

Wood decay 101

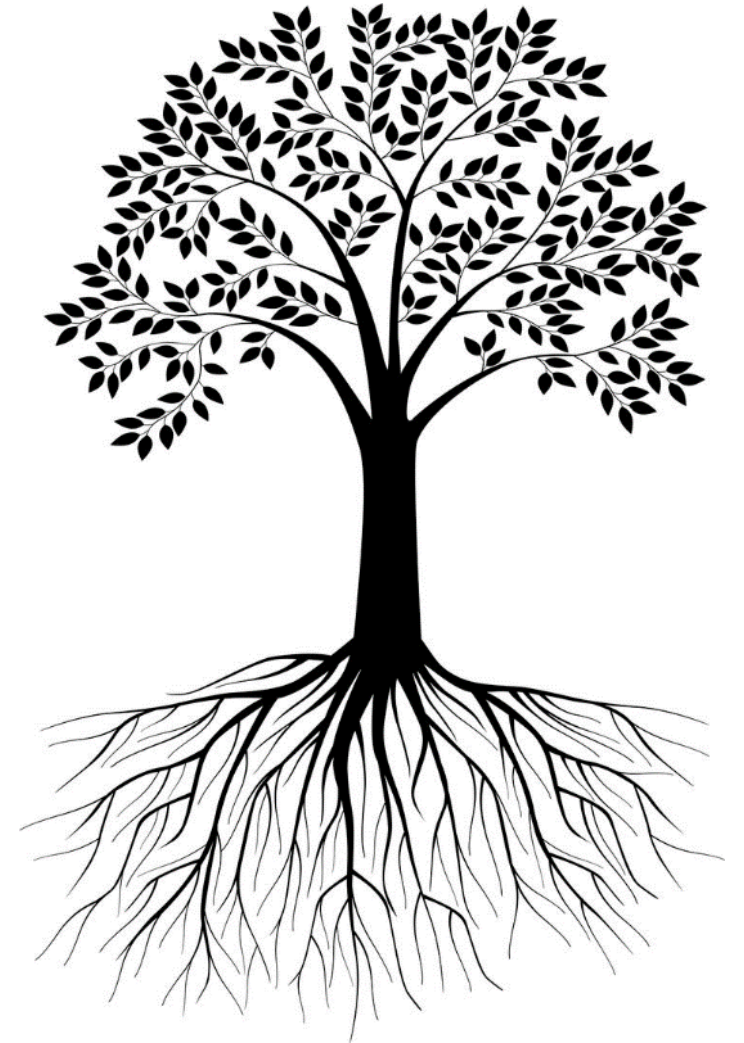
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Rizzo Lab

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Wood decay

- Cause significant decay to living or dead wood
- 2 main types of decay
 - White Rot
 - Brown Rot
- Different part of tree
 - Root rot – *Armillaria spp.*
 - Root and butt rot – *Ganoderma spp.*
 - Heart rot – *Phellinus spp.*



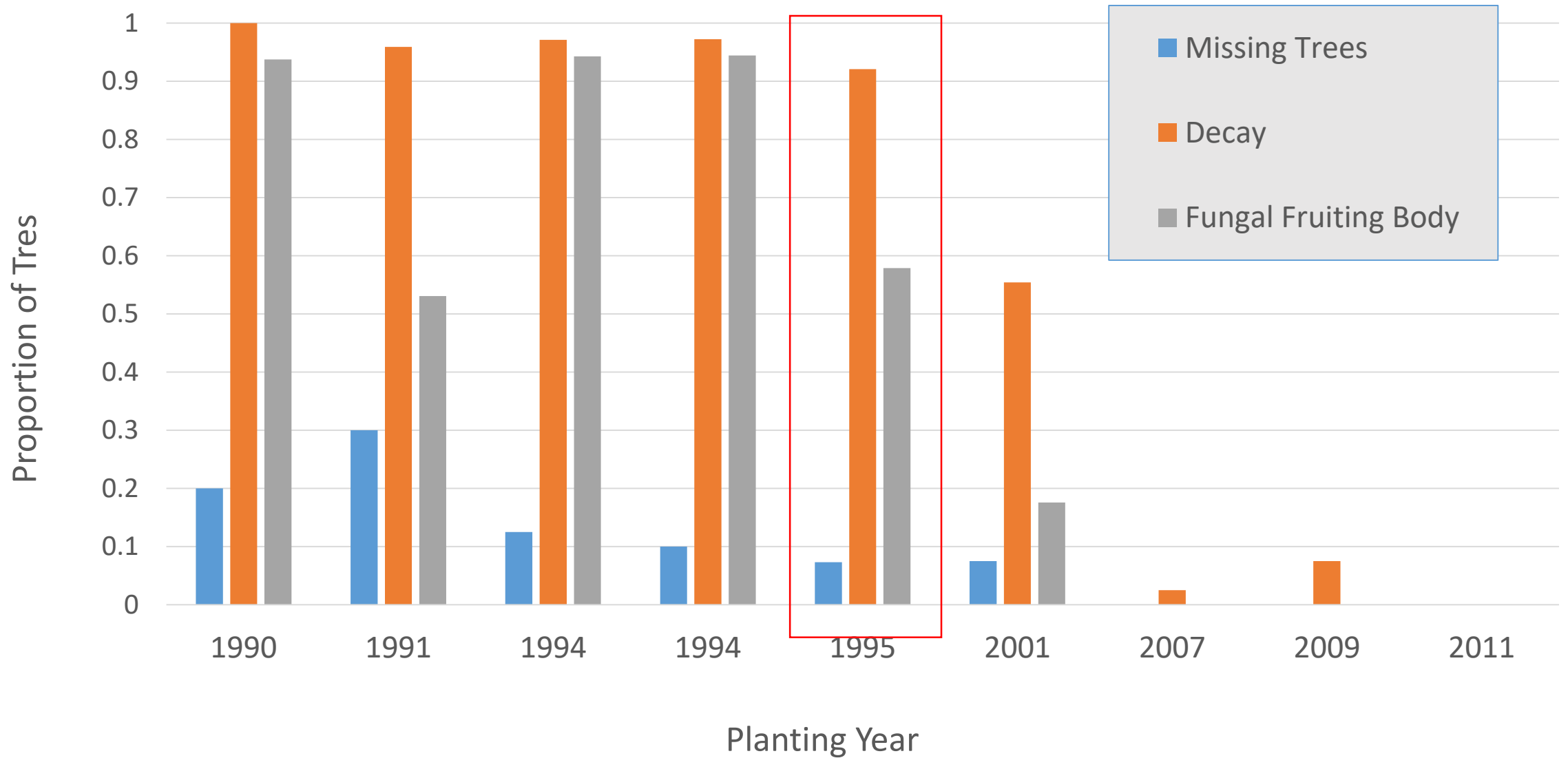
| Fungal species | Number of orchards | Status in Orchard | County |
|-------------------------------|--------------------|-------------------|----------------------|
| Phellinus tuberculosus | 13 | Wide Spread | Sutter, Yolo, Solano |
| Trametes versicolor | 3 | Limited | Sutter, Yolo |
| Fomitopsis cajanderi | 1 | Limited | Sutter |
| Stereum hirsutum | 3 | Limited | Sutter, Solano |
| Ceriporia lacerata | 1 | Unknown | Sutter |
| Antrodia sp. | 1 | Unknown | Tulare |
| Ganoderma sp. | 1 | Unknown | Fresno |



