



INTEGRATION OF SOIL TESTING AND PRECISION TECHNOLOGY



**SOUTH DAKOTA
STATE UNIVERSITY**
*College of Agriculture, Food
and Environmental Sciences*

NIC UILK

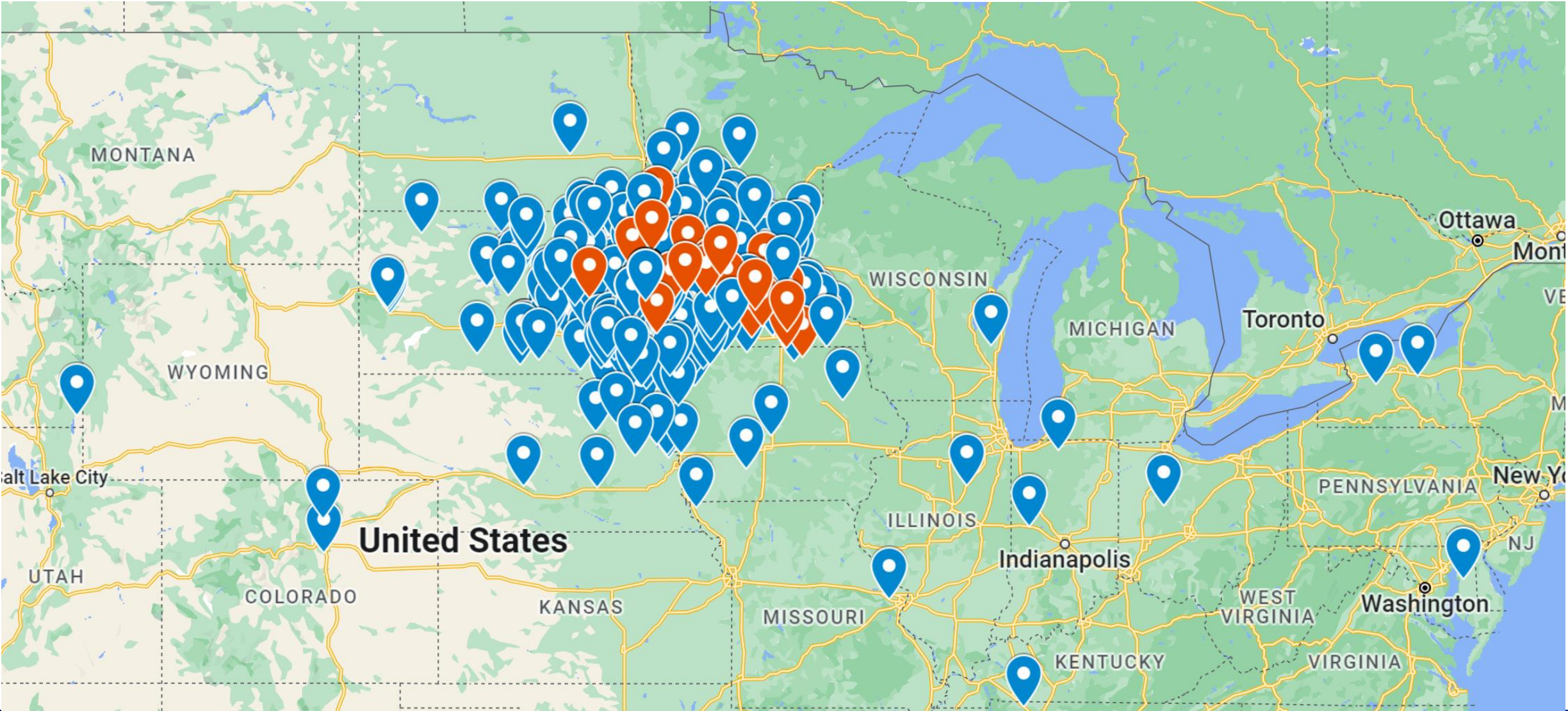
- Ag Systems Technology
 - Precision Ag Emphasis
 - Introduction To Precision Ag course
- Precision Ag Minor added
- Precision Ag major added
- Raven Precision Ag Center



