

Reevaluating Soil-Test-Based Phosphorus and Potassium Recommendations for Soybean

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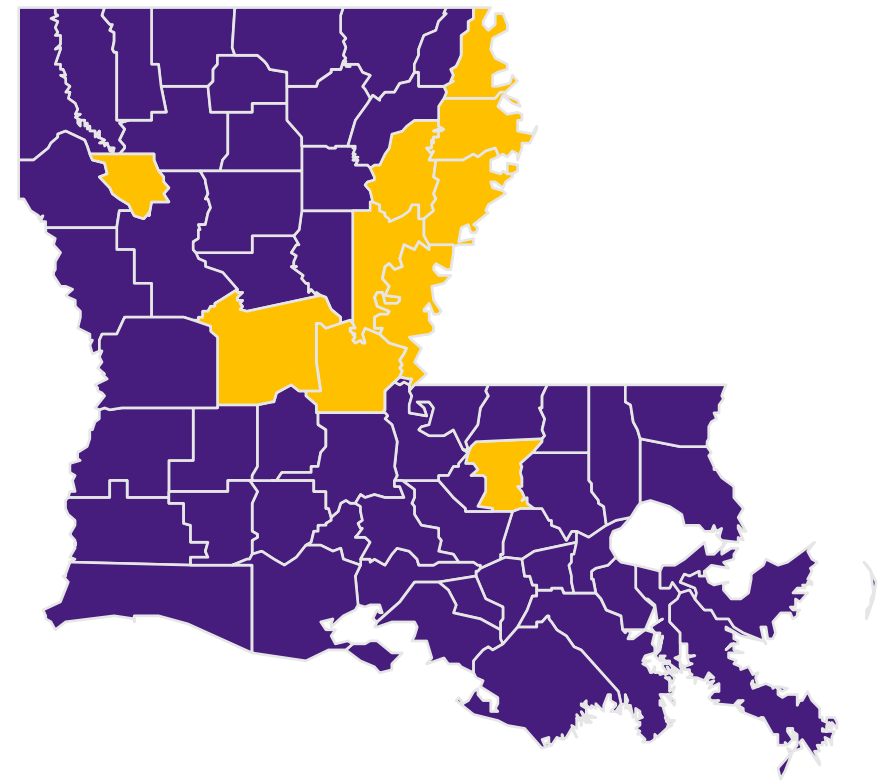


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Field Trials

- ❖ Year: 2020 to 2023
- ❖ Total 61 sites for both P and K trials
 - ✓ 49 LSU AgCenter research station sites
 - ✓ 12 on-farm sites (Producer fields)
- ❖ Soil Types:
 - ✓ Sandy to Silt Loam soils (39 sites)
 - ✓ Clayey soils (22 sites)
- ❖ P and K fertilizer rates (TSP; 0-46-0 & MoP; 0-0-60):
 - ✓ 0, 40, 80, 120, and 160 lb P_2O_5 or K_2O acre⁻¹
- ❖ Soil sampling (0 to 4, 0 to 6, 0 to 8, & 0 to 12 inches) at planting for Mehlich-3 P and K concentrations
- ❖ Around 2600 experimental plots



Current Phosphorus and Potassium Recommendations for Soybean

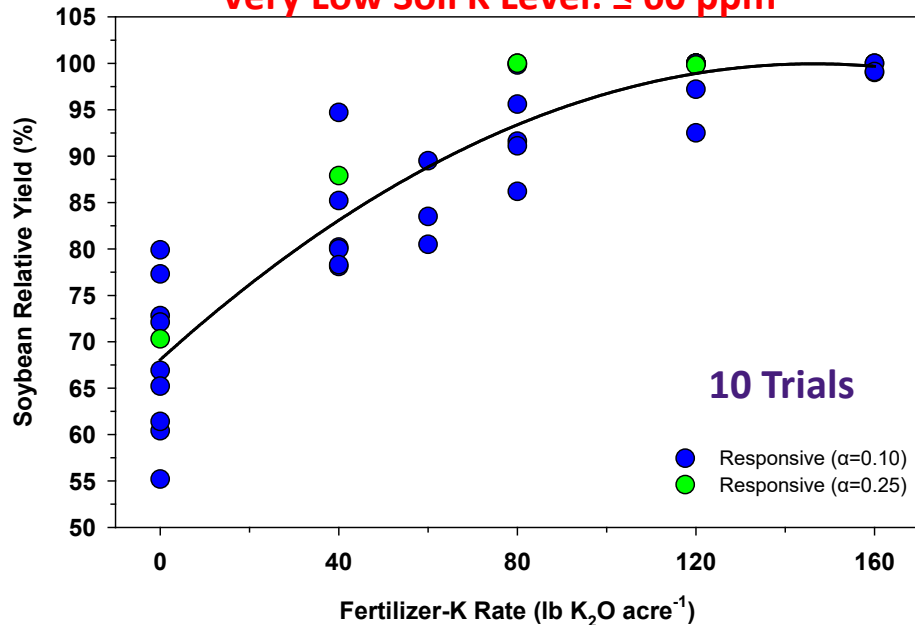
Soil-test Level	Mehlich-3 Soil-test P Conc. (ppm) at 0- to 6-inch depth	Recommendations (lb P ₂ O ₅ acre ⁻¹)
Very Low	≤ 10	80
Low	11 – 20	60
Medium	21 – 35	40
High	36 – 60	0
Very High	> 60	0

- ✓ 0- to 6-inch soil depth
- ✓ Mehlich-3 extractant
- ✓ Sufficiency philosophy

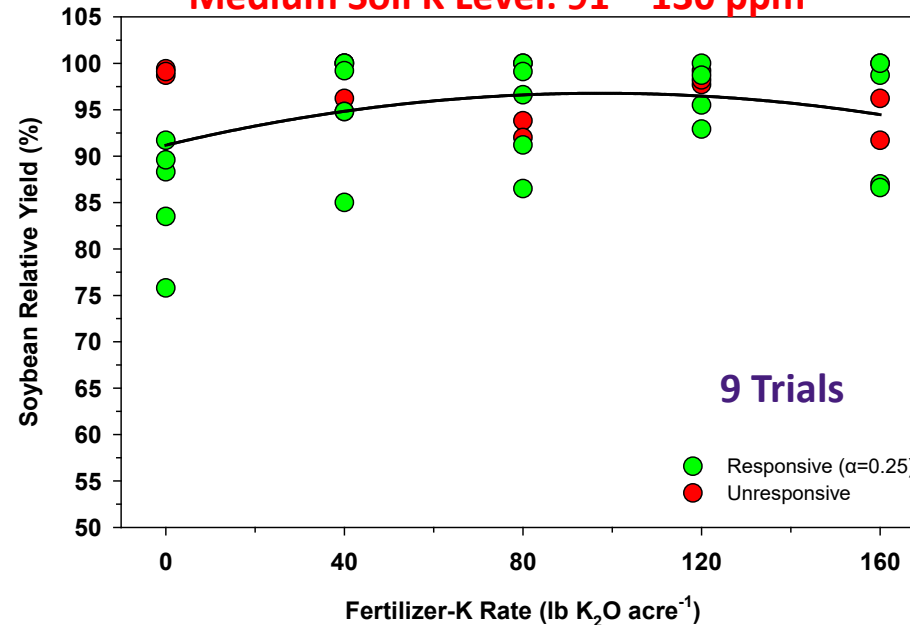
Soil-test Level	Mehlich-3 Soil-test K Concentration (ppm)		Recommendations (lb K ₂ O acre ⁻¹)
	Alluvial Soils	Upland Soils	
Loamy Sand, Sandy Loam			
Very Low	≤ 35	≤ 35	80
Low	36 – 53	36 – 53	60
Medium	54 – 79	54 – 88	30
High	80 – 123	89 – 106	0
Very High	> 123	> 106	0
Very Fine Sandy Loam, Fine Sandy Loam			
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
Loam, Silt Loam			
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
Clay Loam, Silty Clay Loam			
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
Silty Clay, Clay			
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

