



Soil Sampling

Principles of Precision Agriculture

Topic 7

**UNIVERSITY
OF GEORGIA**

Why Soil Sampling?

Varying the application rate of soil amendments in response to measured soil properties is the underlying principle of precision agriculture

Why Soil Sampling?



- To determine the following parameters:
 - nutrient levels
 - pH
 - organic matter content
 - soil texture
 - cation-exchange capacity (CEC)

How to Sample?

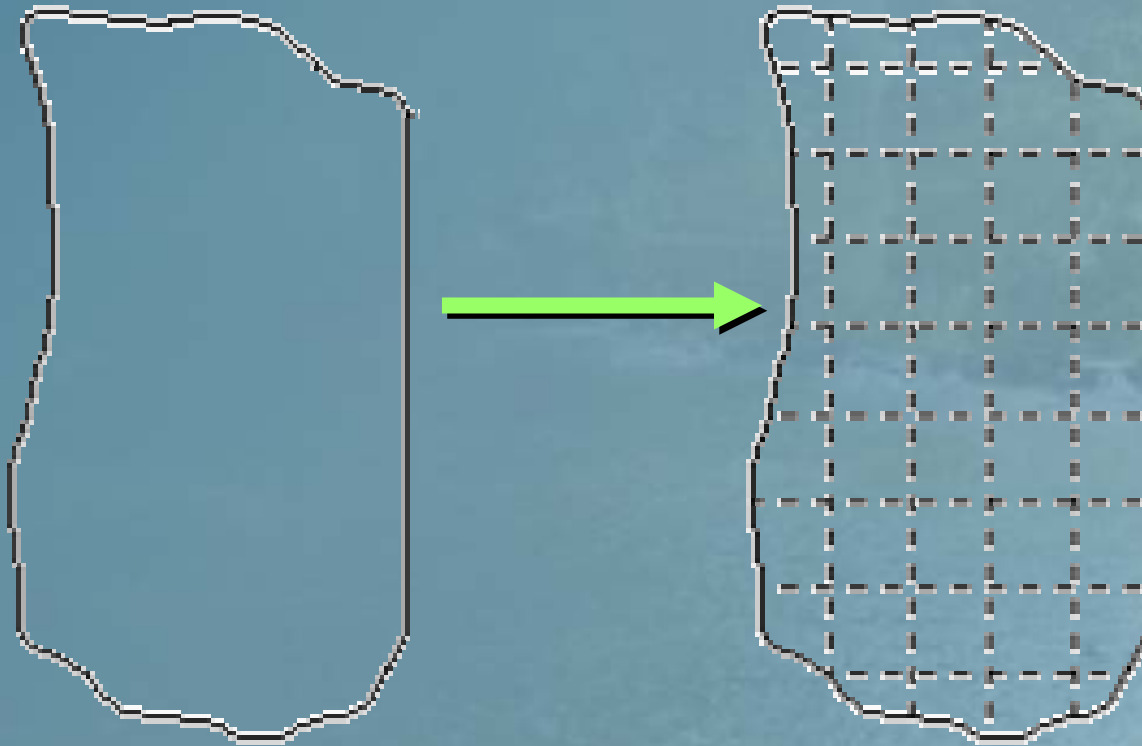
- **Two very different soil sampling philosophies**
 - grid sampling
 - directed sampling
- **Precision ag community initially favored grid sampling but directed sampling is gaining acceptance**

Grid Sampling

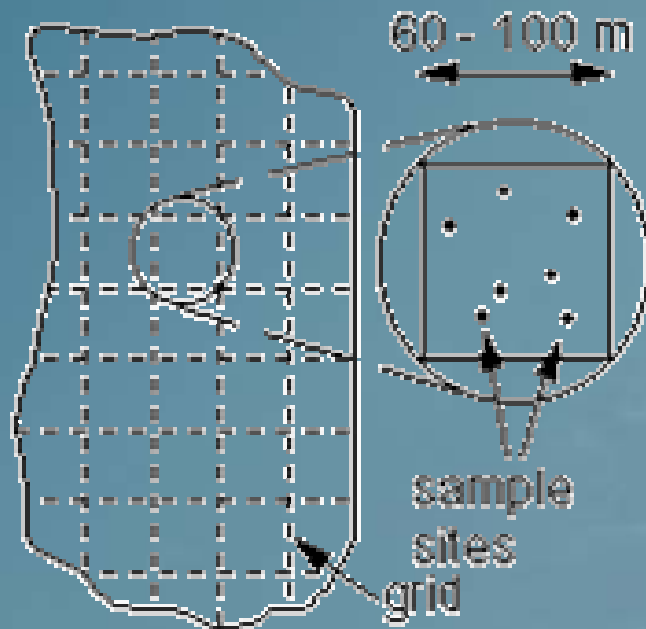
- Favored method because of its simplicity
- Requires little initial field investigation
- Several software packages available to facilitate grid sampling

What is Grid Sampling?

