

# **National Database and Archived Data Review and Summary by Regions, Crops, and Nutrients**

***NRSP11 2024 Annual Meeting***

***3 June 2024***

***Minneapolis, MN***

***Building Collaborative Research Networks to Advance the Science of Soil***

***Fertility: Fertilizer Recommendation Support Tool (FRST)***



# Database Inventory – 05.31.2024

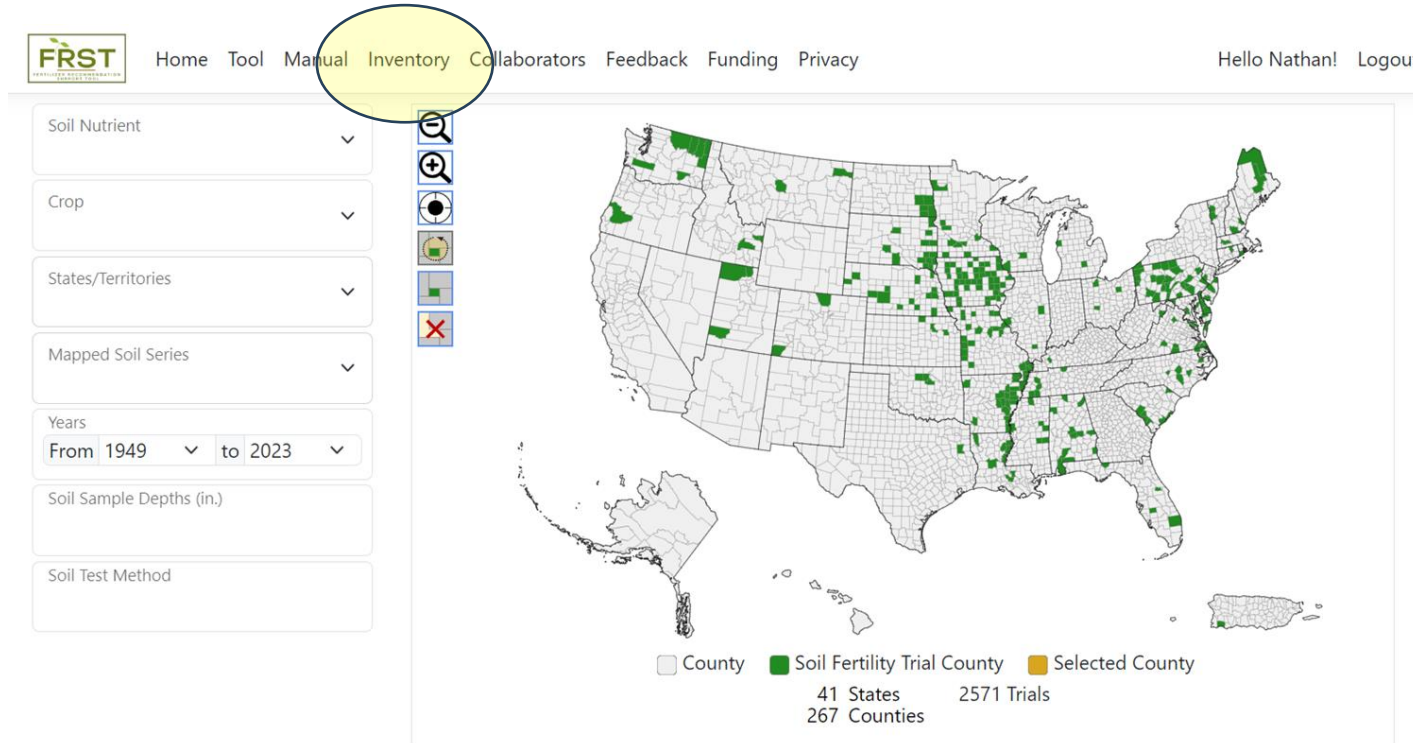
- **P database, 1372 observations**

- 38 states represented
- Corn data, 25 states
- Soybean data, 15 states
- 85% of data from corn & soybean

