

Pecan disease diagnostics and management - taking it to the next level

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Why is this important?

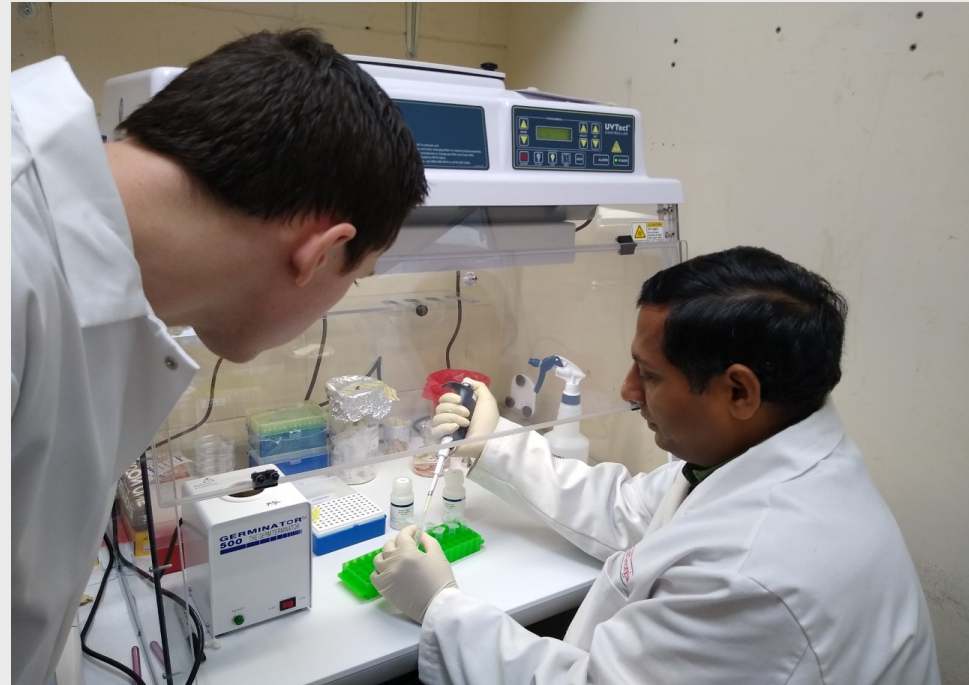
Accurate diagnostics are the foundation of plant pathology – you have to know the pathogens you are dealing with and as much about their biology as possible.

UGA Molecular Diagnostic Lab, Tifton (Dr. Emran Ali)

“I thought UGA already had a diagnostic lab in Tifton?”

- The new lab specializes in adapting the latest molecular methods of diagnostics to the specific pathogens we deal with in Georgia
- These services are available to growers, but there are fees. “You can have good or you can have cheap, but you can’t have both good and cheap”!

UGA Tifton's “Dynamic Duo of Diagnostics”



