

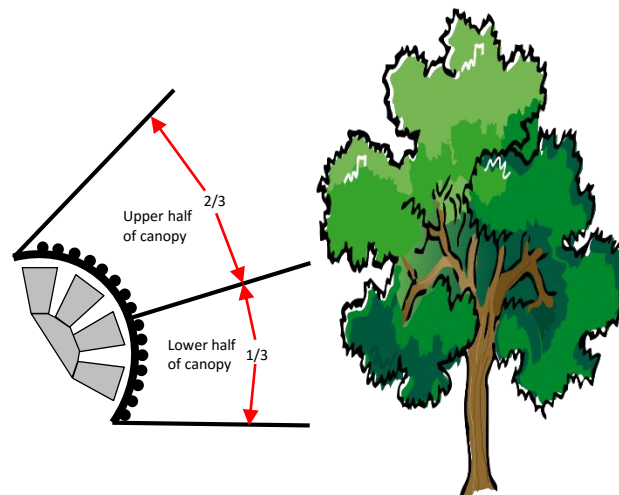
# Pecan scab management

Clive Bock, USDA-ARS-SEFTNRL, Byron, GA



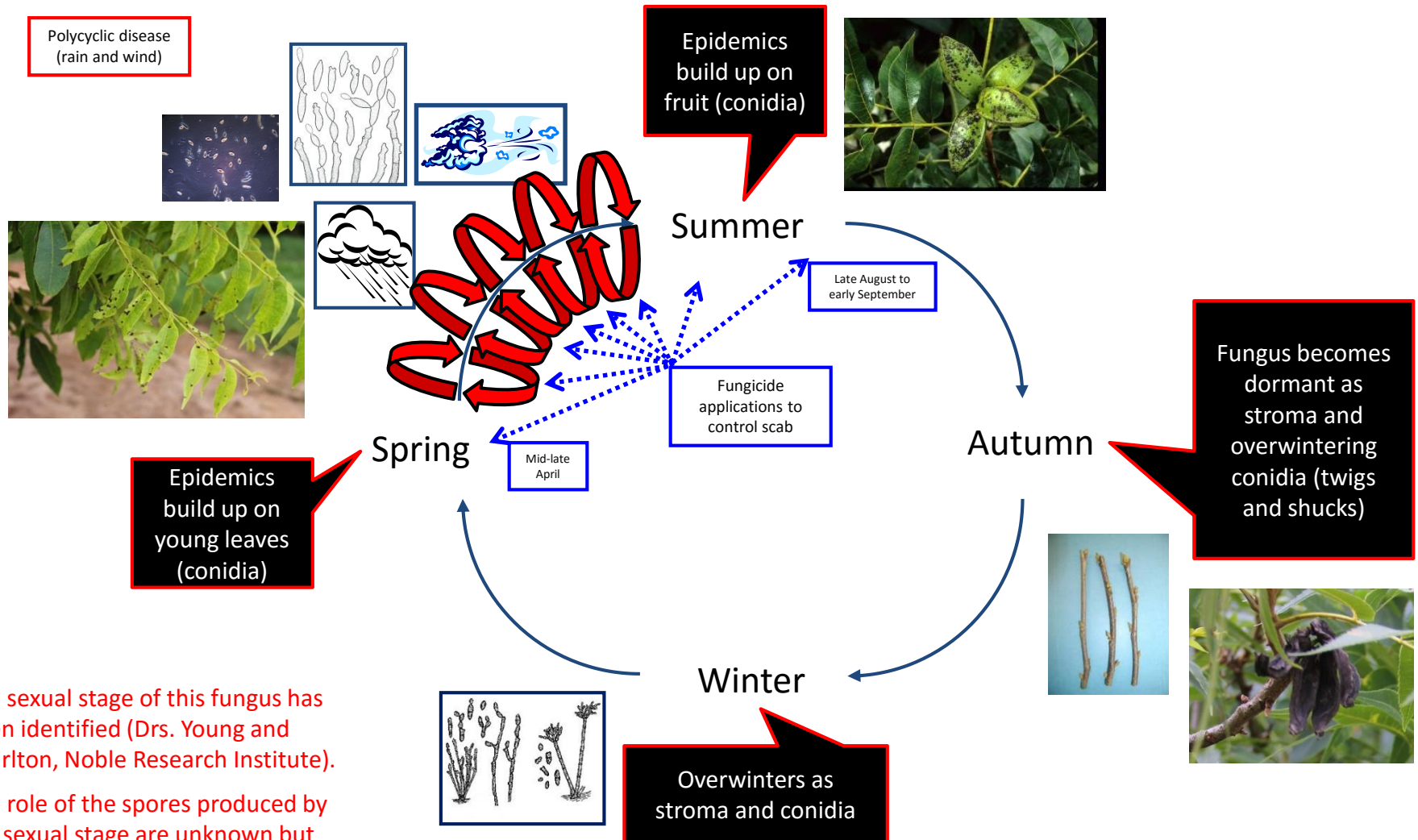
# Structure of presentation

- ❑ Describe the disease and pathogen
- ❑ Major considerations to manage pecan scab
  - ❑ Cultivars
  - ❑ Air-blast sprayers and sprayer set-up
  - ❑ Spraying options (volutes, aerial)
  - ❑ Tree size (tree management/mechanical hedge-pruning/spacing)
  - ❑ Timing of sprays (pre or post pollination)
  - ❑ Chemistry (conventional and organic)



