Potassium Decisions: Timing, Sources, and Management Strategies for Maximizing Yields

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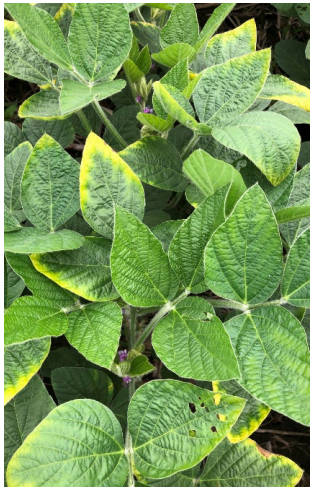


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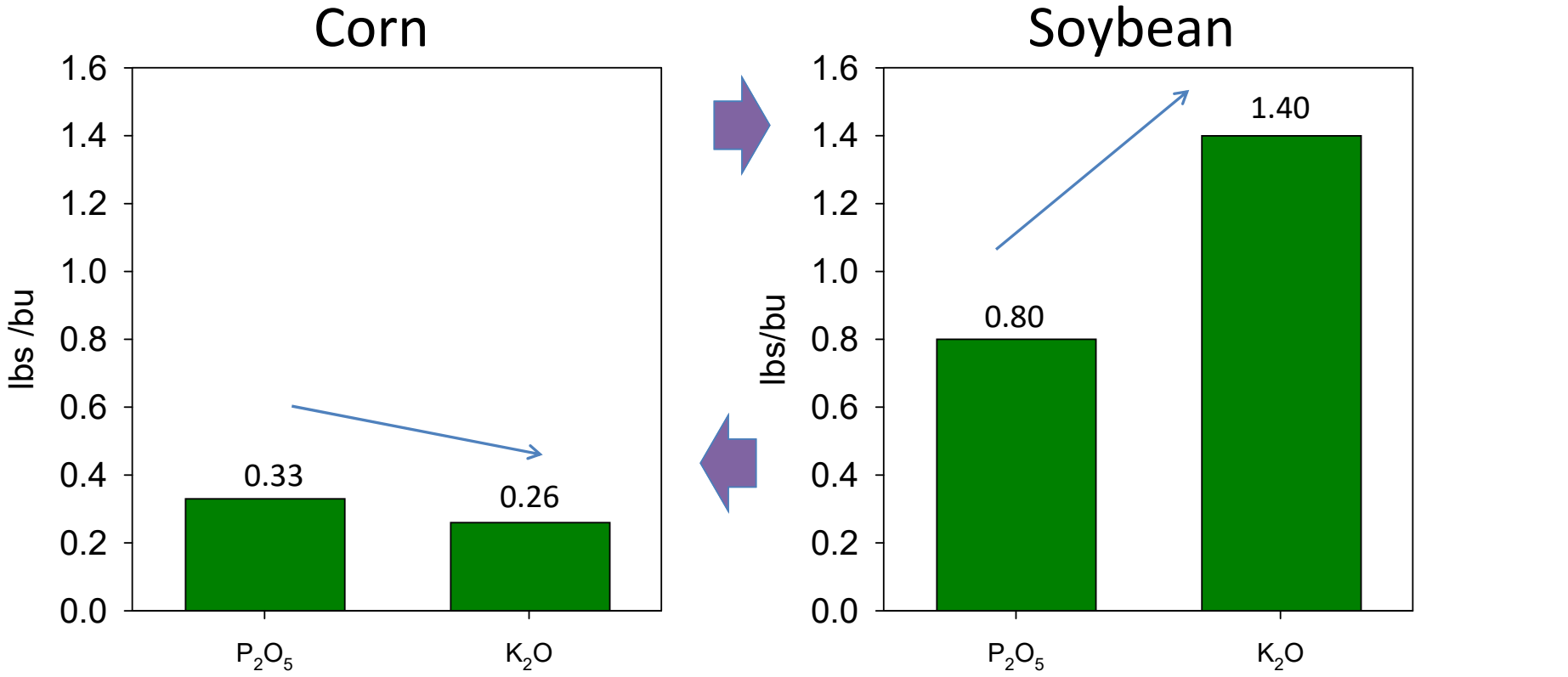
Overview

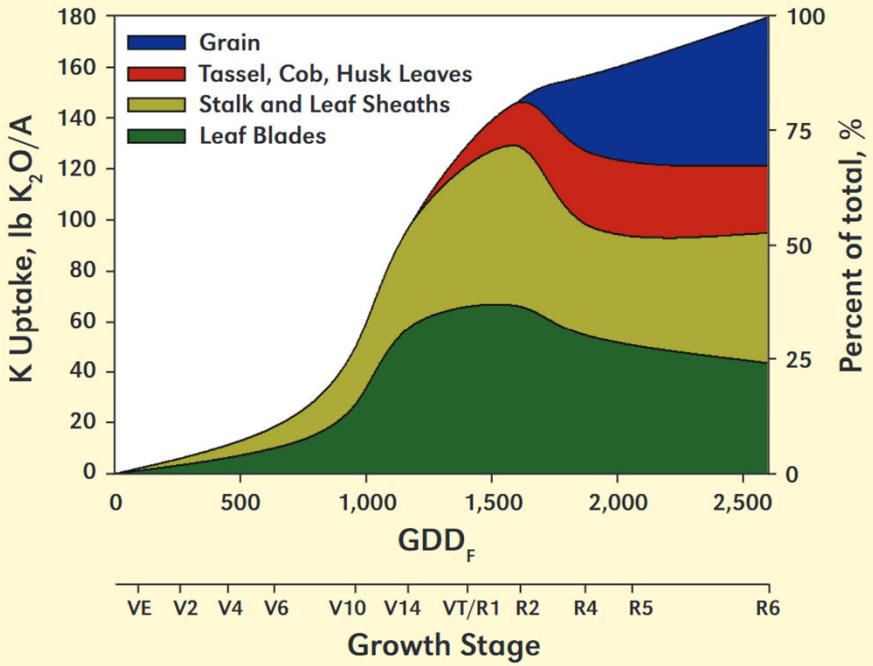
- Potassium crop demand and soil supply
- Potassium timing
  - Pre-plant
  - In-season
- Diagnostic tools
  - Soil test
  - Tissue test
  - Cation exchange resin