Heart rot - *Phellinus tuberculosus*

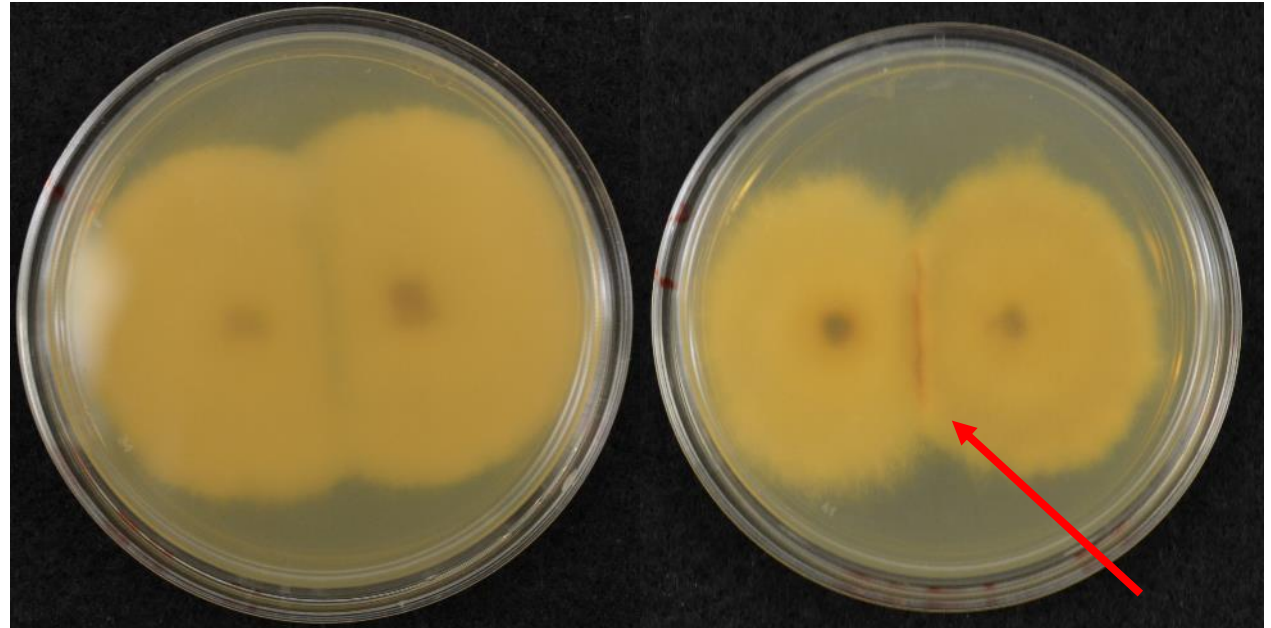
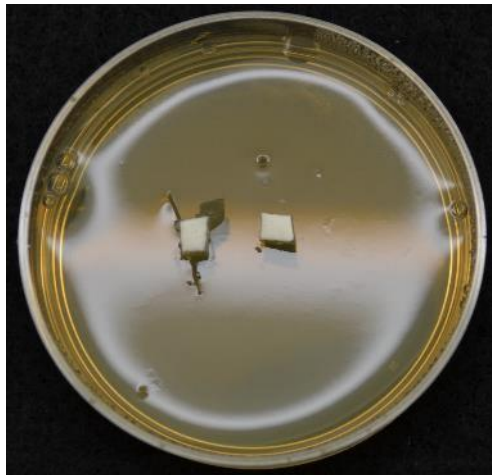


