Improving Soil with Amendments and Testing

Edible Evanston

Presented
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Citizens' Greener Evanston
Act Locally. Breathe Globally.

Workshop Outline

- Soil Basics –
- Soil Testing –
- Enhancing Soil Structure –
- Questions –

Soil Basics

- Good topsoil is a **healthy mix of physical, chemical, and biological components**
  - Soil texture
  - Organic Matter
  - Nutrients
  - Microbiology
  - Moisture

Soil Texture

- **Soil texture refers to the proportion of physical components of the soil:**
  - Sand
  - Silt
  - Clay

-- Texture is typically expressed as a combination of the components (e.g., silty clay; sandy loam)

Organic Matter

- **Organic matter is anything that is living or was once alive.**

- Functions include:
  - Water holding capacity and drainage
  - Air circulation
  - Resistance to compaction
  - Holds cations and anions
  - Provides fertility

Microbiology is Important

- **Microbes make the soil and maintain it**
  - 20,000 to 30,000 in a teaspoon of healthy soil
  - Bacteria, fungi, protists, animals, and plants cooperate and compete in a healthy soil
  - Most are beneficial

What does good topsoil look (or smell) like?

Why amend soils?

- **Increase organic matter, balance nutrient ratios, and improve the soil food web**
  - **Increase organic matter** – Add compost, mulches, and/or cover crops
  - **Balance nutrient ratios** – Add fertilizers, conditioners
  - **Improve the soil food web** – Add microbial inoculants, soil from other ecosystems, worms

Why test soil?

- What is soil testing? Can I do it myself?
- What can it tell me?

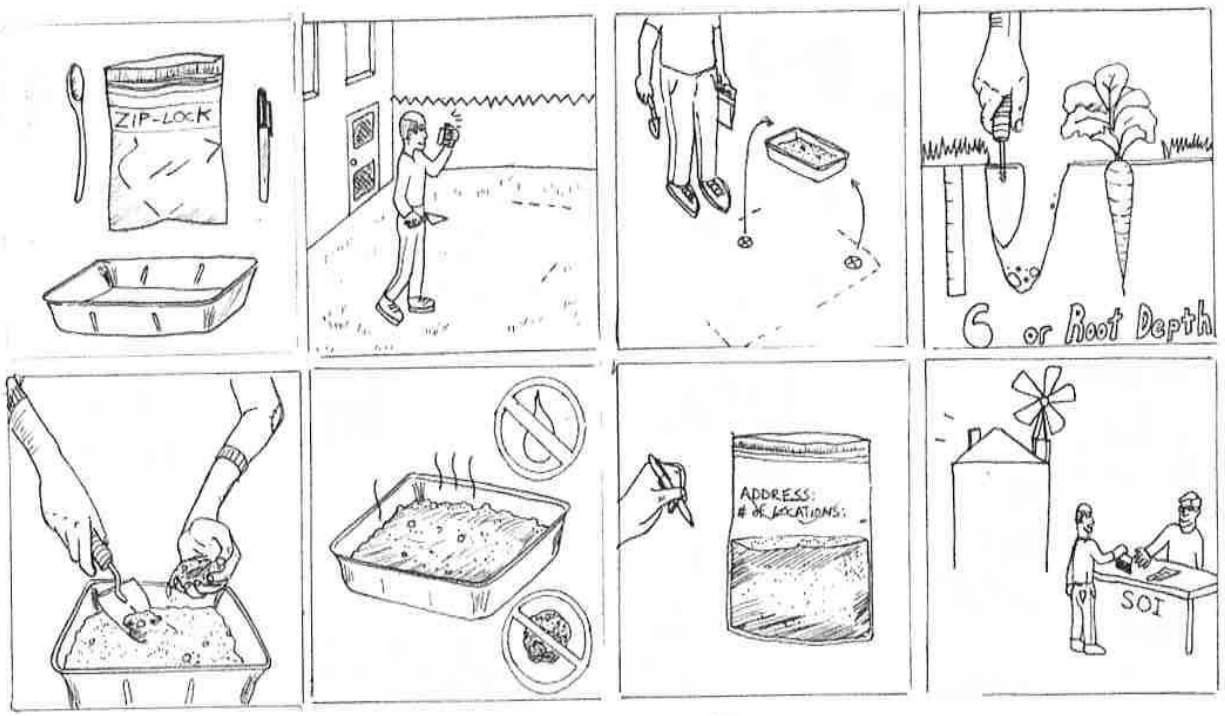
Do I need to test my soil?

- Is it likely to be contaminated?
- Do I have the right soil texture?
- Do I need to know the concentration of nutrients?
- How much fertilizer should I add?

