



Holly Utrata-Halcomb, Executive Director
Hamilton County Soil & Water Conservation District
www.hcswcd.org

My Garden



1. How was our soil formed
2. Soil composition & texture
3. Hamilton County Soils – Clay
4. Fertility – Don't guess, soil test
5. Interpreting our soil test
6. How to amend soils
7. Compost
8. Cover Crops
9. Weed Control
10. Tips and Tricks

Factors that affect the patterns and features associated with streams and floodplains and glaciers

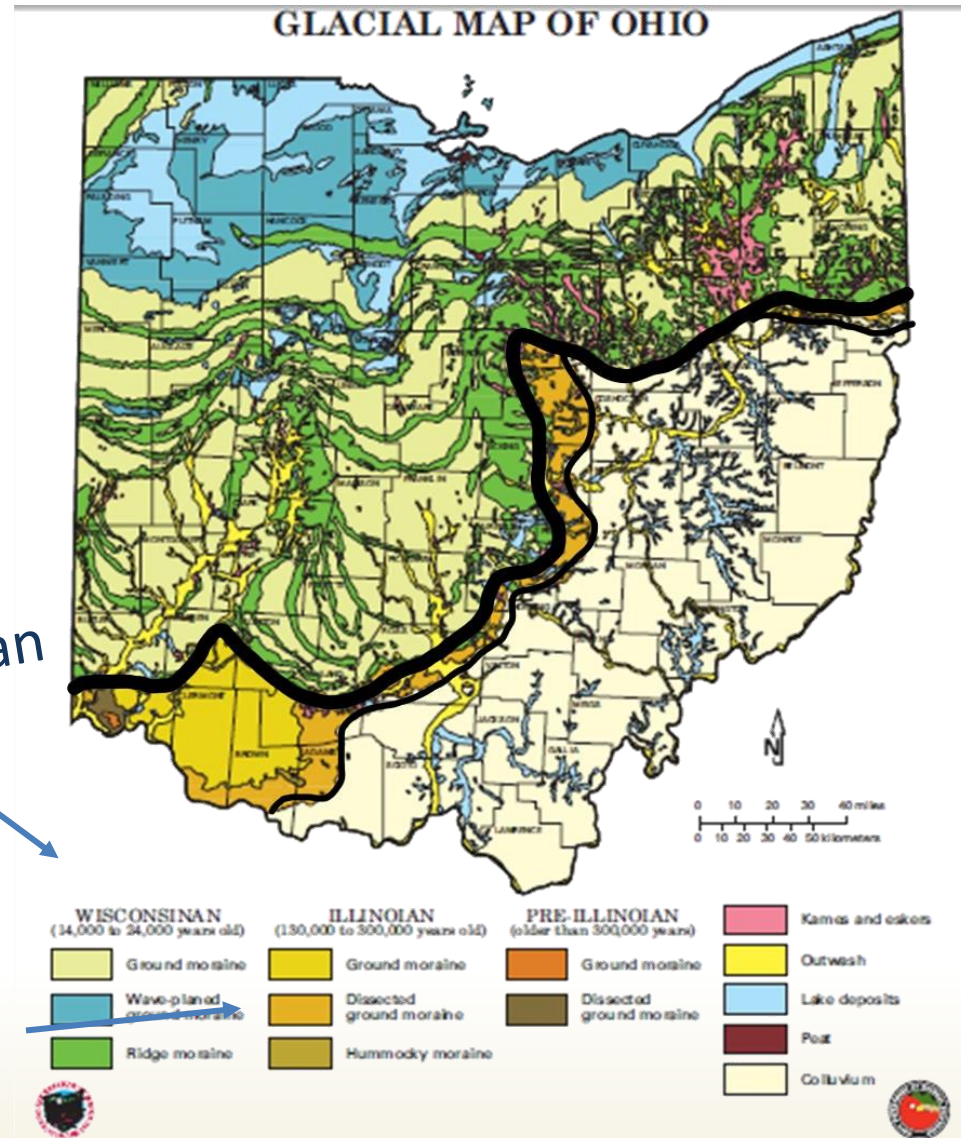
- moraines, outwash, tills, erratic, kettles, eskers

Wisconsinan
Glacier

Resource:

[ODNR Geological Survey](#)

Illinoian
Glacier

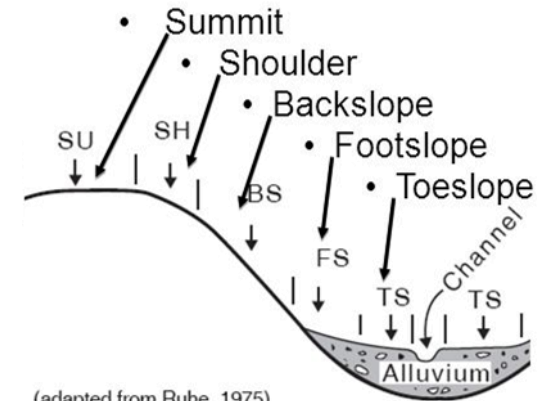


Soil Forming Factors

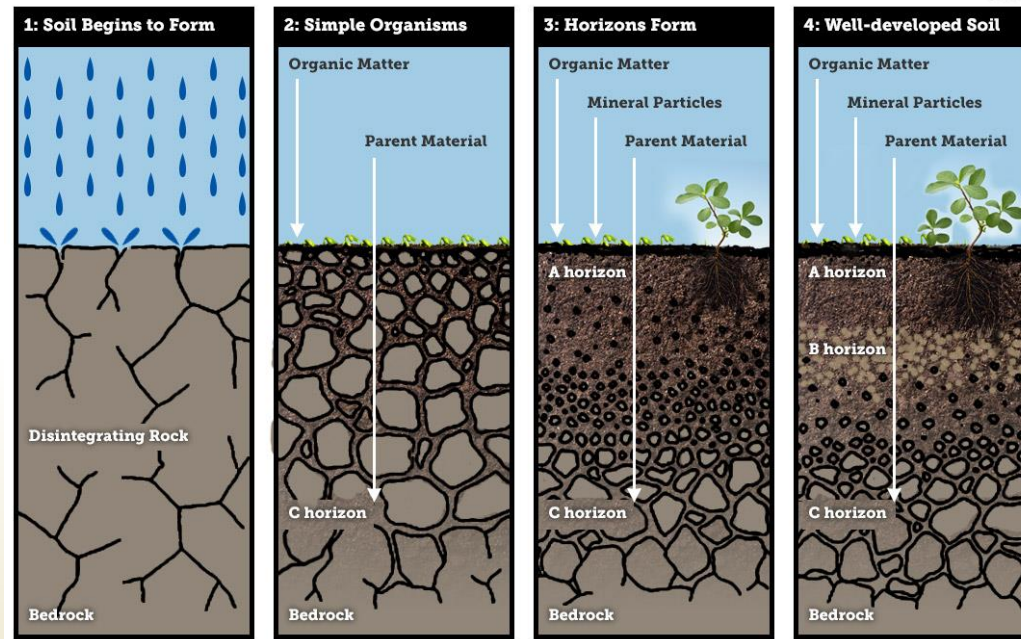
5 Soil Forming Factors:

C L O R P T

1. Climate
2. Living Organisms
3. Relief (Topography)
4. Parent Material
5. Time



(adapted from Ruhe, 1975)



Resource:

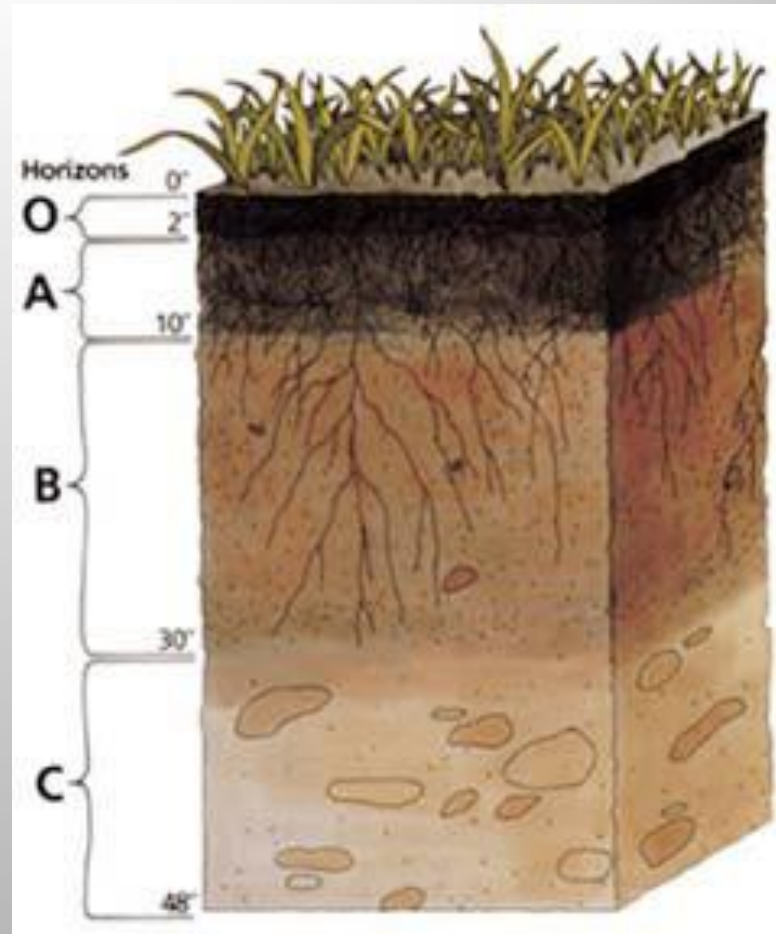
[SSSA Webpage](http://SSSAWebpage)

O – Organic matter, low in mineral content

A - Horizon- the “living” layer often called the “topsoil”
Most fertile layer.