Potassium and phosphorus removal in corn and soybean

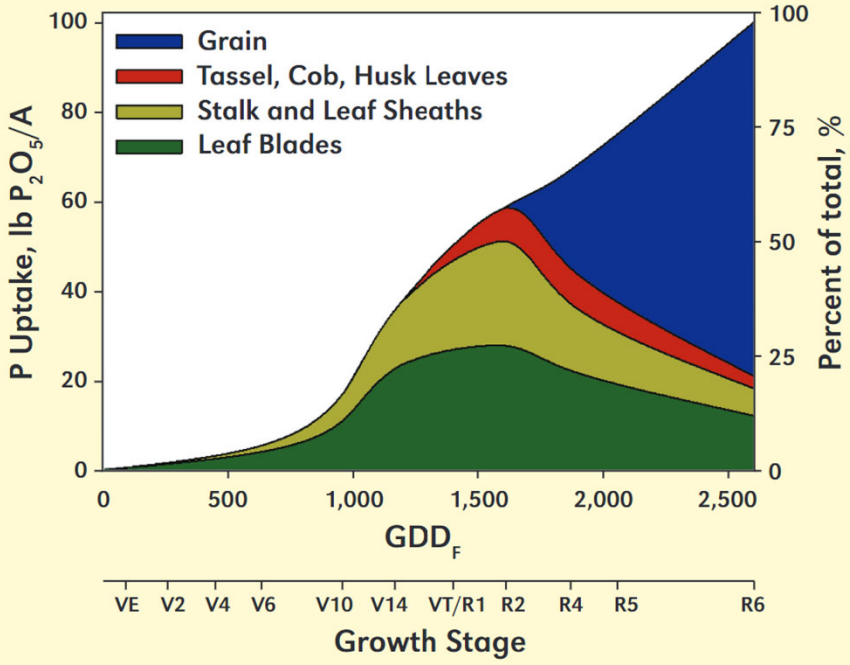


Uptake during the growing season in corn

Potassium

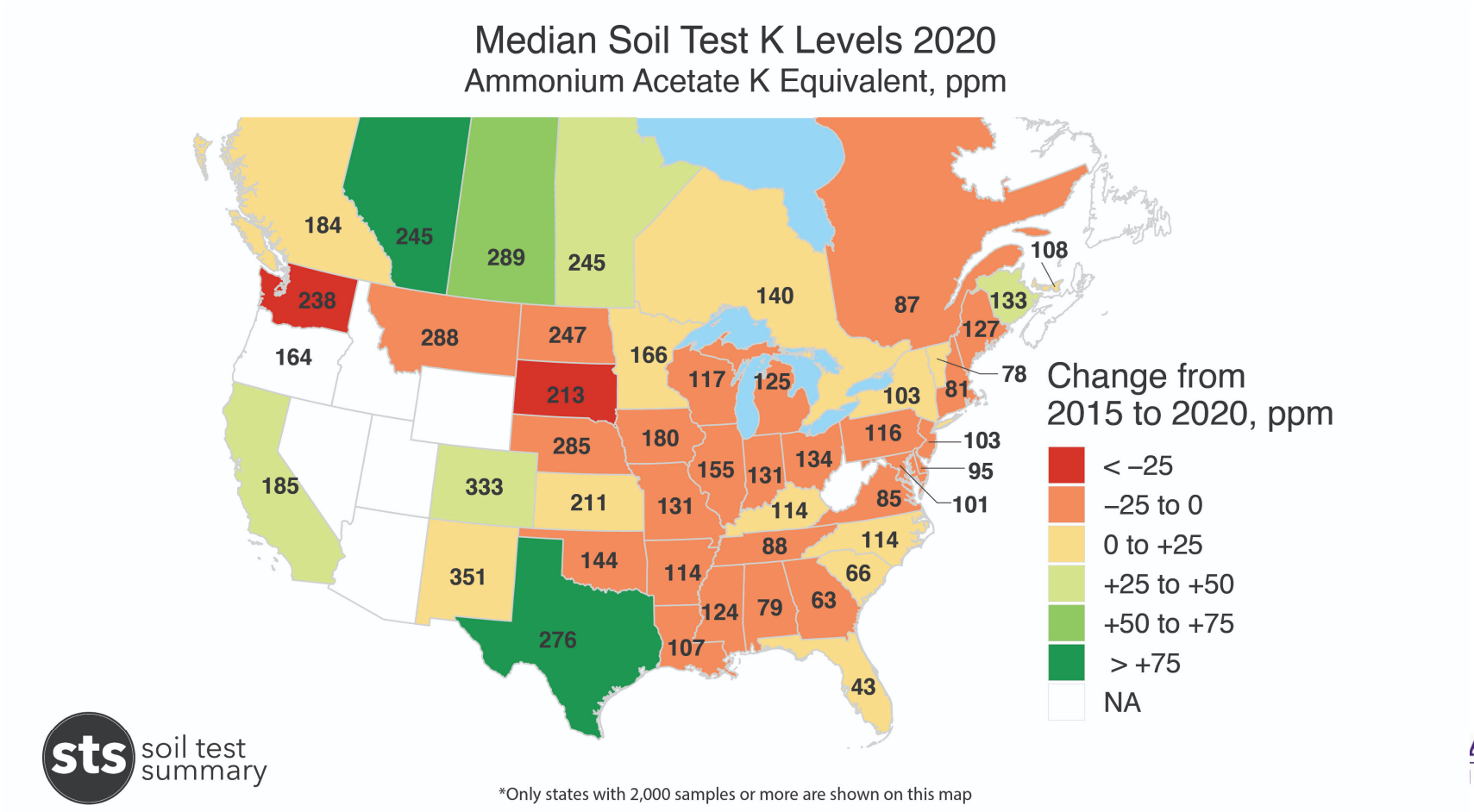


Phosphorus



Bender et al 2015, 230 bu/a corn

Changes in soil test potassium in the region



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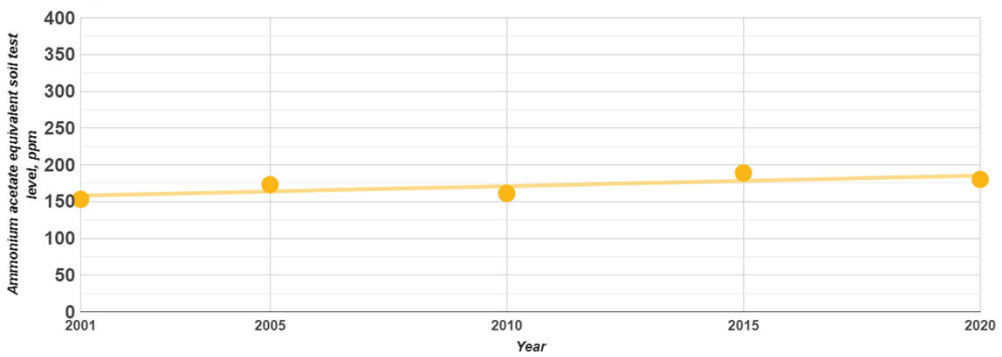
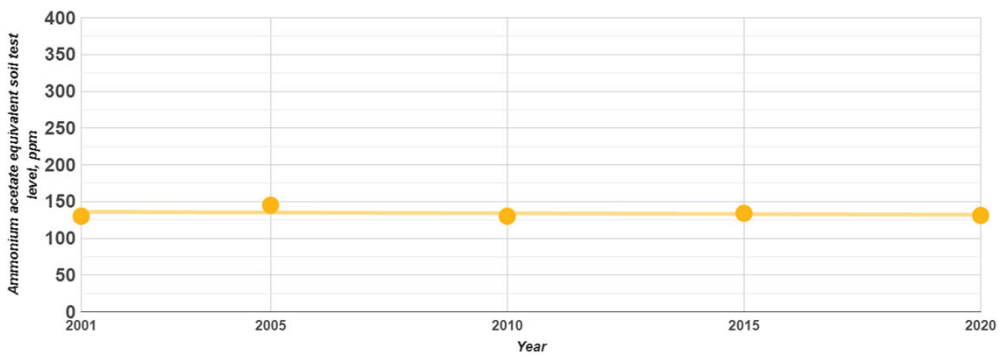
Median soil test values for selected states

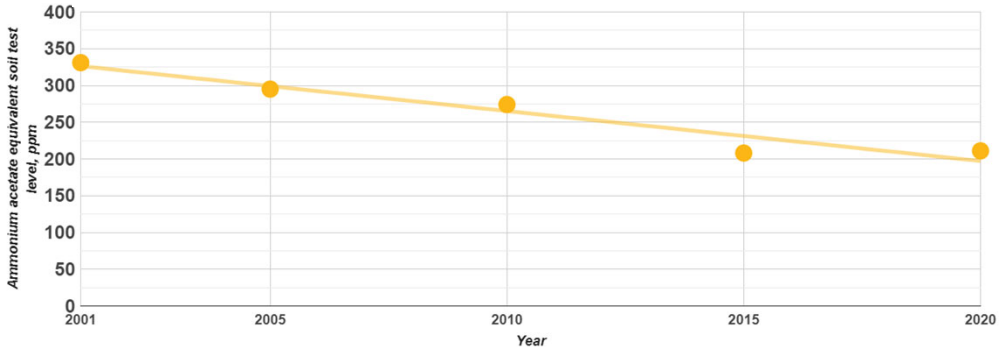
Iowa



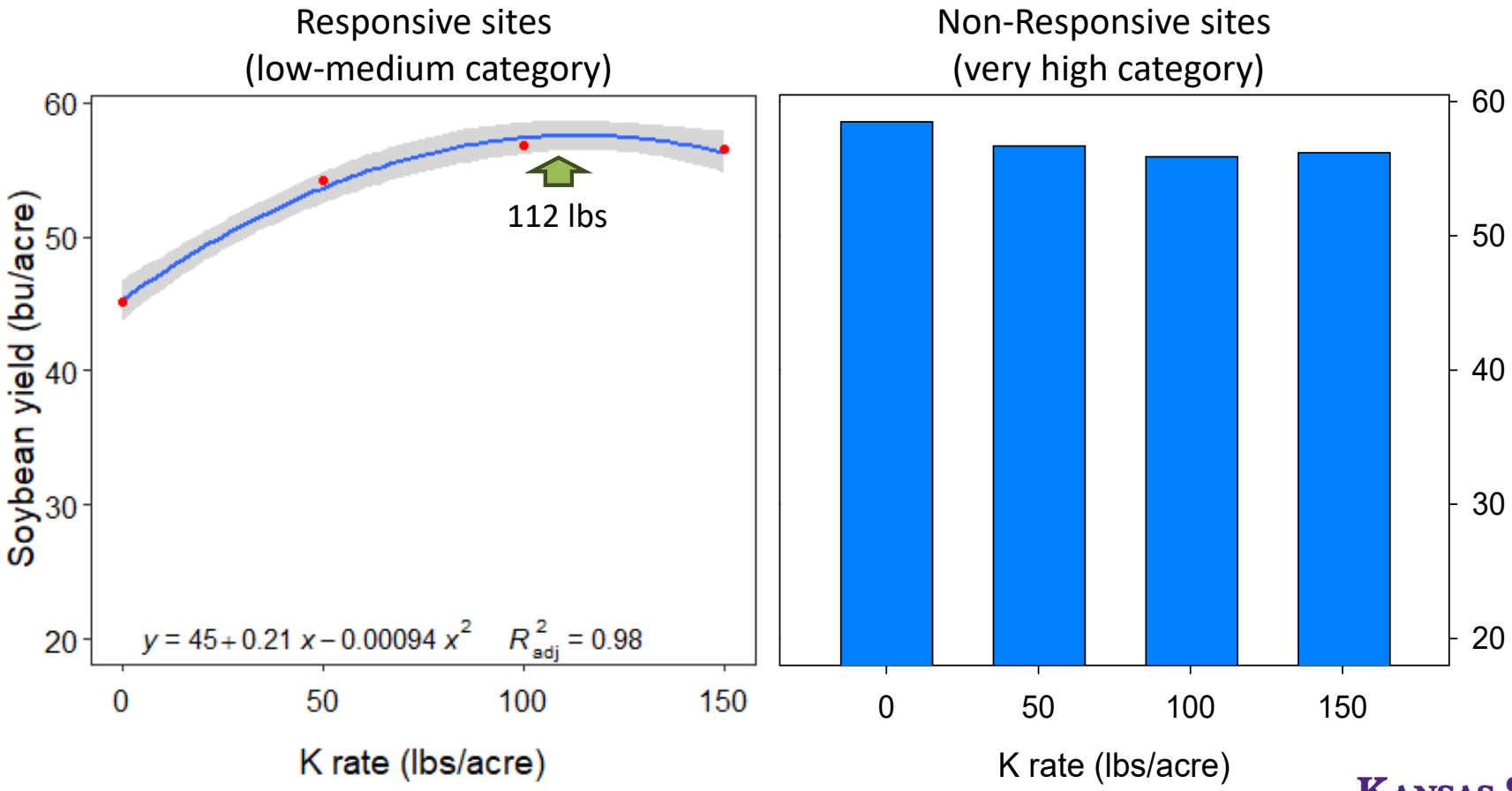
Indiana



Kansas



Potassium fertilizer rate and soybean yield



2022; 10 locations (6 responsive (60-120 ppm), 4 non-responsive (305-409 ppm)