Prune Orchard Surveys for *Phellinus*



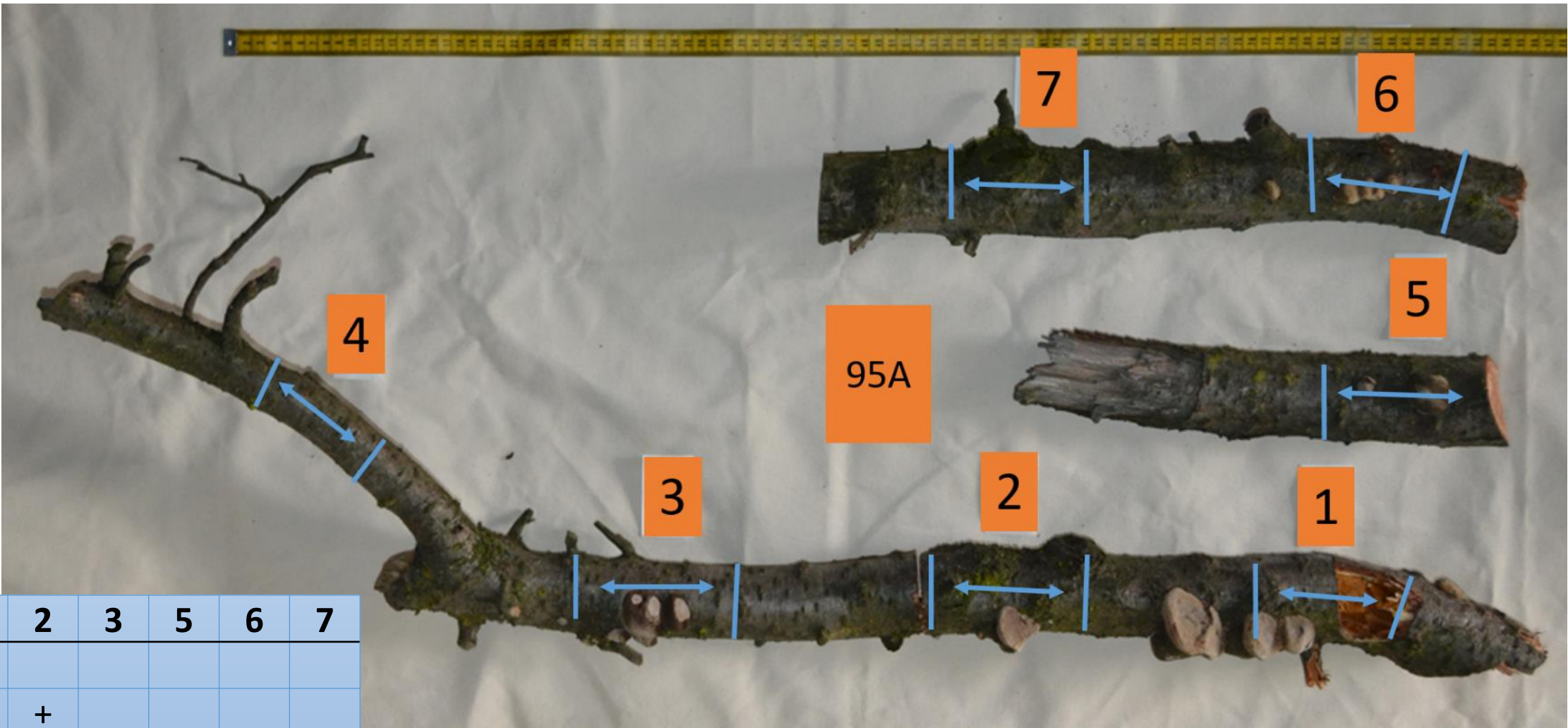
Somatic incompatibility pairings

- Used to determine individuals in Basidiomycota
- Two mycelial plugs 1cm apart on 2%MEA

