# Phytophthora Management and HLB Basics

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**Citrus Health Forum**
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# Outline

- Phytophthora diseases – symptoms and damage
  - Root rot
  - Foot rot
  - Brown rot
- Phytophthora management options
- Huanglongbing (HLB)
  - Symptoms and damage
  - Recommendations for early epidemic

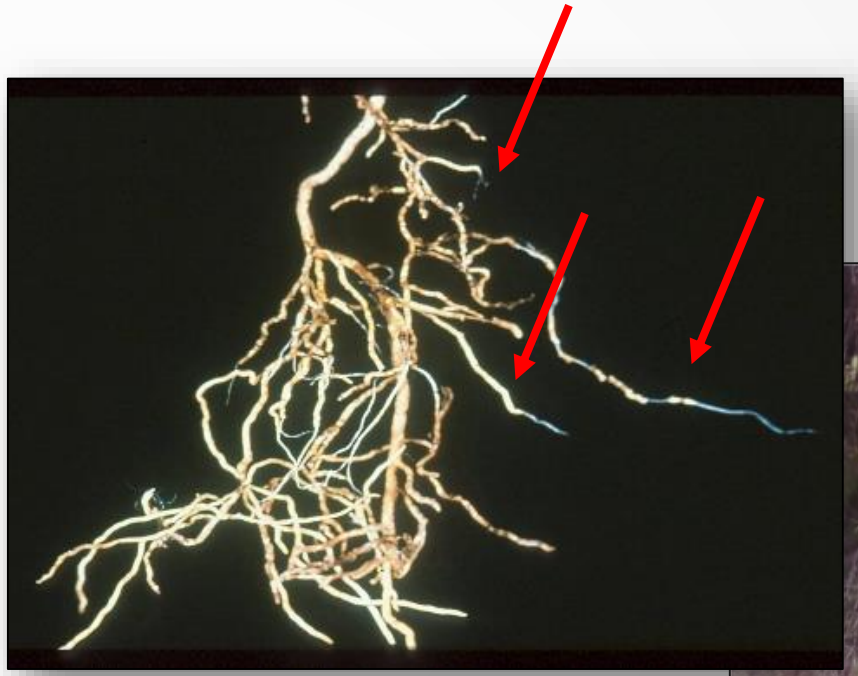
# Phytophthora root/foot/brown rot

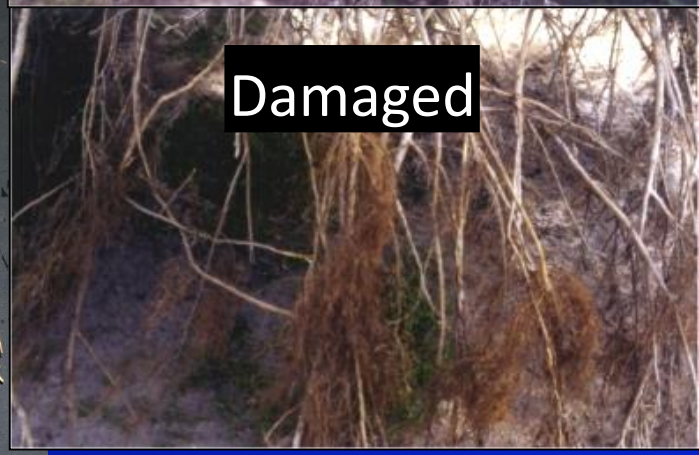
# Phytophthora diseases damage all parts of the tree

- Root rot
- Foot rot and gummosis of trunk and limbs
- Brown rot

# Phytophthora root rot

- Root cortex soft and water soaked
- Cortex sloughs leaving white thread-like tips
- Water and nutrient uptake impaired
- Stored carbohydrates depleted



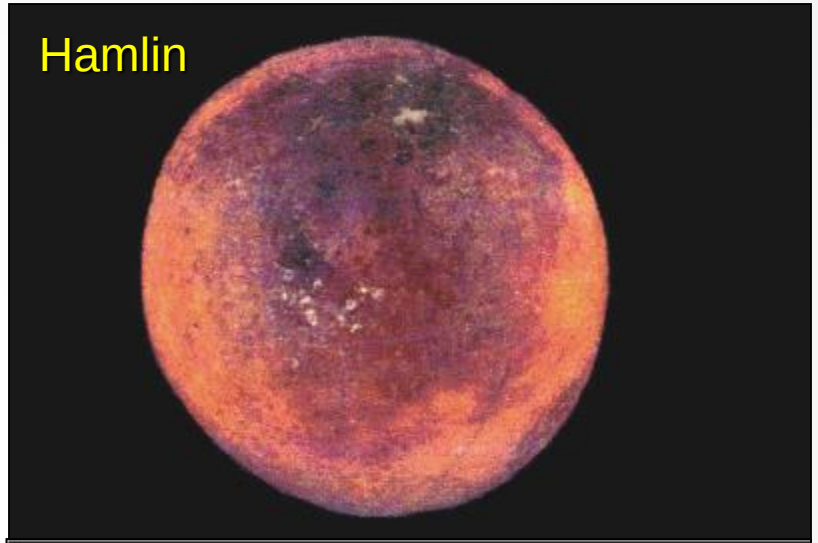



# Foot rot symptoms

- Bark cracks, remains firm
- Water soluble gum is exuded
- Lesions spread around the trunk, or crown below the soil line
- Lesions may heal
- Causes canopy decline
- Can kill a tree if it girdles the trunk