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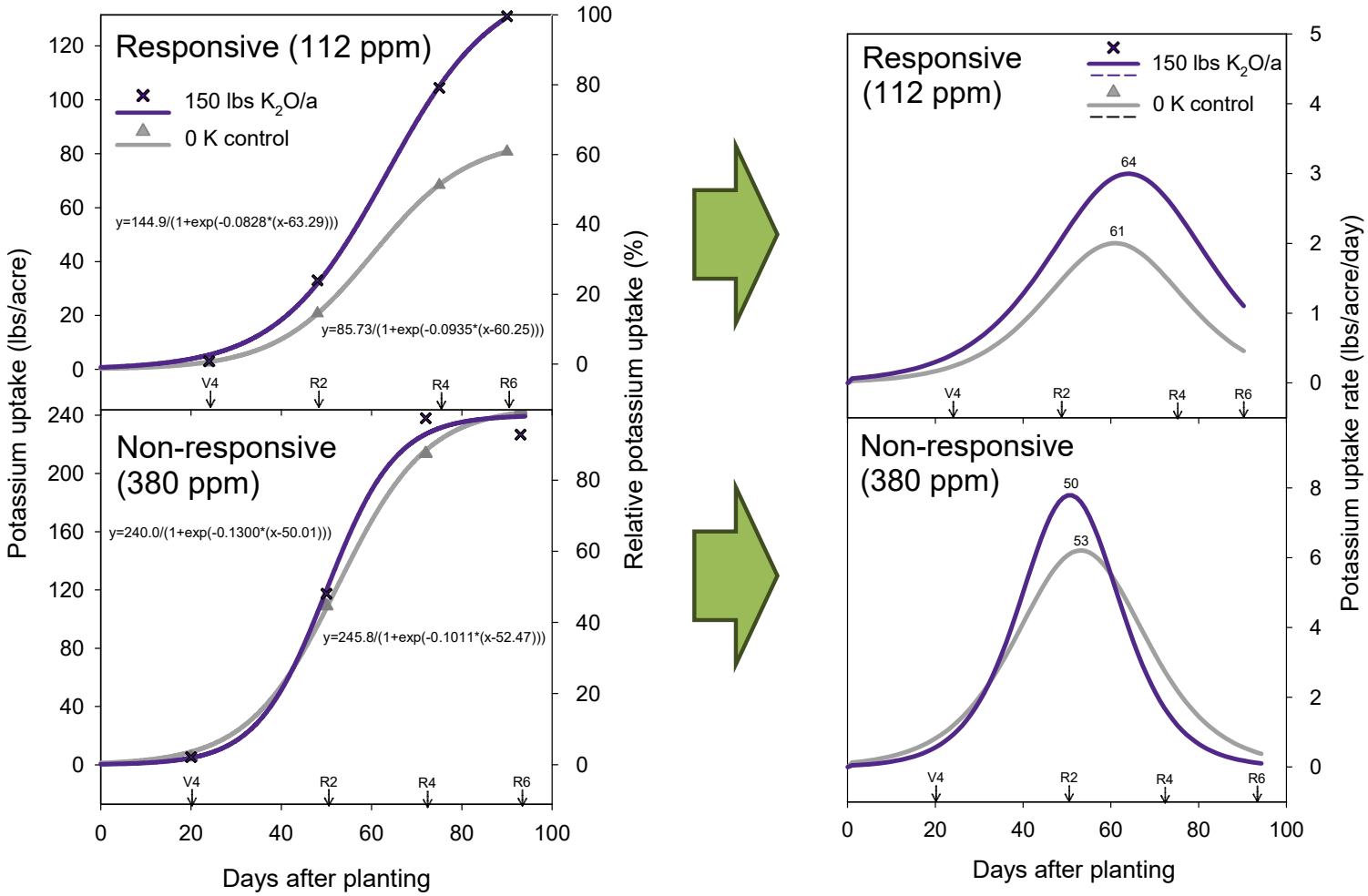
Potassium uptake in soybean under contrasting soil test K levels



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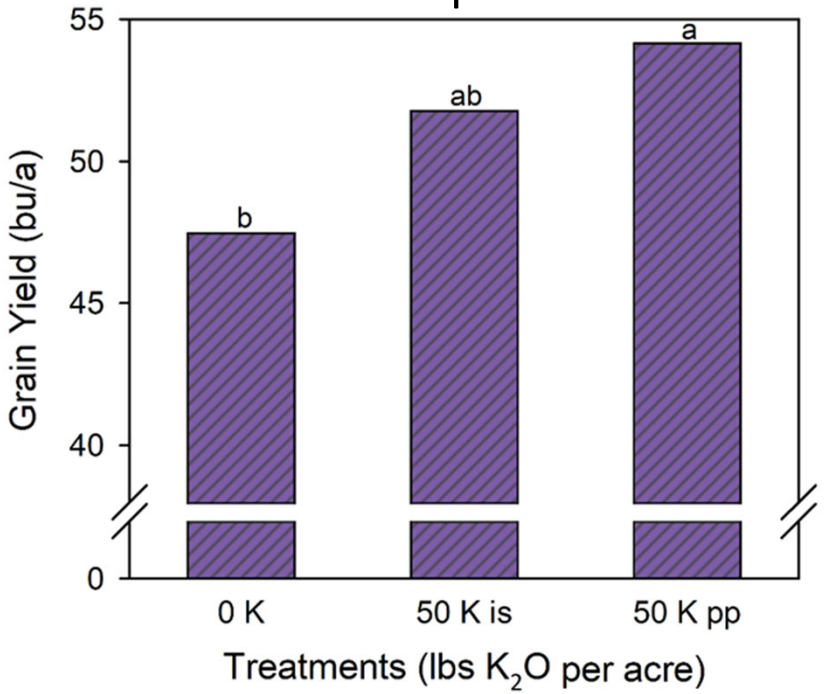
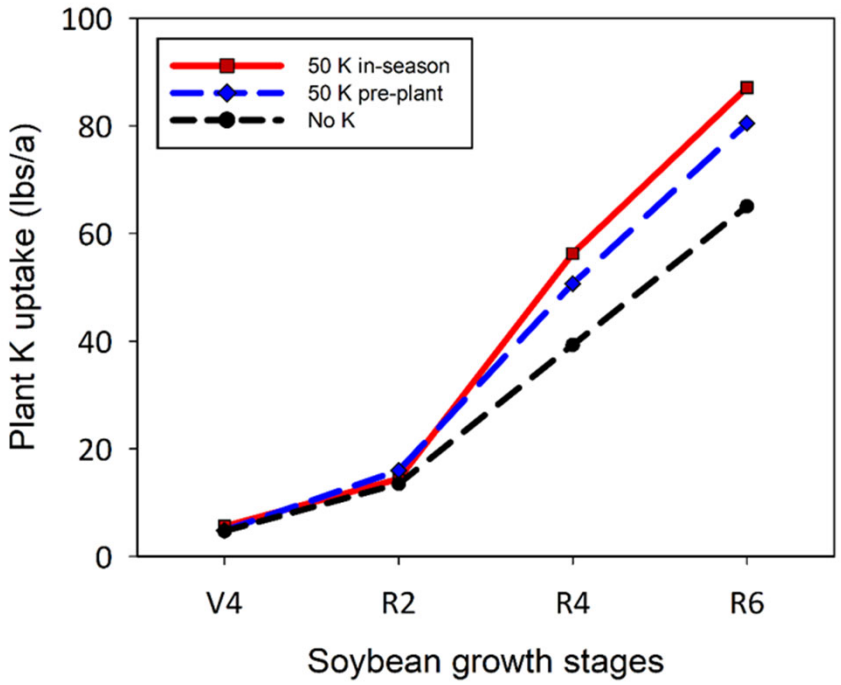
Soybean: In-season K application

