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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 water ways (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

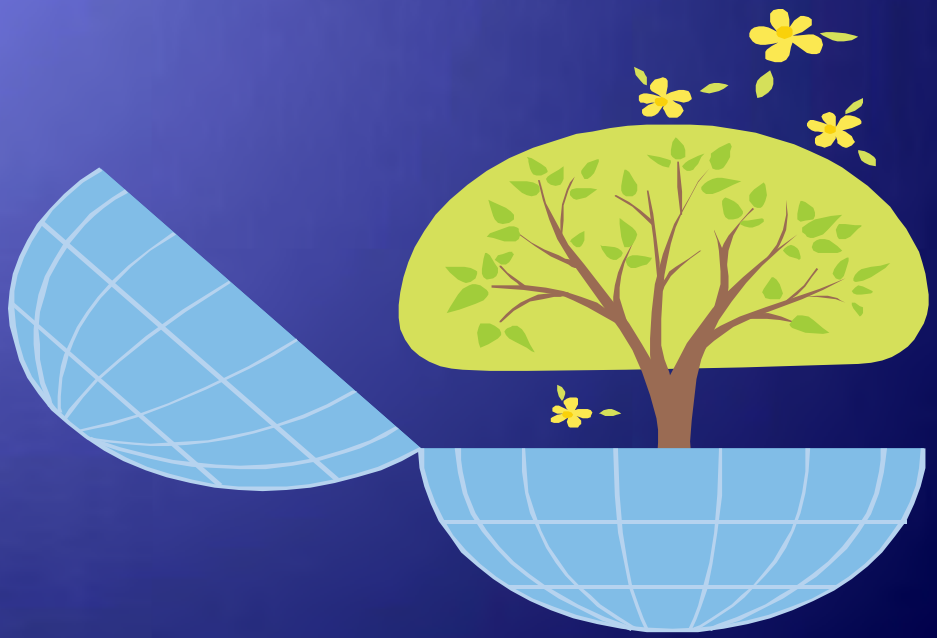
B: subsoil

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

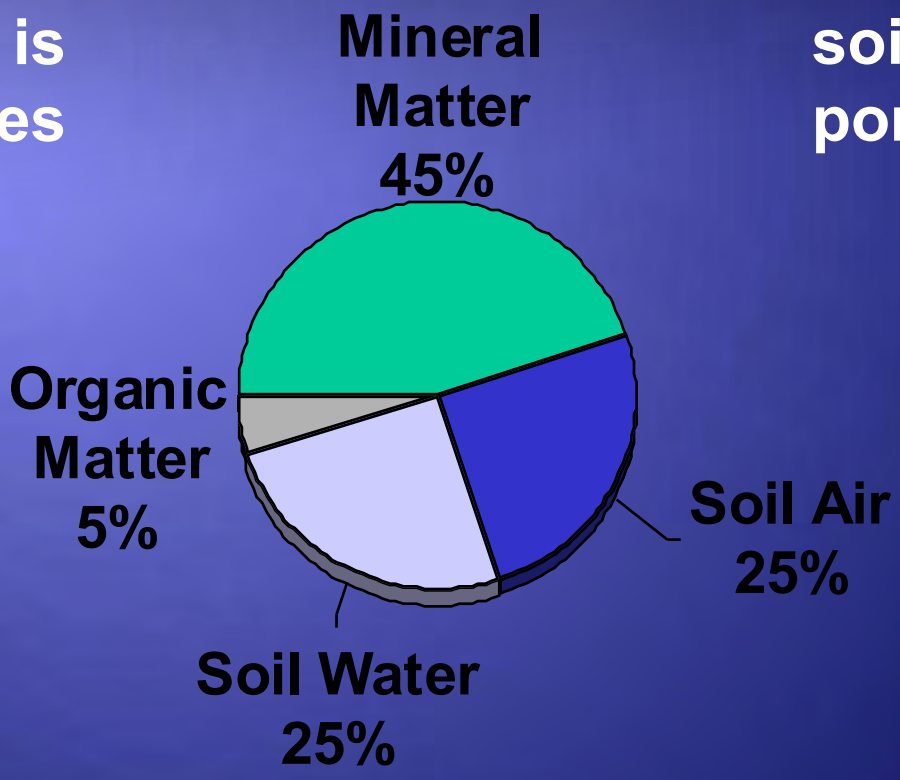
- Mineral Soils < 20% organic matter (OM)
- Organic Soils > 20% OM
- Most PA soils contain 1% to 5% OM

