Radicle Agronomics:
A new era for nutrient management

PRESENTED BY

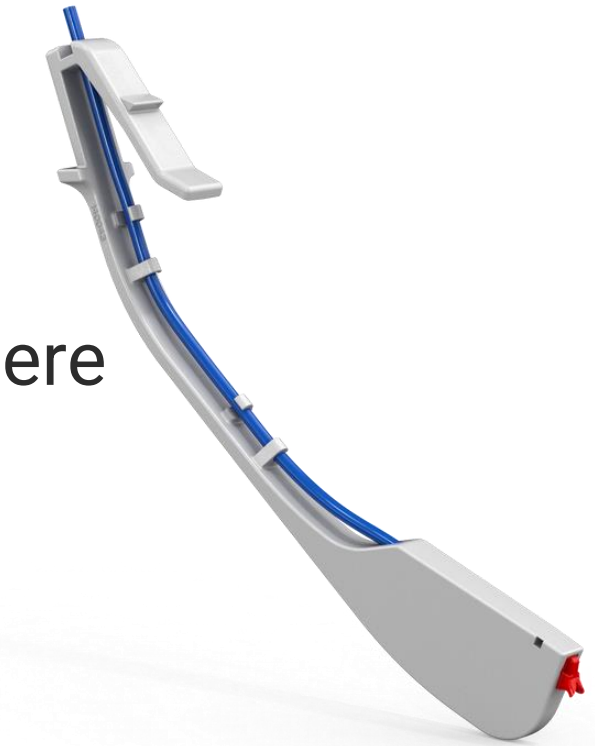
Brad Joern

Lead Soil Scientist

RADICLE AGRONOMICS™

Who is Precision Planting?

- 1993 – Founded in Tremont, IL
- 2012 – Sold to Monsanto
- 2016 – Planter applied fertilizer products introduced
- 2016 – Department of Justice blocks sale to John Deere
- 2017 – Sold to AGCO
- 2022 – Announced entry into the sprayer market
- 2022 – Announced Radicle Agronomics



We Improve the Equipment a Farmer Already Owns

- The retrofit approach makes technology more accessible to more farmers
  - Retrofit = $ New = $$$
- Precision Planting products are primarily sold through a global network of dealers

Equipment We Retrofit

Planters

Combines

Sprayers

Air Seeders

Sidedress Bars

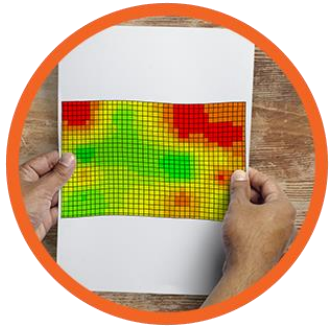
Drills

No farmer *needs* anything that Precision Planting sells

We explain *why* our customers should purchase our products

RADICLE AGRONOMICS™

Better Tools



Better Data

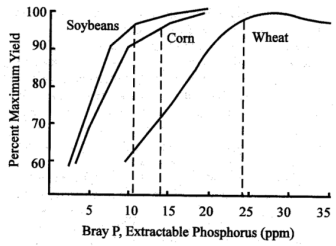
Better Decisions

Nutrient Management Cycle

Soil Sampling

Soil Analysis

Crop Response



Application

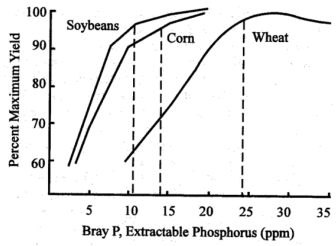
RADICLE AGRONOMICS

Nutrient Management Cycle

Soil Sampling

Soil Analysis

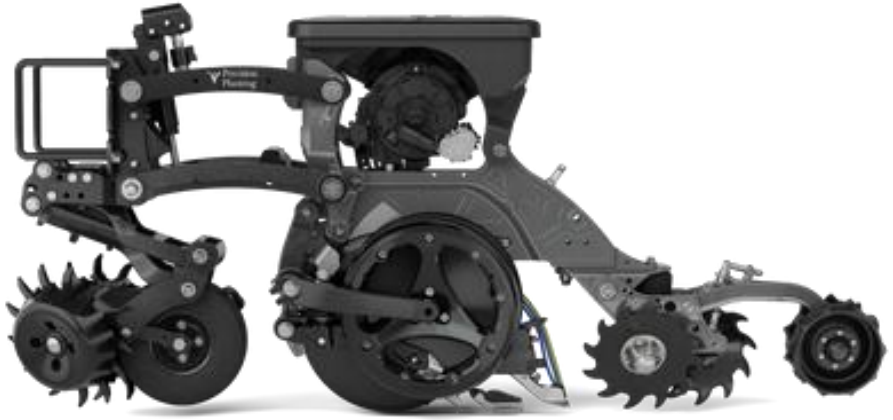
Crop Response



Application

RADICLE AGRONOMICS

Precision Fertilizer Application Technologies Exist



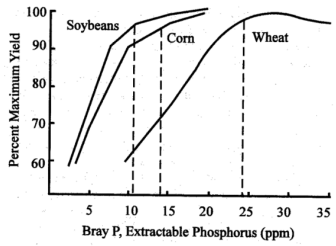
Nutrient Management Cycle

Soil Sampling

Soil Analysis

Application

Crop Response



Soil Sampling Remains in the Dark Ages

Soil Test Interpolations are Nonsensical or Not Standardized

Grids

✓ Easy to create

✗ Ignore everything we know

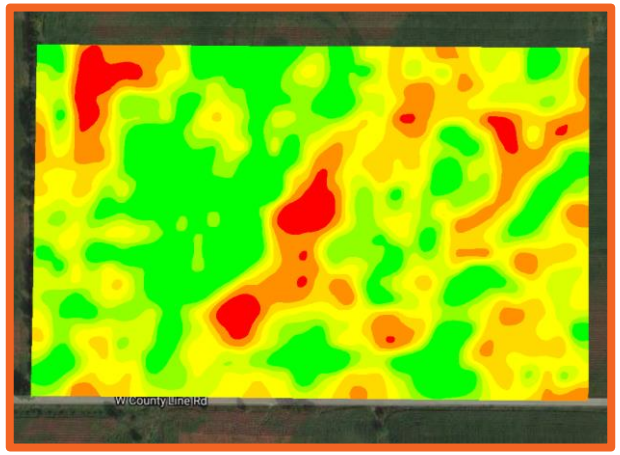
Zones

✓ Group like environments together

✗ Time consuming

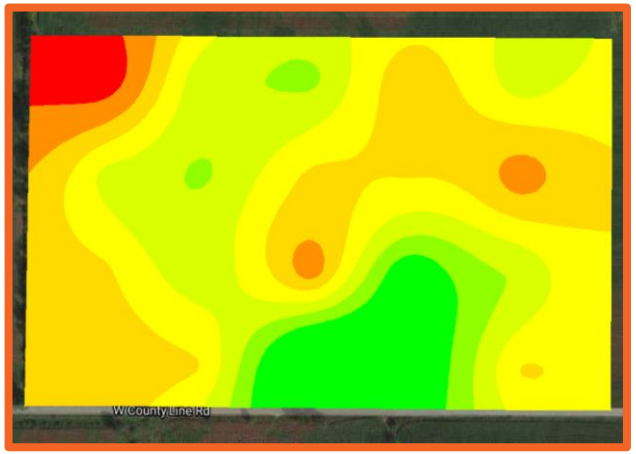
How Accurate are Grids and Zones?

(K soil test within 40 ppm of “truth” layer)



1/16 Acre Grids

“Truth”



2.5 Acre Grids

68%

4 Acre Grids

65%

“Smart” Zones

75%

Nutrient Management Cycle

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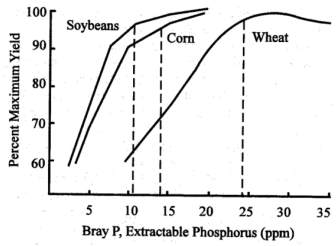
Crop Response



Crop response data supporting fertilizer recommendations can be pretty old!!!

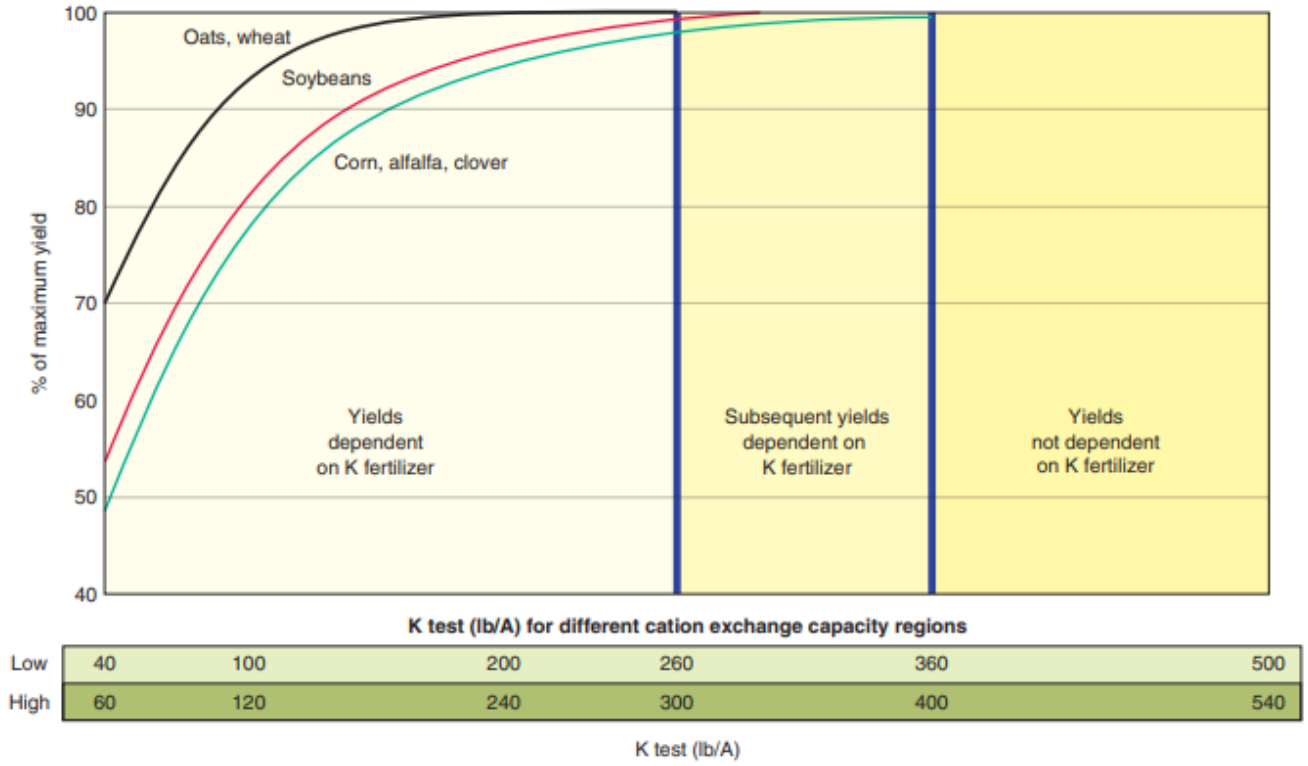
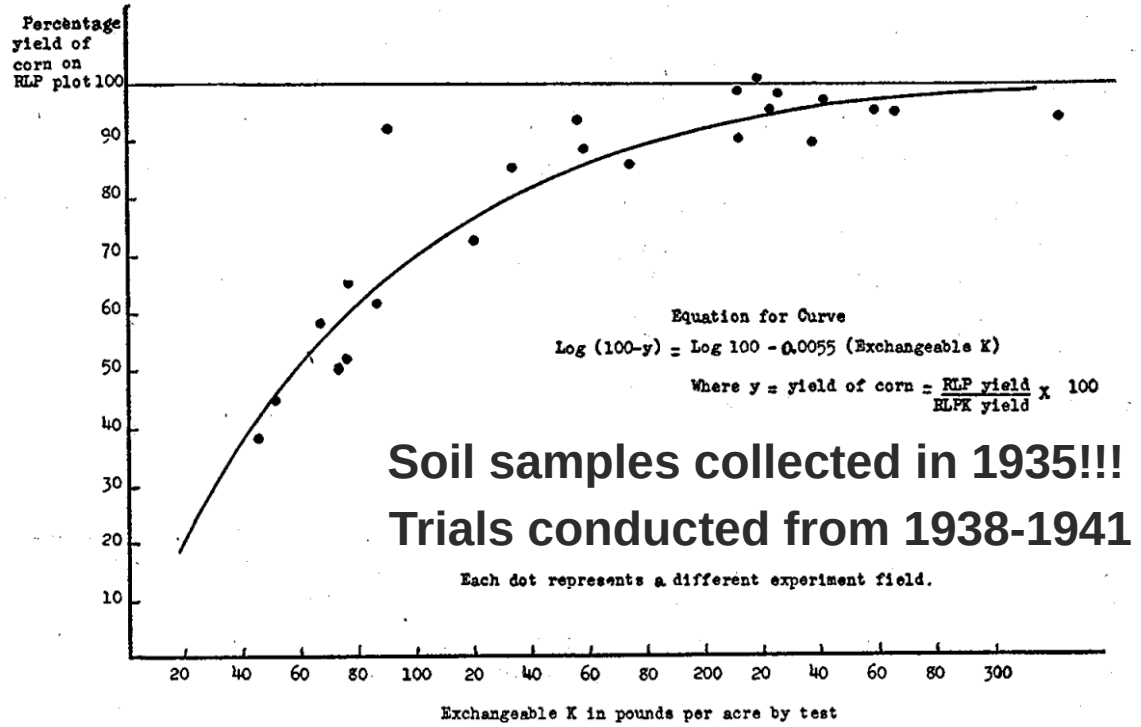


Figure 8.8. Relationship between expected yield and soil K, measured by the ammonium acetate or Mehlich-3 extractable K tests.

