

Capturing the Full Value of your Soil Sampling Program



Information for CCA continuing education credits will
be available at the conclusion of the meeting.

Welcome

- Webinar Logistics
- The Panel
 - Steve Hofing, Falcon Automated Soil Technologies (Moderator)
 - Dr. Harold Reetz Jr., Reetz Agronomics, Presenter
 - Mr. Rich Wildman, Agrinetix, Presenter
- Q&A
- Printed materials available shortly after the session

Falcon Automated Soil Technologies, LLC

- Started in 2013 by Mr. Allan Baucom of North Carolina
- Initial prototype testing in 2013 and 2014, production models in fall of 2015
- Simplicity, Accuracy, Reliability, and Efficiency are Foundational Principles
- Better Samples, Better Analysis, Smarter Input Decisions are the Results

DR. HAROLD REETZ, JR



Capturing the Full Value of Your Soil Sampling Program

Fitting Soil Sampling into Nutrient Management Plans



**Dr. Harold Reetz
Reetz Agronomics**

**Falcon Webinar
August 9, 2016**

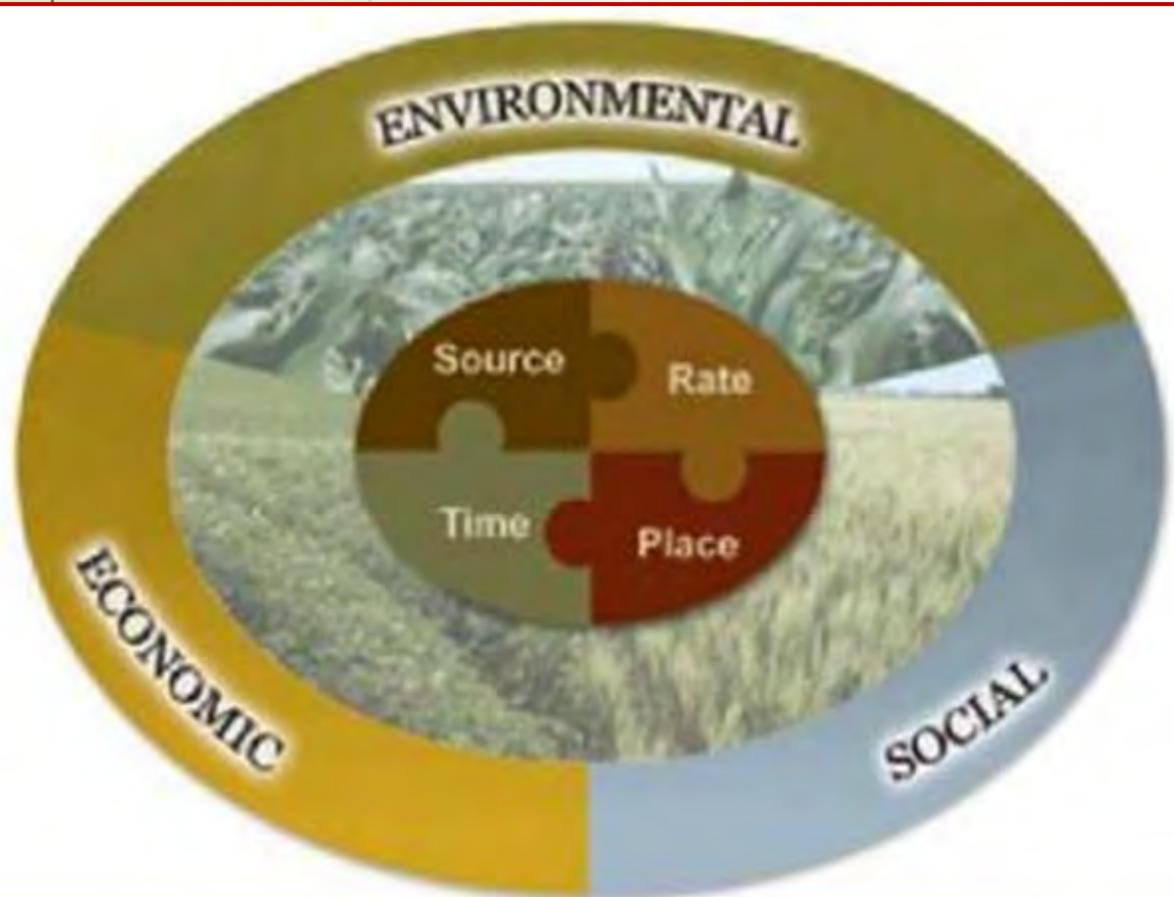


Soil Sampling is the First Step in Nutrient Management Planning

- **Build the Soil**
 - *Improve productivity*
 - *Healthier soil*
- **Feed the Crop**
 - *Higher yield*
 - *Maintain quality*
- **Protect the Environment**
- **Improve Efficiency**
- **Increase Profits**

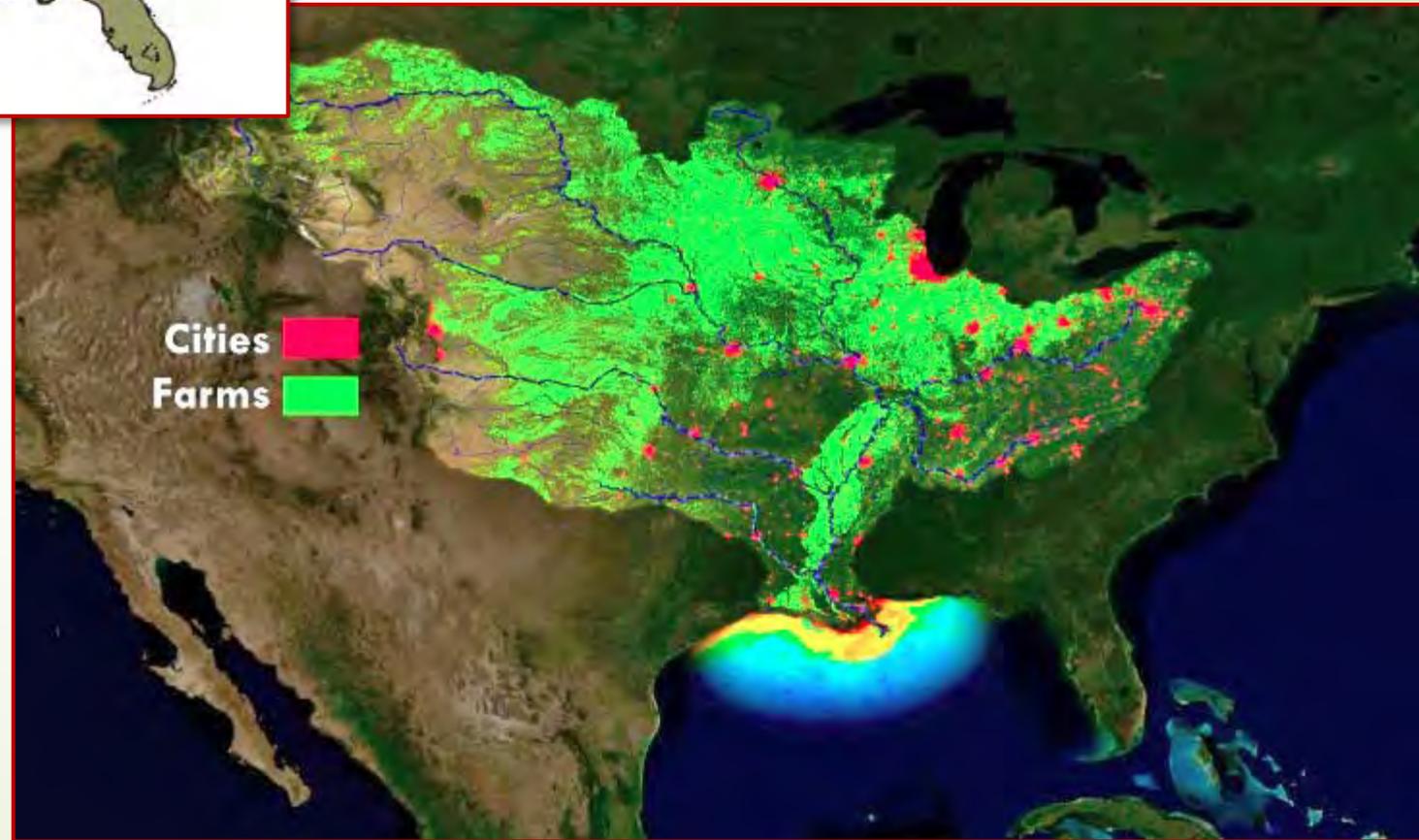
4R Global Framework for Nutrient Management

