

# **Pecan scab – Winning the battle, but will we win the war?**

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Growing pecans can feel like a war sometimes!





The scab “war” is due to the biological reality  
of a devastating pathogen and a very  
favorable climate!



# Most folks won the battle in 2017

- April & May were extremely dry  
(very little leaf scab or stem scab)
- June – early August were very wet, quickly building nut scab in some orchards. Leaves stayed in good condition.



# To win the war, know your enemy!





# **In spite of 2017, scab control begins on the leaves and stems!**

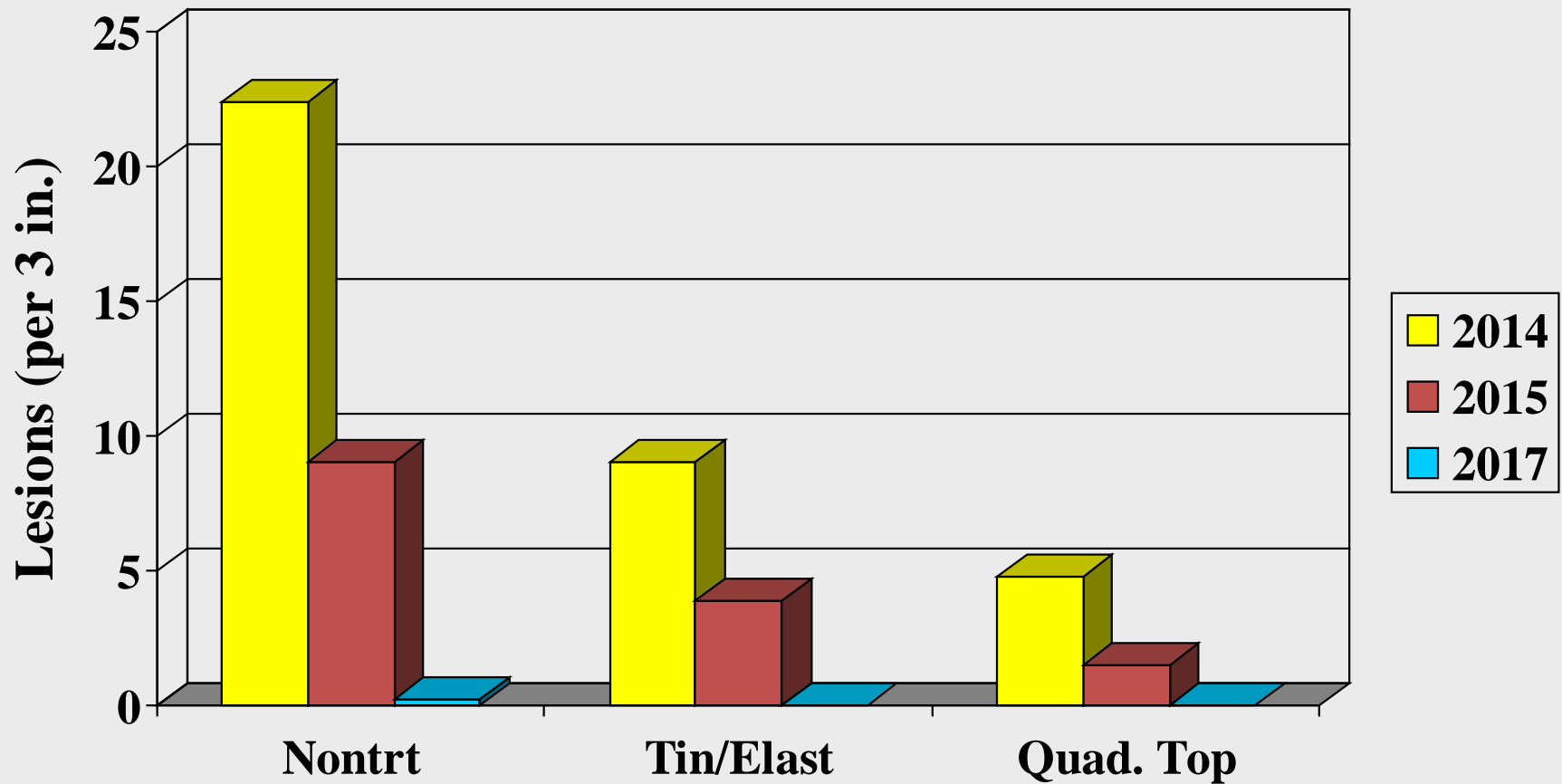
**(up to 90% of foliage in first 30 days!)**



**April 20**

# Stem Lesions on Primary Shoots

(April/May Rain = high, medium and low)



# I thought you said there was very little stem scab in 2017?

(picture taken Aug 30, 2017)





Where do we get LOTS of growth flushes?









Winning this war takes some  
heavy artillery!





The right weapon needs the  
right ammunition!





# Pecan Scab Fungicides

(Increasing use of phosphite's also)

Fungicide Class	Trade names	Mode of Action	Relative use
Benzimidazoles	Topsin	Single site	Low
DIMs*	Orbit, Enable, Folicur-tebuconazole	Single site	<u>Intense</u>
Qols*	Abound Sovran Headline	Single site	Moderate
Guanidines	Elast	Multi-site	<u>Intense</u>
Organotins	Super Tin	Multi-site	<u>Intense</u>

\* Many pre-mixes like Stratego, Absolute, Quadris Top, etc.

