P and K trials to support Illinois and FRST efforts on rate and CSTV recommendations

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>60 owners/operators across Illinois

11 July 2025
FRST Collaborator Meeting

https://margenot.cropsciences.illinois.edu/

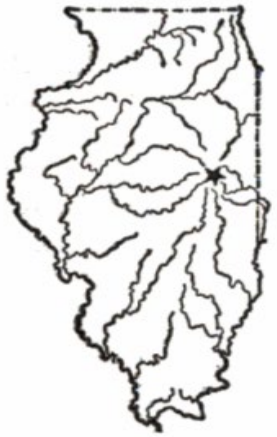
Long history of soil test P work at UIUC: Bray

UNIVERSITY OF ILLINOIS
Agricultural Experiment Station

BULLETIN No. 337

A FIELD TEST FOR AVAILABLE PHOSPHORUS IN SOILS

By R. H. Bray



URBANA, ILLINOIS, AUGUST, 1929

Patent applied for

1929 bulletin; patent 1943

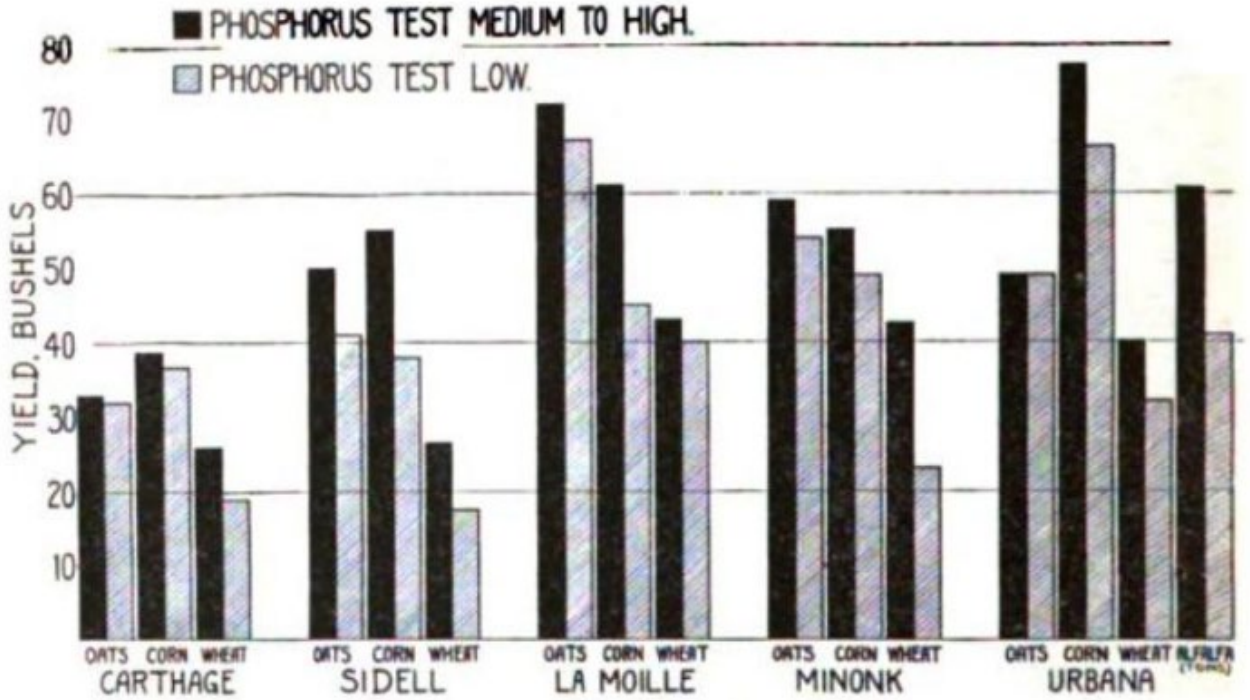


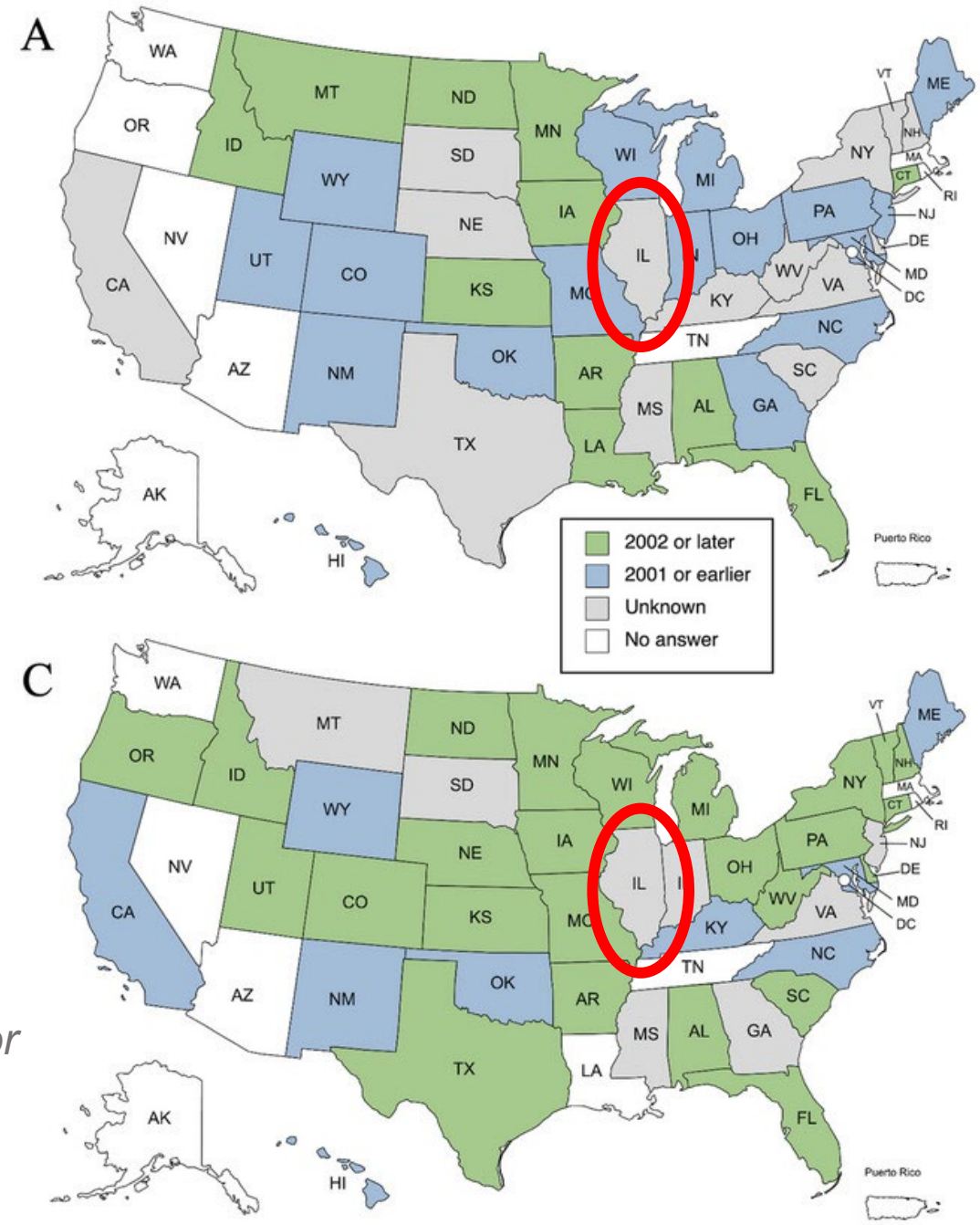
FIG. 2.—RELATION BETWEEN AVAILABLE PHOSPHORUS TEST AND THE PRODUCTIVE LEVEL OF UNTREATED SOILS OF THE ILLINOIS SOIL EXPERIMENT FIELDS

Each pair of contiguous bars represents the crop yield of a high testing and a low testing check plot in the same series of a given experiment field. With the exception of the oats crop at Urbana, the high testing plot outyielded the corresponding low testing plot.

