Overview of Precision Soil Fertility Management

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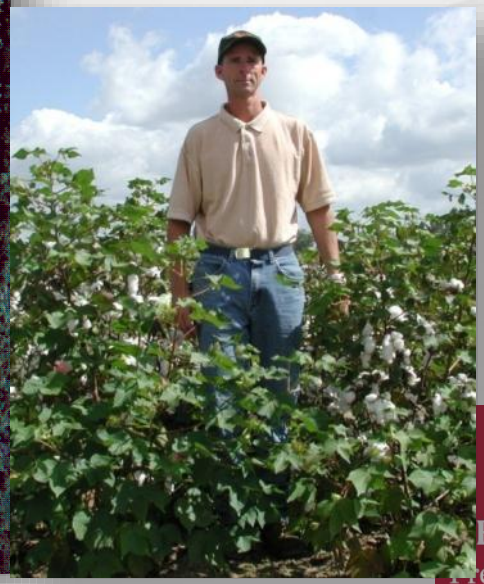
Standard Soil Sampling

- 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?

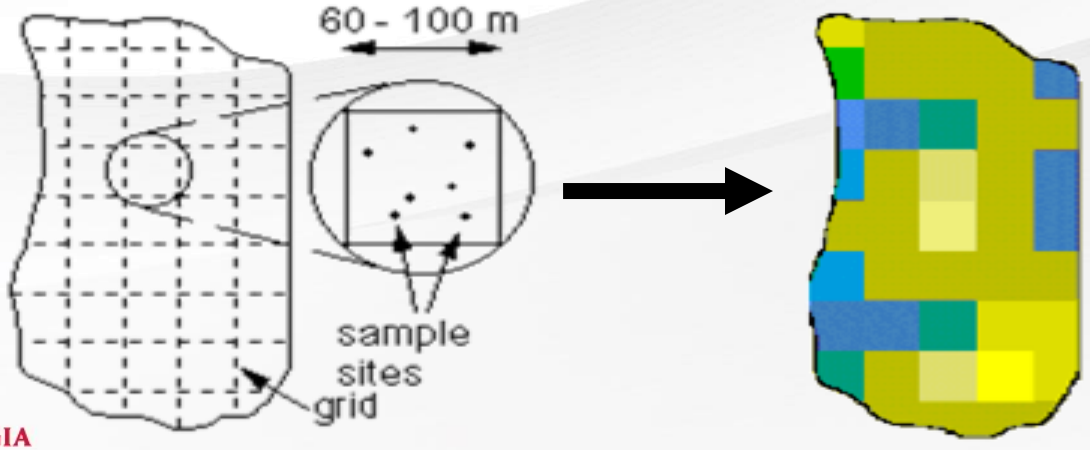


Soil Sampling

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