# Classes of Pecan Fungicides

(~~XXXXXX~~ = Resistance Issues)

Fungicide Class	Trade names	Mode of Action	Relative use
<del>XXXXXX</del> Benzimidazoles	<del>XXXXXX</del> Topsin	<del>XXXXXX</del> Single site	<del>XXXXXX</del> Low
<del>XXXXXX</del> DMIs*	<del>XXXXXX</del> Orbit, Enable, Folicur-tebuconazole	<del>XXXXXX</del> Single site	<del>XXXXXX</del> Intense
<del>XXXXXX</del> QoIs*	<del>XXXXXX</del> Abound, Sovran, Headline	<del>XXXXXX</del> Single site	<del>XXXXXX</del> Moderate
Guanidines	Elast	Multi-site	<u>Intense</u>
<del>XXXXXX</del> Organotin	<del>XXXXXX</del> Super Tin	<del>XXXXXX</del> Multi-site	<del>XXXXXX</del> <u>Intense</u>

\* Many pre-mixes like Stratego, Absolute, Quadris Top, etc.



# Fungicide Resistance

“The last thing we need to hear about is fungicide resistance” Anonymous!

I wish we never had to talk about it, but the biological reality is that we must (and insecticides and herbicides as well).

The last new class of herbicide was in 1984 (and none on the near horizon!). Fungicides are better off, but the trend is the same.

# Why is resistance such a problem with pecan scab?

## Host factors

- Perennial crop
- Tall trees (poor spray coverage)
- Long season (w/ very favorable climate!)
- Susceptible cultivars (more disease)

## Pathogen factors

- Overwinters as stromata on host
- Polycyclic lifecycle (high rate of reproduction)
- Sexual stage (though not yet found in nature)



# 2014 was a bad year – thought we had lost the war!

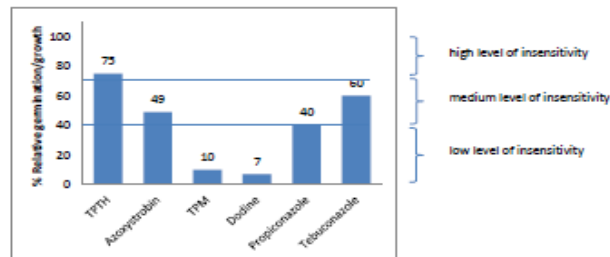
## 2014 UGA PECAN SCAB FUNGICIDE SENSITIVITY MONITORING PROGRAM

Name: Joe Sample  
 Email: [jsample@gmail.com](mailto:jsample@gmail.com)  
 Farm: Nuts Galore  
 County: Dougherty

Sample #: 14000  
 Sampling date: 6/8/14  
 Cultivar: Desirable

Mean % relative germination or growth (RG) on medium containing discriminatory fungicide concentrations ( $\mu\text{g}/\text{ml}$ ) compared to non-amended controls  
 Bulk spore method, 3 groups of 15 lesions from each sample  
 Spore germination (48h): TPTH, azoxystrobin, thiophanate-methyl (TPM), dodine  
 Fungal growth (72h): propiconazole, tebuconazole

Fungicide Concentration	TPTH	Azoxystrobin	TPM	Dodine	Propiconazole	Tebuconazole
% RG	75	49	10	7	40	60



### Key to interpretation of assay results:

% RG	Level of insensitivity
0	none (sensitive)
1 - 39	low
40-69	medium
70 or more	high

### Summary:

Based on the assay results, there is a high level of insensitivity to TPTH and a medium level of insensitivity to propiconazole and tebuconazole at this sampling location. There is a low level of insensitivity to thiophanate-methyl (TPM) and no insensitivity to dodine. There may be a medium level of insensitivity to azoxystrobin; however, further tests will be required to verify insensitivity to azoxystrobin.

For additional interpretation of results or for recommendations on fungicide selection, please contact Jason Brock, UGA Department of Plant Pathology, at [jbrock@uga.edu](mailto:jbrock@uga.edu) or 229-386-7495.



# What does it mean???

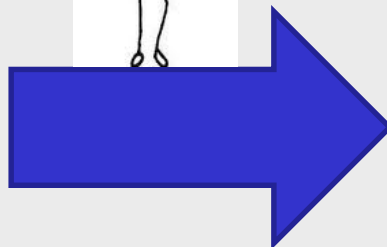
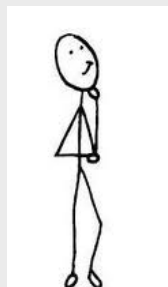
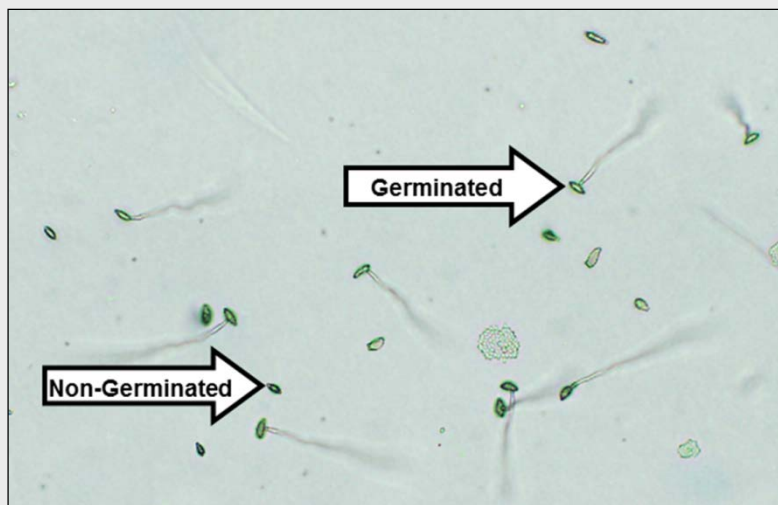


