



RESISTANCE MANAGEMENT SOYBEAN FUNGICIDES

**LOUISIANA
TECHNICAL MANAGEMENT
CONFERENCE
February 16, 2012
Marksville, LA**





COLLABORATORS

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How Does This Happen??

***SELECTION PRESSURE
ON PATHOGEN, THIS INCREASES WITH
INCREASED # OF APPLICATIONS***

***GENETIC VARIABILITY
IN PATHOGEN POPULATION***

How Does This Happen??



SSSSSSSSSSSSSSSS ~~SSSSSSSSSSSSSSSS~~ RRRRRRRRRR
SSSSSS ~~SSSSSS~~ RRRRRR
SSSSSS ~~SSSSSS~~ RRRRRRRRRR
R SPRAY RRR SPRAY SSSS
SSSSSS ~~SSSSSS~~ RRRRRRRRRR
SSSSSS ~~SSSSSS~~ RRRRRR
SSSSSSSSSSSSSSSS ~~SSSSSSSSSSSSSSSS~~ RRRRRRRRRR

Types of Resistance

A white tractor pulling a large orange agricultural machine, possibly a harrow or tillage implement, through a field of green crops under a cloudy sky.

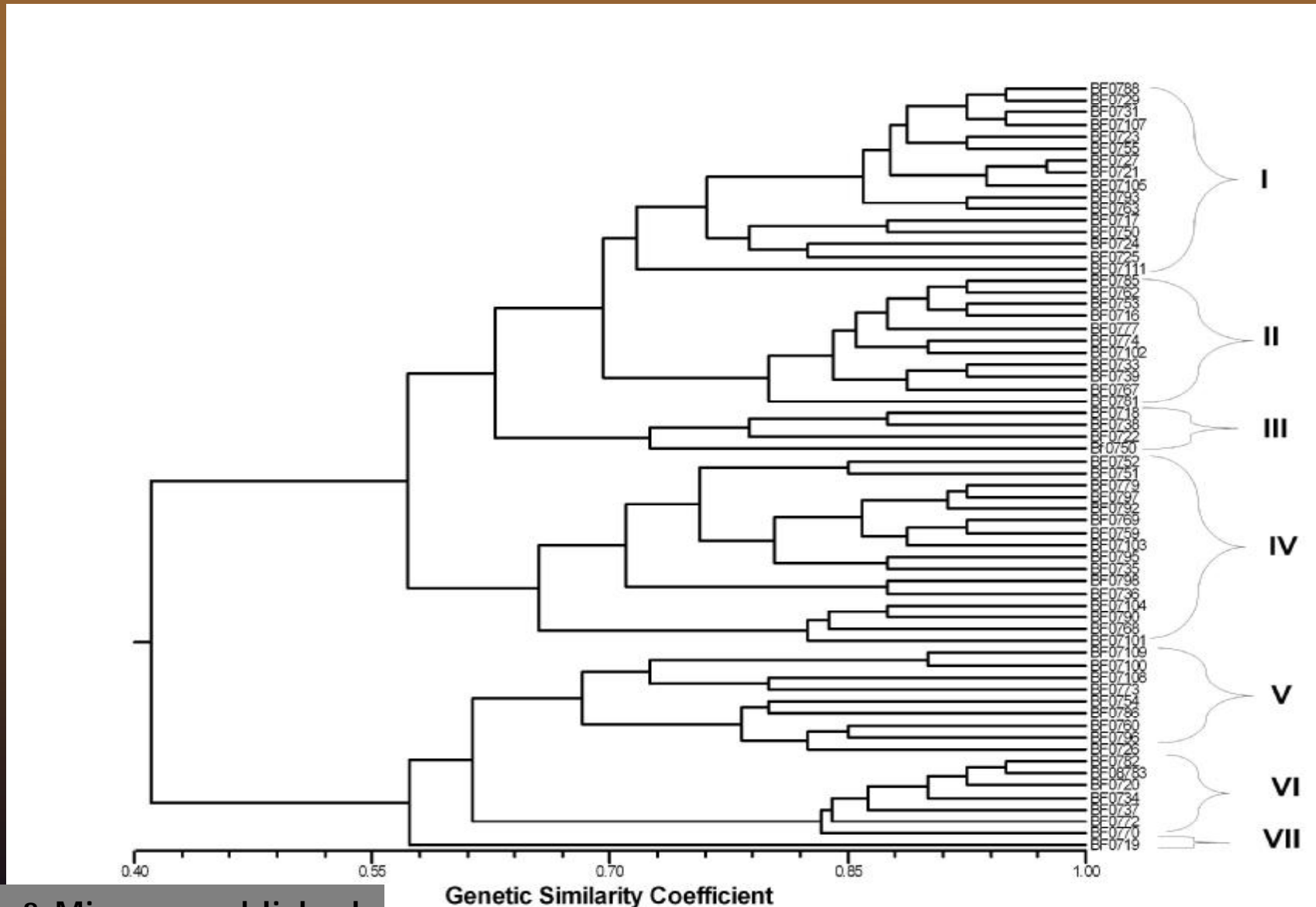
*QUALITATIVE (All or Nothing)
OR
QUANTITATIVE (Rate Dependent)*



