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Efficacy of Neonicotinoids in Agricultural Pest Control

S.P. Conley, Mourtzinis, S., J. Gaska, A. Roth, et al.
Professor of Agronomy and State Soybean Specialist
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UW Extension
University of Wisconsin-Extension

WISCONSIN SOYBEAN MARKETING BOARD

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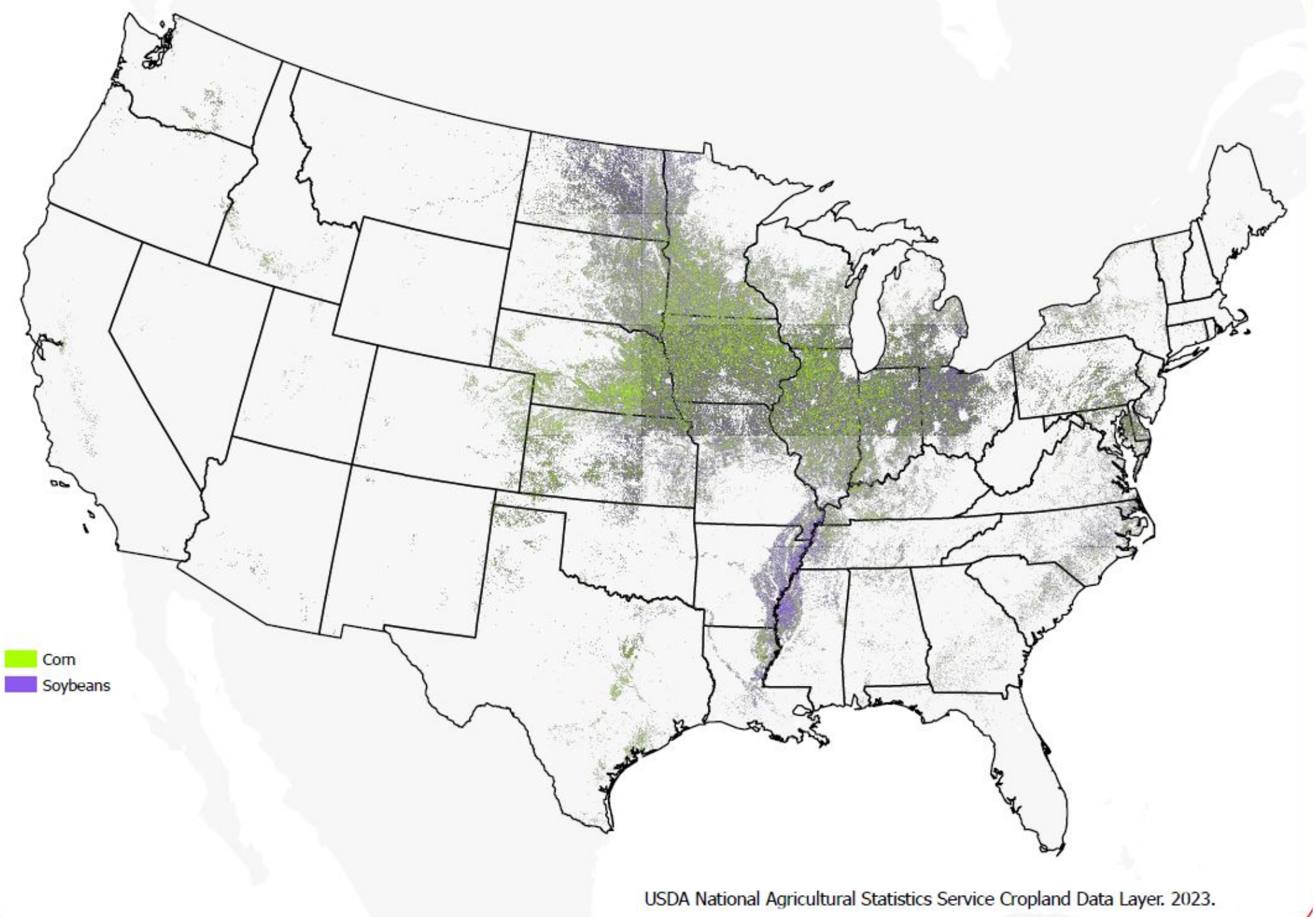

USDA National Agricultural Statistics Service Cropland Data Layer. 2023.

When/Why Neonicotinoid Seed treatments are Used

- When there is a documents history of pest problems
  - Extensive list of pest managed
- High risk (for pest) cropping systems
  - Manure systems
  - Cover crops
  - Transitional
  - Continuous cropping
- Early planting
  - Physiological response
- Risk Mitigation
  - Industry replant protection
  - Farmer risk/yield protection

Corn rootworm

Seedcorn maggot

Wireworm

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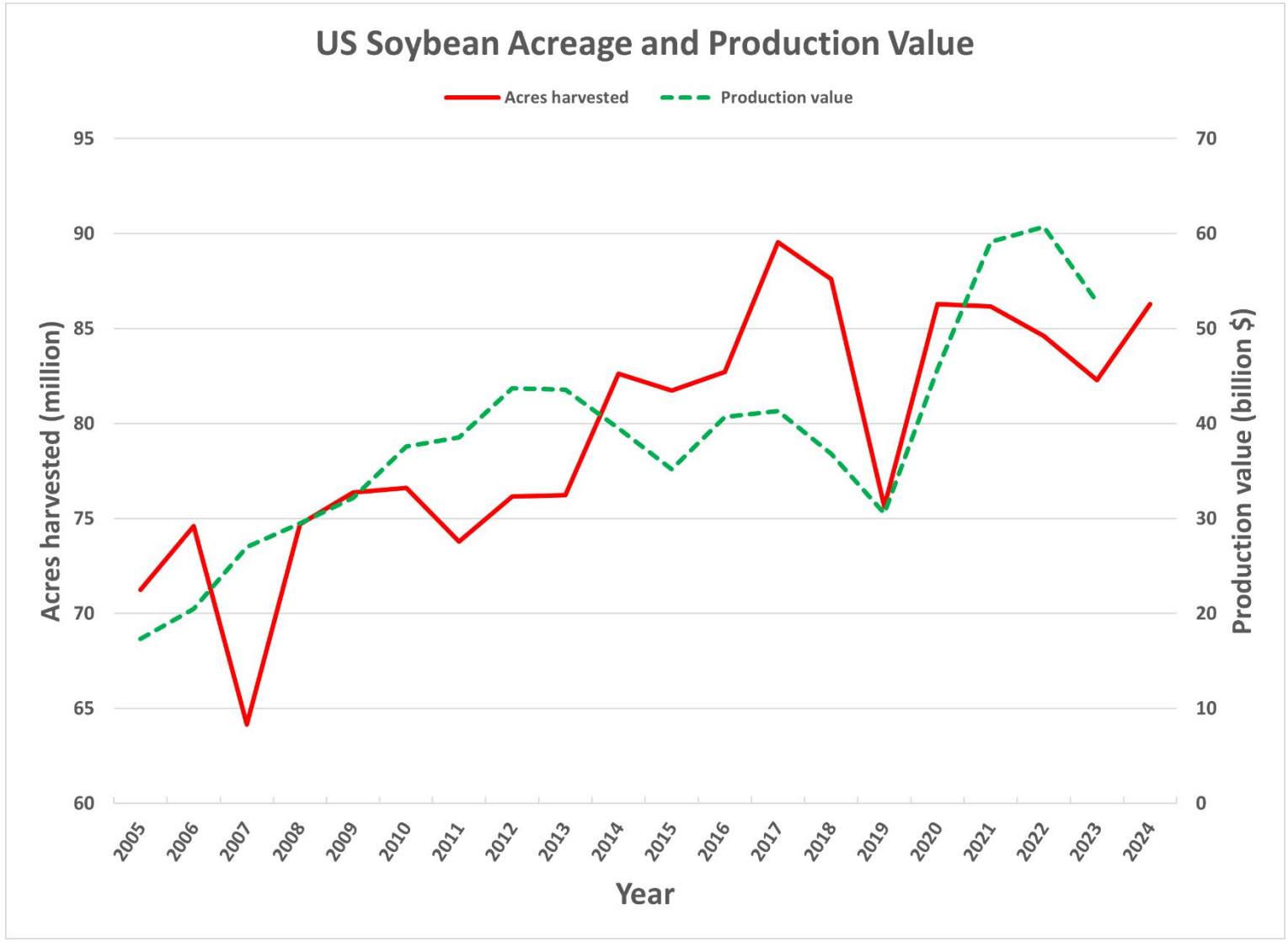
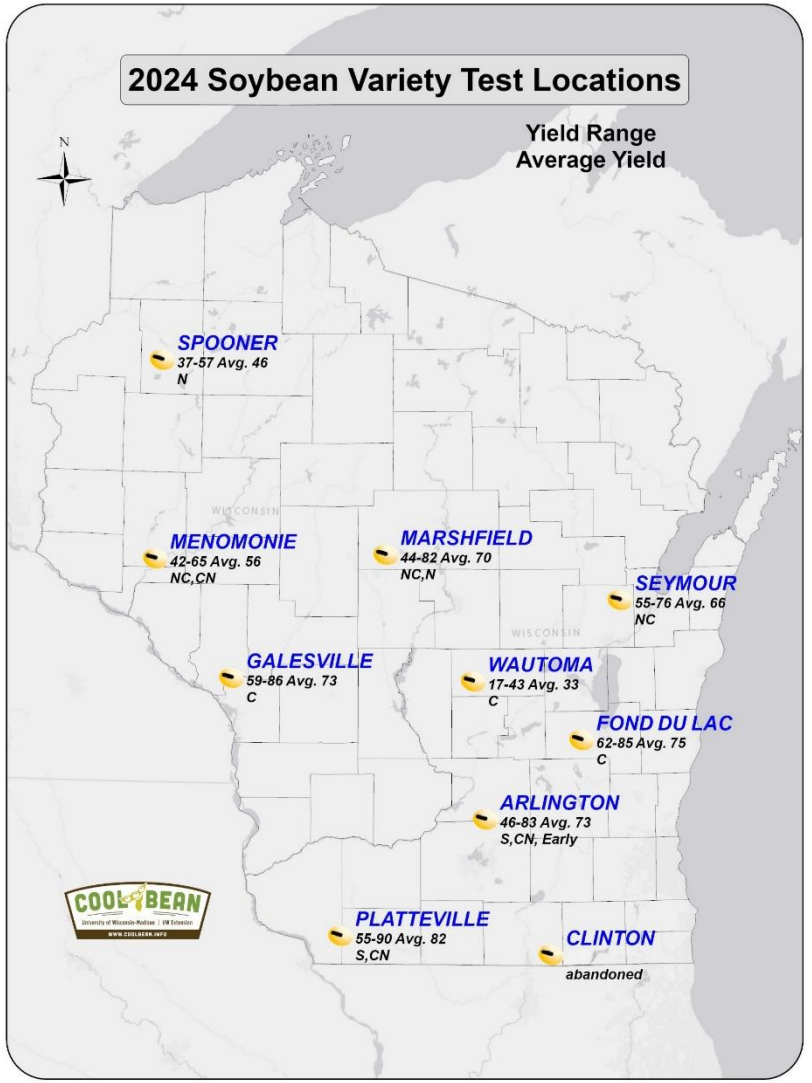
UW BeanTeam Program in Review

