Systemic Fungicides – the Good, the Bad and the Ugly!

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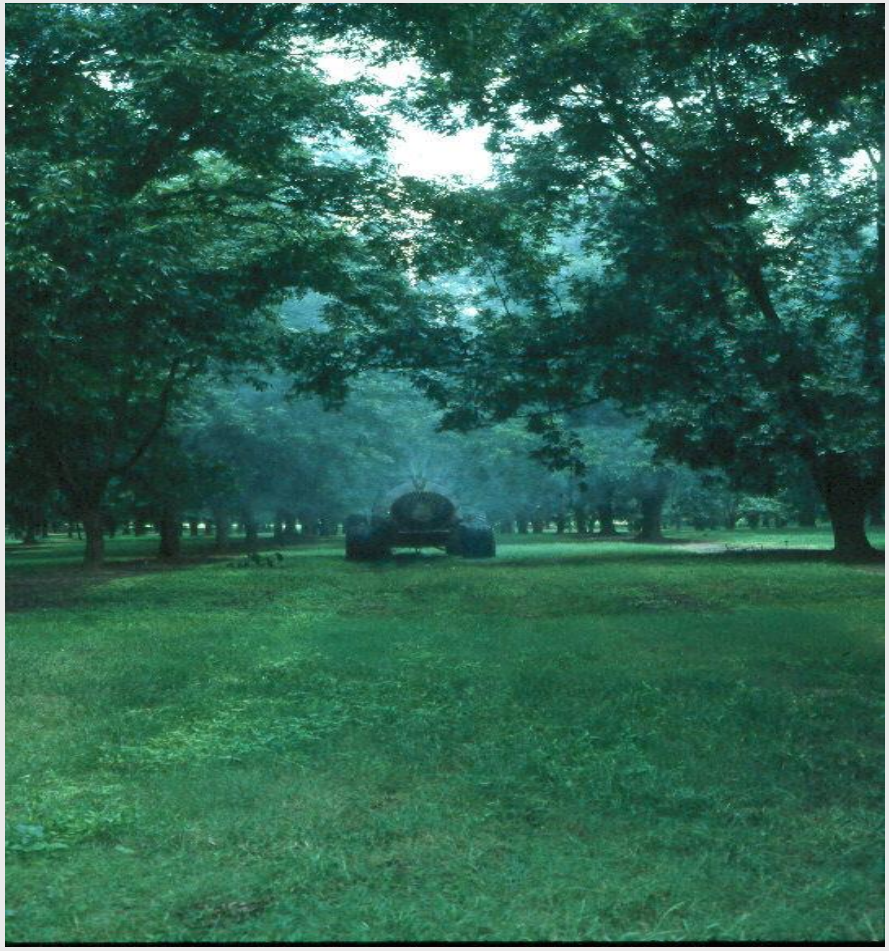
Pecan Fungicides – An Essential Input for SE Growers



- Requires big sprayers and slow speeds (100 GPA)
- Early April – late August on a 10-21 day schedule so can have 15-20 sprays in wet years
- MAJOR cost of production

Types of Fungicides

1. Contacts (Protectants)

   - remain on the plant surface, so no post-infection activity
   - multi-site mode of action, may even be toxic to plant cells if get inside
   - repeated applications for new growth
   - subject to wash off, UV degradation, etc. that decreases efficacy
   - ex. Super Tin, Ziram, Elast, etc.

Types of Fungicides

2. Systemics
   - absorb into the plant tissue
   - may provide post-infection control of some diseases (up to 72 hours)
   - different degrees of movement
     1. Local (within a leaf, ex. translaminar)
     2. Xylem-mobile (move up in plant)
     3. Phloem-mobile (move up and down)

Factors Affecting Systemic Movement

1. Host tissue. (ex. Orbit in leaves vs shucks)
2. Formulation and surfactants (why we use surfactants w/ systemics)
3. Different fungicides in a class can vary widely

   ex. Azoxystrobin (Abound) is xylem mobile, whereas pyraclostrobin (Headline) and trifloxystrobin (Absolute) are local

Systemics – The Good

- may provide post-infection control of some diseases
- usually require less product
- often provide longer periods of control since not subject to weathering
- compensates for poor coverage (ie. Pecans)
- can hit targets that are difficult to spray (ex. roots, interior foliage, etc.)

