



DIVISION OF AGRICULTURE
RESEARCH & EXTENSION

University of Arkansas System

Soils and Soil Sampling

Julie D. Treat

Horticulture Program Technician

What is soil?



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

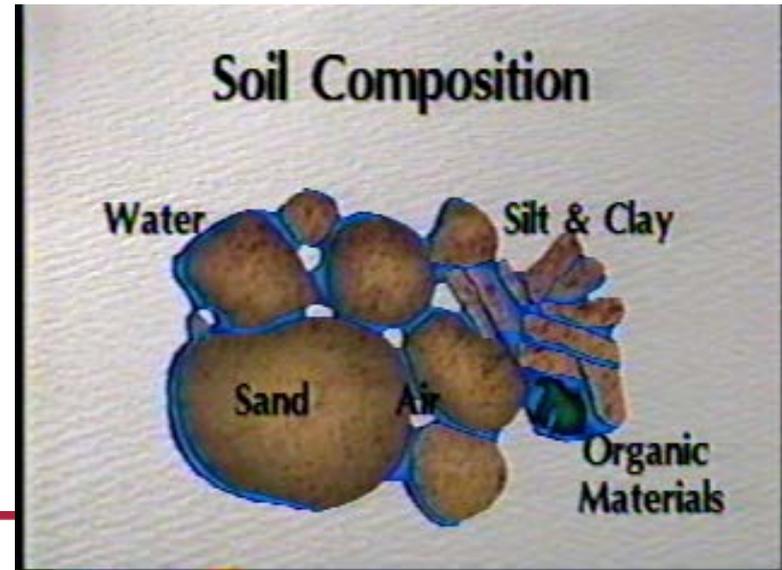
Mineral soils <20% OM by weight.

