Quality Control in Soil Sample Collection

Steve Prochaska, OSU Extension
Why we do soil testing?

• To develop fertilizer recommendations
  • to increase nutrient utilization efficiency
  • for improved crop production and lower input cost.
• There is data that shows water quality impacts are tied to soil test results for phosphorus
Goals to Taking a Quality Soil Test

- To obtain an **accurate representation** of the fertility levels within a particular field
- Document the existing **variability** within a field as it affects yield.
Keys to Taking a Quality Soil Test-
Remember Sample Size is Small

- 1 pint of soil = 1 pound
- “Acre Furrow Slice” = 6.7 inch deep soil slice with one surface acre is equal to 2 million pounds of soil
- 10 acres = 20 million pounds
- 25 acres = 50 million pounds
Keys to Taking a Quality Soil Test - Dividing the landscape

- Sampling area should be no larger than 25 acres for whole fields
- Use a zig-zag pattern layout way points
- Avoid soil sampling after manure application (wait at least 6 months) or fertilizer (2 months)
- Use GPS to mark sample points for follow-up sampling in future years
  - 10-15 cores per sample area
  - Scrape soil surface of debris/residue
  - Increase cores in fields with history of banded fertilizer (20-25)
Keys to Taking a Quality Soil Test-
Dividing the Landscape into Representative Areas

- Yield Data
- Aerial Imagery
- Soil Type
- Topography
- Other factors worth considering
  - Rotations
  - Manure application
  - Fertilizer application method history
  - Are there “odd” areas that should be sampled separately? End zones?
Keys to Taking a Quality Soil Test-
Dividing the Landscape into Representative Areas

- Grid Sampling
  - What Size Grid?
  - Sampling Pattern within the Grid
  - Does the grid pattern relate to any field characteristics?
- Use to establish management zones
Keys to Taking a Quality Soil Test-
Dividing the Landscape into Representative Areas

Zone Sampling

• What are zones based upon?
• Sampling pattern within the zone
• How many samples per zone?
Keys to Taking a Quality Soil Test - Sample Depth

• Consistent sample depth
  • Variation in depth can skew soil test data dramatically
  • 4” sample does not provide same nutrient analysis as 8” sample
  • Tri-State based on 8 inch sample
  • With established forages, no-till and ridges an additional samples should be taken at a shallower depth (0 to 4 inches) to assess acidification of the soil surface and make appropriate lime recommendations.
Keys to Taking a Quality Soil Test- Nutrient Stratification

• Nutrient levels in the upper soil profile (0-2) differ in concentration from the lower soil profile (0-8)

• Stratification is both a natural process and crop system influenced
  • Natural as roots take up nutrient from the lower soil profile and the harvested crop residue re-deposit nutrients on the soil surface.
  • Crop system influenced
    • Fertilizer placement (broadcast versus stripped/banded, etc)
    • Tillage (Plow, Ripper, Disk, Vertical Tillage etc)

• Crop yield has not yet been greatly affected by stratification.

• P loss likely greater with increased stratification in the 0-2 inch layer through tile lines
Keys to Taking a Quality Soil Test-
General effects of depth of sample on soil test

- Phosphorus and Potassium Levels decrease
- pH depends on subsoil
  - Western alkaline subsoil pH goes up to pH 7.0 or above
  - Eastern acid subsoil pH goes down or below 6.2 or less

### Northwestern Ohio (Henry and Fulton County)

<table>
<thead>
<tr>
<th>Depth</th>
<th>PH</th>
<th>P (PPM)</th>
<th>K (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-8</td>
<td>6.7</td>
<td>59</td>
<td>169</td>
</tr>
<tr>
<td>0-4</td>
<td>6.5</td>
<td>66</td>
<td>201</td>
</tr>
<tr>
<td>4-8</td>
<td>6.9</td>
<td>47</td>
<td>130</td>
</tr>
<tr>
<td>8-12</td>
<td>7.2</td>
<td>17</td>
<td>113</td>
</tr>
<tr>
<td>Field 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-8</td>
<td>6.8</td>
<td>15</td>
<td>112</td>
</tr>
<tr>
<td>0-4</td>
<td>6.8</td>
<td>16</td>
<td>136</td>
</tr>
<tr>
<td>4-8</td>
<td>6.6</td>
<td>10</td>
<td>86</td>
</tr>
<tr>
<td>8-12</td>
<td>6.9</td>
<td>4</td>
<td>77</td>
</tr>
</tbody>
</table>
Keys to Taking a Quality Soil Test-
*Tillage systems* affect sampling stratification