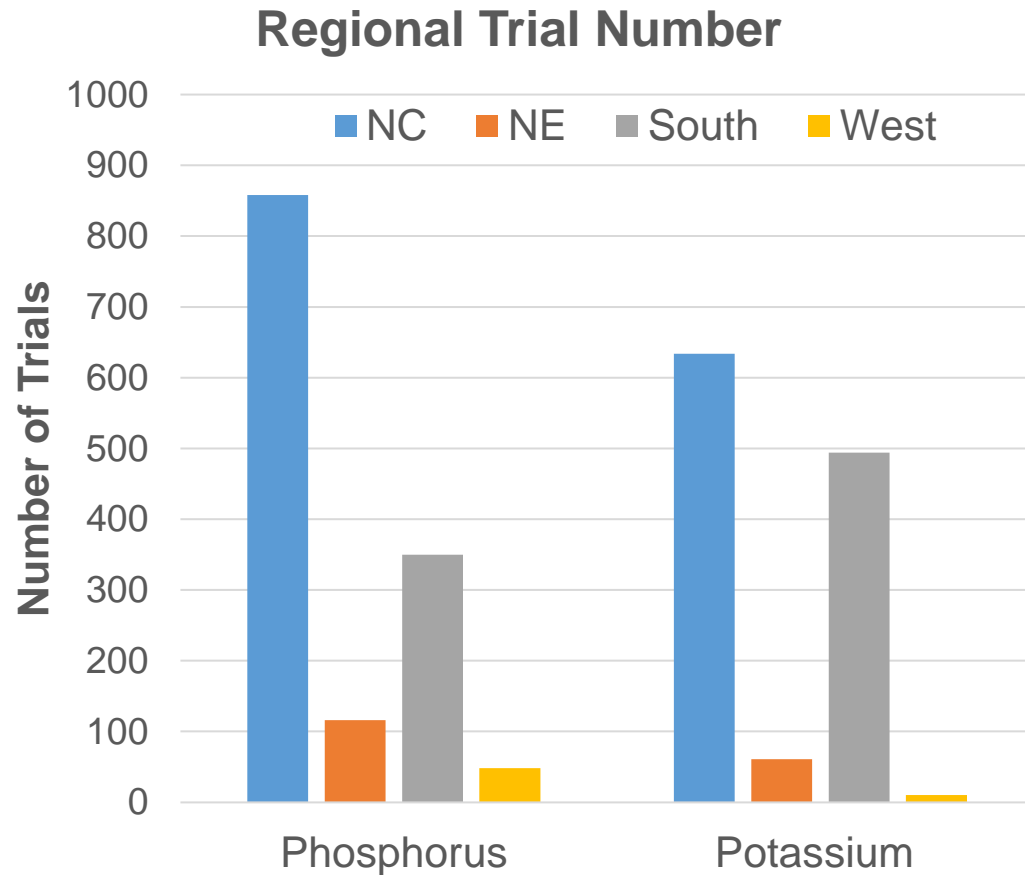
- **K database, 1199 observations**

- 27 states represented
- Corn data, 22 states
- Soybean data, 17 states
- 82% of data from corn & soybean

6/5/2024



# Geography of Soil-Test Correlation Database



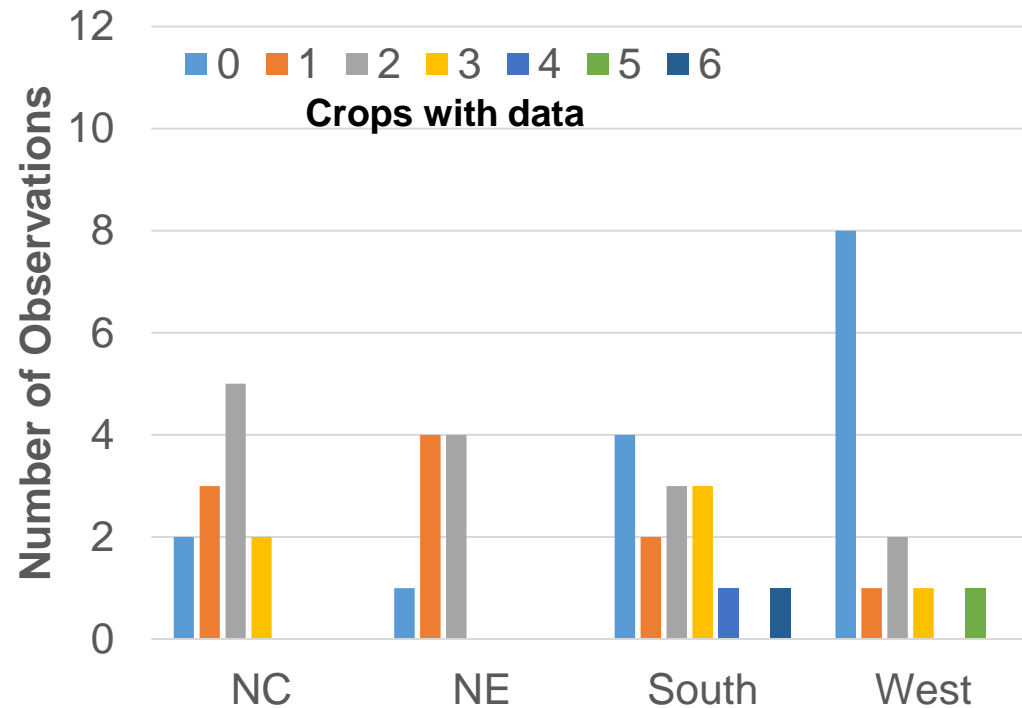
- **Does the database population reflect regional nutrient issue priorities?**