Image. 2017, Oklahoma Cooperative extension

- Does “high insensitivity” = loss of control???
- Qualitative Resistance → Yes (ex. Benlate)
- Quantitative Resistance → ?? (ex. Tebuconazole)
- Very difficult to do this in the greenhouse

'If the mountain will not come to Muhammad, then  
Muhammad must go to the mountain'  
(‘Essays’ by Francis Bacon, 1625)





# Methods

- 9 “high risk” commercial orchards in South Georgia
- Treated Individual Terminals on non-sprayed trees
  - 9 reps per treatment
- Hand sprayed each terminal
  - Fungicide @ full rate diluted to 100 GPA
  - 10 applications @ 2 week intervals



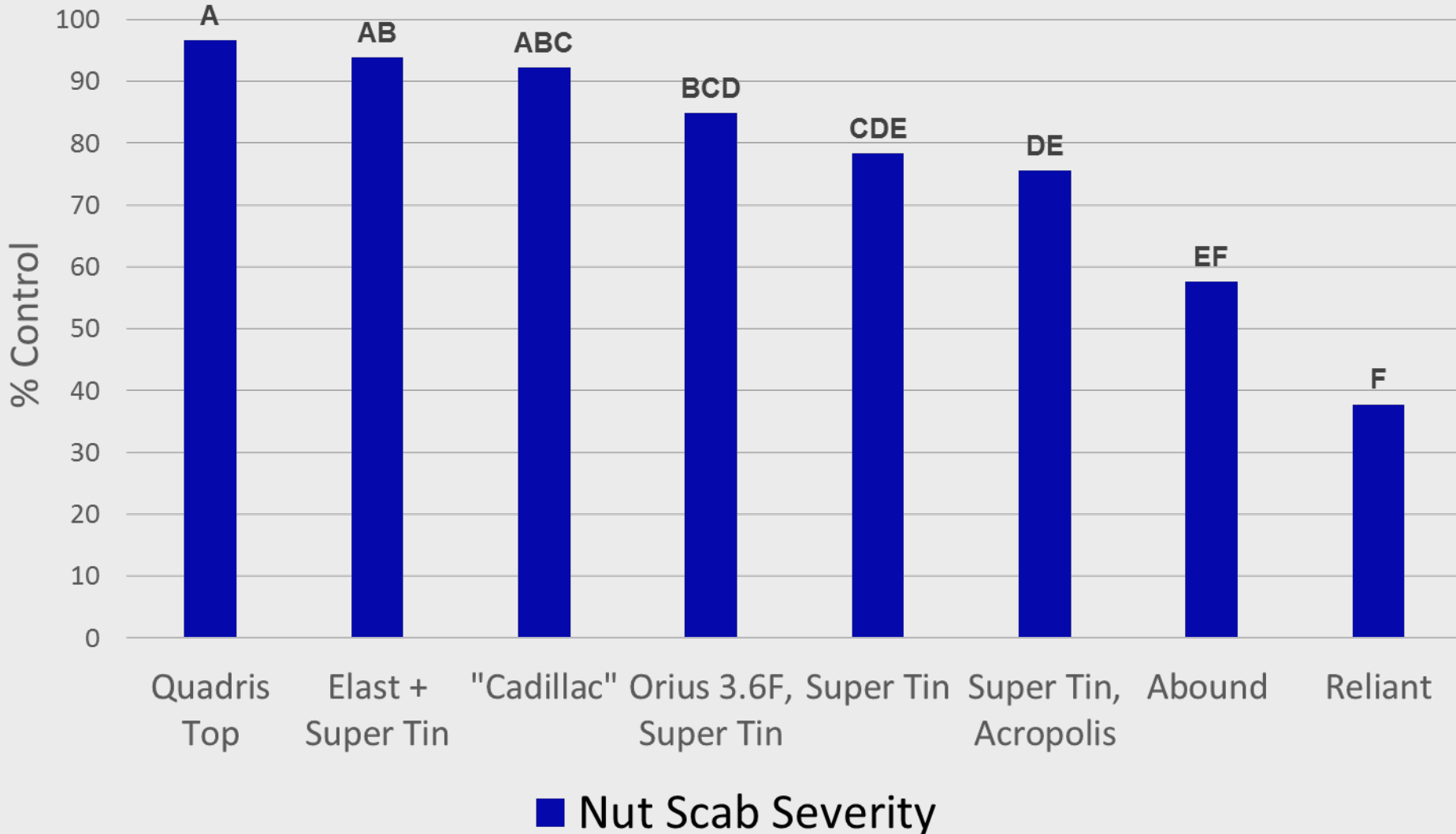
<b>TRT #</b>	<b>Treatments</b>	<b>Applications</b>
1	Super Tin	1-10
2	Super Tin Acropolis	1, 3, 5-10 2 & 4
3	Reliant	1-10
4	Abound	1-10
5	Orius 3.6 F Super Tin	1-4 5-10
6	Elast +Super Tin	1-10
7	Quadris Top	1-10
8	“Cadillac” (Without TPTH)	1-10
9	Untreated	1-10