B - Horizon– “subsoil” More compacted, finer particles. Nutrient rich, low in organic content. Stores water.

C - parent soil material and rock native to the locale. Determines natural fertility, pH & soil depth



What is Soil?

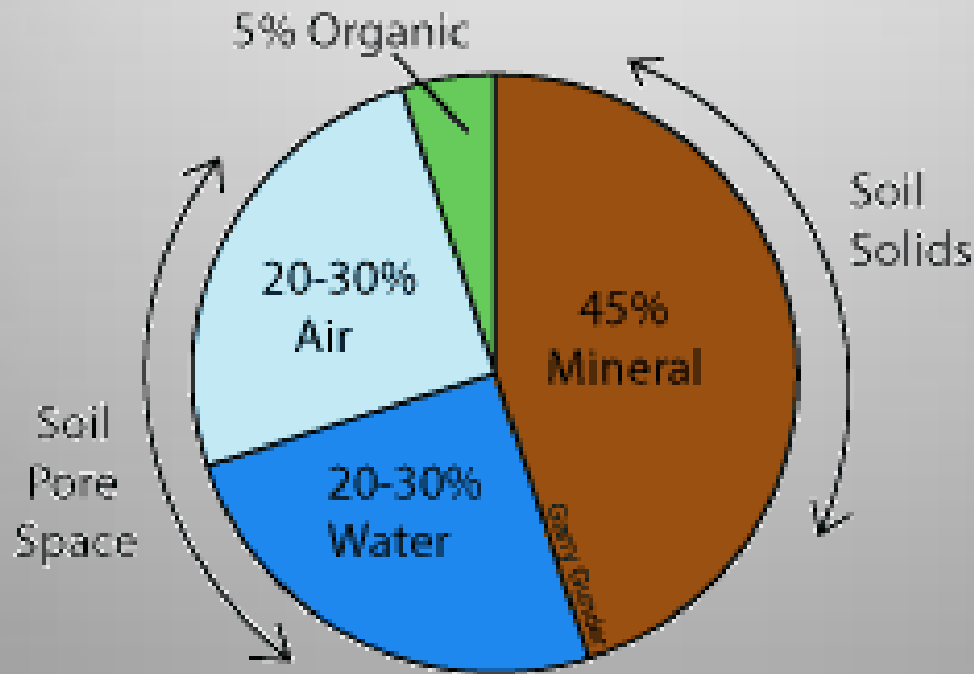


Soils Four Major Roles

- Support plants & animals
- Provide physical, chemical & biological environment for the exchange of H₂O, air, nutrients & energy
- Regulate flow of H₂O and Cycle & Store plant nutrients
- Filter pollutants and Immobilizing/detoxifying organic/inorganic material

What Is Ideal Soil Composition?

Soil Composition by Volume



Soil Texture:

- The way the soil “feels”
- Depends on the percentages sand, silt, and clay in the soil
- Sand, silt, and clay = the mineral particles in the soil
 - **Sand**: the largest particles, they feel “gritty”
 - **Silt**: medium sized particles, they feel soft, silky or “floury”
 - **Clay**: the smallest sized particles, they feel “sticky” when wet

Greater Cincinnati's Key Challenge: Clay Soils!



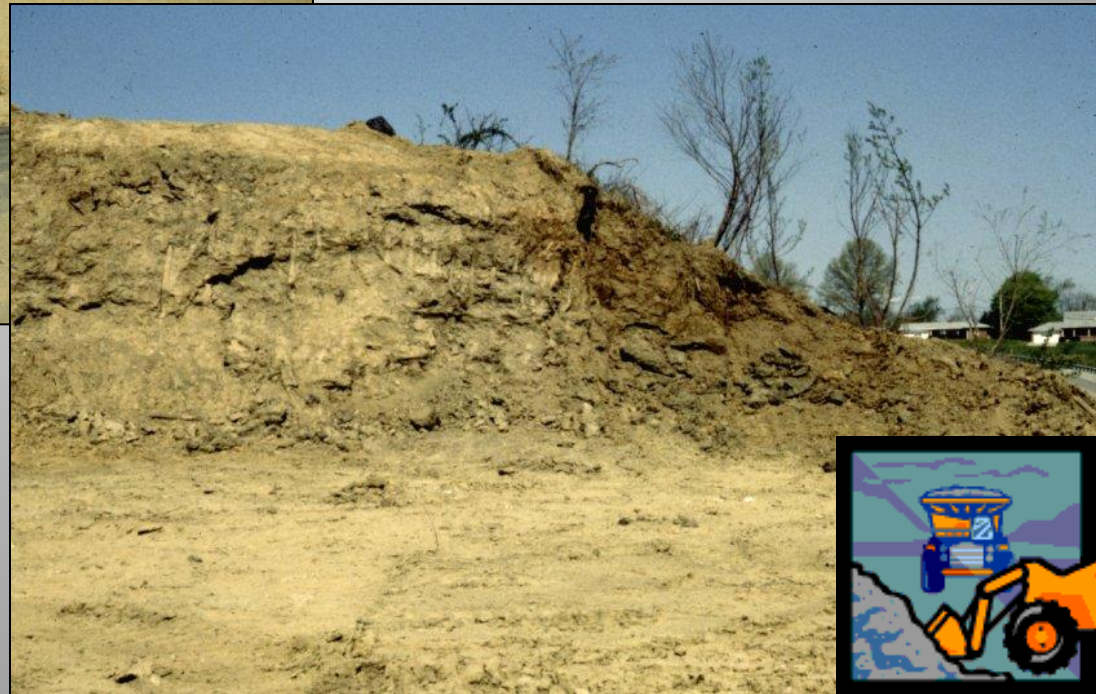
Amend clay soils with compost or peat moss - NEVER sand!

Trouble on the Horizon



**Topsoil
Removed**

**Topsoil
Stockpiled**



Trouble on the Horizon

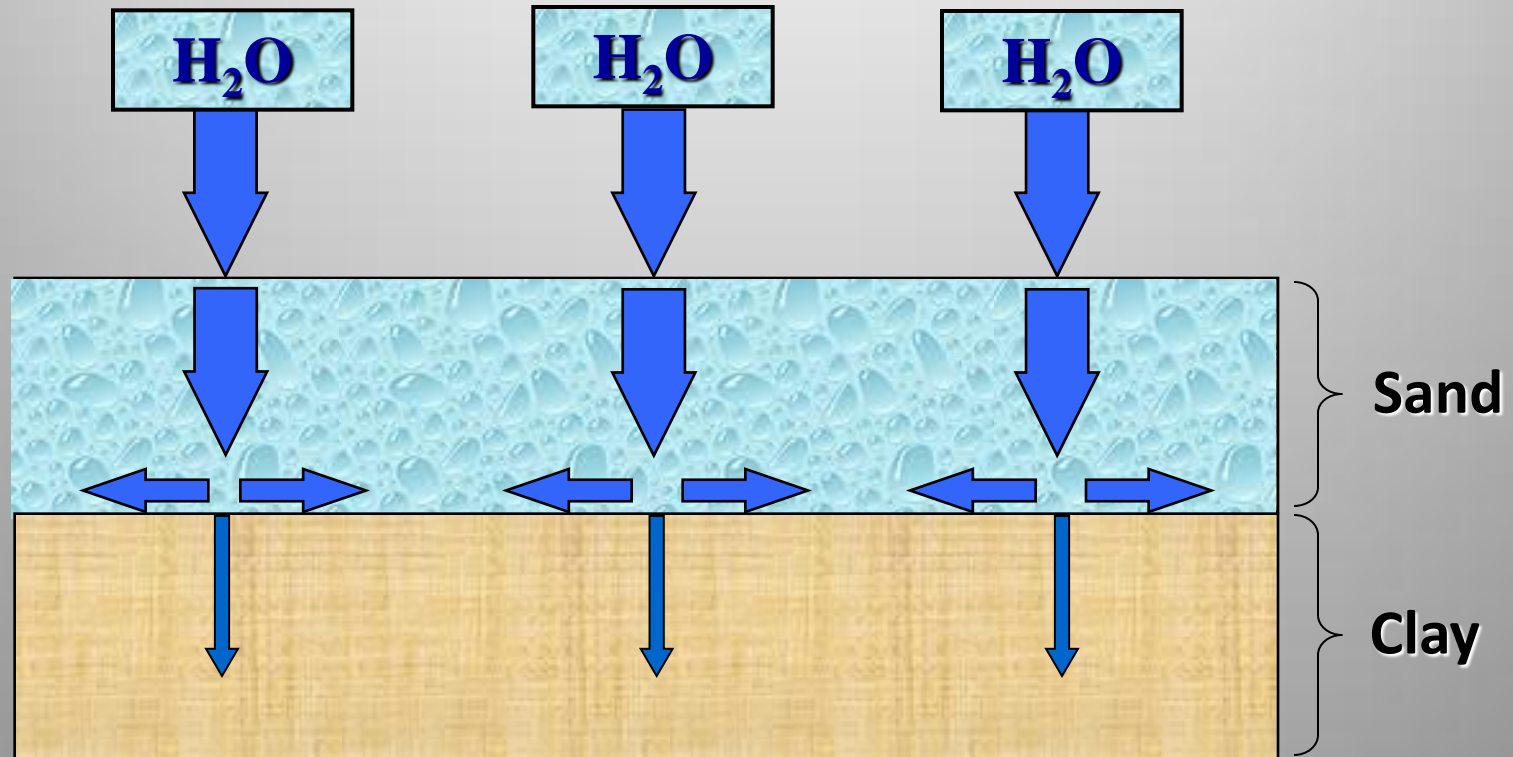
If you're lucky - Only 2-3" of topsoil returned!