Soybean Response to K Fertilization at Different Soil K Levels

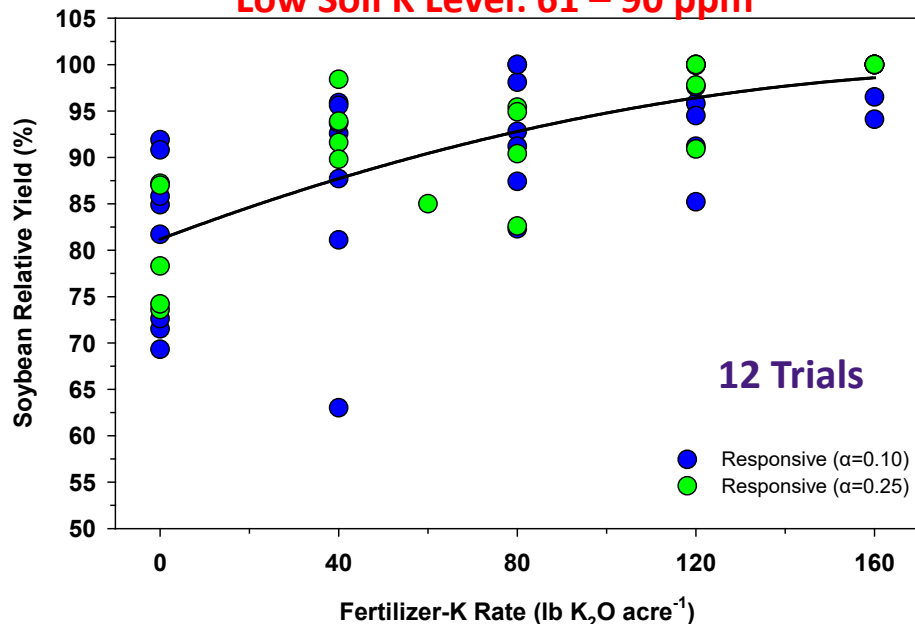
Very Low Soil K Level: ≤ 60 ppm



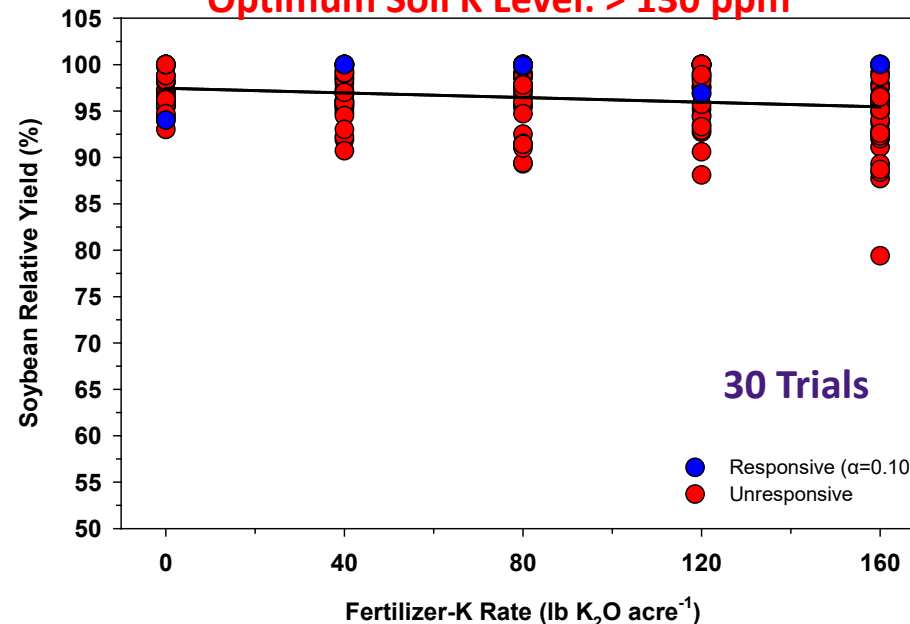
Medium Soil K Level: 91 – 130 ppm



Low Soil K Level: 61 – 90 ppm

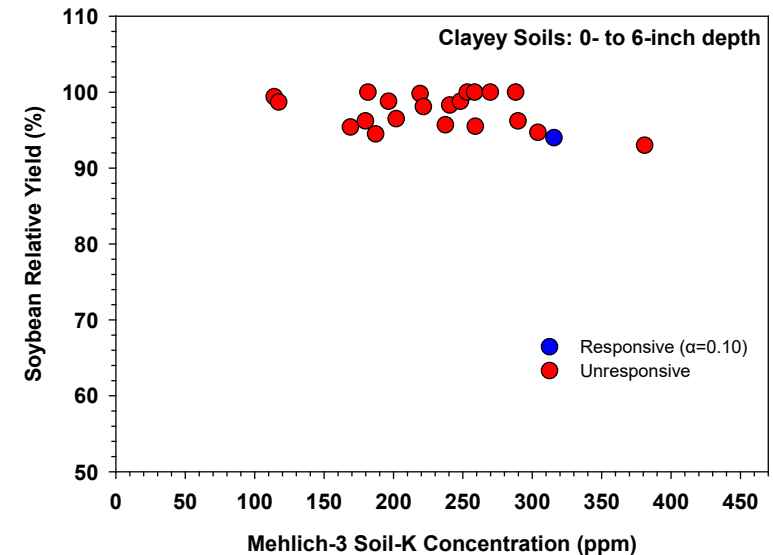
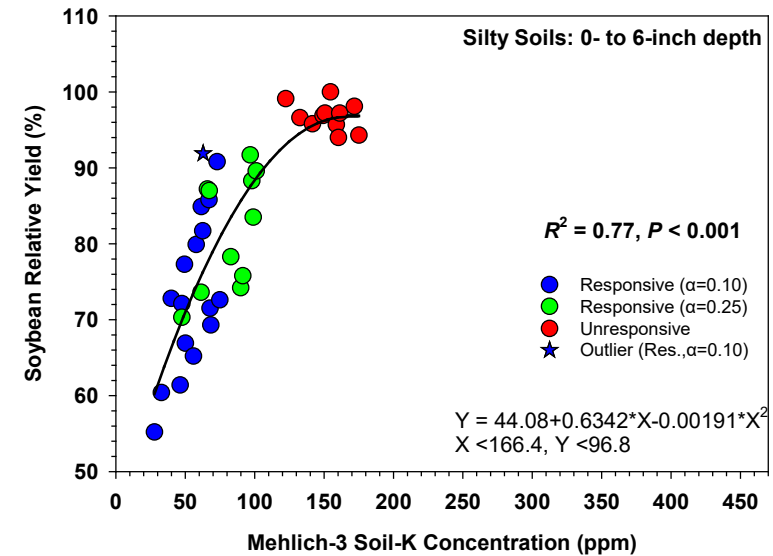
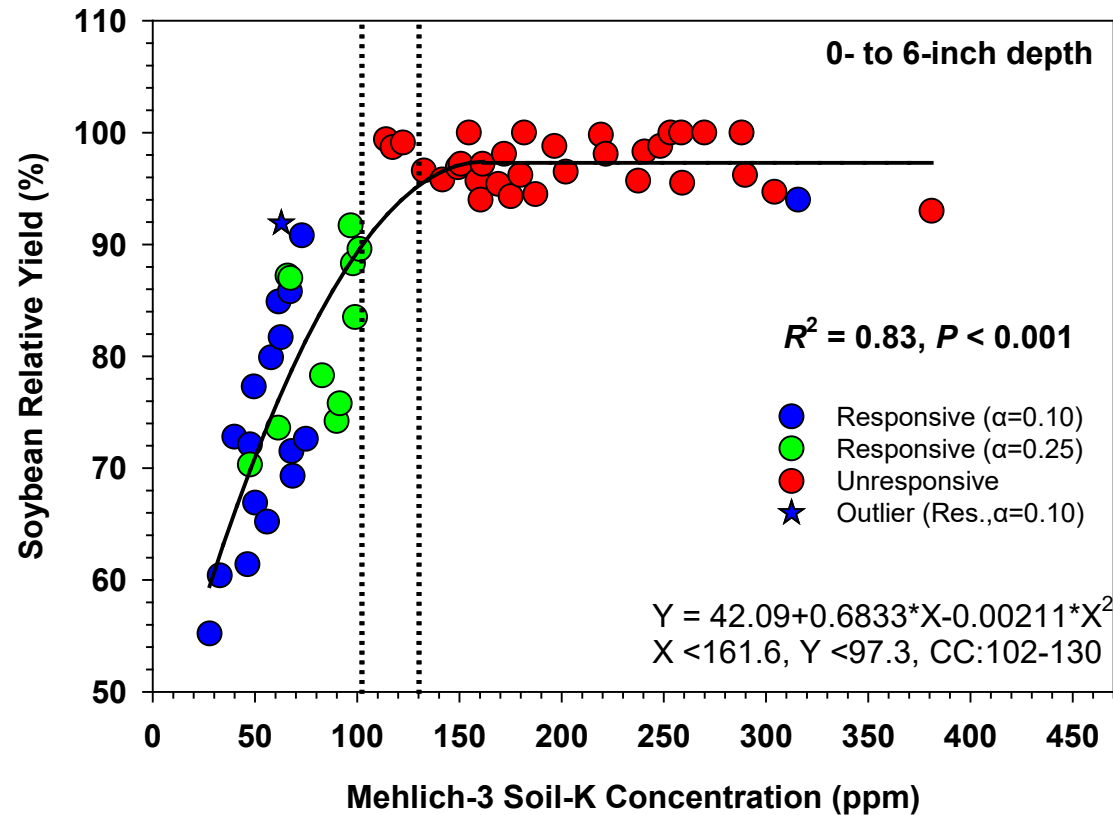


