



# ENTOMOLOGY & PLANT PATHOLOGY

INSTITUTE OF AGRICULTURE | UNIVERSITY OF TENNESSEE

## Tobacco Thrips Insecticide Resistance

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Scott Stewart & Jessica Krob

# Thrips in Cotton

- Early-season pest of seedling cotton
  - Rank among the top 5 insect pests annually
  - Most susceptible to injury from emergence to the 4<sup>th</sup> true leaf
- Both adults and immatures
- 5 main species
  - Tobacco thrips - *Frankliniella Fusca* (Hinds)  
Stewart et. al (2013) J. Cotton Sci
- Injury can delay maturity and cause yield loss
  - TN (2020) - \$27.43/acre (costs + yield loss)

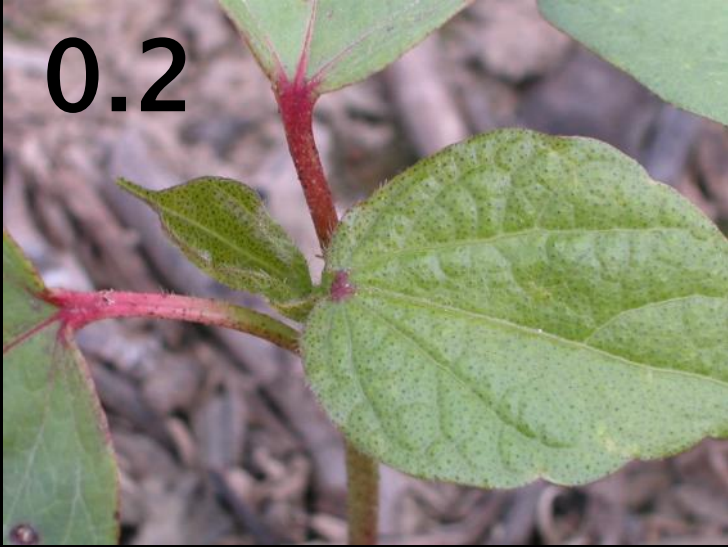


Photo: Mississippi State



# THRIPS INJURY

0.2



1.0



2.3



3.0



4.1

Almost certain yield loss



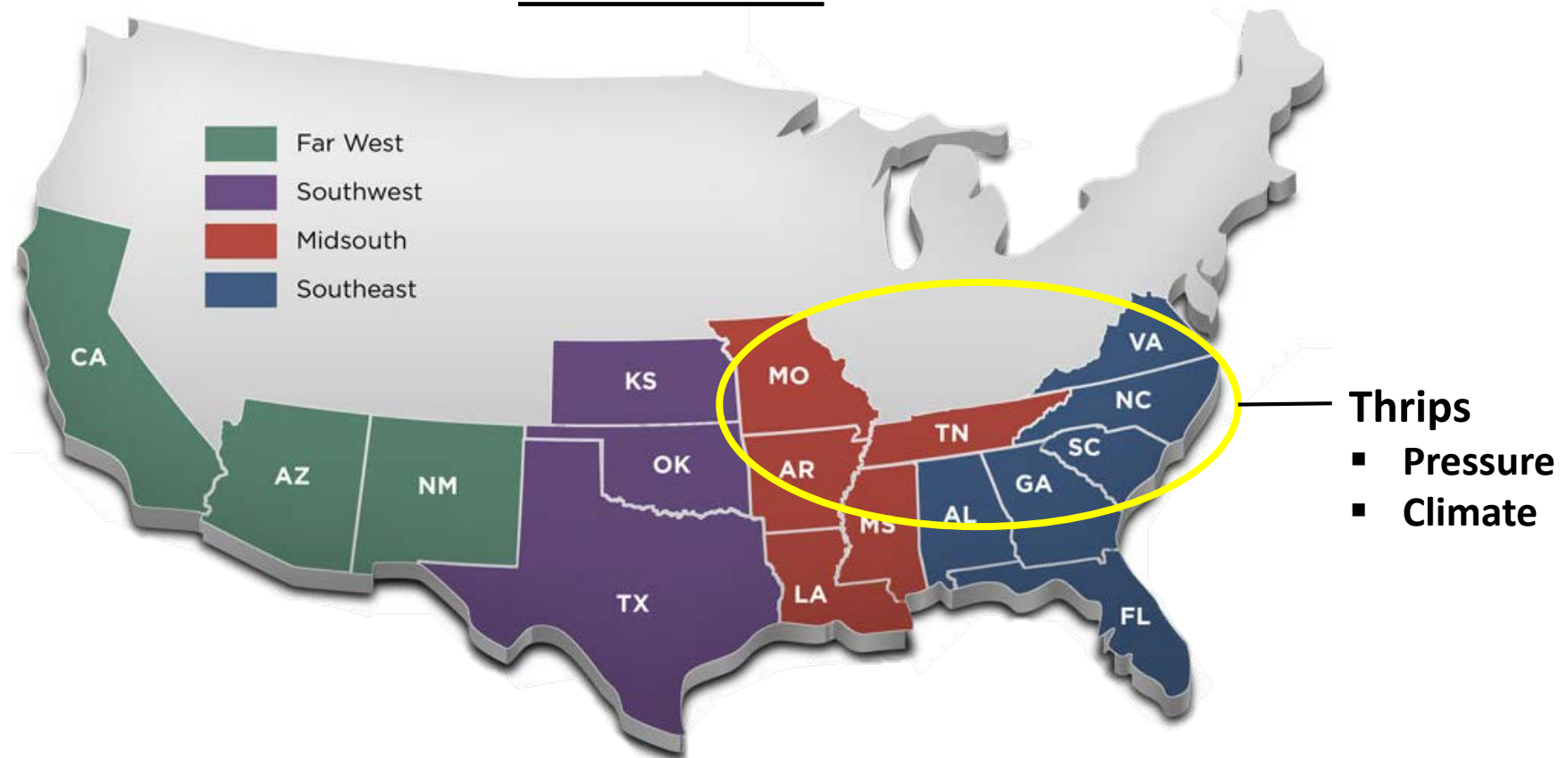
Major yield loss

4.6



# Upland Cotton (*Gossypium hirsutum* L.) US Production Regions

## Cotton Belt

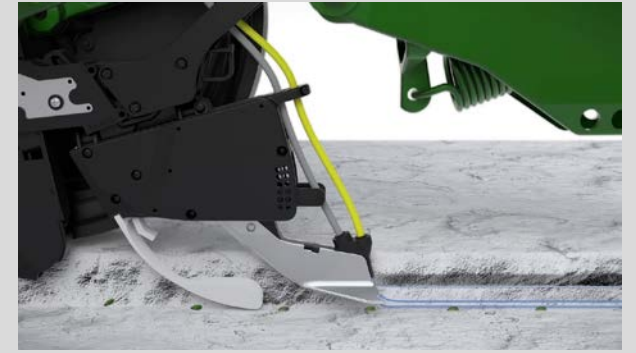


# Thrips Management

## *Proactive, At-Planting Approach*



IRAC Class	Active Ingredient	App.
<i>Carbamate</i>	Aldicarb	Granular
<i>Organophosphate</i>	Acephate	IST/Liquid
<i>Neonicotinoid</i>	Thiamethoxam Imidacloprid	IST/Liquid