\*DMI's, Phosphite's, MBC's applied with Humispread





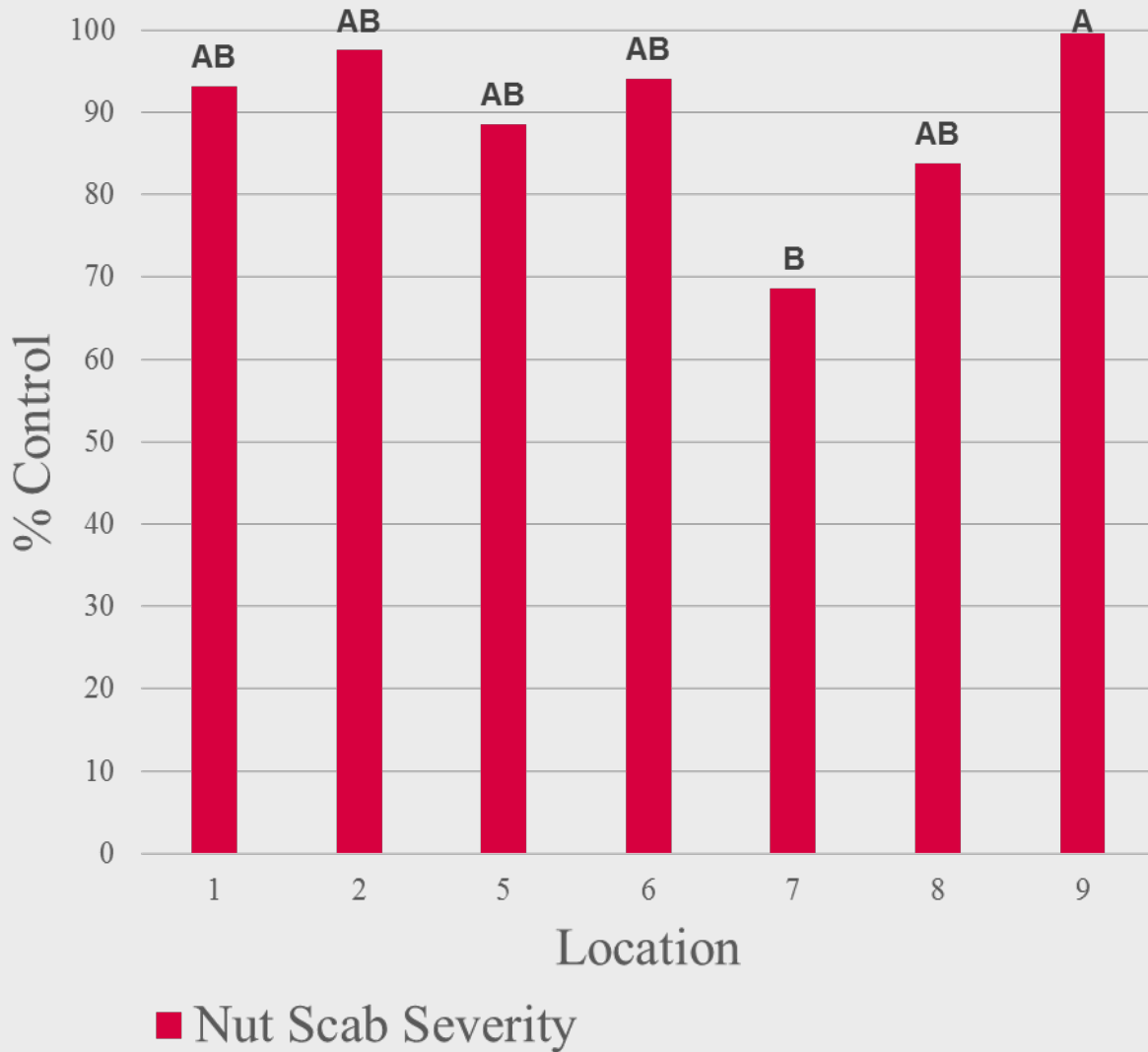
# Percent Control of Nut Scab (Mean of 9 locations)