Soybean

112,360,000 bu in WI in 2024; ~$1.15B





- **What am I planting?**

TABLE 10. CONTINUED. 2023 Characteristics of Soybean Varieties (3 of 9)

Brand	Entry	Maturity Group	Herbicide Trait[1]	Performance Shown in Table(s)	Seed Treatment(s)	SCN Source[2]	PRR Genes[3]	Color[4] Flower	Pubescence	Pod	Hilum
DONMARIO	DM 24E23	2.4	E3	2	Burrus PowerShield	PI 88788	Rps 1-k	P	LTW	BR	BL
DONMARIO	DM 27E34	2.7	E3	2	Burrus PowerShield	PI 88788	Rps 1-c	P	LTW	BR	BL
DONMARIO	DM 28E52	2.8	E3	2	Burrus PowerShield	PI 88788	Rps 1-k	P	G	BR	IB
Dyna-Gro	S16EN42	1.6	E3	3	Equity VIP, Saltro, Vayantis	PI 88788	Rps 3-a	P	G	T	BF
Dyna-Gro	S20EN84	2.0	E3	2,3	Equity VIP, Saltro, Vayantis	Peking	Rps 1-k	P	LTW	T	BR
Dyna-Gro	S20EN92	2.0	E3	3	Equity VIP, Saltro, Vayantis	PI 88788	Rps 1-c	P	G	BR	IB
Dyna-Gro	S21EN81	2.1	E3	2,3	Equity VIP, Saltro, Vayantis	PI 88788	Rps 1-k	P	G	BR	IB
Dyna-Gro	S25EN74	2.5	E3	2	Equity VIP, Saltro, Vayantis	Peking	Rps 1-k	P	LTW	T	BL
Dyna-Gro	S25XF64	2.5	XF	2	Equity VIP, Saltro, Vayantis	PI 88788	Rps 1-c	P	G	BR	IB
Dyna-Gro	S26EN53	2.6	E3	2	Equity VIP, Saltro, Vayantis	PI 88788	Rps 1-c	P	G	T	BF
FS HiSOY	HS 12F30	1.2	XF	2,3	Acceleron F/I, Saltro	PI 88788	Rps 1-c	P	G	T	BF
FS HiSOY	HS 18E30	1.8	E3	2,3	Acceleron F/I, Saltro	Peking	Rps 1-k	P	G	T	BF
FS HiSOY	HS 18F20	1.8	XF	2,3	Acceleron F/I, Saltro	PI 88788	--	P	G	T	BF
FS HiSOY	HS 21E20	2.1	E3	2,3	Acceleron F/I, Saltro	PI 88788	Rps 1-c	P	LTW	T	BL
FS HiSOY	HS 23E10	2.3	E3	2,3	Acceleron F/I, Saltro	PI 88788	Rps 1-k	W	G	T	BF
FS HiSOY	HS 24E30	2.4	E3	2,3	Acceleron F/I, Saltro	PI 88788	Rps 1-c	P	LTW	BR	BL
FS HiSOY	HS 24F00	2.4	XF	2,3	Acceleron F/I, Saltro	PI 88788	Rps 1-c	P	G	T	BF
FS HiSOY	HS 25E30	2.5	E3	2	Acceleron F/I, Saltro	Peking	Rps 1-k	P	LTW	T	BL
FS HiSOY	HS 26E20	2.6	E3	2	Acceleron F/I, Saltro	PI 88788	Rps 1-k	P	G	T	IB
FS HiSOY	HS 28E10	2.8	E3	2	Acceleron F/I, Saltro	PI 88788	Rps 1-k	P	G	BR	IB
FS HiSOY	HS 28F30	2.8	XF	2	Acceleron F/I, Saltro	PI 88788	--	P	LTW	BR	BL
Genesis	G0880E	0.8	E3	5	EclipseUS Trio	Peking	Rps 3-a	P	G	BR	BF
Genesis	G1260E	1.2	E3	4,5	EclipseUS Trio	PI 88788	Rps 1-c	P	G	T	IB
Genesis	G1560E	1.5	E3	4	EclipseUS Trio	PI 88788	Rps 3-a	P	G	T	BF
Genesis	G1760E	1.7	E3	4	EclipseUS Trio	PI 88788	Rps 3-a	P	G	T	BF

All characteristic information is provided by the originator.
[1] Herbicide Trait : CN = conventional, RR2X = dicamba/glyphosate, XF = dicamba/glufosinate/glyphosate, E3 = glufosinate/glyphosate/2,4-D
[2] Source of SCN Resistance.

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NPM
February 2024

What's on your seed?

Extension
UNIVERSITY OF WISCONSIN-MADISON

Micheal Geissinger, Jordan Schuler & Mimi Broeske,
NPM Program

Damon Smith,
Professor of Plant Pathology

This publication is available for download from the Nutrient and Pest Management Program's website: ipcm.wisc.edu

Seed treatments have been used for years, mostly for protection against seedling diseases. However, there are a number of treatments marketed for protection against insects and nematode
clarify the
small grai

Seed treat

- The num
- By treatn
- Then alp

I	clothianidin	**Lumisure**	Corn, Soybean, Small Grains
		Nipsit INSIDE®	Corn, Soybean, Small Grains
		Poncho® 600	Corn, Soybean, Small Grains
		Poncho® XC	Soybean, Small Grains
I	cyantraniliprole	**Fortenza**	Corn, Soybean
I	imidacloprid	**Acceleron™ IX-409**	Soybean
		AXCESS™	Corn, Soybean, Small Grains
		Dyna-Shield® Imidacloprid 5	Corn, Soybean, Small Grains
		Gaucho® 600 Flowable	Corn, Soybean, Small Grains
		Nitro Shield IV	Corn, Soybean, Small Grains
		Resonate 480 ST	Corn, Soybean, Small Grains
		Resonate 600 ST	Corn, Soybean, Small Grains
		Revize Imida ST	Corn, Soybean, Small Grains
		Senator® 600 FS	Corn, Soybean, Small Grains
		Sharda Imidacloprid 5SC	Corn, Soybean, Small Grains
		StartUp IMIDA	Corn, Soybean, Small Grains
I	thiamethoxam	**Cruiser® 5FS**	Corn, Soybean, Small Grains

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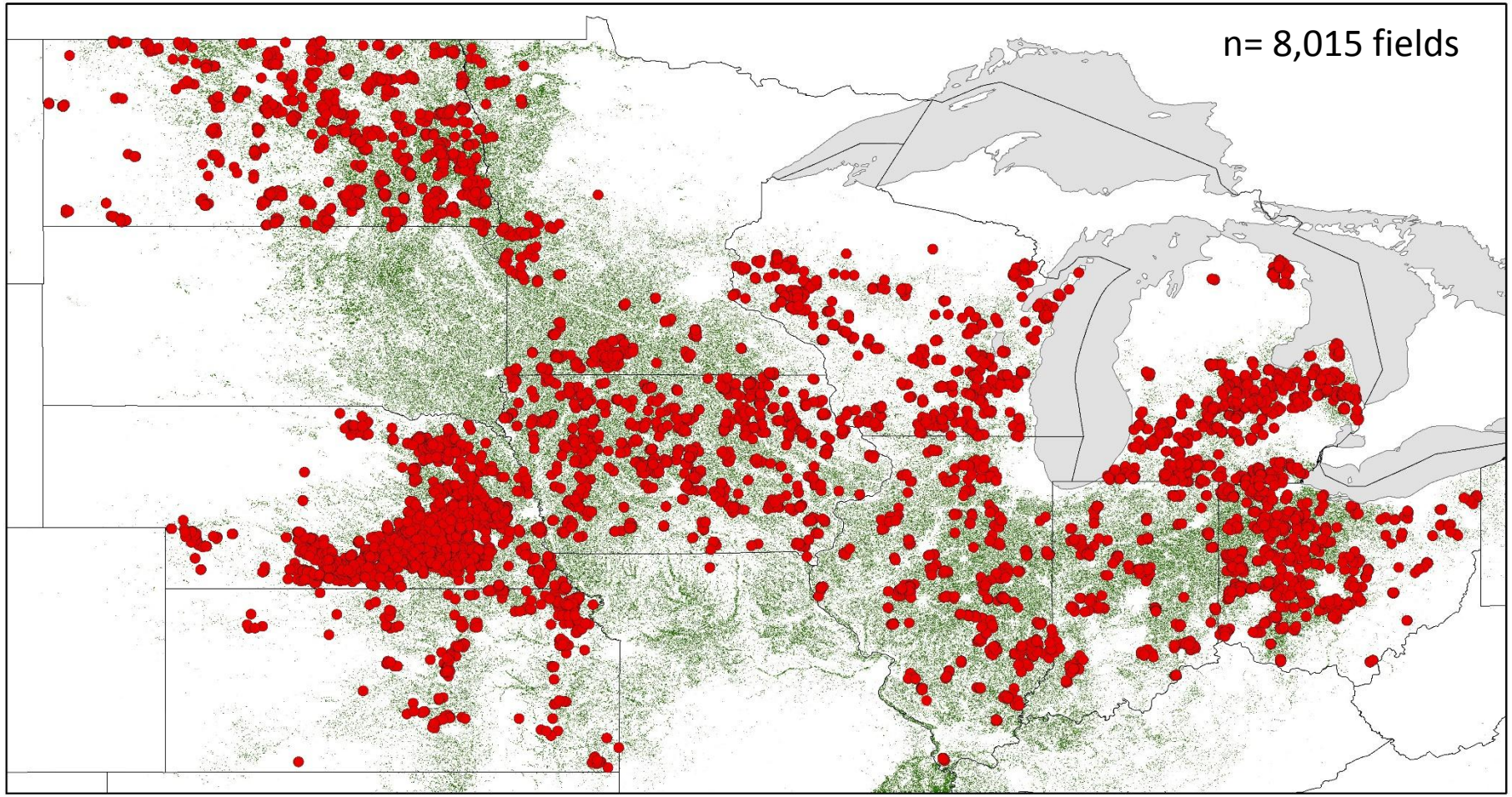
Boots on the Ground On-Farm Validation



