

# SOIL SAMPLING & SOIL TEST INTERPRETATION

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# Some Basics First

- Proper Soil Sampling is Crucial
- Use a Reputable Laboratory
  - Standard Methods that are correlated and calibrated: NAAPT-PAP
  - Local is best—easy interaction and understanding of unique soil properties

# SOIL SAMPLING

## Use Clean Equipment

- Plastic Buckets (not old fertilizer container)
- Clean Soil Sampler
- Do not use galvanized equipment—major Zn contamination!
- Sample prior to fertilization

# SOIL SAMPLING

## Collect a Sufficient number of Samples to Represent the field

- Stay out of abnormal areas -- sample them separately if you want
- Mix well and subdivide into sample bag
- Label Bag & Fill out the paper work
- Submit to Lab ASAP

# Sampling

- Sampling depth should match plant
  - 1' for non-mobile nutrients
  - 1' – 3' for mobile nutrients
    - Usually  $\text{NO}_3\text{-N}$  and  $\text{SO}_4\text{-S}$

# SOIL TEST INTERPRETATIONS

- What do you do with the soil test results?
- Building Fertility vs Replacement, consider the \$'s
  - Sufficiency Level
    - There is a measurable range of concentration for each nutrient which will afford maximum plant growth
      - A fertilizer response can be expected to occur when the soil test level is below that range
      - No response can be expected if above
  - BCSR (Basic Cation Saturation Ratio)
    - Maximum plant growth occurs at certain ratios of Ca, Mg, K
    - Actually does not address N, P and micro-nutrients

# OBSERVATION & PHILOSOPHY

- Plants Can thrive under a wide range of soil test levels of most plant nutrients
  - That is why roots have semi-permeable membranes and active transport mechanisms!
  - Hence, the Sufficiency Range approach is common in the West

# SOIL TESTING

- Availability Index, NOT Total Analysis
- Attempt to Mimic Plant roots
  - Numerous Methods/Extractants developed by various Universities
    - Must be Correlated to plant uptake
    - Must be Calibrated to plant response in plot/field trials to develop fertilizer responses
    - Must interpret the results & make a fertilizer plan
  - Standard Methods are Essential: North American Proficiency Testing Program



# SOIL TEST INTERPRETATIONS - N

- The **only** nutrient we can use lbs/ac calculations
- Consider and measure all sources
  - Nitrate:  $\text{mg/kg or ppm} \times 4 = \text{lbs/ac}$
  - Ammonium:  $\text{mg/kg or ppm} \times 4 = \text{lbs/ac}$
  - Organic Matter:  $\% \times (20 \text{ to } 40) = \text{lbs/ac release/yr}$
- Consider entire root zone for Nitrate
- Consider sample time: spring or fall
- Consider plant requirement & timing

# SOIL TEST INTERPRETATIONS – P

- Sufficiency Range: Varies with Method
  - Olsen: 10-20 mg/kg (most plants)
  - Morgan: 8-12 mg/kg
  - Bray P1 (OSU): 25-75 mg/kg
- Availability greatest near neutral pH
  - Mineralogy: Fe & Al vs. Ca
  - pH management
    - Addition of  $\text{NH}_4$  or  $\text{S}^0$  on alkaline soil enhances availability
    - Addition of some lime on acid soil enhances availability; a lot of lime can decrease availability
  - Free lime reduces availability (high effervescence)

# SOIL TEST INTERPRETATIONS – K

- Sufficiency Range: less variable by method
  - Olsen: 125-175 mg/kg (most plants)
- Other considerations
  - K supplying capacity of soil
    - Very sandy soils—may need to match crop removal
    - Heavier soils produce fine at lower test values
    - Some soils can Fix K (micaceous mineralogy)
  - Plant requirement & rooting depth

# SOIL TEST INTERPRETATIONS – BASIC CATIONS

- No specific sufficiency ranges established
- Liming may cause K to be overwhelmed
  - Don't get too excited about Cation Ratios, but...
    - Ca range: about 60 - 85 % of the CEC
    - Mg range: about 6 - 12 % of the CEC
    - K range: about 2 - 5 % of the CEC
    - Ca + Mg is usually > about 65 % of the CEC