Optimum Soil K Level: > 130 ppm

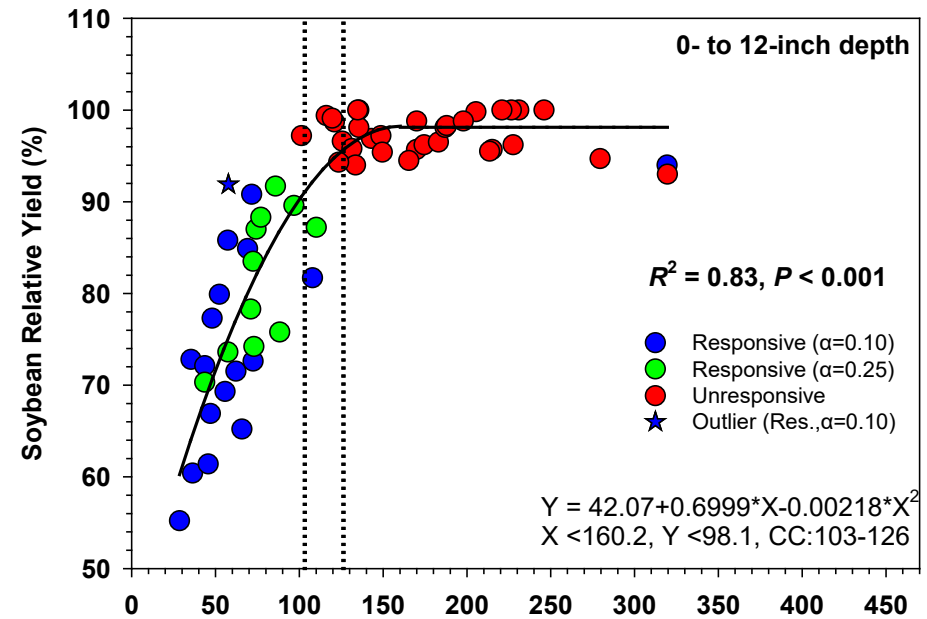
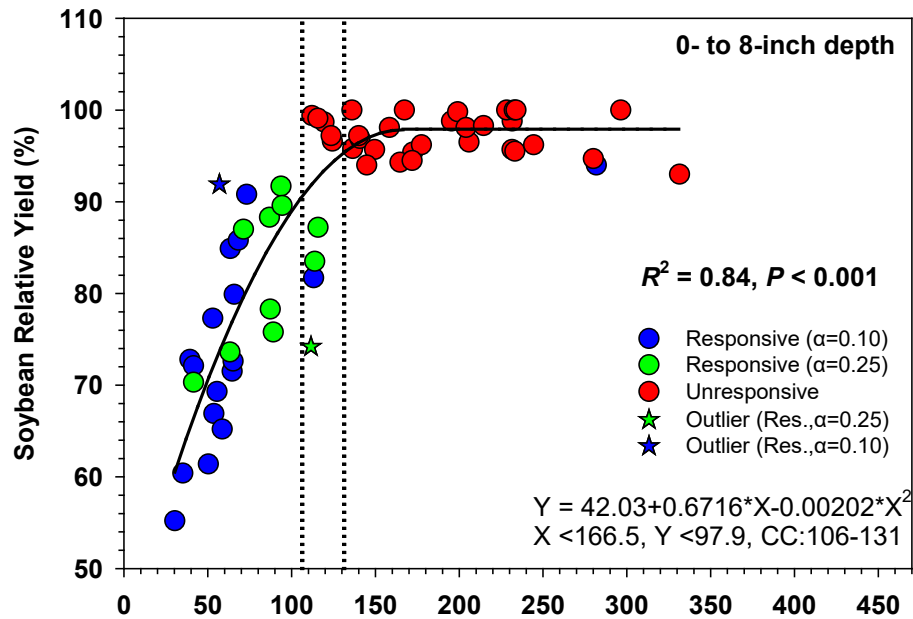
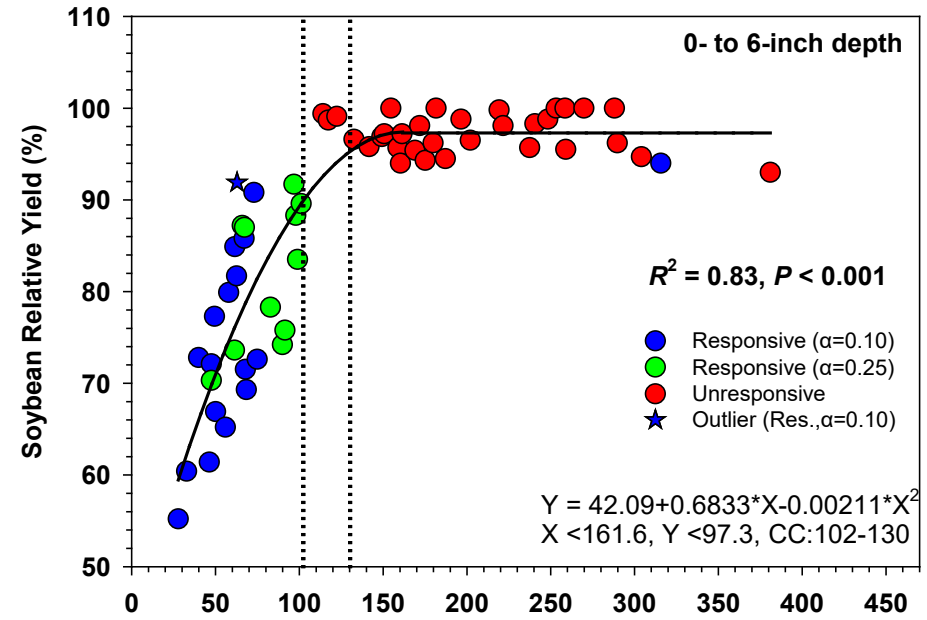
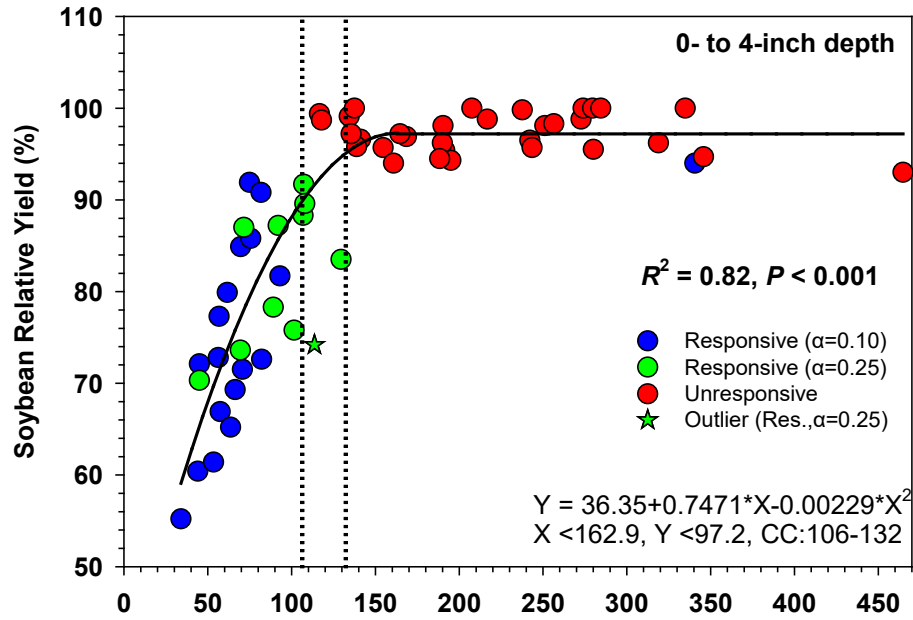