**STROBILURIN
RESISTANCE**
Frogeye Leaf Spot
Cercospora sojina

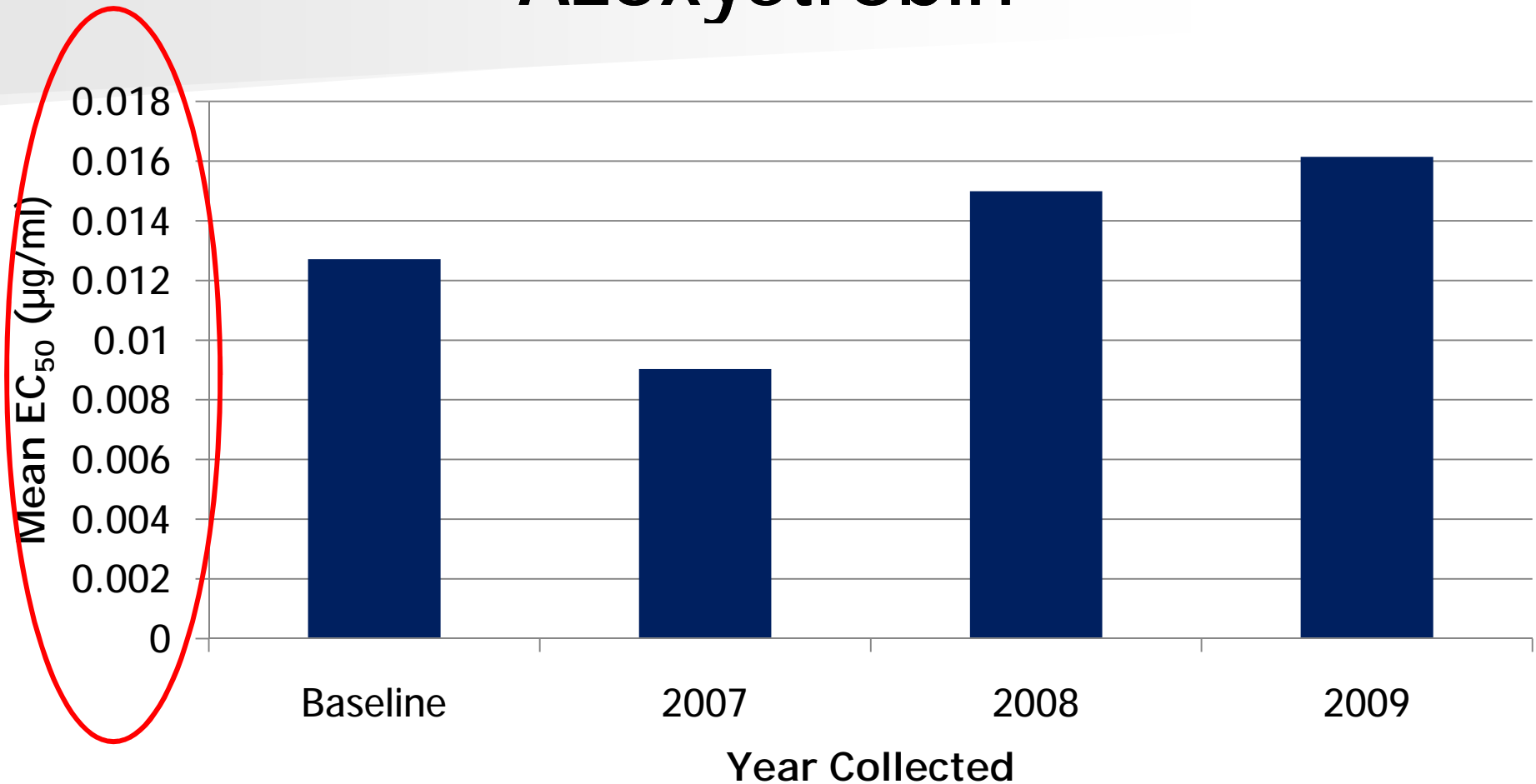


How Genetically Diverse is *Cercospora sojina*?



