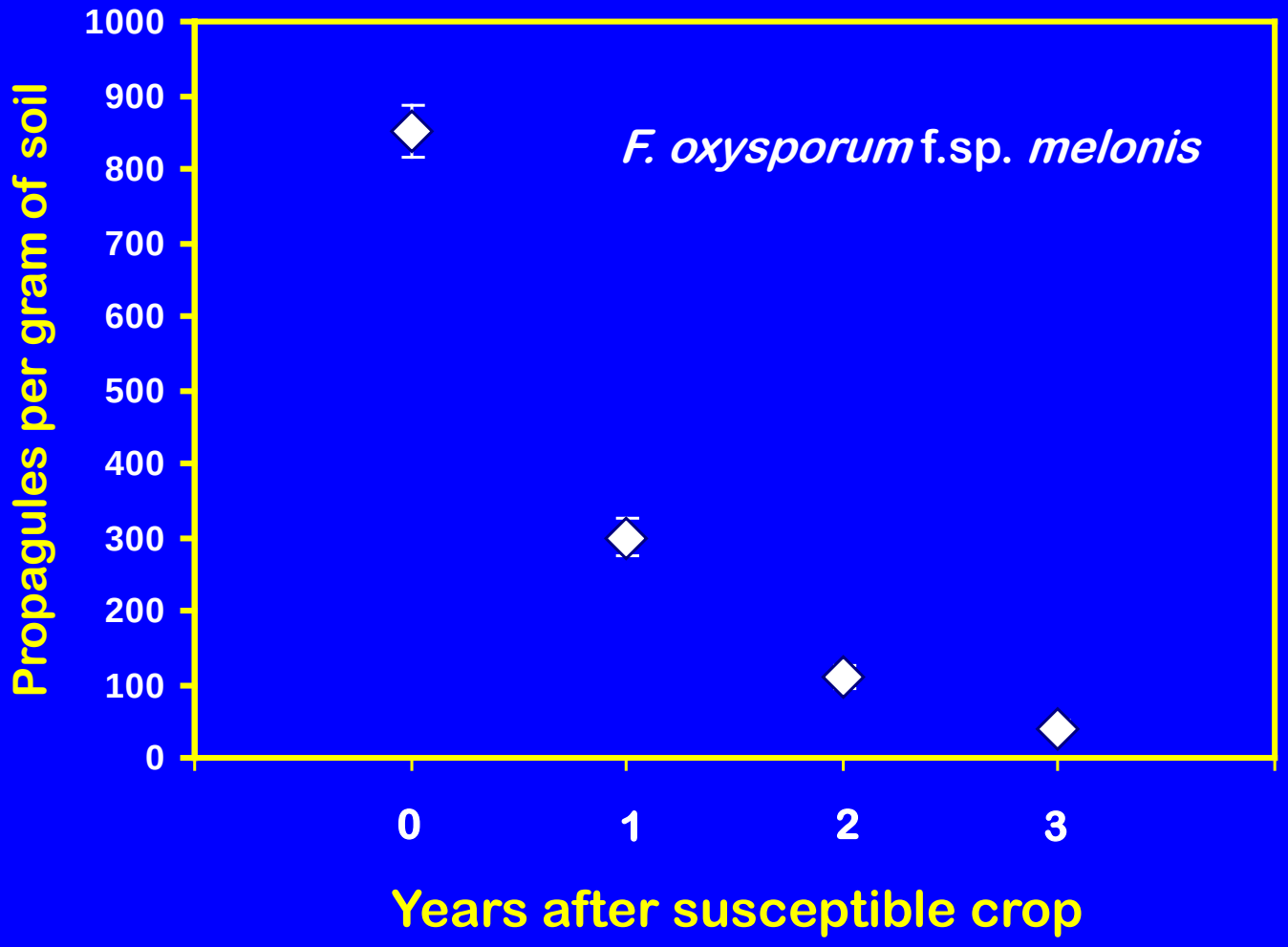
Roots explore a small fraction of soil volume

Most fungal spores in soil will not be affected

Pathogen will persist



Pathogen population in soil



How much inoculum is too much?