# CURRENT THRIPS CONTROL OPTIONS

- Imidacloprid at 0.375 mg ai/seed
  - Gaucho, Aeris, Acceleron IF
- Imidacloprid in-furrow (e.g., Admire Pro)
- Aldicarb (AgLogic 15G at 3.5-5 lb/acre)
- **Acephate seed treatment or in-furrow**
- **Recommended foliar applied insecticides**
  - Acephate (Orthene), Bidrin, Dimethoate, Radiant
  - Typically not used as stand alone approach



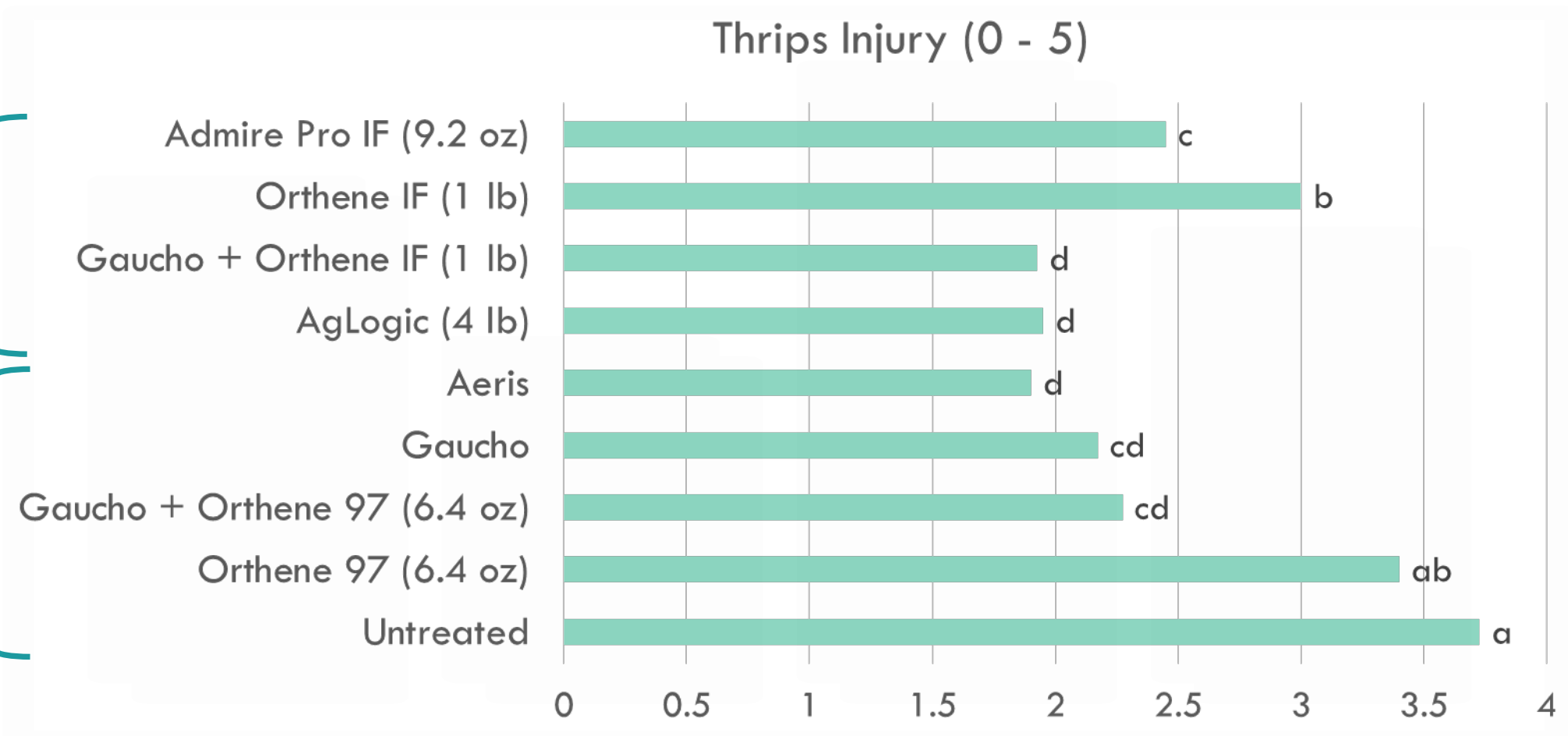
7-node cotton with extreme thrips injury