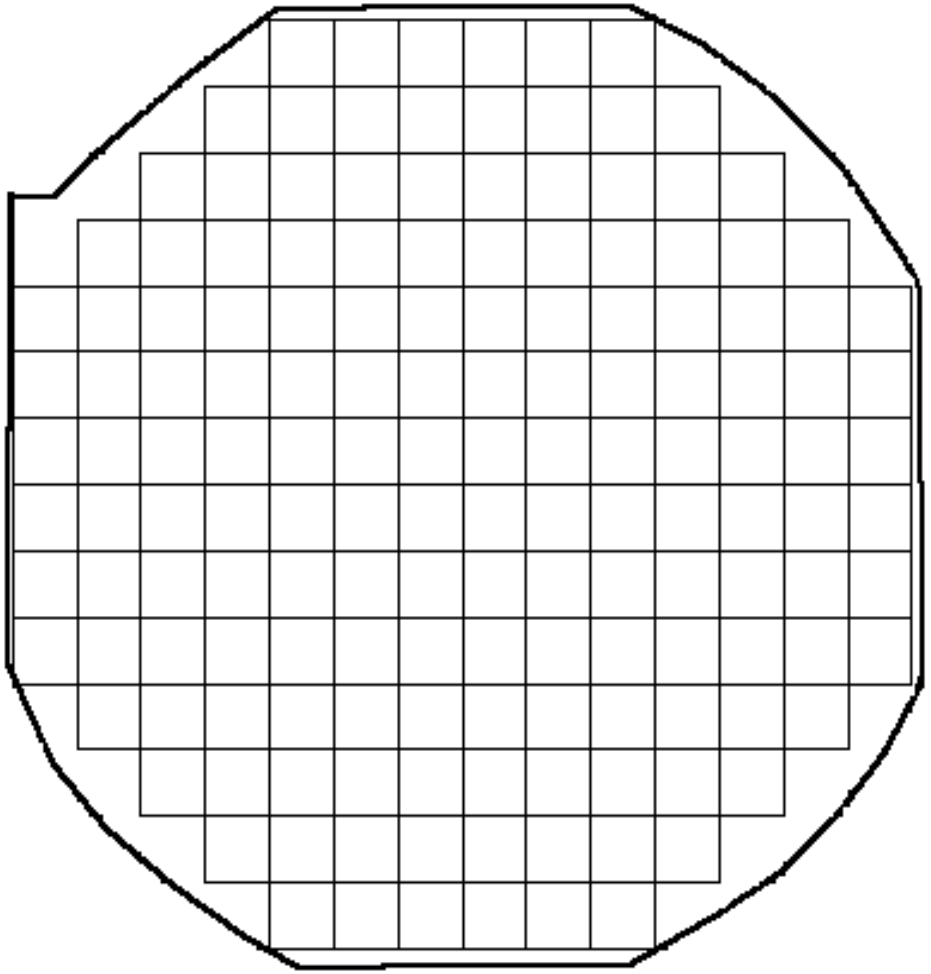
Grid Sampling

- 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



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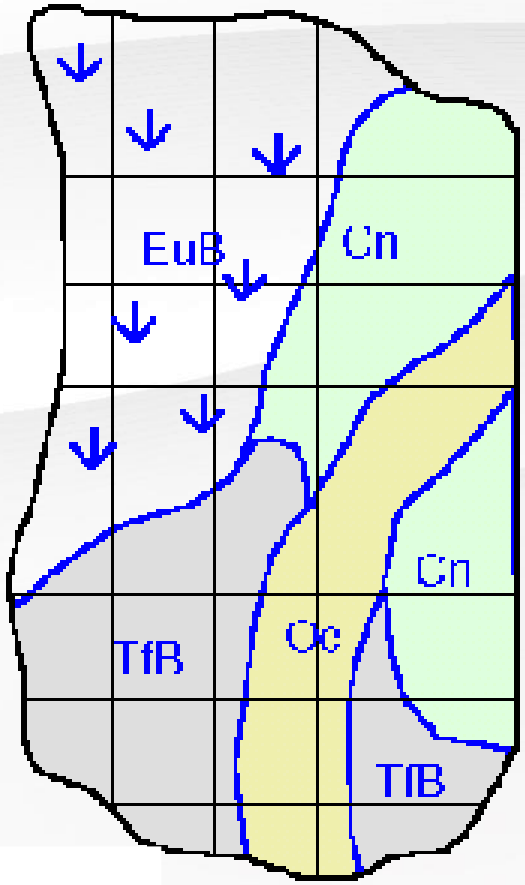
Grid Sampling

- Unfortunately grid samples can miss field variability in a field and may even create variability where it doesn't exist.