Traditional Diagnostics

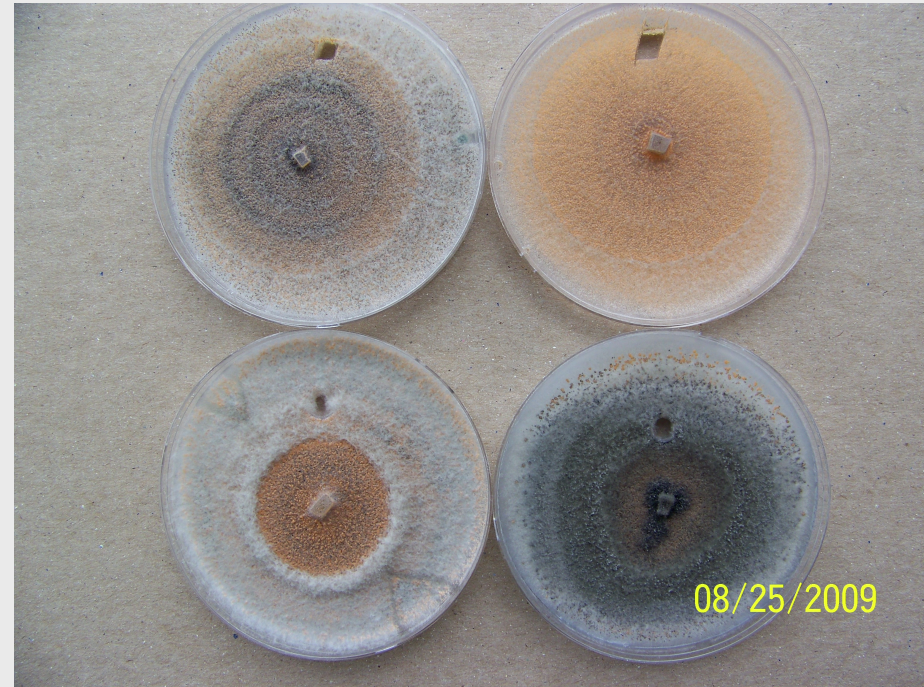
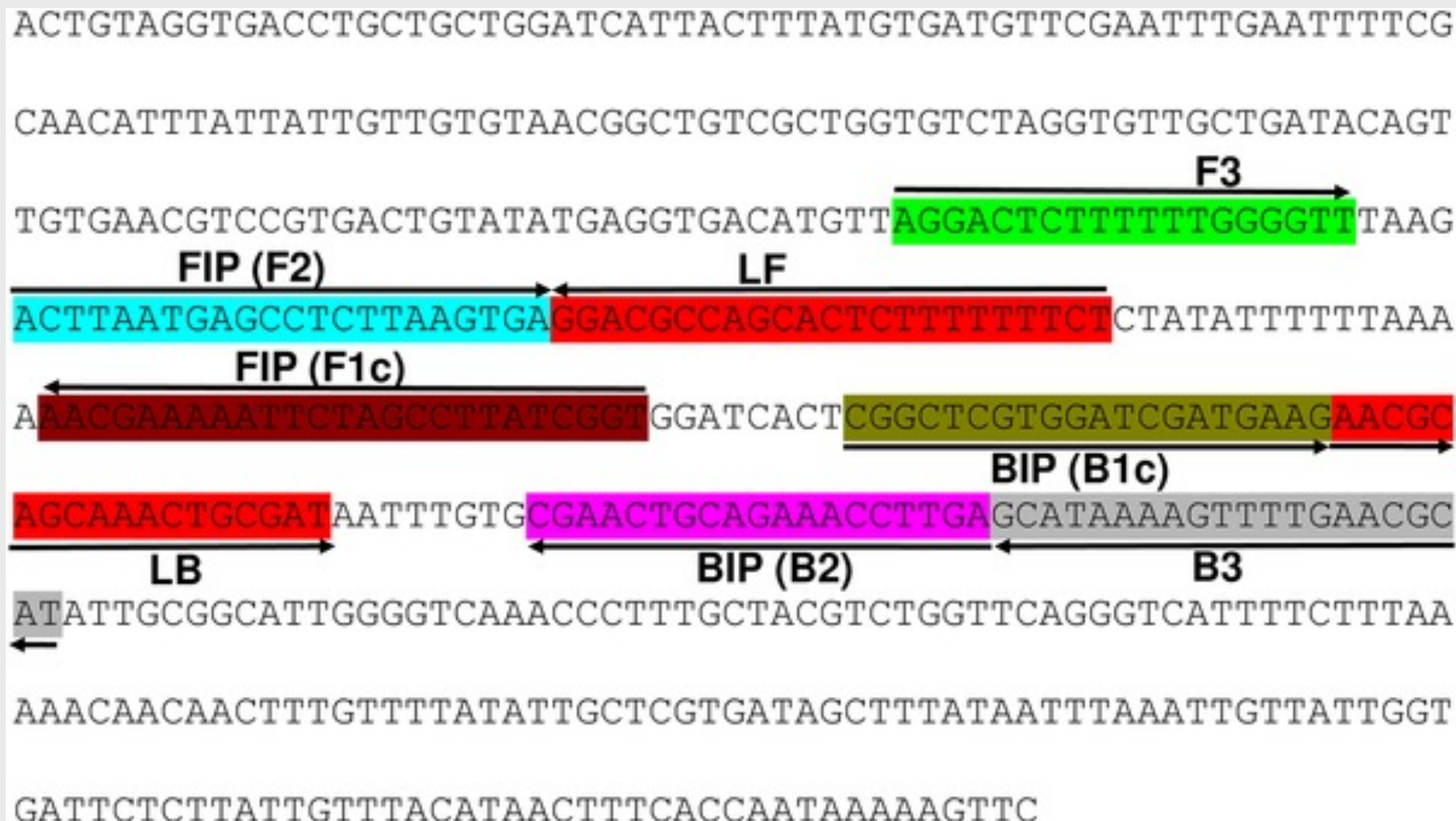


Fig 1. Location and partial sequence of loop-mediated isothermal amplification (LAMP) primer set targeting *Meloidogyne partityla* specific gene Internal Transcribed Spacer (ITS)-18S/5.8S ribosomal RNA.



