

# Updated Phosphorus and Potassium Recommendations for Soybean

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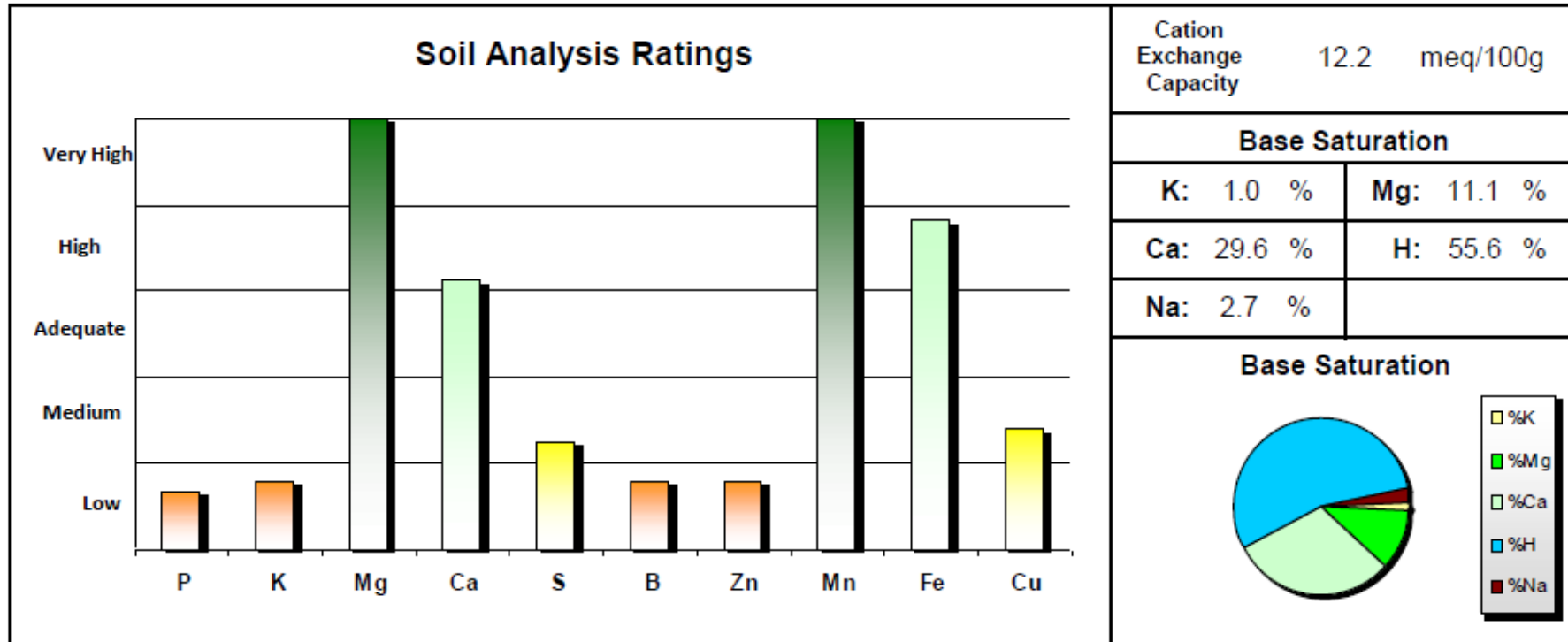


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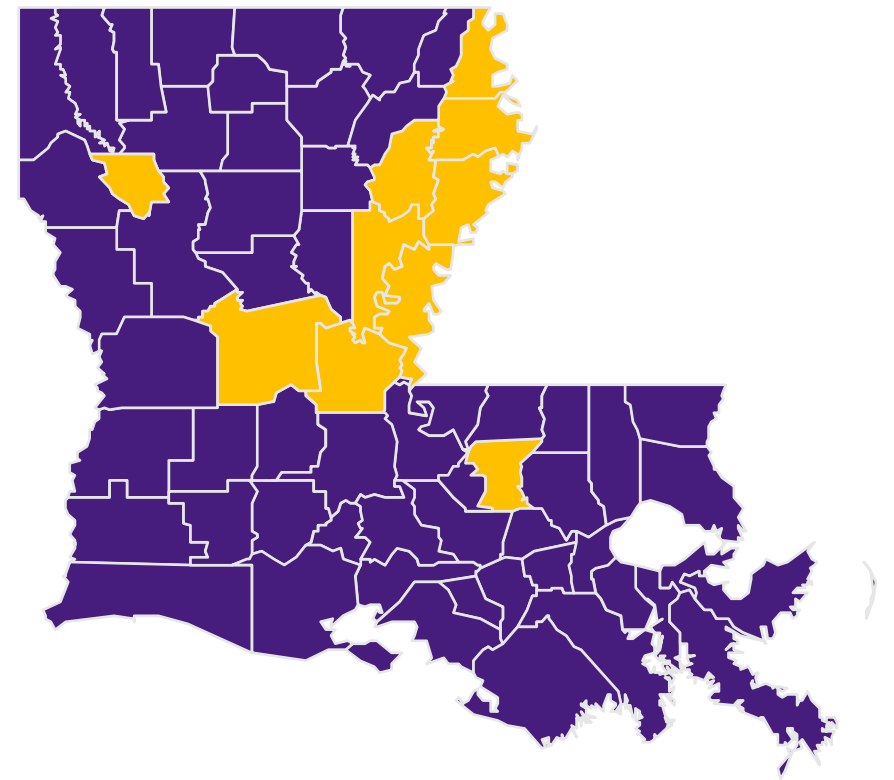
# Soil-Test Report Interpretation

Test Method: Mehlich III		Soil Laboratory Data (ppm)							Target pH 6.5		
<b>P</b> Phosphorus	<b>K</b> Potassium	<b>Mg</b> Magnesium	<b>Ca</b> Calcium	<b>Soil pH</b>	<b>Buffer pH</b> SMP	<b>S</b> Sulfur	<b>B</b> Boron	<b>Zn</b> Zinc	<b>Mn</b> Manganese	<b>Fe</b> Iron	<b>Cu</b> Copper
13.5 L	49 L	163.5 VH	724 H	5.2	6.65	15.5 M	0.4 L	1.6 L	219 VH	181.5 H	1.1 M
<b>Al</b> Aluminum	<b>Na</b> Sodium	<b>NO3-N</b> Nitrate-N	<b>NH4</b> Ammonia	<b>Soluble Salts</b>		<b>Organic Matter</b>	<b>ENR</b>	<b>Mo</b> Molybdenum	<b>Ni</b> Nickel	<b>BiCarbs</b>	
	76					1.65	16.5				
		ppm	ppm	mmhos/cm		%		ppm	ppm	meq/L	



# Field Trials for Developing P & K Recommendations

- ❖ Total 56 sites for both P and K Trials (2020 to 2022)
  - ✓ 42 LSU AgCenter research station sites
  - ✓ 12 on-farm sites (Producer fields)
- ❖ Soil Types:
  - ✓ Sandy to Silt Loam soils (46 sites)
  - ✓ Clayey soils (20 sites)
- ❖ P and K fertilizer (TSP; 0-46-0 & MoP; 0-0-60):
  - ✓ 0, 40, 80, 120, and 160 lb  $P_2O_5$  or  $K_2O$  acre<sup>-1</sup>
- ❖ Soil sampling (0- to 6-inch) at planting for Mehlich-3 P and K concentrations
- ❖ Total 2400 experimental plots (35-ft x 13-ft)



