Soil Fertility -

The ability of a soil to provide the essential nutrients required for optimum plant growth

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Soil Fertility -

Essential Plant Nutrients – 16 (18)

Carbon - Hydrogen - Oxygen

- Major (Macro)Nutrients
  - nitrogen (N)
  - phosphorus (P)
  - potassium (K)
- Secondary Nutrients
  - calcium (Ca)
  - magnesium (Mg)
  - sulfur (S)
- Micronutrients
  - boron - (B)
  - chlorine - (Cl)
  - copper - (Cu)
  - iron - Fe
  - manganese (Mn)
  - molybdenum (Mo)
  - zinc (Zn)
  - Cobalt
  - Nickel

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Soil Fertility -Maintenance

- Soil Testing
- Nutrient Replacement

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Soil Fertility -

Soil Testing

- How often? 2-4 years (4 years common)
- When? Commonly in fall, growing interest in summer, however consistency of time most important
- How deep? Normally 7 inch depth
- How many tests?
  - One composite (five samples) per 2.5 acres (some firms use 3 or 4 acre grids)
  - GPS mapping for variable application

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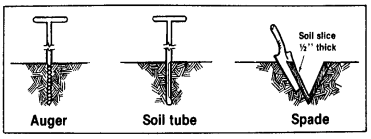
Soil Fertility - Soil Testing Procedures



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Soil Testing

- What tests to run?
  - Wide variety offered
  - pH, P_1, K, perhaps Organic Matter
  - Reliability

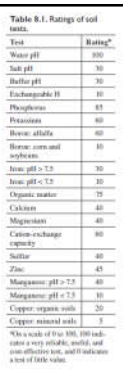

Table 8.1. Ratings of soil tests.

Test	Rating*
Water pH	100
Salt pH	70
Buffer pH	70
Exchangeable H	10
Phosphorus	85
Potassium	80
Boron: alfalfa	60
Boron: corn and soybeans	10
Iron: pH > 7.5	70
Iron: pH < 7.5	20
Organic matter	75
Calcium	40
Magnesium	40
Cation-exchange capacity	80
Sulfur	40
Zinc	45
Manganese: pH > 7.5	40
Manganese: pH < 7.5	10
Copper: organic soils	20
Copper: mineral soils	5

*On a scale of 0 to 100, 100 indicates a very reliable, useful, and cost-effective test, and 0 indicates a test of little value.

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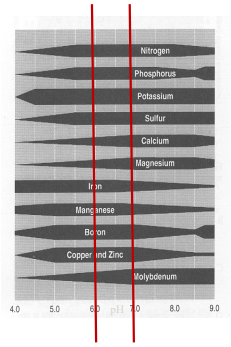
Soil Fertility -

Relationship of pH to Availability of Plant Nutrients in the Soil



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Soil Fertility -

Soil Acidity / Alkalinity

- Most serious limitation
- Seem to have less focus on pH
- pH is key to all nutrients
- Challenge with short-term leasing, frequent corn production, high N use, cash rent

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Soil Fertility -

pH Goals

- 6.0 is minimum pH goal for corn & soybeans
- Choice of materials
  - Ag lime (quarry variance - check CCE & fineness)
    - CCE = Calcium Carbonate Equivalence (quality)
    - Fineness = grinding to what size
  - Liquid lime
  - Pelleted lime
- Normally apply 2 to 4 tons/acre as needed
- Prescription application now common -VRT

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Soil Fertility -

Fertilizer Analysis

Complete	Incomplete
10 -10 -10	46 – 0 - 0
N – P - K	N – P - K
10% Nitrogen	46% Nitrogen
10% P_2O_5	0% P_2O_5
10% K_2O	0% K_2O

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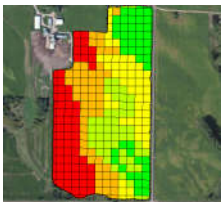
Soil Fertility -