Slide Source - J. Boggs – OSU Extension



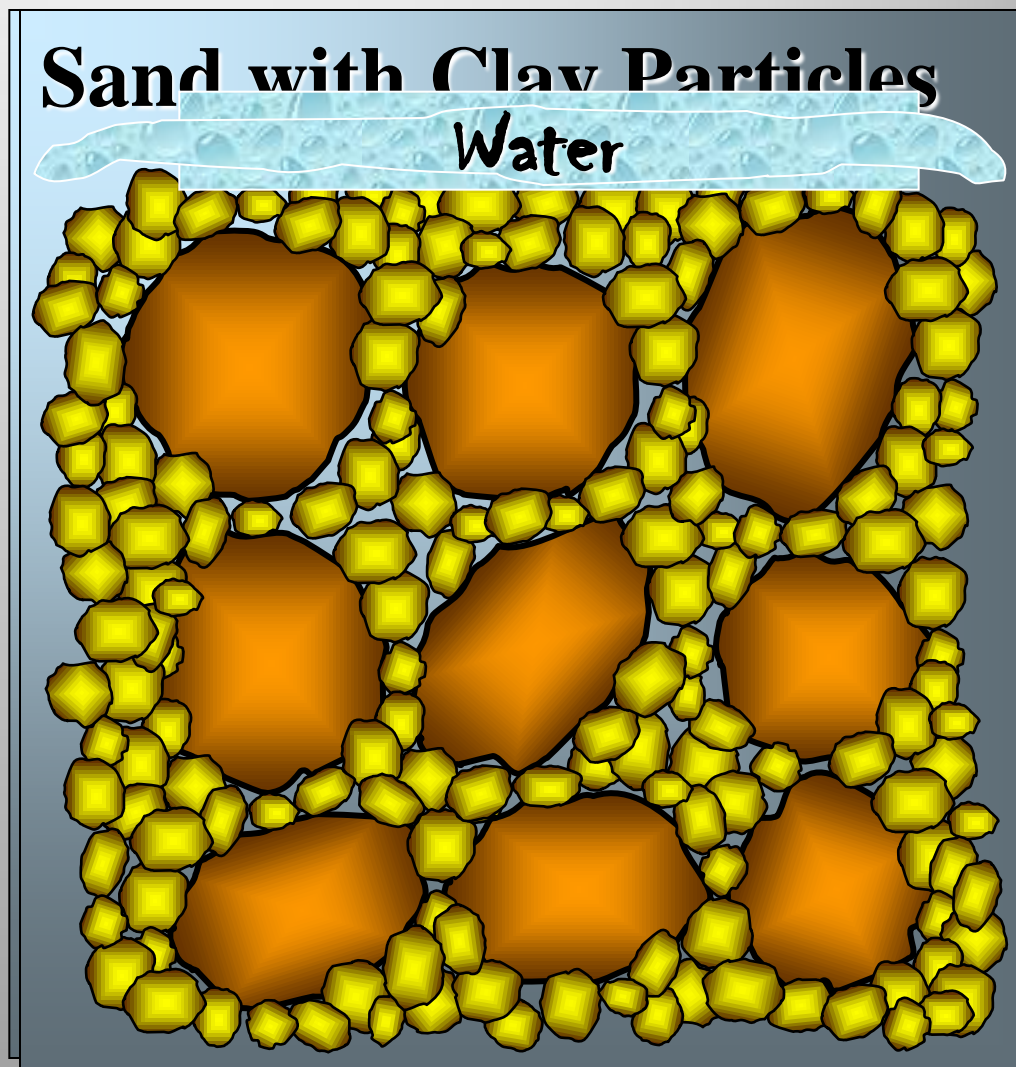
Impermeable Layer: Sand Over Clay



Mixing Sand with Clay: Particle Infiltration

Inhibits Water Drainage

Adding Sand: at least 60% (by volume) to affect change without creating the “concrete” effect.



Why Test Your Soil Fertility

- To understanding the chemical and physical qualities of the soil.
- To learn the soil's pH.
- Discloses information about the nutrient content of the soil.
- Reveals the Cation Exchange Capacity (CEC)
- Discover the "mineral components" of the soil – Soil Texture
- Can also provide information on the organic content of the soil.



Don't Guess – Soil Test



Soil Fertility Testing

By Holly Utrata-Halcomb, District Administrator
Hamilton County Soil & Water Conservation District

- A. Soil tests are used by landscape managers like blood tests are used by physicians. Both types of tests disclose vital information that is mostly hidden from view.

Soil Test Results: Ideal Values								
pH	Phosphorus P lbs. / A*	Potassium K lbs. / A*	Calcium Ca lbs. / A*	Magnesium Mg lbs. / A*	Cationic Exchange Capacity C.E.C. meq./100 gms	Base Saturation		
						% Ca	% Mg	% K
General Ideal Levels	5.5 to 6.5	50 to 100	250 to 400	800 plus	150 to 250	7 to 10 or higher	40 % to 80%	10% to 40% 3% to 5%

* To convert lb/A (pounds per acre) to ppm (parts per million), divide by 2. Example: 100 lb/A = 50 ppm

- Specific crops*: Optimum levels for Turf -
- pH should be between 6.6 – 7.5
 - Phosphorus should be between 10ppm – 20ppm
 - Potassium should be between 60ppm – 125ppm
- Optimum levels for Most Vegetables
- pH should be between 6.2 – 7.2
 - Phosphorus should be between – 40 ppm – 70 ppm
 - Potassium should be between – 90 ppm – 125 ppm
- Optimum levels for Most Flowers
- pH should be between 6.2 – 7.5
 - Phosphorous should be between 70 ppm – 90 ppm
 - Potassium should be between 150 ppm – 200 pmm

*Optimum levels determined by Michigan State University Soil Testing Lab.

How To Take Soil Test Samples

- Collect 10 random soil samples from your lawn or garden area. Each of these samples should be about 1/2 cup.
- To do so, remove a slice of soil (extending to the bottom of the plant roots 3 inches deep for lawn; 7 inches deep for all other plants).
- Do not include roots, thatch or other plant materials in the sample.
- Mix the 10 sub-samples together. If the soil is wet, spread it on paper and allow to air dry overnight before filling the sample bag. Do not use artificial heat (i.e. radiator, oven, microwave, hair dryer, etc.) to force-dry the sample.
- Place roughly 1 cup of the well-mixed soil inside the resealable plastic bag.
- Do not overfill the plastic bag.

Test Methods: 1- 1:1 soil:water pH. 2- Bray P1 Extractant. 3- 1N Ammonium Acetate Extractant

MSU Soil Test.com - Per: X

www.msusoiltest.com/understand-your-soil-test/

Apps SWMS Streamside Landown Ohio Soil Sampling http--chard-snyder... HCSWCD Event Cal: (1) Facebook National Pollutant Di Microsoft Word - O Google Chard Snyder tracker

MICHIGAN STATE UNIVERSITY Extension

MSU Soil Test Home
How to Get Your Soil Tested
Understand Your Soil Test Results
Area Calculator
Fertilizer Calculator
Questions? Ask an Expert
Links

MSU Soil Test.com

Understand Your Soil Test

Step 1 A: MSU Soil Test Report Code

Please enter the 6-character code that you received via e-mail to view your report and receive specific recommendations.

Code

[Step 2 »](#)

Or... Step 1 B: Enter Your Soil Test Details

If you don't have your MSU Soil Test Report Code or if you had your soil tested at another lab, you can enter your information below to receive a customized fertilizer recommendations for the specific plant you are trying to grow.

Change your mind? If you had your soil tested by MSU and indicated you wanted, for example, to grow vegetables, but since receiving your lab results and recommendation you have changed your mind and now want to grow strawberries instead, fill in your soil test results below, choosing the new crop type, and a custom fertilizer recommendation will be generated for your new crop.

Crop

Soil Type

Next to Lake or Stream

Soil pH

Lime Index




Image from
www.geo.msu.edu/SoilProfiles

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<http://www.msusoiltest.com/understand-your-soil-test/>

MSU Soil Test.com - Pers x

www.msusoiltest.com/tools/fertilizer-calculator/

Apps SWIMS Streamside Landown Ohio Soil Sampling http--chard-snyder.co HCSWCD Event Caler (1) Facebook National Pollutant Dis Microsoft Word - OR Google Chard Snyder tracker

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Fertilizer Calculator

Can't find the exact fertilizer analysis that was custom selected for your gardening situation in your MSU Soil Test website fertilizer recommendation? This calculator can be used to determine how much nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O) (in lbs./1000 ft.²) the fertilizer analysis you choose will supply.

All fertilizers have three numbers on the label which indicate the fertilizer analysis, or "percentage by weight" of nitrogen, phosphorus and potassium, in that order. Find the three numbers from the fertilizer label and enter them below, in order, one number in each box. Then click "Calculate."