Waliullah S, Bell J, Jagdale G, Stackhouse T, Hajihassani A, et al. (2020) Rapid detection of pecan root-knot nematode, *Meloidogyne partityla*, in laboratory and field conditions using loop-mediated isothermal amplification. PLOS ONE 15(6): e0228123.

<https://doi.org/10.1371/journal.pone.0228123>

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0228123>

We can now do things that previously were
very difficult or even impossible
(3 examples from pecan)

1. Identify root knot nematodes to species
2. Detect pathogens that are very difficult to grow with conventional methods
3. Understand mechanisms of fungicide resistance.

1. Pecan root knot nematode – A hidden problem with a big impact



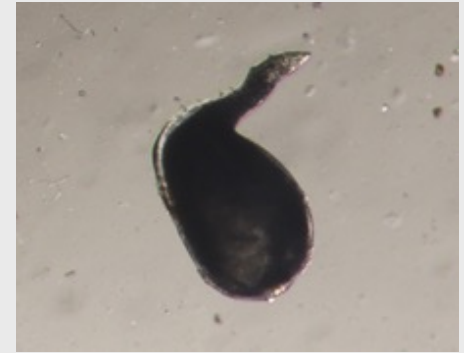
Pecan root-knot Nematodes, *Meloidogyne partityla*



Galled Pecan root.



Exposed females of pecan root-knot nematode inside a gall.



A female of pecan root-knot nematode removed from a gall.



Second stage juveniles (J2) of
pecan root-knot Nematodes
(RKN) *Meloidogyne partityla*
(looks like the other species!)

Root Knot Nematodes Reported on Pecans

Meloidogyne partityla

- Pecan root knot nematode, also attacks hickory, walnut, oaks, etc. (ie. Trees!)

Meloidogyne incognita

- Southern root knot nematode commonly attacks cotton, corn, vegetables, etc.

Meloidogyne arenaria

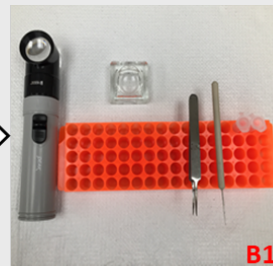
- Peanut root knot nematode commonly attacks peanuts, soybeans, vegetables, etc.

Assay development for the on-site diagnosis of *M. partityla*

Step 1:
Suspected root
collection



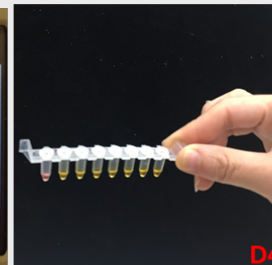
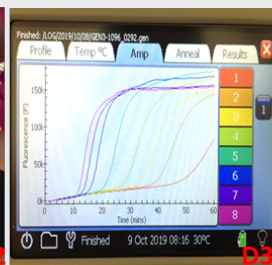
Step 2: Sample
processing and
collection of a
single female
nematode



Step 3:
Nematode
tissue
preparation for
LAMP assay



Step 4:
Detection
based on graph
or color
changes



LAMP Assay for Pecan Root Knot Nematode (*M. partityla*)

1. Accurately identifies root knot nematodes to species (100X more sensitive than conventional PCR)
2. Can be done in the field in about 1 hour!
3. Critical management information such as source of a population, effects of cover crops, etc. in understanding the epidemiology and control of this nematode

