Soil sampling & liming: Key steps in maintaining soil health

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This could be avoided with proper soil sampling

1st step to good soil health is good soil fertility.
Lime is the cornerstone to a good soil fertility program.

Goals of Soil Sampling

- To collect a soil sample that is representative of a field or portion of a field
- Estimate the nutrients needed for economically profitable crop production
- Gain an understanding of nutrient variability within a field
- Monitor changes in nutrient status over time

When to Soil Sample

- pH, P, & K tend to be higher in spring than fall
  - Soil test levels rebound over time – movement between pools within the soil
  - Fall sampling generally provides a more conservative (larger) fertilizer recommendation
  - Overwinter changes in soil test K are dependent on clay mineralogy and soil test level (eg low vs. high)
  - Soil test K will vary depending on how soon after harvest sampling takes place
- Be consistent with timing
- Sampling frozen ground is generally not a good idea

How to Take a Soil Sample

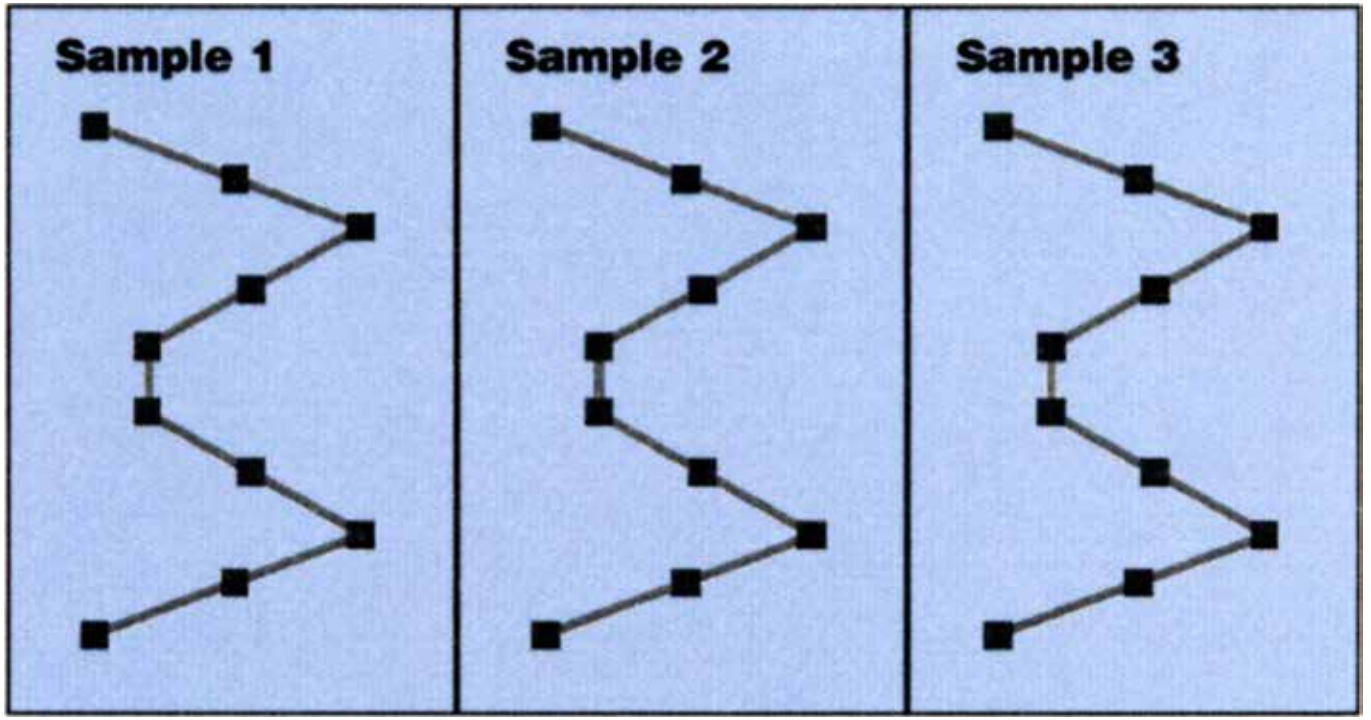
- Place 10-20 cores in buckets and mix thoroughly for a composite sample
  - Sample to a consistent depth!!!
- Place ~ 2 cups of soil in sample bag
- Mark location of sample on an aerial map or drawing