N P K
 - -

[Calculate »](#)



Site Links [Get a Soil Test](#) [Understand a Soil Test](#) [Area Calculator](#)
[Fertilizer Calculator](#) [Links](#) [Privacy Policy](#)

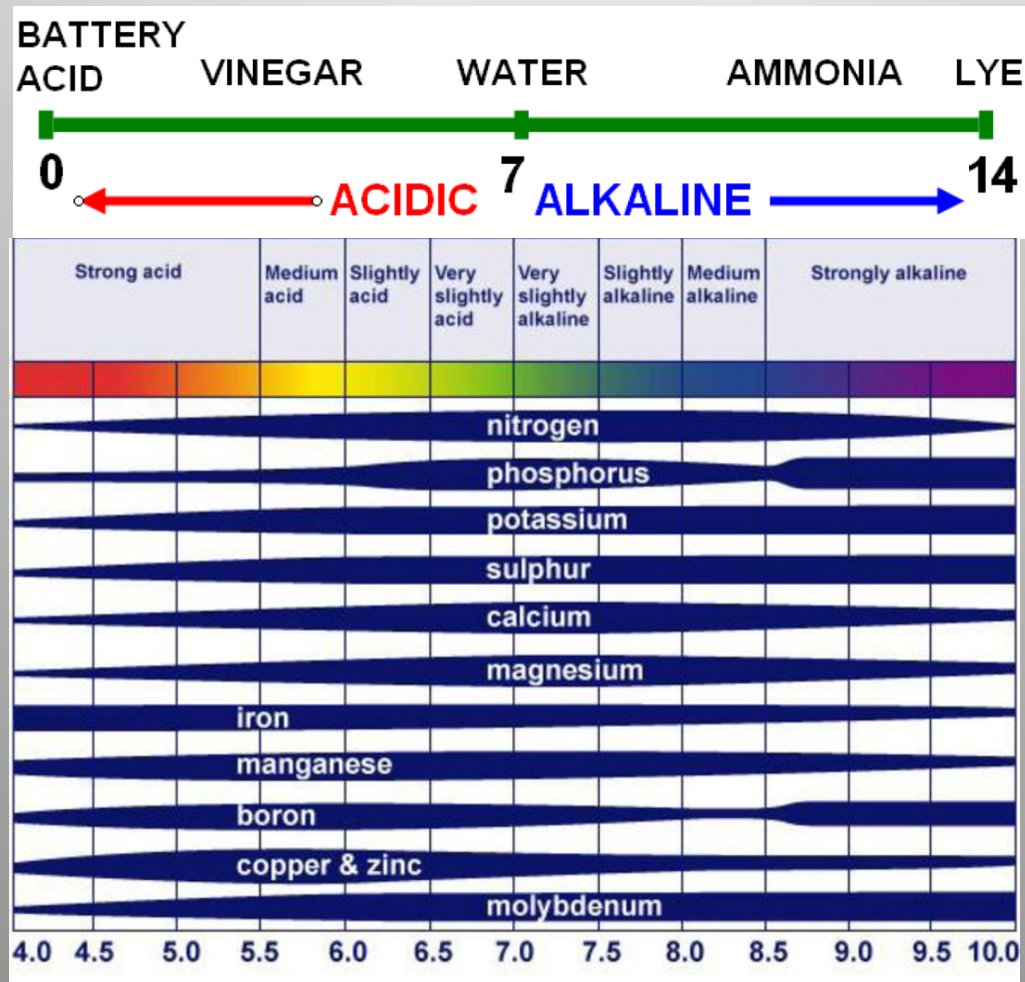
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<http://www.msusoiltest.com/tools/fertilizer-calculator/>

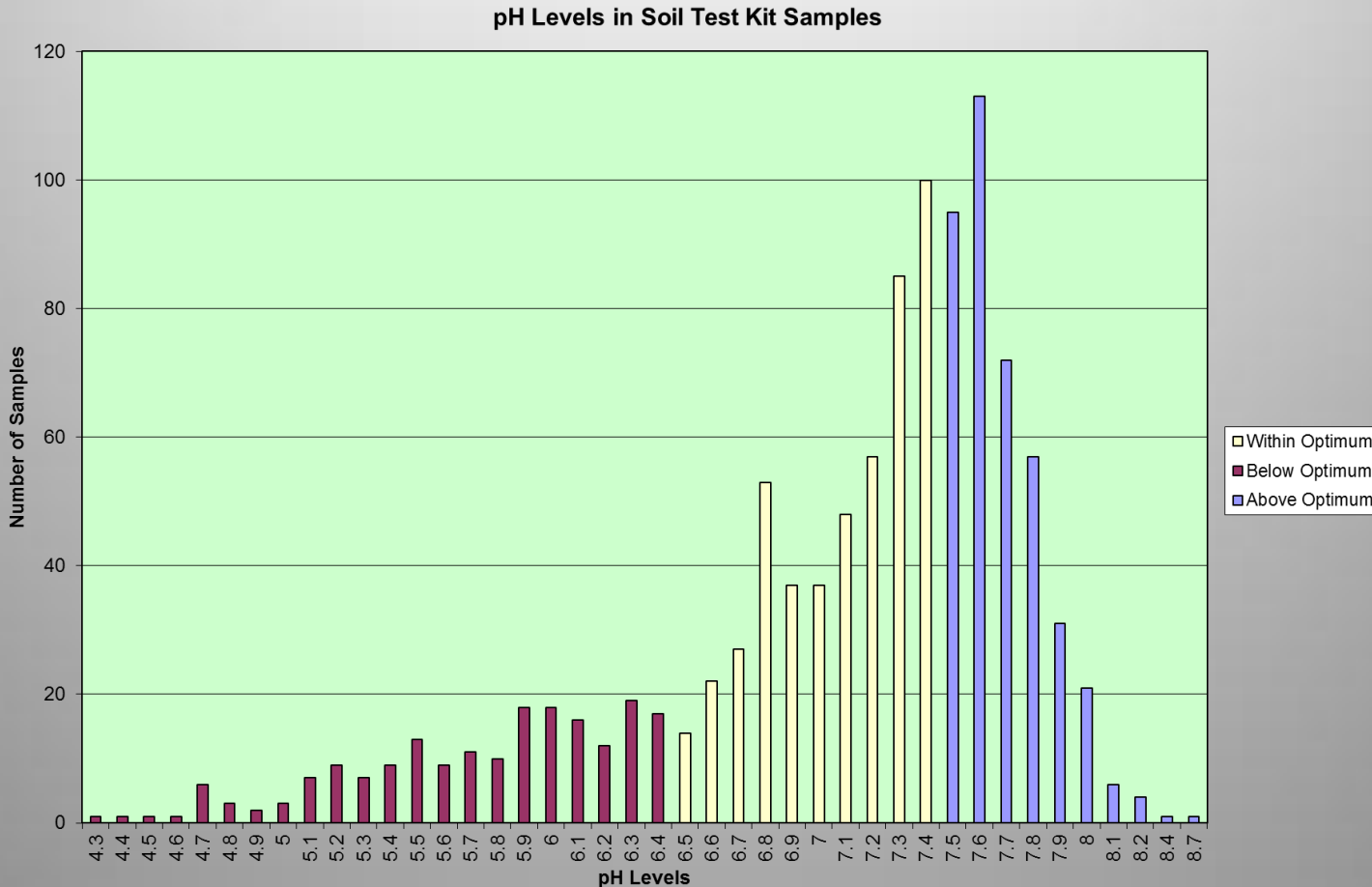
The Soil's pH.

- Problems with soil pH are addressed by lime recommendations to raise the pH, or sulfur (or other soil acidifiers) recommendations to lower soil pH.

