ILLINOIS
Crop Sciences
COLLEGE OF AGRICULTURAL, CONSUMER & ENVIRONMENTAL SCIENCES

Illinois Fertilizer and Chemical Association
Spring Webinar
March 24, 2025

Spring 2025 Nutrient Management Considerations

John Jones

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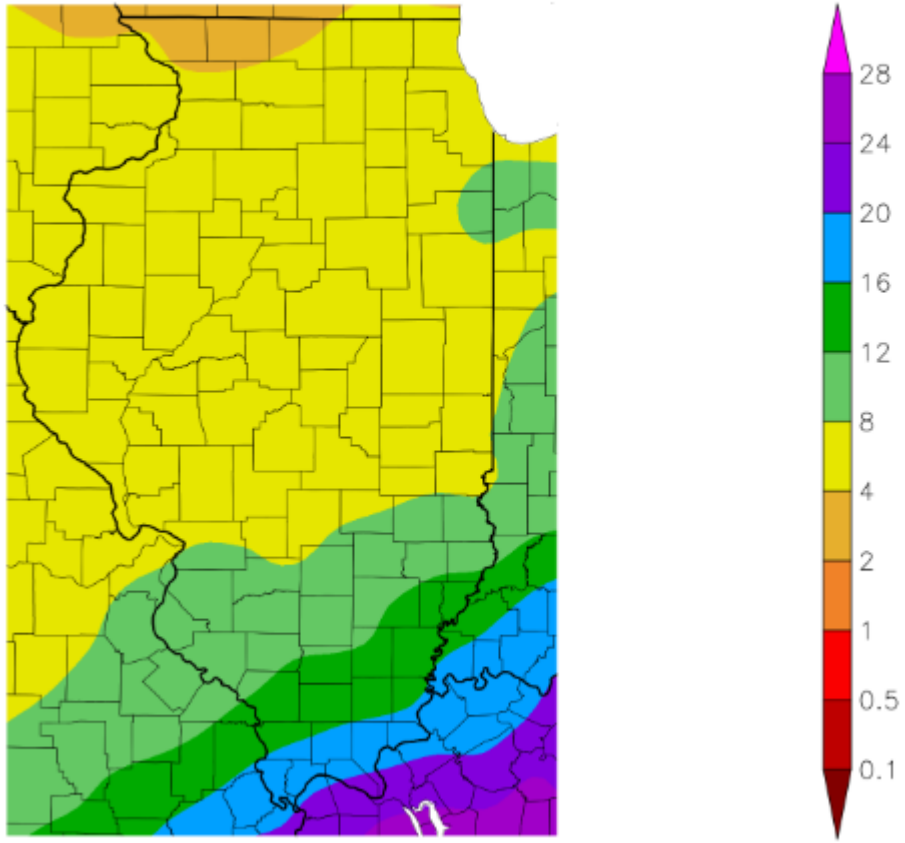
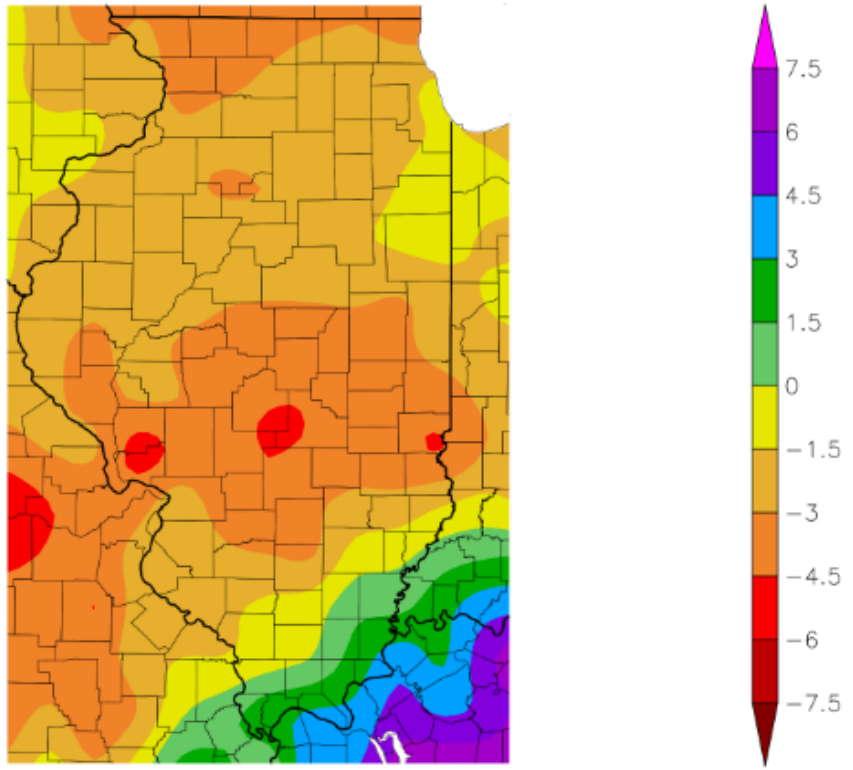
Department of Crop Sciences, University of Illinois

Rapid, local swings in soil moisture since 2024 harvest

Precipitation (in)
11/23/2024 – 3/22/2025

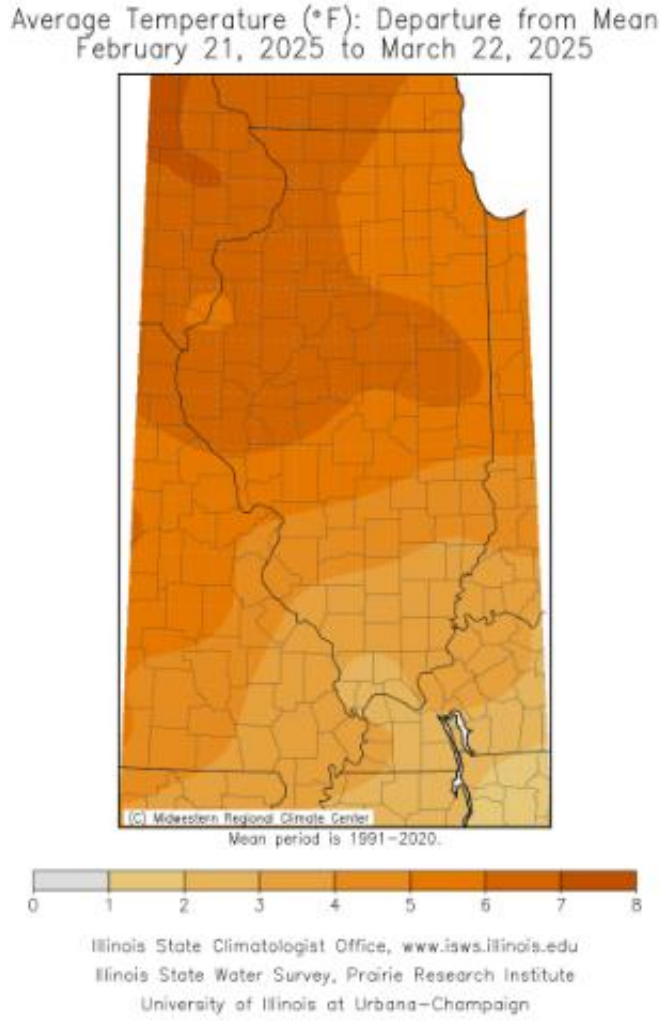


Departure from Normal Precipitation (in)
11/23/2024 – 3/22/2025

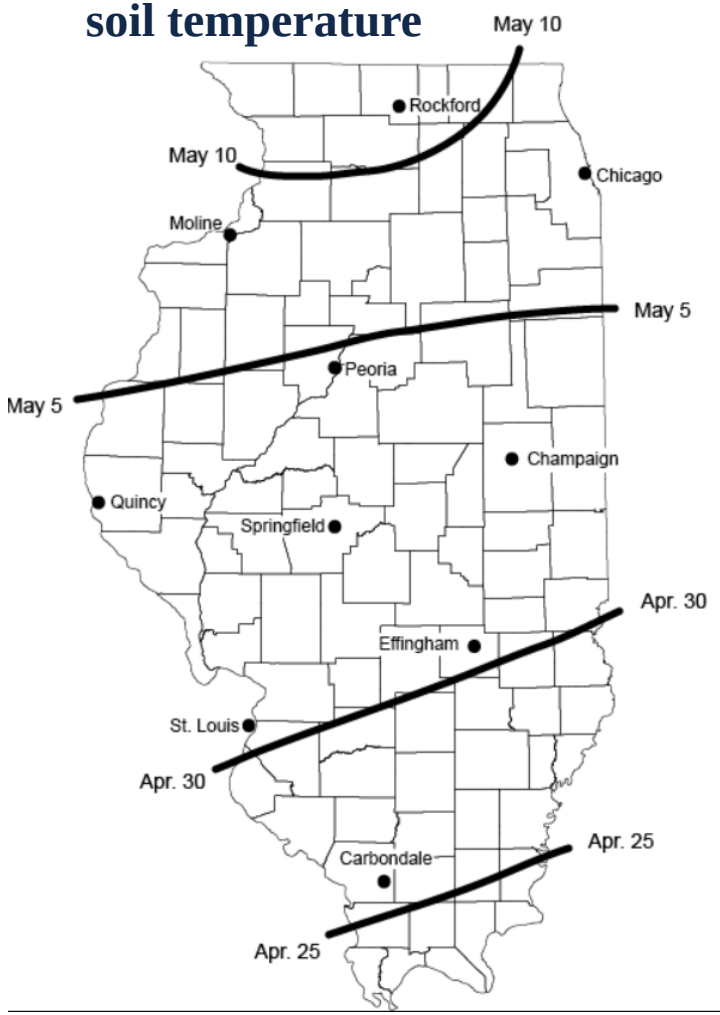


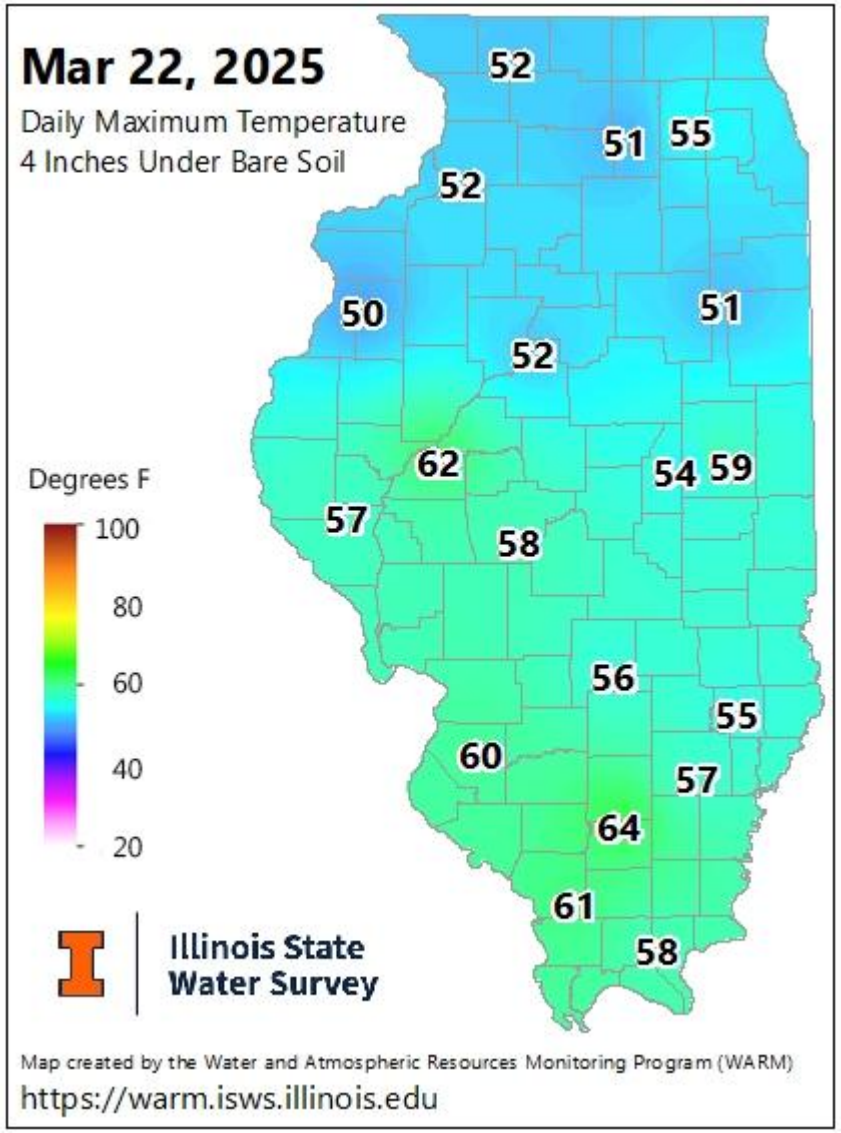
https://hprcc.unl.edu/maps.php?map=ACISClimateMaps

We don’t entirely know how pulses of warm soil affect nitrification (in fall or spring)