Soybean Response to Soil K Concentrations at 0- to 6-inch Depth

Soil-test Level	Mehlich-3 Soil K Conc. (ppm)	
	Alluvial Soils	Upland Soils
Loamy Sand, Sandy Loam		
Very Low	≤ 35	≤ 35
Low	36 – 53	36 – 53
Medium	54 – 79	54 – 88
High	80 – 123	89 – 106
Very High	> 123	> 106
Very Fine Sandy Loam, Fine Sandy Loam		
Very Low	≤ 53	≤ 44
Low	54 – 88	45 – 70
Medium	89 – 123	71 – 106
High	124 – 141	107 – 123
Very High	> 141	> 123
Loam, Silt Loam		
Very Low	≤ 70	≤ 62
Low	71 – 106	63 – 97
Medium	107 – 141	98 – 141
High	142 – 158	142 – 158
Very High	> 158	> 158
Clay Loam, Silty Clay Loam		
Very Low	≤ 123	≤ 88
Low	124 – 176	89 – 141
Medium	177 – 264	142 – 176
High	265 – 282	177 – 194
Very High	> 282	> 194
Silty Clay, Clay		
Very Low	≤ 141	≤ 88
Low	142 – 211	89 – 141
Medium	212 – 317	142 – 176
High	318 – 334	177 – 194
Very High	> 334	> 194



Soybean Response to Soil K Concentrations at Different Depths

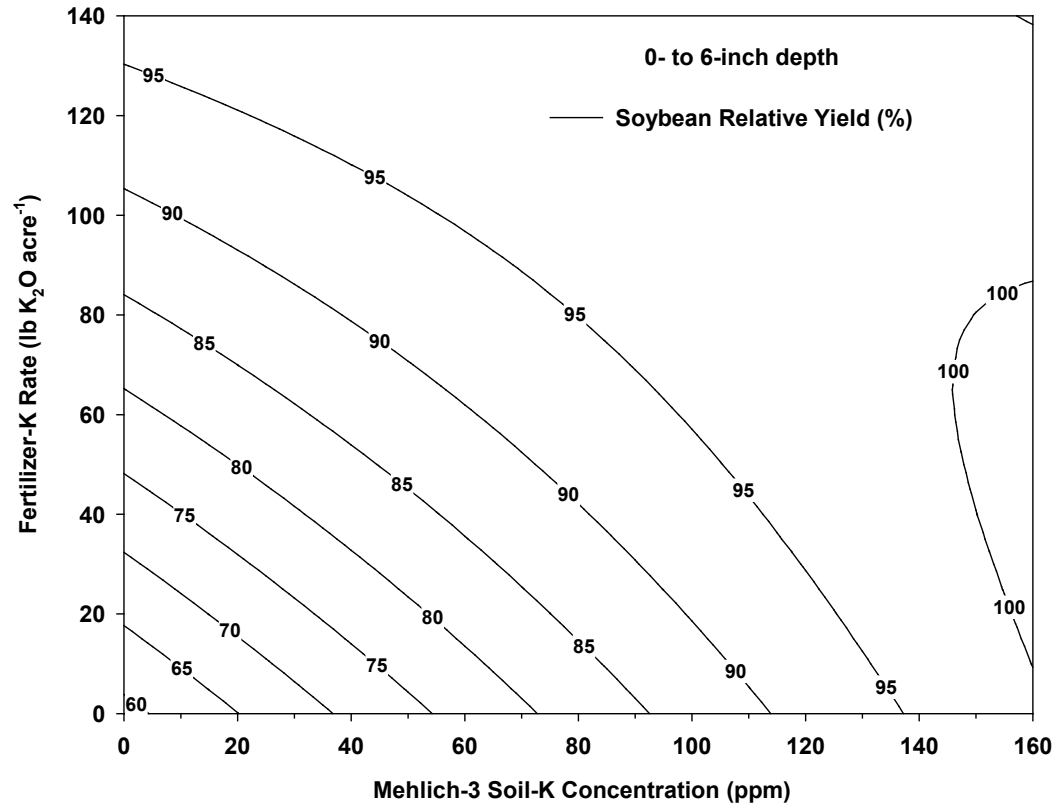


Mehlich-3 Soil-K Concentration (ppm)

Mehlich-3 Soil-K Concentration (ppm)

Updated Fertilizer-K Rate Recommendations for Soybean

Soil-test Level	Mehlich-3 SoilK Conc. (ppm)	Fert-K Rate (lb K ₂ O ac ⁻¹)
Loamy Sand, Sandy Loam		
Very Low	≤ 35	80
Low	36 – 53	60
Medium	54 – 79	30
High	80 – 123	0
Very High	> 123	0
Very Fine Sandy Loam, Fine Sandy Loam		
Very Low	≤ 53	80
Low	54 – 88	60
Medium	89 – 123	30
High	124 – 141	0
Very High	> 141	0
Loam, Silt Loam		
Very Low	≤ 70	80
Low	71 – 106	60
Medium	107 – 141	30
High	142 – 158	0
Very High	> 158	0
Clay Loam, Silty Clay Loam		
Very Low	≤ 123	80
Low	124 – 176	60
Medium	177 – 264	30
High	265 – 282	0
Very High	> 282	0
Silty Clay, Clay		
Very Low	≤ 141	80
Low	142 – 211	60
Medium	212 – 317	30
High	318 – 334	0
Very High	> 334	0



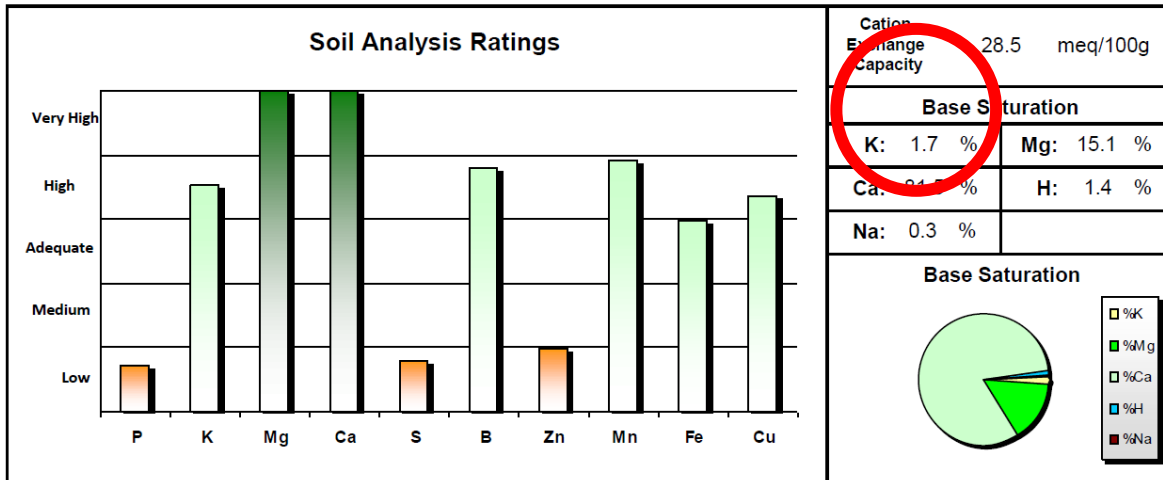
Soil-Test Level	Soil-K Concentration (ppm)	Number of Sites (#)	Range of Yield Increase from K Fertilization		Yield Increase Probability (%)	Recommended K Rate (lb K ₂ O acre ⁻¹)
			(bu/A)	(%)		
Very Low	≤ 60	10	9 – 27	23 – 45	100	120
Low	61 – 90	13	5 – 13	8 – 31	100	90
Medium	91 – 130	8	0 – 6	1 – 24	63	60
Optimum	131 – 160	7	0 – 3	0 – 6	0	0
Very High	> 160	23	0 – 4	0 – 7	0	0

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

Which one is more important?