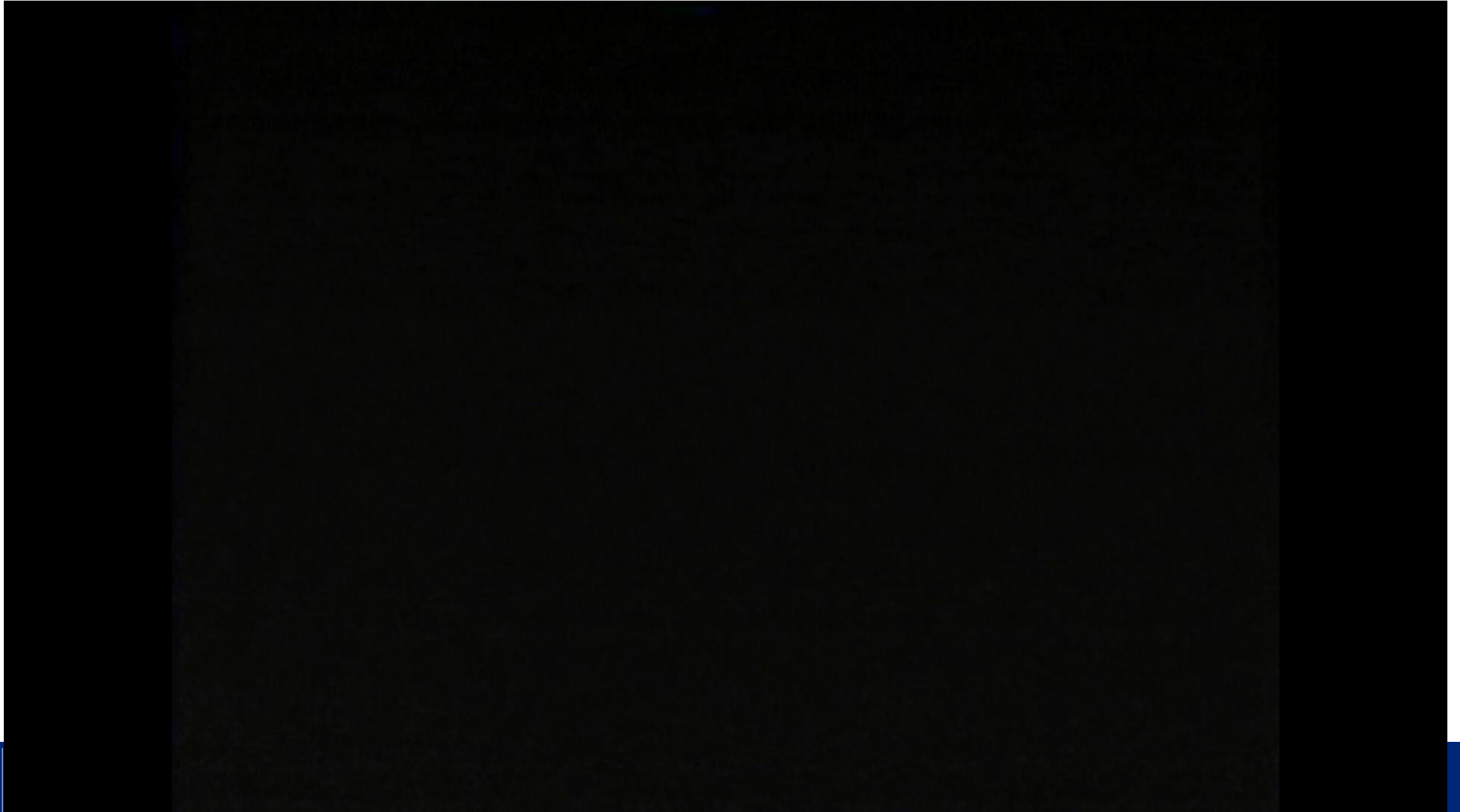
RAVEN PRECISION AG CENTER



MN @



PRECISION AG @ SDSU



INTEGRATION OF SOIL TESTING AND PRECISION TECHNOLOGY

- Integration of soil testing and precision technology
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-

THIS WAS A CHALLENGE!



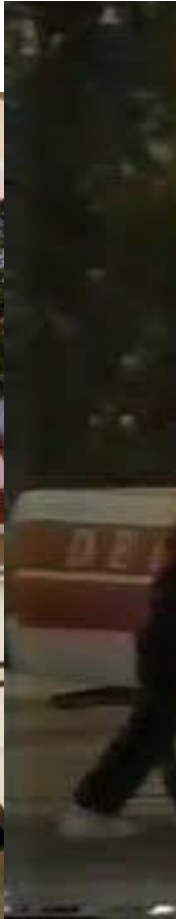
AG POWER TIMELINE



Case IH, Raven Launch Autonomous Spreader



FOOD DELIVERY TIMELINE



WHATS NEXT?



