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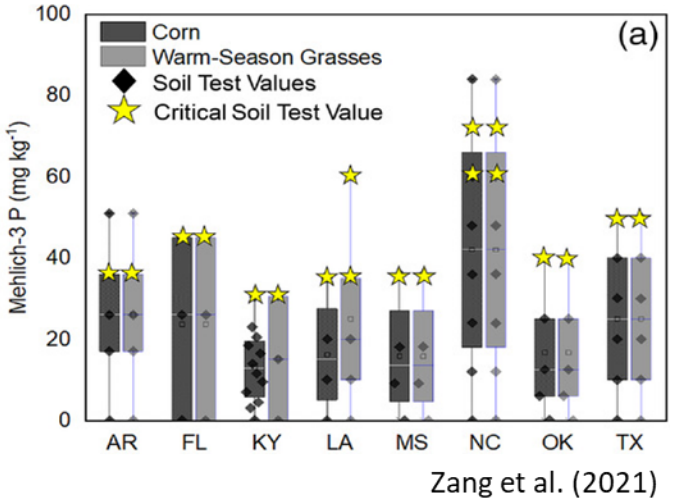
FRST
FERTILIZER RECOMMENDATION SUPPORT TOOL

Critical Soil Test Values of Phosphorus and Potassium for Corn and Soybean in North Carolina

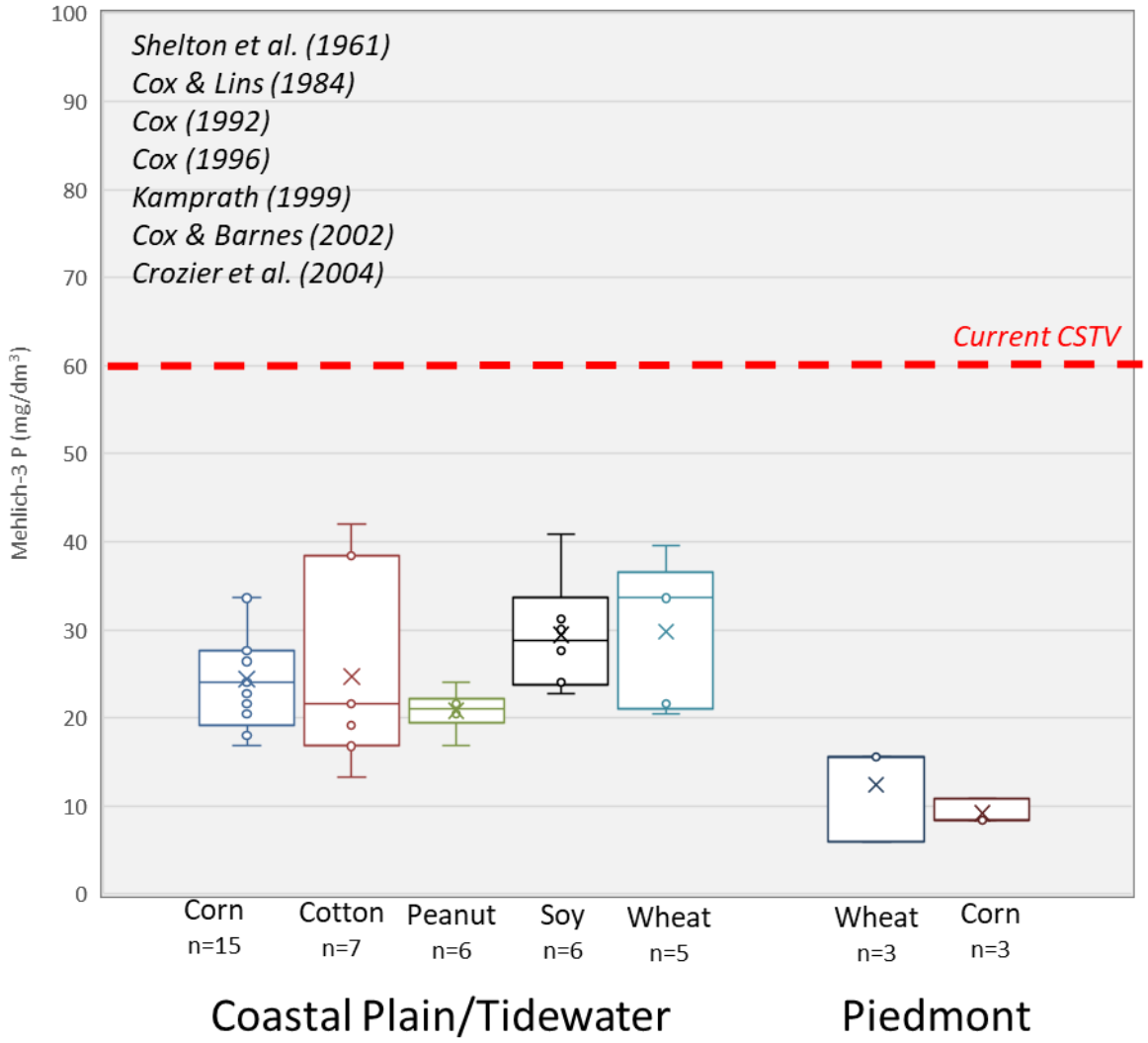
Luke Gatiboni
Associate Professor and Soil fertility Extension Specialist
Crop and Soil Sciences Department
NC State University
Luke_Gatiboni@ncsu.edu

P CSTVs in NC soils and Crops

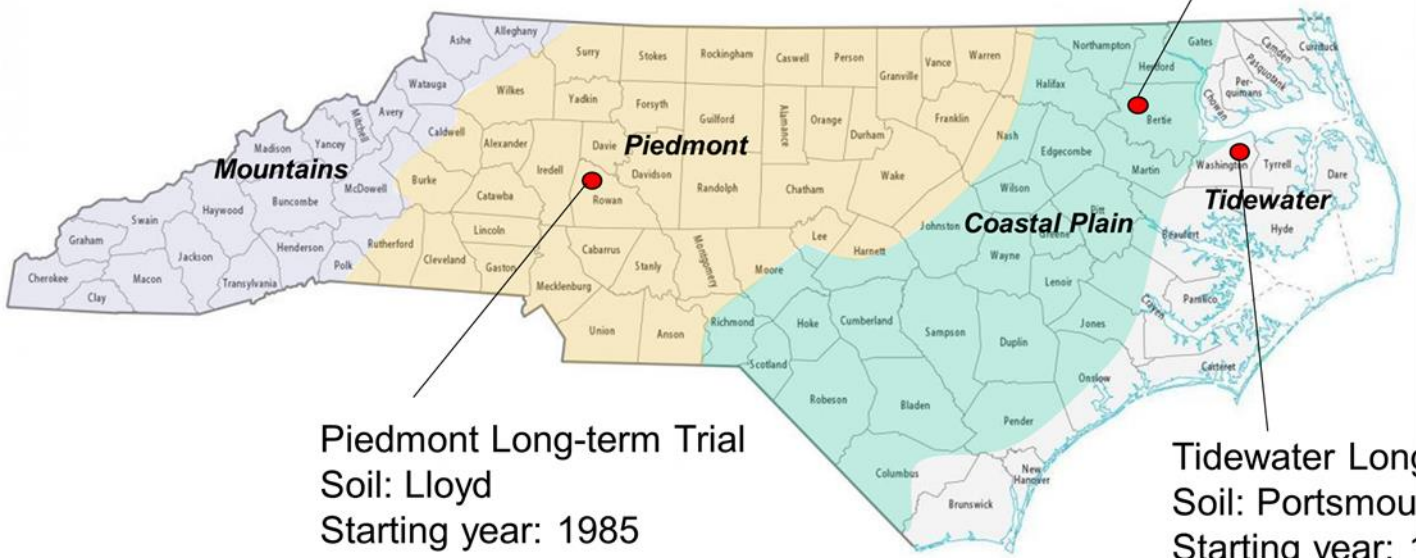
Range of CSTVs in the Southern U.S.



Zang et al. (2021)



Long-term soil fertility trials in North Carolina



Coastal Plain Long-term Trial
Soil: Goldsboro
Starting year: 1982

Piedmont Long-term Trial
Soil: Lloyd
Starting year: 1985

Tidewater Long-term Trial
Soil: Portsmouth
Starting year: 1966

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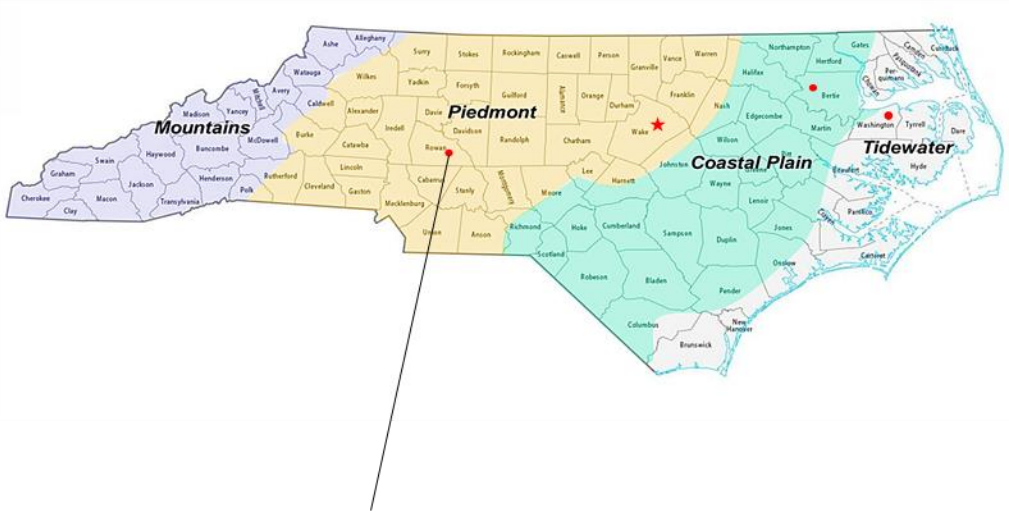
Piedmont Long-term Trial



Location: Piedmont Res. Station
County: Rowan
Soil: Lloyd (**50% clay**)
Starting year: 1985 (39 years)
Tillage system: No-till
Total acreage: 0.55 acres

Piedmont Long-term Trial

Fertilization and sampling

Rates of P and K in 2022 and 2023

Treatment	Cropping year	
	2022	2023
	P rate (kg ha^{-1})	
P1	0	0
P2	5	7
P3	10	15
P4	20	29
	K rate (kg ha^{-1})	
K1	0	0
K2	37	37
K3	75	75
K4	112	149

