Soils and Soil Sampling

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A collection of organic and inorganic bodies on the earth’s surface, modified by the surrounding environment or even made by humans, with characteristic chemical, physical and biological properties.
What is dirt?

Soil out of place
Major Soil Components

- **Minerals**
  Mineral soils <20% OM by weight.

- **Organic matter**
  Organic soils >20% OM by weight; 50% by volume.

- **Air**

- **Water**
Major Soil Properties

- Soil Physical Properties
  - Color, Texture, Structure, Density, Water holding capacity, Aeration.

- Soil Chemical Properties
  - pH, Mineralogy, Clay chemistry, Cation Exchange Capacity, Base Saturation.

- Soil Biological Properties
  - Organic matter, Organisms
Soil Texture

Size distribution of primary soil particles. The amount of sand, silt, and clay a soil contains.

Three large groups by texture are sands, loams, and clays.
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Soil pH

Soil pH is a measure of the H+ ion activity or concentration in soil solution.
Soil pH Classification

- **Soils with pH < 5.0:**
  - Strongly acid -- corrective treatment is needed immediately for most crop production.

- **Soils with pH between 5.0 and 5.5:**
  - Moderate acid -- need corrective treatment, but crops will grow.

- **Soils with pH between 5.5 and 6.5:**
  - Optimum for most crops

- **Soils with a pH range of 6.5 to 7.0:**
  - Near neutral

- **Soils with a pH > 7.0:** - Neutral to alkaline
The pH Scale

Optimum for Most Crops

1 2 3 4 5 6 7 8 9 10 11 12 13 14
How do we correct soil pH problems?

**Acidic pHs (< 5.5):**
Lime is applied to raise the pH to optimum levels.

**Alkaline pHs (>7.5):**
Sulfur can be used.
Acid forming fertilizers may help lower the pH, but most alkaline soils resist any changes in pH.
How do we correct acidic soil pH problems?
Major Soil Properties

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Major Soil Microorganisms

- **Fungi**
  - *(yeasts, molds, mycorhizae, mushrooms)*
- **Algae**
  - *(Green, Cyanobacteria)*
- **Actinomycetes**
- **Bacteria**
  - *(aerobic, anaerobic, facultative)*
## Soil Microflora Per Gram Soil

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Bacteria</th>
<th>Actinomycetes</th>
<th>Fungi</th>
<th>Algae</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>9.8 mill</td>
<td>2.1 mill</td>
<td>119,000</td>
<td>25,000</td>
</tr>
<tr>
<td>8-10</td>
<td>2.2 mill</td>
<td>245,000</td>
<td>50,000</td>
<td>5,000</td>
</tr>
<tr>
<td>12 - 15</td>
<td>570,000</td>
<td>49,000</td>
<td>14,000</td>
<td>500</td>
</tr>
</tbody>
</table>
Soil Organic Matter
Influence of SOM on Soil Physical and Chemical Characteristics

• Color: The dark color is the result of SOM for most soils (but may also be related to manganese)

• Granulation: SOM increases granular structure

• Cation Exchange Capacity: SOM increases CEC
Influence of Organic Matter on Soil Physical and Chemical Characteristics

Nutrient Supply:
- Exchangeable cations
- N, P, S, and micronutrients in organic forms released through mineralization

Aggregate Stability: SOM increases aggregate stability

Water Holding Capacity: SOM increases water-holding capacity
General Plant Nutrition
General Plant Nutrition

Essential element: A chemical element necessary for the normal growth of plants

Categories of essential elements:

1. Macronutrients
   a. Secondary

2. Micronutrients
Nutrients Required for Plant Growth

MACRONUTRIENTS

Nitrogen (N), Phosphorus (P), Potassium (K)
Carbon (C), Hydrogen (H), Oxygen (O₂)

Secondary

Calcium (Ca), Magnesium (Mg), Sulfur (S)

MICRONUTRIENTS

Boron (B), Iron (Fe), Manganese (Mn)
Copper (Cu), Zinc (Zn), Molybdenum (Mo)
Chloride (Cl)
Nitrogen is a major part of all amino acids, which are the building blocks of proteins. N is the nutrient used in largest amounts by plants, providing plants a deep green color.
Role of Nutrients in Plants

P Phosphorus is an essential component of ATP, the energy currency of cells. This is the energy that regulates most enzymes in plants and animals. P is also a component of DNA.
Role of Nutrients in Plants

K Potassium activates many enzymes inside plants. A good supply of K is important for drought conditions. Winter hardiness.
Role of Nutrients in Plants

**Ca** Component of cell walls, plays a role in the permeability of membranes.

**Mg** Constituent of Chlorophyll and enzyme activator.

**S** Constituent of some plant proteins.

**Micronutrients**

In general, micronutrients are involved in the activation of enzymes within a plant. Enzymes regulate most reactions in plants.
Deficiency Symptoms - Ca

- Growing points usually damaged or dead (die back).
- Margins of leaves developing from the growing point are first to turn brown.

http://hubcap.clemson.edu/~blpprt/acid_photos/BlossomEndRot.JPG
Bottom Line

• The soil is very important component of plant health and growth
• It is a good idea to your soil tested
• It is free
• Take advantage
Soil Sampling Procedures

• Reasons for Soil Testing
• How to Collect a Soil Sample
• When to Collect a Soil Sample
• Packaging the Soil Sample
• Drop Location for Soil Sample
Reasons for Soil Sampling

• A necessary step in determining what your plants will need to grow well.
• Soil testing measures the soil’s nutrient holding capacity and provides a basis for sound management decisions.
• Without a clear idea of your soil’s make-up, you can throw all kinds of things into it, but they may not be the right things.
Reasons Continued:

• Soil testing will also tell you the pH of the soil. (Acid versus Alkaline)
• Acid soils, for example, can limit root growth and cause certain nutrients to become unavailable to plants.
• The soil test will reveal the lime and fertilizer recommendations needed for optimum plant growth.
Collecting a Soil Sample

• Before sampling make a diagram or sketch of your area. Can have more than one area.

• Assign a short identification name to each area that will help you remember its location. (8 Character Limit)
Collecting a Soil Sample

- Each sample area should consist of only one general soil type or condition.
- If area varies in slope, drainage, color, or texture, and need to be fertilize separately, submit a separate sample.

It is Still Free For Arkansas!
Collecting a Soil Sample

Rake aside grass, leaves, mulch, and other surface litter.

Next, use a spade, trowel, or soil probe to remove a plug of soil that is approximately six inches deep.

Place sample in a clean bucket.
Collecting a Soil Sample

Repeat this procedure at least 12 times. A zigzag sampling pattern is preferred.

Your Field

= Sampling spots
Collecting a Soil Sample

- Mix soil in bucket thoroughly. Discard rocks, gravels, and roots.
- Soil sample must be dry.

Do Not Submit a Wet Sample!
When to Collect a Soil Sample

• Collect and submit samples any time you can.
• Try to sample the same time of year each time you sample, since analyses can vary depending upon when sample was taken.
• Usually once every two or three years is adequate.
Packaging

• Remove one pint for the laboratory sample.
• Label with field number or name.
• Be sure to completely fill the pint container/box.

Container/Box obtained from your local Extension Office.
Drop Location for Soil Sample

• Take samples to your county Extension Agent’s office.

• You will be asked some brief questions for coding. Such as:

  What are you testing (vegetable garden, lawn, flower bed) and has lime been applied in the last four years.
Get your soil tested, it’s free!