Soil Sampling Precision, How It Impacts Spatial Decisions

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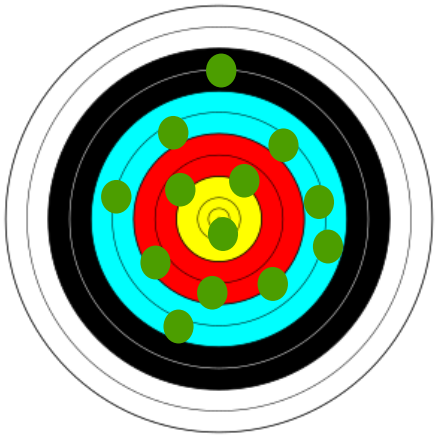
Overview

- Understanding soil sampling
  - How does sample collection impact “precision”?
  - Just how much variability is out there?
- Does spatial scale matter?
  - Does smaller spatial scale mean less “variability”?
  - Is this all theoretical, or does it impact the practical?
- Implications moving forward
  - Are there techniques/approaches to help us out?

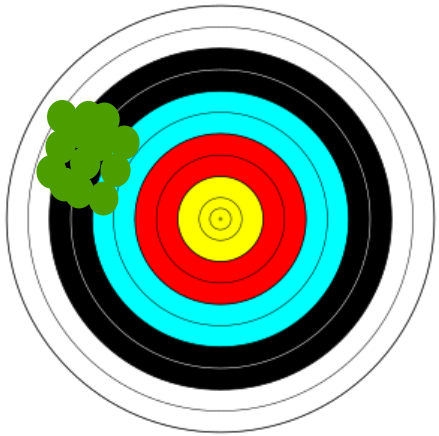
Understanding Soil Sampling

Soil Sampling

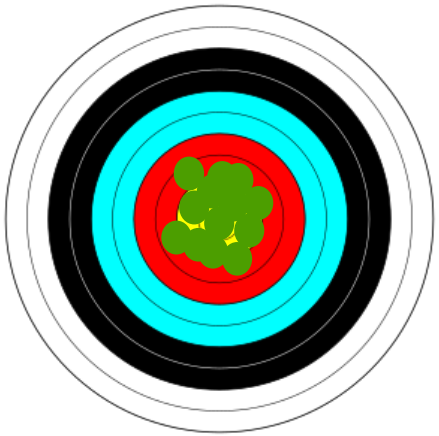
- What is the goal of soil sampling?
  - We are attempting to estimate the average soil test level within a given area (we are trying to be accurate).
- Accuracy versus Precision



Accurate



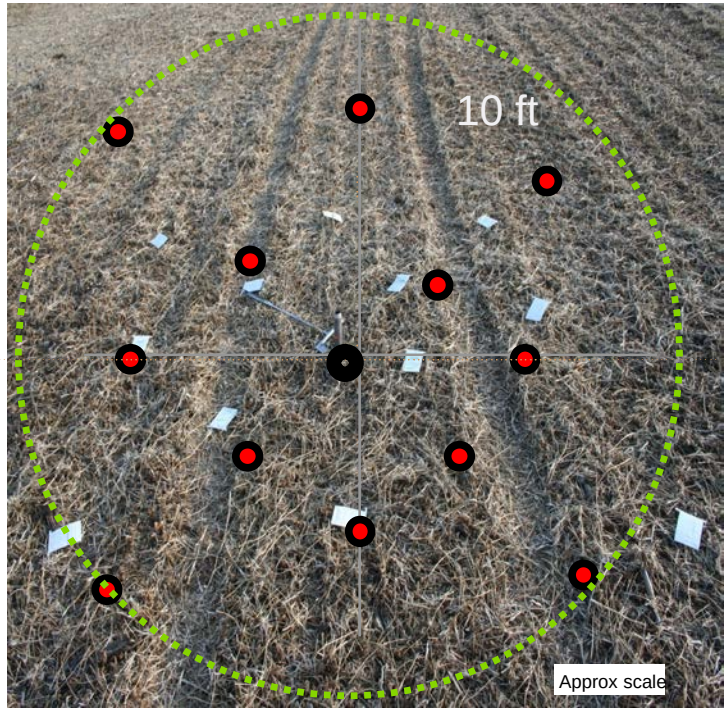
Precise



Accurate/
Precise

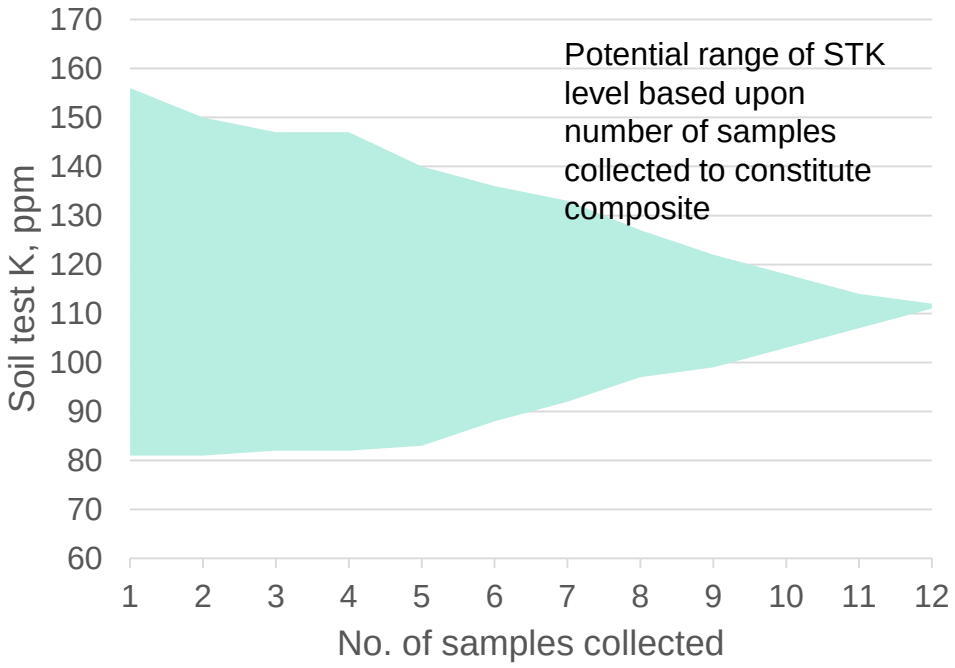
Soil Sampling

- To achieve our estimate of “average” soil test level, we collect a certain number of samples to provide us a “representative sample” (hopefully unbiased).



Soil Sampling

- This sampling approach actually provides a really good estimate of the “average” nutrient status (independent of spatial scale – 160, 50, 20, 10, 5, 2.5, 1, 0.5, 0.01 acres)
  - It is a function of the number of samples though.