Expected date of sustained 50°F soil temperature

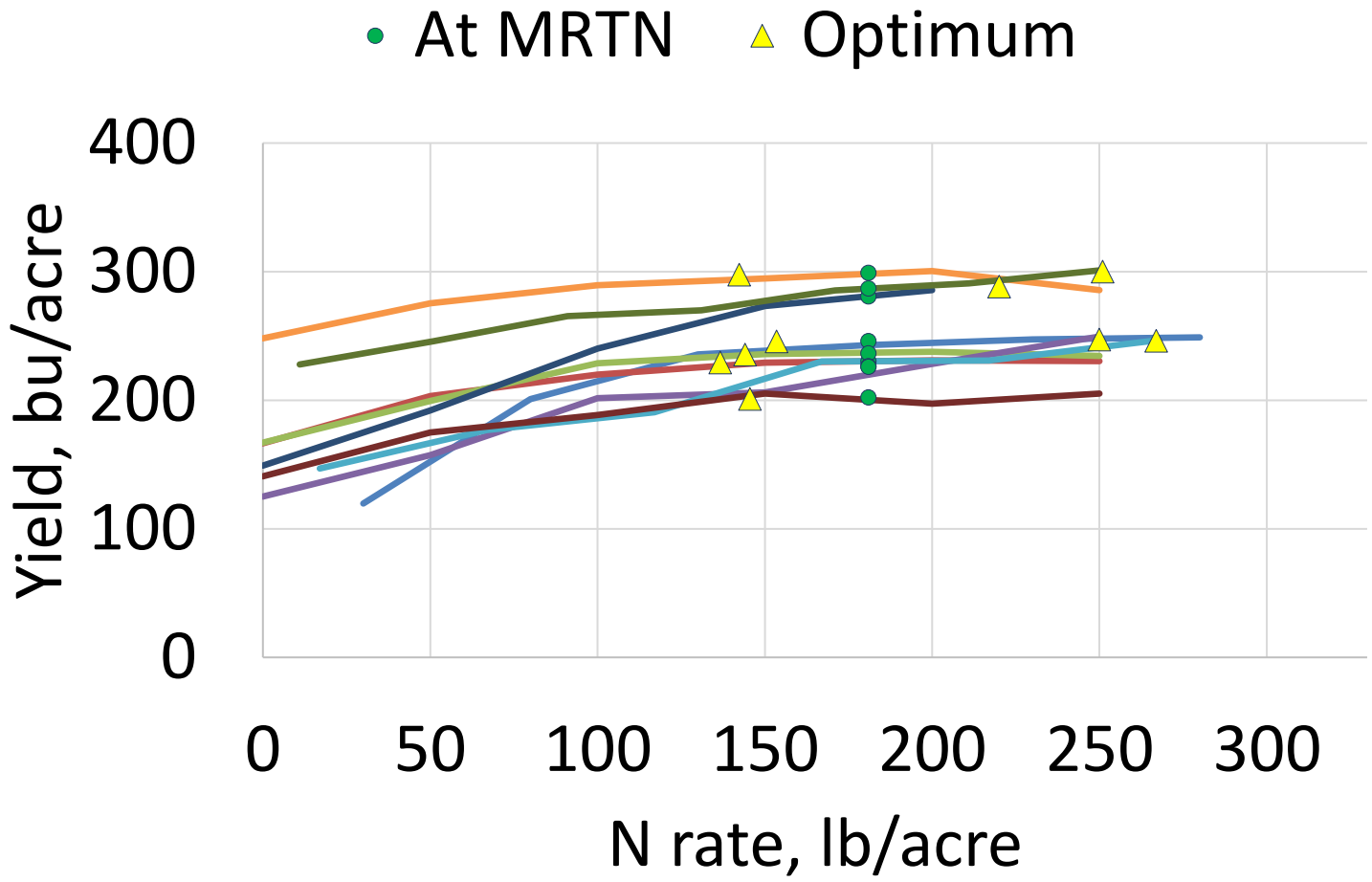




2024 Central/Northern IL Nitrogen rate trials

Soybean-Corn

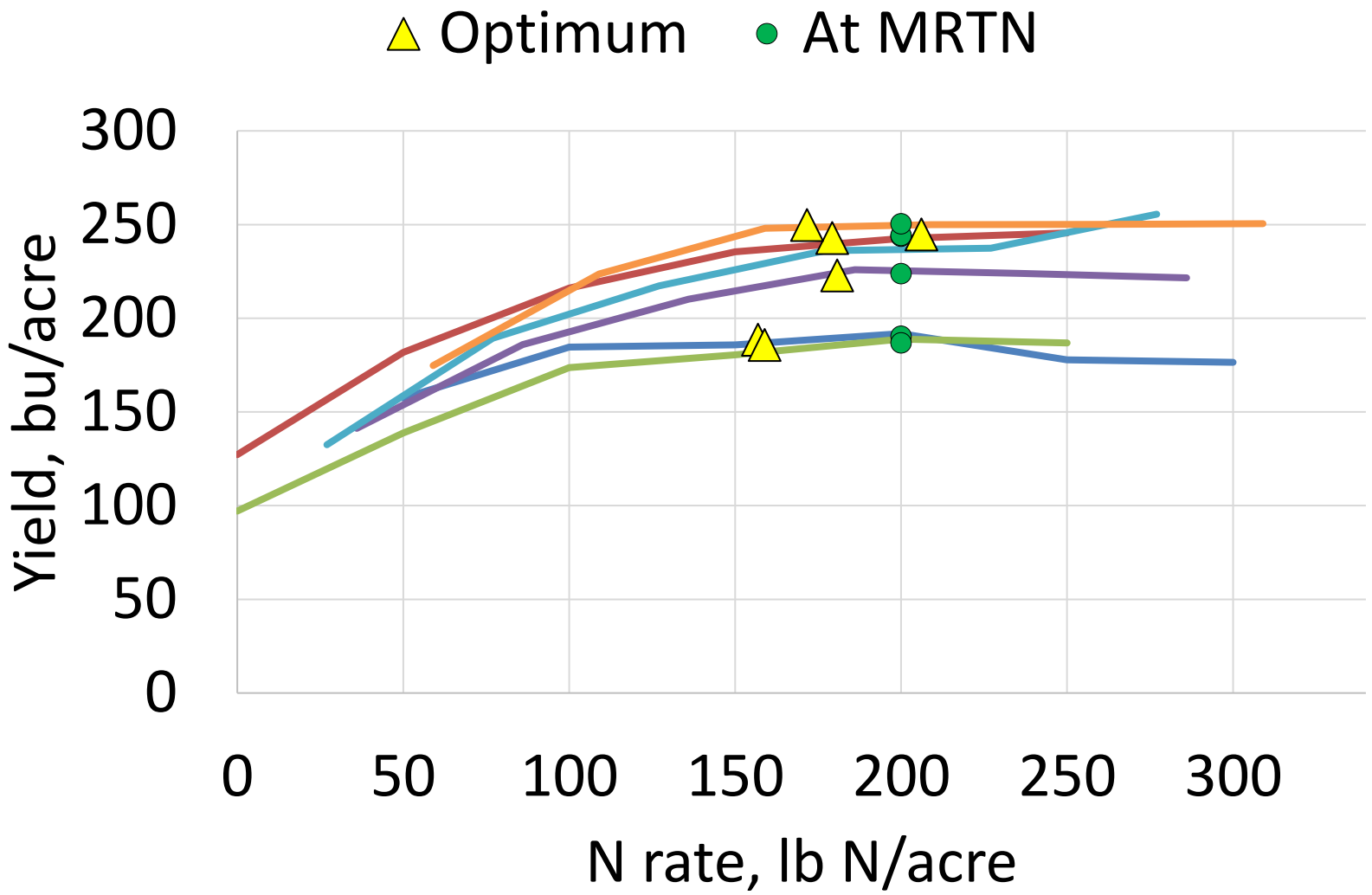
- Pre-2024 data suggested a 181 lb-N/a optimum N rate
- 2024 optimum N rates ranged from 137 to 267 lb-N/a
- Yield at optimum N ranged from 201 to 297 bu/a
- A tale of two response types for these 2024 trials



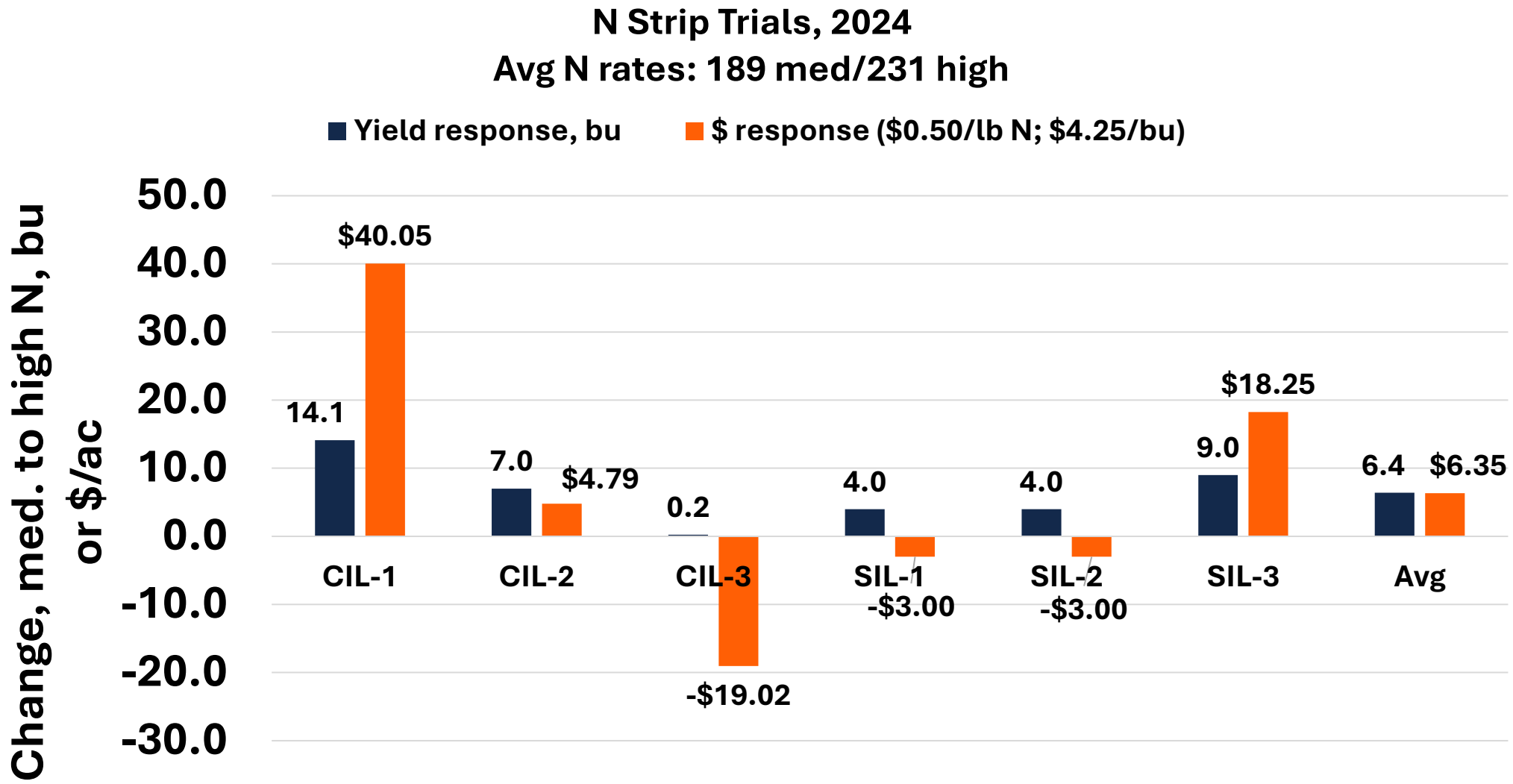
2024 Southern IL Nitrogen rate trials

Soybean-Corn, Southern IL

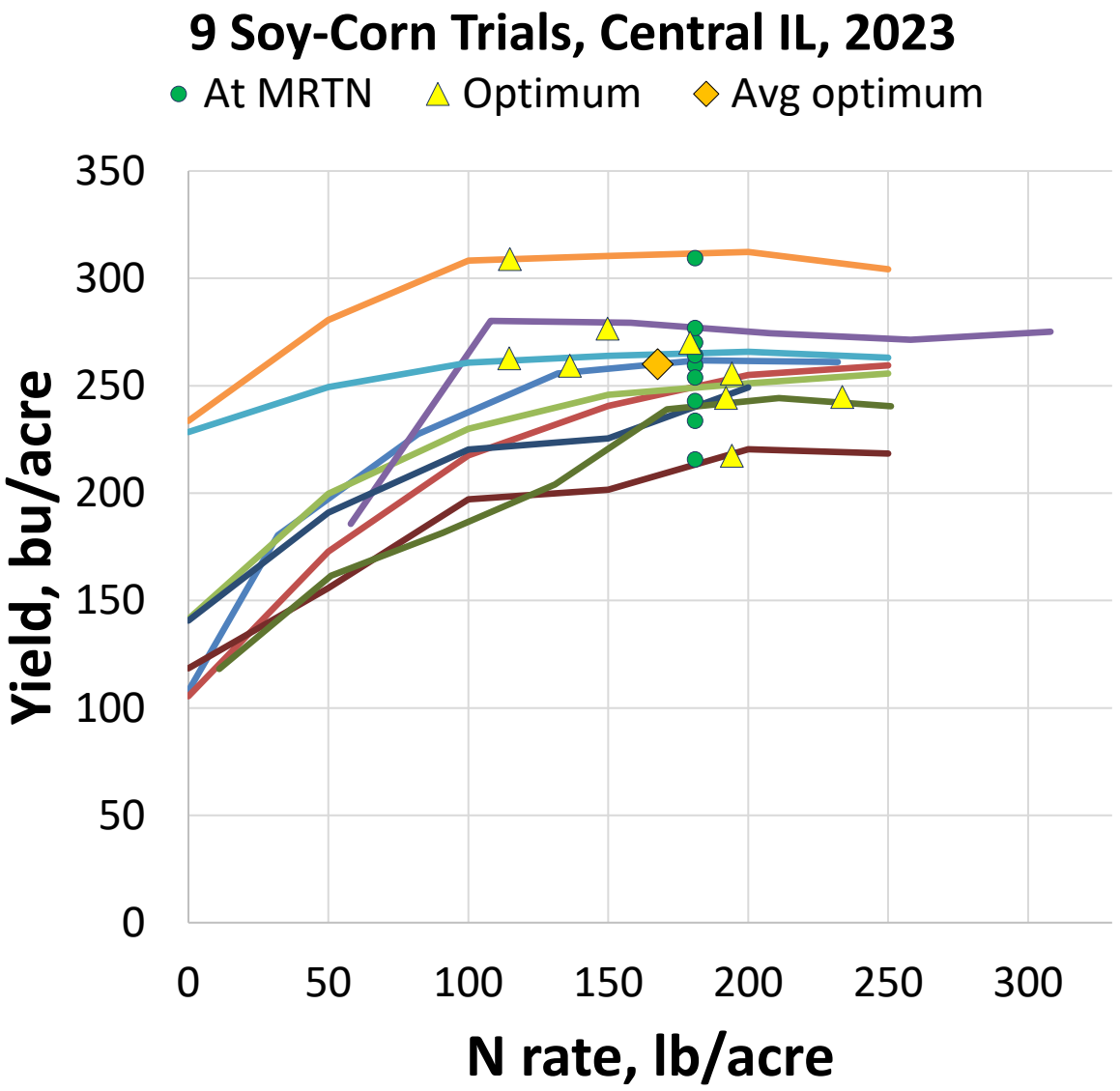
- Pre-2024 data suggested a 200 lb-N/a optimum N rate (154 trials)
- 2024 optimum N rates ranged from 157 to 206 lb-N/a
- Yield at optimum N ranged from 185 to 249 bu/a
- Overall a year with “clean” responses to nitrogen, clear trends.