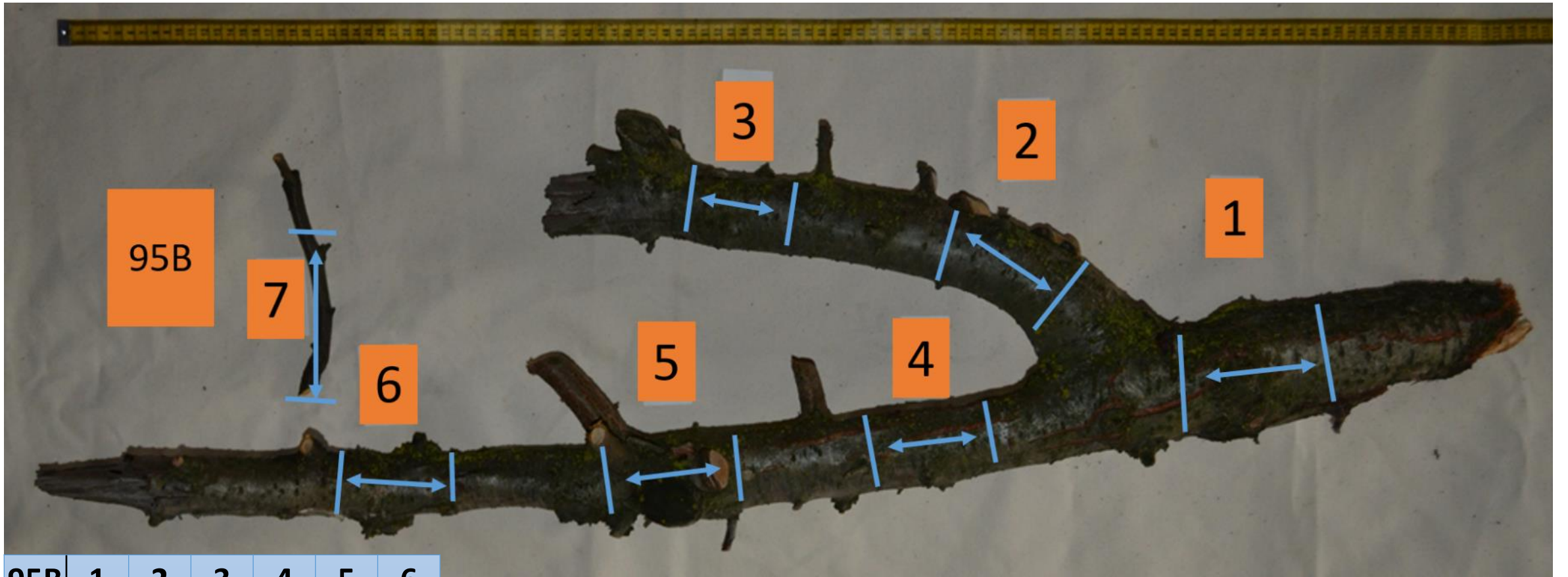


(+)
compatible

(-)
incompatible

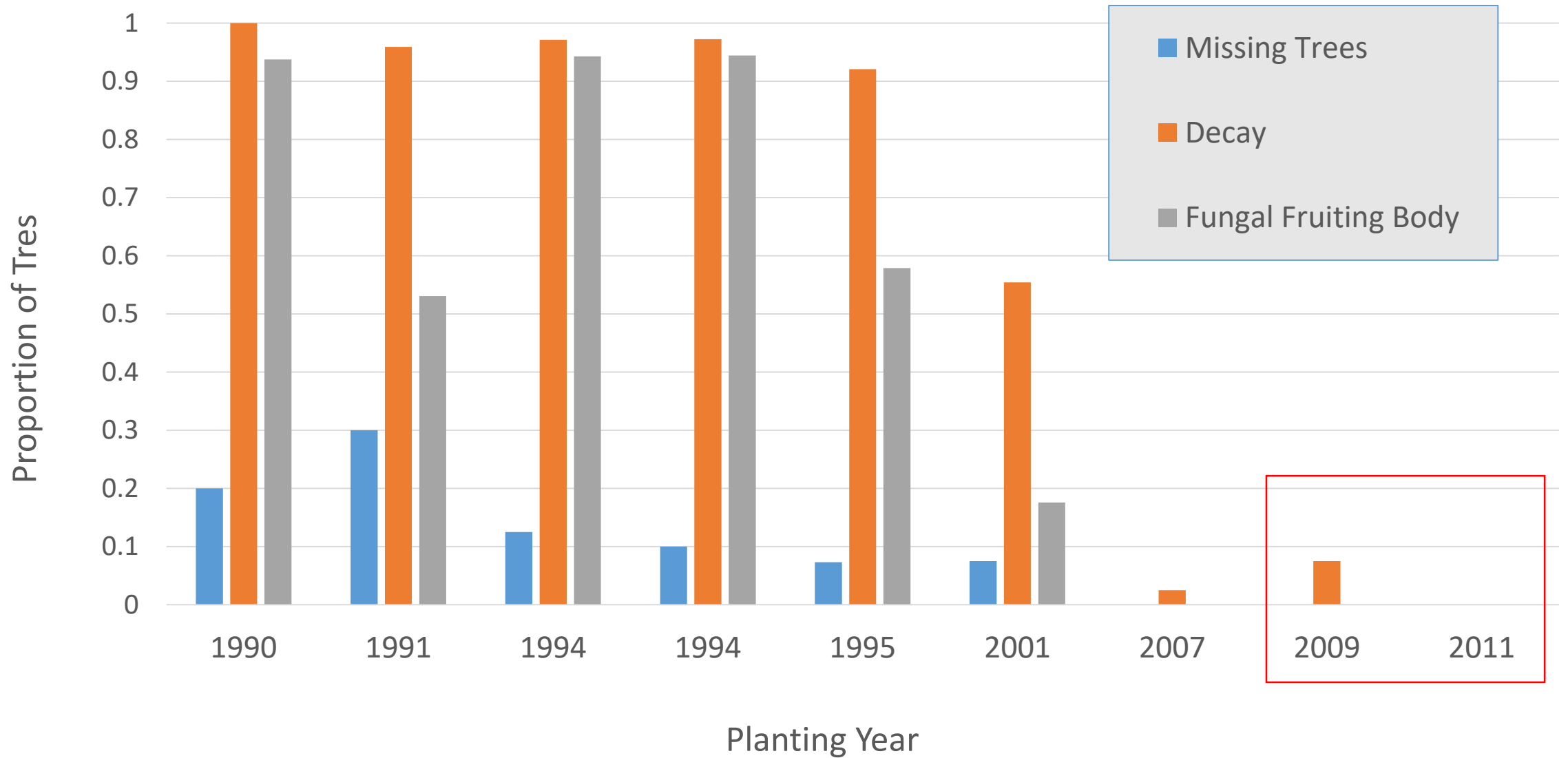


| 95A | 1 | 2 | 3 | 5 | 6 | 7 |
|-----|---|---|---|---|---|---|
| 1 | + | | | | | |
| 2 | + | + | | | | |
| 3 | | + | + | | | |
| 5 | + | | + | + | | |
| 6 | + | | | + | + | |
| 7 | | | | | + | + |



| 95B | 1 | 2 | 3 | 4 | 5 | 6 |
|-----|---|---|---|---|---|---|
| 1 | + | | | | | |
| 2 | - | + | | | | |
| 3 | | - | + | | | |
| 4 | - | - | - | + | | |
| 5 | | | | + | + | |
| 6 | - | | | + | + | + |

Prune Orchard Surveys for *Phellinus*



2009 Orchard Sutter County

| Total Samples | Decay | <i>Phellinus tuberculosus</i> | <i>Trichoderma sp.</i> |
|---------------|-------|-------------------------------|------------------------|
| 10 | 8 | 5 | 3 |



2011 Orchard Sutter County



- No evidence of Decay
- No wood decay fungi isolated
- Molecular detection of pathogen

“French” Prune

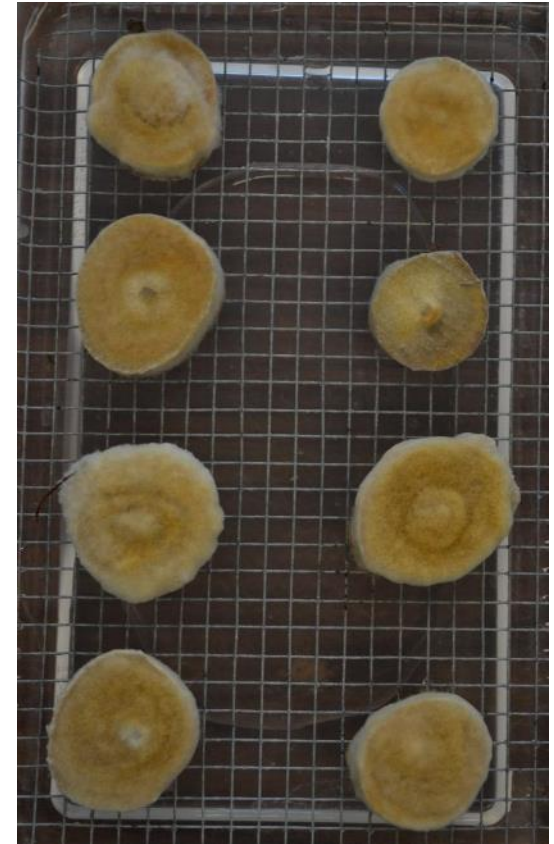
- Commercial production began in 1859
- Improved French selection made around turn of century
- 95% of industry “improved French”
- *Phellinus* has had more than 100 years to adapt to one genotype
- Has reliance on a single variety led to increased virulence by *Phellinus*?

Phellinus vs. different prune varieties

- Improved French
- G27N-31
- H15N-92
- G37S-38
- H13S-65
- H21N-101
- H13S-58
- H8S-75

