

Mind your P's and Q's: The Phytophthora Quandary

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Causal species of Phytophthora diseases in Florida

- *Phytophthora nicotianae* (syn. *P. parasitica*)
 - Common cause of foot and root rot
- *Phytophthora palmivora*
 - Causes brown rot of fruit and root rot in poorly drained soils with high water tables

P. nicotianae

Sporangia round



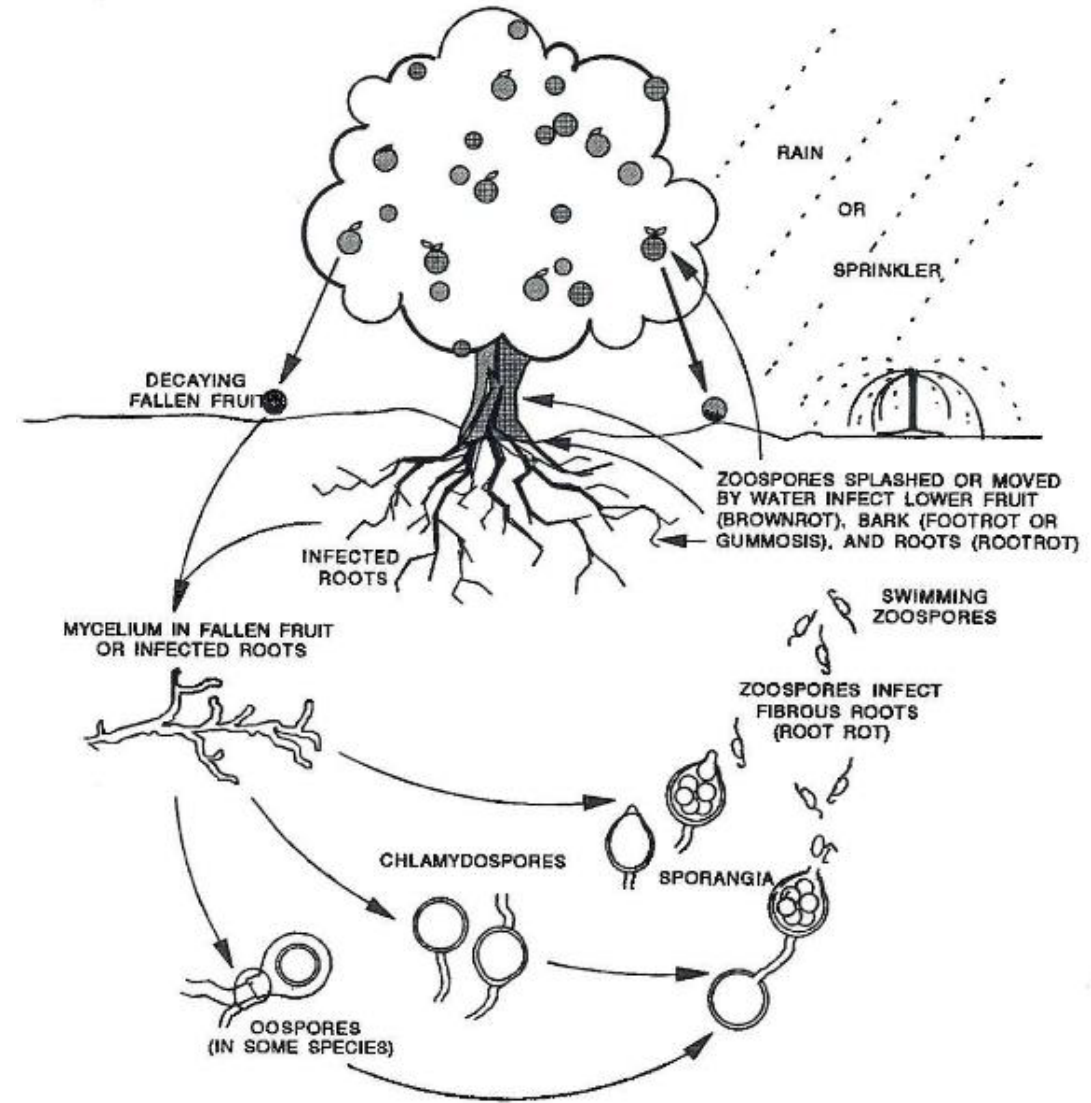
P. palmivora

Sporangia elongated



All Phytophthora diseases connected

- Root Susceptibility
 - Highest during very wet to very dry cycles
- Wetting and drying increases root exudation
 - Attracts zoospores
- Phytophthora attracted to HLB-affected roots
 - Because of >sugar content in roots?
 - Together ~27% root loss
 - Phytophthora alone 10%



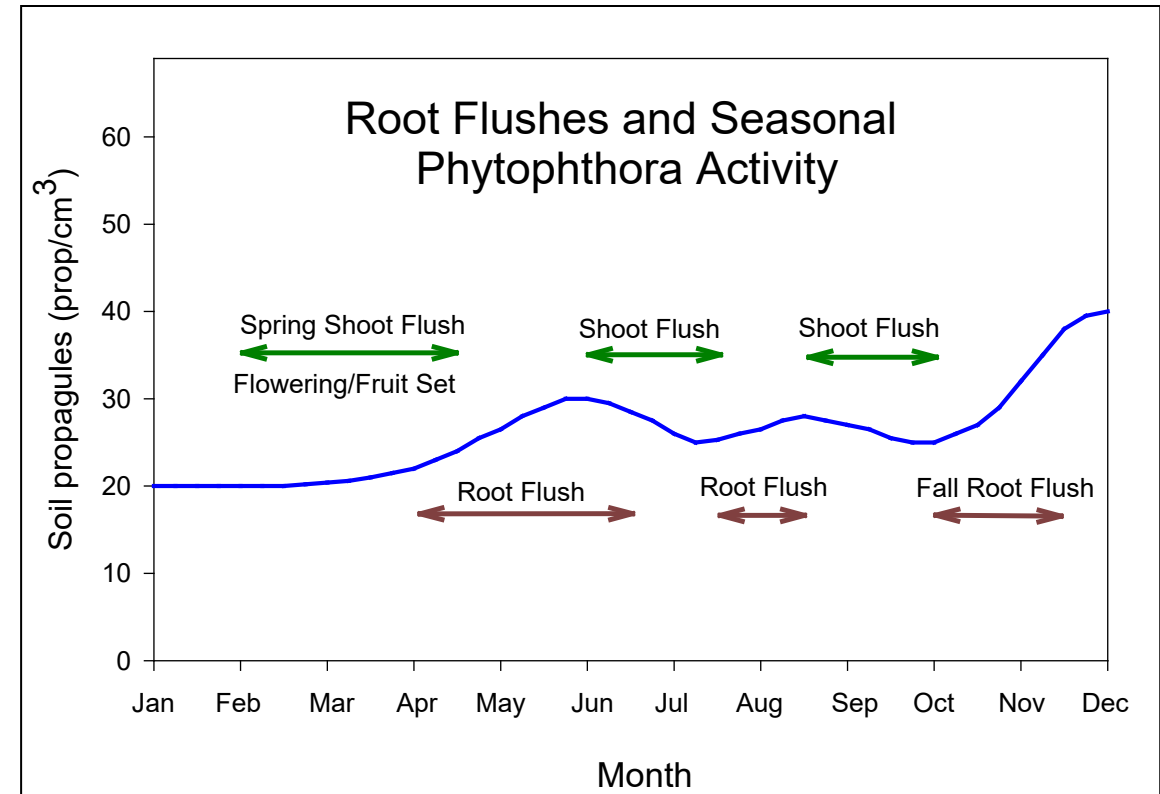
Graham et al., 2013; Wu et al., 2018

Current recommendations for root rot

○ Fungicides

- Phosphites/Fosetyl-Al – induces defenses, limited direct action
- Mefanoxam (Ridomil)– requires root uptake for efficacy
- Oxathiapiprolin (Orondis)
- Fluopicolide (Presidio)
- Mandipropamid (Revus: Brown rot or nurseries)

- Rotate phosphites with more effective products



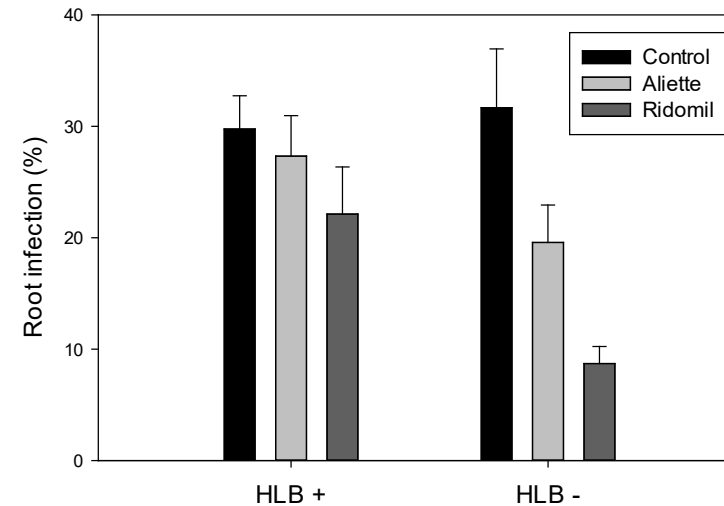
- Treatment threshold 10 to 20 propagules/cm³ soil