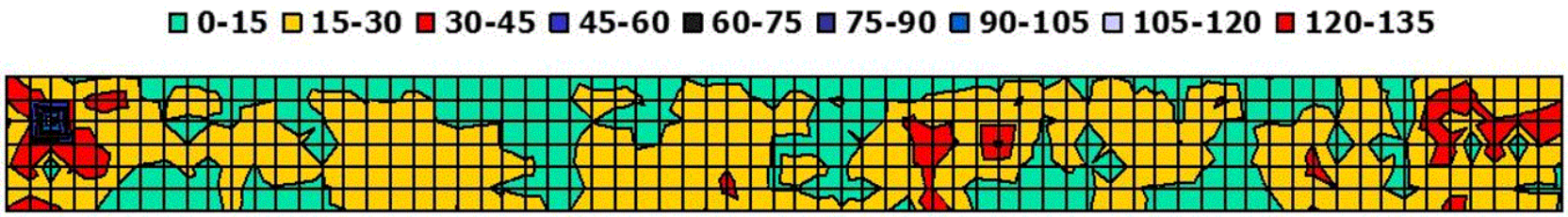


SOURCE: BOB MILLER, CSU

Spatial Scale

Variability – Precision?

- So traditional soil sampling approaches do a good job of approximating the “average” soil test level, but they really do not provide any estimate of precision.
- Does that matter?



Soil Test P, ppm

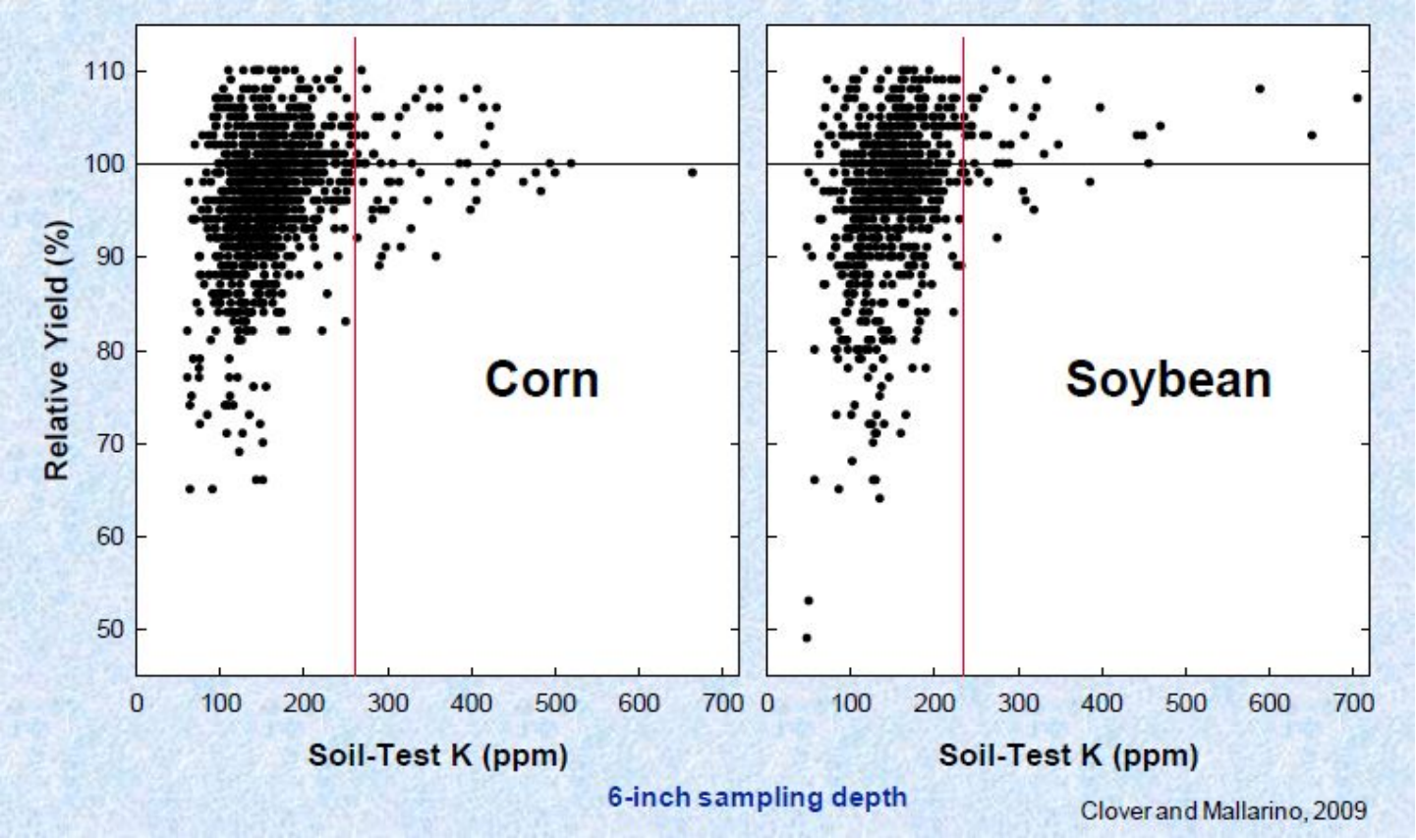
SOURCE: OKLAHOMA STATE UNIVERSITY

Variability – Does it Matter?

- We use soil testing (along with plot research) to determine things like critical levels
  - Soil test level where additional fertilizer is unlikely to result in increased yield
- Does variability influence the establishment of a critical level?

Variability – Does it Really Matter?

- Relationship between STK and relative yield.