Soil Components

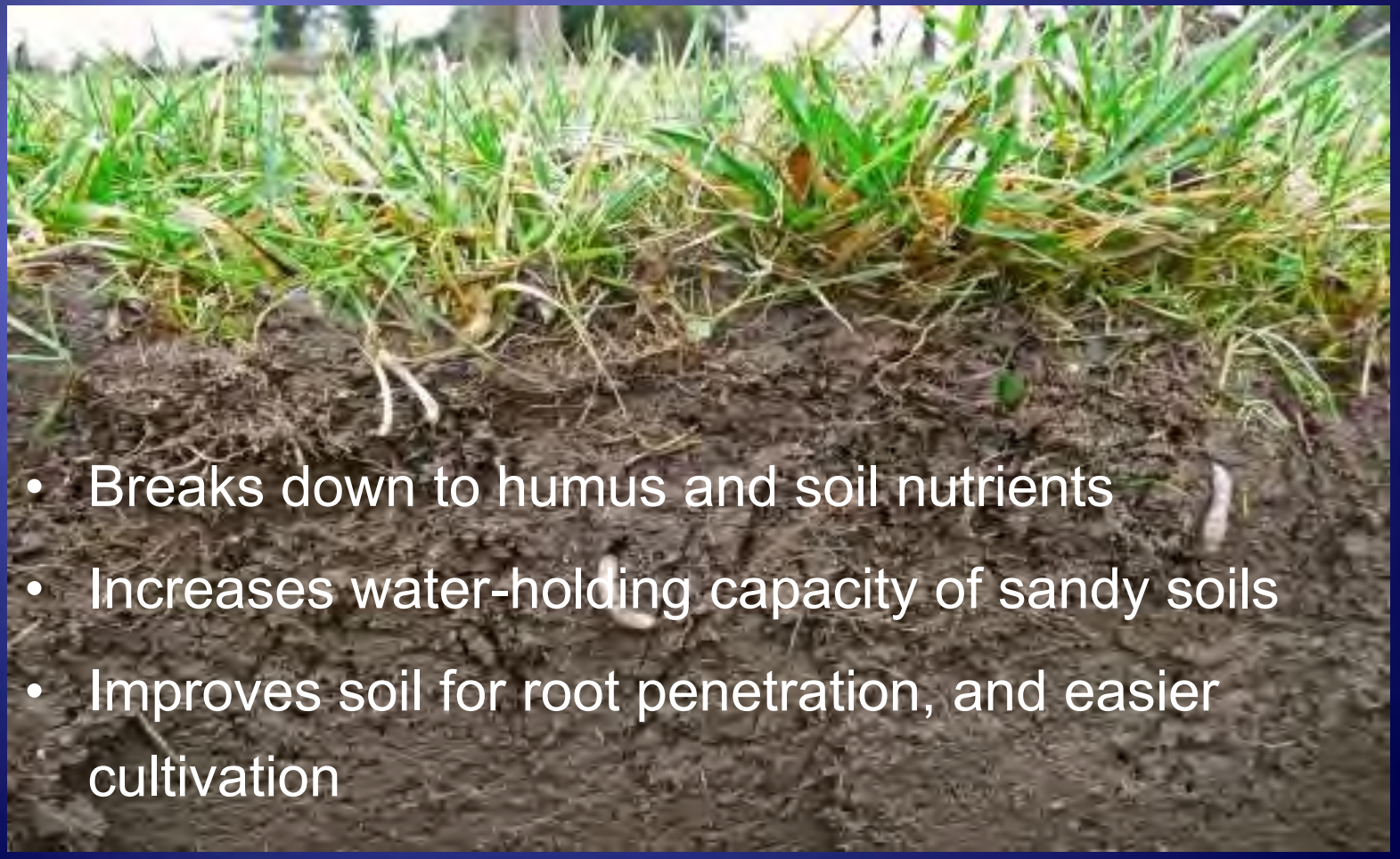
The 4 parts of soil

About ½ of the soil volume is solid particles

About ½ of the soil volume is pore space



Organic Matter

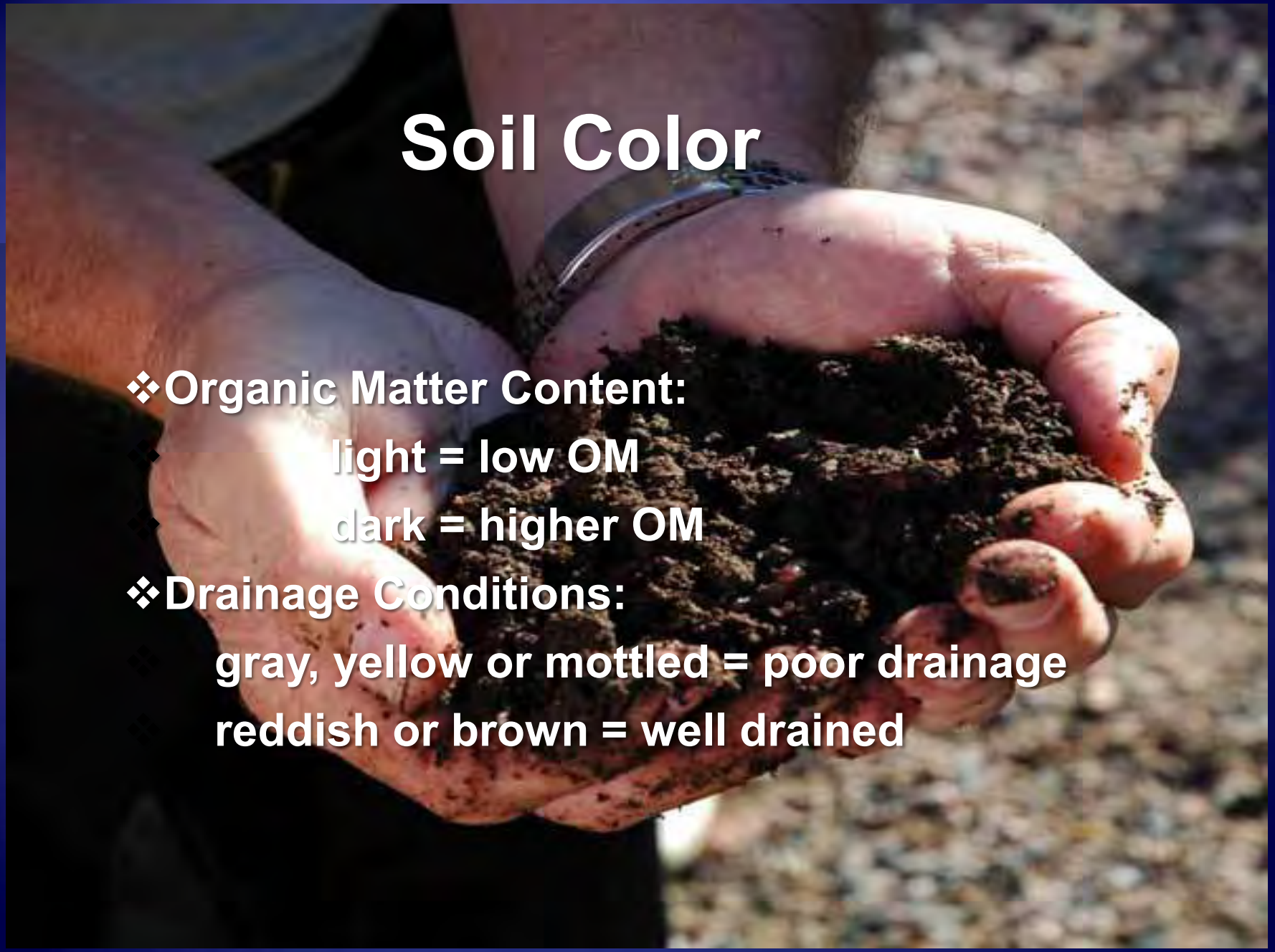


- Breaks down to humus and soil nutrients
- Increases water-holding capacity of sandy soils
- Improves soil for root penetration, and easier cultivation