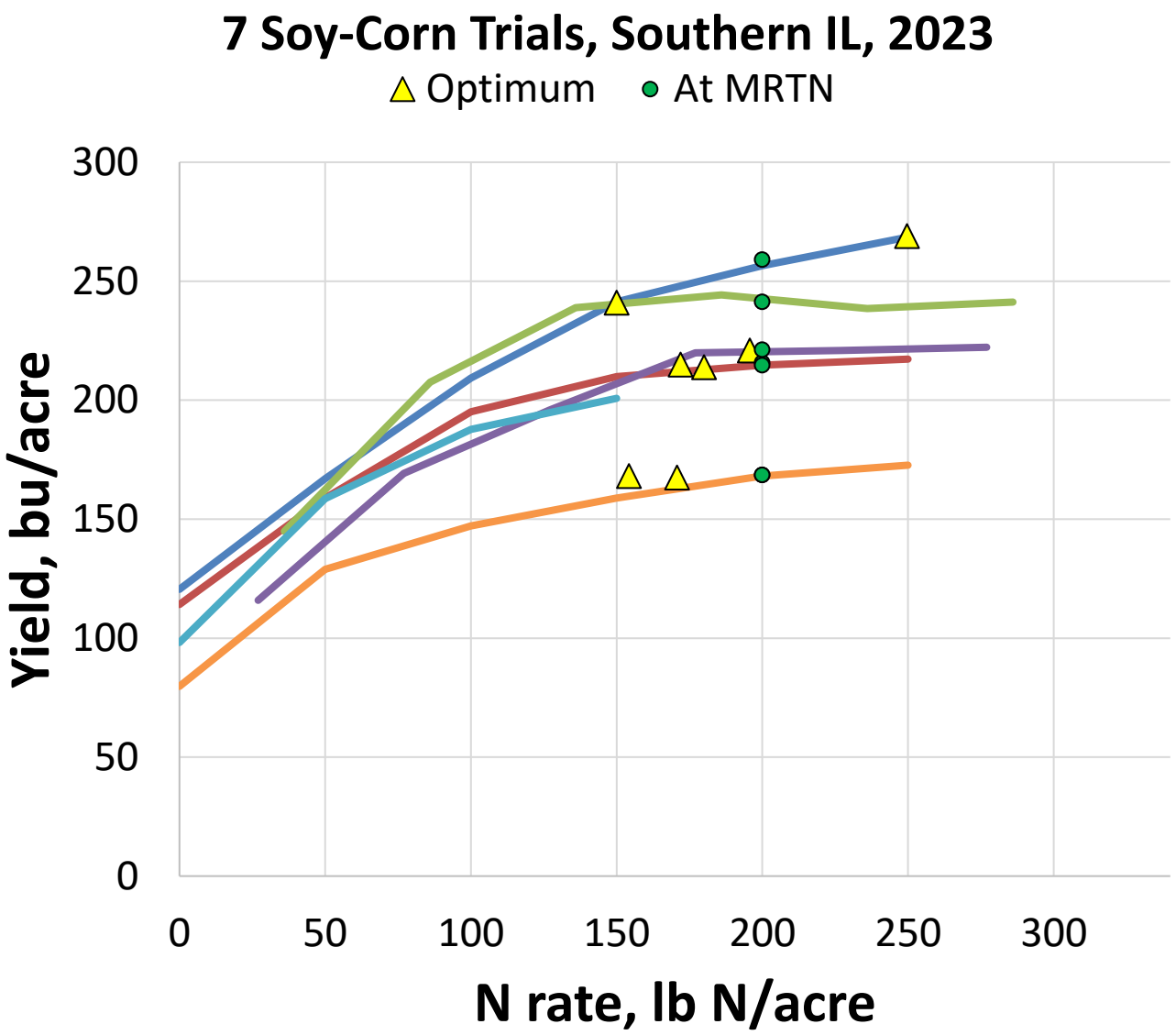


N rate verification trials (2 N rates) in 2024

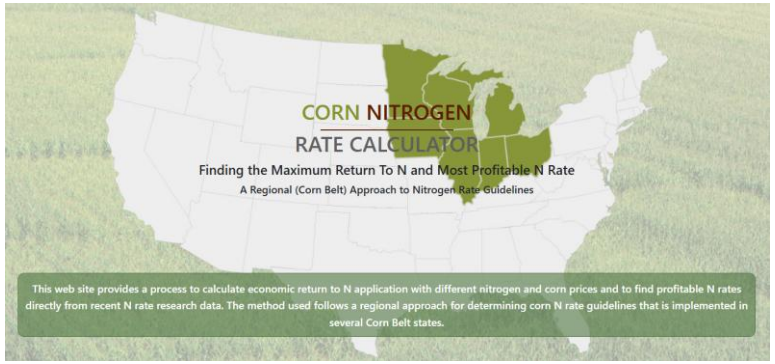


2023 N rate trials





N rate calculator: https://www.cornnratecalc.org/



Website updates being finalized with 2013 to 2024 trial data

Select State *

Illinois

Select Rotation *

Corn following soybean

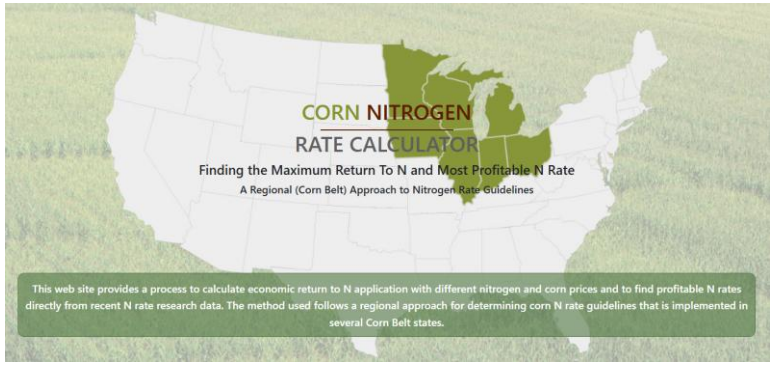
Select Region

South

Set Corn and Nitrogen Prices *

UAN (32% N)	356	($/Ton)
Nitrogen Price	0.56	($/lb N)
Corn Price	4.00	($/bu)

N rate calculator: https://www.cornnratecalc.org/



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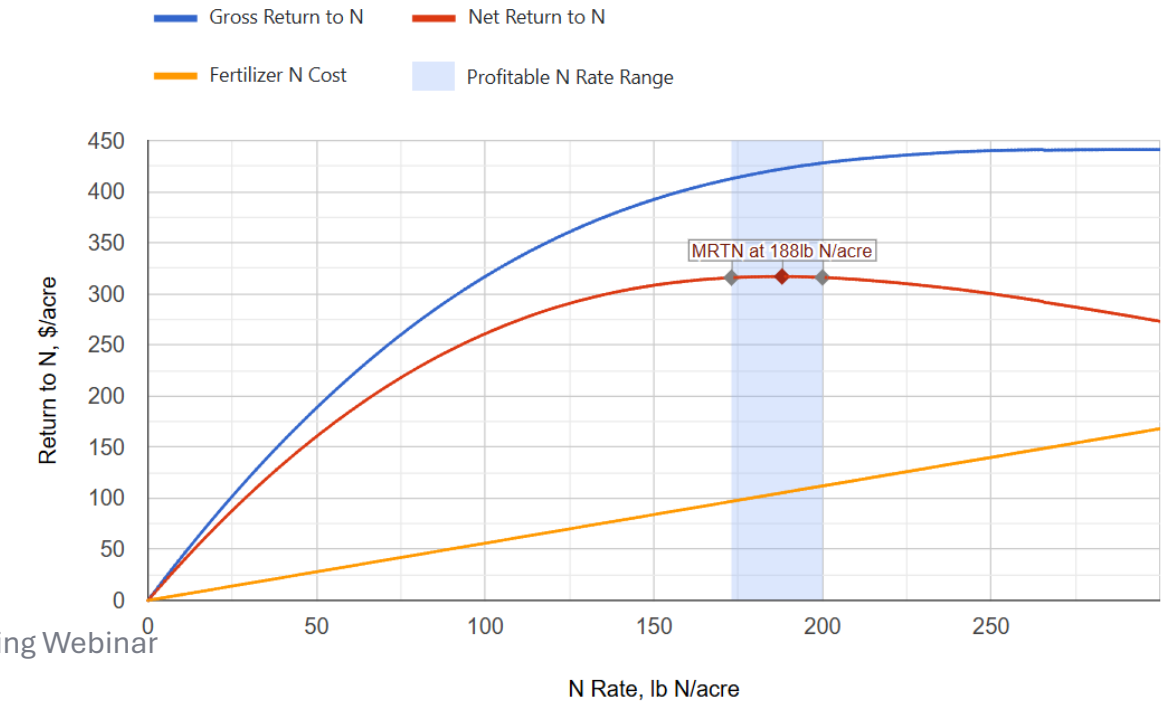
Set Corn and Nitrogen Prices *

UAN (32% N)	356	($/Ton)
Nitrogen Price	0.56	($/lb N)
Corn Price	4.00	($/bu)

State : **Illinois**
Region : **South**
Number of sites : **140**
Rotation : **Corn following soybean**

Nitrogen Price ($/lb):	**0.56**
Corn Price ($/bu):	**4.00**
Price Ratio:	**0.14**
MRTN Rate (lb N/acre):	**188**
Profitable N Rate Range (lb N/acre):	**173 - 200**
Net Return to N at MRTN Rate ($/acre):	**$316.96**
Percent of Maximum Yield at MRTN Rate:	**97%**
UAN (32% N) at MRTN Rate (lb product/acre):	**587**
UAN (32% N) Cost at MRTN Rate ($/acre):	**$105.28**

Return to N



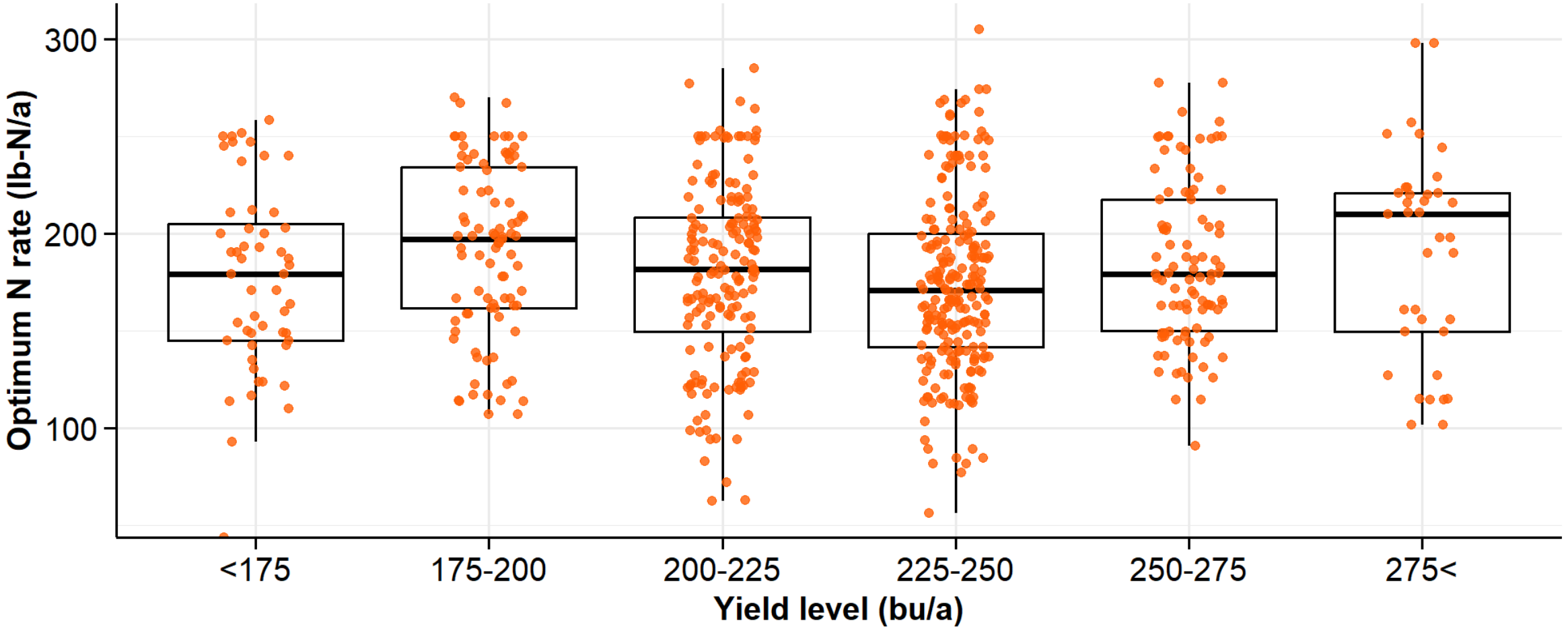
As we update & refine N guidance…

1. Does yield level (historic or target) have relevance?
   - Increasing yield levels does equate to larger total nitrogen uptake in aboveground biomass
2. What is the finest spatial scale can we achieve realistic expectations of predicting corn yield response to N fertilizer?
   - Region, crop reporting district, county, soil association or family level?
3. Can we separate out different N source, timing, and placement strategies? Tillage system and/or cover crop use?
   - Some components are more consistently different (fall vs. spring) compared to others (split at planting & V6 compared to V8)

With well-structured and representative field (on-farm) research we can get close to many refinement goals. This requires collaborative efforts.

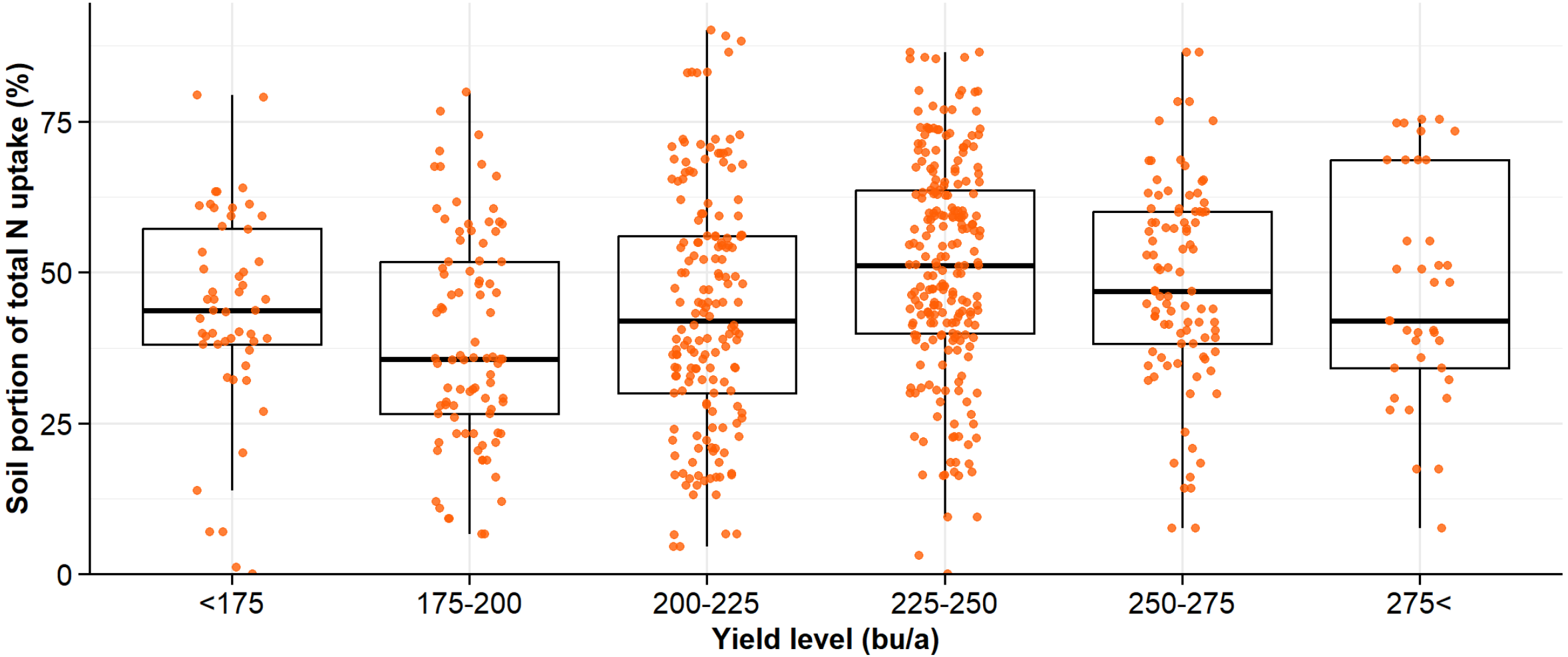
Optimum N rates for yield ranges

(2013-2024, all Illinois corn N rate trials)