Systemics – The Bad

- single-site mode of action so prone to resistance
- movement may also increase exposure to low rates that select for resistant isolates when mixed with a protectant – need good coverage
- usually less broad spectrum (do not control as many different diseases)
- often more expensive

Systemicity of Pecan Scab Fungicides

(**Phosphite's** are xylem/phloem mobile - rare)

Fungicide Class	**Trade names**	**Systemic?***	**Relative use**
Benzimidazoles	Topsin	Xylem	Low
DMIs*	Orbit, Enable, Folicur-tebuconazole	Xylem	Intense
QoIs*	Abound Sovran Headline	Xylem	Moderate
Guanidines	Elast	Protectant*	Intense
Organotins	Super Tin	Protectant	Intense

* Big differences between individual products within a group

Is systemic movement important in pecan disease mangement?

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

April 20, 2015

Proving Systemic Movement

Usually demonstrated on plant tissues with radioactive-labeled material

Ever see one of a pecan leaf?

Are there differences between a soybean (or wheat) plant and a pecan tree?

Do pecan fungicides* move

1) Upward from 1 leaf to another on the same shoot?

2) Downward from 1 leaf to another on the same shoot?

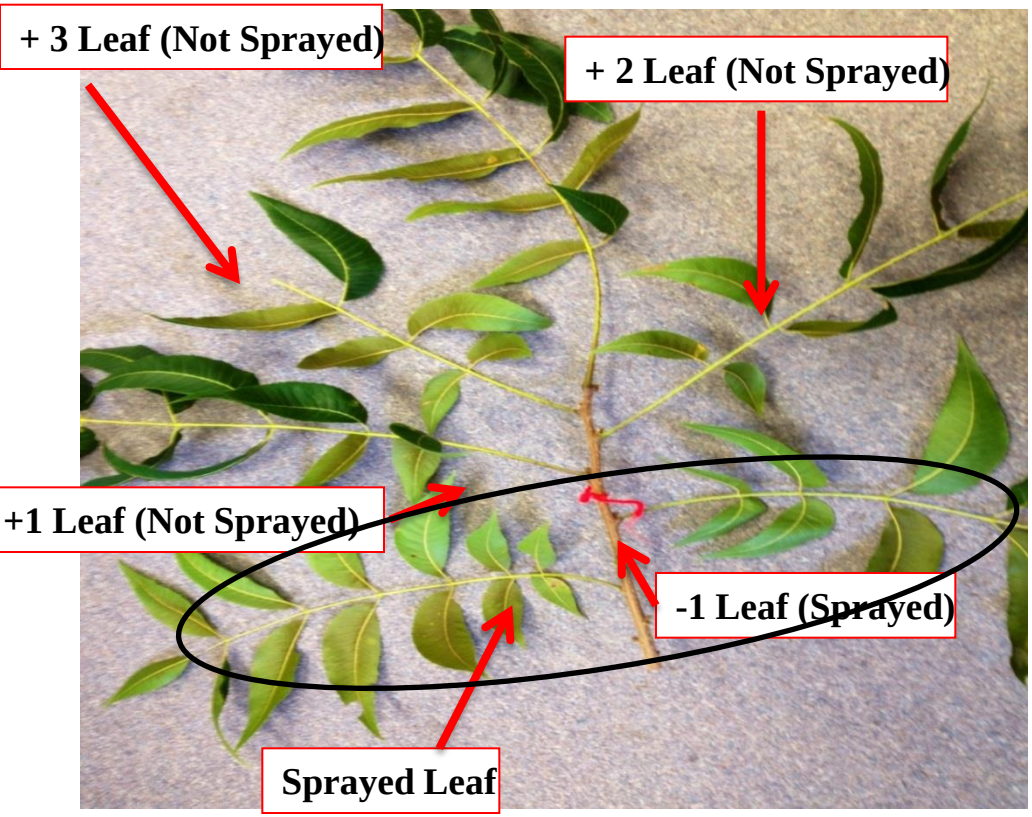
3) Into newly formed, unsprayed leaves?