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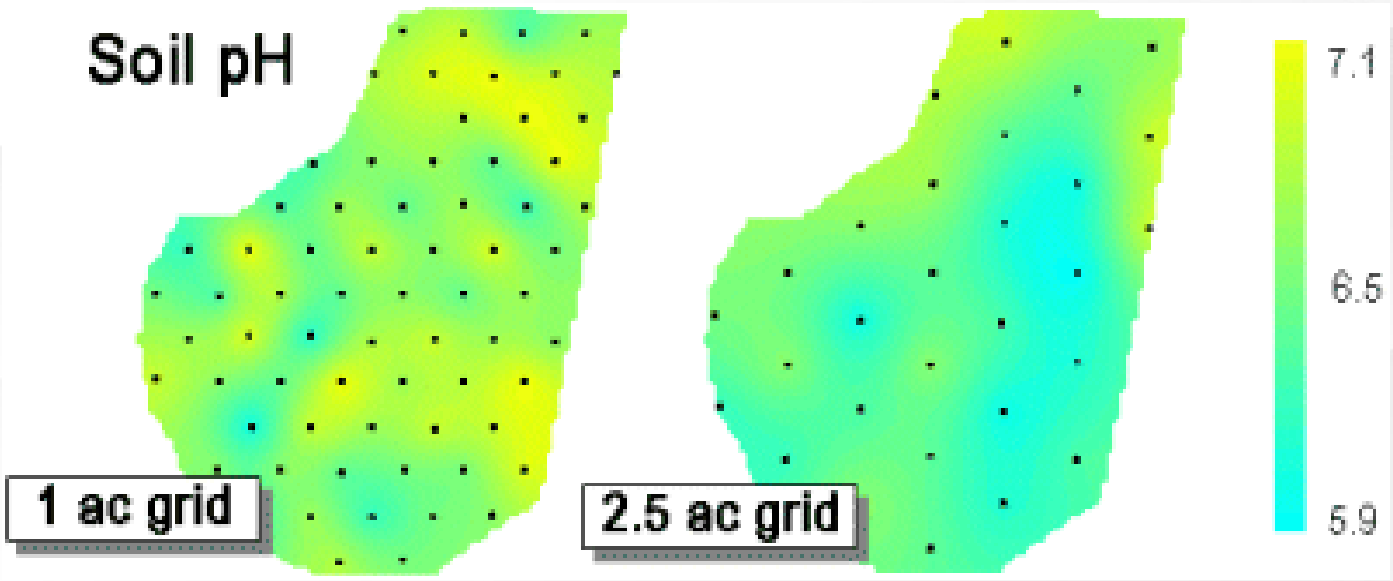
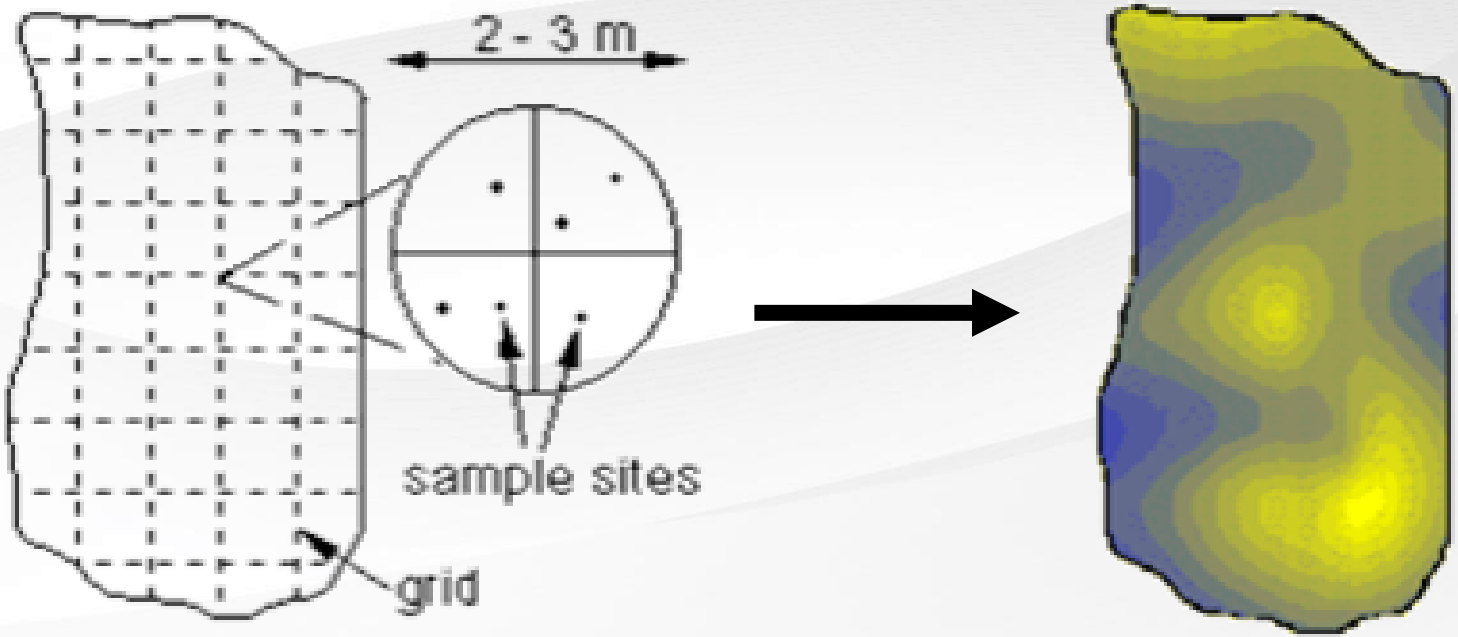
Grid Sampling

- 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.



