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Soils and Fertilizer

Master Gardener Class of 2012

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Ideal Soil


- ❑ 25% air (pore space)
- ❑ 25% water
- ❑ 50 % solid material




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Fun Fact: How long does it take to make top soil?

- ❑ It takes Nature from 500 to 1,000 years to make 1 inch (2.5 centimeters) of topsoil
- ❑ 2,000 to 5,000 years to replace a loss of 5 to 10 inches (13 to 25 centimeters).
- ❑ An inch of top soil can be lost in a single day from erosion



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Solid Material

- ❑ Made up of different kinds and sizes of soil particles
- ❑ Mineral matter is 45-48% of total volume
- ❑ Organic matter is 2-5% of total volume

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Soil And Fertilizer

- ❑ Soil is composed of weathered rock fragments, clays deposited or formed in place, and the decaying remains of plants and animals (organic matter).
- ❑ Soil contains various amounts of air, water, and micro-organisms.

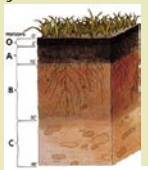



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Soil Profile

Soil profile – distinct soil layers or horizons

- ❑ Surface soil
- ❑ Subsurface soil
- ❑ Subsoil
- ❑ Parent material

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Soil And Fertilizer

- ❑ Soil furnishes physical support for plants and serves as a reservoir for water and nutrients and provides a home for beneficial organisms as well as pests.
- ❑ Synthetic and natural fertilizers supply soil with additional nutrients for plant growth.




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Physical Properties

Physical properties of soil are those characteristics that can be seen, felt, or measured.....color, texture, structure, soil depth, organic matter, water holding capacity, and soil life.


These properties usually control the suitability of the soil as a growth medium.



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Three Major Parts of Soil


- ❑ Air
- ❑ Water
- ❑ Solid material



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Color


Soil color is influenced by organic matter content, soil minerals, drainage conditions, and the degree of oxidation.



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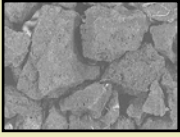

SOIL TEMPERATURE

- Affects rate of chemical reactions
- Affects rate of biological activity
- Affects rate of plant growth
- Biological zero = 41 degrees F



Take soil temperature daily fluctuations beginning Most plants optimal soil temperature more sensitive to temp.



Blocky structure

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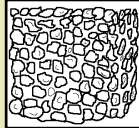

Texture

Soil texture refers to the relative amounts of different sized particles making up the soil.

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Granular Structure

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Structure


Soil structure refers to the grouping of individual soil particles into larger pieces called aggregates. Most of our soils are granular.



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Soil Depth

The effective depth of a soil for plant growth is the vertical distance from the soil surface to a layer that stops downward growth of plant roots.



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STRUCTURE

How the soil particles are organized

Affects:

- Root penetration
- Water movement
- Air-water relationships

❖ Easily destroyed !!




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Organic Matter

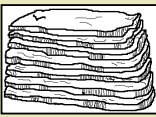


Organic matter consists of the remains of plants and animals and gives a gray, dark brown, or black color to soil.

Humus is the portion of organic matter that remains after most decomposition has taken place.



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Platy structure

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Water Holding Capacity


- Water in the soil comes from precipitation or irrigation. It enters through soil particle openings and forces air out.
- Water is lost through surface runoff, drainage, evaporation and transpiration.
- Water holding capacity is the amount of water retained after gravitational water has drained.



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Soil Life

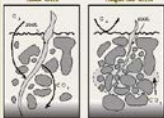

- More life below the soil surface than above:
 - Animals, mites, springtails, nematodes, virus, algae, bacteria, yeast, fungi, and protozoa.



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Soil Compaction and Drainage

- Incorporating an organic material
- No standard for materials called topsoil
- Adding sand to clay decreases drainage
- Adding peat moss to clay will only increase water holding capacity
- Consider amendments:
 - Permatill
 - Ground bark
 - Ground pecan hulls?





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Improving Your Soil

There is no cookbook recipe!


- Ideal soil environment has good aeration, drainage, ability to hold adequate moisture, and nutrients.