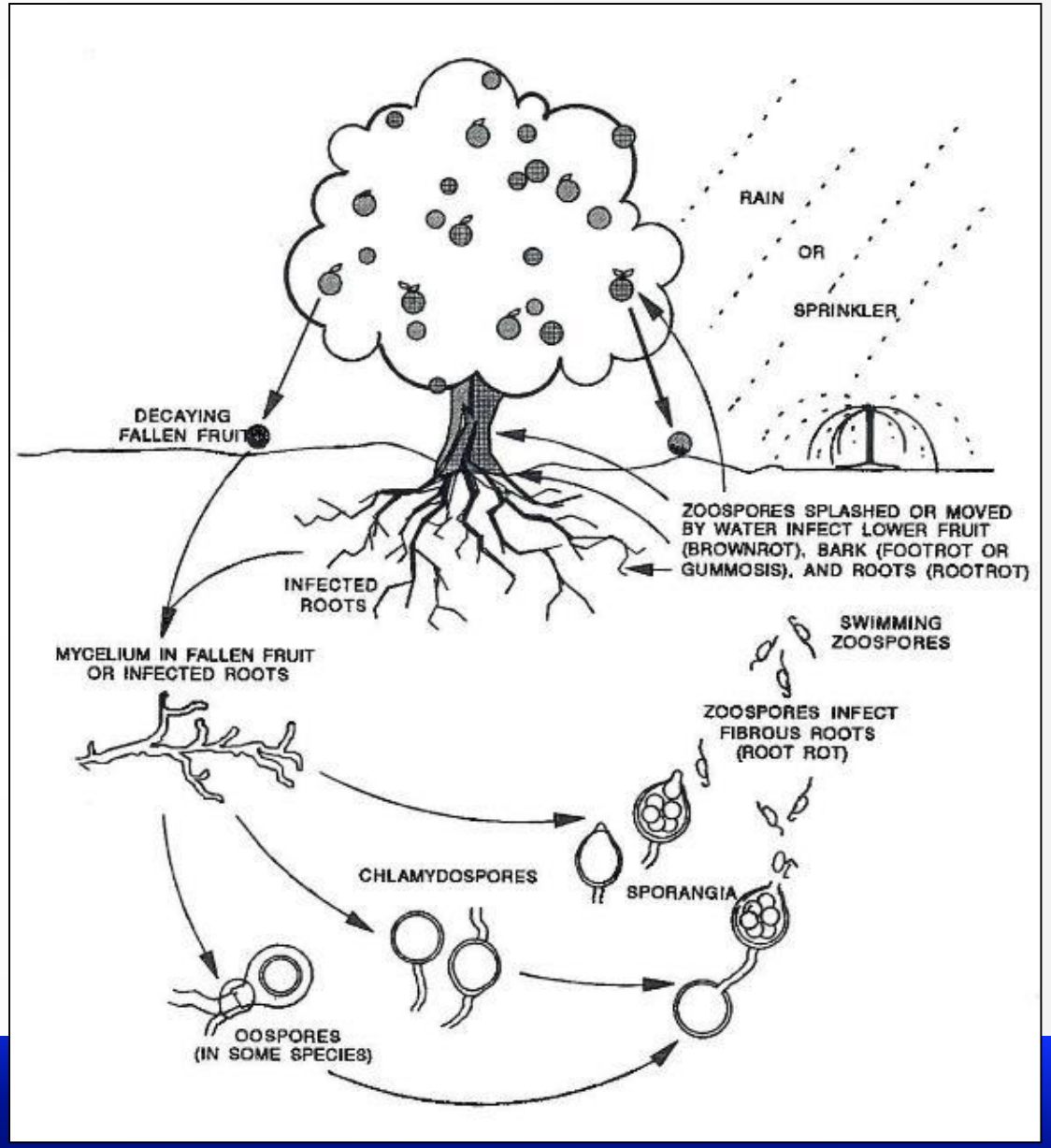
# Brown rot of early season fruit

- Light brown leathery decay
- White fungal growth on surface under humid conditions
- Infected fruit have sharp, pungent odor
- Infection spreads in post harvest
  - Can't harvest until infected fruit drop
- Not sure about Satsuma susceptibility




# Phytophthora disease cycle

- Wet conditions favor root infection cycles
- Susceptibility of roots highest during very wet to very dry cycles
- Wetting and drying increases root exudation attracts zoospores
  - Increases chlamydospore production (resting spores)
- HLB infected roots also exude more exudates that promotes infection

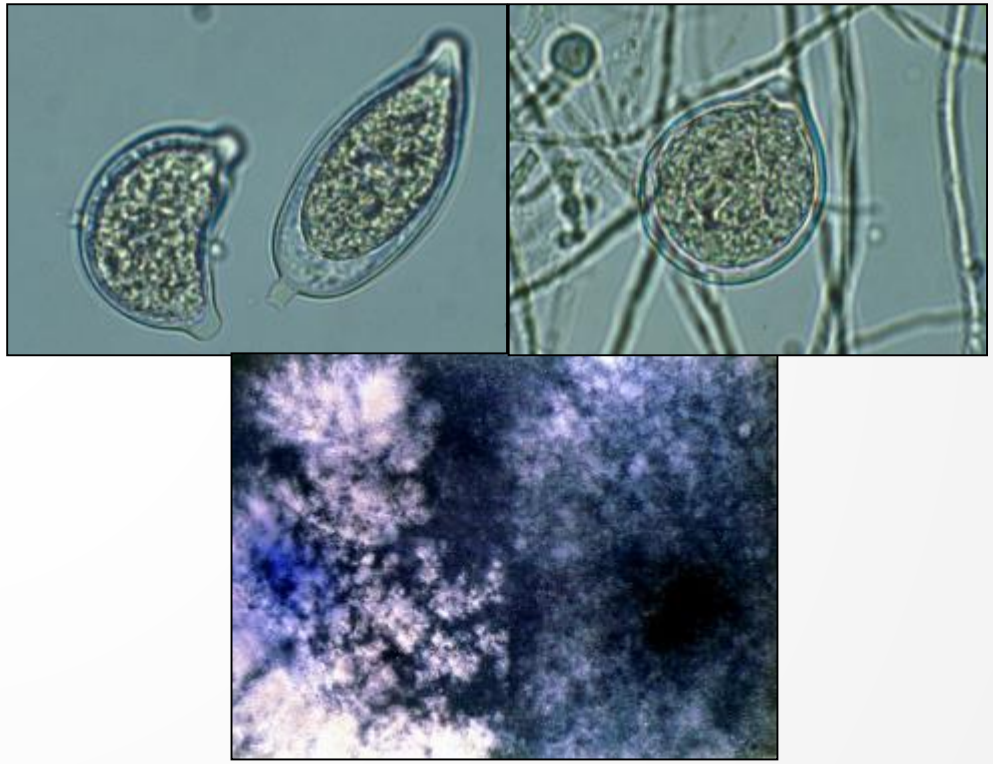


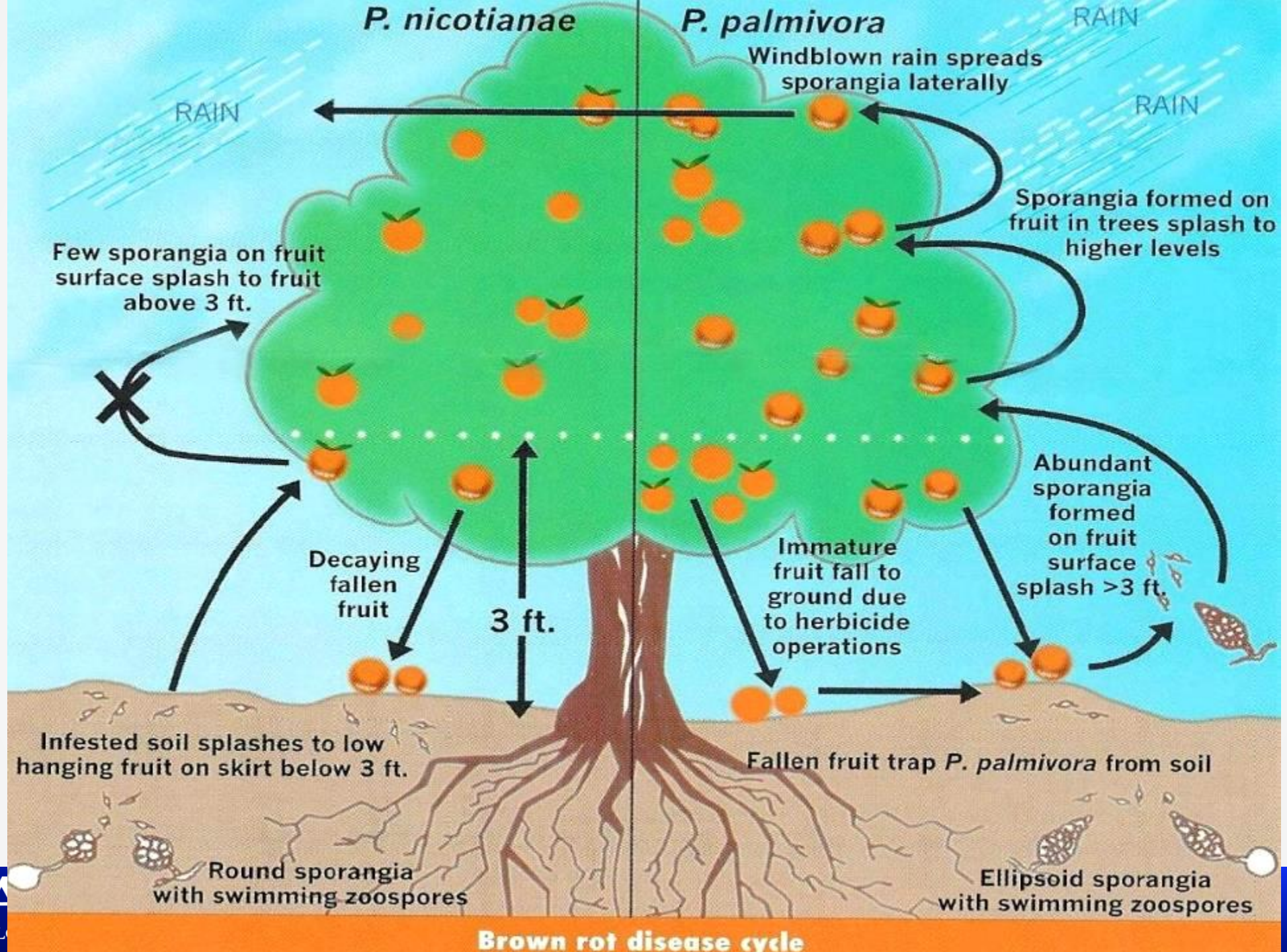
# Causal species of Phytophthora disease

