Create and Sustain Living Soil
Create & Sustain Living Soil

Grow It Eat It Program / Master Gardeners
- Understanding Your Soil
- Identifying Your Soil Type
- Preparing The Soil For Planting
- Identifying Plant Requirements
- Amending Your Soil
Preparing Your Soil For Planting

- What Are You Planting? Know The Plant's Needs
- Light, Water, Space, etc.
- Special Mineral Requirements
- pH
- Soil Structure
- Know Your garden Area
Understanding Your Soil

• Soil is the loose surface material of the earth.
• Plant quality depends on soil quality.
• Soil composition determined by texture & structure.
• Soil benefits plants by providing:
  - Mechanical Support
  - Nutrients
  - Water
  - Air
Soil Formation

Soils are a natural entity of nature.

- Parent Material – rocks, marine or river sediments, and wind blown materials.
- Climate – precipitation
- Landscape position
- Organisms
- Time
Soil Texture: What type of soil do you have?

- Soil is composed of a mixture of mineral particles from weathered rock.

- Particle size varies:
  - Sand: Largest, loose, coarse & gritty
  - Silt: Intermediate, silky like talcum powder
  - Clay: Smallest, smooth & sticky
Soil texture

**SAND** - 2.0 to 0.05 mm

**CLAY** - less than 0.002 mm

**SILT** - 0.05 to 0.002 mm

Textural triangle for the graphically challenged:
- Clay feels sticky when wet
- Sand feels coarse and gritty
- Silt feels silky smooth when wet

Loam is a combination of all these.
Soil Structure

• The arrangement of soil particles.
• Characteristics of “good” soil:
  Clumps (aggregates) of various sizes
  Spaces between the clumps (pores) of various sizes
• Structure is determined by:
  Soil texture
  Decaying organic matter
  Living organisms
Soil Structure

- Granular
- Blocky
- Platy
- Massive
- Single grain
Soil Physical Properties

Texture- sand, silt clay
Structure- granular, blocky, massive
pores for movement of water
spaces for air and plant roots
Soil Food Web

• Biomass- living creatures, worms, bacteria, etc.

• Residues and by products-dead roots, dead creatures, exudates

• Humus- a stable end product of residue decomposition and organic matter.
The Soil Food Web

First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, Parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators
Organic Solids

- Organic matter is material that was part of a living organism.
- Supplies plant nutrients.
- Feeds organisms that live in the soil.
- Increases water holding capacity.
- Supplies oxygen to plant roots.
- Decreases erosion loss.
- Improves soil structure.

As little as 5% organic matter will show these effects.
Living Organisms

• Earthworms digest organic material & create large channels in the soil.
• Fungi serve as extensions of plant roots, assist the plant in taking up nutrients & produce a sticky substance that binds soil particles together.
• Bacteria convert nitrogen from air & make it available to plants.
• Beneficial (& not so) insects.
Good Garden Soil

A mixture of mineral particles, decaying organic matter, living organisms, water with dissolved nutrients & air.

Garden soil is described as having good tilth when it has an abundance of clumps (aggregates) & 50% by volume of pores.
Biochemical Reactors

- Clay and humus particles react with dissolved nutrients.
- Holding nutrients or releasing them into the soil solution.

**Adsorption**: Molecules adhere to the surface of the phase.

**Absorption**: Molecules are drawn into the bulk of the phase.
Biochemical Reactors

- Cation Exchange-

- Dissolved nutrients (Ca+ Mg2+ K+) are held or adsorbed by the negative charged clay particles. The nutrients can be released or held depending upon the plant uptake or excessive rains.
Soils Provide a reservoir for plant nutrition

- Plant nutrients are held in the soil.
- The major nutrients needed by plants are:
  - Nitrogen (N)
  - Phosphorus (P)
  - Potassium (K)
- Low available nutrition in the soil will affect plant growth.
Soil Biology

Soils contain many living creatures. A complex food web is contained in soil. Soils are a reservoir of nutrients, water and air. Plants and animals act and react with soil particles to change the nature of the soil. Plant and animal residues “glue” soil particles together.
"Mr. Osborne, may I be excused? My brain is full."
Soils and plant growth

- Soils in the Mid Atlantic are naturally acidic or low pH.
- Addition of liming materials can improve plant growth by supplying some nutrients making other nutrients more available.
- Limestone applied to a low pH soil will raise the pH.
The diagram illustrates the pH levels for various elements:

- **Strongly Acid (pH 4.0-6.0)**: Nitrogen
- **Neutral (pH 6.5-7.5)**: Potassium, Phosphorus, Sulfur, Calcium, Magnesium
- **Strongly Alkaline (pH 9.0-10.0)**: Iron, Manganese, Boron, Copper & Zinc
Soil Testing To Establish A Baseline

• Provides information about plant available nutrients, and pH of your soil.
• Provides a plan for amending the soil based on your plants' requirements.
• Testing is essential for some plants.
• Avoids having to wait for the plants to tell you something is wrong.
Soil tests are easy to do.

- You provide a soil sample
- Mail it to a soil lab
- The lab mails back the test results.
- Results include:
  - soil pH
  - current soil nutrient levels
  - Recommendations for soil amendments (fertilizer, lime)
Tools for soil test

Several tools can be used to collect samples. The choice depends on soil conditions and sampling depth.