# SOIL TEST INTERPRETATIONS - MICRONUTRIENTS

- DTPA extraction universal in West
- pH is major factor
- Organic matter is important for nutrient cycling
- Foliar applications may be more effective than soil
- Use Plant Testing to verify management

# SOIL TEST INTERPRETATIONS - MICRONUTRIENTS

## Generic Sufficiency Ranges

<u>Nutrient</u>	<u>Sufficiency Range</u>
Zinc (Zn)	0.8 – 1.2 mg/kg
Manganese (Mn)	2.5 – 4.0 mg/kg
Copper (Cu)	0.2 – 0.5 mg/kg
Iron (Fe)	5.0 – 50 mg/kg
Boron (B)	0.3 – 1.0 mg/kg

# SOIL TEST INTERPRETATIONS - pH

- Standard Methods
  - Distilled Water 1:1 and 1:2 most common
  - Saturated Paste: typically about 0.3 lower
  - 0.01 M  $\text{CaCl}_2$  1:1 or 1:2: about 1 unit < Water
- Wide range acceptable—be aware of impact on nutrient availability
- Lime Requirement Methods
  - SMP Buffer 7.6 used on the West-Side
  - A&E Buffer 8.0 used on East-Side soils

# SOIL TEST INTERPRETATIONS

## - pH

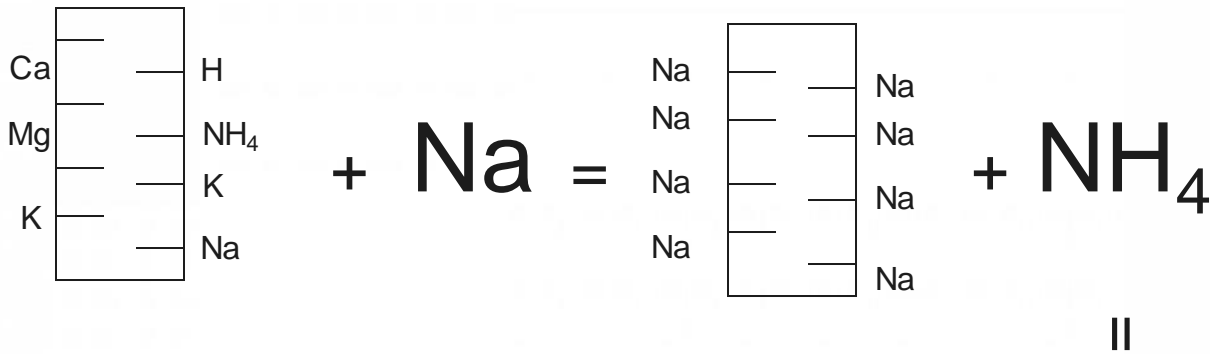
- pH & Base Saturation
  - $BS = (Ca + Mg + K)/CEC$
  - @pH 7, BS=100%; @pH 5, BS → 60%
  - If Base Saturation is > 70 %, then pH is fine
  - Converse: pH >6.0, then BS is likely fine
  - Gypsum raises BS, no direct effect on pH
- Sulfate does not lower pH;  $S^{\circ}$  and  $NH_4$  do



