Citrus Black Spot Management Tools

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Is it really a concern?

- Caused by fungus *Phyllosticta citricarpa*
- Citrus black spot can cause up to 60% yield loss (fruit drop) in severe situations with little management
- More commonly, fruit drop levels of 10-20% in a minimally managed block
  - Still a significant number of fruit
- Producing fresh fruit?
  - Export restrictions to certain regions; particularly EU
- Quarantine disease leading to requirements like tarping

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Is black spot still spreading?

- CHRP program and FDACS continue scouting program each year as fruit ripen
  - New blocks identified each year
- Present in 5 southwestern counties
  - Glades County was most recent county with quarantine zones
- Mostly in commercial groves
  - First residential find in 2019 (Lee County)
  - Appears to have been present in location for more than a year

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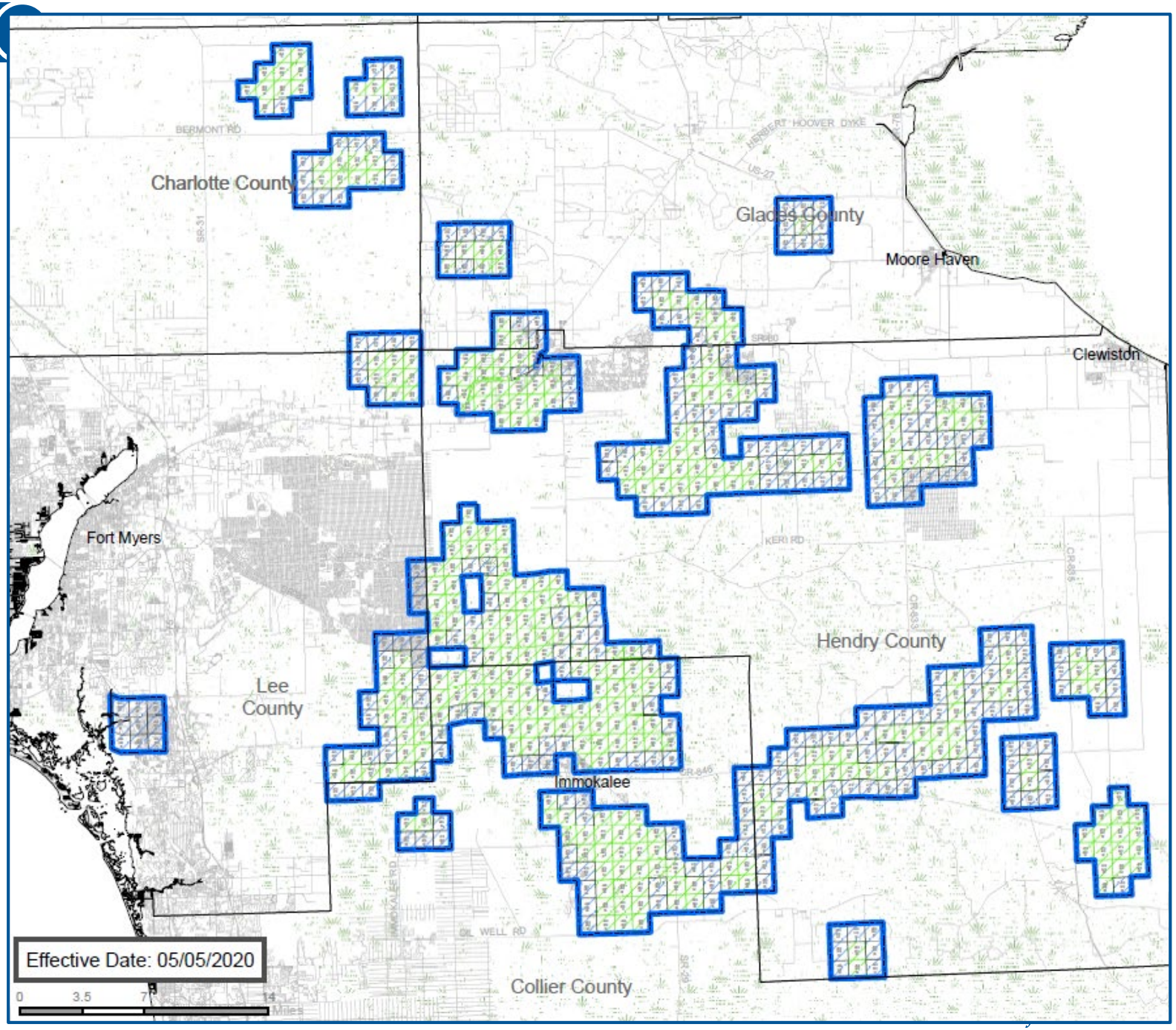
Current locations in Southwest Florida



www.fdacs.gov

Effects of Irma

- Irma likely moved black spot to new areas
  - Difficult to determine how far may have moved
  - May not see result for up to five years post-storm
    - Latent period of disease in groves
- If downwind of black spot groves, at significant risk of outbreak
  - Should be scouting regularly for symptoms
  - Ask for CHRP multipest survey if concerned that disease in grove
- This is in addition to spread that would have occurred anyway