Total N uptake supplied by the soil

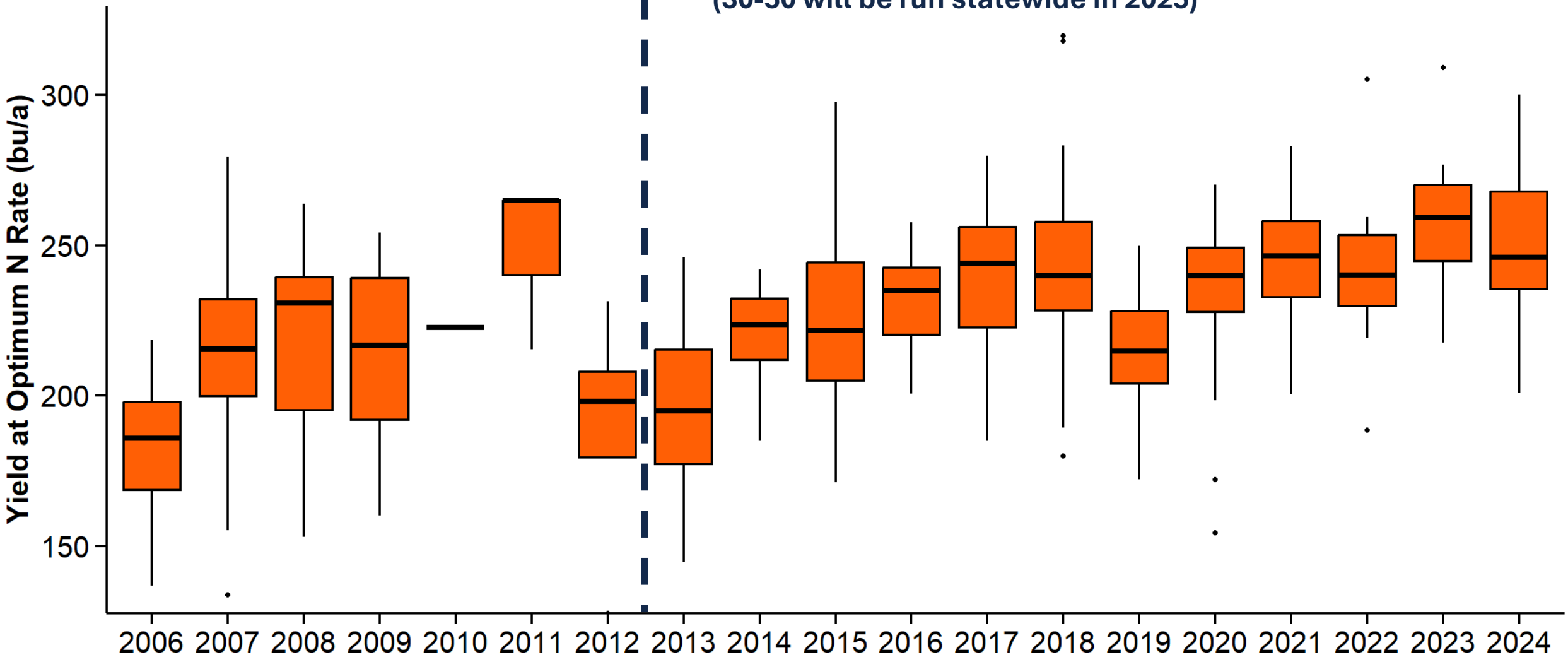
(2013-2024, all Illinois corn N rate trials)



Yield at optimum N rate over time – Central/North IL

(2006-2024; soybean-corn)

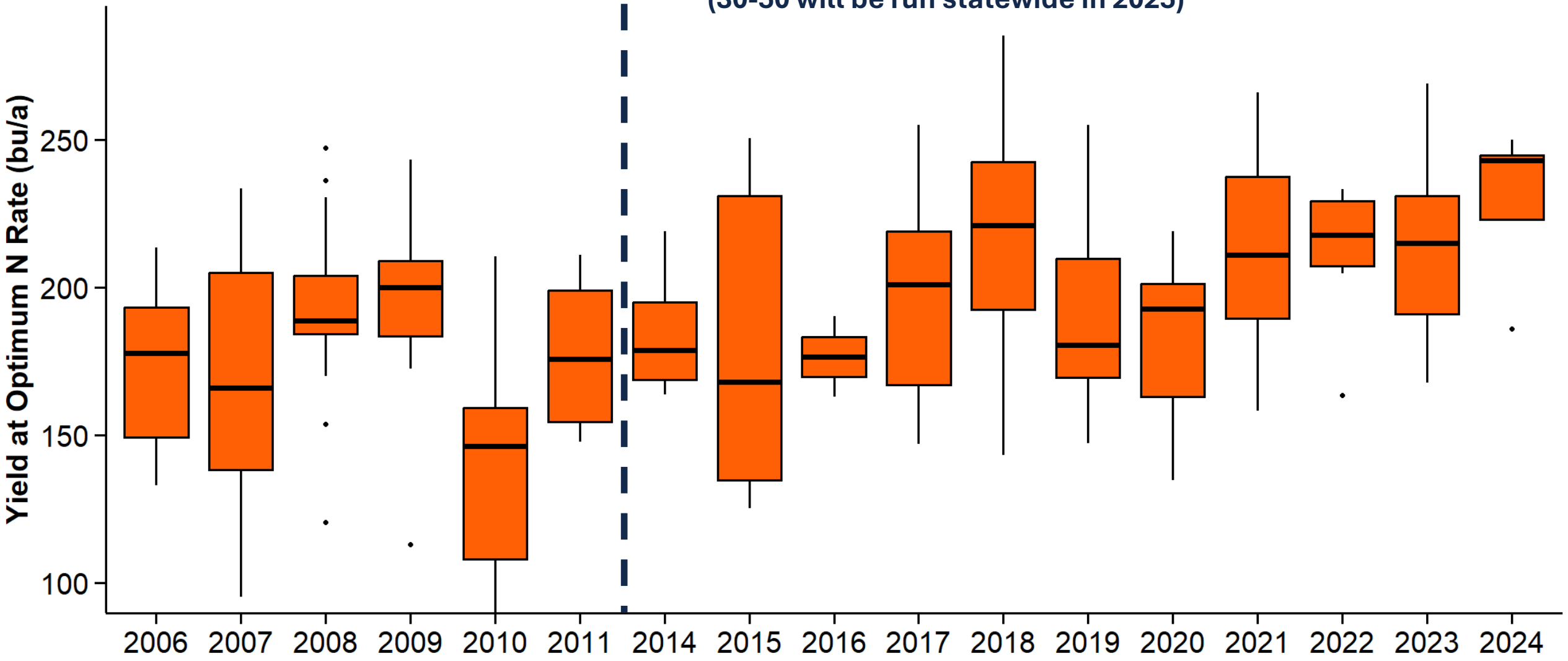
We shifted to only using 2013 to 2024 trials
(30-50 will be run statewide in 2025)



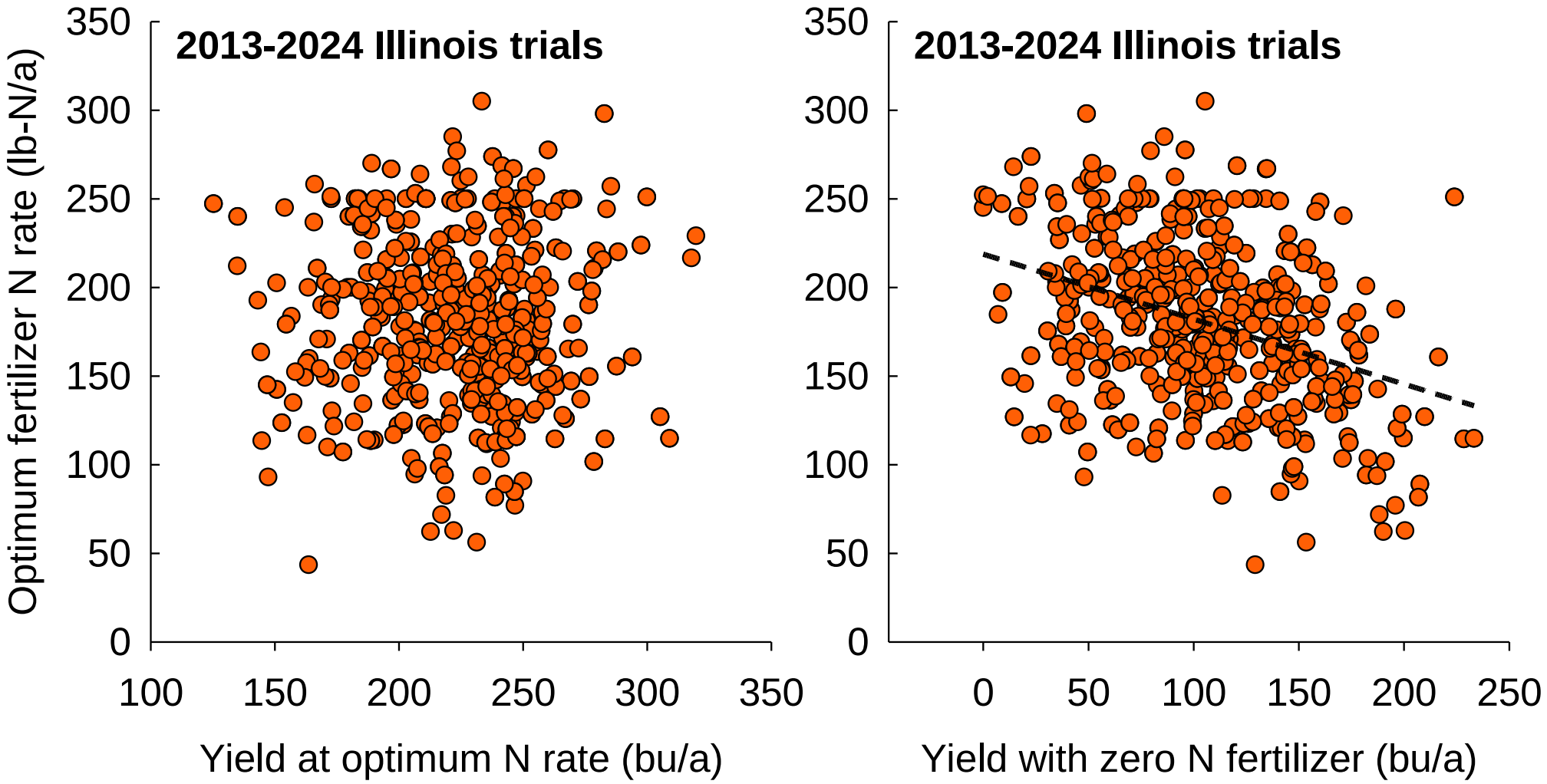
Yield at optimum N rate over time – Southern IL

(2006-2024; soybean-corn)

We shifted to only using 2013 to 2024 trials
(30-50 will be run statewide in 2025)