- *Phytophthora nicotianae (parasitica)* common cause of foot rot and root rot
- *Phytophthora palmivora* causes brown rot of fruit, root rot in poorly drained soils with high water tables
- *Phytophthora citrophthora* not known to exist in Florida
- Most damaging in wet soil conditions

*P. palmivora*
*Sporangia elongated*

*P. nicotianae*
*Sporangia round*



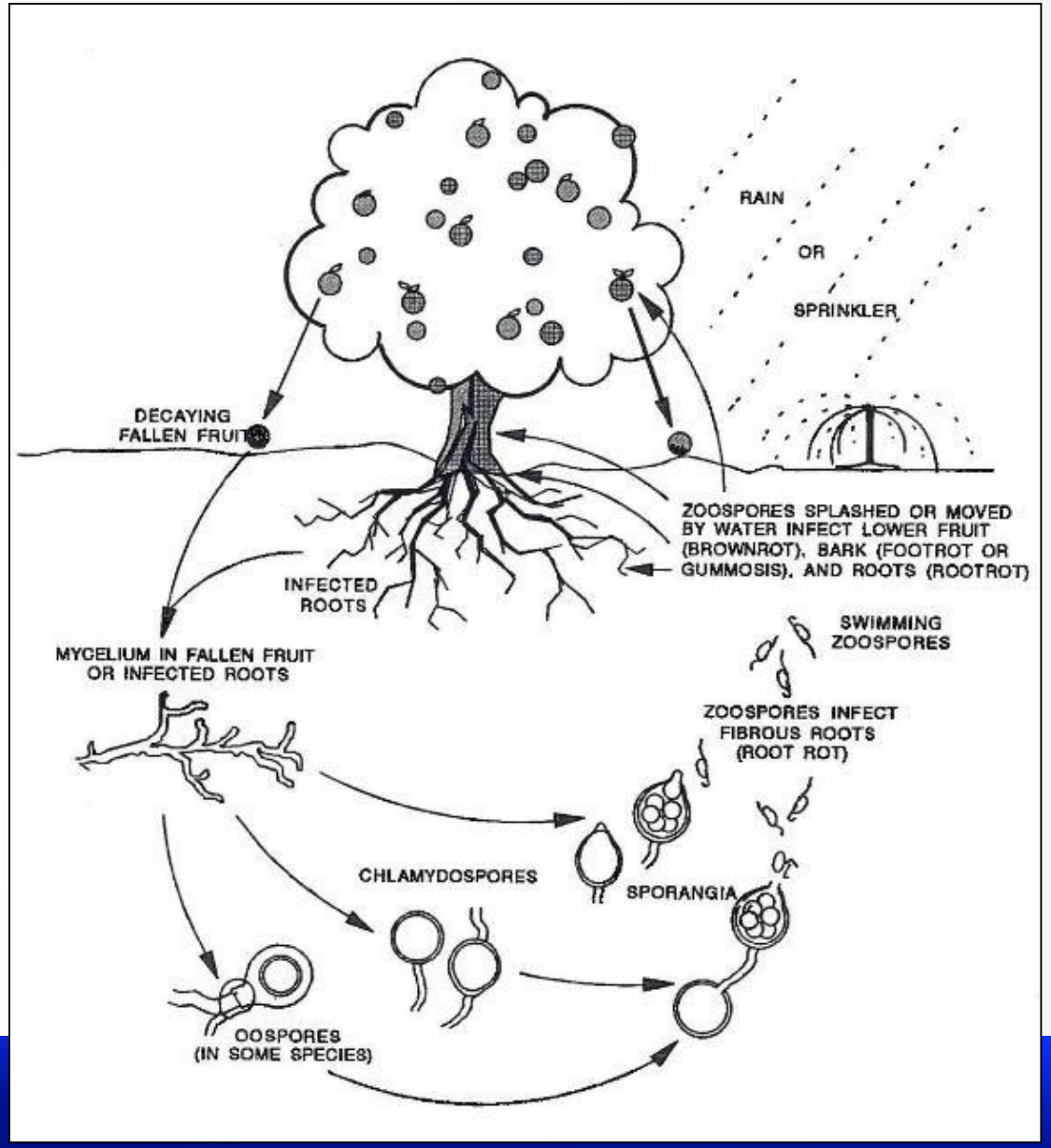

P. nicotianae
P. palmivora
RAIN
RAIN
RAIN
Windblown rain spreads sporangia laterally
Sporangia formed on fruit in trees splash to higher levels
Few sporangia on fruit surface splash to fruit above 3 ft.
Abundant sporangia formed on fruit surface splash >3 ft.
Immature fruit fall to ground due to herbicide operations
Decaying fallen fruit
3 ft.
Infested soil splashes to low hanging fruit on skirt below 3 ft.
Fallen fruit trap P. palmivora from soil
Round sporangia with swimming zoospores
Ellipsoid sporangia with swimming zoospores
Brown rot disease cycle

# Brown rot management

- Cultural
  - Avoid premature drop of fruit to reduce inoculum (not possible with HLB)
  - Raise tree skirts to increase air movement and promote drying of foliage
- Chemical
  - Apply preventative sprays of phosphites, copper
  - Phosphite sprays in July and October if rainy season is prolonged
  - Copper can prevent spread after initial infections

# Brown rot control begins at the roots

- Roots are the source of inoculum for brown rot
- Managing root rot will reduce brown rot risk
- If root rot isn't damaging, brown rot control is cheaper and easier



# When should root rot be managed?

- *Phytophthora nicotianae (parasitica)*
- can infect over 255 genera
- Present in all Florida soils
- Highly dependent on environment
- How do you decide if it is a problem worth treating?

# When should root rot be managed?

*Phytophthora nicotianae (parasitica)*

- can infect over 255 genera
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- Highly dependent on environment
- How do you decide if it is a problem worth treating?