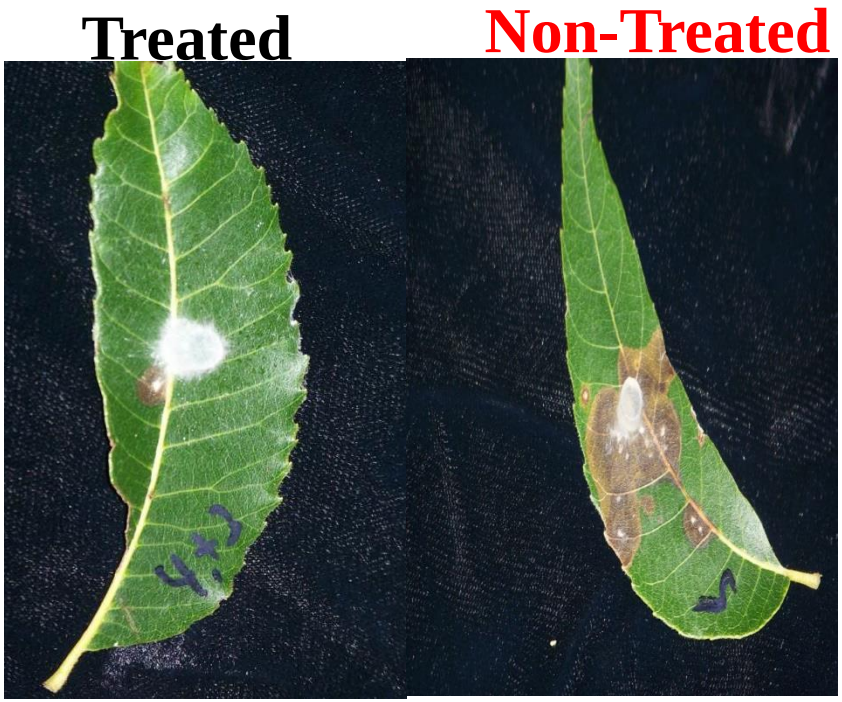
4) Into the tops of trees in the xylem?

*azoxystrobin (Abound), tebuconazole & phosphite

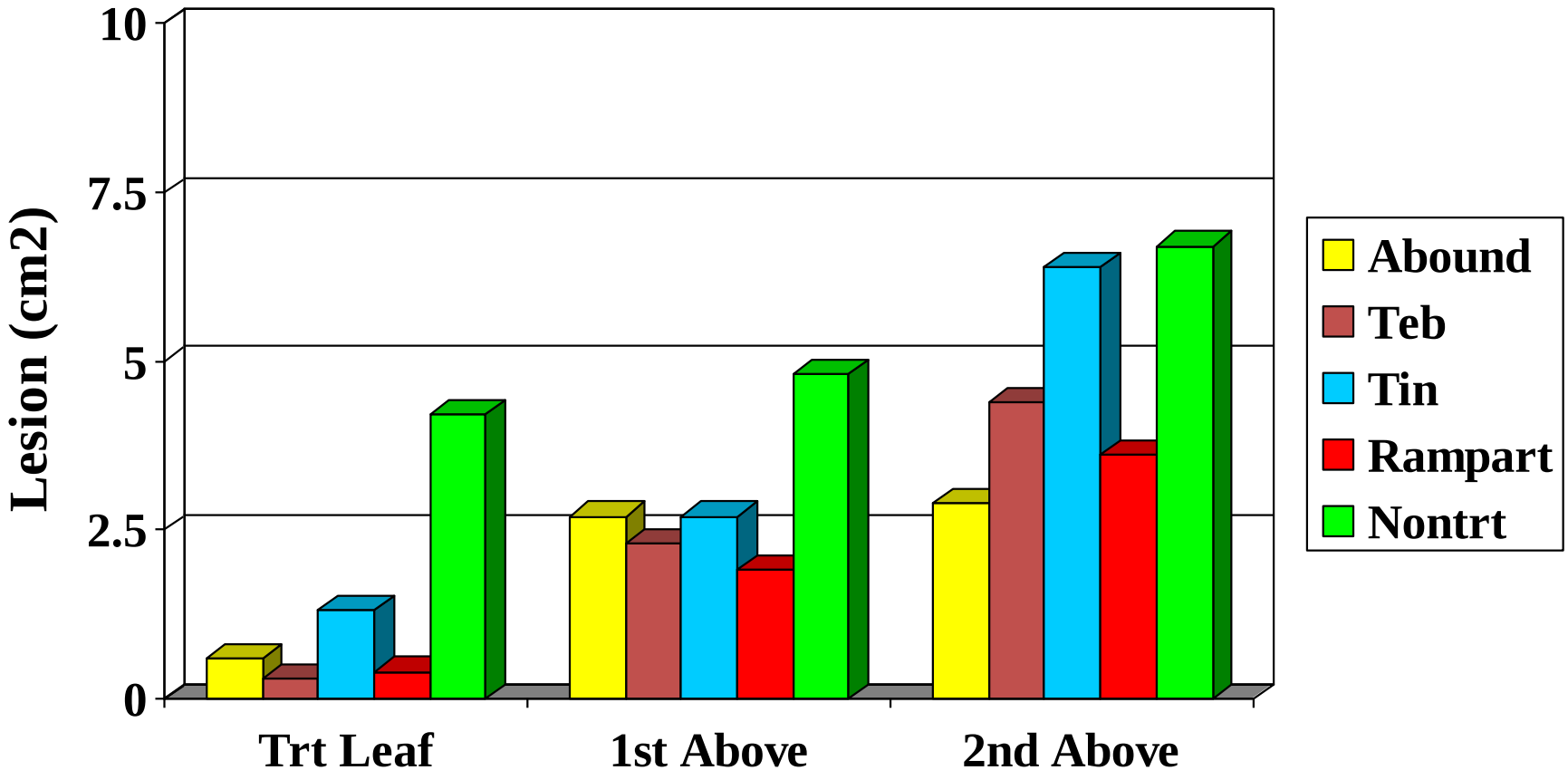
Mapping Fungicide Movement w/ a Bioassay Technique