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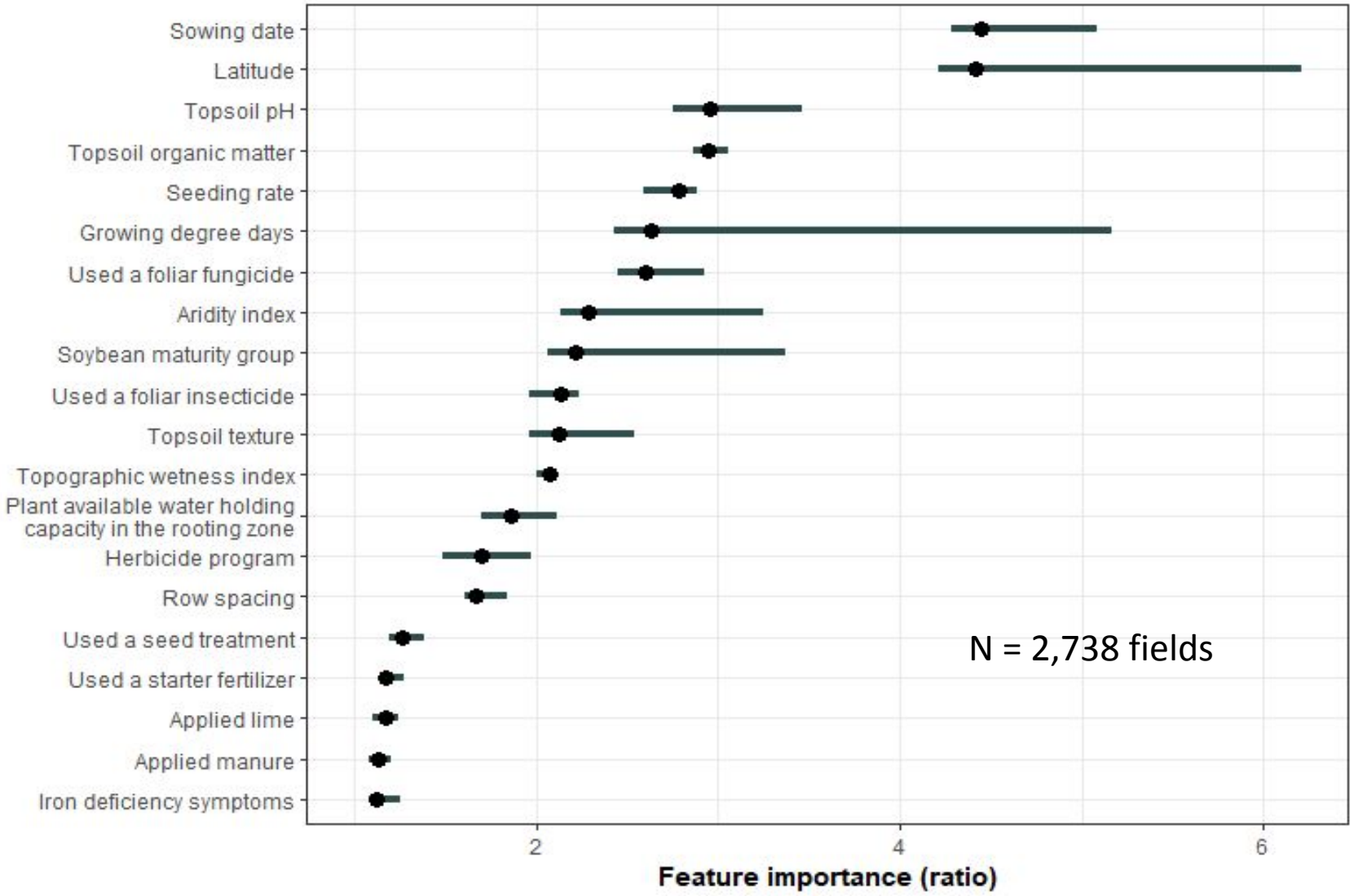
Importance of management-based variables in a random forest model predicting soybean yield.

Shah, A.D., T. R. Butts, S. Mourtzinis, J. I. Rattalino Edreira, P. Grassini, S. P. Conley and P. D. Esker. 2021. An interpretable machine learning assessment of foliar fungicide contribution to soybean yield in the north-central United States. Scientific Reports 11:18769. https://doi.org/10.1038/s41598-021-98230-2.



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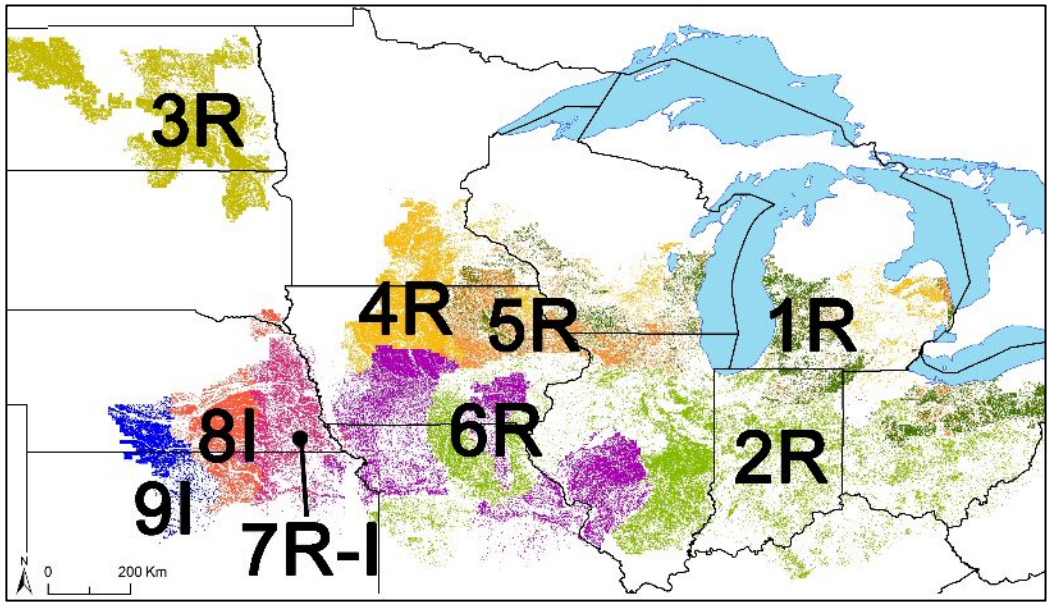
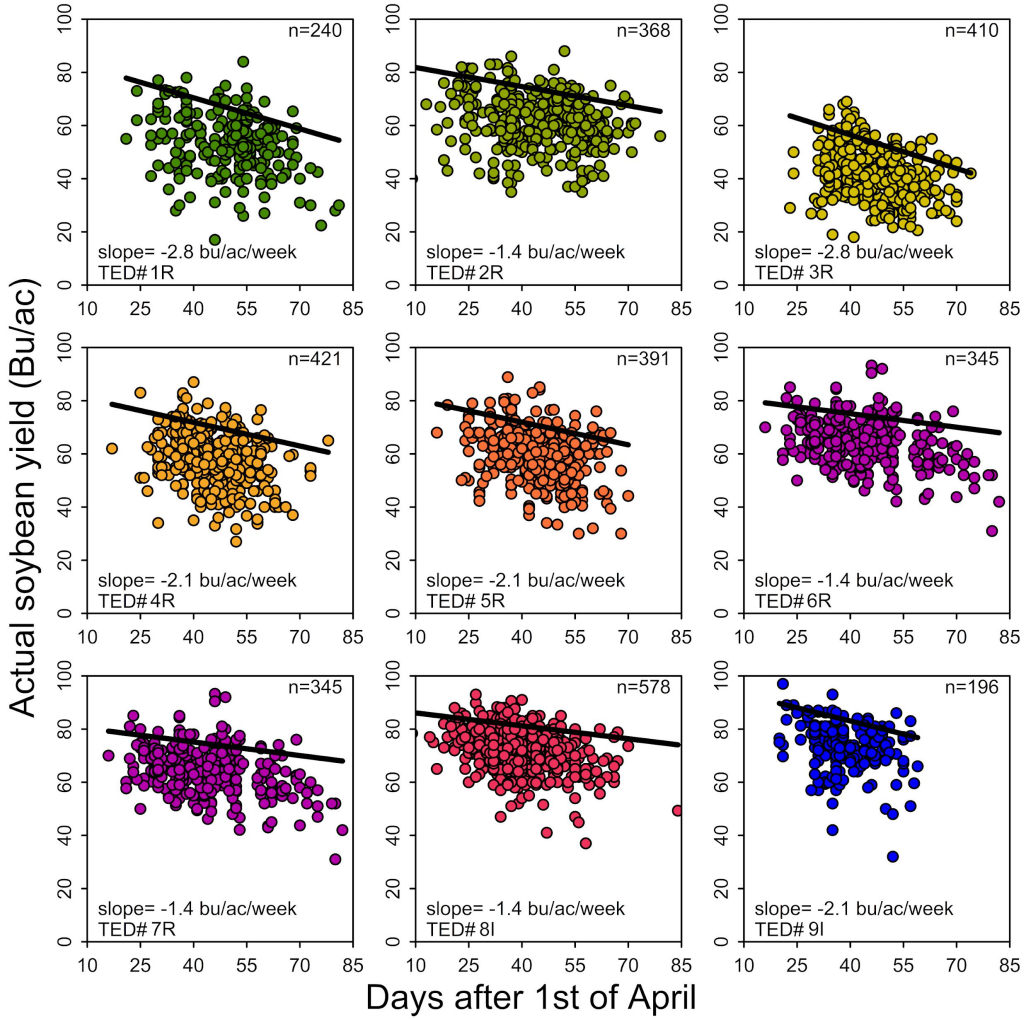
Influence of planting date on soy yield by TED