# Pecan scab (*Venturia effusa*)

## □ Lifecycle of *Venturia effusa*, cause of pecan scab

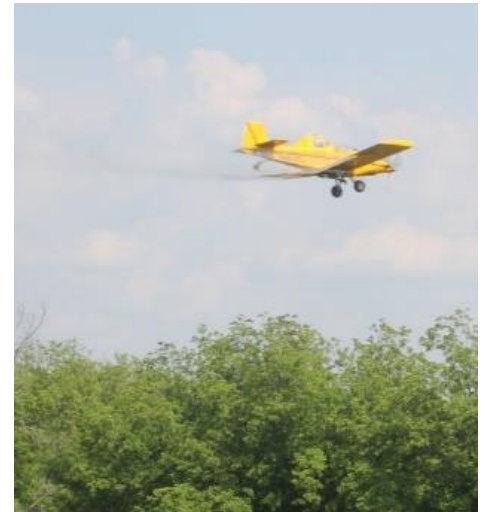


The sexual stage of this fungus has been identified (Drs. Young and Charlton, Noble Research Institute).

The role of the spores produced by the sexual stage are unknown but may play an important role in disease development.

# Cultivars, tree size, and appropriate equipment

- ❑ If planting new in the southeastern region endeavor to obtain scab resistant cultivars (Excel, Elliott, Avalon,....). Availability?
- ❑ Susceptible cultivars will require fungicide sprays in most or all seasons/locations (and they are very widely grown)
- ❑ It is possible to spray small trees with less powerful sprayers (<25-30 ft)
- ❑ Once tree height exceeds ~25 ft, a full sized orchard sprayer is a necessity



# Sprayer set-up and coverage

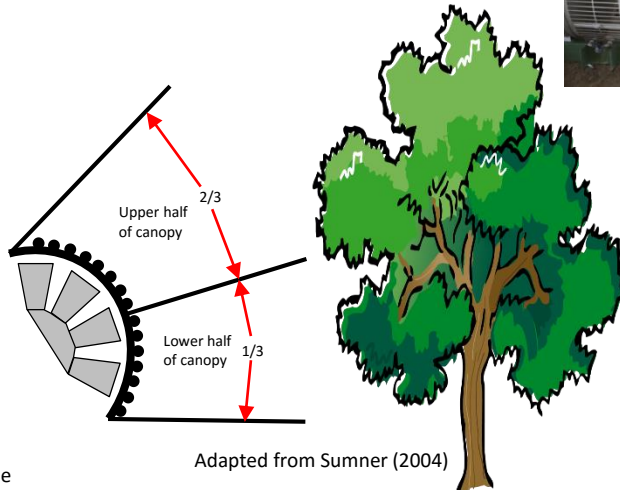
- ❑  $\frac{2}{3}$  to  $\frac{3}{4}$  of spray directed to upper  $\frac{1}{2}$  of the canopy
- ❑ Adjust the vanes/sprayer nozzles accordingly
- ❑ Even with perfectly adjusted vanes, the velocity of the air declines with distance from the sprayer
- ❑ Volume can be determined based on tree size
- ❑ Sprayer calibration



## Small to medium height trees (<40 ft)

Upper 10 nozzles: 2 x D7-45, 4 x D6-45, 4 x D5-45  
Lower 7 nozzles: 4 x D5-45, 2 x D4-45, 1 x D3-45