(Kyle Brown, M.S. 2015)



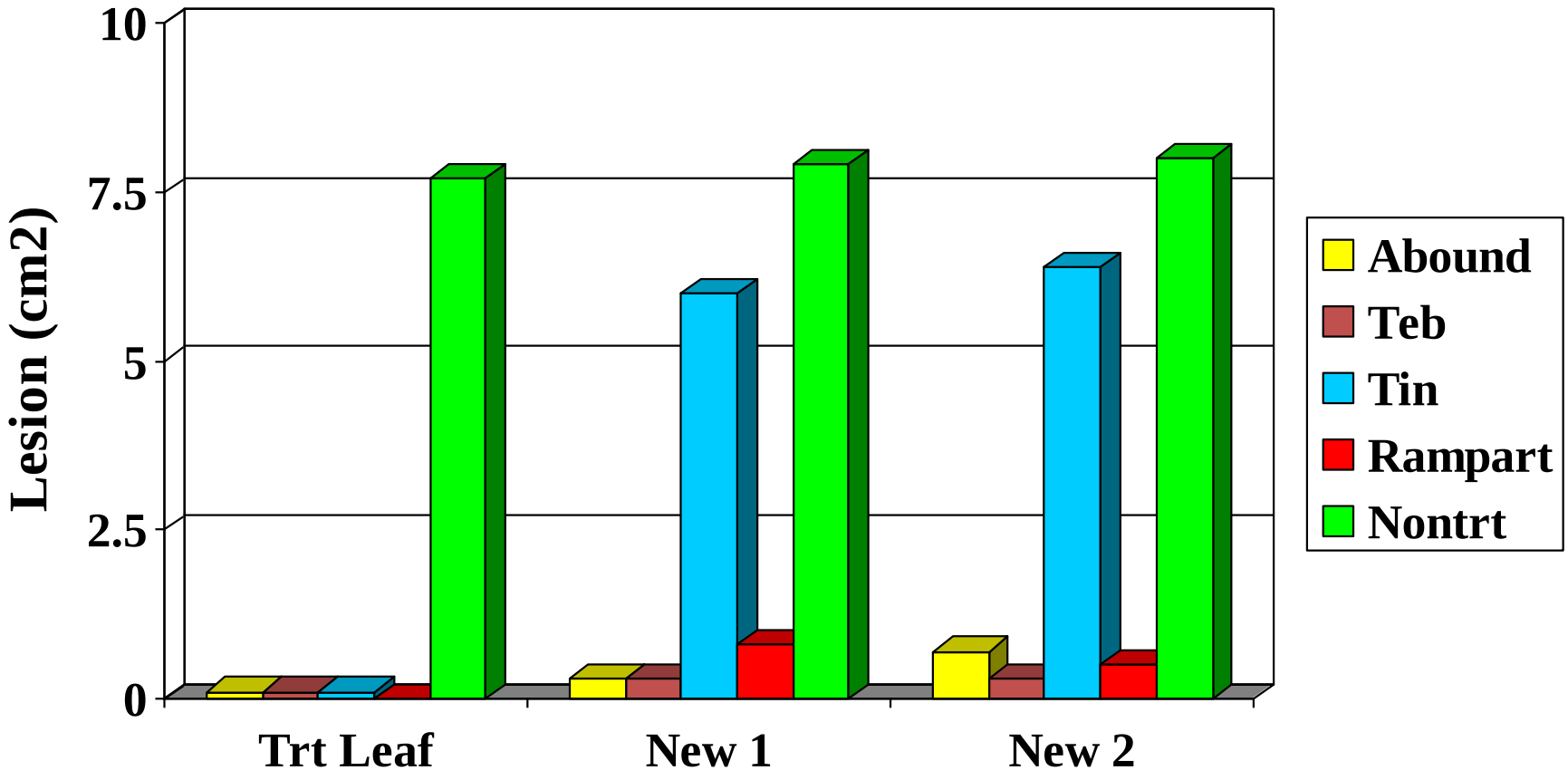


Fungicide Movement Upward From Treated to Nontreated Leaves

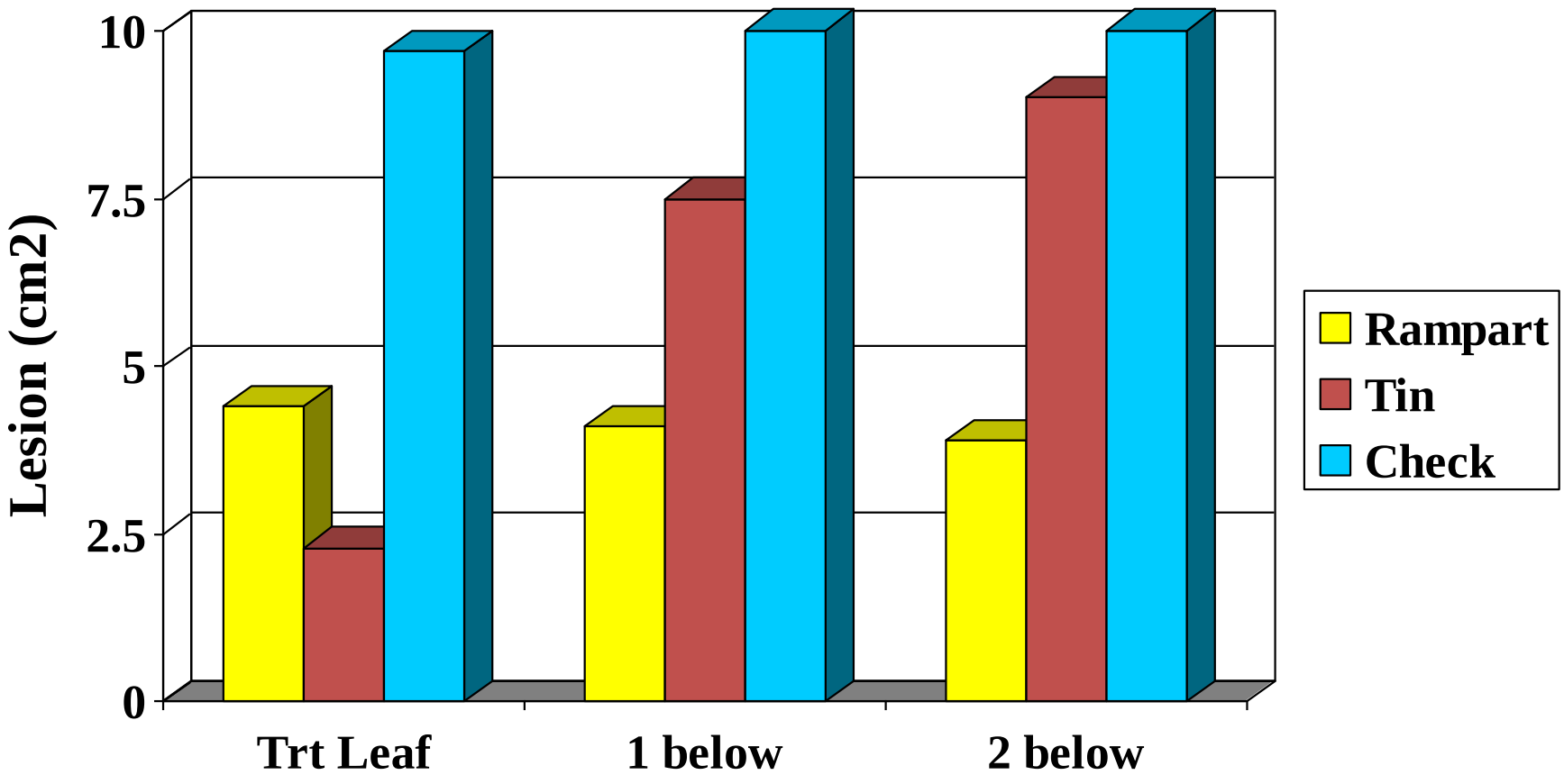


Fungicide Movement into New* Leaves

(* Emerged After Application)



Fungicide Movement Down into Lower Leaves on the Same Stem



Systemic Fungicide Movement in Pecans