Fernandez, F.G., and R.G. Hoeft. 2009. Managing soil pH and crop nutrients. pp. 91-112. *In* 24th edition of Illinois Agronomy Handbook. Univ. of IL.



Soil samples collected in 1935!!!

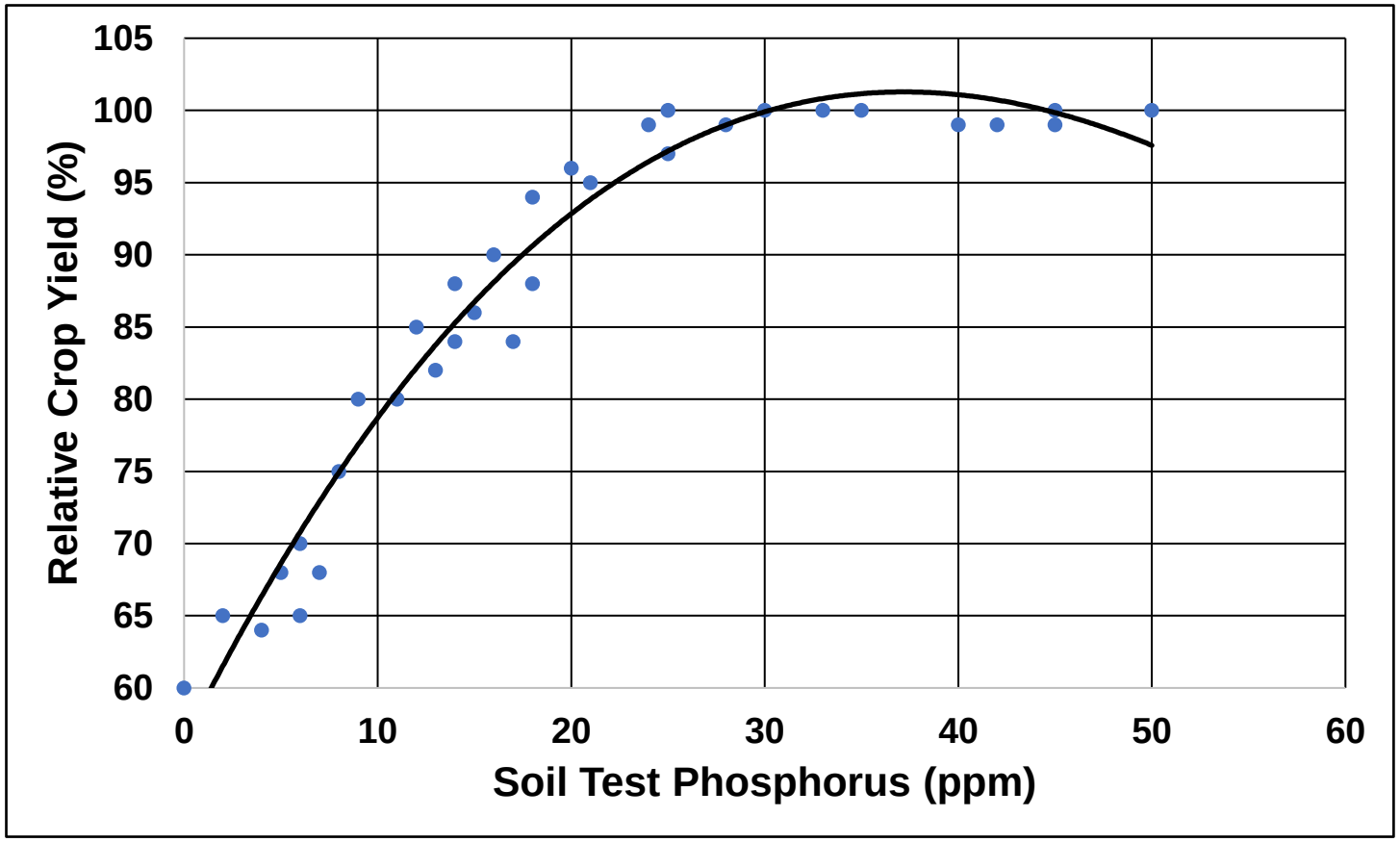
Trials conducted from 1938-1941

FIG. 2. RELATIONSHIP BETWEEN EXCHANGEABLE POTASSIUM AND CORN YIELDS ON UNTREATED PLOTS RECEIVING NO K_2O

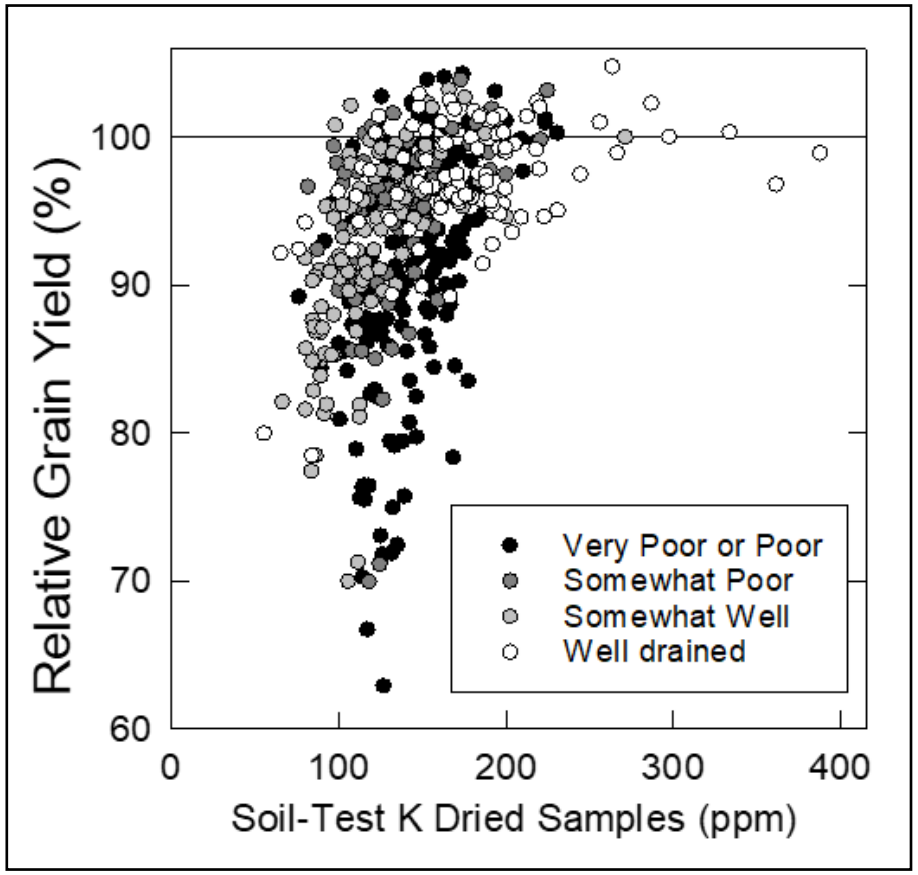
Bray, R.H. 1944. Soil-plant relations. Soil Sci. 58: 305-324.

Crop response trials can be pretty messy!