# THRIPS - SEED TREATMENT & IN-FURROW

## 2019, JACKSON, TN

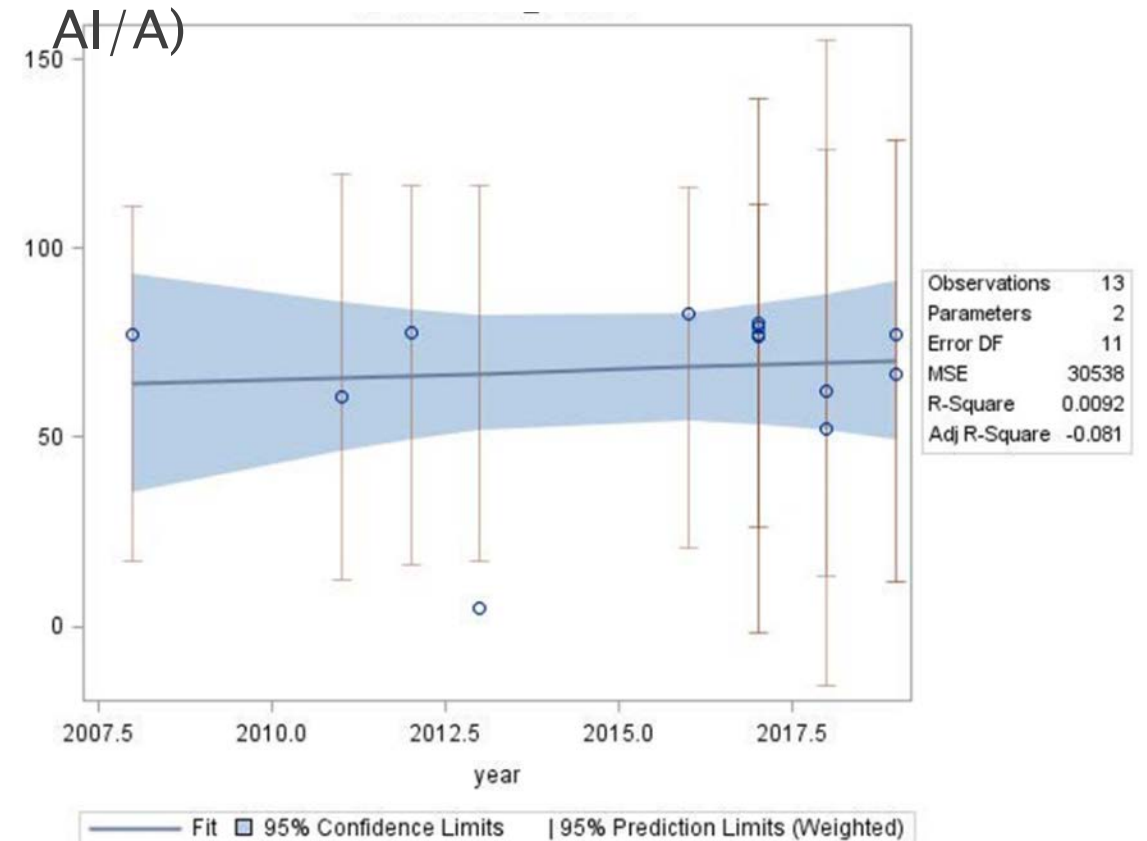
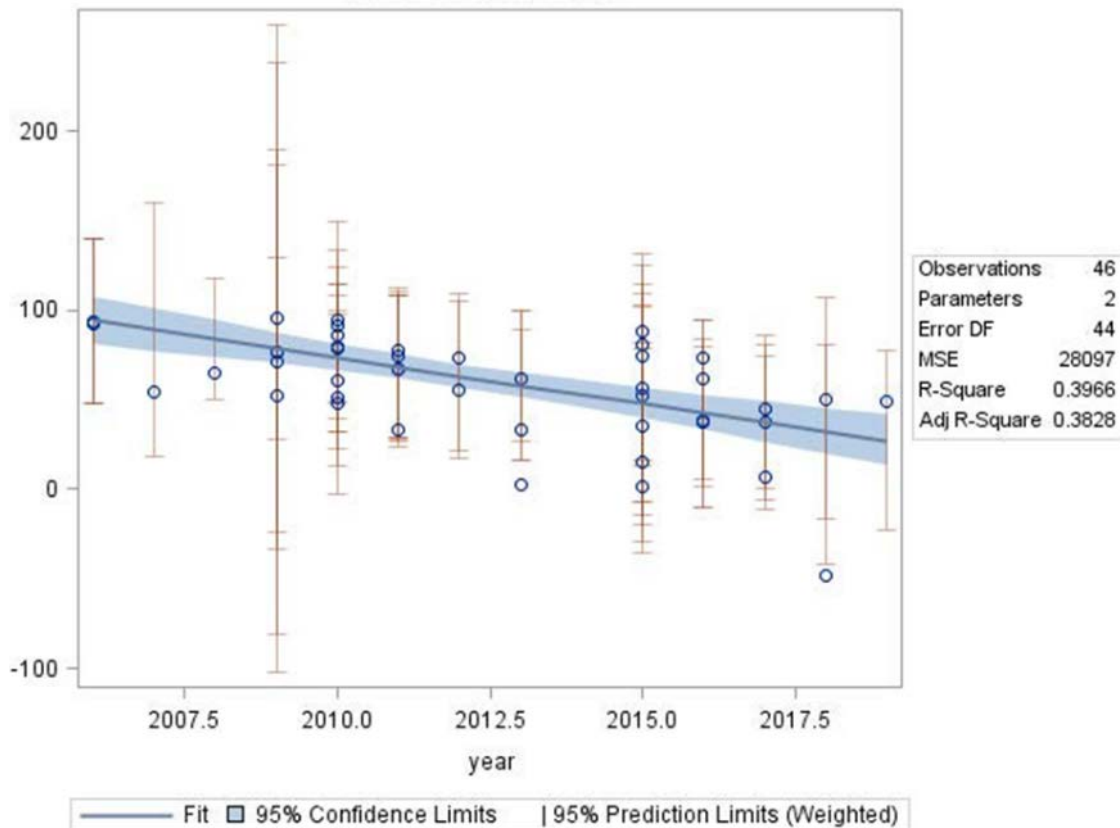
Furrow

Seed



# THRIPS - PERFORMANCE OF FOLIAR APPLICATIONS OF ACEPHATE AND SPINETORAM (RADIANT OR INTREPID EDGE) IN TENNESSEE 2005 - 2019

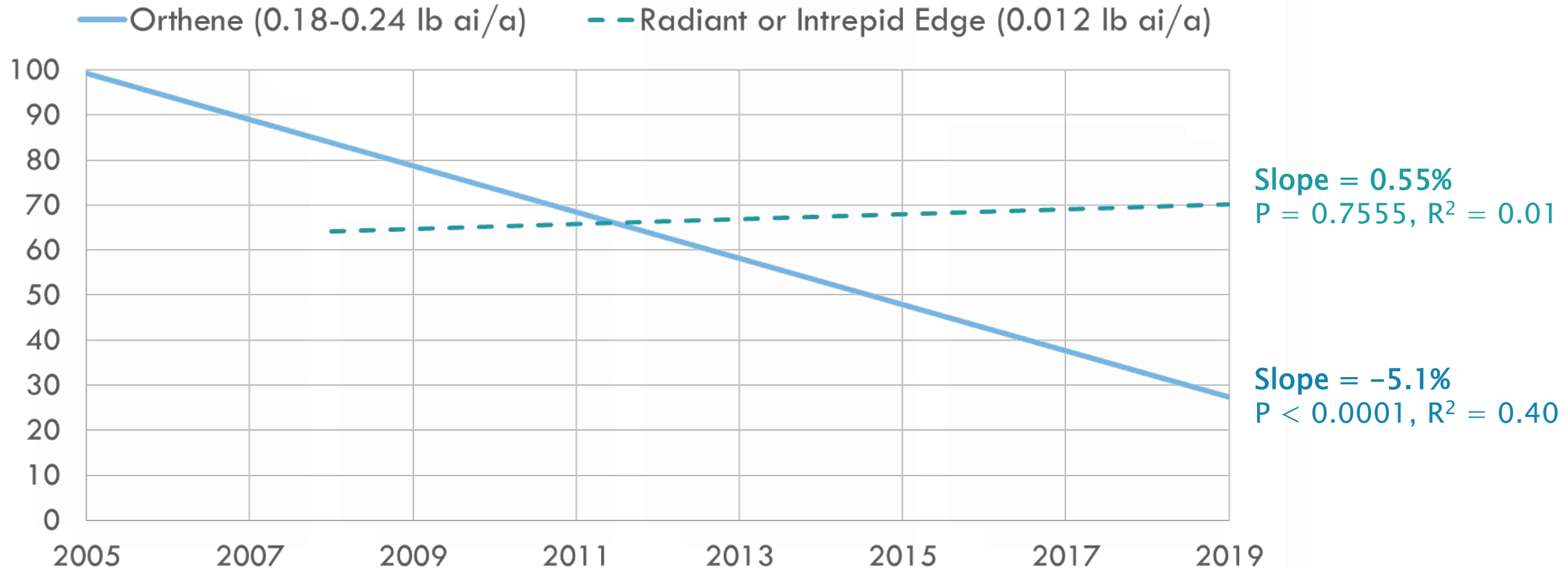
% Control With Acephate (0.18–0.24 Lb AI/A)    % Control With Spinetoram (0.012 Lb AI/A)