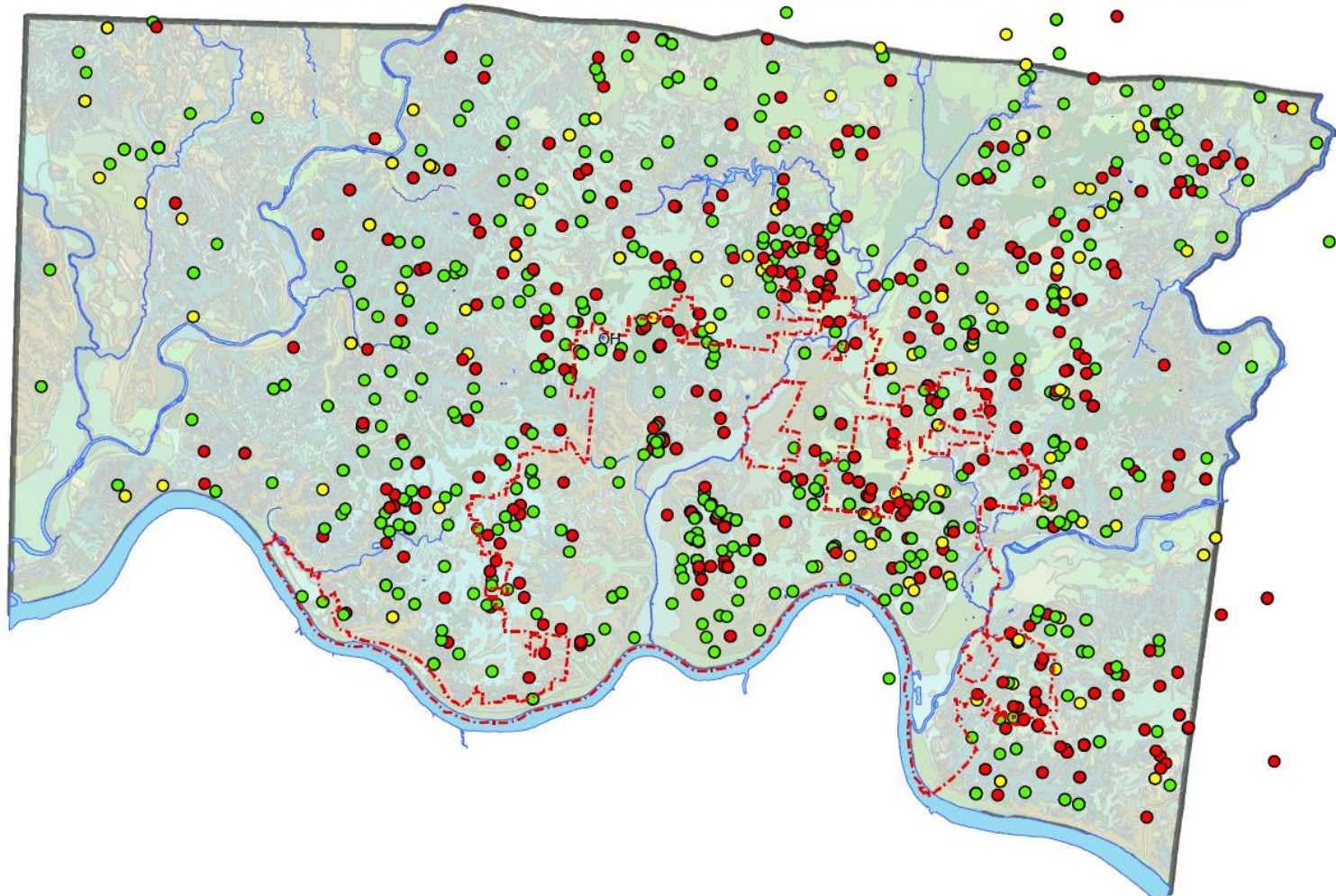


10 - Years of pH Data

A pH of 7.5 is 10 times more alkaline than a pH of 6.5.



pH Levels of Soil Test Kit Samples in Hamilton County



Legend

pH Levels

● < 6.2 Less Optimum

● 6.2 - 7.5 General Ideal Level

● > 7.5 More Optimum

■ Rivers and Streams

■ Cincinnati Boundary

■ Hamilton County Boundary

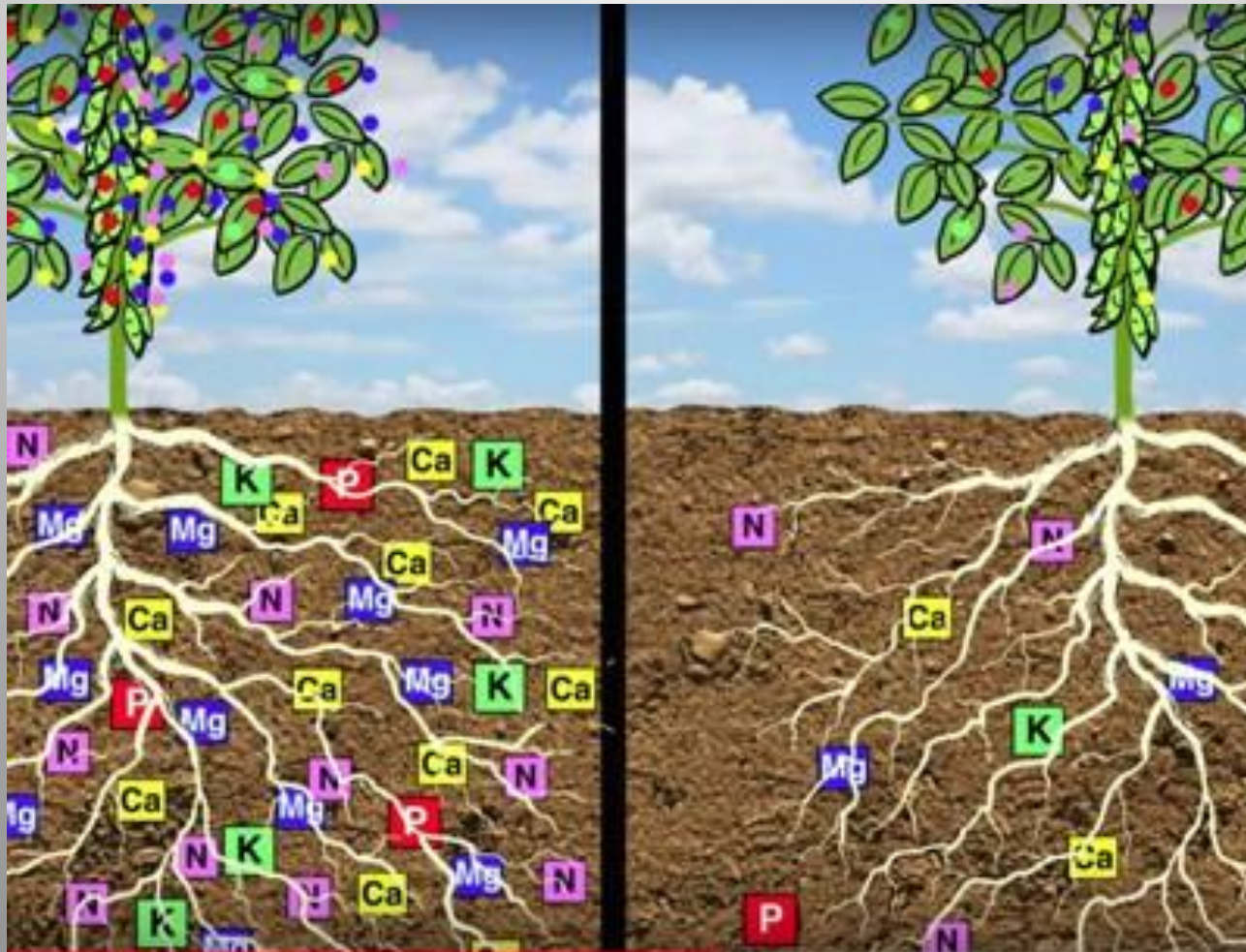


0 2.5 5 10 15 20 Miles



Cation Exchange Capacity

High – More Clay Low- More Sand



Cations

potassium (K^+),

ammonium (NH_4^+),

calcium (Ca^{++}),

magnesium (Mg^{++}),

hydrogen (H^+)

sodium (Na^+)

iron (Fe)

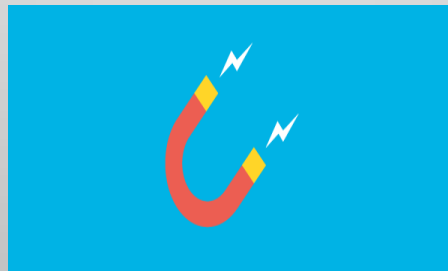
nickel (Ni^+)

copper (Cu^+)

Zinc (Zn^+)

NO MINERAL IS
AN ISLAND

Neutral
Boron



Anions

nitrate (NO_3^-),

phosphate (PO_4^{3-})

chlorine (Cl^-),

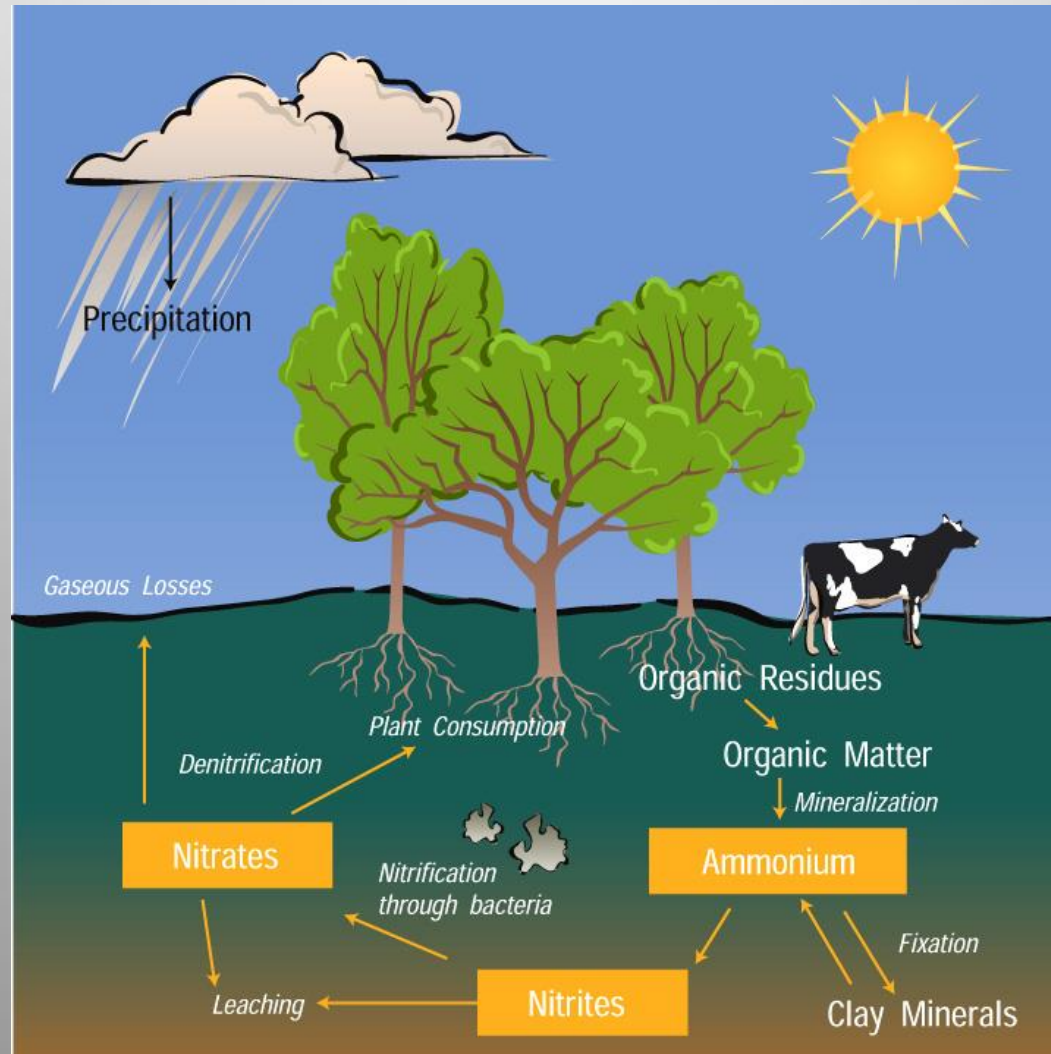
sulfate ($SO_4^{=}$)

chlorine (Cl^-)