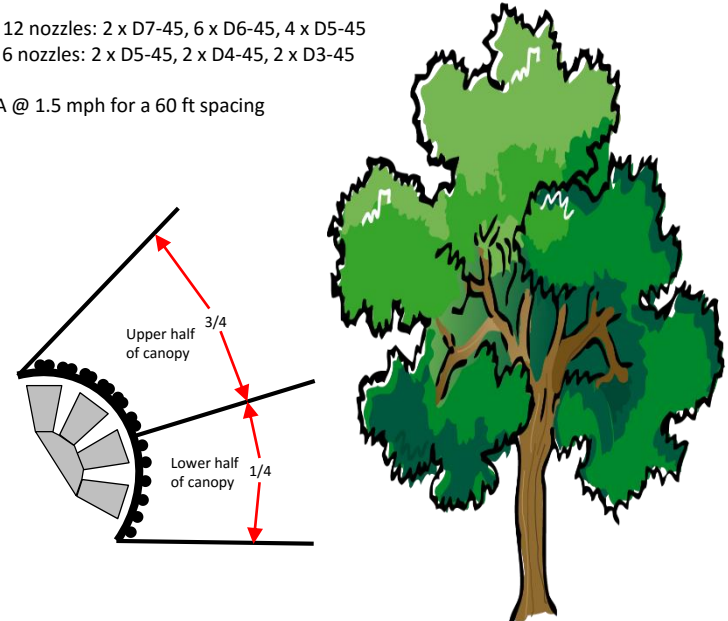
88 GPA @ 1.5 mph for a 60 ft spacing



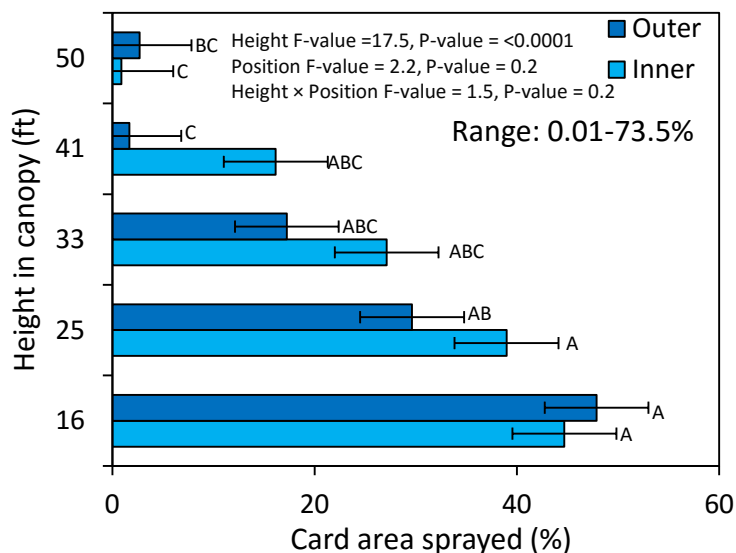
## Mature, tall trees (>40 ft)

Upper 12 nozzles: 2 x D7-45, 6 x D6-45, 4 x D5-45  
Lower 6 nozzles: 2 x D5-45, 2 x D4-45, 2 x D3-45

93 GPA @ 1.5 mph for a 60 ft spacing



# Spray distribution and disease

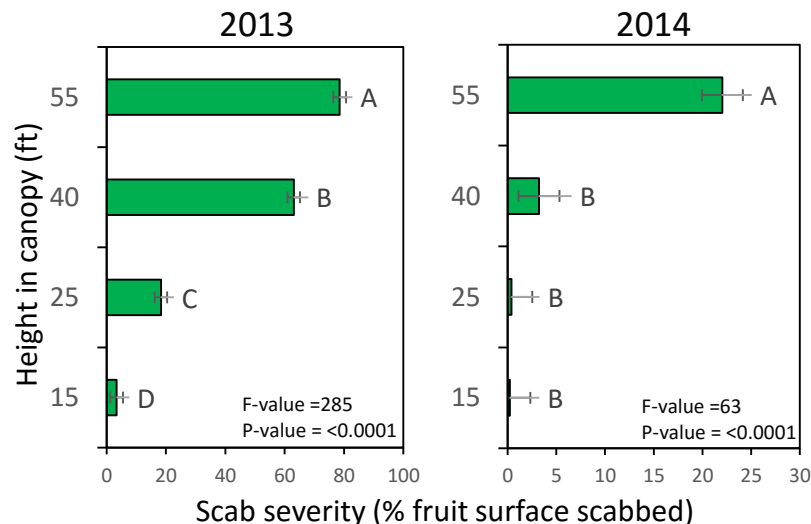


15.0 m  
12.5 m  
10.0 m  
7.5 m  
5.0 m



Bock, C.H., Hotchkiss, M.W., Cottrell, T.E. and Wood, B.W. 2015. The effect of sample height on spray coverage in mature pecan trees. Plant Dis. 99: 916-925.