# THRIPS - PERFORMANCE OF FOLIAR APPLICATIONS OF ACEPHATE AND SPINETORAM IN TENNESSEE

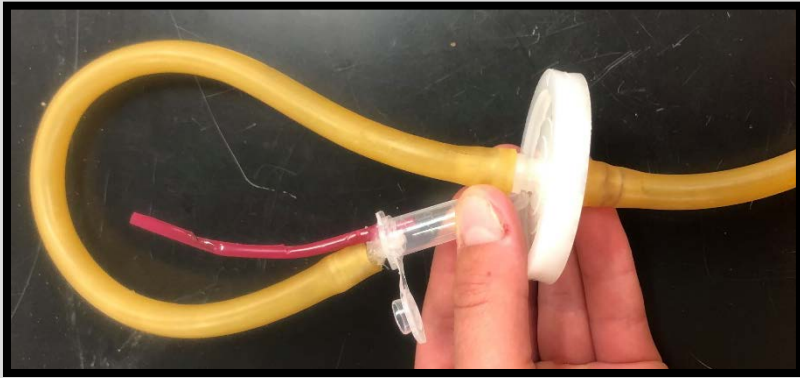
% Control of Thrips Over Time



# Leaf-Dip Bioassays

Thanks to Dr. George Kennedy for Suggesting This Approach

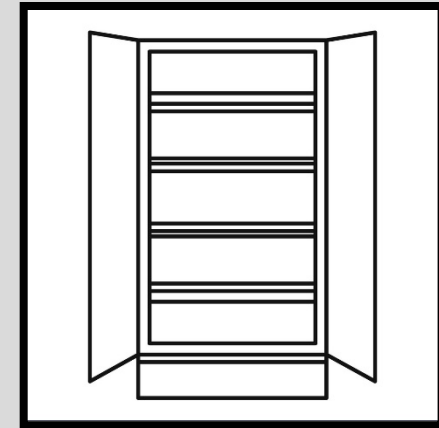
## Collect Thrips



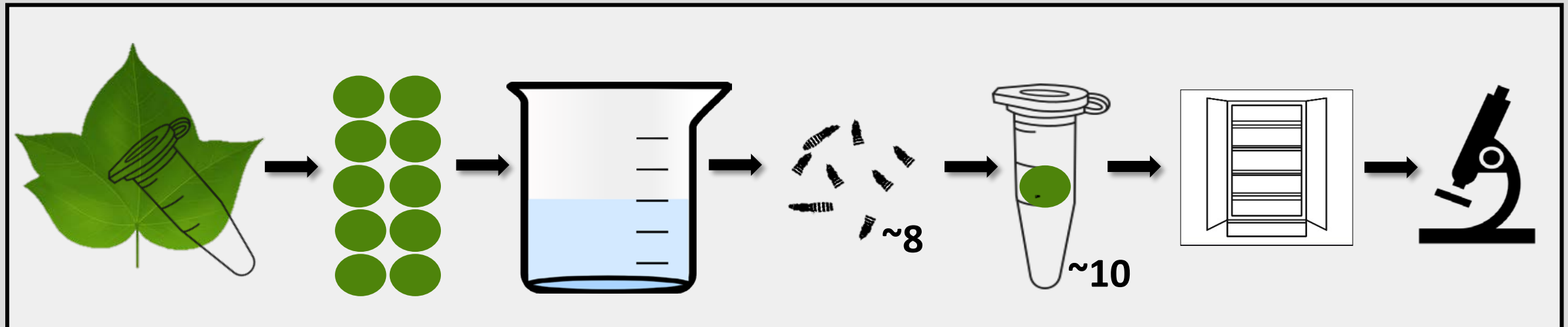
## Deliver or Ship



## Incubator

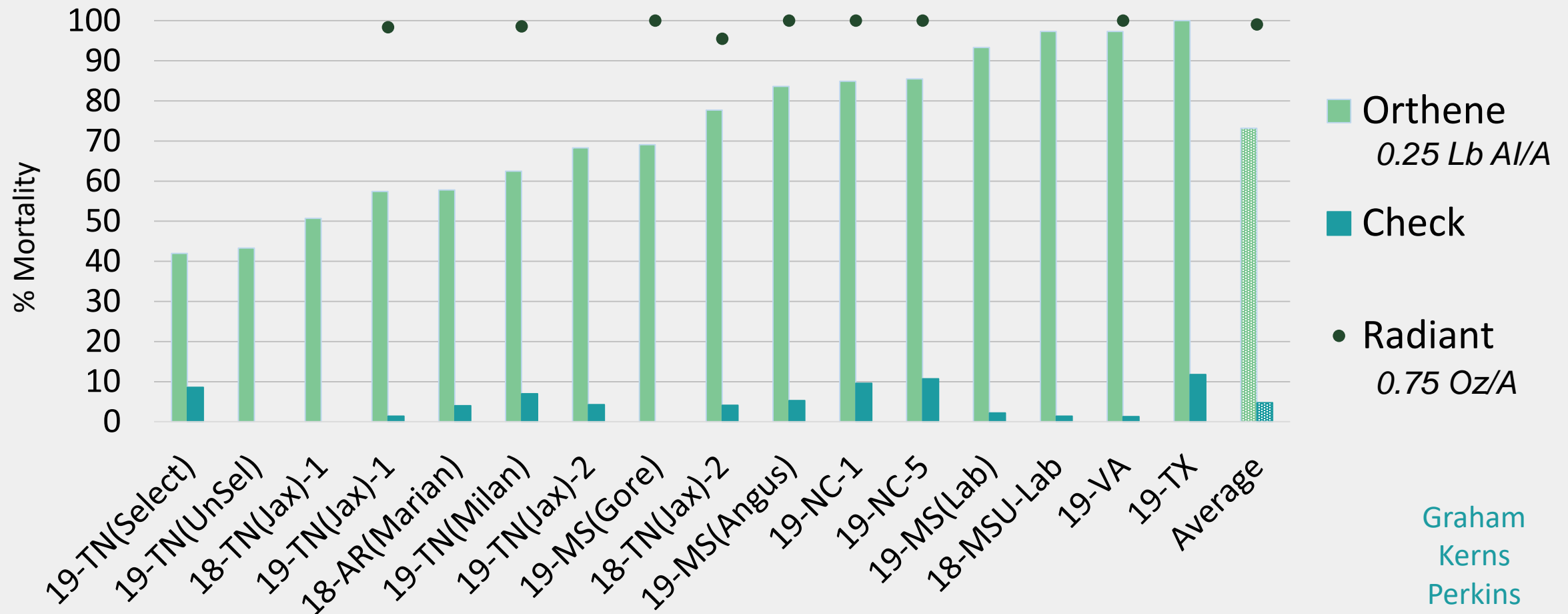


$28 \pm 1^\circ\text{C}$   
60-70% RH  
14:10 L:D



# Tobacco Thrips Leaf-Dip Bioassays, 2018 - 2019

## Adult Mortality at 24 Hours



# Tobacco Thrips Bioassays, 2020-2021 (Jessica Krob)

## Discriminating Dose Bioassays (All Populations)

2020 – Submitted Field Populations (F1 Generation)

2021 - Submitted Field Populations (F0 Generation)

## Dose-Response Curves for Acephate

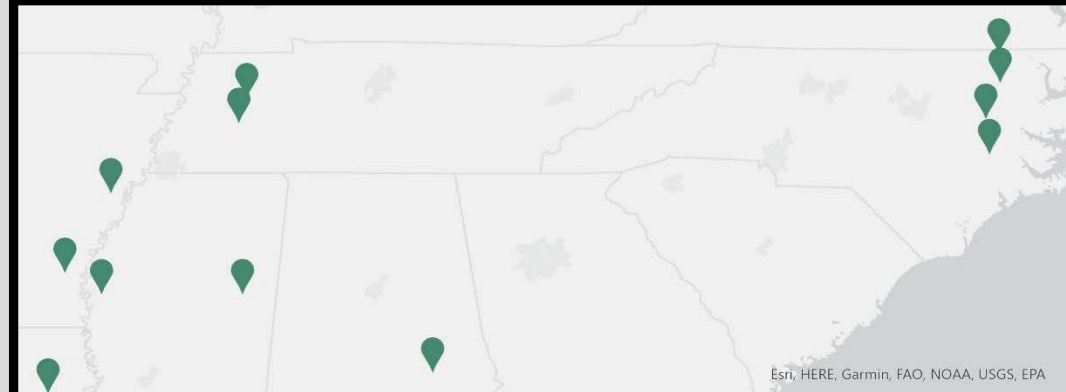
Tennessee Resistant

North Carolina Susceptible

## Data Analyses

Standard ANOVA/GLIMMIX/ PROBIT procedures using SAS<sup>®</sup> software ( $\alpha = 0.05$ )