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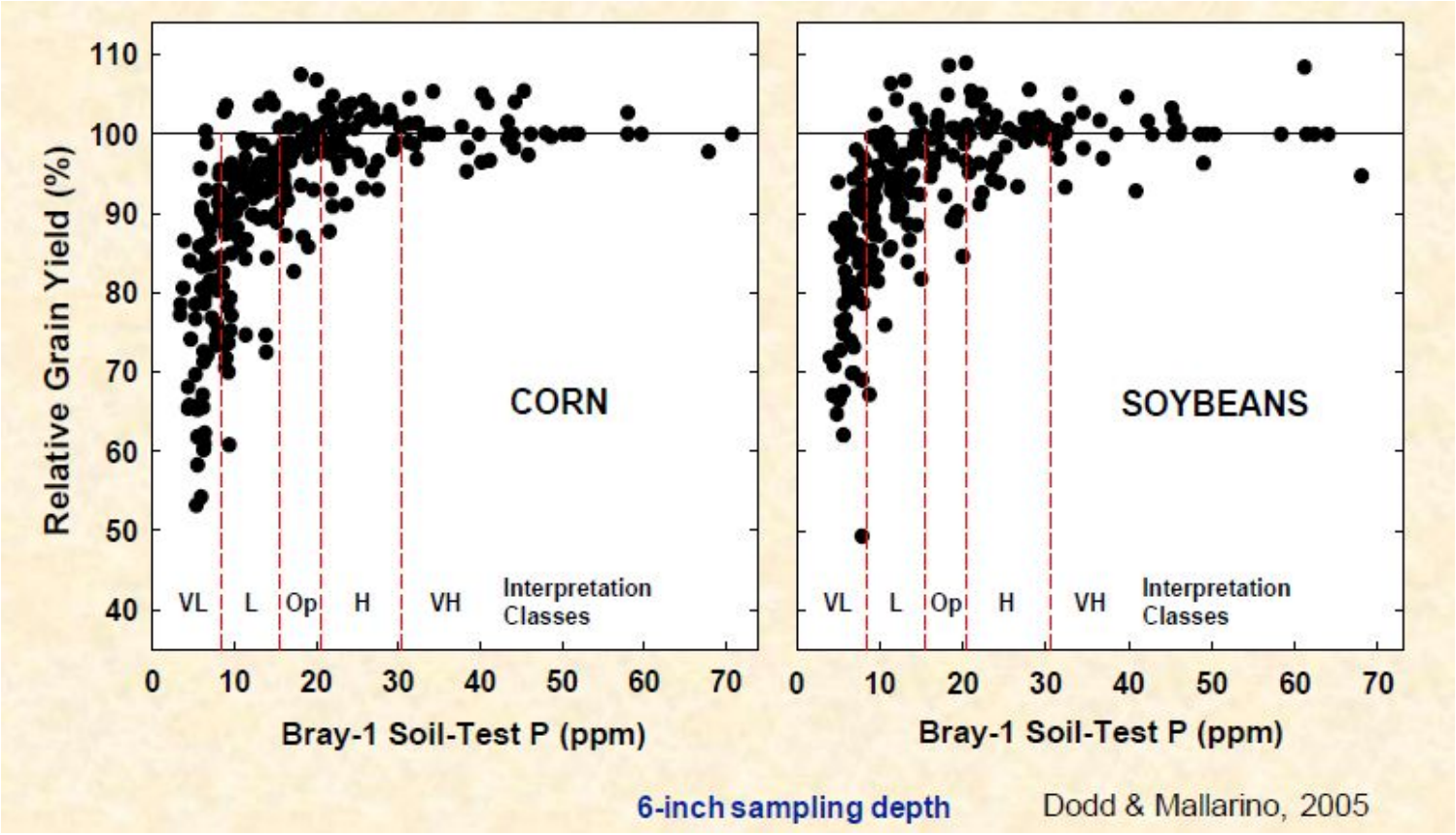
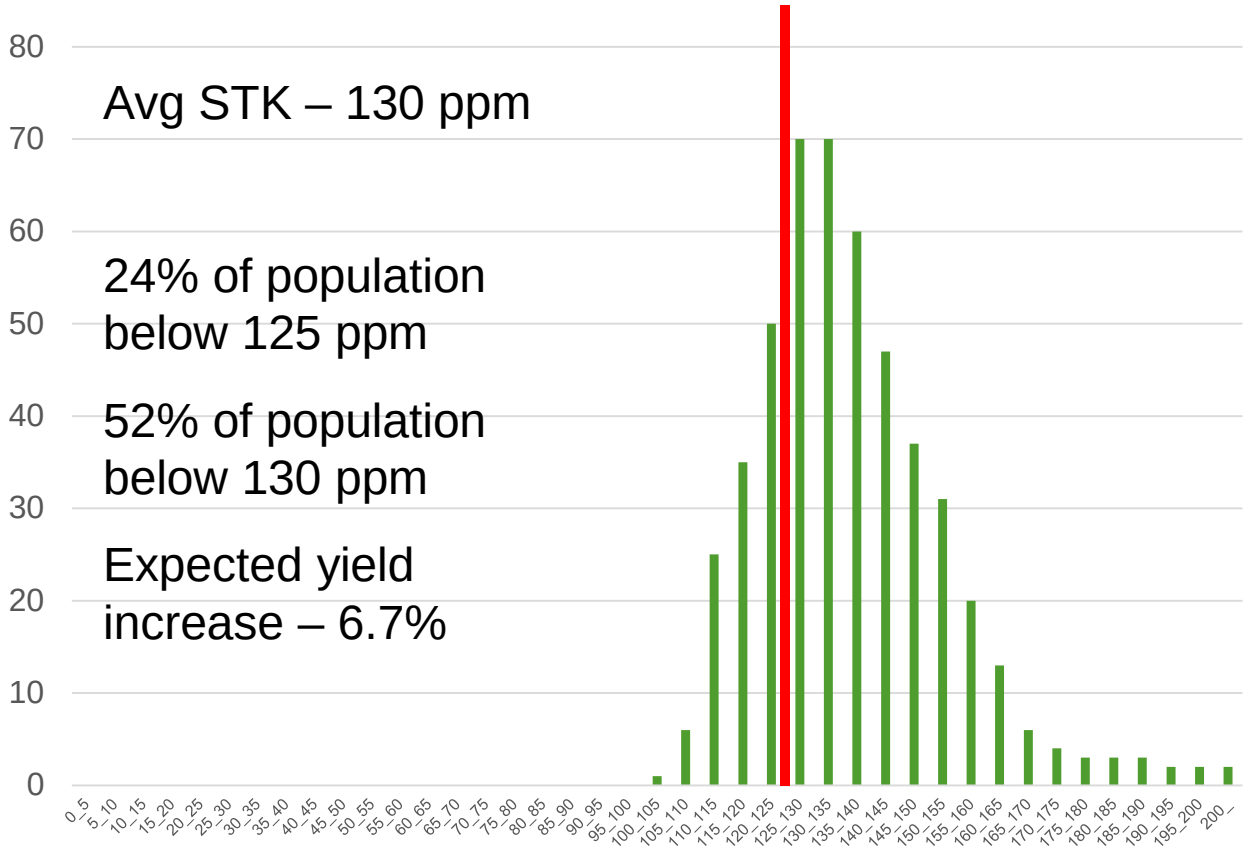