Apply a 1 to 2.5 acre grid over a field

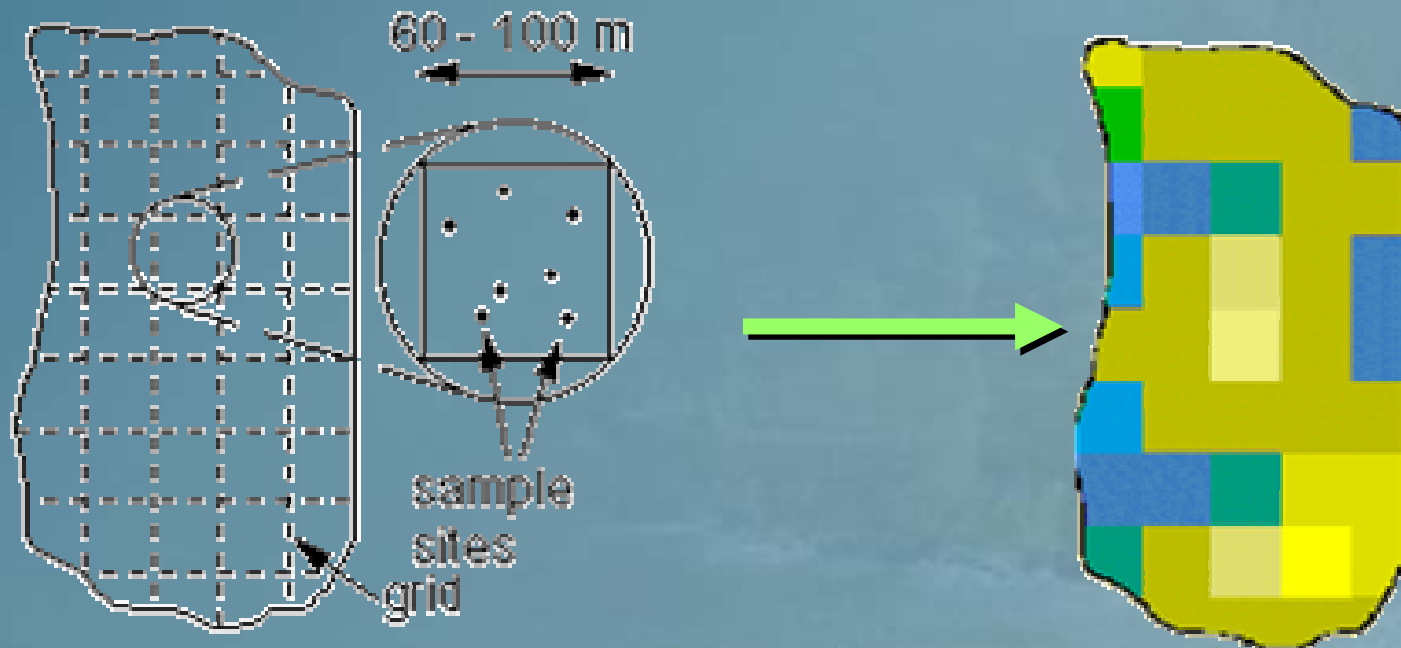


Grid Cell Sampling



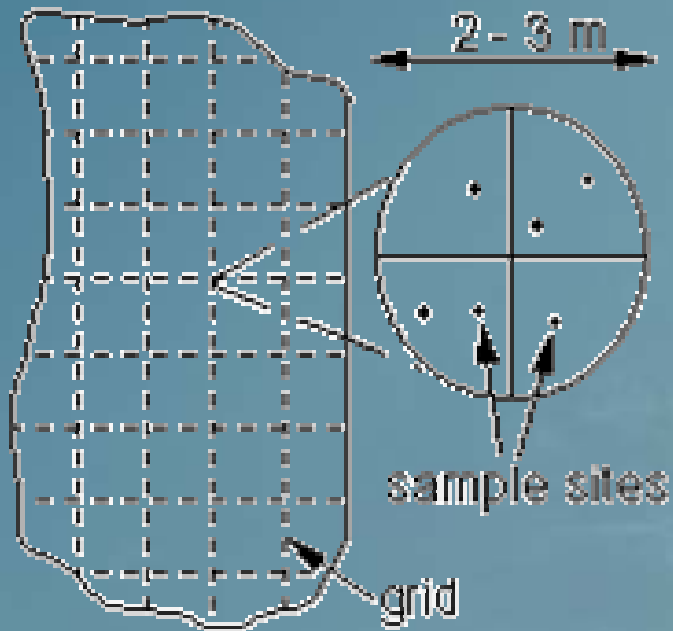
samples are collected from within the boundaries of a predefined cell and composited

Grid Cell Sampling



soil analysis results are assigned to entire cell