## Thrips Populations (2020)



## Discriminating Doses

IRAC Class	Active Ingredient	g AI L <sup>-1</sup>
<i>Spinosyn</i>	Spinetoram	0.07
<i>Organophosphate</i>	Acephate	2.92
	Dicrotophos	1.5
<i>Pyrethroid</i>	Lambda-cyhalothrin	0.20
<i>Neonicotinoid</i>	Imidacloprid	0.54

# Standardized Field Trials (2020 and 2021)

## Field Trial Locations

Tennessee (2)  
Mississippi (2)  
Arkansas (2)  
Louisiana (1)  
Texas (1)

## Experimental Design

RCBD  
4 rows wide  
4 replications  
No IST



Esri, HERE, Garmin, FAO, NOAA, USGS, EPA

## Foliar Insecticide Treatments

IRAC Class	Active Ingredient	kg AI ha <sup>-1</sup>
<i>Spinosyn</i>	Spinetoram + (Methoxyfenozide)	0.01 0.07
	Spinetoram	0.01
<i>Organo-phosphate</i>	Acephate	0.23, 0.56
	Dicrotophos	0.22
	Dimethoate	0.23
<i>Pyrethroid</i>	Lambda-cyhalothrin	0.02

## Data Collection

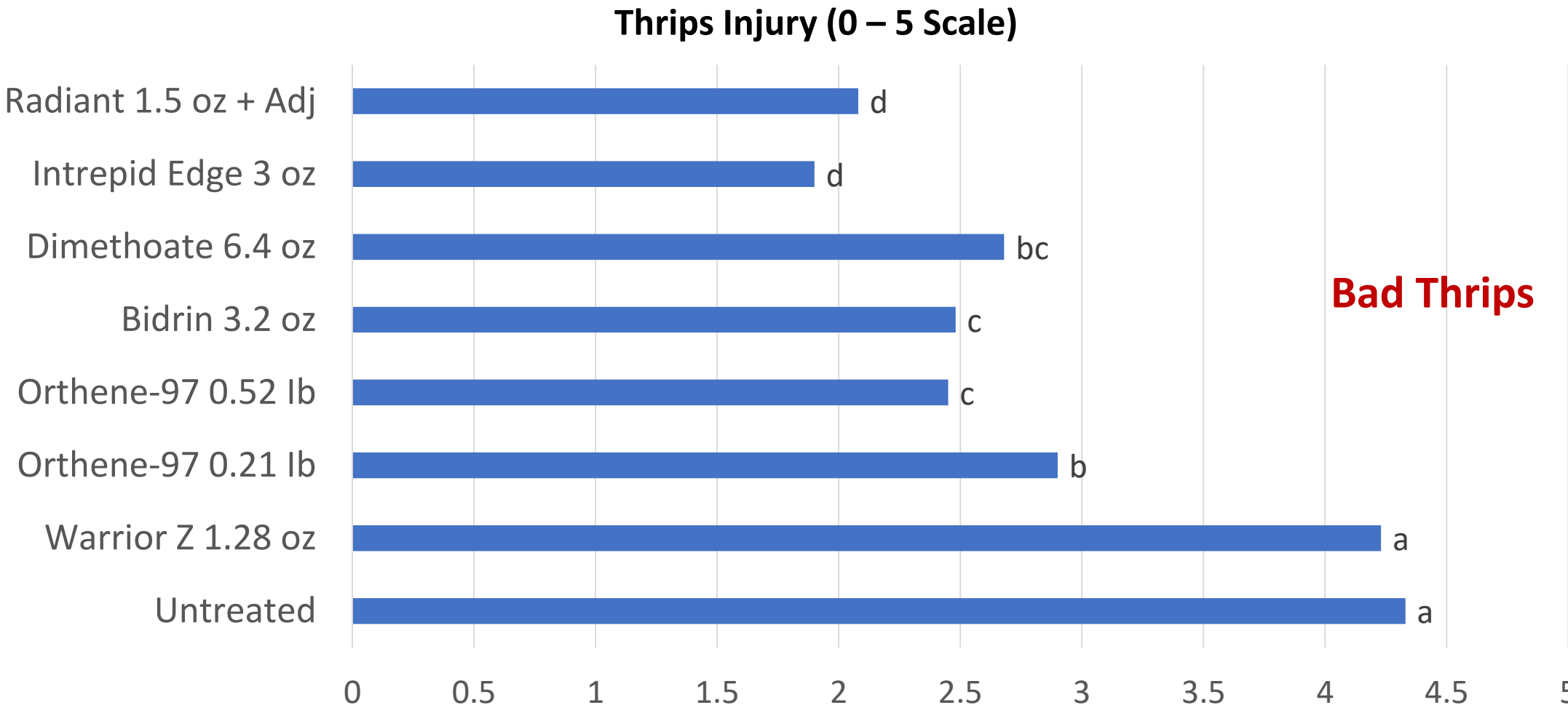
thrips numbers, visual thrips injury ratings,  
yield estimates