Phytophthora management with HLB

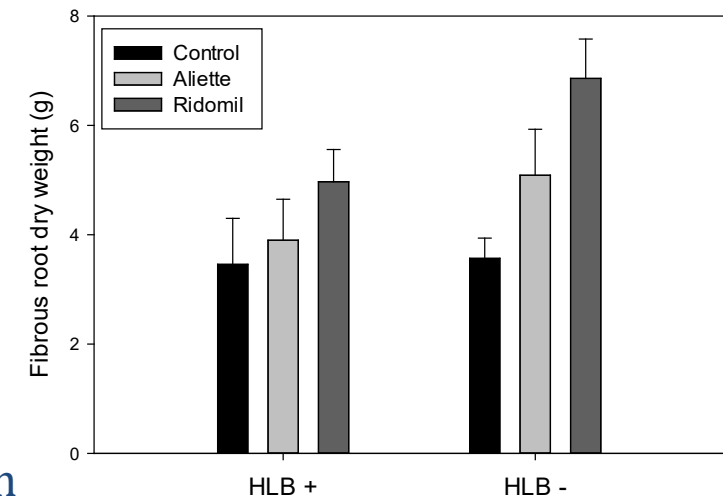
How well does it work?

- Greenhouse data
- HLB reduces efficacy of Phytophthora management
- Need strong root establishment prior to HLB
- Cost-effectiveness uncertain once tree infected with HLB

Root infection with Pn



Fibrous root dry weight



Data from E.G. Johnson

Two sites

- In locations with history of Phytophthora foot and root rot
- Two sites in Southwestern Florida initiated in 2021, continued in 2022
 - High water table, sandy soils with trees planted on berms
 - 10-year-old 'Hamlin' Sweet Orange on Swingle rootstock
 - 20+ year-old 'Valencia' Sweet Orange on Swingle rootstock
- Two sites in South Central Florida initiated in 2022
 - 20+ year-old mixed 'Hamlin' and 'Pineapple' Sweet Oranges on Swingle rootstock
 - 20+ year-old 'Valencia' Sweet Orange on Swingle rootstock
 - High water table, sandy soil with no berms. Likely drained

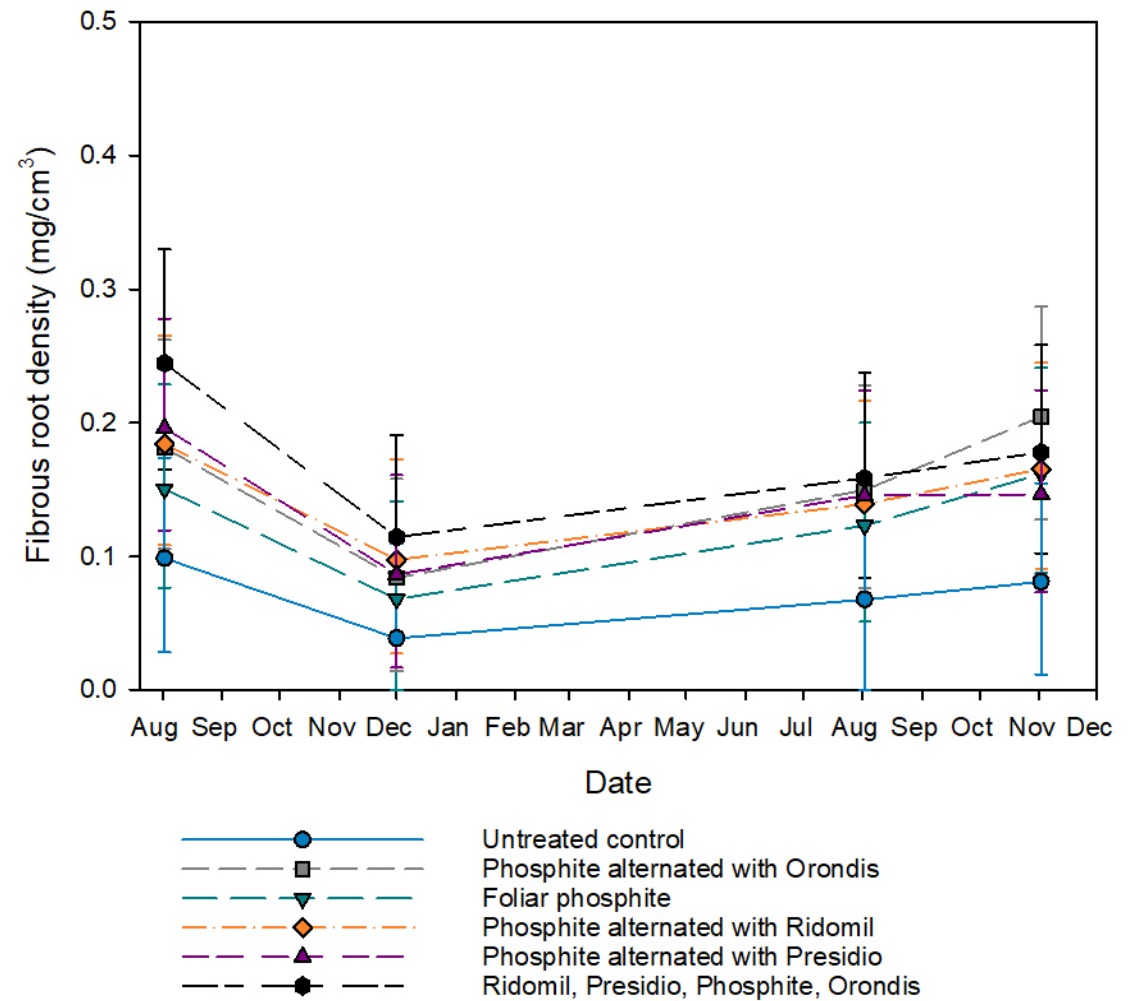
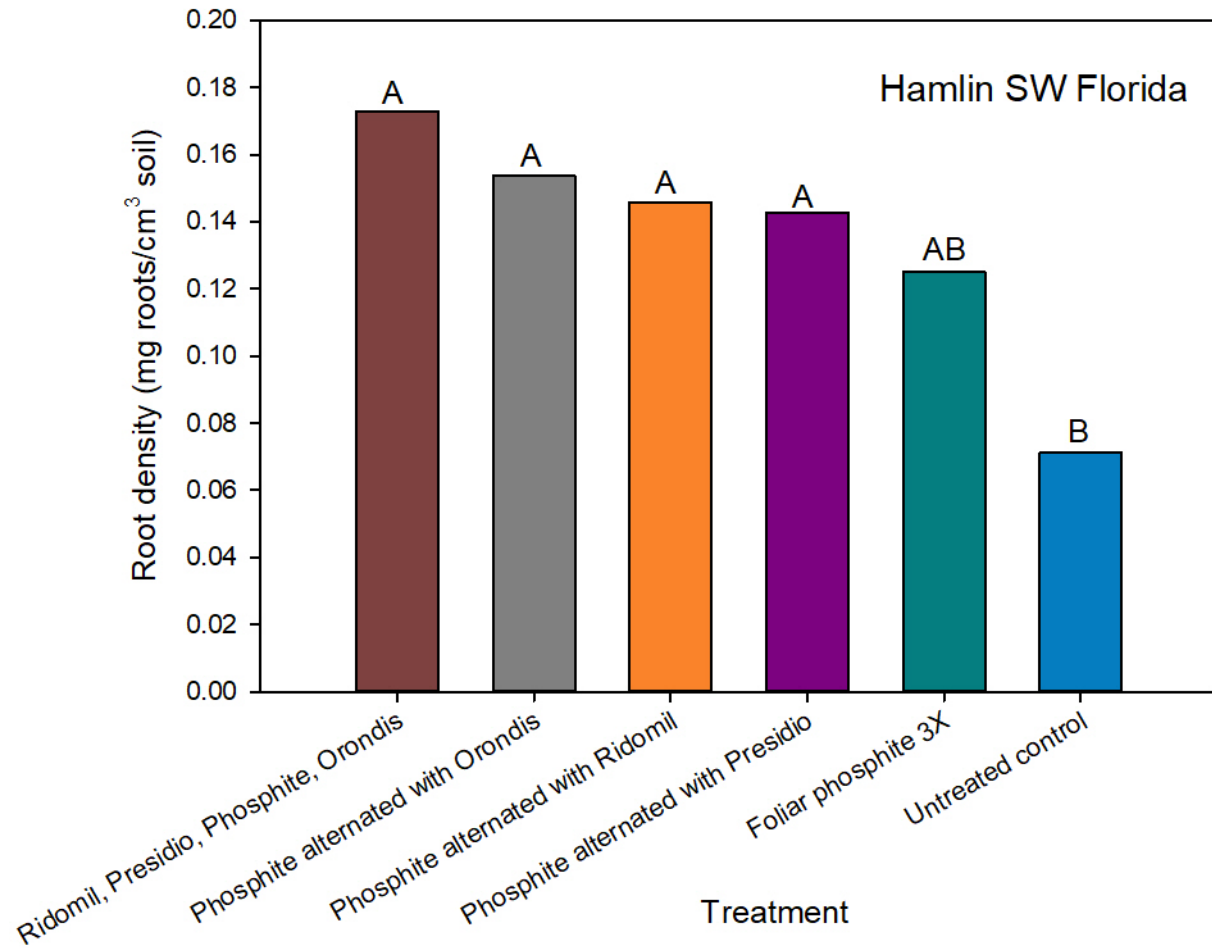
Treatments