Where to Soil Sample

- At a minimum collect 1 sample per 5 acres
- Types of sampling schemes
  - Whole field
  - Grid
  - Zone
- Scheme used is determined by:
  - Expected fertilizer management approach
  - Sampling history
  - Existing fertility level

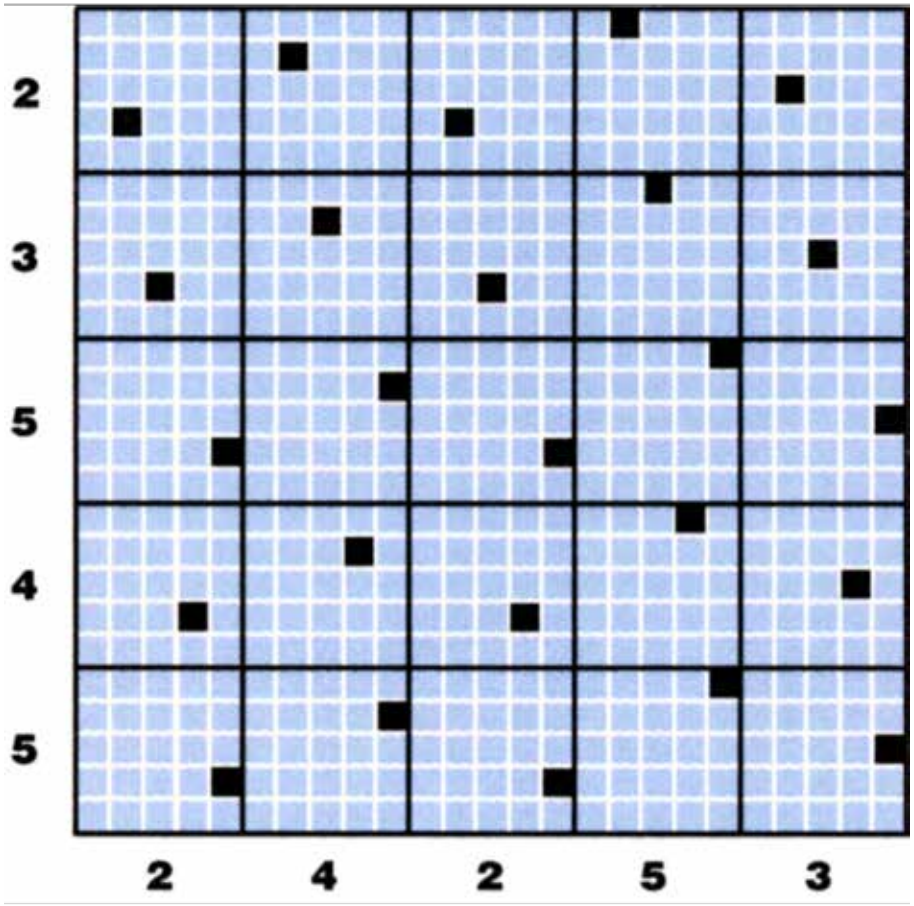
Whole Field

- Sampling pattern for 15 acre field with past soil tests in responsive range



- Each sample should be composed of at least 10 cores

Grid



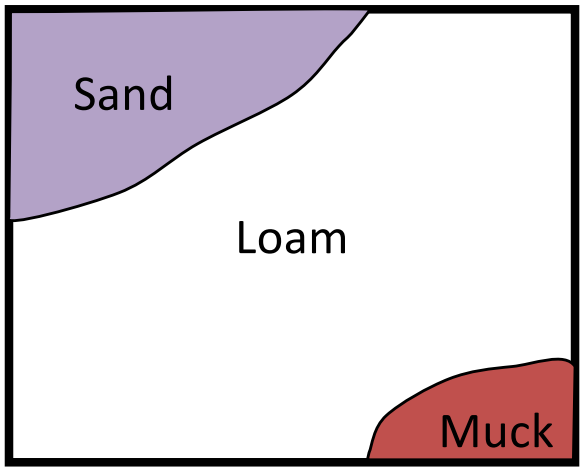
- Sample locations have GPS coordinates
- Sample consists of at least 10 cores composited within a 10’ radius of grid point
- Unaligned systematic grid point method
  - **300’ (2.1 acre) grid** – if both P & K are in non-responsive categories (VH & EH)
  - **200’ (0.92 acre) grid** – if either P or K are in responsive categories (below H)