Grid Point Sampling



samples are collected around a predetermined point and composited

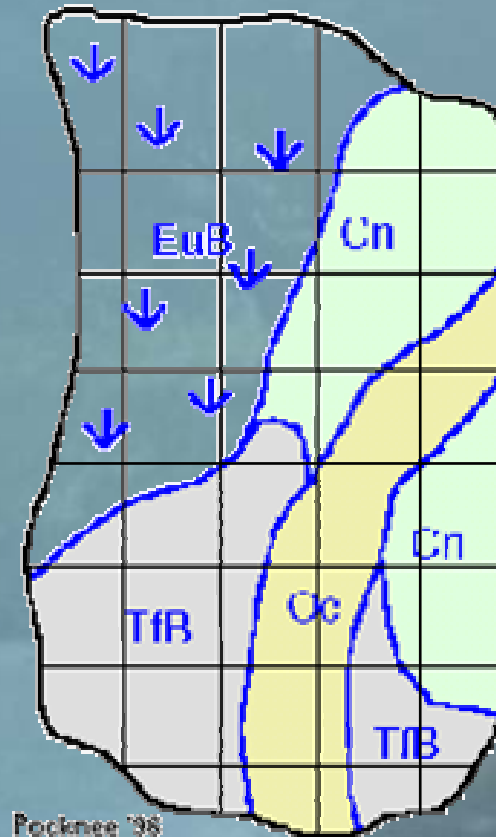
Grid Point Sampling



soil analysis results are assigned to the grid point and mapping software is used to interpolate between points