Needs for updating – and expanding? –Illinois Agronomy Handbook recs on P and K

Reasons to update:

1. Changes in how we test for soil P and K
2. Changes in crop management (e.g., plant populations, hybrids, tillage)
3. Crop species
4. Changes in how we calculate the CSTV
5. Soil types
6. Soil sampling depth: going beyond 7”



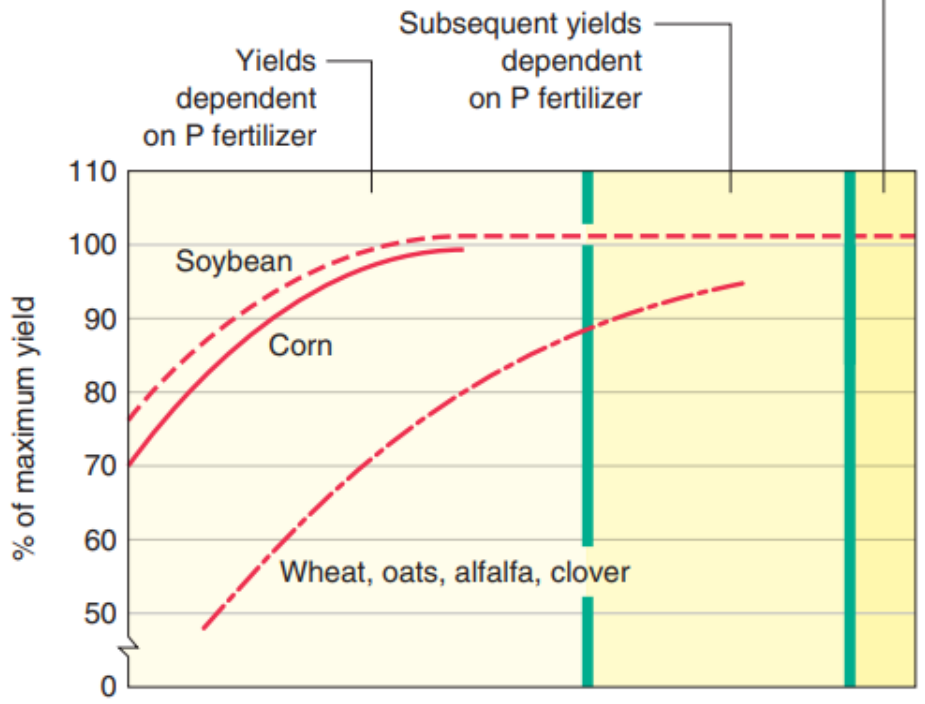
Year (A) current soil test P field correlation was last established or validated for corn grain, and year (C) P calibration or rate recommendations were last revised or validated for corn grain

Lyons et al 2023 *SSSAJ* 87(4):985

Illinois Agronomy Handbook: P and K CSTV

- Last updated…unclear. Suspected to be at least pre-2000, major tenets pre-1980

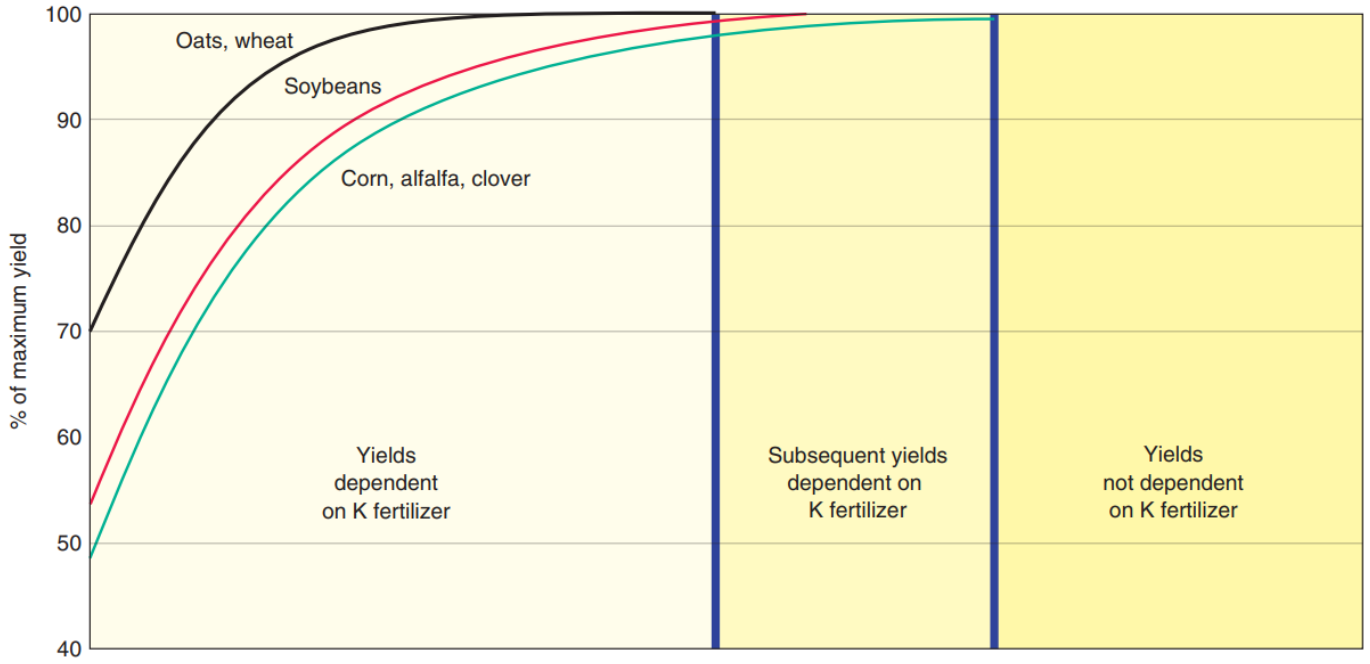
Range of 20-35 ppm (Bray)
CSTV 20-25 ppm