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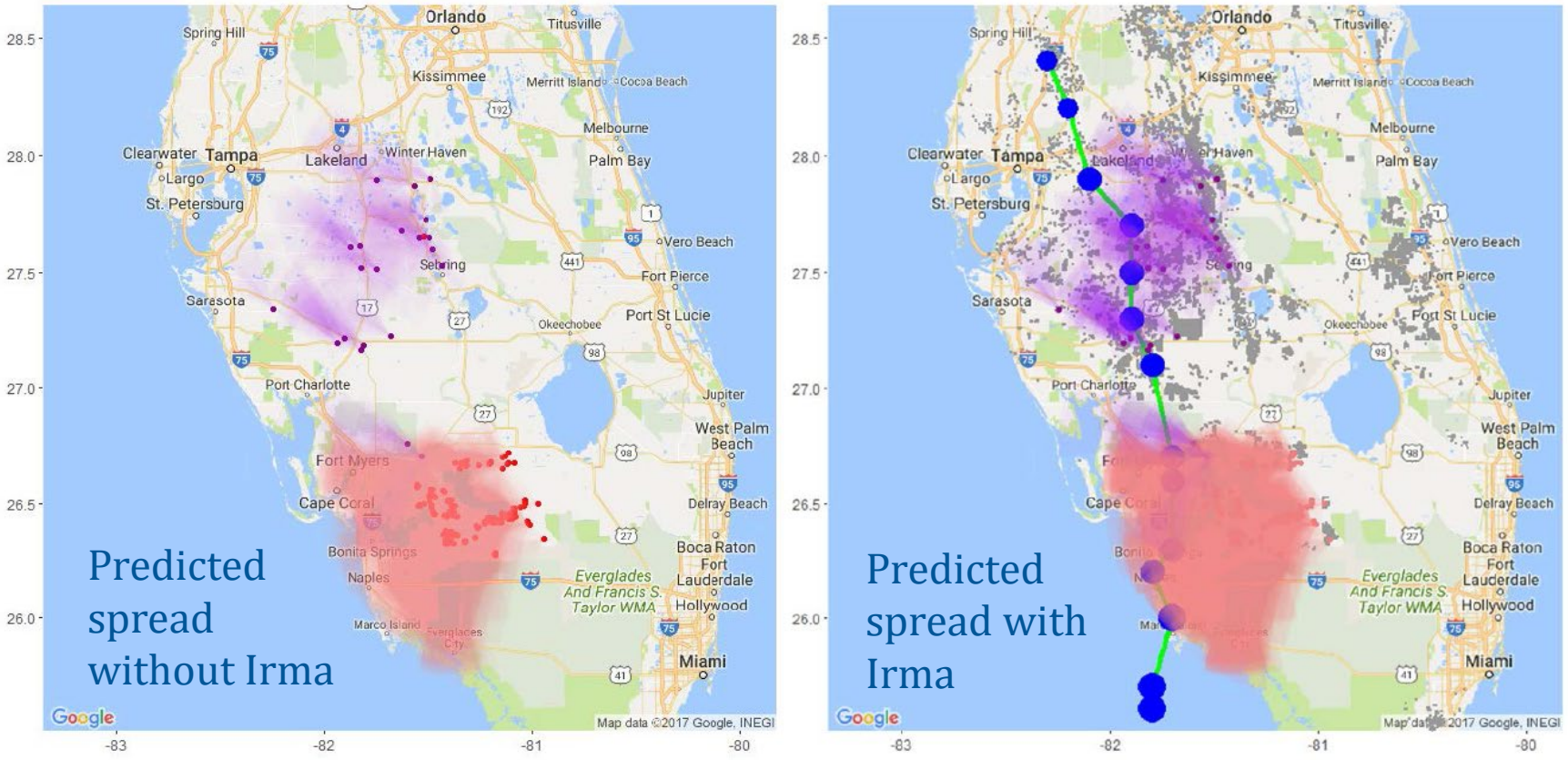
Hurricane Irma
Citrus Black Spot dispersal areas

Gottwald et al.

- Red points are locations where CBS is present
- Purple points are locations where CBS is possible but undetected



How could a location have undetected CBS?

- Near processing or packing plants
  - Culls and citrus trash is brought with fruit from around state
- Trash disposal sites for processors or packing plants
  - Trash from locations that were not in the quarantine areas in one year disposed of in normal manner but had CBS finds in subsequent years
    - Fungus could have been inadvertently released
- Proximity to transportation corridors
  - Debris falls from trucks when untarped

Not in a survey area but concerned

- Learn to recognize symptoms and scout
  - Train grove workers to keep an eye out for unusual things
  - CREC extension program can train staff on request
    - Contact Jamie Burrow: 863-956-8648; jdyates@ufl.edu
- Contact CHRP and arrange for a multipest survey on property
  - CHRP contact number: 863-298-3000