Right Source/Right Rate/Right Time/Right Place



- **Environmental benefits**
 - *better crop performance*
 - *improved soil health*
 - *reduced environmental impacts,*
 - *protection of biodiversity.*
- **Economic benefits**
 - *increase in farmers' profits*
 - *economic improvement in communities.*
- **Social benefits**
 - *reduced prevalence of hunger and malnutrition,*
 - *improved rural livelihoods,*
 - *stronger farming communities.*
 - *Ecological Services*

Hypoxic Zone





Nutrient Management Plan

- Significant component of a **soil/crop/management** system
- Fertilizer to meet crop needs **throughout** the growing season
- Avoid water contamination
 - Local water supplies
 - Downstream issues—Gulf of Mexico Hypoxia
 - Ecosystem services
- Optimize economics
 - Increased **yield**
 - **Cost per bushel** of production
 - Overall **profitability**



Soil Type is Major Source of Yield Variability

- Basic source of **within-field nutrient** variability.
- Digital Soil Survey
 - Database of ***soil characteristics***
 - Foundation for geo-referenced ***record-keeping***
 - Guide for ***management decisions***
 - Soil test fertilizer recommendations
 - 4R Nutrient Management: ***Source, Rate, Time, Place***
 - Tillage selection
 - Crop genetics
 - Weed control options
 - Available on **USDA-NRCS** website

<http://websoilsurvey.sc.egov.usda.gov/>

Web Soil Survey— USDA/NRCS

The screenshot displays the USDA Web Soil Survey interface. A prominent red callout box at the top contains the text "Soil Map". Below this, the website header includes the USDA logo and navigation links such as "Contact Us", "Download Soil Data", and "Web Soil Survey". A secondary navigation bar features buttons for "Area of Interest (AOI)", "Soil Map" (highlighted with a red circle), "Soil Data Explorer", and "Shopping Cart (Free)".

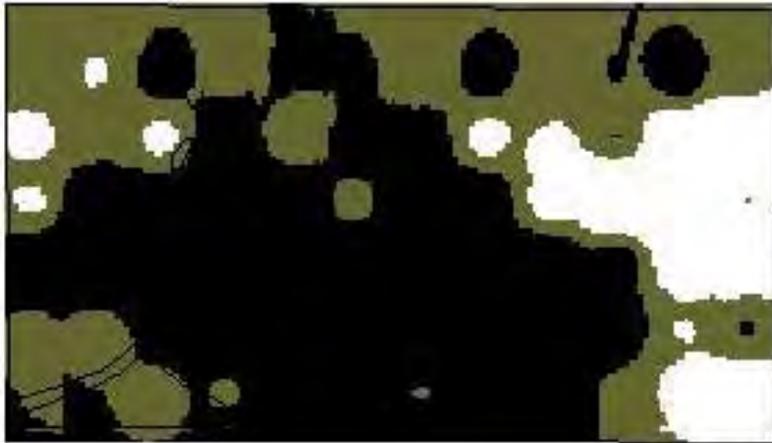
The main content area is divided into two panels. The left panel, titled "Map Unit Legend", displays a table for "Solano County, California (CA095)". The table lists various soil map units with their respective names, areas in acres, and percentages of the total area of interest (AOI).

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ca	Capey silt clay loam	174.3	24.5%
Cc	Capey clay	263.7	37.1%
CaA	Clear Lake clay, 0 to 2 percent slopes	98.3	13.8%
SeA	San Joaquin sandy loam, 0 to 2 percent slopes	62.1	8.6%
SeA	San Joaquin sandy loam, thick surface, 0 to 2 percent slopes	111.0	15.4%
Totals for Area of Interest		710.4	100.0%

The right panel, titled "Soil Map", shows a satellite-style map of the area with colored overlays representing different soil types. A red line indicates the boundary of the area of interest. The map includes a scale of 1:22,400 and a north arrow.

Variable-Rate Application—Fertilize by Need

—*Right Rate; Right Place*



K soil test map of Illinois field
90 acres (36.5 ha)

Yield Goals:

Corn – 200 bu/A = 12,548 kg/ha

Soybeans – 60 bu/A = 4,033 kg/ha

K Recommendations



13% needed **no K**

30% needed **maintenance** rate

47% needed **higher** (build-up) K rate



Nutrient Use Efficiency (NUE)