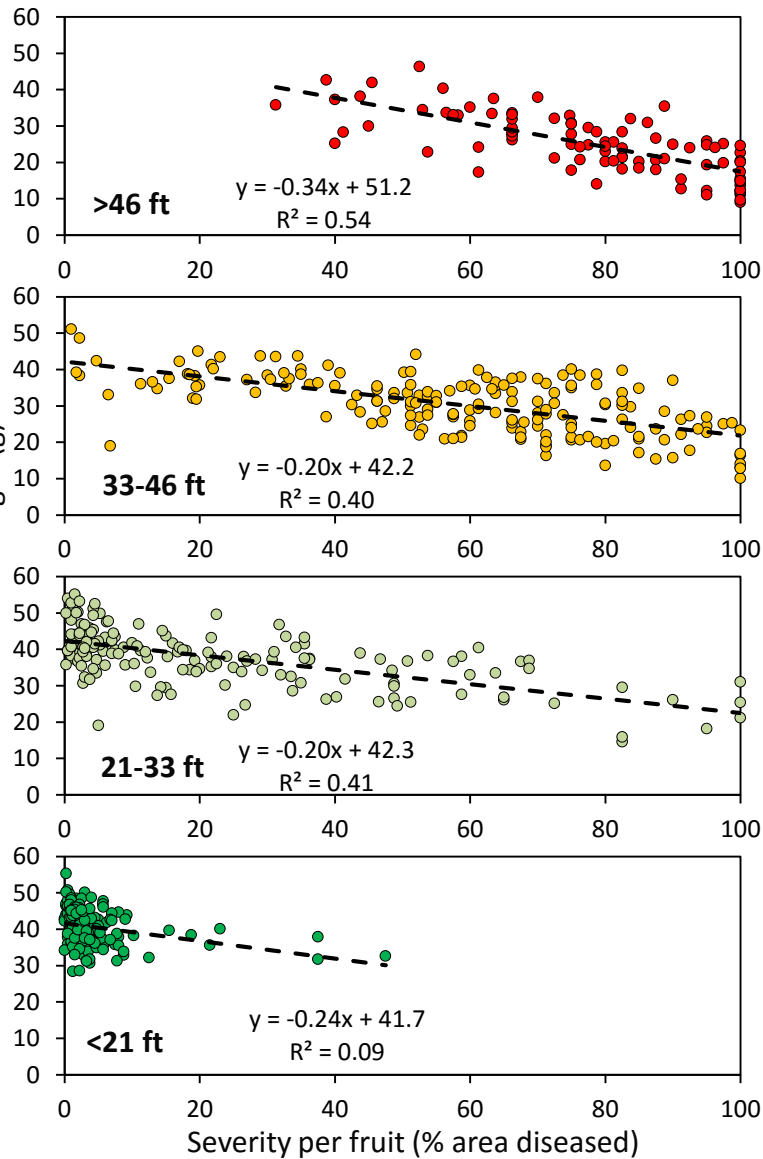
- Spray coverage declines with tree height
- Planting distance/tree structure
- Air-blast sprayers provide good protection up to ~40 ft.
- Protection dependent on season



Bock, C. H., Hotchkiss, M. W., Brenneman, T. B., Stevenson, K. L., Goff, W. D., Smith, M. W., Wells, L., and Wood, B. W. Severity of scab and its effect on fruit weight in mechanically hedge-pruned and topped pecan trees. Plant Disease 101: 785-793. 2017.

# Fruit weight with tree height

The relationship between scab and fruit weight at different heights



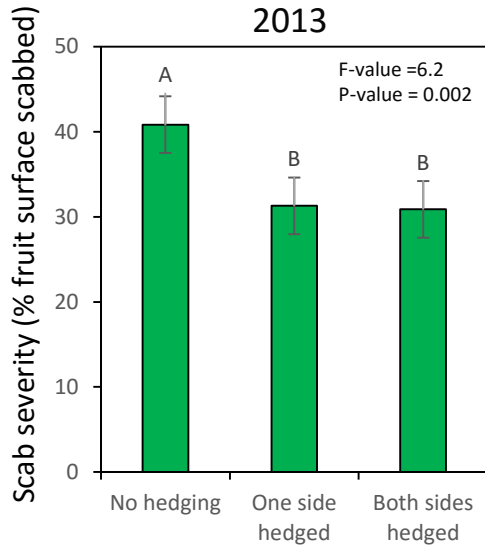
Results from an experiment in 2013 (a wet, scab conducive year) in non-hedged trees of cv Desirable



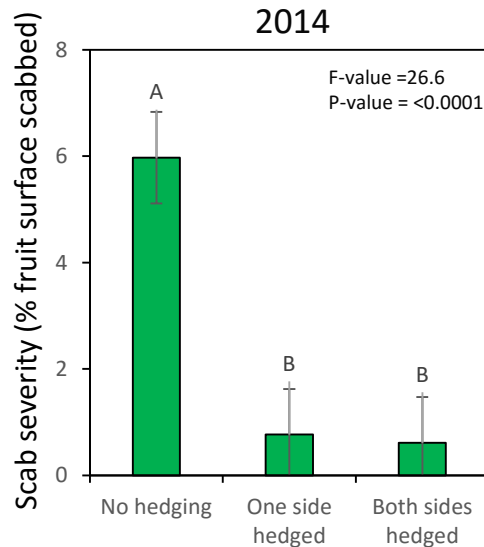
- ❑ The nuts will be larger and of higher quality where spray coverage (scab control) is better
- ❑ Hedge-pruning reduces tree height and ensures more spray reaches the foliage and fruit

# Tree size - hedging

Hedge-pruning ~60 ft trees to ~40 ft



- ❑ Hedge pruning reduces tree height
- ❑ More spray reaches the foliage and fruit
- ❑ Tall, non-hedged trees have significantly more severe scab (and hence yield loss)
- ❑ A 2 to 4 y cycle of hedging? In regard to scab control, shorter trees will always be better