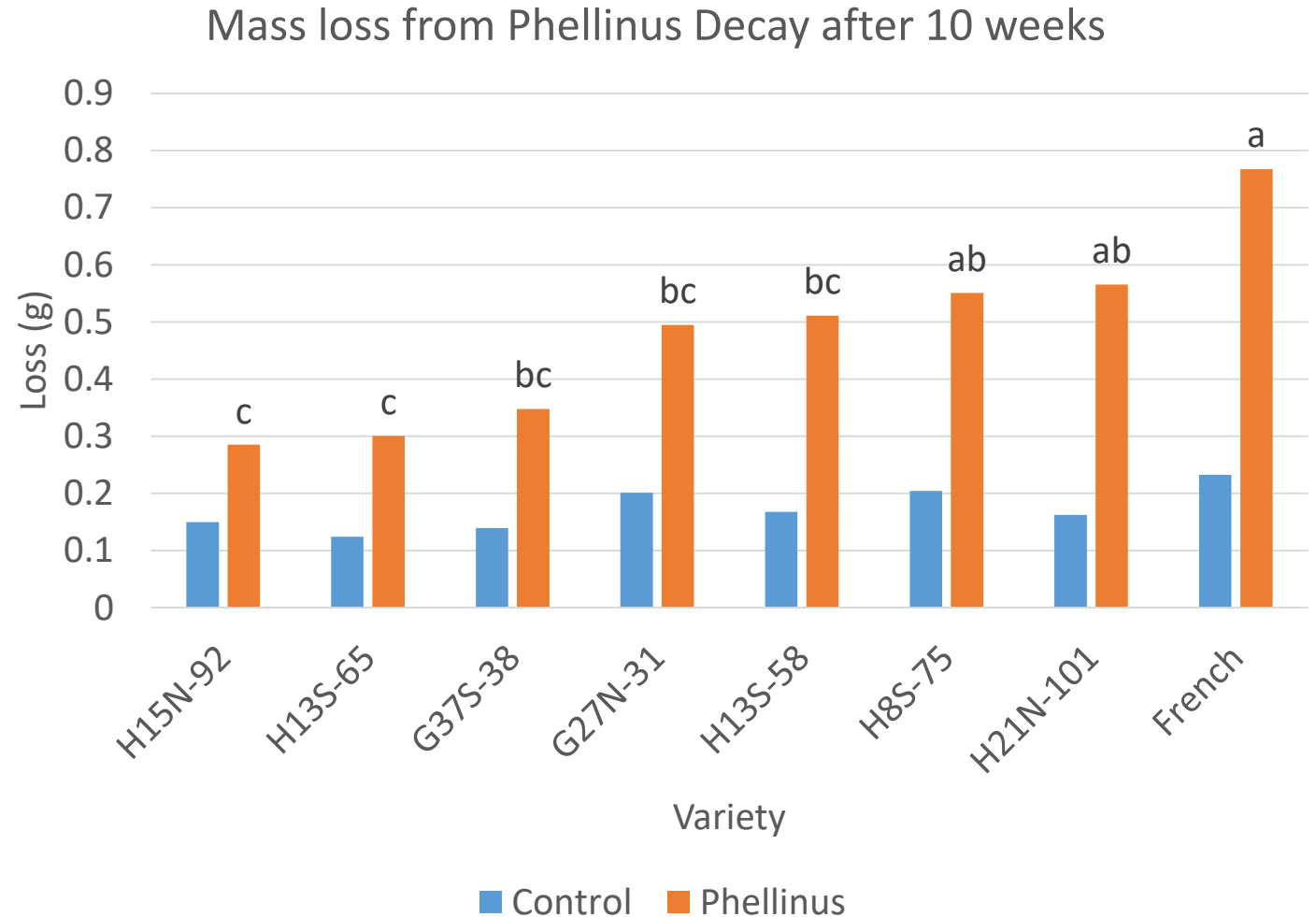
5 replicates

No difference in survival



Phellinus decay on different prune varieties

- 8 varieties
- 10 replications
- Autoclaved
- Dry mass 10 weeks after Phellinus inoculation



Pruning wound protection?

Probably will not work on already infected trees

When is a wound susceptible to *Phellinus* infection?

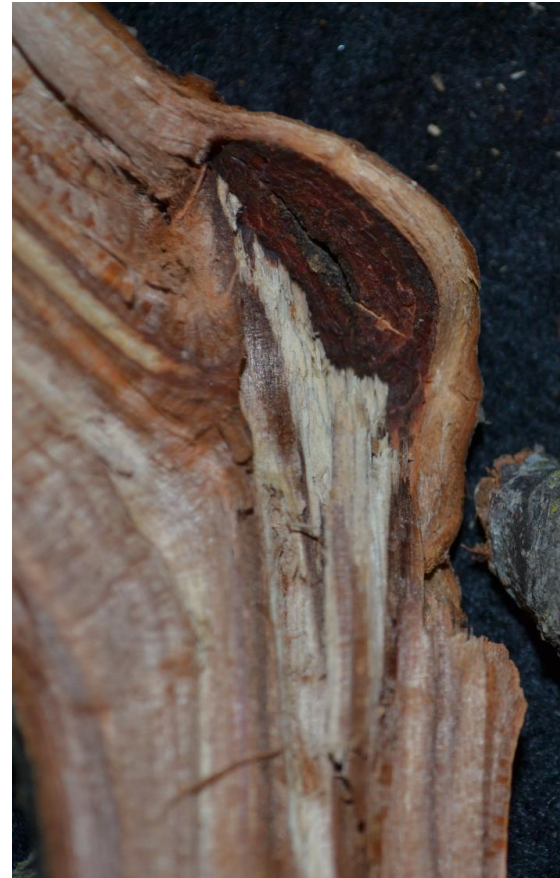
- Wood
- Moist

Chemical

- Would require repeated treatments
- Unknown efficacy on basidiomycetes

Biological

- Colonize wounds
- Grow into wood
- Available products



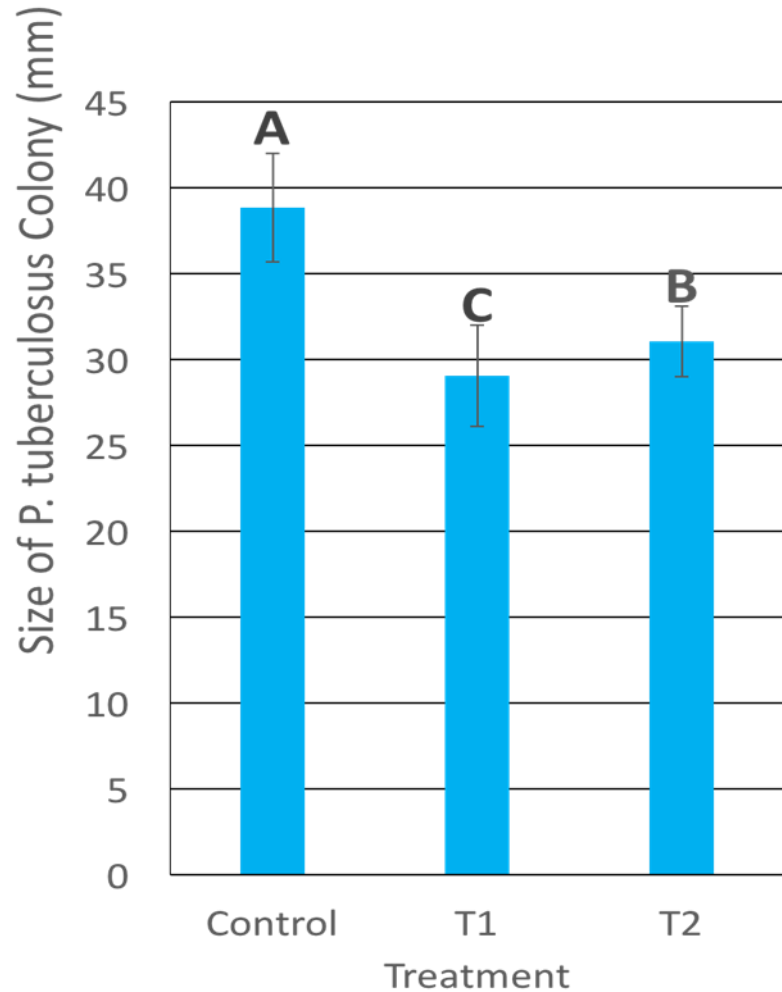
Trichoderma spp.