Theory



Reality

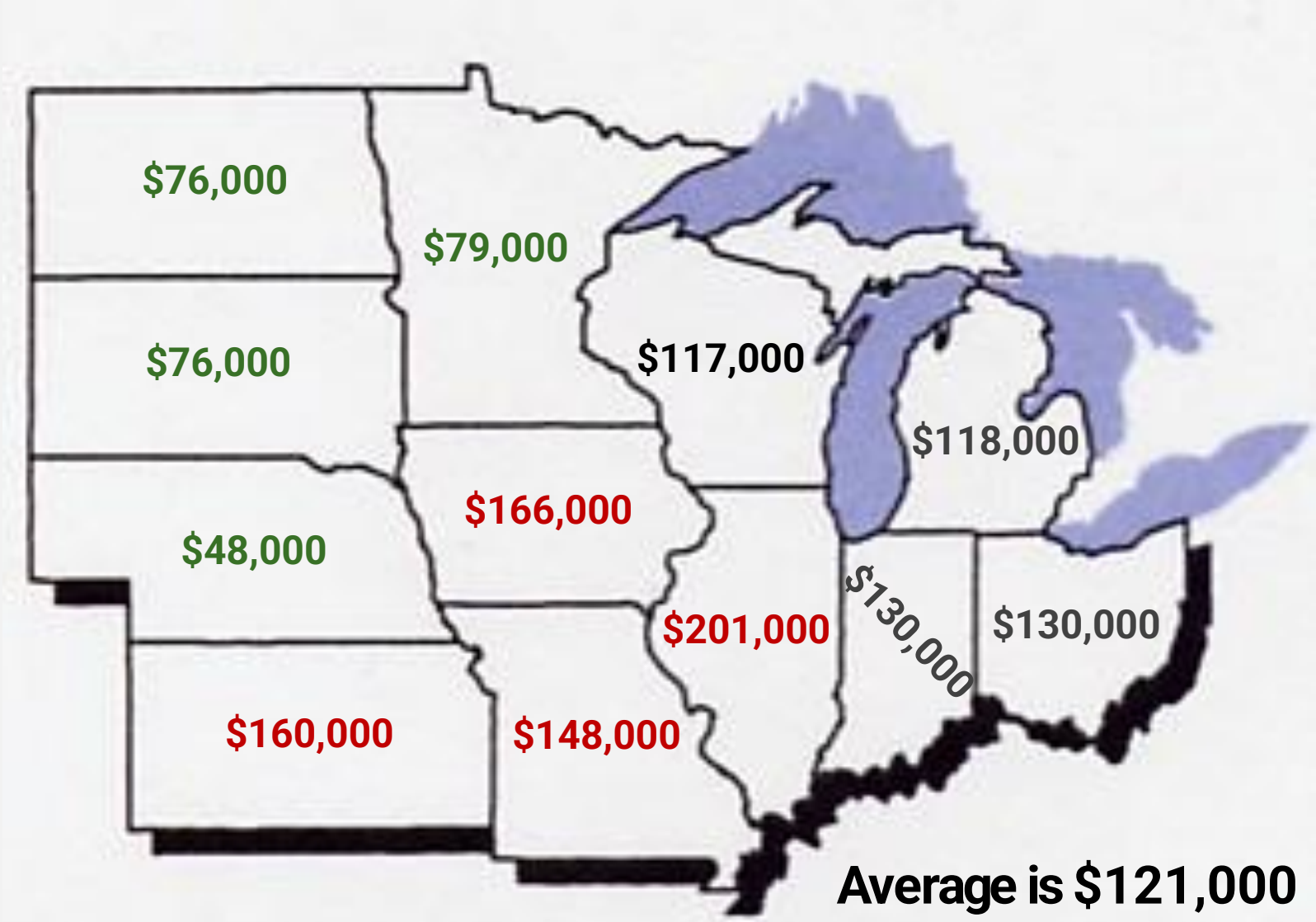


Courtesy A.P. Mallarino, Iowa State University

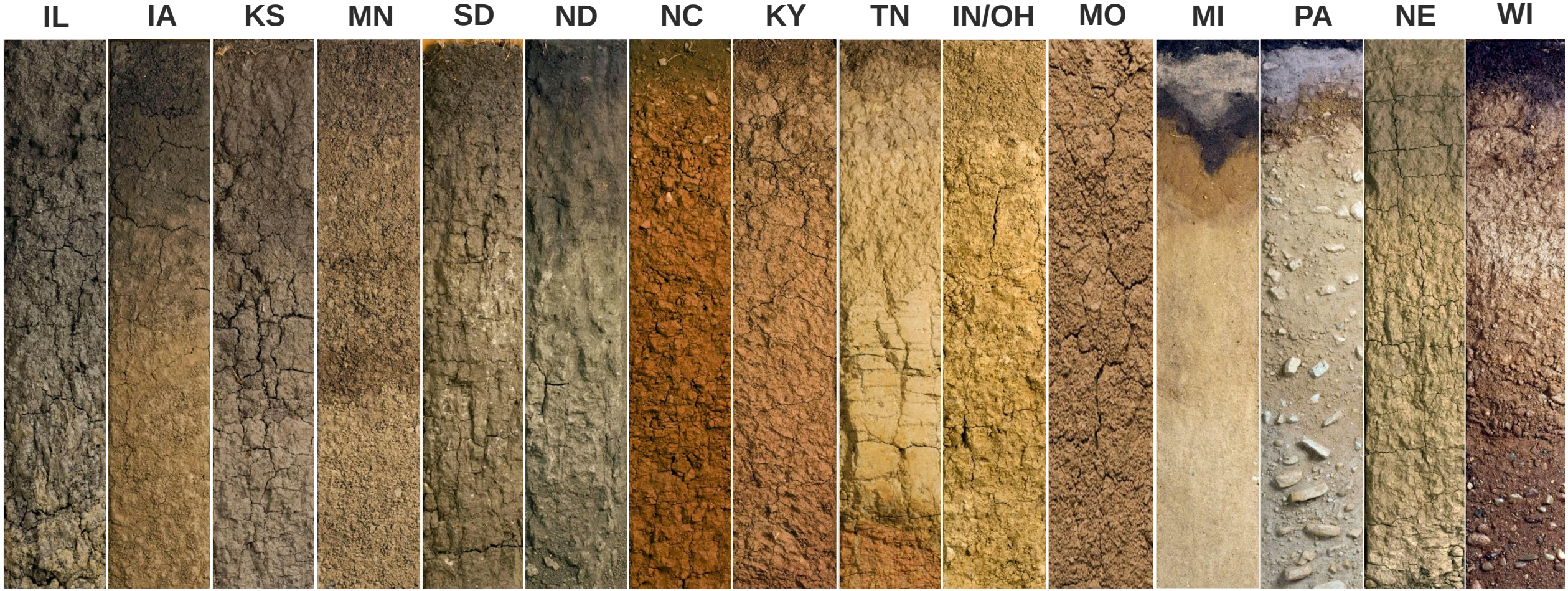
RADICLE AGRONOMICS

Impact of State on 2-year P_2O_5 and K_2O Fertilizer Costs/1000 acres

175 bu/acre corn and 60 bu/acre soybean: $0.50/lb for P_2O_5 and K_2O



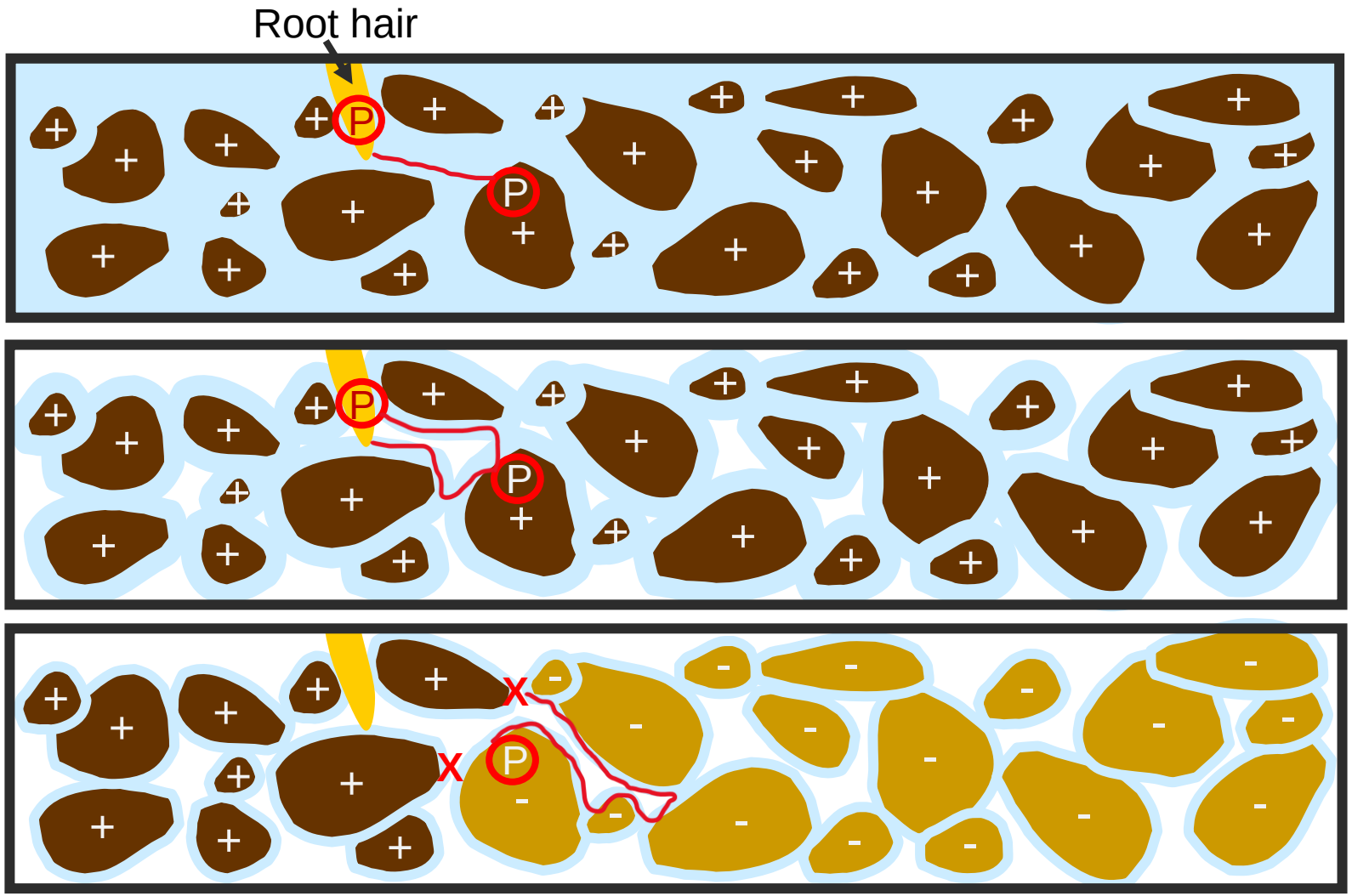
Soils Vary



https://www.soils4teachers.org/state-soils

RADICLE AGRONOMICS

Soil Moisture/Topography Impacts Nutrient Availability



Nutrient Management Cycle

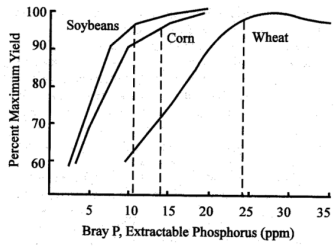
Soil Sampling

Soil Analysis





Crop Response



Application

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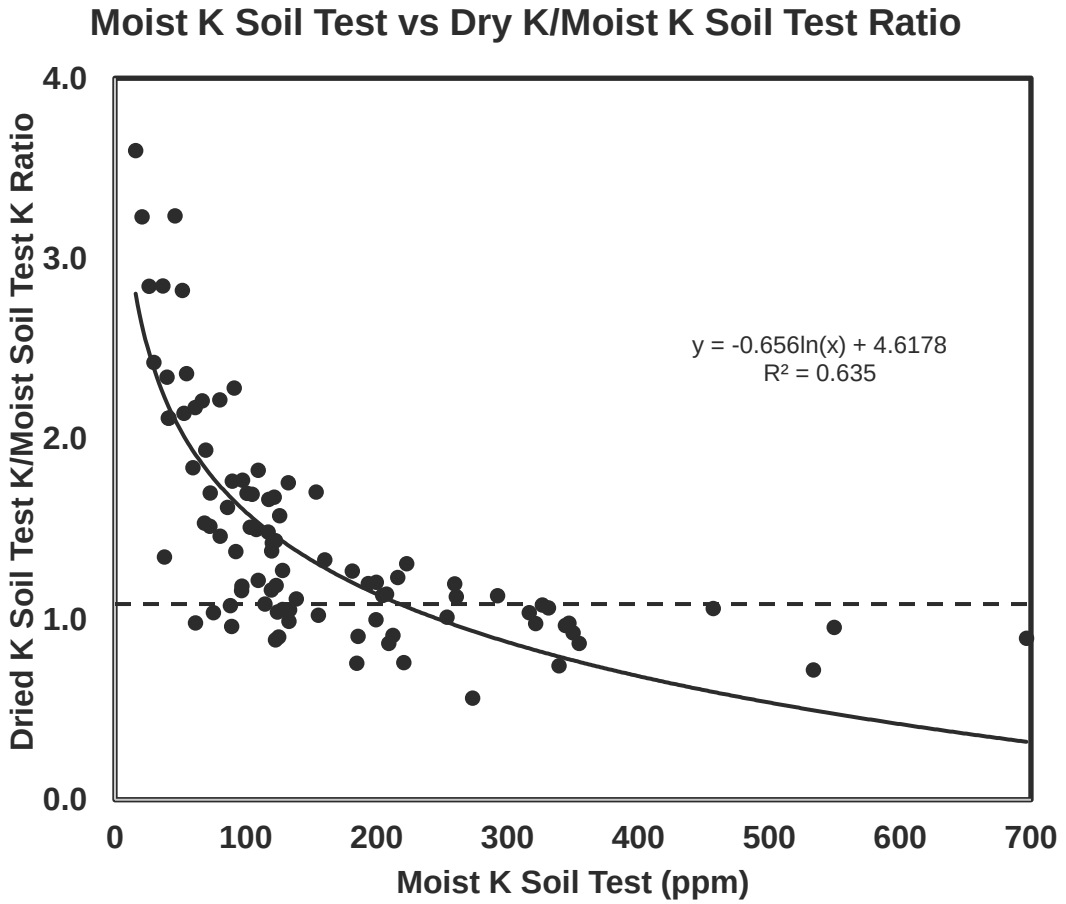
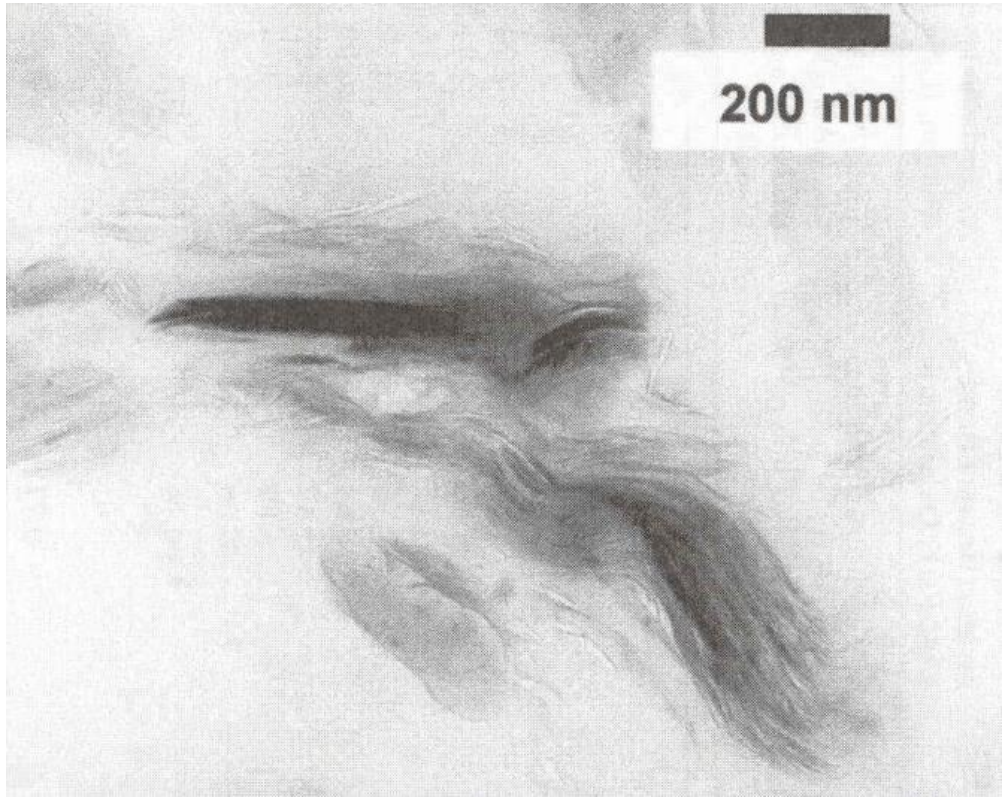
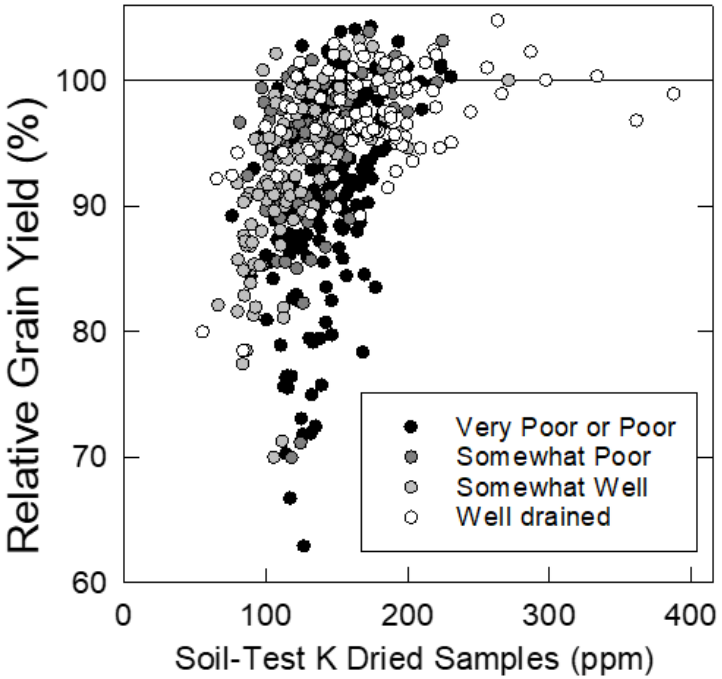
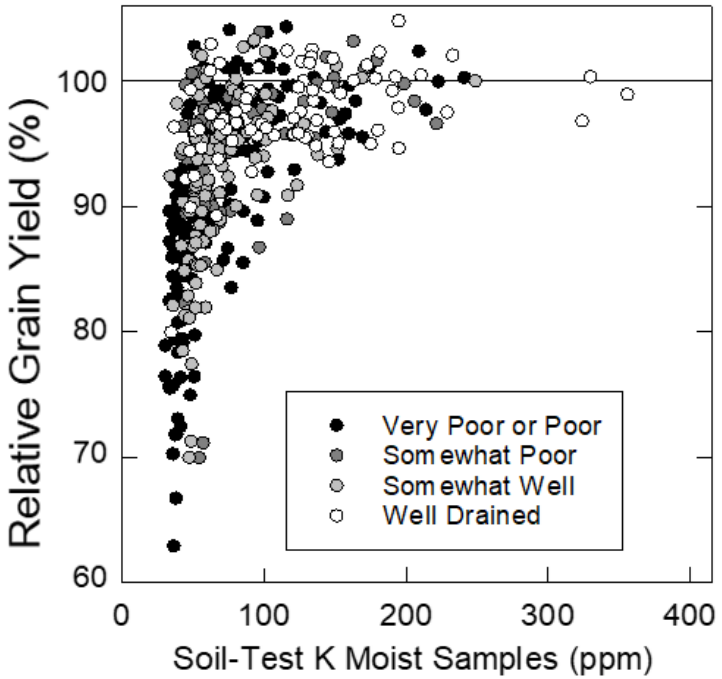
Why is potassium soil testing so challenging?