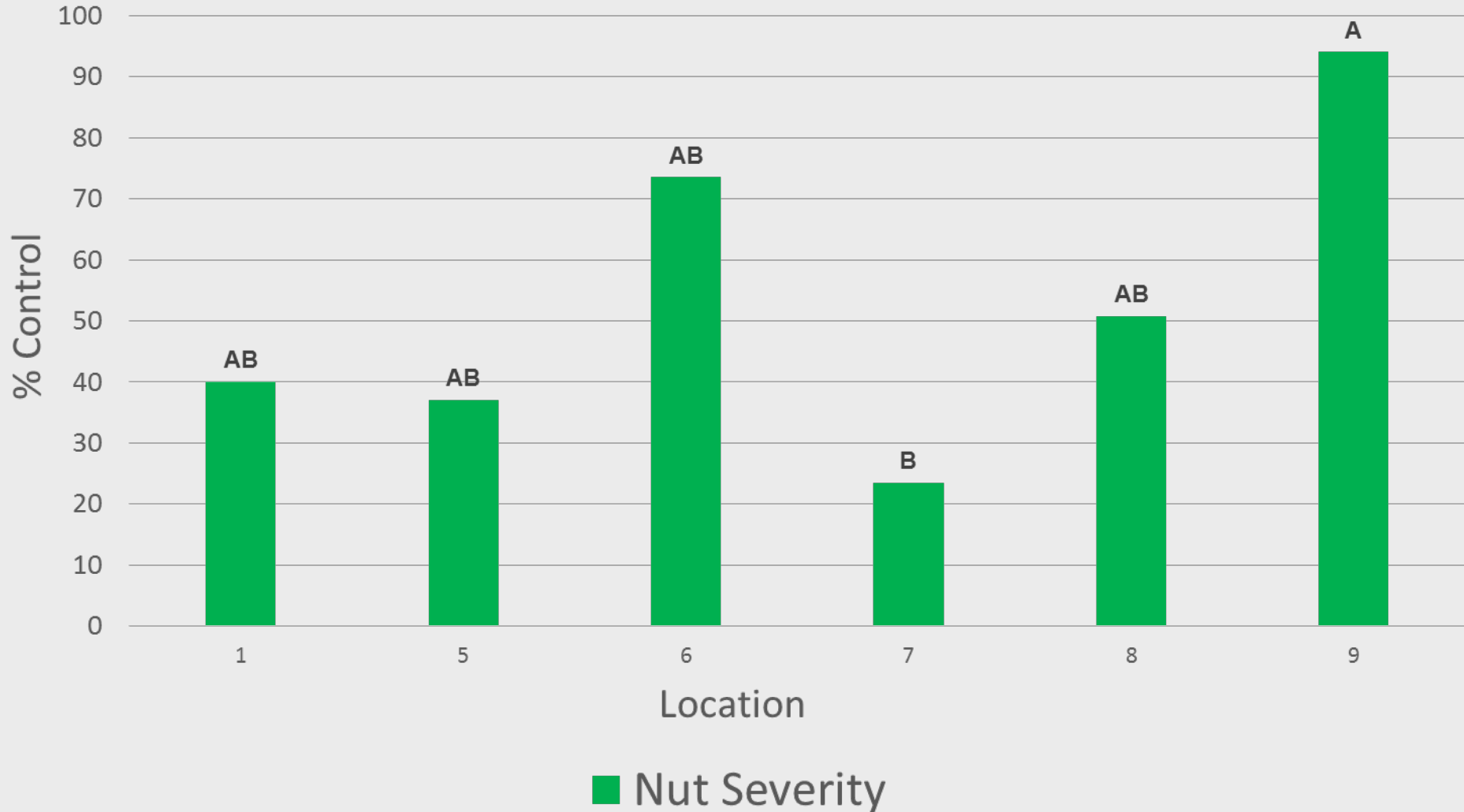
# “Cadillac” – spray program without TPTH

Timing	Treatment
1	Elast
2	Reliant+Orius 3.6F
3	Abound
4	Reliant+Topsin M
5	Abound+Elast
6	Quadris Top
7	Ziram+Elast+Reliant
8	Quadris Top
9	Ziram+Elast+Reliant
10	Abound +Enable