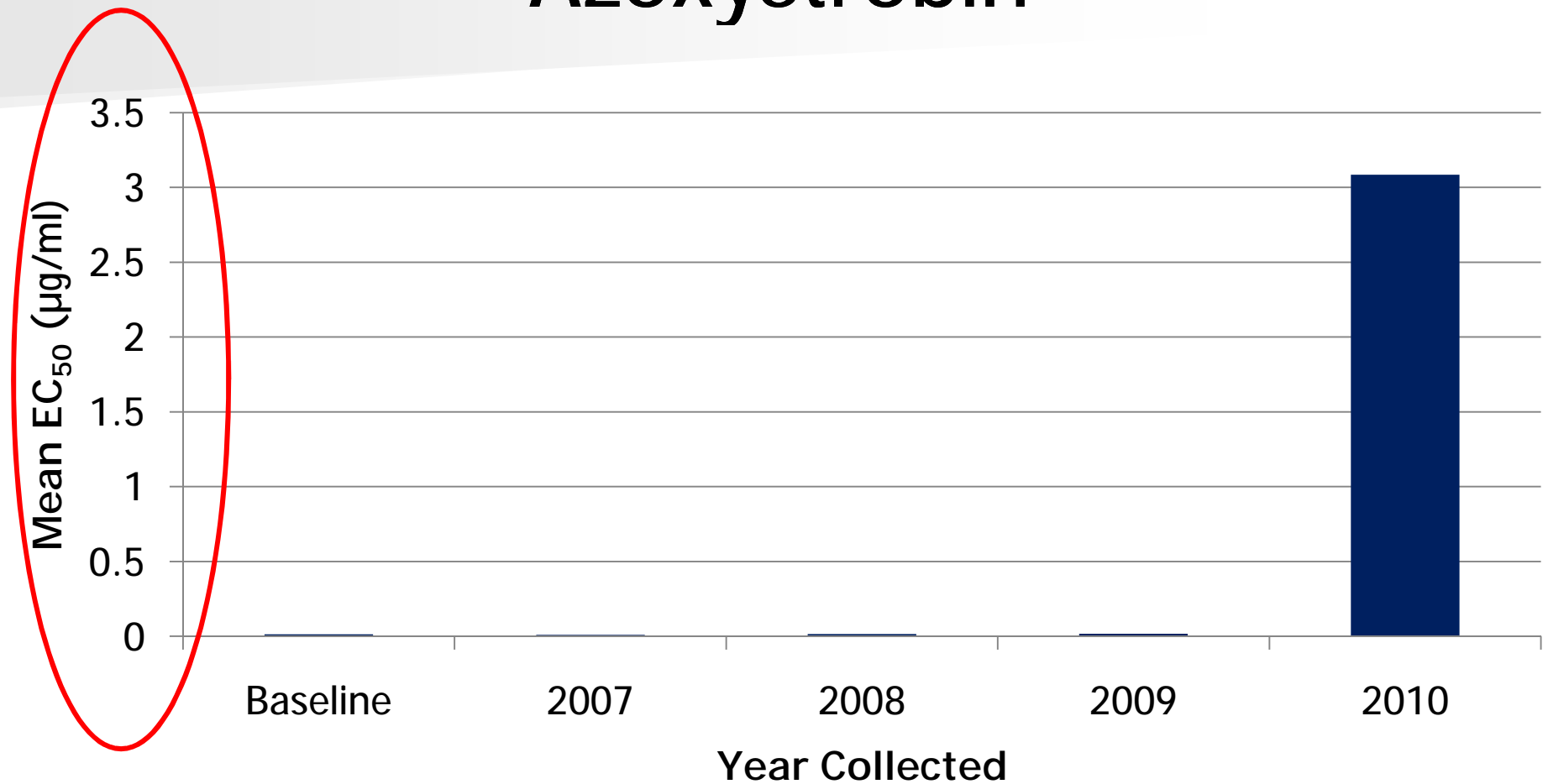
Bradley & Ming, unpublished

Evaluation of EC₅₀ levels across years Azoxystrobin



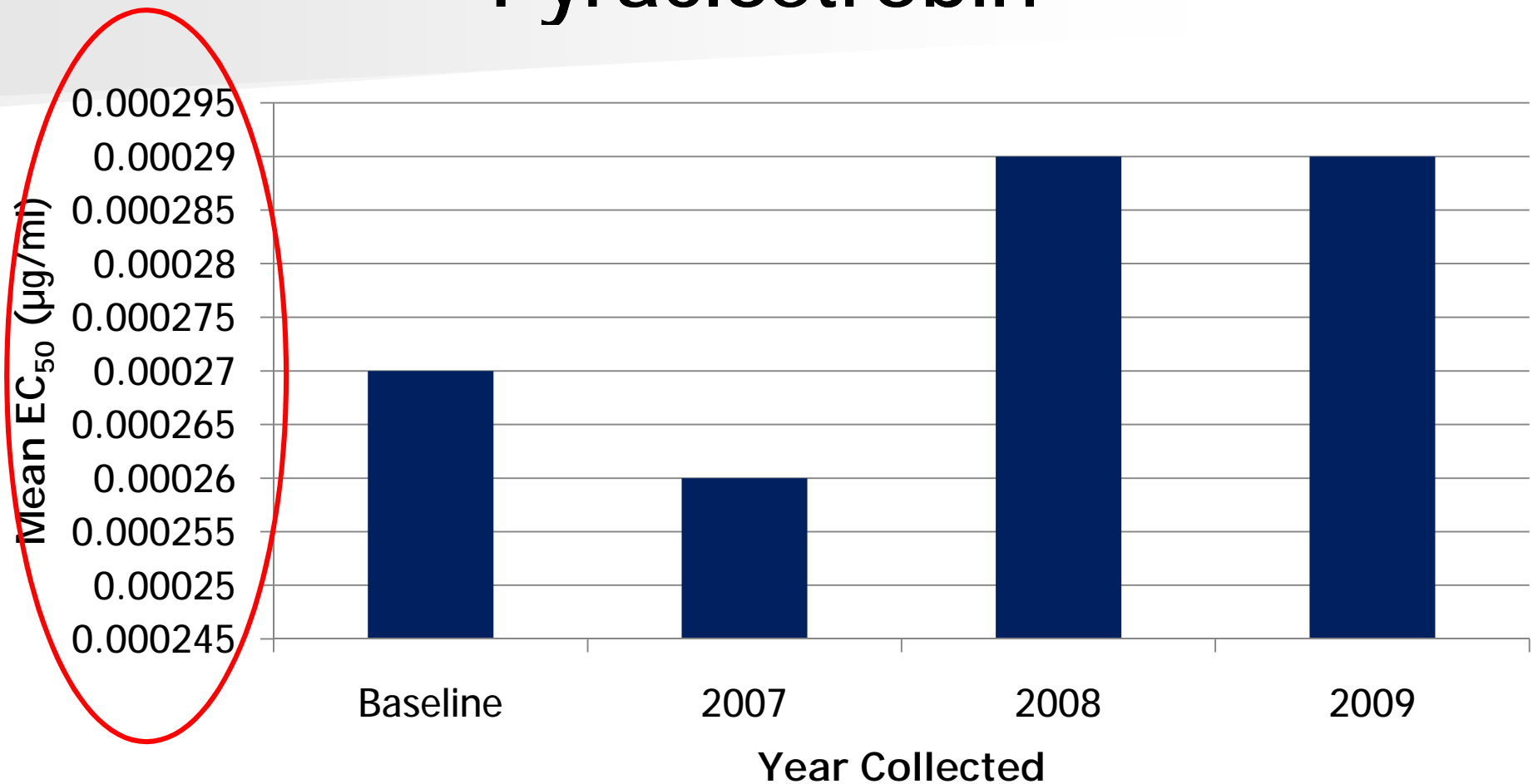
Courtesy of Dr. Carl Bradley – Univ of Illinois

Evaluation of EC₅₀ levels across years Azoxystrobin



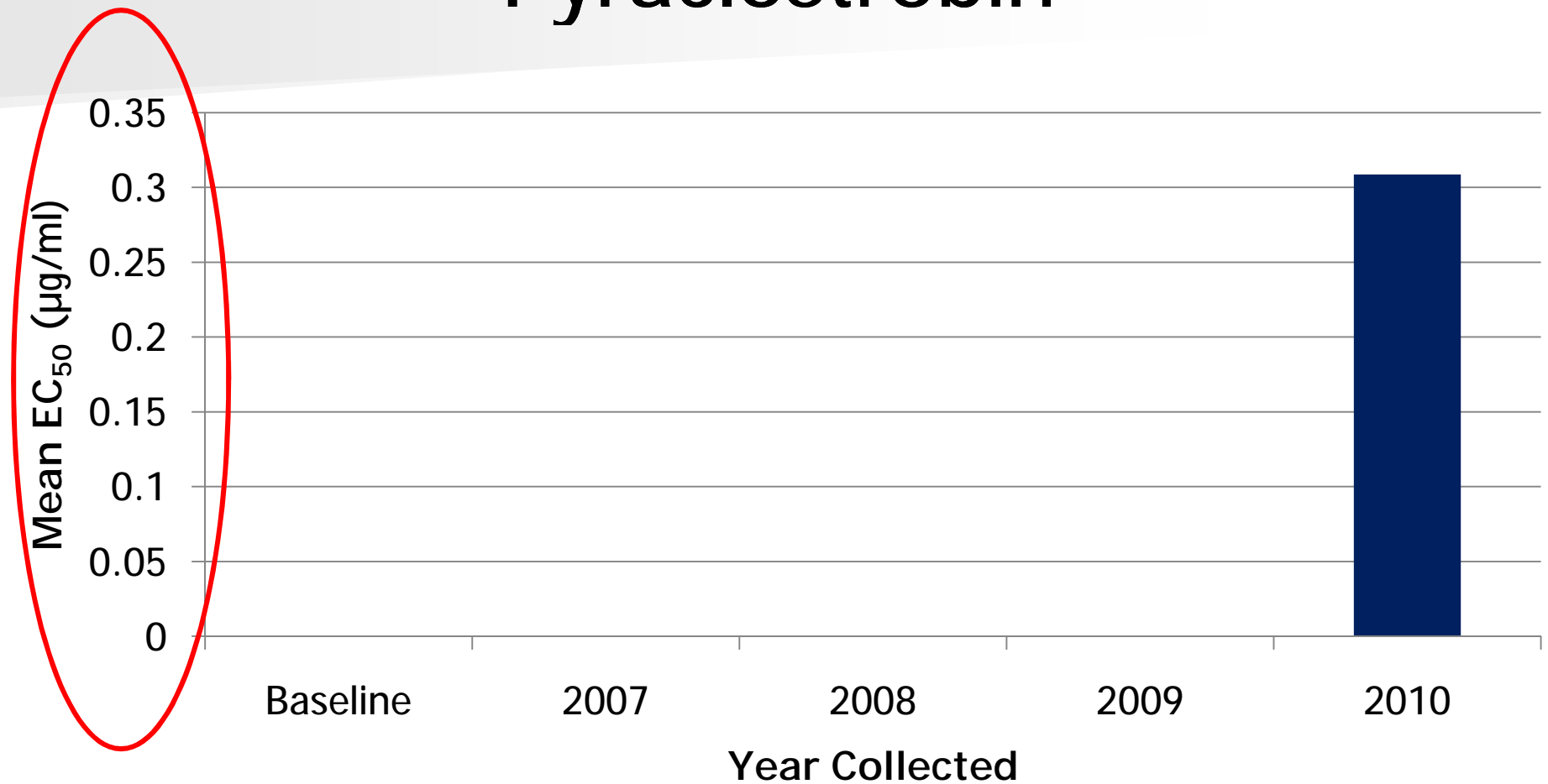
Courtesy of Dr. Carl Bradley – Univ of Illinois