5-acre grid point sampling

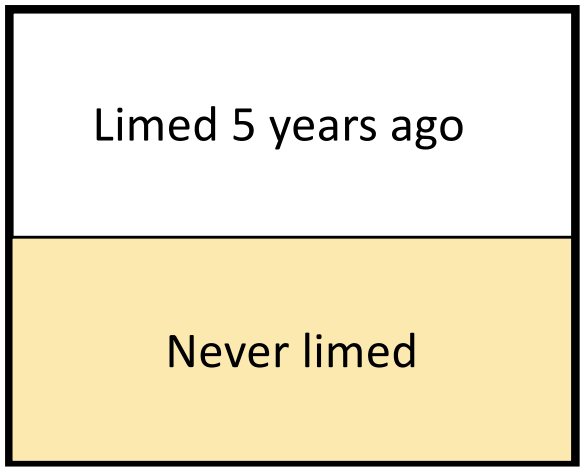
- May be used if:
  - Field last sampled ≤ 4 years ago *AND*
  - Previous soil tests in the non-responsive range

- Do not use if above criteria not met
  - This type of sampling may not adequately represent variability within a field
  - Small changes in soil test level at VL, L, or O result in different fertilizer recommendations

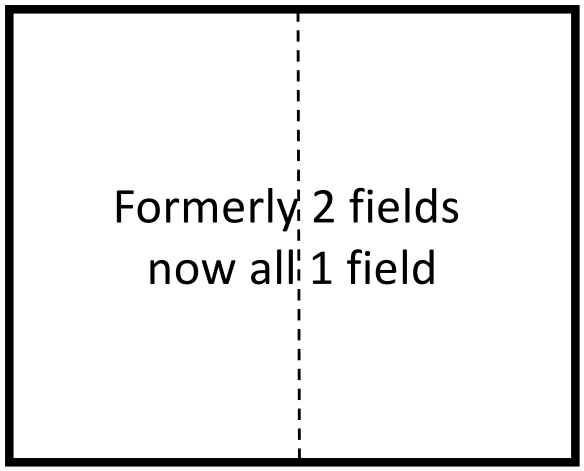
Zone Delineation



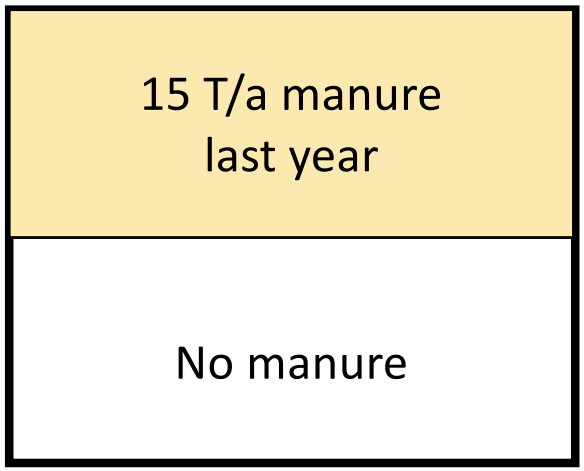
3 zones