- More yield with less fertilizer per bushel
 - Keep it in the Crop
- 

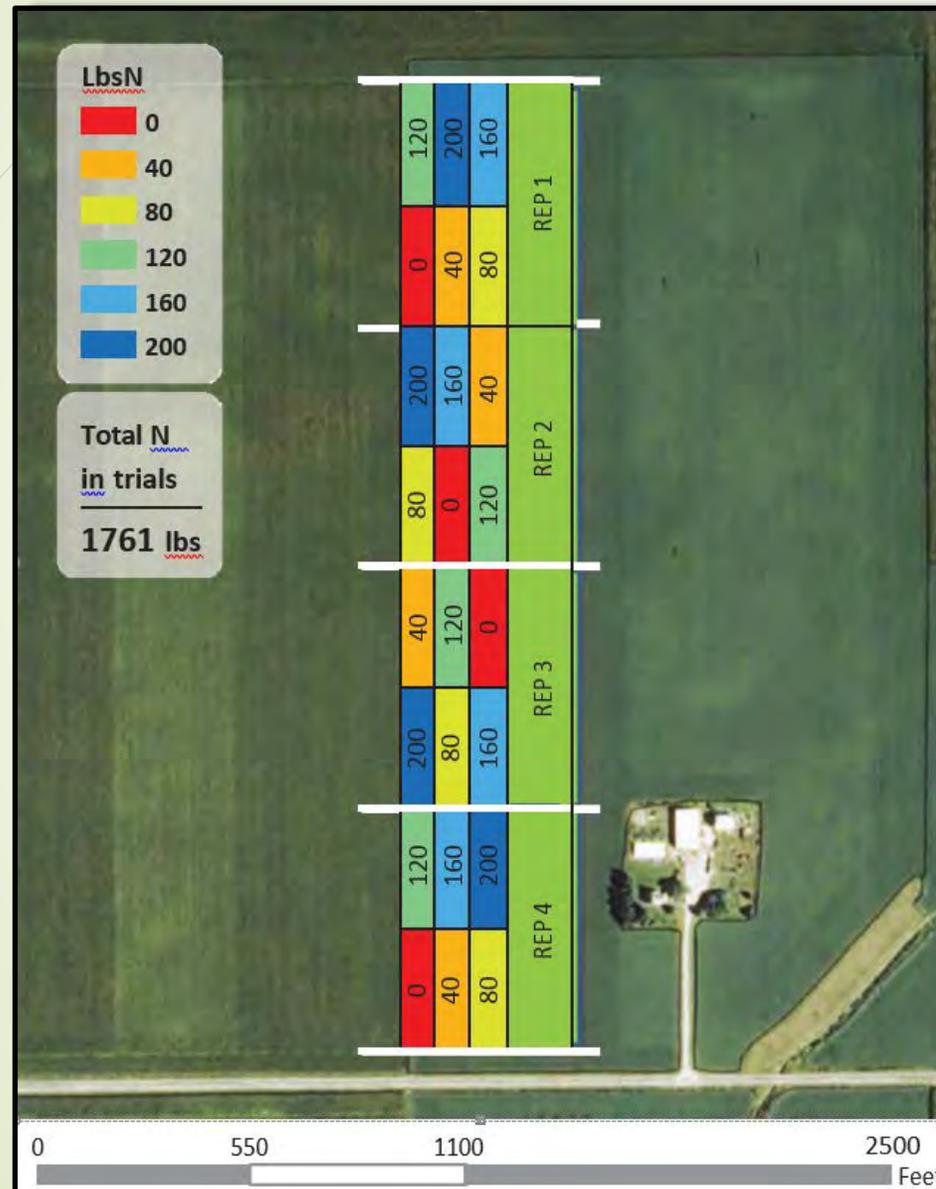


Build Your Own Nutrient Management Database

- ▶ On-farm fertilizer rate trials
- ▶ Confirm university and commercial soil test calibrations
- ▶ Fine-tune recommendations to **YOUR** soil/weather/management

Easy to Establish On-farm Nutrient Trials

-For Any Nutrient



- Example plot layout for an on-farm N rate comparison
- 6 N rates and 4 replications.
- Plots established and harvested using **conventional field equipment**.
- RTK **GPS guidance** and variable-rate application systems.

- Set up in application file in advance
- Generate **“As-Applied”** map
- Harvest with combine/yield monitor
- No measuring, no staking, no weighing
- Very little interference with field work.



(Source: Reetz Agronomics)

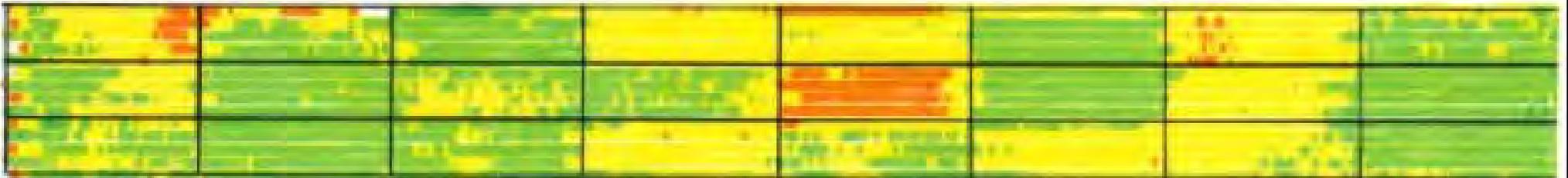
Evaluate Yield Monitor Results

Top-dress N rate

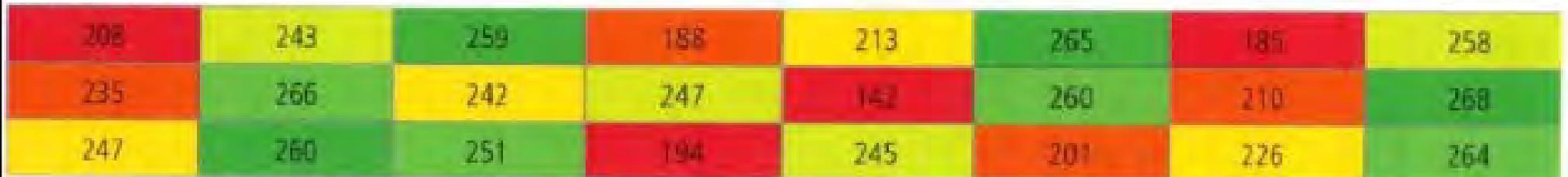
(a)



Yield Monitor (b)



Average plot yield (c)



Lbs N ■ 0 ■ 40 ■ 80 ■ 120 ■ 160 ■ 200

Crop Nutrient Response Tool (CNRT) v4.5

R ² -weighted Mean	Quadratic (Q)	Quadratic-Plateau (QP)	Mitscherlich (M)	Linear-Plateau (LP)	Spherical (SP)
A:	148	148	285	163	155
B:	0.92	0.92	-144	0.55	108
C:	-0.0018	-0.0018	-0.008	262	231
R^2	100%	100%	100%	100%	100%

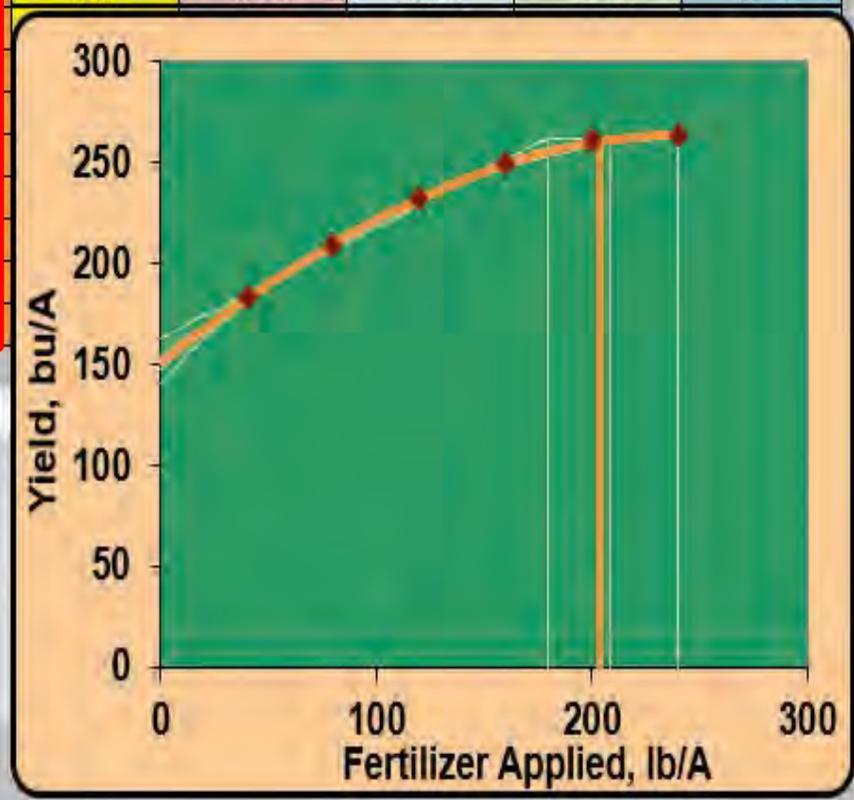
Step 1: Enter rate and yield data.
 Step 2: Click the Fit button.
 Step 3: Adjust crop and fertilizer prices.
 Step 4: Click to append information to summary.