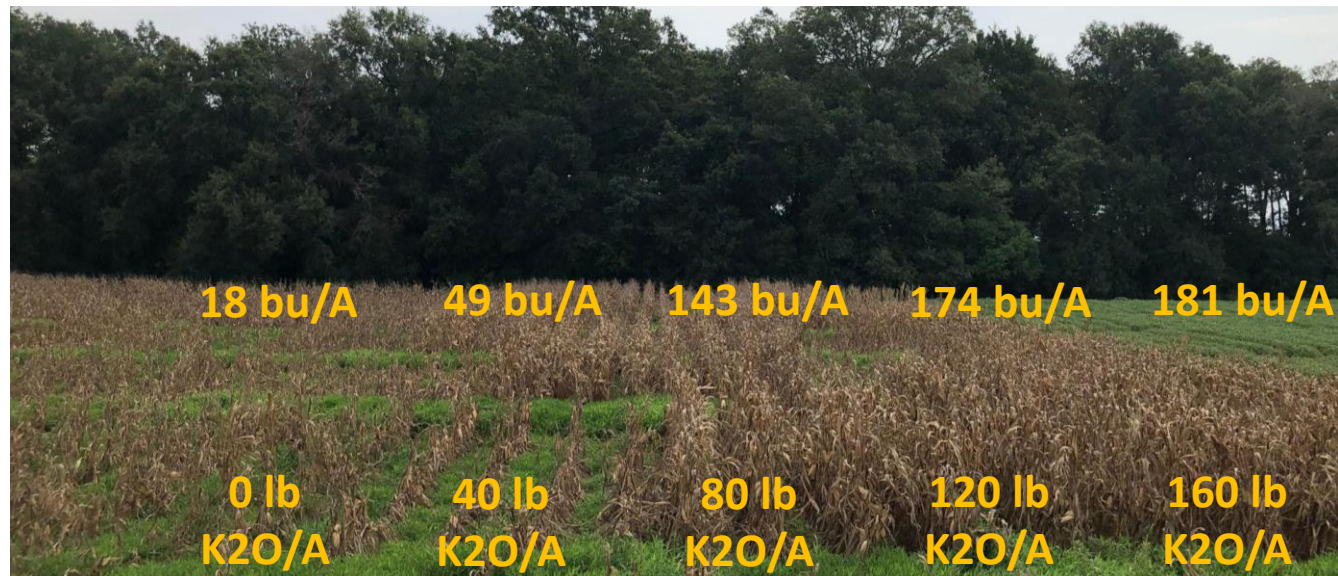
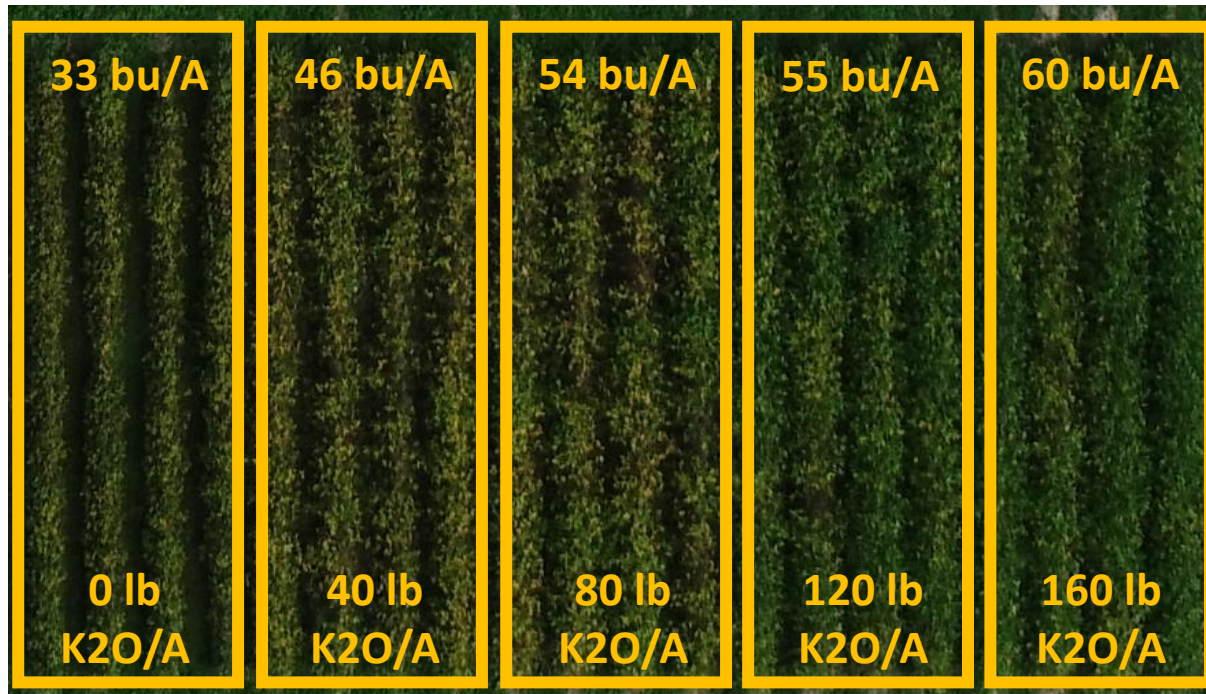
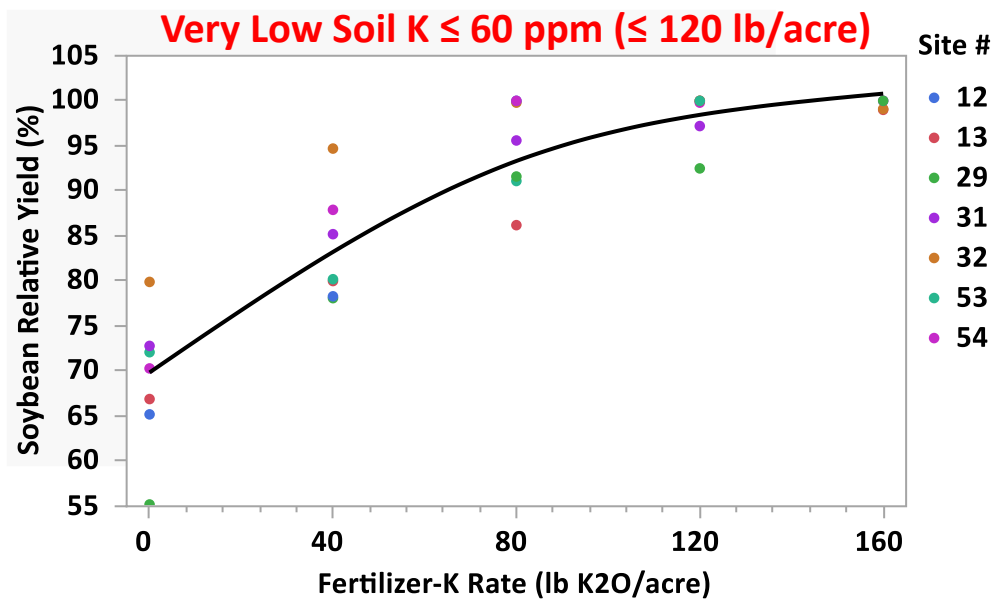
# Soil Fertility Field Day in 2021