Molybdenum (Mo^-)

Hydrogen (H^+) Oxygen (O^-) Carbon -Neutral

Nitrogen Cycle



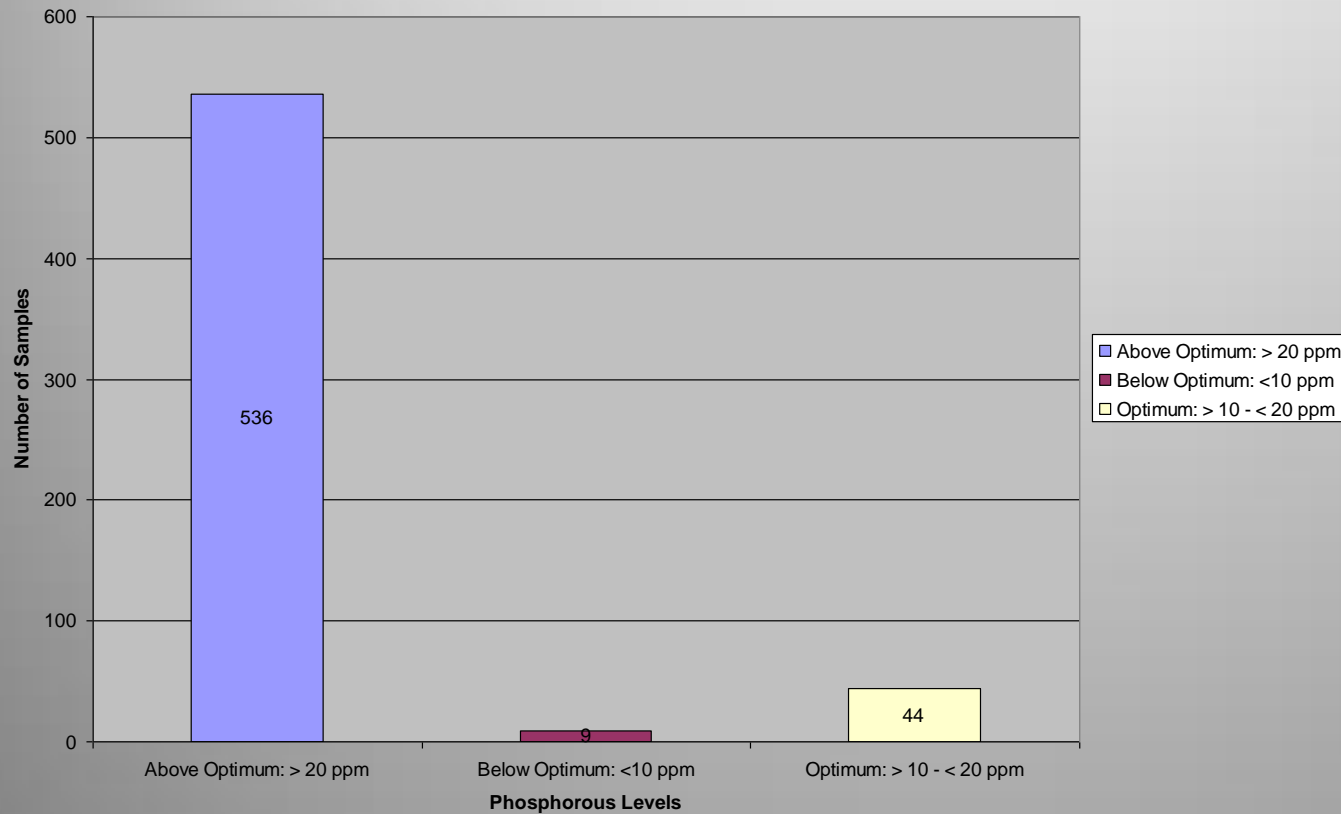
Nitrogen compounds comprise from 40 to 50% of the dry matter of plant cells. For this reason nitrogen is required in relatively large quantities in connection with all growth processes in plants.



Phosphorus Results for Turf-

589 Samples

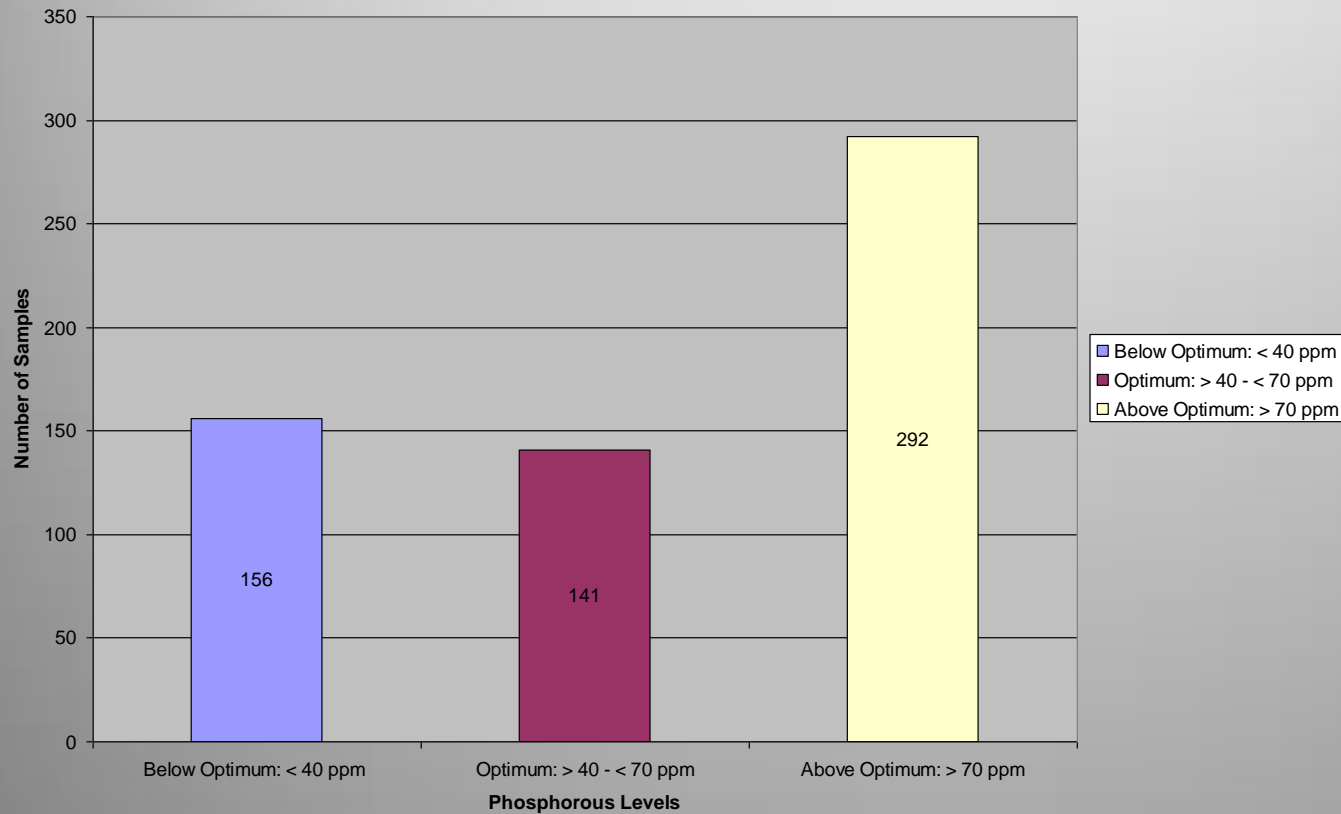
Phosphorous Levels (ppm) in Soil Test Kit Samples
Showing Optimum Ranges for Turf



Phosphorus Results for Vegetable Gardening

589 samples

Phosphorous Levels (ppm) in Soil Test Kit Samples
Showing Optimum Ranges for Vegetable Gardens

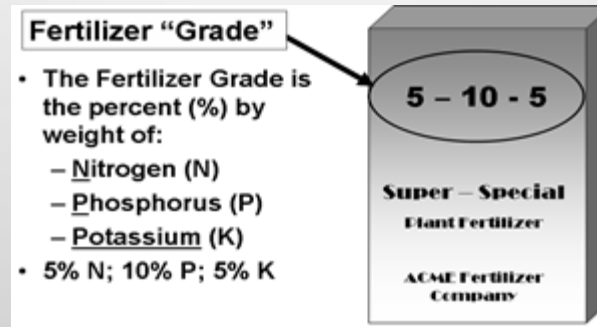


Phosphorus = Flowers and Fruit

- **Plants that don't get enough P have spindly, thin-stems that are weak**
- **Growth is stunted or Shortened**
- **Marginal chlorosis progressing into a dry leathery tan scorch on recently matured leaves.**
- **Phosphorus deficient plants have little production of seed, flowers, and fruits**



Fertilizer Decoding



Grade: the percent, by weight of N-P-K in a fertilizer product.