Physical Properties of Soil

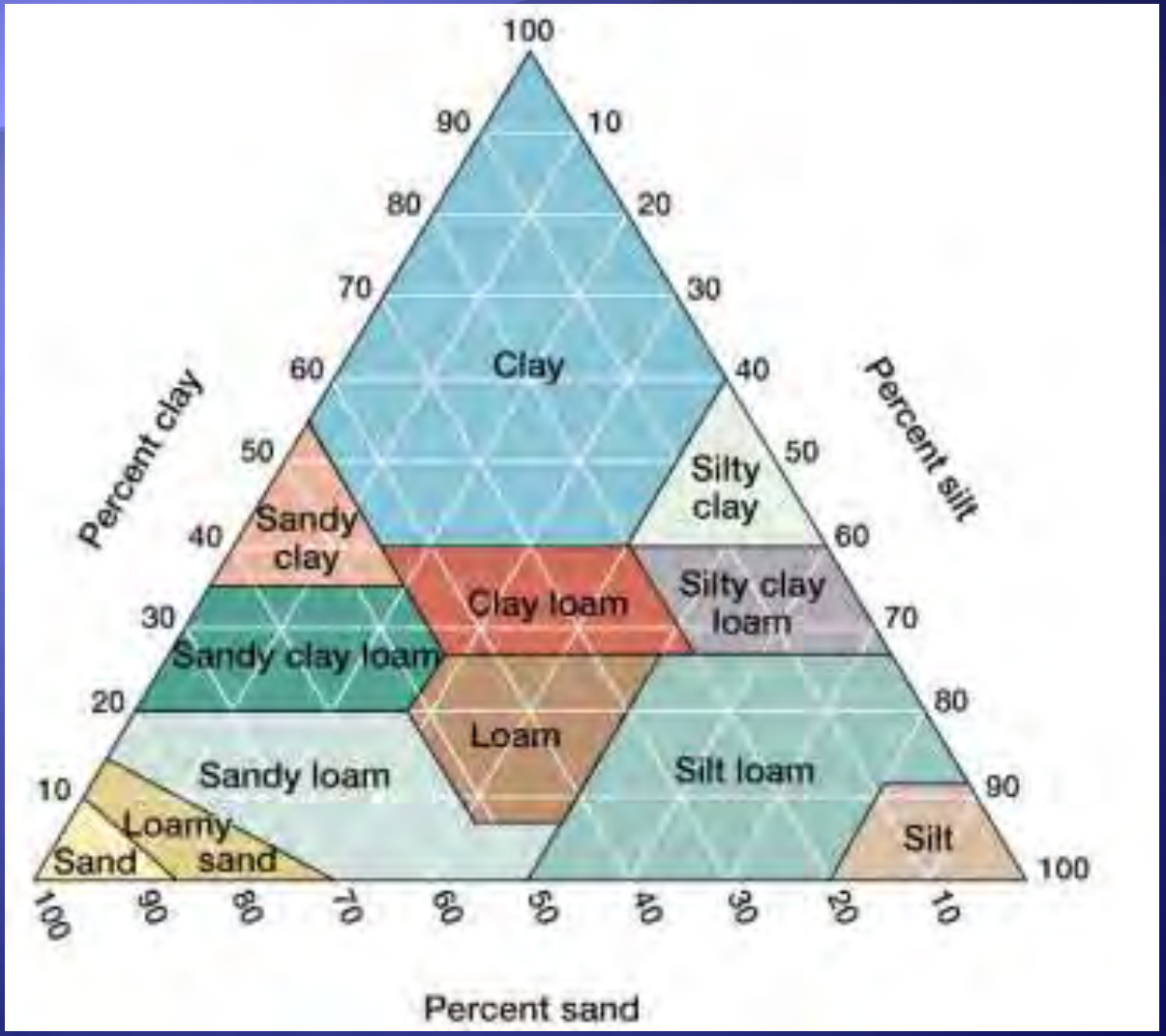
- Color
- Texture
- Structure
- Internal drainage
- Depth

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)

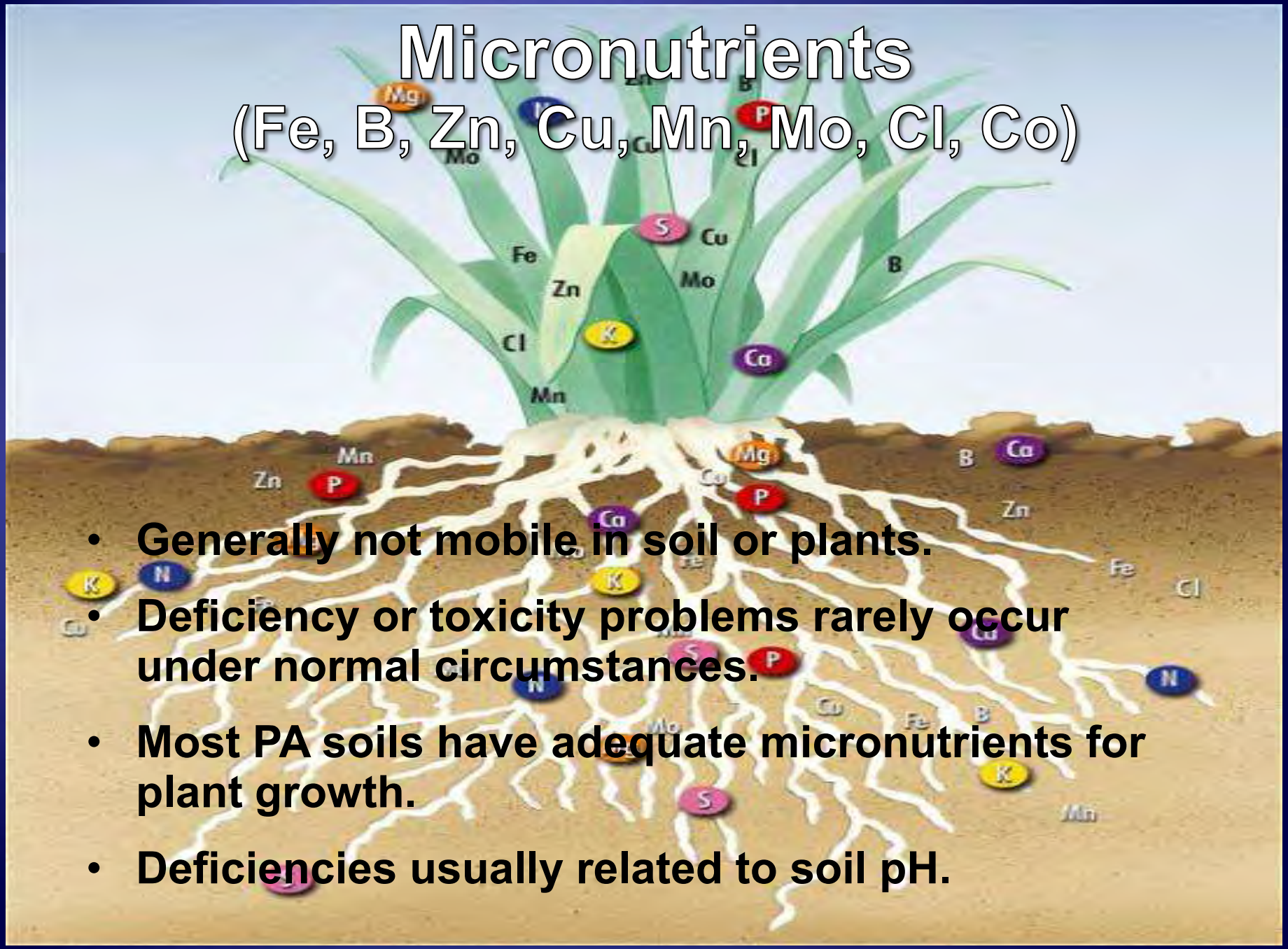
- Essential for cold hardiness, disease resistance, and stalk strength
- Excessive K: can cause Ca and Mg deficiencies
- K deficiency: reduced growth, shortened internodes, „scorched' leaf margins

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.