## Data Analyses

Standard ANOVA/GLIMMIX procedures  
using SAS<sup>®</sup> software ( $\alpha = 0.05$ )

# Thrips Injury in Foliar Insecticide Trial (Milan, 2020)

4<sup>th</sup> leaf after two insecticide applications, no insecticide seed treatment



401 5	402 4	403 3	404 6	405 1	406 3	407 2	408 7
301 6	302 7	303 2	304 1	305 8	306 5	307 4	308 3
201 2	202 3	203 7	204 5	205 4	206 8	207 1	208 6
101 1	102 2	103 3	104 4	105 5	106 6	107 7	108 8

Border - No IST or Foliar

Pyr

Chk

IE

Rad

Rad

IE

Chk

Pyr

IE

Rad

Pyr

Chk

Chk

IE

O-.25

O-.5

Bid

Dim

Rad

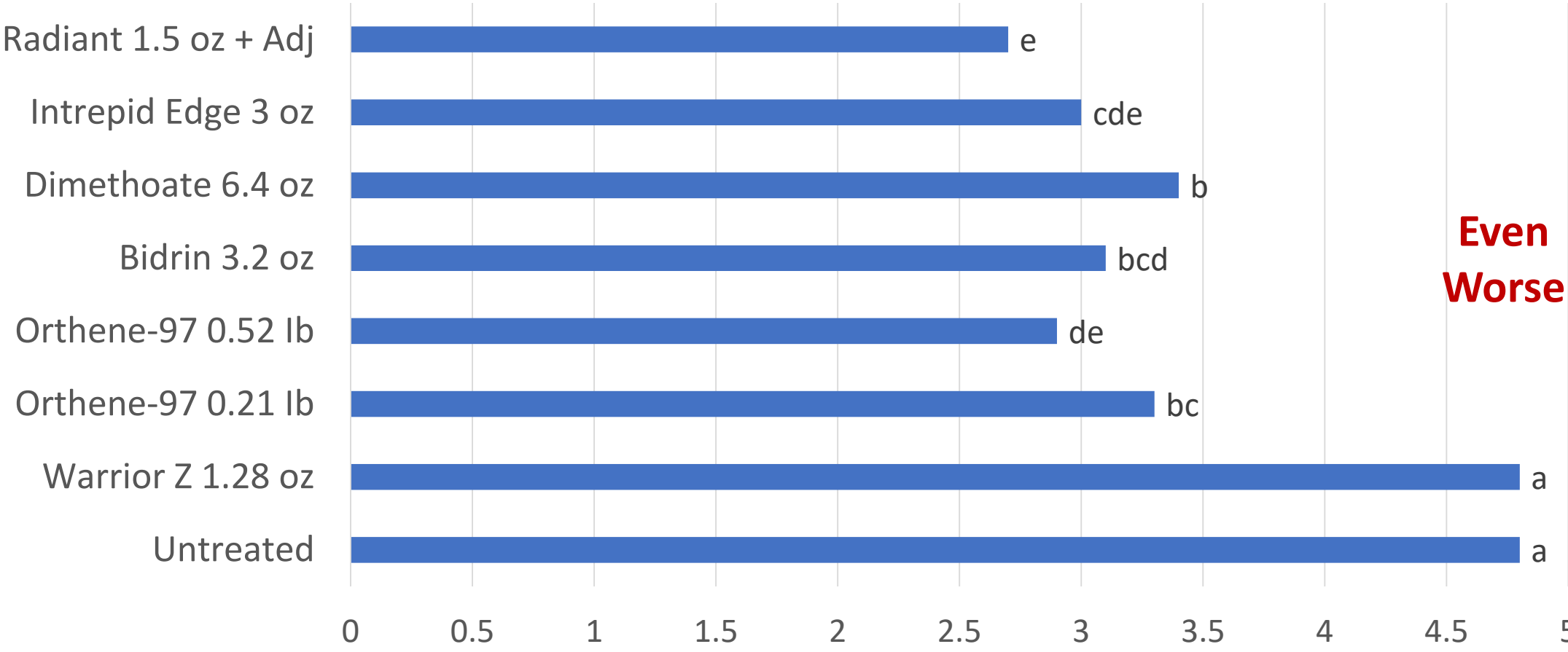
Pyr

Foliar applications at 1<sup>st</sup> and 2<sup>nd</sup> true leaf

# Thrips Injury in Foliar Insecticide Trial (Milan, 2021)

4<sup>th</sup> leaf after two insecticide applications, no insecticide seed treatment

Thrips Injury (0 – 5 Scale)



