Soil test recommendations

Josh Lofton, Assistant Professor LSU-AgCenter

LATMC pre-conference

February 13th, 2013

Presentation outline

- Soil fertility principles
- What is the process of soil sampling
  - Soil collection
  - Lab analysis
  - Interpretation

14 Essential elements

- Needed by all crops
  - Complete its life cycle
    - Yield
- Divided based on crop uptake

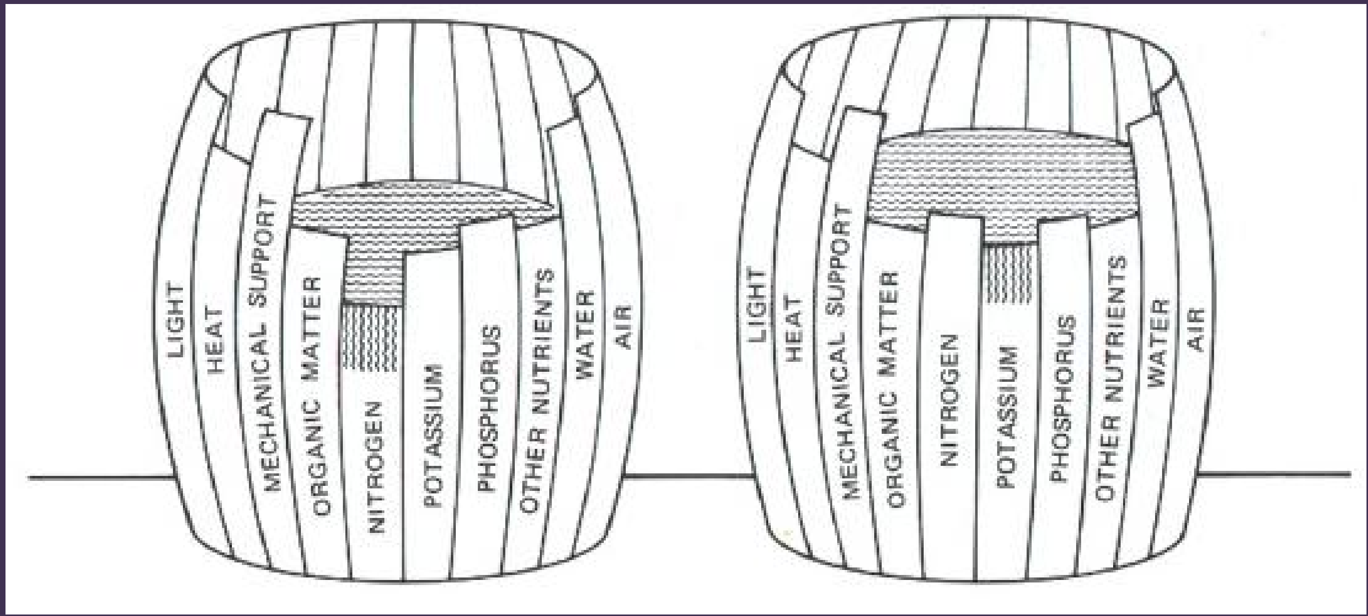
Soil obtained nutrients		
Primary Macro	Secondary Macro	Micro
N	Ca	Fe
P	Mg	B
K	S	Cu
		Cl
		Mn
		Mo
		Zn
		Ni

Soil fertility- More than just N

- Justus Von Liebig
  - Law of the minimum
  - "If one crop nutrient is missing or deficient, plant growth will be poor, even if other elements are abundant."
  - Emphasizes balanced nutrient management