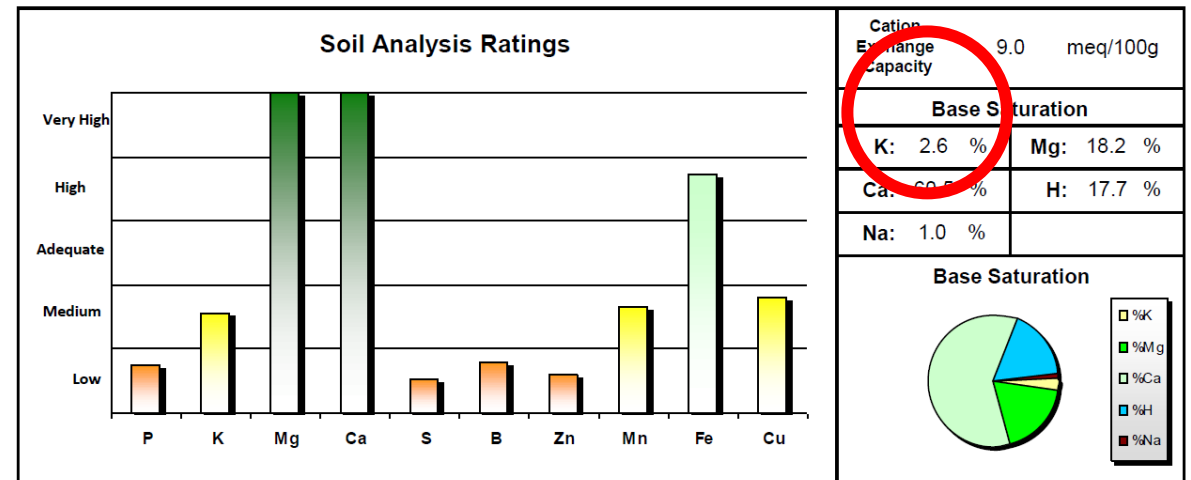
Customer: 65829	Sample ID: 1292
LSU AG CENTER M.D. RASEL PRAVEJ 212A MACON RIDGE ROAD WINNSBORO, LA 71295 UNITED STATES	Grower: RASEL PARVEJ Farm ID: RASEL PARVEJ Field ID: Lab Number: 870214SM Layer ID: Received: 8/19/2021 Processed: 8/23/2021

Test Method: Mullich III		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 H	17 VH	4646 VH	7.8	7.45	10 L	1.2 H	1.95 L	193 H	99.5 A	4.1 H	
Al	Na	NO3-N	NH4	Soluble Salts		Organic Matter	ENR	Mo	Ni	BiCarbs		
Aluminum	Sodium	Nitrate-N	Ammonia					Molybdenum	Nickel			
	20.5			mmhos/cm		1.23 %	12.5	ppm	ppm	meq/L		



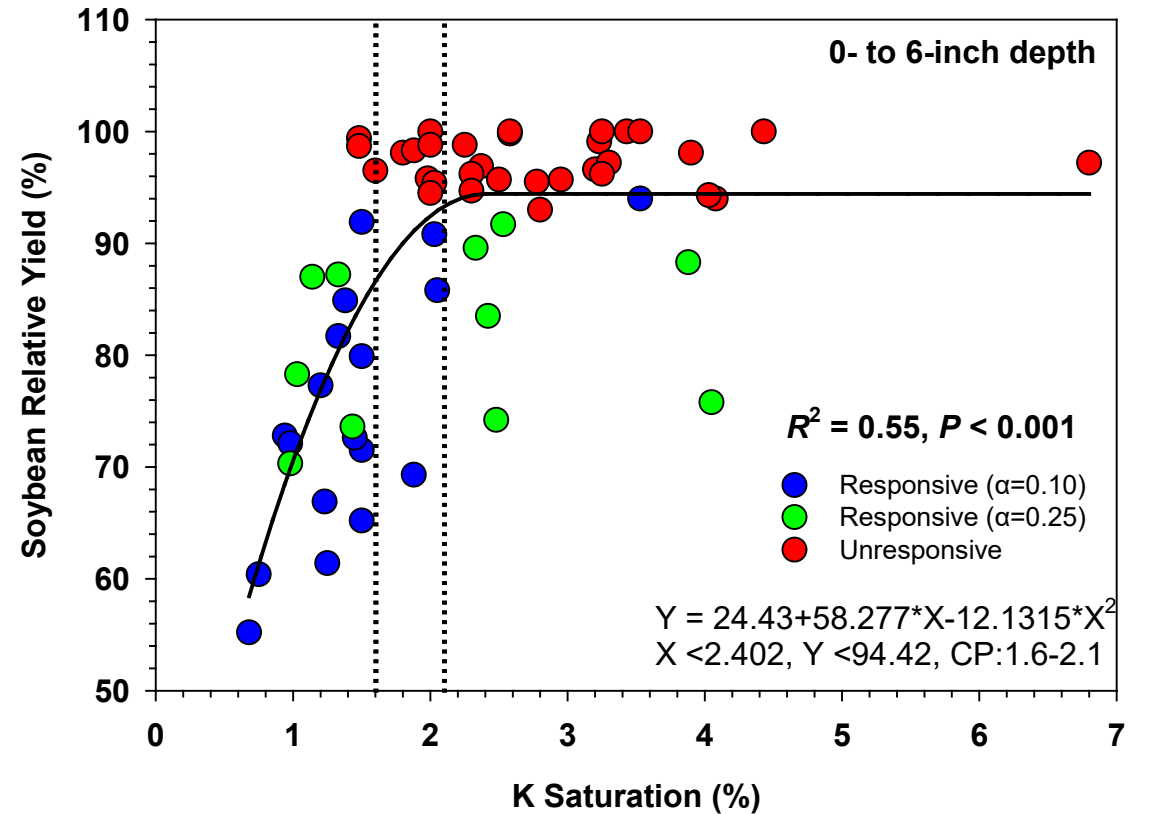
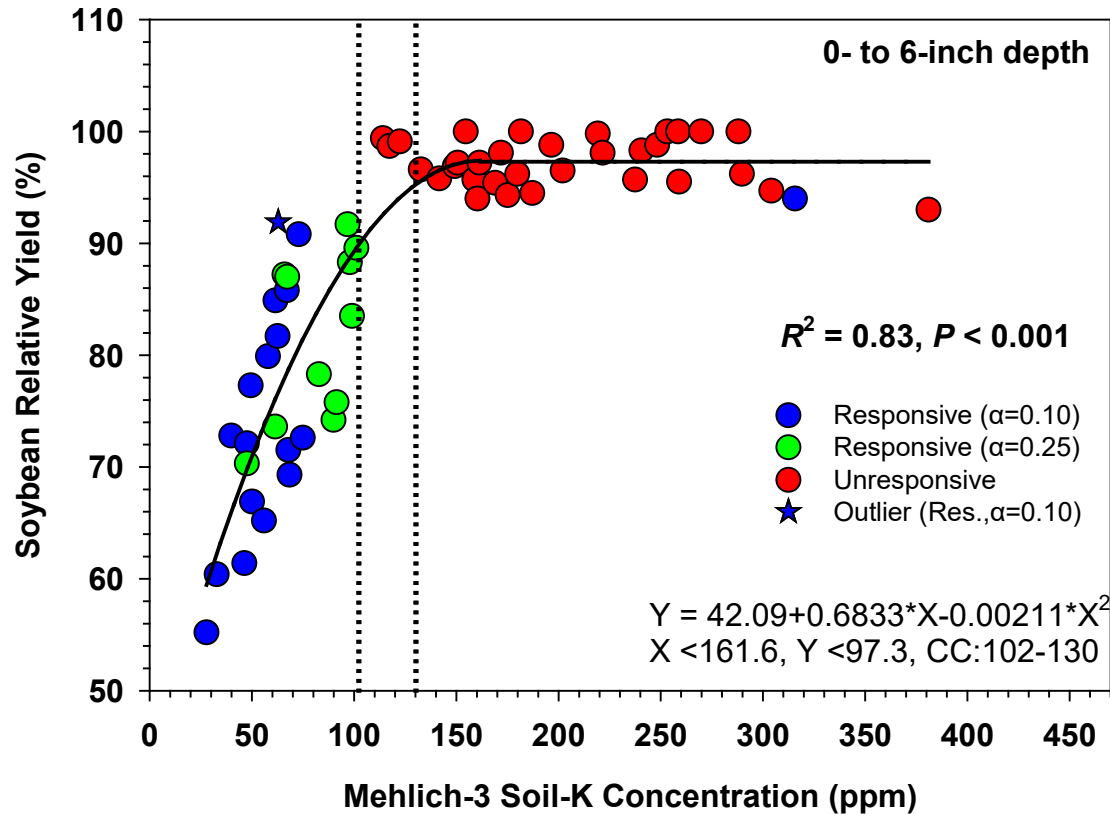
Customer: 65829	Sample ID: 1346
LSU AG CENTER M.D. RASEL PRAVEJ 212A MACON RIDGE ROAD WINNSBORO, LA 71295 UNITED STATES	Grower: RASEL PARVEJ Farm ID: RASEL PARVEJ Field ID: Lab Number: 870231SM Layer ID: Received: 8/19/2021 Processed: 8/23/2021