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Good idea:

“Sand is a part of many soil mixes. Adding sand alone as a soil amendment may not be a good idea, however. For example, sand added to a predominately clay soil will result in a concrete-like texture unfit for planting.”



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What You Can Do

- Minimize soil compaction
- Reduce drainage problems
- Decrease erosion
- Consider planting a cover crop
- Incorporate organic matter




Core Aerator




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Soil Erosion


- Produce crops to which soil is suited
- Adequate fertility to growth
- Contour planting
- Proper tillage methods
- Mulch
- Create a diversion or waterway
- Winter cover crop



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Soil Compaction and Drainage


- Recent construction
- Deep cultivation to loosen
- Redirect surface water
- Installing drainage tile



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Cover Crops

- Increase organic matter
- Smother unwanted weeds
- Aerate compacted soils
- Warm or cool season
- Green manure are tilled in before dry




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Conservation Tillage





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Organic Matter

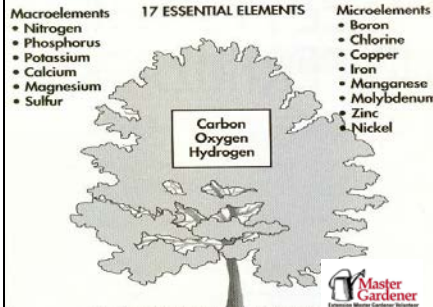
Organic amendments can improve soils that suffer from high compaction, poor drainage, and erosion.

<u>More economical:</u>	<u>Less economical:</u>
Compost	Vermiculite
Manures	Topsoil
Pine bark	Peat Moss



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17 ESSENTIAL ELEMENTS




Macroelements

- Nitrogen
- Phosphorus
- Potassium
- Calcium
- Magnesium
- Sulfur

Microelements

- Boron
- Chlorine
- Copper
- Iron
- Manganese
- Molybdenum
- Zinc
- Nickel

Center box: Carbon, Oxygen, Hydrogen




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Organic Matter

Apply a 3 to 6 inch layer of organic material and incorporate.

Decomposition rate is affected by moisture, temperature, particle size, the carbon to nitrogen ratio, and nitrogen availability.

- Florida soils vs New England soils




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Nutrients Present in Three Ways

1. Un-dissolved or granular.
2. Chemically bound to soil particles.
3. Dissolved in soil water.


Nutrients are not helpful to plants simply by being present in the soil, however, for an element to be absorbed by plants it must be in a chemical for the plant can use which is dissolved in the soil water.



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Soil Nutrition


- For healthy growth, plants need 18 nutrients, each in varying amounts.
- Of these three – carbon, hydrogen, and oxygen – are found in air and water.



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Nutrients


Exist as either anions (negative charge) or cations (positive charge).



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Macronutrients


- Nitrogen
- Potassium
- Magnesium
- Calcium
- Phosphorus
- Sulfur



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Factors Improving Plant Use

1. Type of soil
2. Soil pH
3. Type of nutrients in soil
4. Adequate amount of soil water
5. Anything that affects plant's growth




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Micronutrients

- Iron
- Zinc
- Nickel
- Molybdenum
- Manganese
- Boron
- Copper
- Cobalt
- Chlorine

Boron is a very valuable trace element in vegetables-particularly tomatoes and the leafy crops.


Molybdenum is essential for poinsettias



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What do they do? Nitrogen


- Nitrogen- most important element in plant growth
- primary component of proteins and part of living cell
- Necessary for green growth and the production of chlorophyll
- Leaches freely in the soil
- Produced chemically or organically found in many products or manures.
- most responsible for plant growth



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What do they do? Phosphorus

- Phosphorus-important for young seedling growth-increases flowering
- Essential for root growth and expansion-used in transplant solutions
- Bone meal-ground and burned bones
- Rock phosphate-a mined element
- photosynthesis, respiration and energy storage
- Most deficient element in Rowan County soils because of erosion or grading.