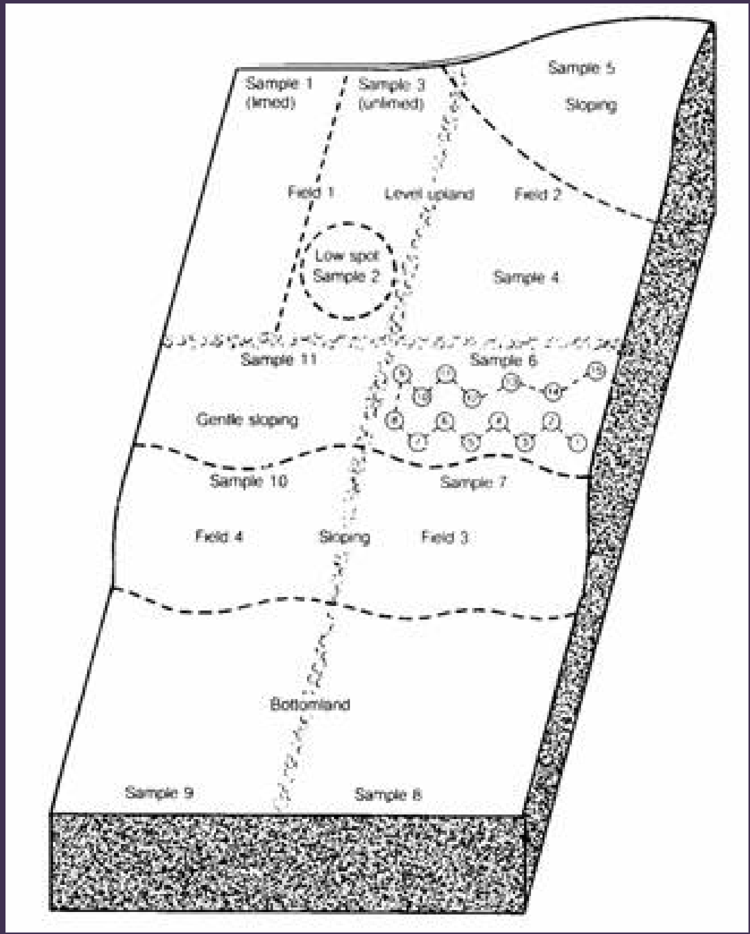
LSU AgCenter
Research & Extension

Law of the minimum



Collecting a good soil sample

- Error in sampling
  - Occurs in soil sample
  - Little occurs during the procedures
- Collect samples
  - Divide field into management zones
  - Across a management zone
  - Proper depth



Soil test methods- Extraction procedures

- Specific amount of soil
  - Small compared to sample
    - The weight of approximately two pennies
  - Makes collection vital
- Meant to represent soil solution conditions that are present in your soil
- Extraction removes exchangeable nutrients
- Collection of extract to measure on ICP, etc.

Soil test reports

- Soil test reports typically contain
  - Soil concentration
  - Soil test class
  - Recommendation

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

Soil test report

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	5.53	**Low**	**Low**
Phosphorus, ppm	4.19	**Very Low**	**Very Low**
Potassium, ppm	70.98	**Low**	**Low**
Calcium, ppm	1,007.23	**Very High**	**Very High**
Magnesium, ppm	242.68	**Very High**	**Very High**
Sodium, ppm	32.32	**Optimum**	**Optimum**
Sulfur, ppm	11.01	**Low**	**Low**
Copper, ppm	1.04	**High**	**High**
Zinc, ppm	0.44	**Low**	**Low**

Soil test K	Category
0-68	Very low
69-114	Low
115-159	Medium
160-182	High
>182	Very high

Soil test report

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	5.53	**Low**	**Low**
Phosphorus, ppm	4.19	**Very Low**	**Very Low**
Potassium, ppm	70.98	**Low**	**Low**
Calcium, ppm	1,007.23	**Very High**	**Very High**
Magnesium, ppm	242.68	**Very High**	**Very High**
Sodium, ppm	32.32	**Optimum**	**Optimum**
Sulfur, ppm	11.01	**Low**	**Low**
Copper, ppm	1.04	**High**	**High**
Zinc, ppm	0.44	**Low**	**Low**

Soil test K	Category
0-68	Very low
69-114	Low
115-159	Medium
160-182	High
>182	Very high

RECOMMENDATION

Crop	Form	*Units: lb/Acre*	Nitrogen	Phosphate	Potash	Expected pH / Acre with adding Lime 1 Ton
corn (field)	corn grain		120-160	80	60	6.54 High

Soil test report

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	7.63	**High**	**High**
Phosphorus, ppm	38.64	**High**	**High**
Potassium, ppm	83.74	**Low**	**Low**
Calcium, ppm	2,645.27	**Very High**	**Very High**
Magnesium, ppm	111.82	**Very High**	**Very High**
Sodium, ppm	12.84	**Optimum**	**Optimum**
Sulfur, ppm	12.82	**Medium**	**Medium**
Copper, ppm	1.74	**High**	**High**
Zinc, ppm	3.70	**High**	**High**