- Applications made in April, Early June, July, and September
 1. Untreated control
 2. Foliar ProPhyt applications (potassium phosphite, 54%)
 - 3 applications at 4 pints/acre
 - Early June timing was skipped

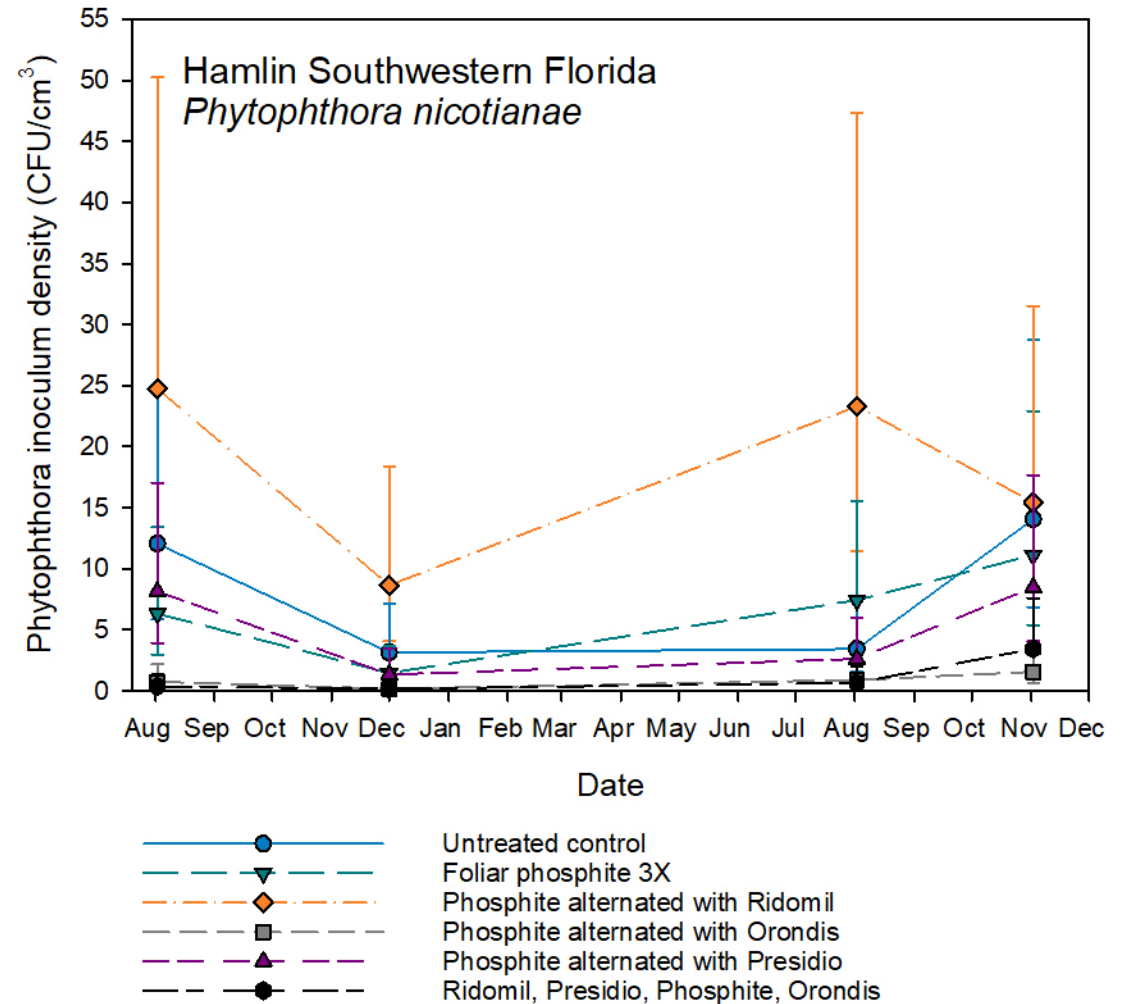
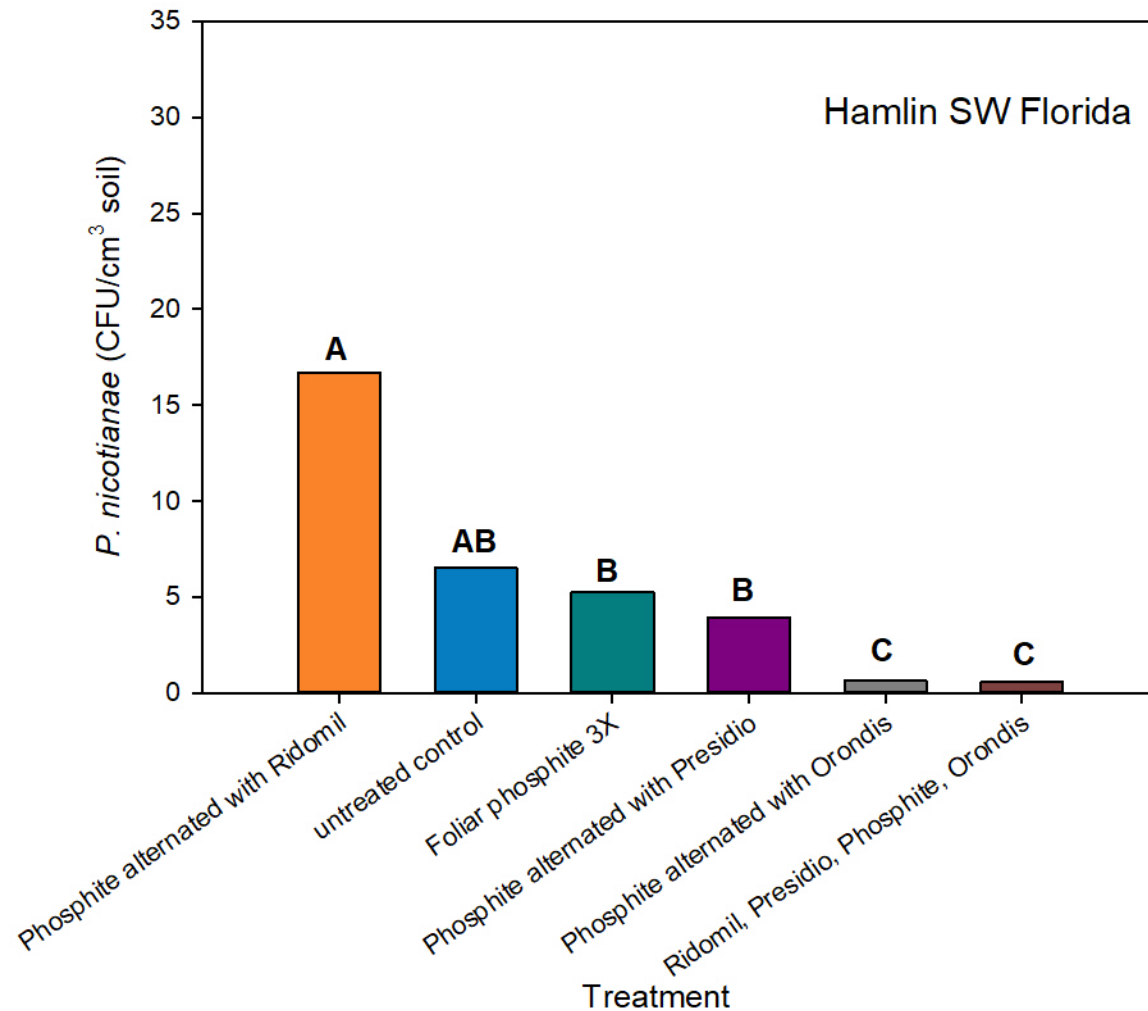
Treatments continued