- Abound, tebuconazole and phosphites show some movement up into existing foliage, and excellent movement into new leaves not present when sprayed
- Phosphites also move down (at least 2 leaves) into existing foliage
- Can a highly mobile fungicide (ie. Phosphite) move into the tops of trees from the lower treated foliage?

From trunk sprays on a young tree with thin bark? Yes

Single-sided w/ & w/out Volute

“Whole Tree” Systemicity Test

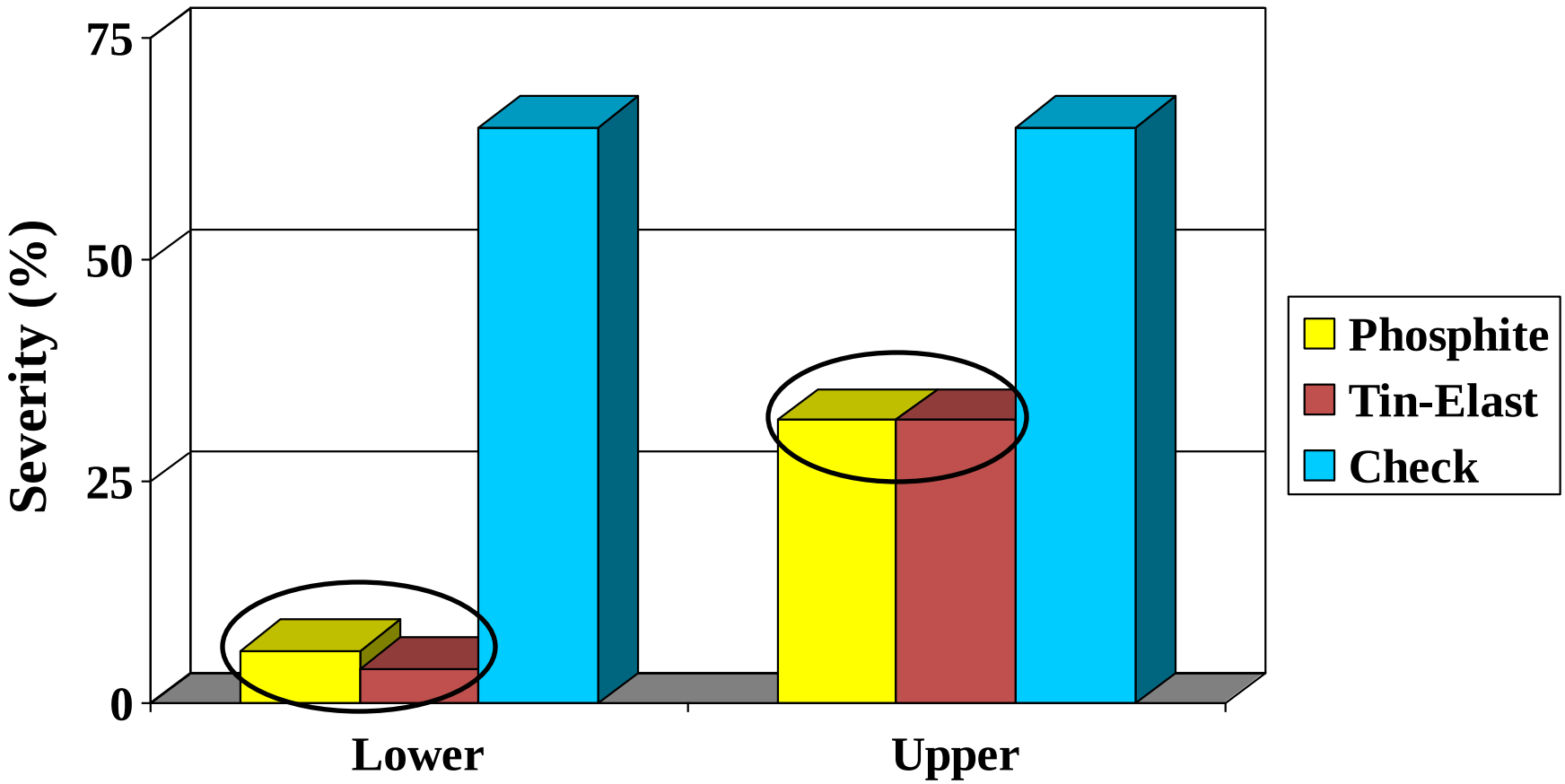
Treatment	Rate/A
1. Rampart (apps. 2,4,6,8,10)	96 fl oz.
Super Tin 4L + Elast (apps. 1,3,5,7,9)	6 fl oz. + 25 fl oz.
2. Super Tin 4L (apps. 1-10)	6 fl oz.
+ Elast	25 fl oz.
3. Nontreated	