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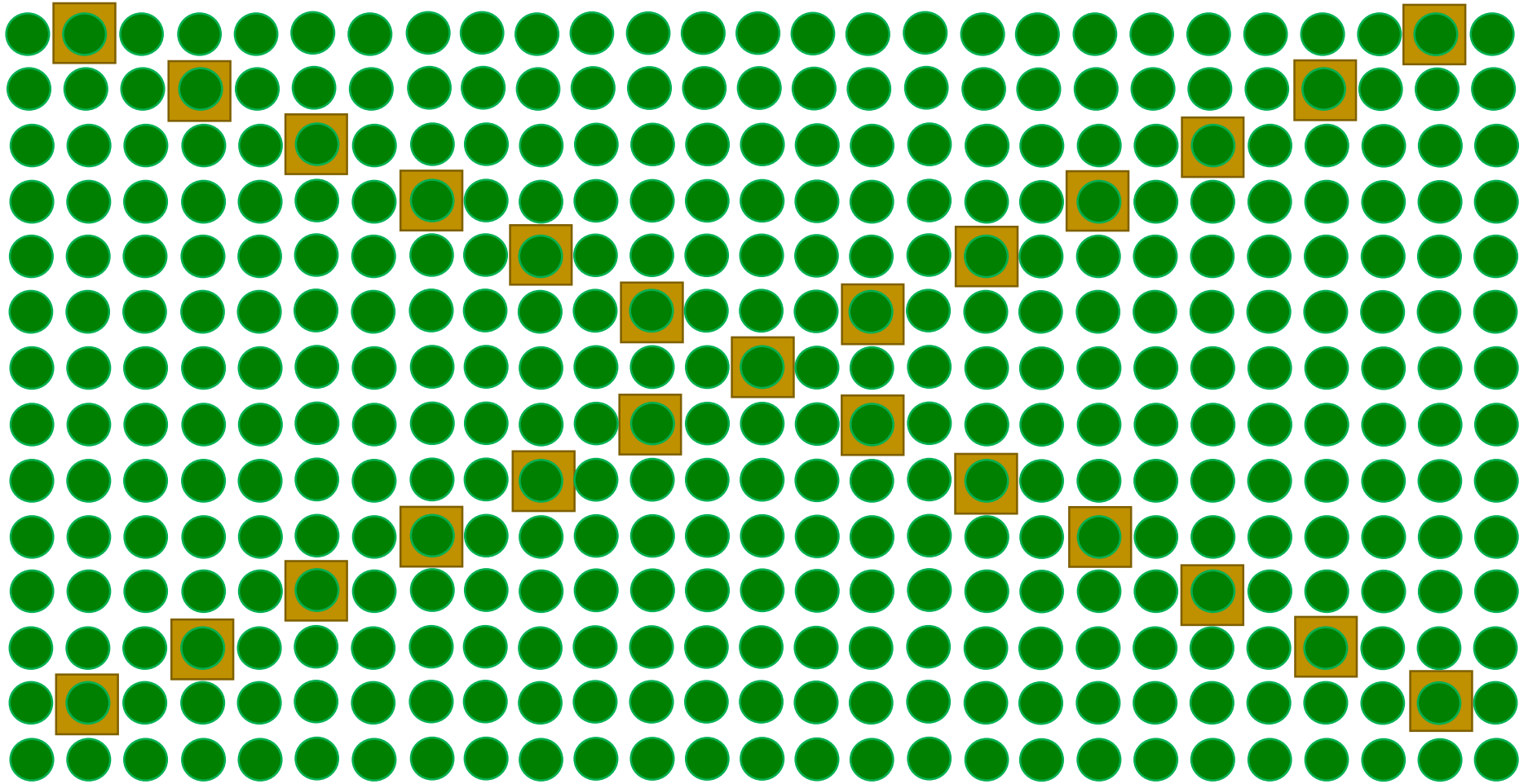
How to scout for CBS

- Wait for color break or about 1 month before harvest
- Visit multiple locations in grove
  - Disease tends to be found in clusters
    - Multiple trees in a small area with asymptomatic trees surrounding
  - Particular areas of interest: along roads or near staging areas for equipment or fruit trucks
- Declining trees tend to have more disease
- Sunny sides of trees tend to express symptoms first

Potential scouting pattern



Three to four rows

Sample trees

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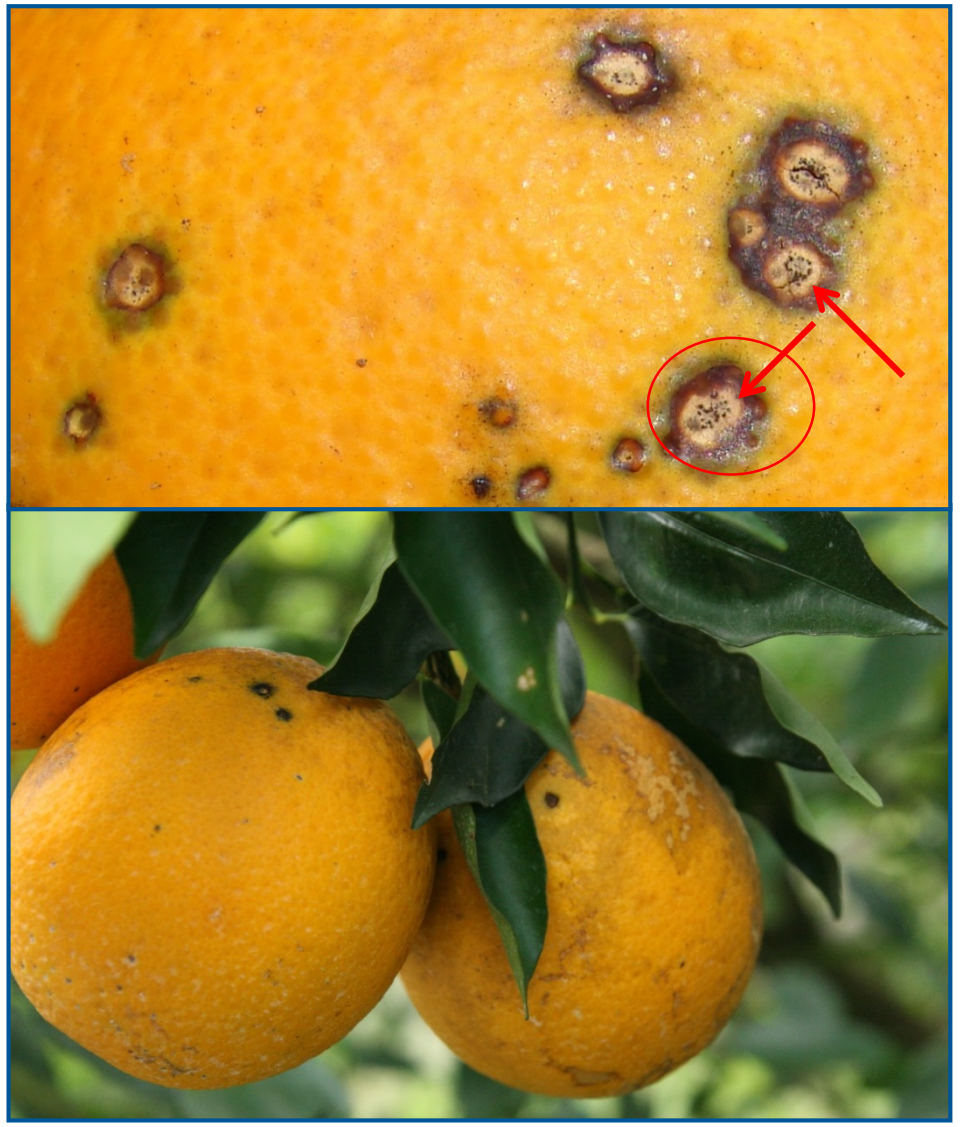
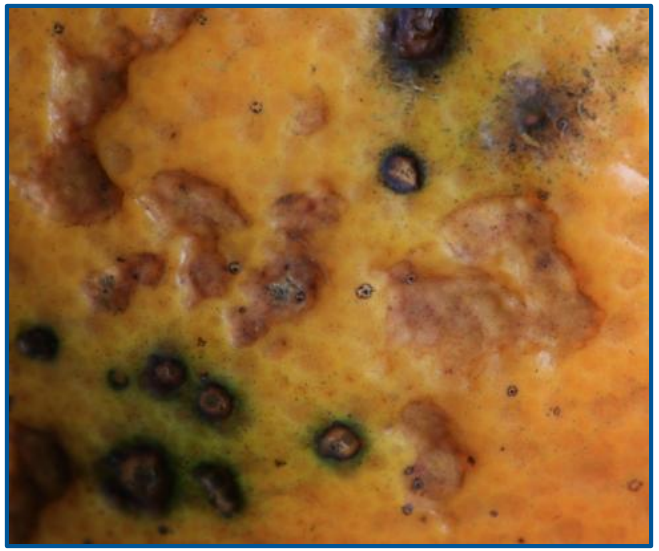
Cracked Spot and Hard Spot