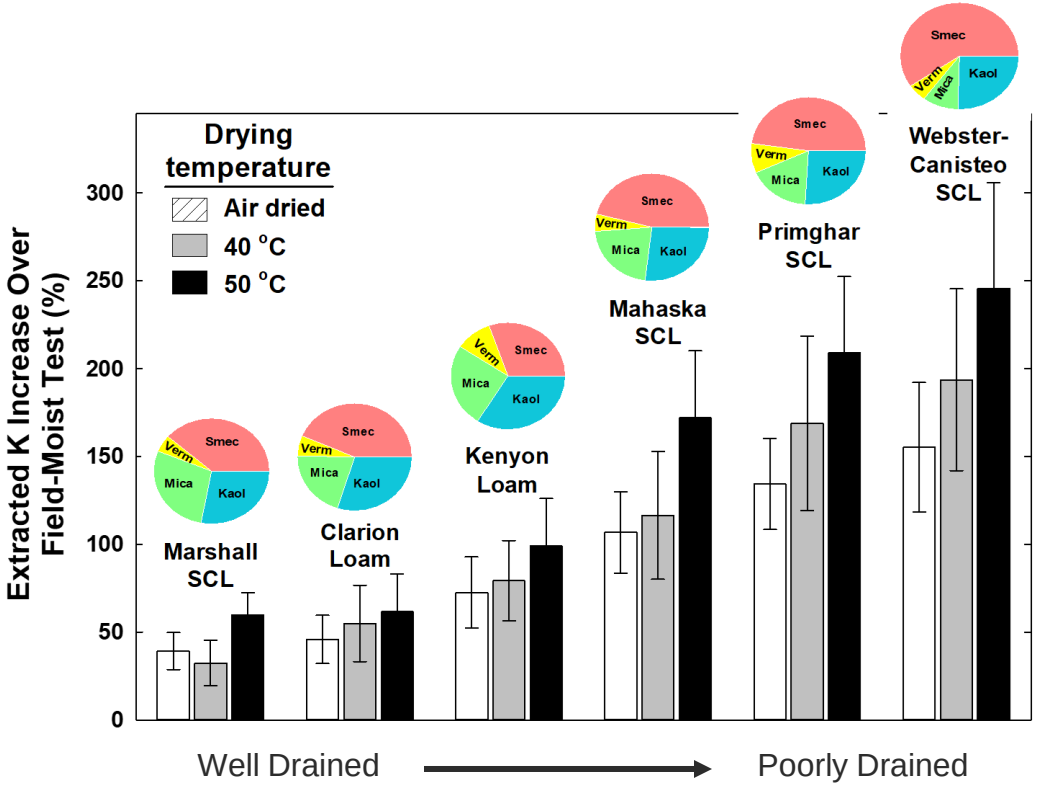




Why is it better to analyze a moist soil sample?







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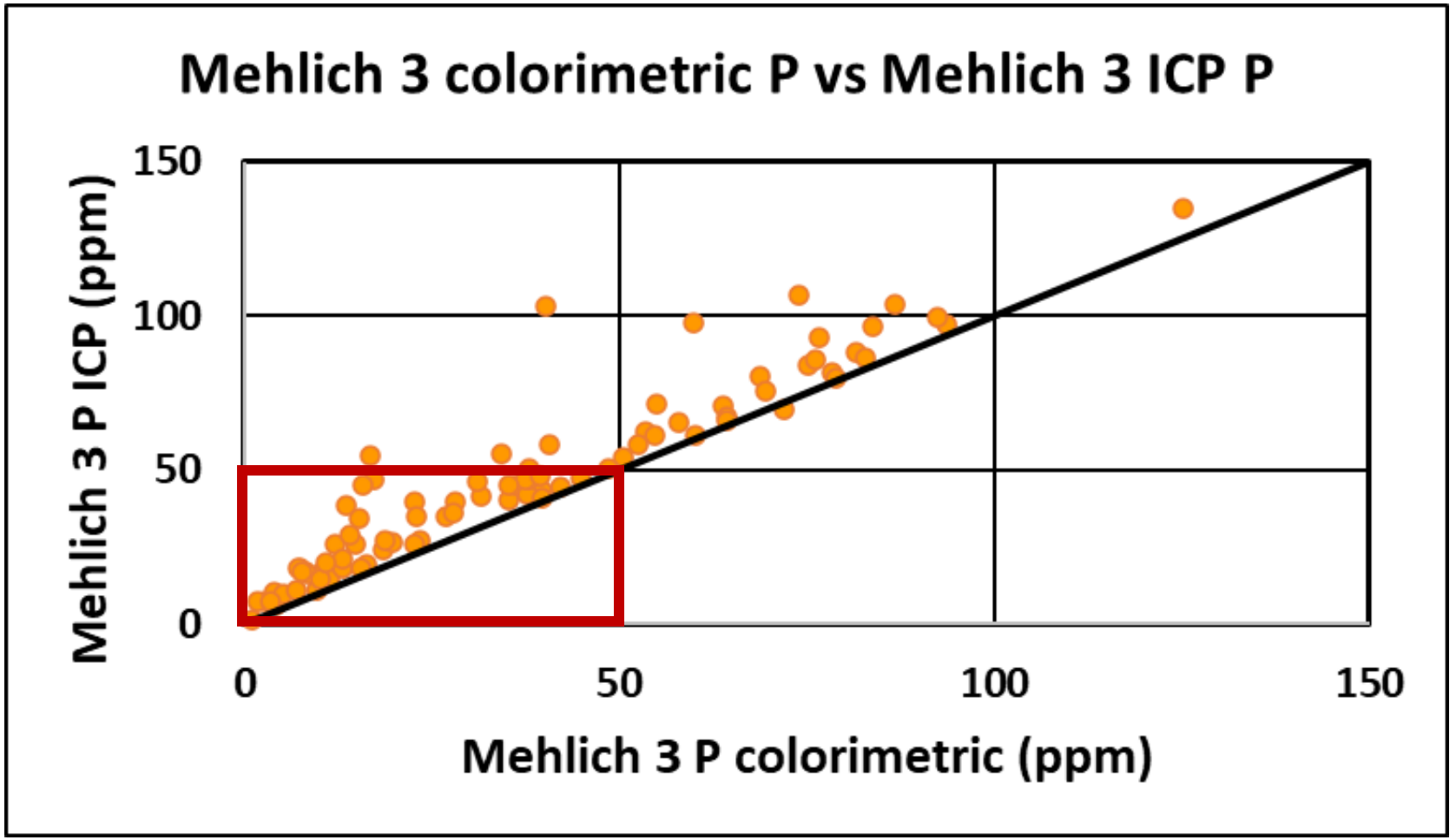
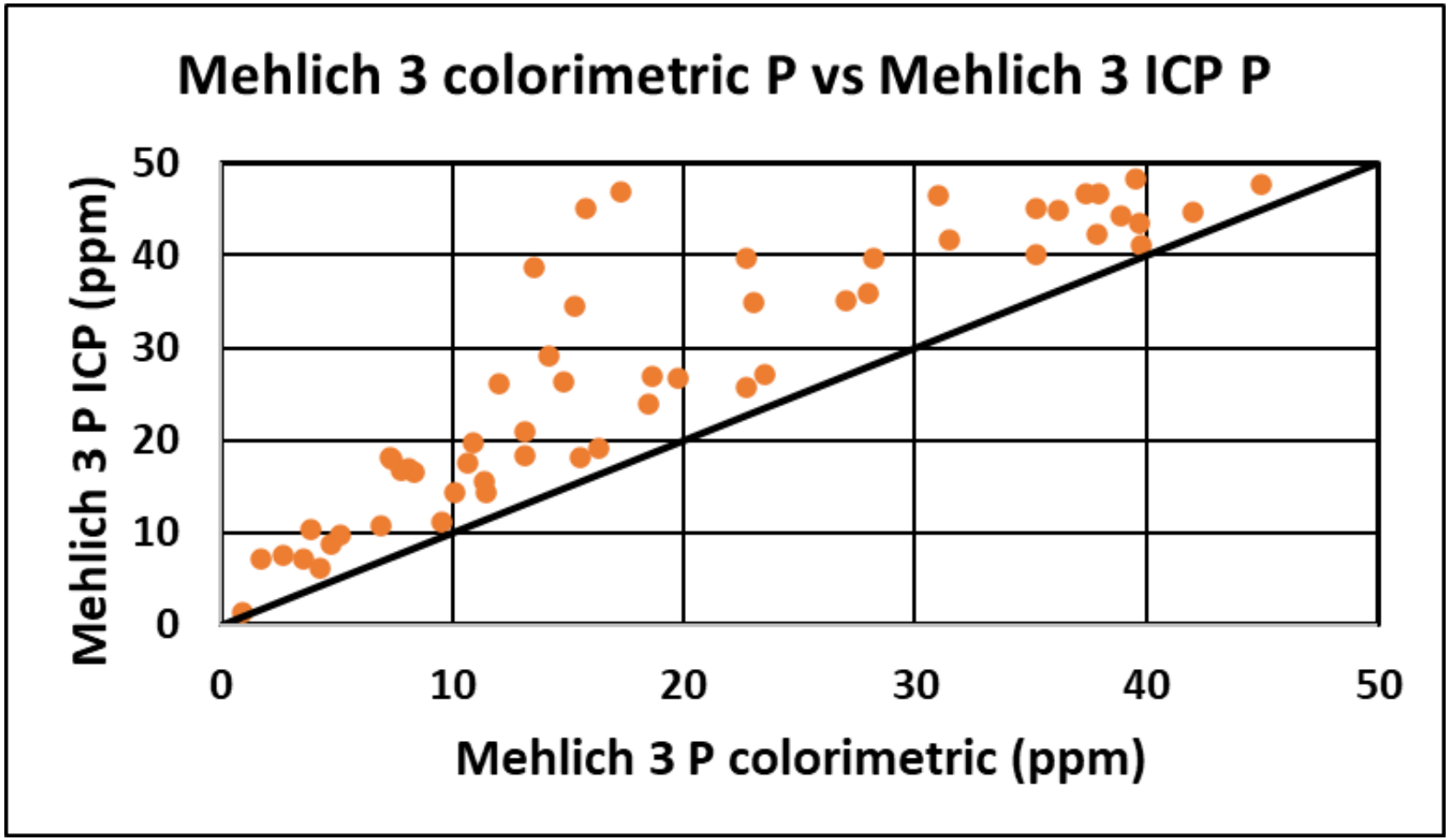
RADICLE AGRONOMICS

Inorganic P or total P: Which is better?



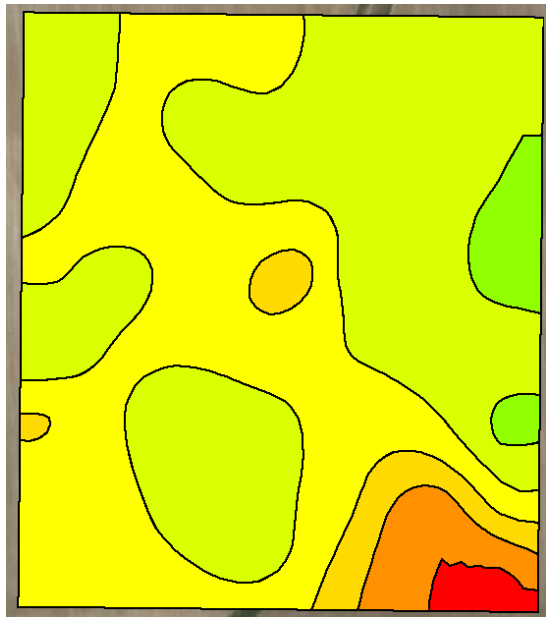
Inorganic P or total P: Which is better?



Lab Variability Impacts Farmers Financially

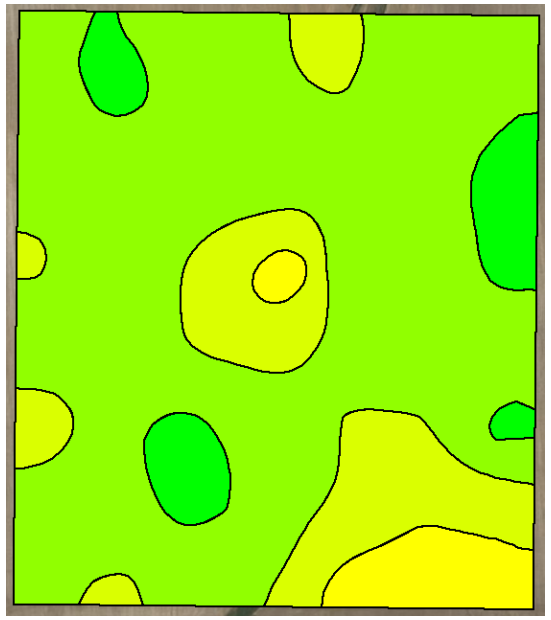
2-year P and K costs using IL Agronomy handbook, 215 bu corn, 65 bu soy, DAP @ $630, KCl @ $475

PP Chemistry Lab



Total: $230/acre

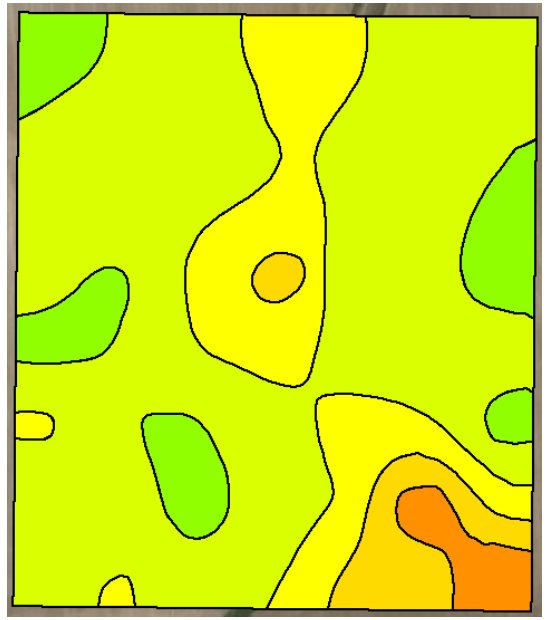
Lab 1



Total: $296/acre

$65/acre more

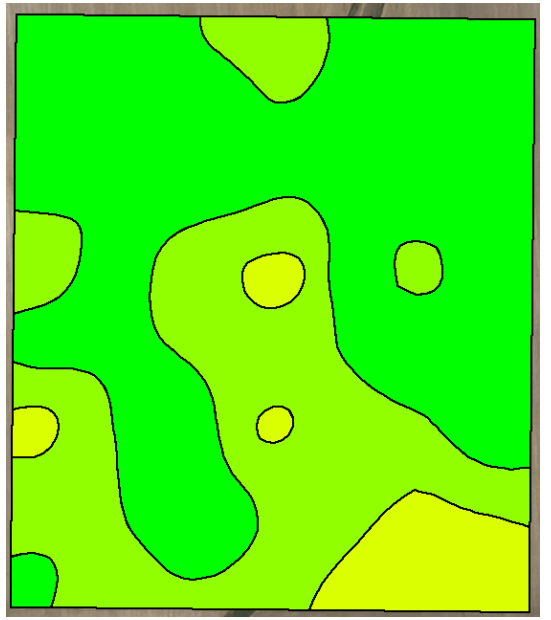
Lab 2



Total: $246/acre

$16/acre more

Lab 3



Total: $325/acre

$95/acre more

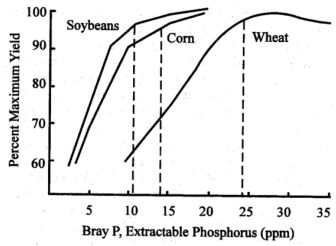
Which One is Right?