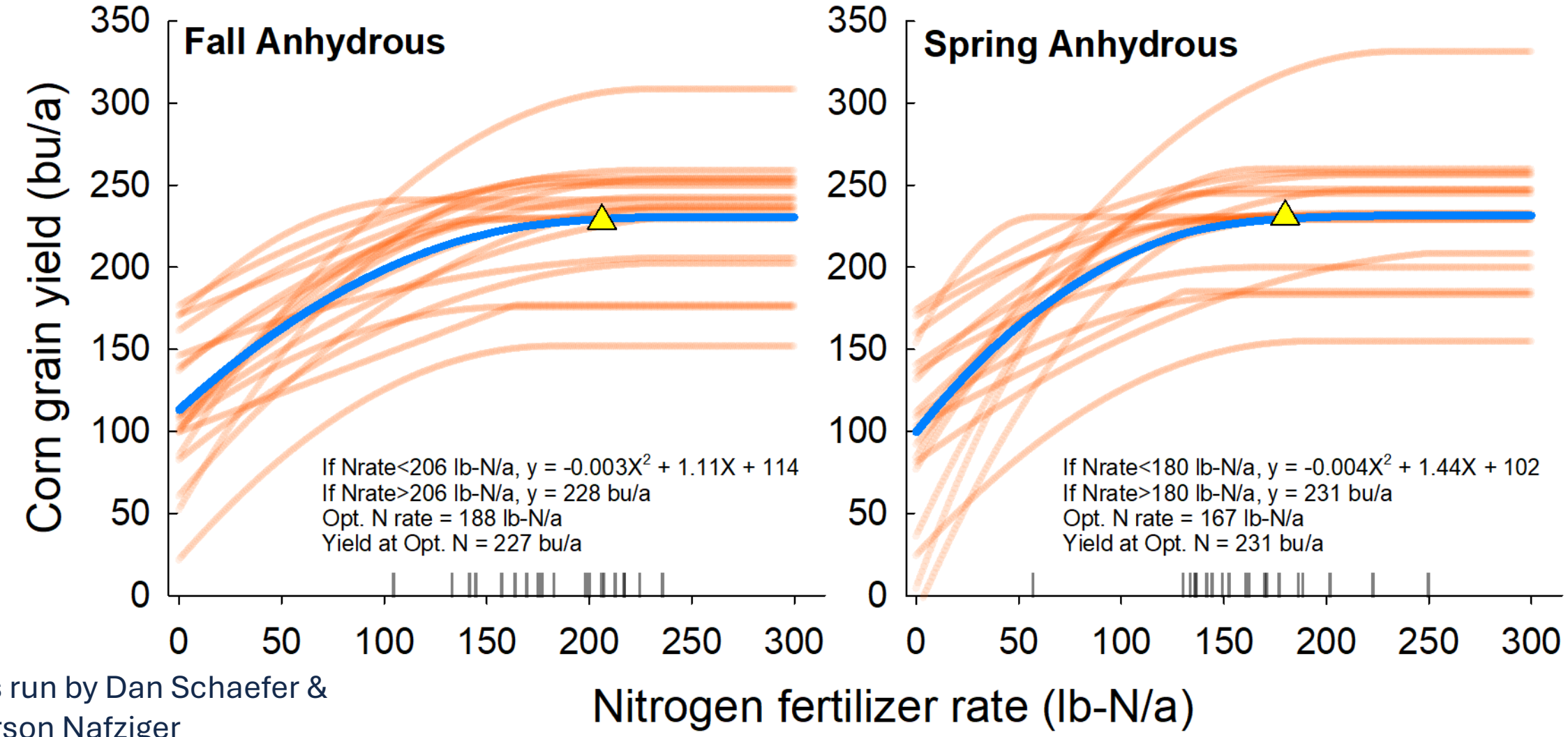


Only yield with little N points to a (weak) relationship with optimum N rate



Fall vs. spring applied anhydrous, 2013-2020

Fall application led to a 21 lb-N/a higher optimum N rate



Trials run by Dan Schaefer & Emerson Nafziger

MRTN rate as N price varies

Corn at $4.50; N price as indicated; 2013-2024 supporting data

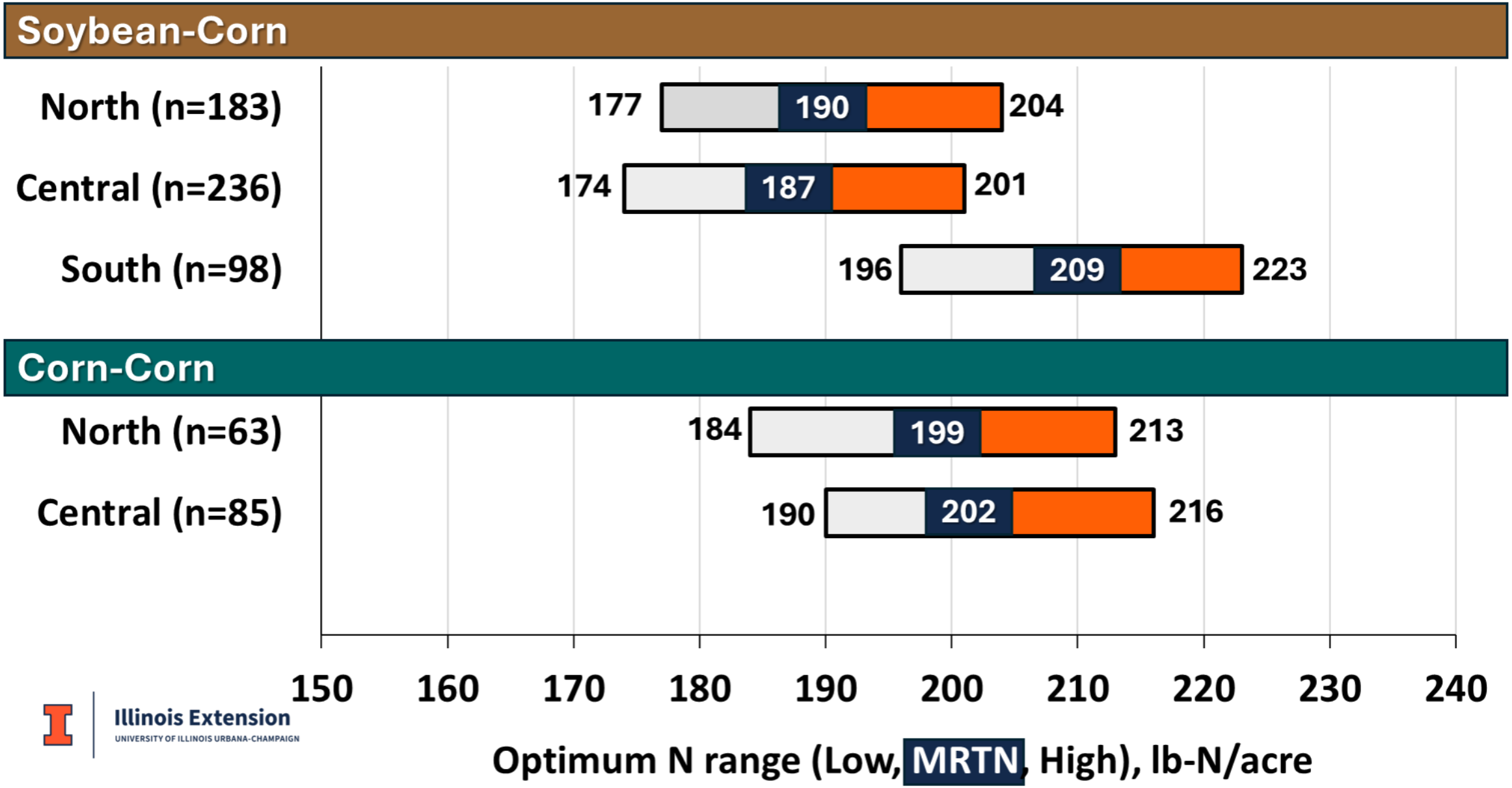
Profitable ranges are MRTN rate +/- 12-14 lb

		NH_3		UAN (32%)	
IL Region	Rotation	$775 (0.47)	$350 (0.55)	$375 (0.59)	$400 (0.63)
North	**Soy-Corn**	189	182	179	176
	Corn-Corn	197	188	184	180
Central	**Soy-Corn**	186	179	176	174
	Corn-Corn	200	196	192	189
South	**Soy-Corn**	207	200	199	195

Southern IL data shows stronger responses to N and is less affected by price compared to north and central IL

Illinois corn Maximum Return to N ranges for 2025

Numbers below at N:corn price ratio of 1:10 ($0.45/lb N; $4.50/bu corn); 2013-2024 data



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Illinois corn Maximum Return to N ranges for 2025

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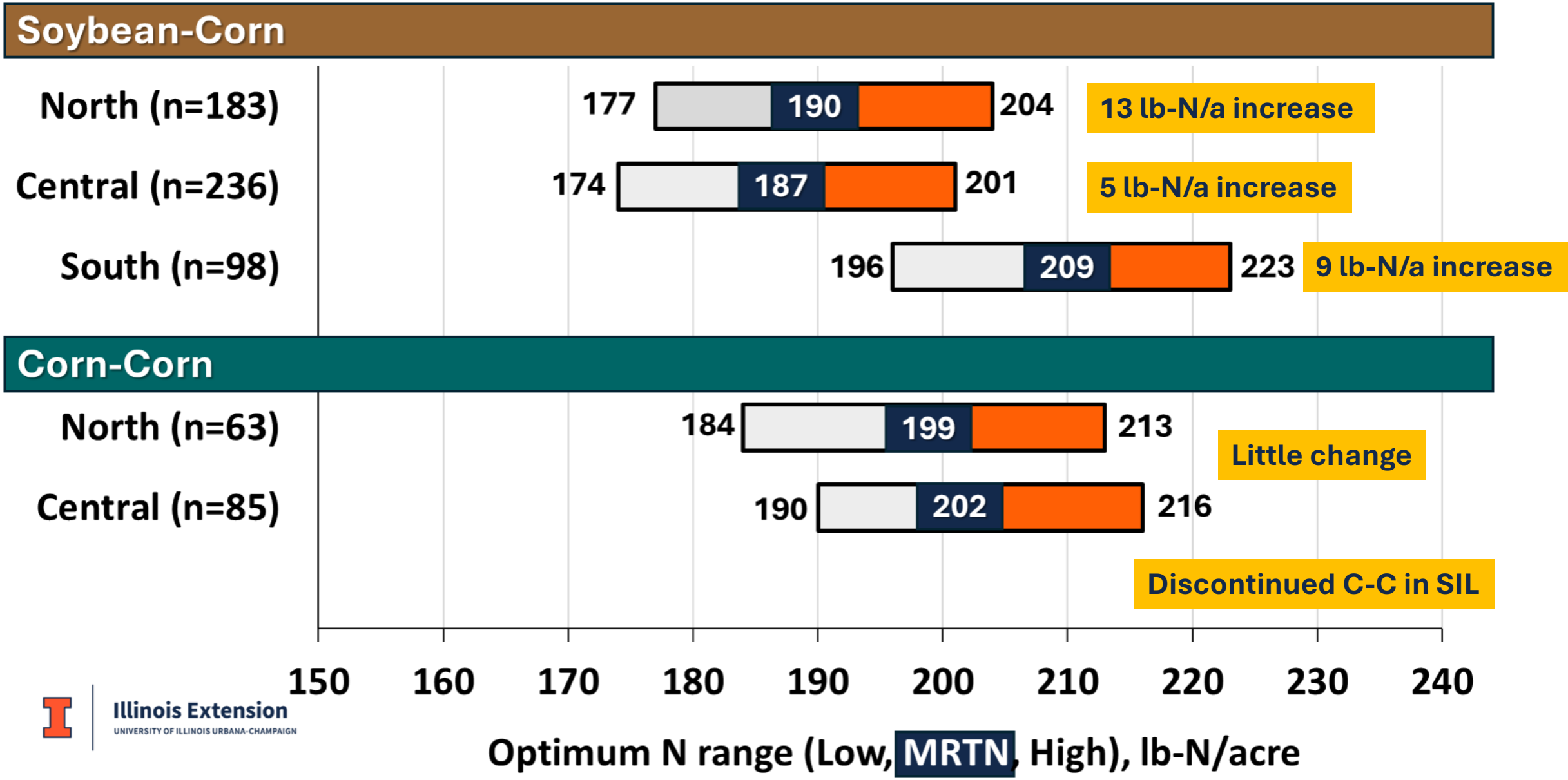

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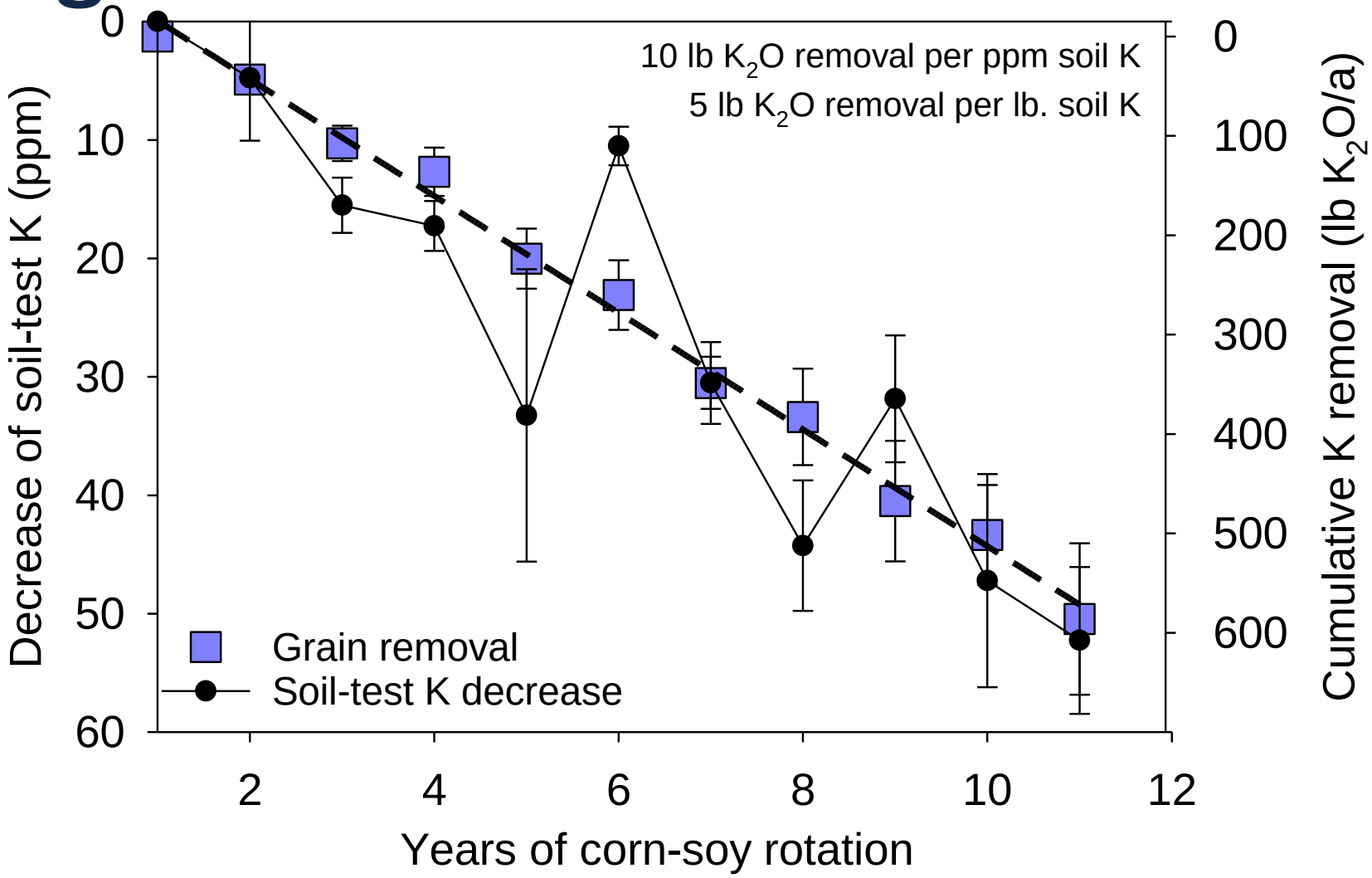
Important points for P&K applications in 2025

- How soil test reports are interpreted (low vs. high testing) should not change as prices become unfavorable
- Critically assessing what are your high to very high testing fields can allow for cost savings or shift applications to those testing very low to optimum.
- Wherever your soil test are at, ROI to fertilization needs to be stressed.
- Know your level from last sampling and realistic removal values if fertilizing based on removal
- Be cautious if working with 2020 and 2022 sample data (dry fall)

Soil sampling ROI generally increase with tight margins

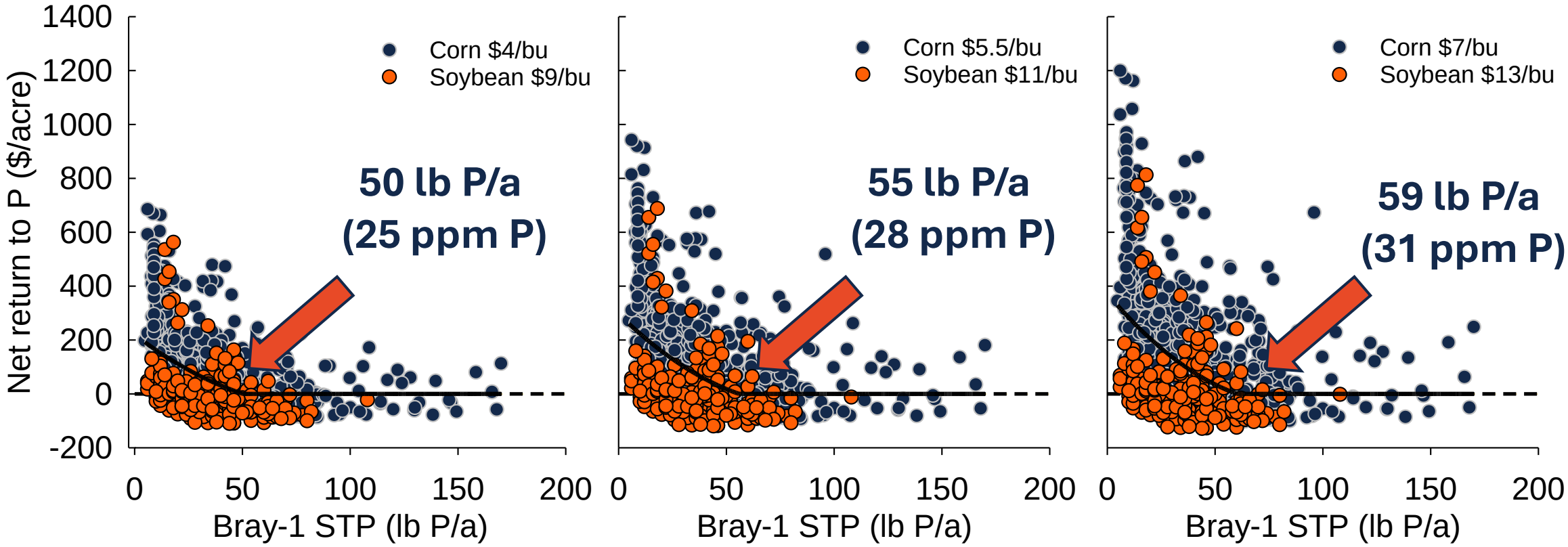


Saybrook SiL
Continuous no-till

Jones (2023)

ROI to P fertilizer as grain prices change

Silt loam to silty clay loam soils; \$0.75/lb P_2O_5 (\$690/T DAP or \$780/T MAP)