False Melanose and Virulent Spot



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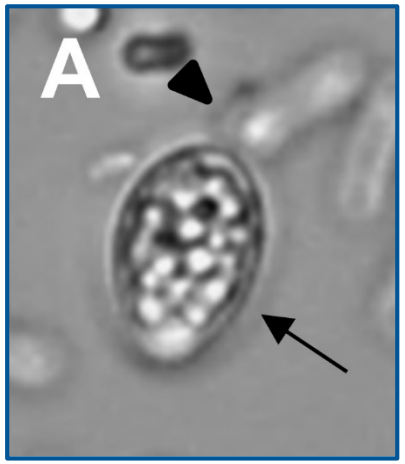
The most important spores



- Only one spore type present in Florida
  - Only splash dispersed conidia present
  - Every other location with disease has two: ascospores and conidia

- Known to be abundant in the leaf litter
  - Present in high numbers all year
  - When in canopy, tend to move down more than splash up
  - Rain splash likely moves spores into lower canopy from leaf litter

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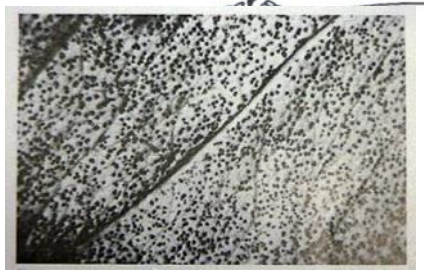
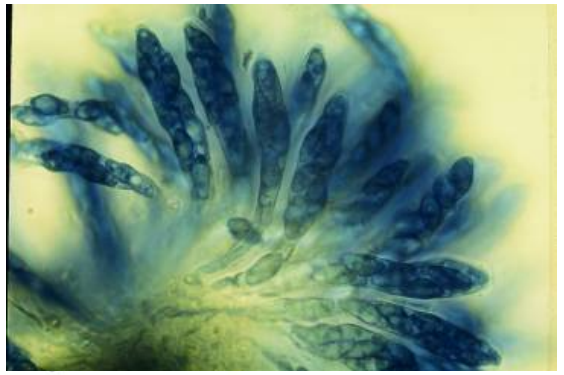
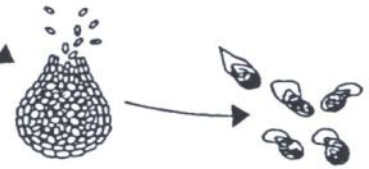
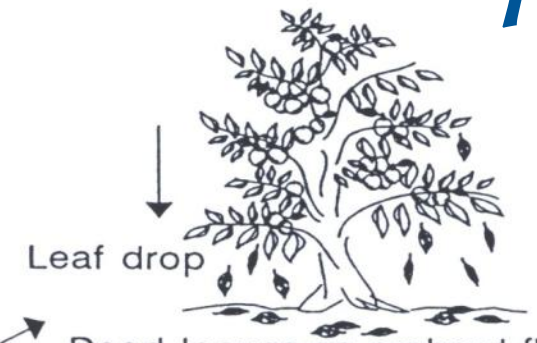
Black Spot Disease Cycle Caused by *Phyllosticta citricarpa*









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Disease cycle highlights

- Only part of disease cycle that concerns Florida is the conidia
  - Present most of the year in leaf litter
  - Splash dispersed spore so needs rain to move
  - Symptomatic fruit also inoculum source while on tree
- Evidence conidia in twigs in Florida, particularly dead ones
- Older trees most a risk but in resets can be infected in 2-3 years in high inoculum groves
- Fruit most susceptible from formation to September
  - April often dry but application may be necessary if rain

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Leaves Are Nearly Symptomless

- On oranges, if chemical control used, symptoms rare
  - Have spotted in local groves
- Does not mean leaves are not infected
  - Certain proportion will harbor the organism
  - Estimate 15-25% of leaves if tree near infected tree
- When symptomatic trees removed, not likely removing disease from grove
  - Need to balance between cost of lost trees and cost of living with black spot
- When disease suppression is reduced, disease reappears

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Black spot fungicide program

- Currently recommended products in the 2020-2021 Florida Citrus Production Guide
- Alternate copper (full rate of chosen product) with a strobilurin, a premix, or Enable
  - Preferable to alternate among modes of action
  - Strobs are Abound, Gem, Headline
  - Premixes are Pristine (SDHI), Amistar Top (DMI), and Priaxor (SDHI) and contain a strobilurin
- Coverage is key so at least 125 gal/acre and slow!