Fertilizer rate, lb/A	Crop Yield, bu/A	Fit
40	183	
80	209	
120	232	
160	249	
200	261	
240	263	

Site Details	
Site	Maier Farm
Year	2014
Town	Forrest
County	Livingston
State or province	Illinois
Latitude	
Longitude	
Altitude	
Soil texture class	Silty clay loam
Preceding crop	Soybean
Expected Yield (bu/A)	200
Tillage	Chisel/field cultivator
Nutrient Source	Super U
Nutrient Timing	10-12" corn
Nutrient Placement	Topdress
Planting date	5-10-2014 ?
PSNT (ppm)	
Manure N (lb/A)	
Harvest date	10-10-2014 ?

MERN (lb/A):	204
Yield @ MERN (bu/A)	260
Partial Factor Productivity (PFP), bu/lb	1.28
Agronomic Efficiency (AE), bu/lb	0.53
Estimated Partial N Balance (PNB), %	83%
Estimated Recovery Efficiency (RE), %	52%
Delta Yield (bu/A)	109
Relative Yield (%)	58%

My rate 154
 Yield at my rate 247
 PFP 1.60
 AE 0.62
 PNB 104%
 RE 61%
 Delta Yield (bu/A) 96
 Relative Yield (%) 61%



ESSENTIAL INFORMATION	
Crop (\$/bu)	4.00
Fertilizer (\$/lb)	0.64
Price ratio (f/c)	0.160
Crop nutrient content (lb/bu)	0.65
Nutrient harvest index	0.666

IPNI Crop Nutrient Response Tool

Bruulsema, Tom. 2013. *Crop Nutrient Response Tool*. International Plant Nutrition Institute (IPNI). www.ipni.net

Think “Systems” Management

► Risk management

► *The goal of most decisions*

► Components **interact** for management decisions.

► “System” considers:

► All component **practices**,

► The **data** (all available information).

► **Results** of the management decisions.

► **Agronomic** responses (yield) .

► **Economic** evaluation.

► **Environmental** consequences.



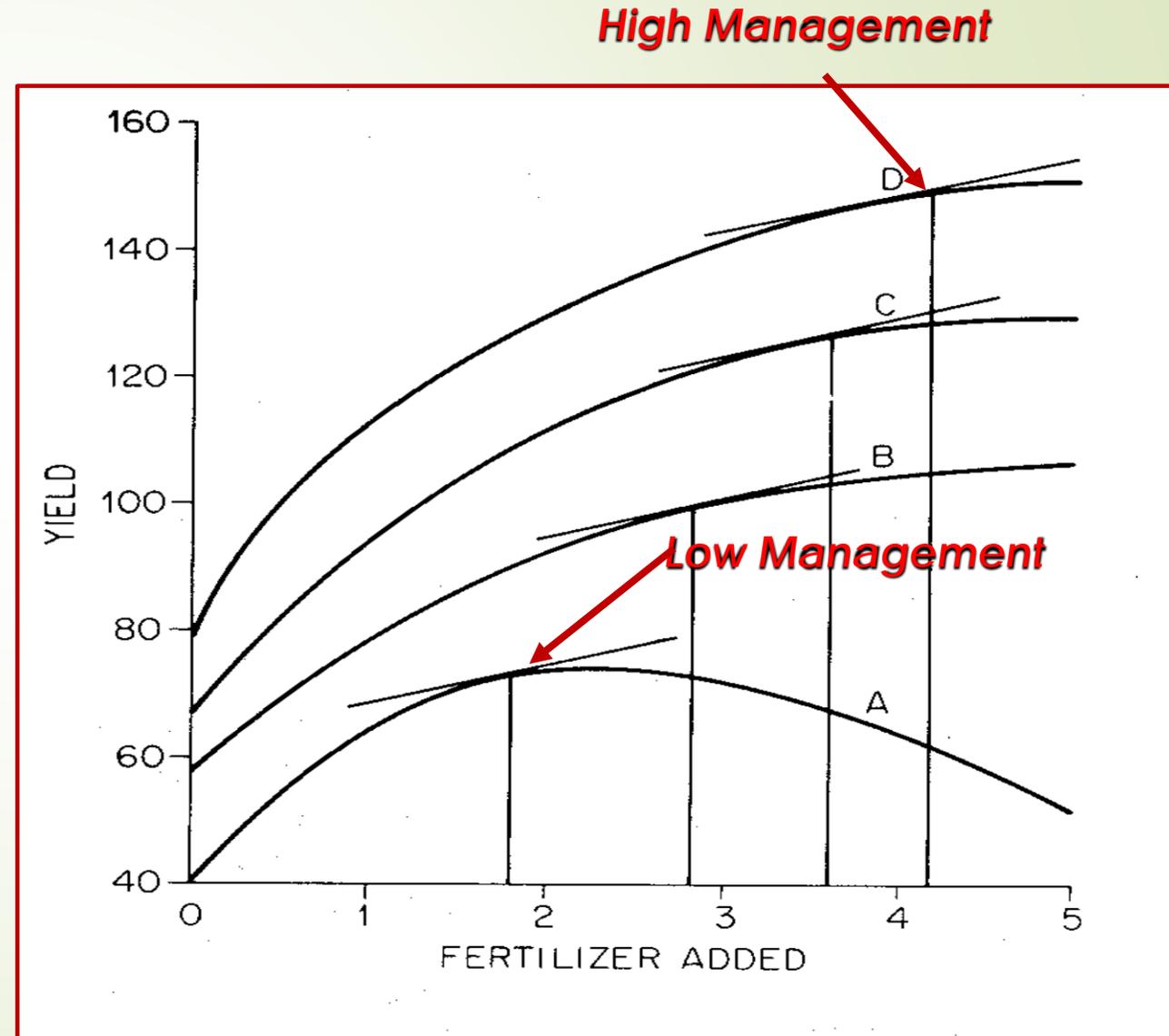
HIGH-TECH TOOLS FOR SITE-SPECIFIC CROP NUTRIENT MANAGEMENT



Illustration of various component practices and technologies commonly associated with specific precision agriculture systems