FARM DATA TIMELINE

Mon	1	Cash on hand	170
		1 Heavy rain storm Shed Cap and Mand	
		2 Tons Coal	
Tue	2	Attended Dredgers' Court at Paritans. Program File #16. Expenses	
Wed	3	Paid grocery bill at M Bill on file, p. 16	
Thurs	4	Bought mulch cow d 4 Attended concert of Jubilee Singers	
Fri	5	Sold calf to P.A. and 1 pair Shes	
Sat	6	Bought for cash 10 ^{1/2} 1 ^{1/2} , Ham	
	6	Went to Paritan implements	
Sun	7	Dr. E. Hamilton "Civic Honor"	
Tues	9	Shes for Ted	
			177 81,50



SOIL NUTRIENT TIMELINE



SOIL SAMPLING ADVANCEMENTS

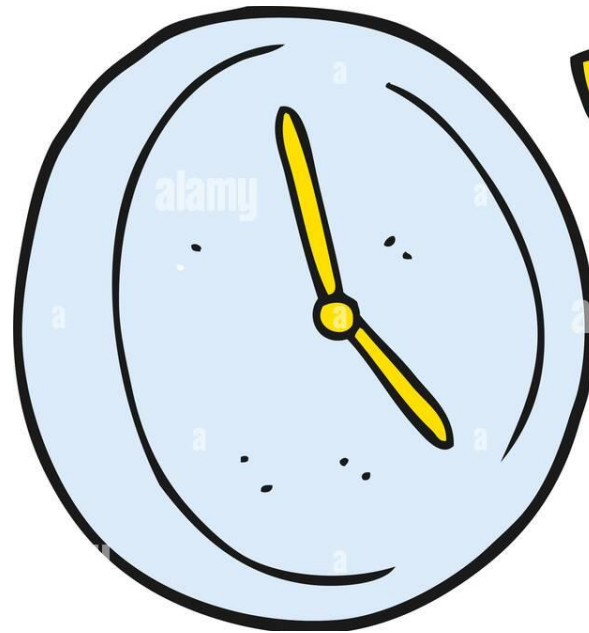


SOIL SAMPLING ADVANCEMENTS



AUTOMATED SAMPLING

- The obvious advantage...

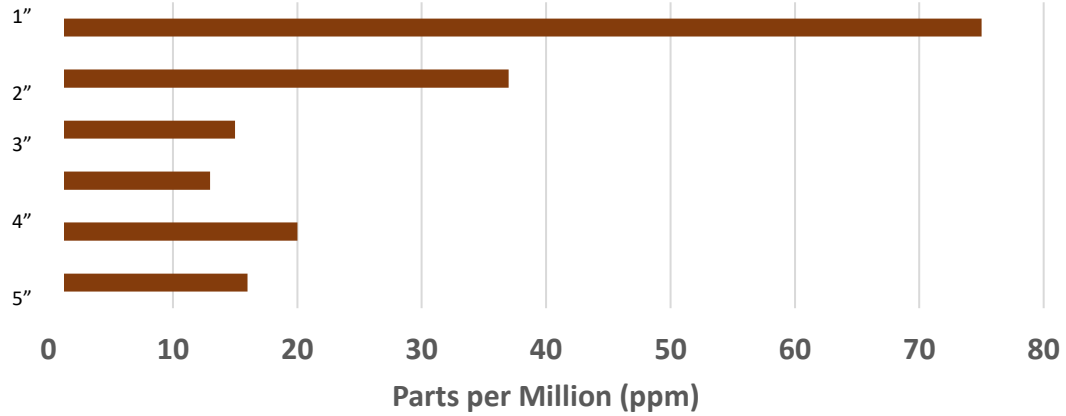


TICK.
TOCK!