- Each tillage system affects nutrient stratification differently
  - Most stratified No-till
  - Chisel plow/disk rippers medium
  - Moldboard low stratification

*Source:* Mallarino, Iowa State
Keys to Taking a Quality Soil Test - Time of Year

- When should soil samples be collected?
  - Spring or fall
  - Be consistent about sampling time so soil test trends can be tracked

- How often should soil samples be collected?
  - Once per rotation or at least every four years
  - Typically collected after soybeans in corn-soybean rotation

Source: Managing Seasonal Fluctuation of Soil Test, University of Kentucky
What nutrients can we test for?

• Measure soil acidity for lime recommendation
  • pH
    • Affects plant nutrient availability
• Provide nutrient recommendation for two immobile macro nutrients utilizing realistic crop yield goals
  • Phosphorus
  • Potassium
  • Nitrogen? .. mobile
What Nutrients can we test for?
- Micronutrients
  • Soil tests tend not to correlate to crop uptake for many micronutrients
  • Soil test based micronutrient recommendations for mineral soils in the Tri-State include Manganese, Zinc
  • Generally micronutrient deficiencies are most common on low organic matter (<1.5 %), lighter textured soils or where pH is out of normal ranges
    • Tissue test plus soil test should be used in micronutrient deficiency diagnosis
Keys to Taking a Quality Soil Test- Selecting a Soil Testing Lab

• Soil testing labs generally do a good job of analysis.
  • Much of the variation is in sample collection
• An OSU Study sent blind samples to 13 labs, 12 of 13 labs were within acceptable ranges.

Source: Purdue University
OSU Fertility Spreadsheet

7 Fields or Zone Product and Cost
P, K and Lime

Link on Page 18 of Manual

OHIO STATE UNIVERSITY EXTENSION

Fertility Recommendation Calculator

This spreadsheet calculates fertilizer application rates and costs for major field crops in Ohio. Users should start by selecting phosphorous test and unit by clicking on box and making selection using down arrow on right side of box. Users can then enter crops, yield goals and soil tests results in the "Input Information" tab. Soil fertilizer application rates are summarized in the "Recommendation Summary" tab, or reported individually with cost on the "lime" and "fertilizer" tabs. All calculations are based on the "Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa.

Report for:
Prepared by:

Units Used to Report P&K Results (From soil test report or call lab)
ppm
Test Used to report Phosphorus results (From soil test report or call lab)
Bray 1

Note for all sheets that light gray areas for data entry & white areas show results

To Begin Click Start=====>

Developed by:
Greg LaBarge
Field Specialist, Agronomic Systems
Ohio State University Extension
labarge.1@osu.edu

Reviewed by:
Dr. Steve Culman
Extension Specialist, Soil Fertility
Ohio State University Extension
culman.2@osu.edu

Sources:
Understanding Soil Test for Plant Available Phosphorus

Version 2014-1. Published 5/2014

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES
Keys to Taking a Quality Soil Test-
Selecting a Soil Testing Lab

- Criteria to define sample handling, processing and chemical extraction for the Midwest is defined in NCR-221
- North American Proficiency Testing is a voluntary program which conducts blind samples [http://www.naptprogram.org/](http://www.naptprogram.org/)
- Ask about internal checks and quality control procedures
- Selecting a soil testing lab
Questions?

For More Information
http://agcrops.osu.edu/specialists/fertility

Developed by:
Greg LaBarge, Harold Watters, Steve Prochaska
- Field Specialists, Agronomic Systems
John Barker, Mark Landefeld and Jason Hartschuh
- Extension Educators
and
Steve Culman State Soil Fertility Specialist