2. Bacterial leaf scorch caused by *Xylella fastidiosa* Subsp. *multiplex*

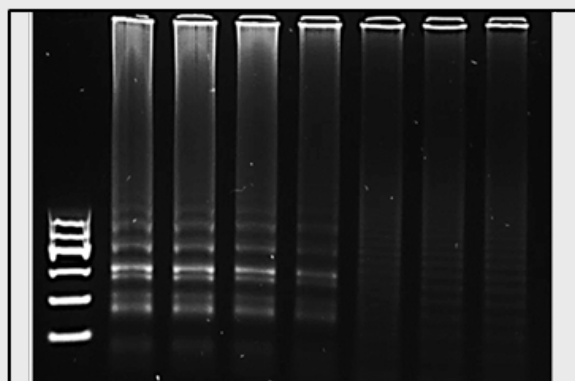
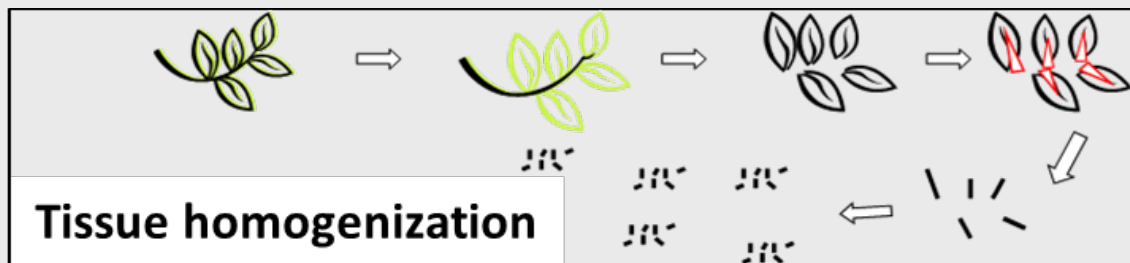


- Can cause severe defoliation and yield loss of some cultivars
- Spread by insects and plant propagation (grafting & seed??)
- Cape Fear is a “super host”, but found in numerous cultivars
- Diagnosis confounded by dormant infections, confusing symptoms, and hard to isolate
- Molecular detection is ideal

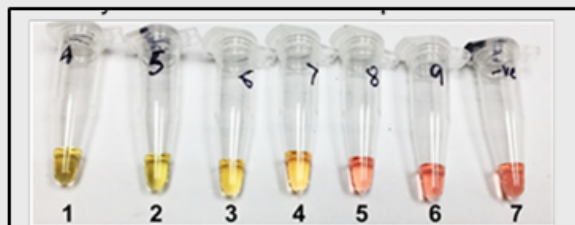
MDL developed a rapid LAMP assay for the rapid detection of *Xylella fastidiosa* causing pecan bacterial leaf scorch

❖ The LAMP assay was developed primer set for the detection of *Xylella fastidiosa* causing pecan bacterial leaf scorch

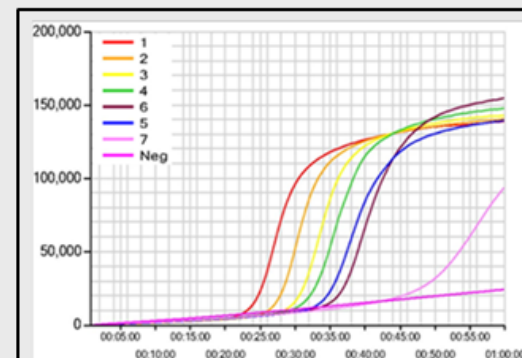
❖ Highly sensitive method with detection level > 100X better than previously



(A) agarose gel electrophoresis analysis of the LAMP product



(B) Naked eye visualization; yellow color represents positive amplification



(C) Melt curve represents the positive amplification

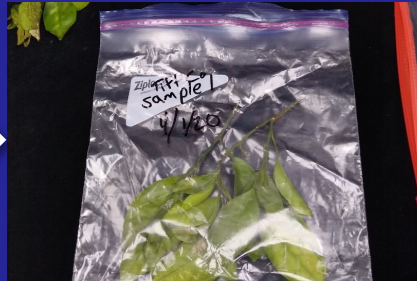
Bacterial Leaf Scorch Project (ex. Seed transmission?)



Sample Submission Procedures to MDL



1. Collect sample of 10-12 leaves still attached to branches. Place sample in plastic zipper bag & seal.



2. Clearly label with date of collection and provide unique names for each bag so that samples can be differentiated.

UNIVERSITY OF GEORGIA Department of Plant Pathology Tifton campus	Sample Submission Form Molecular Diagnostic Laboratory Shipping Address: Tifton, CAES Campus, 2360 Rainwater Rd., Tifton, GA 31793 Phone: 229-386-7230 Fax: 229-386-7285 Email: emran.ali@uga.edu
	Submitter/ Client Information Submitter name Address Phone no Email Client name Address Phone no

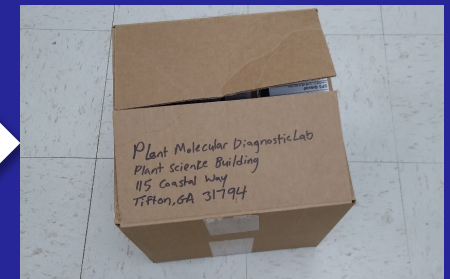
3. Fill out sample submission form as completely as possible. Ensure that all contact info. is correct.