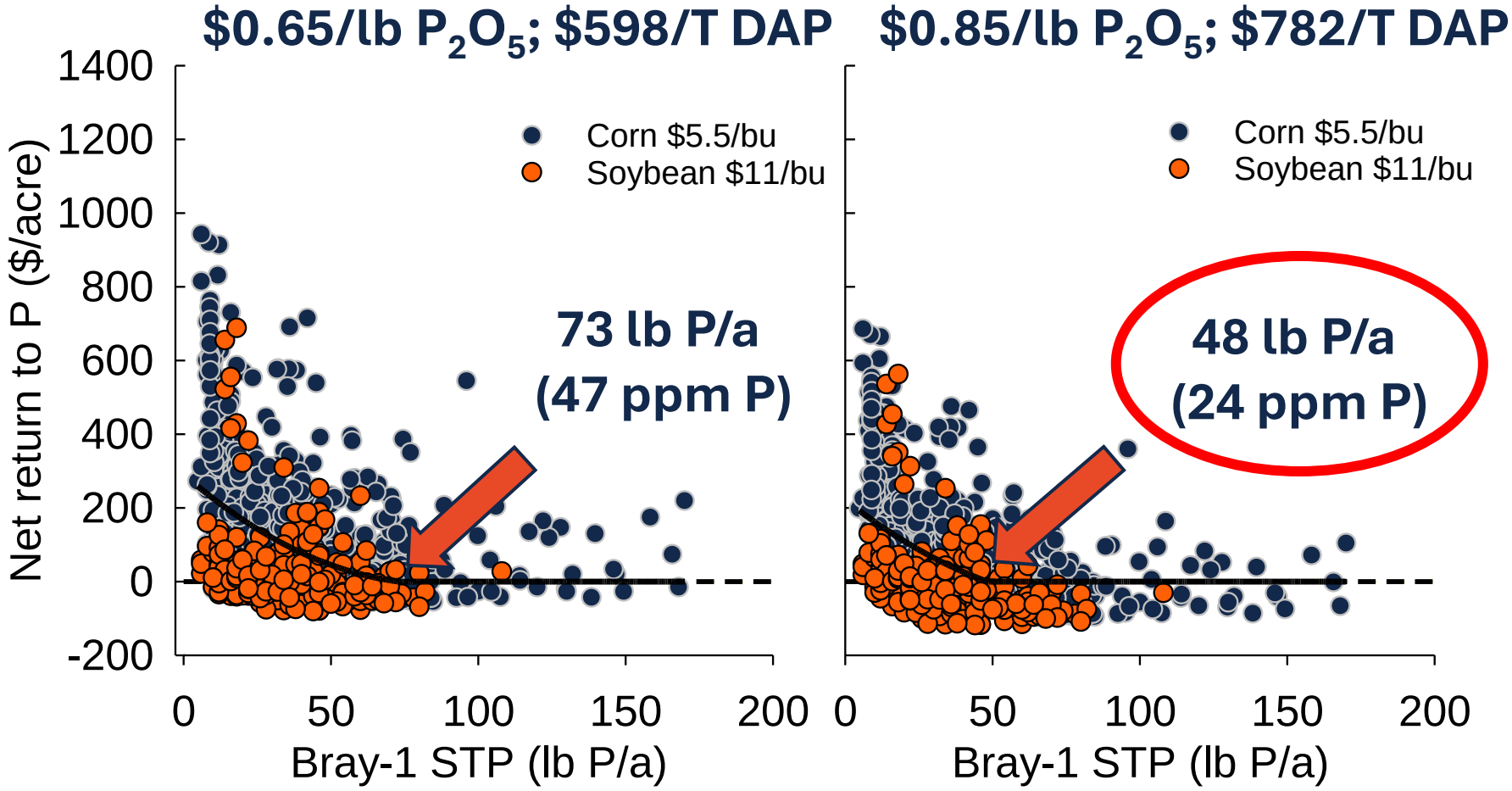


- The breakeven point should be near the optimum STP range at reasonable prices
- Price considerations should adjust P fertilizer rates, not soil-test interpretation

Jones (2025)

ROI to P fertilizer as fertilizer price changes

Silt loam to silty clay loam soils

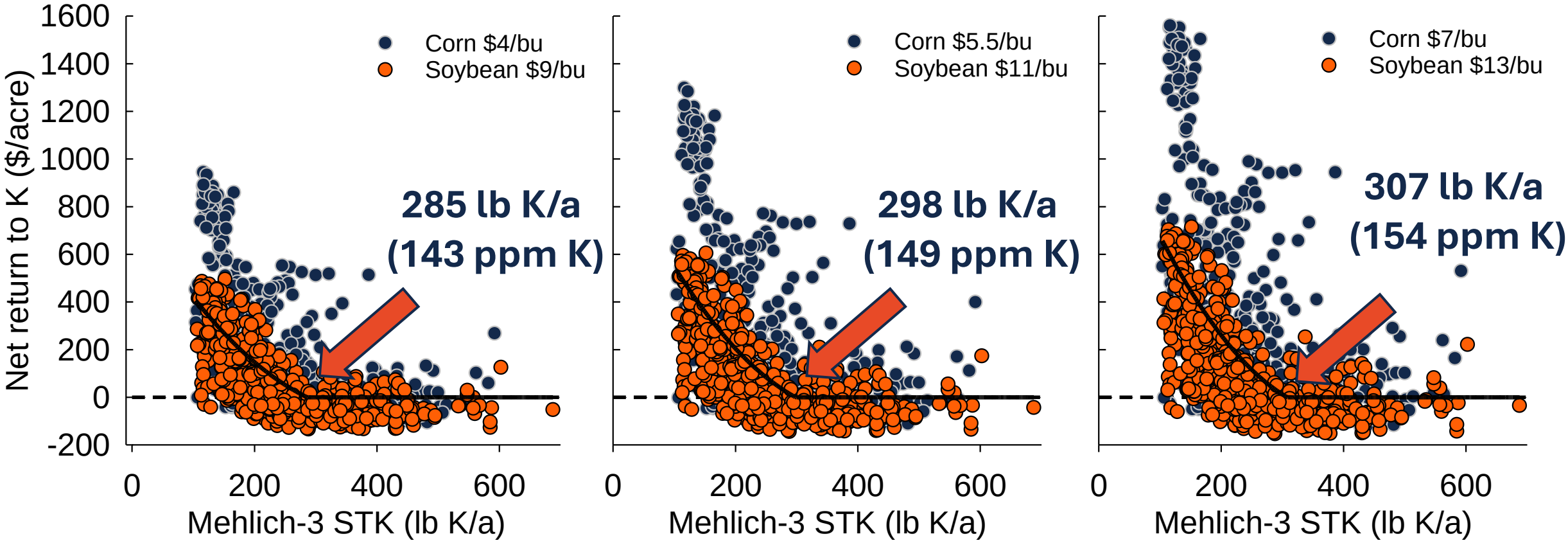


Variable fertilizer and grain prices support maintaining optimum levels to 'buffer' tough times

Jones (2025)

ROI to K fertilizer as grain prices change

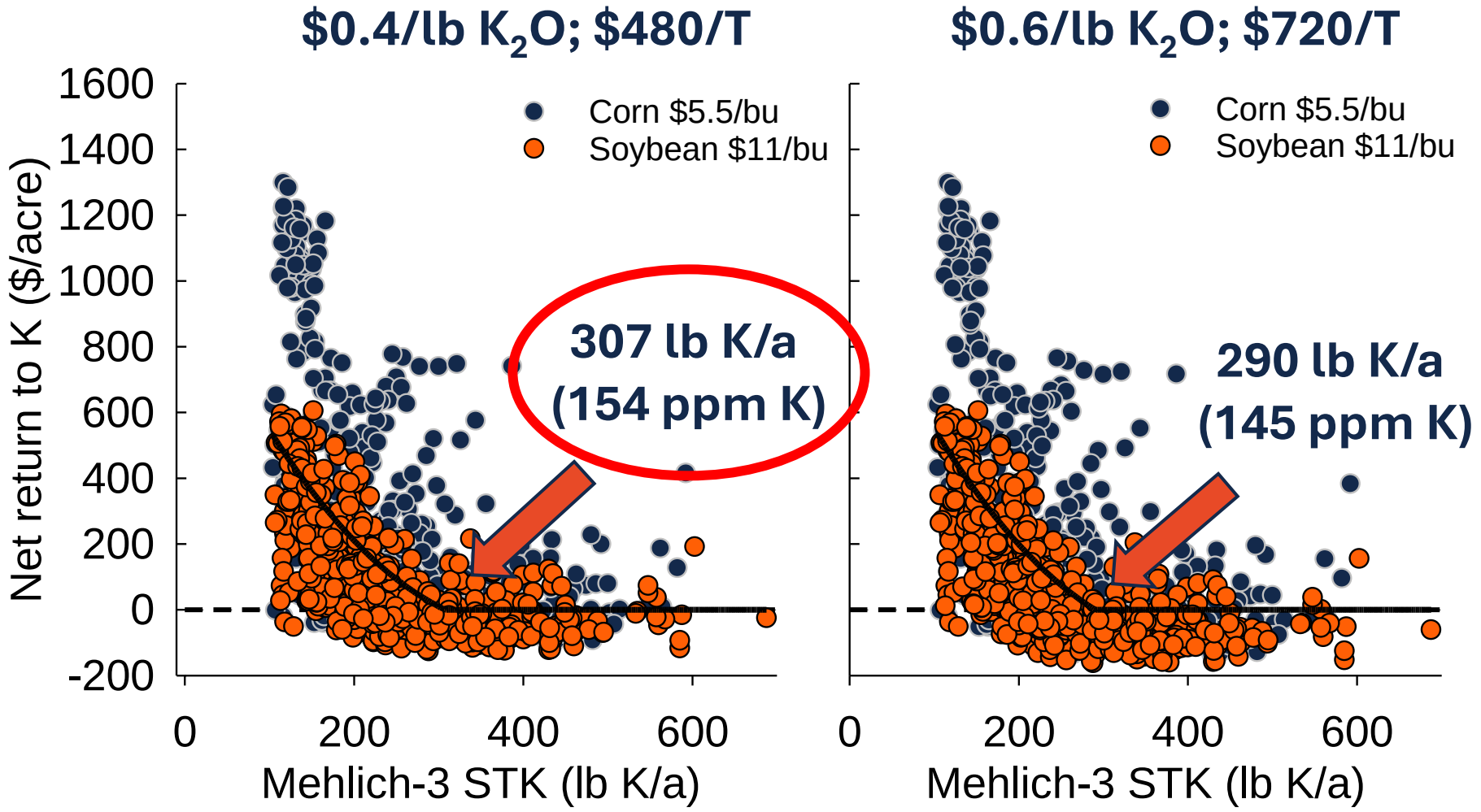
Silt loam to silty clay loam soils; $0.50/lb K_2O ($600/T 0-0-60)



While K responses supported high ROI, breakeven responses to grain prices did not suggest a need to shift target STK, instead keep focus on the range Jones (2025)

ROI to P fertilizer as fertilizer price changes

Silt loam to silty clay loam soils



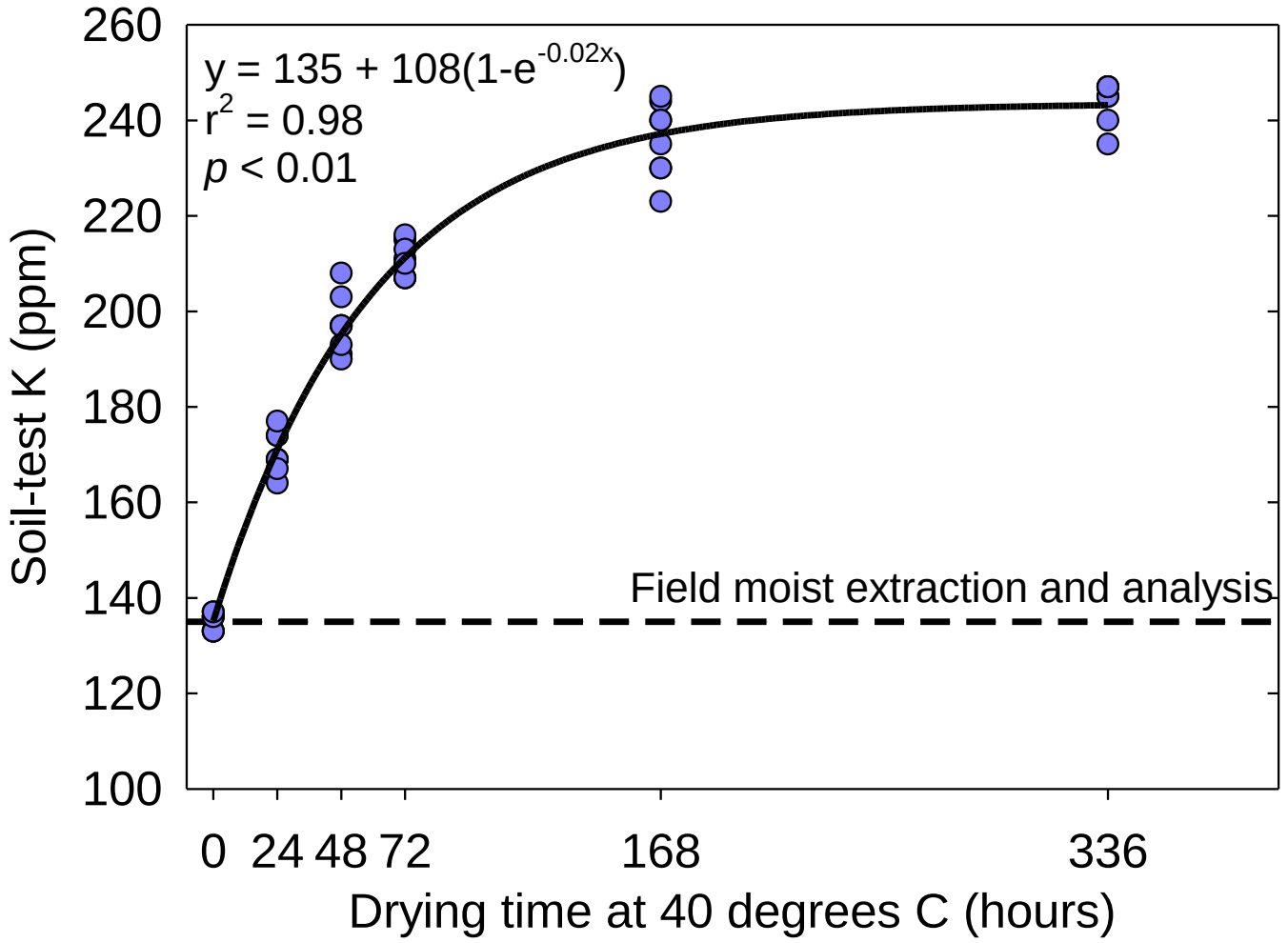
Jones (2025)

Grain removal values (applied to maintenance soil-test P&K ranges)

Crop	Moisture	Pounds per Bushel	
		P_2O_5	K_2O
Corn	15%	0.37	0.23
Soybean	13%	0.75	1.15
Wheat	13.5%	0.46	0.24