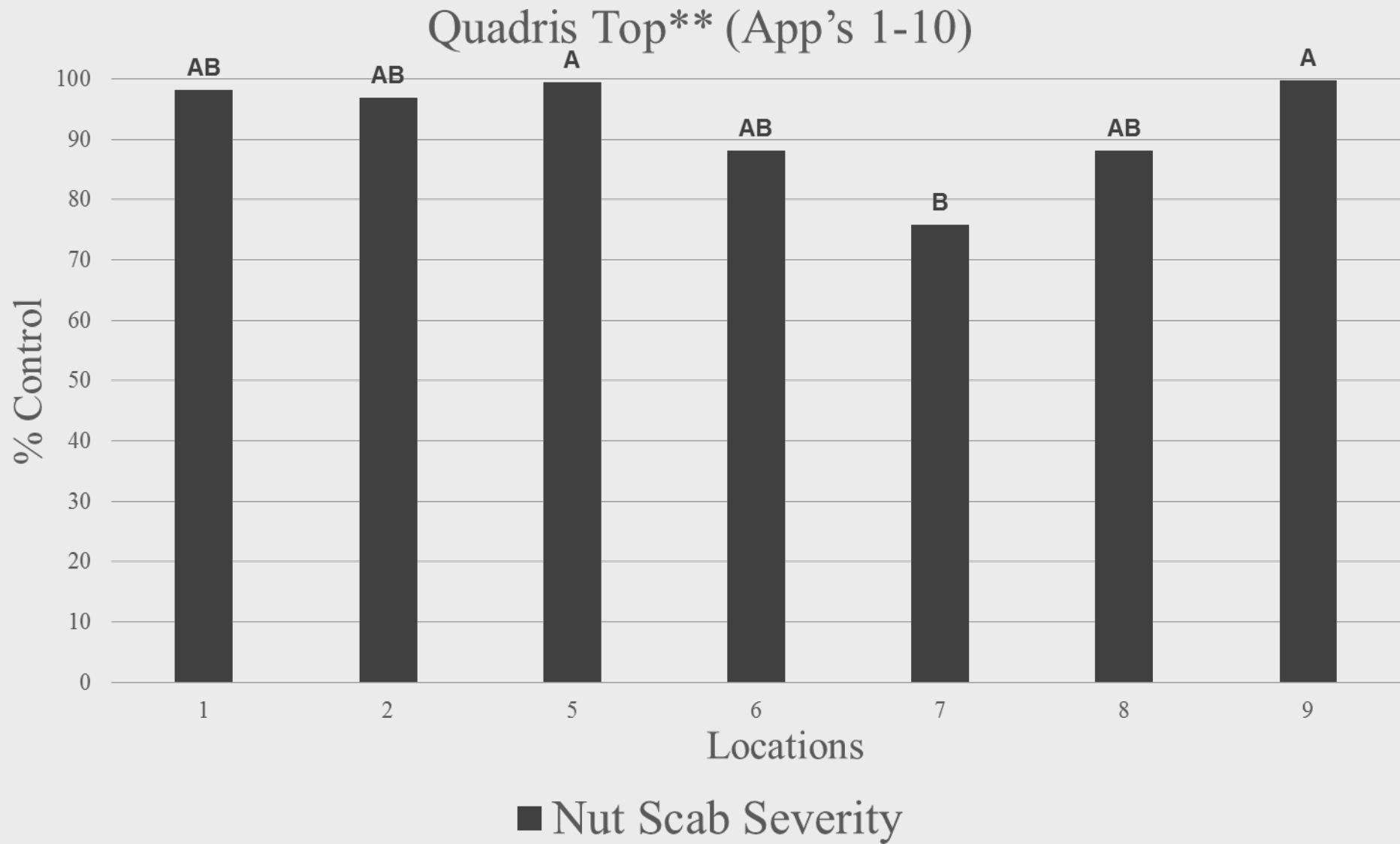
# QoI/Strobiluruns

Abound (App's 1-10)



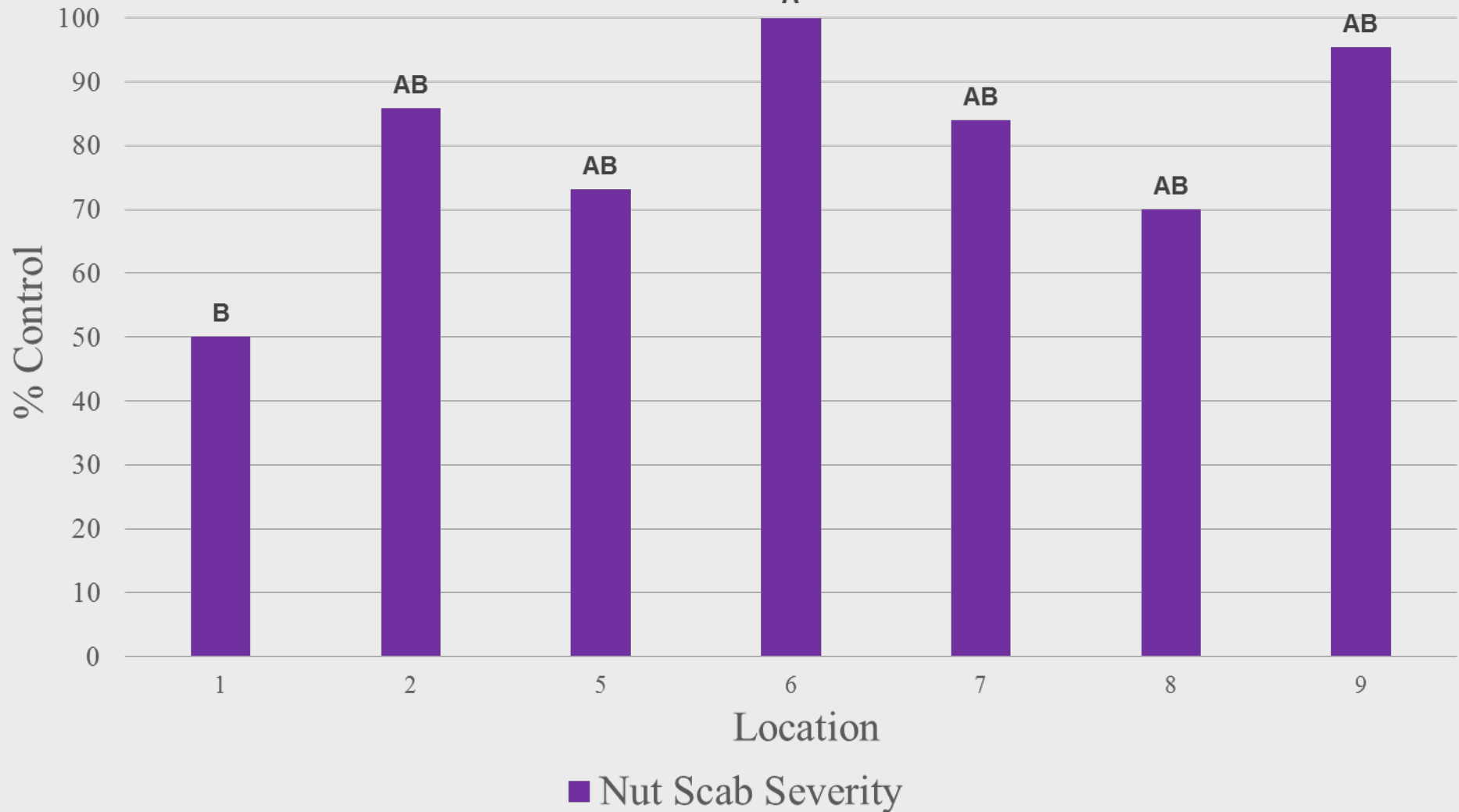


# Nut Scab Control w/ Quadris Top (QoI + DMI)



# Nut Scab Control w/ DMI's + Organotin

Orius 3.6F (App's 1-4), TPTH ( App's 5-10)



# What does resistance really mean in terms of disease control?

- Trials are being repeated in 2018
- Disease control matched with sensitivity profiles for each individual orchard
- Stay tuned!