Soil test report

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	7.63	**High**	**High**
Phosphorus, ppm	38.64	**High**	**High**
Potassium, ppm	83.74	**Low**	**Low**
Calcium, ppm	2,645.27	**Very High**	**Very High**
Magnesium, ppm	111.82	**Very High**	**Very High**
Sodium, ppm	12.84	**Optimum**	**Optimum**
Sulfur, ppm	12.82	**Medium**	**Medium**
Copper, ppm	1.74	**High**	**High**
Zinc, ppm	3.70	**High**	**High**

RECOMMENDATION

Crop	**Form**	***Units: lb/Acre***	**Nitrogen**	**Phosphate**	**Potash**
corn (field)	corn grain		120-160	0	60

Soil test report

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	6.04	**Optimum**	**Optimum**
Phosphorus, ppm	35.36	**High**	**High**
Potassium, ppm	388.54	**Very High**	**Very High**
Calcium, ppm	4,275.98	**Very High**	**Very High**
Magnesium, ppm	906.04	**Very High**	**Very High**
Sodium, ppm	17.30	**Optimum**	**Optimum**
Sulfur, ppm	9.41	**Low**	**Low**
Copper, ppm	5.67	**High**	**High**
Zinc, ppm	3.59	**High**	**High**

Soil test report

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	6.04	**Optimum**	**Optimum**
Phosphorus, ppm	35.36	**High**	**High**
Potassium, ppm	388.54	**Very High**	**Very High**
Calcium, ppm	4,275.98	**Very High**	**Very High**
Magnesium, ppm	906.04	**Very High**	**Very High**
Sodium, ppm	17.30	**Optimum**	**Optimum**
Sulfur, ppm	9.41	**Low**	**Low**
Copper, ppm	5.67	**High**	**High**
Zinc, ppm	3.59	**High**	**High**

RECOMMENDATION

Crop	**Form**	***Units: lb/Acre***	**Nitrogen**	**Phosphate**	**Potash**
corn (field)	corn grain		120-160	0	0

The real decisions

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	7.32	**High**	**High**
Phosphorus, ppm	24.15	**Medium**	**Medium**
Potassium, ppm	340.46	**Very High**	**Very High**
Calcium, ppm	3,750.06	**Very High**	**Very High**
Magnesium, ppm	809.14	**Very High**	**Very High**
Sodium, ppm	12.05	**Optimum**	**Optimum**
Sulfur, ppm	12.83	**Medium**	**Medium**
Copper, ppm	4.26	**High**	**High**
Zinc, ppm	2.17	**Medium**	**Medium**

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

The real decisions

Element (Mehlich3)	Value	Corn (field)	Soybeans
pH (1:1 Water)	7.32	**High**	**High**
Phosphorus, ppm	24.15	**Medium**	**Medium**
Potassium, ppm	340.46	**Very High**	**Very High**
Calcium, ppm	3,750.06	**Very High**	**Very High**
Magnesium, ppm	809.14	**Very High**	**Very High**
Sodium, ppm	12.05	**Optimum**	**Optimum**
Sulfur, ppm	12.83	**Medium**	**Medium**
Copper, ppm	4.26	**High**	**High**
Zinc, ppm	2.17	**Medium**	**Medium**

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

RECOMMENDATION

Crop	Form	*Units: lb/Acre*	Nitrogen	Phosphate	Potash
corn (field)	corn grain		120-160	40	0

Interpreting soil test reports

- Knowing when and how much to fertilize depends on approach
  - Sufficiency
  - Build-maintenance

LSU AgCenter Research & Extension

Sufficiency method

- Attempt to maximize profit in the given year
- Applications are typically needed yearly
  - Unless soil test populations are high
- Placement becomes critical
  - Lower soil test levels since not building
- Method used
  - High input cost and funds unavailable
  - Renting property for short-term