P test (lb/A) for different subsoil phosphorus-supplying power regions

High	7	15	20	40	60
Medium	10	20	30	45	65
Low	20	30	38	50	70

Range of 130-200 ppm (AA)
CSTV 130-150 ppm



K test (lb/A) for different cation exchange capacity regions

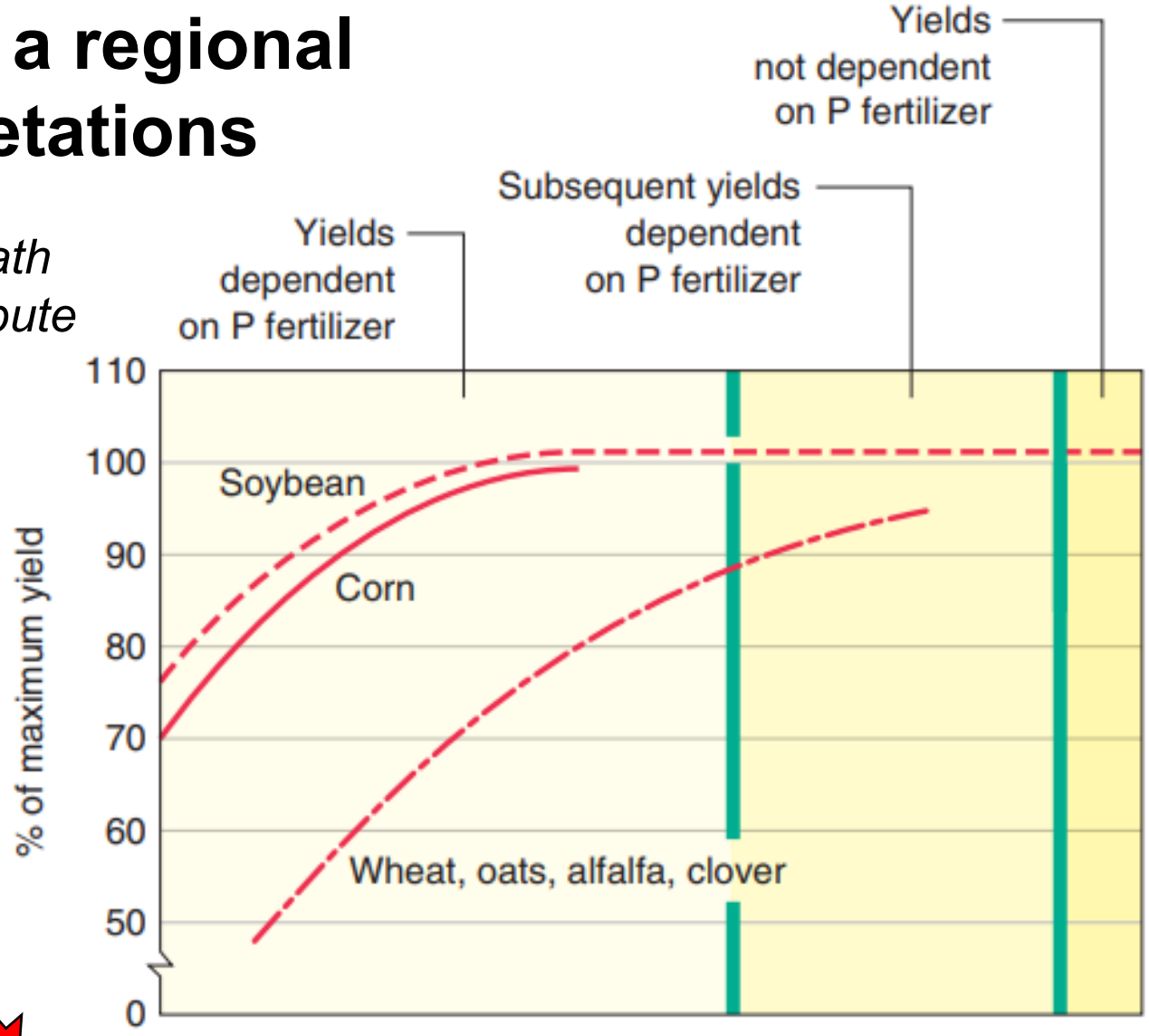
Low	40	100	200	260	360	500
High	60	120	240	300	400	540

K test (lb/A)

Subsoil P supply power as a regional modifier for STP interpretations

8.4. Subsoil phosphorus-supplying power in Illinois.

Concept: *P beneath top 12" can contribute to crop needs*



P test (lb/A) for different subsoil phosphorus-supplying power regions

High	7	15	20	40	60
Medium	10	20	30	45	65
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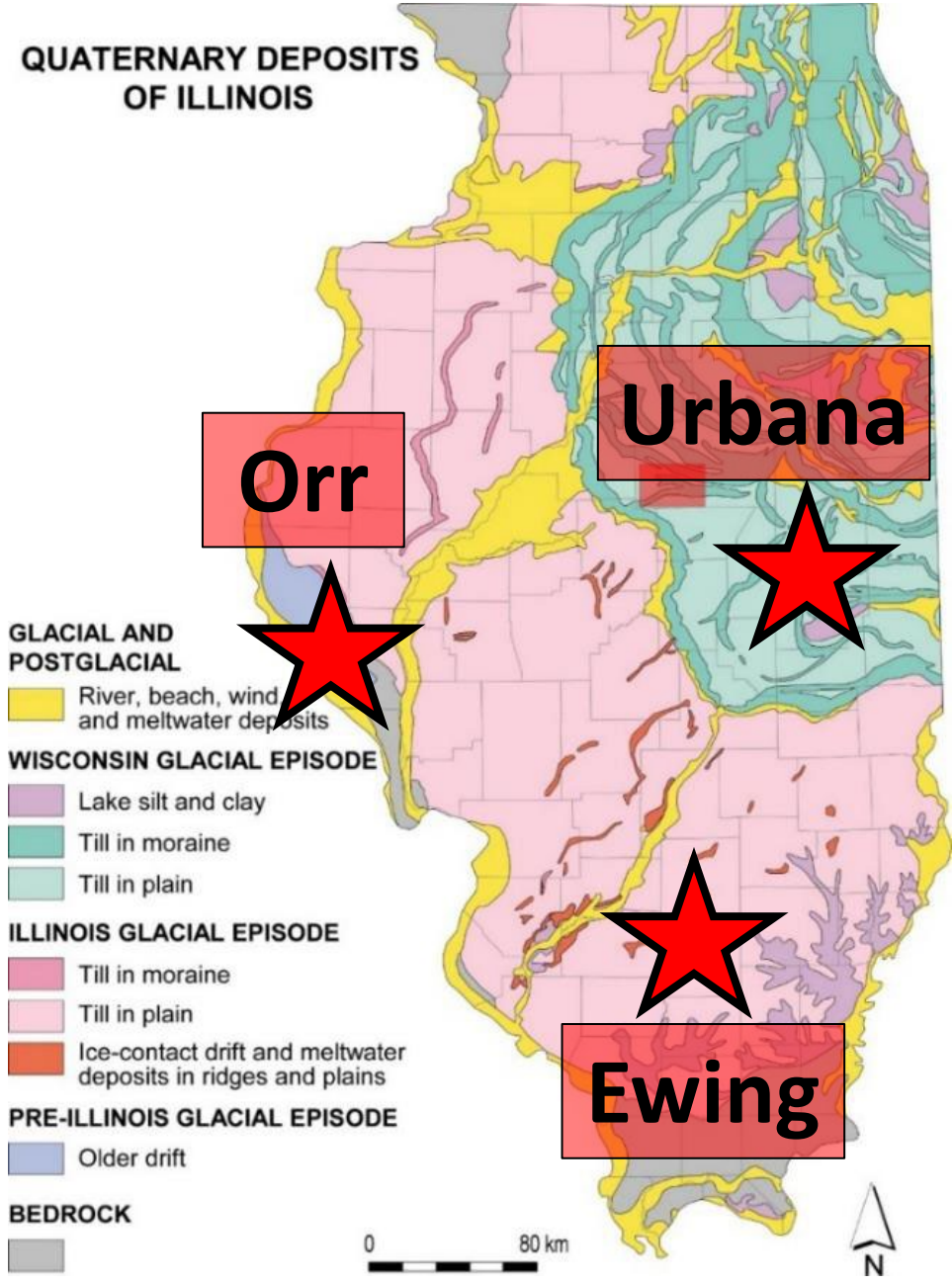
FRST(-OCP) trials