Soil moisture and soil K status

As drying time increases, measured nutrient concentrations change – K example

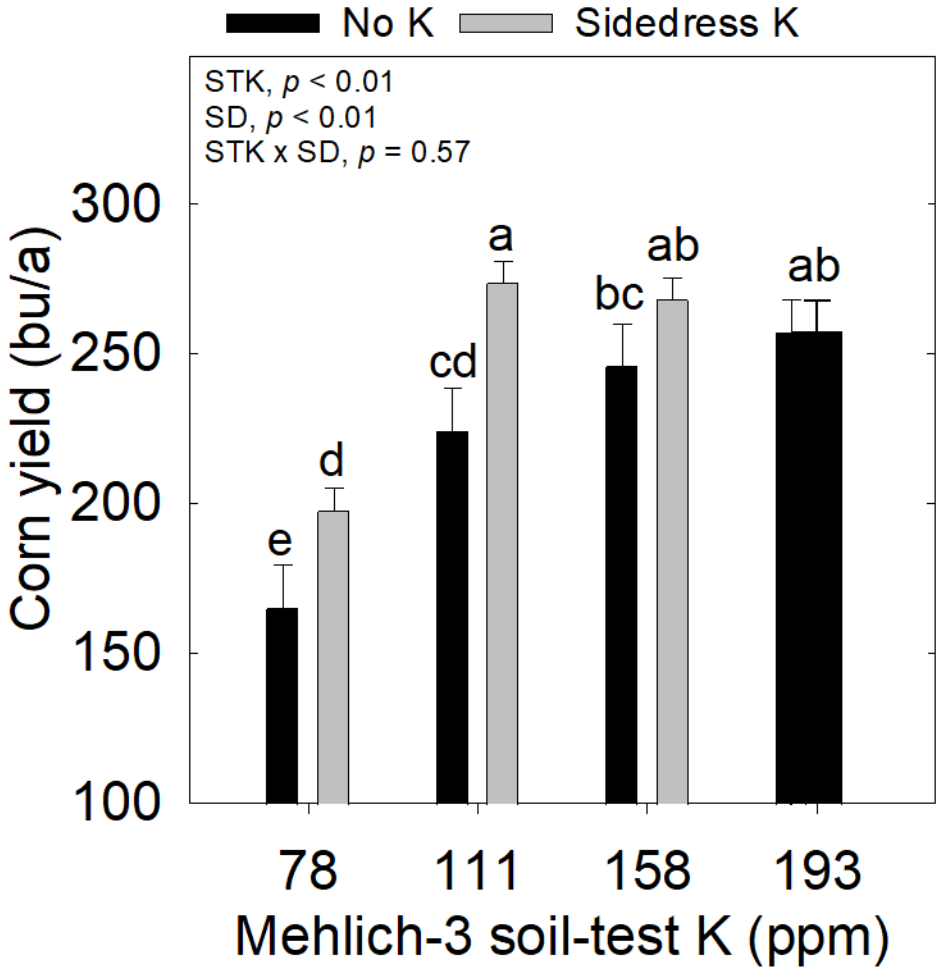


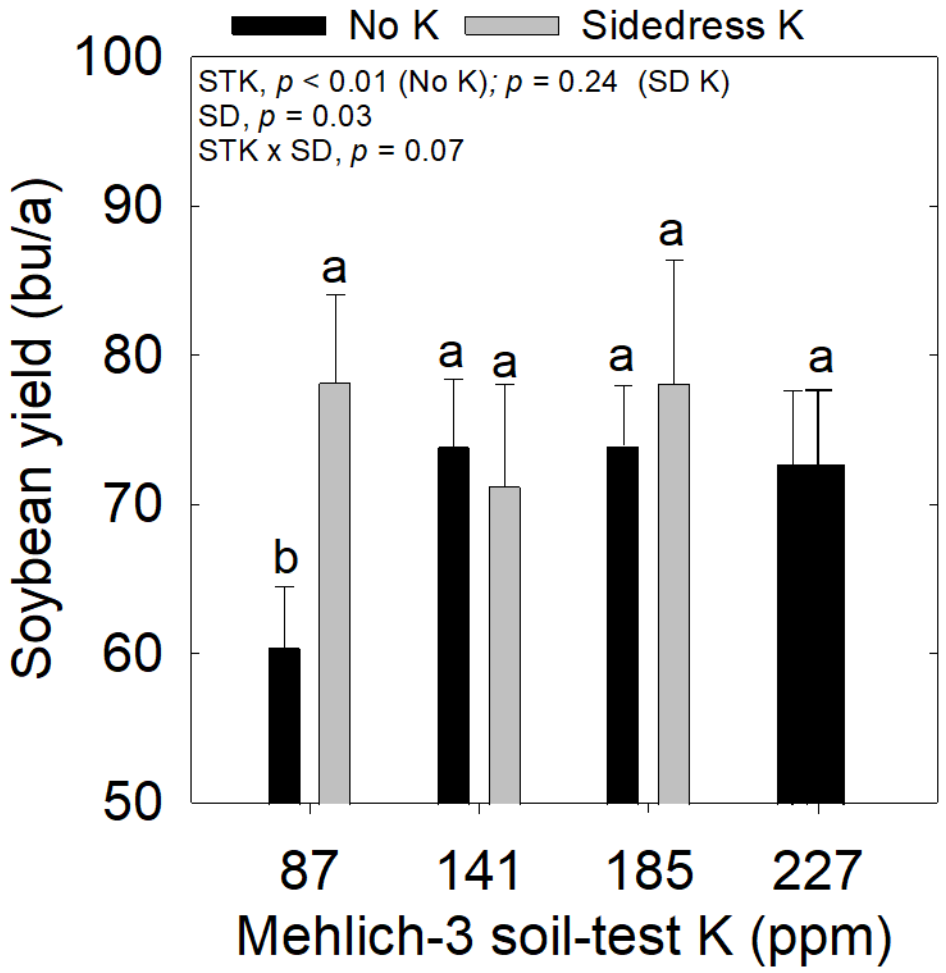
Plano silt loam
0 to 6-inch sample

Jones (2024)

Scenarios where in-season K is benefitial?

In-season K (as potassium acetate) to compensate for low testing soils?

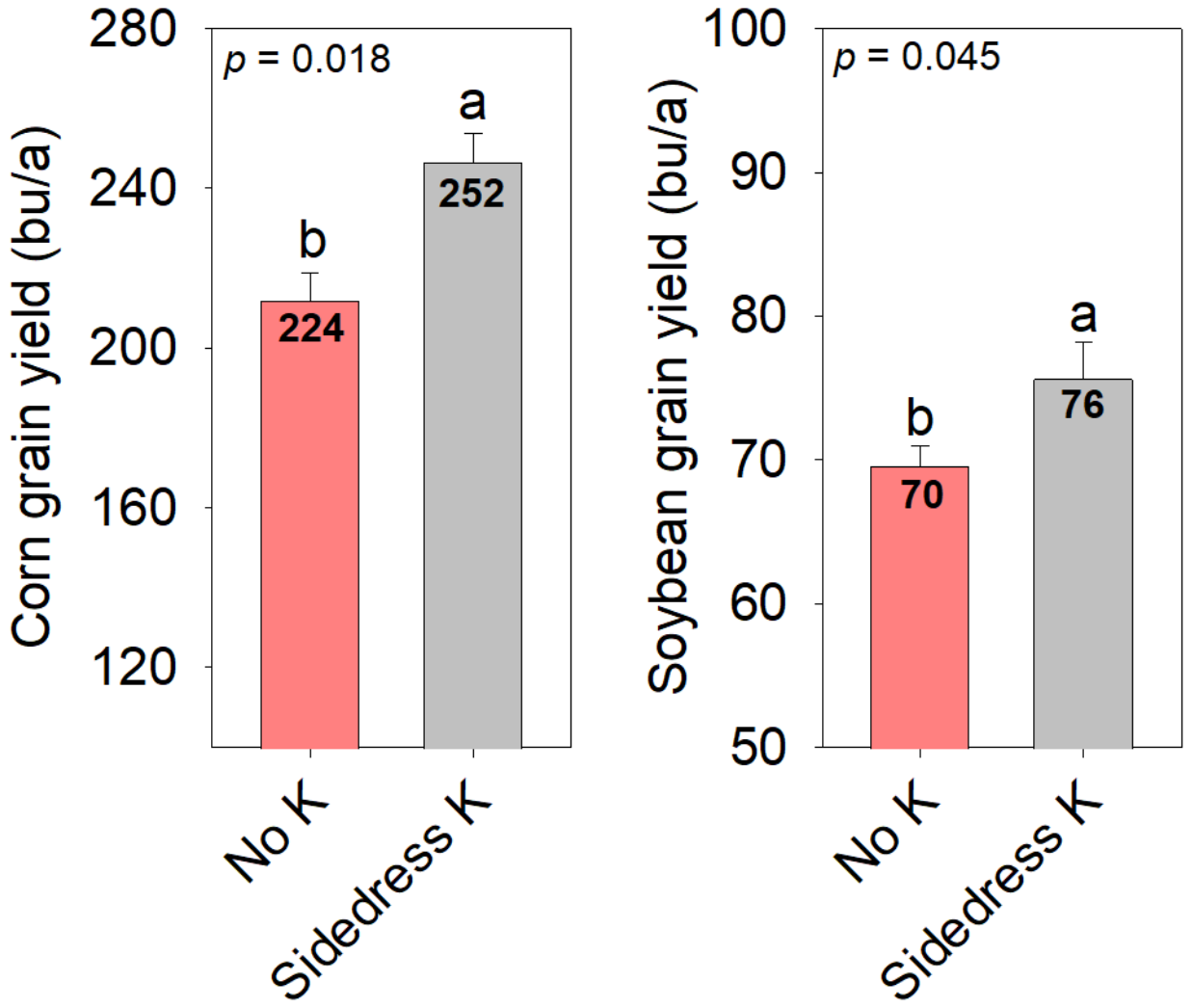




Jones (2023)

Potassium acetate trial at two sites in 2023

- Only significant responses to in-season K in LOW TESTING soils
- Maintaining optimum/maintenance or higher would have been as effective at avoiding K deficiencies
- No “rescue” treatments are effective. Accumulation of organic acids has already burned the tissue.



Jones (2023)

Spring N management for wheat

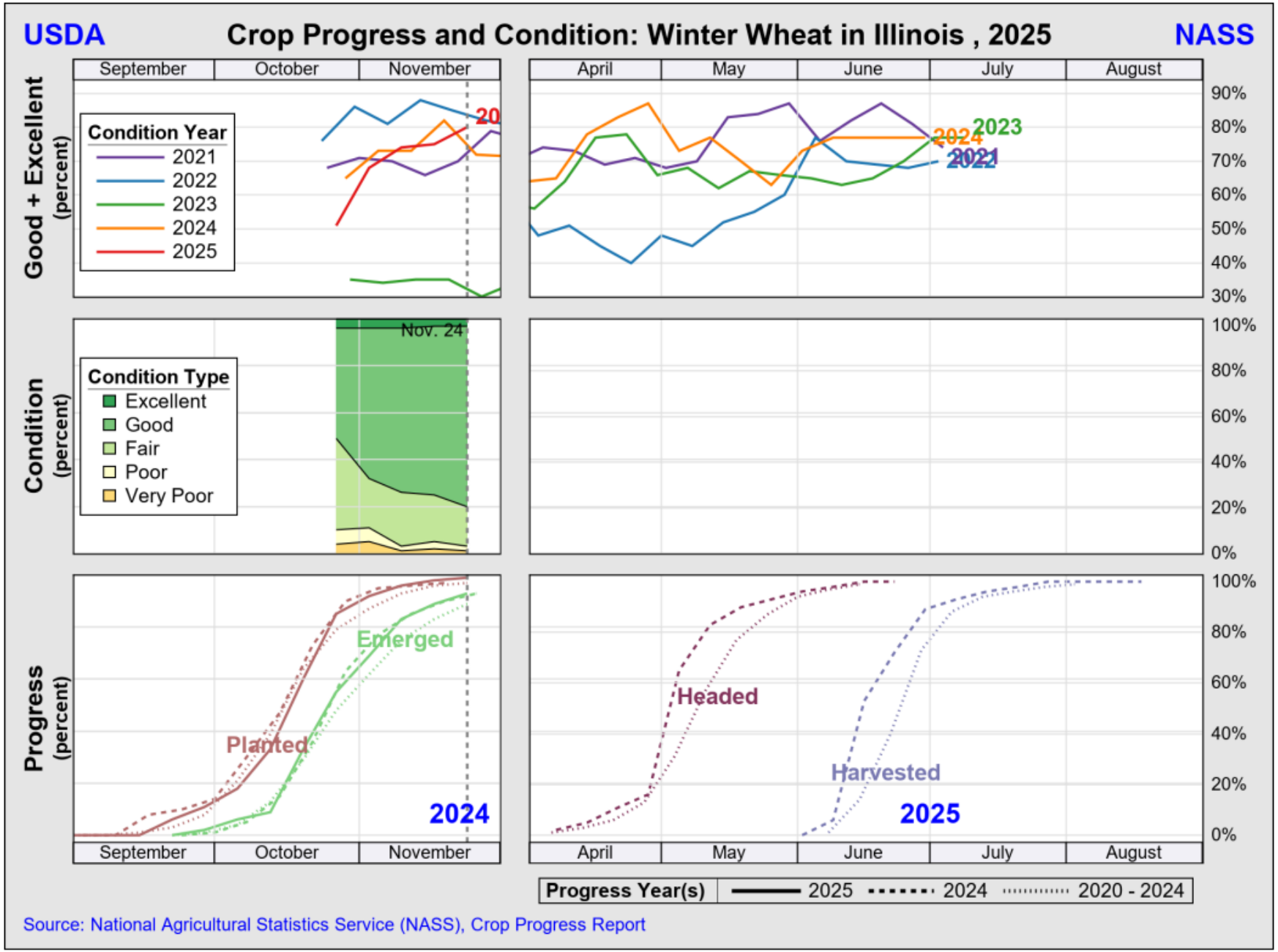
- First spring applications are currently being applied (or already finished)
- Watch following 48-hour conditions for potential N loss
- Current wheat & UAN prices: one bushel of wheat "buys" about 11 pounds of N

Table 9.2. Recommended spring nitrogen application rates for wheat.

Soil situation	Organic matter	Amt of N that 1 bushel of wheat will "buy"			
		Very high (>13 lb)	High (9–13 lb)	Medium (5–9 lb)	Low (<5 lb)
		lb N/A			
Low in capacity to supply nitrogen: inherently low in organic matter (forested soils)	<2%	150	120–150	90–120	60–90
Medium in capacity to supply nitrogen: moderately dark-colored soils	2–4%	100–120	80–100	60–80	40–60
High in capacity to supply nitrogen: deep, dark-colored soils	>4%	70–90	50–70	30–50	30

Rates assume no more than 30 lb of fall-applied N and spring application at greenup.