Nutrient Management Cycle

Soil Sampling

Soil Analysis

Crop Response



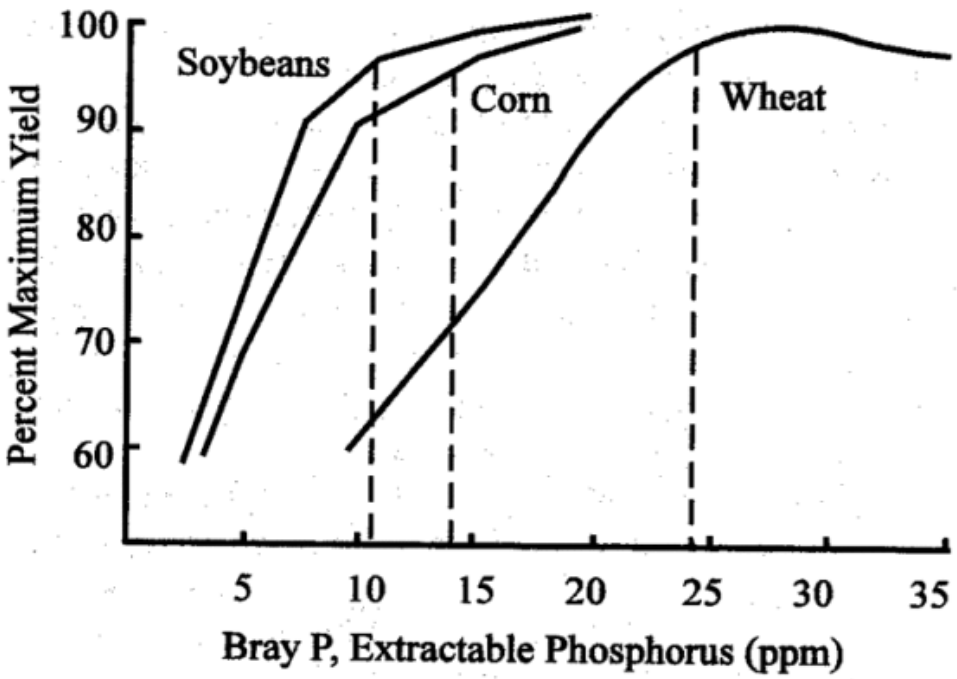
Application

RADICLE AGRONOMICS

“It’s the Best We’ve Got”

“It’s Not Good Enough”