Micronutrients
(Fe, B, Zn, Cu, Mn, Mo, Cl, Co)



- **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.**

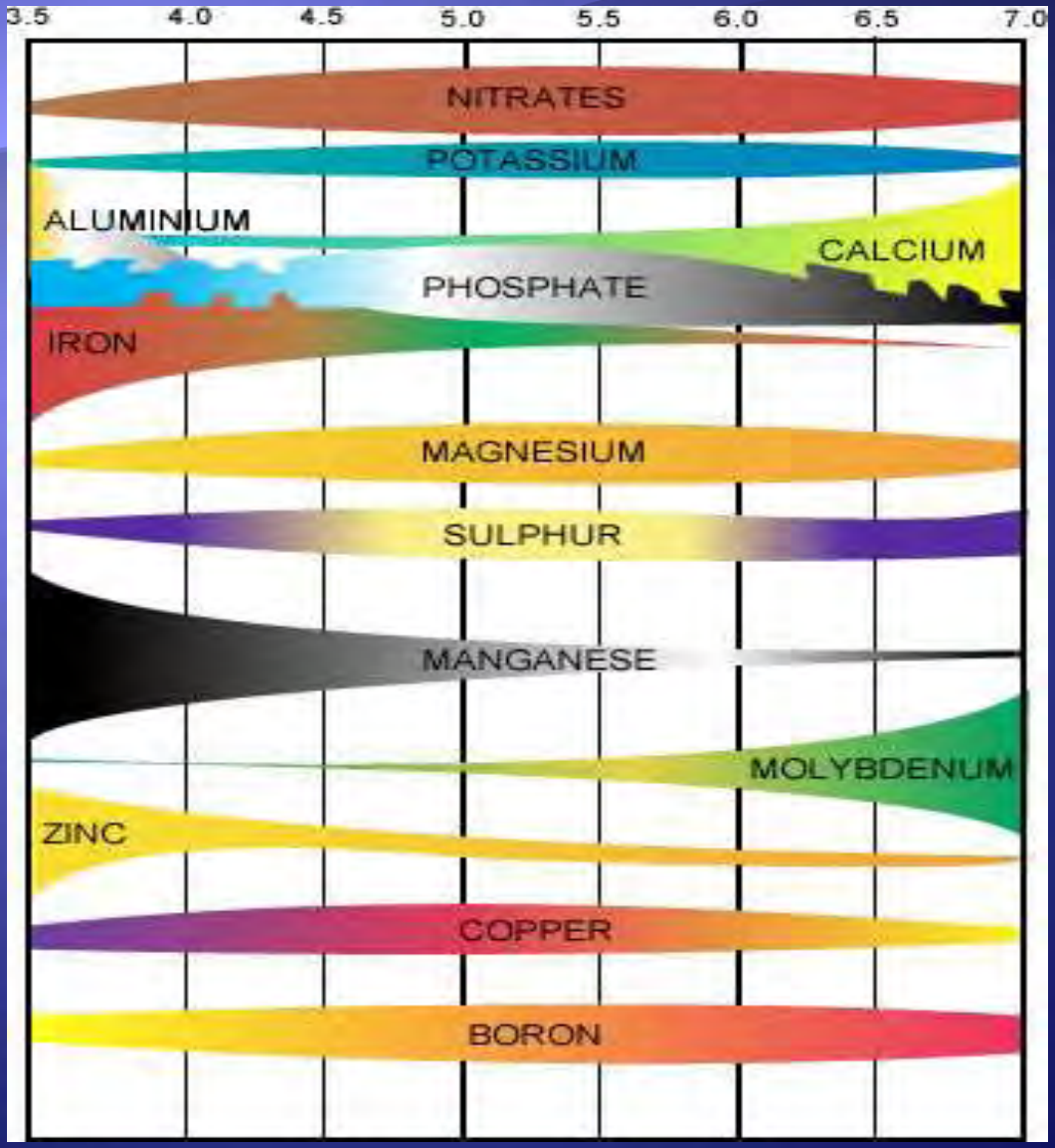
Soil pH

- Measures concentration of H ions

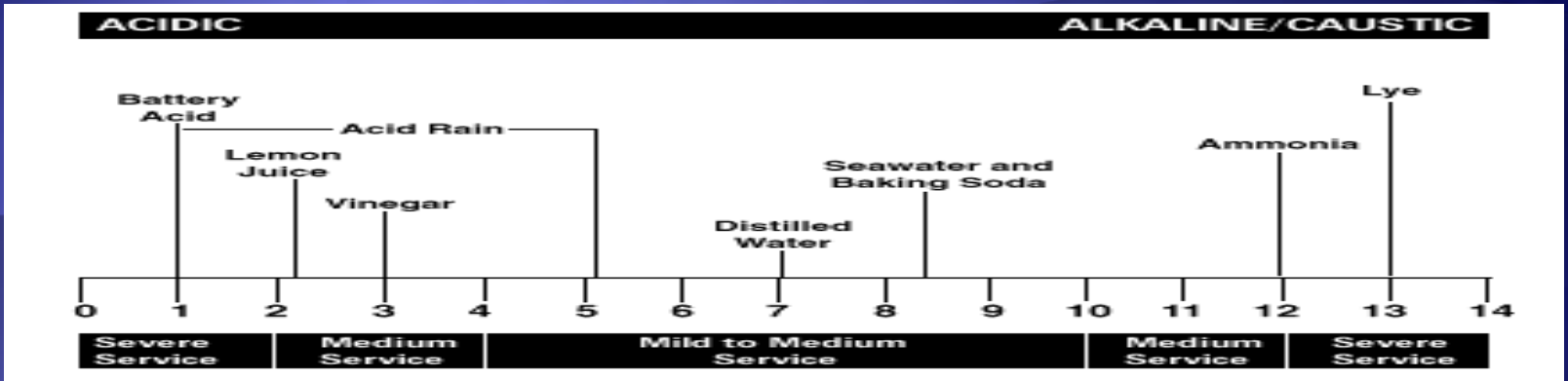
  in soil (acidity or alkalinity)
- Ranges 0 (extremely acidic) to

  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.