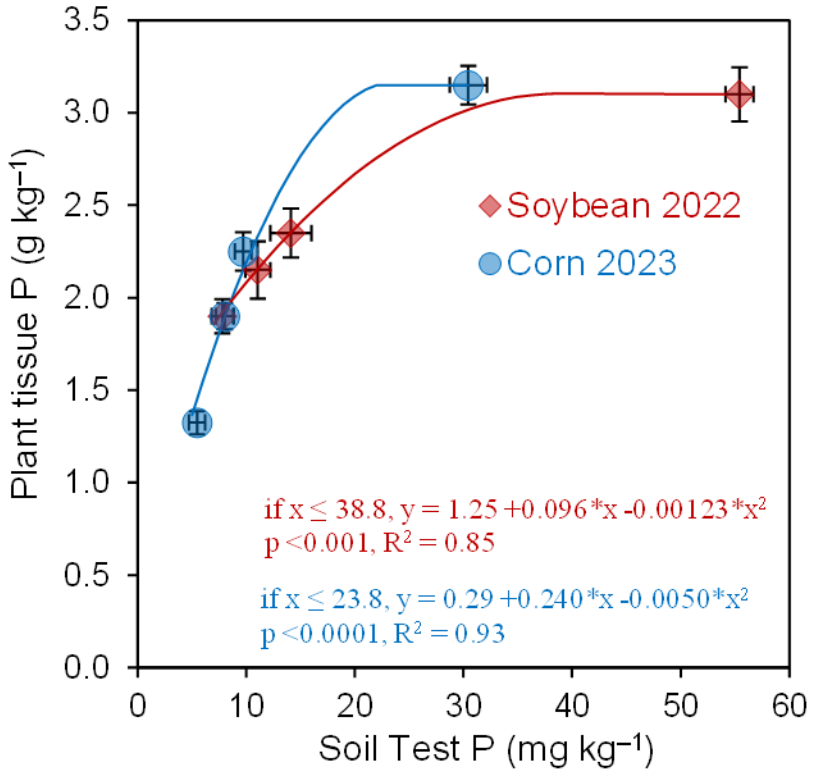
- Soil Sampling: 0-10 cm depth
- Tissue sampling at VT (corn) or R1/R2 (soybean)

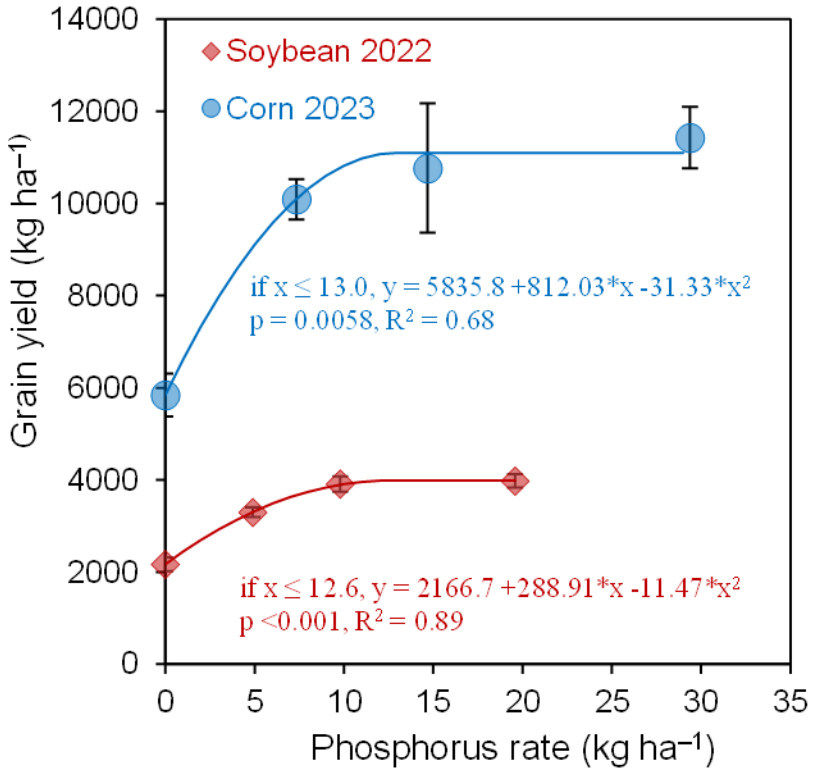
Phosphorus - Piedmont Site

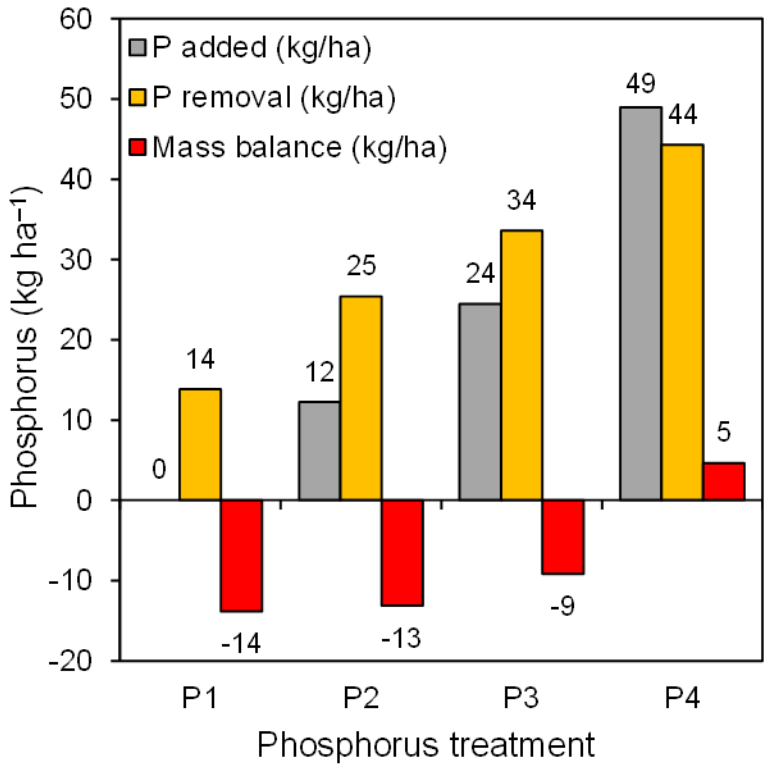
P1 = 0 kg ha^{-1}

P4 = 29 kg ha^{-1}

Effect of P rates on tissue P, yield, and mass balance

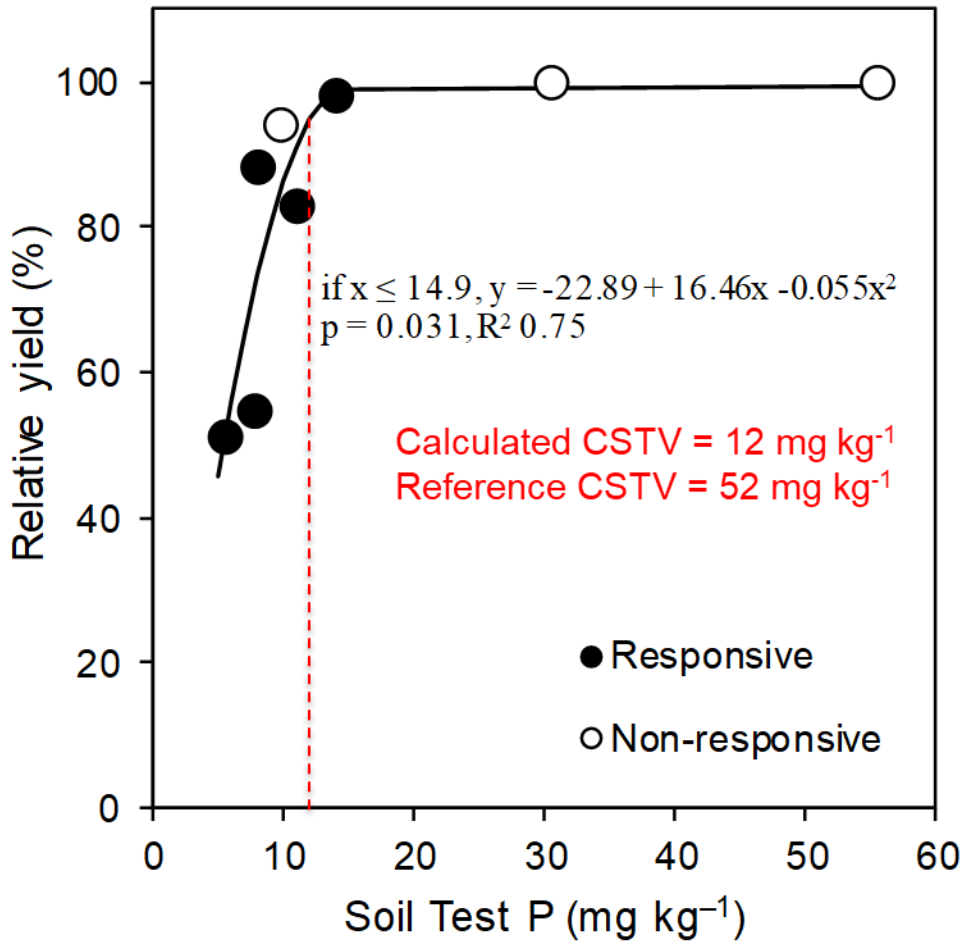




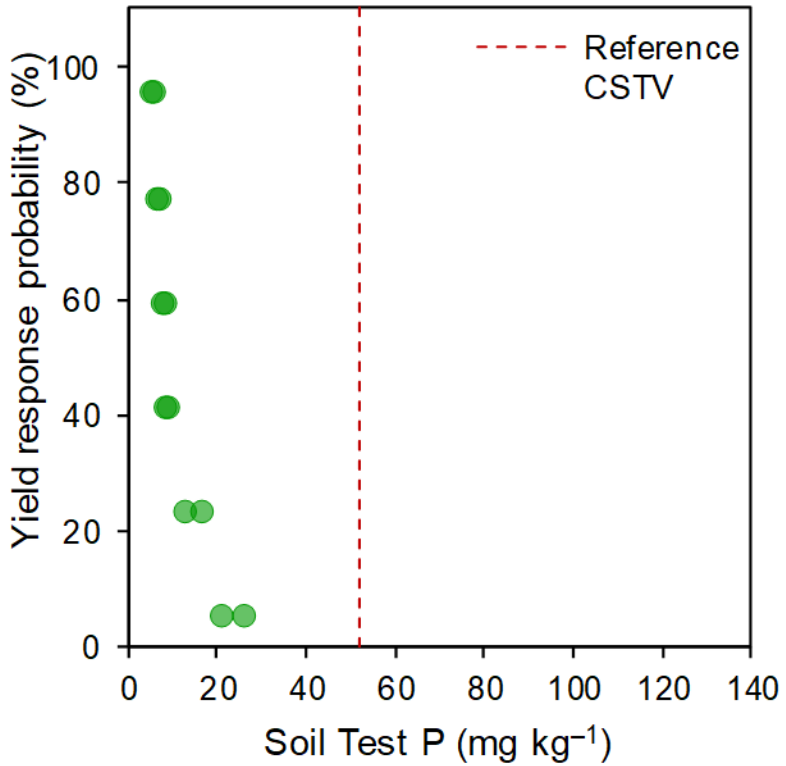


Average grain yield NC
Soybean (2022) = 2589 kg ha^{-1} (38.5 bu ac^{-1})
Corn (2023) = 9227 kg ha^{-1} (147 bu ac^{-1})