4. Place completed form in a separate plastic zipper bag.



5. Inside shipping box, place samples and submission form into a single zipper bag.



6. Close box securely with packing tape. Clearly label, and mail overnight to the Plant Molecular Diagnostic Lab.



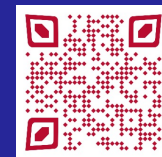
Want to learn about our services and research? Check out our website!
<https://site.caes.uga.edu/alimdl/>

Shipping address (Mail or in person)

Plant Molecular Diagnostic Lab
University of Georgia, Tifton Campus
2360 Rainwater Rd
Tifton, GA 31793

Contacts:

229-386-3070 **alimdl@uga.edu**



Want more UGA MDL updates?
 Check out our Facebook!
<https://www.facebook.com/ugamd/>

Olive groves in Italy devastated by *Xylella fastidiosa* Subsp. *pauca* since discovery in 2013



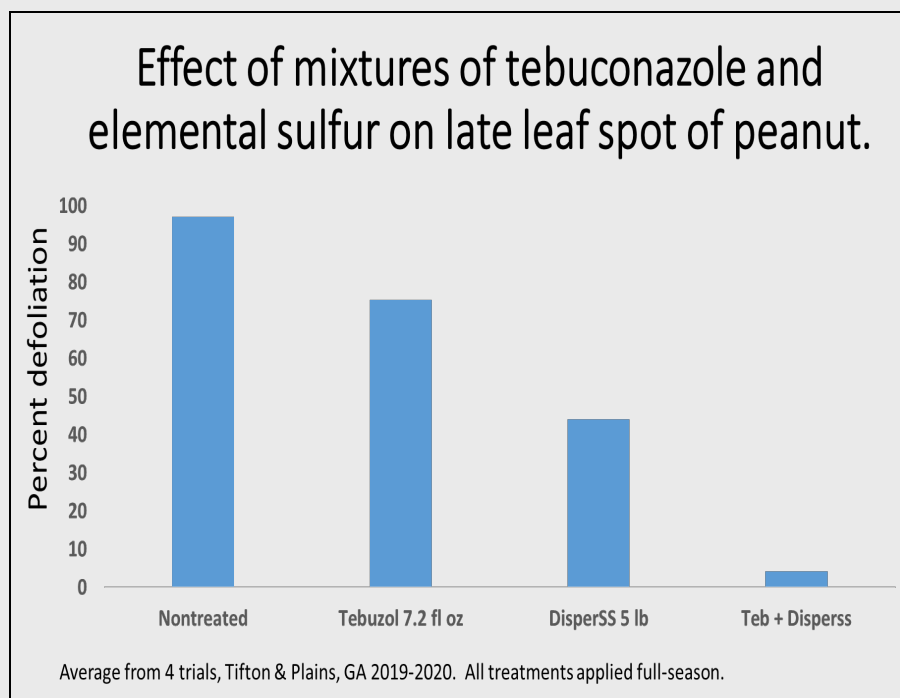
Pecan Scab

Other than weather, “The weakest link” to pecan production in the SE



The “Magic” of Micronized Sulfur

(Microthiol Disperss, KollaSulfur, etc.)

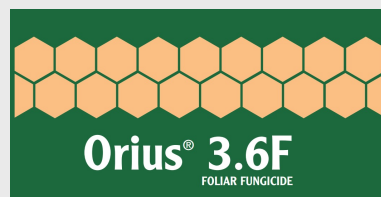


Data by Dr. Albert Culbreath, UGA

- 3-5 lb of micronized sulfur greatly improve activity of several fungicides on peanut leaf spot
- Will it do the same for those same fungicides on pecan scab?