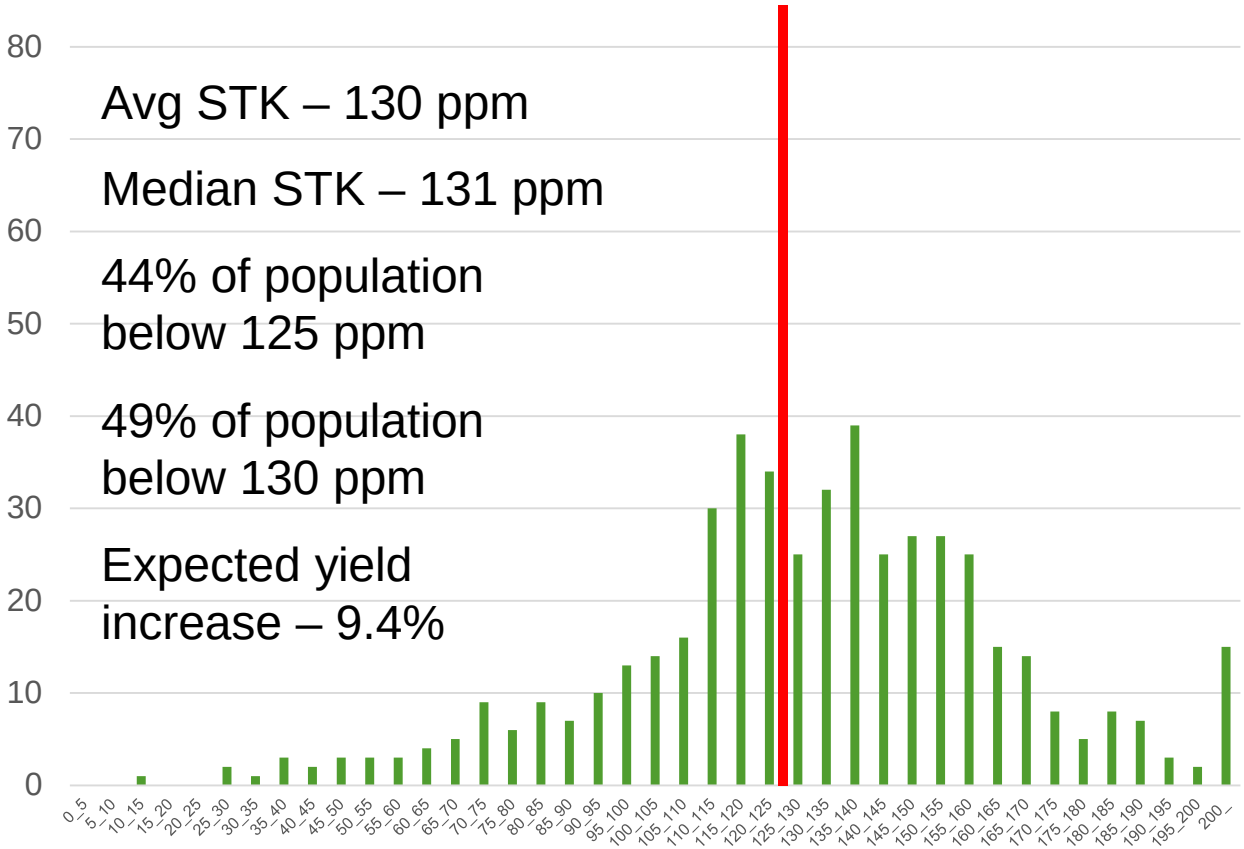
Variability – Does it Really Matter?

- Theoretical frequency distribution for STK.



Variability – Does it Really Matter?

- Frequency distribution of the OK State data set – STK



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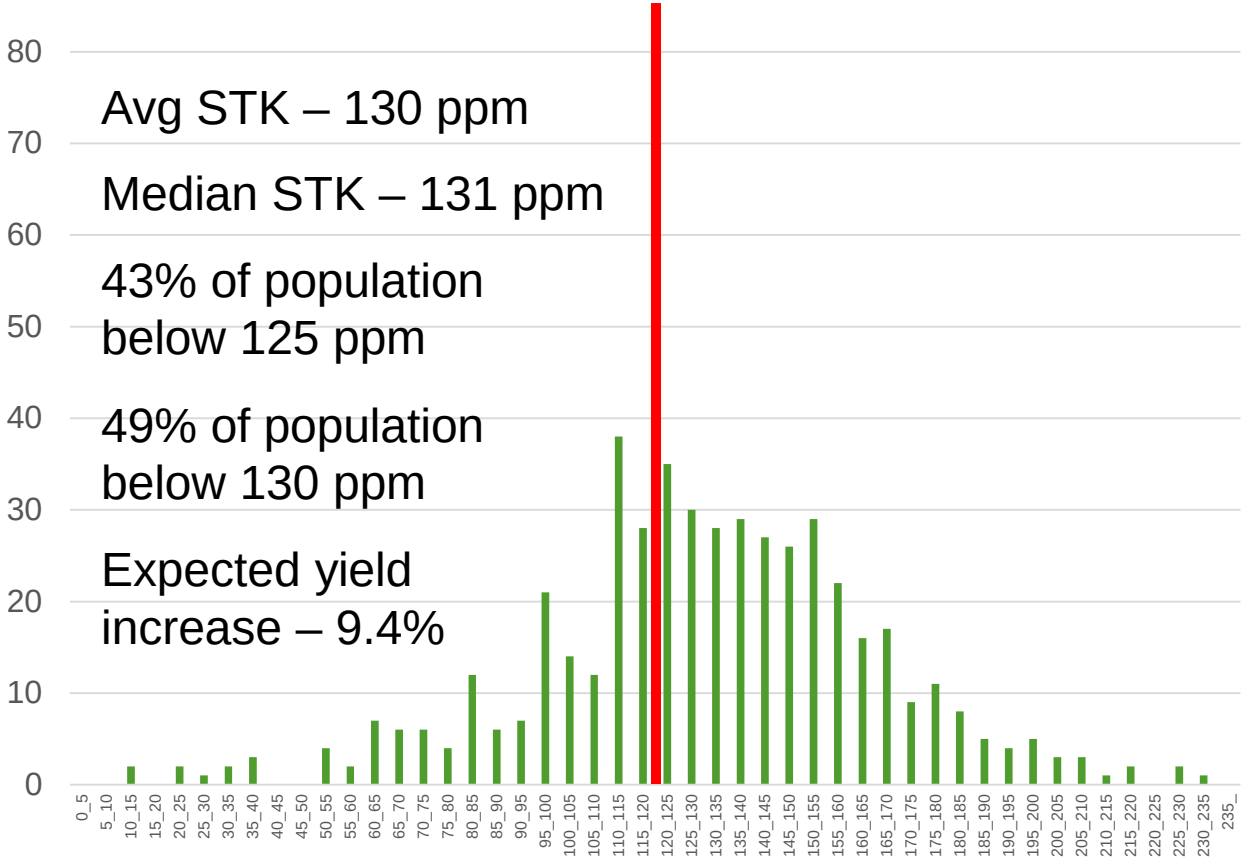
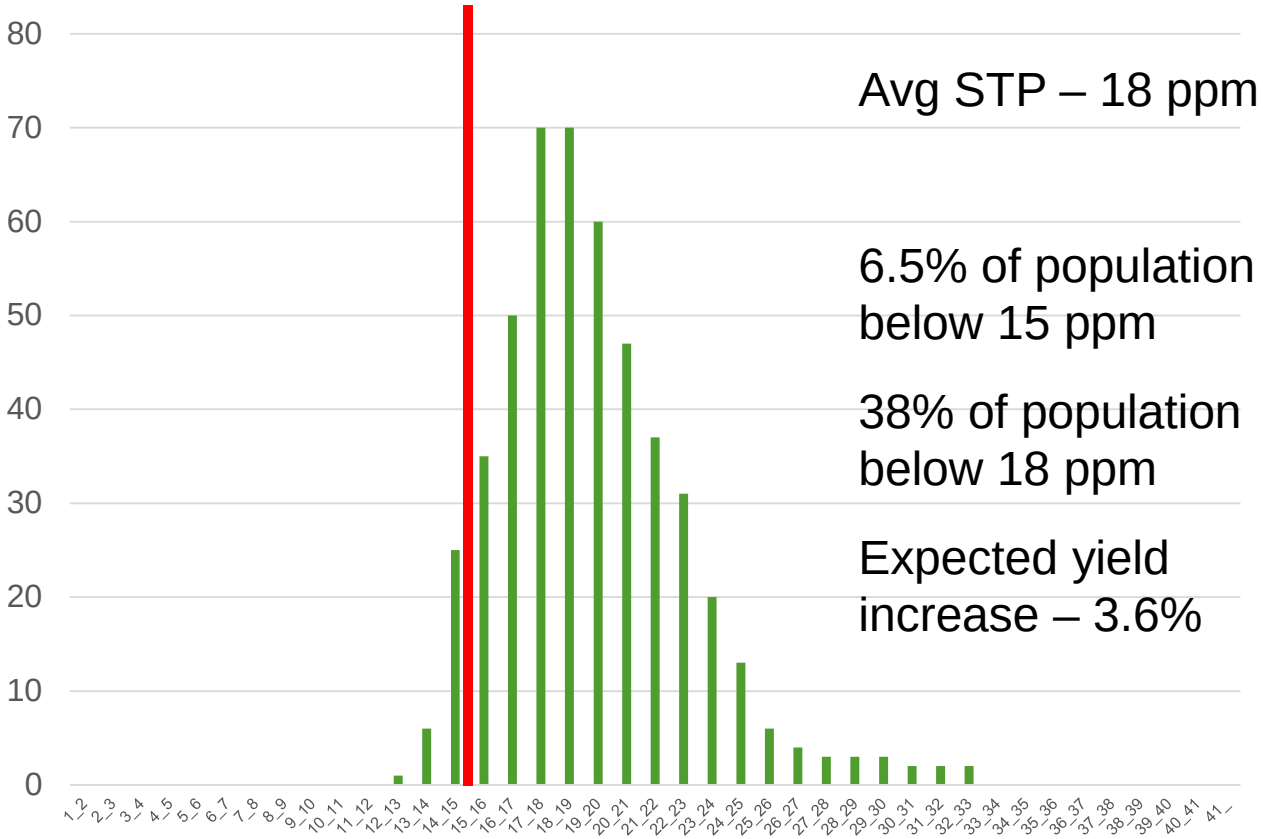