Relative Yield and P-CSTV



Response Frequency

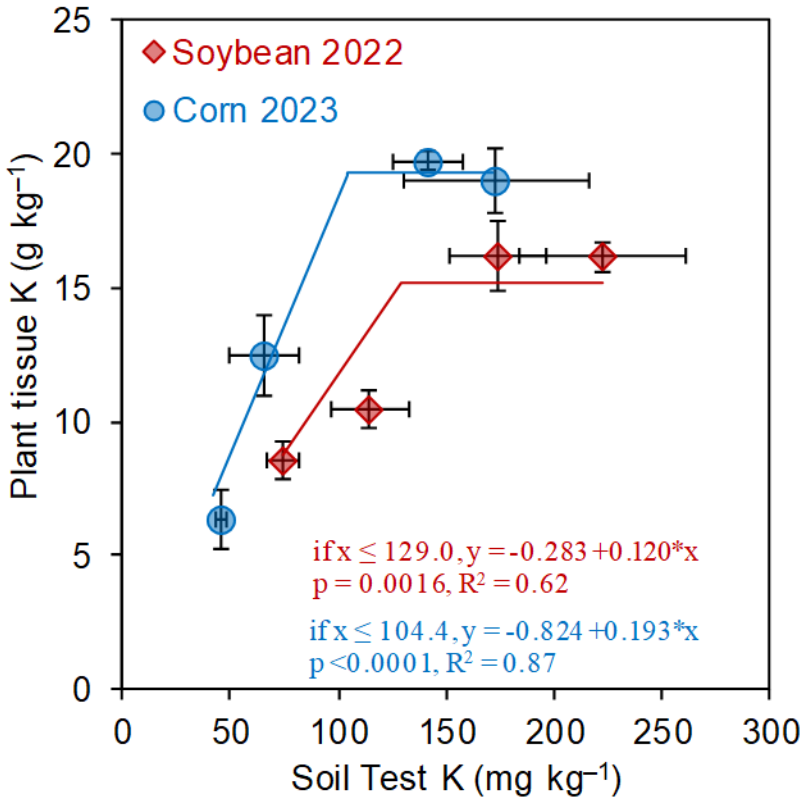


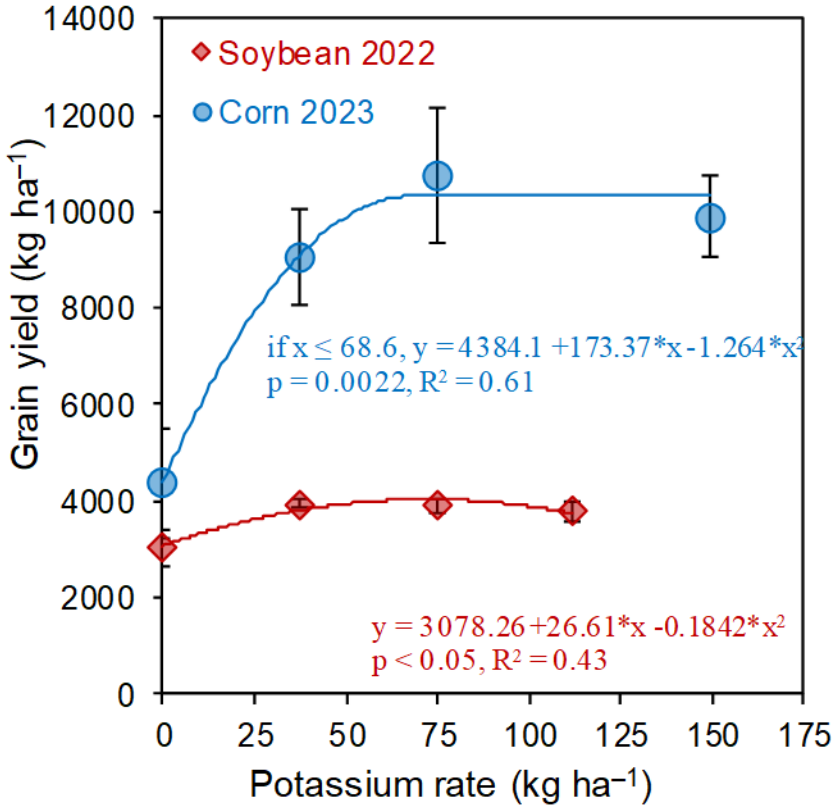
Potassium - Piedmont Site

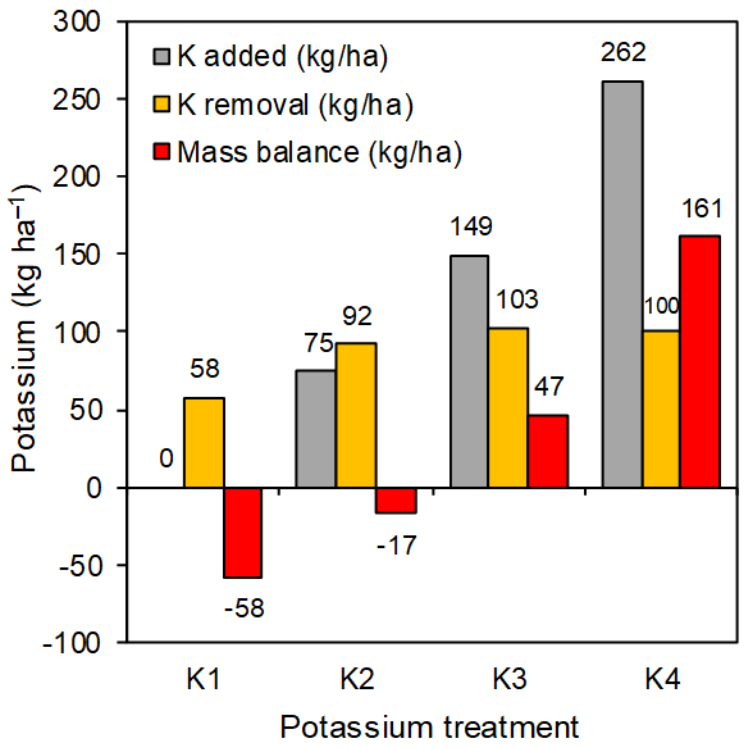
K1 = 0 kg ha^{-1}

K4 = 149 kg ha^{-1}

Effect of K rates on tissue K, yield, and mass balance







Average grain yield NC
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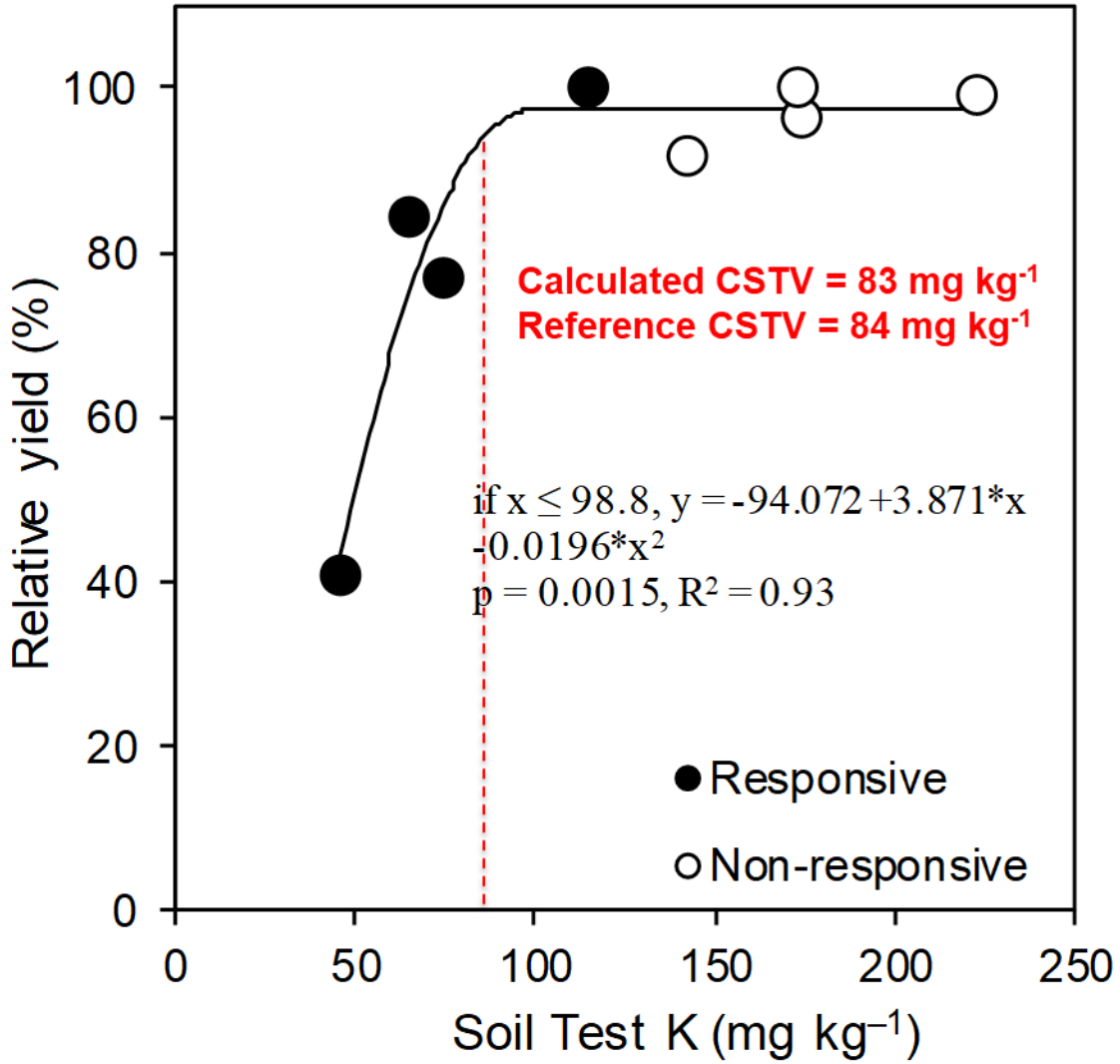
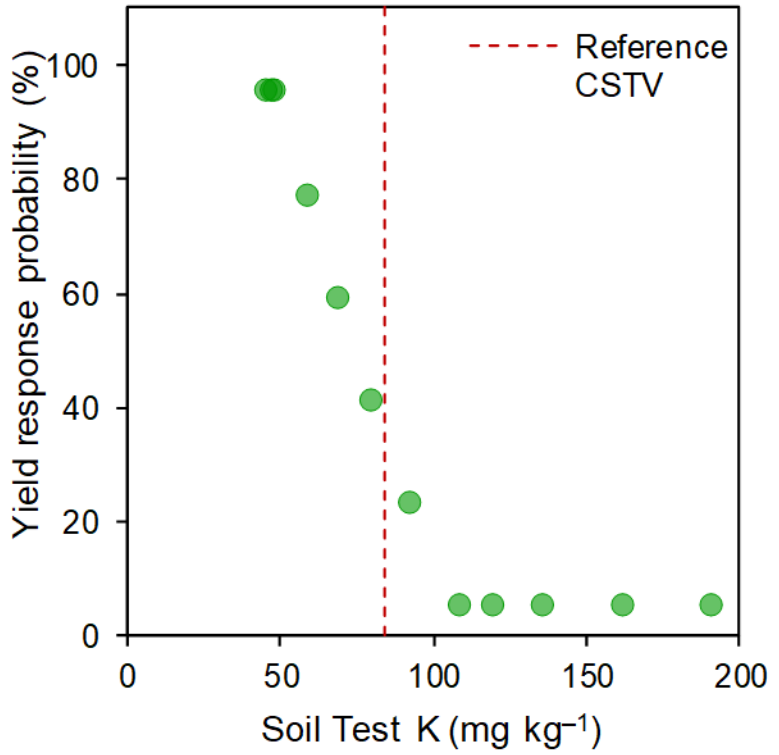
Relative Yield and K-CSTV