Manage the System – Not Just Nutrients

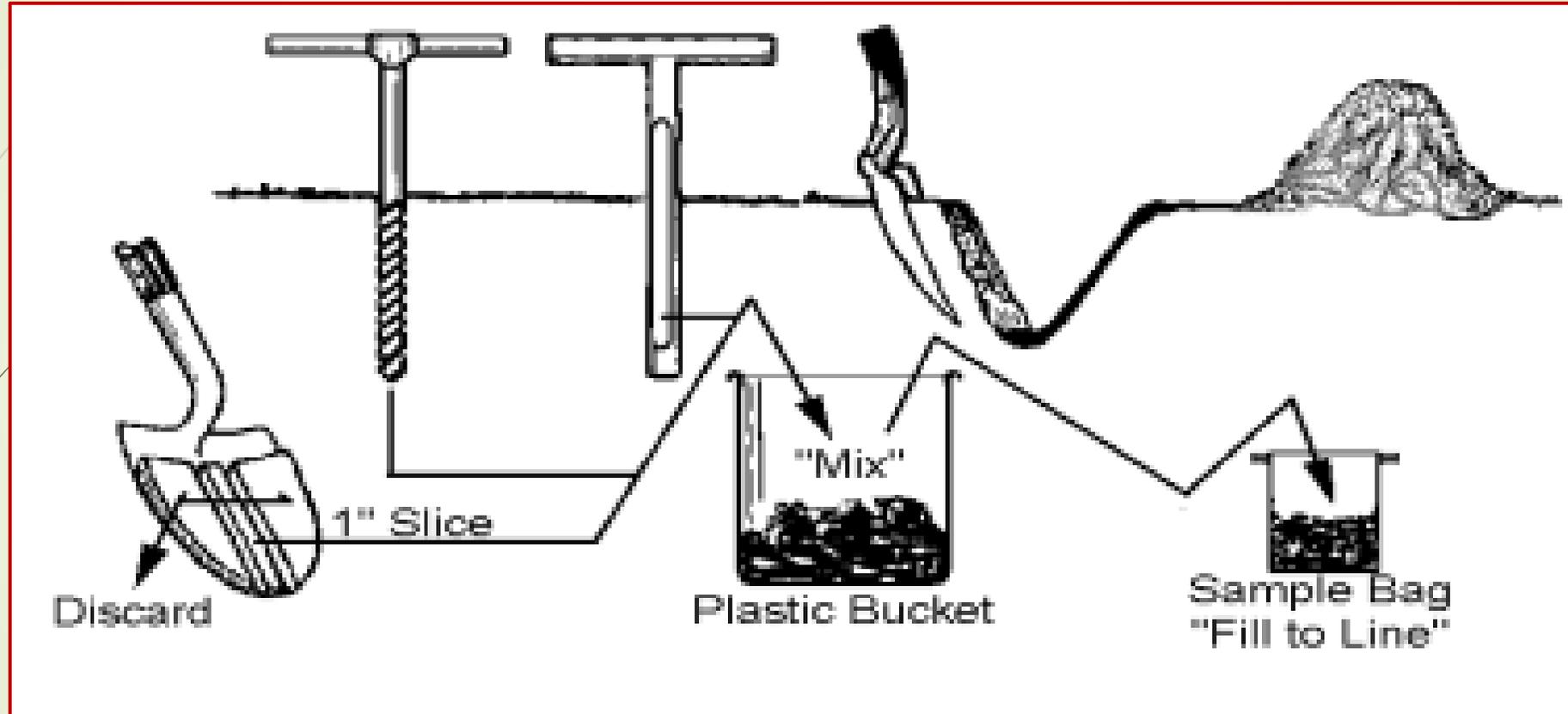
Higher overall management responds to higher fertility.



Sample Carefully

- ▶ The greatest potential for error in soil testing is in collecting the sample.
- ▶ Remember a soil sample is just a SAMPLE.
 - ▶ Each sample represents a portion of the field for which nutrient management recommendations are being generated.
 - ▶ If you are collecting one **one-pound sample** for each 2 ½ acres, that sample (about a **teaspoon** of soil in the lab) **represents about 5 million pounds of soil in the field**.
 - ▶ ***An acre of soil 6 to 7 inches deep (acre-furrow-slice) is about 2 million pounds of soil***.
- ▶ **16 samples in a 40-acre field**, means only analyze **16 teaspoons** of soil to represent **80 million pounds**.
- ▶ *And you make the decisions on **\$8,000 to \$10,000 or more worth of fertilizer**, based on those samples.*
- ▶ Take every precaution to collect **representative samples**.

Collect a Representative Sample



- Collect **10 to 15 cores** (1" diameter) for each sample.
- Mix well in a **PLASTIC** bucket
- Put a subsample in **labelled** bag/box



Sampling Depth is Critical

- Sampling depth should be the same as the depth used for the calibration samples used for recommendations.
- Remember soil testing does not **MEASURE** nutrient levels. It provides an **INDEX** representing the probability of getting a yield increase.

Truck/ATV – Mounted Sampling Probe



- Easier than hand probes
- Can be set for consistent depth
- Facilitates deep sampling



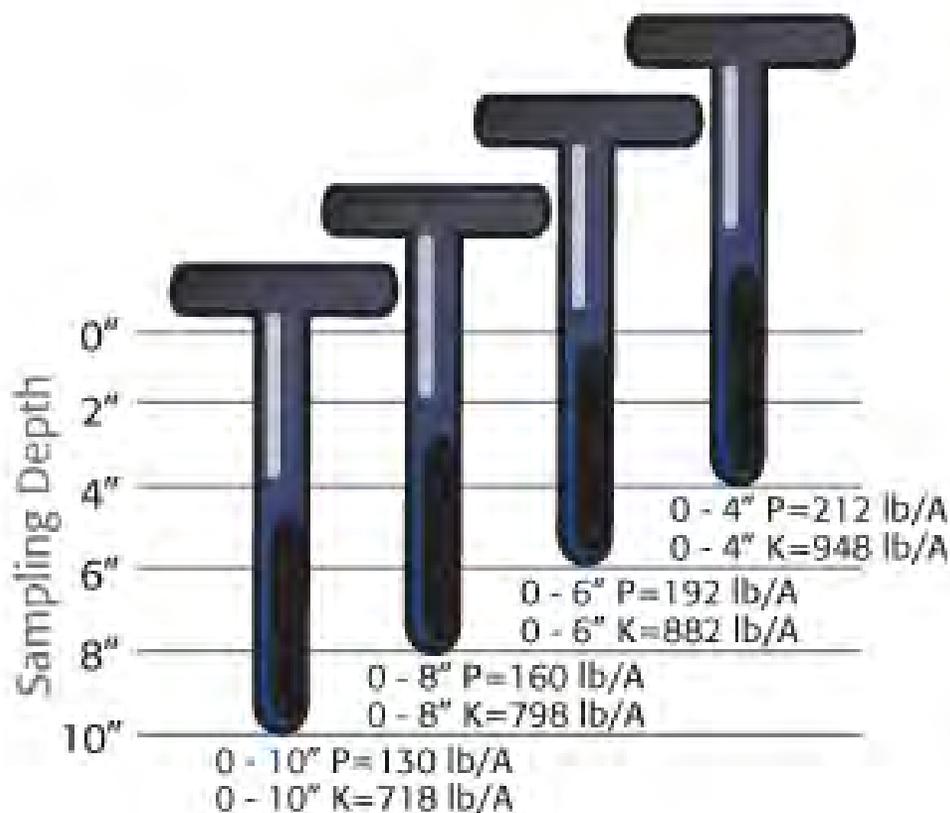
Automatic Soil Sampler

- **Stainless steel** probe and drum, Teflon-coated
- **Consistent** depth
- Collects and mixes samples, records **GPS** coordinates
- **15.5'** between cores
- **Efficient**
 - 12 samples Non-stop; multiple (10 or more) cores per sample
 - Fills and labels sample boxes in carousel
 - 12 carousel storage on-board (144 samples total)
- **Geo-referenced** by core, linked wirelessly to **"cloud"**



Falcon Automatic
Soil Sampler

Sampling Depth Affects Results



Effect of sampling depth on P and K soil test results. Source: IPNI

Stratification of nutrients

- ▶ Shallow samples tend to be high-testing
- ▶ Deeper samples tend to be low testing
- ▶ **Wrong recommendations**