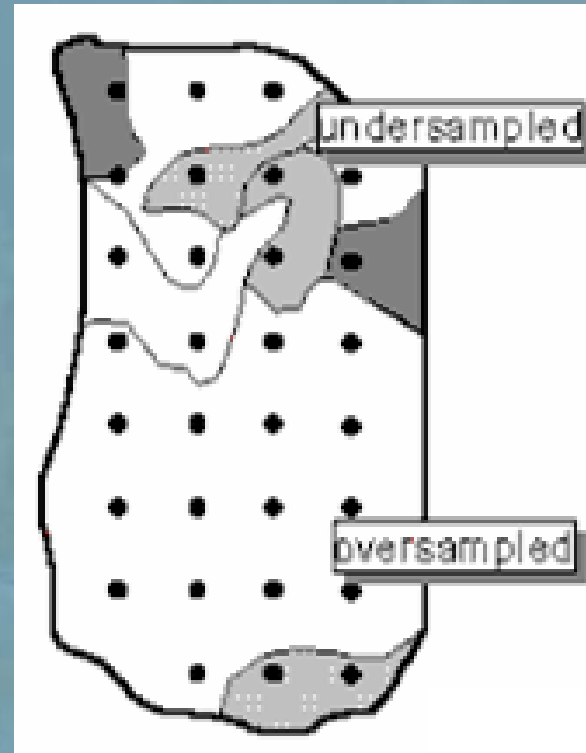
Problems with Grid Sampling

Grid cell sampling results in cells being averaged over dissimilar soil types



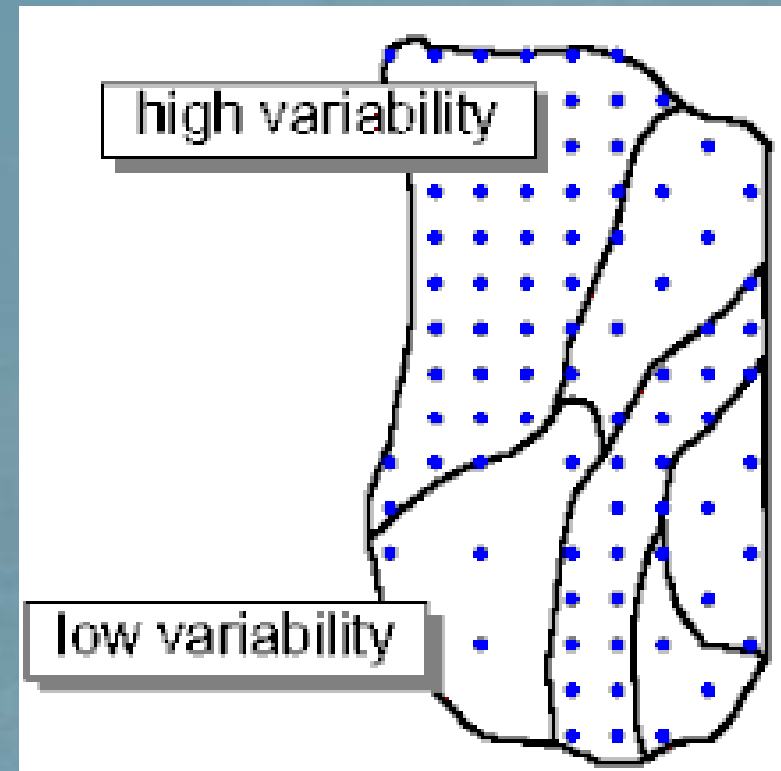
Problems with Grid Sampling

Grid sampling may result in over sampling uniform areas while under sampling areas with the greatest variability

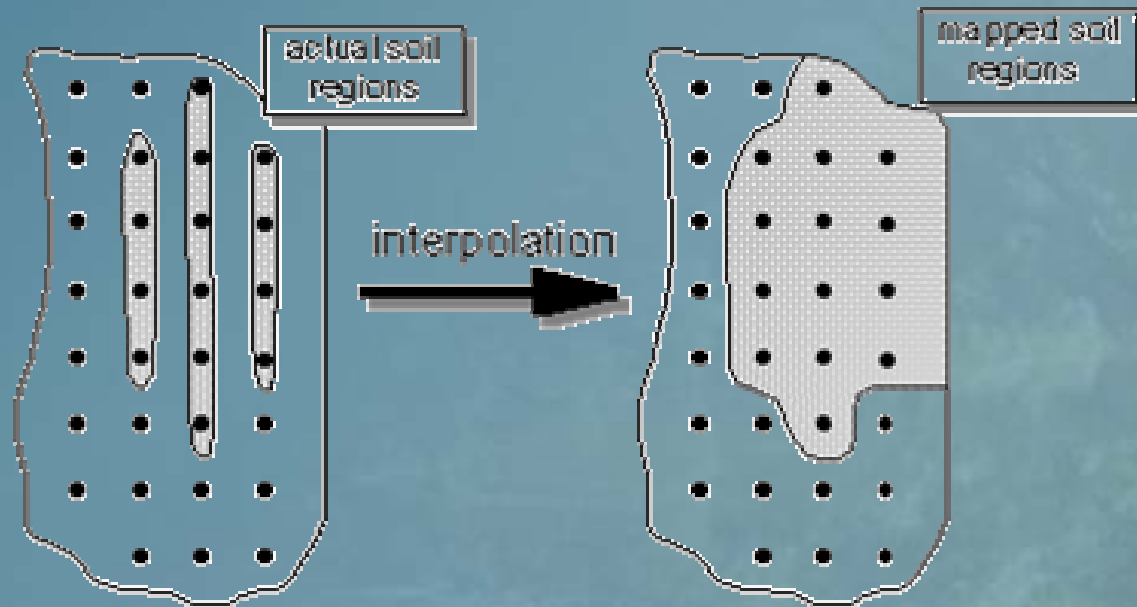


A Way to Improve

Increase or decrease grid sampling intensity based on prior knowledge of field variability