Objectives

1. Contribute to a larger CSTV calibration with dataset on P and K for FRST and Illinois Agronomy Handbook updates
2. Contribute to rate calibrations
3. Test P rate × source impacts on CSTV (P only)

lb P_2O_5 ac^{-1}	source	lb K_2O ac^{-1}	
0	MAP (12-52-0)	0	
15	DAP (18-46-0)	35	*as potash (0-0-60)*
30	APP (10-34-0)	70	
45	TSP (0-46-0)	105	
60		140	



Corn/soybean yields largely unresponsive to P and K

Ewing

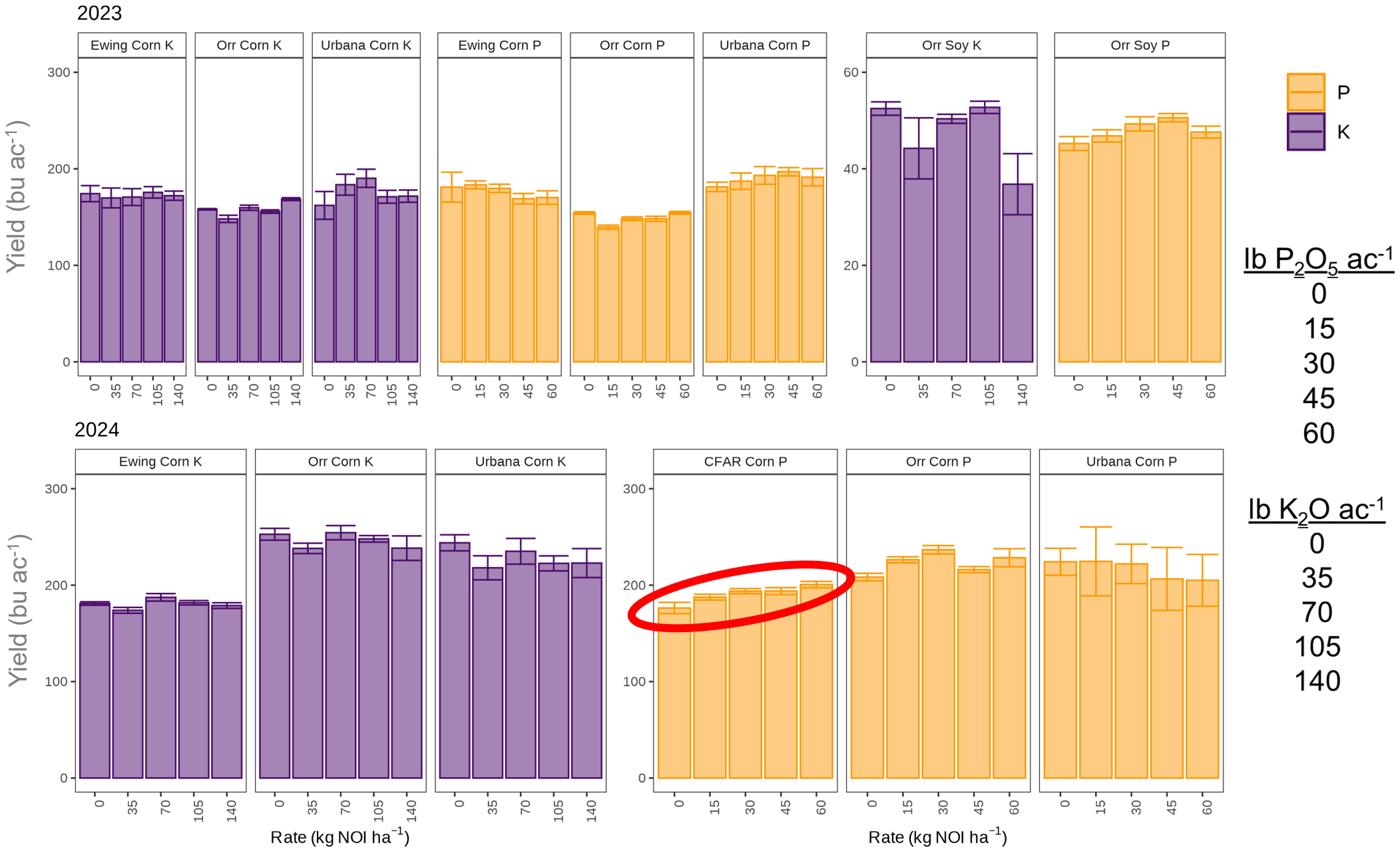
M3-P (mg kg^{-1})
0-6”: 22
6-12”: 6
M3-K (mg kg^{-1})
0-6”: 73
6-12”: 84

Urbana/CFAR

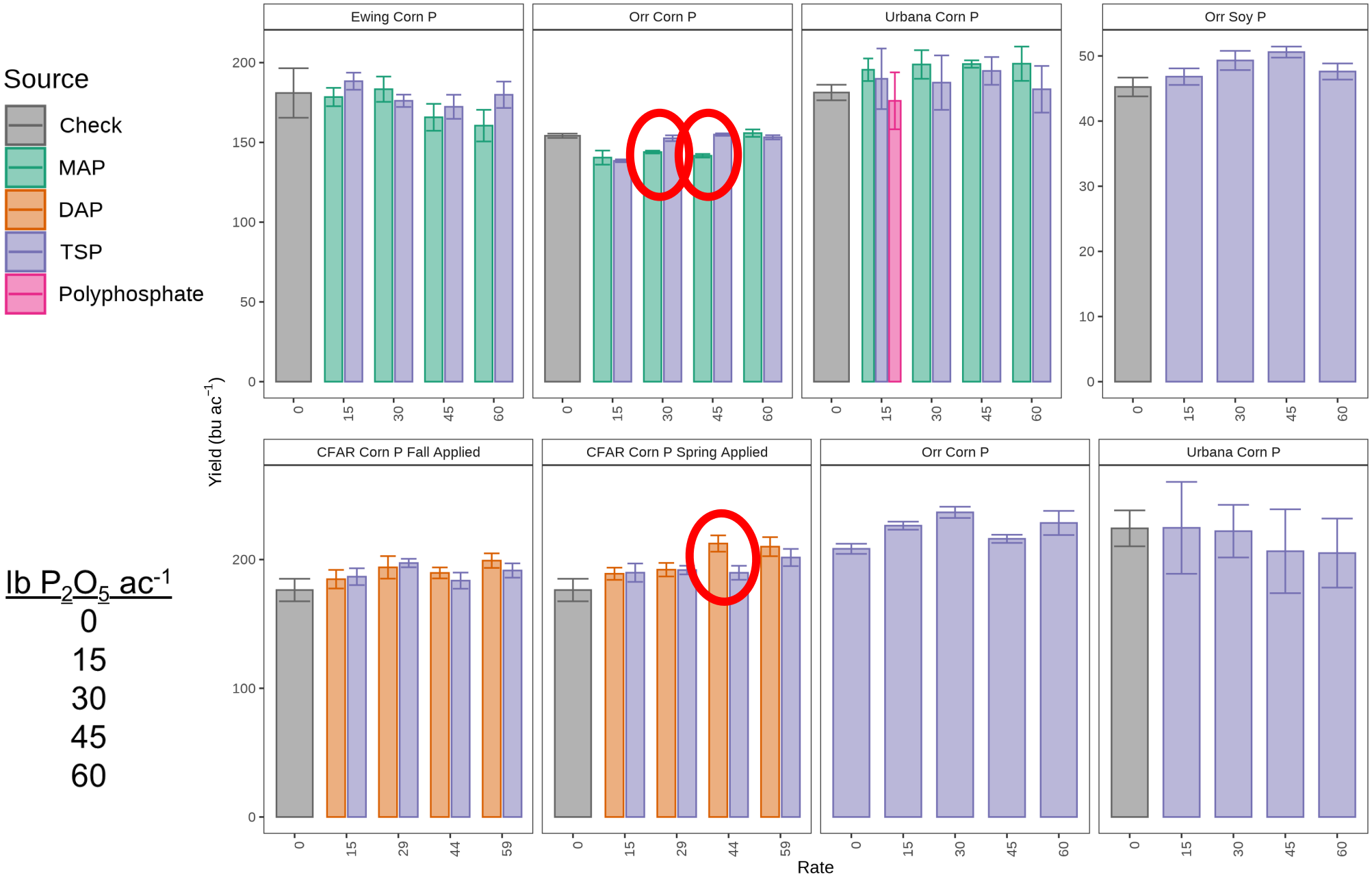
M3-P (mg kg^{-1})
0-6”: 31
6-12”: 18
M3-K (mg kg^{-1})
0-6”: 203
6-12”: 165

