Soils-Natural Lawn Care Basics

Soil and Water Conservation District of Lake County

Nick Spittlemeister
March 3, 2010
Why Are We Talking About Soils?

- How does soil relate to natural lawn care?
- What’s underneath our feet? A short introduction to understanding soils
- How to find out your Soil type?
- Soil Sampling-How to Sample your lawn!
Soil Basics: Soils Are A Medium For The Growth Of Plants

- Plants cannot sustain life without soil
- Plant roots in soil
  - Foundation for roots
  - Regulate temps
- Key nutrient elements supplied
- Soil pores
  - Supply roots with $O_2$ and allow $CO_2$ to vent off
  - Allow roots access to water
- Soil types strongly influence/determine the nature of the vegetation present in a given area
  - Can also prevent the growth of certain plants
Basic Soil Lingo

- **Soil Profile**
  - vertical section exposing layers or horizons of a soil

- **Soil Horizons**
  - distinctive, yet highly variable soil layers, typically parallel the ground surface

- **Soil Texture**
  - How the soil feels, broken down in percentages of sand, silt, and clay.
Soil Horizons

- **O** = undecomposed or decomposing organic matter, usually at the surface of forest soils.
- **A** = organic material and mineral matter; darker colors; commonly called **topsoil**.
  - The preferred soil horizon for plant growth
- **E** = leached zone; usually lighter color
- **B** = zone of accumulation of clays, iron and aluminum oxides, gypsum, or CaCO$_2$
  - Very hard, lightly colored compacted soil (silty clay loam)
- **C** = relatively unweathered, unconsolidated parent material
- **R** = rock parent material
What is Soil Composed Of?

- **Mineral** = inorganic materials derived from weathering/erosion of rock.
- **Organic Matter** = comes from living organisms, remains of dead organisms, and other organic compounds (influence fertility, water-holding abilities).
- **Water** = held within soil pores; contains dissolved organic and inorganic substances (really a soil solution); its pH is crucial for plant growth.
- **Air** = also held within soil pores; varies within a soil; high relative humidity is common; CO₂ is higher, O₂ lower than atmosphere; displaced by water.
How Is Soil Formed?
Soil Forming Factors

1.) Parent Material
   - Vary greatly and their nature has a profound influence on soil characteristics, especially things like texture, and chemical and mineral composition.
   - Three types of Parent Material: Residual, Transported, and Organic

2.) Climate
   - Effects on soil development are seen
     - directly in the form of effective precipitation and temperature, and
     - indirectly through its influence on natural vegetation

3.) Biota
   - Living Organisms: Plants and Animals

4.) Topography
   - Influences: soil loss, water infiltration, local climate, drainage, and parent materials

5.) Time
   - Glaciers have impacted the amount of time in soil development
Parent Material

- Parent material has had a great impact on the soils of northeastern Illinois
- Is a major factor in determining the pH of the soil
Biota: A-Horizon Development Grassland vs. Forest Soils (A Classic Comparison)

- Grassland soils have a tremendous amount of organic matter added to them due to the root systems of grassland plants.
  - A horizons tend to be very dark and thick.

- In forests, organic matter is added to soils primarily by leaf accumulation.
  - Much thinner A horizons or may be missing entirely.
Soil Properties

- Soil Color
  - Condition Indicator

- Soil Texture
  - Texture Triangle
  - Texture by Feel

- Soil Structure

Mollisol

Alfisol
Soil colors may indicate a number of things:

- **Black or dark brown**
  - organic matter-rich
  - soils found in northern Illinois

- **Gray, bluish, grey-green (gleyed)**
  - Anaerobic conditions
  - soils found in wetlands

- **White or light grey**
  - leaching in humid climate
  - or calcium carbonate in arid, semi-arid climates

- **Orange or red**
  - iron-rich
Soil Texture - Mineral Soil

- Proportion of different sized mineral particles (textural classes).
  - Refers to a major size class of individual soil particles or soil separate (sand, silt, clay).
  - Usually applies to proportion of different particles in fine earth fraction (particles <2 mm in diameter).

- Soil Particle Sizes
  - Sand
    - Size: 0.05 mm to 2mm
  - Silt
    - Size: 0.002 mm to 0.05 mm
  - Clay
    - Size: Less than 0.002 mm
Soil Particles

- **Sand**
  - Soil voids between sand grains are large, surface area is relatively low (compared to other smaller sized particles)
  - Noncohesive
    - the individual particles do not stick together
  - Water moves through sand easily and the particles do not hold much water, which means sandy soils tend to be droughty.

- **Silt**
  - Pores between silt particles are smaller than in sand, consequently silt holds more water but has slower infiltration rates than sand.
  - Low stickiness (cohesion), low plasticity (malleability) means silts are easily washed away by flowing water (high potential for fluvial erosion).

- **Clay**
  - Particles have tremendously large surface area
    - means they have the largest water holding capacity
  - Very sticky (cohesive) and high plasticity (malleability)
  - May behave as colloids
    - stay suspended indefinitely in fluids (like blood cells in blood stream)
  - Movements of water and air are very slow.
Soil Texture Classes

- 12 textural classes, keyed to textural triangle:
  - sand, loamy sand, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay

- Loam (only term not self-explanatory)
  - Mix of sand, silt, and clay exhibits properties of these textures in equal amounts (doesn't mean an equal mix).
  - Modifiers indicate which particular separate is dominant in the loam.
Determining Soil Texture-Hand Texturing by the “Feel” Method