(Rattalino Edreira et al. 2017a, Agric. For. Meteorol. 247, 170-180)



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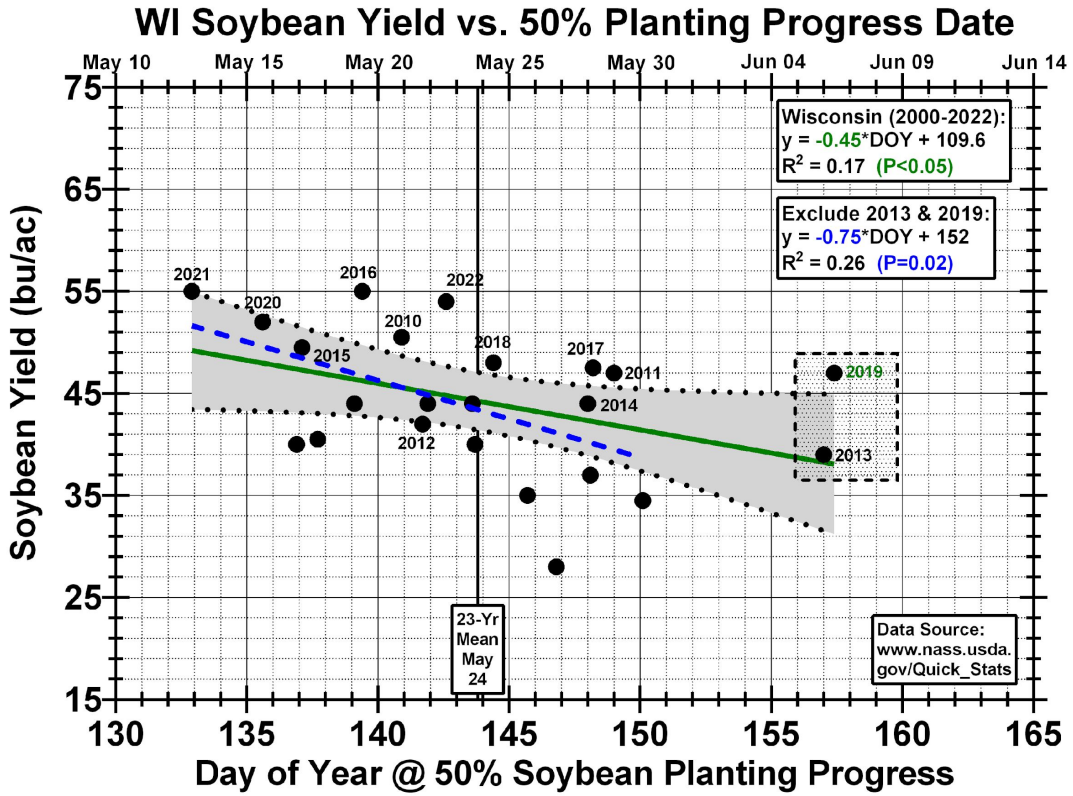
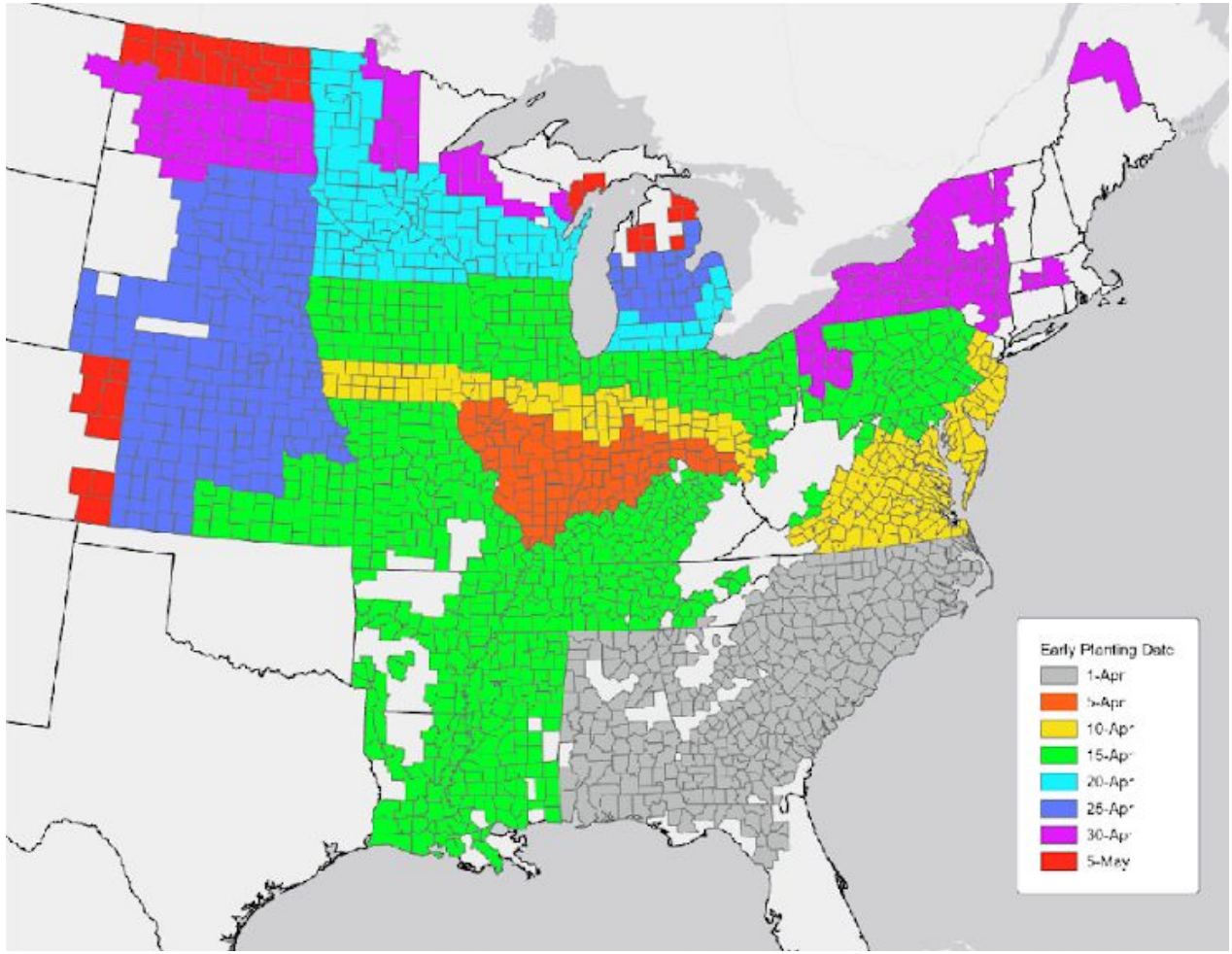
SCIENCE FOR SUCCESS