Variable Rate Technology

- Global Positioning Systems are allowing accuracy of testing and mapping



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Soil Fertility -

Nitrogen

- Not a consideration for soybeans (as long as have grown a legume recently)
- Very mobile nutrient (atmosphere/soil/water)
- For many years - rate of 1.2 lb. N/bushel of yield goal – now use N Rate Calculator (MRTN)
- A bushel of corn removes .8 pounds N
  - 200 bushel yield takes out 160 lb
  - 200 bushel crop needs 240 lb. in the plant = 1.2 #

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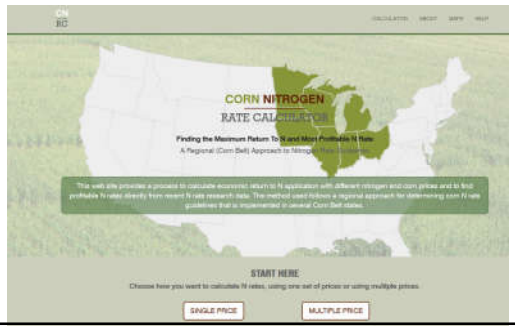
MRTN Calculator



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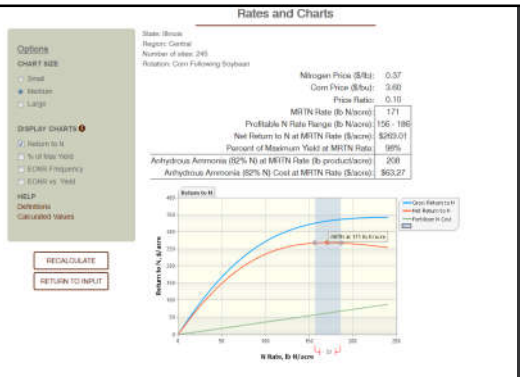

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Soil Fertility - *Nitrogen*

- Sources of Nitrogen
  - Soybeans (normally 40# N leftover)
  - Alfalfa (can be as high as 100# N leftover)
- Manure (depends on livestock species)
- Anhydrous Ammonia (82% N) (82-0-0)
- Urea (45% N) (45-0-0)
- Solutions (normally 28-32%N)(28-0-0)

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Soil Fertility -

Nitrogen Timing

- Soil testing can be used but timing critical
- N needed most at pollination and fertilization
- Fall applied (with stabilization) – COOL soils
- Spring applied (stabilization & timed planting)
- Side dressed (challenge for large acres or weather)
- Most mobility at high moisture and warm temperature

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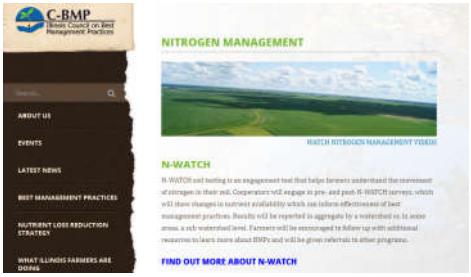
Nitrogen Management Concerns



4 R's – rate, source, timing, placement

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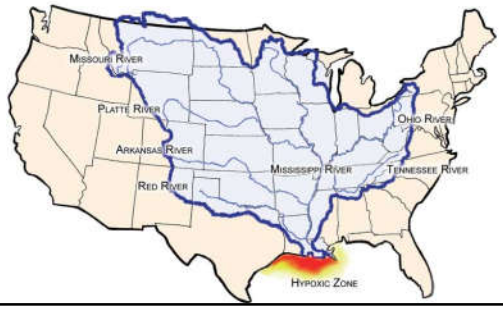
Mississippi watershed & Hypoxia



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Soil Fertility - Phosphorus

- Triple Super Phosphate - 46% P (0-46-0)
- Diammonium Phosphate-46% P & 18% N
  - DAP (18-46-0)
- Monoammonium Phosphate – 52% P, plus 11% N
  - MAP (11-52-0)
- Maintenance (new rate Fall '17)
- Corn –
  - Each bushel removes .37lb. P_2O_5
  - 200 bu/A - 74 # P_2O_5, (160 # DAP)
- Soybeans –
  - Each bushel removes .75 lb. P_2O_5
  - 60 bu/A - 45 # P_2O_5, (97 # DAP)

Figure 8.4. Subsoil phosphorus-supplying power in Illinois.