SOURCES: OKLAHOMA STATE UNIVERSITY – EFAW

Variability – Does it Really Matter?

- Theoretical frequency distribution.



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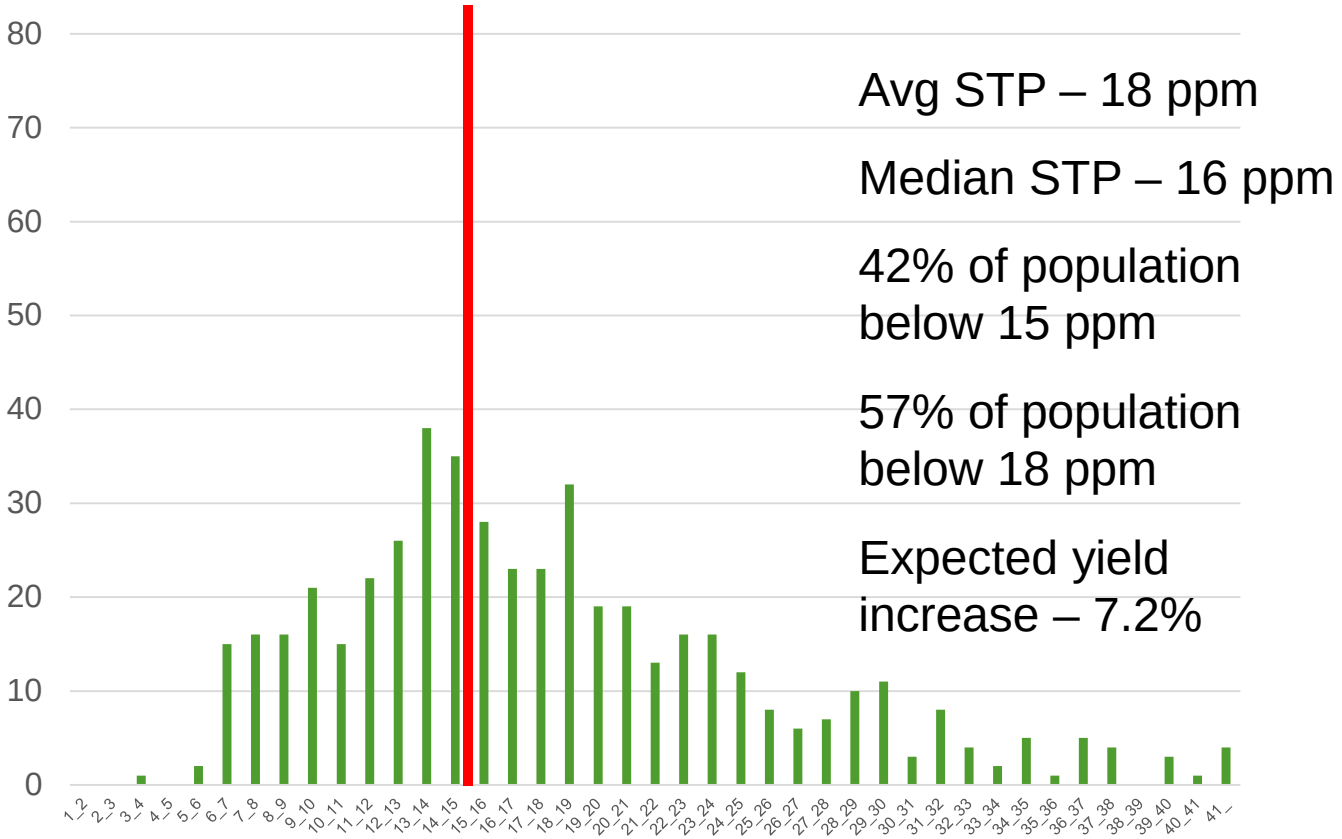