Orr

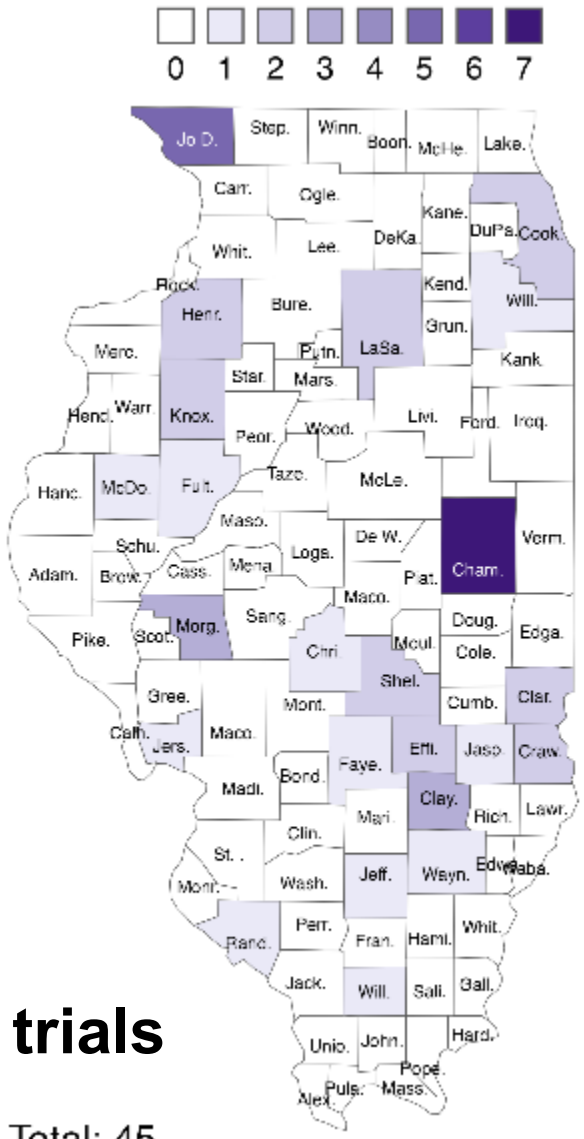
M3-P (mg kg^{-1})
0-6”: 17
6-12”: 7
M3-K (mg kg^{-1})
0-6”: 156
6-12”: 112