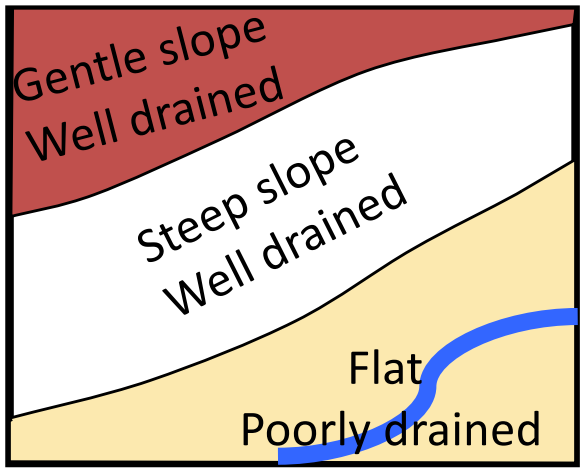
2 zones



2 zones



2 zones

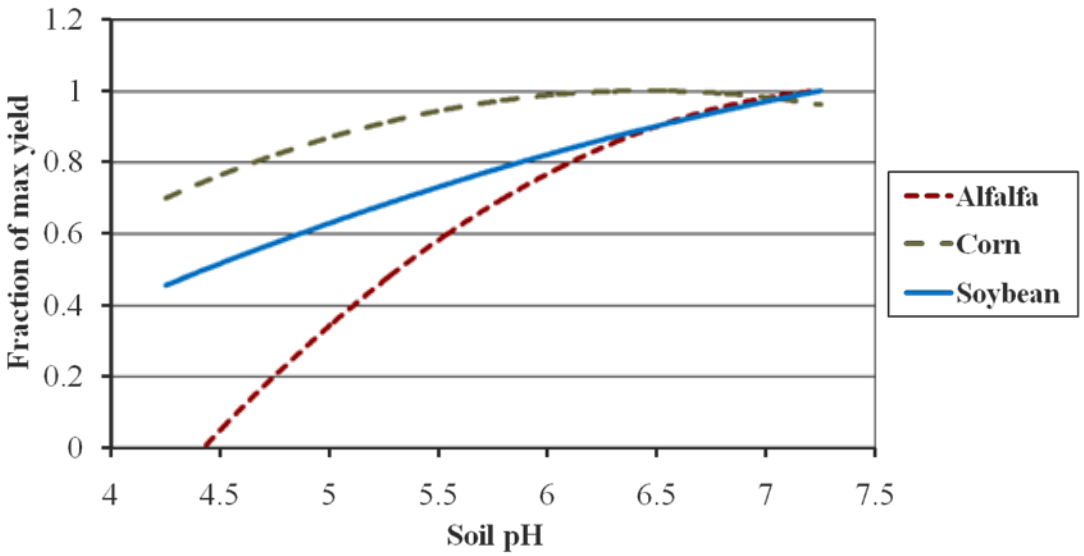


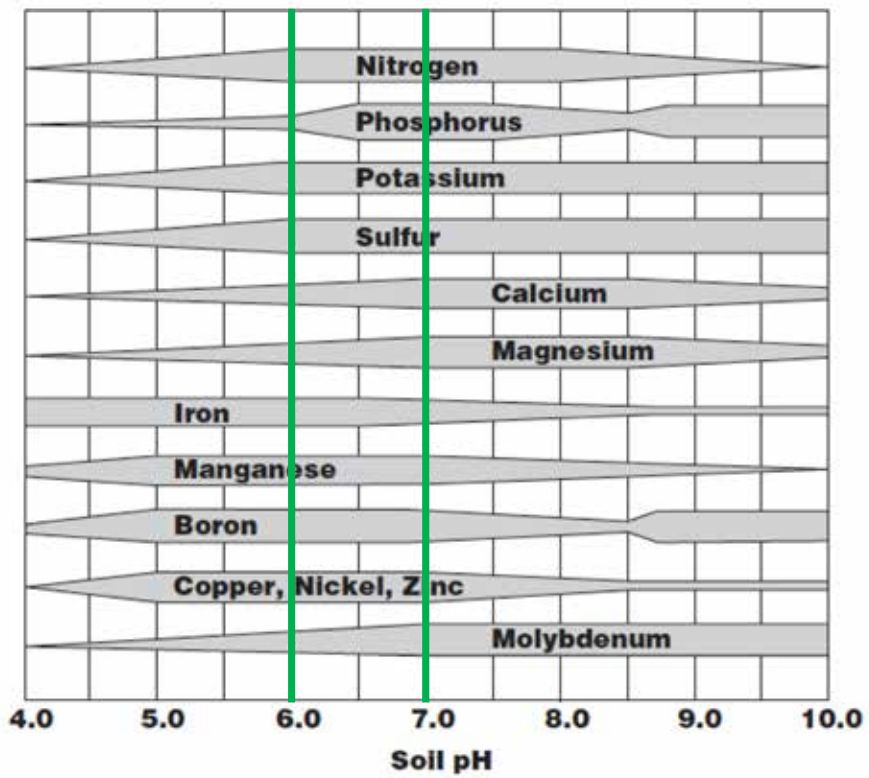
3 zones

Sampling Contour Strip Fields

- If strips are ≥ 5 acres, sample each strip separately
  - Use whole field sampling intensity guidelines
- If strips are < 5 acres and cropping & management histories are identical:
  - Combine cores from 2 – 3 strips
- If grid sampling, make sure sampling locations are in each strip
  - Generally, grid sampling these fields is not a good idea