Evaluation of EC₅₀ levels across years Pyraclostrobin



Courtesy of Dr. Carl Bradley – Univ of Illinois

Evaluation of EC₅₀ levels across years Pyraclostrobin



Courtesy of Dr. Carl Bradley – Univ of Illinois

Cercospora sojina strobilurin fungicide-resistant strains

State	County / Parish	Year(s) identified
Illinois	Gallatin	2010, 2011
	Pope	2010,2011
Kentucky	Caldwell	2010
	Calloway	2011
	Carlisle	2011
	Hickman	2011
	Livingston	2011
	Marshall	2011
Missouri	Pemiscot	2011
Tennessee	Dyer	2011
	Gibson	2010, 2011
	Lauderdale	2010, 2011
	Lawrence	2011
Louisiana	Pointe Coupee	2011
	Ouachita	2011

Courtesy of Dr. Carl Bradley – Univ of Illinois



CERCOSPORA BLIGHT

Cercospora kikuchii



ü Very Diverse Populations





2004 Concordia Parish

DP 5915 8-Apr / 30 Sep

Treatment (Rate/A)	Appl	13-Sep	1-Sep	% Def	Test wt	Yield bu/A
		CB 1-9	FE 1-9			
Nontreated	--	7.0	3.0	100	56	35
Headline (6.2 fl oz)	R4	4.0	2.3	50	54	42
Quadris (6.2 fl oz)	R4	5.2	2.8	75	56	40
Quadris (3.0 fl oz) + Topsin-M (0.5 lb)	R4	5.0	2.8	75	55	40
TM 85 (0.6 lb)	R4	5.8	3.2	80	57	36
Topsin-M (0.75 lb)	R4	5.0	2.5	95	56	38

RMSB0401

2006 Berken Farms Demonstration

Treatment (fl oz product/A)	GS @ Appl ¹	Sep-18 AB (0-9)	Sep-18 CB (0-9)	Oct-9 Yield bu/A
Non-treated #1	--	6	6	33.0
Non-treated #2	--	6	7	32.4
Quadris 2.08SC (6.0)	R4	3	5	42.0
Headline 2.08EC (6.0)	R4	3	4	45.0
Stratego (10.0)	R4	4	5	41.1
Quilt 1.67SC (14.0)	R4	1	3	43.2
Domark 1.9ME (5.0)	R4	5	6	34.3

David Lanclos / Allen Hogan / Donald Berken

2009 Soybean Fungicide Trial

Dean Lee RS, Alexandria, LA

Treatment (fl oz/A)	GS @ Appl	10-Sep CB (1-9)	25-Sep % PD	17-Sep % GS	Yield bu/A
Non-treated	--	6.1	41.3	13.7	65.5
Quadris (6.0) + COC (1%)	R3	5.3	45.0	33.9	65.6
Quadris (6.0) + COC (1%)	R5	5.4	40.0	22.6	67.2
Quadris (6.0) + COC (1%)	R3R5	5.4	33.8	42.5	66.4
Leadline (6.0) + NIS (1/4%)	R3	5.4	42.5	15.0	65.0
Leadline (6.0) + NIS (1/4%)	R5	5.4	43.8	14.0	62.2
Leadline (6.0) + NIS (1/4%)	R3R5	5.4	38.8	20.1	64.8
LSD (P=0.05)	--	1.0	8.0	22.2	4.3

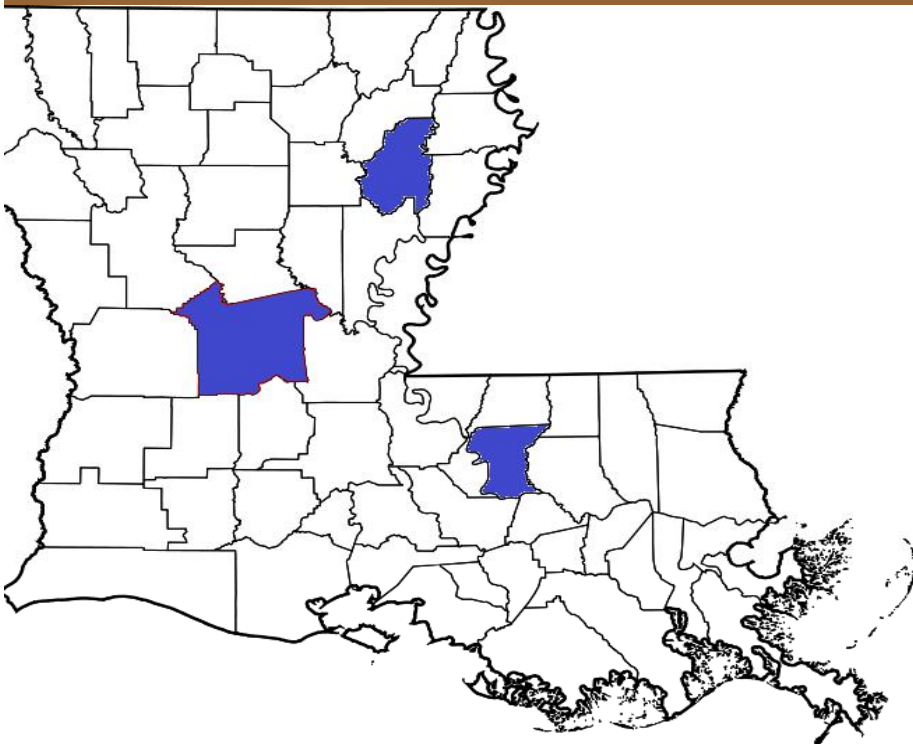
2011 Macon Ridge

Treatment (fl oz/a)	GS @ Appl	12-Sep CB (1-9)	% Purple	% Damage	3-Oct bu/A
Non-treated	--	6.3	0.3	4.8	38.6
Approach (6) ¹	R3	5.3	0.5	7.8	42.8
Approach (9) ¹	R3	5.3	0.3	5.8	44.7
Headline (6) ¹	R3	5.0	0.0	2.0	40.9
Evito (2) ²	R3	5.5	0.5	4.8	43.3
Evito T (4) ²	R3	5.8	0.0	4.0	43.9
LSD (P=0.05)	--	1.1	0.8	4.4	4.7

¹Treatments contain Induce @ 0.25% v/v.