Soil Analytical Testing

- **Physical**
  - Gradation, organic content
- **Chemical**
  - pH (target is 7 – 7.5)
  - Nutrients (N – nitrogen; P – Phosphorous;
  - K – potassium; Mg – magnesium; Ca – calcium)
  - Metals
  - Ionic balance (cations and anions)

Taking a Soil Sample



Nutrient Analytical Laboratories

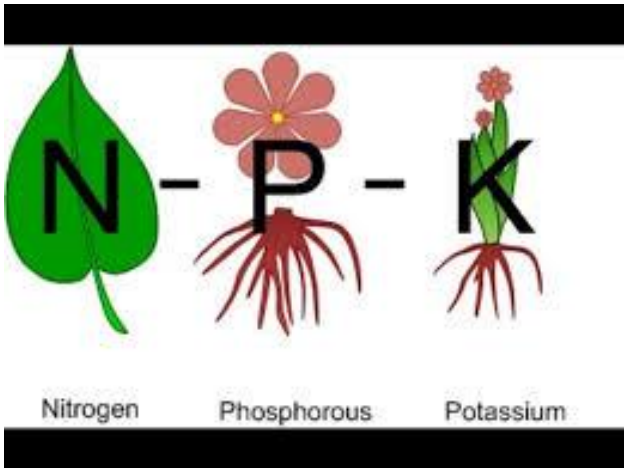
- A & L Great Lakes Laboratories, Inc.
  - www.algreatlakes.com
- Illinois Extension Service (additional labs)
  - http://urbanext.illinois.edu/soiltest/

Example of Soil Nutrients Testing

Nutrients	Desired Level *	MC – 14	Relative Level
Potassium (K)	100 mg/kg	538 mg/kg	Very High
Phosphorus (P)	200 mg/kg	239 mg/kg	High
Magnesium (Mg)	280 mg/kg	770 mg/kg	Very High
Calcium (Ca)	> 2000 mg/kg	5650 mg/kg	High
Sodium (Na)	< 70 mg/kg	28 mg/kg	Low
pH	7.0	7.4	High
Organic Matter		13.4 %	High
Desired ratios: Mg is 14% of Ca; P to K ratio: 1:1; CEC (cation exchange capacity) * Lab recommended adding Nitrogen (N);		13.6 % 0.44 36.2 Good 4 lbs/1000 sq ft.	 Good Low

Plant Macronutrients

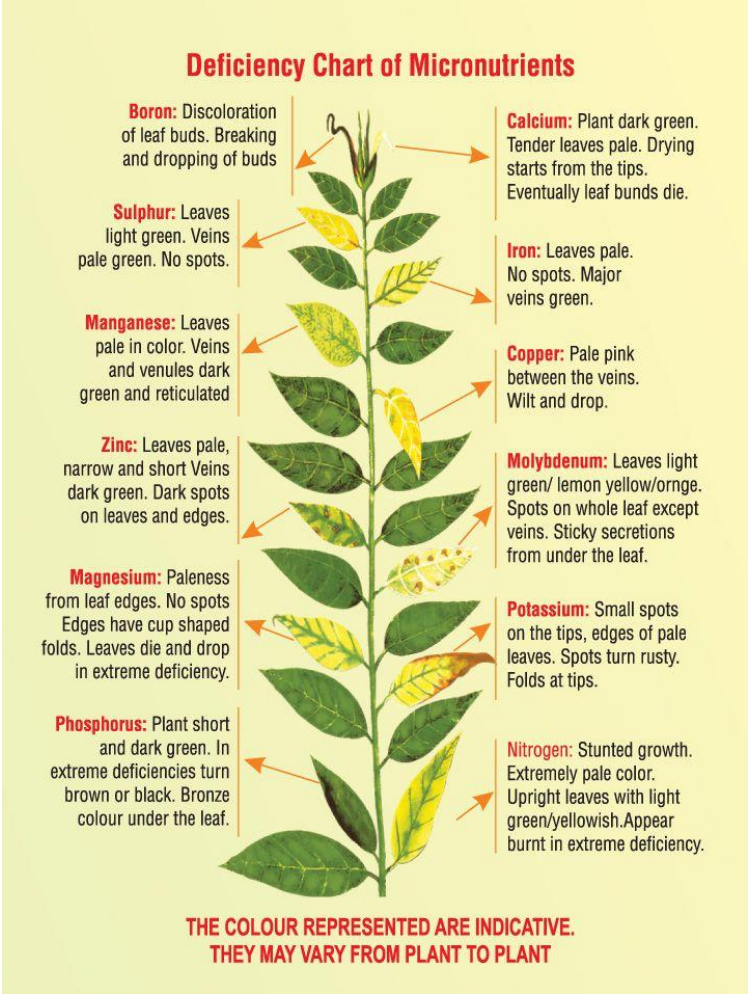
- N: Nitrogen
  - Important for leafy growth
- P: Phosphorus
  - Root growth, flowers and fruits
- K: Potassium
  - Root structure and overall plant health; disease resistance