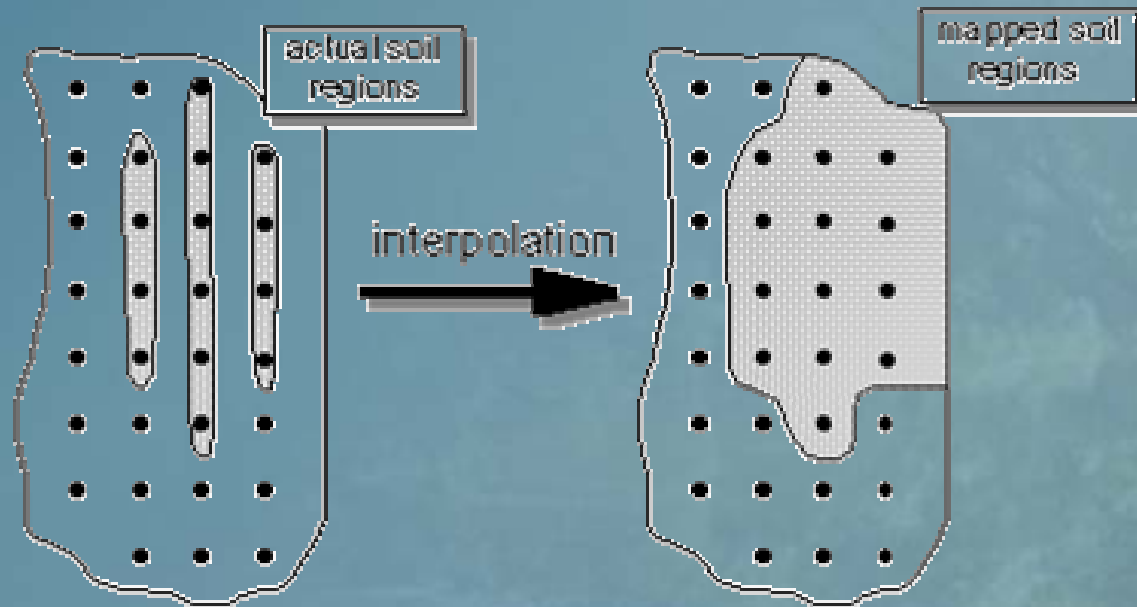


Problems with Grid Sampling



Grid point sampling may lead to inaccurate maps because they can be over-influenced by localized irregularities and systematic patterns

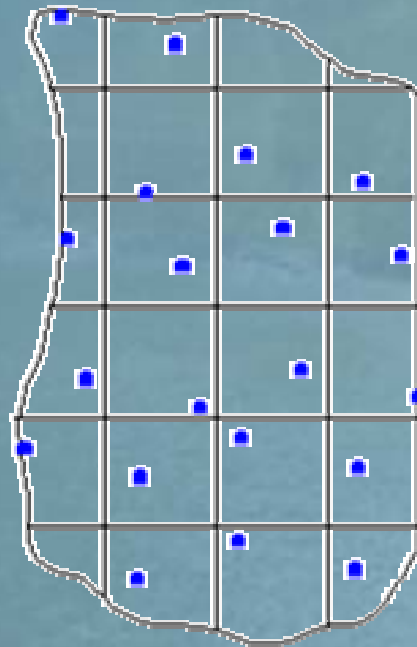
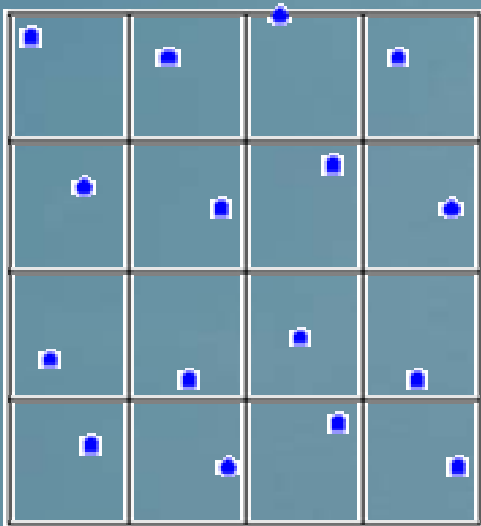
Problems with Grid Sampling