The selected tool must be able to cut a slice or core through the desired layer of soil. The objective is to obtain a cross section of the plow layer or layer being sub-sampled.
Soil test results

Virginia Cooperative Extension
Soil Test Report

Richmond County Office
P.O. Box 152
Warsaw, VA 22572
804-333-3420

Virginia Tech Soil Testing Laboratory
145 Smyth Hall (0465)
Blacksburg, VA 24061
www.soiltest.vt.edu

Owner
MORAN KEISTOPHER
3156 ELLWOOD AVE
RICHMOND, VA 23221

Sample History

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<tr>
<th>Sample</th>
<th>Field</th>
<th>Last Crop Name</th>
<th>Yield</th>
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<th>Tons/Acre</th>
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<th>SMU-2 %</th>
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Lab Test Results (see Note 1)

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<tr>
<th>Analysis</th>
<th>P (lb/A)</th>
<th>K (lb/A)</th>
<th>Ca (lb/A)</th>
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<th>Fe (ppm)</th>
<th>B (ppm)</th>
<th>S.Salts (ppm)</th>
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Crop: VEGETABLE GARDEN (210)

610. LIME RECOMMENDATIONS: Apply 9 pounds of agricultural limestone (ground or pulverized) per 100 square feet. If lime is not going to be mixed into the soil, make several small applications of up to 5 lbs each, at intervals of 1 to 6 months, until the full amount is applied.

990. We are trying to improve our service. PLEASE take a moment to complete our brief, anonymous customer survey at tinyurl.com/soiltestsurvey

221. FERTILIZER RECOMMENDATIONS: Apply 4 lbs of 5-10-10 per 100 square feet. For additional information on fertilization, see Note 19 (enclosed).

677. Soluble Salts are not high enough to cause salt injury.
Methods For Amending The Soil

• Adjusting The pH
• Correcting Mineral Deficiencies
• Improving Soil Condition
• Natural Soil Improvement
What is pH?

- It is a measure of acidity.
- Proper pH assists plants' ability to absorb minerals & nutrients from the soil.
Correcting the pH Level

• Proper pH assists plants' ability to absorb minerals & nutrients from the soil.
• Low pH (acid) is corrected by adding
  • Lime, Wood ash
• Increase acidity by adding
  • Iron sulfate, Sulfur
Correcting Mineral Deficiencies

Applying fertilizer

- Soil test results include the type, amount and timing of needed nutrients.
- Inorganic or organic materials can be used.
Synthetic fertilizer

- Inorganic Fertilizer
- Provide quick release of nutrients
- Rapid adsorption
- Nitrogen component is manufactured.
- Phosphorus is usually crushed rock
- Potassium is usually crushed potassium minerals.
Organic fertilizer

- Contains lower levels of nutrients
- Provides a slower release of nutrients
- Slower absorption by plants over longer period
- Provides other benefits such as soil conditioning

- Nitrogen source from manures or food processing wastes like fish meal.
- Potassium and Phosphorus from crushed minerals.
Organic material as a Soil Conditioner

• Improves Soil Structure, Encourages Microbial Activity, Adds Nutrients
  • Aged composted manure,
  • Organic residues-leaf clippings, leaves

• Use composted manure, not fresh

• Types: Horse, Cow, Pig, Chicken, Rabbit, Worm

• Know about the source of the manure
• Mix green(manure, grass) with brown (tree leaves) to compost.
Compost Creates Healthy Living Soil

- Decomposed Plant and Animal waste Material
- Improves Soil Structure, Encourages Microbial Activity
- Rich In Nutrients
- Natural Pesticide
- Key Ingredient to Organic Gardening
Soil test results

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Soil Test Report

Lab ID: 09-15183
2009-02-27

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Periodic Soil Maintenance

• Visual Inspection/Testing
• Fall Prep: Cover Crops, Garden Composting, Cover/Smother
• Raised Bed/Container Gardening
• Adding Compost When Planting
• Till Or Spade?
Summary

• Soil is a living, breathing, dynamic material that provides plants with the conditions needed for growth.
• Understand your plants' needs before you amend the soil.
• Apply compost to your gardens on a regular basis.
• Maintain your soil's health throughout the year.
Glossary

Tilth - Soil that has the proper structure & nutrients to grow healthy crops.
Friable - Ability of a solid substance to be reduced to smaller pieces with little effort. Good friability prevents severe compaction.
Humus - Organic matter that has reached a point of stability, where it will break down no further.
pH - Measure of the acidity or alkalinity of a solution.
Resources

• Grow it! Eat it! - www.growit.umd.edu
  o Join the network! Access to valuable and practical gardening tips and information. Share your experiences in our blog.

• Maryland Master Gardener Program - www.mastergardener.umd.edu
  o Consider becoming an MG volunteer in Carroll County

• Home and Garden Information Center Can answer your gardening questions…
  o Call the “hotline” Mon-Fri, 8am-1pm.
    1-800-342-2507

NRCS Web Soil Survey
This program was brought to you by Maryland Master Garden Program Carroll County University of Maryland Extension