**Even  
Worse**





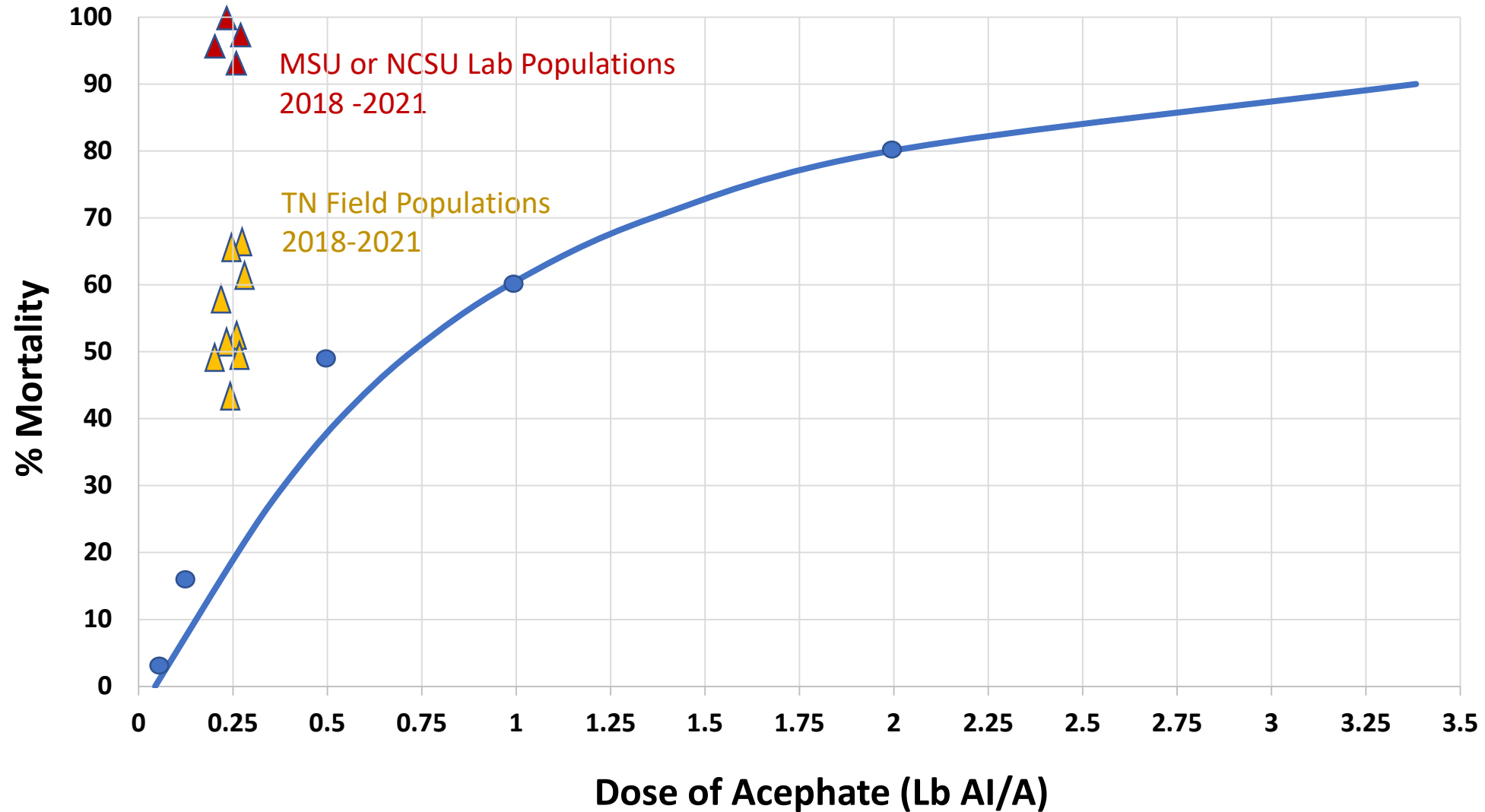
# Tobacco Thrips % Mortality (Leaf-Dip Bioassays)

Population 2020, 2021	Check	Spinetoram	Acephate	Imidacloprid	Lambda-cy.	Dicrotophos
		Radiant 0.75 Oz/A	Orthene 0.25 Lb/A	Admire Pro 1.25 Oz/A	Warrior 1.0 Oz/A	Bidrin 2 Oz/A
TN (WTREC)-1	3, 5	100	50	26	0	47
TN (WTREC)-2	3	100	47	42	3	74
TN (MREC)-1	6	100	67	42	2	64
TN (MREC)-Clover	3	100	46	35	0	-
AR (Mar., Tiller)	0	-	43, 67	-	-	-
MS (Starkville)	6	-	78	-	-	-
VA (Suffolk)	9	100	82	57	5	83
AL (Tallassee)	9	-	88	-	-	-
NC (Edgecombe)	0	100	97	-	-	-
NC (Nash)	0	-	93	-	-	-
NC (Plymouth)	2	100	94	-	4	-
NC (Lab)	0	93, -	99, 91	100, 94	100, 78	-
TX (Snook)	6	100, -	100, 93	-	50	-

# Tobacco Thrips Dose Response Curve (Acephate, 2021)

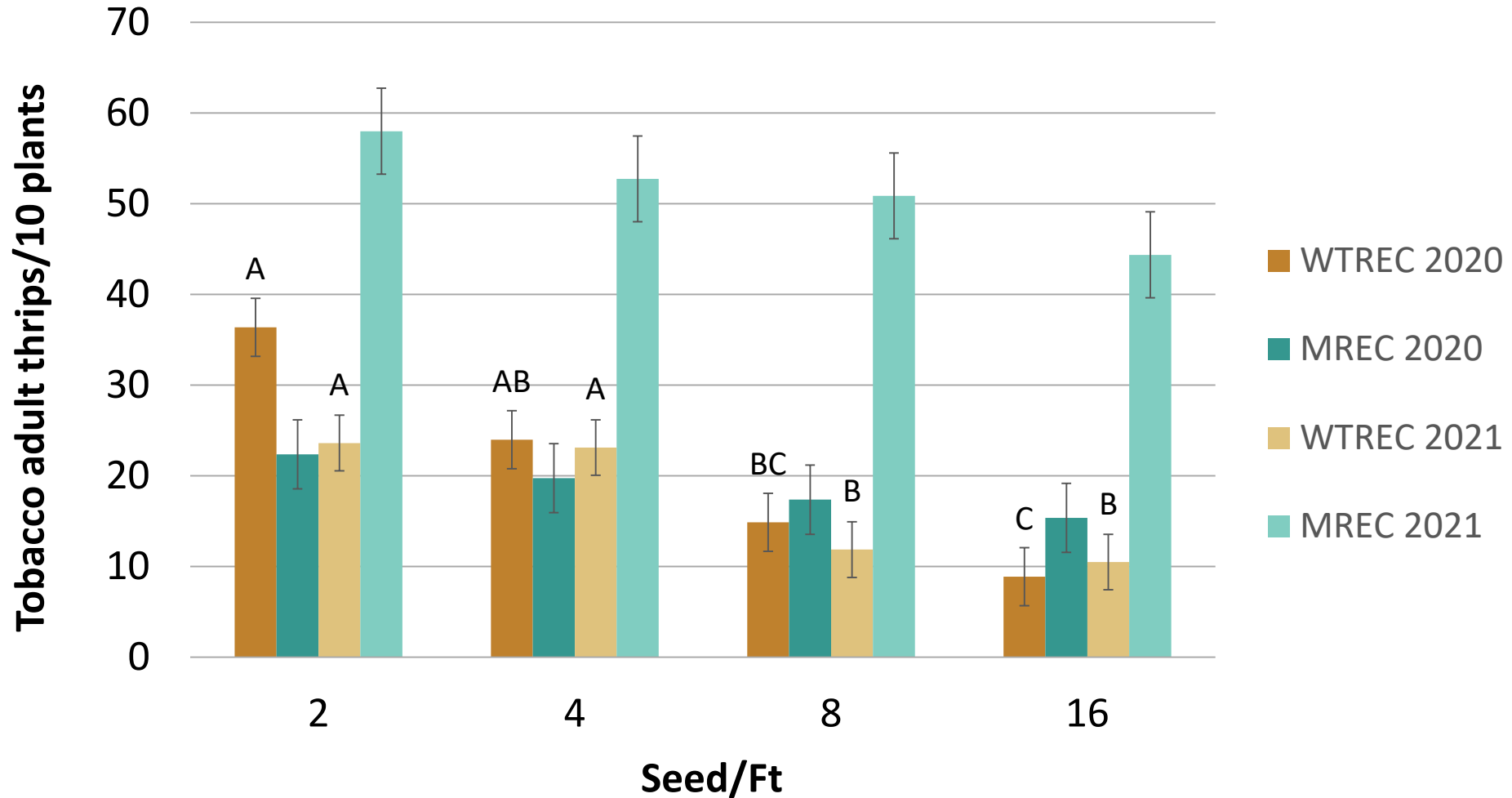
*Milan Clover Population Kept in Colony (F1)*