- NC Region has more P data than K data
- South has more K data than P data

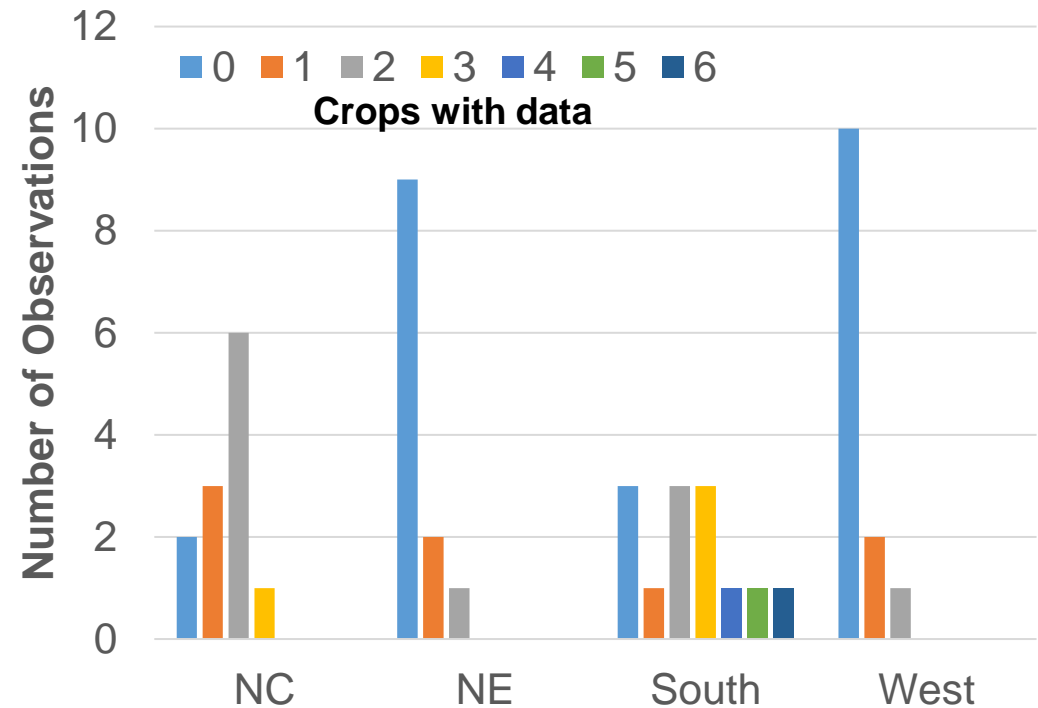
Region	Phosphorus		Potassium	
	trials	%	trials	%
NC	858	63	634	53
NE	116	9	61	5
South	350	26	494	41
West	48	<4	10	<1
Total	1372	--	1199	--

# Regional Crop Diversity in Database

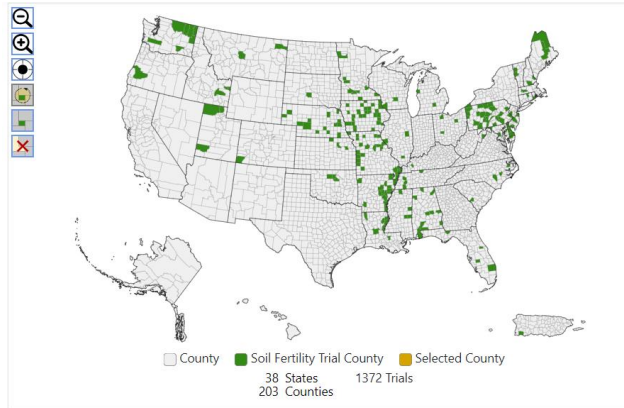
## Phosphorus



## Potassium



# FRST Database Summary - Phosphorus

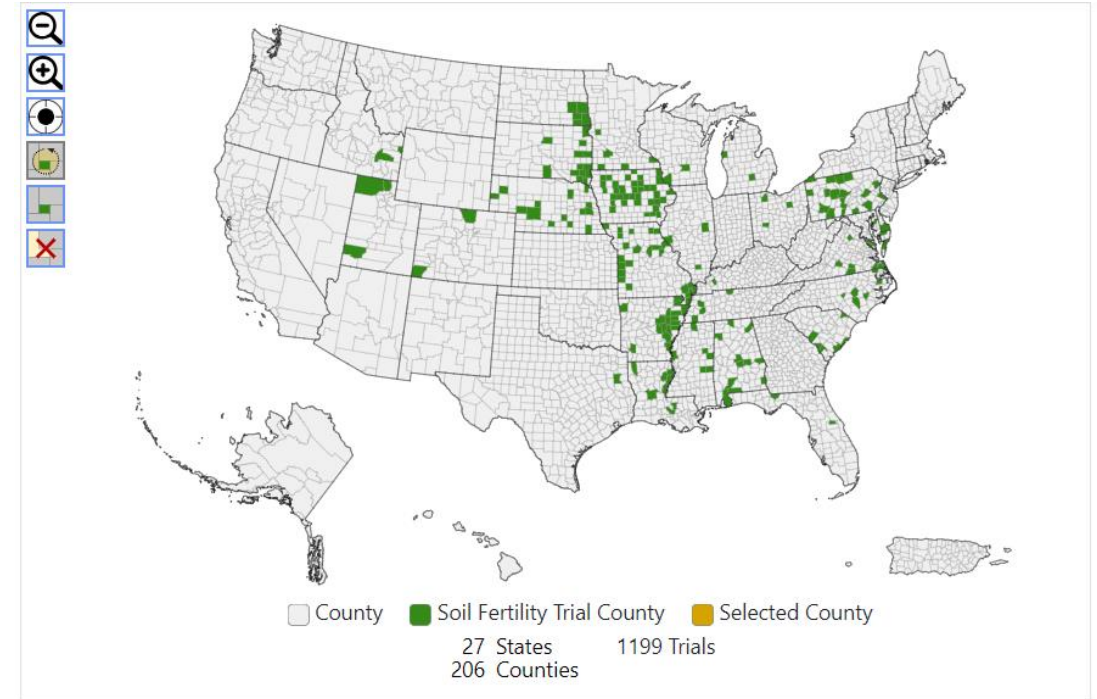


Phosphorus Crops	Trials	States	Counties	Years
Alfalfa	16	3	7	1967-2023
Bermudagrass	41	2	3	1960-2012
Corn	702	25	145	1955-2023
Corn Silage	26	7	12	1998-2023
Cotton	25	2	9	1957-1994
Rice	24	1	4	2013-2015
Soybean	457	15	67	1975-2023
Winter Wheat	31	5	13	1990-2016