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Black spot fungicide timing

- All citrus is vulnerable, but late hanging sweet oranges are the most susceptible varieties in Florida
- Goal is to maintain coverage on fruit
- Minimum once a month applications for best control
- Start May if dry in April
  - Otherwise start applications in April

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Fungicide trial for CBS in 2019-2020 season

- Collaborative effort with Ozgur Batuman, SWFREC
- Trial undertaken in 20+ year-old 'Valencia' grove with known infection
- Trees were evaluated for citrus black spot symptoms on fruit before trial
  - March 12 and 13th, 2019
  - 25 fruit per tree
- Tried to use initial rating to make disease levels in treatments as equivalent as possible

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Trial details cont.

- Application dates of fungicides
  - May 16 and 17th, June 3 and 4th, June 24 and 25th, July 15th, August 19th, and September 10, 2019
  - Applied with handgun
- Trial evaluated March 9th, 2020
  - 50 fruit per tree

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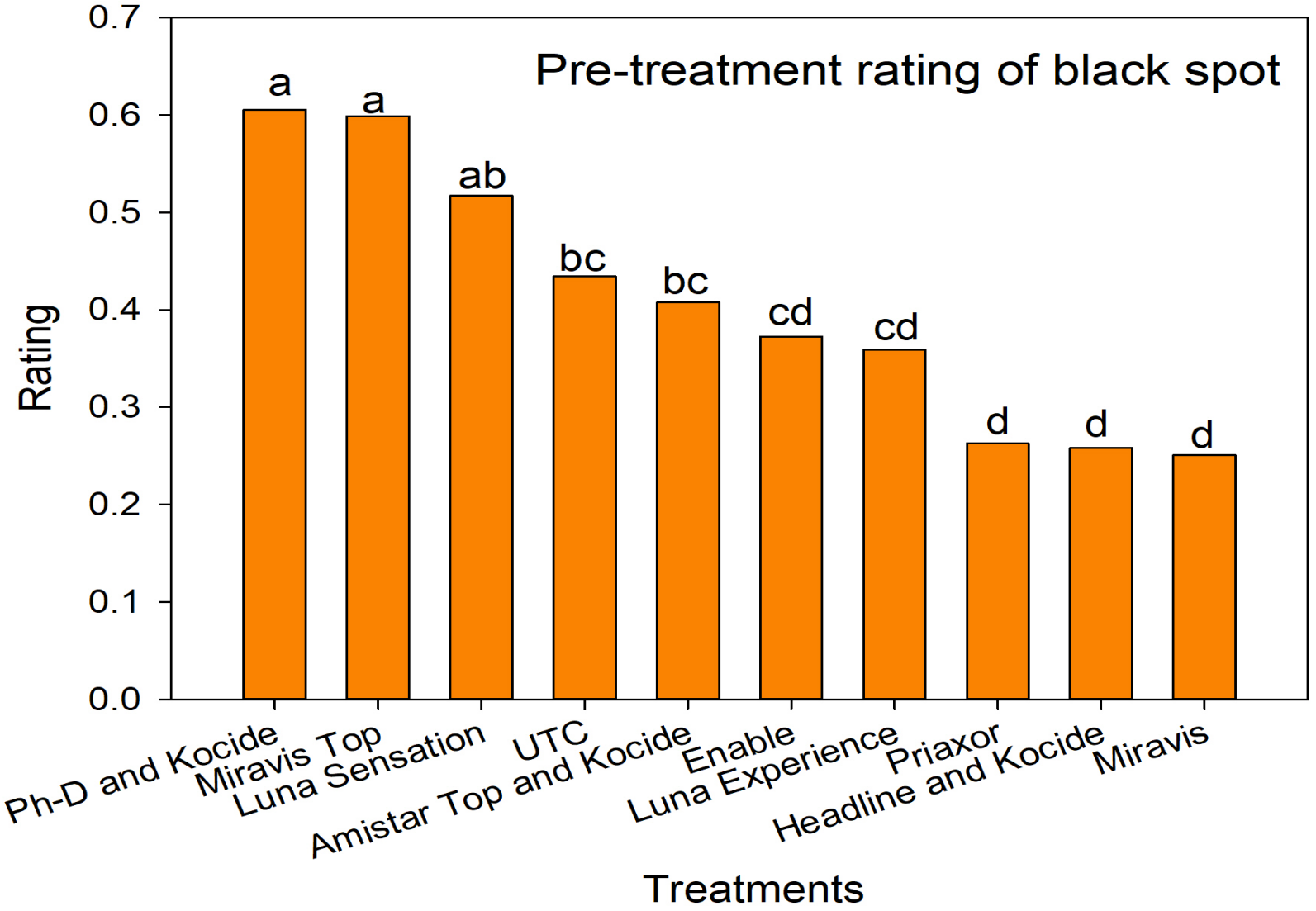
Pre-treatment levels of Citrus Black Spot



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Treatment list

Treatment (FRAC code)	Rate/acre	Active Ingredient
Miravis (7)	14.9 fl. oz.	Pydiflumetofen
Miravis Top (7+3)	15.0 fl. oz.	Pydiflumetofen and difenoconazole
Enable (3)	8 fl. oz.	Fenbuconazole
Amistar Top (11+3) rotated with Kocide 3000 (M 01)	15.4 fl. oz. or 3.5 lbs	Azoxystrobin and difenoconazole or copper hydroxide (30% metallic)
Luna Sensation (11+7)	4 fl. oz.	Trifloxystrobin and fluopyram
Luna Experience (7+3)	8 fl. oz.	Fluopyram and tebuconazole

Treatment list cont.