# SOIL TEST INTERPRETATIONS – SOLUBLE SALTS

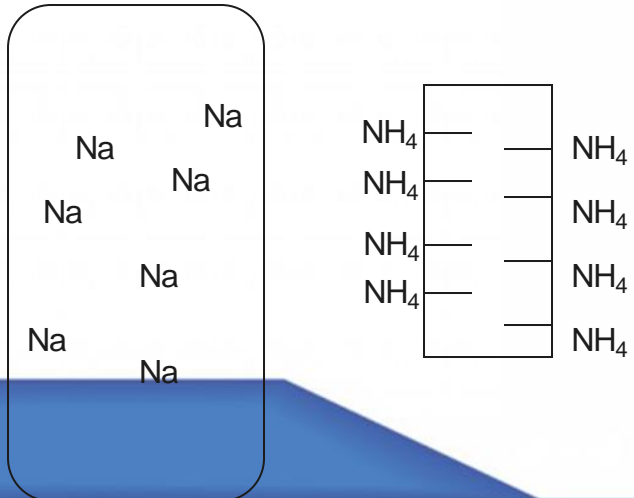
- Standard Methods
  - Saturated Paste—tedious but the method to which plant responses are calibrated
  - 1:1 or 1:2—commonly used, not calibrated
- Salinity should not exceed 2-3 mmho/cm (saturated paste method)
  - Find out what salts are high & why
    - Na—seldom toxic, causes soil infiltration problems
    - Cl—some crops very sensitive (e.g. peach & grape)
    - Sulfate causes little problem other than osmotic