Materials and Methods

- Treatments applied with a small PTO-driven air-blast sprayer to 25 year-old Desirable trees hedged to 25 ft the year prior to the study
- 4 replications per treatment

- poor coverage in tops of trees, and lots of regrowth (metabolic sink)

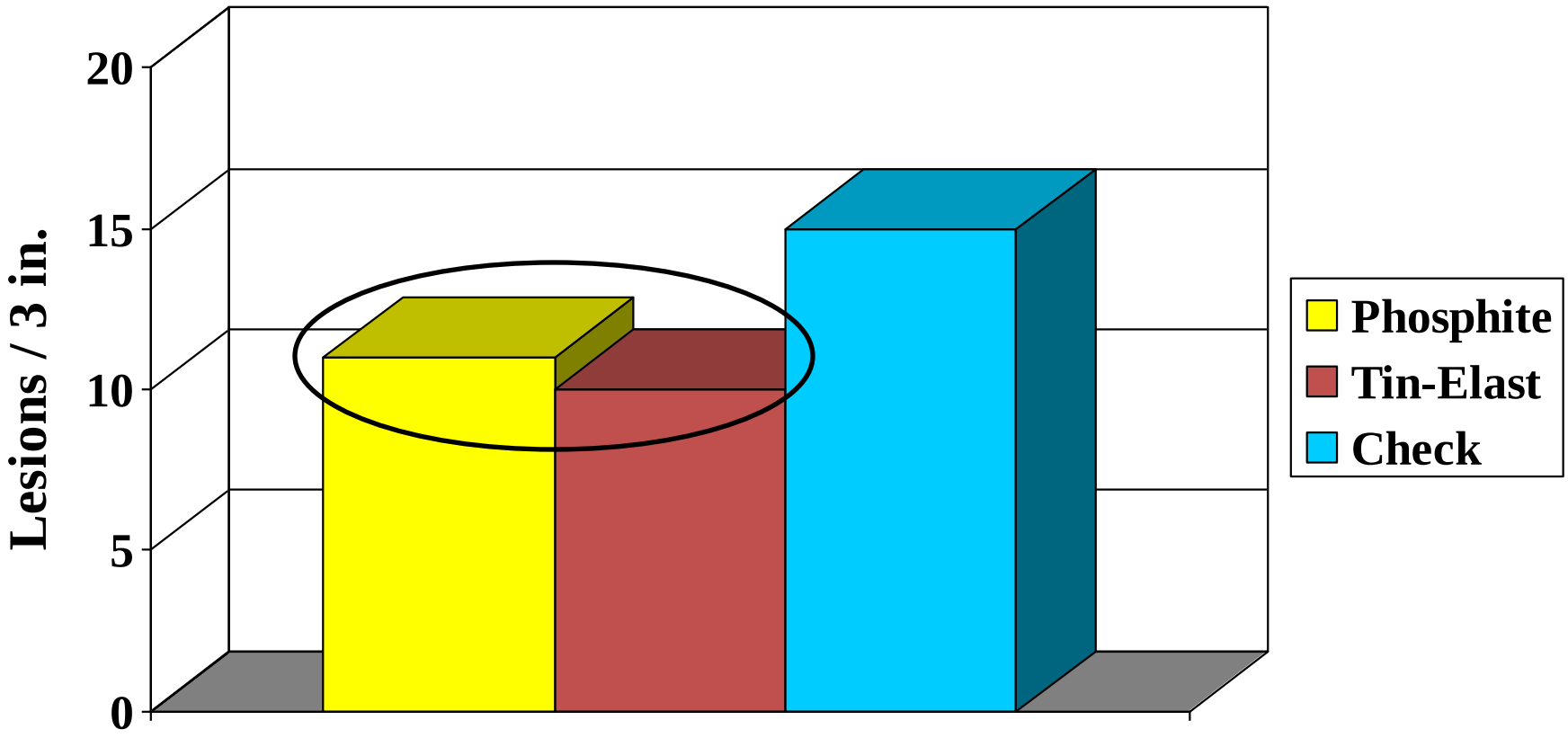
Protectant vs Systemic Scab Control in the Upper vs Lower Canopy (Nut Scab)