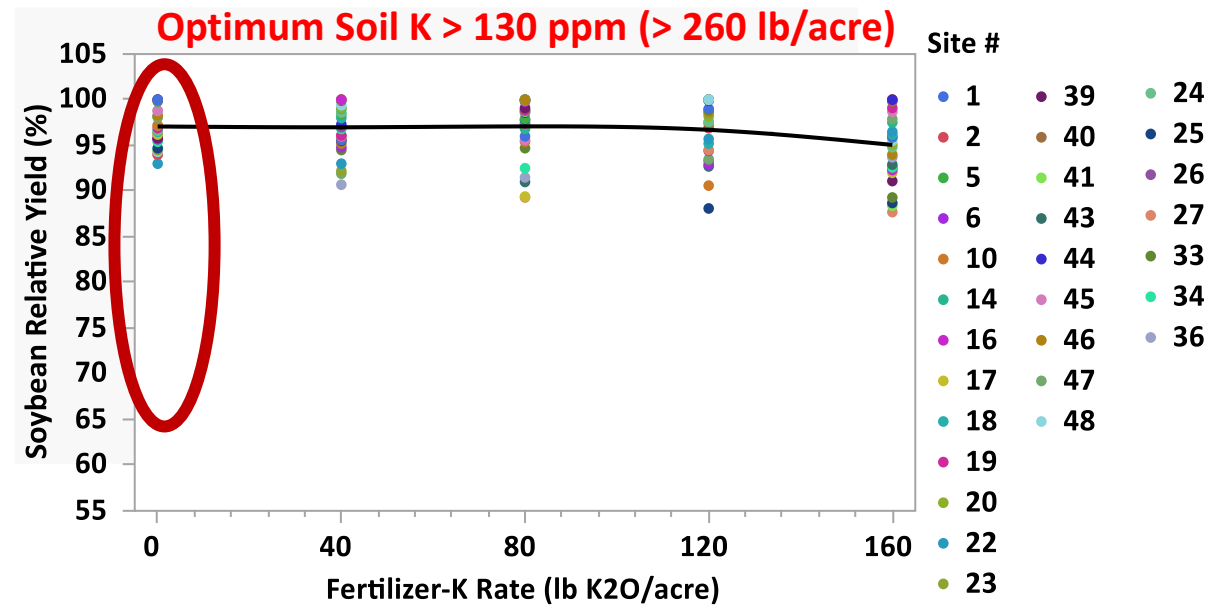
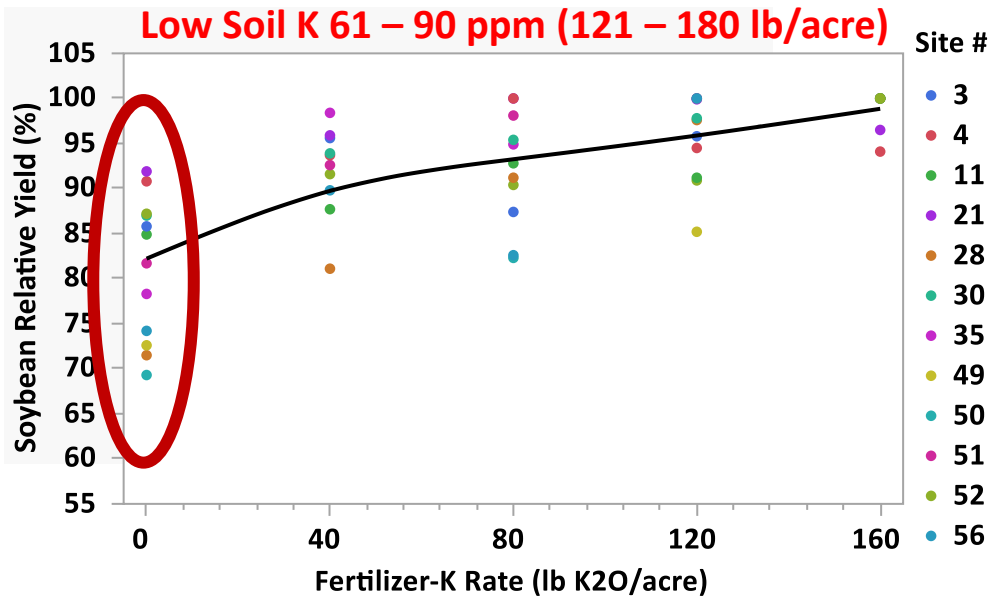
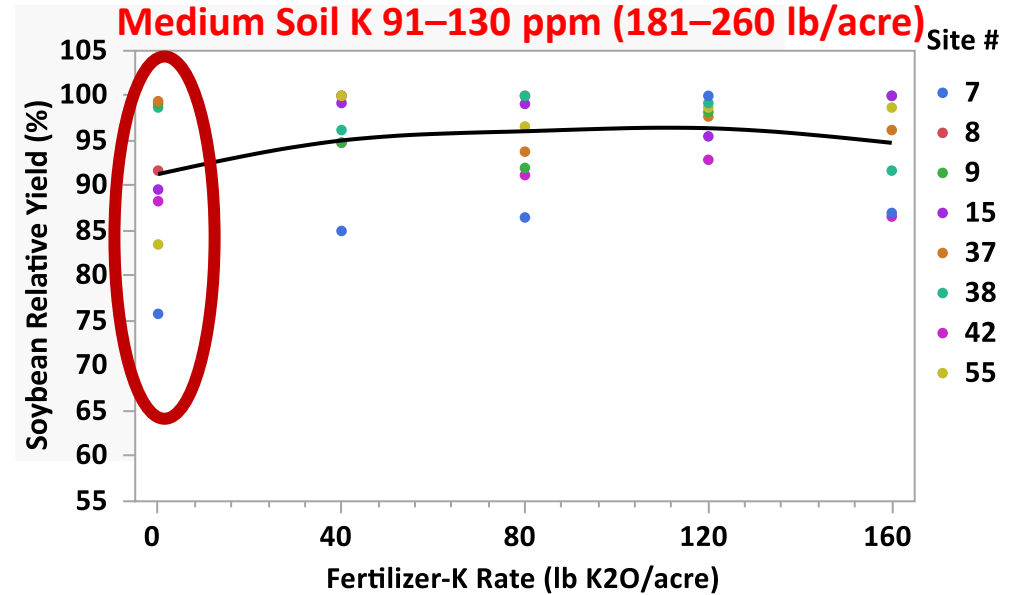
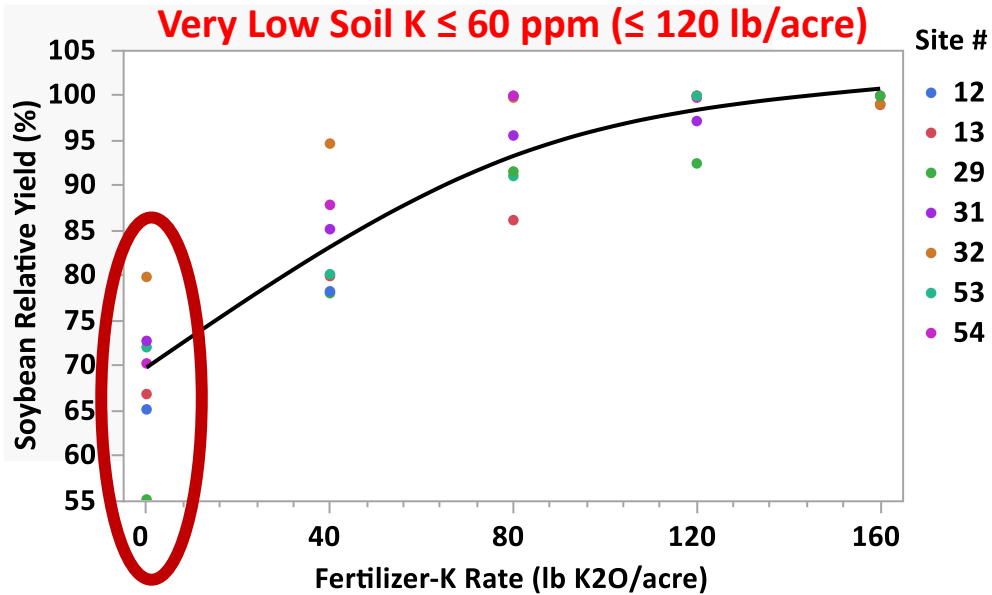
Photo Courtesy: Dr. Trey Price



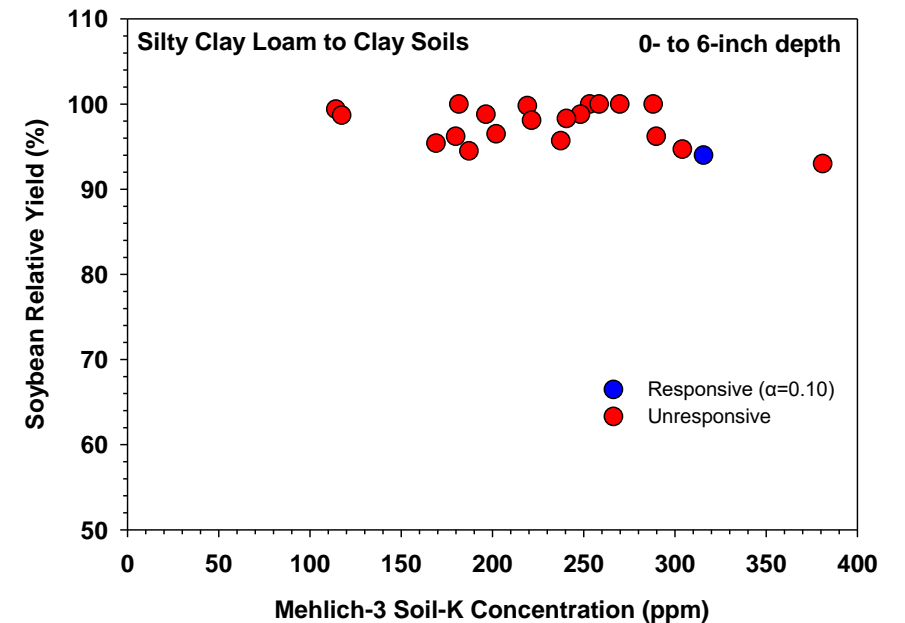
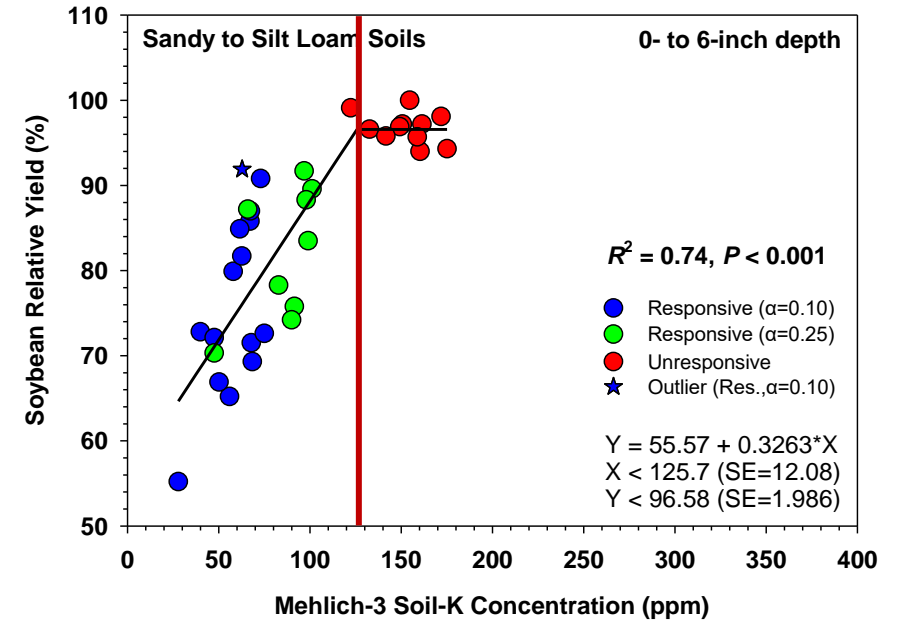
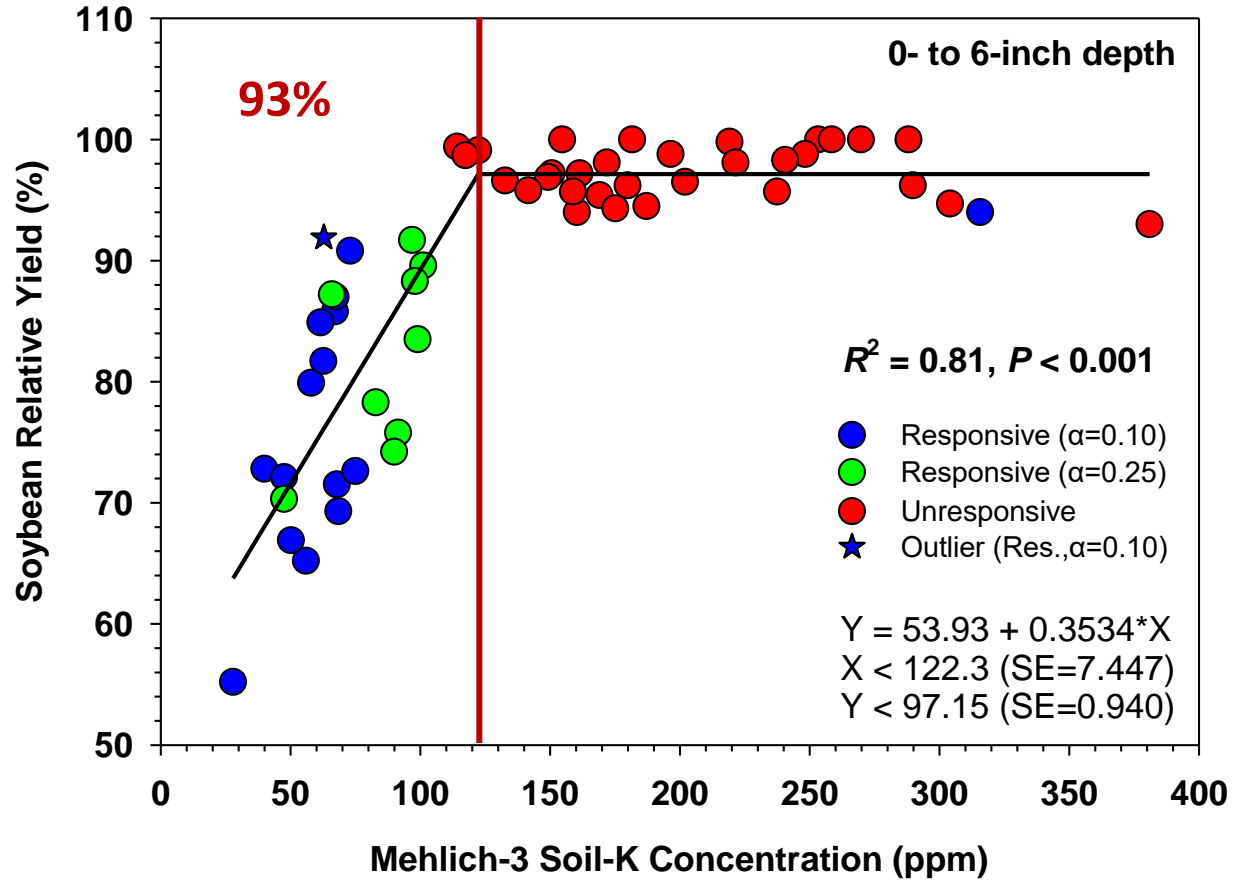
# Soybean Response to K Fertilization at Different Soil-Test K Levels