Will you make a return on your investment?

- Yield improvement > Cost of application

Will Foot rot or Brown rot be a problem?

- Starts from soil inoculum
- Soil inoculum a result of root rot

# Field Monitoring of Phytophthora spp.

- Soil populations used to predict the need for management
- Soil sampling is most important step
- Commercial labs are available to conduct assays
  - Will be posted online at CREC Extension website shortly
- *P. palmivora* can be distinguished from *P. nicotianae* on selective medium

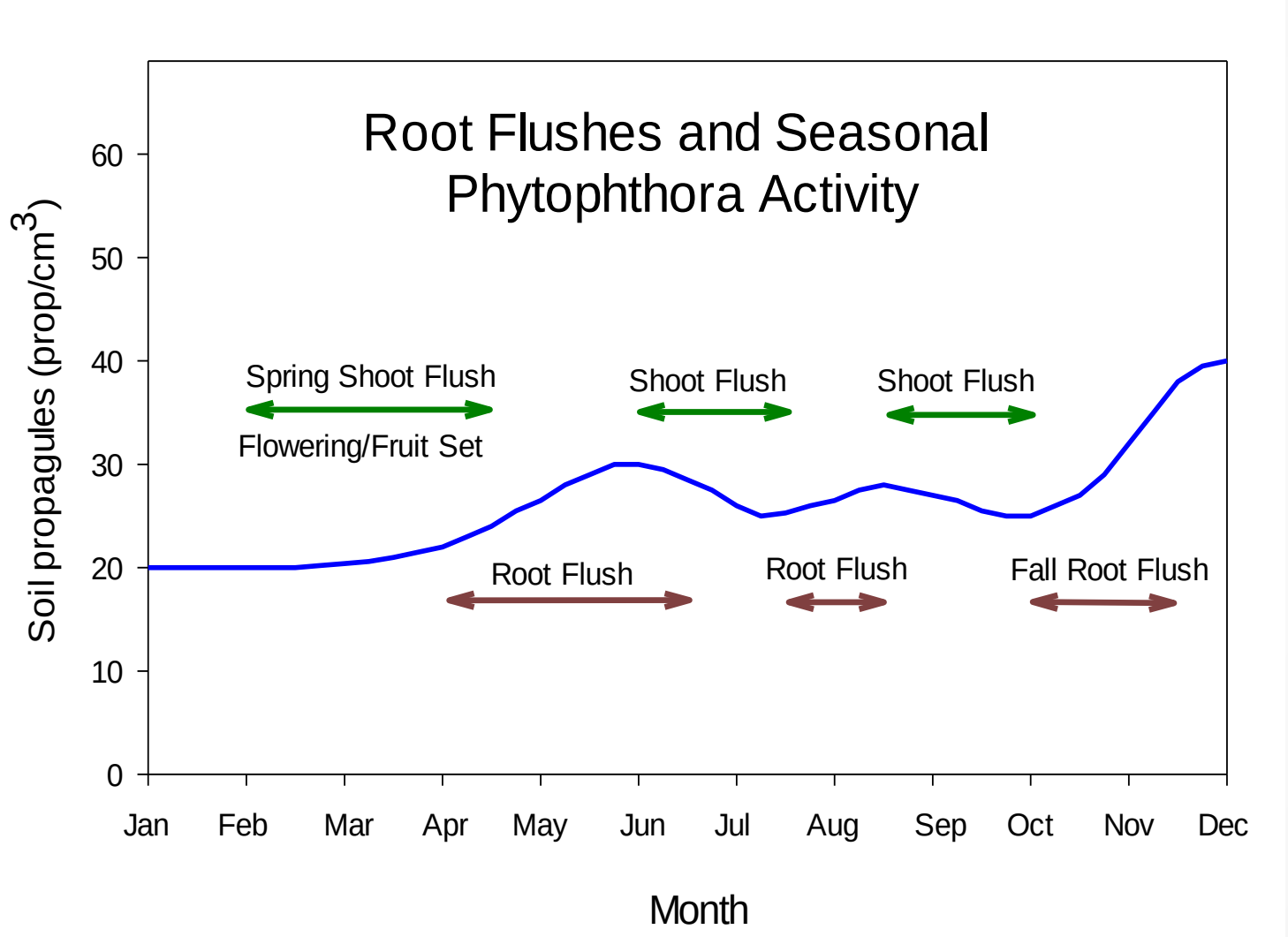
# Sample Collection

- Samples sites at random in the problem area (not the worst or the best trees)
- Collect root-soil cores from 1/2 between trunk & dripline
- 20-40 samples/10 acre
- Composite in a 1 gal. resealable bag, store cool not cold
- Ship to lab within 24-48 hr

# Phytophthora control

- Treat based on propagule count
  - >20 propagules per $cm^3$ of soil
- Time application for maximum effect
  - Phytophthora damages root flushes
  - Treatments are protective – apply at/just before root flush
- Rotate modes of action
  - Ridomil/Presidio/Orondis and Phosphites

# Target soil applications of fungicides to root flushes




*Timing may be different for Satsumas in North Florida

# Chemical Management of Phytophthora

- Treat the worst root health problem first – details in FCPMG
- www.crec.ifas.ufl.edu/extension/pest/
- Phytophthora count >10-20 propagules/$cm^3$ recommend rotation of fungicides:
- Aliette/phosphite after spring shoot flush
- Mefenoxam or Presidio after spring-early summer rains begin
- Aliette/phosphite after midsummer shoot flush
- Mefenoxam or Presidio after fall shoot flushes
- Remember root flushes follow shoot flushes

- New oomycete material, Orondis, available
  - Promising results in California, not fully tested in FL

# An ounce of prevention is worth a pound of cure

- Key to managing Phytophthora is minimizing soil inoculum
- Design effective drainage before planting
- Choose resistant or tolerant rootstocks
  - Can be soil type specific
  - Trifoliate and trifoliate hybrids like Swingle and Carrizo perform well in acidic soils, but fail in alkaline/calcareous soils
- Plant clean trees
  - Discuss Phytophthora controls with your nurseries
  - Buy trees from nurseries with good Phytophthora reputations.

# Foot rot management

- Easily prevented with resistant rootstocks with graft union 9 inches above soil level

- If you find foot rot lesions trunk paints of copper or mefanoxam can prevent growth of lesion

Cleopatra mandarin rootstock with nursery infection

# Phytophthora Diaprepes complex

Infection follows damage by larval feeding on the root bark

Root girdling by the *P. nicotianae-Diaprepes* Complex on sour orange (Desoto Co.)