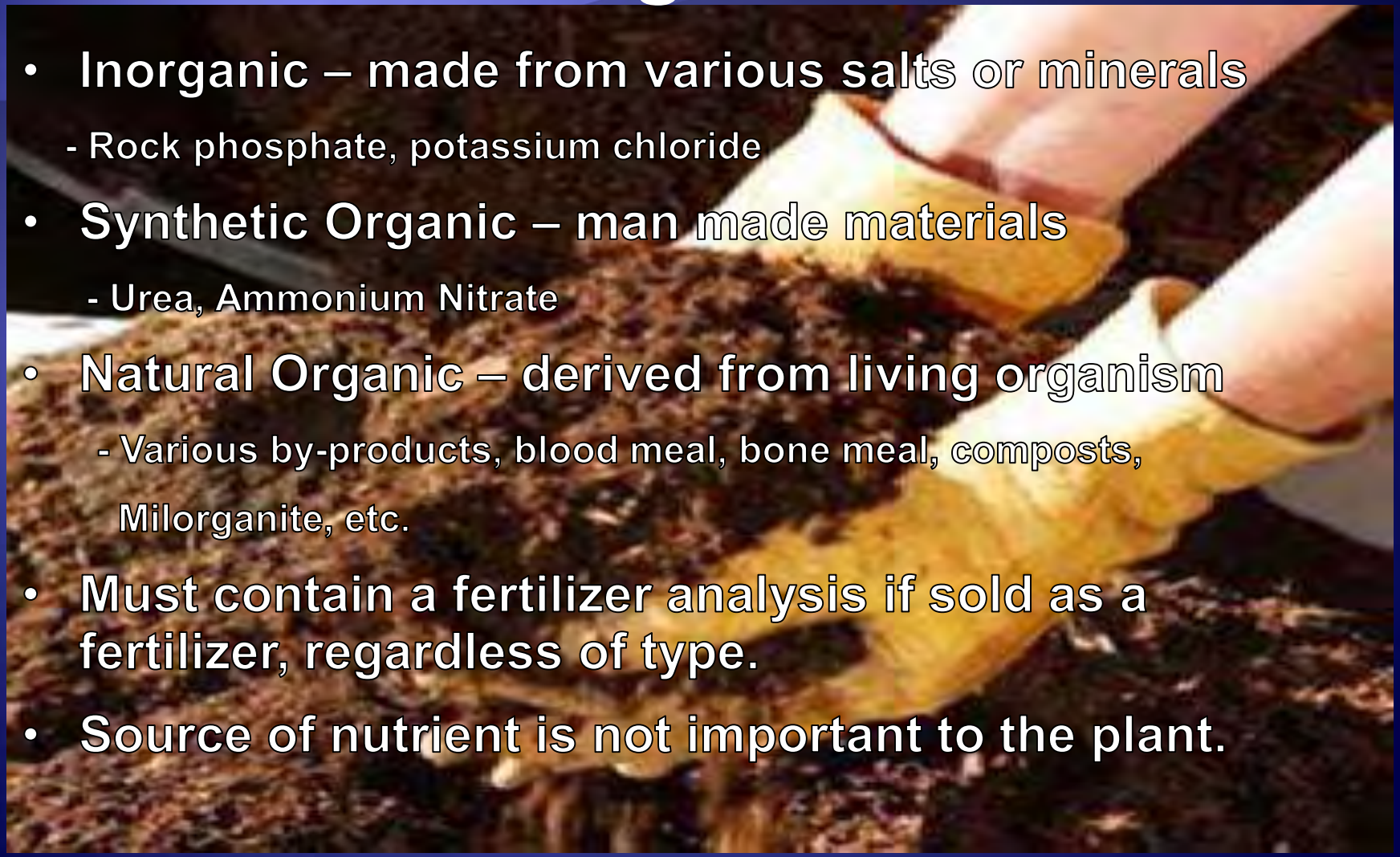
Fertilizers

- 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



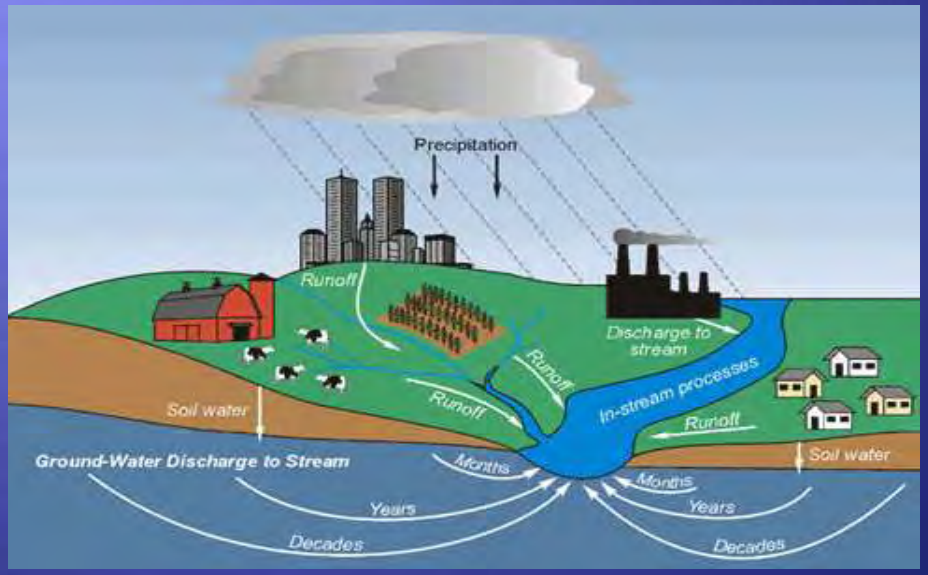
- Inorganic – made from various salts or minerals
  - Rock phosphate, potassium chloride
- Synthetic Organic – man made materials
  - Urea, Ammonium Nitrate
- Natural Organic – derived from living organism
  - Various by-products, blood meal, bone meal, composts, Milorganite, etc.
- Must contain a fertilizer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