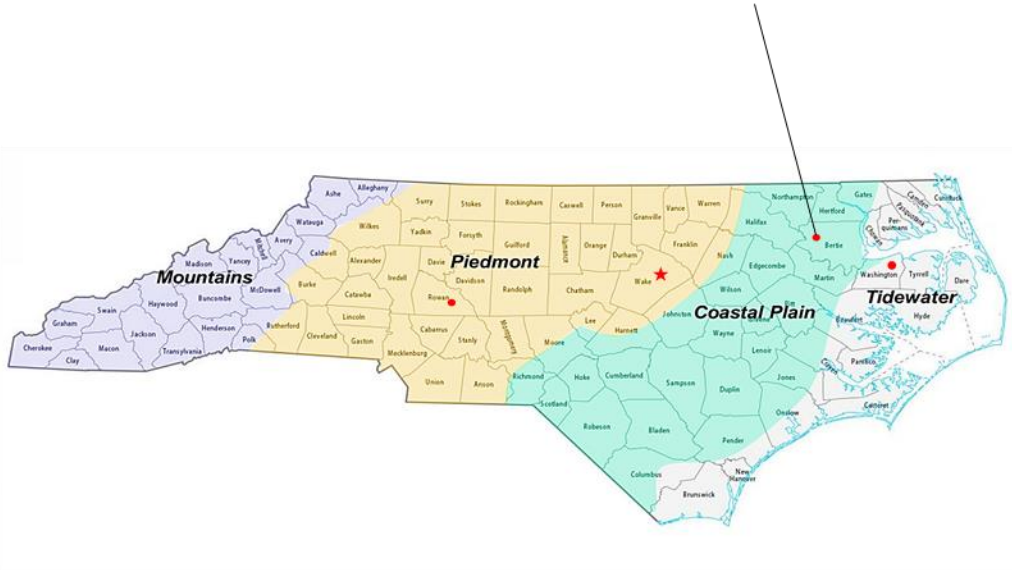


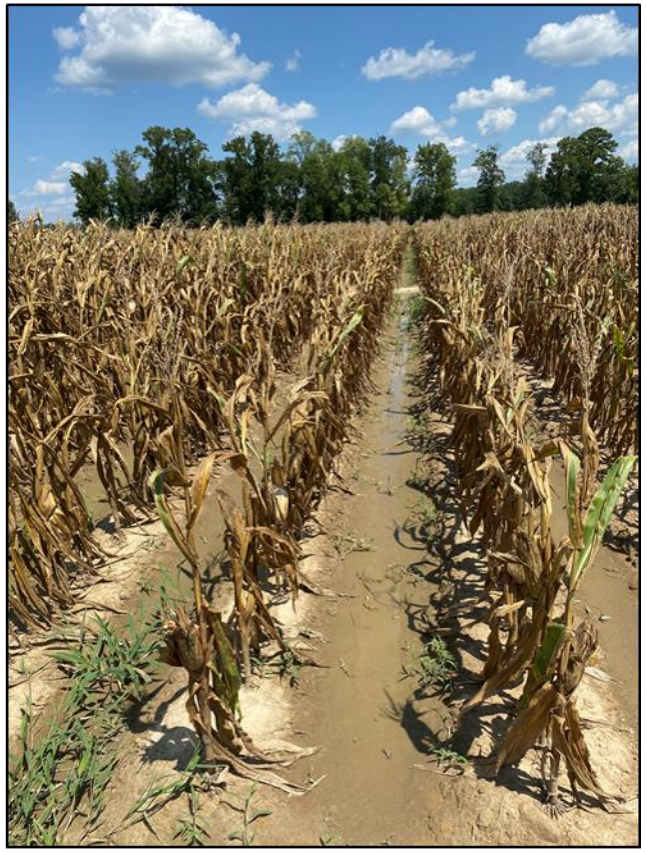
Response Frequency



Coastal Plain Long-term Trial

Location: Peanut Belt Res. Station
County: Bertie
Soil: Goldsboro (**10% clay**)
Starting year: 1982 (42 years)
Tillage system: Conventional tillage
Acreage: 1.3 acres





Coastal Plain Long-term Trial

Description

Rates of P and K applied in 2022 and 2023

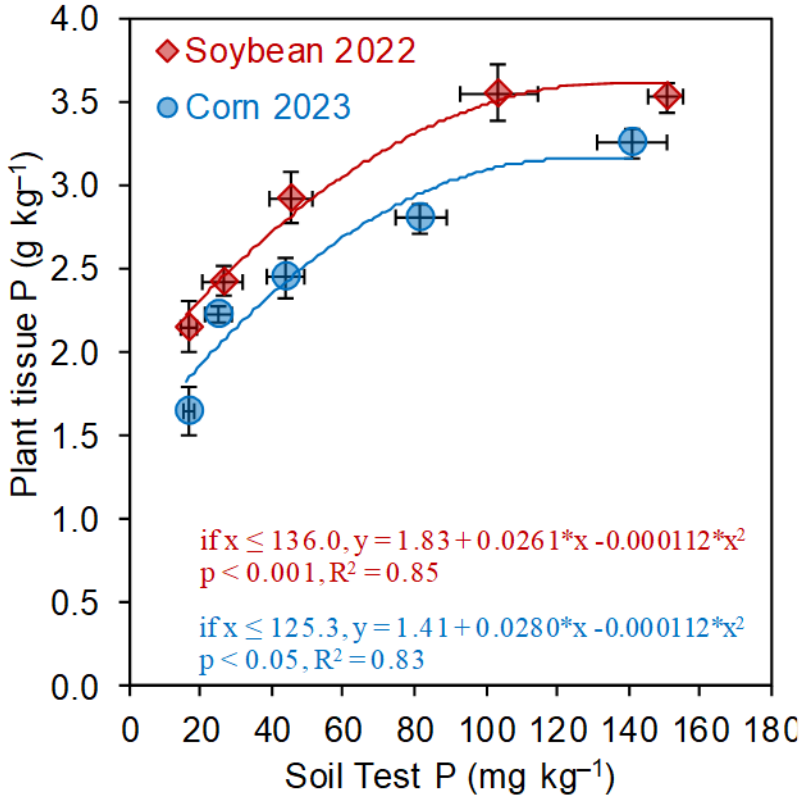
Treatment	Cropping year	
	2022	2023
	P rate (kg ha^{-1})	
P1	0	0
P2	11	10
P3	22	20
P4	44	39
	K rate (kg ha^{-1})	
K1	0	0
K2	37	37
K3	75	75
K4	112	112

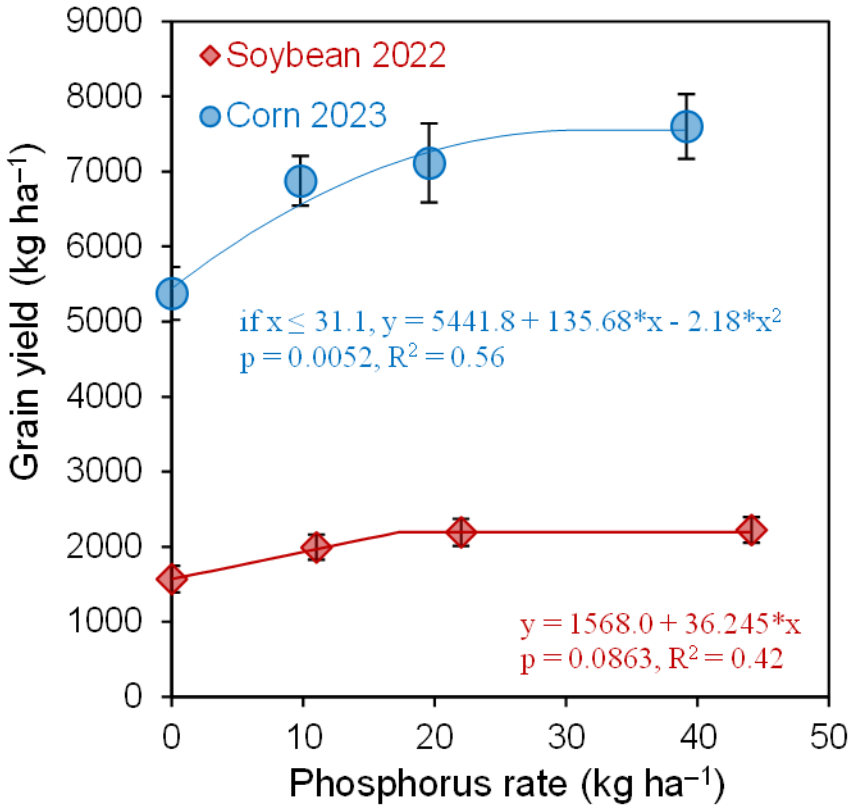
- Soil Sampling: 0-20 cm depth
- Tissue sampling at VT (corn) or R1/R2 (soybean)