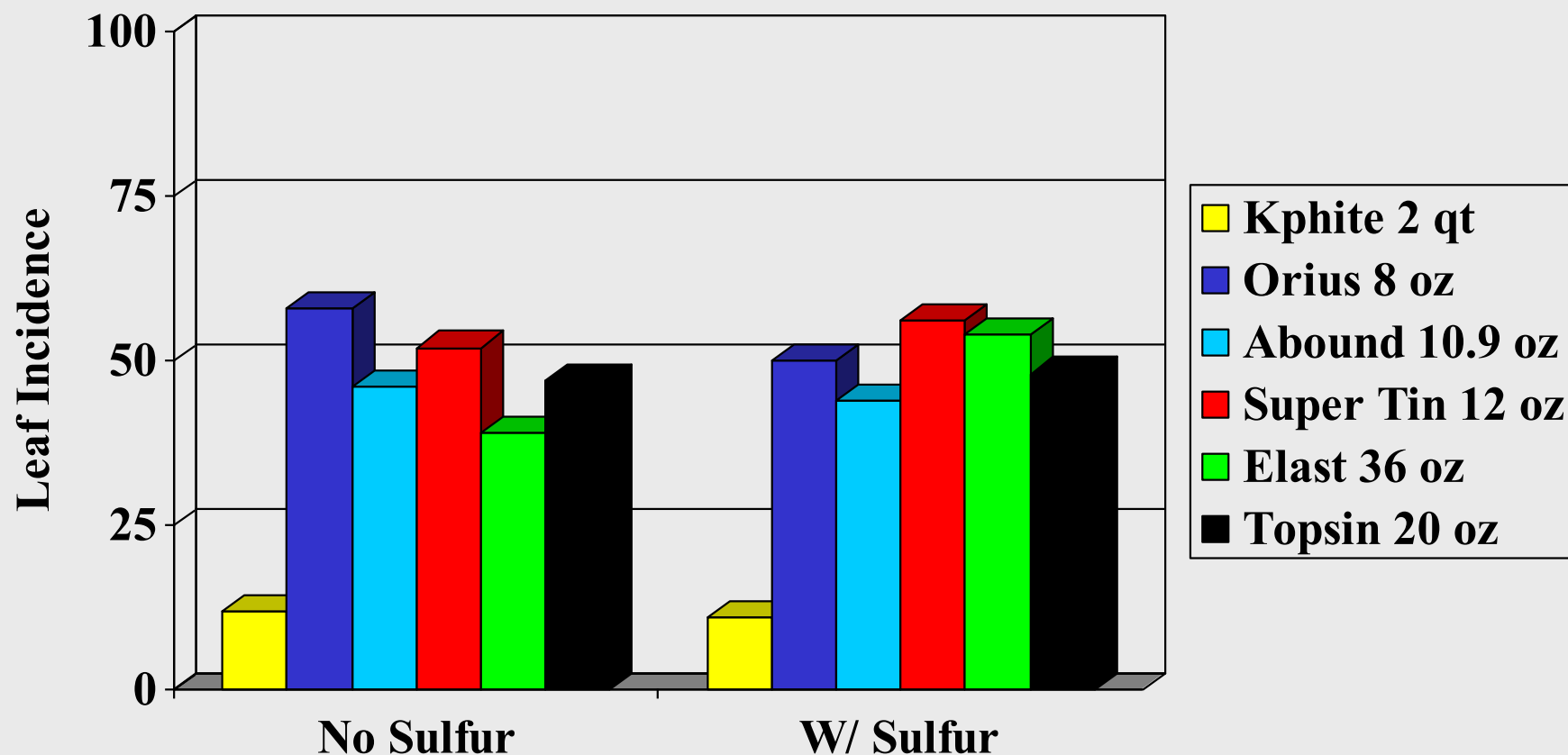
Micronized Sulfur Studies, Summer 2021

Treatment	Rate (/A)
Kphite	2.0 qt
Kphite + Sulfur	2.0 qt 6.00 lb
Tebuconazole	8.0 fl oz
Tebuconazole + Sulfur	8.0 fl oz 6.00 lb
Abound	10.9 fl oz
Abound + Sulfur	10.9 fl oz 6.00 lb
Super Tin	12.0 fl oz
Super Tin + Sulfur	12.0 fl oz 6.00 lb
Elast	36.0 fl oz
Elast + Sulfur	36.0 fl oz 6.00 lb
Topsin	20.0 fl oz
Topsin + Sulfur	20.0 fl oz 6.00 lb
Sulfur	6.00 lb
Nontreated Control	n/a



Effects of sulfur on multiple chemistries for scab, 2021

(Terminal Leaves, Sulfur = 65%, Nonsprayed = 78%)