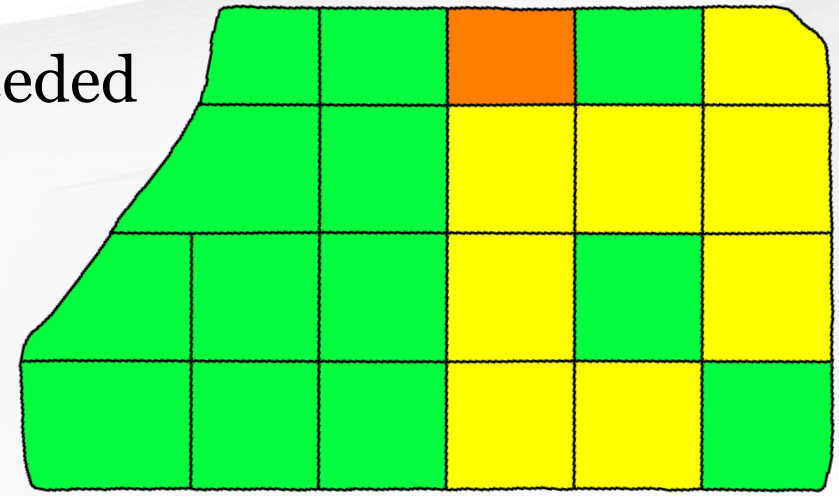
Grid Sampling

Advantages:

- Assess nutrient variability in the field
- No prior knowledge of field history required
- Identify hot spots/issues 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 decided 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

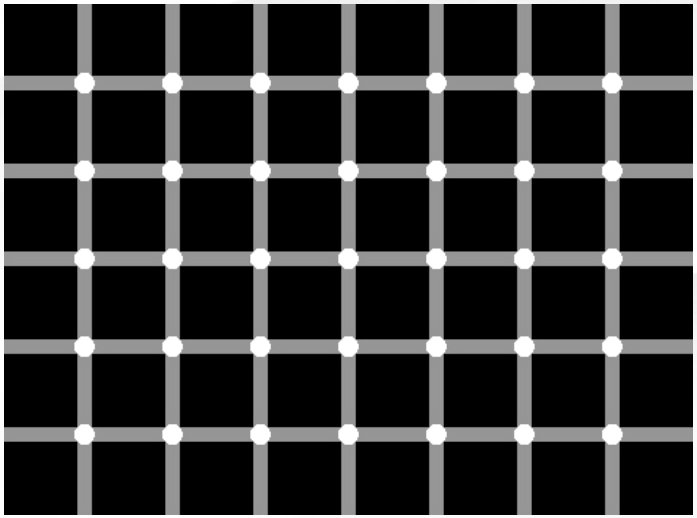
Burke County, Georgia (GA033)

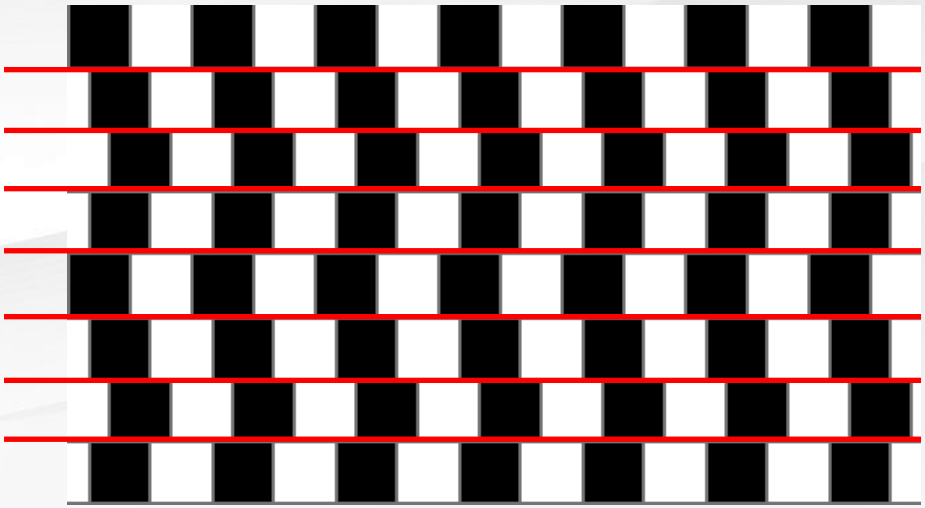
Burke County, Georgia (GA033)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CnA	Clarendon loamy sand, 0 to 2 percent slopes	9.2	5.3%
DoA	Dothan loamy sand, 0 to 2 percent slopes	51.9	30.2%
DoB	Dothan loamy sand, 2 to 5 percent slopes	50.2	29.2%
GR	Grady-Rembert association	45.2	26.3%
TfA	Tifton loamy sand, 0 to 2 percent slopes	2.7	1.6%
TfB	Tifton loamy sand, 2 to 5 percent slopes	12.8	7.4%
Totals for Area of Interest		**172.0**	**100.0%**