- Four chemigated treatments (through microjet sprinklers) alternated with foliar ProPhyt applications
 - ProPhyt was the first application in the year
 - Injections for 15 min of irrigation and 5 min flush
- 3. Orondis (Oxathiapiprolin, 18.4%) at 9.6 fl oz/A
- 4. Ridomil Gold (mefenoxam, 45.3%) at 0.5 pint/A
- 5. Presidio (fluopicolide, 39.5%) at 4 fl oz/A
- 6. Ridomil Gold, Presidio, ProPhyt, Orondis

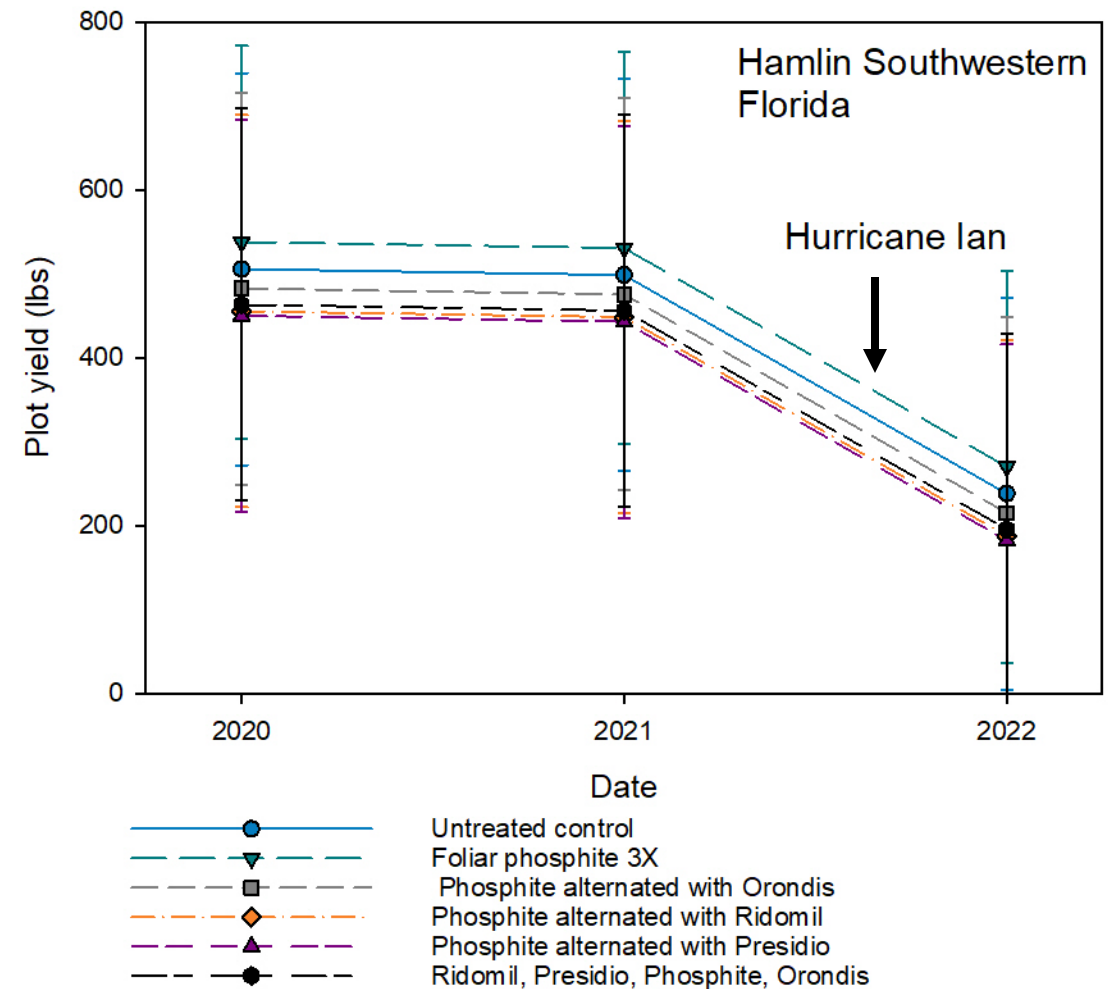
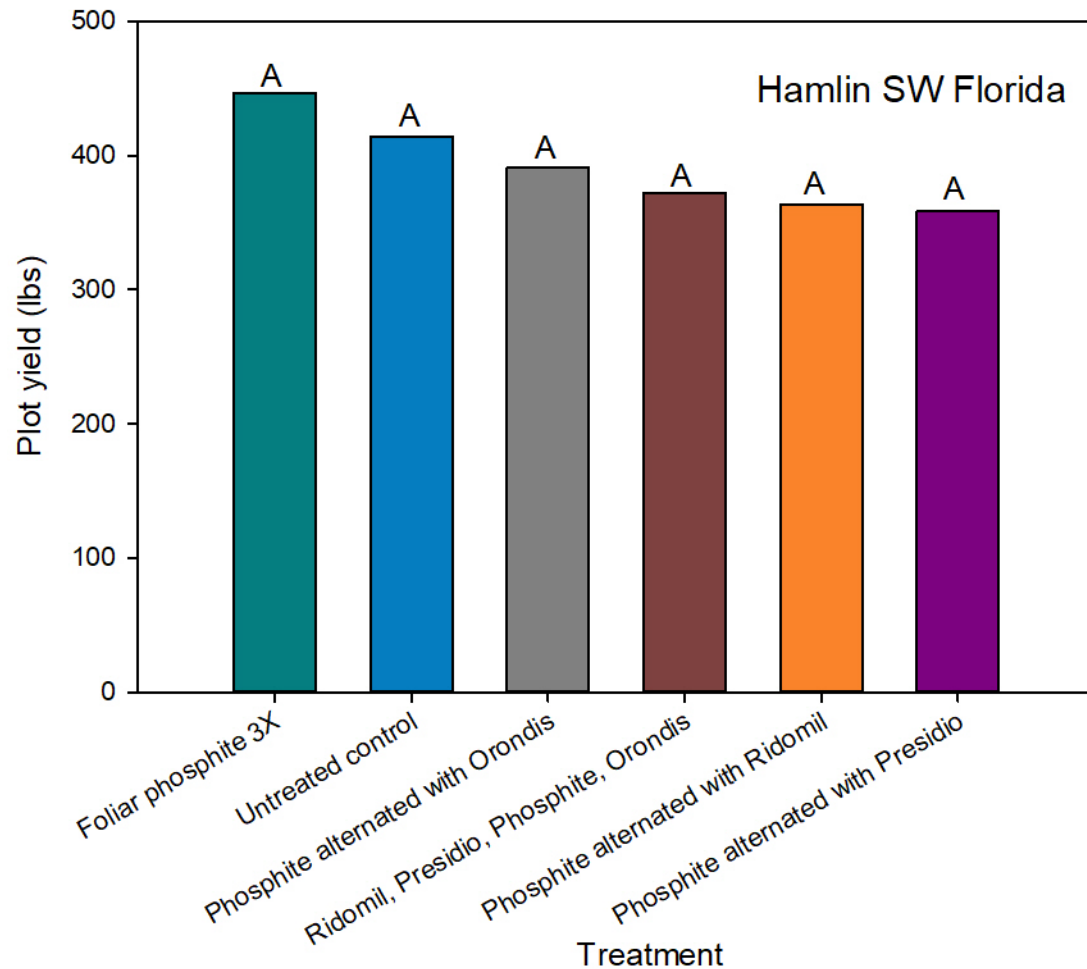
Root Density - Hamlin SW Florida