Treatment (FRAC code)	Rate/acre	Active Ingredient
P*h*-D (19) rotated with Kocide 3000 (M 01)	6.2 oz. or 3.5 lbs	Polyoxin D zinc salt or copper hydroxide (30% metallic)
Priaxor (11+7)	11 fl. oz.	Pyraclostrobin and fluxapyroxad
Headline (11) rotated with Kocide 3000 (M 01)	15.0 fl. oz. or 3.5 lbs	Pyraclostrobin or copper hydroxide (30% metallic)
Untreated control (UTC)	--	--

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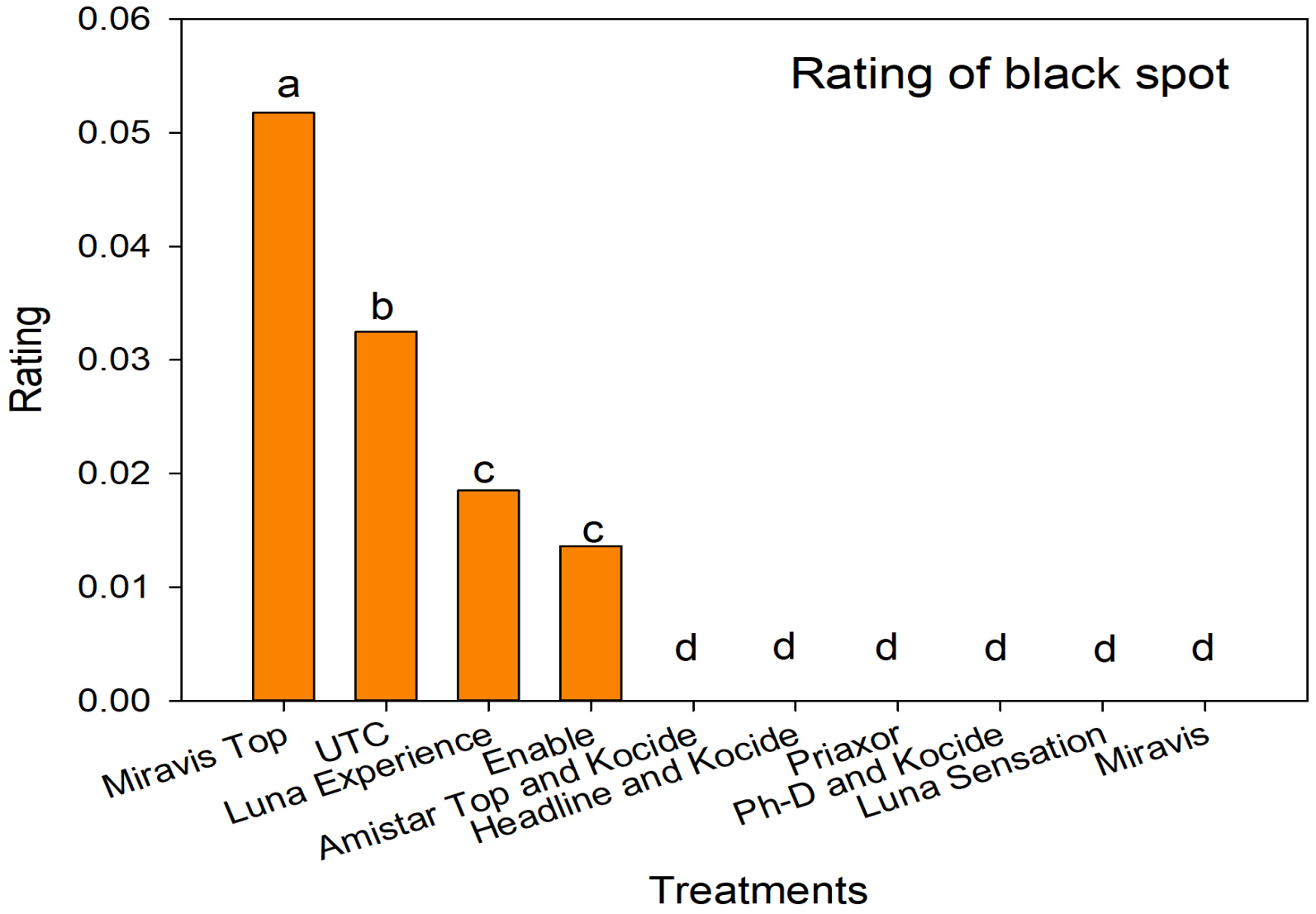
Post-treatment CBS level