P source × rate × timing (2024): limited differences

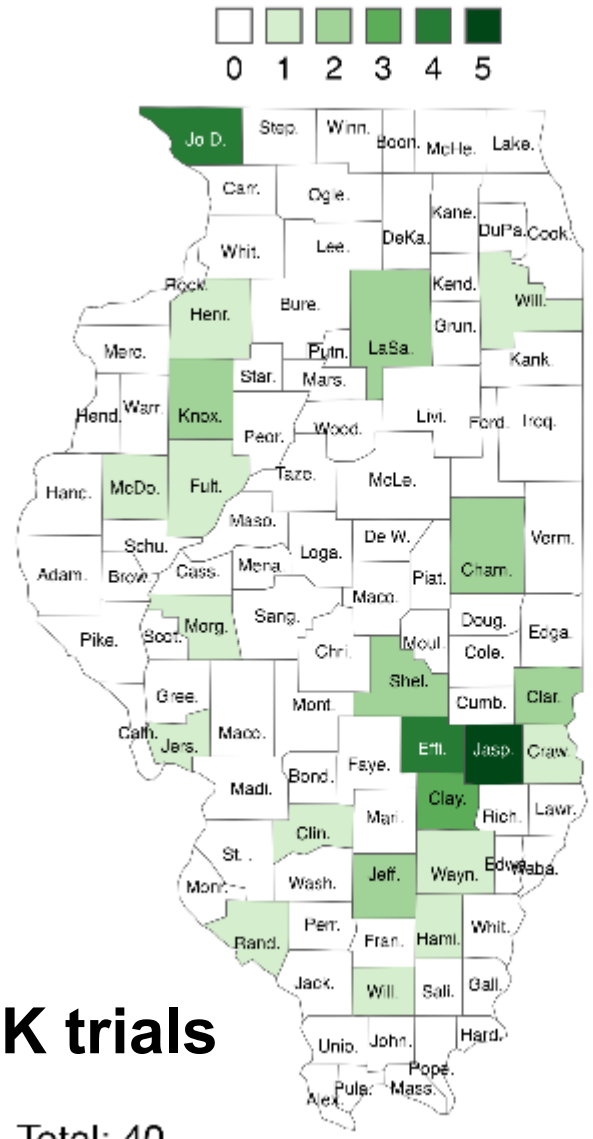


On-farm trial network of omission plots for CSTV calibrations



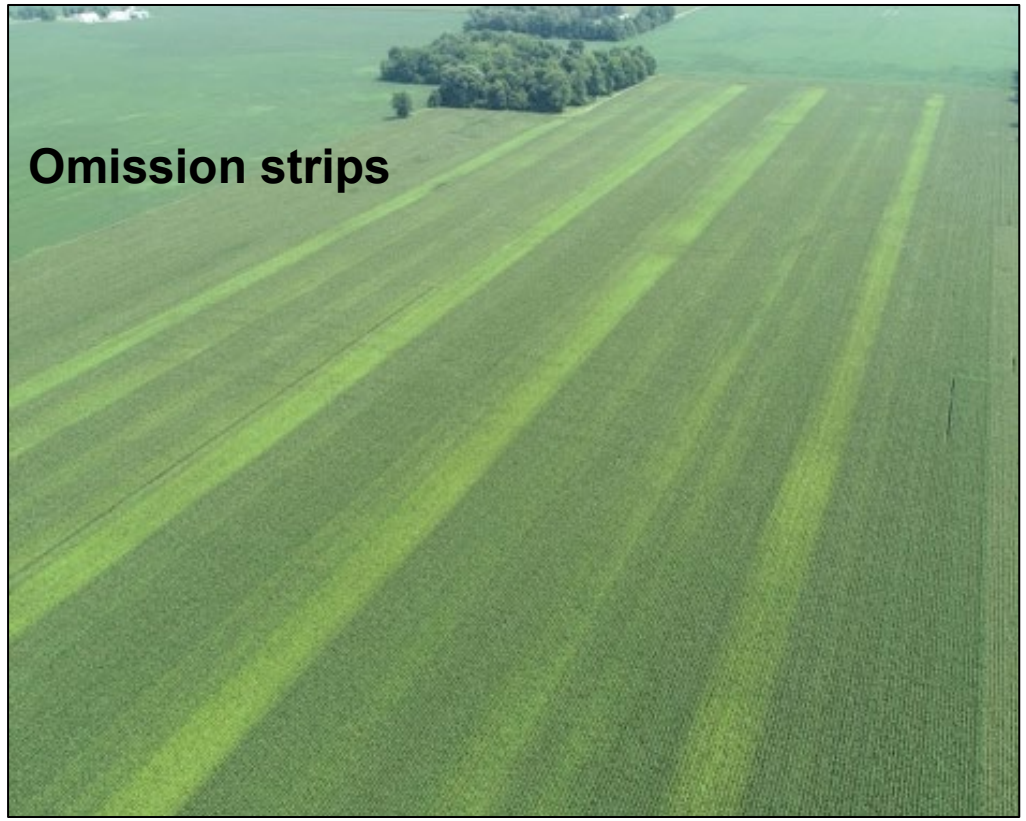
P trials

Total: 45

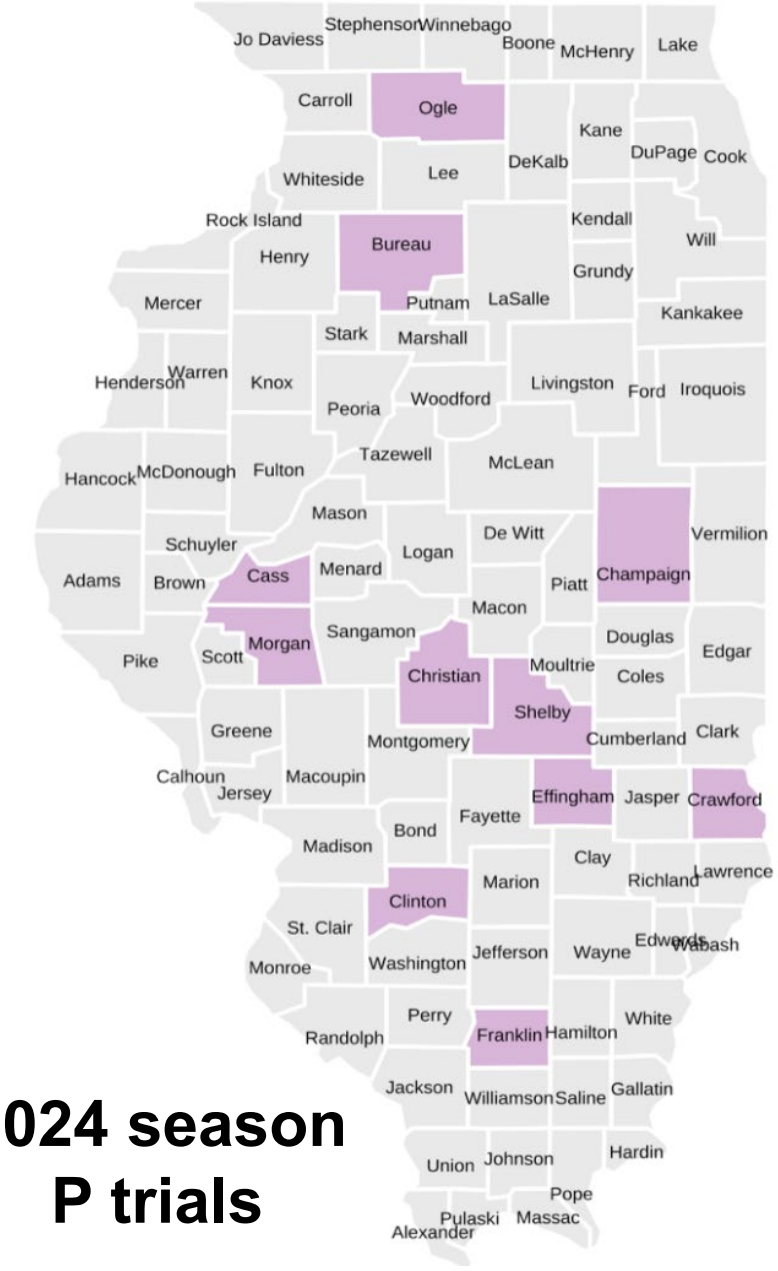


K trials

Total: 40

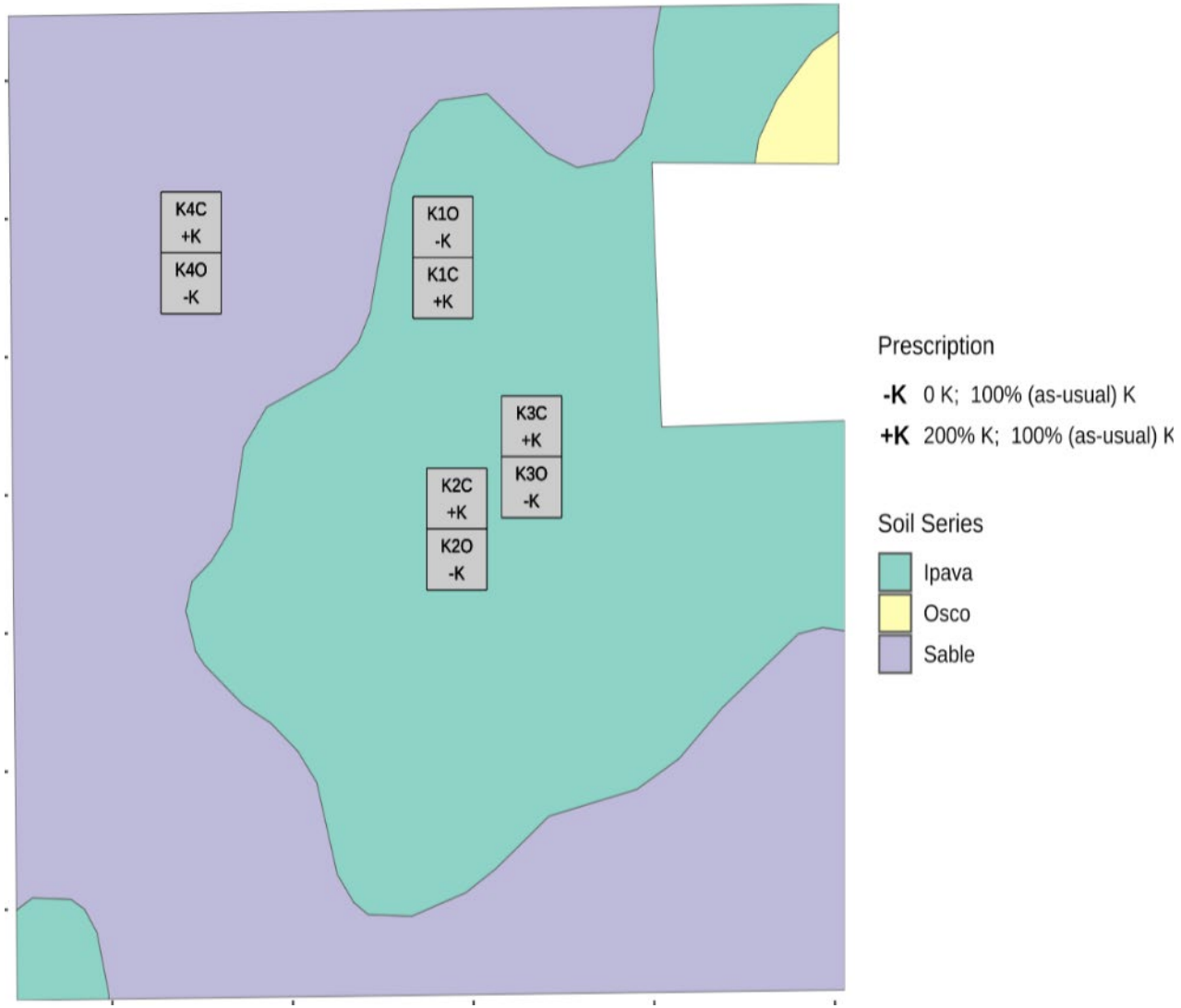


On-farm trial network of omission plots for CSTV calibrations



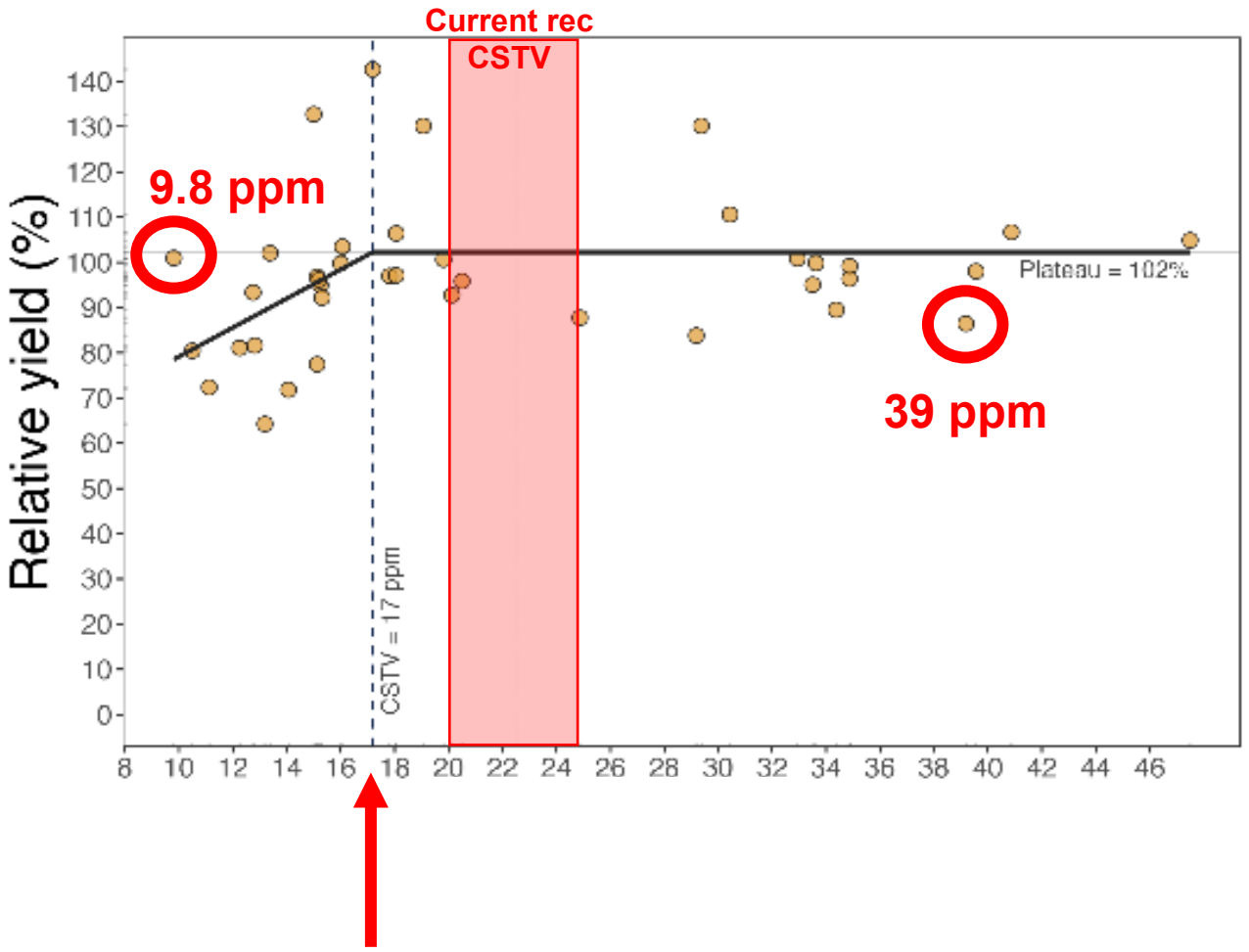
2024 season
P trials

Prescription maps for applicators