# Soil CEC

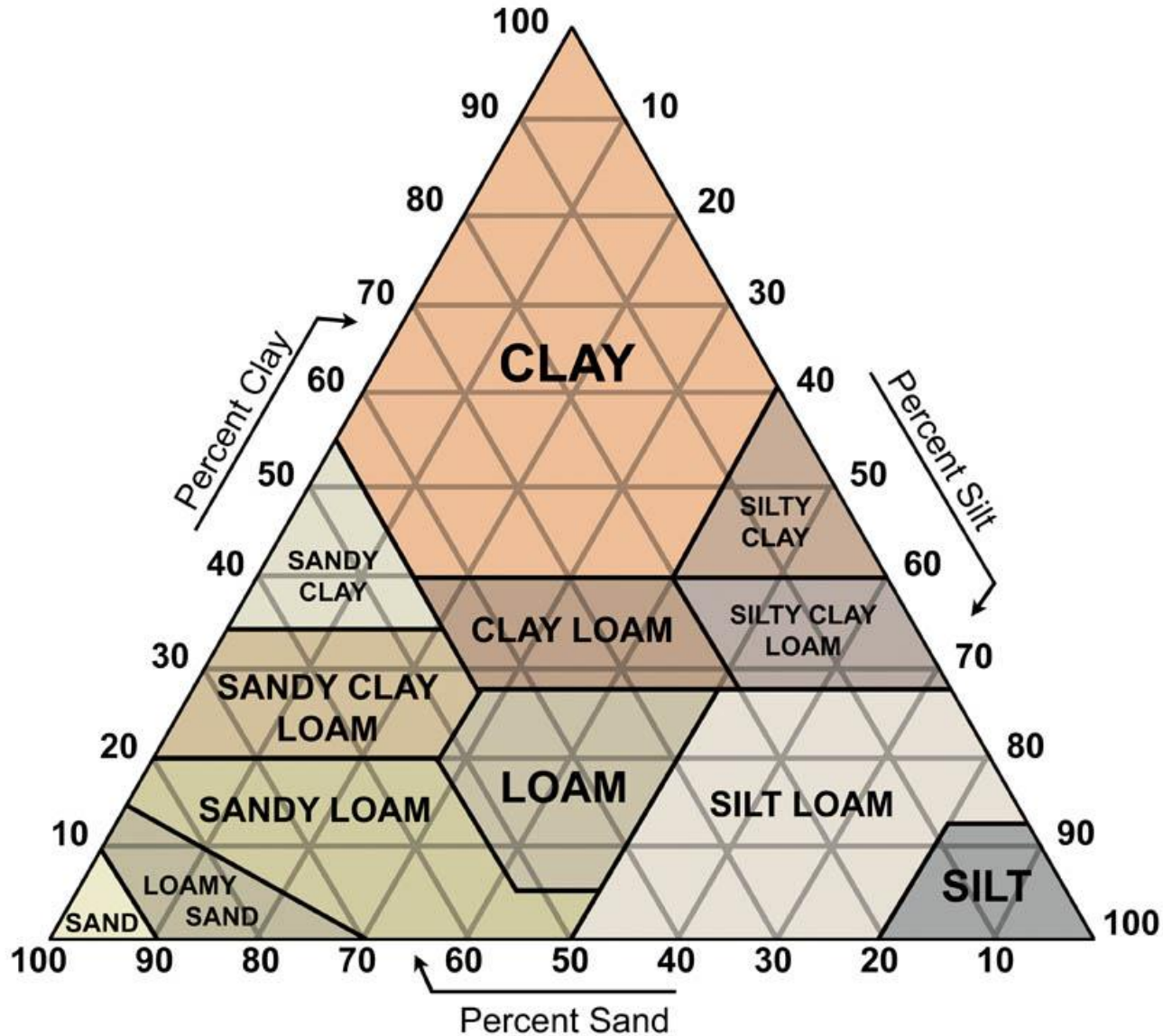


Results are indicated as meq/100g of soil

These are the same units as the bases on the report

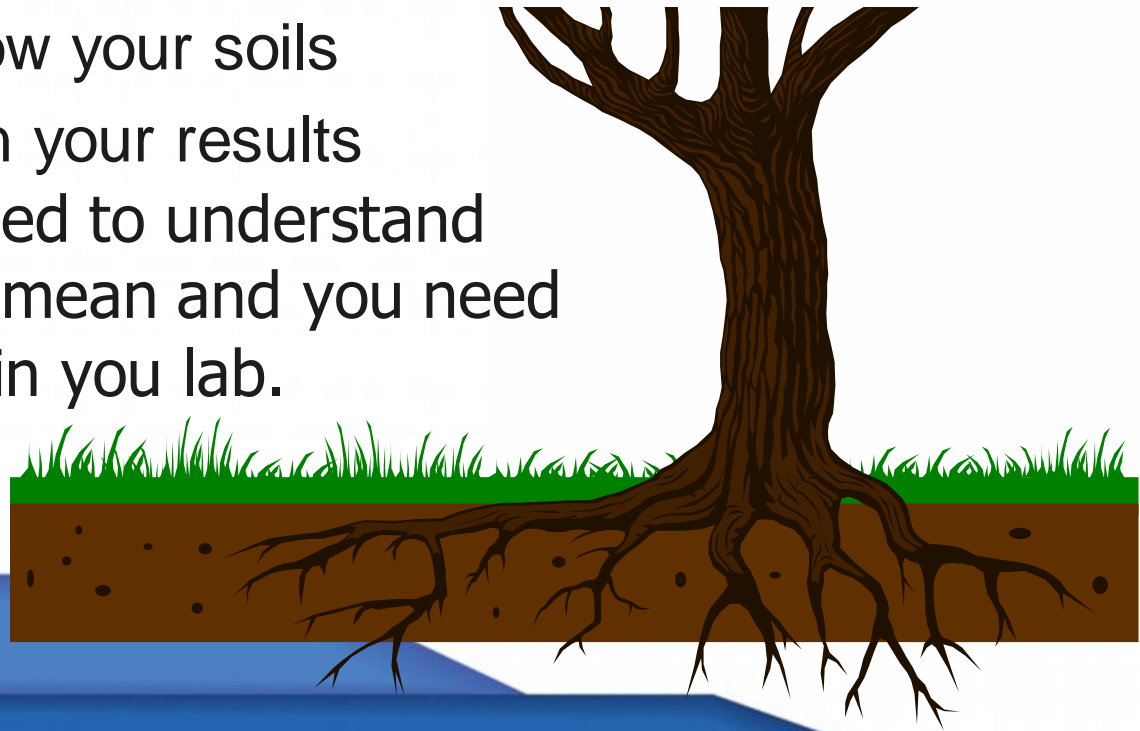


# Soil Texture



# Soil Test Interpretation-- Summary

- Lab results are no better than the sample you submit.
- Know your lab, ask questions about methods & performance & recommendation philosophy
- Keep records & know your soils
- Ask questions when your results  
Come back. You need to understand  
what your analyses mean and you need  
to have confidence in you lab.



Questions?