Yield response to K



Plant K uptake



5 bu @ $9 = $45

50 lbs K @ $0.35 = $17.5

+ $ 27.5

Average of 4 locations, low STK

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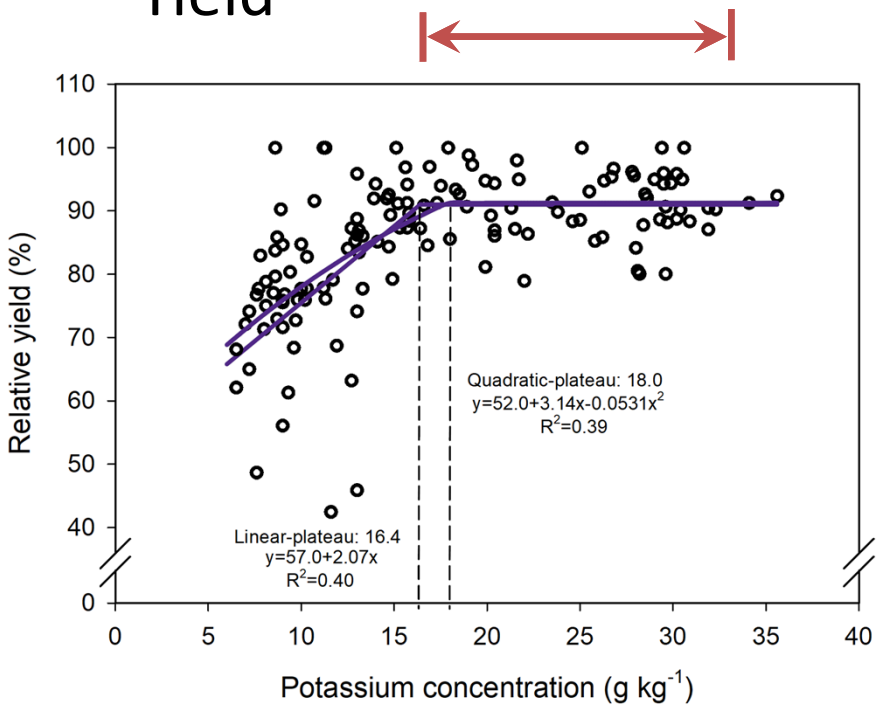
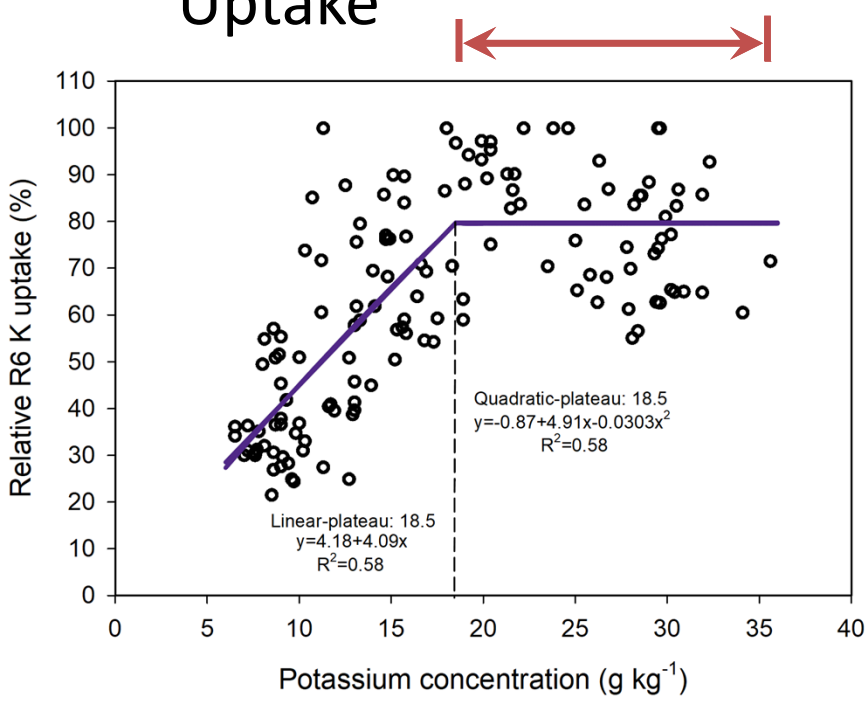
Critical value: K concentration at V4 soybean

Yield



Uptake



K critical value:	**1.6 – 1.8 %**	**1.8 %**

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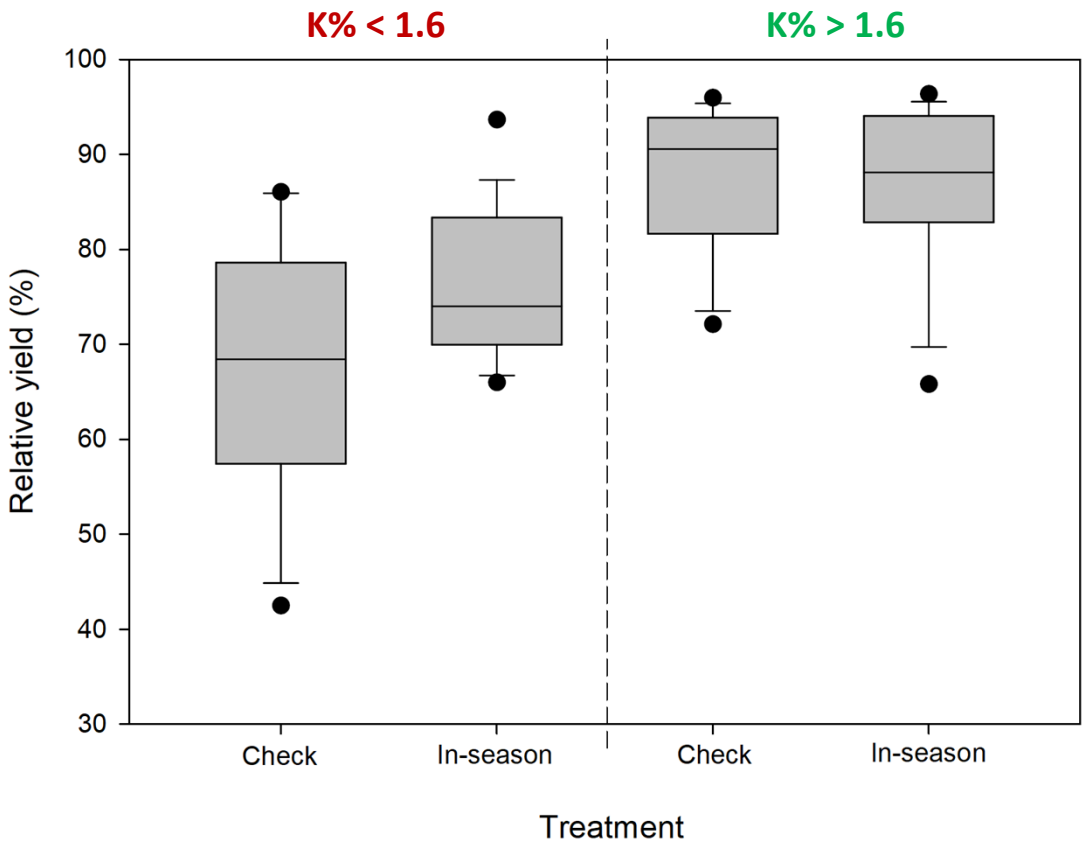
Soybean tissue K at V4, and response to in-season K fertilizer



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Corn: Potassium deficiency and in-season K

STK: 82 ppm

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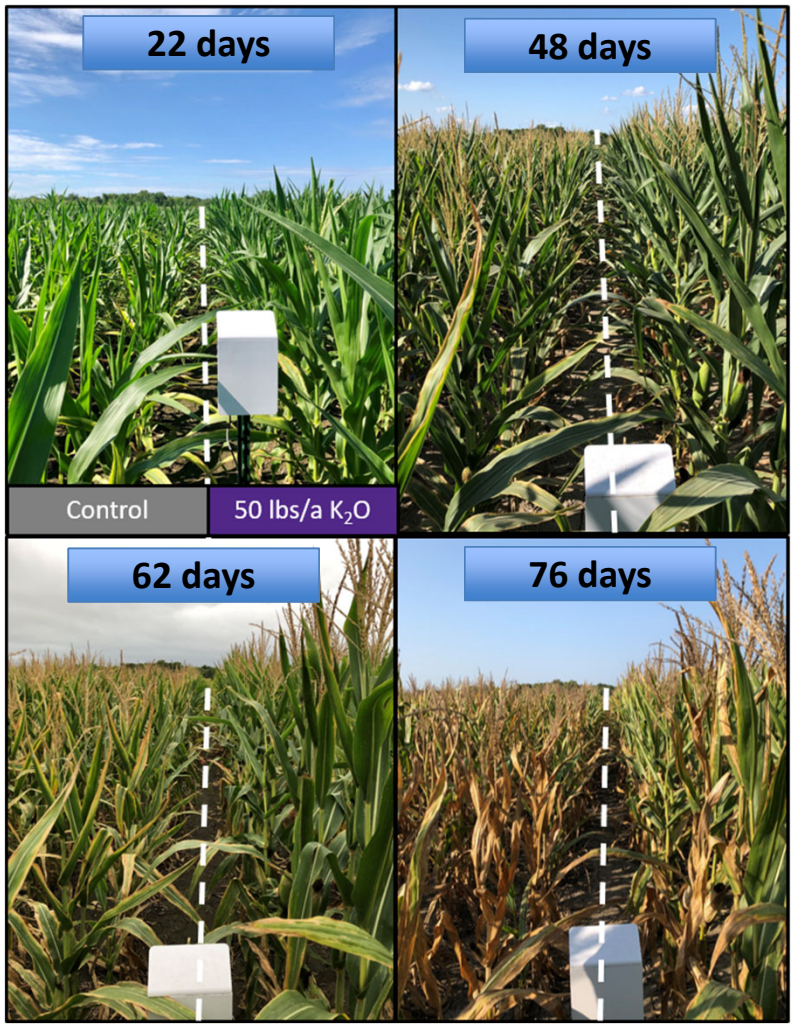
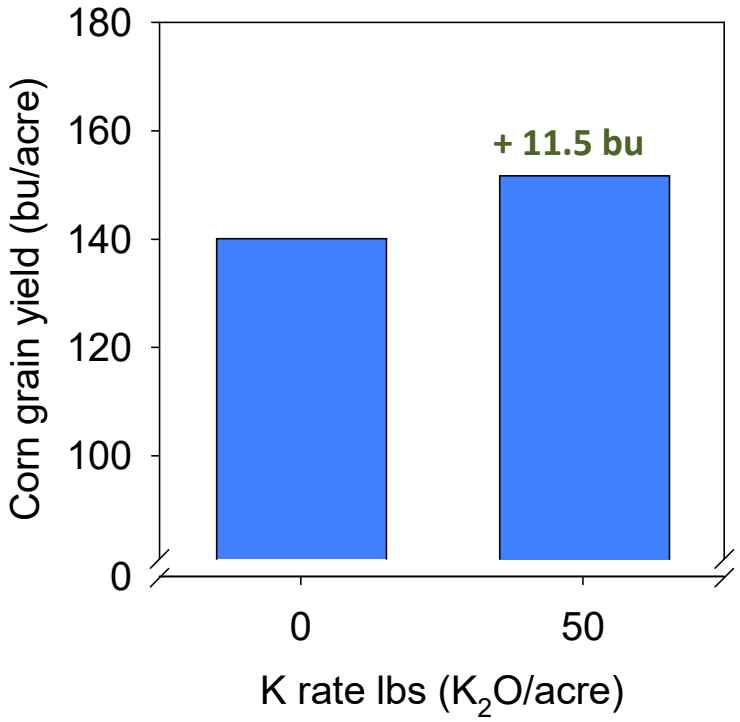
Corn: In-season K application