160 x 160’ paired plots, 4 reps



Preliminary (2023 season) results: P

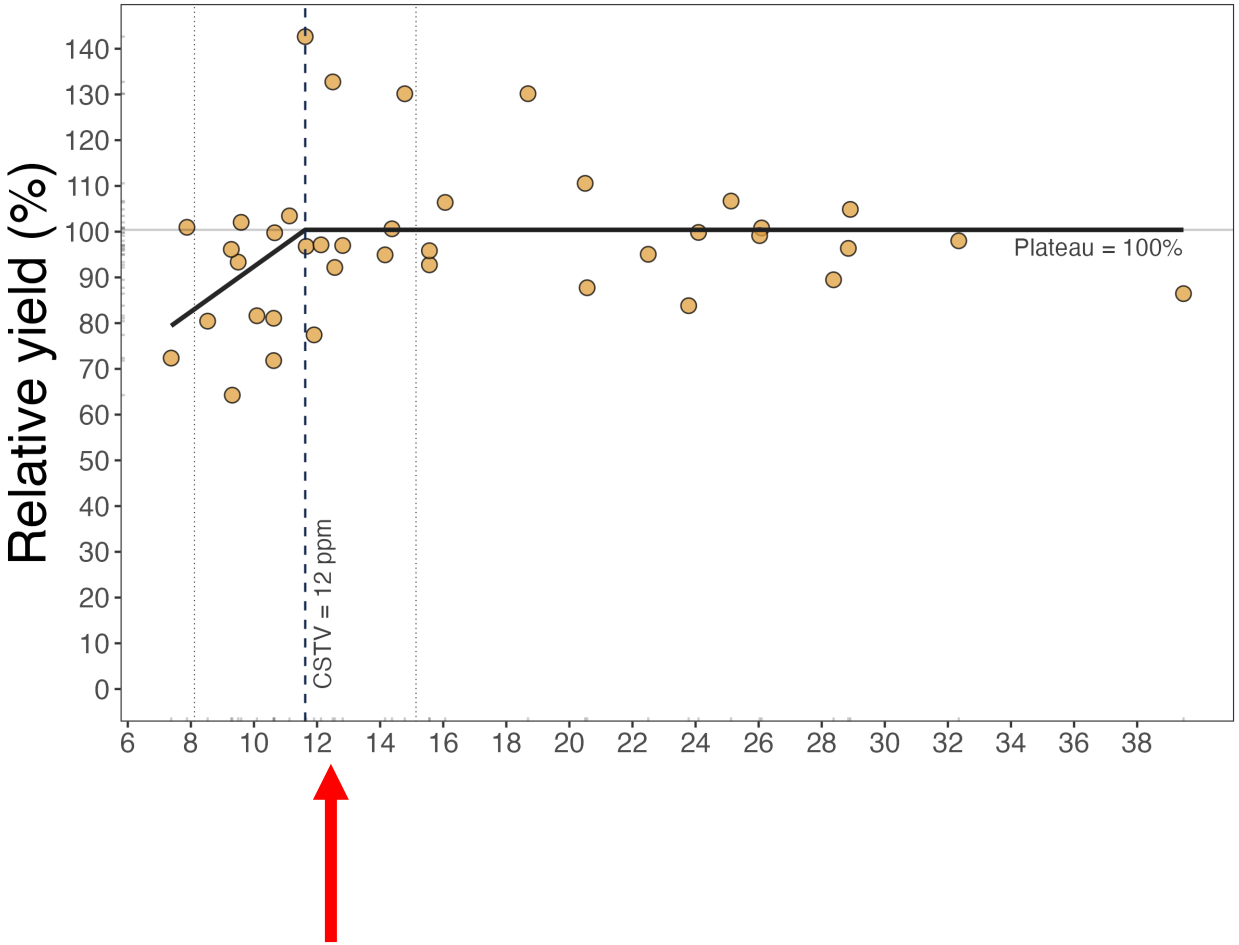
0-7” depth



17 ppm “CSTV”

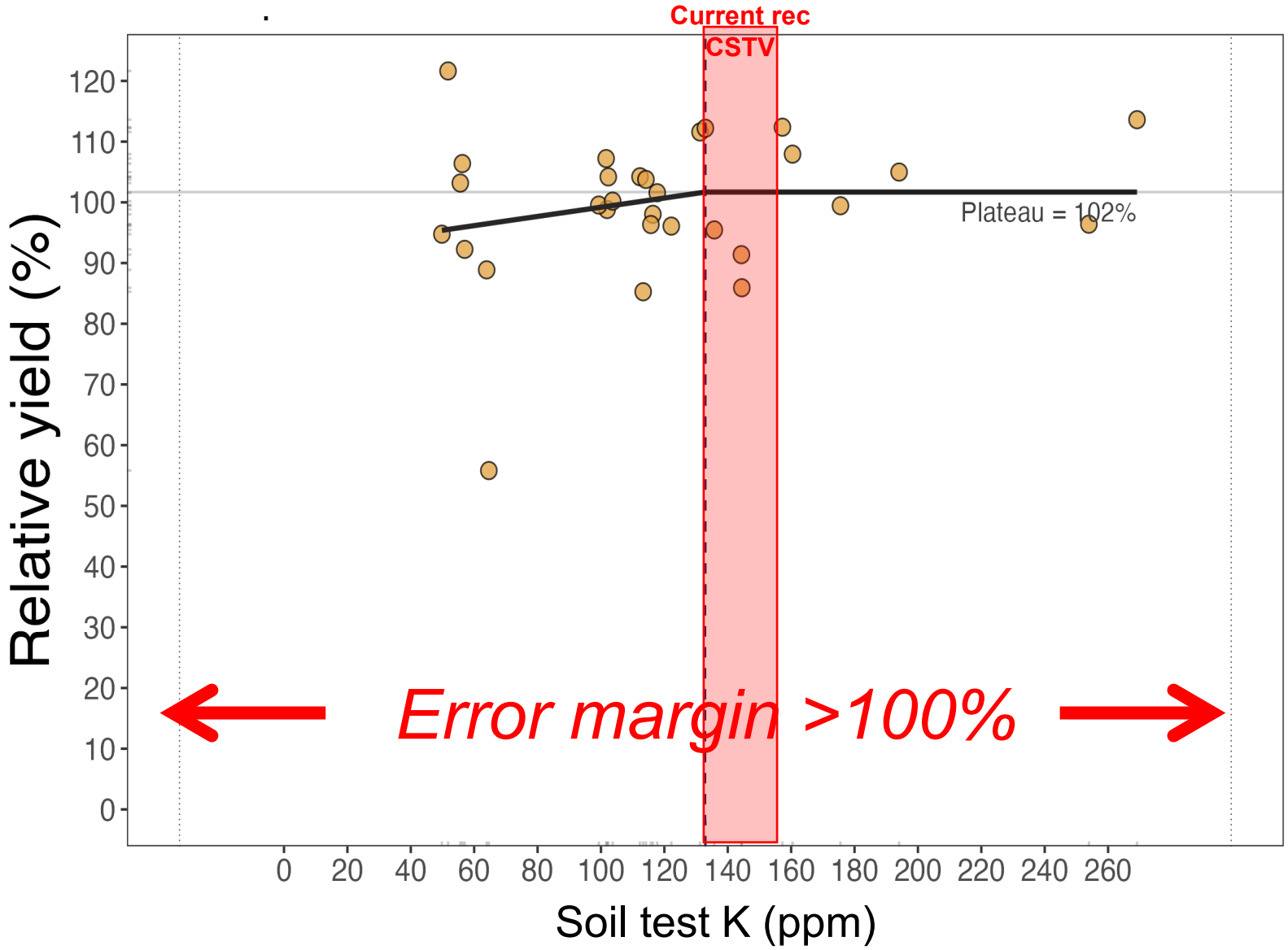
- 15% than current recs

7-14” depth



12 ppm “CSTV”

Preliminary (2023 season) results: K



- Linear-plateau CSTV model
- High variability in K CSTV at both depths (only 0-7” shown)
- 133 ppm “CSTV”

Summary

- Illinois recommendations on P and K
  - Provided in the Illinois Agronomy Handbook
  - In need of updated CSTV, adding application rates, and optimizing AORs and EORs
- FRST-OCP on-station trials (2022-2025+) coupled with Illinois NREC on-farm trials (2024-2025+)
- Preliminary results indicate
  - Limited effect of P or K for corn and soybean even for sites with STP/K below current Illinois CSTV
  - Limited effect of P source; TSP > MAP at 15-30 lb/ac in some site-years, but DAP > TSP in some site-years
  - On-farm omission trials require many more site years (currently n≈45 per nutrient)