Microthiol Sulfur (6 lb per 100 gallons), data are the mean of 4 trials

Conclusions

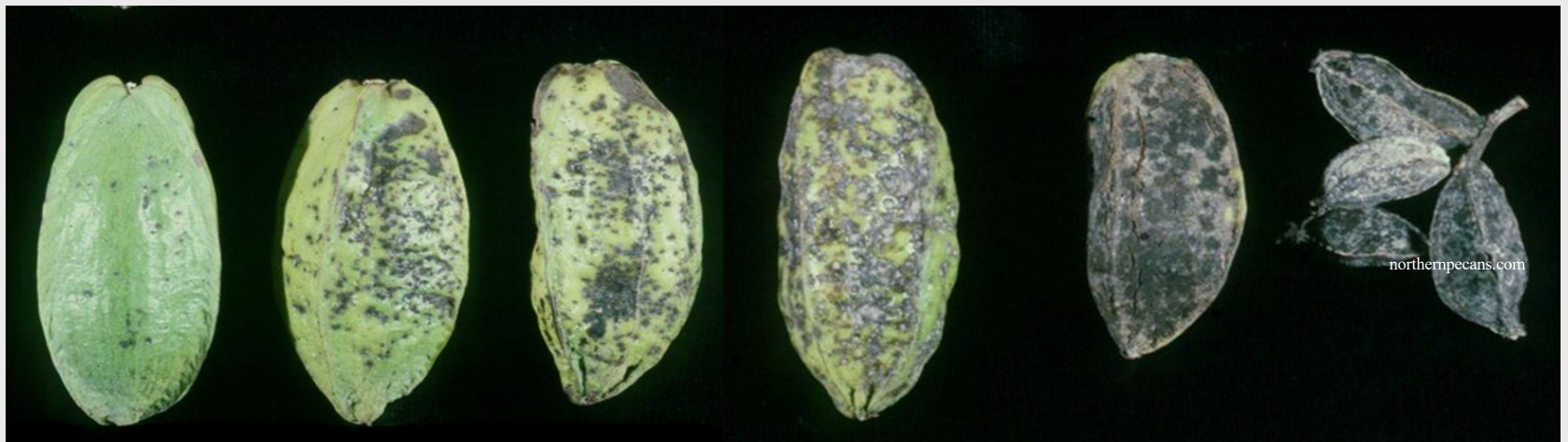
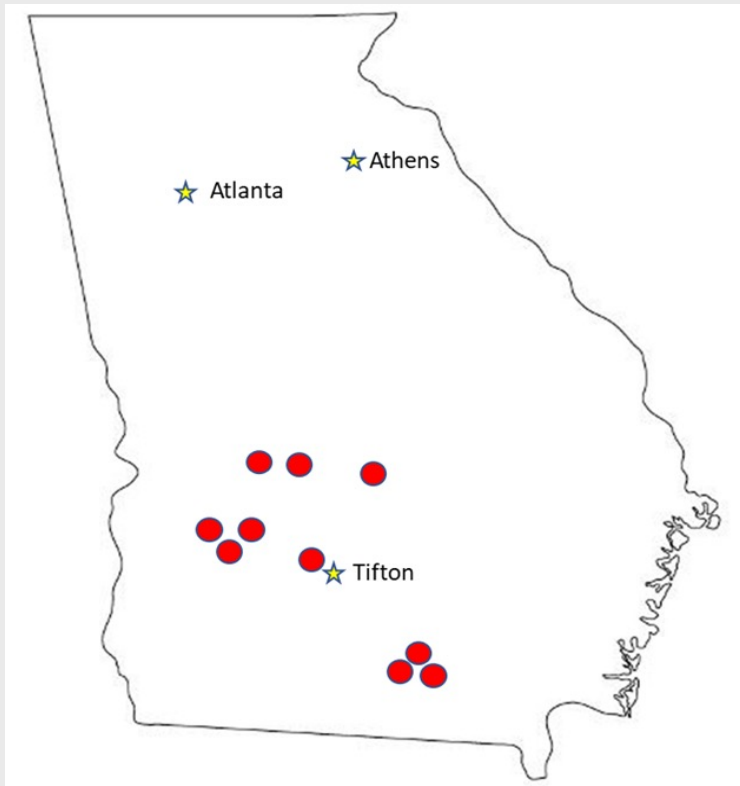
- Are reasons to spray sulfur on pecans, but improved scab control may not be one!
(saw the same with Cevya the last 2 years)
- Difference from peanut results may be a function of greater dilution?
- Phosphites are excellent leaf scab fungicides, and for managing resistance