FUNDED BY THE SOYBEAN CHECKOFF

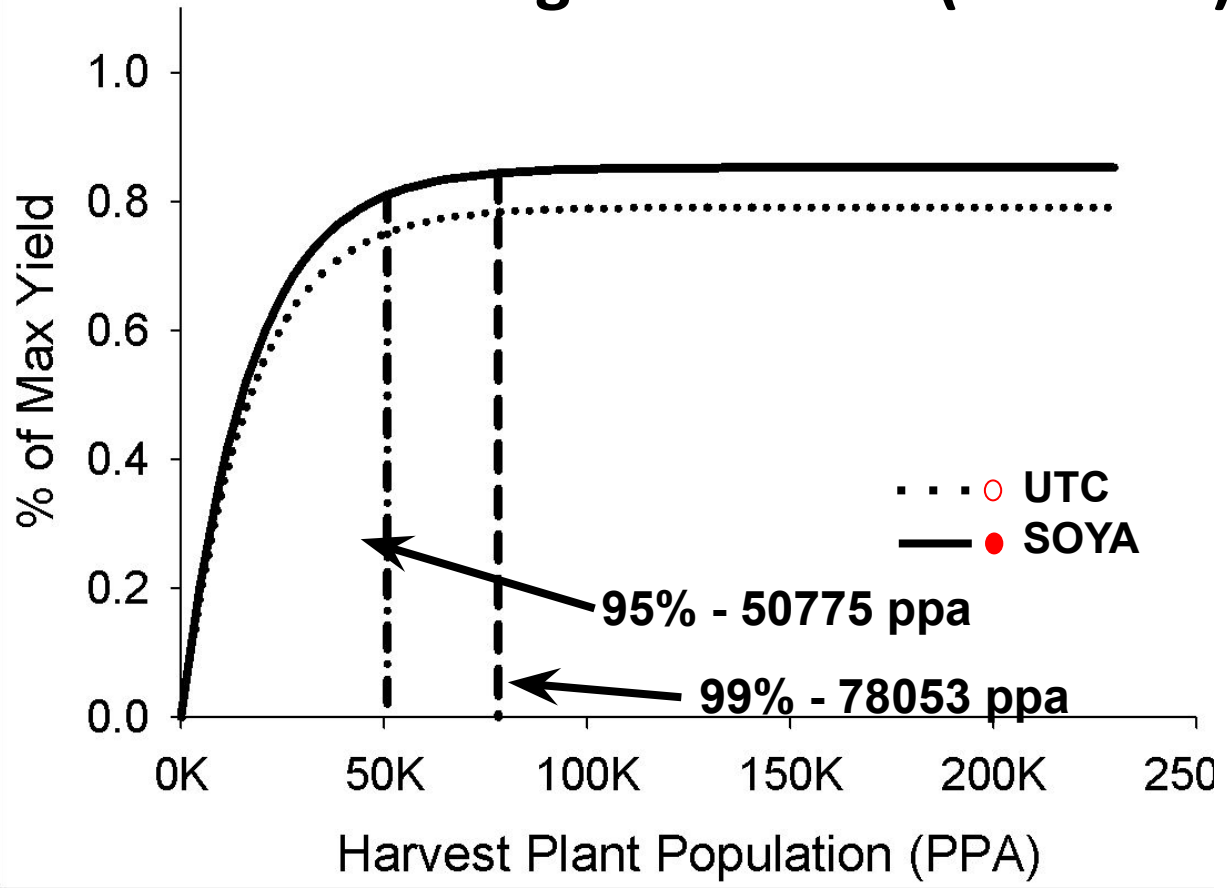
- Informed policy changes
  - Updated RMA replant coverage





Soybean harvest population and yield resilience

2012-2014 Average Yield Env. (43 Envs.)



LSD(.05) = 2 bu a^{-1}

CIPAR & CumNDVI Planting Date x Thiamethoxam

- Delaying planting decreases CIPAR & CumNDVI
- CruiserMaxx increased CIPAR & CumNDVI within first planting date.

Table 7. Cumulative intercepted photosynthetically active radiation (CIPAR) and cumulative normalized difference vegetative index (CumNDVI) means for the seed treatment and planting date main effects and their interaction pooled across all seeding rates during 2012 and 2013.

	Planting date			
Variable	Early	Mid	Late	Mean†‡
CIPAR, MJ m^{-2}				
Seed treatment				
UTC§	631	599	541	590
ApronMaxx	631	601	542	591
CruiserMaxx	645	606	544	598
LSD (0.05)	11			
Mean†	635	602	542	
CumNDVI¶				
Seed treatment				
UTC	34.0	30.8	28.1	31
ApronMaxx	33.8	30.9	27.9	30.9
CruiserMaxx	35.2	31.2	28.6	31.7
LSD (0.05)	0.8			
Mean‡	34.4	31.0	28.2	

† CIPAR main effect means have a LSD (0.05) of 3 for seed treatment and 14 for planting date.

‡ CumNDVI main effect means have a LSD (0.05) of 0.2 for seed treatment and 0.9 for planting date.

§ UTC, untreated control.

¶ CumNDVI has no units for measurement because it is a relative number.

Soybean F&I Seed Treatments

SCIENTIFIC REPORTS
nature research

OPEN

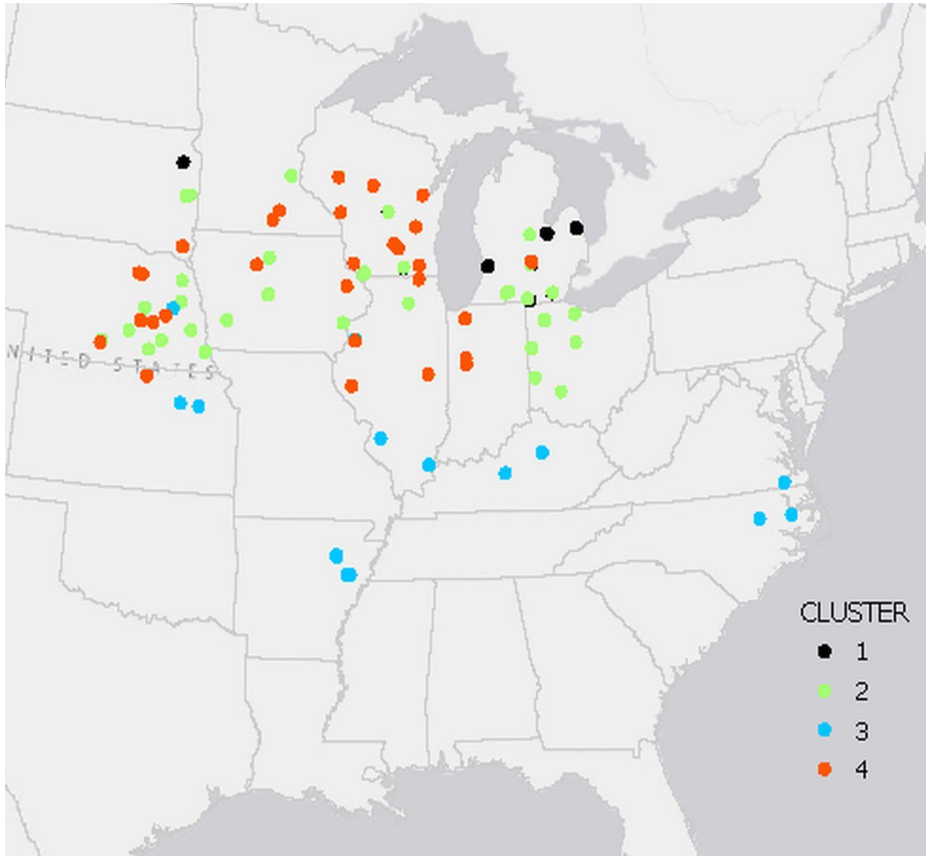
Neonicotinoid seed treatments of soybean provide negligible benefits to US farmers

Received: 31 January 2019
Accepted: 17 July 2019
Published online: 09 September 2019

Spyridon Mourtzinis[1], Christian H. Krupke[2], Paul D. Esker[3], Adam Varenhorst[4], Nicholas J. Arneson[1], Carl A. Bradley[6], Adam M. Byrne[7], Martin I. Chilvers[7], Loren J. Giesler[5], Ames Herbert[8], Yuba R. Kandel[9], Maciej J. Kazula[10], Catherine Hunt[9], Laura E. Lindsey[11], Sean Malone[8], Daren S. Mueller[9], Seth Naeve[10], Emerson Nafziger[12], Dominic D. Reisig[13], William J. Ross[14], Devon R. Rossman[7], Sally Taylor[8] & Shawn P. Conley[1]

- Soybean yield data were aggregated from 194 replicated field experiments established from 2006 to 2017, within 14 states

- The database consisted of 11,146 plot-specific yields



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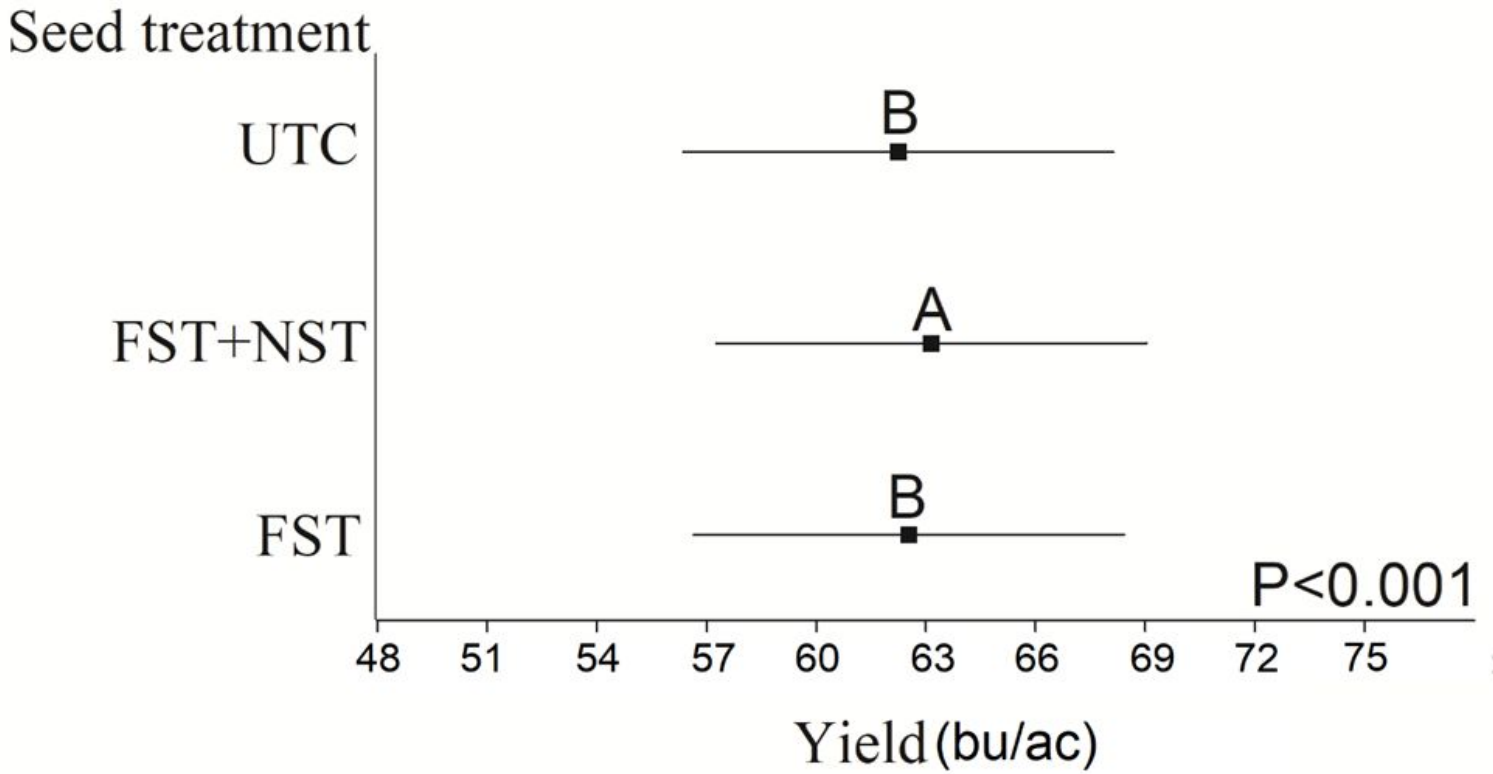
Results