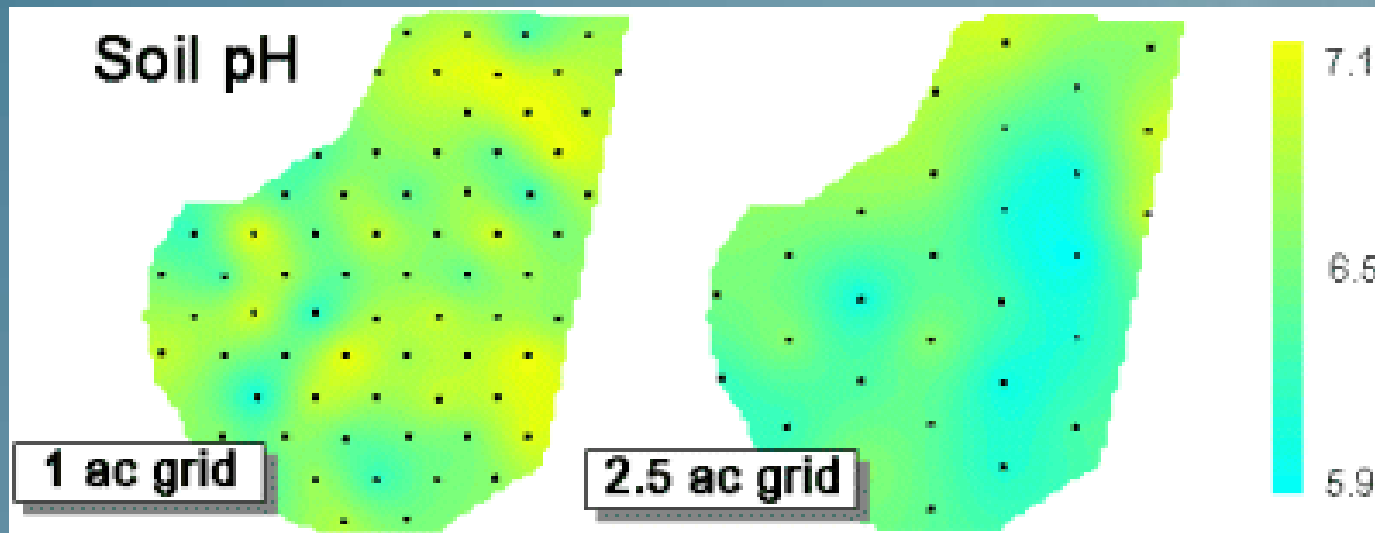
Systematic patterns are caused by fertilizer banding, uneven fertilizer application, terraces, continuous 1-way row cropping, tile drains, and other factors

A Way to Improve

Use an unaligned (somewhat random) sampling design to minimize systematic errors



Problems with Grid Sampling

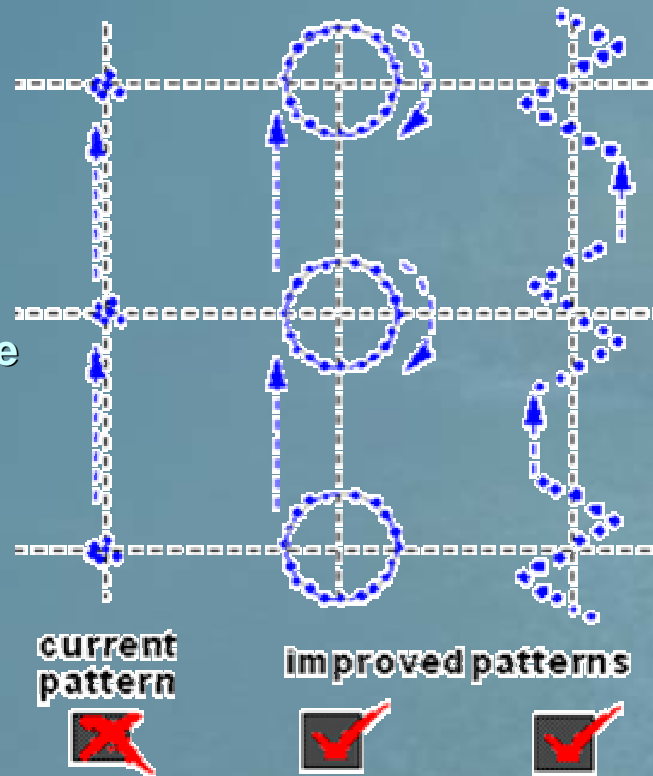


No consensus on appropriate grid size yet grid size can greatly affect the appearance of maps

A Way to Improve

You can enhance grid sampling by using more complex sampling patterns.