- Textural classes determined in field by hand.
- Process involves a great deal of practice, but some soil scientists become experts at it.
- For example,
  - sand has a gritty feel to it, will not form a ball;
  - silt is non-gritty, feels like flour (smooth and silky), and will form a ball and short ribbon when moist;
  - clay feels greasy, will form long ribbon when moist.
Soil Structure

- Crumb or granular
- Platy
- Blocky
- Prismatic or columnar
Soil pH

- pH is the measure of the acidity or alkalinity in the soil.
- Ranges from 0 – 14, below 7 is considered acidic, and above 7 is considered alkaline.
- Most common soil pH classes:
  - Extremely acid  3.5 – 4.4
  - Very strongly acid   4.5 – 5.5
  - Moderately acid   5.6 – 6.0
  - Slightly acid   6.1 – 6.5
  - Neutral   6.6 – 7.3
  - Slightly alkaline   7.4 – 7.8
  - Moderately alkaline   7.9 – 8.4
  - Strongly alkaline   8.5 – 9.0
What Controls the Soil pH?

- The acidity or alkalinity in soils have several different sources.
- pH is affected (naturally) variably by:
  - Mineralogy (Bedrock/Substrate)
  - Climate
  - Weathering
- pH is also affected by soil management
  - Fertilizers (acid-forming nitrogen fertilizers)
  - Organic Matter
Soil pH-Availability of Nutrients

- Soil pH influences the solubility of nutrients, thus affecting the availability of several important plant nutrients.
- pH range of 6 to 7 is generally most favorable for plant growth because plant nutrients are most readily available in this range.
- Soils with a soil pH below 5.5 have low available calcium, magnesium, and phosphorus, while solubility is high for iron, aluminum and boron.
- At pH of 7.8 or more, calcium and magnesium are abundant, while phosphorus, iron, copper, boron have inadequate availabilities.
Soil pH—Some Plant Preferences

- The optimum pH for most plants and soil microorganisms is between 6.0 and 7.0
- However, some plants have niches, and can thrive in fairly alkaline or acidic soils
- Look to native plants of a region
- Some examples of plants in extreme pH’s
  - Alkaline Soils: Alfalfa, Aster, Geranium, Carnation, Sunflower, Lewisia, Magnolia, Yew, Barberry, Juniper, Boxwood, Spirea, Lilac, Currant, Smoke Tree, Mountain Ash, Maple, Hawthorn, Sumac
  - Acidic Soils: Alyssum, Crocus, Ferns, Strawberry, Blueberry, Witch Hazel, Ivy, Rhododendrons, Birch, Magnolia, Crabapples, Spruce, Hemlock, Fir, Pine
pH Amendments

- **Myth:** Lime is the cure-all soil amendment
- **Raising the pH**
  - Palletized lime—weaker substitute for crushed limestone
  - Agricultural (crushed) limestone
  - **Rule:** if the limestone is finely ground, the reaction is faster
  - Wood Ash
  - Mushroom Compost
- **Reducing the pH**—Chemical amendments that contain sulfur generally form an acid, which lowers the soil pH
  - Aluminum sulfate
  - Elemental sulfur
- **Generally,** sulfur/sulfate is not recommended unless pH is above 7.50
Soil Nutrients

- **Primary Nutrients**-are needed in large quantities
  - Nitrogen (N): Nitrate-Nitrogen: 20-60 lbs/acre
  - Potassium (K): 300 lbs/acre
  - Phosphorus (P): 40-60 lbs/acre

- **Secondary Nutrients**-needed in lesser quantities
  - Calcium (Ca)
  - Magnesium (Mg)
  - Sulfur (S)

- **Micronutrients**-required in very small amounts
  - Zinc (Zn)
  - Manganese (Mn)
Finding Your Soil Type - Soil Survey

- County Soil Survey
  - Contact your local Soil and Water Conservation District office for a digital (CD) or paper copy of the soil survey

- Web Soil Survey
  - Soil Survey information is available online through the USDA-Natural Resources Conservation Service
Soil Testing—Why and When to Sample

Why should you get your soil tested?
- Periodic soil testing will help to correct nutrient deficiencies, avoid excess fertilizer applications and maintain a healthy lawn.

When should you get your soil tested?
- Before establishing a new lawn, whether from seed, sod, or sprigs.
- Every three years on established lawns (late summer or fall is best time).
  - Majority of people get their soil tested in the spring
- Annually when attempting to correct a nutrient deficiency or change the soil pH.
- When fertilizers containing phosphate or potash have been used on a regular basis for a number of years.
Sampling Lawn and Garden Soils for Testing

- **Sampling Lawns**
  - 5-10 random locations throughout yard
  - Each hole should be 4 inches deep
  - Remove any turf at the top of the sample

- **Sampling Gardens**
  - 3-5 random locations through garden
  - Each hole should be 6-8 inches deep

- **Equipment Needed:**
  - Clean Bucket
  - Garden Trowel, Shovel, or Soil Probe
  - Ziploc Bags
  - Wax Paper or Newspaper
Lake County SWCD Soil Testing Program

- Test for pH, phosphorus, and potassium.
- Also provides the soil color, soil texture, and soil color of the sample.
- Test samples from gardens, lawns, and flower beds
- Provides recommendation on remediation of the soil which includes fertilizer rates of application.
- Cost for each Sample is $20
- Results will be returned within 10 days.
- Visit [www.lakeswcd.org/Soil%20Testing.htm](http://www.lakeswcd.org/Soil%20Testing.htm) for more information.
Questions?

Thank you!

Nick Spittlemeister
Soil and Water Conservation District of Lake County
100 N. Atkinson Rd., Ste. 102-A
Grayslake, IL 60030
Phone: 847-223-1056
nspittle@sbcglobal.net
www.lakeswcd.org