Chapter 9 Illinois Agronomy Handbook


USDA
Crop Progress and Condition: Winter Wheat in Illinois , 2025
NASS
September
October
November
April
May
June
July
August
Good + Excellent (percent)
Condition Year
2021
2022
2023
2024
2025
2023
2024
2021
90%
80%
70%
60%
50%
40%
30%
Condition (percent)
Condition Type
Excellent
Good
Fair
Poor
Very Poor
Nov. 24
100%
80%
60%
40%
20%
0%
Progress (percent)
Emerged
Planted
2024
Headed
Harvested
2025
Progress Year(s)
2025
2024
2020 - 2024
Source: National Agricultural Statistics Service (NASS), Crop Progress Report

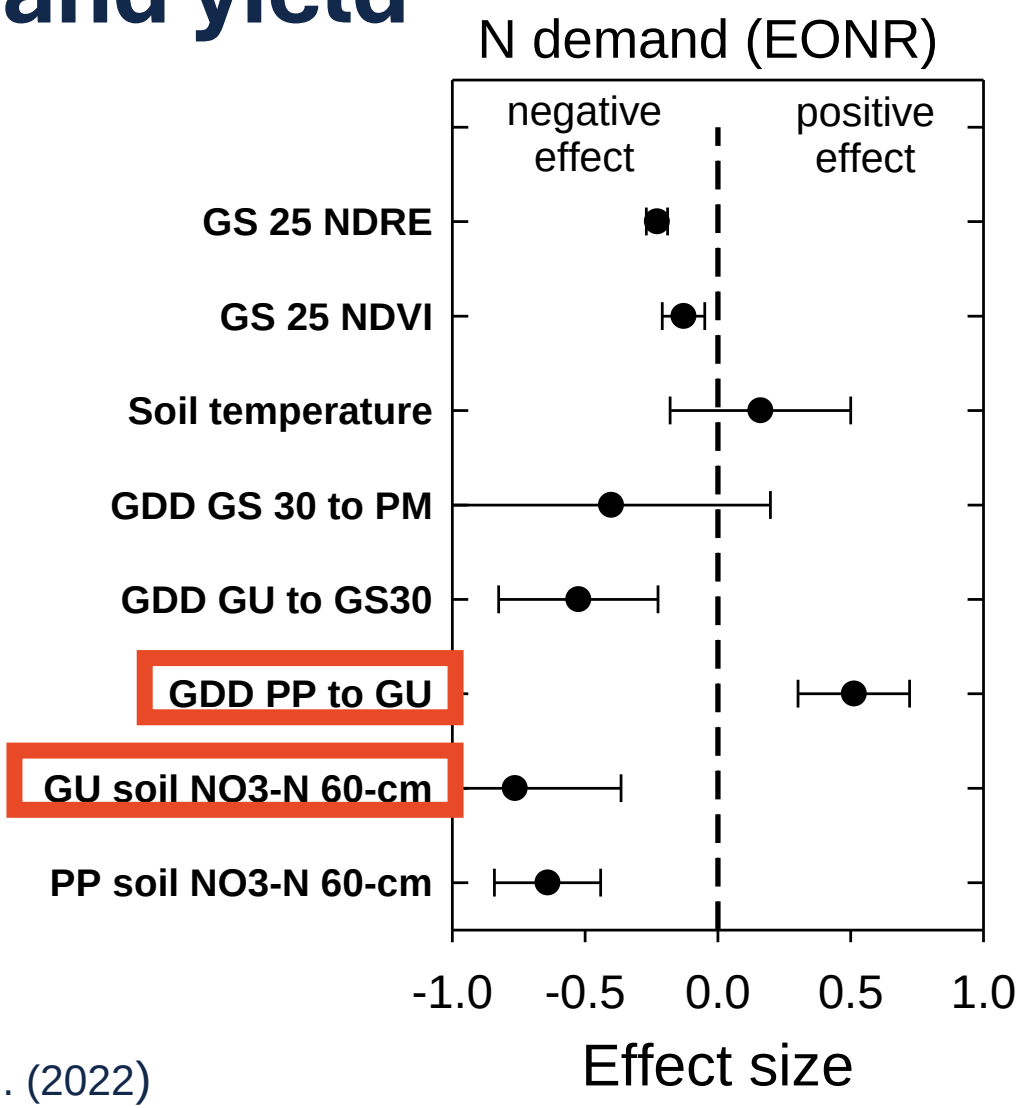
Effects of system variables on winter wheat nitrogen demand and yield

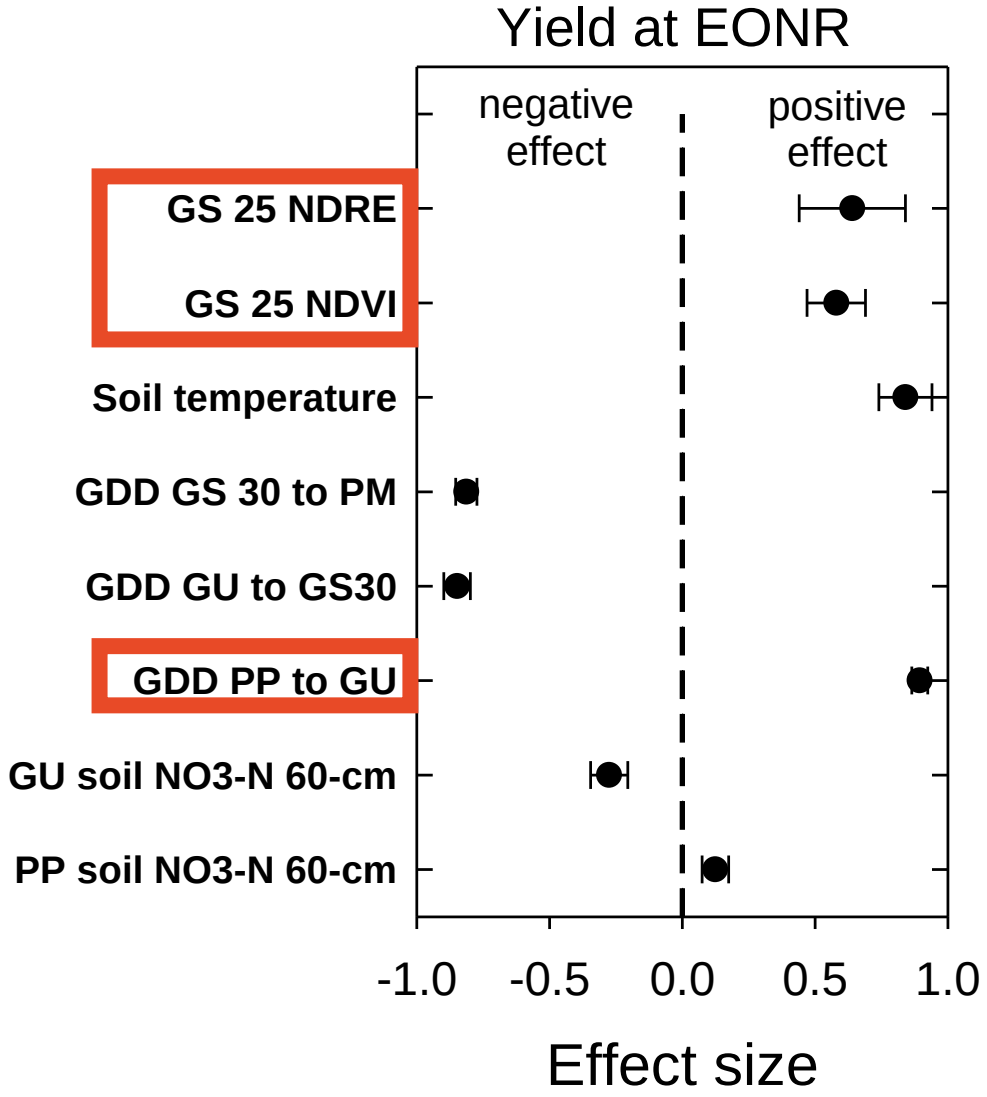
(WI research)

(Days >50ºF planting to GU)

Fraction of total Growing degree days between growth stages

Planting date (GDD PP to GU) and green-up soil N had the largest and most consistent effect on EONR





Adapted from Jones et al. (2022)

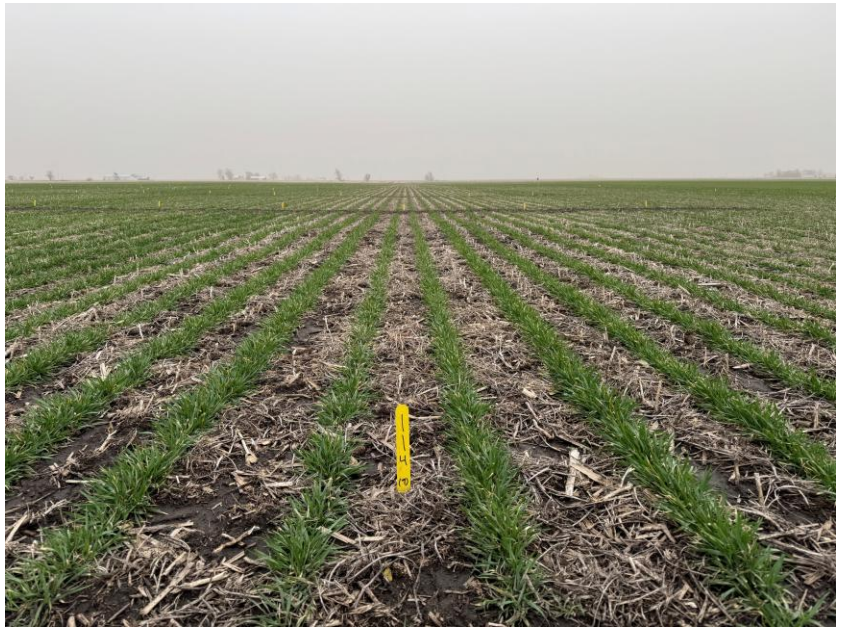
Ongoing/future wheat N, P, and S trials

- Winter wheat (in double-crop systems) response to nitrogen rate, timing, phosphorus source, and sulfur rate (3 sites planted fall 2024)

Zero fall N

40 lb fall N as SuperU

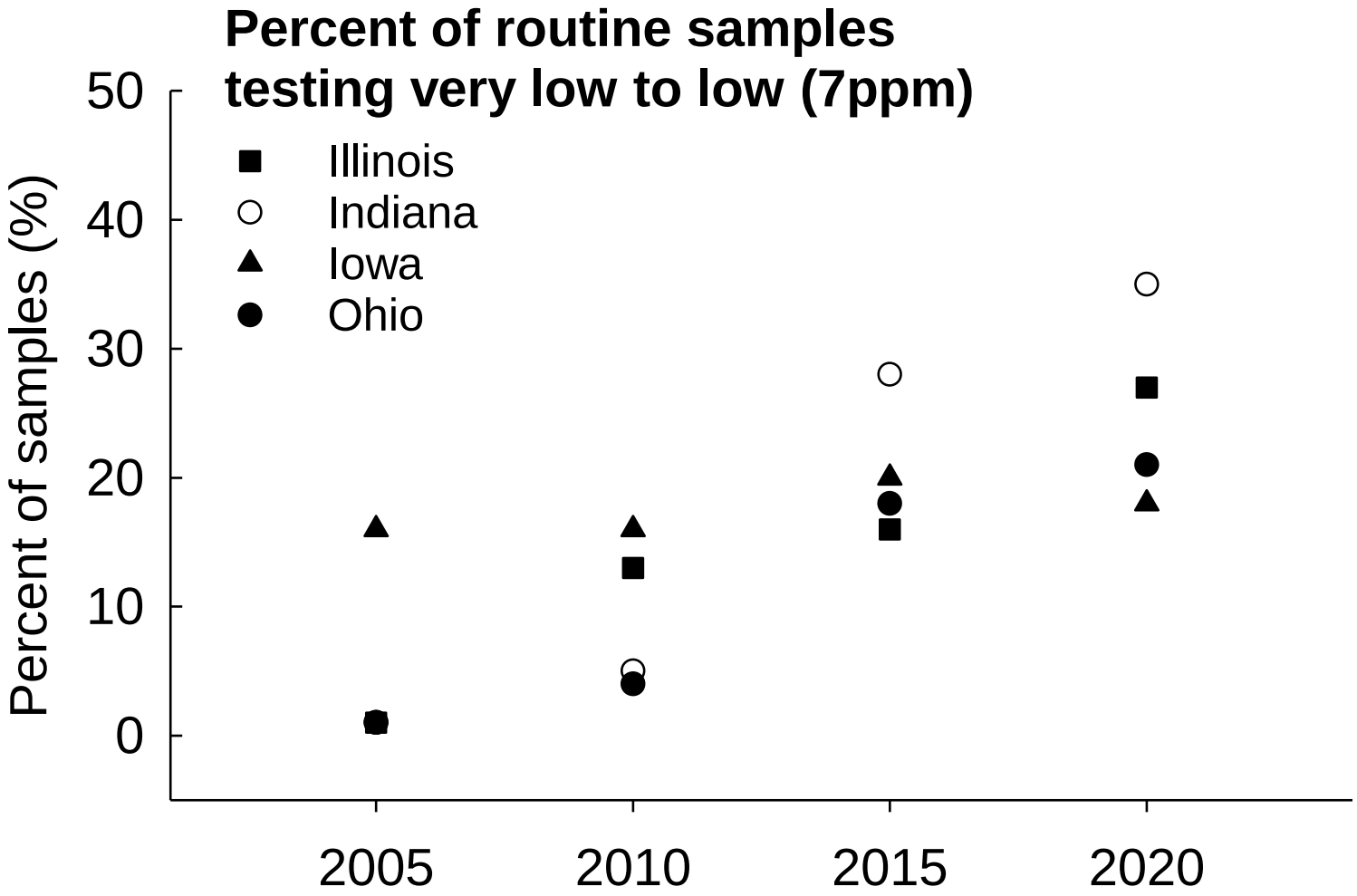
40 lb fall N as MAP



Pictures taken 3/16; Piatt County

Soil-test S does not inform much, but it is more often testing low

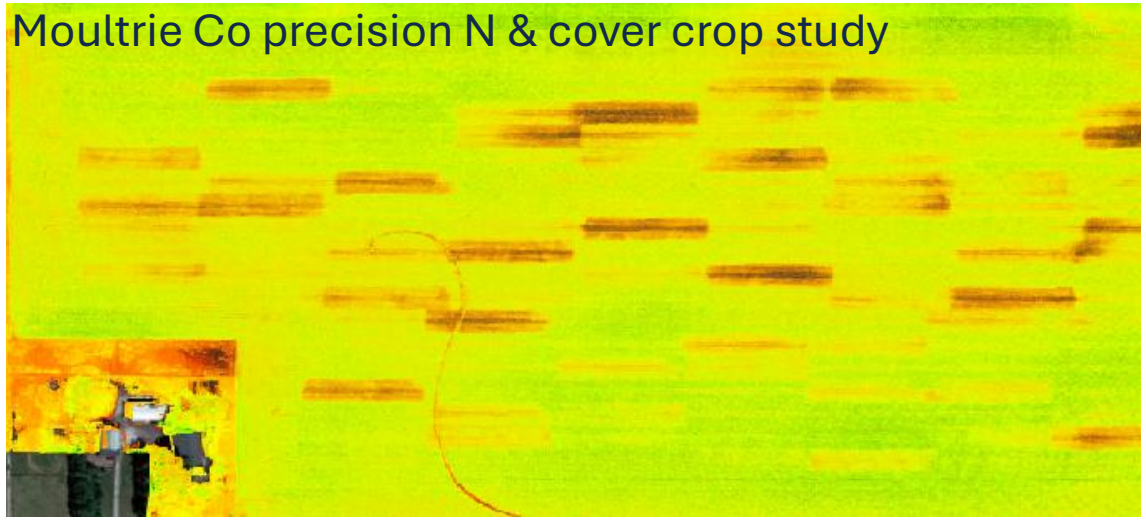
- North American Soil Test Summary (2020)
- From routine respective depths for each state
- Soil or early plant tissue S does not predict yield response to S well
- ***Rely on confirming deficiencies and target those fields***



2025 on-farm research efforts statewide

If interested in collaborating, please reach out

1. On-farm corn N rate trials – focus on yield, soil N, and plant N
2. Soil-test P & K calibration and spatial variability
3. Precision N management
4. Corn nitrogen x sulfur/potassium – 2 or 3 S/K rates x 6 N rates
5. Winter wheat/soybean N rate trials – N rate, timing, and P source



Thank you!

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Dan Schaefer, Illinois Fertilizer & Chemical Association

John Pike, Pike Ag, LLC