Soil Test Results Provide Probability of Response

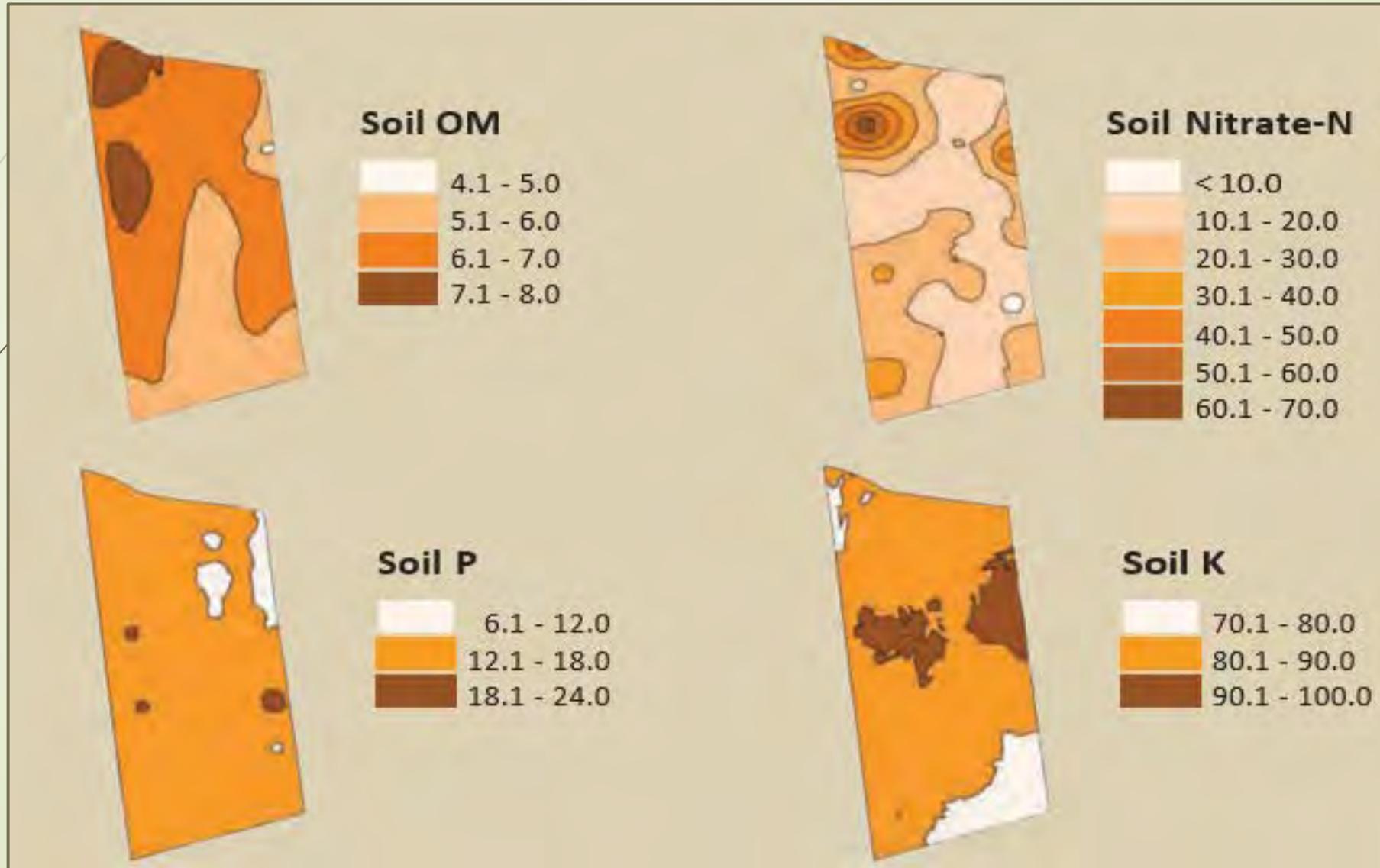
- ▶ Cannot use a “**checkbook**” approach to balance nutrients.
- ▶ Soil testing was intended to **track trends**, not to be an accounting system.
- ▶ Soil test does not **measure** nutrient levels.
 - ▶ It gives an index of ***probability of response***.
 - ▶ Based upon the ***calibration data set*** for the test.



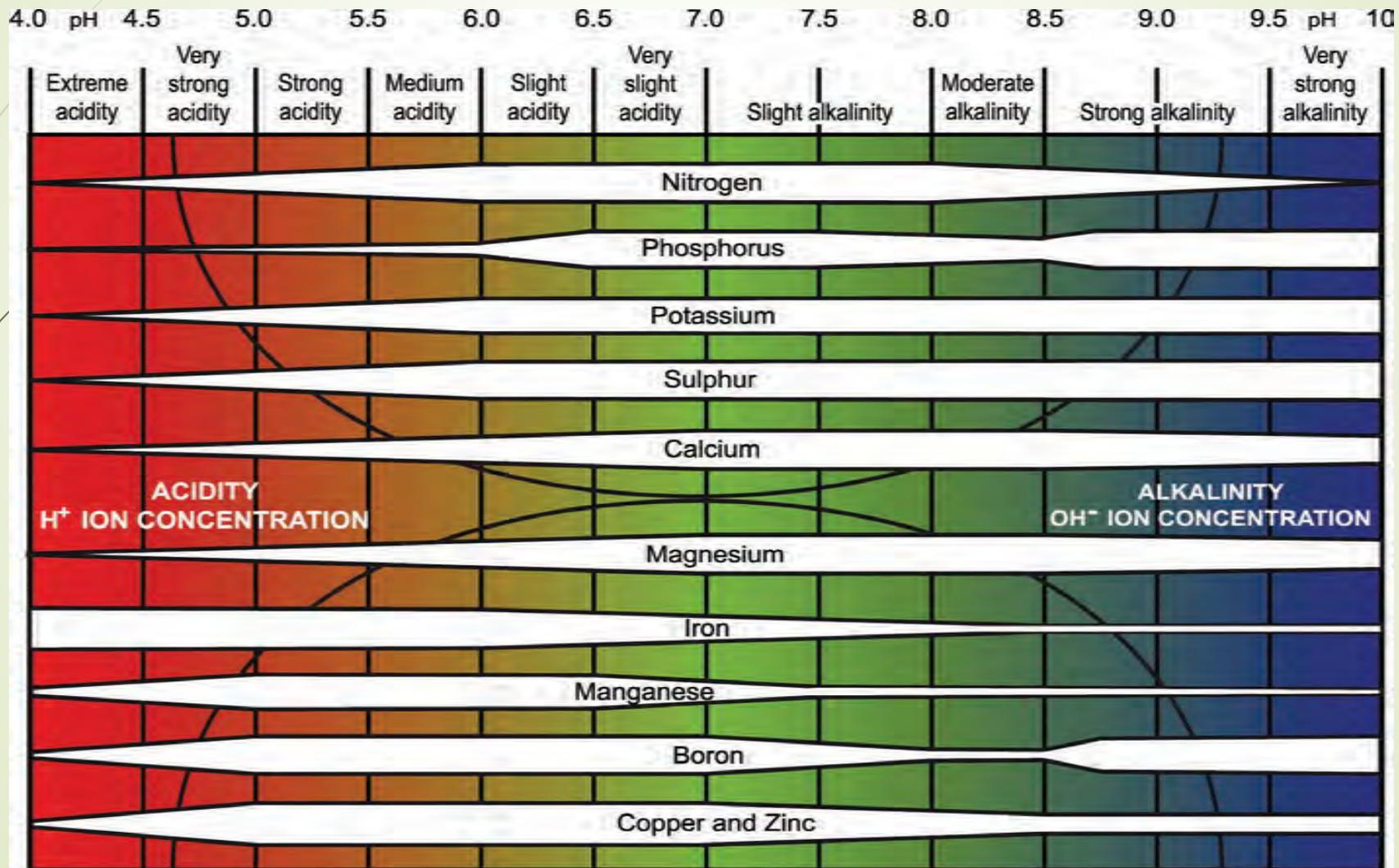
Soil Sampling is ESSENTIAL for Nutrient Management Planning