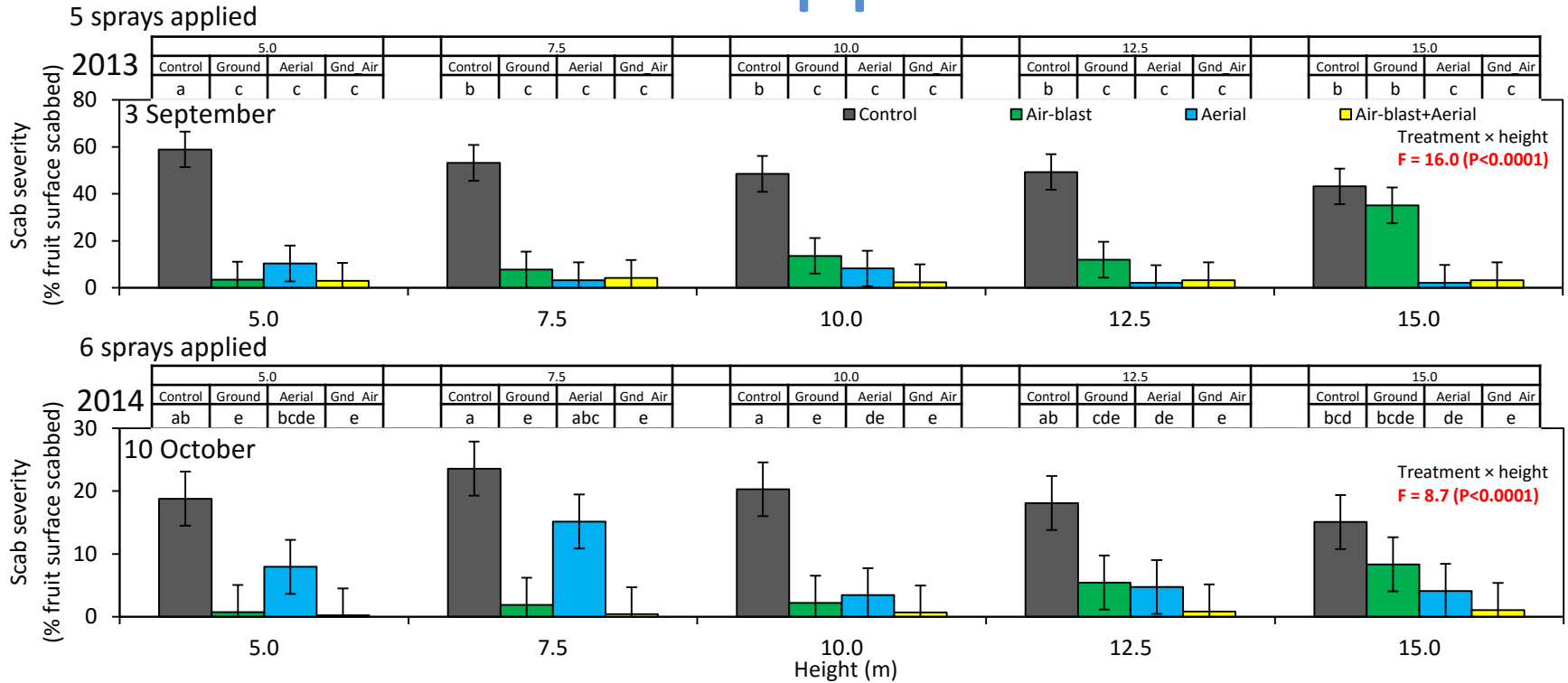
# Sprayer set-up - volutes

- ❑ Increases spray volume going to the upper canopy of tall trees
- ❑ Do not have much data on the spray coverage or efficacy of volutes applied spray



Demonstration spray results at USDA-ARS-SEFTNRL pecan field day, September 2015. Spray applied using a regular orchard sprayer (no volute) or spray applied using a volute

# Aerial application



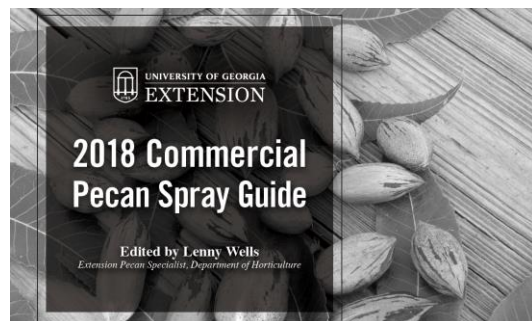
Ground = 100 GPA  
Aerial = ~10 GPA

- The same number/timing of aerial sprays as ground may provides a similar level of control
- Both combined minimize disease throughout canopy
- If limited then apply as many aerial sprays as possible to complement ground sprays during nut development
- Economics?