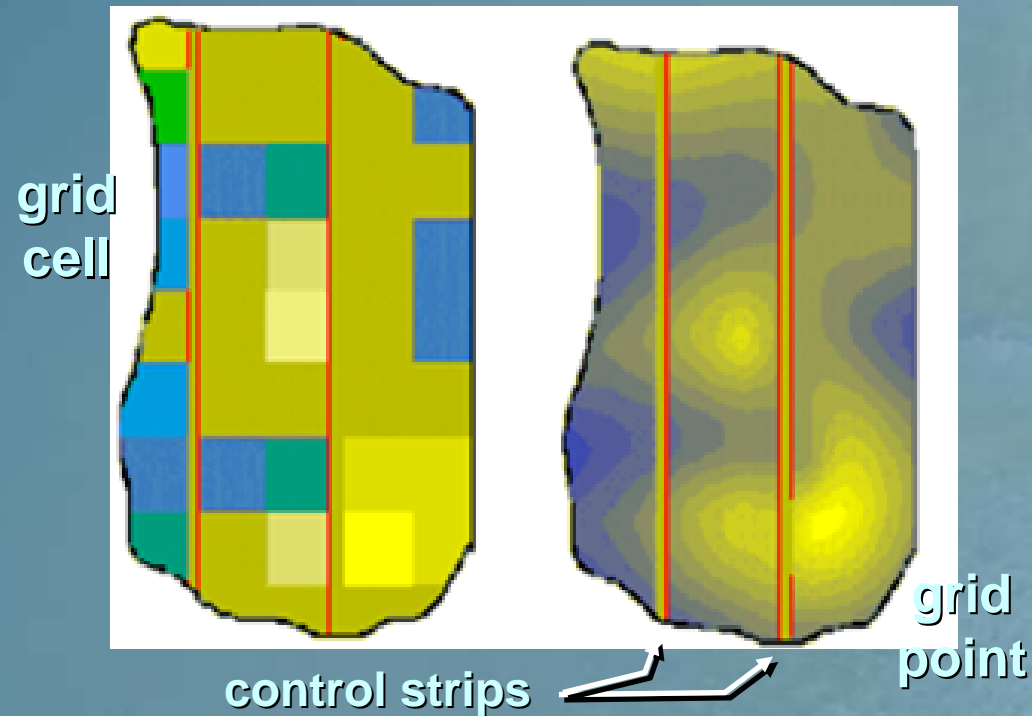
● individual cores used in a composite soil sample



- collect 15-20 cores from each grid point
- increase sampling radius to 25% or more of distance between grid points
 - 80 ft radius for 2.5 acre grids

A Way to Improve

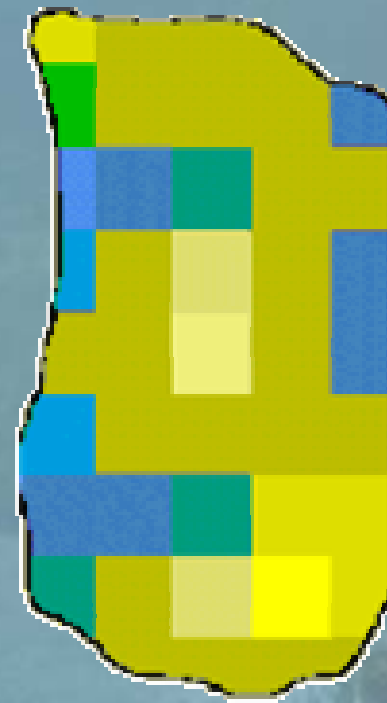
When applying soil amendments (fertilizer, lime, etc.) incorporate strip plots with recommendations based on a separate whole field soil sample.