- *Trichoderma* spp. is a common soil fungus often used as a Biological Control Agent, well known for its rapid growth rate (Howell, 2003).
- Through a variety of mechanisms, including competition, mycoparasitism, and the production of secondary metabolites such as enzymes and antibiotics, *Trichoderma* spp. is able to aggressively engage and parasitize neighboring fungi (Benítez et al, 2004).



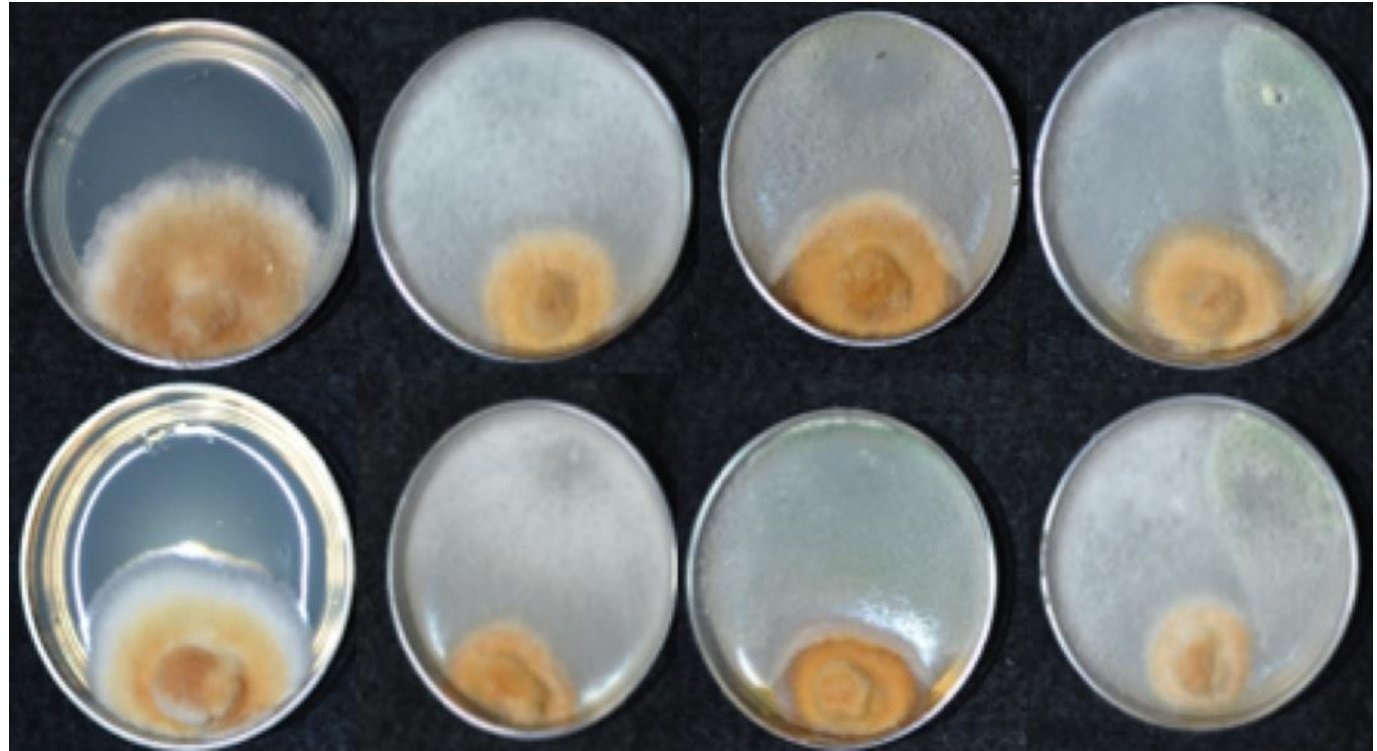
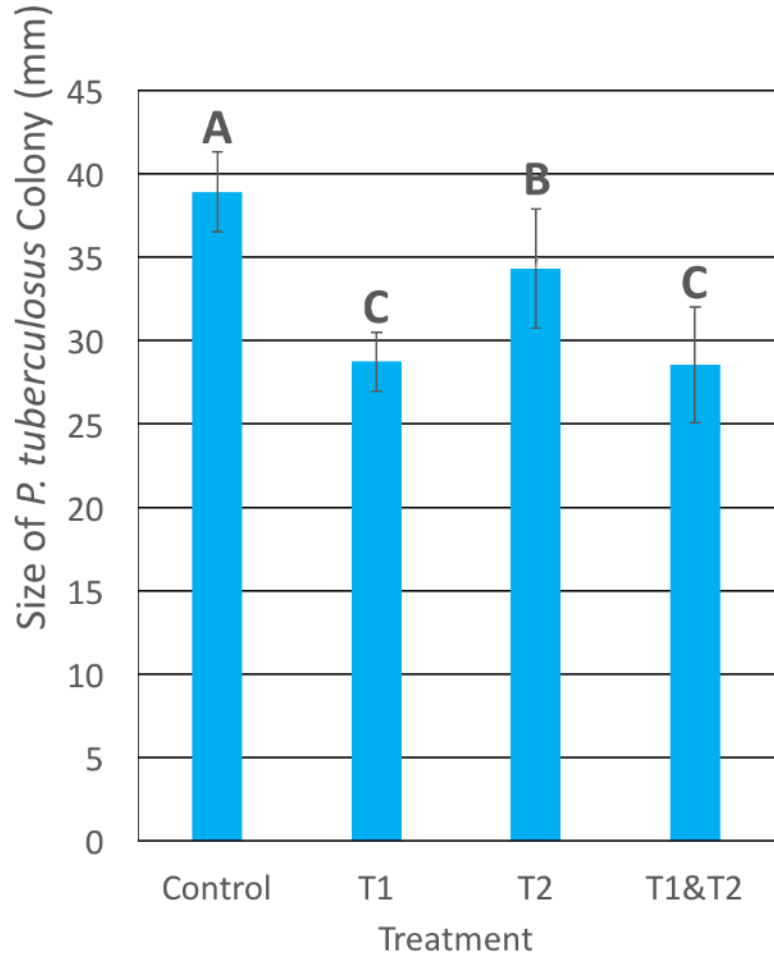
Phellinus vs. *Trichoderma*