# HLB symptoms and damage

# Huanglongbing (citrus greening)

- Causes citrus tree to decline (faster for young trees)
- Gradual reduction in fruit quality and quantity
- Affects all citrus varieties

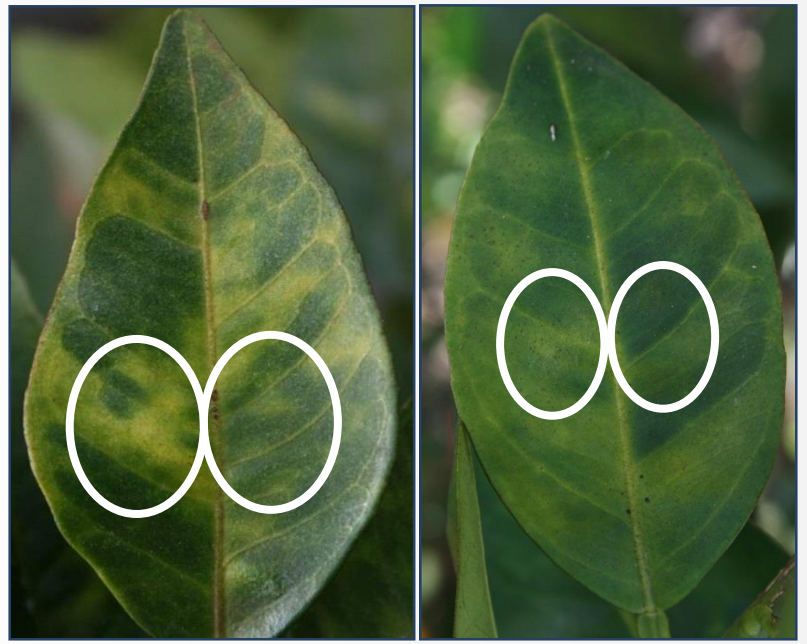
# HLB symptoms

## Early

- Root dieback
- Single or few branches with
  - Early bloom
  - Nutrient deficiency
  - Yellow leaves
- Blotchy mottle (diagnostic symptom)

**Yellow shoots**
**-chlorosis or nutrient deficiency**

**Blotchy mottle**



# HLB symptoms

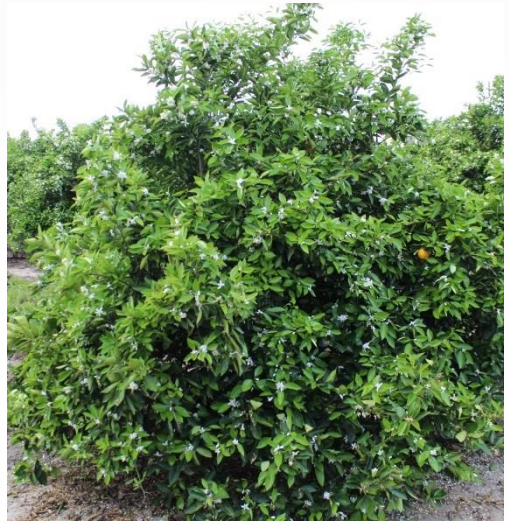
**Late**

- Corky veins
- Small and/or leathery leaves
- Small and misshapen fruit
- Branch Dieback
- Leaf drop
- Preharvest fruit drop

# HLB root loss

Healthy

Symptomless Infected



Thinning

Full roots

30-50% root loss

70-80% root loss

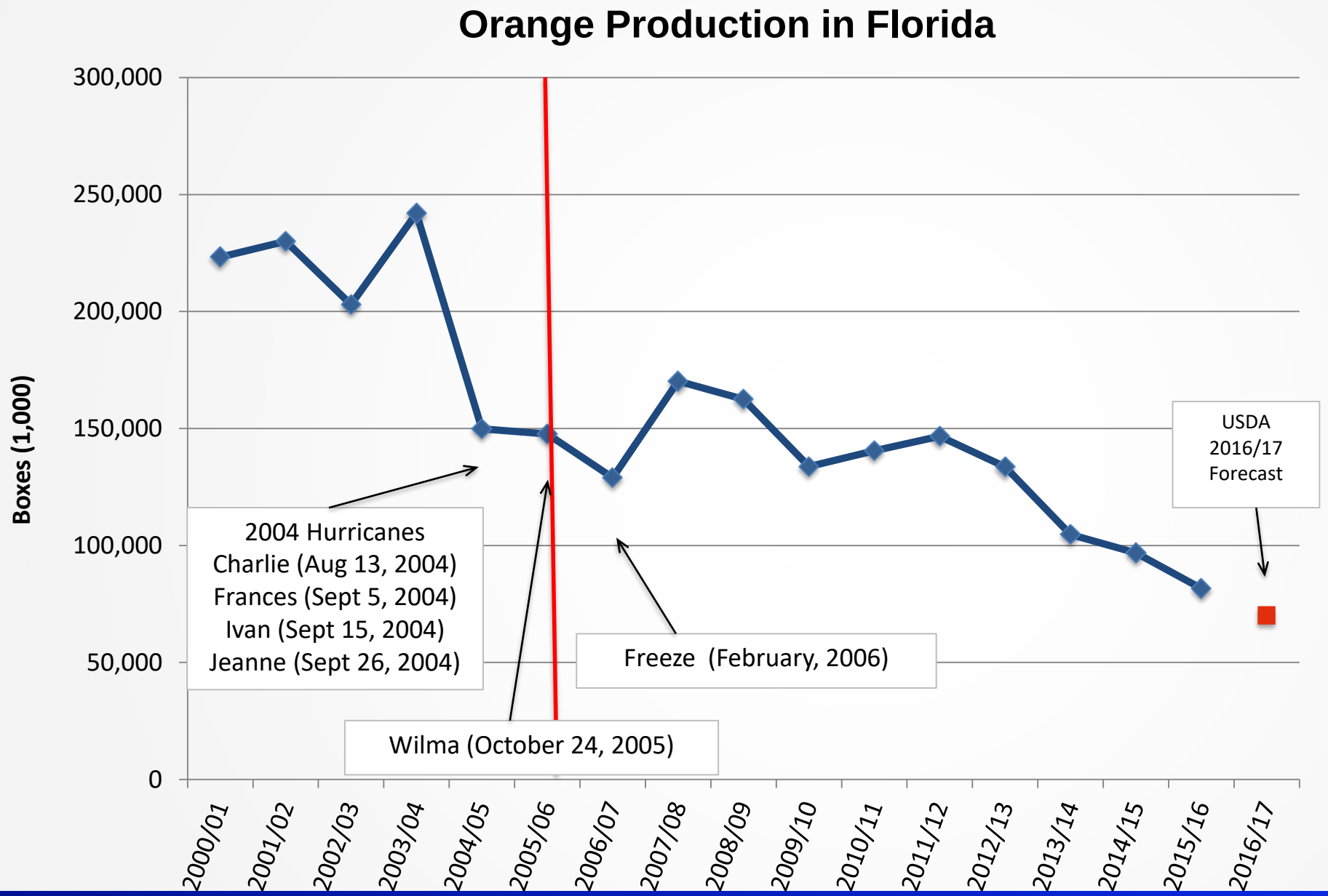
# Root symptoms of Huanglongbing

- 30-50% root loss before symptoms develop
- >70% root loss as visible canopy decline begins

Ridge root system

30-50% root loss

>70% root loss




*Once tree is infected, No proven treatments

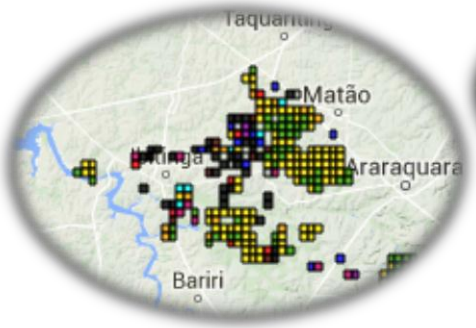
*Some may slightly slow tree decline
-less effective for young plantings