🕒 Organic matter

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

🕒 Air

🕒 Water



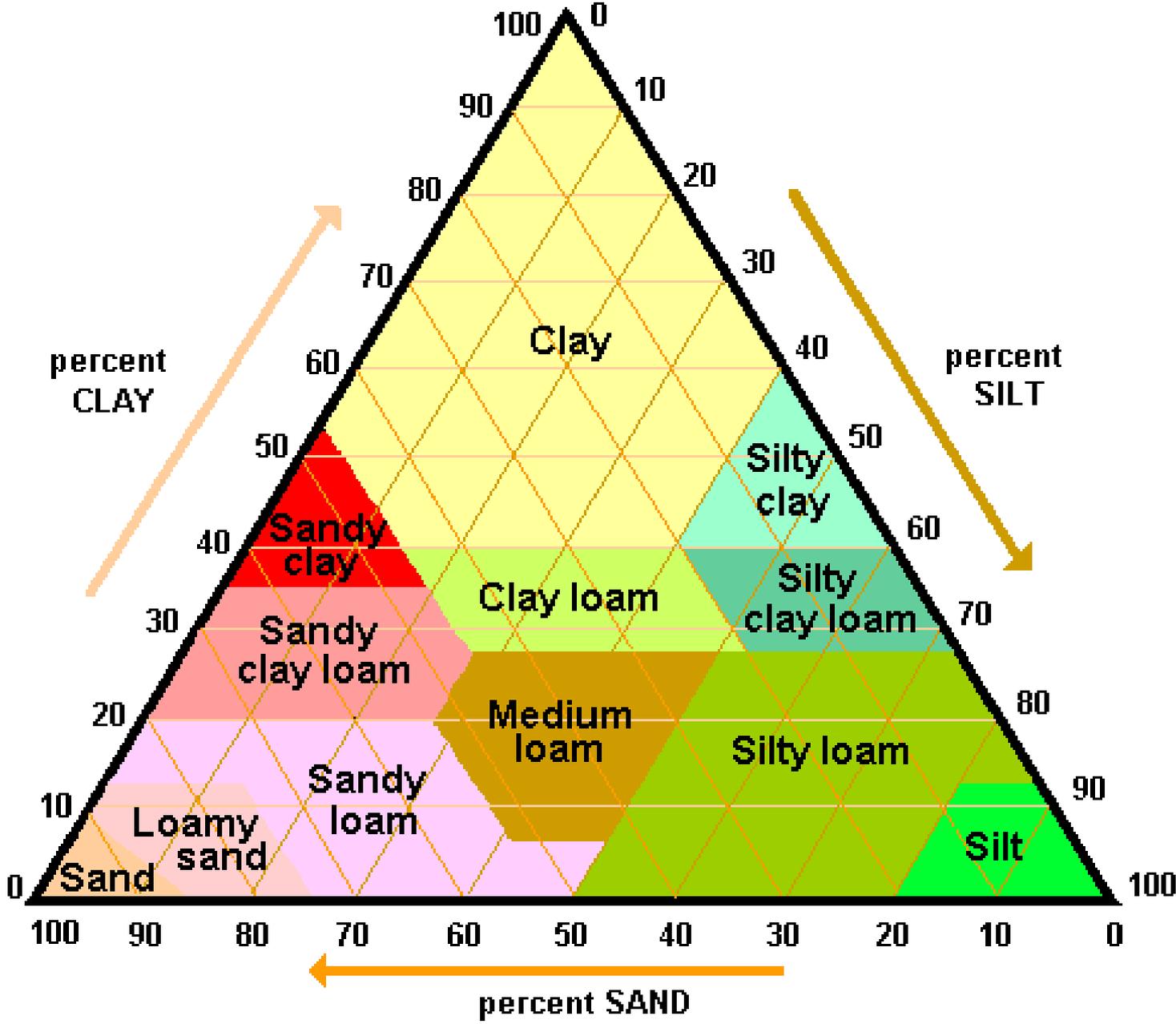
Major Soil Properties

- 🕒 **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



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 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:***