²Treatments contain Basic Blend @ 0.125% v/v.

Current Studies – thiophanate-methyl



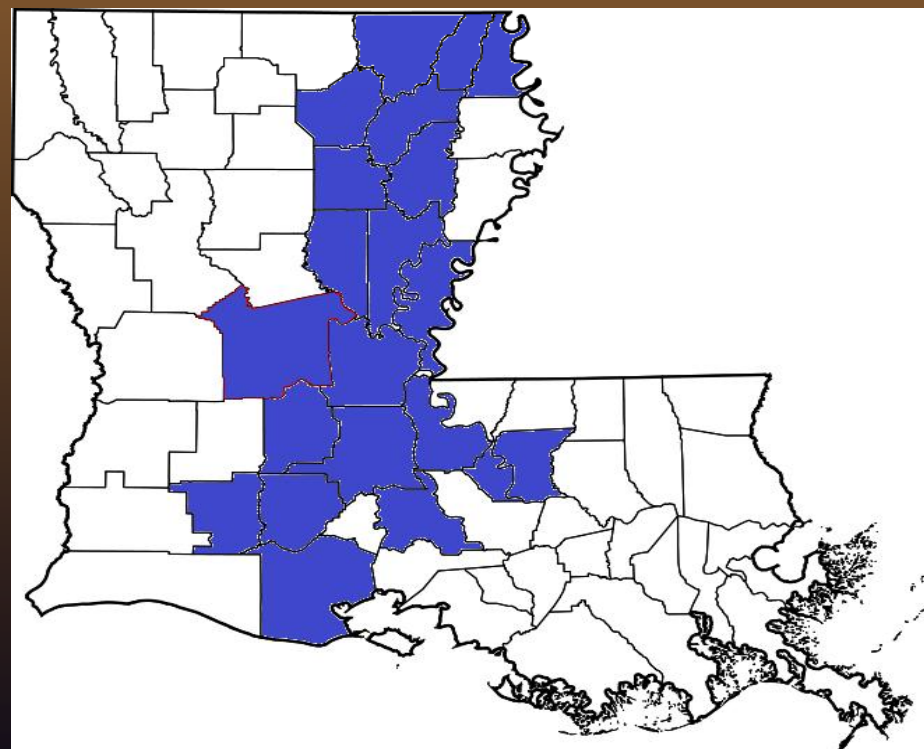
Year 2000 Isolates

- 3 Parishes
- 176 isolates (seed and foliar)
- Discovered in storage on campus

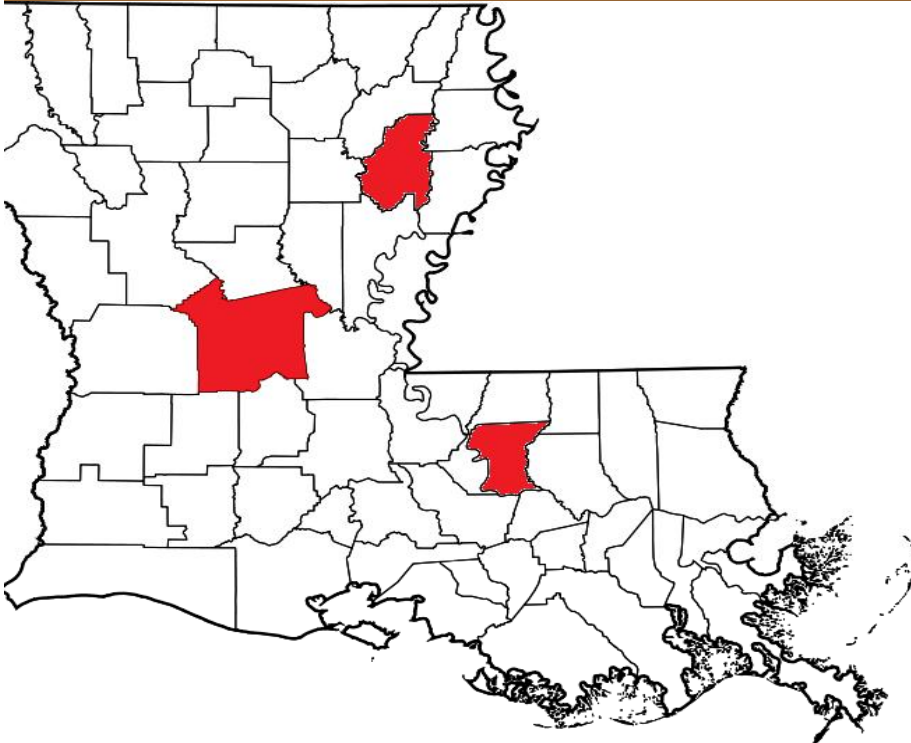
*Discriminatory Dose = 5 $\mu\text{g}/\text{ml}$
Technical Product