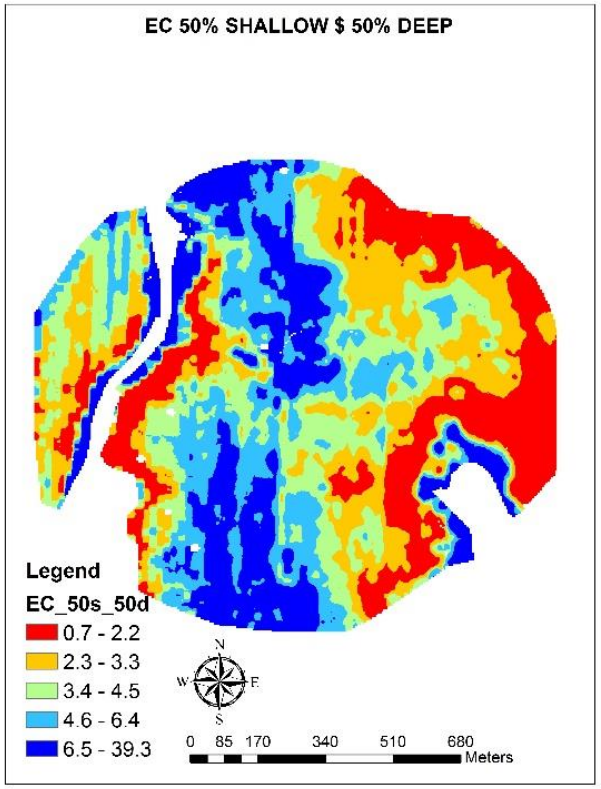
Visual Zone Development

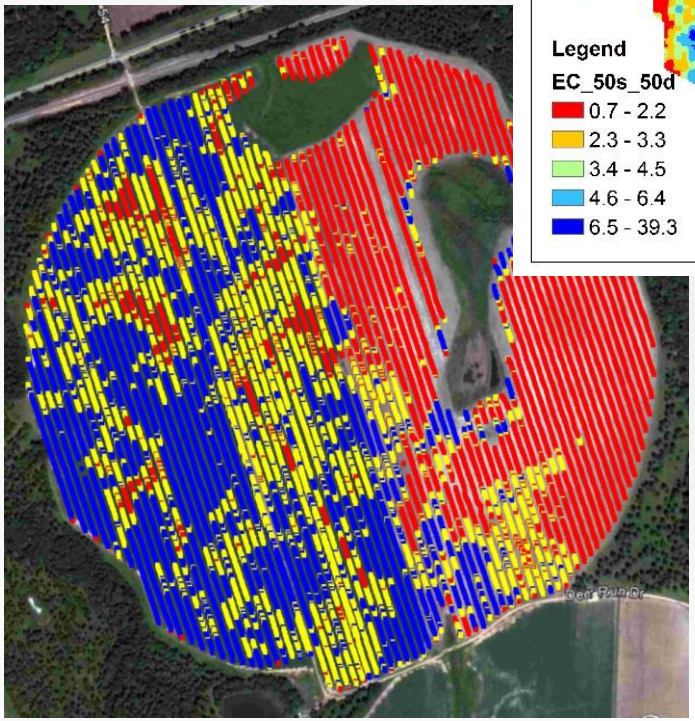
BE CAREFUL EVERYTHING IS NOT ALWAYS CLEAR CUT!!!