Building-maintenance

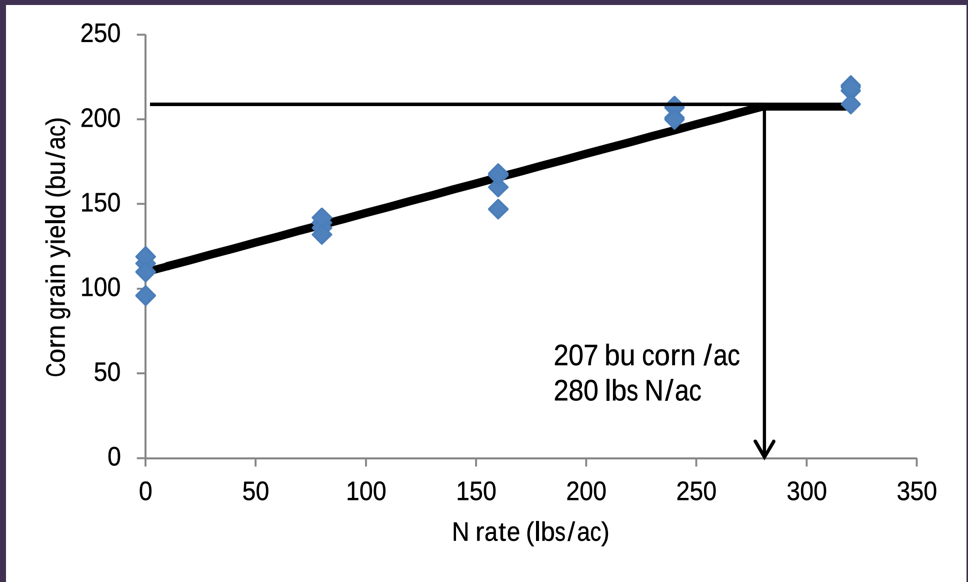
- Focused on P and K
- Applications
  - Current year
  - Future production years
- Less risk associated with uncertainties
- Needs lots of planning to ensure
  - Economical
  - Environmental

How to choose which approach is correct

- Short term cost of building approach
  – Offers long-term flexibility
- Determine what fits best into
  – Rotations
  – Cultural management systems
  – Cultivar/hybrid selection
  – Environmental conditions

N-recommendations

- Based on in-field calibration trials
  - Many soil conditions
  - Many years



Take home points

- Balanced nutrition is critical
  - Will not see response if other deficiencies are not accounted for
- Soil sampling allows for determination of deficient nutrients
  - Proper sampling
  - Proper interpretation
  - Plan on application based on the right approach for your production system

Water sensors

Using water sensors

- "Checkbook" approach for soil water can allow for easy determination of crop needs
- Must have some way to measure precipitation
  - Total rainfall during a given cycle
  - Direct measurement of soil water content

LSU AgCenter Research & Extension

How to measure soil water content

- Tensiometers
- WaterMark® sensors
- Electric sensors

Tensiometers

- Measures how tightly the soil holds water
  - Tells you how energy need to for plant uptake
- Dry soil
  - Water drains out of the column and increases pressure (reading)
- Moist soil
  - Water fills the column and decrease pressure

Tensiometers

- Requires suction to be ever-present
  - If not needs recalibration
  - Problem in our shrink-swell soils

Watermark® sensors

- Functions similar to gypsum blocks
  - Enclosed in capsule to minimize salinity effects
- Measures resistance flow between two electrodes
  - As moisture enters decrease resistance
  - Resistances is automatically transferred to soil moisture readings

Watermark® sensors

- Very user friendly
  - Relatively cheap
  - Somewhat easy to install
  - Somewhat stable and sturdy
- Extremely focused
  - Only measures soil moisture
  - Lacks long-term data collection units with many companies
  - Typically requires a converter

LSU AgCenter
Research & Extension

Soil moisture sensors

- Very commercially available
  - Variety of outputs
- Have ability to measure multiple soil components
  - EC
  - Heat
- Measures water potential in the surrounding soil

LSU AgCenter Research & Extension

Soil moisture sensors

- Can be relatively expensive
- Installation can be time consuming
- Sensors are more sensitive
  - Both with sturdiness and measurement
- Readings can be taken
  - Over multiple components
  - Continually recorded

Take home points

- All sensors have their own merit
  - Some are more beneficial in certain areas compared to other
  - Something is better than nothing or guessing

Thank you and Questions?