STK: 82 ppm
50 lbs K2O/acre
Broadcast KCl at V8 corn



Osage Co, KS, 2022

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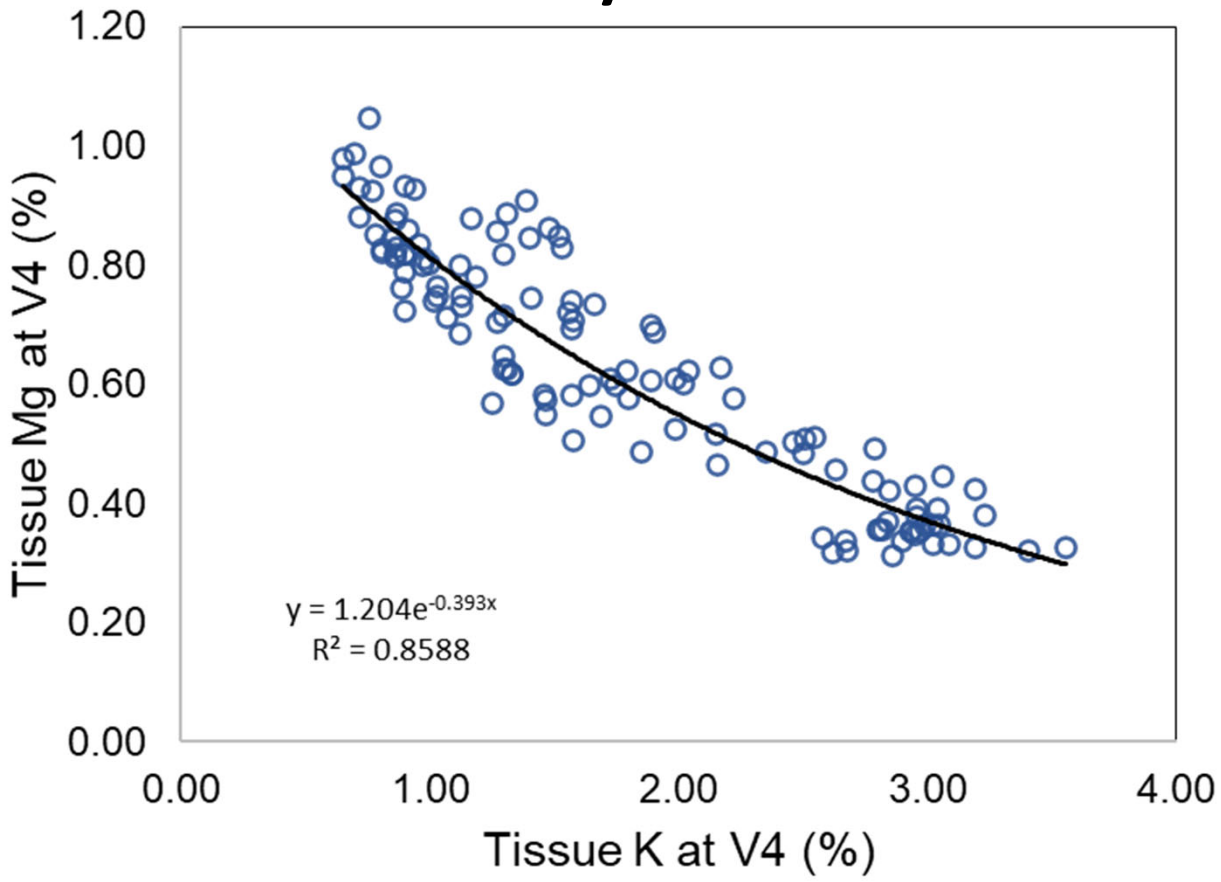
K and Mg concentration at the V4 stage soybean



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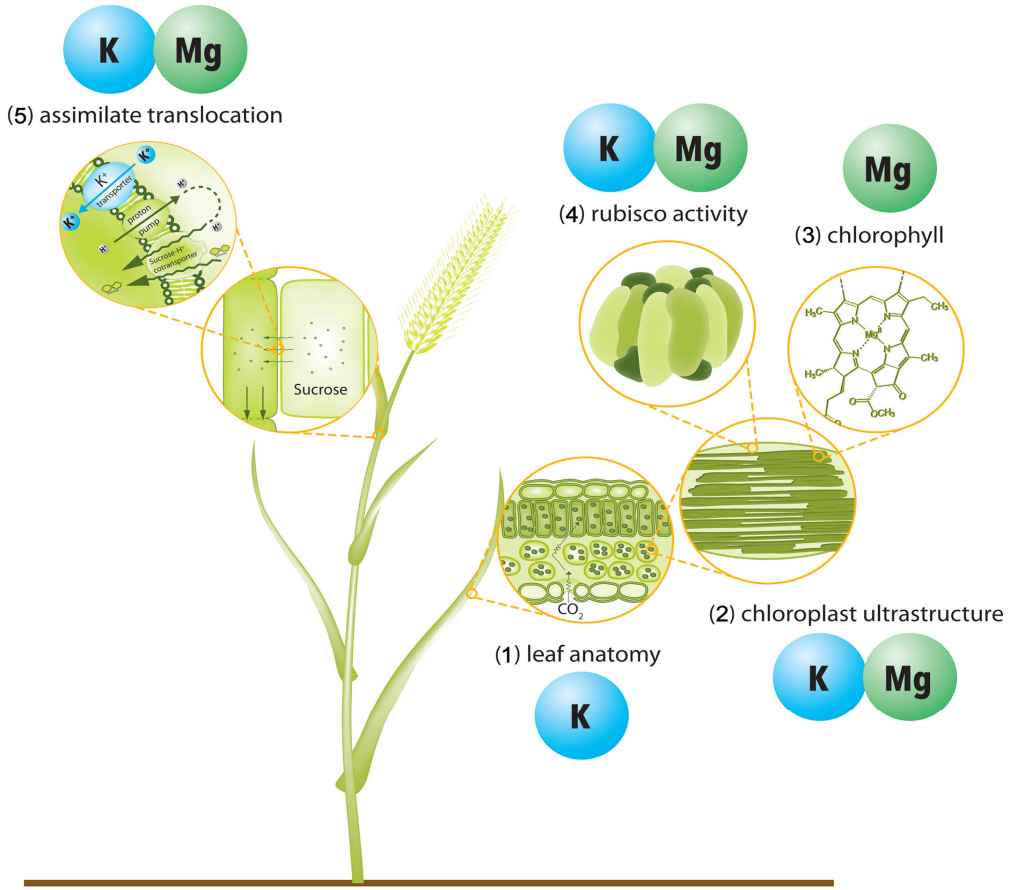
K and Mg functions in the plant