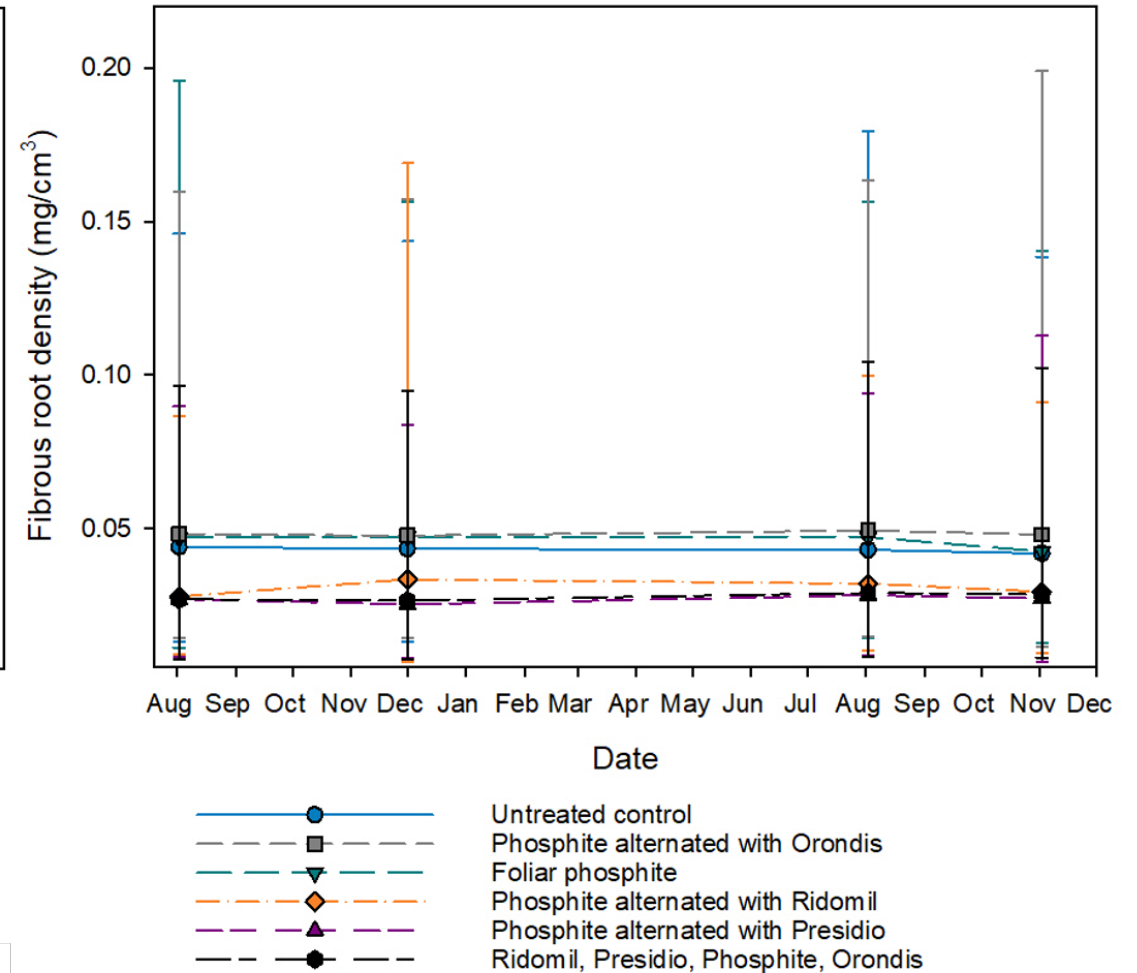
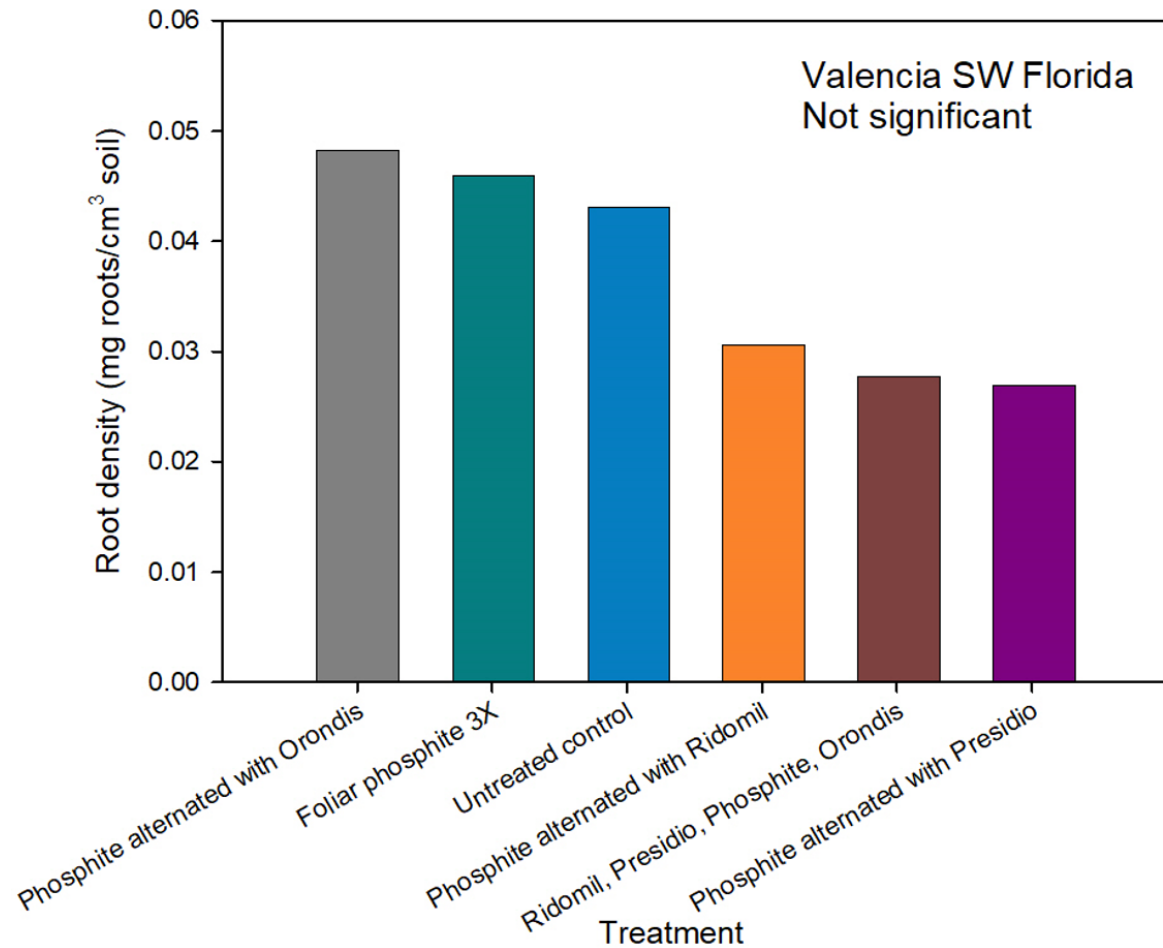
Phytophthora nicotianae propagules - Hamlin