Test Method: Mullich III		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 M	97 VH	1094 VH	6.1	7.30	6.5 L	0.4 L	1.2 L	25 M	172 H	1.4 M	
Al	Na	NO3-N	NH4	Soluble Salts		Organic Matter	ENR	Mo	Ni	BiCarbs		
Aluminum	Sodium	Nitrate-N	Ammonia					Molybdenum	Nickel			
	20.5			mmhos/cm		0.59 %	6	ppm	ppm	meq/L		

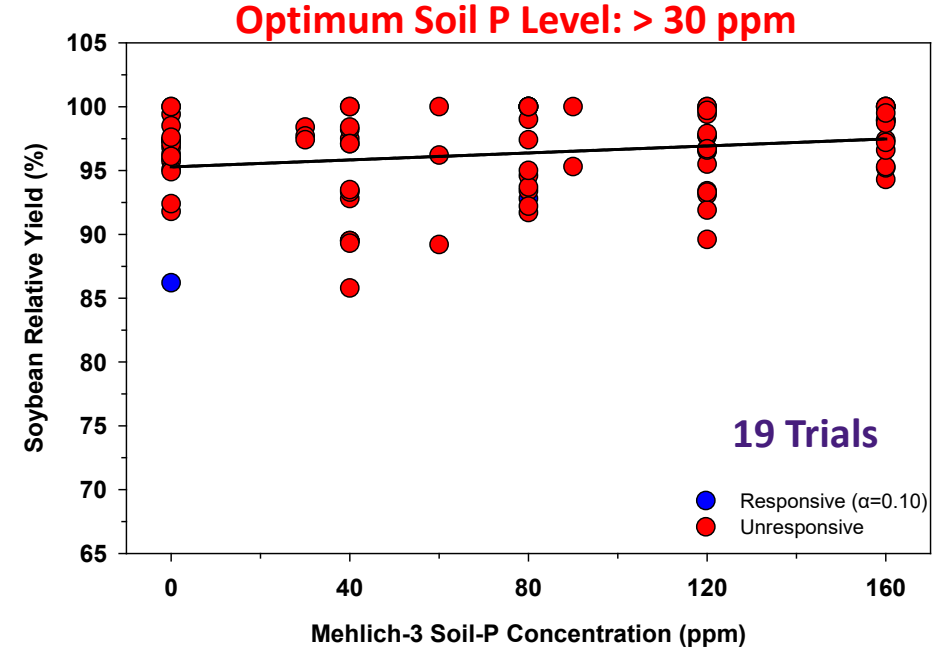
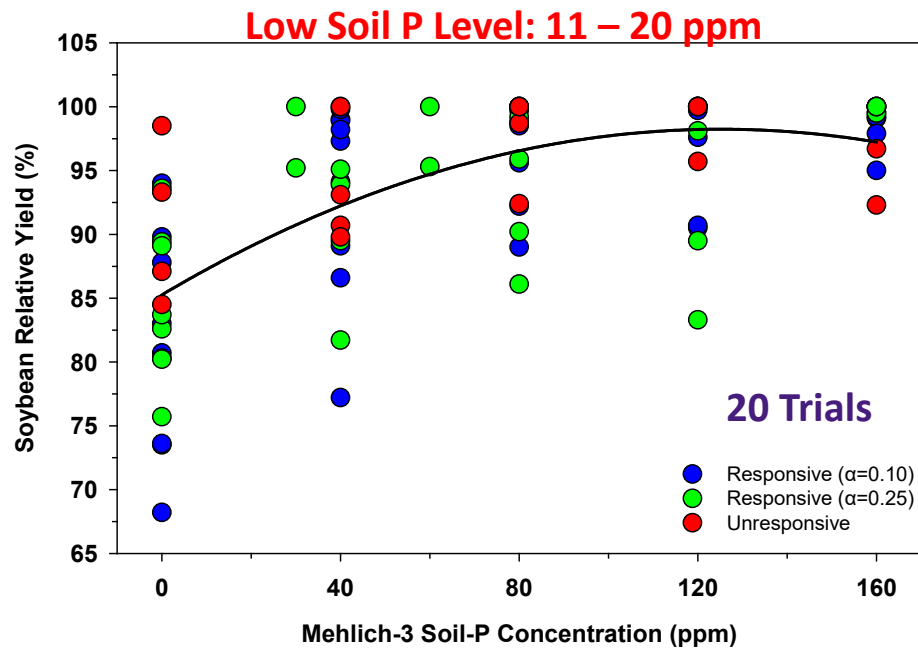
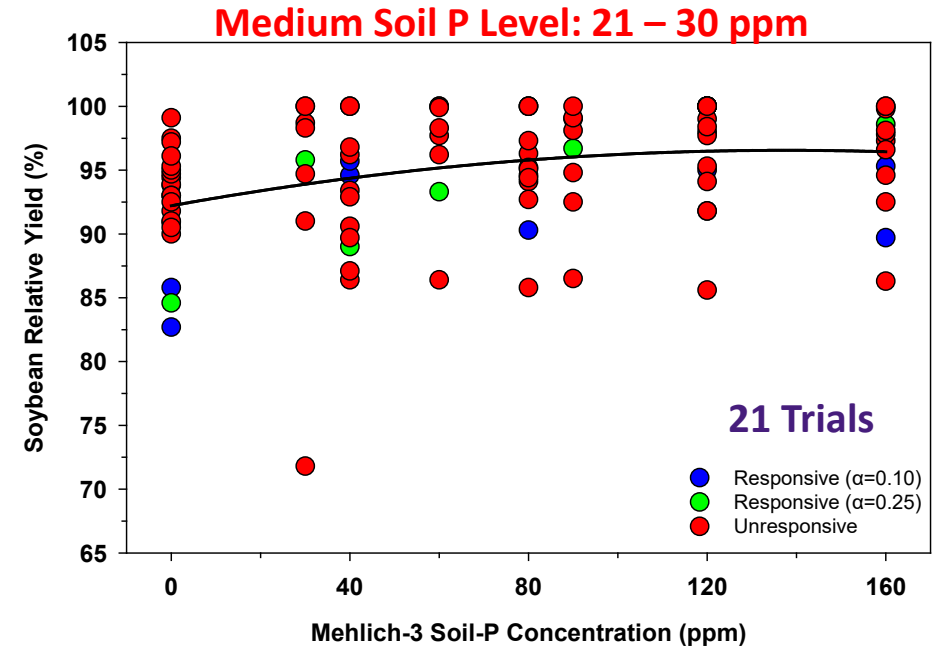
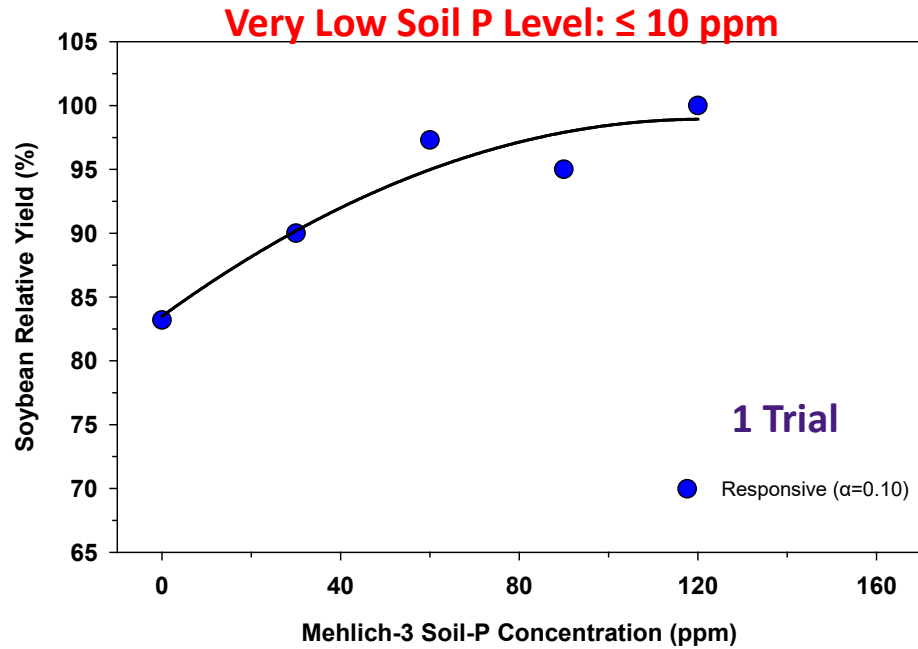