- Every field should have a **Nutrient Management Plan**
 - Monitor nutrient **trends**
 - Identify nutrient **variability**
 - **Agronomic** management
 - *Optimize yields*
 - *Avoid under-application*
 - *Reduce over-application*
 - **Economic** benefits
- Improve environmental **stewardship**
- May be **required** in the future

Soil Nutrient Levels Vary Independently



Effect of Soil pH on Nutrient Availability



Soil Test Classes and Response Probability

Soil Test Class	Probability of Response
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Very low	Profitable response in all but rare cases
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Low	Profitable response in most seasons
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Medium	Average response over years is profitable
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High	Occasional profitable responses
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Very High	Profitable response during the season of application unlikely
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Soil Test Interpretation Approaches

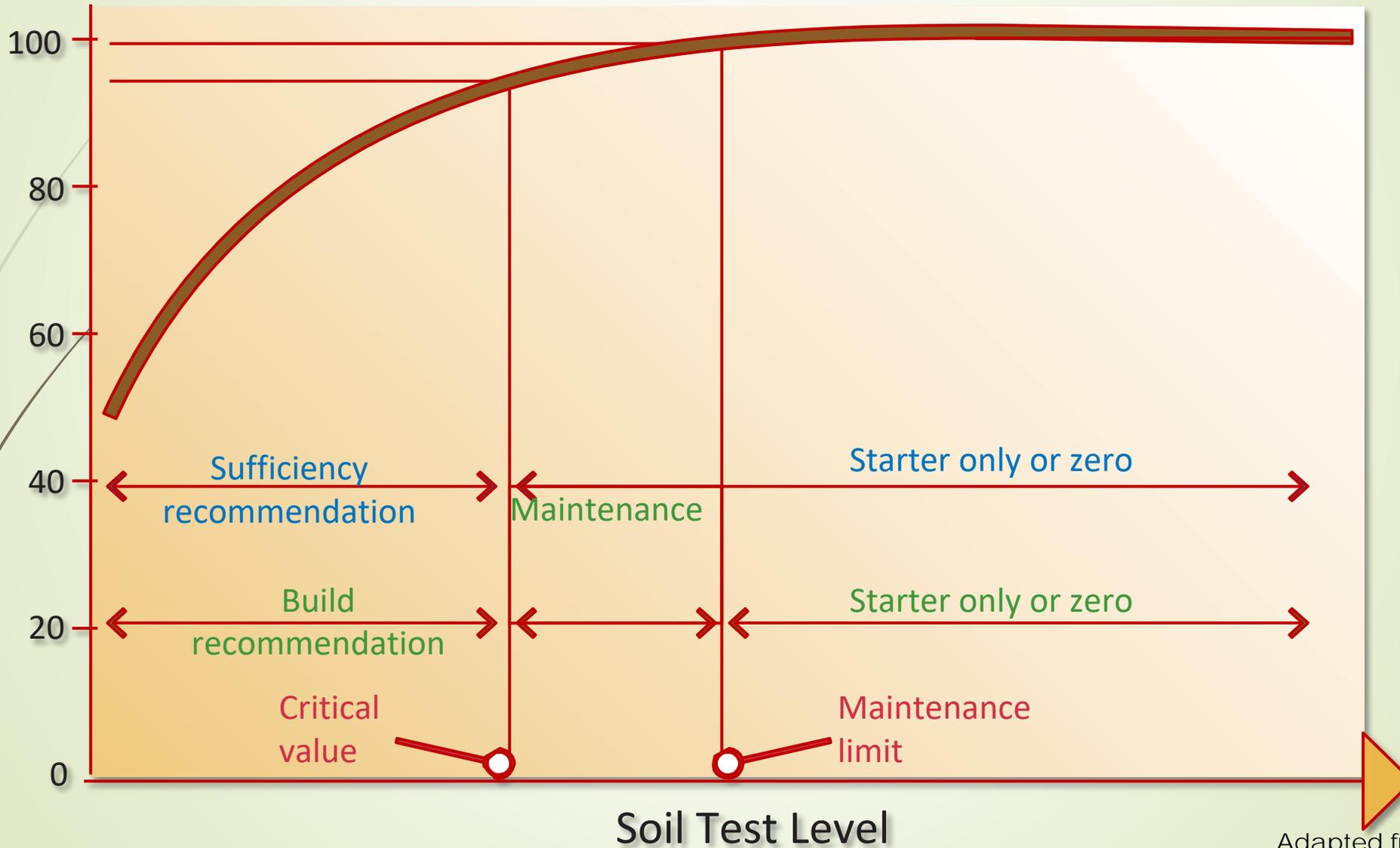
► Sufficiency

- Add necessary rates of deficient nutrients so yields are not limited in **present** crop