Soil EC Zone Development





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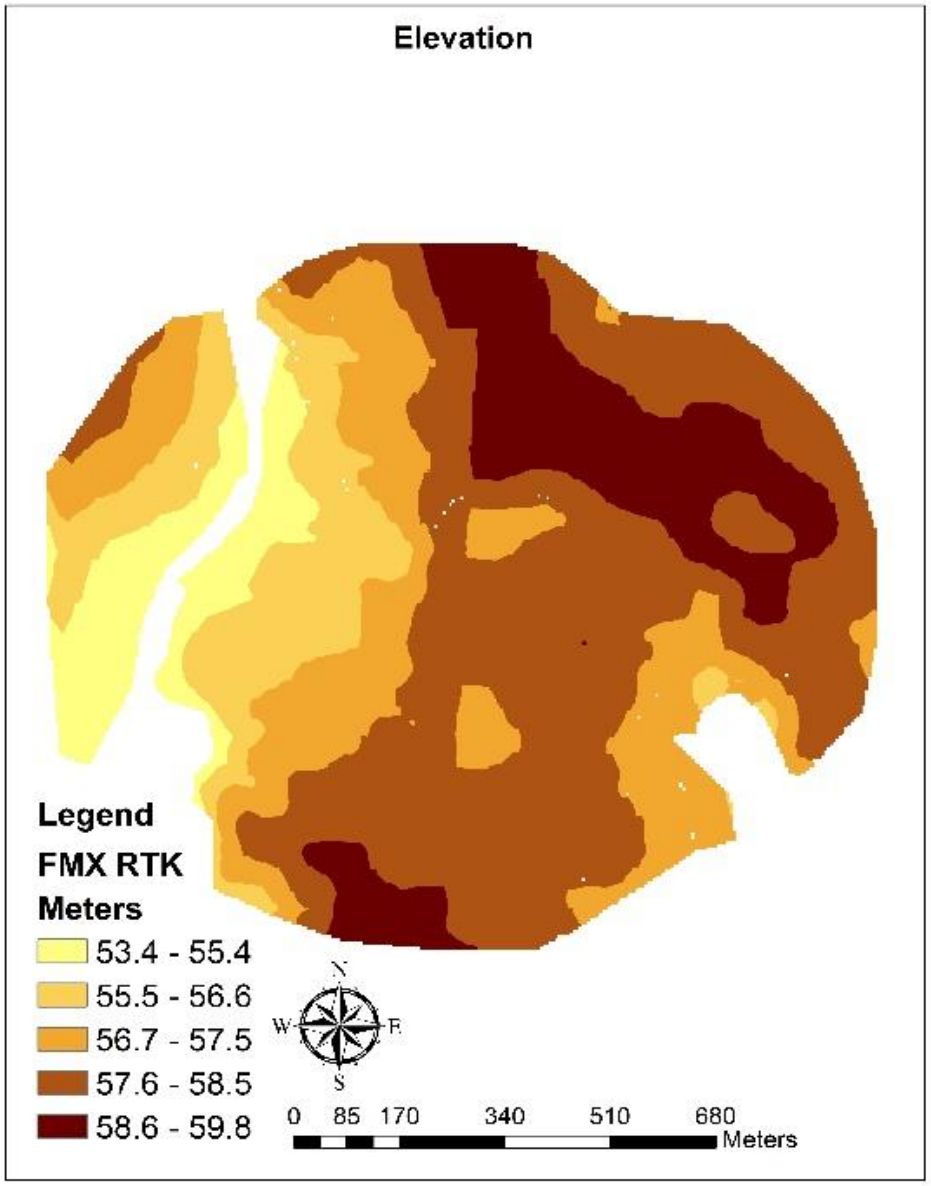
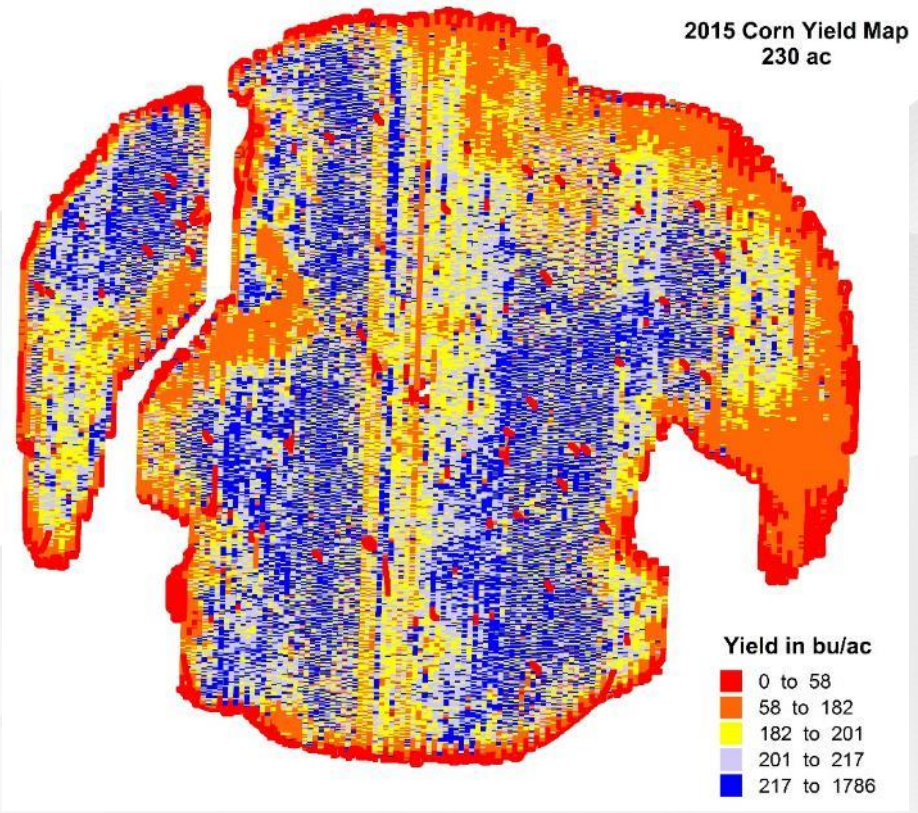
Elevation Zone Development