Phosphorus Crops	Trials	States	Counties	Years
Bahiagrass	2	2	2	1990-2023
Barley	2	1	2	2023
Brachiariagrass	1	1	1	2021
Clover-Grass	2	1	1	1976-1977
Lentil	4	1	1	2004-2005
Lentil Forage	2	1	1	2004
Pea	7	2	2	1962-2005
Pea Forage	4	1	1	2004-2005
Potato	3	2	3	2021
Sorghum	1	1	1	1993
Spring Wheat	6	2	3	1967-2023
Sweet Potato	3	1	1	1976-1978

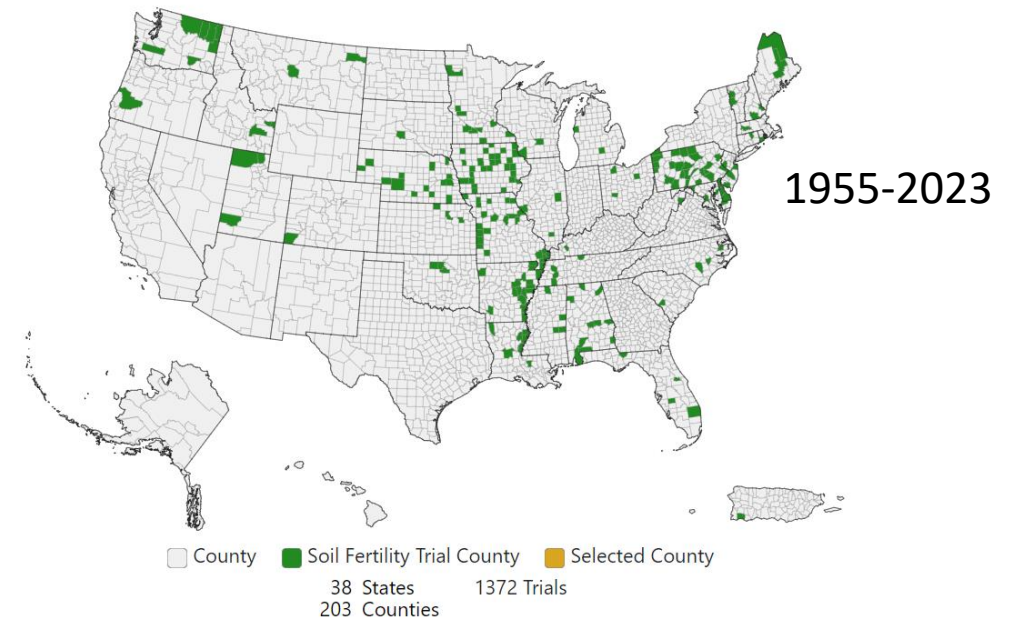
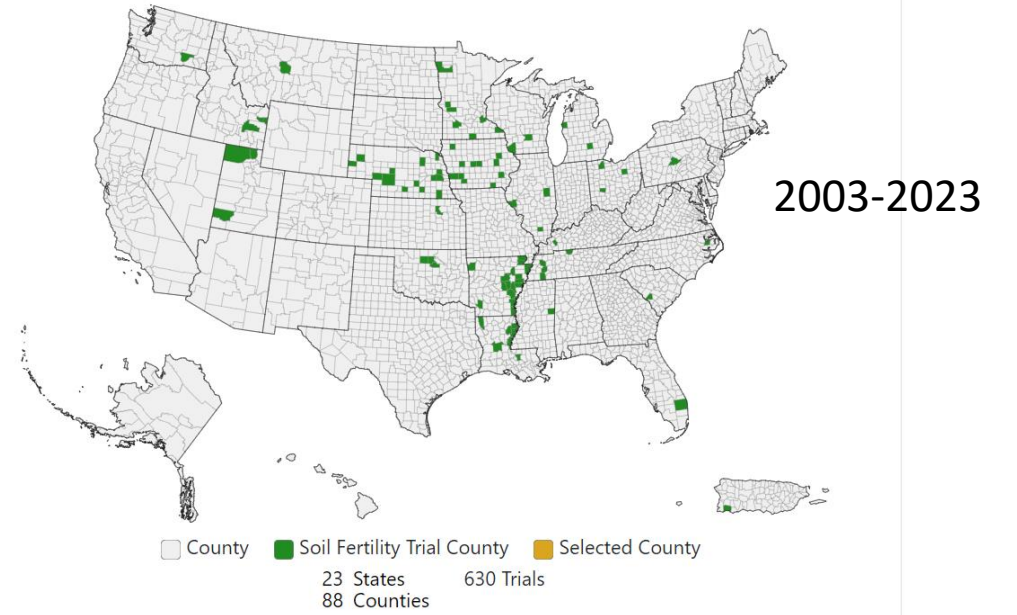
# FRST Database Summary Potassium