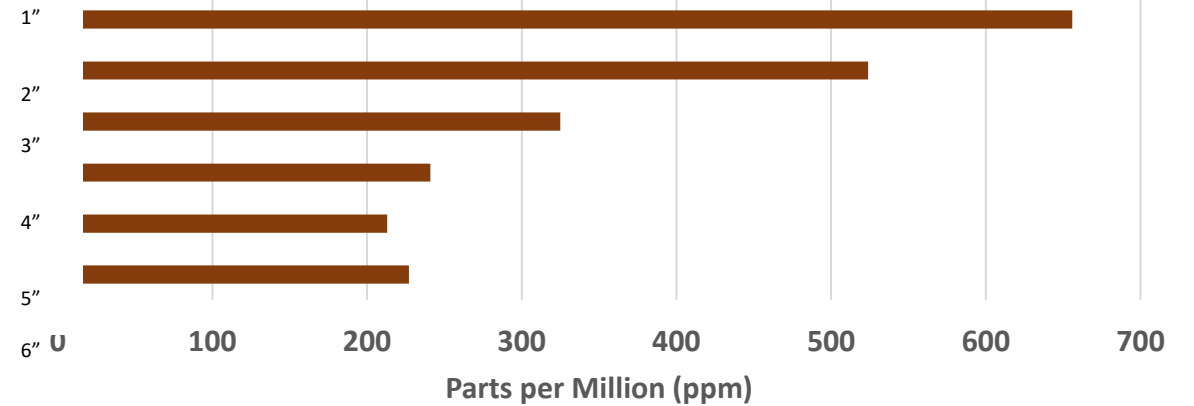


THE MAIN ADVANTAGE

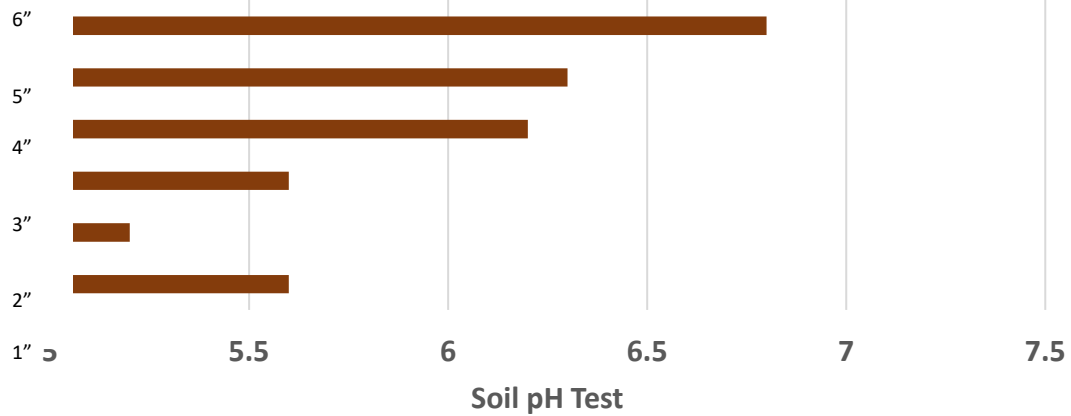
Olsen Phosphorus Test



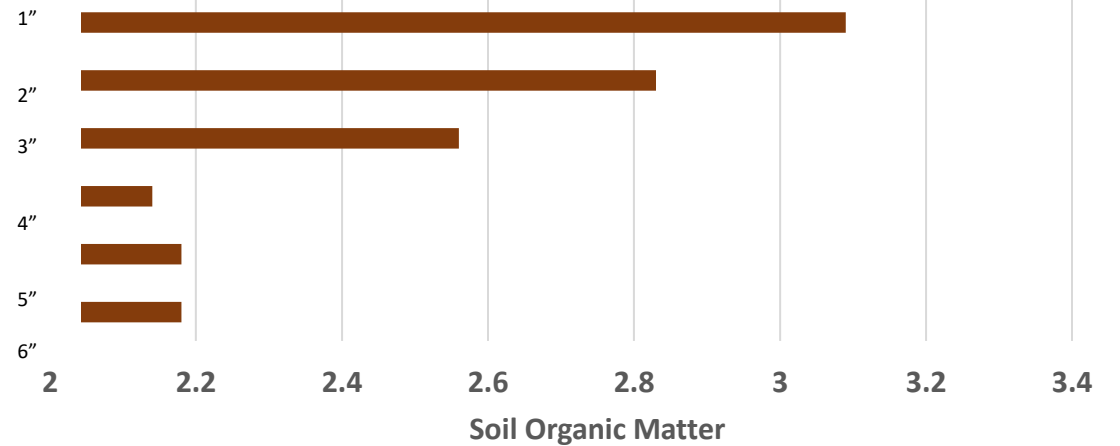
Potassium Test



pH Test



Organic Matter





SOIL SAMPLING PRAG 203L

64 students pull 64
points each
semester...



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*Every .5" of soil=
164,666 lbs of soil!*

Depth	Olsen P	Potassium	pH	Organic Matter
A	32	391	5.8	2.8
B	30.5	375	6	2.7
C	29.3	364	6.3	2.6
D	28	350	6.4	2.4
E	27	344	6.5	2.4

AUTOMATED SAMPLING REMOVES HUMAN ERROR

- Olsen P
 - 10 ppm
 - Cost: \$53/acre
 - 14 ppm
 - Cost: \$17.3/acre
 - Difference of \$46/acre

Yield goal 230 BPA, P cost \$0.90, using SD fertility recommendation guide



GRID SAMPLING ADOPTION HURDLES STILL EXIST



FARMER ADOPTION OF SERVICES

Table 2, Q11: Farmer use of precision technologies, market area estimated by retailers.