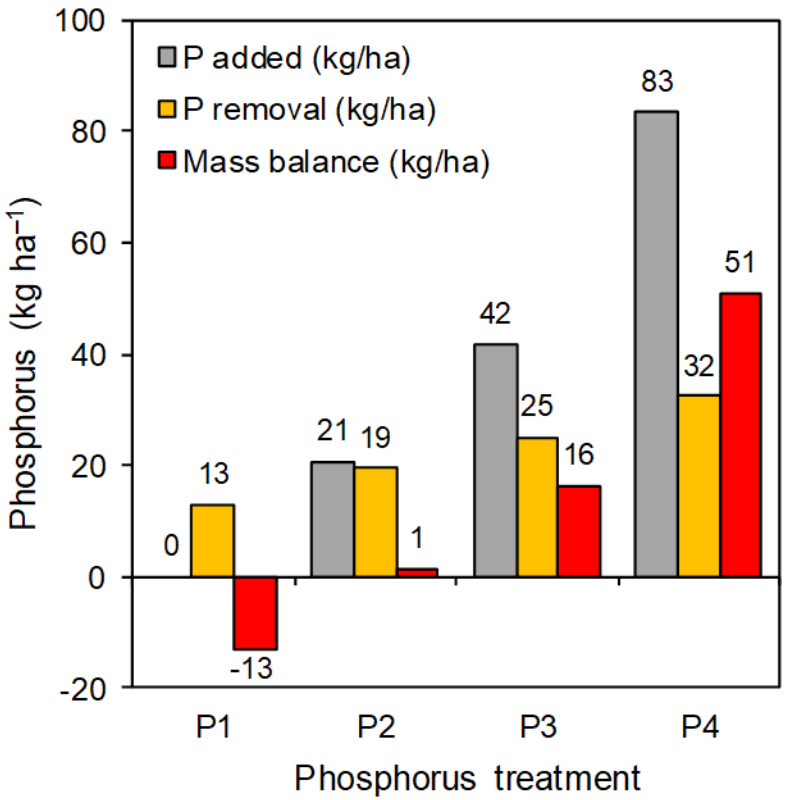
Phosphorus - Coastal Plain Site

P1	P2	P3	P4
0 kg ha^{-1}	10 kg ha^{-1}	20 kg ha^{-1}	39 kg ha^{-1}

Effect of P rates on tissue P, yield, and mass balance







Average grain yield NC
Soybean (2022) = 2589 kg ha^{-1} (38.5 bu ac^{-1})
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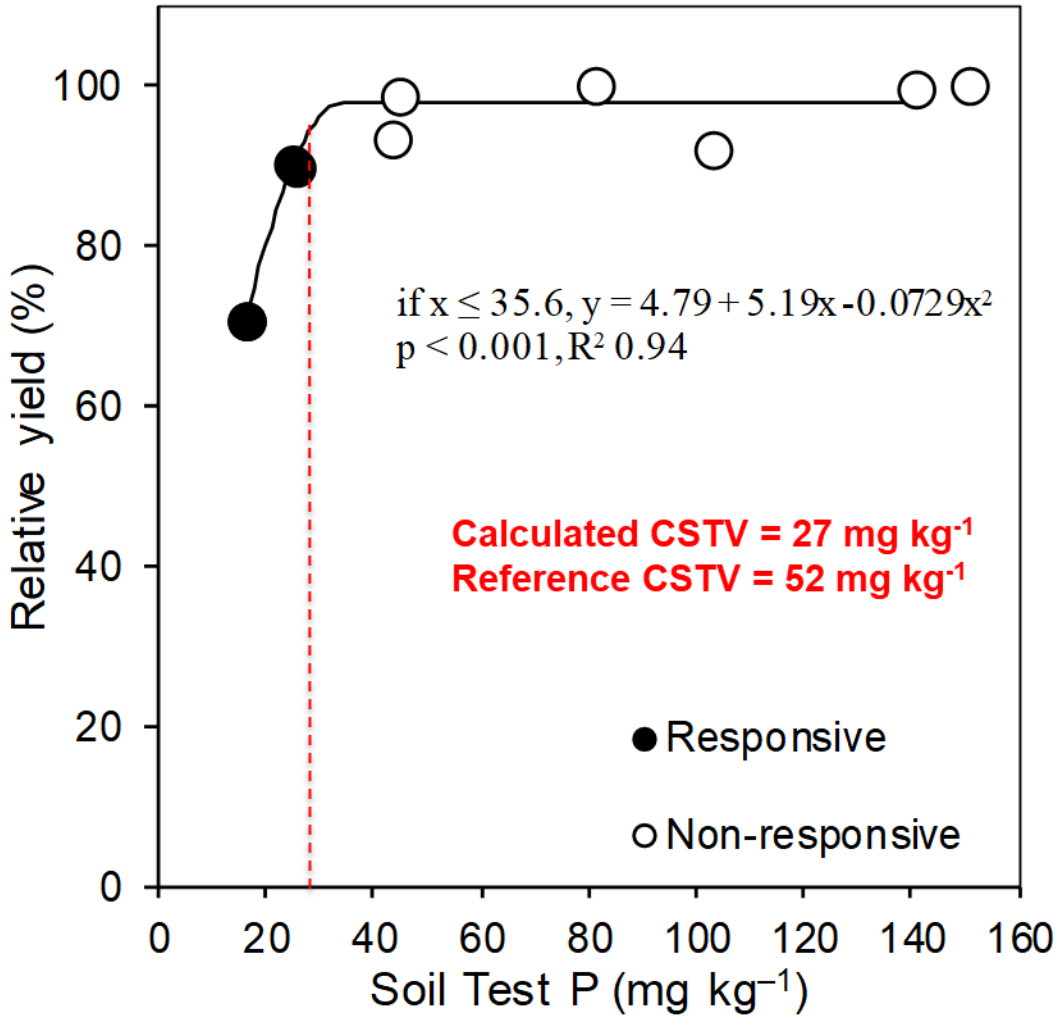
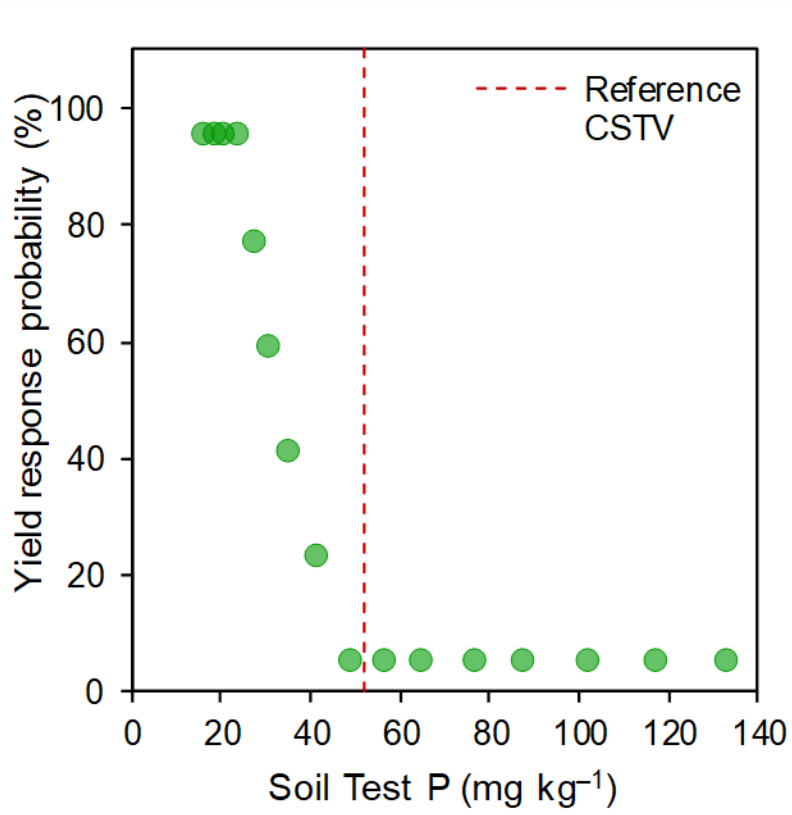
Relative Yield and P-CSTV



Response Frequency

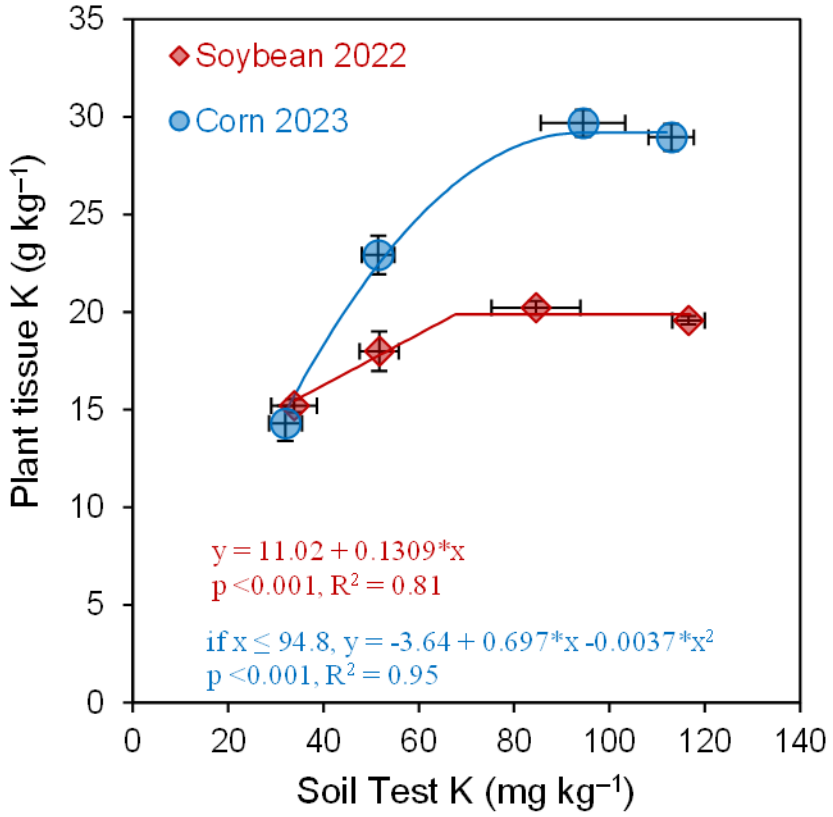


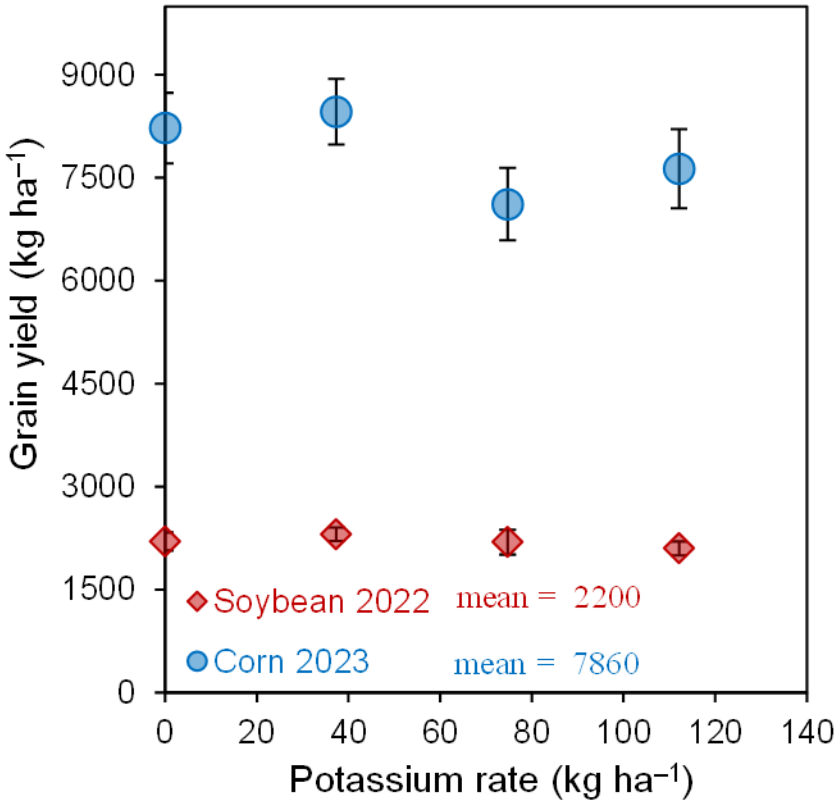
Potassium - Coastal Plain Site

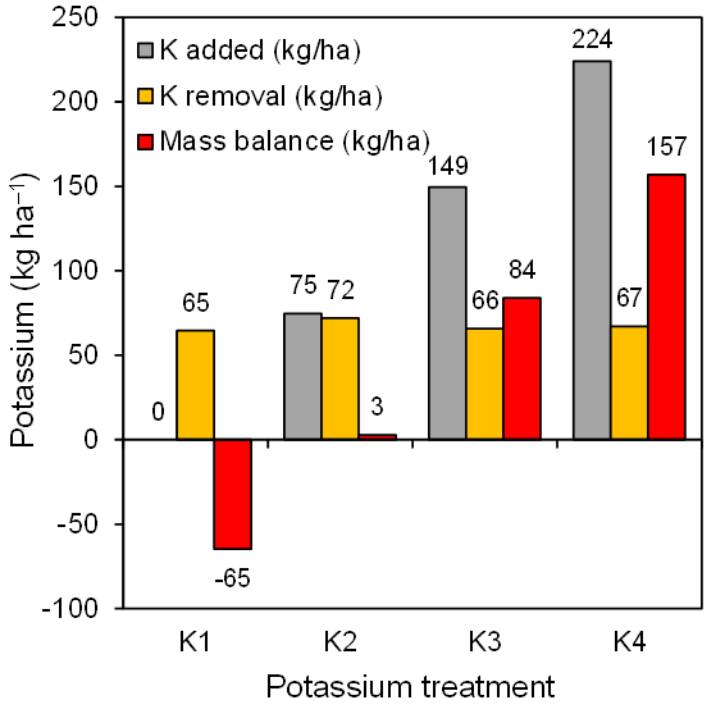
K1 = 0 kg K ha^{-1}

K4 = 112 kg K ha^{-1} (100 lb K ac^{-1})