This allows an on-site evaluation of the grid design and soil amendment application

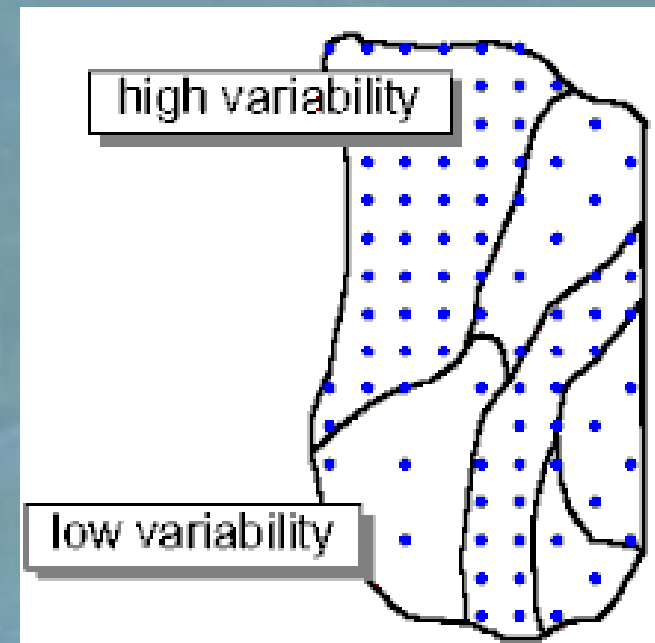
Grid Sampling & Management Zones

- Grid sampling may be used to help delineate management zones
 - when multiple neighboring sampling points return a similar soil test value, they may be grouped into **preliminary** management zones
 - unless sampling pattern is very dense, it is **dangerous** to rely on grid samples alone to delineate management zones



How Dense?

- **First of all, requires some prior knowledge of the field**
 - sample at density well below that of the predetermined minimum management zone size
 - increase density in areas where you expect high variability
 - decrease density in areas that you expect to have less variability



Grid Sampling & Management Zones

- **Grid sampling may be used to help delineate management zones**
 - data from grid samples may be combined with other information (aerial photos) to assist in delineating management zones

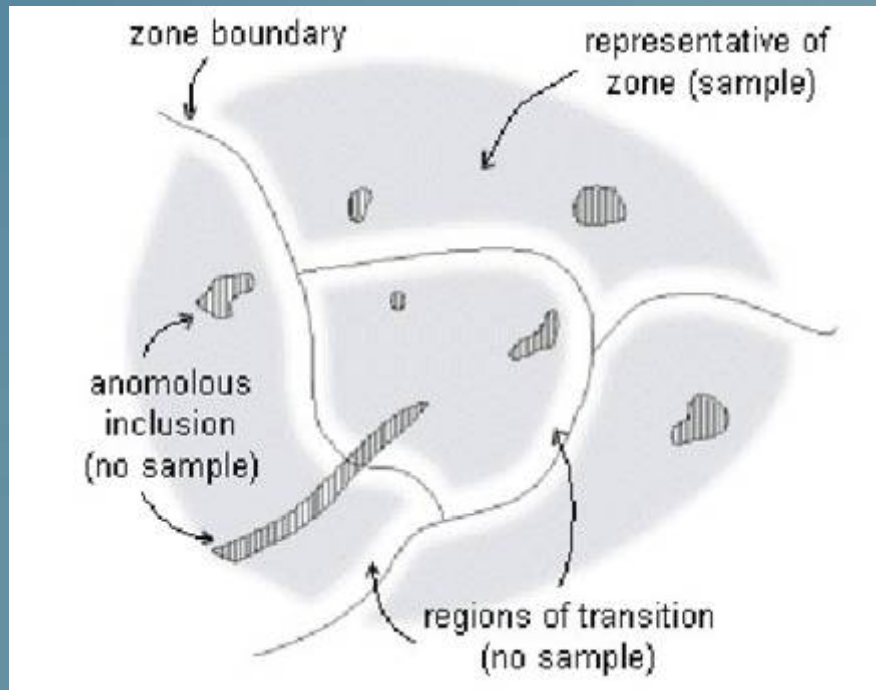


Beyond Grids – Directed Sampling

- Field is broken up into regions which are sampled individually
- Shape and size of each region is based on
 - variability present
 - intensity of management that is necessary / practical

Beyond Grids – Directed Sampling

Pre-established Management Zones are the best regions to use for soil sampling



Sampling patterns should consider transition areas and avoid anomalies

How to Collect Samples

- **It is always beneficial to collect many individual cores and composite them into one sample.**
 - this allows you to better characterize the management zone
 - reduces the potential of one core overly affecting results
 - additional costs are relatively small
- **Always a good idea to send samples for analysis in duplicate**
- **How many samples to analyze per management zone is matter of choice and economics**