Crop Response Must Be Tied to a Lab



A Repeatable Lab ⟷ Crop Response

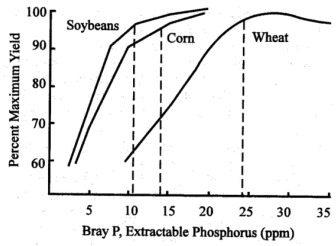
Nutrient Management Cycle

Soil Sampling

Soil Analysis

Application

Crop Response



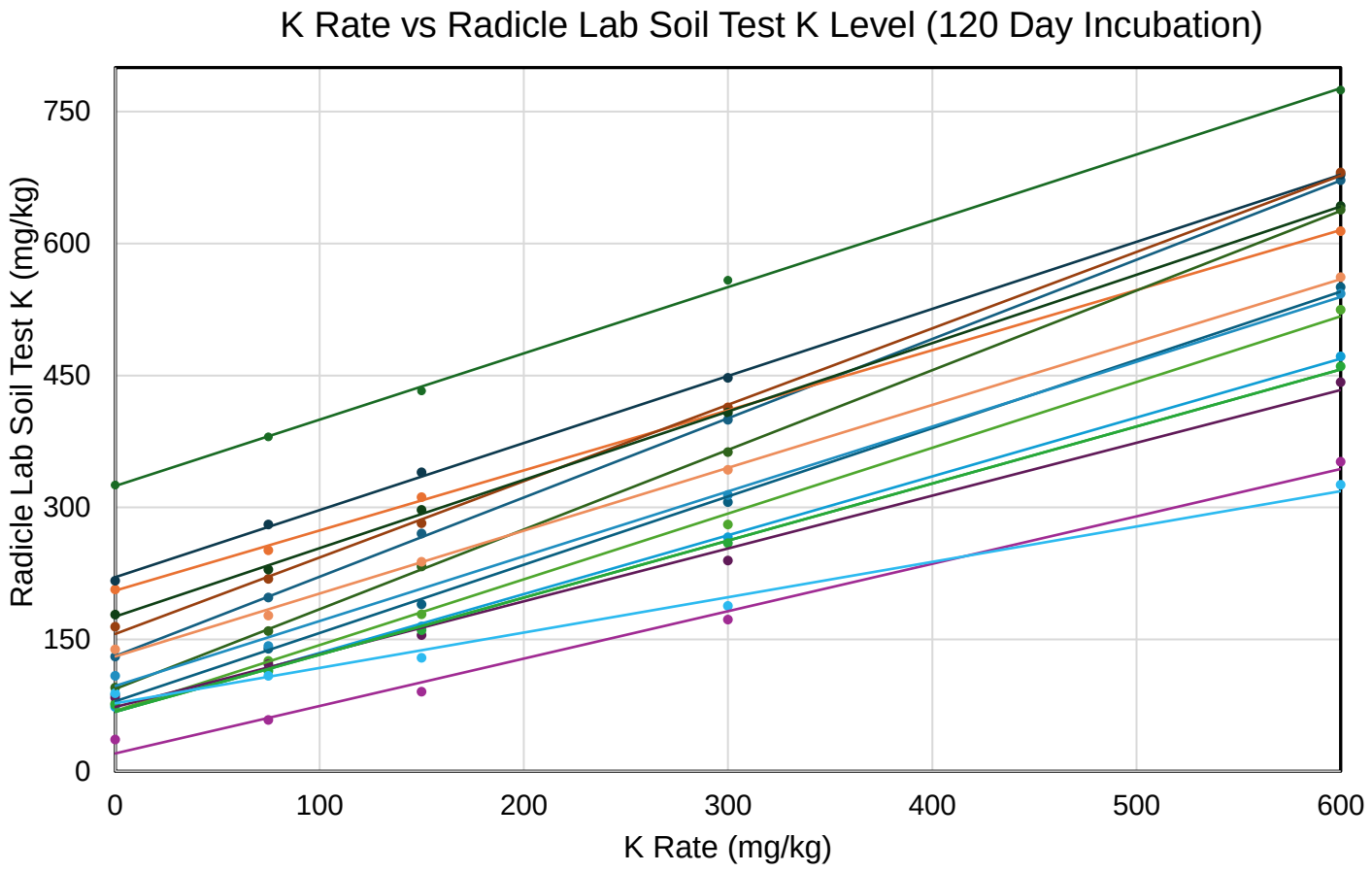
Radicle Agronomics Chemistry Laboratory

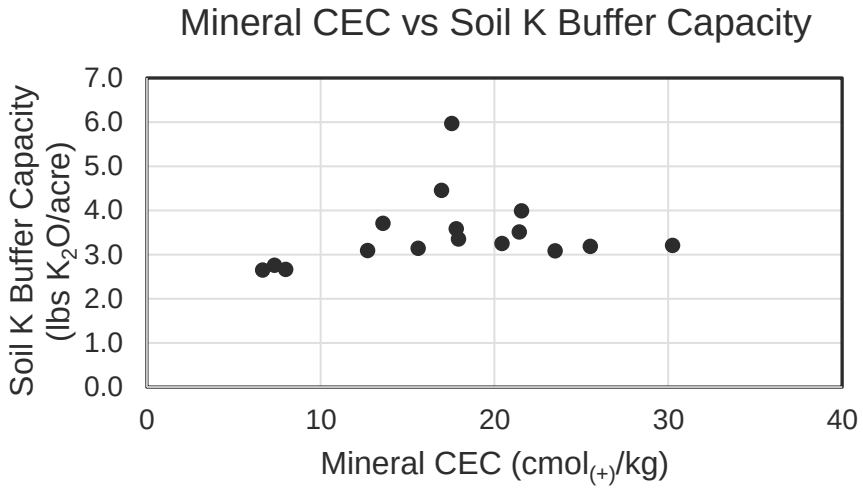
Radicle Agronomics Greenhouse

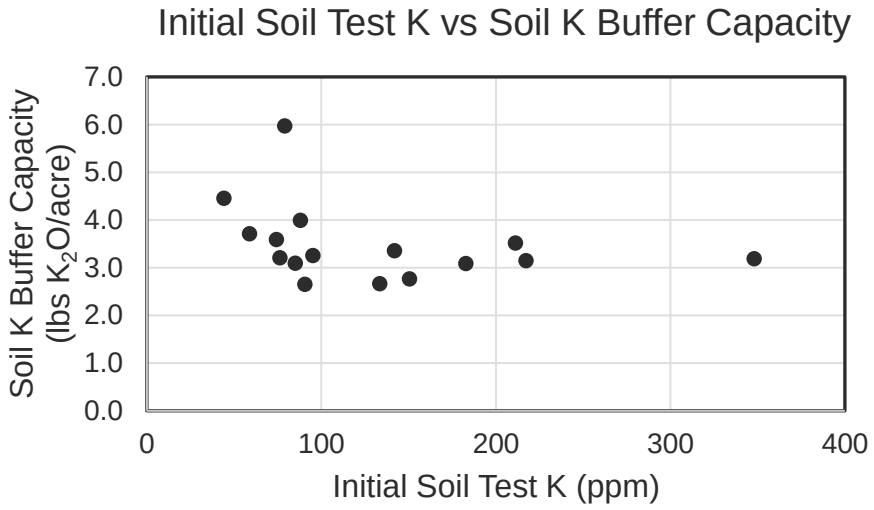
P deficiency

K deficiency

Radicle Agronomics Soil K Incubation Trial Results







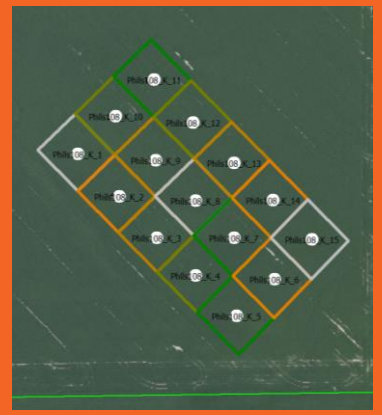
RADICLE AGRONOMICS

Radicle Agronomics Crop Response Trial Efforts

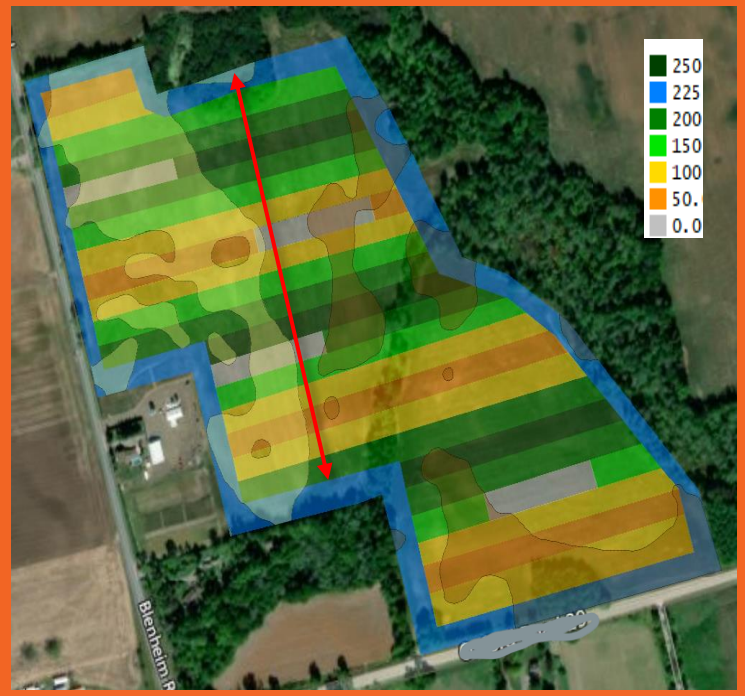
Greenhouse

Small Plots

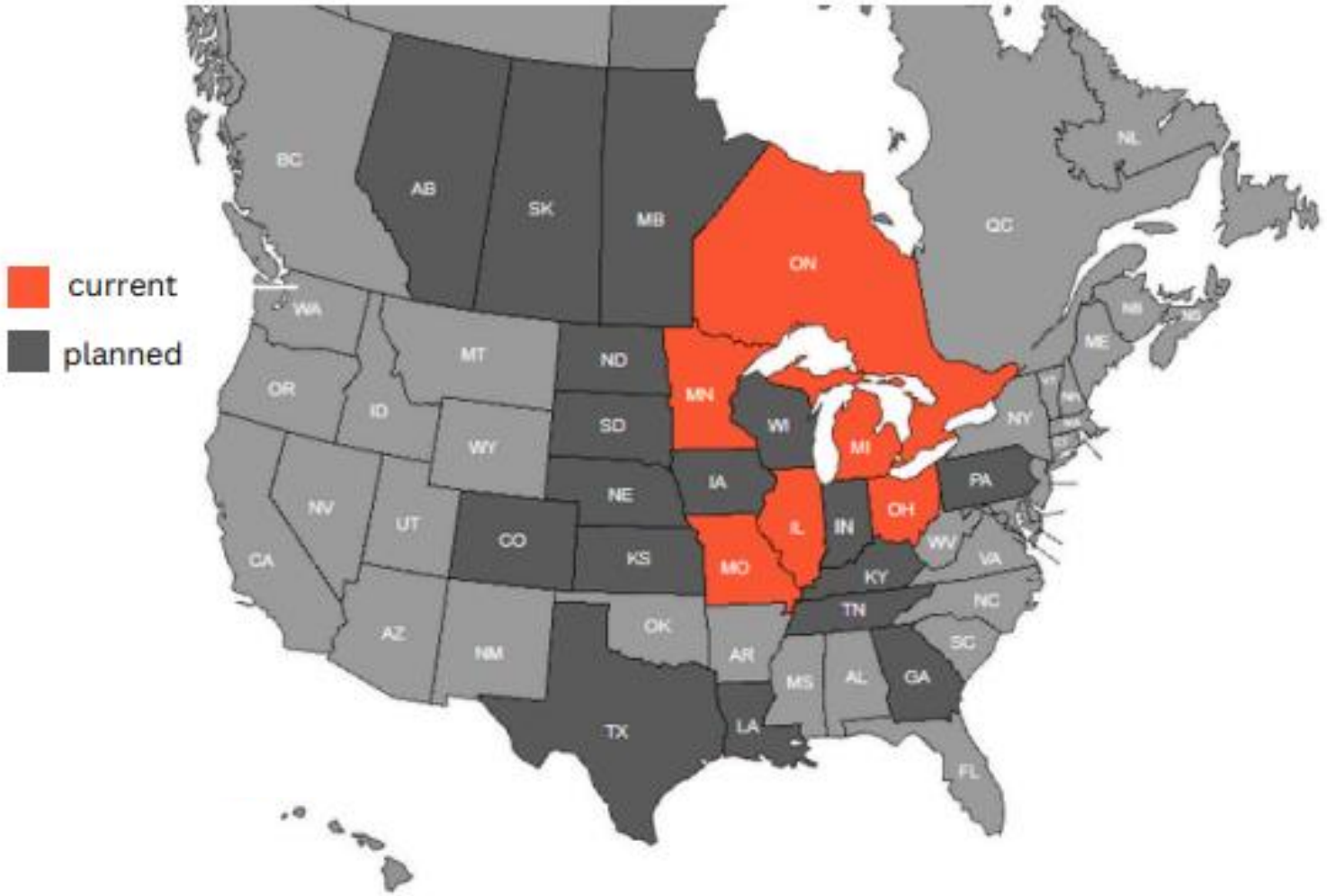
Generation 1



Generation 2



Radicle Agronomics Field Trials



Radicle Agronomics Soil Library

Radicle Agronomics Fertility Resource Center

- Sampling Strategies
- Management Zones
- Layer Evaluations
- P and K impacts on Tissue
- Weather Impacts

RADICLE AGRONOMICS™

- Soil Type Specific Response
- Soil Specific Ideal soil test values
- Seasonal Soil Test Values
- Fertility Systems
- Application Method
- Product Specific
- Geographic Response

Nutrient Management Cycle

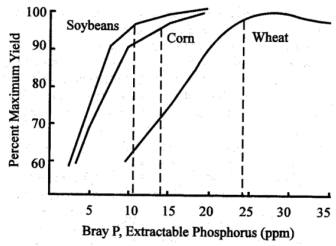
Soil Sampling

Soil Analysis





Crop Response



Application

RADICLE AGRONOMICS

RADICLE AGRONOMICS™

GEOPRESS™

RADICLE LAB™

RADICLE


SURFACE
SUBSOIL
GROWER
SAMPLE ID:
Fill bag to within red band
ag123st


SURFACE
SUBSOIL
GROWER
SAMPLE ID:
Fill bag to within red band
163L7I
southwest
corner @
4' to E