Potassium Crops	Trials	States	Counties	Years
Alfalfa	12	3	4	1980-2023
Bahiagrass	1	1	1	2023
Barley	2	1	2	2023
Bermudagrass	54	4	5	1955-2012
<b>Corn</b>	<b>612</b>	<b>22</b>	<b>150</b>	<b>1955-2023</b>
Corn Silage	2	1	2	2021
<b>Cotton</b>	<b>65</b>	<b>5</b>	<b>22</b>	<b>1949-2023</b>
<b>Rice</b>	<b>55</b>	<b>1</b>	<b>7</b>	<b>2004-2015</b>
<b>Soybean</b>	<b>373</b>	<b>17</b>	<b>92</b>	<b>1971-2023</b>
Sugarcane	6	1	1	2007-2008
Sweet Potato	5	1	2	1976-1978
Winter Wheat	12	2	7	2001-2015



# Data Age – Phosphorus data since 2003

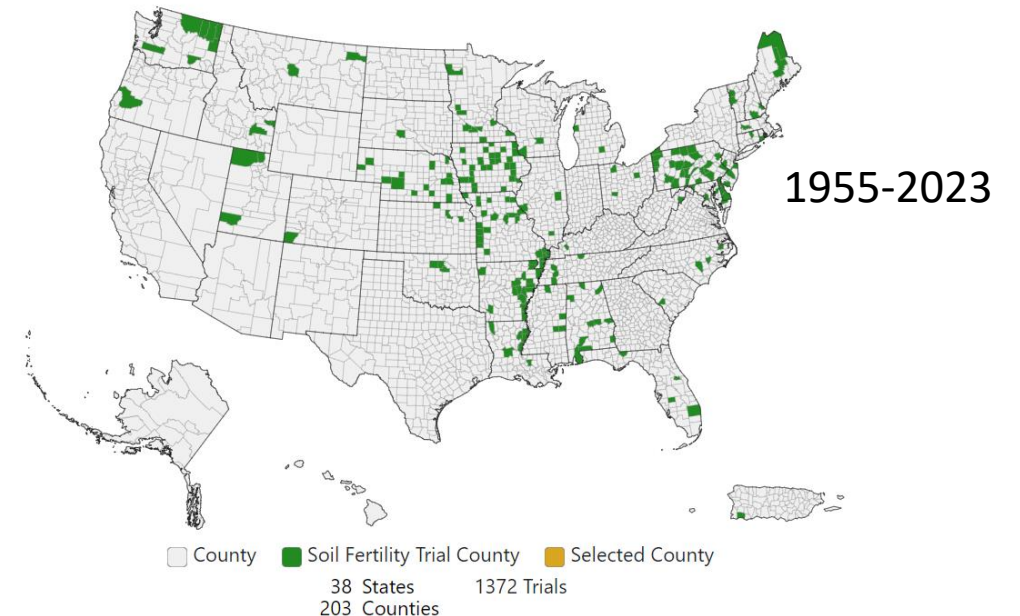
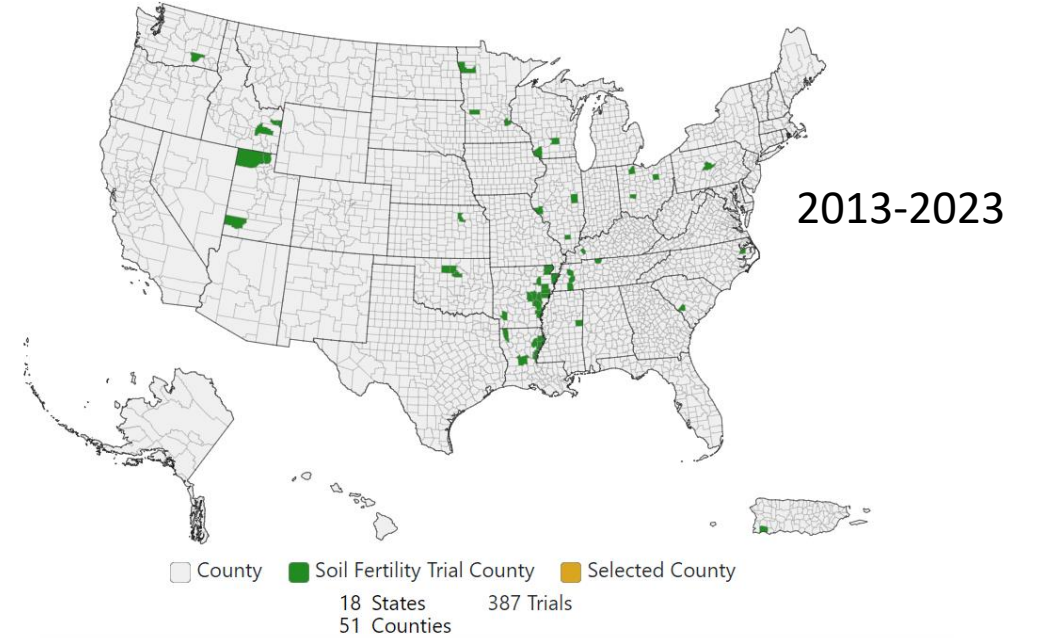
Phosphorus Crop	Trials	States	Counties	% of Total
Total	630	23	88	46%
Corn	336	14	63	48%
Soybean	215	12	39	47%
Winter Wheat	13	2	5	42%
Bermudagrass	9	1	2	22%
Corn Silage	4	1	3	15%
Cotton	0	--	--	0%
Rice	24	1	4	100%
Alfalfa	1	1	1	8%





