URBAN SOIL NUTRIENT MANAGEMENT PROGRAM

Presented by the Master Gardeners of Lycoming County
OBJECTIVES

Educate and engage homeowners to:

• Understand how to minimize the amounts of nutrients and pesticides from reaching our waterways (Chesapeake Bay)

• Gain better understanding of Proper lawn care

• Understand the importance of Soil testing
What is soil?

• Unconsolidated cover on the surface on the Earth.

• Made up of mineral particles, organic matter, air and water.

• Capable of supporting plant growth
Soil horizon/Soil profile

A: mineral horizon w/ organic matter

E: subsurface horizon, little organic matter

B: subsoil

C: unconsolidated material

R: bedrock
Roles of Soil

Soils play multiple roles in the quality of life throughout the world.
Importance of Proper Lawn Care

• Soil protection – ground cover
  ~ prevents erosion

• Nonpoint Source Pollution Reduction
  ~ correct fertilizing and pesticide use decreases pollution downriver

• Chesapeake Bay Tributary Strategy
  ~ river-specific 'on-the-ground' actions
PROBLEMS CAUSED BY IMPROPER LAWN MOWING

• Restricts root growth
• Increases susceptibility to damage from insects, disease, drought, traffic, and weed infestation

*Optimum mowing heights for lawns:
• Kentucky bluegrass 2.0 to 3.5”
• Perennial ryegrass 2.0 to 3.5”
• Fine fescue 2.0 to 3.5”
• Tall fescue 2.5 to 4.0”*
Mineral vs. Organic Soils

- Mineral Soils < 20% organic matter (OM)
- Organic Soils > 20% OM
- Most PA soils contain 1% to 5% OM
Soil Components

The 4 parts of soil

About \( \frac{1}{2} \) of the soil volume is solid particles.

About \( \frac{1}{2} \) of the soil volume is pore space.

Organic Matter
5%

Mineral Matter
45%

Soil Water
25%

Soil Air
25%
Organic Matter

- Breaks down to humus and soil nutrients
- Increases water-holding capacity of sandy soils
- Improves soil for root penetration, and easier cultivation
Physical Properties of Soil

- Color
- Texture
- Structure
- Internal drainage
- Depth
Soil Color

- Organic Matter Content:
  - light = low OM
  - dark = higher OM

- Drainage Conditions:
  - gray, yellow or mottled = poor drainage
  - reddish or brown = well drained
Soil Texture
Protect Soil Structure

- Never till wet soil
- Don’t “over-till” soil
- Keep heavy equipment off of soil
- Limit foot traffic in areas to be planted
Improving Soil Structure

- Coarse sand
- Vermiculite, perlite
- Manure
- Leaf mold
- Compost
Physical Factors Influencing Plant Growth

- **Internal Drainage**
- **Soil Depth**-
  - Very shallow: < 10 inches
  - Shallow: 10 – 20 inches
  - Moderately Deep: 20 – 36 inches
  - Deep: 36 – 60 inches
  - Very Deep: > 60 inches
Plant Nutrients

• 17 nutrients for growth
  ~ C, H, O from air and water
  ~ Other 14 nutrients from soil
• Macro-nutrients
• Micro-nutrients
Supplying Plant Nutrients

Nutrients plants obtain from the soil

• Macronutrients:
  • (needed in large amounts)
  • Nitrogen (N)
  • Phosphorus (P)
  • Potassium (K)
  • Calcium (Ca)
  • Magnesium (Mg)
  • Sulfur (S)

• Micronutrients:
  • (needed in small amounts)
  • Chlorine (Cl)
  • Cobalt (Co)
  • Copper (Cu)
  • Iron (Fe)
  • Manganese (Mn)
  • Molybdenum (Mo)
  • Nickel (Ni)
  • Zinc (Zn)
Nitrogen (N)

- Very mobile in soil
- Mobile in the plant
- Essential for leafy top growth.
- Excess N: succulent growth, dark green color, spindly plants, reduced fruiting
- N Deficiency: reduced growth, yellowing

http://www.ksuturf.com/Turf%20Diagnostic%20Guide.html
Phosphorus (P)

• Not mobile in soil
• Mobile in the plant
• Essential for root and fruit production.
• Excessive P: micro-nutrient deficiencies
• P deficiency: reduced growth, purpling or browning.

