Soil Testing 101

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Post Rock District Crop Production Agent

Crop Nutrient Management Meeting
January 22, 2024
Smith Center
Why soil sampling and testing?

- Determine how much fertilizer to apply?
- Determine how much nutrient is available from the soil?
Why soil sampling and testing?

- Estimate probability of nutrient response.
- Determine the amount of plant available NO$_3$-N.
- Identify fertility trends.
- Estimate long-term nutrient sufficiency.
- Estimate long-term average nutrient rates.
- Diagnosing problems / problem solving.
Probability of Fertilizer Response

<table>
<thead>
<tr>
<th>P Test Level, ppm</th>
<th>Probability of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>85-100%</td>
</tr>
<tr>
<td>6-12</td>
<td>60-85%</td>
</tr>
<tr>
<td>13-20</td>
<td>30-60%</td>
</tr>
<tr>
<td>20-30</td>
<td>10-30%</td>
</tr>
<tr>
<td>&gt;30</td>
<td>0-10%</td>
</tr>
</tbody>
</table>
Potential limitations

- Variability in test results.
- Time and work to take samples.
- Time to get results back from lab.
- What tests are needed?
Overview

- Proper soil sampling
- Taking soil samples
- Proper sampling depths
Proper soil sampling

- Consistency in depth of sample.
- Appropriate number of subsamples.
- Proper care of collected samples.
- Attention to details.
Basic tools

- Soil probe
- Bucket
- Bag
Considerations

- **Recommended sampling depth:**
  - 0-6 inches = pH, P, K, Zn, Fe, B.
  - 0-24 inches = Nitrate, Cl, S.

- **Where in the field?**

- **When?**
Types of soil sampling: WHERE in the field

- Simple random – good in homogeneous fields.
- Systematic – follow some pattern to cover different areas.
- Stratified – by management zones.
- Composite – mixing all sample units.
WHEN to Take Samples

- Sampling can take place during any period of the year.
- However, it is best to sample a field at about the same time of year. Be consistent.
- Wait a minimum of thirty days to sample after applications of fertilizer, lime, or sulfur.
WHEN to Take Samples for N, S and Cl

- For corn and sorghum, late winter or early spring is ideal.
- For wheat, before planting in the fall.
- Only reason to measure N before soybeans is for required environmental monitoring.
Number of Cores and Acres per Sample

- 15-20 subsamples per sample submitted to laboratory.

- A smaller number can introduce variability into the results from different sampling years.

- There is no rule for the number of acres to include in a single sample. Depends on the local situation. A treatable area of 5-20 acres is ideal.

- Very small sampling areas, such as residential landscape plants and some small gardens may use fewer cores per sample.
How often should I sample?

- Every 2-4 years or every rotation.
- Every year to develop history.

Soil Test P changes over time

30 lb. P$_2$O$_5$/acre

Barney Gordon, 2008

- **With P**
- **No P**
How to prepare samples for shipment to the lab

- Ideally hermetic bags avoiding potential contamination.
- Preferably should not be dried before submitting.

Precautions:

- Do not apply any heat
- Protect from contamination
- No microwaves
NOT Useful soil tests

➢ There is no value in running tests that have no calibration-interpretation for the region.

Not useful in Kansas:
- Bray P-2
- Copper
- Manganese
- Magnesium
- Cation Percentage of CEC
Useful soil tests

- Profile Nitrate-N
- Bray P-1 Extractable P
- Olsen Extractable P
- Mehlich III Extractable P
- Exchangeable K
- DTPA Extractable Zn
- Chloride
- Soil pH
- Lime Requirement / Buffer pH
- Soil Organic Matter
**Soil Test Report**

**Prepared For:**
Sandra Wick
Post Rock Ext Dist - Mitchell
115 S, Hersey
Beloit, KS 67420

**Billing Account #:** 30

**Send Copy To:**

**Sample Information:**
Sample ID: Gasper 1
Order Number: 5143
Lab Number: 002687
Received: 10/20/2016
Reported: 10/24/2016
County: (where sample was taken)

**Results**

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Value Found</th>
<th>Analysis</th>
<th>Value Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil pH (1:1, soil:water)</td>
<td>6.3</td>
<td>Buffer pH</td>
<td>6.4</td>
</tr>
<tr>
<td>Organic Matter (LOI), %</td>
<td>2.4 %</td>
<td>Nitrate (NO₃) surface or 1st sample</td>
<td>19 ppm</td>
</tr>
<tr>
<td>Phosphorus (P) Mehlich-3</td>
<td>36 ppm</td>
<td>Potassium (K)</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Zinc (Zn) DTPA Extraction</td>
<td>0.5 ppm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Wheat (Target pH of 6.0) Yield Goal: 55.0 bushels / Acre**

**Nutrient Graph**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Very Low</th>
<th>Low</th>
<th>Medium</th>
<th>Optimum</th>
<th>Above Opt</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.3</td>
<td>6.0</td>
<td></td>
<td>7.0</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>36</td>
<td>20</td>
<td>40</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>500</td>
<td>130</td>
<td>161</td>
<td>260</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lime ECC</th>
<th>Nitrogen, N</th>
<th>Phosphorus, P₂O₅</th>
<th>Potassium, K₂O</th>
<th>Zinc Zn</th>
<th>Sulfur S</th>
<th>Boron B</th>
<th>Chloride Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Nutrient Units in lbs / acre</td>
<td>0</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Comments:**
KSU Soil test interpretations and recommendations

Soil Test Interpretations and Fertilizer Recommendations in Kansas
Summary

- Soil samples should be representative of the field.
- Recommendations were developed based on calibrations for specific soil depths. **Sampling depth is important.**
- Take lots of cores.
- Profile nitrogen can be a source of nitrogen for the following crop as well.
Summary

➢ Yield goal is a key factor for current recommendations, be realistic about yield potential.

➢ Recommended sampling depths:
  ➢ 0-6 inches = pH, P, K, Zn, Fe, B.
  ➢ 0-24 inches = Nitrate, Cl, S.

➢ Sampling technique presents the greatest chance for errors in results.
Questions?

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