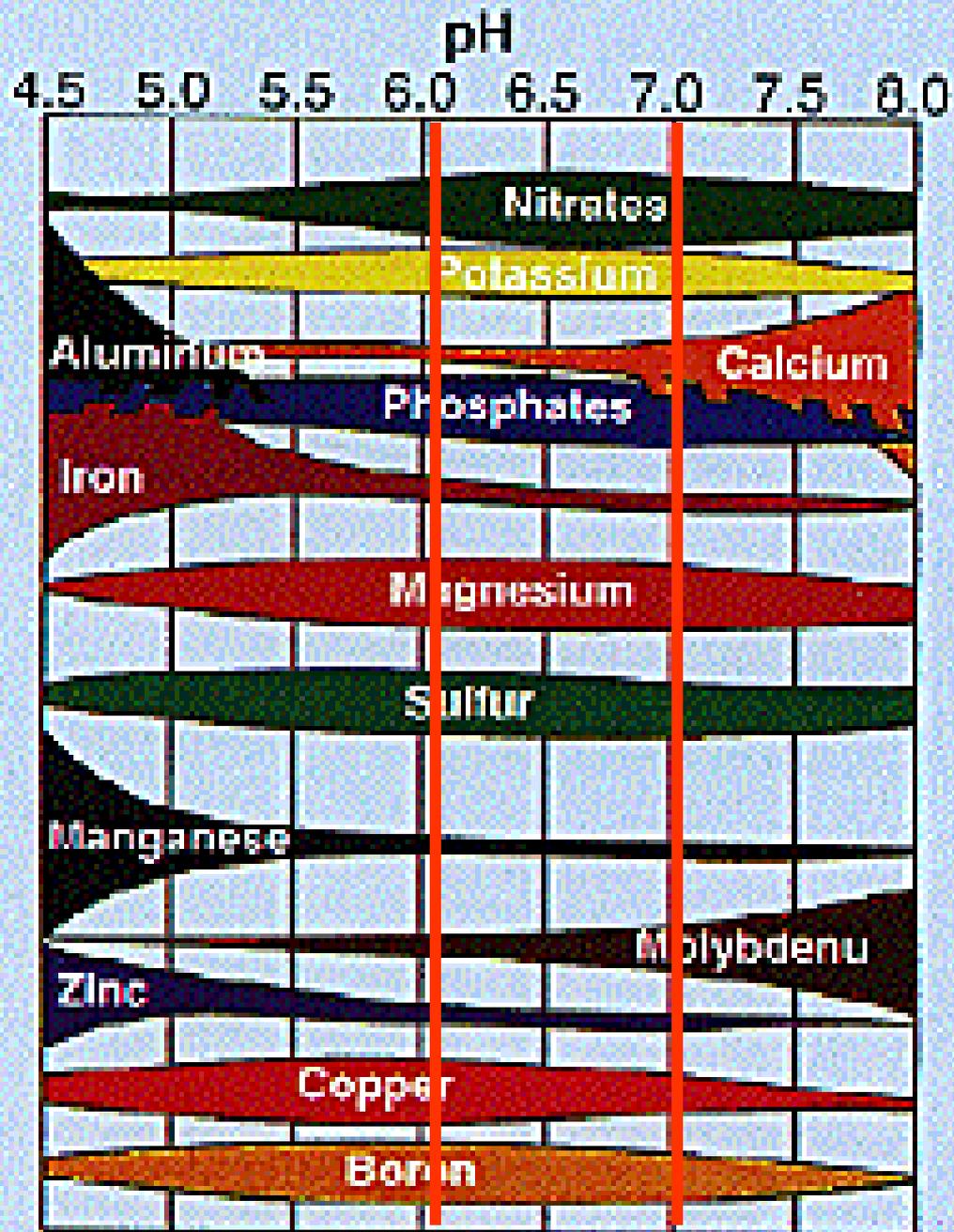
-Near neutral

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

The pH Scale

Optimum for
Most Crops





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

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**

Major Soil Microorganisms

- **Fungi**
 - (yeasts, molds, mycorrhizae, mushrooms)
- **Algae**
 - (Green, Cyanobacteria)
- **Actinomycetes**
- **Bacteria**
 - (aerobic, anaerobic, facultative)

Soil Microflora Per Gram Soil

Depth (inches)	Bacteria	Actinomycetes	Fungi	Algae
1-3	9.8 mill	2.1 mill	119,000	25,000
8-10	2.2 mill	245,000	50,000	5,000
12 - 15	570,000	49,000	14,000	500

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)**

Role of Nutrients in Plants

N 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/~blprrt/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.



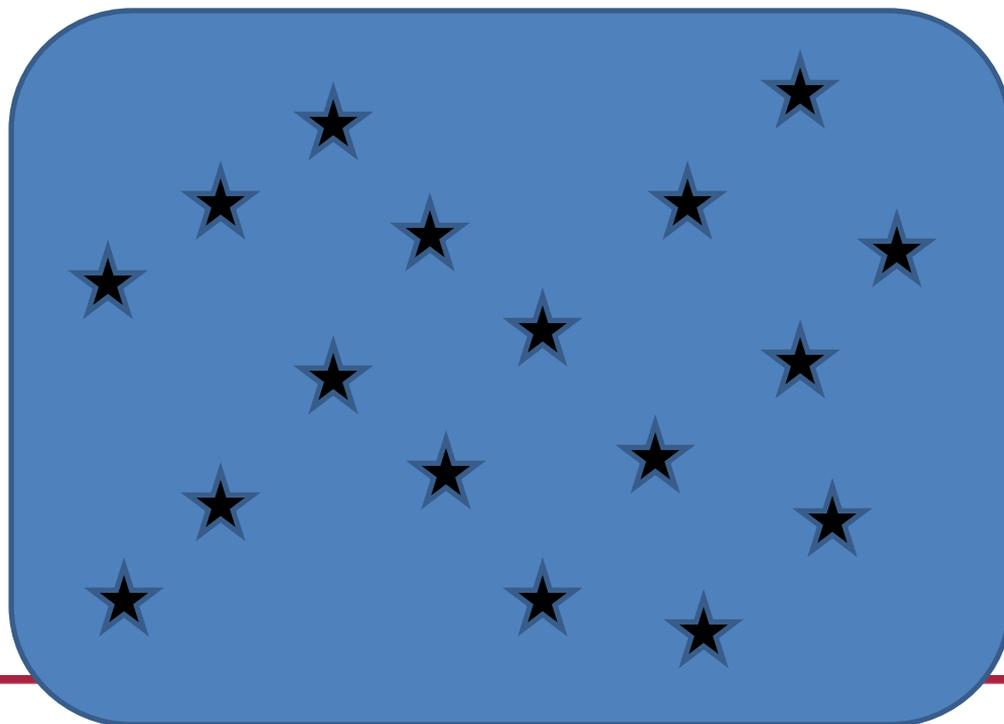


Collecting a Soil Sample

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

★ = Sampling spots

Your Field



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.



A white rectangular label with the following text and fields:

- SAMPLE INFORMATION**
- Sample # **237421**
(name as 2nd column from left hand side on CES form)
- Name _____
- Address _____
- City/Zip _____
- State _____
- County _____
- Field Sample ID **SWAMP**

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!