Effect of K rates on tissue K, yield, and mass balance







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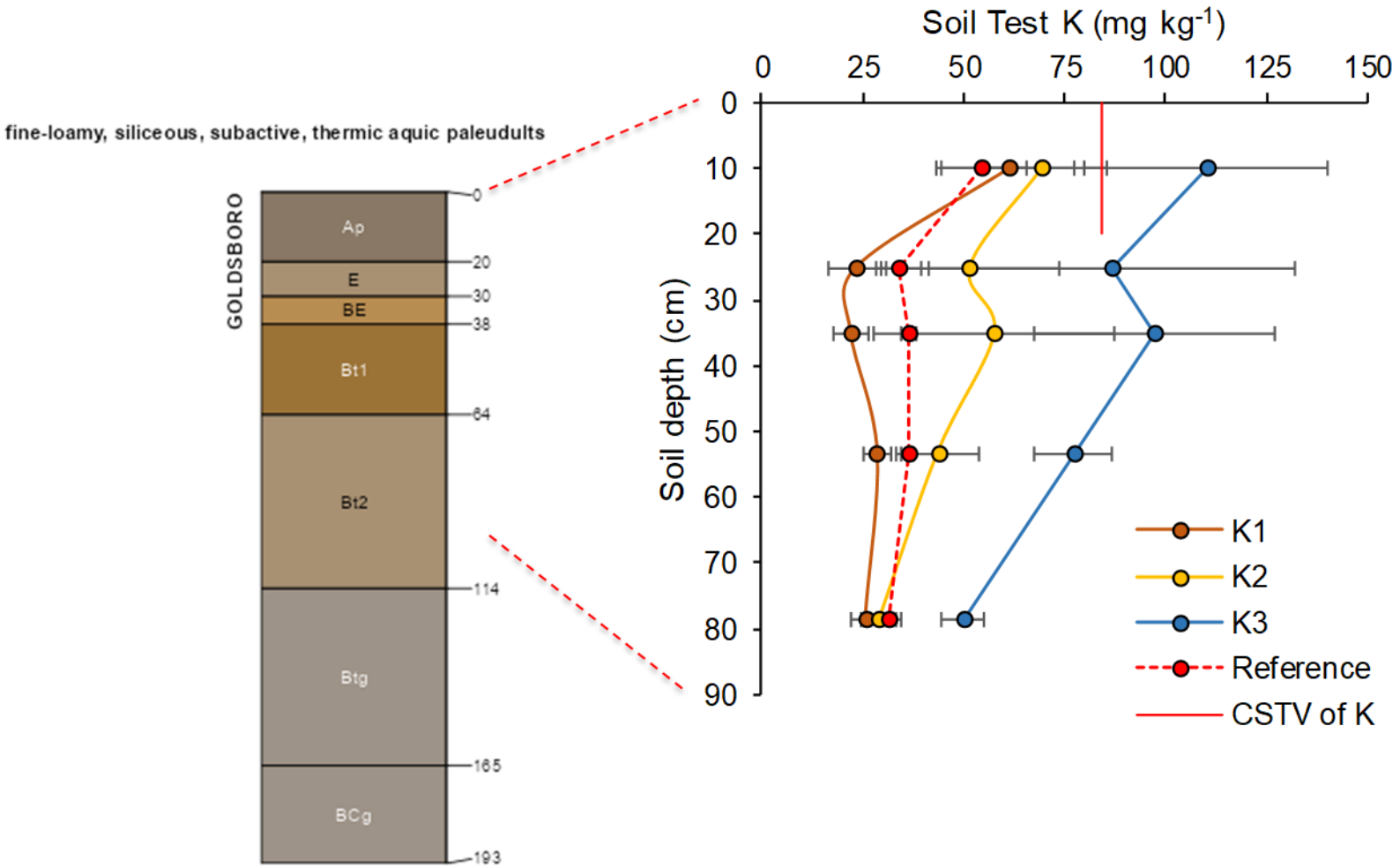
Corn (2023) = 9227 kg ha^{-1} (147 bu ac^{-1})



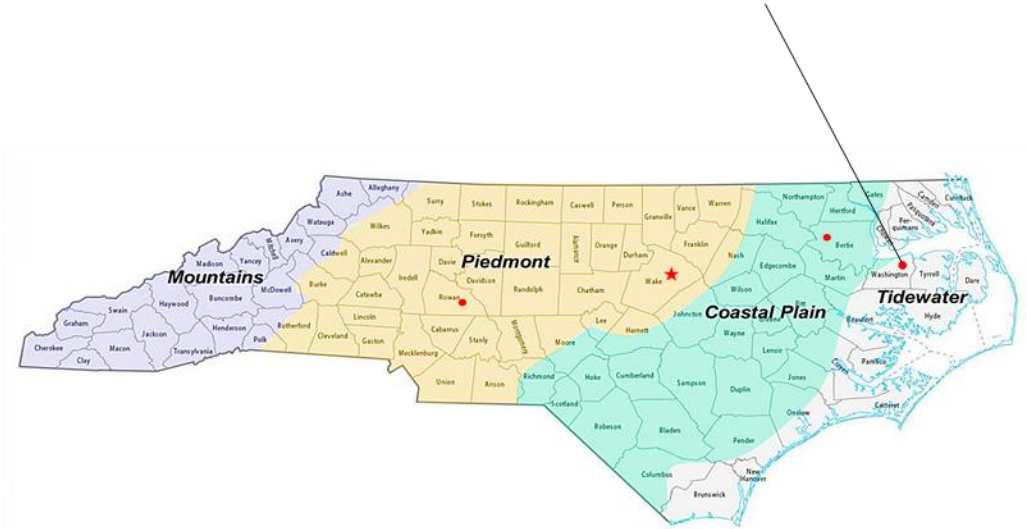
Ongoing Investigation

- Accumulation of K in the subsoil
- Quantification of non-available K

Tidewater Long-term Trial

Description

Location: Tidewater Res. Station
County: Washington
Soil: Portsmouth (**20% clay**)
Starting year: 1966 (58 years)
Tillage system: Minimum tillage
Acreage: 5.5 acres



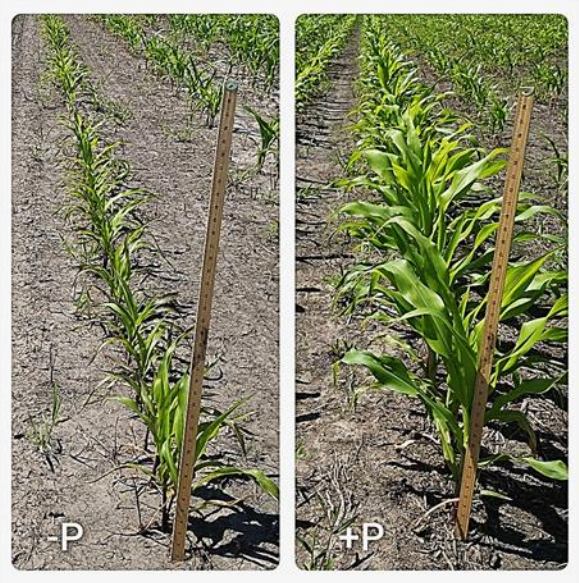
Tidewater Long-term Trial

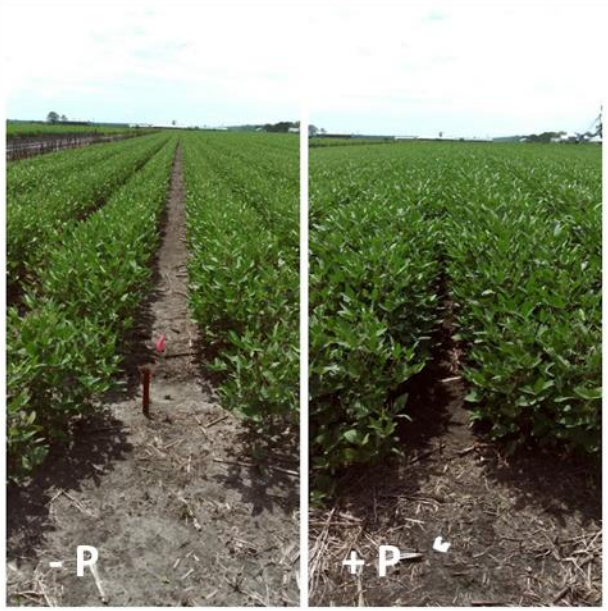
Rates of P and K 2022 and 2023

Treatment	Cropping year	
	2022	2023
	P rate (kg ha^{-1})	
P1	0	0
P2	5	7
P3	10	14
P4	29	27
P5	73	55
	K rate (kg ha^{-1})	
K1	0	0
K2	0	28
K3	0	56
K4	20	84
K5	40	112

Description

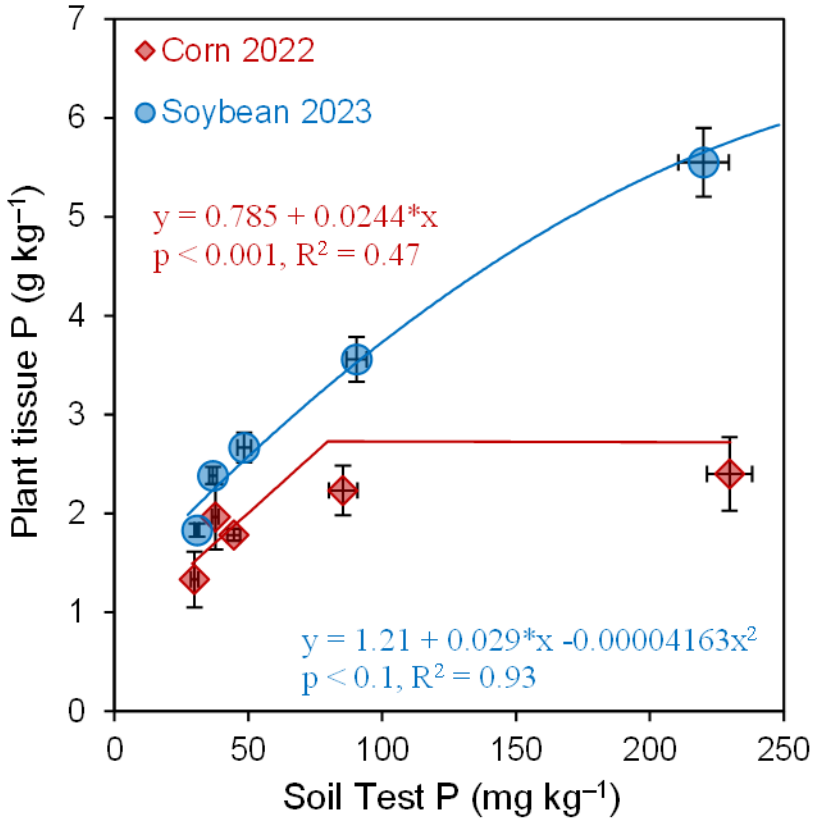
- Soil Sampling: 0-20 cm depth
- Tissue sampling at VT (corn) or R1/R2 (soybean)