# Data Age – Phosphorus data since 2013

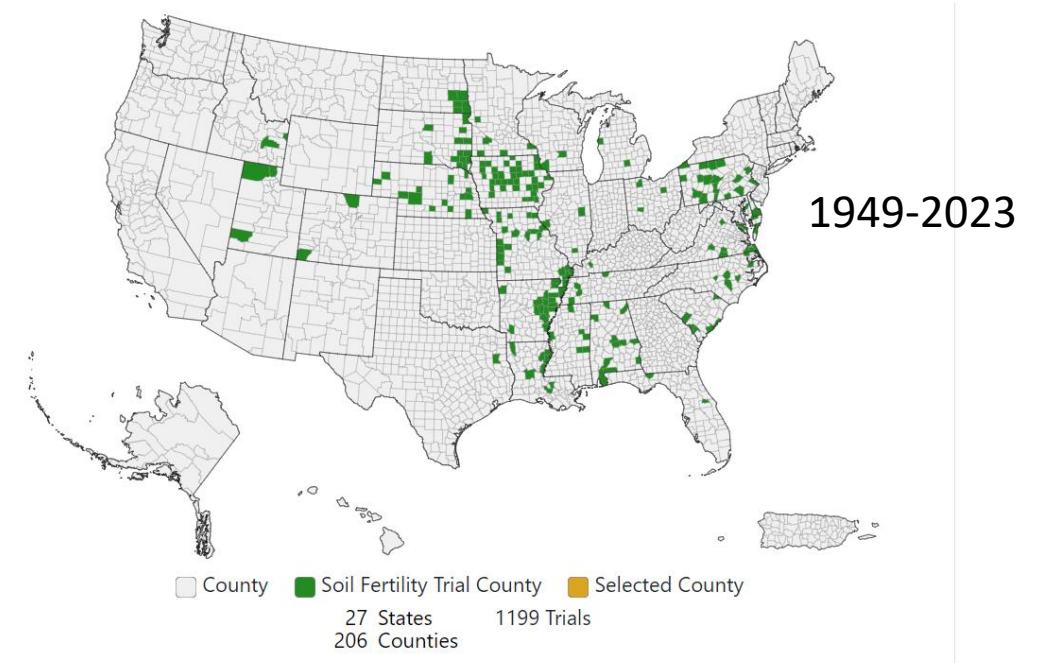
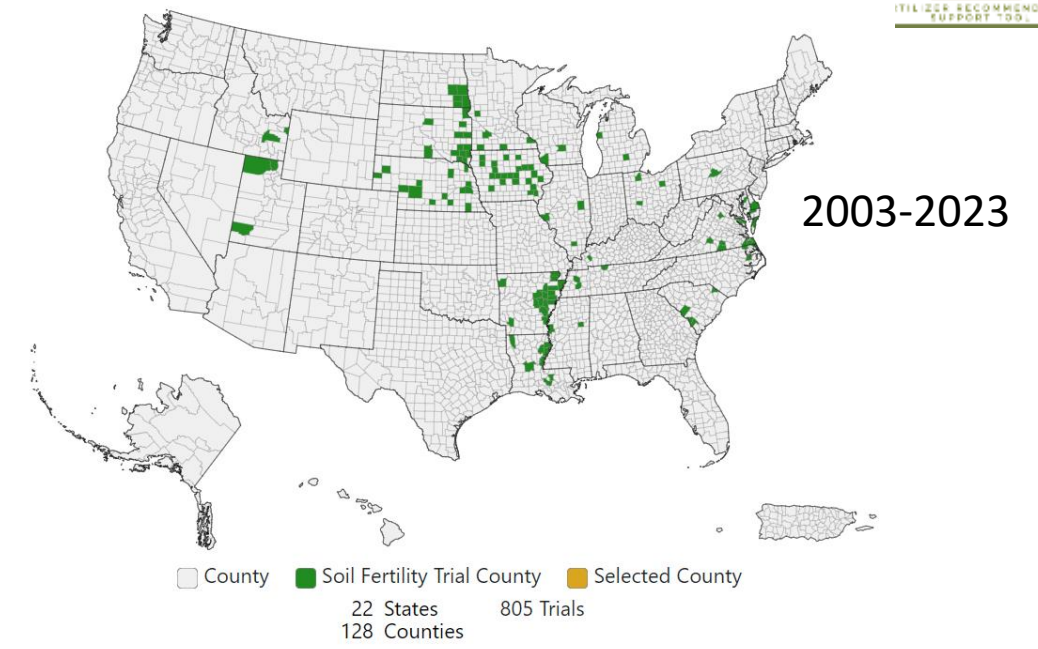
Phosphorus Crop	Trials	States	Counties	% of Total
Total	387	18	51	28%
Corn	187	11	31	27%
Soybean	149	9	24	33%
Winter Wheat	13	2	5	42%
Bermudagrass	0	--	--	0%
Corn Silage	4	1	3	15
Cotton	0	--	--	0%
Rice	24	1	4	100%
Alfalfa	1	1	1	6%