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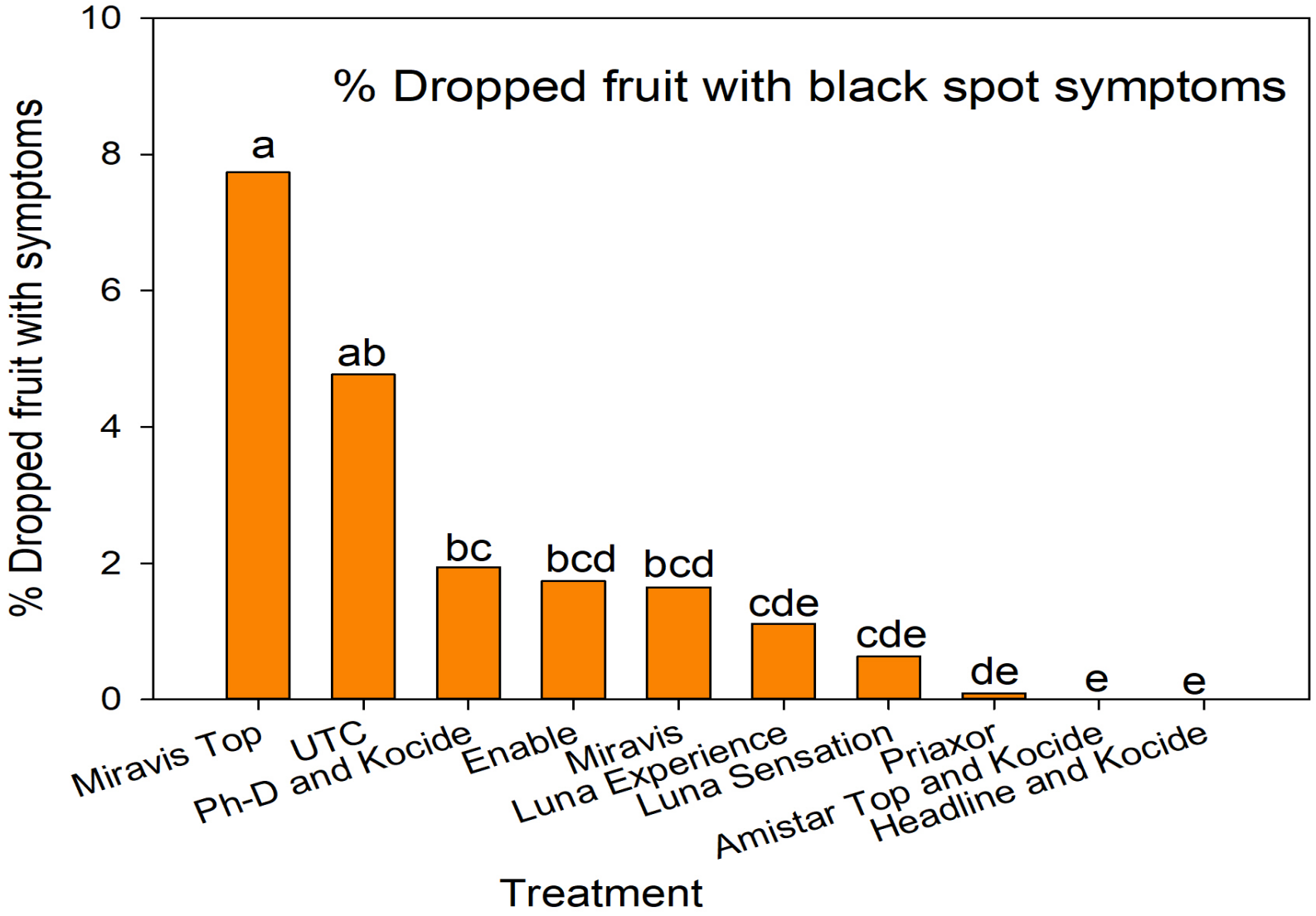
Dropped fruit with CBS



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Leaf litter management

- 20 year-old ‘Valencia’ on ‘Cleopatra’ mandarin rootstock
- 3 treatments
  - Urea (40 lb/acre)
  - Soil-set (1.3 fl oz/acre)
    - a compost accelerator
  - Untreated control
- Applied with herbicide booms at 50 gal/acre in a 10 ft strip
- Three rows treated per rep
  - Middle row evaluated for disease

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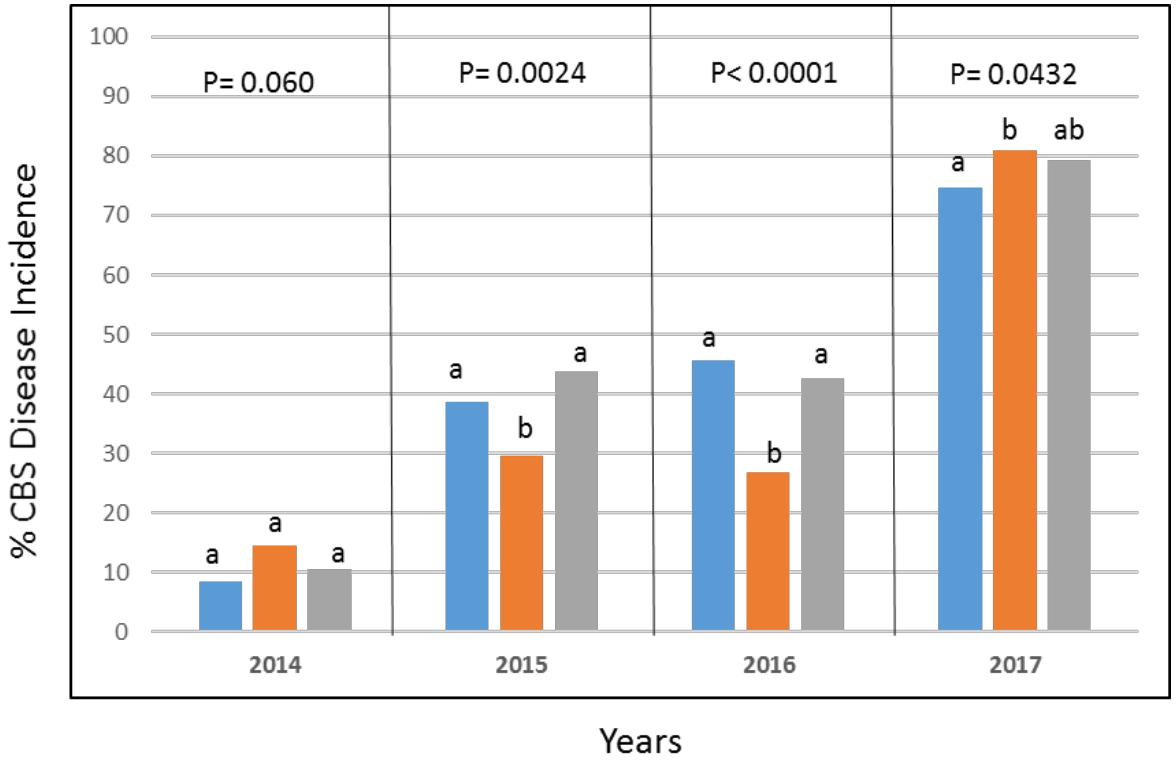
Disease incidence (presence/absence)