Phosphorus deficiency symptoms in tomato. (Epstein and Bloom 2004)
Potassium (K)

- Essential for cold hardiness, disease resistance, and stalk strength
- Excessive K: can cause Ca and Mg deficiencies
- K deficiency: reduced growth, shortened internodes, „scorched’ leaf margins

Potassium deficiency symptoms in tomato. (Epstein and Bloom 2004)
Magnesium (Mg)

- Mobile in soil
- Mobile in the plant
- Excessive Mg: inhibits Ca uptake
- Mg deficiency: reduced growth, chlorosis, cupped leaves.
• Generally not mobile in soil or plants.
• Deficiency or toxicity problems rarely occur under normal circumstances.
• Most PA soils have adequate micronutrients for plant growth.
• Deficiencies usually related to soil pH.
Soil pH

- Measures concentration of H ions in soil (acidity or alkalinity)
- Ranges 0 (extremely acidic) to 14 (extremely alkaline); 7 neutral.
- Logarithmic scale
- Most plants optimum pH 6.0 to 7.0
Soil pH and Nutrient Availability
Soil pH

- Most soils in PA are naturally acidic due to:
  - Leaching of positive cations (i.e. Ca and Mg)
  - Addition of N fertilizers or manure
  - Acid rain
- To increase pH, apply lime
- To decrease pH, apply sulfur, gypsum, or other commercial products used to acidify soil.
Fertilizers

- Lists the 3 primary macronutrients: N – P – K
- Fertilizer analysis:
  ~ % by Wt. of element in a fertilizer
  ~ A 50 lb bag of 10 – 10 – 10 has 5 lbs N, 5 lbs P, and 5 lbs K
  ~ Fertilizer Ratio: 1 – 1 – 1, 1 – 2 – 1, etc.
Fertilizers

- Complete vs. Blended fertilizer
- Special purpose fertilizers
  - Rhododendron/Azalea Food
  - Rose Food
  - Research proven?
- Slow release fertilizers
  - Dissolve slowly
  - organic fertilizers
  - Coated granules
Inorganic, Synthetic Organic & Natural Organic Fertilizers

- **Inorganic** – made from various salts or minerals
  - Rock phosphate, potassium chloride
- **Synthetic Organic** – man made materials
  - Urea, Ammonium Nitrate
- **Natural Organic** – derived from living organism
  - Various by-products, blood meal, bone meal, composts, Milorganite, etc.

- **Must contain a fertilizer analysis if sold as a fertilizer, regardless of type.**
- **Source of nutrient is not important to the plant.**
Fertilizers

- Fertilizers with pesticides – “weed and feed”
- Dry vs. Liquid fertilizer
- Proper application
- Timing of fertilizer applications depends on soil type and crop.
- Application methods
  - Broadcasting
  - Banding
  - Starter
  - Side Dressing
  - Foliar Feeding
Consequences of Over Fertilizing

- Harm to the lawn
- Pollution – excess fertilizer runoff
- Affects all downstream – Chesapeake Bay

Nutrients from urban, suburban and agricultural lands enter the groundwater and river flow that discharge into the Chesapeake. Once in the Bay, the overabundance of nutrients fuels the growth of algae blooms, which block sunlight and reduce dissolved oxygen levels. Image courtesy: S. Phillips / USGS
How Nutrient Management Affects the Environment

The main nutrients that contribute to pollution in our ground water and open waterways are nitrogen and phosphorus.
The algae bloom in the Chesapeake Bay by the start of the Hampton Roads Bridge Tunnel in Norfolk, 8-18-09

(Ryan C. Henriksen | The Virginian-Pilot)
As of 2000, the Susquehanna drainage basin population was 3,968,635. Its total area is 27,486 square miles.

Accounts for 45% of Pennsylvania, 11% of New York, and 3% of Maryland.