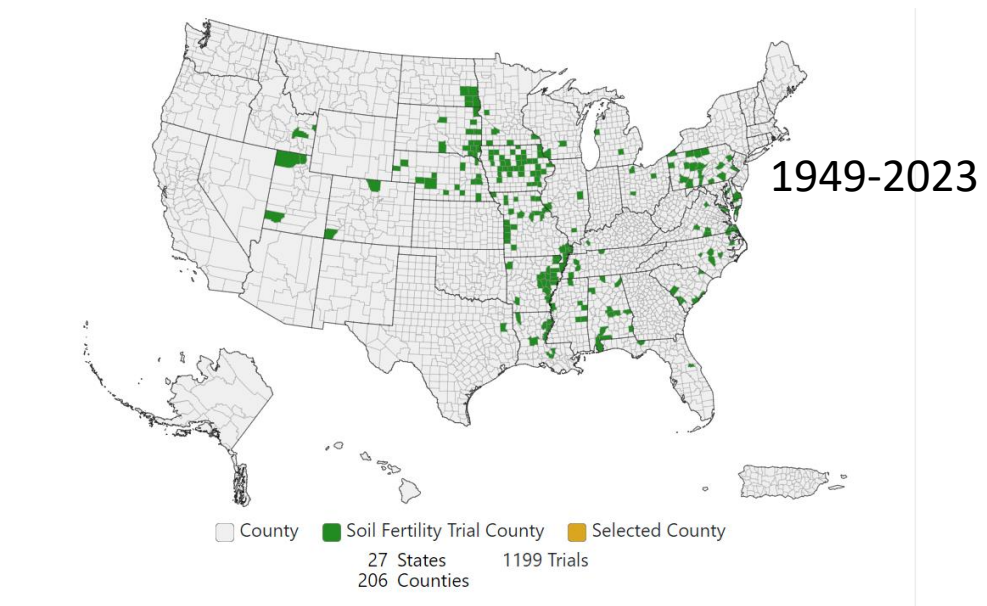
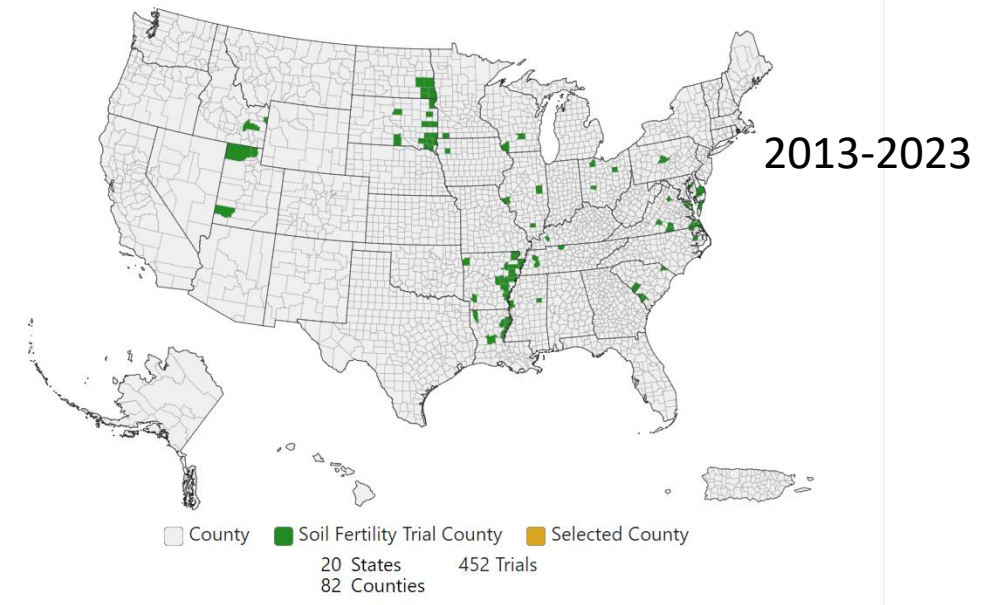
# Data Age – Potassium data since 2003

Potassium Crop	Trials	States	Counties	% of Total
Total	805	22	128	67%
Corn	424	16	95	69%
Soybean	286	13	65	77%
Cotton	9	3	9	14%
Bermudagrass	9	1	2	16%
Rice	55	1	7	100%
Alfalfa	7	2	2	58%
Winter wheat	4	1	2	33%



# Data Age – Potassium data since 2013

Potassium Crop	Trials	States	Counties	% of Total
Total	452	20	82	37%
Corn	240	14	52	39%
Soybean	165	10	36	44%
Cotton	9	3	9	14%
Bermudagrass	0	0	0	0%
Rice	24	1	4	44%
Alfalfa	5	2	2	42%
Winter wheat	4	1	2	33%



# Legacy Data (03.15.2024 Summary)

- 218 of 545 site-years of legacy data in archived reports have suitable information
  - Replicated trial
  - No-P or No-K control
  - Yield data by treatment
  - Soil sample depth
  - Soil test method
  - Soil test values (pre-fertilization)
- Other limitations of legacy data
  - Very low yields
  - Locations
  - Lack of metadata