Soil K Conc. vs. K Saturation in Developing K Recommendations

Unfertilized-K Yield Across 61 Sites

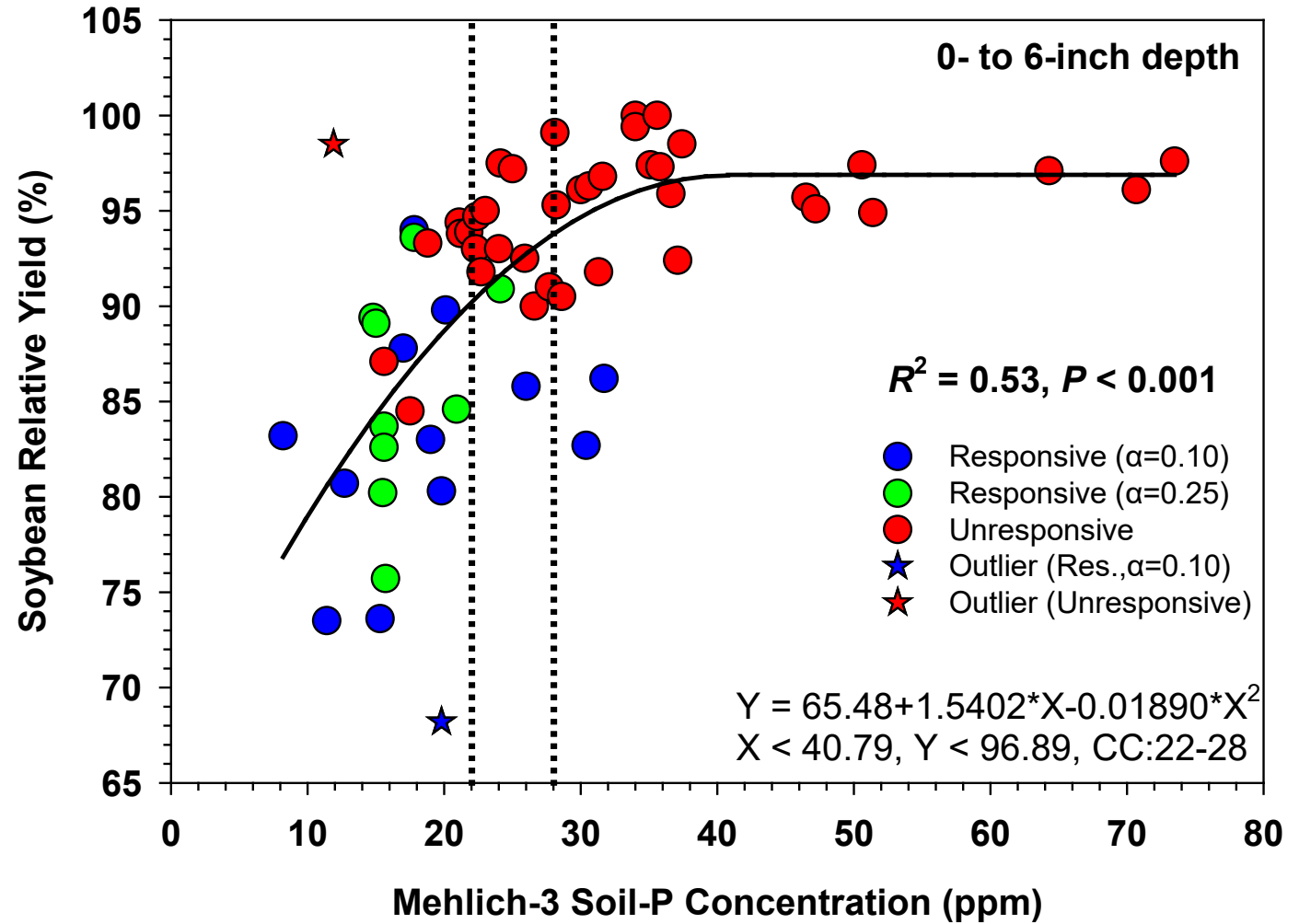


Soybean Response to P Fertilization at Different Soil-Test P Levels

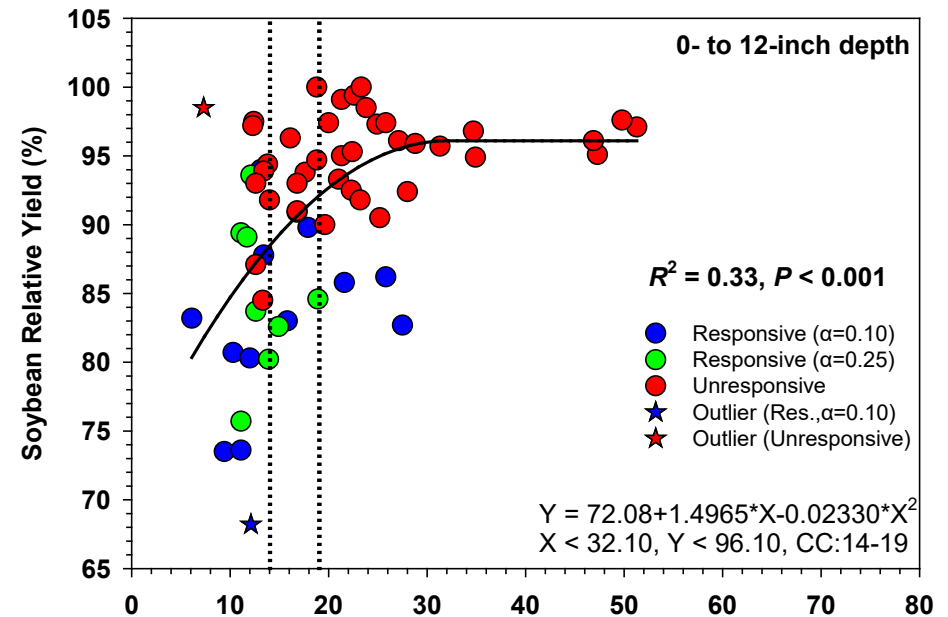
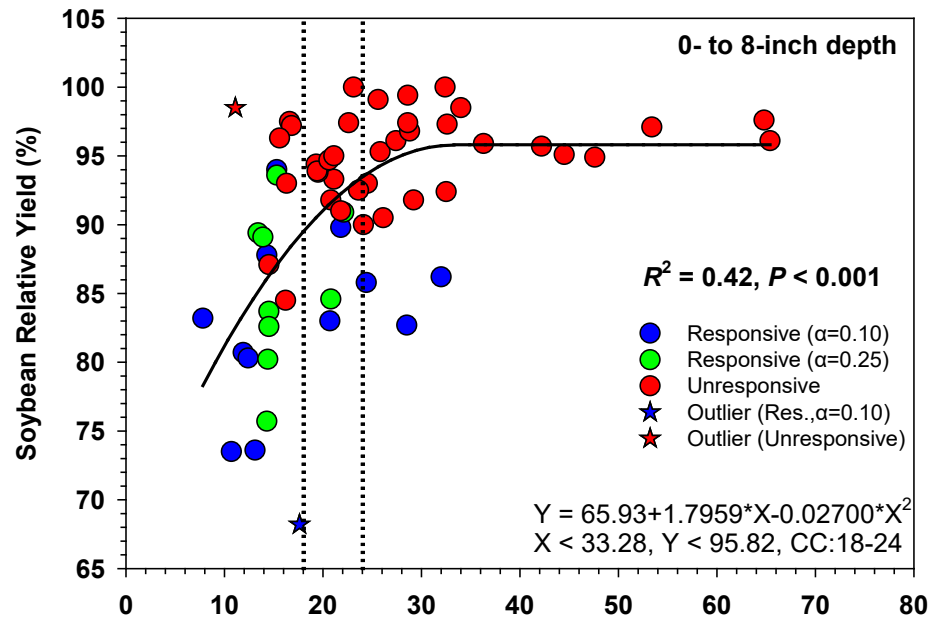
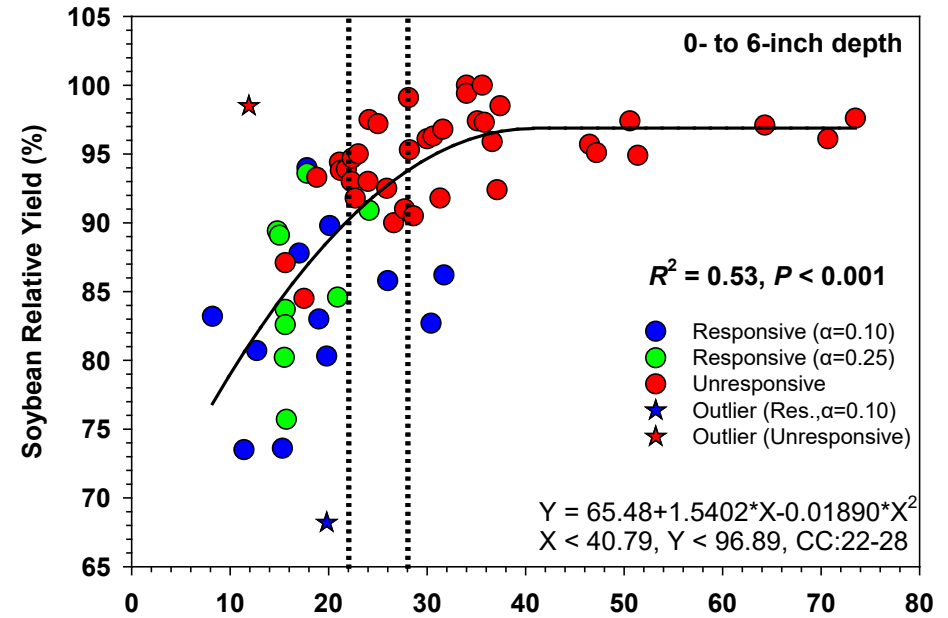
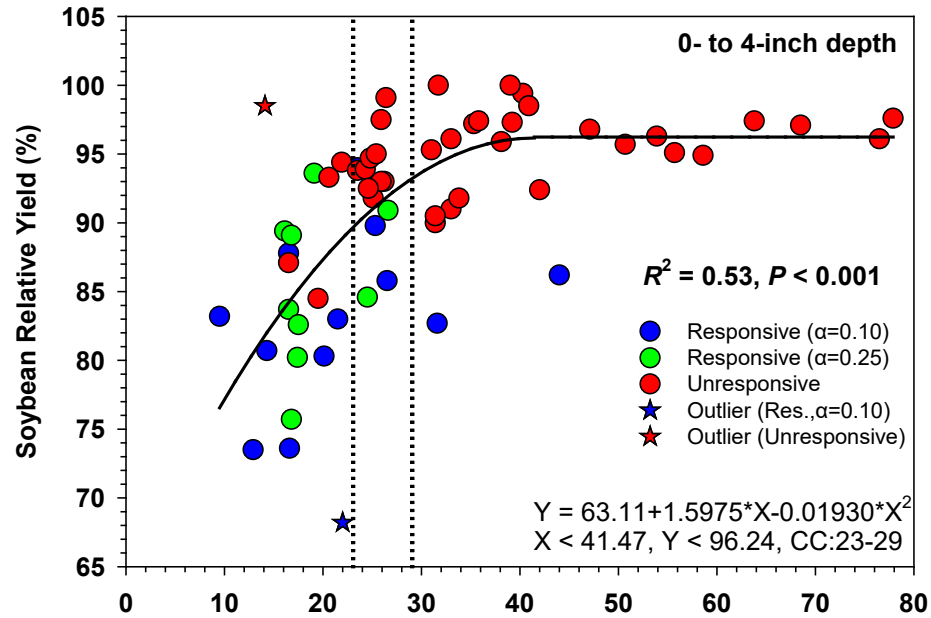


Soybean Response to Soil P Concentrations at 0- to 6-inch Depth

Soil-test Level	Mehlich-3 Soil-test P Concentration (ppm)	Recommended P Rate (lb P ₂ O ₅ acre ⁻¹)
Very Low	≤ 10	80
Low	11 – 20	60
Medium	21 – 35	40
High	36 – 60	0
Very High	> 60	0



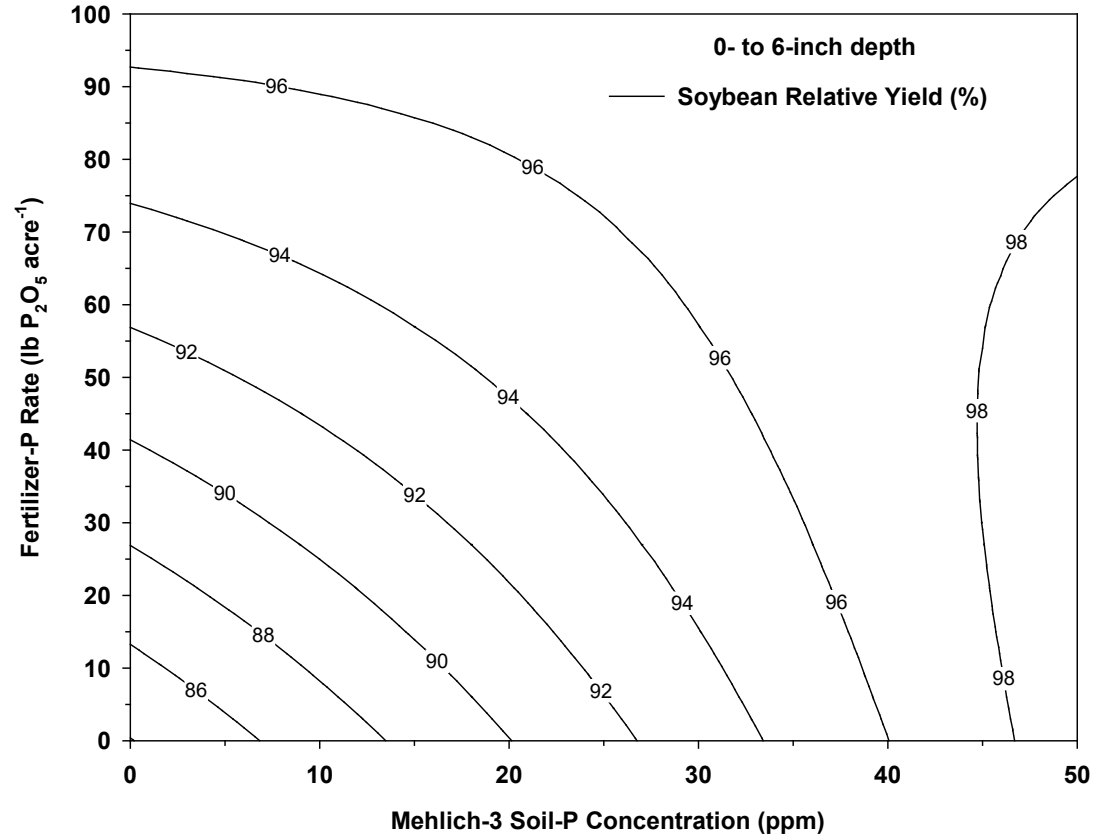
Soybean Response to Soil P Concentrations at Different Depths



Mehlich-3 Soil-P Concentration (ppm)

Mehlich-3 Soil-P Concentration (ppm)

Updated Fertilizer-P Rate Recommendations for Soybean



Soil-test Level	Mehlich-3 Soil-test P Concentration (ppm)	Recommended P Rate (lb P ₂ O ₅ acre ⁻¹)
Very Low	≤ 10	80
Low	11 – 20	60
Medium	21 – 35	40
High	36 – 60	0
Very High	> 60	0

Soil-Test Level	Mehlich-3 Soil-P Conc. (ppm)	Number of Sites (#)	Range of Yield Increase from P Fertilization		Yield Increase Probability (%)	Recommended P Rate (lb P ₂ O ₅ acre ⁻¹)
			(bu/A)	(%)		
Very Low	≤ 10	1	10	17	100	90
Low	11 – 20	20	1 – 20	2 – 32	80	60
Medium	21 – 30	21	1 – 11	1 – 17	19	40
Optimum	30 – 50	14	0 – 8	0 – 14	7	0
Very High	> 50	5	1 – 5	2 – 5	0	0

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