	2017	2019	2020	2021	2022
Guidance/Autosteer	60%	66%	66%	76%	69%
Yield Monitor	-	69%	65%	75%	68%
Sprayer Section Controllers	-	56%	62%	65%	63%
Grid or Zone Soil Sampling	45%	52%	52%	60%	57%
VRT Lime Application	40%	41%	44%	56%	52%

Data obtained from Purdue Precision Ag Adoption Survey

DEEPER LOOK AT PURDUE ADOPTION SURVEY

Table 2, Q11: Farmer use of precision technologies, market area estimated by retailers.

	2017	2019	2020	2021	2022
VRT Fertilizer Application	38%	39%	44%	51%	49%
VRT Lime Application	40%	41%	44%	56%	52%
Satellite or Aerial Imagery	19%	26%	31%	27%	31%
VRT Seeding	13%	19%	19%	23%	22%
Soil EC Mapping	9%	10%	14%	17%	19%
Wired or Wireless Sensor Networks	-	-	-	-	18%



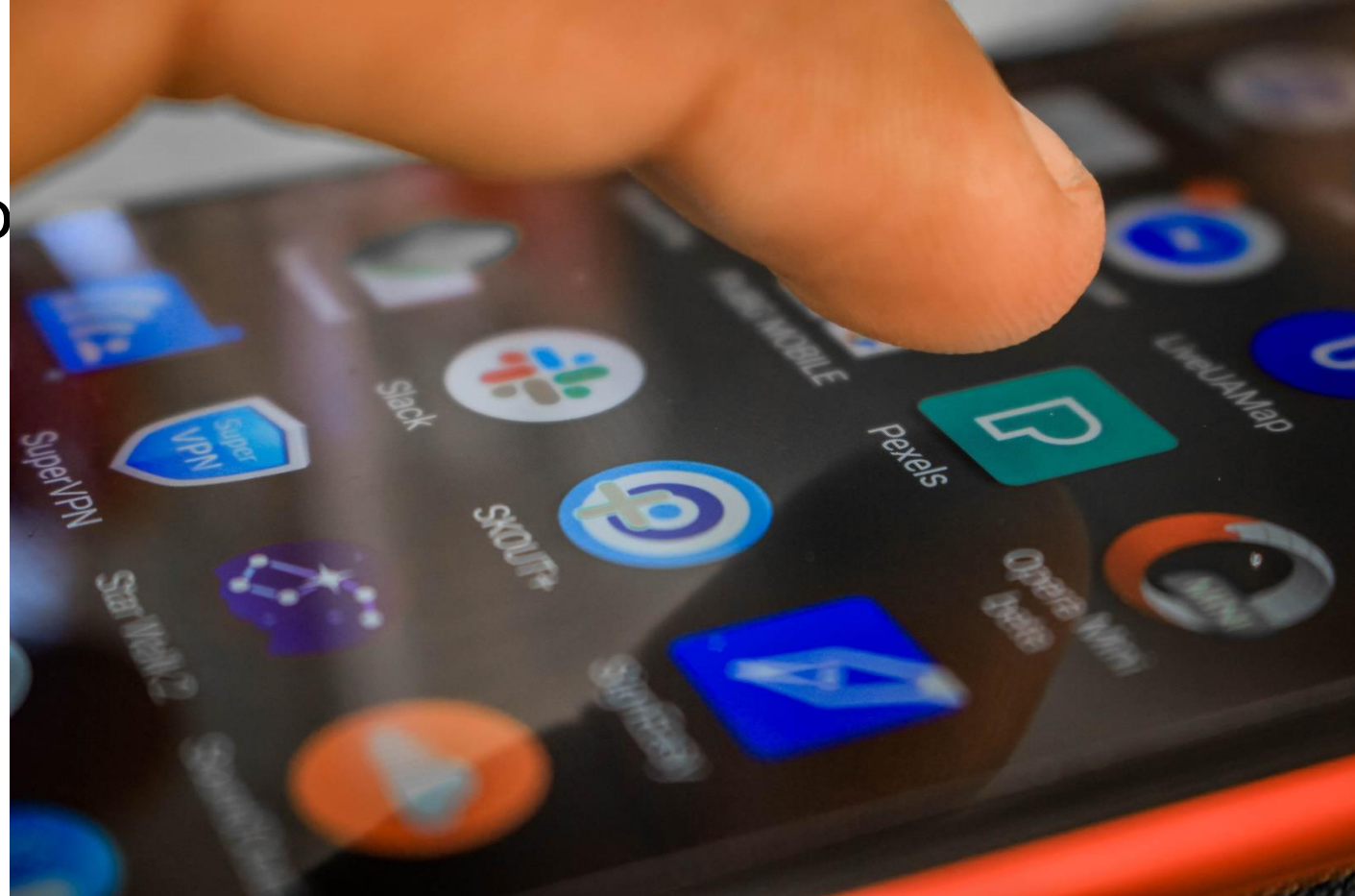
FROM PURDUE PRECISION AG SURVEY

- Commercially available for over two decades, most dealers are still not offering soil electrical conductivity (EC) mapping or chlorophyll/greenness sensors such as Greenseeker, CropSpec, or OptRx. But 15% of dealers say they will be adding soil EC mapping and 17% plan to add chlorophyll/greenness sensors as part of their services three years out, perhaps a response related to recent increases in fertilizer prices.