Source: USDA-NASS

Courtesy of Ariel Singerman

# Successful HLB management in Brazil

# Meeting with Neighbors- Regional Management




FUNDECITRUS
FUNDO DE DEFESA DA CITRICULTURA

20 ANOS DE PESQUISA

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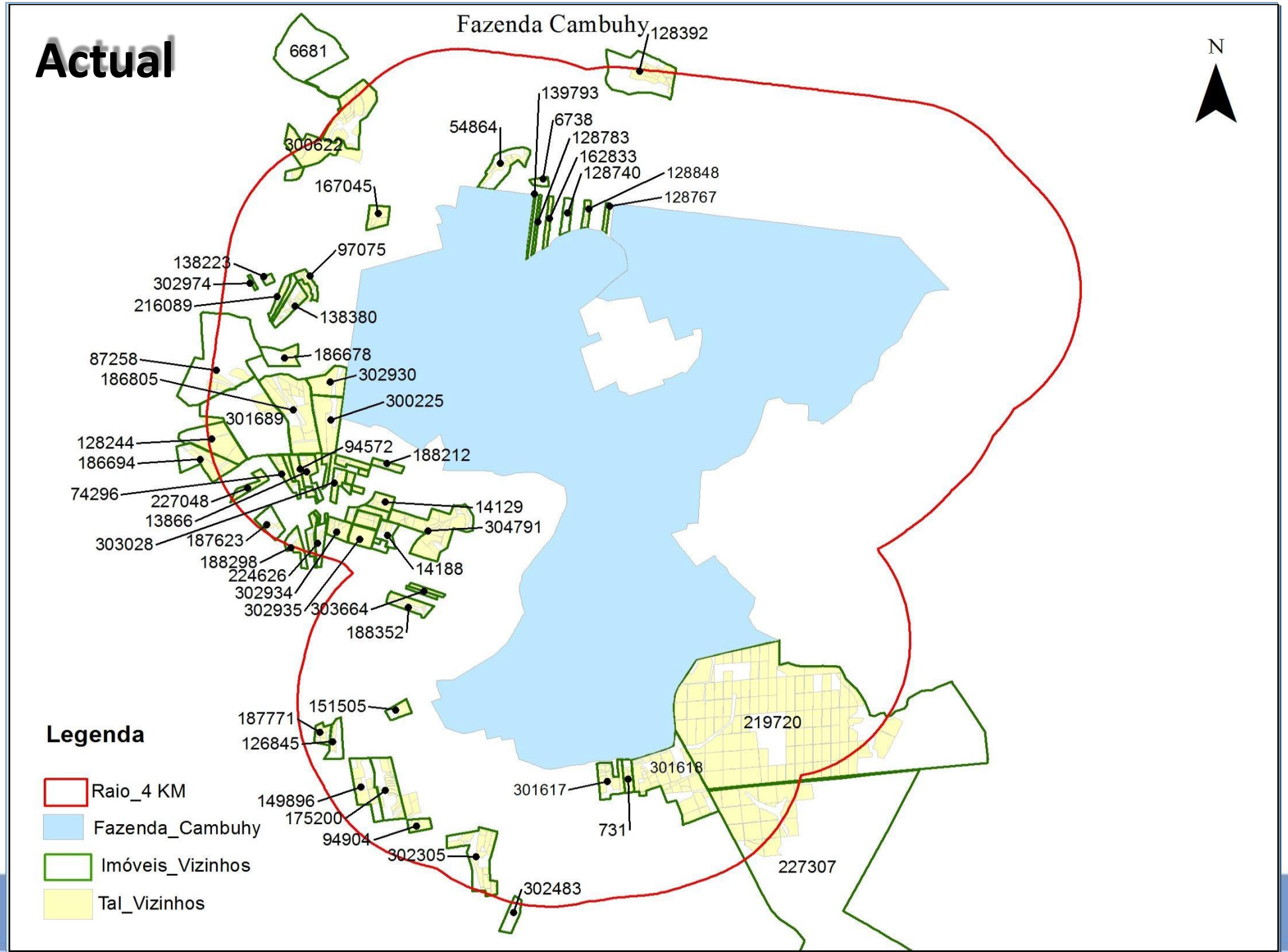
# Actual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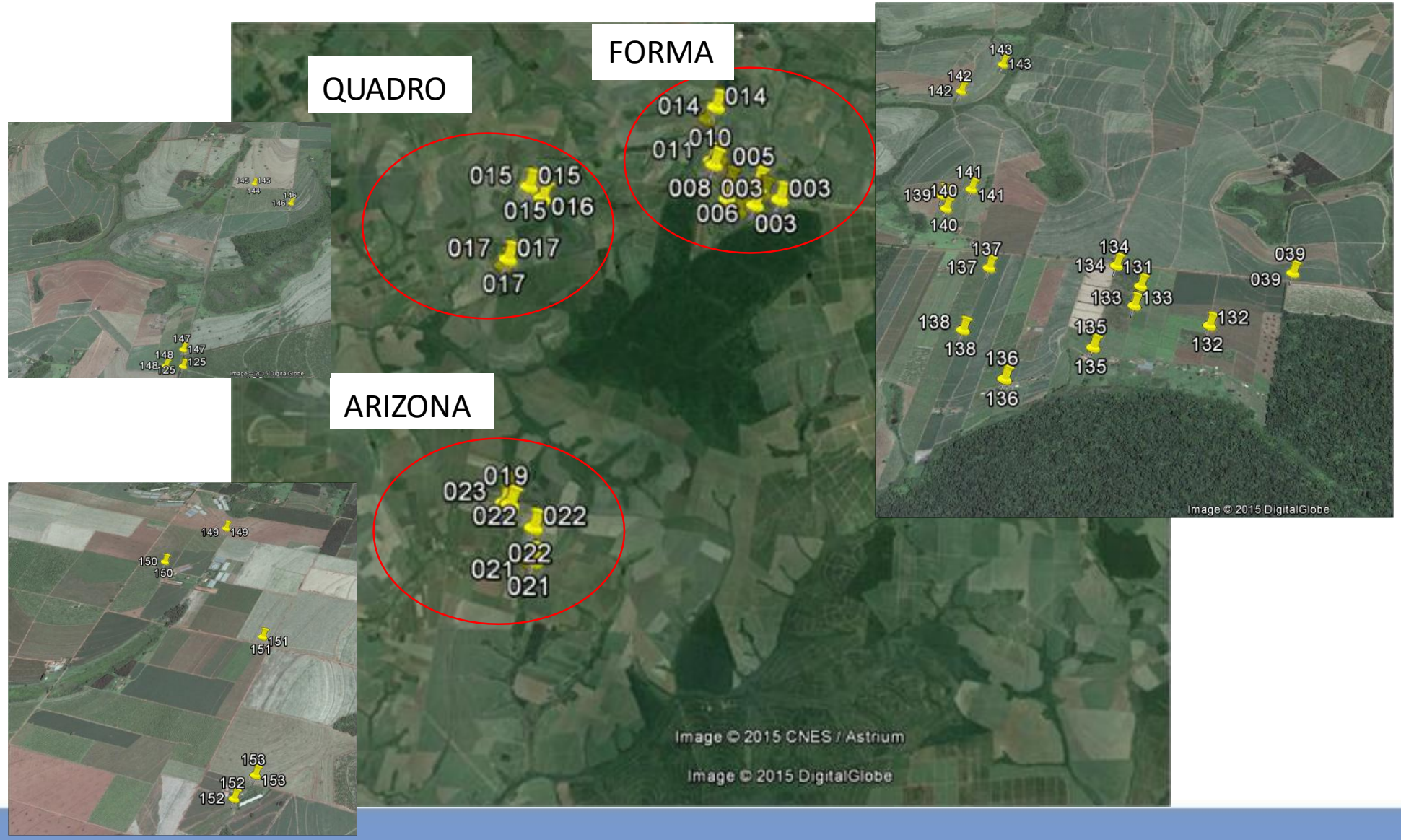
# Neighbors (Yellow stick traps)