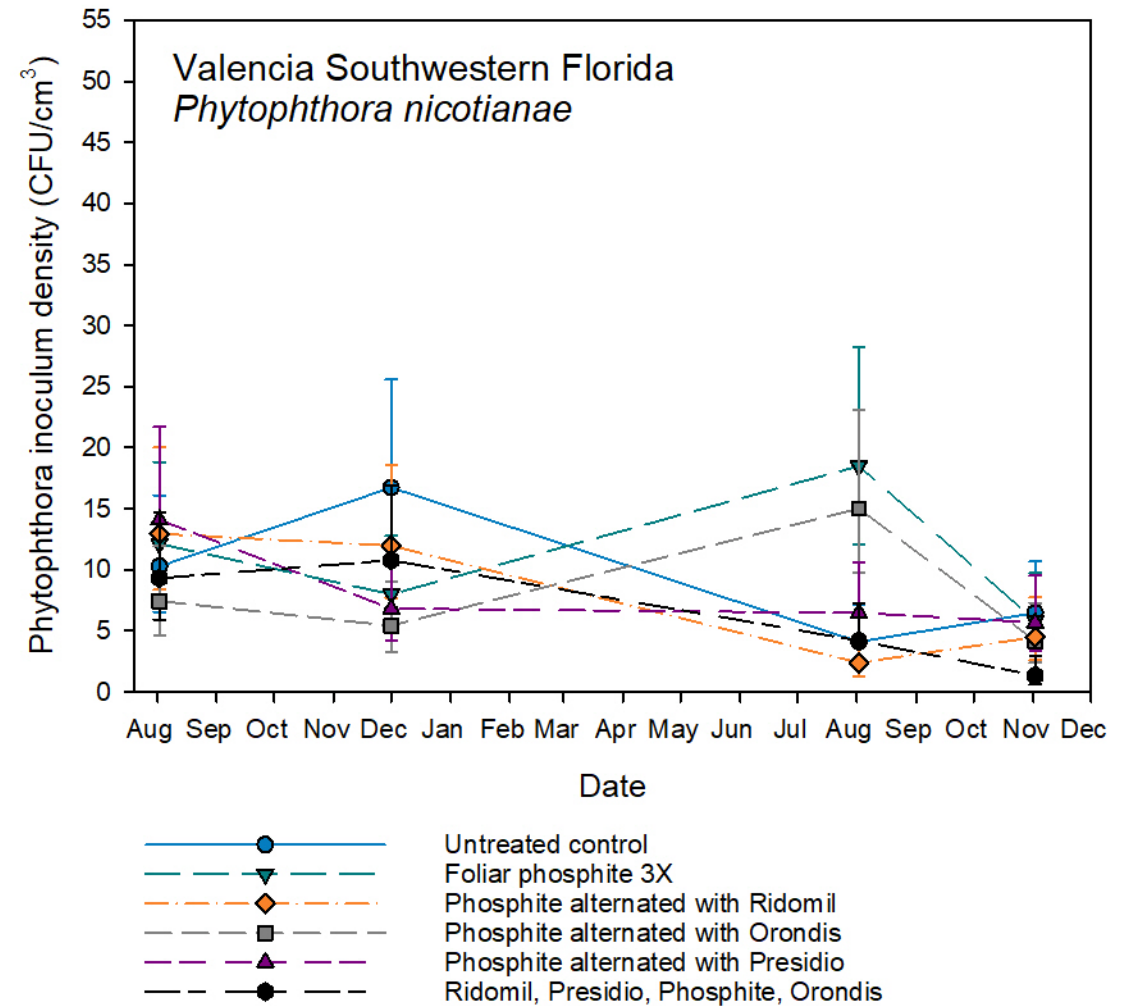
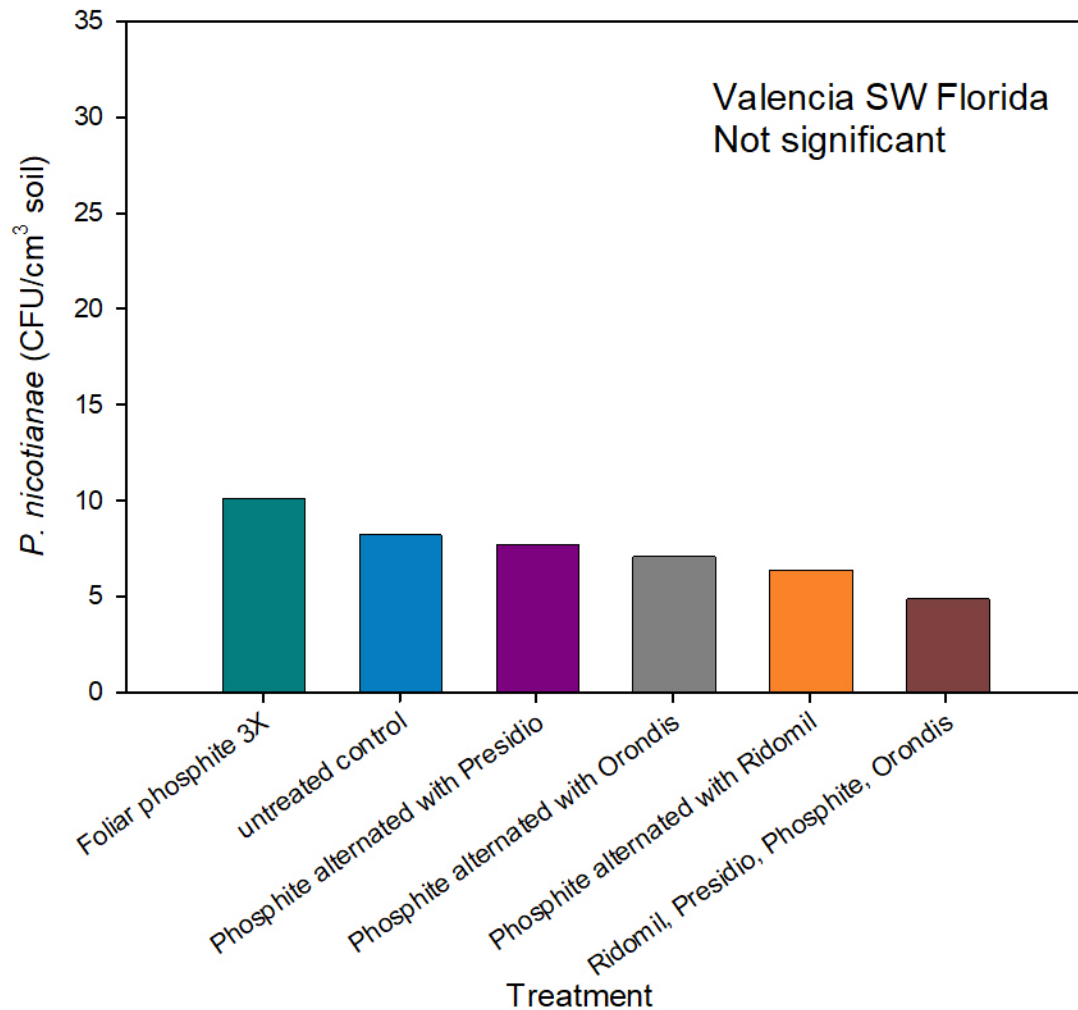
Yield - Hamlin SW Florida



Root Density – Valencia SW Florida



Phytophthora nicotianae propagules - Valencia



Juice quality measures

- Similar outcomes for both cultivars
- Measured pound solids per box, °Brix, Acid, Brix:Acid ratio
 - To pass maturity need minimum °Brix > 8.0, % Acid < 0.4, Ratio > 10.0
 - In all years, the Acid was too high to pass
- There were no significant differences among treatments

Conclusions

- Hamlin block had higher propagule counts over all
- Root density was higher in Hamlin than Valencia block
 - Valencia root density highly variable
 - May have masked any treatment differences
- Best treatment to reduce propagule count was Ridomil Gold, Presidio, ProPhyt, Orondis
 - A significant decrease for Hamlin but only numerical for Valencia