► Build-Maintenance

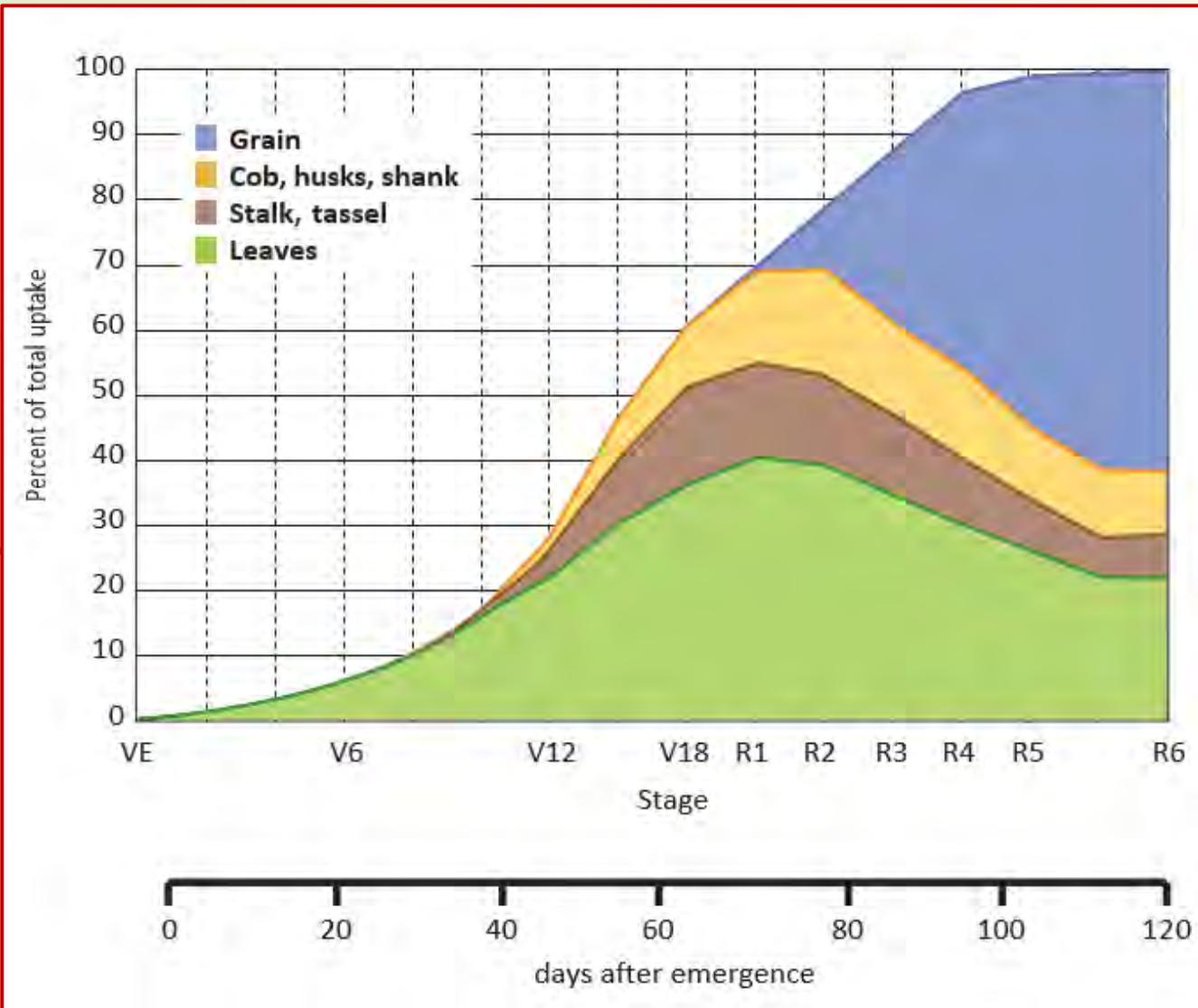
1. Add enough of needed nutrient/s to supply present crop need, and **gradually increase soil supply** to non-limiting level
2. **Replace** nutrients removed in **crop harvest** to keep plant nutrient levels at **non-limiting** levels for **future** crops

Recommendation Philosophies



Be Sure Crop Nutrient Needs Are Met

...At ALL TIMES



- Nutrient uptake by the corn crop at different growth stages and region of accumulation within the plant.
- Different patterns for each nutrient.

(Adapted from "How a Corn Plant Develops", Iowa State University Extension Special Publication #48).

Role of Soil Tests in the World of “Big Data”

- ▶ **Build Your on-farm database**
 - ▶ Separate soil test dataset for each **Farm-Tract-Field**
 - ▶ Tracking **soil fertility trends**
 - ▶ **Documenting** soil tests for fertilizer applications
 - ▶ Correlating with **yield trends**
 - ▶ **Economic** analysis
 - ▶ **Better-informed decisions**
 - ▶ Value grows as years are added
 - ▶ Data ownership
 - ▶ Value to **dealers** and **consultants**
 - ▶ Value to **“Big Data”** organizations
- ▶ **Values of sharing** soil test data
 - ▶ *With land owners*
 - ▶ *With farm managers and crop consultants*
- ▶ **Enhanced Land Value**

Crop Production in the Information Age



David Hula
Charles City, Virginia



Proper Soil Sampling Guides Your Future

- ▶ Use a good **soil testing** and **nutrient management** plan.
- ▶ Improve yields
- ▶ Improve environmental **stewardship**
- ▶ Enhance **profits**
- ▶ Automated sampling can improve **efficiency** and **uniformity** of sample collection
 - ▶ *Less **time** per sample*
 - ▶ *Consistent **depth***
 - ▶ *More **cores** per sample*
 - ▶ *More **representative** samples*

Reference

To order a hardcopy or to download the pdf:

http://www.fertilizer.org/En/Knowledge_Resources/Library/IFA_Selection_Fertilizer_Use.aspx

INTERNATIONAL FERTILIZER INDUSTRY ASSOCIATION
49 avenue d'Éléna, 75116 Paris, France



**Fertilizers and
their Efficient Use**

Harold F. Reetz, Jr.



Thank You!

Harold F. Reetz, Jr.

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RICHARD WILDMAN



SEEKING THE PERFECT SOIL SAMPLE

Thoughts From 30 Years In The Business



AGRINETIX

Rich Wildman
Agrinetix, LLC

RICH WILDMAN

- Soil Sampling Technician – 1980 First Job
- Founded ACS – 1983
- ACS – Largest Independent Crop Consulting Firm East of Mississippi – 1990
- ACS – Largest CAFO Planning Firm in US – 2005
- Founded Agrinetix – 2011



AGRINETIX

AGRINETIX

Serves the market as a provider of wholesale GIS services, sampling services, technology, and customized consultation to large producers and large retailers.



AGRINETIX

Seeking to Improve Soil Sampling

...we have tried a lot of things

- Moly chrome steel engineered probes
- High Floatation Lift-Kitted Geo Tracker with hydraulic auger.
- ATV on tracks
- Truck-mounted and ATV mechanical samplers
- Drying/Grinding/Re-Packing samples to speed up process and reduce shipping and lab costs.
- Developing GPS and Barcode systems to reduce sample label errors
- Summer sampling in the crop to increase capacity.
- Winter sampling on snow shoes and snowmobiles to increase capacity
- Contracting with third-party specialized sampling firm for soil collection.
- Becoming a third-party specialized sampling firm for soil collection.



AGRINETIX

Seeking to Improve Soil Sampling

...we have tried a lot of things

...Important whether you:

- Do your own sampling for your own agronomy practice.
- Purchase sampling from others.
- Sell sampling to others.



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The Major Takeaway

...sampling capacity is the key driver/constraint to overall growth

Throughout all of these approaches, we were ultimately still bound by two hard to control things:

1. The number of days that we could actually sample (weather/harvest constraints/fertility application window constraints)
2. Meeting customer needs by having available hours to get things done within that variable window.

The result:

Either... not enough hours (and therefore insufficient time to cover the acres we needed to cover)

Or... an imbalance of labor (too much or too little).

While this realization and the result seem to be obvious (and they are), the ultimate takeaway was that :

Solving this problem was critical to our overall business growth, and

Automated sampling has the most promise to do that



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SOIL SAMPLING AS A BUSINESS

...THE CRITICAL QUESTIONS

- **Is Soil Sampling Capacity and Timing a Constraint to Business Growth?**
- **Does Our Approach Provide a Better Fertilizer Recommendation?**
- **Does Our Approach Improve Our Strategic Position in the Marketplace?**



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AUTOMATED SOIL SAMPLING

...it saves money, but that's not why we do it.

- Automated sampling is a tool to my business.

...it allows me to add capacity without adding labor



- Tangible proof to our clients that we are taking advantage of the latest tools and technology in our service to them.



AGRINETIX



Thank You!
Rich Wildman
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877-9-RTK-GPS



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QUESTIONS FOR HAROLD AND RICH

We Appreciate Your Participation!

For Further Information



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Sales
704-753-4264



Thank you for attending!



CCAs will receive an email following the completion of the webinar to receive continuing education credits.