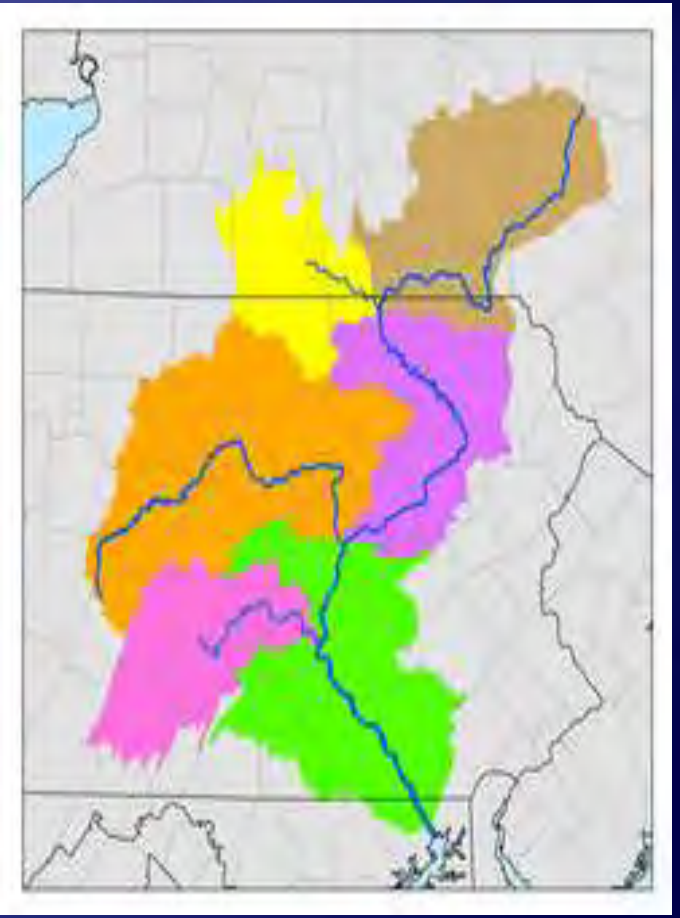
Chesapeake Bay Watershed

Susquehanna River Watershed

- As of 2000, the Susquehanna drainage basin population was 3,968,635. Its total area is 27,486 square miles

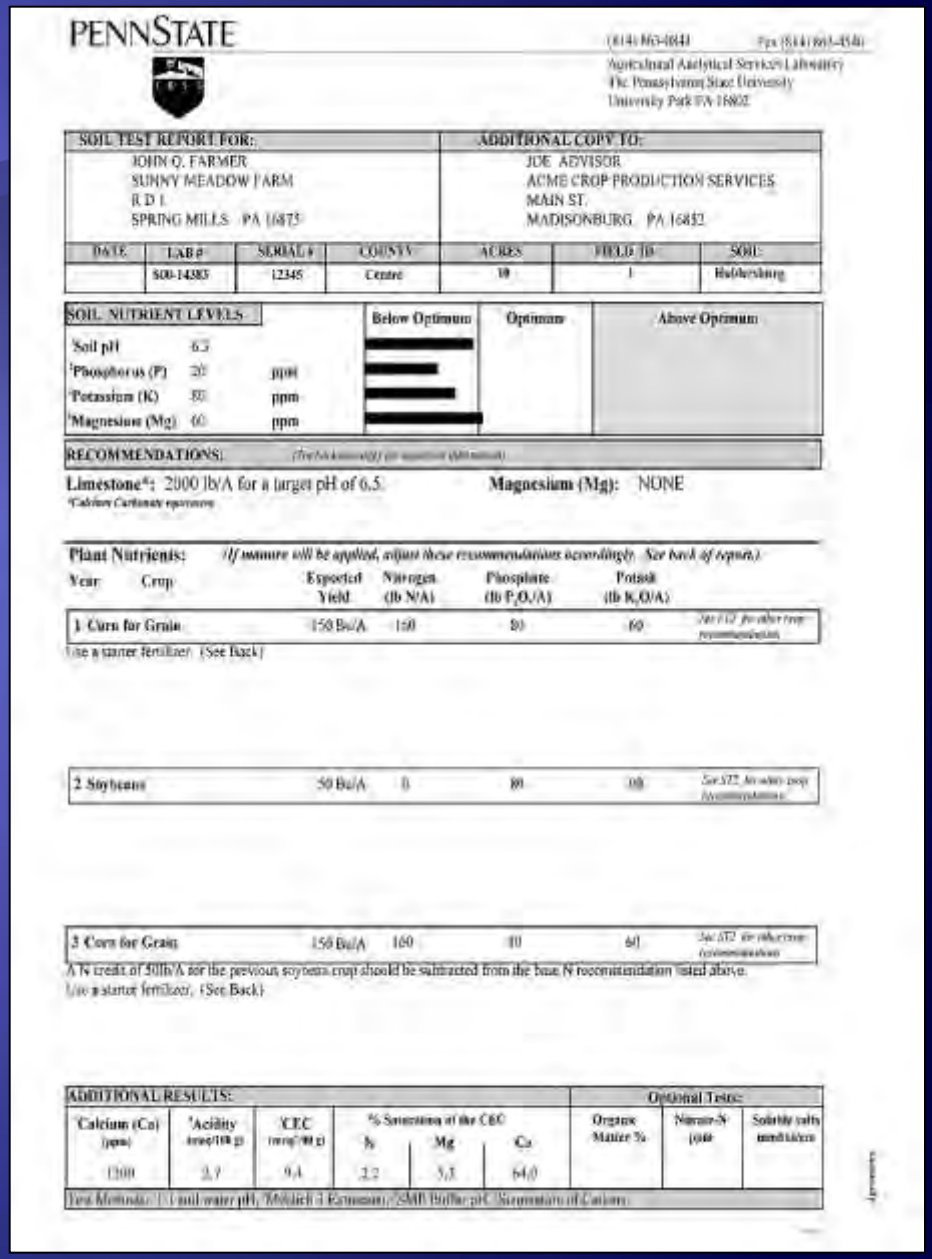
- Accounts for 45% of Pennsylvania, 11% of New York, and 3% of Maryland .