Year 2011 Isolates

- 21 Parishes
- 160 isolates (foliar)
- Single-Spore isolates



Confirmed thiophanate-methyl Resistance



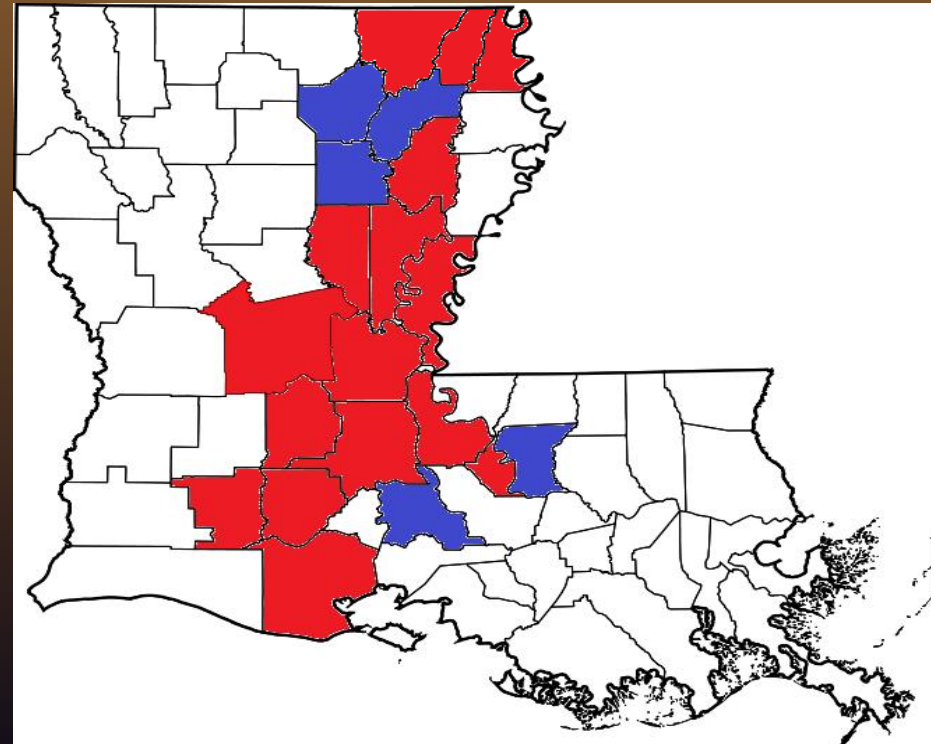
Year 2000 Isolates

- 3 of 3 Parishes confirmed
- 23.3% of 176 isolates resistant

*Discriminatory Dose = 5 $\mu\text{g}/\text{ml}$
Technical Product

Year 2011 Isolates

- 16 of 21 Parishes confirmed
- 44.8% of 160 isolates resistant

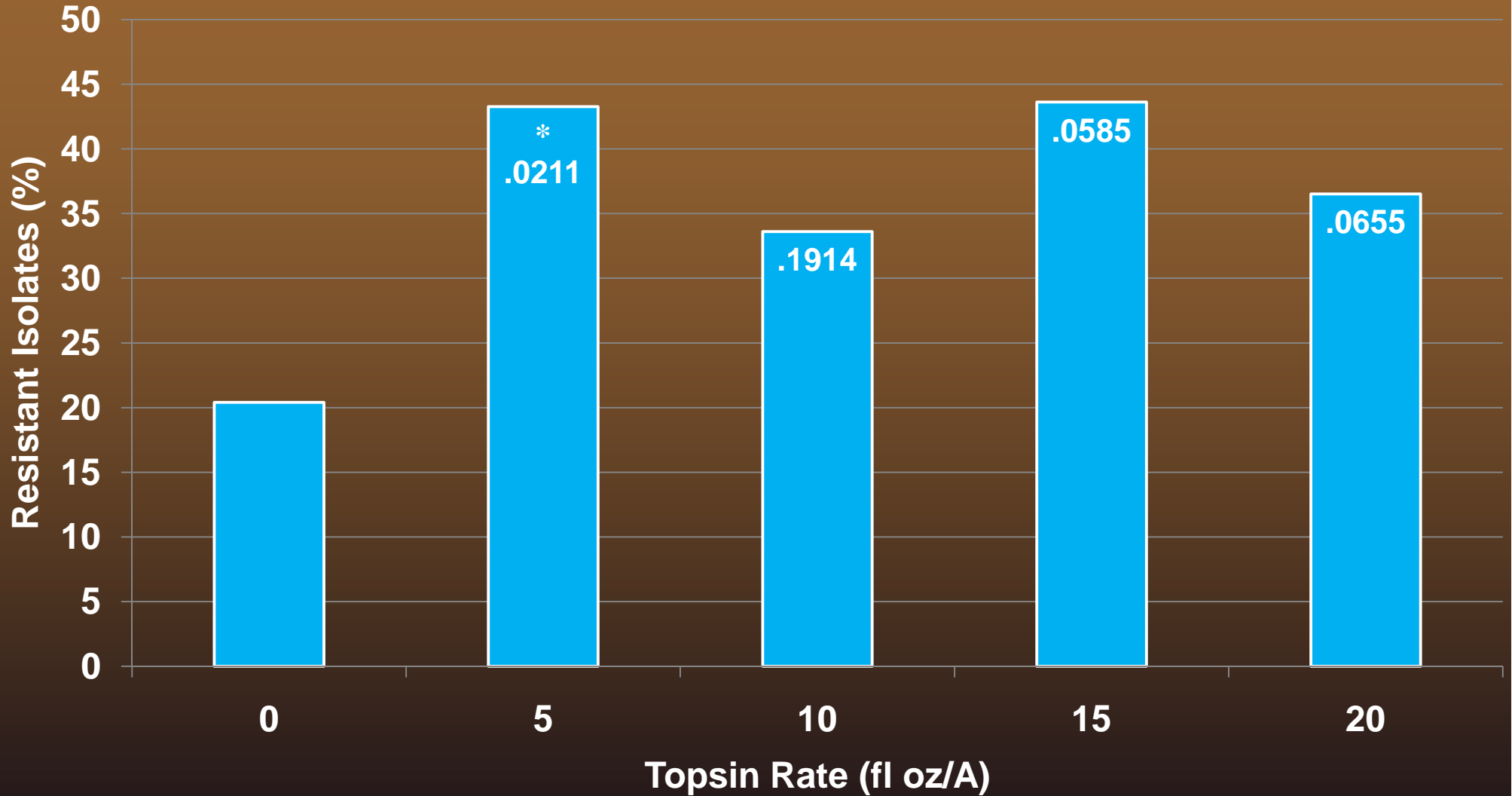


Comparison of thiophanate-methyl Resistance by Year



