Soil Sensing, Soil Testing, Zone Management

Brian Arnall
SW/NW Ag In-Service Agenda
11–30–2010
Soil Sample Collection

- Errors or differences in Soil samples
  - Collection method > laboratory
  - Environment > laboratory
- Field Variability
  - Composite sample no matter area is an AVERAGE
  - Average of highs and lows
- #of Cores
  - 15 to 20 for each management area
- Depth
  - Nutrients can change with depth (P and pH)
  - No–till and pasture systems
  - Crop: bermudagrass, wheat, cotton
Variability in your fields

- Impact on soil sampling
- Zone Management
  - What is the Product?
  - Yield Based
  - Topography based
  - Soil based
- Grid Soil Sampling
  - What is the product?
  - Is it worth the money?
Electrical Conductivity (EC)

- Soil EC is soil electrical conductivity— a measurement of how much electrical current soil can conduct. It’s an effective way to map soil texture because smaller soil particles such as clay conduct more current than larger silt and sand particles. Soil EC measurements have been used since the early 1900’s—
- Veris mobilized the process and added GPS. As the Veris EC cart is pulled through the field, one pair of coulter-electrodes injects a known voltage into the soil, while the other coulter-electrodes measure the drop in that voltage.
- The result: a detailed map of the soil texture variability in the crop rooting zone
Large Scale Field Variability

- RTK Elevation
- Ran Veris EC Rig
- Grid Soil Sampled at 2.5 ac Resolution
  - Basic, Secondary, Micro, & OM
- Will collect Yield Monitor data for the next 5 yrs.
- Will apply test strips across each field to measure the variation in response to nutrients added.
  - Supported by the Oklahoma Soybean Board.
Phosphorus

<table>
<thead>
<tr>
<th>Soil Test P Index</th>
<th>% Sufficiency</th>
<th>P2O5 lbs/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>80</td>
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<td>30</td>
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<td>30</td>
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<tr>
<td>40</td>
<td>90</td>
<td>20</td>
</tr>
<tr>
<td>65+</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

P (lb/ac)
- 15.0 - 23.5 (19.5 ac. - 15.6%)
- 23.5 - 31.1 (44.1 ac. - 36.2%)
- 31.1 - 36.7 (33.8 ac. - 27.0%)
- 36.7 - 49.3 (20.0 ac. - 15.8%)
- 30.7 - 49.3 (7.9 ac. - 0.3%)
Potassium

<table>
<thead>
<tr>
<th>Soil Test K Index</th>
<th>% Sufficiency</th>
<th>K2O lbs/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>60</td>
</tr>
<tr>
<td>75</td>
<td>70</td>
<td>50</td>
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<tr>
<td>125</td>
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<td>200</td>
<td>95</td>
<td>20</td>
</tr>
<tr>
<td>250+</td>
<td>100</td>
<td>0</td>
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</table>

K (lb/ac)
- 281.0 - 338.1 (25.8 ac. - 20.6%)
- 338.1 - 370.9 (42.2 ac. - 33.7%)
- 370.9 - 406.0 (26.0 ac. - 29.7%)
- 406.0 - 453.7 (20.0 ac. - 16.7%)
- 453.7 - 520.5 (10.3 ac. - 8.2%)
Determining the Variable

- Using 1 factor to determine other unrelated factors
## Buffer Index

<table>
<thead>
<tr>
<th>Buffer Index</th>
<th>Lime required (tons 100% ECCE)</th>
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<tbody>
<tr>
<td>pH 6.8</td>
<td>pH 6.4</td>
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<tr>
<td>Over 7.1</td>
<td>None</td>
</tr>
<tr>
<td>7.1</td>
<td>0.5</td>
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<tr>
<td>7.0</td>
<td>0.7</td>
</tr>
<tr>
<td>6.9</td>
<td>1.0</td>
</tr>
<tr>
<td>6.8</td>
<td>1.2</td>
</tr>
<tr>
<td>6.7</td>
<td>1.4</td>
</tr>
<tr>
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<tr>
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<tr>
<td>6.4</td>
<td>3.1</td>
</tr>
<tr>
<td>6.3</td>
<td>3.7</td>
</tr>
</tbody>
</table>