SOURCE: OKLAHOMA STATE UNIVERSITY - BURNEYVILLE

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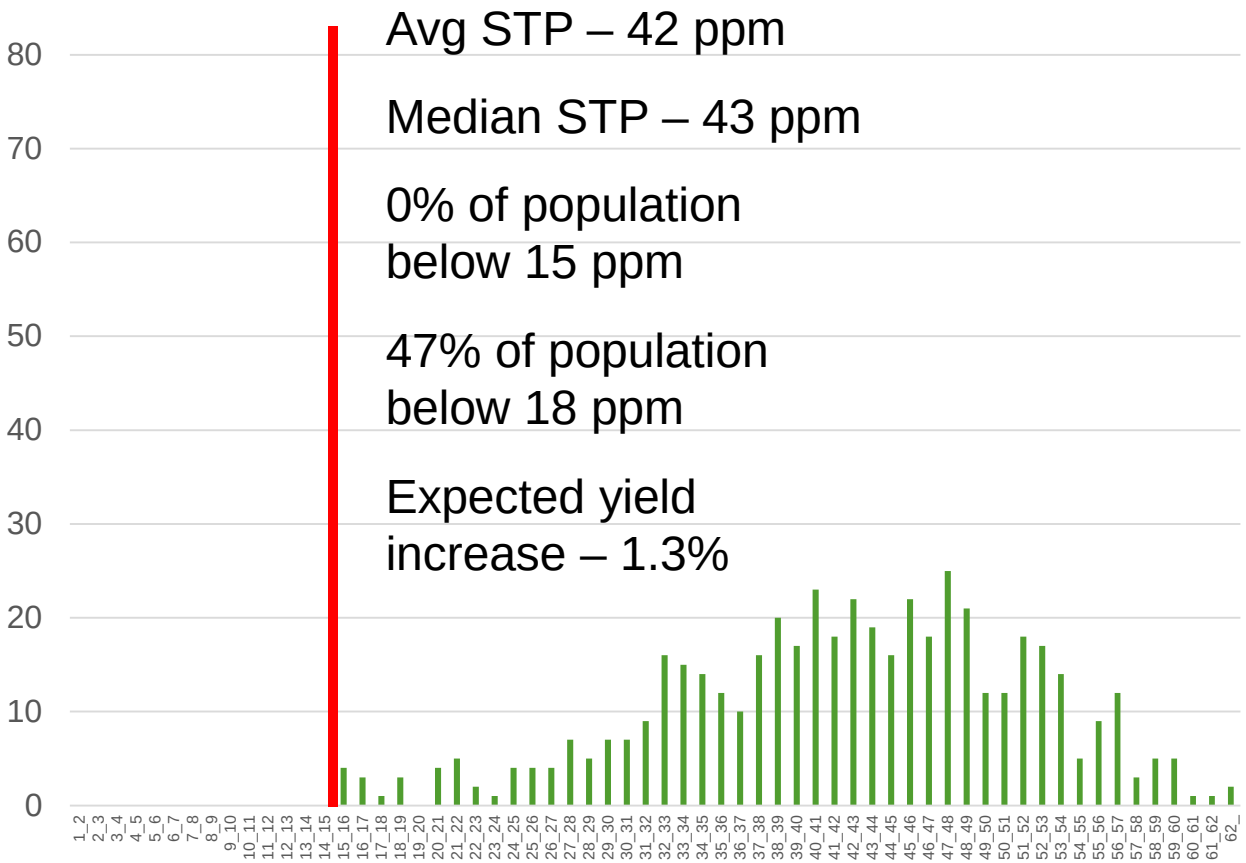


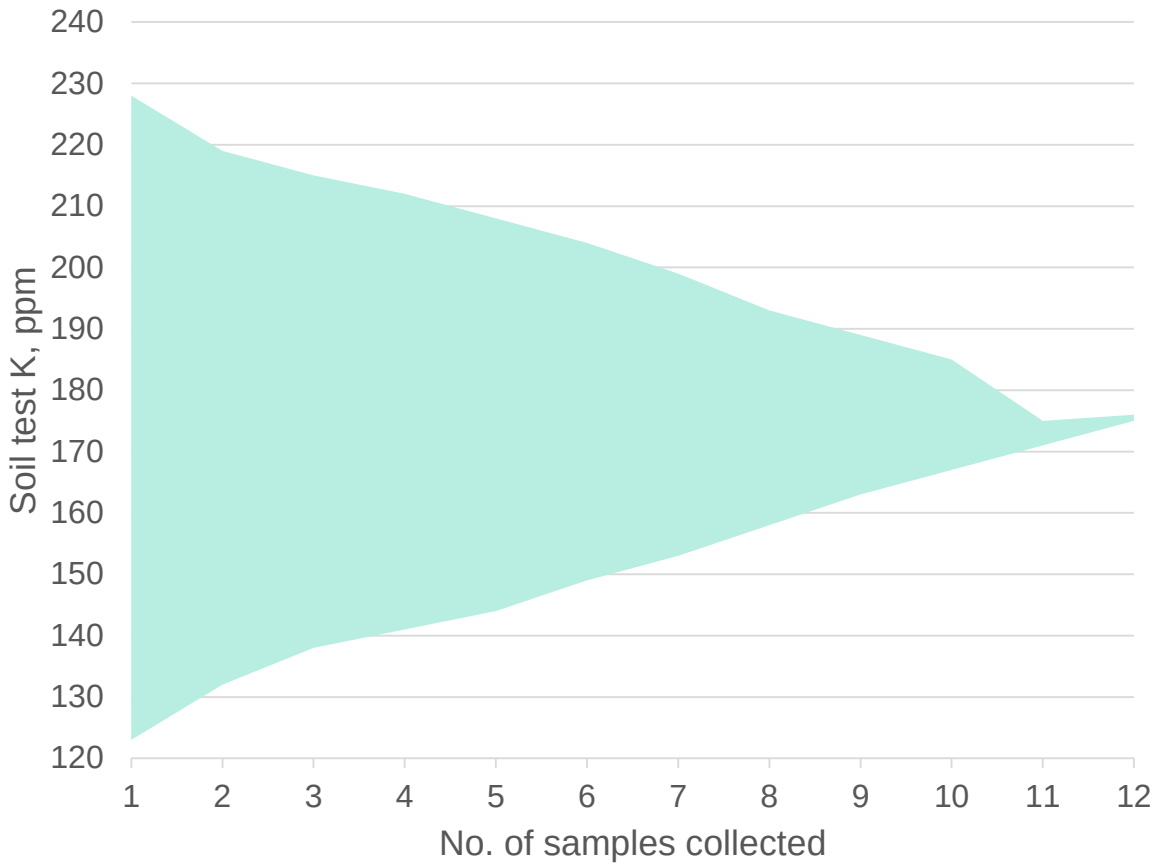
SOURCE: OKLAHOMA STATE UNIVERSITY - EFAW

Variability – Does it Really Matter?