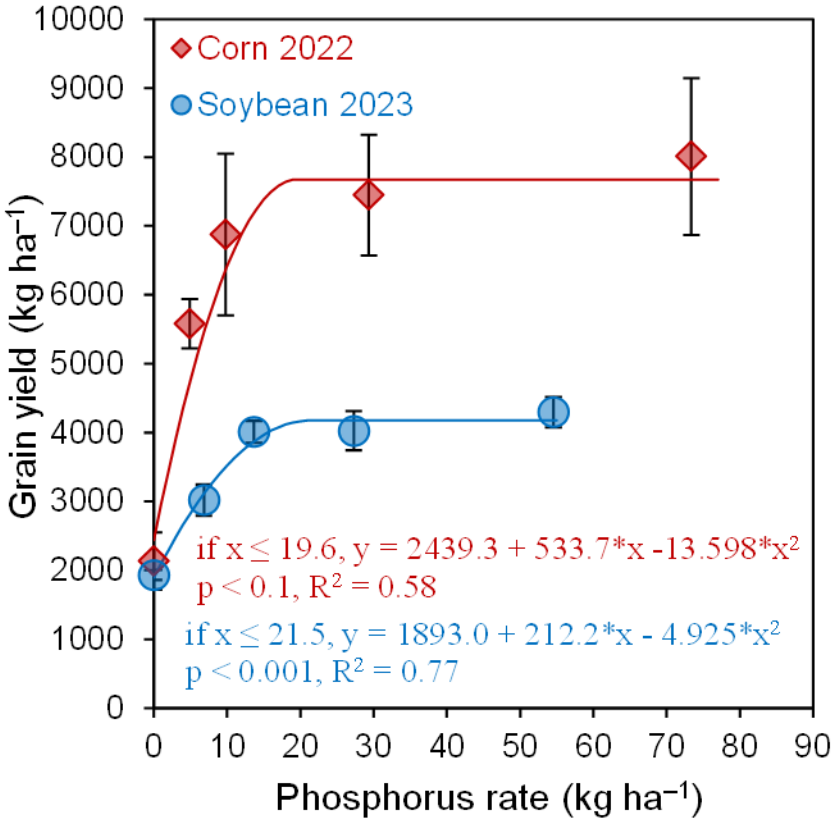


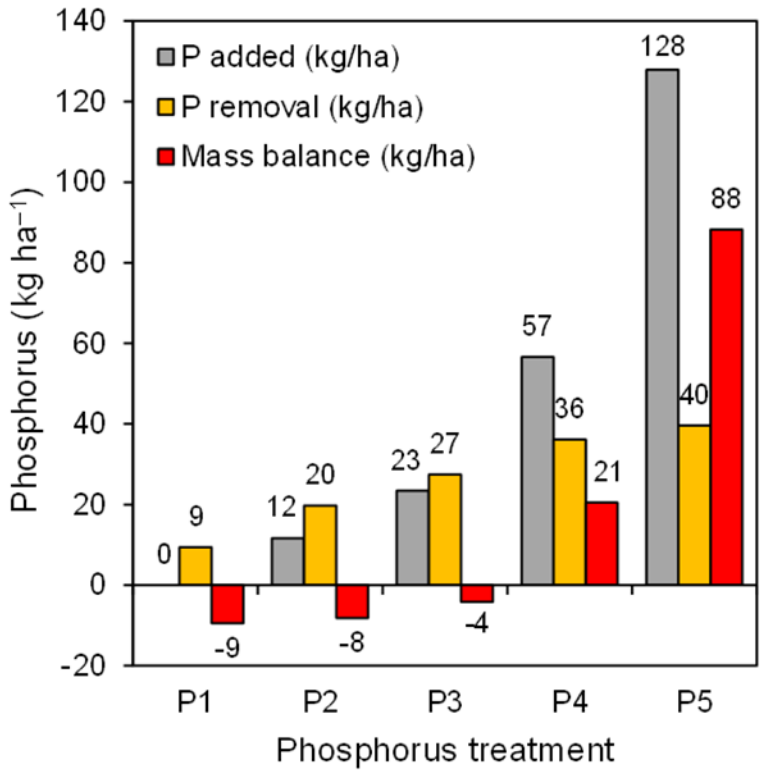


Phosphorus - Tidewater Site

Effect of P rates on tissue P, yield, and mass balance

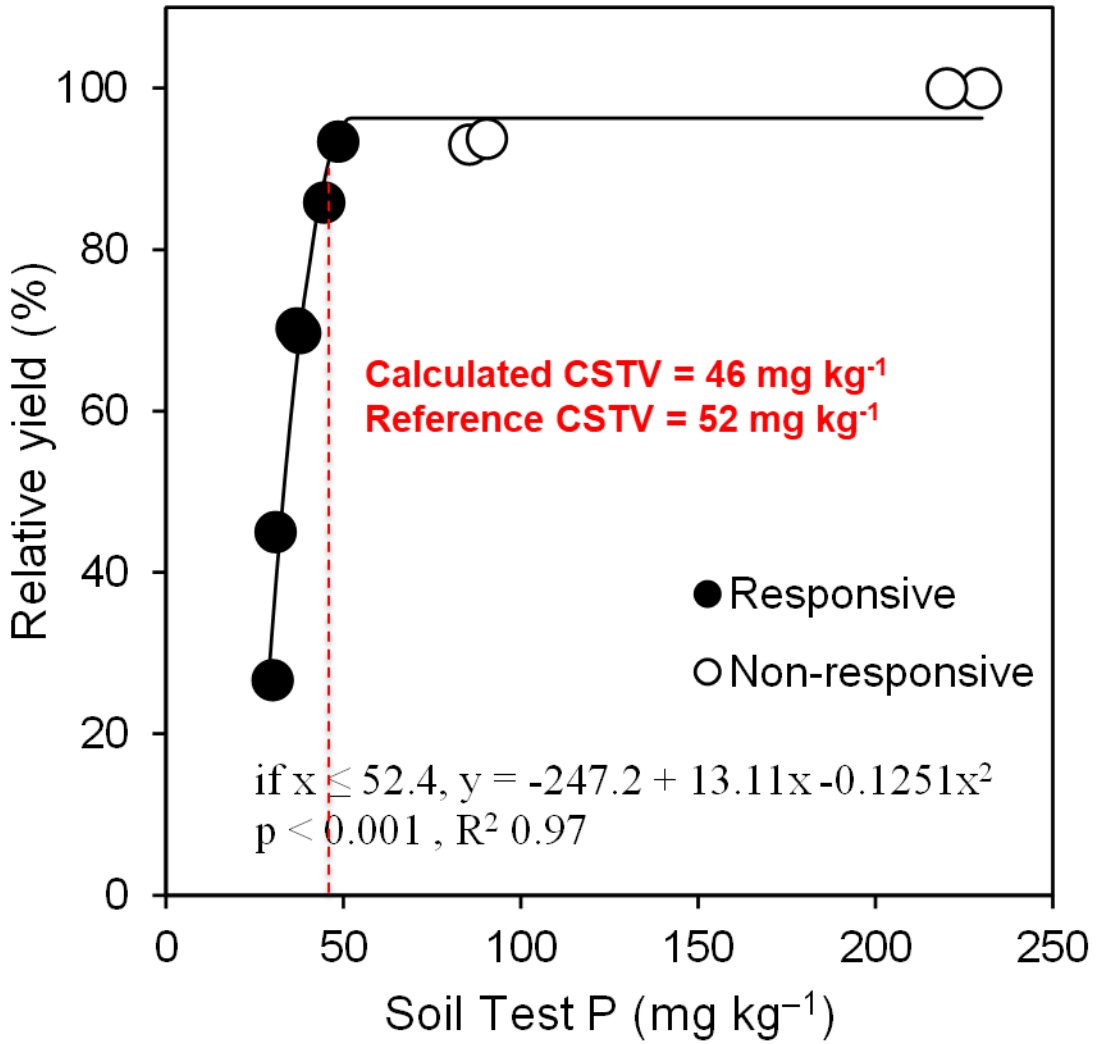




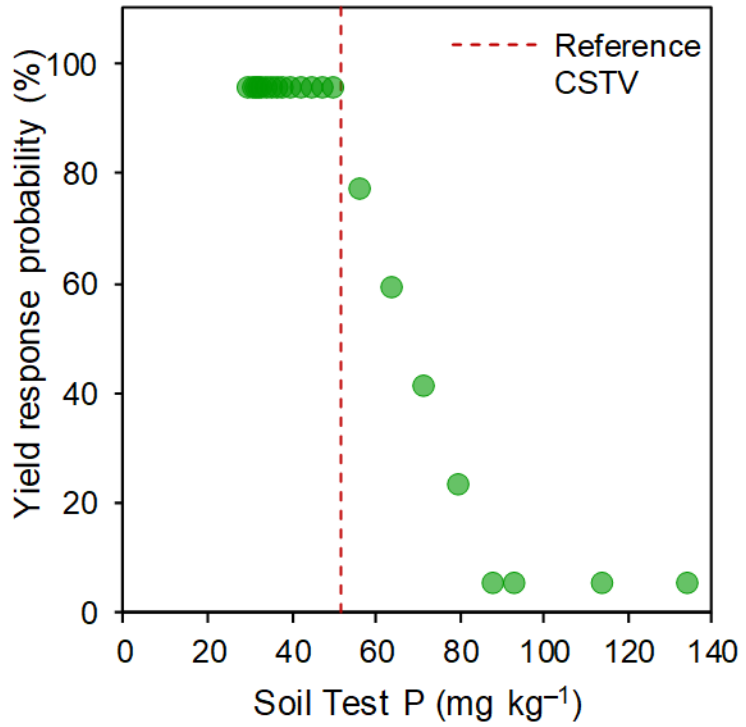


Average grain yield NC
Corn (2022) = 7909 kg ha^{-1} (126 bu ac^{-1})
Soybean (2023) = 2589 kg ha^{-1} (38.5 bu ac^{-1})