Effects on Embedded Scab Lesions

- Growing shoots very susceptible to scab
- Extended growing period in tree tops gives more chance for infection, particularly after hedging
- Less fungicide coverage
- Inoculum well placed to cause disease

Protectant vs Systemic Scab Control of Stem Lesions in the Upper Canopy, 2015



No Evidence for “Whole tree” movement of phosphites to terminals

Systemics – The Good and the Bad, what about the Ugly?

1. **Residues**

- Move into plant tissue, so higher chance of pesticide residues in those plants
- We have an elaborate (and expensive), science-based registration process to insure safety of the crops we grow.
- Public policy is becoming less reliant on science – case in point, phosphites!

What are Phosphites?

(ProPhyt, Phostrol, Kphite, Rampart, Reliant, Fungi-phite, Nutri-phite, etc.)

- Phosphorous acid salts; NOT phosphate (fertilizer)
- Have very good activity on pecan scab, anthracnose, and other diseases; stronger on leaves than nuts
- Highly systemic in the tree, up and down
- Cheap and have a different mode of action (both direct on pathogen and increased plant defenses)
- <u>Have been used A LOT in Georgia the last couple years, especially to combat fungicide resistance</u>

So what is the problem?

- EPA regulates phosphites like fertilizers, ie. no residue data are even required
- The EU considers them a pesticide, and have started testing for residues in other crops
- There has never been formal residue testing on pecans, so MRL set very low (2 ppm)
- Virtually any use will exceed this level

What do we do?

- Big gray area – risk of illegal residues in nuts (only in EU for now)
- Some other crops have discontinued use, even though phosphites fully labeled in the US
- Definite need for residue data on pecans. Working with IR-4 but will take time
- Be aware . . . . . will be an issue for multiple commodities in the years ahead (ex. peanuts)

The Ugly – Part 2

Nontarget affects

- ex. Phosphites. Plants cannot get P from phosphite, so it is NOT a fertilizer.
- <u>Phosphite can mimic P, "fooling" a P deficient plant and make deficiency worse</u>

- seen even at 80-90% sufficiency level, and increasingly worse at low levels of P
- Perhaps call this an "unfertilizer"?

-

N:P Imbalance
(made worse by phosphite???)

Systemic Fungicides

- Incredibly valuable tools for managing pecan diseases
- Know their strengths and weaknesses and use them accordingly!

Thanks to the Georgia Pecan Commission for funding this research

Hope this years crop exceeds all your expectations!