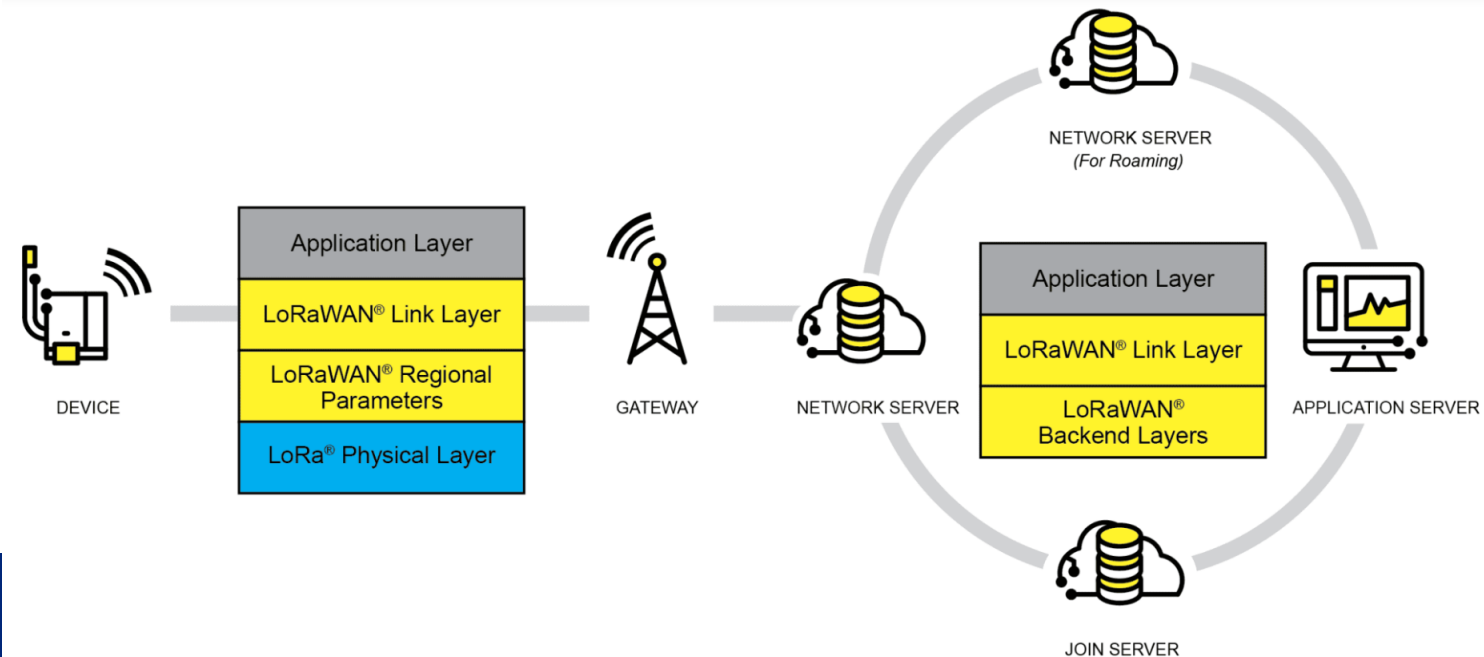
LOOKING FORWARD, ARE CHANGES COMING?

- It seems the desire to find the “easy button” is at an all time high.
- There's nothing we can't find an answer to “right now”
- How might this effect the soil world?