### Bph Polygons

- 6.3 - 6.7 (6.4 ac. - 61%)
- 6.7 - 6.9 (4.4 ac. - 3.5%)
- 6.8 - 6.9 (23.2 ac. - 18.5%)
- 6.9 - 7.0 (69.0 ac. - 56.1%)
- 7.0 - 7.1 (22.3 ac. - 17.8%)
Phosphorus

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<td>0</td>
</tr>
</tbody>
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P (lb/ac)

- 15.0 - 23.5 (19.5 ac - 15.6%)
- 23.5 - 27.2 (44.1 ac - 35.2%)
- 27.2 - 31.1 (33.9 ac - 27.0%)
- 31.1 - 36.7 (20.0 ac - 15.9%)
- 36.7 - 49.3 (7.9 ac - 0.3%)
Elevation

Elevation (m)
- 257.4 - 258.5 (12.6 ac. - 11.6%)
- 258.5 - 259.3 (22.5 ac. - 20.6%)
- 259.3 - 260.0 (32.9 ac. - 30.2%)
- 260.0 - 260.5 (25.6 ac. - 23.5%)
- 260.5 - 261.4 (15.3 ac. - 14.1%)
- (109.0 ac.) Field Boundary
Phosphorus

P Soil Test (lb/ac)

- 9.3 - 18.8 (14.1 ac. - 13.0%)
- 18.8 - 25.2 (30.6 ac. - 28.0%)
- 25.2 - 31.5 (40.5 ac. - 37.2%)
- 31.5 - 41.1 (17.8 ac. - 16.4%)
- 41.1 - 59.0 (5.9 ac. - 5.5%)
Potassium

K Soil Test (lb/ac)
- 78.0 - 95.8 (14.8 ac. - 13.5%)
- 95.8 - 104.5 (33.8 ac. - 31.0%)
- 104.5 - 113.9 (23.3 ac. - 21.4%)
- 113.9 - 123.1 (21.7 ac. - 19.9%)
- 123.1 - 135.8 (15.5 ac. - 14.2%)
- (109.0 ac.) Field Boundary
Partners in Research

Souder South Application Strips

- P rich strip will be the south strip in each rep, apply 60 lb P2O5/acre
- K rich strip will be the middle strip, apply 80 lb K2O/acre
- North strip in each rep will be a P and K rich strip that receives both 60 lb P2O5/acre and 80 lb K2O/acre
Partners in Research

- Yield most closely related to BI < .0001,
- Yield not statistically related to any other variable. Relationship between all micros Sig but negatively.
Ph

Ph Polygons
- 5.0 - 5.5 (40.4 ac. - 28.0%)
- 5.5 - 5.7 (50.1 ac. - 34.6%)
- 5.7 - 6.0 (34.4 ac. - 23.8%)
- 6.0 - 6.6 (13.3 ac. - 9.2%)
- 6.6 - 7.5 (6.3 ac. - 4.4%)
Buffer Index

Bph Polygons
- 6.5 - 6.7 (20.3 ac. - 14.1%)
- 6.7 - 6.8 (57.8 ac. - 40.0%)
- 6.8 - 6.8 (0.0 ac. - 0.0%)
- 6.8 - 6.9 (47.1 ac. - 32.6%)
- 6.9 - 7.1 (19.3 ac. - 13.4%)
Phosphorus

P (lb/ac)
- 11 - 20 (3.8 ac. - 2.6%)
- 20 - 30 (46.6 ac. - 32.2%)
- 30 - 40 (49.9 ac. - 34.5%)
- 40 - 50 (19.5 ac. - 13.5%)
- 50 - 300 (24.8 ac. - 17.2%)
EC

EC (mmhos/cm)
- 0 - 65.8  (16.0 ac. - 11.1%)
- 65.8 - 101.8  (78.0 ac. - 54.0%)
- 101.8 - 144  (50.5 ac. - 35.0%)
Summary

- All techniques are potentially the right way and the wrong way.
- MUST have variability before you treat for variability!
- Variable Rate Lime, Most economical.
- Sometimes Nutrient need are the same sometimes its not, more often its not.
- Look at the cost of the method versus the economics of the production system.
Thank you!!!

Brian Arnall
373 Ag Hall
405–744–1722
b.arnall@okstate.edu
Presentation available @
www.npk.okstate.edu
Twitter: OSU_NPK