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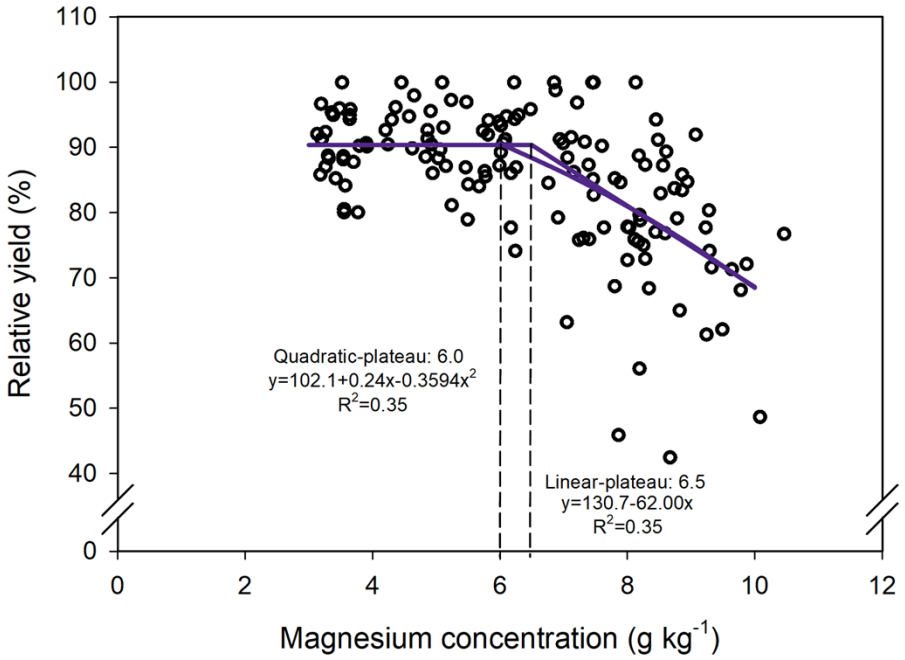
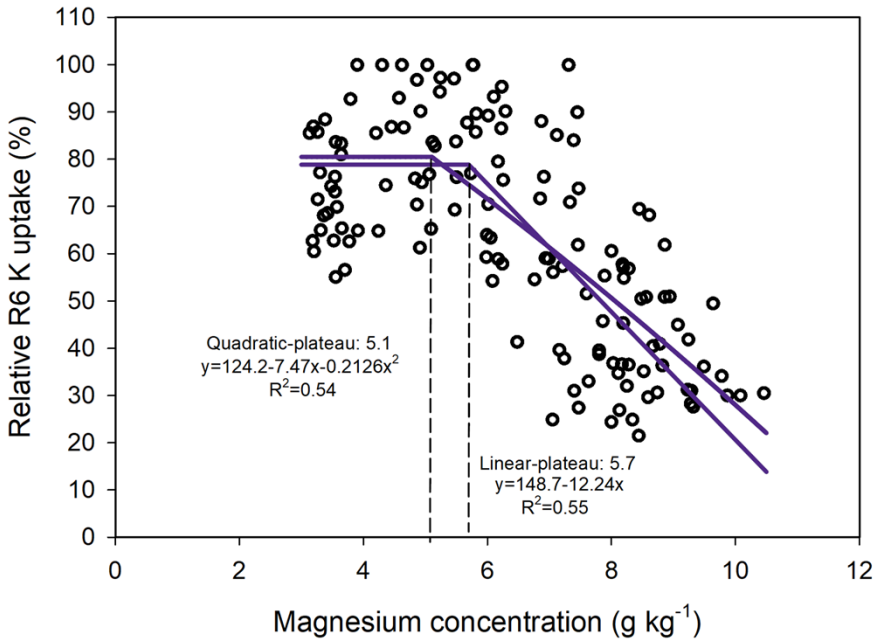
Critical value: Mg concentration at the V4 soybean stage

Yield



Uptake



Mg critical value:	**0.60 – 0.65 %**	**0.51 -0.60 %**

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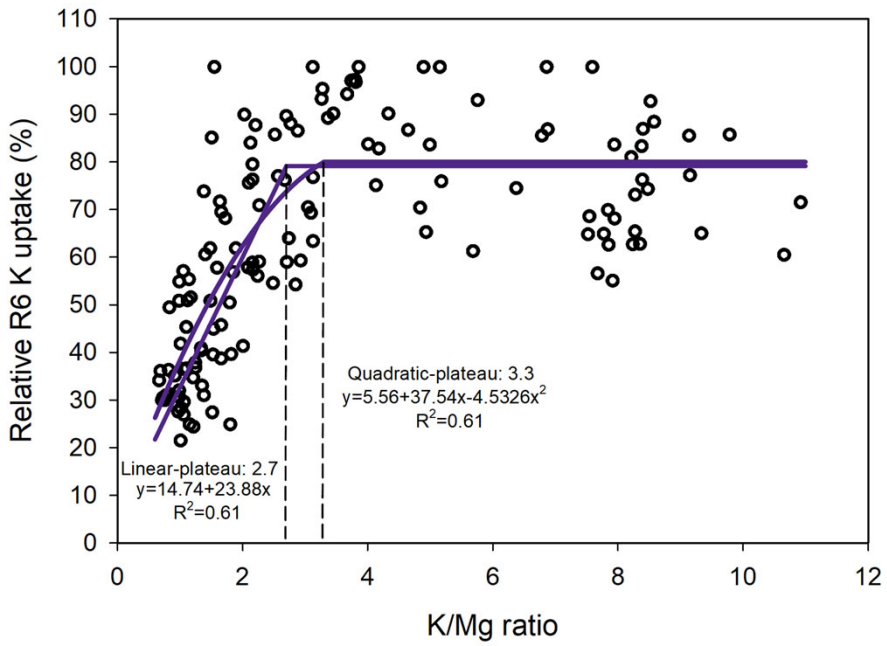
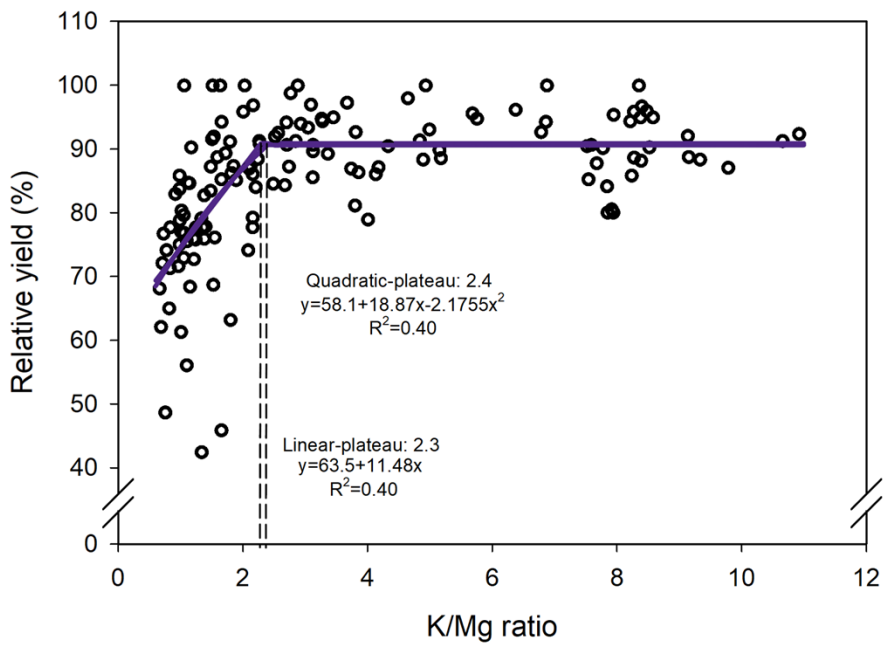
Critical value: K/Mg ratio n the plant at the V4 soybean stage

Yield



Uptake



K/Mg critical range:	2.7 – 3.3	2.3 – 2.4

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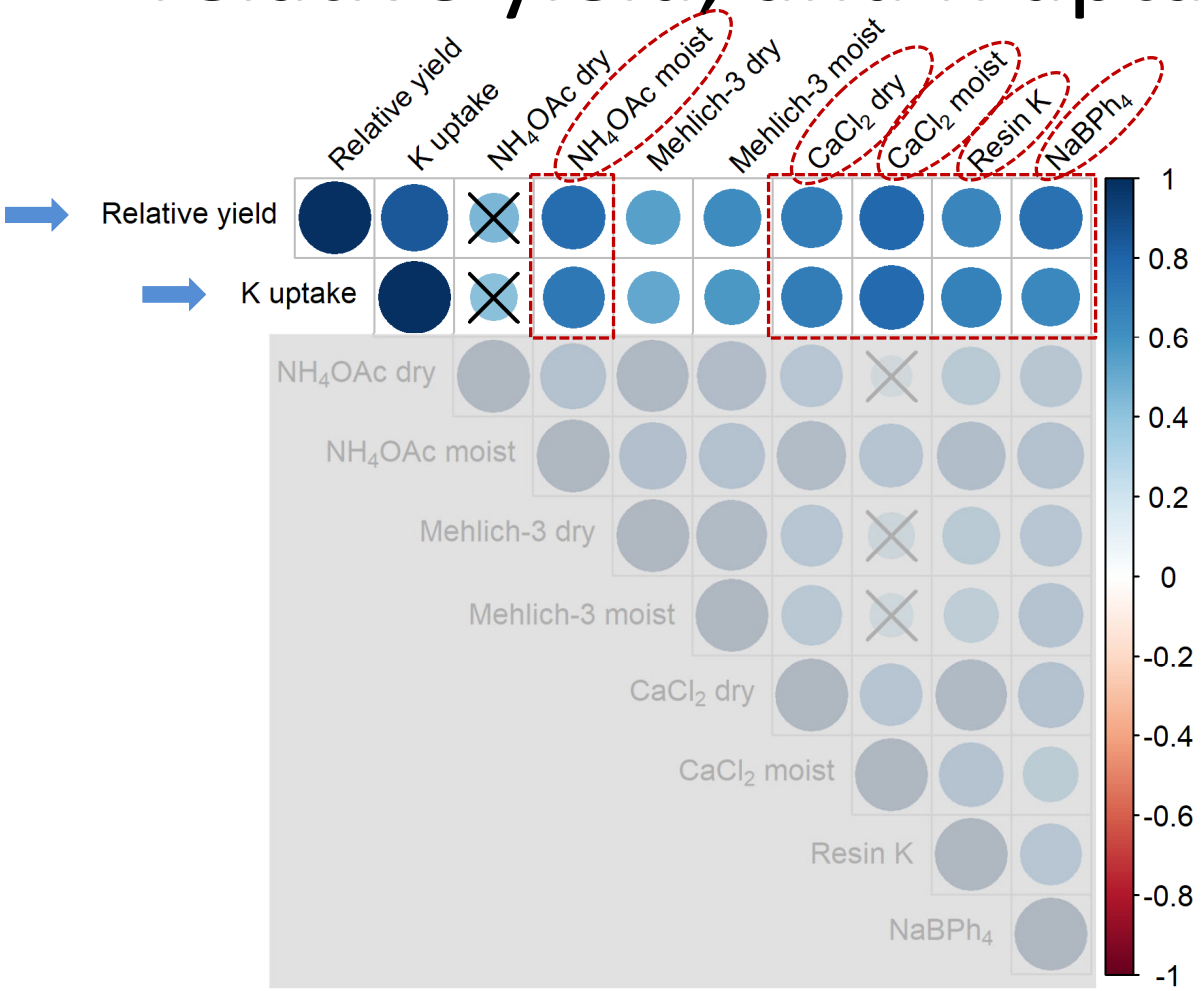
Tissue test for K management?