- Data taken spring following treatment
- 2014 is pre-treatment disease
- Disease incidence lower in 2015 and 2016 post-treatment for Soil-set but not in 2017



Blue = urea
Orange = Soil-set
Gray = UTC

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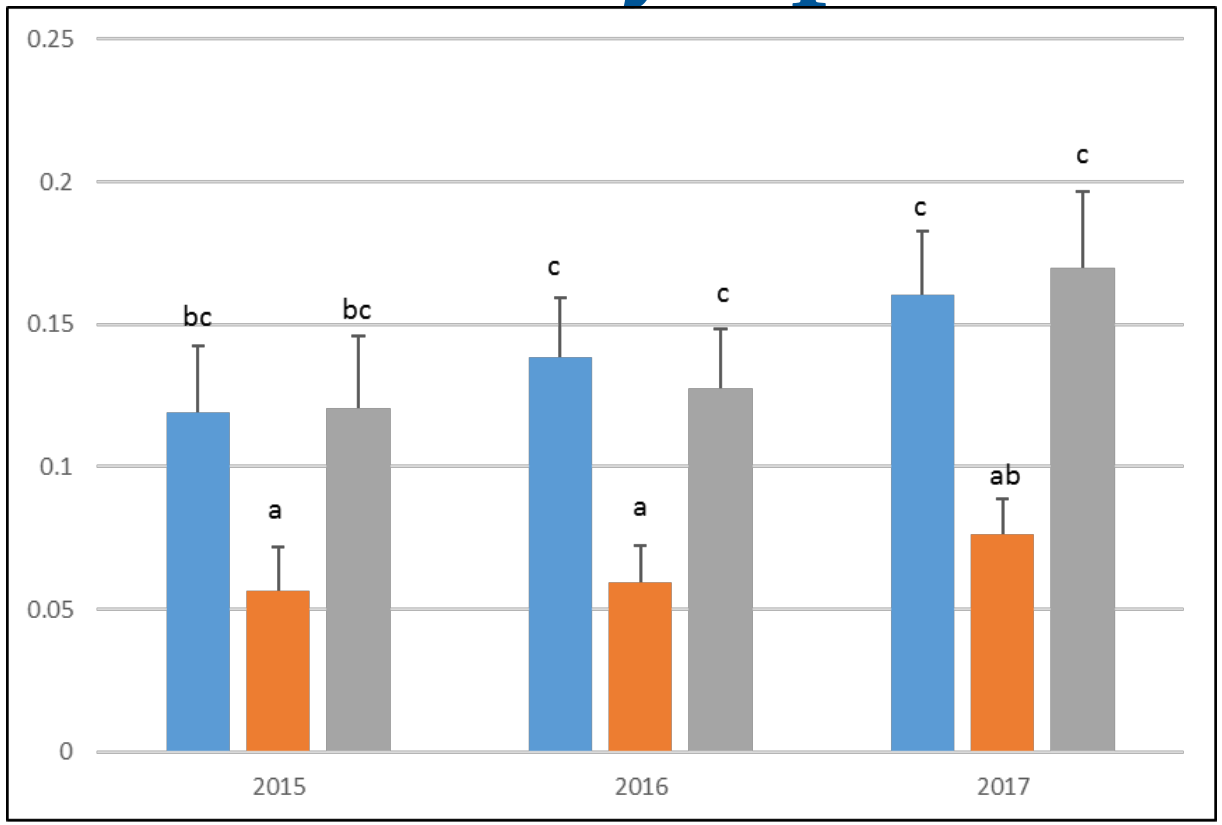
Disease severity (how bad are the symptoms)

- Soil-set consistently had the lowest disease severity
  - Severity data not taken in 2014
- Urea did not perform as expected
  - No disease reduction



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Management summary

- Determine if black spot is in your area or grove
  - Are your groves near a transport corridor or processing/packing facility?
  - Check quarantine information on www.fdacs.gov for most recent areas
  - Scout on your own or contact CHRP for multi-pest survey
- Fungicide program
  - Recommend a multiple mode of action program for resistance management
    - Use copper in the program as an alternation

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Management summary cont.

- Manage your leaf litter to enhance effect of fungicide program
  - Could use Soil-set or composting
  - Particularly where disease is severe; less need if only a few trees
- Remove as much dead wood as possible and destroy it on site
  - Conidia are formed in dead twigs
- Practice vehicle and equipment decontamination when leaving affected sites
- If you reduce or eliminate CBS management program, disease will return

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Thank you!

Dewdney Program

- Tracey Hobbs
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Batuman Program

- Alec Pica
- Samantha Gebben
- Keanu Thomas
- George Ugartemendia
- Other lab members

- Funding agencies

USDA United States Department of Agriculture National Institute of Food and Agriculture

CRDF Citrus Research and Development Foundation, Inc.

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