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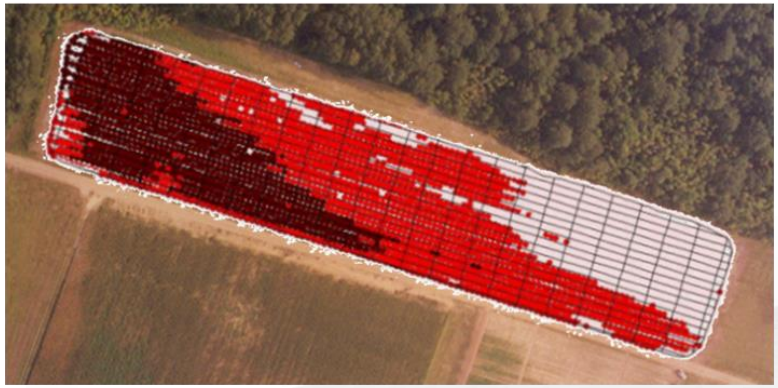
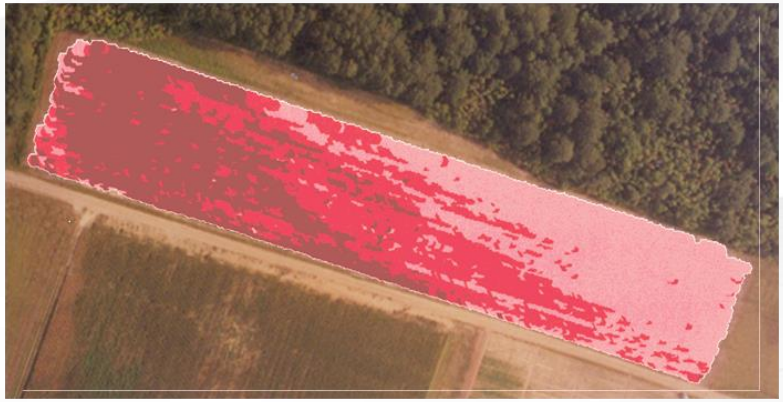
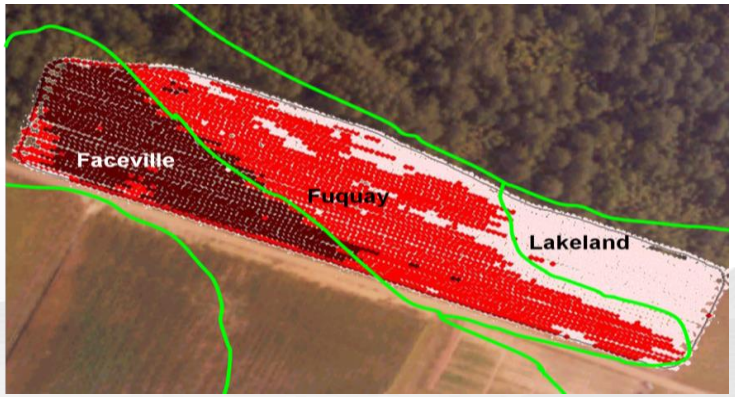
Yield Zone Development