- Early season sampling may allow for some corrective action
- K concentration and K/Mg ratio (at V4) show similar correlation to relative yield
- Emphasis on critical values vs “normal ranges”?

Correlation between soil test methods, relative yield, and K uptake



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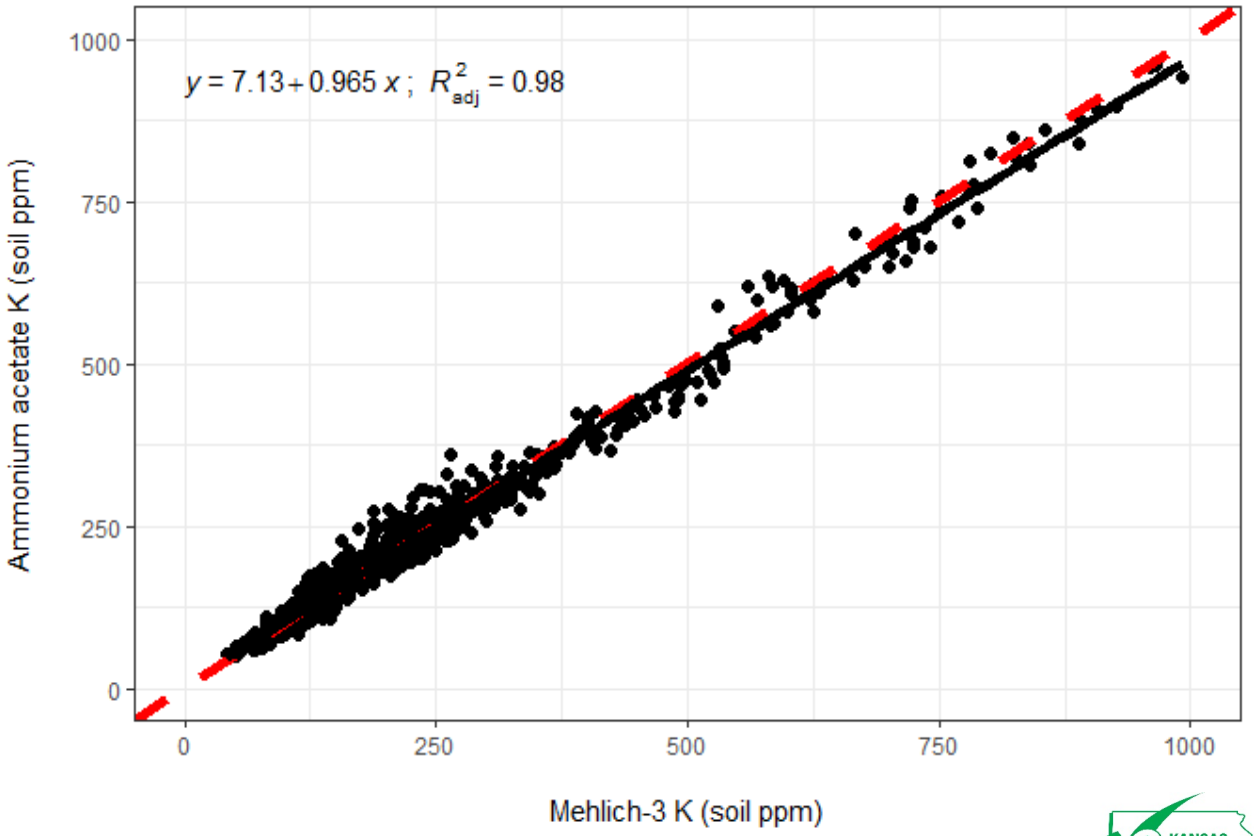
Ammonium acetate and Mehlich-3 soil test K



750 soil samples from Kansas

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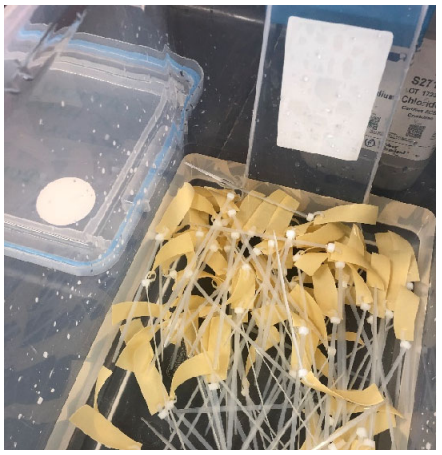
Cation Exchange Resins to assess K supply

- A CER is a cross-linked polymer with negatively charged structural units
- To “simulate” plant root activity and allow to measure ion supply in-situ with minimal disturbance