Inoculum density adjacent to diseased and healthy plants

Blackberry

Fusarium wilt

Management

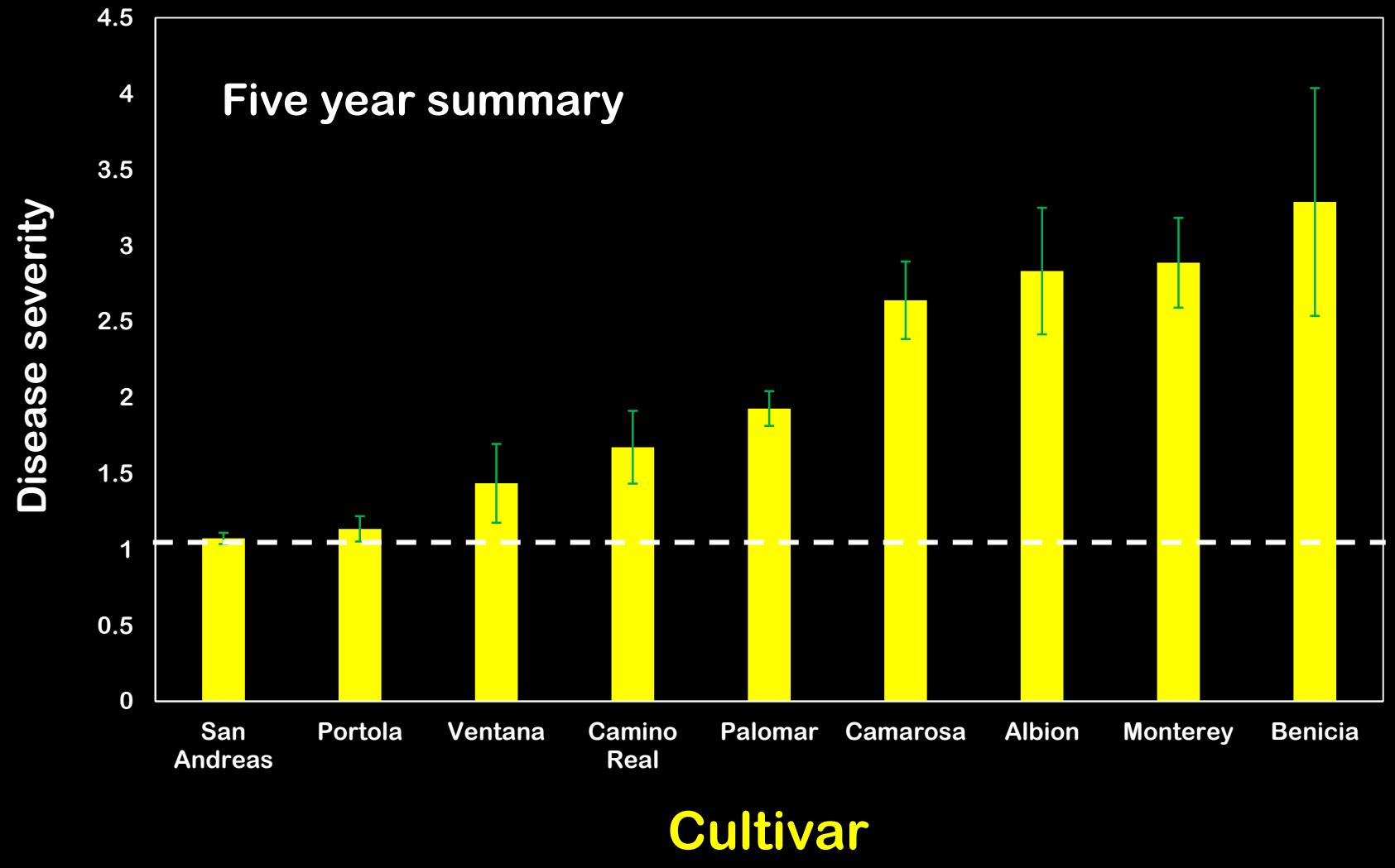
Disease resistance

Differences in susceptibility to Fusarium wilt

Camarosa

Ventana

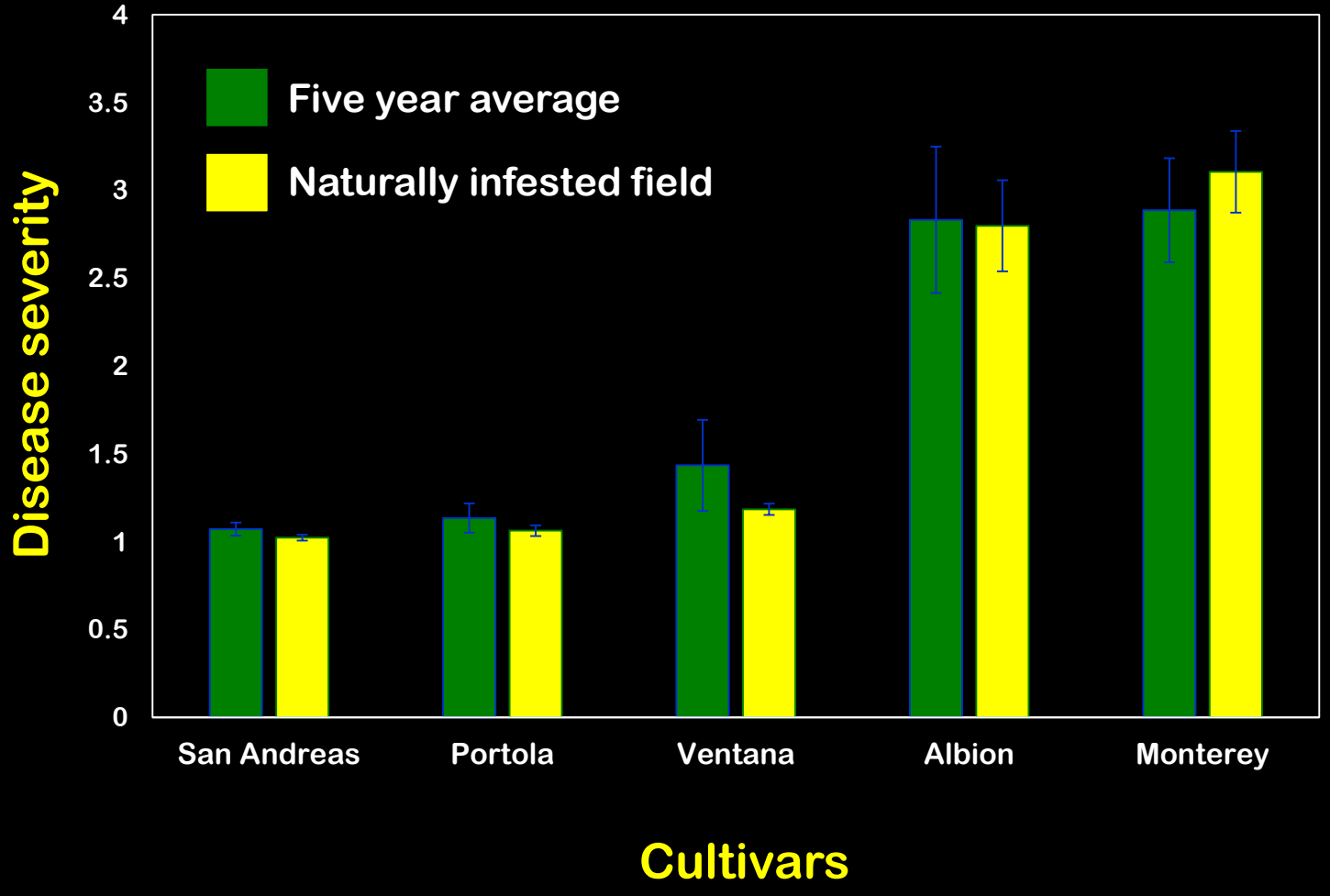
Susceptibility to Fusarium wilt




Naturally infested field

Comparison of resistance assessments

Correlation coefficient = 0.9908



Susceptibility to Fusarium wilt

San Andreas Portola Fronteras	Highly resistant
Ventana Petaluma	Resistant
Monterey Albion	Susceptible

Susceptibility to Fusarium wilt

San Andreas Portola Fronteras	Highly resistant
Festival Ventana Petaluma	Resistant
Monterey Albion	Susceptible