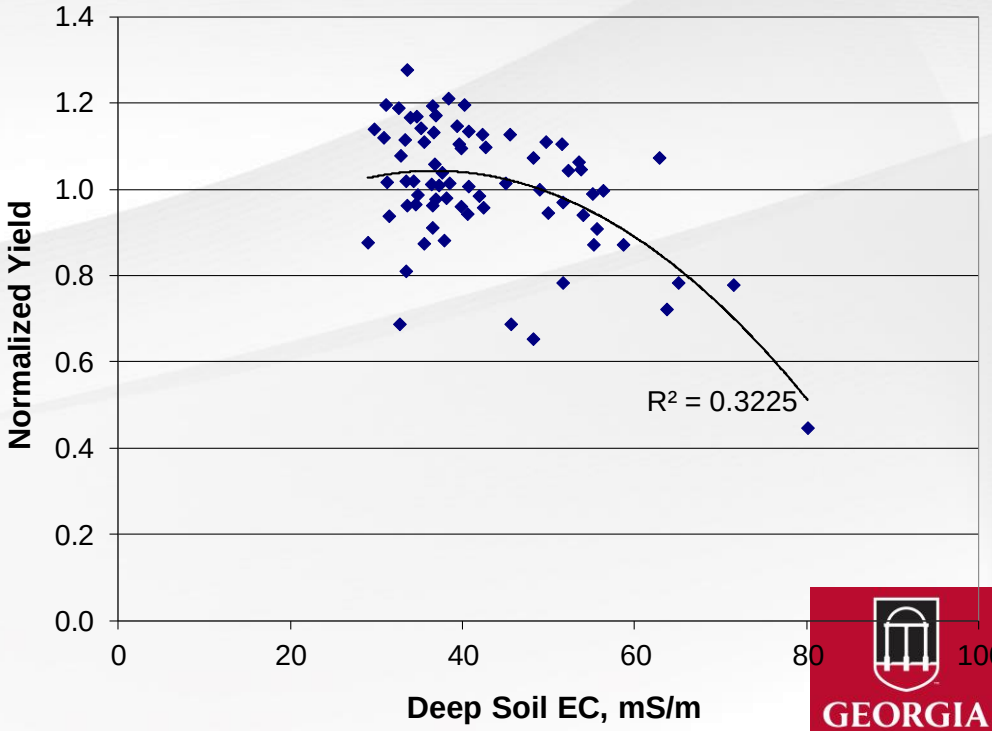


Soil EC, at planting



Cotton Yield





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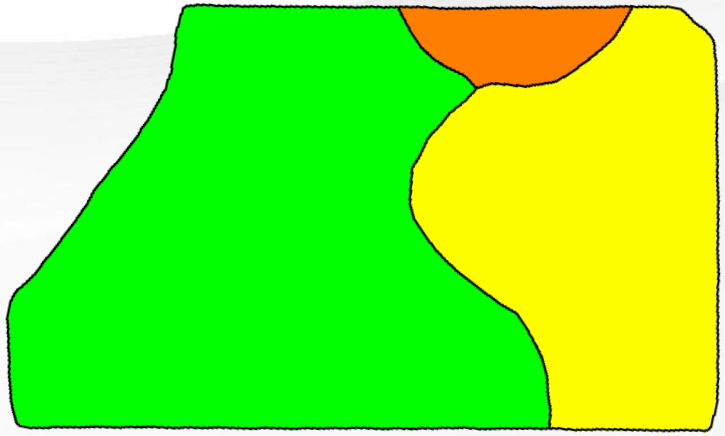
Zone Sampling

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

Recommended Grid Sizes	
1 to 2.5 acres	P, K, pH
5 acres	Organic matter, Texture
Lifetime Map Usefulness	
5 years	P, K
10 years	pH
10-20 years	Organic matter, Cation exchange capacity, Texture

Map Type	Soil Characteristics
Grid	Nutrients, pH, organic matter
Soil Survey	Texture
Topography	Predict runoff/leaching
Aerial photos	Soil color, normalized difference vegetation index (NDVI)
Yield Maps	Actual yearly harvest
EC Maps	Texture, water holding
pH Maps	Soil pH

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!

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THANK YOU

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