- 5-10-5 fertilizer would have: 5% nitrogen; 10% phosphorus;
- and 5% potassium.
- A 10 lb. bag of that fertilizer would have: .5 lbs. of N; 1 lbs. of phosphorus; and .5 lbs. of potassium.

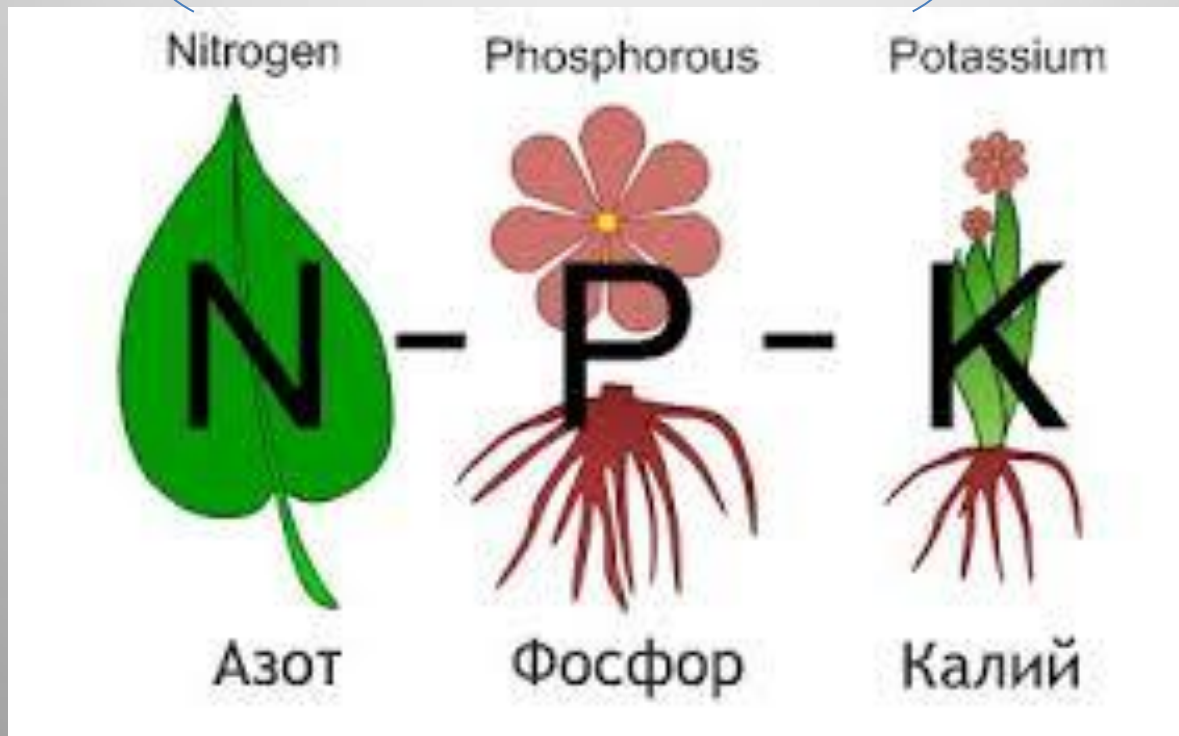
Example - $\frac{10 \text{ lbs.}}{\text{lbs. of Fertilizer}} \times \frac{.05 \text{ lbs. of Nitrogen}}{\text{lbs. of Nutrient (\%)}} = \frac{.5 \text{ or } \frac{1}{2} \text{ pound of Nitrogen}}{\text{lbs. of that Nutrient in the entire bag}}$

Potassium (K) is important in the photosynthesis process and in helping plants metabolize their food to get energy.

- Potassium controls water and chemicals inside plants that help plants function well.
- Leaf symptoms include dull bluish-green discolorations, particularly in the interveinal areas of the leaves, dull, general chlorosis particularly at the leaf tips and margins; tip burning and marginal scorch on the older leaves with the leaves
- curling under or upwards
- Granite meal, green sand or kelp meal are good organic sources.



Potassium affects nitrate
(NO₃) absorption and
reduction

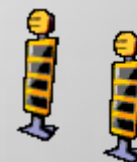


Practices to Help Maintain or Improve Soil Quality

- **Reduce tillage and minimize cultivation**
- **Do not drive on or work wet soil**
- **Diversify and lengthen rotations**
- **Grow cover crops**
- **Use living plants and the plant residue as mulch**
- **Apply organic amendments**



CAUTION



Beware of Different Types of Organic
Matter



Compost The Most



2010 COMPOST DATA

LOCATIONS

CHEMICALS

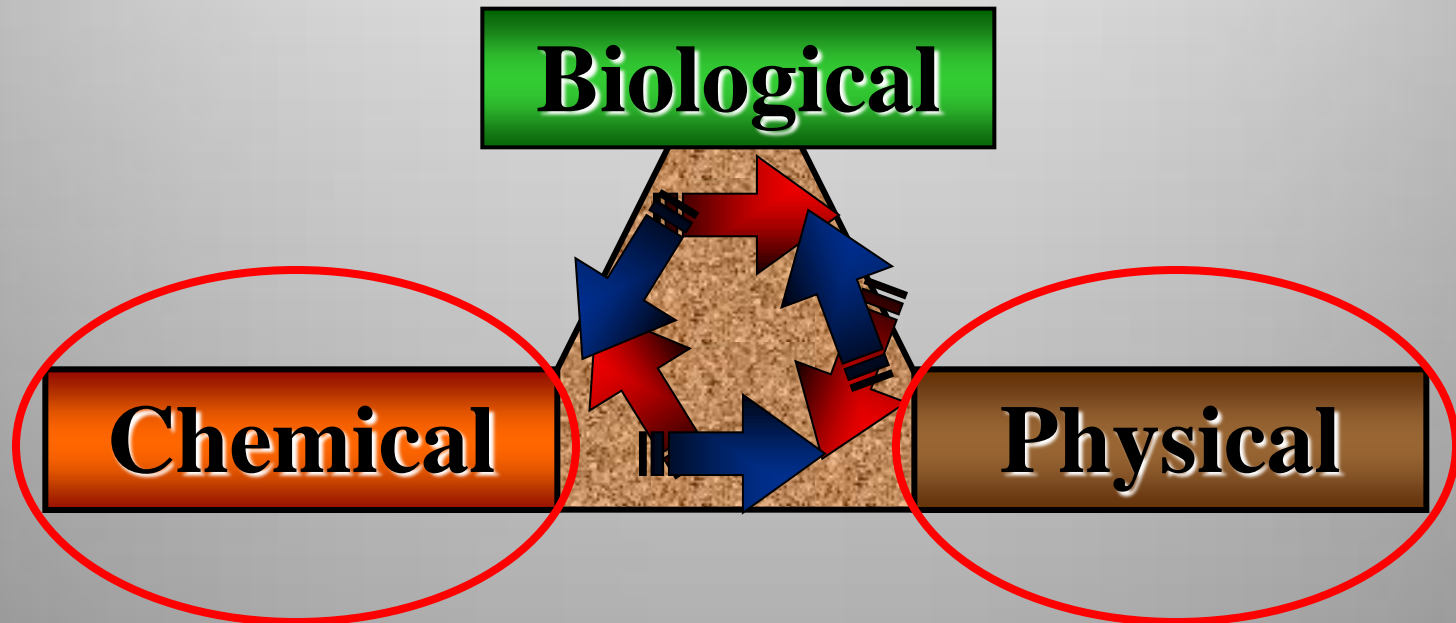
	J D Yard		B Alan		IGO		Can		F M		W C		SWCD
Calcium ppm	788		409		825		300		1125		713		1255
Chloride ppm	42		155		285		41		1400		580		800
Conductivity	5.4		1.87		4.21		1		4.46		4		6.09
Magnesium ppm	195		100		145		46		23		46		23
MMHO	0		0		0		0		0		0		0
Nitrate ppm	327		54		191		24		5		1		171
PH	6.6		7.6		7.1		8.1		7.7		8.4		8
Phosphorus ppm	108.7		2.3		11.6		8.7		127.8		131.9		71.1
Potassium ppm	884		56		614		99		2184		1350		1938
Sodium ppm	32		56		108		15		441		84		287
	Waste, Veggie Scraps		Leaves		Yard Waste		Oak leaves, Veggie Scraps, Wood Ash		Food Scraps		Horse Manure		Worm Castings