The drainage basin is divided into six subbasins by the Susquehanna River Basin Commission.
Soil Testing

- Take the sample
- Fill out the form
- Review test results
- Apply indicated lime & fertilizer
Taking the Soil Sample

• Clean, rust-free Spade or Soil Probe
• Clean Plastic Bucket
• A Few Sheets of Newspaper
• Clean rust-free Screen or Sifter (optional)
Soil Sampling

- Don’t wait until the last minute
- Sample uniform areas
- Take at least 15-20 cores from various areas of the area to be planted
- Avoid atypical areas or sample them separately
- Sample to tillage depth (or 4” for pastures)
- Collect samples in clean container, remove debris & let dry thoroughly
- Complete the information sheet
After Sampling....

• Spread soil on a newspaper to air dry.
  • DO NOT dry the sample in oven or microwave!
• Sift/pick out stones, clumps, plant matter, etc.
• Take a sub-sample (about 1 cup).
• Put sub-sample in kit bag.
• Fill out the information page in the kit.
Understanding Your Soil Test Results

![Soil Test Report](image-url)

**SOIL TEST REPORT FOR:**

<table>
<thead>
<tr>
<th>JOE'S FARM</th>
<th>SUNNY MEADOW FARM</th>
<th>SPRING MILLS, PA 16872</th>
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</thead>
</table>

**ADDITIONAL COMPOUND:**

<table>
<thead>
<tr>
<th>JOE JERVIS</th>
<th>ACME &amp; ROY PRODUCTION SERVICES</th>
<th>MAIN ST</th>
<th>MADISONBURG, PA 16422</th>
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**DATE:**

| 3/20/2023 | 12/24/23 | CENOS | VB | 1 | 1 | 1 |

**SOIL NUTRIENT LEVELS:**

<table>
<thead>
<tr>
<th>Soil pH</th>
<th>Phosphate (P)</th>
<th>Potassium (K)</th>
<th>Magnesium (Mg)</th>
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</thead>
<tbody>
<tr>
<td>6.5</td>
<td>20 ppm</td>
<td>80 ppm</td>
<td>10 ppm</td>
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**RECOMMENDATIONS:**

- **Lime:** 2800 Bc/A for a pH of 6.5.
- **Magnesium (Mg):** NONE
- **Plant Nutrients:**
  - Corn for Grain:
    - Fertilizer Yield (Bc/A):
      - 1750 Bc/A
    - 150 Bc/A
    - Nitrogen (N):
      - 10 Bc/A
    - Phosphorus (P):
      - 20 Bc/A
    - Potassium (K):
      - 50 Bc/A
  - Soybeans:
    - Fertilizer Yield (Bc/A):
      - 50 Bc/A
    - 10 Bc/A
    - Nitrogen (N):
      - 10 Bc/A
    - Phosphorus (P):
      - 50 Bc/A
    - Potassium (K):
      - 10 Bc/A
  - Corn for Grain:
    - Fertilizer Yield (Bc/A):
      - 150 Bc/A
    - 100 Bc/A
    - Nitrogen (N):
      - 100 Bc/A
    - Phosphorus (P):
      - 100 Bc/A
    - Potassium (K):
      - 100 Bc/A

**ADDITIONAL RESULTS:**

<table>
<thead>
<tr>
<th>Calcium (Ca)</th>
<th>Acidity</th>
<th>CEC</th>
<th>% Saturation of the CEC</th>
<th>Optional Tests</th>
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</thead>
<tbody>
<tr>
<td>10 ppm</td>
<td>3.7</td>
<td>9.4</td>
<td>2.2</td>
<td></td>
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<td>9.4</td>
<td>2.2</td>
<td>10.0</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The report includes additional details such as soil pH, organic matter, and other soil characteristics, which are not fully transcribed here.
This Program was sponsored by the Pennsylvania Conservation District through a grant from the Pennsylvania Association of Conservation Districts on behalf of the nonpoint source Pollution prevention mini-grant program.

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For more information on the Chesapeake Bay Program, go to http://www.chesapeakebay.net
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