# Soybean Response to K Fertilization at Different Soil-Test K Levels

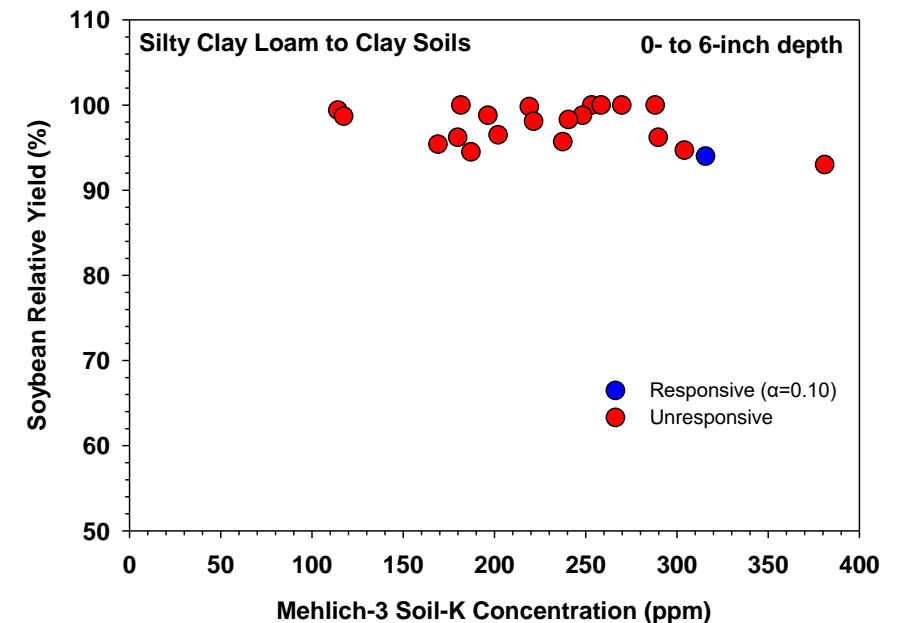
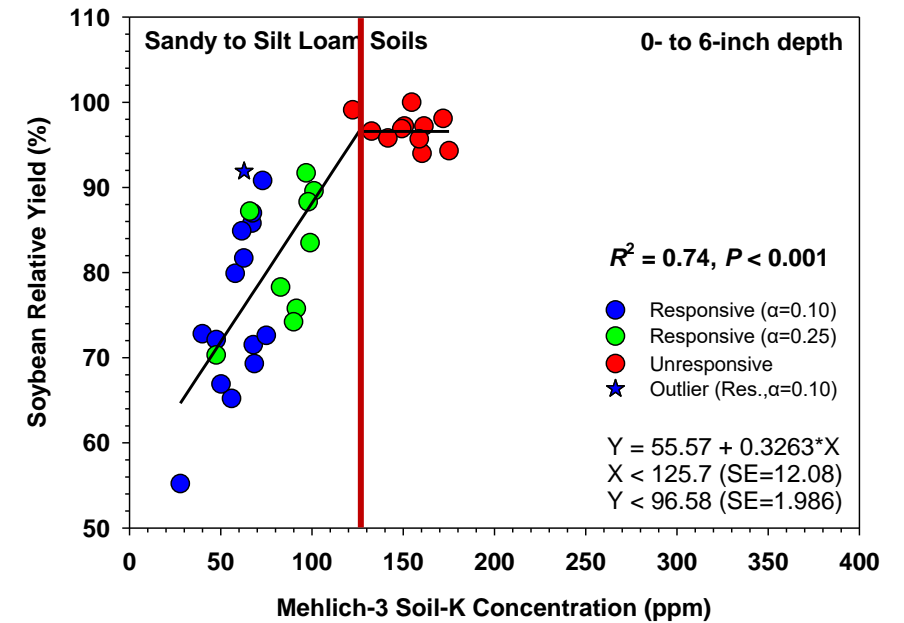


