Overview of Precision Soil Fertility Management

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Standard Soil Sampling

• Typically a composite soil sample(s) are collected from a field and sent to a lab for soil testing.

• The soil test results are based on a crop, yield goal, and a few other field parameters.

• Once the results are received then a fertilizer blend is ordered and applied to the field using fertilizer spreader.

• This is the most common practice, so why is it a problem?
Soil Sampling

• To better match fertility requirements to crop requirements a more intensive soil sampling strategy should be employed:
  • Composite Samples
  • Grid Sampling
  • Zone Sampling
Grid Sampling

- Overlay a grid on a field and collect samples from the grid.
- Composite samples should be pulled from each of the grid cells, not a single sample from each grid cell.
- Soil tests are performed by each composite from each grid and an application map is developed to apply a different rate per grid.
Grid Sampling

• How do we select an appropriate grid size?
  • Field Size
  • Application Equipment
  • Field Variability
  • Cost
  • 0.25, 2.5, 5, 10 acre grids
Grid Sampling

• Unfortunately grid samples can miss field variability in a field and may even create variability where it doesn’t exist.
Grid Sampling

• Improper grid size selection can also cause some of these problems.
Grid Sampling

- Should utilize grid sample results in combination with an Ag GIS software to develop a contour map of results.
Grid Sampling

Advantages:
- Assess nutrient variability in the field
- No prior knowledge of field history required
- Identify hot spots/areas
- Minimize excess nutrient application
- Target inputs where needed
- Minimum skill level

Disadvantages:
- No justification for grid sizes
- Grid arbitrarily placed in the field
- Ignores soil properties and characteristics
- Labor and time intensive
- Expensive
Zone Soil Sampling

- Another soil sampling strategy that can aid in better addressing field variability is zone management.
- Unlike grid sampling, zone sampling develops zones based on another measured field parameter.
Zone Soil Sampling

• Need to find areas that are homogeneous and treat them accordingly.
• Need to decide what is homogeneous.
• How big should your management zones be?
• A “good” zone is more uniform than a larger area that contains a zone and has a different value than an adjacent or nearby zone.
• Straight lines are manmade and usually follow travel patterns.
• Usually more irregular patterns are naturally occurring.
Zone Soil Sampling

• There are multiple ways to delineate zones
  • Knowing that specific areas are different than other areas.
  • Comes from previous observations

• A measured difference between areas
  • Visual
  • Soil Type
  • Soil EC
  • Elevation
  • Yield Data
  • Remotely sensed data
  • Etc.....
Visual Zone Development

Burke County, Georgia (GA033)

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CtA</td>
<td>Clarendon loamy sand, 0 to 2 percent slopes</td>
<td>9.2</td>
<td>5.3%</td>
</tr>
<tr>
<td>DoA</td>
<td>Dothan loamy sand, 0 to 2 percent slopes</td>
<td>51.9</td>
<td>30.2%</td>
</tr>
<tr>
<td>DoB</td>
<td>Dothan loamy sand, 2 to 5 percent slopes</td>
<td>50.2</td>
<td>29.2%</td>
</tr>
<tr>
<td>GR</td>
<td>Grady-Rembert association</td>
<td>45.2</td>
<td>26.3%</td>
</tr>
<tr>
<td>TTA</td>
<td>Tifton loamy sand, 0 to 2 percent slopes</td>
<td>2.7</td>
<td>1.6%</td>
</tr>
<tr>
<td>TTB</td>
<td>Tifton loamy sand, 2 to 5 percent slopes</td>
<td>12.8</td>
<td>7.4%</td>
</tr>
<tr>
<td>Totals of Area of Interest</td>
<td></td>
<td>172.0</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

EC Shallow (dS/m)

- 4.90 – ∞ (6)
- 2.98 – 4.90 (3)
- 1.05 – 2.98 (4)
- ∞ – 1.05 (5)
Visual Zone Development

BE CAREFUL EVERYTHING IS NOT ALWAYS CLEAR CUT!!!
Soil EC Zone Development
Yield Zone Development

Soil EC, at planting

Cotton Yield

R² = 0.3225

Normalized Yield vs Deep Soil EC, mS/m
Zone Sampling

Advantages:
- Zones delineated based on past field performance and soil properties
- Classifies spatial variability
- Reduced time and labor
- More economical

Disadvantages:
- Greater initial time and investment to implement zone management
- Higher skill level required
- Requires field knowledge and history
When to use:

**Grid Sampling**
- No to little information available on field history
- Fields where variability is expected but field history is unknown
- Differences in soil type or varied management practices have been used in the past
- Important data layer when planning to implement zone management for future fertilizer applications

**Zone Sampling**
- Field history known for multiple years (at least 3-5 years)
- Topography varies and can be used to define zones
- Yield data over time shows consistent low and high yielding zones
- Any other data layer (soil type or remote sensed crop properties) is available to overlay to define zones
How often and when to soil sample?

• Grid Sampling:
  – 1 or 2.5 acre grids
  – 4 to 5 years

• Zone Sampling:
  – 3 zones (optimal)
  – 1 to 2 years

Collect samples after harvest and close to the next planting as possible (same time every year to eliminate seasonal variability)

*Consistent sampling time is the key!*
THANK YOU