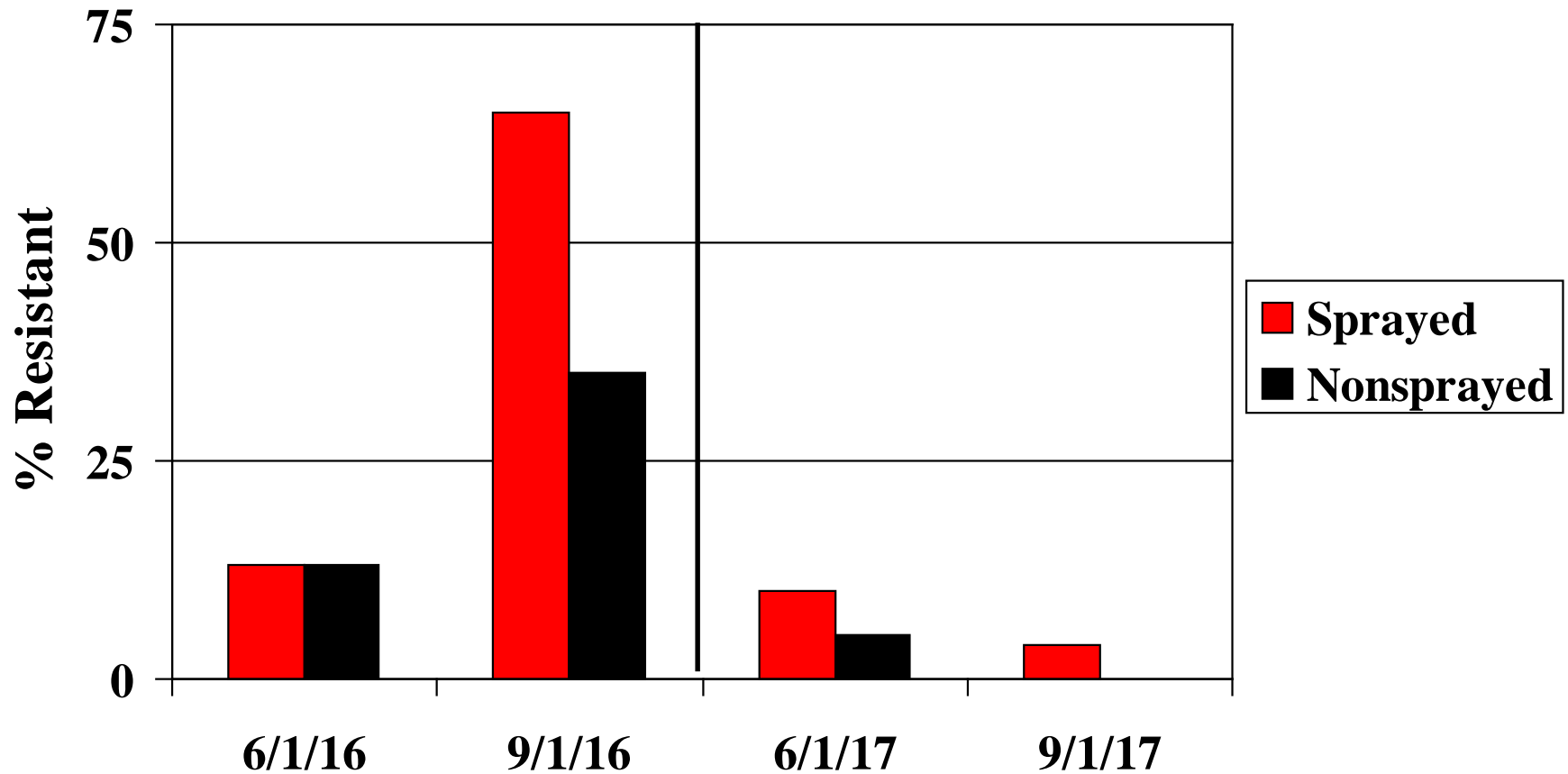
# To “win the war” we need to know the biology of fungicide resistance

Jeff Standish at UGA (Stevenson and Brenneman)