# Correlation of Soybean Yield with Soil-Test K Concentrations



# Correlation of Soybean Yield with Soil-Test K Concentrations

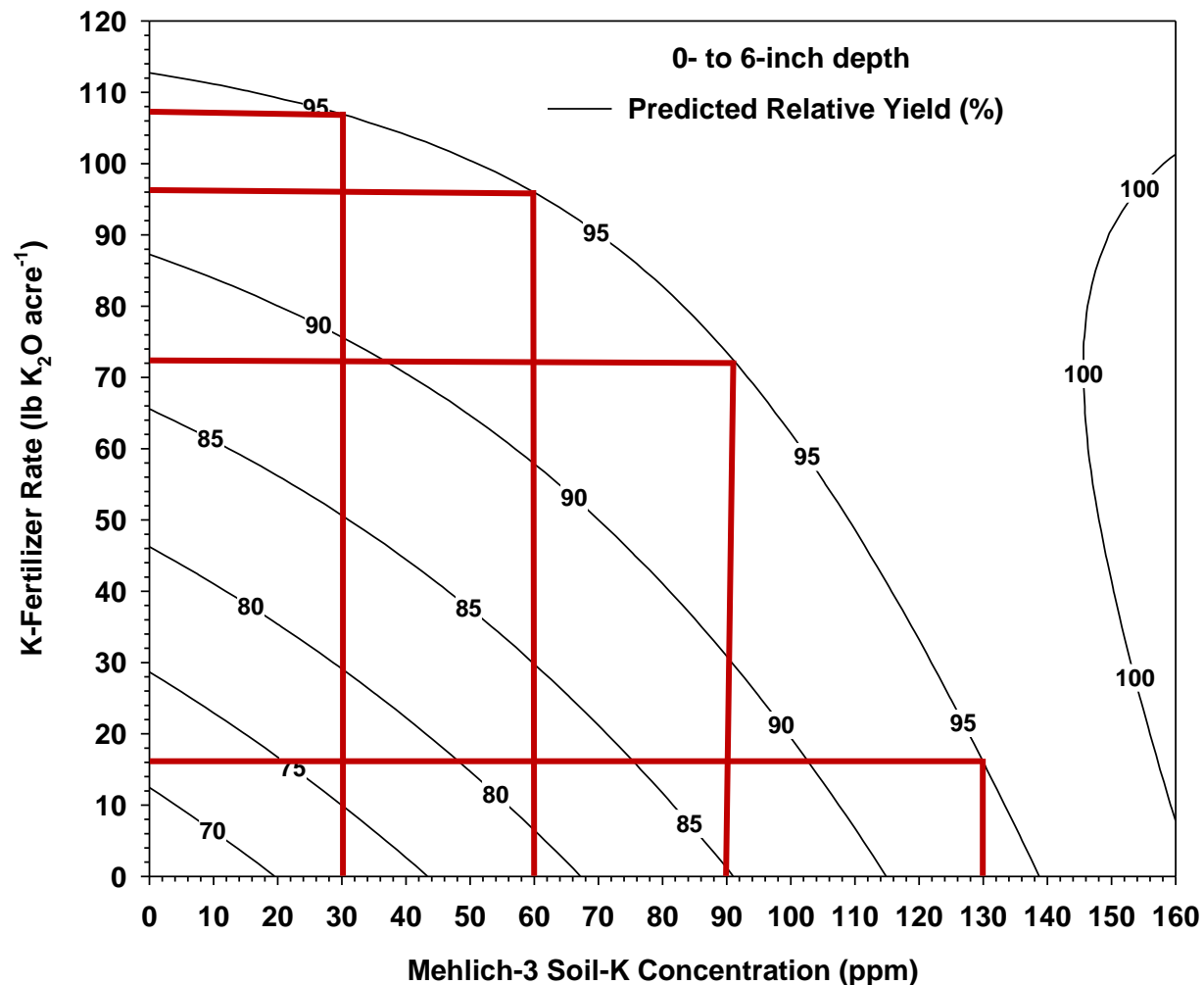
Soil-test Level	Mehlich-3 Soil-test K Concentration (ppm)		Recommendations (lb K <sub>2</sub> O acre <sup>-1</sup> )
	Alluvial Soils	Upland Soils	
<b>Loamy Sand, Sandy Loam</b>			
Very Low	≤ 35	≤ 35	80
Low	36 – 53	36 – 53	60
Medium	54 – 79	54 – 88	30
High	80 – 123	89 – 106	0
Very High	> 123	> 106	0
<b>Very Fine Sandy Loam, Fine Sandy Loam</b>			
Very Low	≤ 53	≤ 44	80
Low	54 – 88	45 – 70	60
Medium	89 – 123	71 – 106	30
High	124 – 141	107 – 123	0
Very High	> 141	> 123	0
<b>Loam, Silt Loam</b>			
Very Low	≤ 70	≤ 62	80
Low	71 – 106	63 – 97	60
Medium	107 – 141	98 – 141	30
High	142 – 158	142 – 158	0
Very High	> 158	> 158	0
<b>Clay Loam, Silty Clay Loam</b>			
Very Low	≤ 123	≤ 88	80
Low	124 – 176	89 – 141	60
Medium	177 – 264	142 – 176	30
High	265 – 282	177 – 194	0
Very High	> 282	> 194	0
<b>Silty Clay, Clay</b>			
Very Low	≤ 141	≤ 88	80
Low	142 – 211	89 – 141	60
Medium	212 – 317	142 – 176	30
High	318 – 334	177 – 194	0
Very High	> 334	> 194	0





# Calibration: Soil-Test-Based Fertilizer-K Recommendations

Soil-test Level	Mehlich-3 Soil-test K Concentration (ppm)		Recommendations (lb K <sub>2</sub> O acre <sup>-1</sup> )
	Alluvial Soils	Upland Soils	
<b>Loamy Sand, Sandy Loam</b>			
Very Low	≤ 35	≤ 35	80
Low	36 – 53	36 – 53	60
Medium	54 – 79	54 – 88	30
High	80 – 123	89 – 106	0
Very High	> 123	> 106	0
<b>Very Fine Sandy Loam, Fine Sandy Loam</b>			
Very Low	≤ 53	≤ 44	80
Low	54 – 88	45 – 70	60
Medium	89 – 123	71 – 106	30
High	124 – 141	107 – 123	0
Very High	> 141	> 123	0
<b>Loam, Silt Loam</b>			
Very Low	≤ 70	≤ 62	80
Low	71 – 106	63 – 97	60
Medium	107 – 141	98 – 141	30
High	142 – 158	142 – 158	0
Very High	> 158	> 158	0
<b>Clay Loam, Silty Clay Loam</b>			
Very Low	≤ 123	≤ 88	80
Low	124 – 176	89 – 141	60
Medium	177 – 264	142 – 176	30
High	265 – 282	177 – 194	0
Very High	> 282	> 194	0
<b>Silty Clay, Clay</b>			
Very Low	≤ 141	≤ 88	80
Low	142 – 211	89 – 141	60
Medium	212 – 317	142 – 176	30
High	318 – 334	177 – 194	0
Very High	> 334	> 194	0



# Updated Fertilizer-K Recommendations for Soybean

Soil-Test Level	Soil-K Concentration (ppm)	Number of Sites (#)	Mean Yield Increase from K Fertilization		Yield Increase Probability (%)	Recommended K Rate (lb K <sub>2</sub> O acre <sup>-1</sup> )
			(bu/A)	(%)		
Very Low	≤ 60	7	16	31	100	120
Low	61 – 90	12	9	19	100	90
Medium	91 – 130	8	3	9	63	60
Optimum	131 – 160	7	2	3	0	0
Very High	> 160	22	1	2	0	0

# Comparing Fertilizer-K Recommendations for Soybean

## Louisiana

Soil-Test Level	Soil-Test K Value (ppm)	Fertilizer-K Rate (lb K <sub>2</sub> O acre <sup>-1</sup> )
Very Low	≤ 60	120
Low	61 – 90	90
Medium	91 – 130	60
Optimum	131 – 160	0
Very High	> 160	0

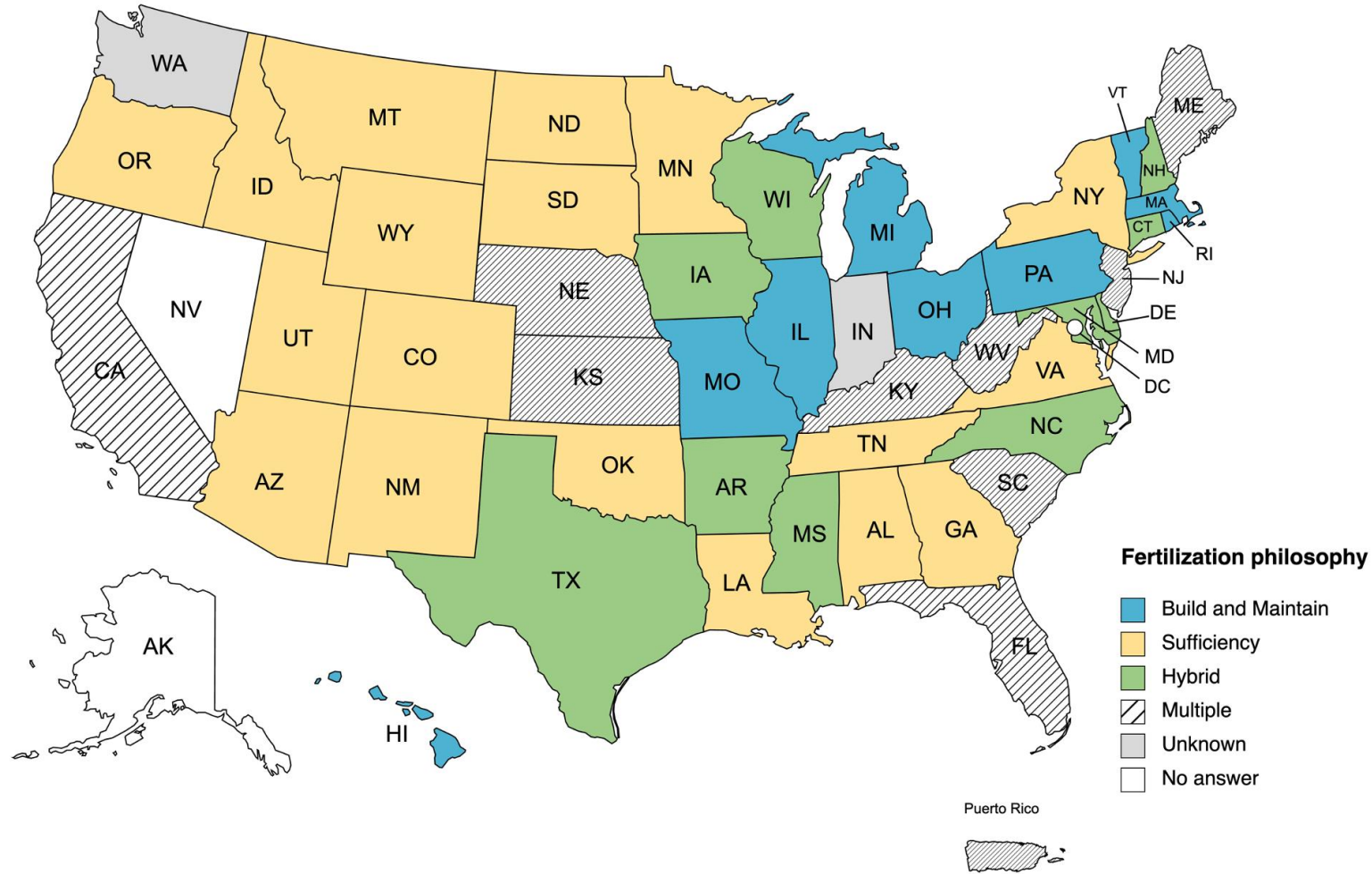
Rasel Parvej (2023)