Trial 1: Mean Colony Diameter of *P. tuberculosis* after *T. atroviride*



| Re-isolation | Control | T1 | T2 |
|--------------|---------|-----|----|
| 7 days | 100% | 50% | 0% |
| 14 days | 100% | 0% | 0% |

Trial 2: Mean Colony Diameter of *P. tuberculosis* after *T. atroviride*



| Re-isolation | Control | T1 | T2 | T1 + T2 |
|--------------|---------|----|----|---------|
| 7 days | 100% | 0% | 0% | 0% |
| 14 days | 100% | 0% | 0% | 0% |

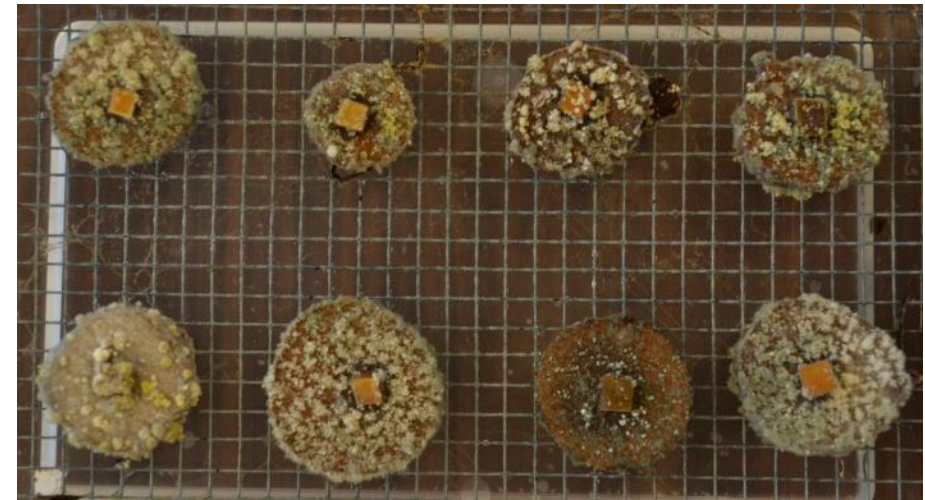
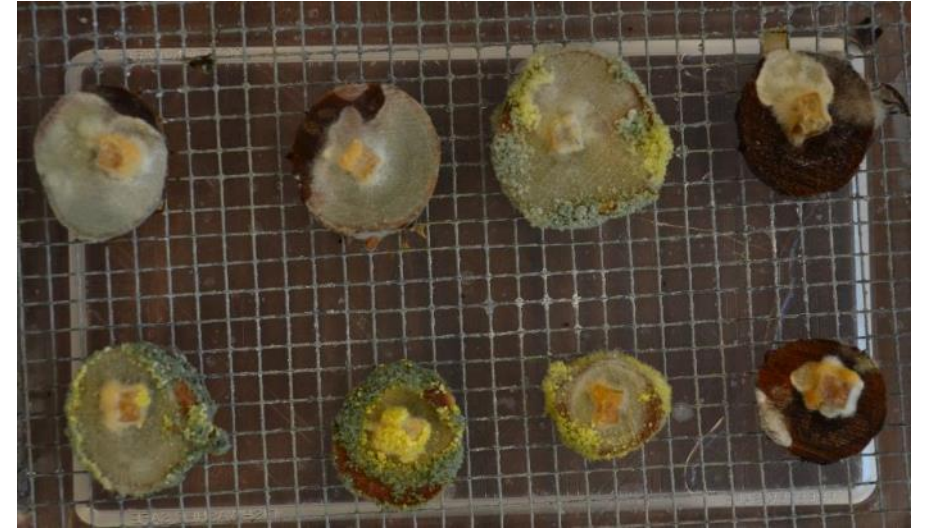
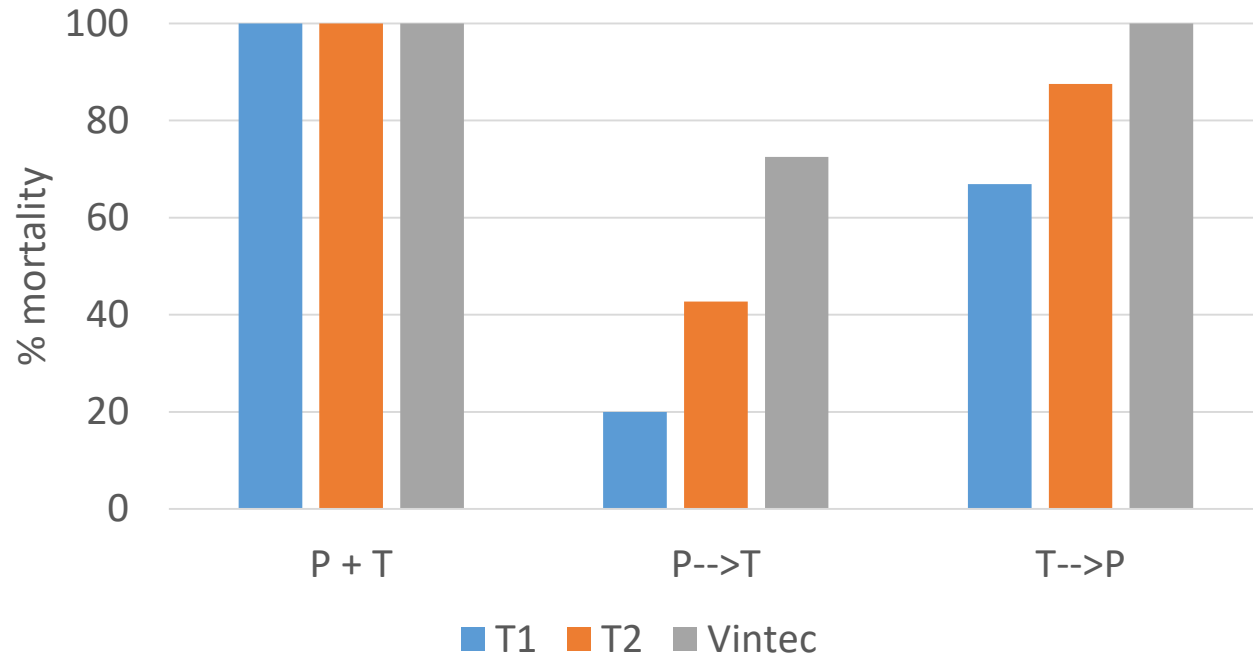
Trichoderma vs. *Phellinus* on prune wood pieces



| Trichoderma Treatments | Inoculation Timings |
|--|--|
| T1 – <i>Trichoderma atroviride</i> | <i>Phellinus</i> + <i>Trichoderma</i> |
| T2 – <i>Trichoderma atroviride</i> | <i>Phellinus</i> then <i>Trichoderma</i> at 7 days |
| Vintec – <i>Trichoderma atroviride</i> product | <i>Trichoderma</i> then <i>Phellinus</i> at 7 days |
| Replicated 5 times | |