ORGANIC MATTER

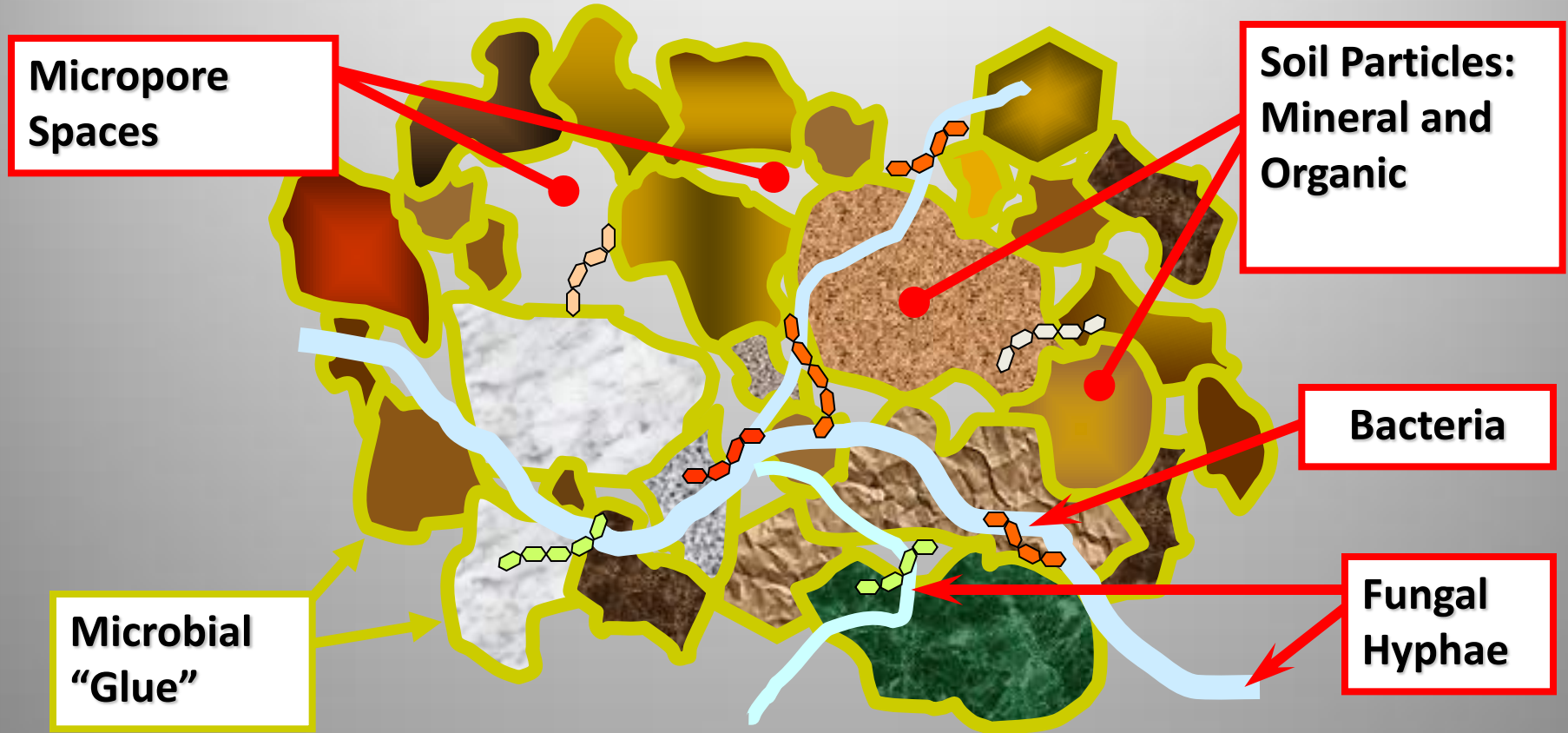
Improves Soil's Chemical, Physical and Biological Properties

- Increases water holding potential
- pH buffer – Canadian Sphagnum Peat Moss has a pH of 3 - 4.
- Cation exchange capacity
- Improves soil structure
- Erosion control
- Suppresses plant diseases
- Supplies macro/micro nutrients, organic matter and beneficial soil microbes

Soil Properties: They Are Not Independent!



The Living Soil



Life in 1 Cubic Foot of Soil



[MSU Soil Test Home](#)[How to Get Your Soil Tested](#)[Understand Your Soil Test Results](#)[Area Calculator](#)[Fertilizer Calculator](#)[Questions? Ask an Expert](#)[Links](#)

Understand Your Soil Test

Step 1 A: MSU Soil Test Report Code

Please enter the 6-character code that you received via e-mail to view your report and receive specific recommendations.

Code

[Step 2 »](#)

Or... Step 1 B: Enter Your Soil Test Details

If you don't have your MSU Soil Test Report Code or if you had your soil tested at another lab, you can enter your information below to receive a customized fertilizer recommendations for the specific plant you are trying to grow.

Change your mind? If you had your soil tested by MSU and indicated you wanted, for example, to grow vegetables, but since receiving your lab results and recommendation you have changed your mind and now want to grow strawberries instead, fill in your soil test results below, choosing the new crop type, and a custom fertilizer recommendation will be generated for your new crop.

Crop

Vegetable garden ▼

Soil Type

Clay ▼

Next to Lake or
Stream

No ▼





COVER CROPS

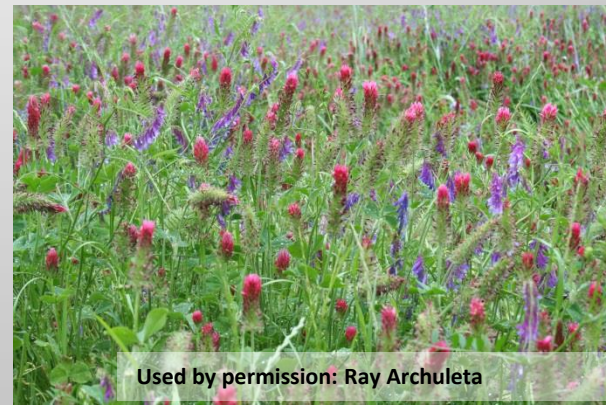
David and Jay Brandt 7/26/2012

General Types of Cover Crops

Grasses/Grains



Legumes



Brassicas



Broadleaf



What are Cover Crops?

- A cover crop is a crop that is not harvested but is grown to benefit the soil and/or other crops in a number of ways.
 - reduced soil erosion
 - improved soil quality
 - reduced weed pressure
 - reduced insect and other pest problems.



Brandt 6 Way Mix





Cereal Rye

What plants are Legumes?

- Peas, Clover, Vetch



Rhizomes from
inoculant promote the
“fixing” of atmospheric
Nitrogen nodules on
plant roots



Fibrous root mass protects
the soil from erosion, aids
water permeation and
provides food and
environment for micro -
organisms

What are Non-Legumes?

- Grasses

- Cereal Grains

- Oats
 - Flax
 - Rye

- Broadleaf

- Brassica

- Turnip or Radish
 - Mustard
 - Canola



Grass Cover Crop Advantages

- Provides erosion control
- Scavenges nitrogen
- Grows a deep and fibrous root mass
- Quick to establish
- Relatively inexpensive
- Can be broadcast and lightly tilled in
- Intercropping will add additional value

Brassica Advantages

- Prevent erosion
- Suppress weed growth
- Suppress soil borne pests
- Reduce soil compaction
- Scavenge nutrients
- Intercropping will add additional value



Planting Cover Crops



Apply Cover Crops broad casting by hand, small hand spreader, or with a large broad cast spreader. Cover with $\frac{1}{2}$ inch of soil or mulch for best results.

One Year Cover Crop



No-Till Garden Examples



Tips and Trick for a Better (easier) Gardening Experience



Straw Bale Gardening



Bale Conditioning

- Water the new bales thoroughly and keep them wet for 3 days.
- Days 4, 5, and 6, sprinkle the top of each bale with 1 cup of ammonium sulfate (21-0-0) or a half cup of urea (46-0-0), watering the fertilizer in well after application.
- Days 7, 8, and 9 Use 10-10-10 fertilizer at $\frac{1}{4}$ cup/bale
- Day 10, stop adding fertilizer, but keep the bales moist.
- Day 11, feel the top of the bale. Once cool to touch, you can plant your bale garden.

Pop Bottle Gardening Tower



Raised Row Gardening



**THE LOVE OF
GARDENING IS A
SEED ONCE SOWN
THAT NEVER DIES.**

Programs and Support

- SWCD Cover Crop Seed Program
 - 11 Offices in Ohio Participating
- Research/Testing/Experience
- Presentations/Education

To contact Ann Brandt: 330-475-6352 or ann.brandt@walnutcreekseed.com
or Holly Utrata-Halcomb: 513-772-7645 or holly.utrata-halcomb@hamilton-co.org

Questions?

Holly Utrata-Halcomb, Administrator
Hamilton County Soil & Water
conservation District
1325 East Kemper Rd. #115
Cincinnati, Ohio 45246

513-772-7645

www.hcswcd.org

Separate Test for Each Crop

	Soil Test Results: General Ideal Values								
	pH	Phosphorous (P) lbs./A*	Potassium (K) lbs./A*	Calcium (Ca) lbs./A*	Magnesium (Mg) lbs./A*	Cationic Exchange Capacit C.E.C. meq./100gms	Base Saturation		
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General Ideal Levels	6.2 to 7.5	10 ppm to 90 ppm	60 ppm to 200 ppm	800 ppm Plus	150 ppm to 250 ppm	7 to 10 or higher	40% to 80%	10% to 40%	3% to 5%
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Optimum levels for Most Flowers

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*Optimum levels determined by Michigan State University Soil Testing Lab.