- 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



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(814) 863-0841 Fax (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park PA 16802

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
JOHN Q. FARMER SUNNY MEADOW FARM R D 1 SPRING MILLS PA 16875	JOE ADVISOR ACME CROP PRODUCTION SERVICES MAIN ST. MADISONBURG PA 16852

DATE	LAB #	SERIAL #	COUNTY	ACRES	FIELD ID	SOIL
	S00-14383	12345	Centre	10	1	Hublersburg

SOIL NUTRIENT LEVELS			Below Optimum	Optimum	Above Optimum
Soil pH	6.3				
Phosphorus (P)	20	ppm			
Potassium (K)	80	ppm			
Magnesium (Mg)	60	ppm			

RECOMMENDATIONS:

Limestone*: 2000 lb/A for a target pH of 6.5. Magnesium (Mg): NONE

*Calcium Carbonate equivalent

Plant Nutrients: *If manure will be applied, adjust these recommendations accordingly. See back of report.*

Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P_2O_5/A)	Potash (lb K_2O/A)	
1	Corn for Grain	150 Bu/A	160	80	60	See 1/2 for other crop recommendations

Use a starter fertilizer. (See back)

2 Soybeans	50 Bu/A	0	80	100	See 3/2 for other crop recommendations

3 Corn for Grain	150 Bu/A	160	80	60	See 3/2 for other crop recommendations

A N credit of 50lb/A for the previous soybean crop should be subtracted from the base N recommendation listed above.
Use a starter fertilizer. (See Back)

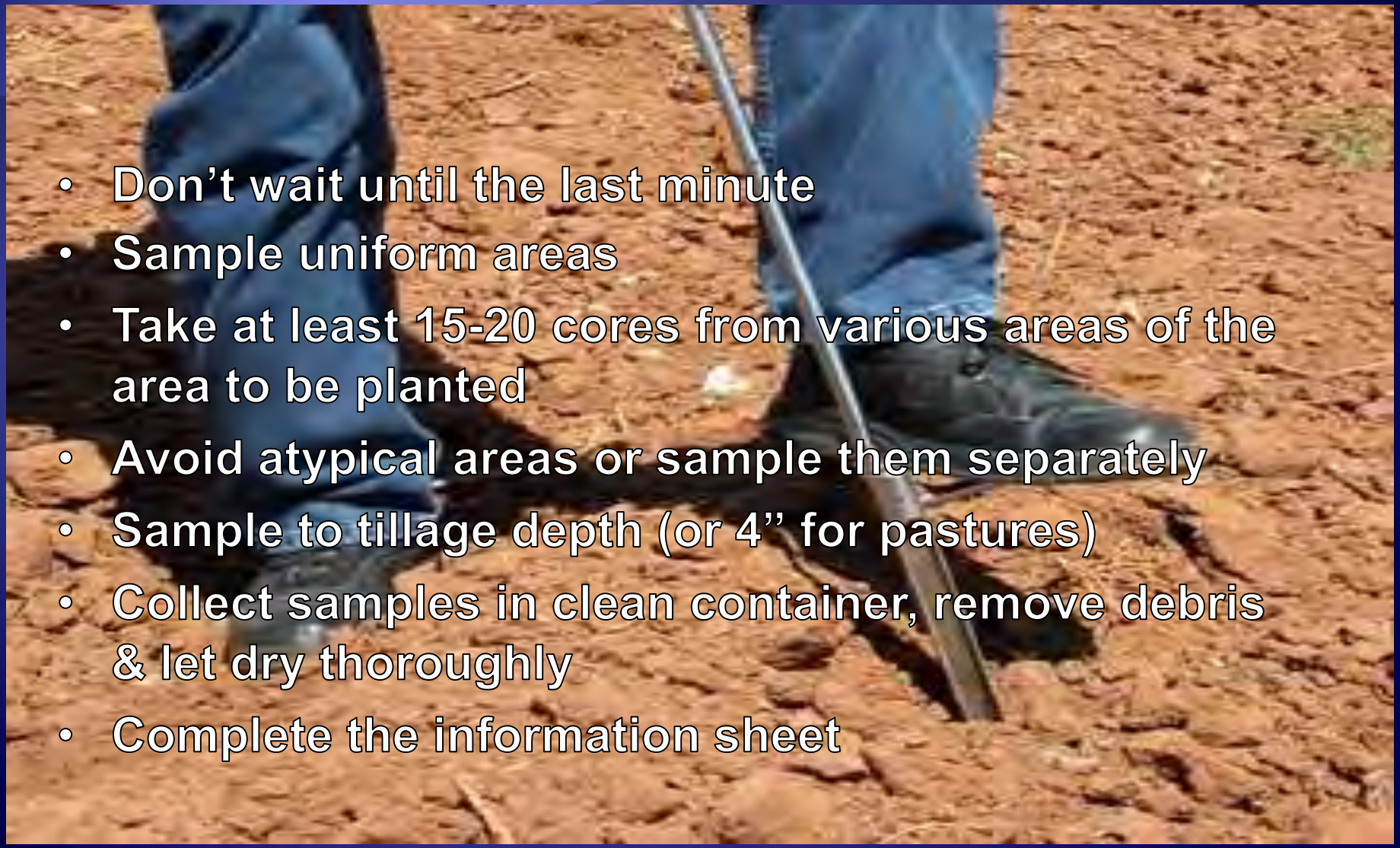
ADDITIONAL RESULTS:						Optional Tests:		
Calcium (Ca) (ppm)	Acidity meq/100 g	CEC meq/100 g	% Saturation of the CEC: K	Mg	Ca	Organic Matter %	Nitrate-N (ppm	Soluble salts mmhos/cm
1200	2.7	9.4	2.2	5.3	64.0			

Test Methods: 1:1 soil:water pH, Modified Morgan/SMP Buffer pH, Summation of Cations