## Arkansas

Soil-Test Level	Soil-Test K Value (ppm)	Fertilizer-K Rate (lb K <sub>2</sub> O acre <sup>-1</sup> )
Very Low	≤ 60	160
Low	61 – 90	120
Medium	91 – 130	75
Optimum	131 – 175	50
Above Optimum	≥ 176	0

Nathan Slaton (2021)

# Fertilization philosophies used by each state and Puerto Rico



States with a hybrid approach blend the Build and Maintain and Sufficiency philosophies

# Comparing Fertilizer-K Recommendations for Soybean

## Louisiana

Soil-Test Level	Soil-Test K Value (ppm)	Fertilizer-K Rate (lb K <sub>2</sub> O acre <sup>-1</sup> )
Very Low	≤ 60	120
Low	61 – 90	90
Medium	91 – 130	60
Optimum	131 – 160	0
Very High	> 160	0

Rasel Parvej (2023)

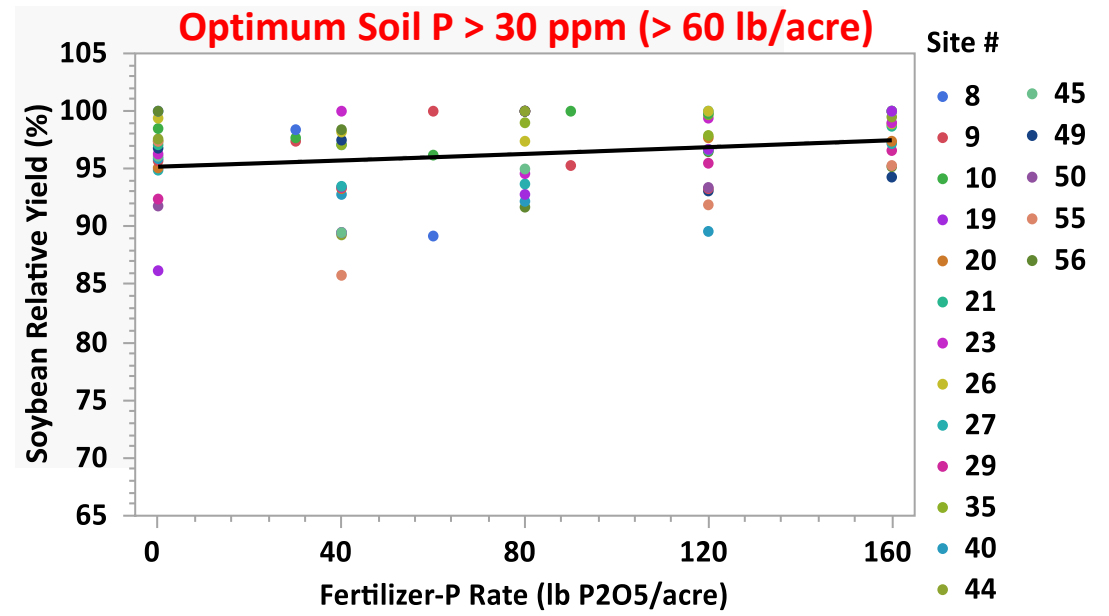
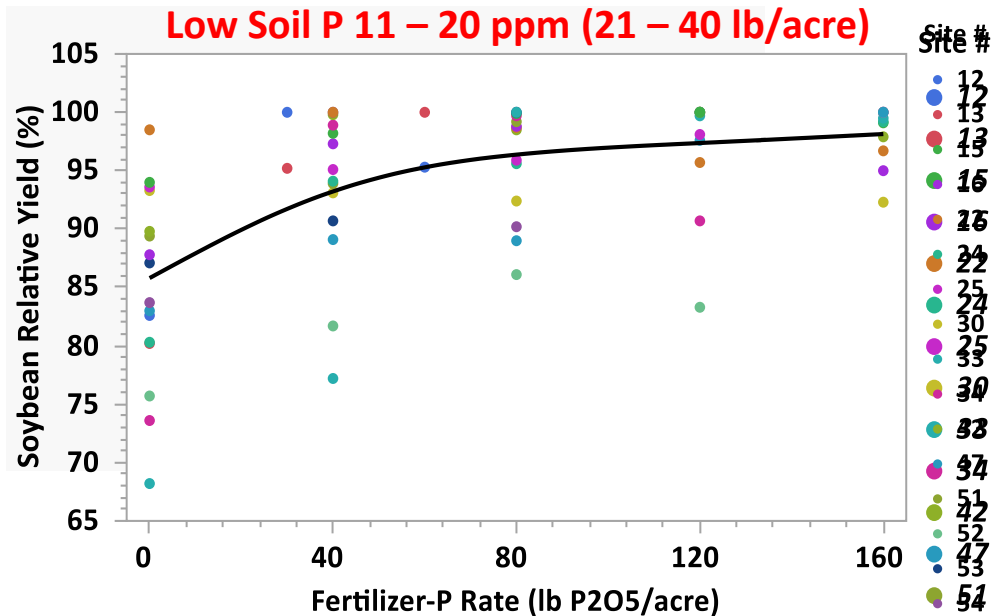
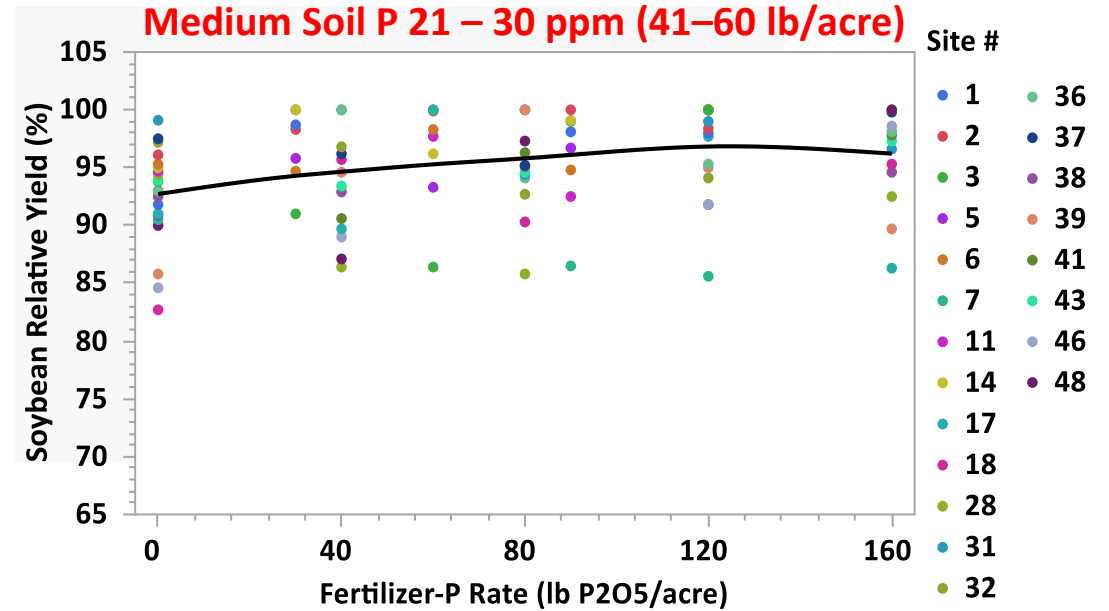
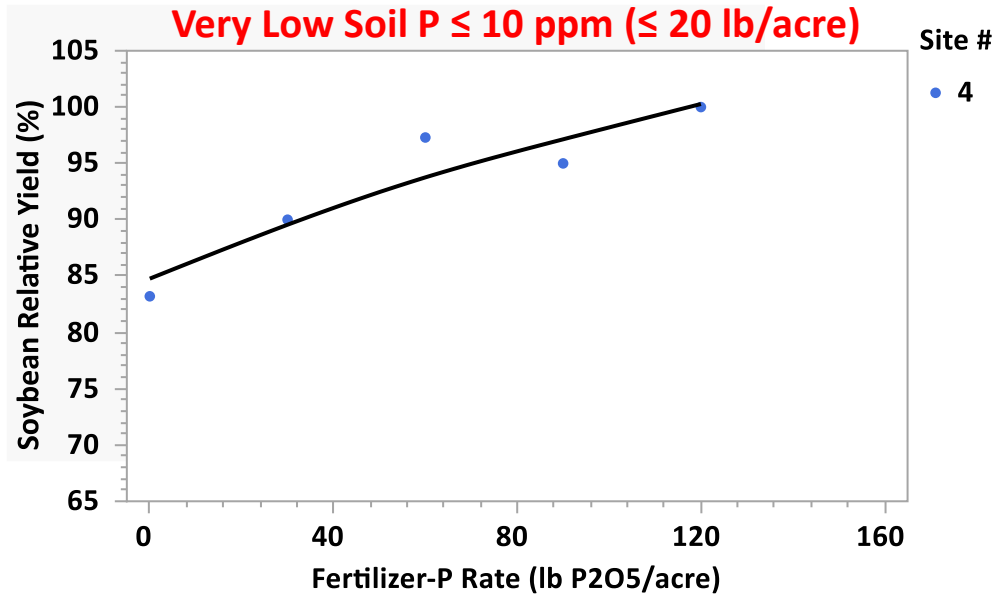
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Soil-Test Level	Soil-Test K Value (ppm)	Fertilizer-K Rate (lb K <sub>2</sub> O acre <sup>-1</sup> )
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Optimum	131 – 175	50
Above Optimum	≥ 176	0