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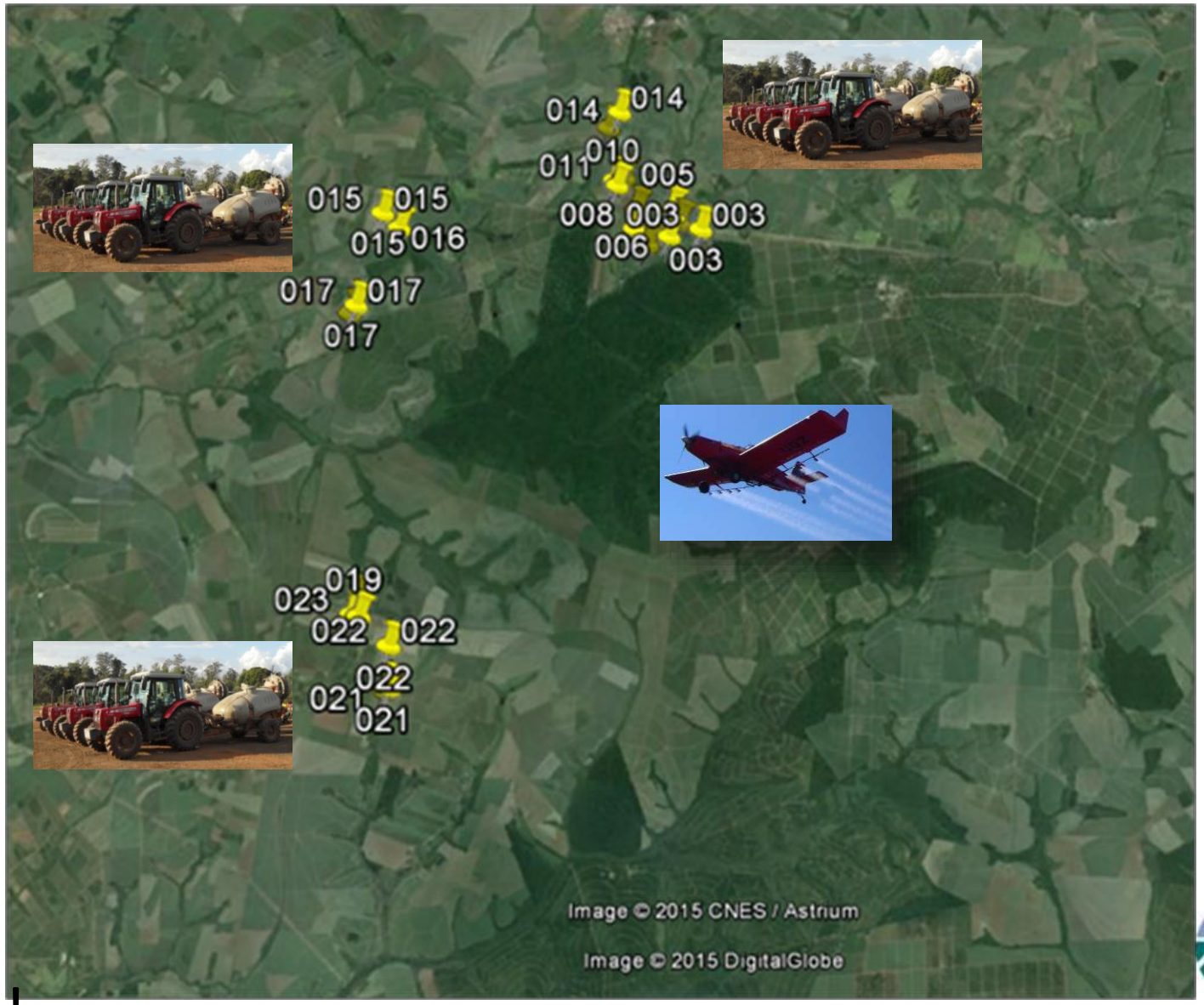
# Neighbors control




At the same time!!!

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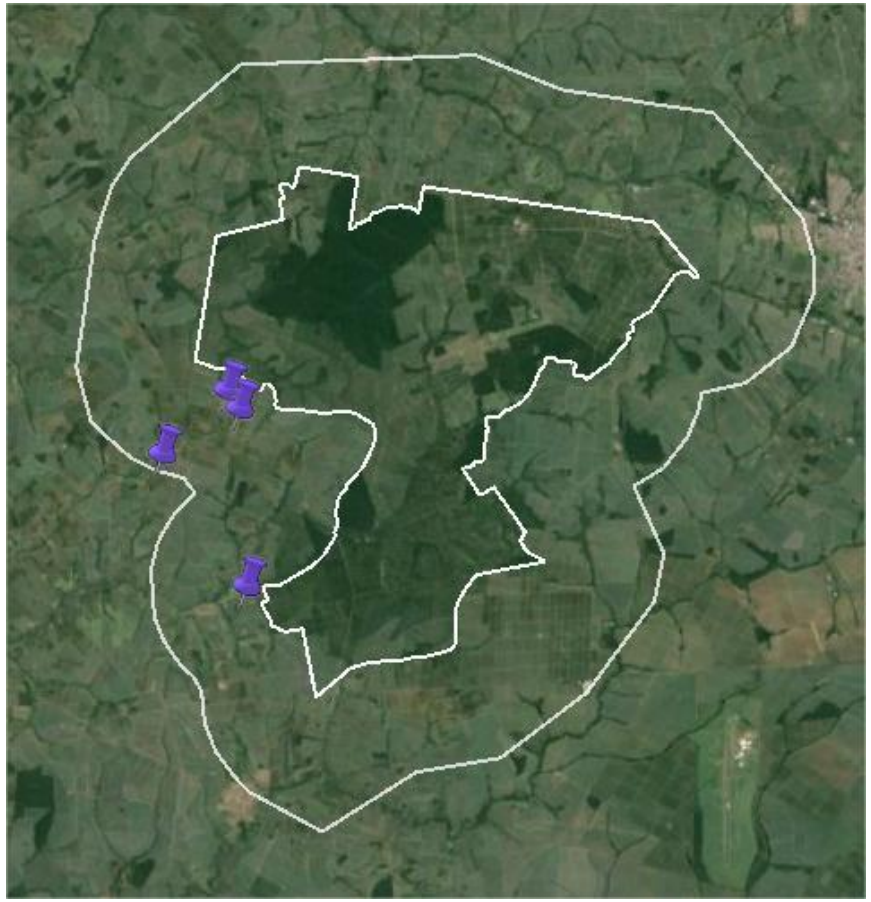
# Eradication




- Comercial orchards **(Avoid Abandoned areas and high pyllids population)**;

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# Backyards- Spray


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# Neighbors Eradication- Backyard