- One thing about the OK State dataset
  - It is still not a representation of true variability.
  - Each 1ft2 cell is a composite sample of 8 individual cores.
    - So there is even more variability that we are not seeing.
- What about real “point sample” variability?
- Let’s revisit Bob Miller’s data from Illinois (we could look at more sites….okay we will)

Variability - Surprising

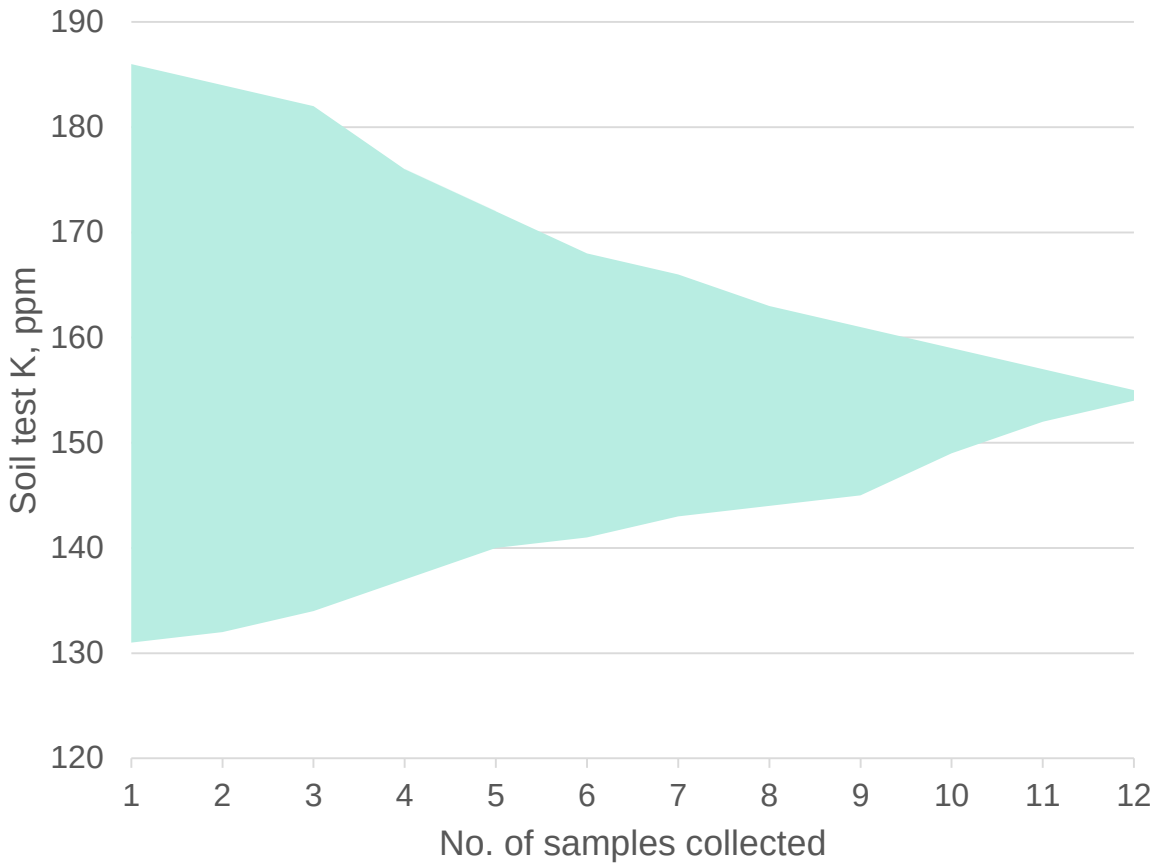
- Site 1 (T).



SOURCE: BOB MILLER, CSU

Variability - Surprising

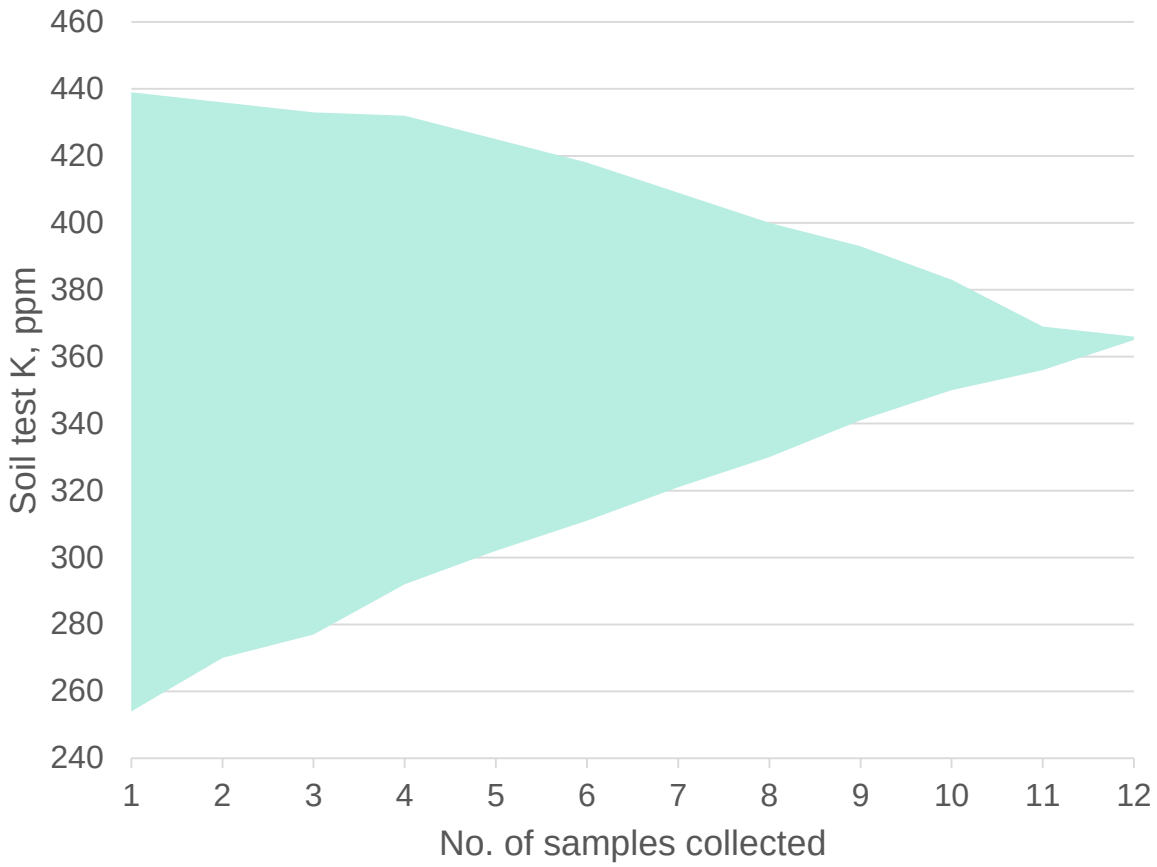
- Site 2 (V).