Crops	P Trials				K Trials			
	Northeast	North Central	Southeast	West	Northeast	North Central	Southeast	West
Alfalfa	0	11	0	10	0	1	0	0
Bahiagrass	0	0	9	0	0	0	9	0
Coastal_Bermudagrass	0	0	0	0	0	0	7	0
Corn	0	14	2	0	4	39	2	0
Cotton	0	0	0	0	0	0	16	0
Grass-Clover_Pastures	0	0	0	14	0	0	0	14
Peas	0	0	0	1	0	0	0	0
Sorghum	0	16	0	0	0	6	0	0
Soybean	0	9	1	0	0	17	128	0
Subclover	0	0	0	4	0	0	0	0
Sunflower	0	1	0	0	0	0	0	0
Wheat	0	4	0	0	0	1	0	0
Winter_Wheat	0	3	0	81	0	0	0	0

*Information summarized by Dr. Qudus Uthman*

# Importance of Minimum Dataset

- Soil test correlation data is being generated
  - Data not contributed or published
- Some papers published without critical information
  - Soil test information
  - Yield data
  - No data published as supplemental material
- Time lag for adoption?
- USDA Open Access Mandate

Received: 22 September 2023 | Accepted: 5 April 2024  
 DOI: 10.1002/agj2.21575

Agronomy Journal

**ORIGINAL ARTICLE**  
 Agronomy, Soils, and Environmental Quality

**Potassium and harvest time interaction effect on alfalfa production and profitability**

Received: 1 September 2023 | Accepted: 7 January 2024 | Published online: 28 February 2024  
 DOI: 10.1002/agj2.21546

Agronomy Journal

**ORIGINAL ARTICLE**  
 Soil Fertility and Crop Nutrition

**Cotton cultivar response to potassium fertilizer under irrigated and dryland conditions**

## Implementation Plan to Increase Public Access to USDA-Funded Research Results June 28, 2023

**2. UPDATING POLICIES ON PUBLIC ACCESS TO SCHOLARLY PUBLICATIONS AND THEIR ASSOCIATED RESEARCH DATA**

Established policy – in the form of a USDA Departmental Regulation and subsequent federal rulemakings – is the backbone for all other implementation activities. This section of the implementation plan describes USDA's policy approach to ensure free, immediate, and equitable public access to scholarly publications and their underlying scientific data funded by USDA.

The USDA will develop public access policies that will ensure, as appropriate and consistent with applicable law and implementing regulations, that:

# Summary

- Overall database
  - 1372 trials for P
    - 21 different crops
    - 46% of data from last 20 yr
    - 9 crops  $\geq$  12 observations
      - minimum for FRST modeling
      - Does not account for reductions from soil sample depth or soil test method
  - 1199 trials for K
    - 12 different crops
    - 67% of data from last 20 yr
    - 7 crops  $\geq$  12 observations
- Soil test correlation data is
  - dominated by 2 crops
  - aging, especially for crops in the southern USA
  - geographically skewed
- Continuing to build the FRST database is critical
  - NRCS-CIG Grant data
  - Voluntary data contributions needed/encouraged

# FRST Objectives

1. Identify the factors that inhibit end-user adoption of soil-test services for nutrient management.
  - Survey land-grant institution soil-test-based recommendations to understand the complexity and variation of existing recommendations and provide a synthesis of results.
  - **Develop standardized terminology for use in soil-test-based nutrient management recommendations that enhance end-user understanding and adoption of soil testing.**
2. Establish minimum data requirements for legacy dataset inclusion and future correlation-calibration studies to standardize best practices.
3. Develop a database that archives soil fertility data and is populated with legacy and current data for soil-test correlation and calibration studies for major field crops grown in North America. The database should be:
  - Accessible and searchable through the decision-support tool.
  - Easy to use so that new data can be readily uploaded. The data should meet the minimum data requirements based on the protocol developed in objective 2.
4. Develop a searchable, decision support tool that:
  - Provides soil test correlation and calibration analysis output based on filter terms such as crop, soil-test method, soil sample depth, soil series, etc.
  - Provide soil test correlation and calibration data for nutrient management researchers and modelers for in-depth analysis.



# Soil Test Levels (by State LGU)

- Soil test level has no official definition by the *Soil Science Society of America*
- Proposed FRST activity
  - Review soil test levels and the associated recommendations to develop and propose a structure with definitions for soil test levels

Soil Test Level Number	Number of States
None (no documentation)	6
3	12
4	10
5	20
6	3
<i>As determined using literature from each land grant university.</i>	

# Soil Test Level Terms (Phosphorus)

Term	States with Level	Fertilizer Recommended	
		Yes	No
Very Low	19	x	
Low	31	x	
Deficient	3	x	
Below optimum	3	x	
Medium	27	x	
Marginal	1	x	
Adequate	1		x

Term	States with Level	Fertilizer Recommended	
		Yes	No
Sufficient	5	x (1)	x (4)
Optimum	18	x	
Above optimum	7		x
High	24	x (9)	x (16)
Very high	16	x (1)	x (15)
Excessive	7		x
Excessively high	1		x

# Soil Test Units used in Land Grant Institution Recommendations

Soil Test Unit	Northeast (12)	North Central (12)	Southeast (14)	West (13)	Total (51)
Index	2	1	2	—	5
ppm	4	10	5	11	30
lbs/acre	3	1	7	—	11
Unknown	3	—	—	2	5

*No information on soil-test recommendations and units were found for Maine, New Hampshire, Rhode Island in the Northeast and Nevada and Wyoming in the West*

# FRST Team + Collaborators

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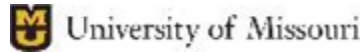
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