Taking the Soil Sample

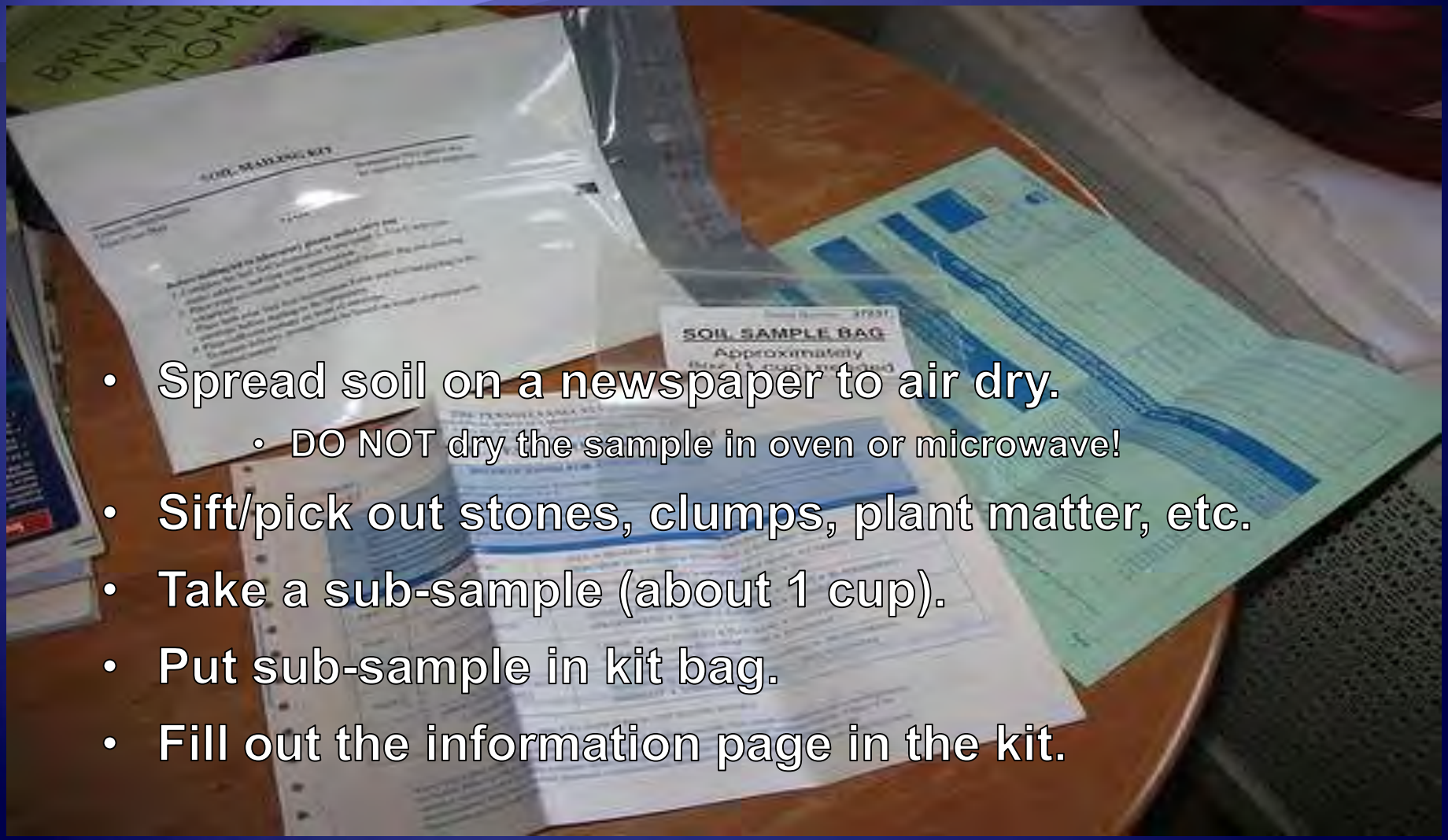
- Clean, rust-free Spade or Soil Probe
- Clean Plastic Bucket
- A Few Sheets of Newspaper
- Clean rust-free Screen or Sifter (optional)

Soil Sampling



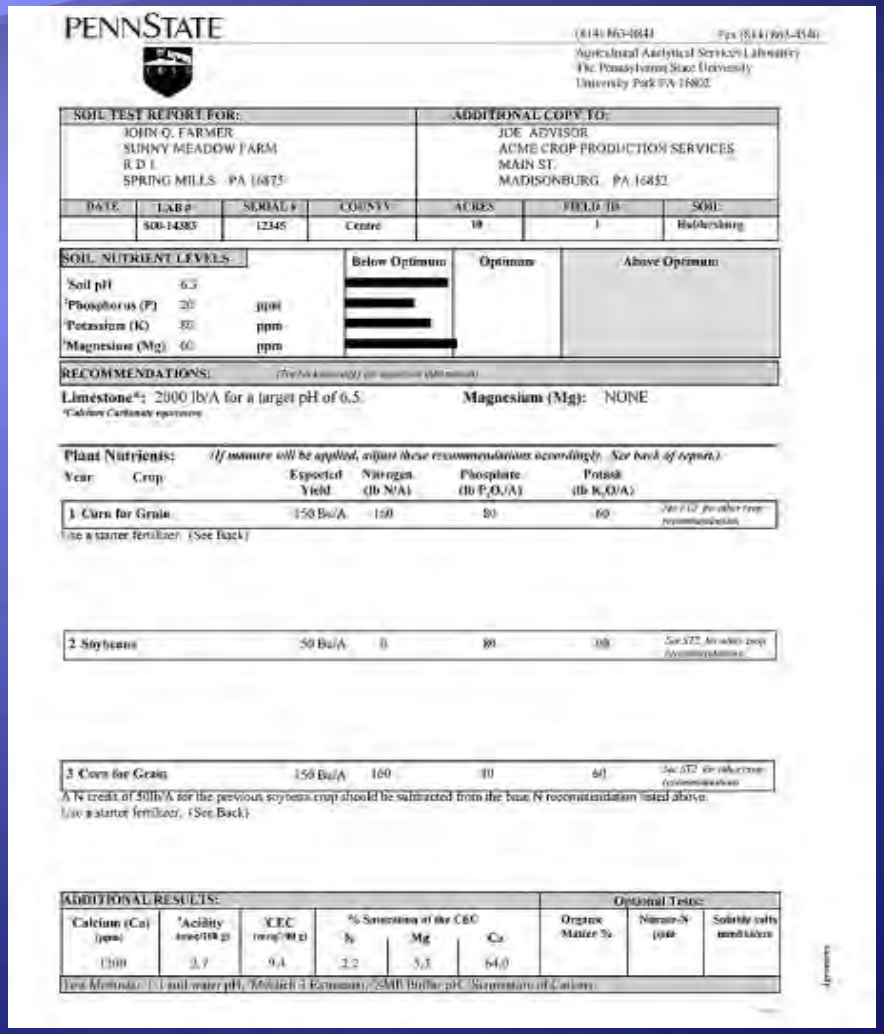
- Don’t wait until the last minute
- Sample uniform areas
- Take at least 15-20 cores from various areas of the area to be planted
- Avoid atypical areas or sample them separately
- Sample to tillage depth (or 4” for pastures)
- Collect samples in clean container, remove debris & let dry thoroughly
-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



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Potassium (K)	80	ppm			
Magnesium (Mg)	60	ppm			

RECOMMENDATIONS:

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*Calcium Carbonate equivalent

Plant Nutrients: *If manure will be applied, adjust these recommendations accordingly. See back of report.*

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Use a starter fertilizer. (See Back)

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1500	2.9	9.4	2.2	5.3	64.0			

Test Methods: 1:1 soil-water pH, Modified Kelowna, SMP Buffer pH, Summation of Cations

Agronomy

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

Financial and other support to make this workshop possible is provided by the Pennsylvania Association of Conservation Districts, Inc. and the Pennsylvania Department of Environmental Protection's Chesapeake Bay Program.

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

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