# Chemistry and timing of sprays (pre/post pollination)

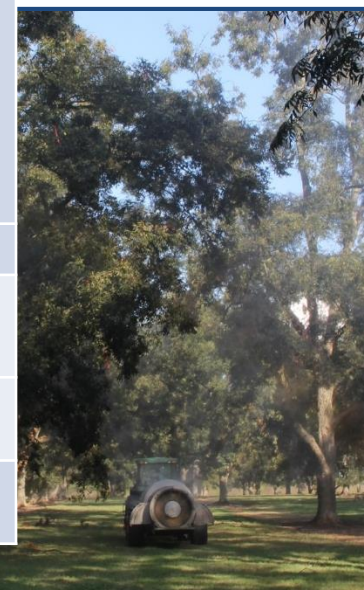
- ❑ UGA spray guide outlines well the chemistries and timing of sprays available for managing pecan scab
- ❑ Two periods: Pre pollination (10-14 day intervals) and post pollination (10 to 21 day intervals)
- ❑ Some fungicides are known to be inherently efficacious on leaf or nut scab
- ❑ Tin and Elast on fruit (also combinations and Quadris top)
- ❑ Phosphites and other products on foliage
- ❑ Fungicide resistance is an issue and should be considered in the program



# Conventional fungicides

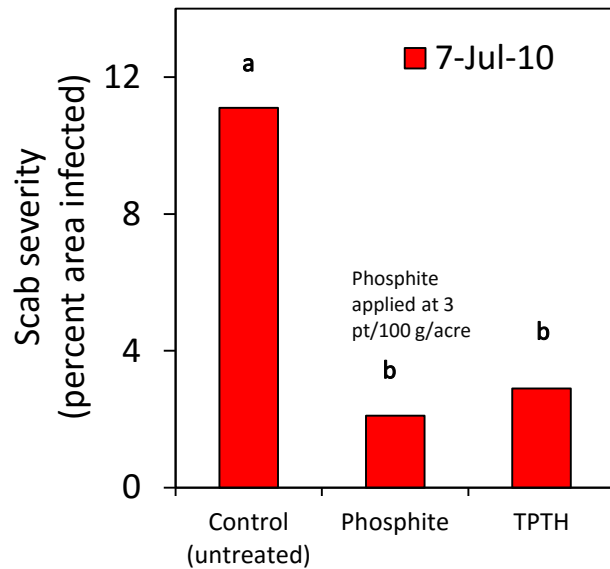


No.	Fungicide group	FRAC code	Common name	Trade names	Risk of resistance
1	MBCs (benzimidazoles)	1	thiophanate-methyl	Topsin-M	High
2	DMIs (sterol inhibitors)	3	Propiconazole	Orbit, Propimax, Bumper, Quilt, Quilt Excel	Medium
			Febuconazole	Enable	
			Tebuconazole	Folicur, Tebuzole, Monsoon, Orius, Toledo, Absolute	
			Metaconazole	Quash	
			Difenconazole	Quadris Top	
3	Qols (strobilurins)	11	Kresoxim-methyl	Sovran	Medium-low
			Azoxystrobin	Abound, Quilt, Quilt Excel, Quadris Top	
			Pyraclostrobin	Headline	
			Trifloxystrobin	Absolute	
4	Guanadines	U12	Dodine	Elast	Medium-low
5	Organotins	30	Fentin hydroxide	SuperTin	Medium-low
				AgriTin	
6	Phosphites	33	Phosphorous acid	Phostrol, Prophyt Fungiphite, Reliant	Medium-low
7	Ziram	M3	Zinc dimethyldithiocarbamate	Ziram	Low