Relative Yield and P-CSTV

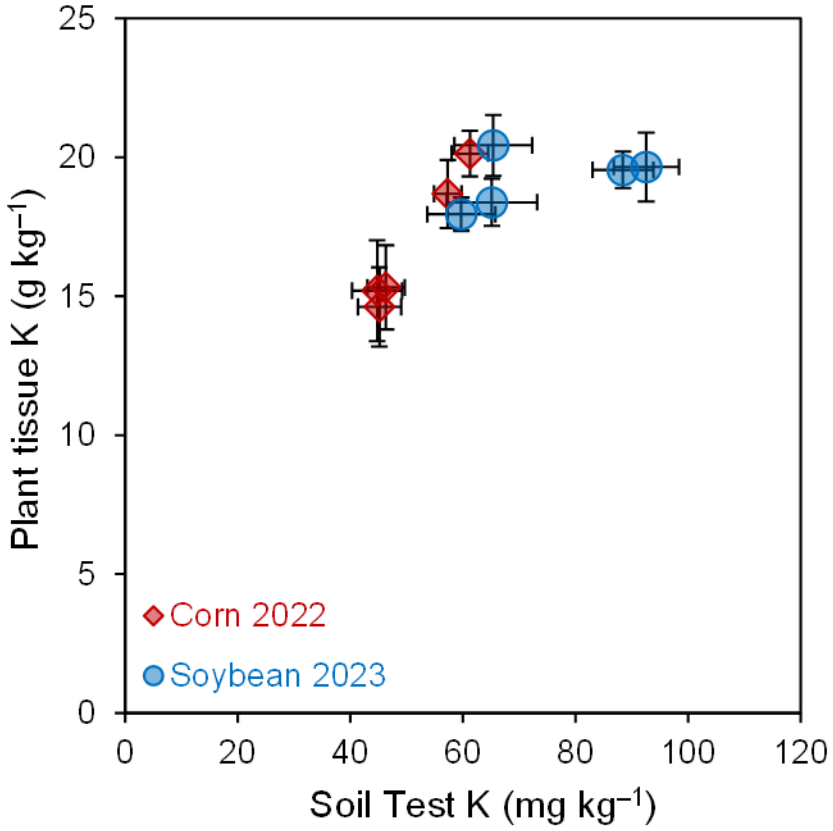


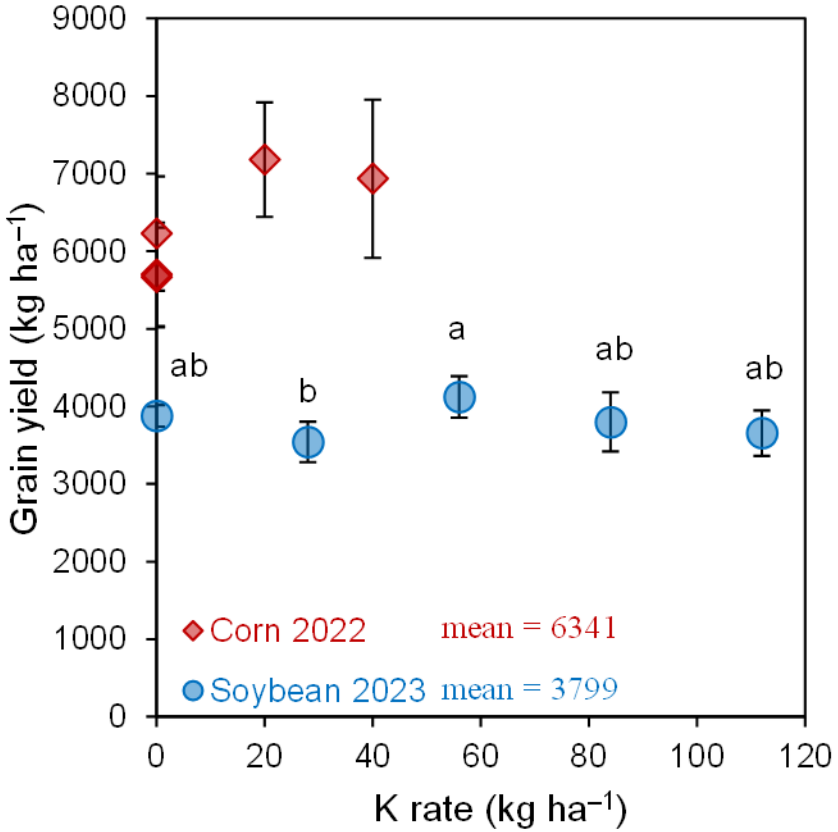
Response Frequency

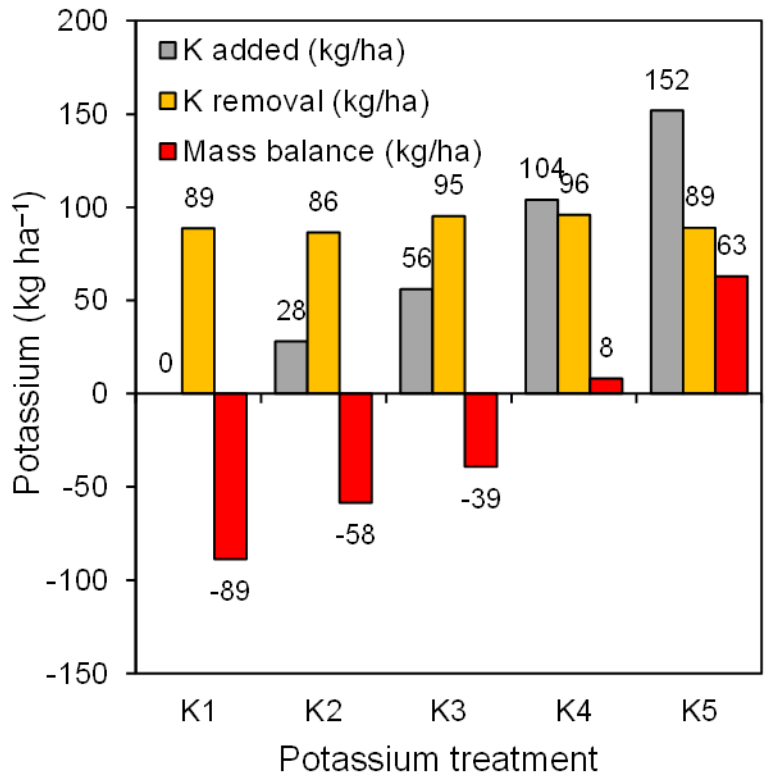


Potassium- Tidewater Site

Effect of K rates on tissue K, yield, and mass balance

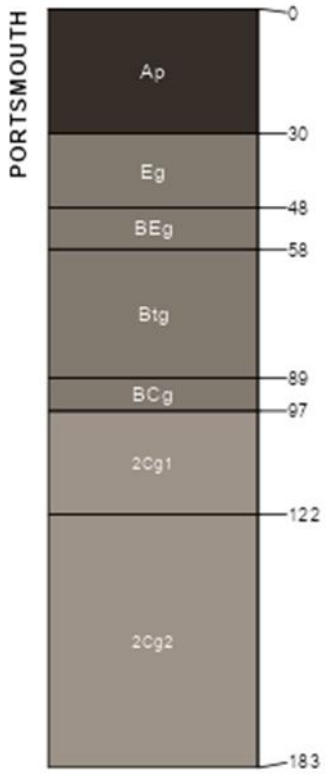






Average grain yield NC
Corn (2022) = 7909 kg ha^{-1} (126 bu ac^{-1})
Soybean (2023) = 2589 kg ha^{-1} (38.5 bu ac^{-1})

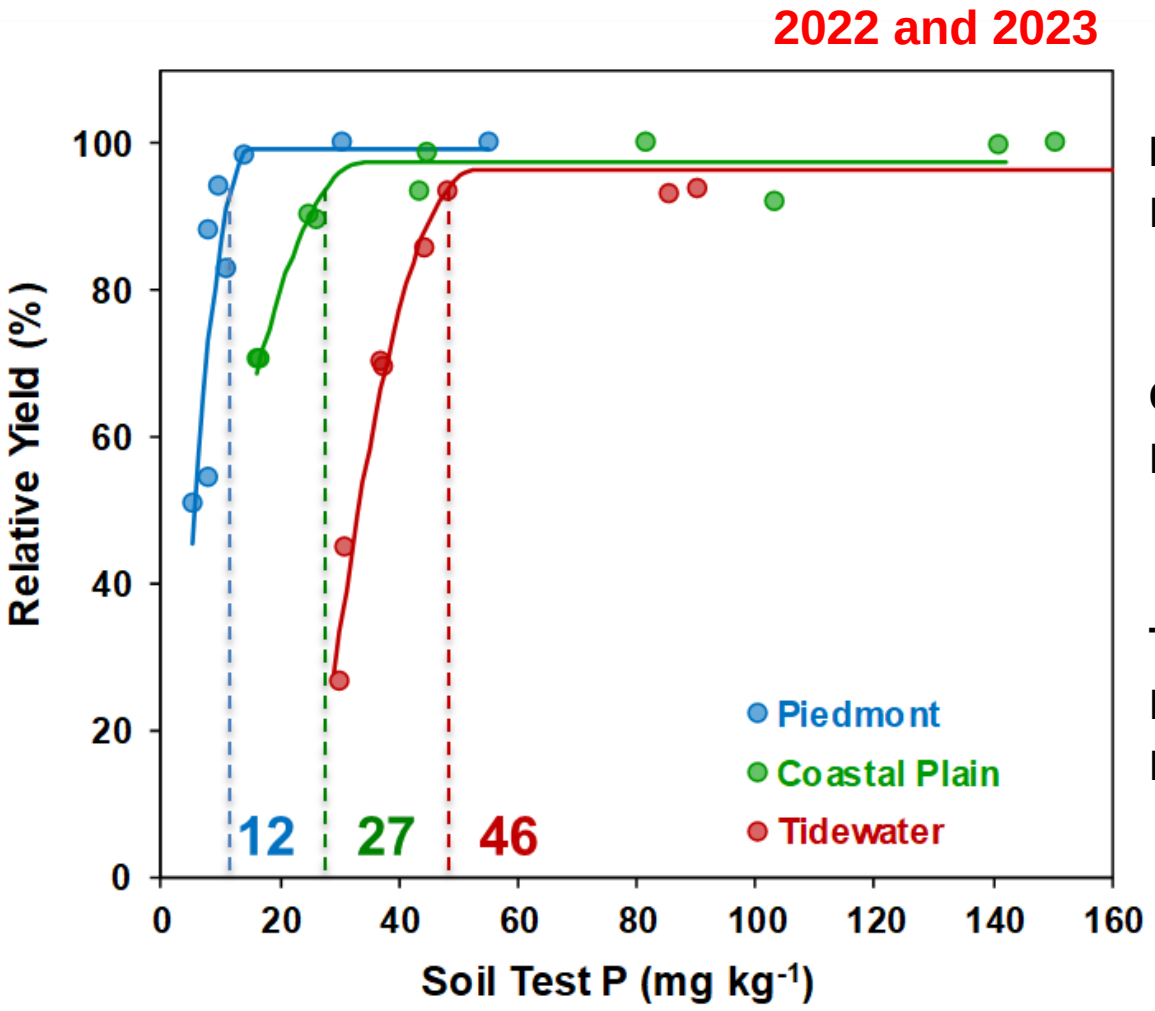
fine-loamy over sandy or sandy-skeletal, mixed, semiactive, thermic typic umbraquults



Ongoing Investigation

- Accumulation of K in the subsoil
- Quantification of non-available K

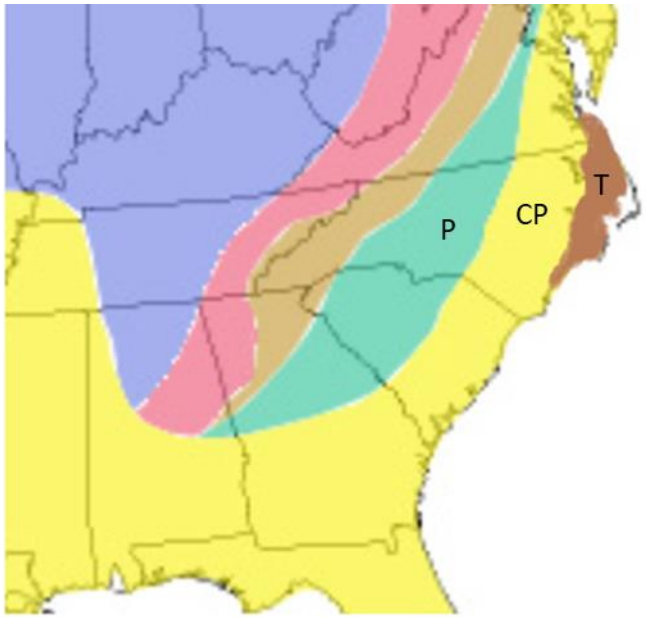
Summary of Results (Phosphorus)



Piedmont
High P-buffering capacity

Coastal Plain
Low P-buffering capacity

Tidewater
Low P-buffering capacity
Poor drainage



Acknowledgments

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NC SOYBEAN PRODUCERS ASSOCIATION

corn growers
Association of North Carolina

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