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Phosphorus Buildup

- Soils Natural ability to supply - thickness of loess
  - Build P_1 to 40 (High) None if >60
  - Build P_1 to 45 (Medium) None if >65
  - Build P_1 to 50 (Low) None if >70
- To Build, Add 9#P_2O_5 to raise the soil test P_1 1#

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Potassium

- Potash (KCl) most common (60% K)
- Also immobile, needs placement
- Maintenance – new rates Fall '17
- Corn
  - Each bushel removes .24 lb. K_2O
  - 200 bu/A - 48 # K_2O, (80 # Potash)
- Soybeans –
  - Each bushel removes 1.17 lb. K_2O
  - 60 bu/A - 70.2# K_2O, (117 # Potash)

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Potassium

- Ability to supply based on
  - CEC – Cation Exchange Capacity (clay, OM, drainage, etc.)
- Build Low to 260, build High to 300
- Building Program = 4 # K_2O
  - per soil test number to grow
- Little potential
  - if K if higher than:
    - 360 for "high" soils (retest in 4 years)

Potassium Recommendations

Tests on soil samples that are taken before May 1 or after September 30 should be adjusted downward as follows: subtract 30 for the dark-colored soils in central and northern Illinois; subtract 45 for the light-colored soils in central and northern Illinois and for fine-textured bottomland soils; subtract 60 for the medium- and light-colored soils in southern Illinois.

Figure 8.7. Cation-exchange capacity of Illinois soils. The darkest areas are sands with low capacity.

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Soil Fertility -

Micronutrients

- Normally tissue test, rather than soil test
- Sulfur beginning to show, especially on sandy soils
- Will likely grow in need as we grow yields

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Cover Crops

Much interest in Cover Crops – Why?

- Soil erosion protection
- May reduce soil compaction
- May help suppress winter annual weeds
- Additional Organic Matter for soil – no harvest of cover crops – soil tilth, porosity, infiltration
- Nutrient tie-up for release to next crop
- Researching income producing cover crops
  - Pennycress (ISU/WIU)

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Cover Crops

What is being grown?

- Cereal grains – oats, cereal rye
- Annual rye grass
- Radish
- Crimson clover, vetch, winter peas

How are they seeded?

- Aerial or ground rig

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Soil - Drainage

The ability of the soil profile to hold adequate plant available water and oxygen for root growth

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Soil – Drainage

- Drainage Districts

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Weed Control

- Tolerable Weed Control - What is it?
  - More a landowner concern/personal pride issue
  - Are we spending more than necessary?
  - Generally 1 lb. of weed equals 1 lb. less crop

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Weed Control -(con't)

- Trends
  - Growing number of post-emergent products rather than pre-emergence
  - Using MANY less pounds per acre than in past decades
  - As we reduce tillage, we spend more on chemicals
  - 98% of our crop land has herbicide application
  - Weed resistance **is now** an issue, need to switch "families" – glyphosate problems
  - Genetically altered crops allow special herbicide programs

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Insect Issues

- Changing corn rootworm pressures with rotated corn
- Bt genetics and corn borer management
- Spider mites (not an insect) and soybeans

Disease Pressures

- Stalk rot in corn
- Foliar Diseases
- Cyst Nematode, BSR, SDS in soybeans
- Increasing problems

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Summary

- Knowledge of Farm (Agronomy Handbook)
- Business Partnership (Communicate!!)
- Annual Planning between partners
- Farm management can assist
- Consultants available

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Thank you for coming!

Final session: Grain Marketing
March 8, 2018

McLean County Farm Bureau

Illinois State University

Don Meyer
Licensed Farmland Auctioneer/Broker
Lee Realty

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