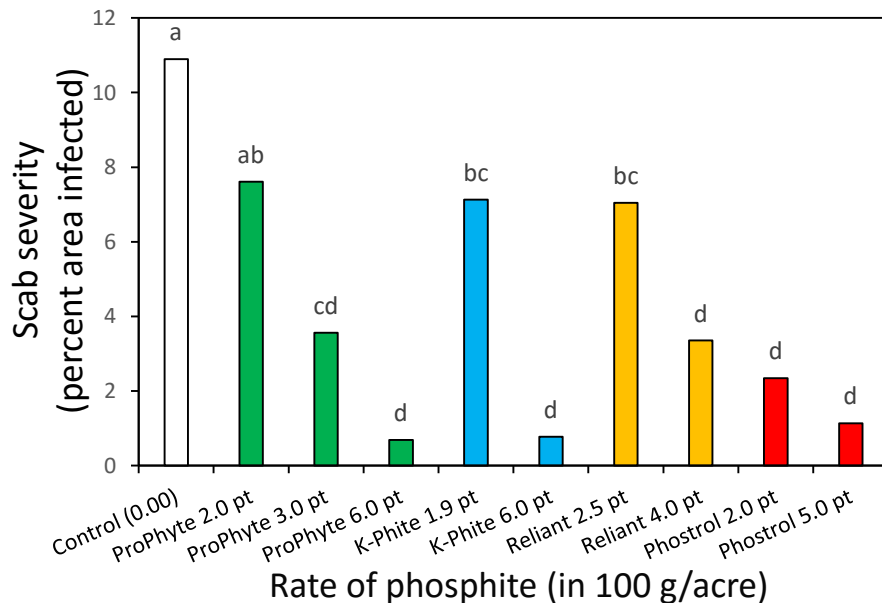
# Phosphites – updates

Phosphites are efficacious – fruit and foliage

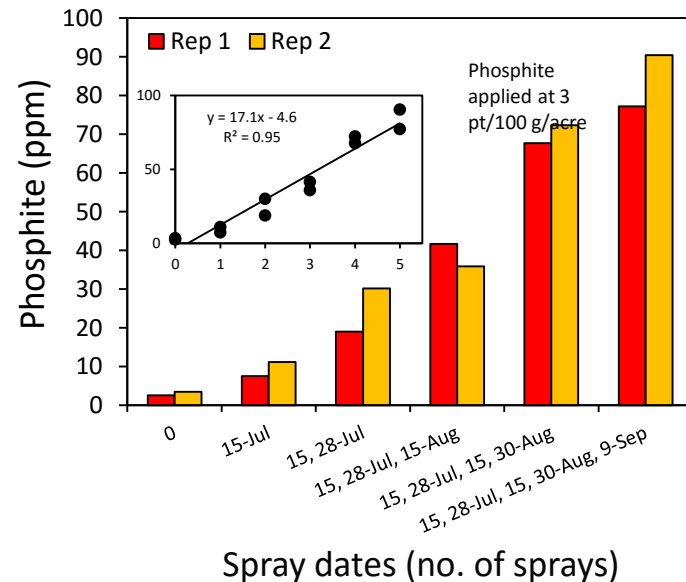


- ☐ Fungicide resistance is an issue in scab
- ☐ Phosphites are efficacious – particularly on foliage
- ☐ We have demonstrated that higher rates effective on fruit
- ☐ Worked with the pecan industry to generate data on phosphite usage in light of recent phosphite MRLs in the EU
- ☐ MRL ruling in Dec 2017 = 500 ppm

Higher rates are more efficacious – especially on fruit



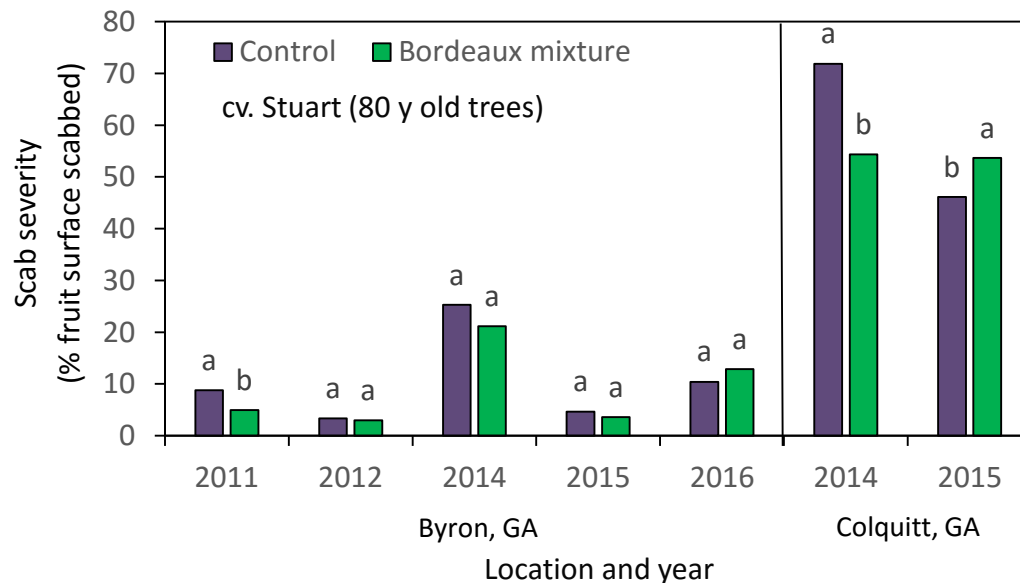
Residues were an issue 2013-2018 – now resolved



Spray dates (no. of sprays)

# Organic chemistry to manage scab

- ❑ Historically Bordeaux mixture (hydrated lime + copper sulfate) was used to manage scab (~1960)
- ❑ We have tested Bordeaux mixture in multiple trials over several years and at two sites. Number of applications:
  - ❑ Byron, GA 2011 (6), 2012 (5), 2014 (5), 2015 (6) and 2016 (6)
  - ❑ Colquitt, GA 2014 (5) and 2015 (5)
- ❑ Efficacy is not reliable, and level of control is not particularly impressive
- ❑ Although some historical reports indicated it could be effective