Soybean yield due to the applied seed treatments across the entire region. The black rectangles show the mean yield and the lines extend to the lower and upper 95% confidence limits

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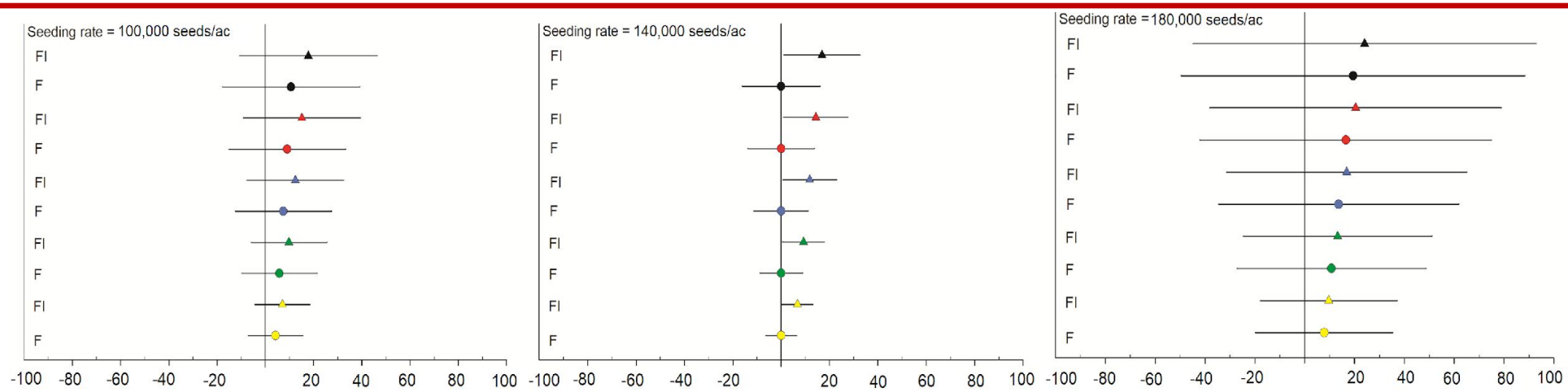
Results *cont.*



Breakeven cost of fungicide only (F - circles), fungicide + insecticide (FI - triangles) seeds compared to untreated (line at 0 $/a) for 8 $/bu (yellow), 11 $/bu (green), 14 $/bu (blue), 17 $/bu (red), and 20 $/bu (black) soybean price scenarios. The lines extend to the lower and upper 95% confidence limits of each income difference (FST-UTC and FST+NST-UTC)

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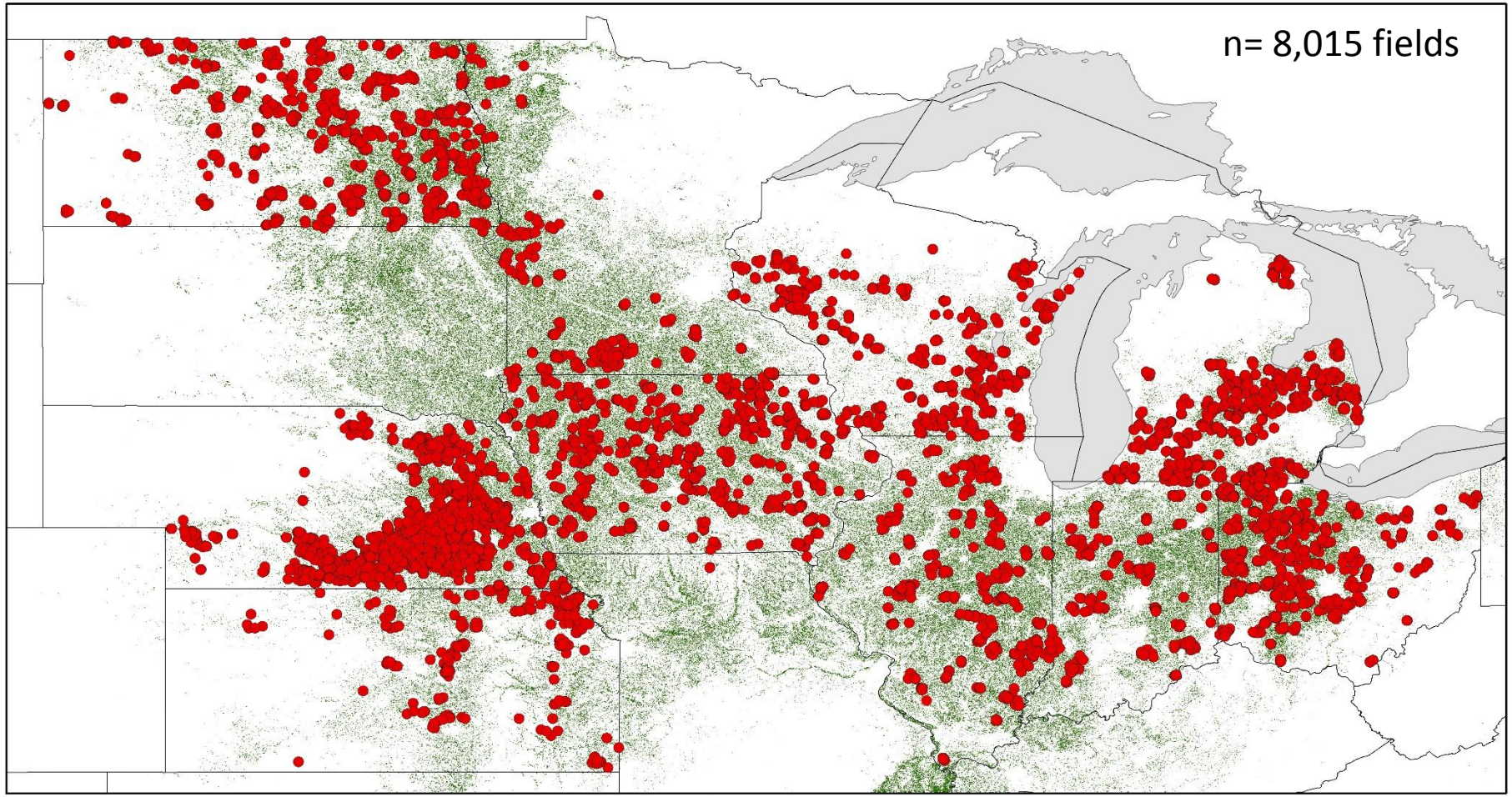

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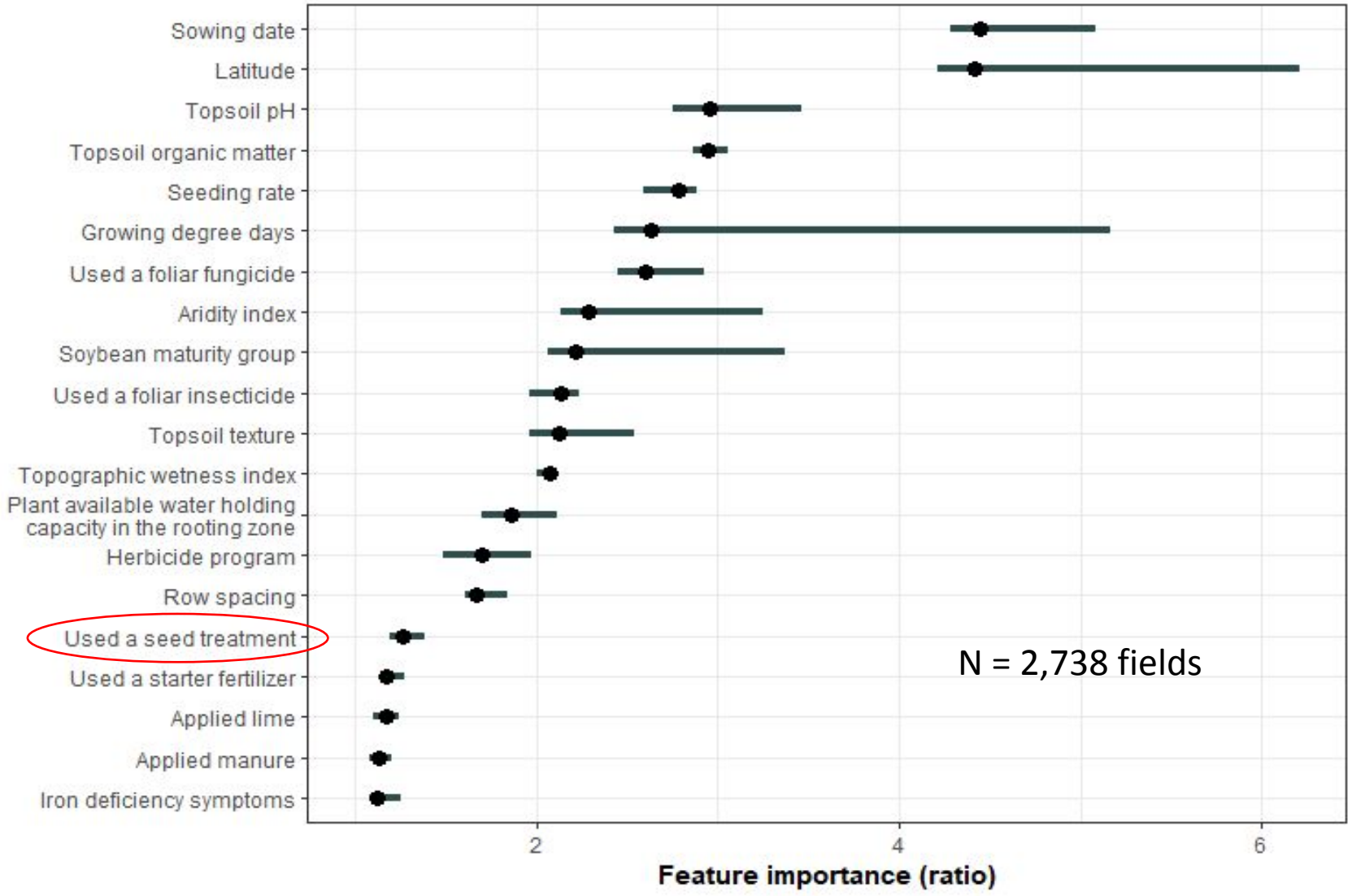