SOURCE: BOB MILLER, CSU

Variability - Surprising

- Site 3 (K).



SOURCE: BOB MILLER, CSU

Variability – Take Home

- A couple of important points
  - Collect an adequate number of samples to constitute a composite
    - If you do not, you can get squiffy information
  - There is a tremendous amount of variability out there (maybe even more so depending upon management fertilizer application, harvest operations, etc)

Variability – Take Home

- Does finer resolution mean less variability?
  - For practical purposes – NO!
  - Does this mean that sampling at finer resolutions is a waste of time?
    - NO! There can be underlying historical practices that make this an effective way of managing nutrient inputs (different crops, different tillage, history of manure, old homesteads, animal grazing, etc, etc)
- Would measuring variability possibly help?
  - Maybe
- So how could that be done?

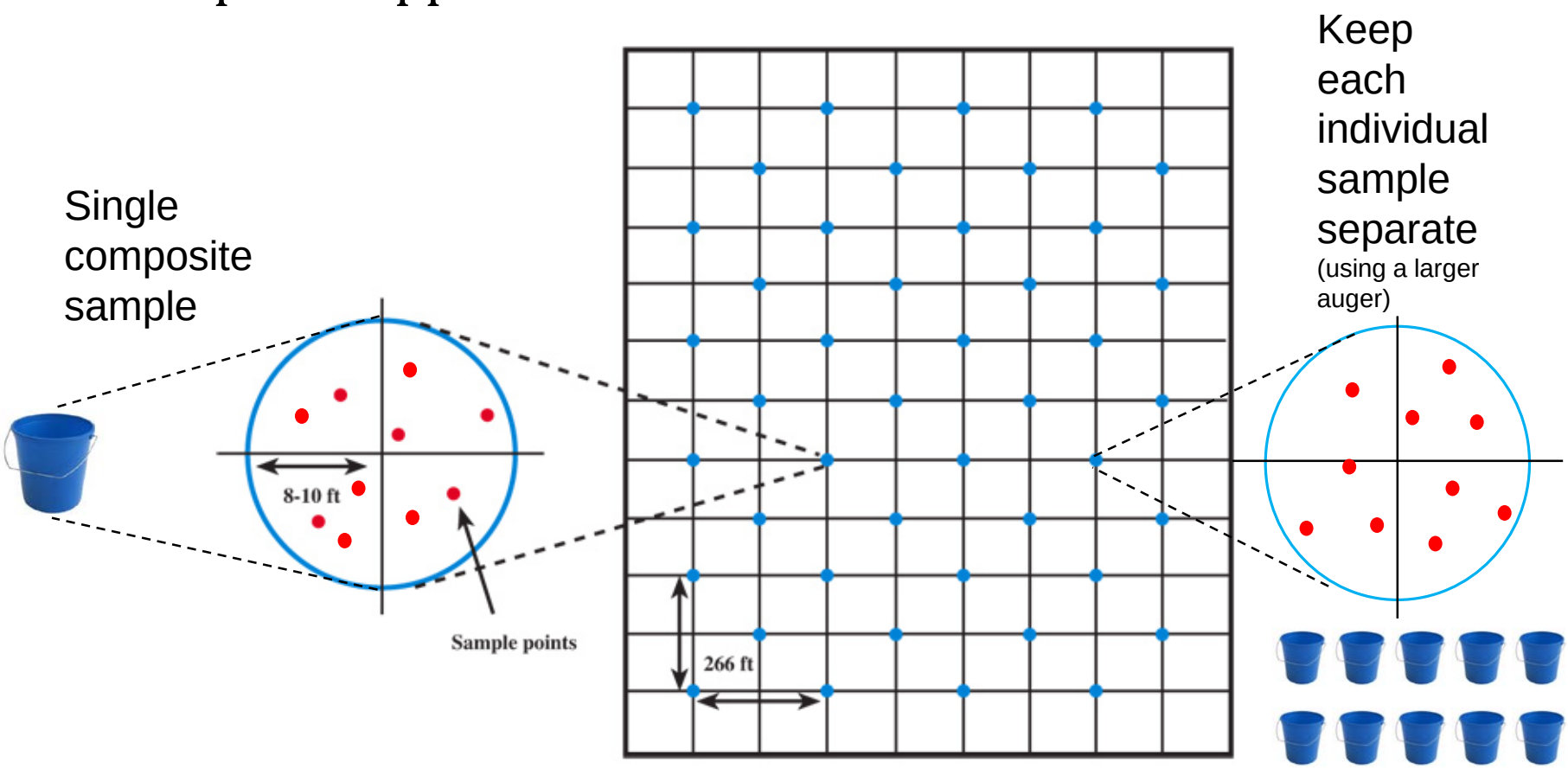
Moving Forward

Measuring Variability

- Is there a “practical” (not necessarily affordable) way to account for variability?
  - Assuming you are not going to conduct intensive soil sampling at a crazy resolution (you could not afford it).
- Maybe…

Measuring Variability

- Proposed approach



SOURCE: UNIV. OF NEBRASKA

Measuring Variability

- One would not have to conduct point sampling at every grid point (that would be way too expensive)
- Maybe do 10% of the grid points
  - Again the goal is to get a representation of the variability (we are back to the average)

- This is just an idea from a recovering academic

Summary

- Traditional sampling strategies have moved us a long way down the road to making better decisions.
  - Implementing approaches that attempt to account for spatial variability (grid, zone, hybrids, etc) have moved us further still.
    - Be careful of sample number when doing point sampling.
    - Too few samples can lead to bad information and consequently a bad decision.

Summary

- Sampling methods that account for variability (precision) is likely the next step (there are other things as well).
  - Like all life decisions there is a difference between what we want to do and what we can afford to do.
    - Measuring and treating at a high resolution is expensive.
    - There are still application limitations in place (equipment), but those can be overcome.
  - If we could tie average soil test level with some measure of variability, could we make a better decision?
    - Experimentally? I think so.
    - Practically? - ……

Thanks. Questions?

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