WIRED OR WIRELESS SENSOR NETWORKS

- Currently soil moisture for irrigation purposes
- LoRaWAN will enable sensor network expansion
 - 2.5 mile
 - Low battery requirement



NPK SENSORS

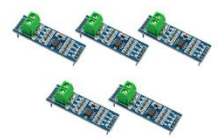


Neufday Soil NPK Sensor, High Precision Soil Nutrient Intelligent Fertilizer Detector Tester Meter NPK Sensor

★★★★★ 1

\$82⁷⁷

Patio, Lawn & Garden › Gardening & Lawn Care › Plant & Soil Monitoring › Soil Meters



Max485 Chip RS-485 Module TTL to RS-485 Module Raspberry Pi Pack of 5

★★★★★ 81

\$6⁹⁹



LaMotte N-I

★★★★★

\$44⁹⁹



Taidacent RS485 Soil NPK PH Sensor Probe NPK Sensors Detector Meter for Agricultural Soil Nitrogen Tester (Soil nitrogen, Phosphorus and Potassium Moisture)

Visit the Taidacent Store

★★★★★ 4 ratings

\$149⁷⁸

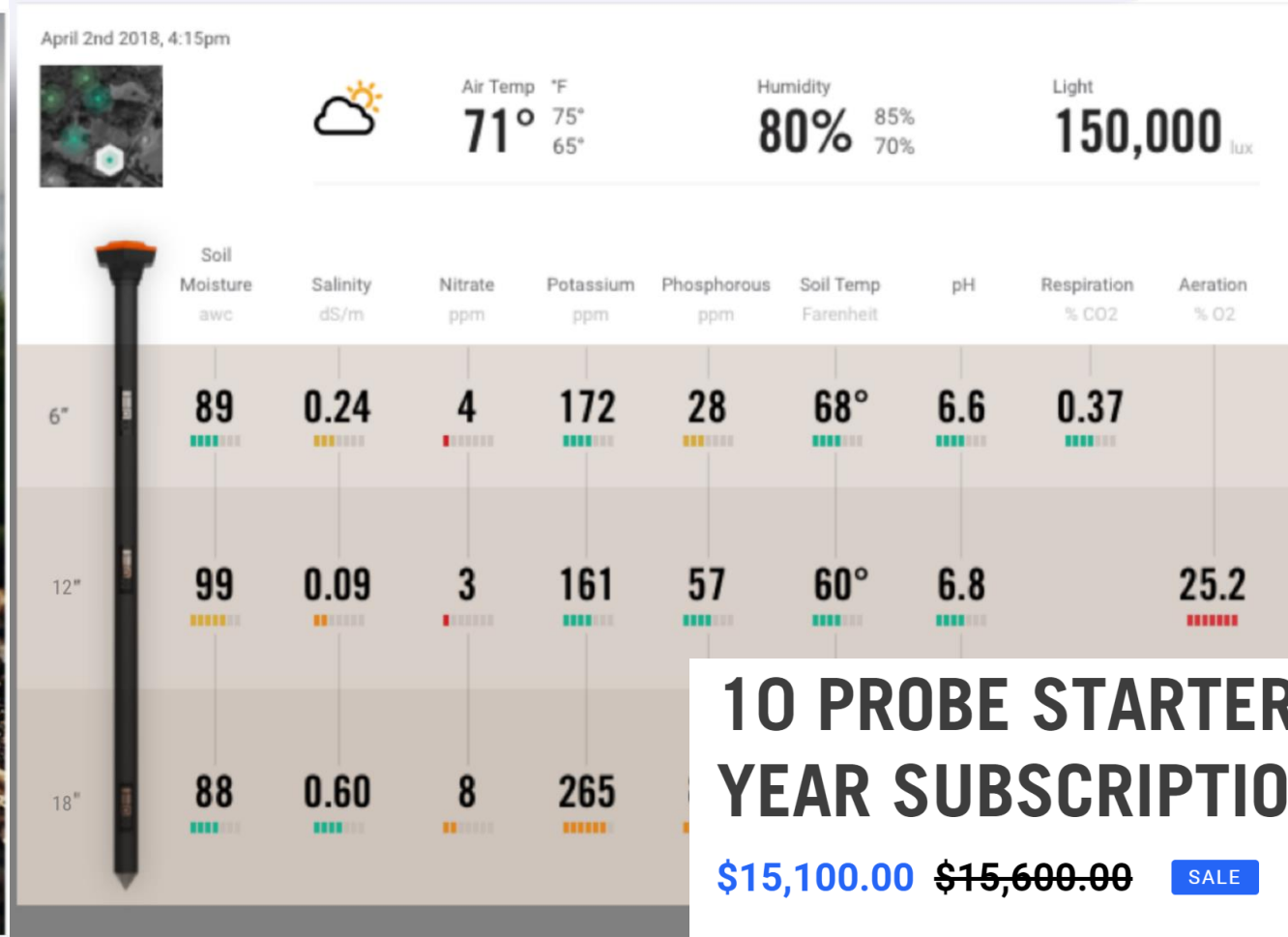
FREE Returns

Get \$60 off instantly: Pay \$89.78 ~~\$149.78~~ upon approval for the Amazon Rewards Visa Card. No annual fee.