Conclusions

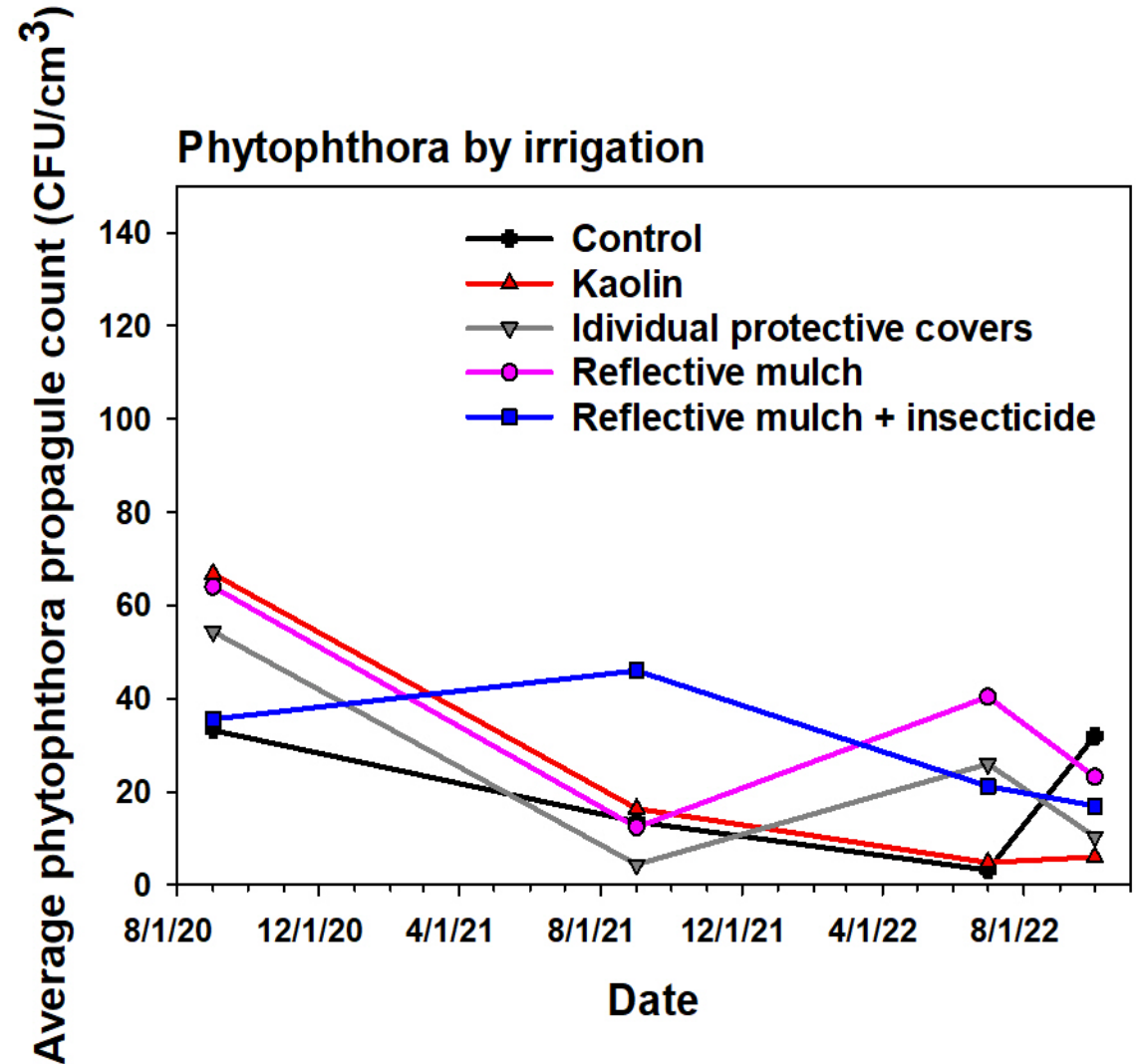
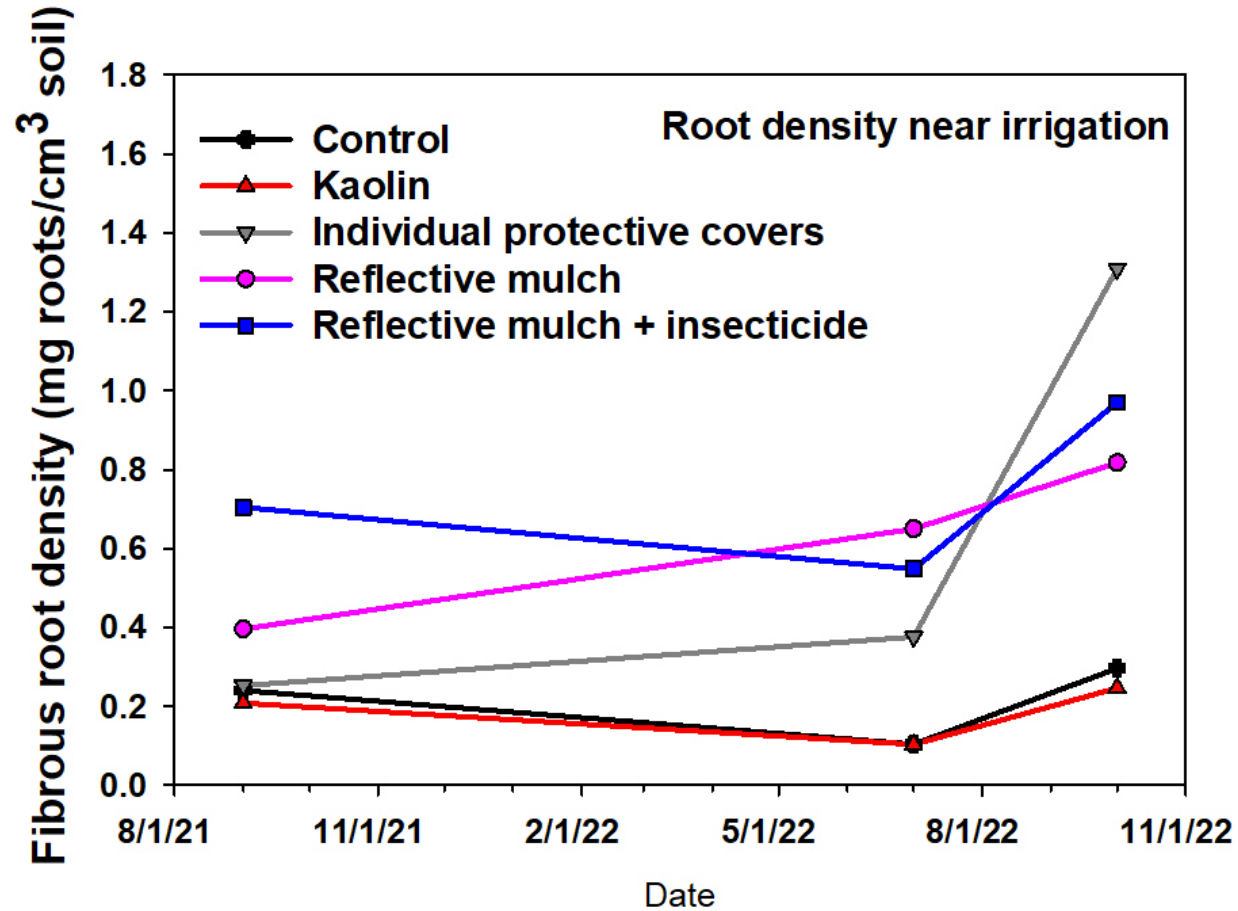
- Yields are unaffected by treatments after 2 years
 - Appears to be other decline in Hamlin grove as trees in some plots nearly collapsed
 - It may take several years for root systems to recover before canopy and yield are affected, if ever
- Hurricane Ian did not help trial results
- Two other sites in Wachula saw similar non-significant effects as Valencia after 1 year of data
 - Hurricane Ian direct hit on grove and caused a lot of damage
 - Harvests recently finished

Young trees

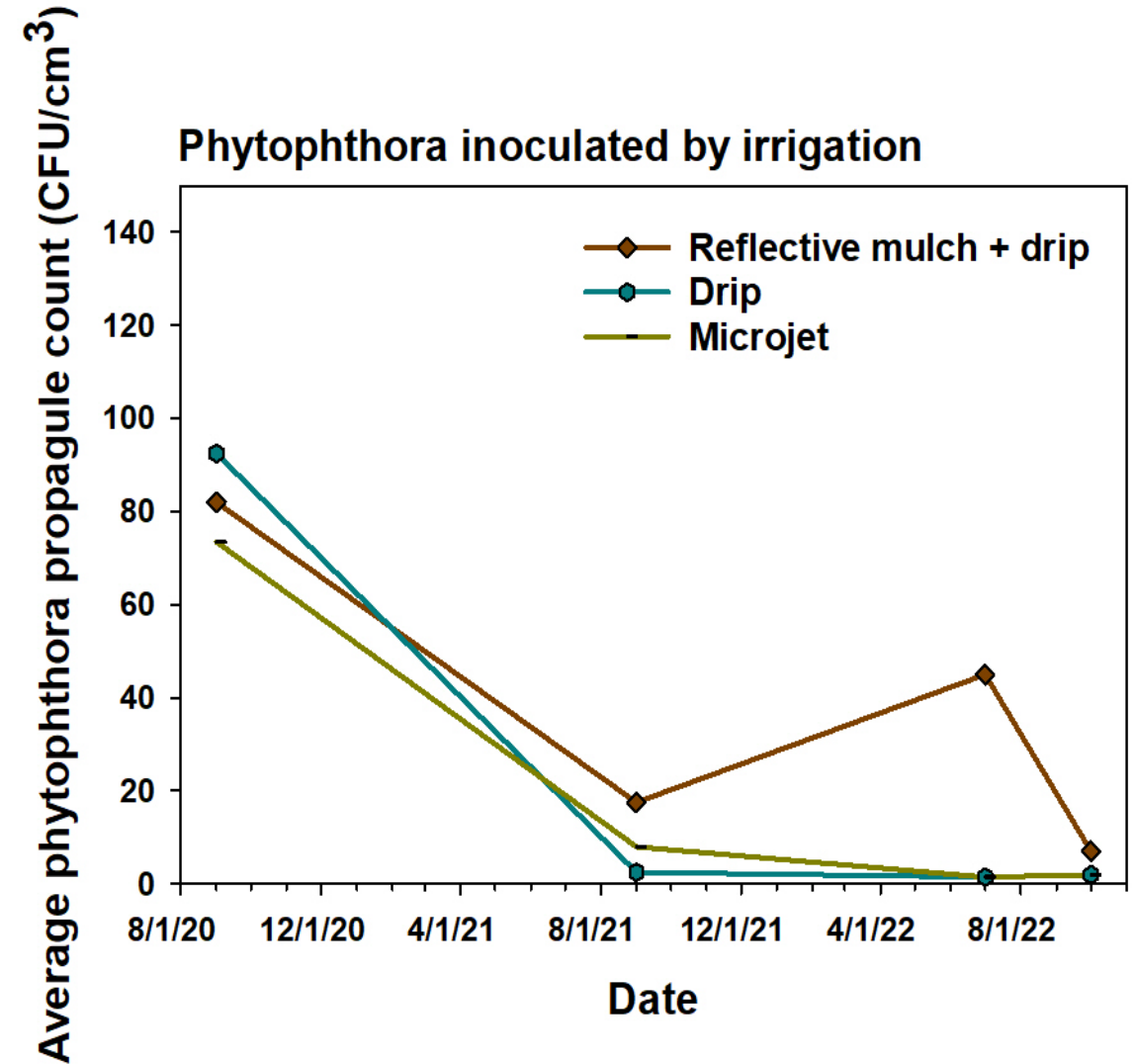
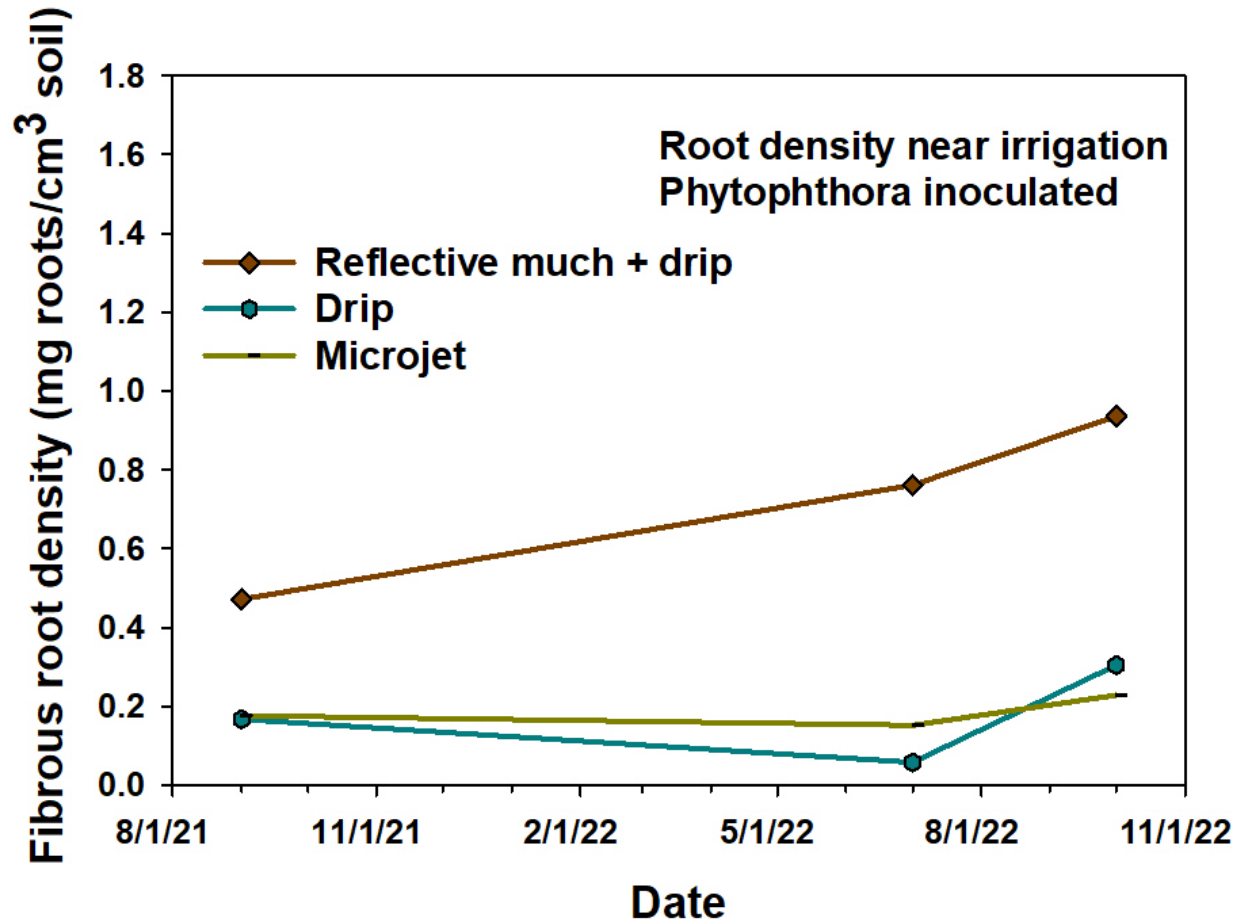
- From comparison trial of planting methods
 - Monthly insecticide sprays
 - Metallicized mulch
 - Red-died kaolin clay
 - Individual protective covers (IPC)
- Samples taken near and distant from irrigation emitters
- Some treatments inoculated