Proper soil pH is important





Soil bacteria are influenced by soil pH

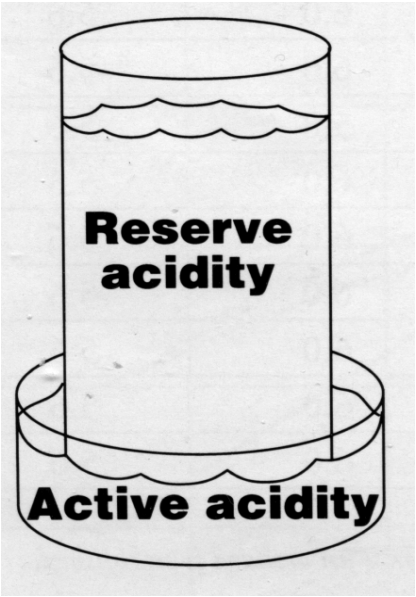
Soil pH

- pH is a measure of soil acidity
  - Acid soil has more hydrogen ions (H^+) than hydroxide ions (OH^-) in soil solution

- $pH = -\log[H^+]$

Characteristics of soil acidity

- pH buffering
  - Ability of the soil to resist pH change
  - Increases with increasing CEC
    - Clay content
    - Organic matter content
  - Weakly buffered
    - pH is easier to change
  - Strongly buffered
    - pH is more difficult to change



How a soil becomes acid

- Use of acid-forming fertilizer
- Removal of basic cations
  - Ca^{2+}, Mg^{2+}, K^{+}
  - Older soils tend to have more basic cations leached and have lower pH
- Respiration by plant roots

Calculating Lime Requirement

- Maintaining soil pH at target pH for the most sensitive crop in the rotation will insure good yields
- Lime is required when soil pH is more than 0.2 units less than target pH for the rotation
- Target pH for rotation is determined by the crop with highest pH need

Crop	Target pH
Alfalfa	6.8
Clover	6.6
Soybean	6.3
Corn	6.0
Wheat	6.0

Lime Recommendation Equations

Target pH	Lime recommendation equation
	T/a of 60-69 lime to apply
5.2	36.1 – (3.29 x BpH) – (2.67 x pH)
5.4	48.2 – (4.84 x BpH) – (3.03 x pH)
5.6	51.0 – (5.40 x BpH) – (2.67 x pH)
5.8	57.2 – (5.55 x BpH) – (3.50 x pH)
6.0	72. 7 – (7.59 x BpH) – (3.78 x pH)
6.3	103 – (12. 6 x BpH) – (3.18 x pH)
6.5	134 – (17.2 x BpH) – (2.73 x pH)
6.6	152 – (20. 3 x BpH) – (2.17 x pH)
6.8	195 – (28.4 x BpH) + (0.144 x pH)

BpH = Sikora 1:1:1

Adjustments to Lime Recommendations

- If the calculated recommendation is < 2 T/a on medium- and fine-textured soils, then the recommendation is 2 T/a
- If the calculated recommendation is < 1.5 T/a on coarse-textured soils, then the recommendation is 1 T/a
- No more than 12 T/a should be applied at one time
  - No more than 8 T/a for potato
- No-till management for > 5 years
  - Lime needed if pH in 0-2" sample is >0.2 units below target pH
  - Apply 1 T/a

Adjusting lime requirement for materials with varying NI

- Lime requirement (LR) in Wisconsin is given for NI of 60-69
  - If liming material has a NI different than above then,

$$\text{LR (T/a) of material} = \text{T/a of 60-69 LR} \times \frac{65}{\text{NI of material}}$$

For More Information

- Video
  - Soil sampling: https://www.youtube.com/watch?v=xInDRvs1Gt0&index=7&list=PLMF9p1QYShgy2s5lniB5L7N_8QgcETs9-&t=0s
  - Liming: https://www.youtube.com/watch?v=B6FfCGzwt9o&index=11&list=PLMF9p1QYShgy2s5lniB5L7N_8QgcETs9-&t=0s
- Publications at: http://learningstore.uwex.edu
  - Chapter 2 & 5 in UWEX Publication A2809 *Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin*
  - Chapter 6. Soil Acidity and Liming in UWEX Publication A3588 *Management of Wisconsin Soils*