SURFACE
SUBSOIL
GROWER
SAMPLE ID:
Fill bag to within red band

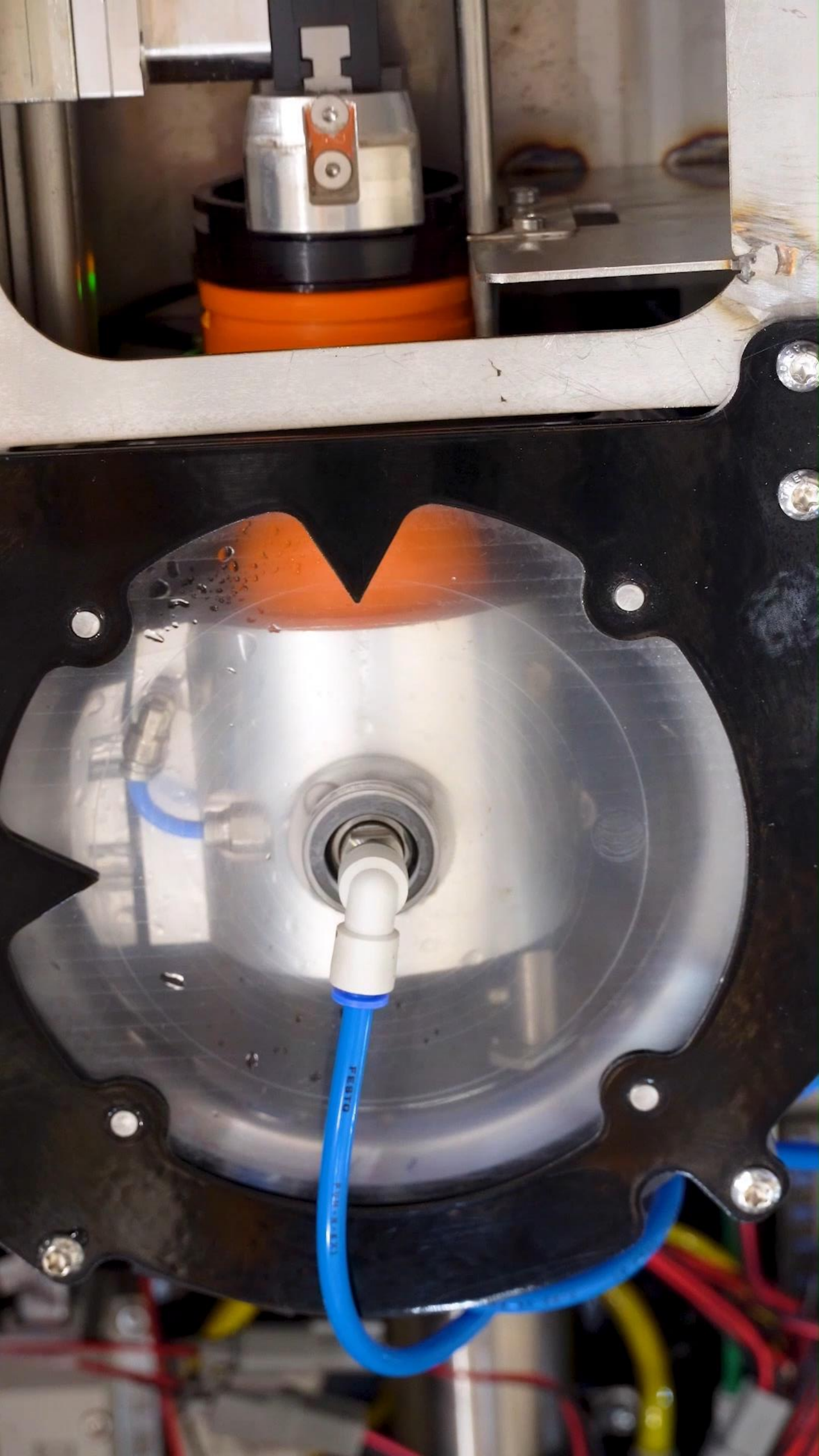
GEOTUBE™

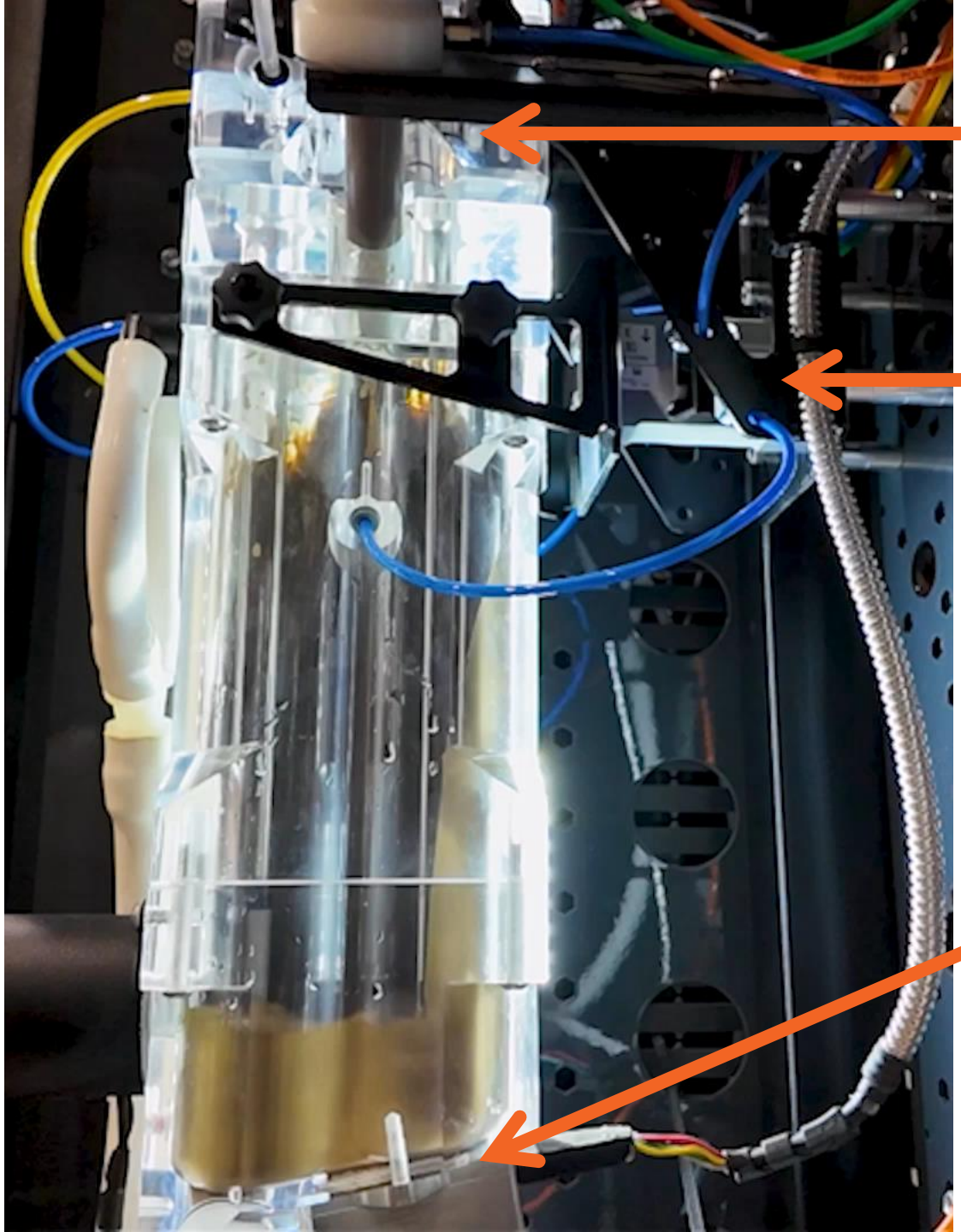
RADICLE AGRONOMICS

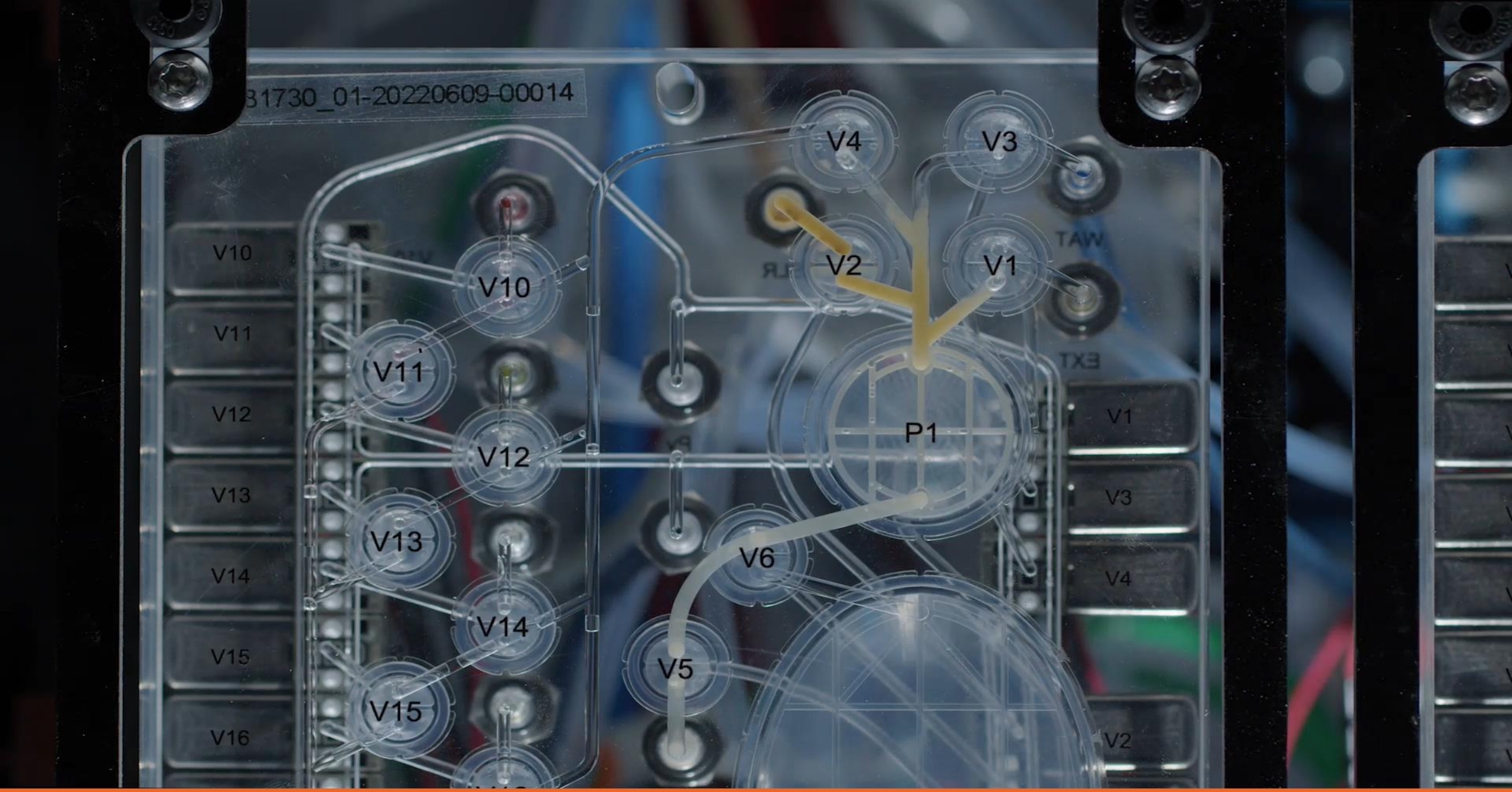
GEOPRESS™

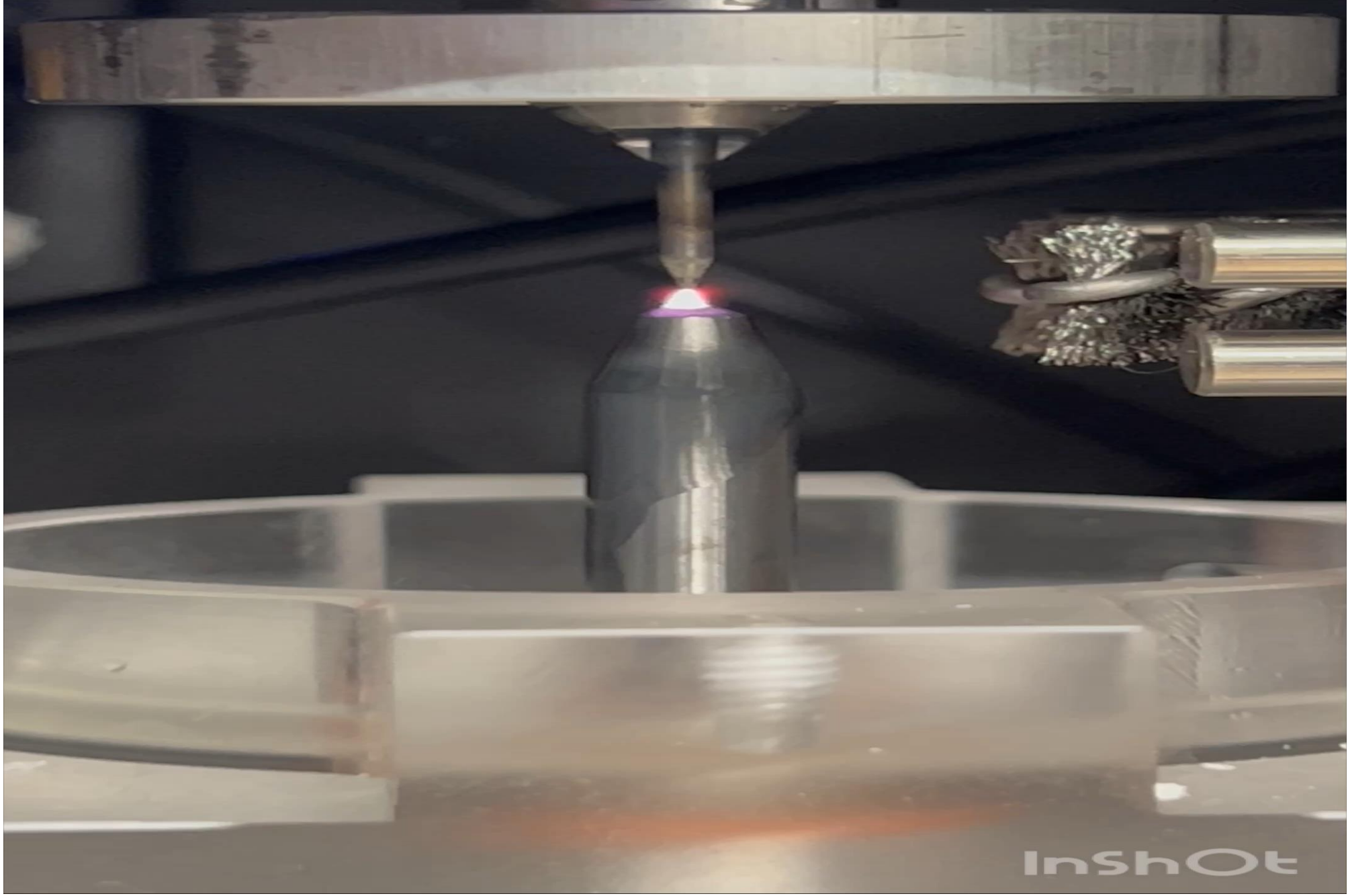

GEOPRESS
Traditional

RADICLE LAB™


FESTO


Volume Sensor
Weight Sensor
Soil Density Sensor


V4
V3
V2
V1
V10
V11
V12
V13
V14
V15
V16
P1
V6
V5
V10
V11
V12
V13
V14
V15
V1
V3
V4
V2


InShOt

Current Analytical Advantages of Radicle Labs

- Moist soil analysis
- Consistent sample mass
- Entire Geotube subsampled for analysis
- Consistent and precise chemical additions, extraction times, and filtering times
- Measure pH in 0.01M $CaCl_2$
- Measure P colorimetrically

Radicle Labs are clones with little lab to lab or within lab variability

Current Analytical Disadvantages of Radicle Labs

Premium analysis

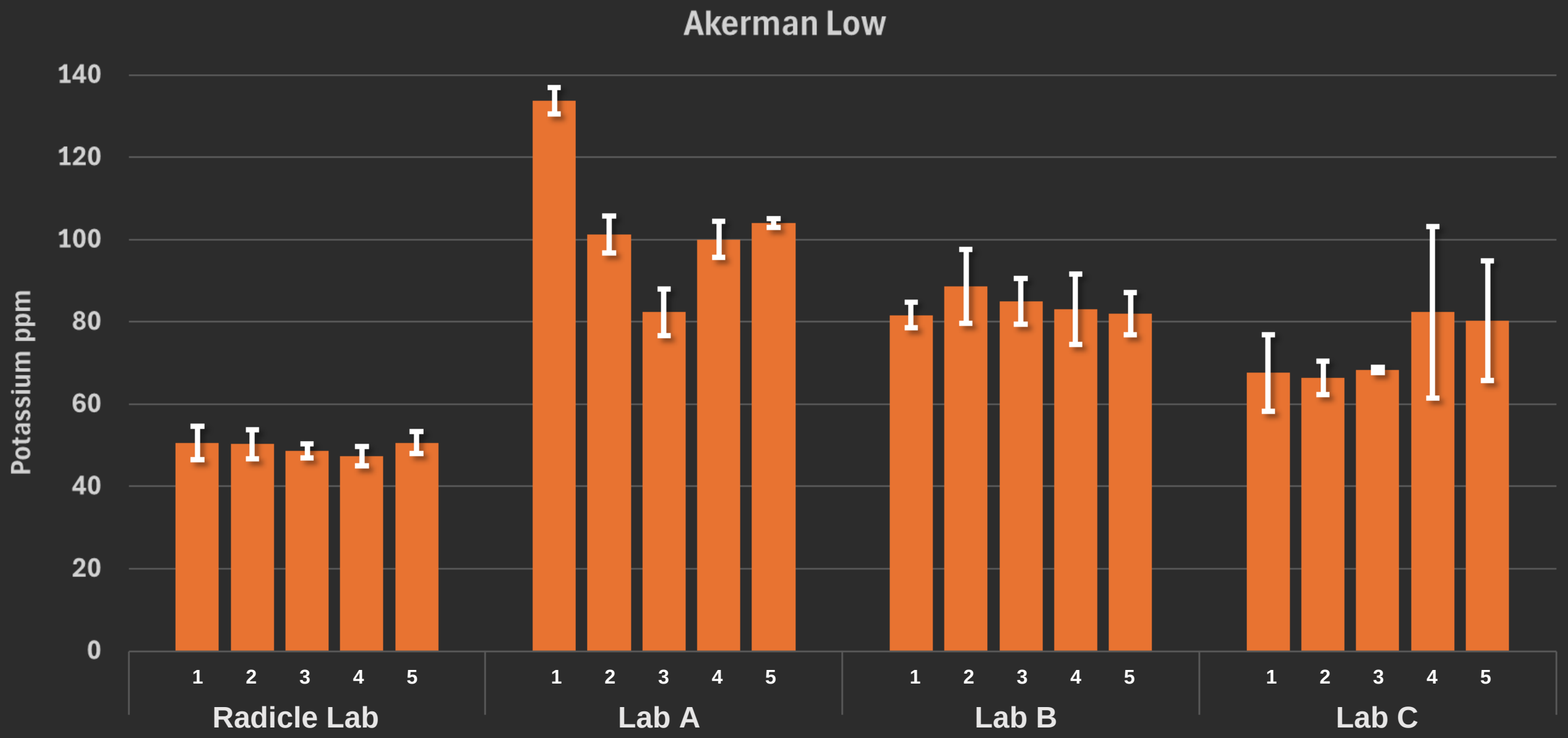
Do not measure:

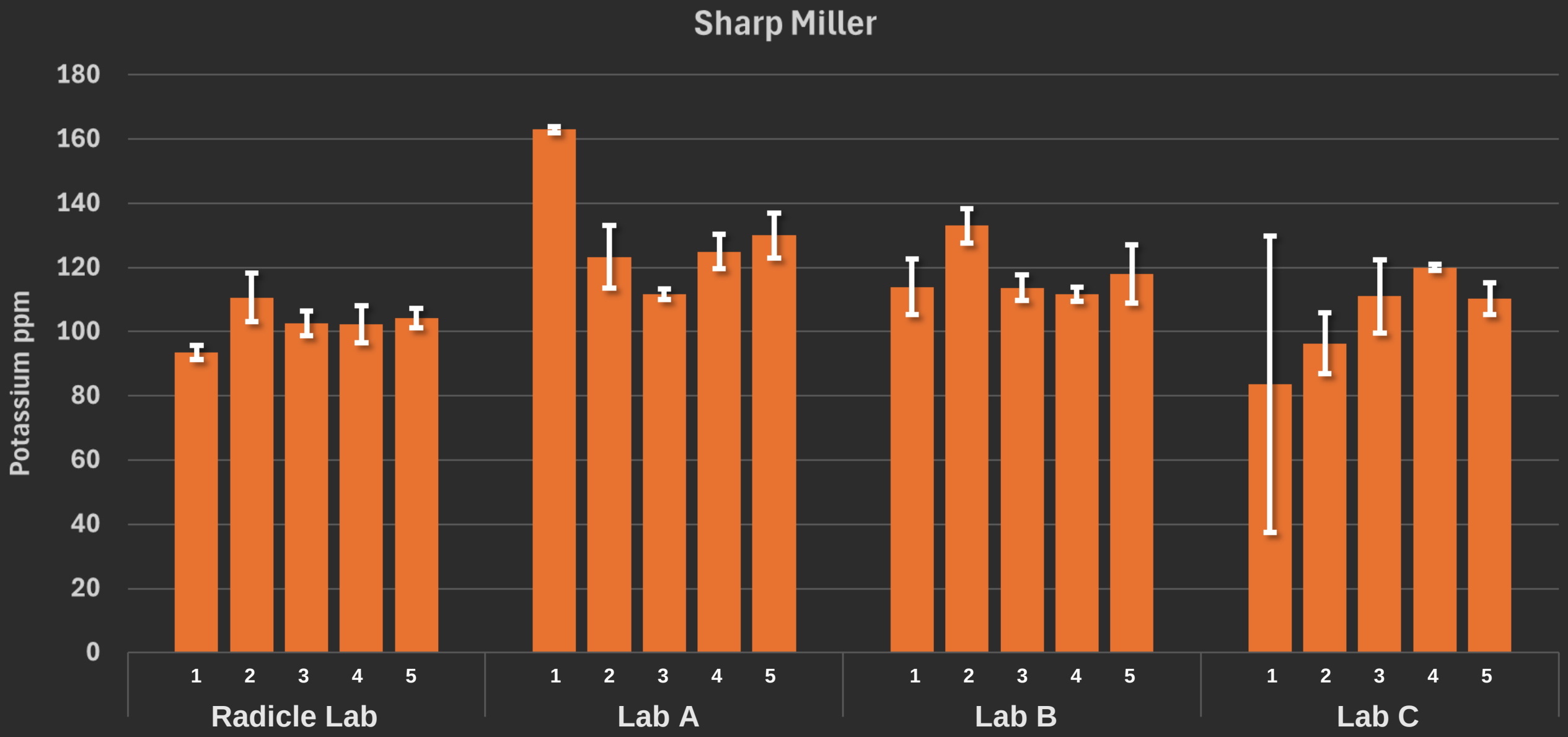
- Organic matter
- Nitrate or ammonium
- Micronutrients
- Soil texture
- Soil health metrics
- No plant analysis