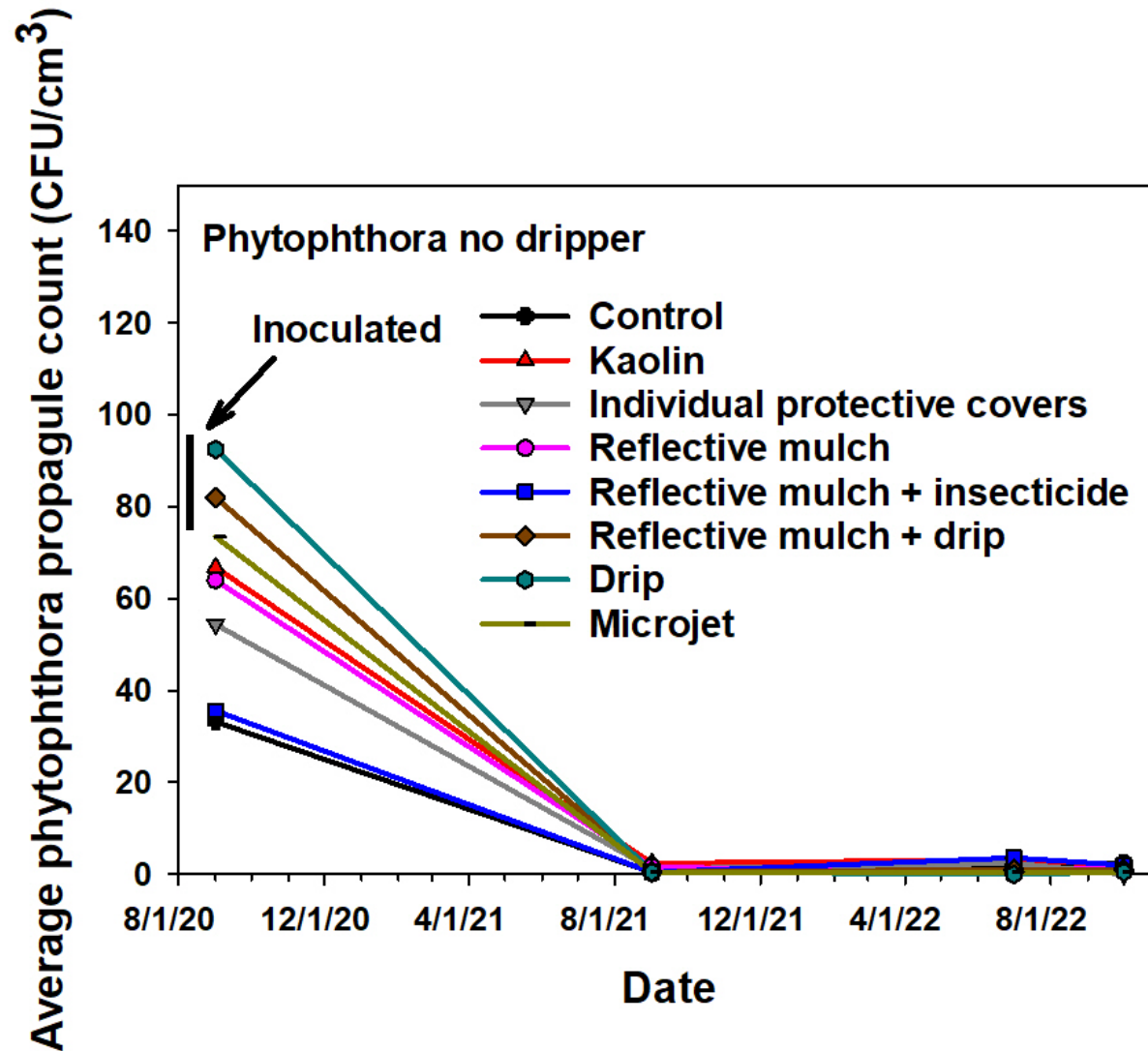
Irrigated zone



Phytophthora inoculated plots



Irrigation matters for Phytophthora



Conclusions

- Young trees with healthy roots systems are vulnerable to phytophthora still
 - Little has changed for vulnerable blocks with history of phytophthora
- No irrigation, no phytophthora
 - Ensure you are sampling in the irrigated zone
- Near irrigation, treatments with good root growth; more phytophthora
 - Mulch helps root density
 - IPC have better canopies and roots

What does it all mean?

- Always need to verify phytophthora still problem in a location
- Should we treat older, declining trees for phytophthora?
 - Little effect on yield
 - Concern about what happens if treatments stop in long term
 - Preserve every root possible
- Young trees with healthy roots remain vulnerable
- What about effect on trees treated with OTC?
 - To date difficult to say whether those trees have recovering root systems

How to follow up?

- Need to know more about whether root systems can recover with joint treatment of Phytophthora and HLB
 - Would there be a better response from treatment of both diseases than treatment of either disease by itself?
 - Some locations respond better to OTC treatment than others.
- Should the propagule thresholds be revised?

Acknowledgements

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