Plant Micronutrients

- Calcium
- Magnesium

- Sulfur
- Zinc
- Manganese
- Molybdenum
- Iron
- Copper
- Boron



University of Arizona Cooperative Extension

Amendments vs. Fertilizers

- Fertilizers: Feed the plants directly; have an N-P-K rating
- Amendments: Work indirectly… they feed the soil and microbiome; the soil then feeds the plants
- Some products function as both
- …So what should I use?

The Long Answer:

It depends on your soil…

Greensand Rock Phosphate Leaf Mulch
Vermicompost Manure Seaweed
Lime Mycorrhizae Guano
Azomite Bone Meal Sulfur
Blood Meal Gypsum Dolomite Peat
Perlite Sand

The Short Answer:

Soil Amendments Can…

- Increase organic matter
- Modify pH
- Modify texture
- Increase nutrients
- Increase beneficial microbes

To increase organic matter, add…

- Compost (homemade or purchased)
- Manure (cow, horse, pig, chicken, rabbit, etc.)
- Leaf mulch (composted leaves)
- Peat moss

To modify pH…

- Ideal soil pH is about 6.5
- To raise pH
  - Lime (agricultural lime or dolomitic lime)
  - Wood ash
- To lower pH
  - Sulfur
  - Peat moss
  - Coffee grounds

To increase macronutrients…

- **Nitrogen**
  - Manure
  - Seed meals
  - Blood meal, feather meal, fish meal
- **Phosphorus (Phosphate)**
  - Rock phosphate
  - Bone meal
  - Guano
  - Keep soil pH balanced
- **Potassium (Potash)**
  - Wood ash
  - Greensand
  - Azomite
  - Seaweed/kelp

To increase micronutrients…

- **Seaweed/kelp**
  - Trace minerals, potassium
- **Greensand**
  - Glauconite: marine potash, silica, iron, 22 trace minerals
- **Rock phosphate powder**
  - Phosphorus, limestone, clay, trace minerals
- **Azomite**
  - Trademarked, volcanic ash/ancient seabed deposit in Utah, silicate high in trace minerals
- **Lime, dolomite or gypsum**
  - Calcium, magnesium (dolomite), sulfur (gypsum)

To increase beneficial microbes…

- Compost (and compost tea)
- Vermicompost
- Manure
- Mycorrhizae supplement
- Soil from a healthy garden

New Gardeners Program-- Example Soil Test Results

- Bulk planting mix from local supplier
  - Alkaline pH: between 9.1-9.4
  - Low calcium: between 2050-2650 ppm
  - High sodium: between 1412-2299 ppm
  - Organic matter, potassium, phosphorus, magnesium ok

- To remedy:
  - Add gypsum to increase calcium without increasing pH; calcium will also help replace sodium in soil
  - Add sulfur and/or peat moss to lower pH
  - Always follow product directions… More is NOT better! Err on the side of not enough. It's easier to add more than to mitigate excess.

Big Box Store Packaged “Soils”

Big Box Store Packaged "Soils"

- **Pre-mixed soils**
- – Potting Soil
- – Raised Bed Soil
- – Garden Soil
- **Soil Mixing**
- – Topsoil
- – Soil conditioner
- – Compost/manure
- – Peat moss

Composting

- **Quality: What goes in, comes out**
- **Keep it simple (or not)**
  - Equal “brown” and “green”
  - Jump start with good topsoil
  - Mix occasionally
  - Nothing greater than 6 in. long

Outside Composting Containers

Cover Crops

Loosen compacted soil
Add organic matter
Fix nitrogen in soil
Sequester carbon in soil
Prevent weed growth

Prepare soil for crops
Plant in fall or early spring

The Goal

- Keeping your soil full of life and healthy!

Questions and Discussion

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Recommended Reading

Building Soils Naturally: Innovative Methods for Organic Gardeners

By Phil Nauta

info@acresusa.com

Teaming With Microbes: The Organic Gardener's Guide to the Soil Food Web

By Jeff Lowenfels and Wayne Lewis

The Ultimate Guide to Soil: The Real Dirt on Cultivating Crops, Compost, and a Healthier Home

By Anna Hess