Susceptibility to Fusarium wilt

San Andreas
Portola
Fronteras

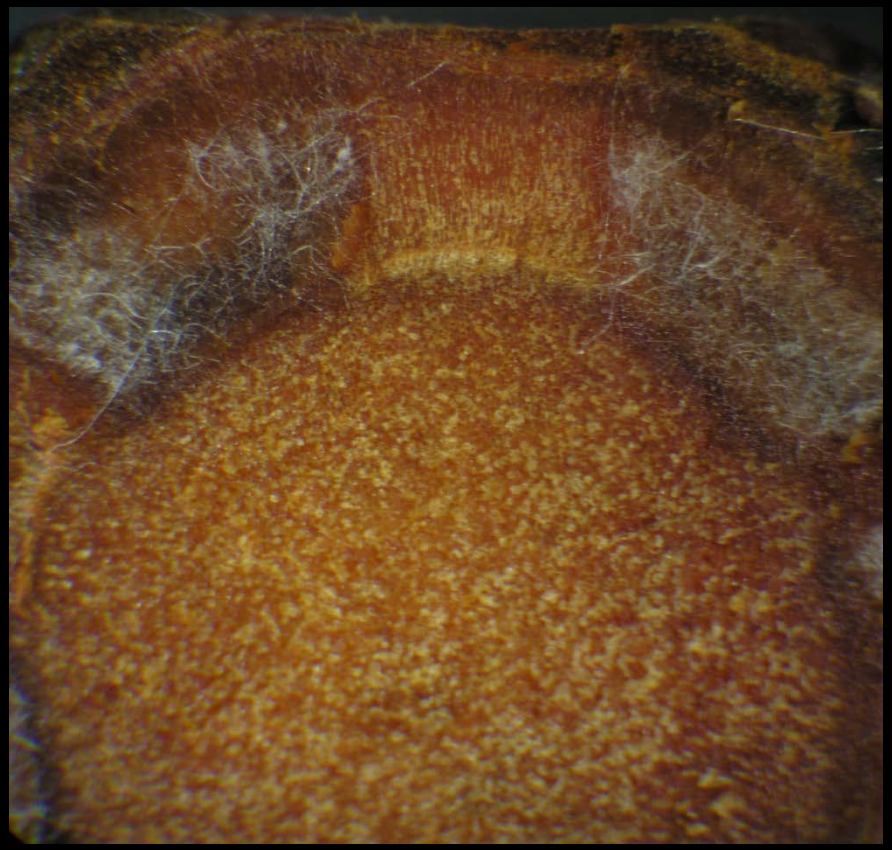
} Highly resistant

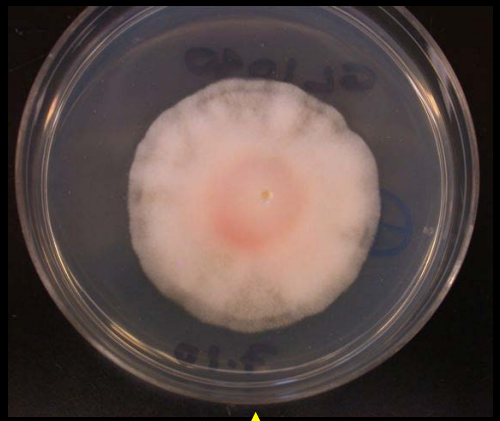
Festival
Safari

} Resistant

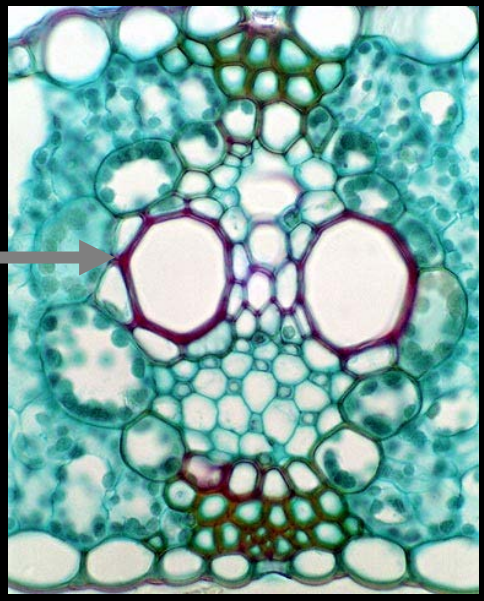
Sweet Ann

Pathogen can colonize resistant crops



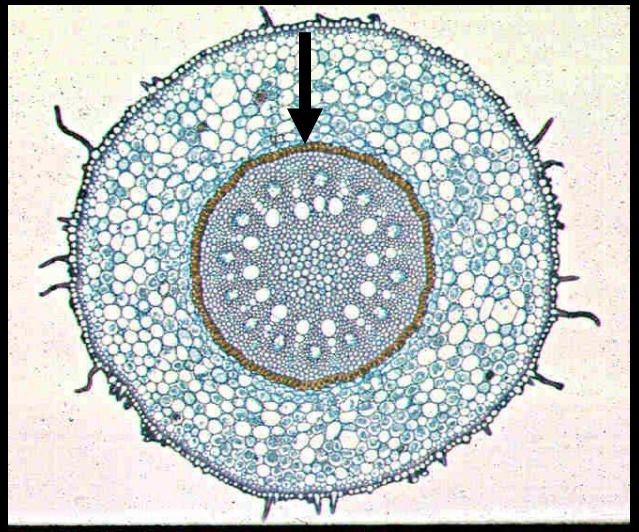


May allow inoculum build-up in soil



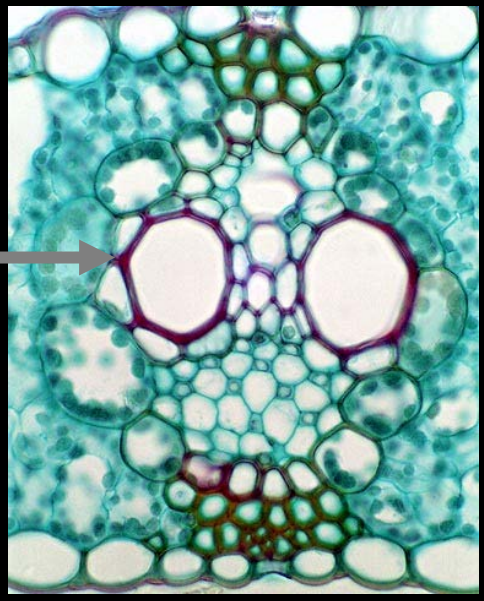
Enter xylem vessels

Root colonization



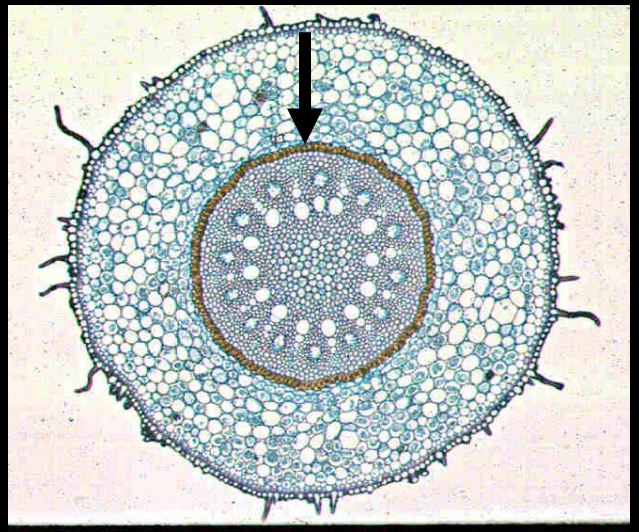
Penetrate endodermis

Resistant plants prevent movement in the xylem



xylem vessels

Root colonization



Penetrate endodermis

Resistance may be overcome

Risk is proportional to pathogen growth and reproduction

Suppression of pathogen populations still important

Management of soilborne pathogens

Reduce inoculum levels

Avoid introductions

Disease resistance

Thanks

california STRAWBERRY COMMISSION

CALIFORNIA STRAWBERRIES
A HEALTHY INDULGENCE

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Sierra-Cascade Nursery
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