Rapid vegetative growth is a challenge for fungicide protection

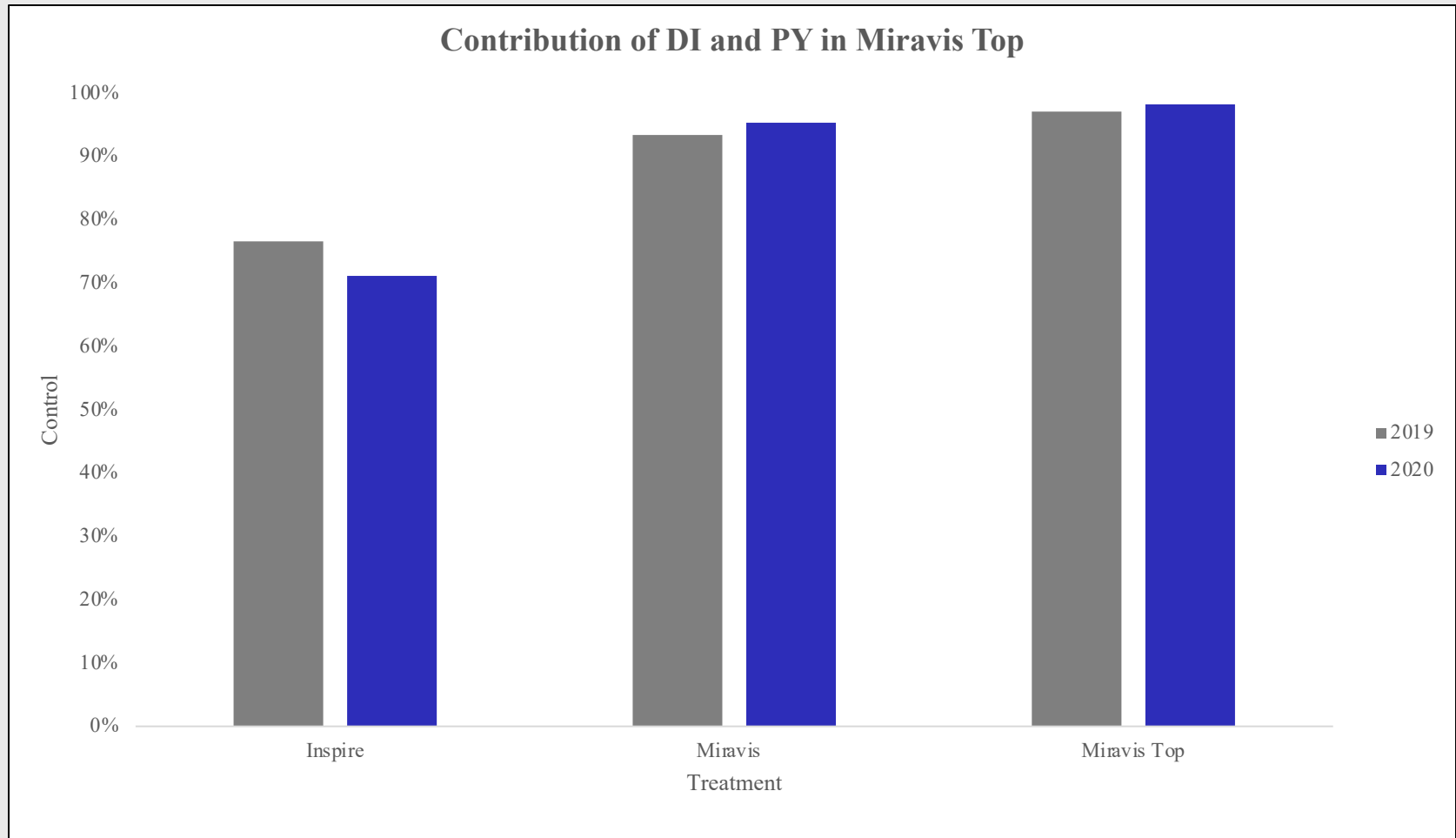


Miravis Top – Has it met expectations?

- Contains Miravis, an excellent new SDHI, just recently labeled on pecans
- Also has difenoconazole (same as in Amistar Top) which is a very active DMI
- Early trials gave superior scab control in all locations across south Georgia
- Competitively priced, so widely used



Performance of Miravis Top and Components on Farm in 2019 and 2020



What do I need to be spraying when I get home?

- Leaves hardening off , but nuts will be sizing
- Early nut sizing is a great time for Miravis Top (not a post infection product)
- Please use other classes of fungicides in alternations or blocks for resistance management (Tin and Elast in particular)

Thank you to . . .

Georgia Pecan Commission for their generous support

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