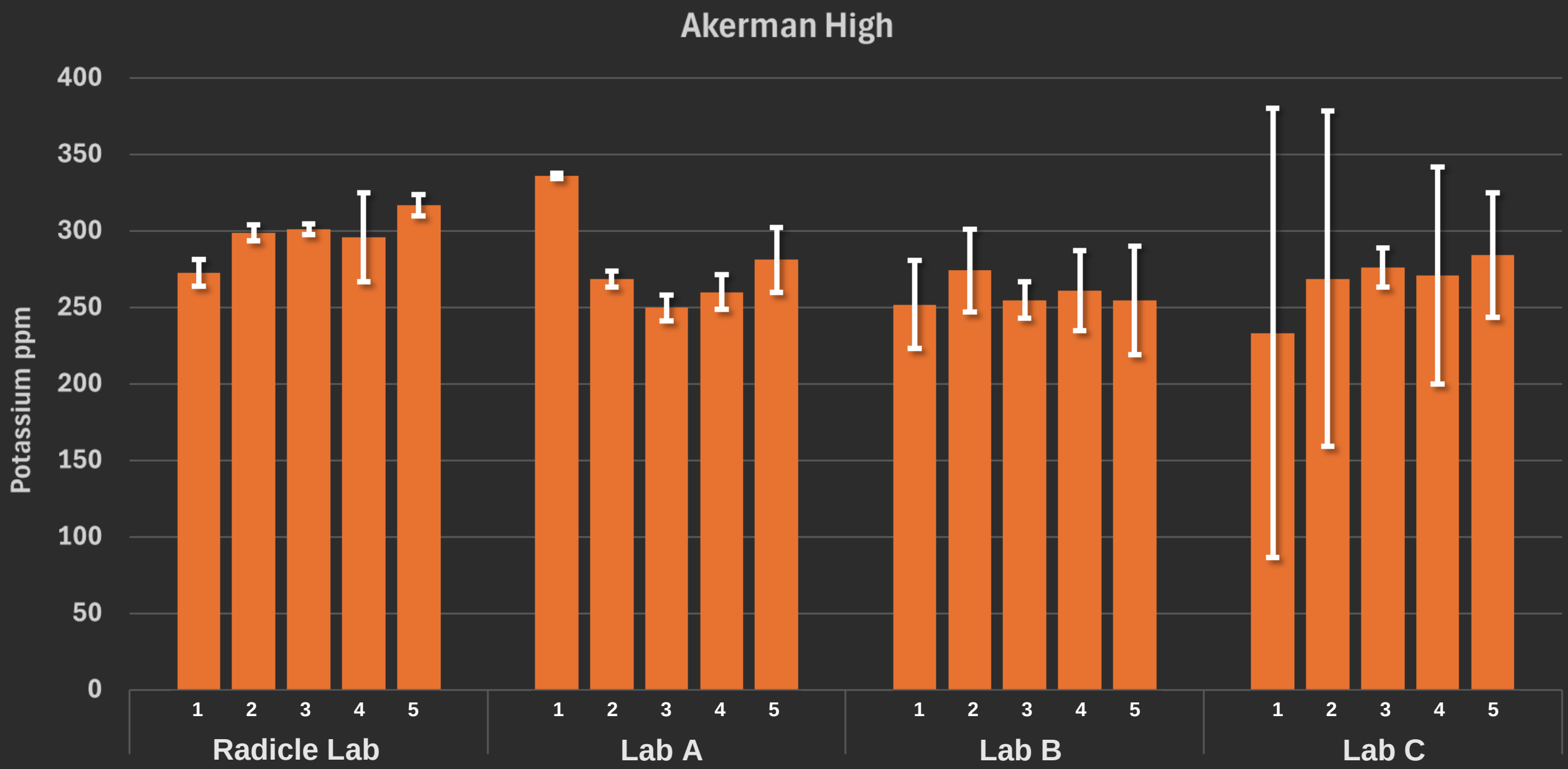
RADICLE AGRONOMICS™

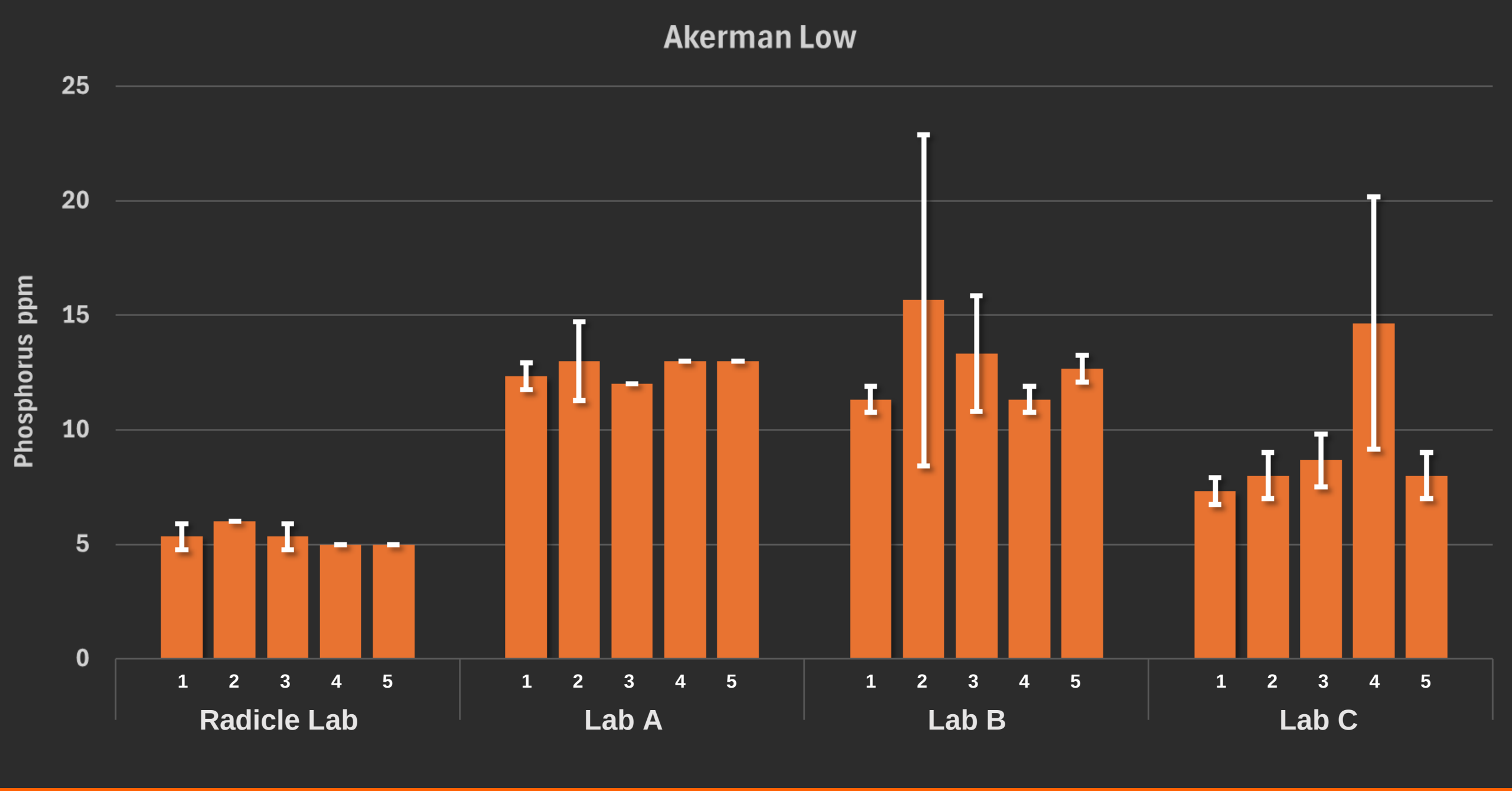
We are happy to discuss potential collaboration!

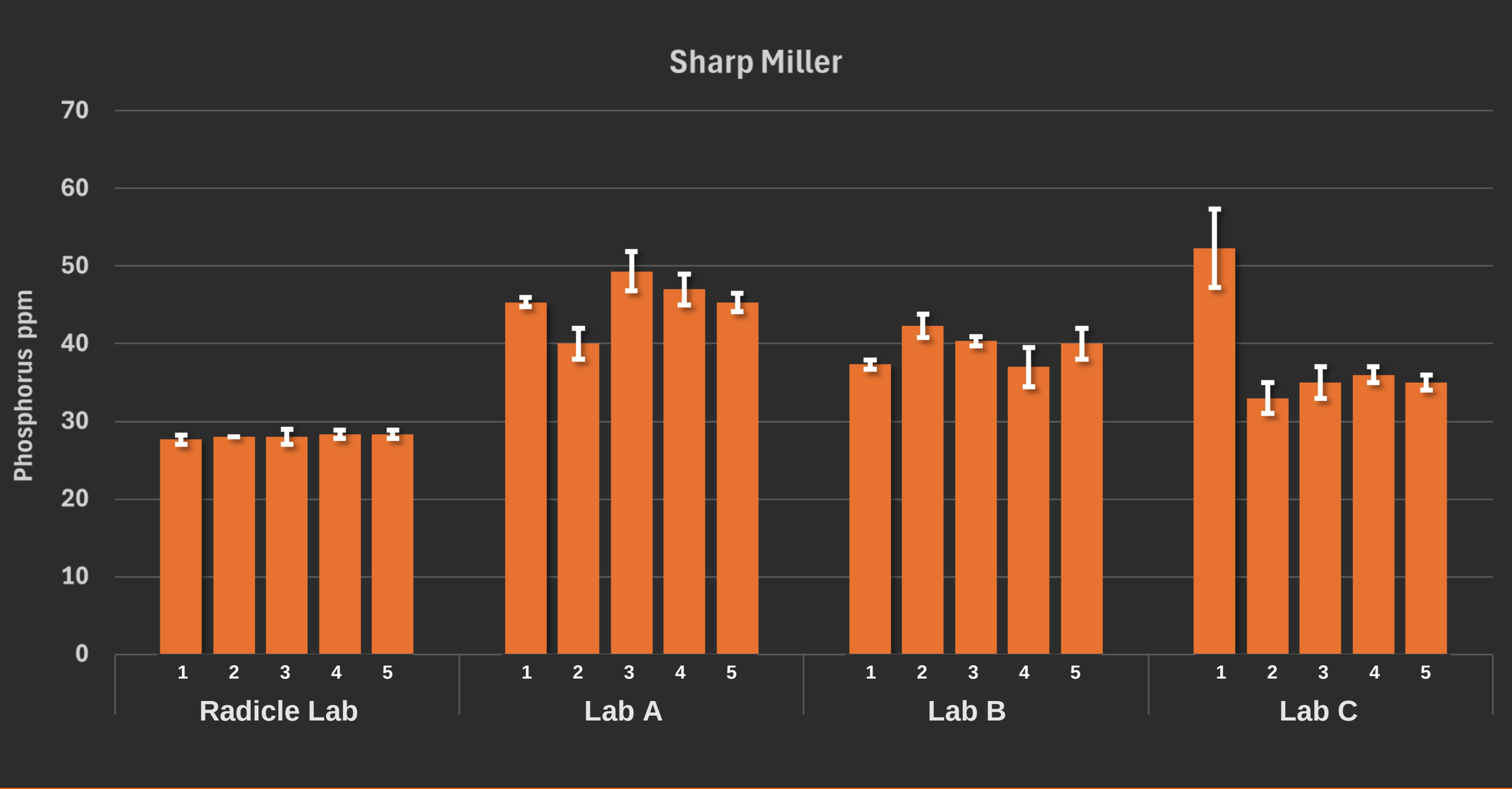
2024 Repeatability Study


Akerman Low
Potassium ppm
140
120
100
80
60
40
20
0
1 2 3 4 5
Radicle Lab
1 2 3 4 5
Lab A
1 2 3 4 5
Lab B
1 2 3 4 5
Lab C


Sharp Miller
Potassium ppm
180
160
140
120
100
80
60
40
20
0
1 2 3 4 5
Radicle Lab
1 2 3 4 5
Lab A
1 2 3 4 5
Lab B
1 2 3 4 5
Lab C


Akerman High
Potassium ppm
400
350
300
250
200
150
100
50
0
1 2 3 4 5
Radicle Lab
1 2 3 4 5
Lab A
1 2 3 4 5
Lab B
1 2 3 4 5
Lab C


Akerman Low
Phosphorus ppm
25
20
15
10
5
0
1 2 3 4 5
Radicle Lab
1 2 3 4 5
Lab A
1 2 3 4 5
Lab B
1 2 3 4 5
Lab C


Sharp Miller
Phosphorus ppm
70
60
50
40
30
20
10
0
1 2 3 4 5
Radicle Lab
1 2 3 4 5
Lab A
1 2 3 4 5
Lab B
1 2 3 4 5
Lab C