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Fertilizers

Fertilization Vs Plant Nutrition


- Plant nutrition refers to the needs and uses of the basic elements in the plant.
- Fertilization is the term used when these materials are supplied as an amendment.
- Fertilizers provide some elements that might be lacking in the soil.
- All fertilizers have three numbers eg. 10-10-10 which is percentage by weight.
 - Nitrogen (N)
 - Phosphorus (P)
 - (K)



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What do they do-Potassium


- Necessary for stiff stalks, seed formation
- Leaches very freely through the soil
- Found in wood ashes-wood ashes will change the pH of the soil without adding calcium
- affects many plant growth processes and is vital for photosynthesis
- helps regulate water in the plant
- helps plant overcome drought stress
- increases disease resistance
- improves winter hardiness.



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Complete vs Incomplete Fertilizers


- Complete fertilizers have all three basic elements NPK
- Incomplete fertilizers will be missing a major component
 - urea 46-0-0
 - triple super phosphate 0-46-0
 - potash 0-0-60



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What do they do?


- Magnesium-good source is epsom salts-Chlorophyll production
- Calcium-bud development, blossom end rot, lime is source along with bone meal
- Sulfur-usually supplied in air pollution, green-leaves-gives onions strong flavor



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What is Fertilizer Analysis?


- it is the amount of the different nutrients found in a fertilizer
- the amount is listed as a percent
- it is ALWAYS listed Nitrogen-Phosphorous-Potassium (N-P-K)
- a fertilizer labeled 10-15-10 is 10% Nitrogen, 15% Phosphorous, and 10% Potassium
- if there is a fourth letter it is for Sulfur



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Most overlooked in plant growth is the element-Oxygen


- Essential for root growth and expansion
- Problem in clay or poorly drained soils
- How to increase O2
 - Perma Til
 - Vermiculite
 - Ground pine bark
 - perlite
 - Compost
 - Good cultural practices



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How many pounds of Nitrogen are in a 50# bag of 10-15-10?


- 10% of 50# = 5# Nitrogen



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Fertilizer Analysis


- All fertilizer containers must show 3 basic nutrients-NPK
- These are depicted as percentages-the rest are fillers-lime or clay
- Some materials may contain nutrients, but legally are not sold as fertilizers-these are referred to as soil amendments. Examples: lime, compost, cow manure, etc.



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Pounds of Actual Nutrients in a 50# bag of 10-15-10?


- add up 10+15+10 = 35% nutrients or 17.5#



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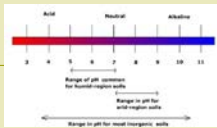
What is the other 65% of this bag?

- inert materials (filler)




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Soil pH



- Soil pH is a measure of the hydrogen (acid forming) ion activity of the soil solution.
- The more acids (H+) held on the soil particles the lower the pH.
- The scale has 14 divisions.....pH 7 is neutral.



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Special Purpose Fertilizers


- Fertilizers that are blended for special uses
 - camellia
 - pecan
 - poinsettia
 - rose foods
 - pond fertilizers



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Influences on Soil pH


1. Organic matter
2. Precipitation-Soils in areas with high rainfall are usually acid because basic cations are leached more readily than others
3. Native vegetation
4. Soil depth
5. Crops grown
6. Type and amount of fertilizer used



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Comparison of Fertilizers
Slow Release Fertilizers


- Fewer Applications
- Low burn potential
- Less leaching
- Expensive
- Limited to certain specialty crops
- Release governed by factors other than plant need



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Major Impact of pH


The major impact pH has on plant growth is the availability of plant nutrients and concentration of toxic elements.



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Comparison of Fertilizers
Manures

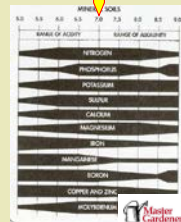

- Low burn potential
- Relatively slow release
- Contains micronutrients
- conditions the soil
- Salts could be a problem
- Bulky and difficult to handle
- Expensive per pound of actual nutrient
- Weed seed a problem



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What does pH have to do with plant growth??


- Inhibits nutrient uptake
- Soils are typically low in the Piedmont
- pH can be raised by:
 - lime-calcitic and dolomitic
 - wood ashes

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Comparison of fertilizers
Conventional fertilizers

- Fast acting
- Some are acid forming
- Relatively low cost per unit
- Easy to find
- Greater burn potential
- May be a problem if wet
- Nitrogen leaches readily



Information from a Soil Test

- Soil Classification
- Weight per volume
- CEC
- Base saturation
- pH