Trichoderma on prune wood pieces

Phellinus mortality in the presence of Trichoderma 14 days after first inoculation



Trichoderma vs. Phellinus on prune wood

4 treatments

Control

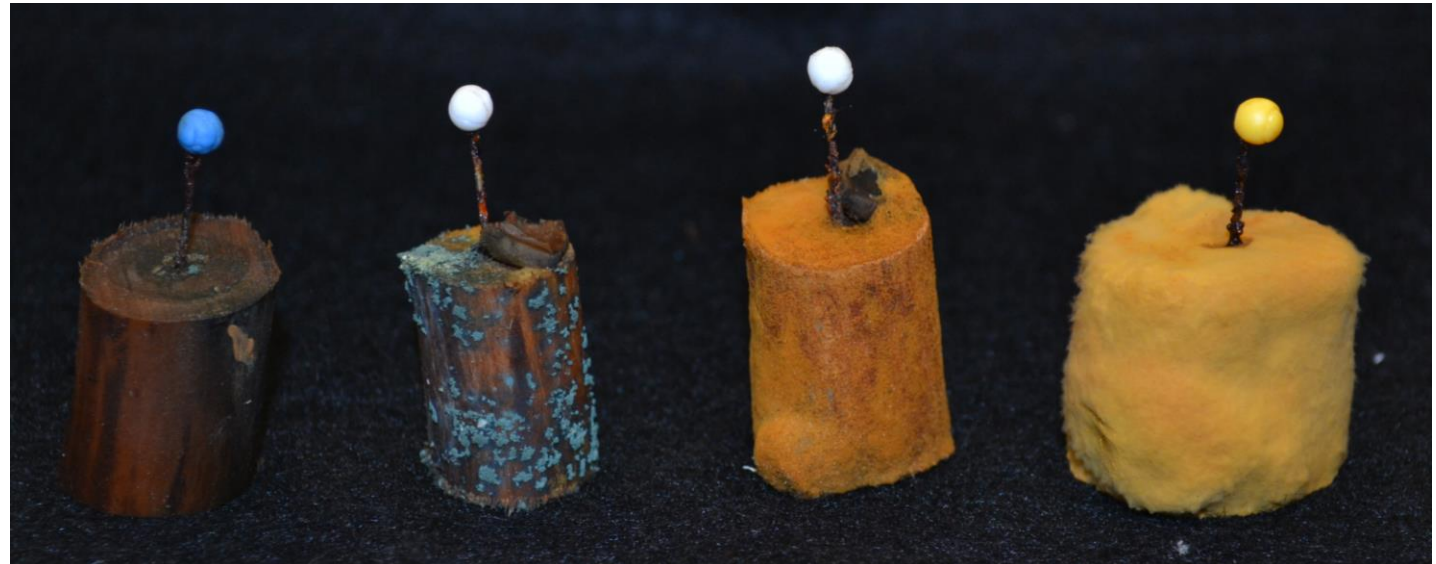
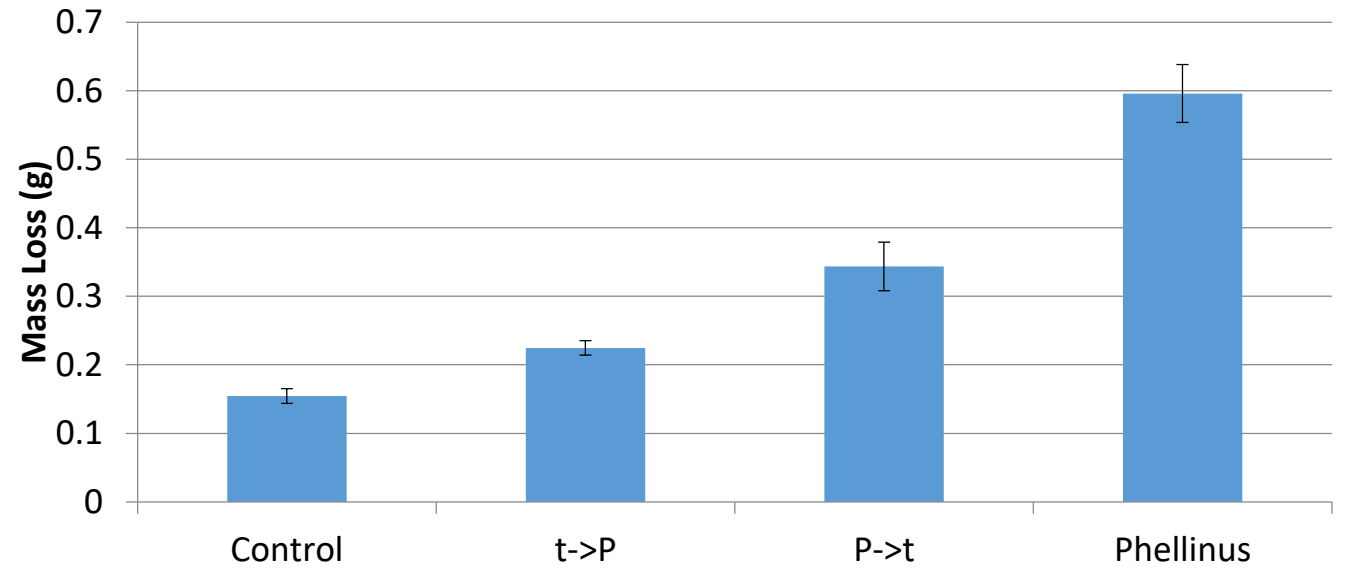
Vintec -> Phellinus

Phellinus -> Vintec

Phellinus

10 replications

Incubated 10 weeks



Trichoderma field trials 2018

- 5 year old trees
- 2 products
 - Vintec – *T. atroviride*
 - Plantshield – *T. herzianum*
- Applications at pruning for 3 years.
- Monitor for disease.



Conclusions and Recommendations

- Limit pruning wounds during dormant season
 - Don't top trees
- Large diameter pruning during summer
- Limit tree stress
- Pruning wound protection?!
- Phellinus does not fruit on dead wood

Thanks

Dried Plum Board of
California

Rizzo lab

Ian Good

Franz Neiderholzer

Cooperating growers