Color: Soil nitrogen, phosphorus and potassium



TERALYTIC NPK SENSORS



10 PROBE STARTER KIT 1 or 3-YEAR SUBSCRIPTION

\$15,100.00 ~~\$15,600.00~~ **SALE**

NPK SENSOR



LIBS NUTRIENT SENSOR



A new study using SciAps Z-300 LIBS shows handheld laser induced breakdown spectroscopy to be a promising sensor technique for the in-field determination of various soil parameters. The key to this new approach is moving LIBS out of the lab and to the work site. [Read our interview](#) with one of the German researchers advancing agricultural analysis.



SOILOPTIX



Predictive Top Soil Mapping

Our gamma radiation-based sensor data is combined with strategically located physical soil samples as calibration, providing you with soil mapping results in high resolution top soil property layers.



PRECISION PLANTING RADICLE AGRONOMICS



Radicle Lab™, the cornerstone of this new suite of tools, is the world's first fully automated soil laboratory. Its small footprint, self-calibration technology and the ability to run hundreds of samples unattended allow agronomists to simplify their workflow. The revolutionary, patent-pending **Microflow™** technology built into Radicle Lab™ removes all human touches which occur

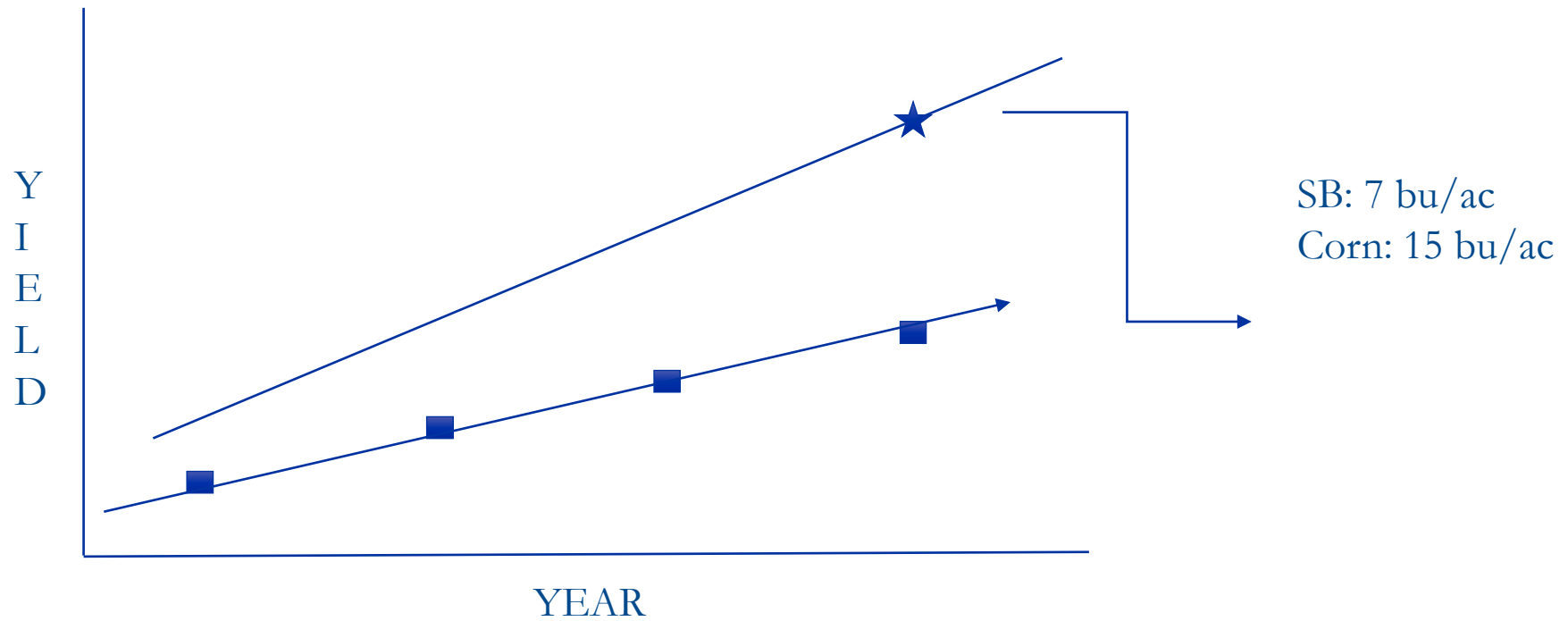


ONE MORE PIECE OF INFORMATION FROM THE PURDUE SURVEY

- Twenty-three percent of dealers say they are currently offering crop inputs applied via a UAV/drone, a flying robot, just the second time for this question, but 45% expect to be offering this by 2025 (Figure 7).



YOUR IMPACT



THANK YOU



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