Nathan Slaton (2021)

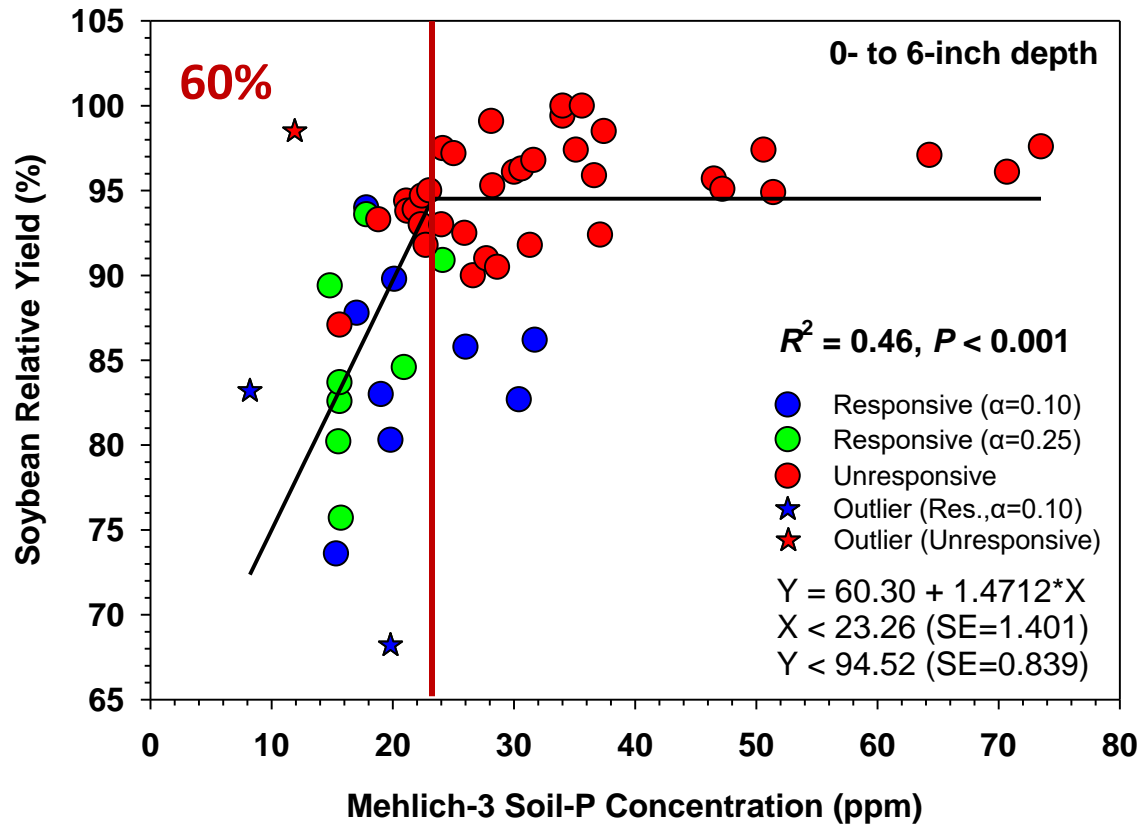
Soil Test	Arkansas Stepwise Rate	Arkansas VRT Rate	PRC K rate	PRC Profit Advantage
ppm	lb K <sub>2</sub> O/acre			\$/acre
50	<b>160</b>	157	<b>124</b>	<b>\$ 9.43</b>

# Soybean Response to P Fertilization at Different Soil-Test P Levels

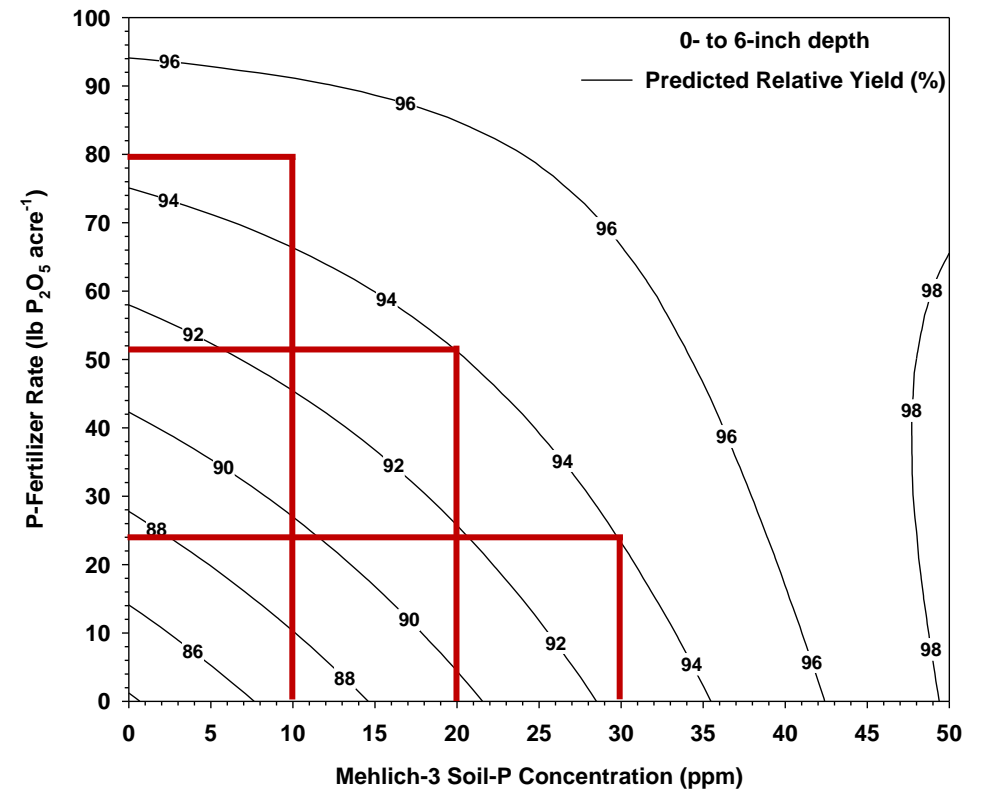


# Correlation & Calibration of Soybean Yield with Soil-Test K Concentrations & P Fertilization

## Soybean Response to Soil P Concentrations



## Fertilizer-P Recommendations



# Updated Fertilizer-P Rate Recommendations for Soybean

Soil-Test Level	Soil-P Concentration (ppm)	Number of Sites (#)	Mean Yield Increase from P Fertilization		Yield Increase Probability (%)	Recommended P Rate (lb P <sub>2</sub> O <sub>5</sub> acre <sup>-1</sup> )
			(bu/A)	(%)		
Very Low	≤ 10	1	10	17	100	80
Low	11 – 20	16	7	15	81	60
Medium	21 – 30	21	4	7	19	40
Optimum	31 – 50	13	2	4	7	0
Very High	> 50	5	2	3	0	0



## Take home messages .....

- ✓ Fertilize your crop based on true soil test values and the probabilities of yield response. Invest little more money on soil testing.
- ✓ Use respective state soil-test-based recommendations for crop production in that state.
- ✓ These recommendations will be provided to LSU AgCenter and other private soil labs.

## **WARNING**

- ✓ These recommendations will work best for 40 to 80 bu/acre soybean yield.
- ✓ Please do not use this recommendations for corn and cotton. It may or may not work.
- ✓ These recommendations are based on Mechlich-3 soil extractant for 0- to 6-inch soil depth.