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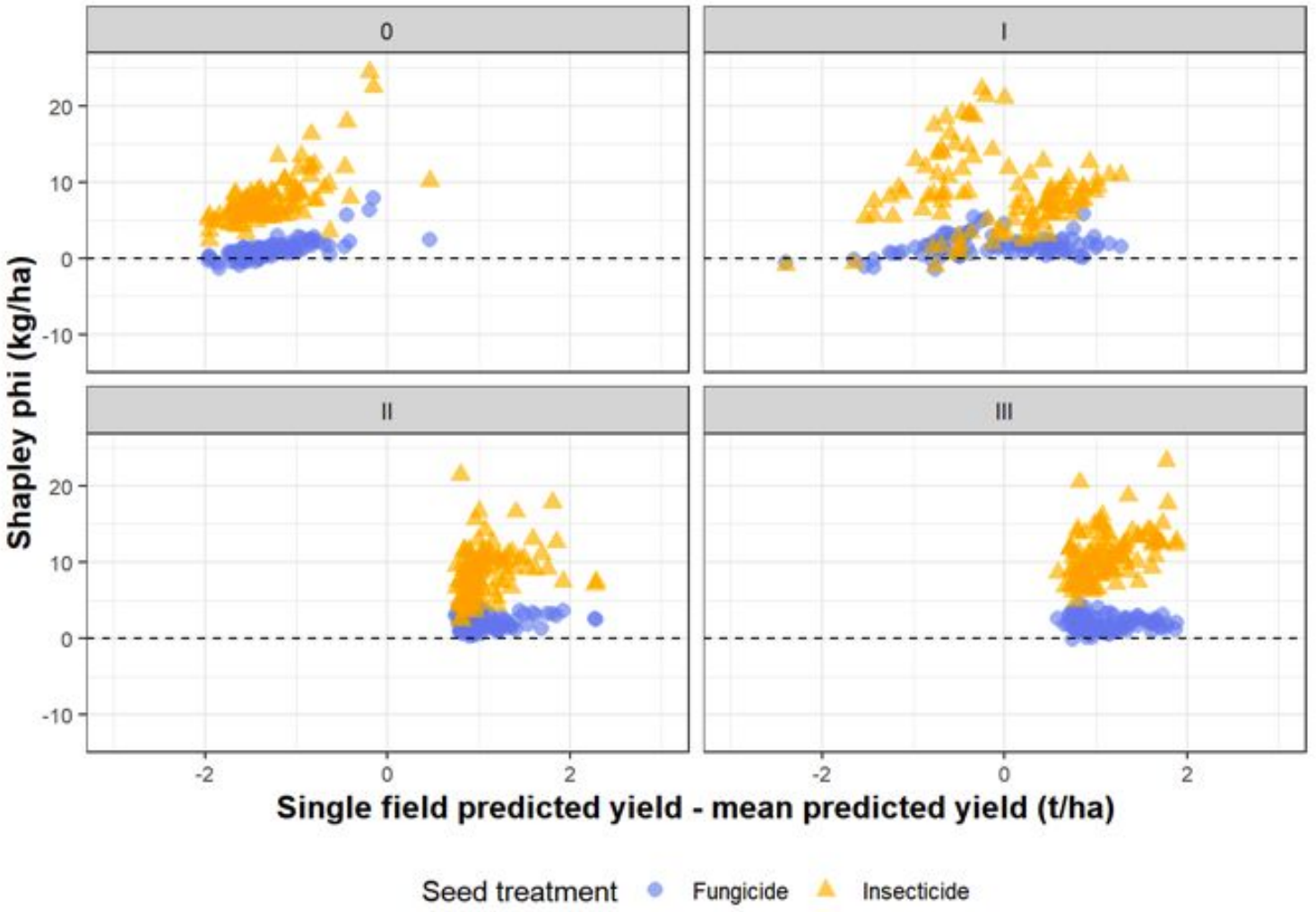
Are fungicide (and other) seed treatments needed?

Stratified by maturity group



10 kg/ha = 0.15 bu/ac
20 kg/ha = 0.30 bu/ac

Shah et al. (*in preparation*)

Does Intensive Soybean Management Reduce Downside Yield Risk Across the US

Shawn Conley

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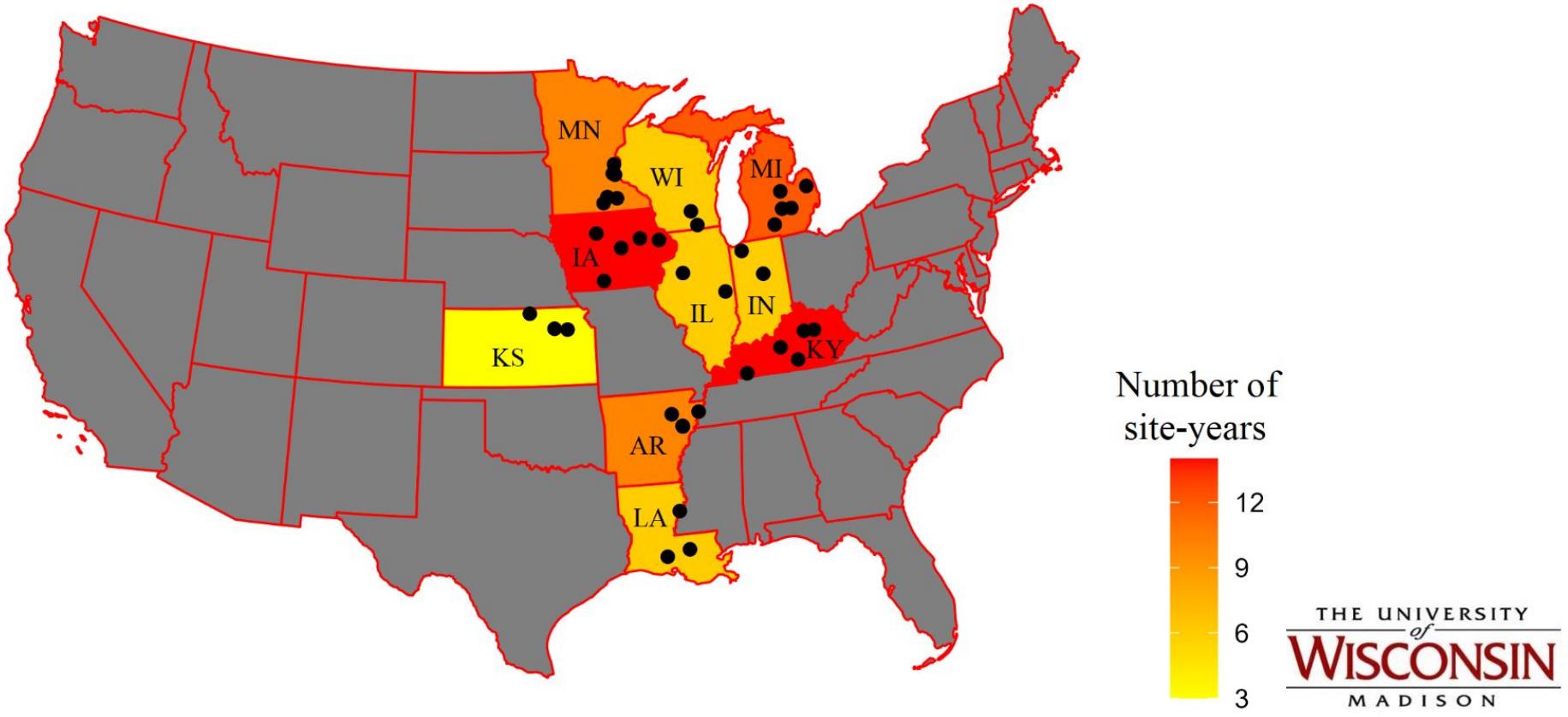
Objective

- Our objective was to measure the effect of high-input management systems on soybean yield and risk by analyzing yield data from field experiments over the period 2009–2014 across the US



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Methods

The high-input cropping system included fungicide, insecticide and biological seed treatments, soil and foliar fertilizer and foliar fungicide and insecticide applications. None of these inputs were applied in the low input system.