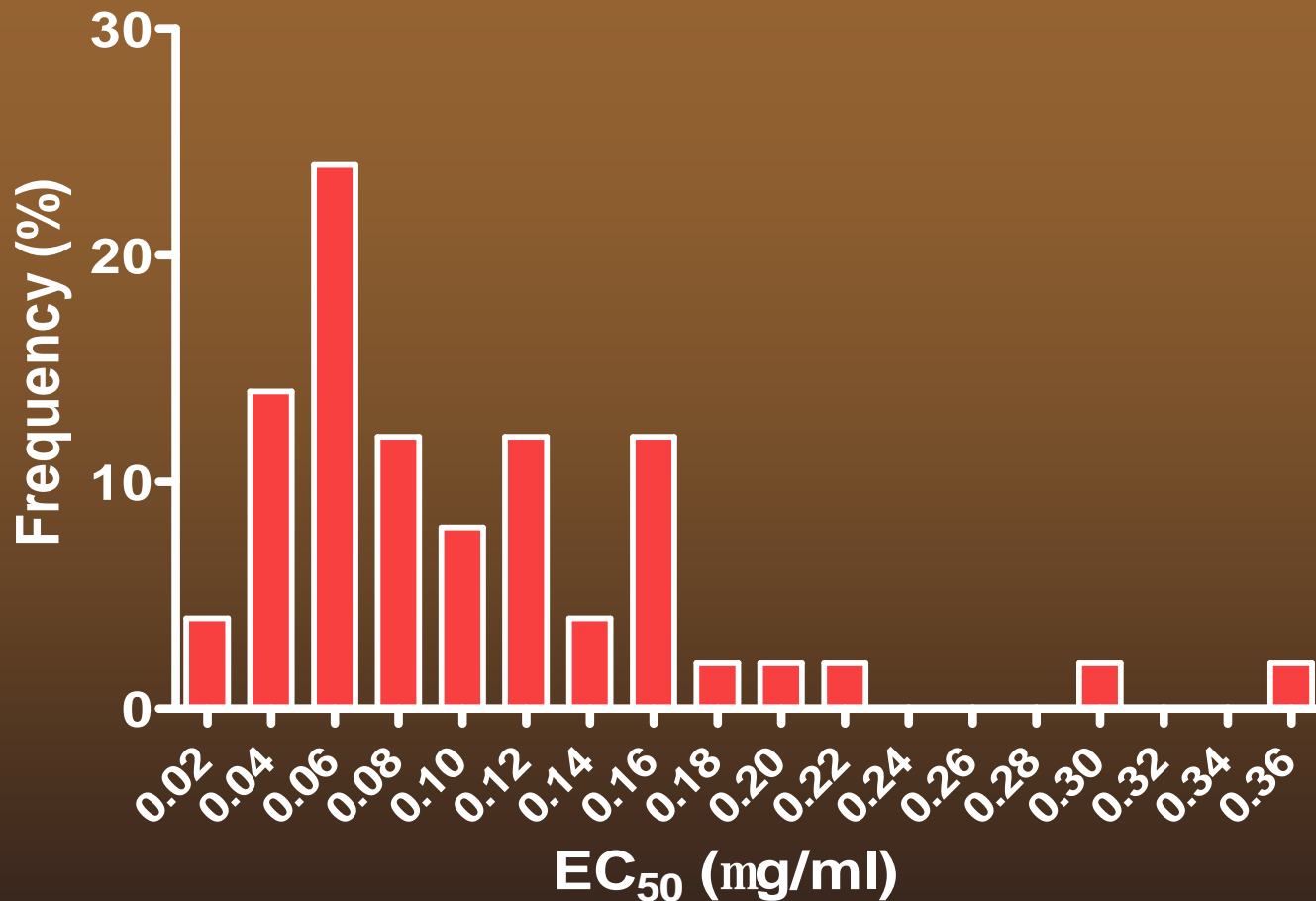
Proportions of resistant isolates were dependent on year (d.f.=1; $\chi^2=15.9811$; $P=<.0001$).

Effect of Application Rate on Proportion of Resistant Isolates



Significant at $\alpha=0.05$. Data were analyzed using PROC MIXED and means were compared with the no-treated control using Dunnett's post hoc adjustment.

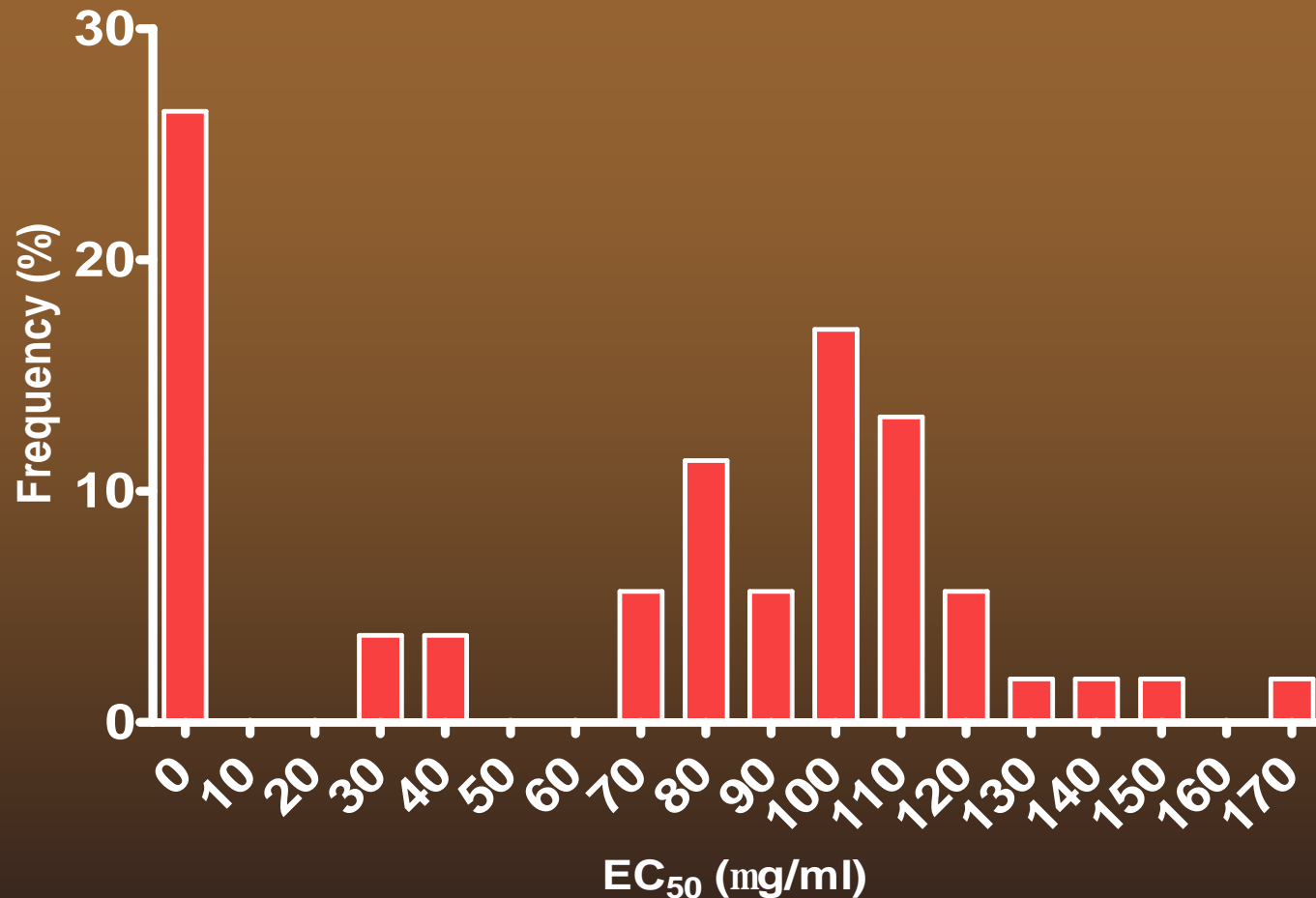
C. kikuchii Baseline Sensitivity (azoxystrobin)



EC_{50} = the concentration of fungicide that inhibits 50 percent of radial growth.