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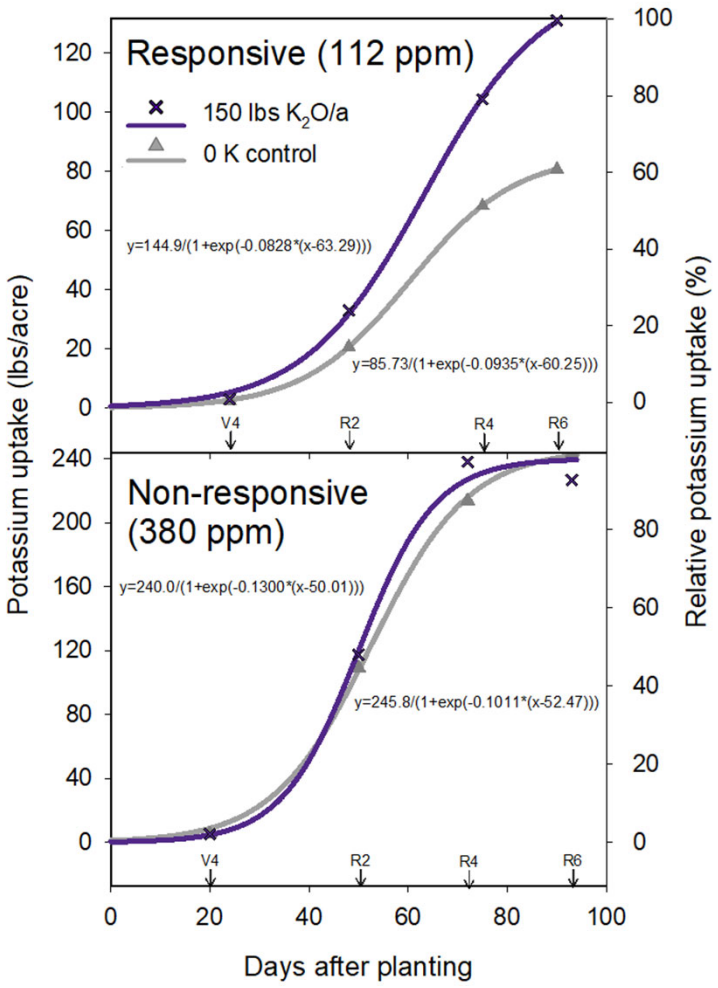
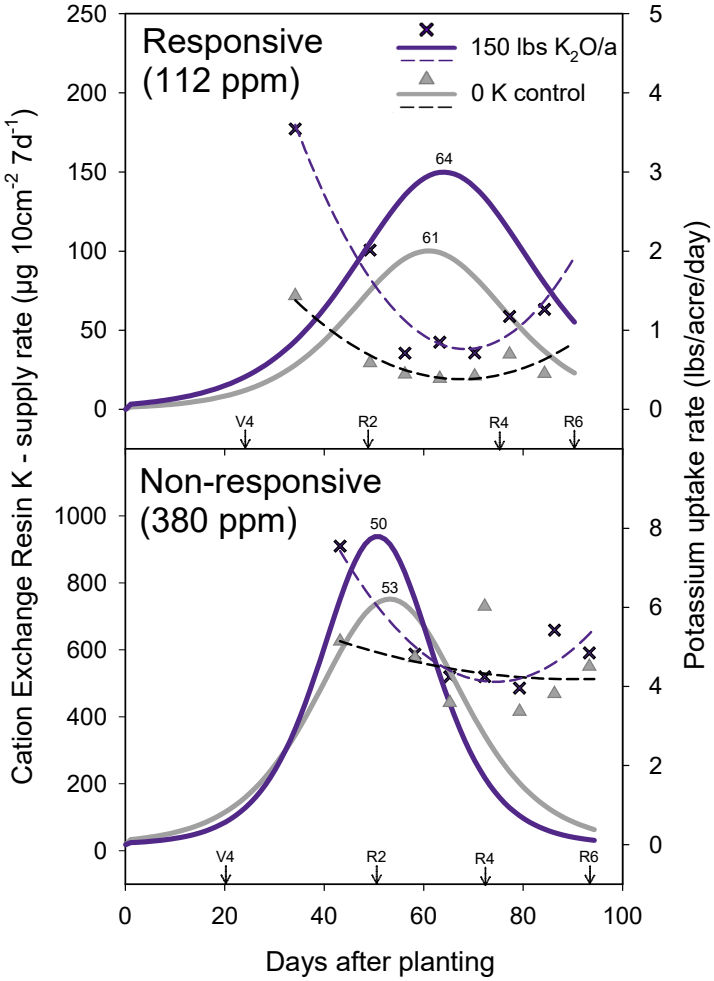
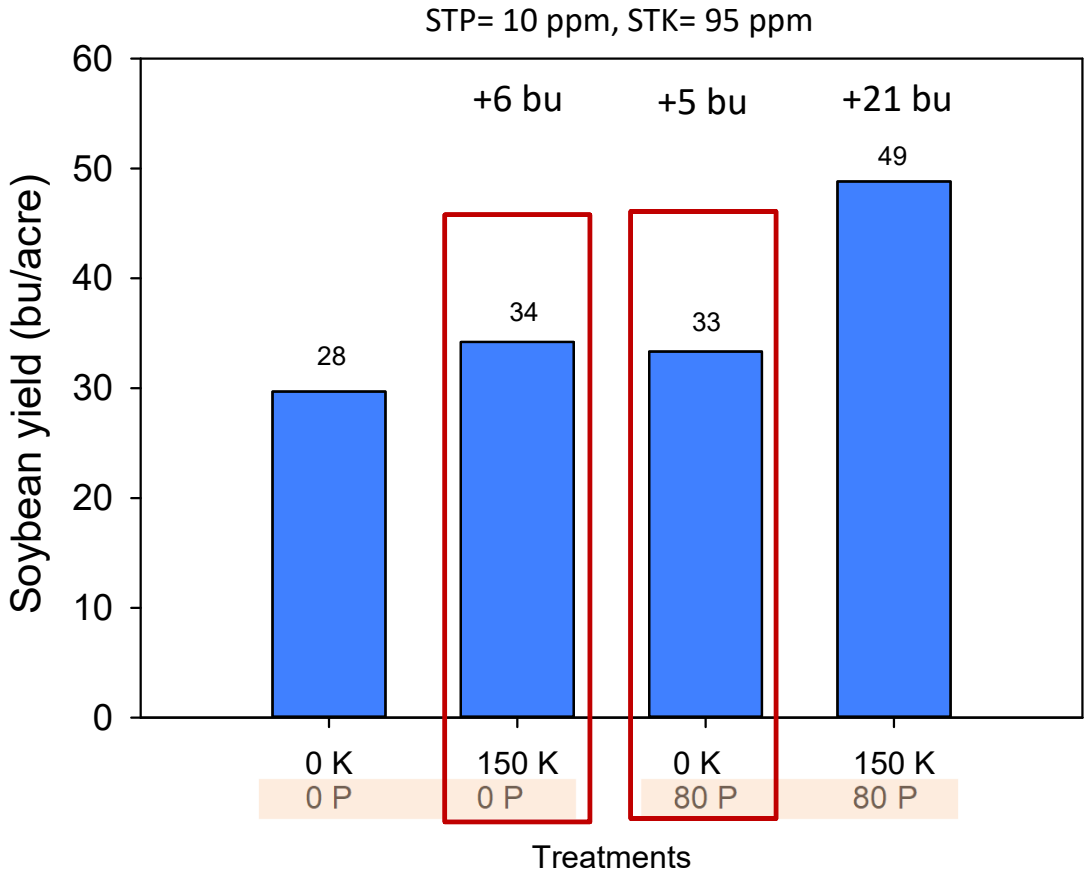
K deficient field vs high testing K soil





Soybean: response to K and P in low testing soils



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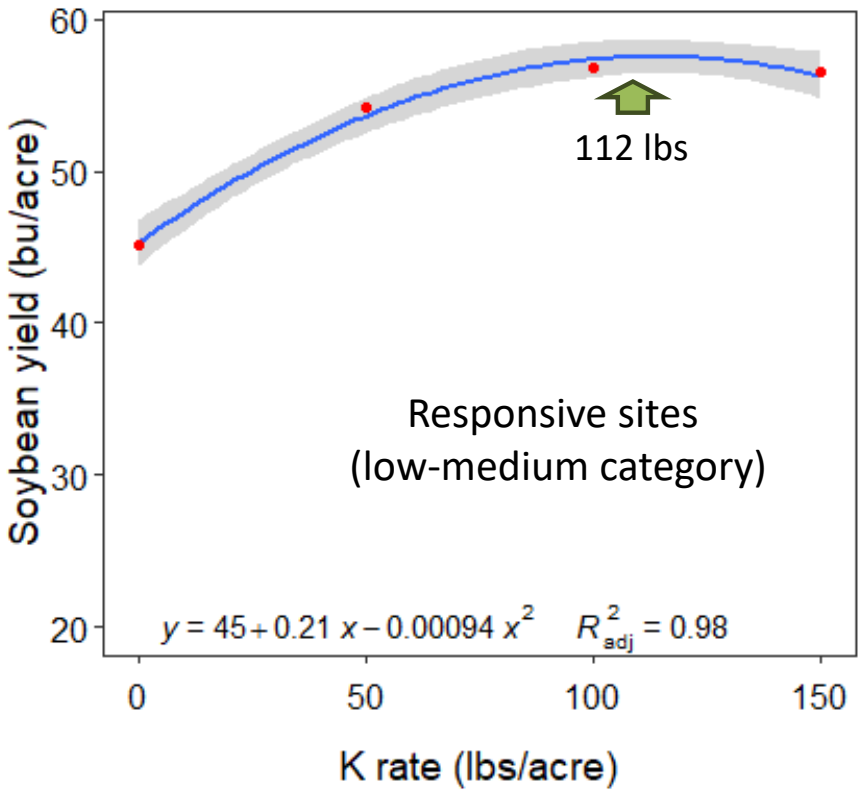
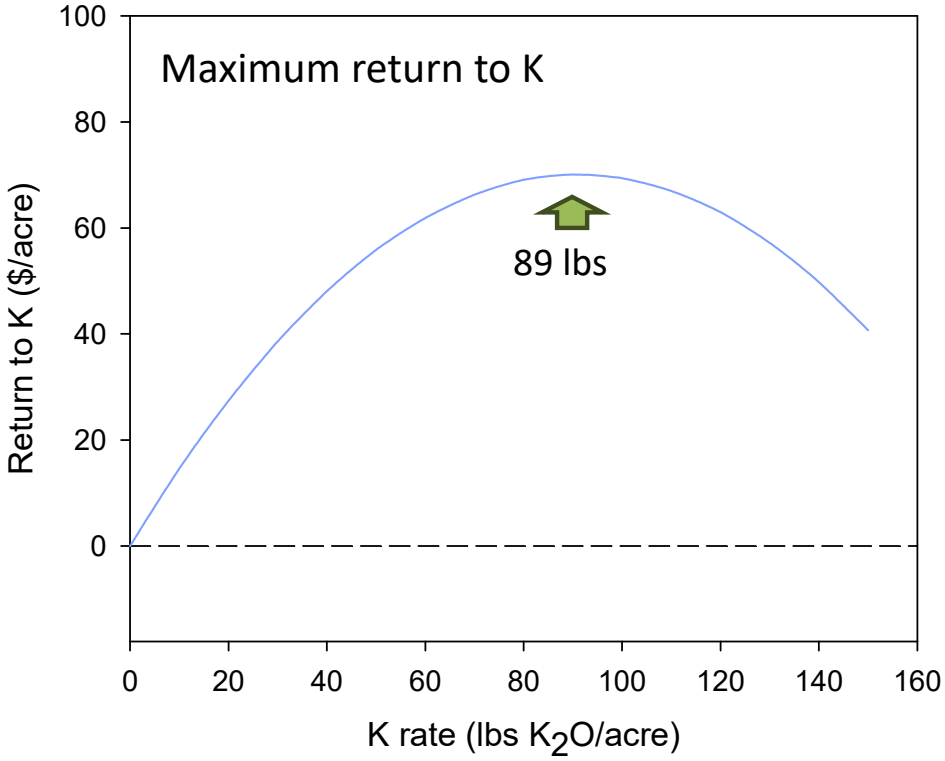
Return to K fertilizer ($0.35 K & $9 soybean) for one growing season





2022; 6 responsive locations (60-120 ppm)

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Potassium in corn and soybean

- Given low grain prices use caution not to cut on K (and P) in low testing soils!
- Early K side-dress can contribute to K uptake and yield for corn and soybean
  - Moisture can be a limiting factor
- Yield response is smaller when compared to pre-plant
  - An option as “rescue” application only

Soil test/diagnostic and K management

- Commonly used soil test K methods (AA and M3 dry soil) are not the best predictors in some soils
- Soil samples for K should be collected the same time of the year (season variability)
- Need for more adequate soil test methods for some regions/soils: clay minerology? drainage? CEC?

Thank you!

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