Years applied	Input system	Seed treatment			Foliar fertilizer	Soil fertilizer	Foliar fungicide	Foliar insecticide	N	Mean yield (bu/ac)
		Fungicide	Insecticide	Biological						
2009-2011	high	yes	yes	yes	yes	yes	yes	yes	238	60
2012-2014	high	yes	yes	yes	yes	yes	yes	yes	204	66
2009-2014	low	no	no	no	no	no	no	no	448	57.5

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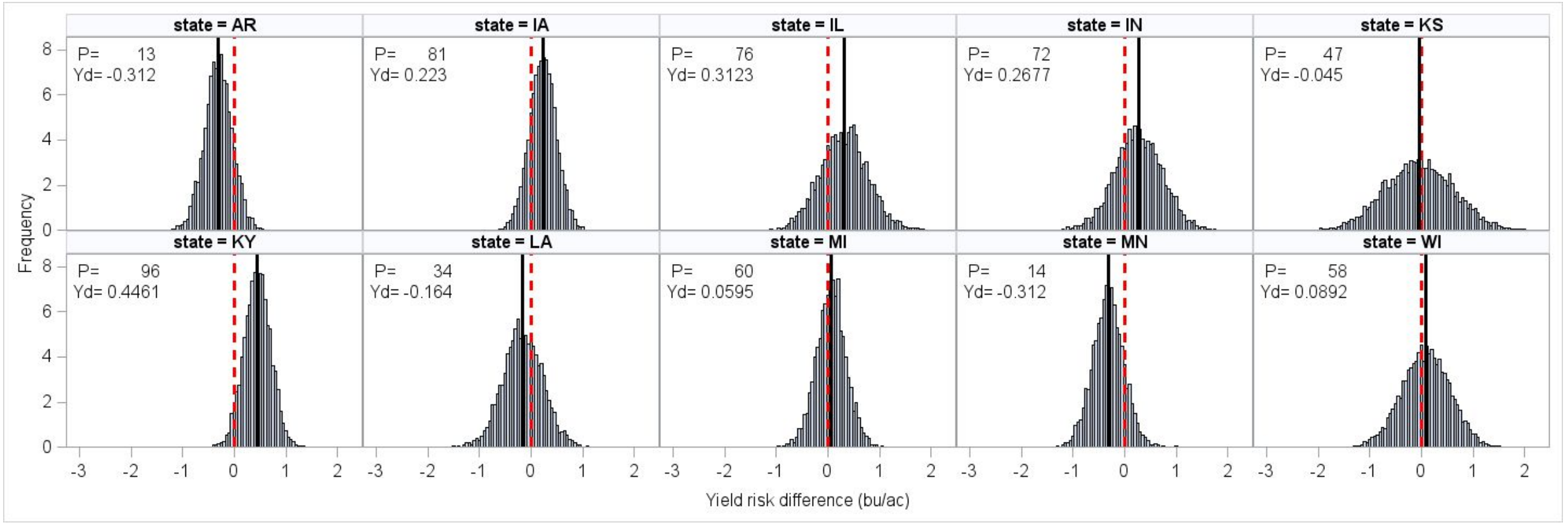
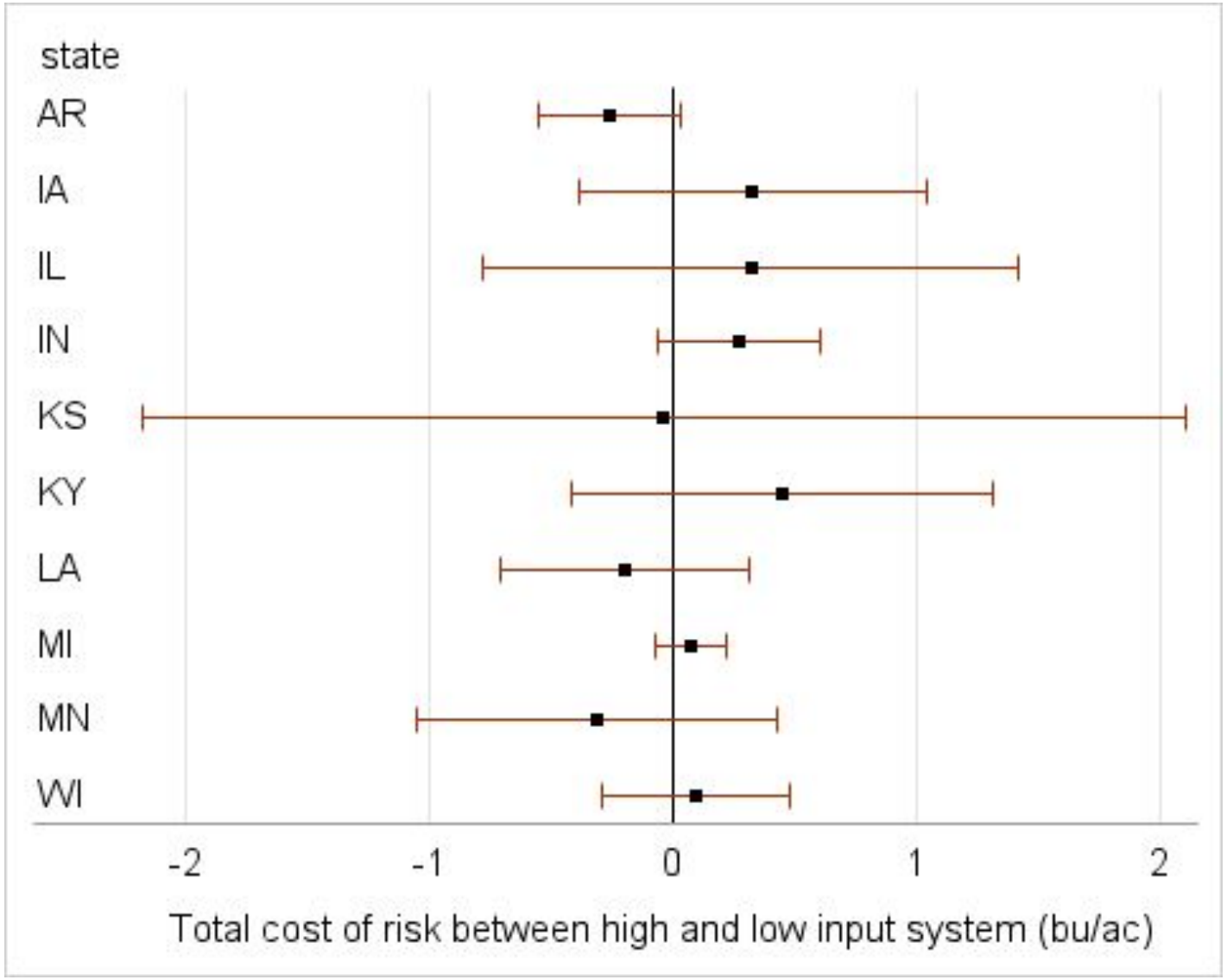
The cost of Risk

Distribution of the change in the cost of yield risk (bu/ac) between high- and low-input cropping systems in each state and probability (P) as a percentage that the cost difference > 0. Within each state, the red dashed line shows the zero-cost difference, and the black line indicates the mean cost difference (Yd).



The cost of Risk

Mean cost of yield risk (bu/ac) difference between high and low input cropping systems in each state for moderate level of risk-neutral farmer (r=3). The errors show the 95% confidence intervals.



Cover crops, climate and slugs oh my!

In this study, we collected soil samples from 21 long-term soybean cropping system trials across the United States (US) to assess the impact of management practices on soil health indicators.

Highlights from the trials found:

Overall results suggest that cover crops can play a crucial role in building soil health in soybean-based cropping systems.

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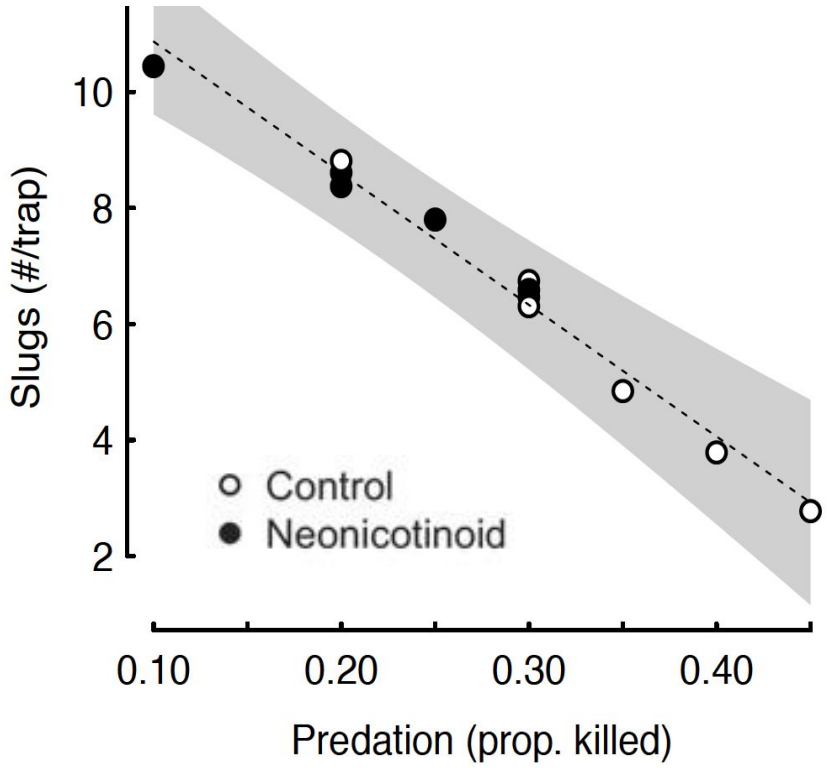
Field data: Neonic seed treatments disrupted biological control

↓ 31%

↑ 67%

↓ 19%

↓ 5%



Douglas, Rohr & Tooker 2015 *Journal of Applied Ecology*

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