EC_{50} values determined by linear interpolation from relative differences in radial growth on P₁ amended with azoxystrobin at concentrations of 0, .0001, .001, .01, .1, 1, and 10 μ g/ml (GraphPad Prism)

C. kikuchii 2011 Sensitivity (azoxystrobin)



EC₅₀ = the concentration of fungicide that inhibits 50 percent of radial growth.

EC₅₀ values determined by linear interpolation from relative differences in radial growth on P₁ amended with azoxystrobin at concentrations of 0, .0001, .001, .01, .1, 1, and 10 µg/ml (GraphPad Prism)

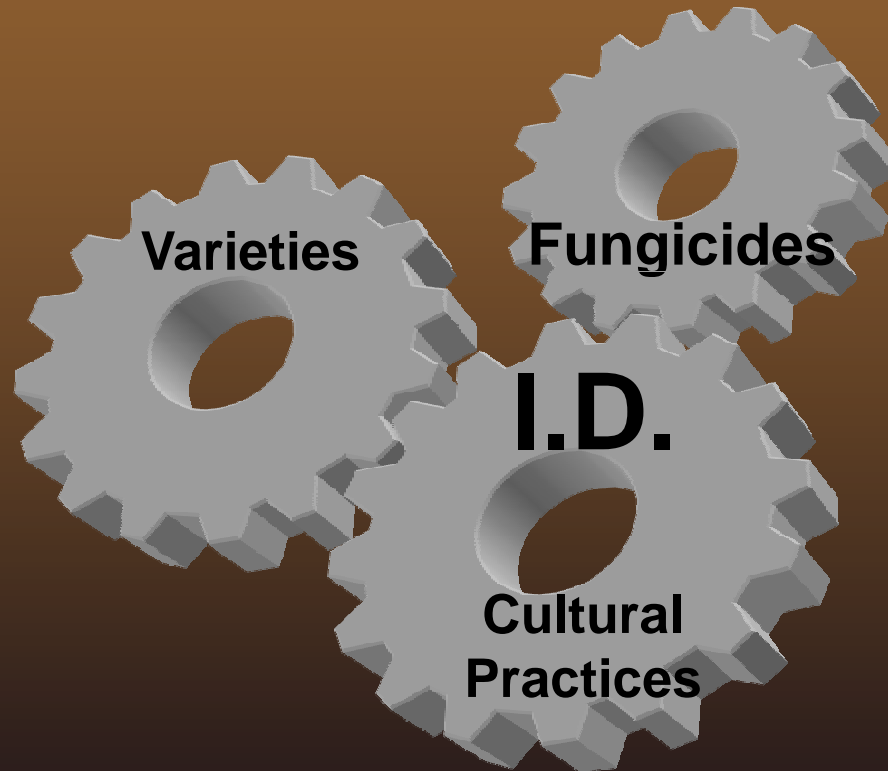


RESISTANCE MANAGEMENT



Effective Disease Management

*Gotta Have
All the Parts*



*Working
Together*



UNIVERSITY VARIETY EVALUATIONS



**Naturally-Occurring
Diseases**

**CHOOSE VARIETIES
TESTED IN THE REGION
OF THE STATE
WHERE YOU FARM !!!!**

2005 Variety Evaluations

Variety	Jeff Davis CB (1-9)	Macon Ridge CB (1-9)
Delta King 5161	2.0	8.3
Dyna-Gro 33B52	7.0	8.3
Asgrow 5903	4.0	7.8
Terral 56R12	3.0	8.5

Allen Hogan, County Agent

2010 LSU AgCenter Variety Evaluations

Variety	Dean Lee CB (1-9)	Macon Ridge CB (1-9)
Asgrow 5503	2.0	5.5
Asgrow 5606	5.0	4.5
Delta Grow 5970RR	3.0	3.0
Delta King 1534	7.0	7.0
Dyna-Gro 35F53	5.0	8.0
Pioneer 95M82	4.0	5.0
Terral 55R20	5.0	7.0
Terral 59R16	3.0	5.0



Developing An Effective Disease Management Program

- ü **Disease I.D.**
- ü **Genetic Resistance**
- ü **Cultural Practices**
- ü **Fungicides**



Developing An Effective Disease Management Program



- ü Disease I.D.
- ü Genetic Resistance
- ü Cultural Practices
- ü Fungicides



Application Strategies



- ü Rotation
- ü Premixes
- ü Multiple MOA
- ü NO REDUCED RATES!!!



Application Considerations



ü Coverage

ü Setup

ü Timing

ü Fungicide

APPLICATION TIMING

R1 (1st Flower) Probably Another Application

R3 (Pod Initiation) Usually Best on Foliar Diseases

R4 (Pod Elongation) Pod and Foliar Diseases, Residual Could Run Out

R5 (Seed Initiation) Best on Pod Diseases

Disease Management

A white tractor with a large orange sprayer tank and long boom is operating in a green field under a cloudy sky. The tractor is positioned in the middle ground, moving from left to right. The field is filled with dense green crops, likely soybeans. The sky is overcast with grey clouds.

***A BAD APPLICATION WITH A
GOOD FUNGICIDE***

=

Undesirable Results

Thank You!!!!

- *Producers*
- *Co-workers*



*Louisiana Soybean
and Grains Research
and Promotion Board*





Celebrating Excellence in Research



In 2012, we celebrate 125 years of research excellence at the LSU AgCenter through the Louisiana Agricultural Experiment Station, which was established in 1887. That was the year Congress passed the Hatch Act, which provided federal funding to support agricultural experiment stations at the nation's land-grant colleges. The year 2012 also is the 40th anniversary of the LSU AgCenter, which was established in 1972.



LSUAgCenter.com

2003 Fungicide Evaluations

Group V / Macon Ridge

Treatment (fl oz/A)	GS	11-Sep CB ¹	2-Oct % PD	Yield bu/A
Non-sprayed	---	6.3	26.3	54.5
Headline (6.1)	R3	4.0	8.0	60.7
Headline (6.1)	R5	3.5	5.0	51.7
Headline (6.1)	R3/R5	3.0	3.8	56.9
Quadris (6.2)	R3	5.3	12.5	64.2
Quadris (6.2)	R5	4.5	3.5	62.4
Quadris (6.2)	R3/R5	3.8	3.3	63.2
Topsin M (0.5#)	R3/R5	5.5	10.5	61.0
LSD (P=0.10)		1.1	5.9	9.8

¹ 1-9 Scale, 1=No Disease 9=Dead or Defoliated from Disease.