## Expected 24 h Mortality from Probit Analysis (Leaf-Dip Bioassay)

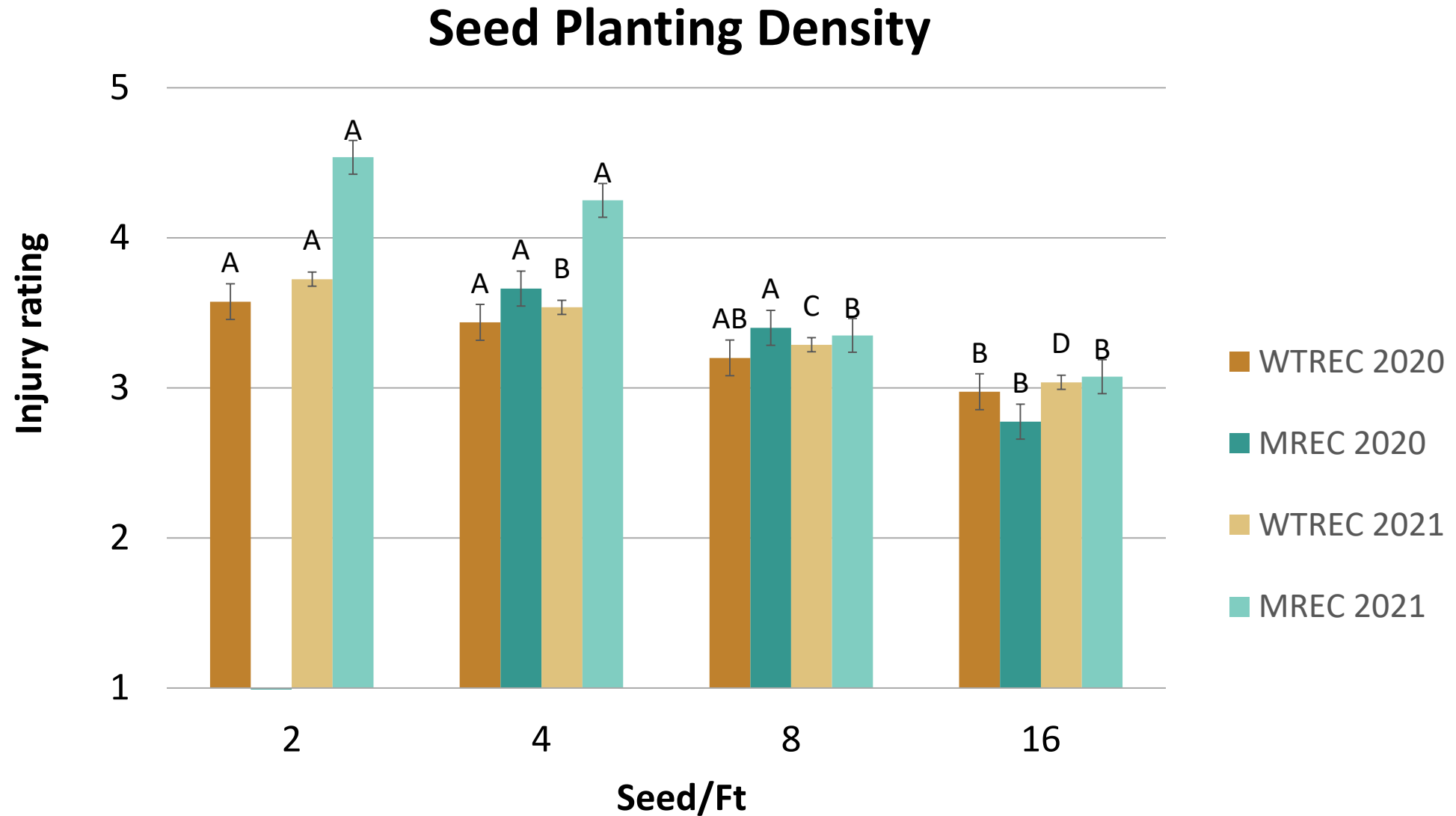


# Tobacco **Adult** Thrips (1-2 Leaf, 2020 and 2021)

## Seed Planting Density



# Thrips Injury on 4-Leaf Cotton (2020 and 2021)



# SOME TAKE HOME POINTS

Tobacco thrips have developed some level of resistance to acephate (and likely other OP insecticides)

- It isn't a problem everywhere (parts of the upper Mid-South)

Improvement with higher rates of Acephate (0.5 Lb)

- Bidrin at 3.2 Oz/A is a better option than Acephate at 0.25 Lb
- Spinetoram (Intrepid Edge or Radiant) is most consistent option when resistance is present, but you will not notice it all the time when using a seed trt, when thrips pressure is light, etc.

What I would do if I were me?

- Limp to the finish line (ThryvOn) – Use Bidrin (3.2 Oz/A), Acephate (0.5 Lb/A) ... or use Intrepid Edge (3 Oz/A) under very poor emergence and growing conditions
  - More aggressive and earlier than you think, don't cut seeding rates, use the 'thrips forecast model'