<b>Corn for grain</b>					
Interpretation	Soil Test P ppm	P <sub>2</sub> O <sub>5</sub> Recommendation, lbs/ac			
		Alluvial		Upland	
		Irrigated	Non	Irrigated	Non
Very low	10 and <	120	100	100	80
Low	11-20	90	80	80	60
Medium	21-35	60	60	60	40
High	36-60	0	0	0	0
Very High	>60	0	0	0	0

Interpretation	Soil Test K ppm	K <sub>2</sub> O Recommendation, lbs/ac			
		Alluvial		Upland	
		Irrigated	Non	Irrigated	Non
<b>clay, silty clay</b>					
Very Low	141 and <	120	100	100	80
Low	211	90	80	80	60
Medium	317	60	60	60	40
High	334	0	0	0	0
Very High	> 334	0	0	0	0
<b>silty clay loam, clay loam</b>					
Very Low	123 and <	120	100	100	80
Low	176	90	80	80	60
Medium	264	60	60	60	40
High	282	0	0	0	0
Very High	> 282	0	0	0	0
<b>silt loam</b>					
Very Low	70 and <	120	100	100	80
Low	106	90	80	80	60
Medium	141	60	60	60	40
High	158	0	0	0	0
Very High	> 158	0	0	0	0
<b>loam, very fine sandy loam, fine sandy loam, sandy loam, loamy sand</b>					
Very Low	53 and <	120	100	100	80
Low	88	90	80	80	60
Medium	123	60	60	60	40
High	141	0	0	0	0
Very High	> 141	0	0	0	0

# What's Next ?

<b>Cotton</b>					
Interpretation	Soil Test P ppm	P <sub>2</sub> O <sub>5</sub> Recommendation, lbs/ac			
		Alluvial		Upland	
		Irrigated	Non	Irrigated	Non
<b>clay, silty clay, silty clay loam, clay loam</b>					
Very low	10 and <	90	80	90	80
Low	11-20	70	60	70	60
Medium	21-35	50	40	50	40
High	36-60	0	0	0	0
Very High	>60	0	0	0	0
<b>silt loam, loam, very fine sandy loam, fine sandy loam, sandy loam, loamy sand</b>					
Very low	10 and <	100	80	100	80
Low	11-20	80	60	80	60
Medium	21-35	60	40	60	40
High	36-60	0	0	0	0
Very High	>60	0	0	0	0
Interpretation	Soil Test K ppm	K <sub>2</sub> O Recommendation, lbs/ac			
		Alluvial		Upland	
		Irrigated	Non	Irrigated	Non
<b>clay, silty clay</b>					
Very Low	141 and <	100	80	100	80
Low	211	80	60	80	60
Medium	317	60	40	60	40
High	334	0	0	0	0
Very High	> 334	0	0	0	0
<b>silty clay loam, clay loam</b>					
Very Low	123 and <	100	80	100	80
Low	176	80	60	80	60
Medium	264	60	40	60	40
High	282	0	0	0	0
Very High	> 282	0	0	0	0
<b>silt loam</b>					
Very Low	70 and <	120	100	120	100
Low	106	90	80	90	80
Medium	141	60	40	60	40
High	158	0	0	0	0
Very High	> 158	0	0	0	0
<b>loam, very fine sandy loam, fine sandy loam, sandy loam, loamy sand</b>					
Very Low	53 and <	120	100	120	100
Low	88	90	80	90	80
Medium	123	60	40	60	40
High	141	0	0	0	0
Very High	> 141	0	0	0	0

# Thank You

## Rasel Parvej

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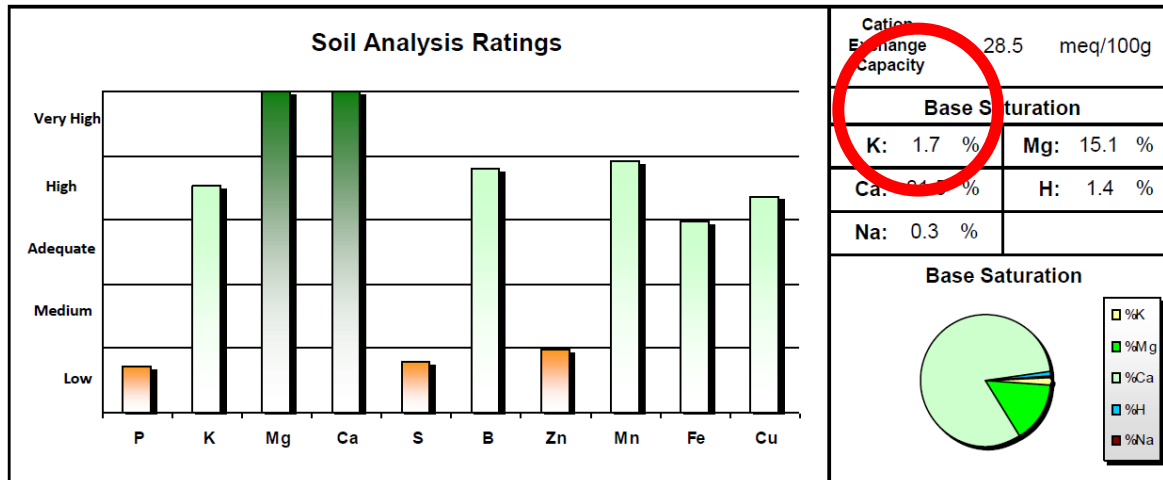


# Soil-Test K Concentration vs. K Saturation for K Recommendations

## Which one is more important?

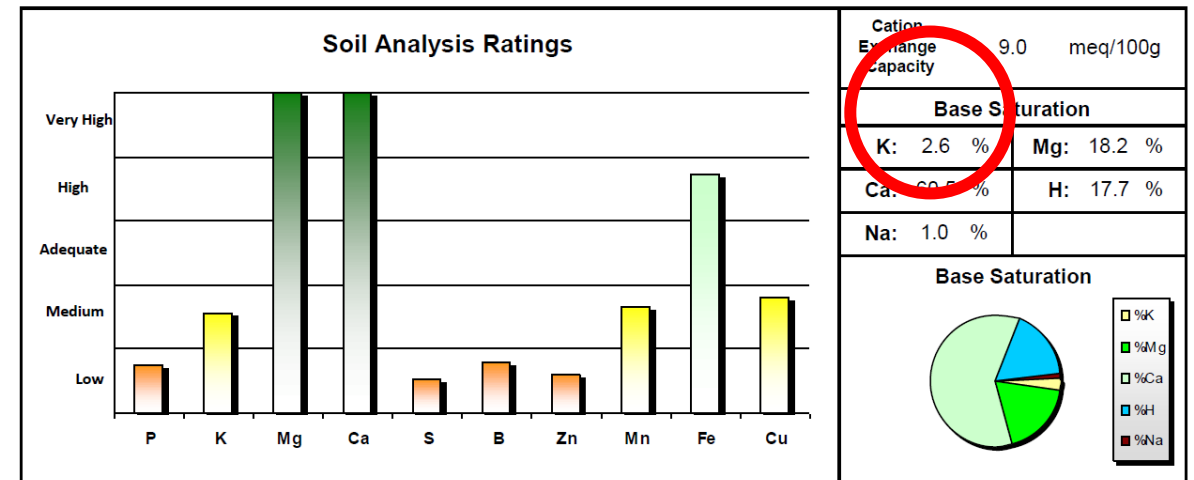
<b>Customer: 65829</b>	<b>Sample ID: 1292</b>
LSU AG CENTER M.D. RASEL PRAVEJ 212A MACON RIDGE ROAD WINNSBORO, LA 71295 UNITED STATES	Grower: RASEL PARVEJ Farm ID: RASEL PARVEJ Field ID: Lab Number: 870214SM Layer ID: Received: 8/19/2021 Processed: 8/23/2021

Soil Laboratory Data (ppm)												Target pH 6.5
P	K	Mg	Ca	Soil pH	Buffer pH	S	B	Zn	Mn	Fe	Cu	
Phosphorus	Potassium	Magnesium	Calcium		SMP	Sulfur	Boron	Zinc	Manganese	Iron	Copper	
14.5	189 <b>H</b>	17 <b>VH</b>	4646 <b>VH</b>	7.8	7.45	10 <b>L</b>	1.2 <b>H</b>	1.95 <b>L</b>	193 <b>H</b>	99.5 <b>A</b>	4.1 <b>H</b>	
Al	Na	NO3-N	NH4	Soluble Salts		Organic Matter	ENR	Mo	Ni	BiCarbs		
Aluminum	Sodium	Nitrate-N	Ammonia					Molybdenum	Nickel			
	20.5					1.23 %	12.5					
		ppm	ppm			mmhos/cm		ppm	ppm	meq/L		



<b>Customer: 65829</b>	<b>Sample ID: 1346</b>
LSU AG CENTER M.D. RASEL PRAVEJ 212A MACON RIDGE ROAD WINNSBORO, LA 71295 UNITED STATES	Grower: RASEL PARVEJ Farm ID: RASEL PARVEJ Field ID: Lab Number: 870231SM Layer ID: Received: 8/19/2021 Processed: 8/23/2021

Soil Laboratory Data (ppm)												Target pH 6.5
P	K	Mg	Ca	Soil pH	Buffer pH	S	B	Zn	Mn	Fe	Cu	
Phosphorus	Potassium	Magnesium	Calcium		SMP	Sulfur	Boron	Zinc	Manganese	Iron	Copper	
15	91 <b>M</b>	97 <b>VH</b>	1094 <b>VH</b>	6.1	7.30	6.5 <b>L</b>	0.4 <b>L</b>	1.2 <b>L</b>	25 <b>M</b>	172 <b>H</b>	1.4 <b>M</b>	
Al	Na	NO3-N	NH4	Soluble Salts		Organic Matter	ENR	Mo	Ni	BiCarbs		
Aluminum	Sodium	Nitrate-N	Ammonia					Molybdenum	Nickel			
	20.5					0.59 %	6					
		ppm	ppm			mmhos/cm		ppm	ppm	meq/L		



# Soil-Test K Conc. vs. K Saturation in Developing K Recommendations

## Unfertilized-K Yield Across 56 Sites