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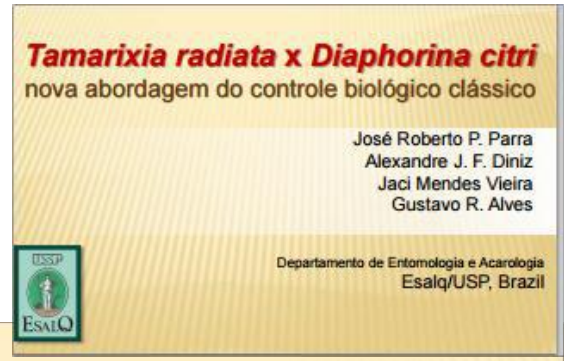
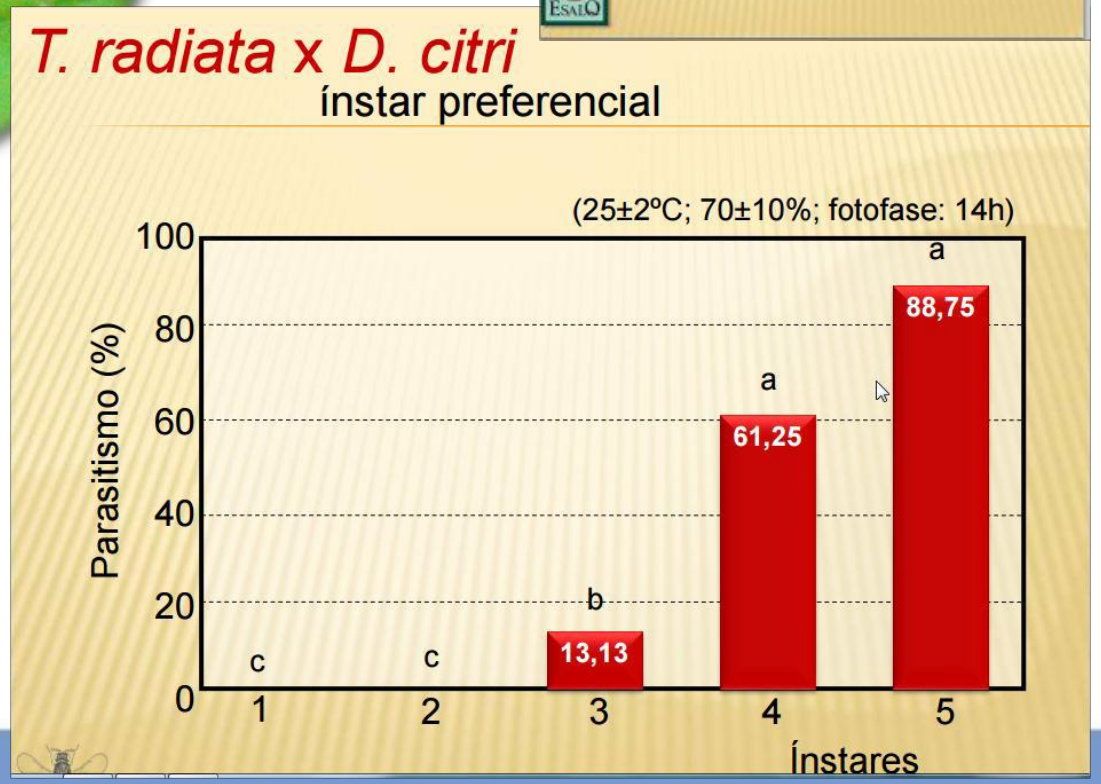
# *Tamarixia sp* Release

- ✓**Backyards**
- ✓**Abandoned areas**

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# HLB Results

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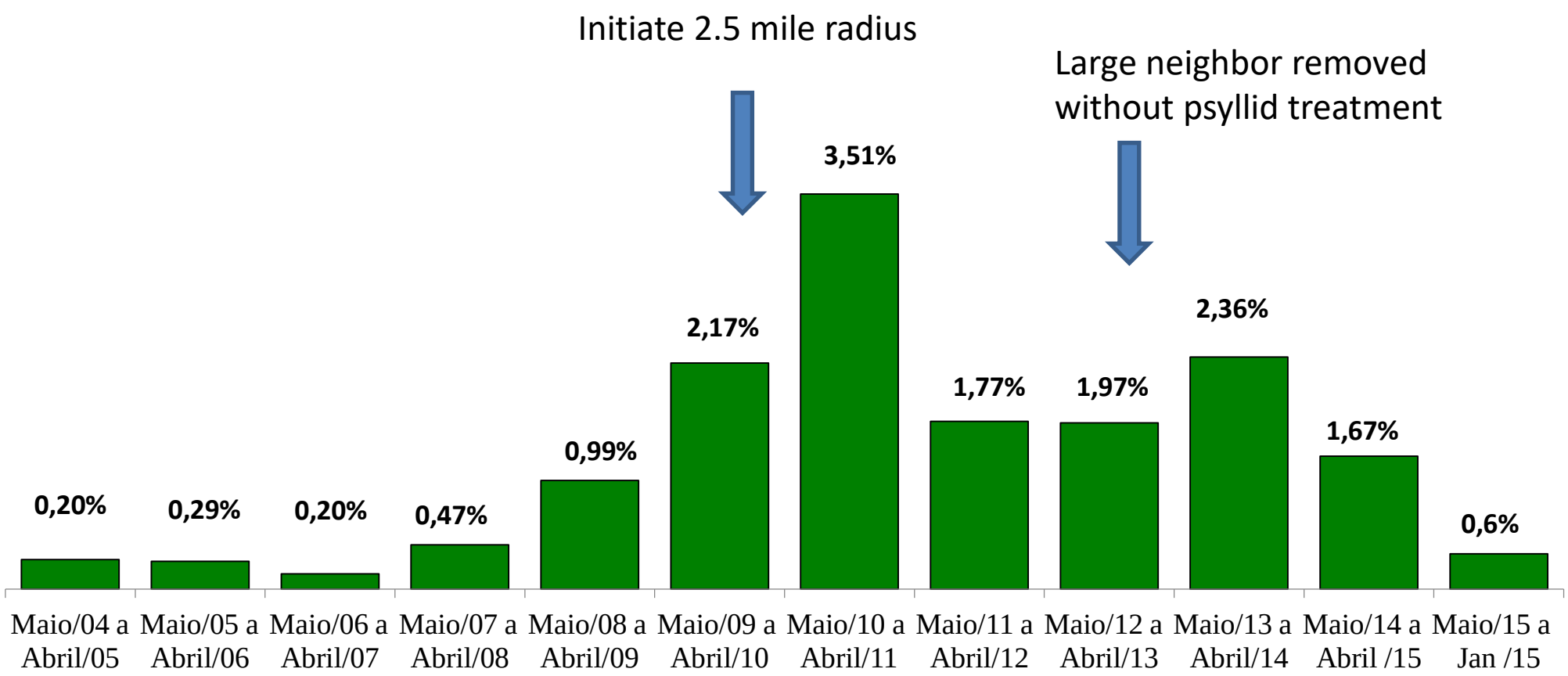
# HLB Eradication since 2004

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# A Plant Pathologist's recommendation for North Florida

# HLB recommendations for North Florida

- Regional psyllid management is essential
  - Active scouting for ACP
  - Coordinate psyllid sprays
- Remove infected trees
  - A little fruit loss now prevents a lot of fruit loss later
- Work with homeowners to treat for psyllids or remove trees
  - Be friendly, they have to do it voluntarily

# Questions?