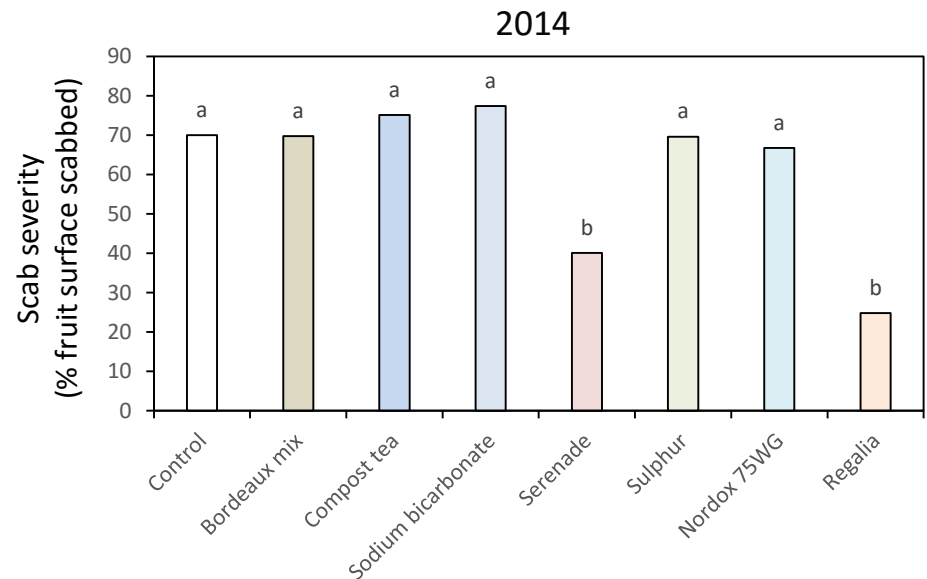
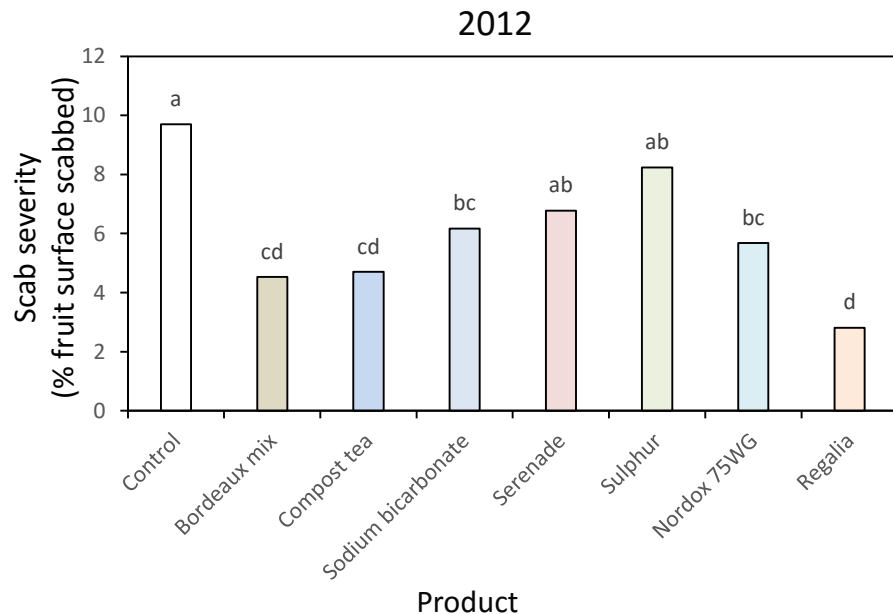


Fruit disease assessments:  
Byron, GA  
2011 (12 Oct), 2012 (8 Oct),  
2014 (18 Aug), 2015 (12 Aug)  
and 2016 (22 Aug)  
Colquitt, GA 2014 (20 Aug) and  
2015 (1 Sep)

Means within the same year  
with different letters are  
significantly different ( $\alpha = 0.05$ )

# New organic chemistry?

- ❑ Explored a range of OMRI approved alternatives to Bordeaux mixture
- ❑ A total of 5 sprays applied in both 2012 and 2014
- ❑ Assessments made on 19 October 2012 and 18 August 2014
- ❑ Regalia consistently, and to a lesser extent Serenade reduced severity of pecan scab
- ❑ Efficacy variable between years with different products (inoculum pressure?)



# Summary

- ❑ Scab is a difficult disease to manage
- ❑ Fortunately there are several angles from which we can approach management of scab
  - ❑ Cultivars (if planting a new orchard select a scab resistant cultivar if possible)
  - ❑ Tree spacing (wider the better to reduce scab)
  - ❑ Tree size (hedge-pruning?)
  - ❑ Chemistry (alternate modes of action). Organic options available
  - ❑ Ground and aerial application (ensure calibrated appropriately)





# Acknowledgements

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Dr. Tim Brenneman, Dr. Lenny Wells, Dr. Katy Stevenson



Thank you

Questions?