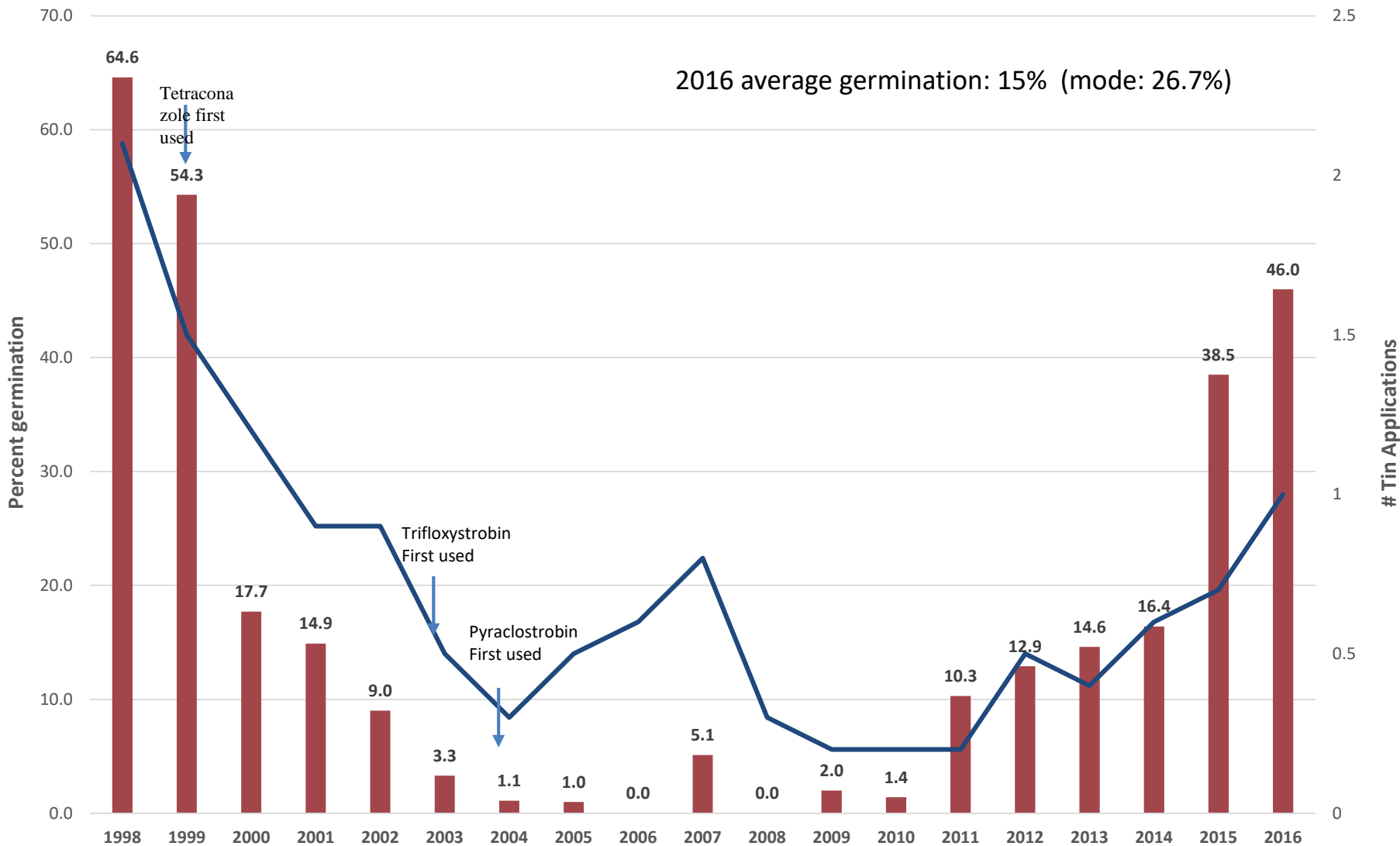
- 1) Found an intron giving greatly reduced risk of QoI resistance (Abound, Sovran, Quadris Top, Absolute, etc.)
- 2) Finding an apparent “Fitness Cost” with Tin resistance

# Persistence of Tin Resistance

(UGA Ponder farm – same trees with 10 sprays of TPTH per year)



# Sensitivity (percent samples with growth) of *Cercospora beticola* isolates collected in ND and MM from 1998 to 2016 on media amended with triphenyltin hydroxide (Tin) at 1 ppm





Great News!!!!



# Former Scenario

Fungicide Class	Trade names	Mode of Action	Relative use
<del>XX</del> Benzimidazoles <del>XX</del>	<del>XX</del> Topsin <del>XX</del> <del>XX</del> <del>XX</del>	<del>XX</del> Single site <del>XX</del> <del>XX</del>	<del>XX</del> Low <del>XX</del>
<del>XX</del> DMIs* <del>XX</del>	Orbit, Enable, <del>XX</del> Folicur-tebuconazole <del>XX</del> <del>XX</del> <del>XX</del> <del>XX</del>	<del>XX</del> Single site <del>XX</del> <del>XX</del>	<del>XX</del> Intense <del>XX</del>
<del>XX</del> Qols* <del>XX</del>	Abound Sovran <del>XX</del> Headline <del>XX</del> <del>XX</del> <del>XX</del> <del>XX</del> <del>XX</del>	<del>XX</del> Single site <del>XX</del> <del>XX</del>	<del>XX</del> Moderate <del>XX</del>
Guanidines	Elast	Multi-site	<u>Intense</u>
<del>XX</del> Organotin <del>XX</del>	<del>XX</del> Super Tin <del>XX</del> <del>XX</del> <del>XX</del>	<del>XX</del> Multi-site <del>XX</del> <del>XX</del>	<del>XX</del> <u>Intense</u> <del>XX</del>

\* Many pre-mixes like Stratego, Absolute, Quadris Top, etc.

# New Scenario

Fungicide Class	Trade names	Mode of Action	Relative use
<del>Benzimidazoles</del>	<del>Topsin</del>	<del>Single site</del>	<del>Low</del>
<del>DMIs*</del>	<del>Orbit, Enable, Folicur-tebuconazole</del>	<del>Single site</del>	<del>Intense</del>
Qols*	Abound Sovran Headline	Single site	Moderate
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\* Many pre-mixes like Stratego, Absolute, Quadris Top, etc.



# Will we win the war?

1. Need more integrated control, ie. **Resistant Cultivars**, orchard planning, etc.
2. Chemical control is still essential. New “bullets” will be few and far between, so we **MUST** manage resistance and preserve the ones we have.

**Spring is coming fast!**



# Acknowledgements

- Dr. Katy Stevenson
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- Brent Biles
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- Sonny Able
- Clint Ray



**The Georgia Agricultural  
Commodity Commission for Pecans**