Vegetable Gardening I

2019

Soils, Compost and Cover Crops

Presented by
Harriet Carter, Patrick Lucas, Thomas Bolles

Virginia Cooperative Extension

- Partnership
- Mission
- What we offer in Prince William County
  - Parenting Education
  - Financial Education
  - Nutrition Education
  - 4-H Youth Development
  - Environmental and Natural Resources

Housekeeping

- Evaluations
- **Asking Questions**
- Bathrooms
- Horticulture Helpline: Master_gardener@pwcgov.org or 703-792-7747
- Teaching Garden Blog: teachinggardenpwc.wordpress.com
- Look for us on Facebook at *Teaching Garden: VCE Master Gardeners of PWC*
- Class resources will be uploaded to the Master Gardens of Prince William website: mgpw.org


Nature as a Guide
© Patty Hankins BeautifulFlowerPictures.com

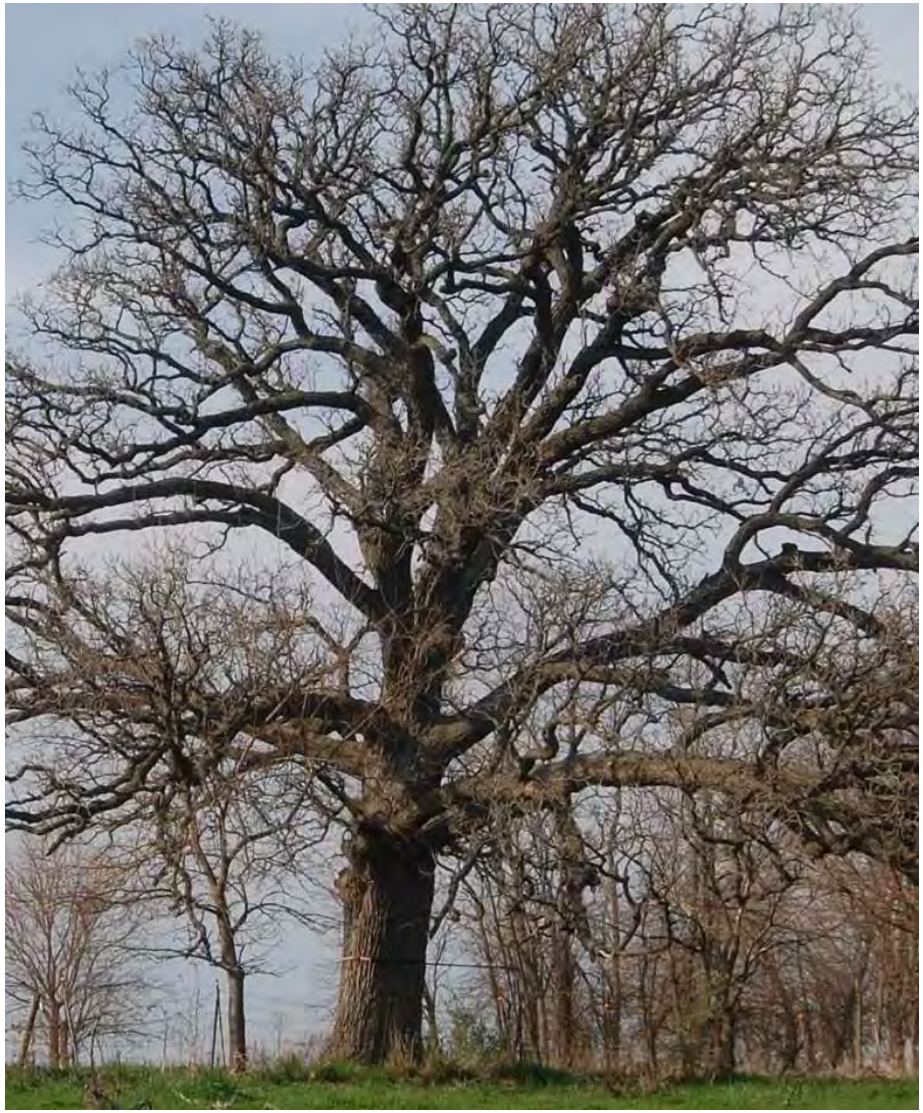
Selecting Your Space

So you want to grow vegetables?

Where do you start?

Ask yourself important questions:

- Suitable Space
- Environment
- Soil/dirt
- Selecting your plants



Don’t survey when trees are bare.

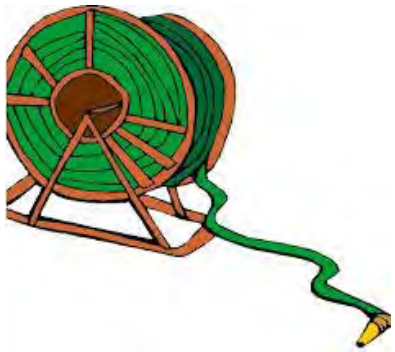
What is in the way?

- Above ground
- Shade, inadequate sunlight
- Under ground
- Roots
- Rocks

811

Know what's **below.**
Call before you dig.

Access to Water



Wildlife in your Space

Planning Your Garden

- Setting your goals
- Select your favorite vegetables
- Who will be part of your team
- Will your existing soil work or will it have to be amended

Setting goals – be conservative

Balconies and containers make great gardens

How to get started- from seeds or from seedlings

Right Plant for the Right Space

- Grow what you would like to eat (or would want your family to eat)
- Start simple and add more every year
- Easy vegetable favorites
- Growing requirements for your favorites

Grow your favorites

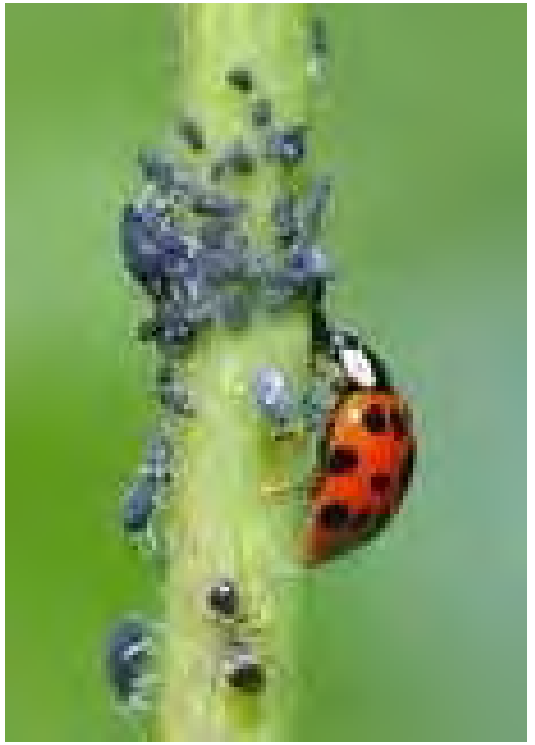
Do You Have a Team?

To Grow or
Not to Grow?

What starts small can grow huge

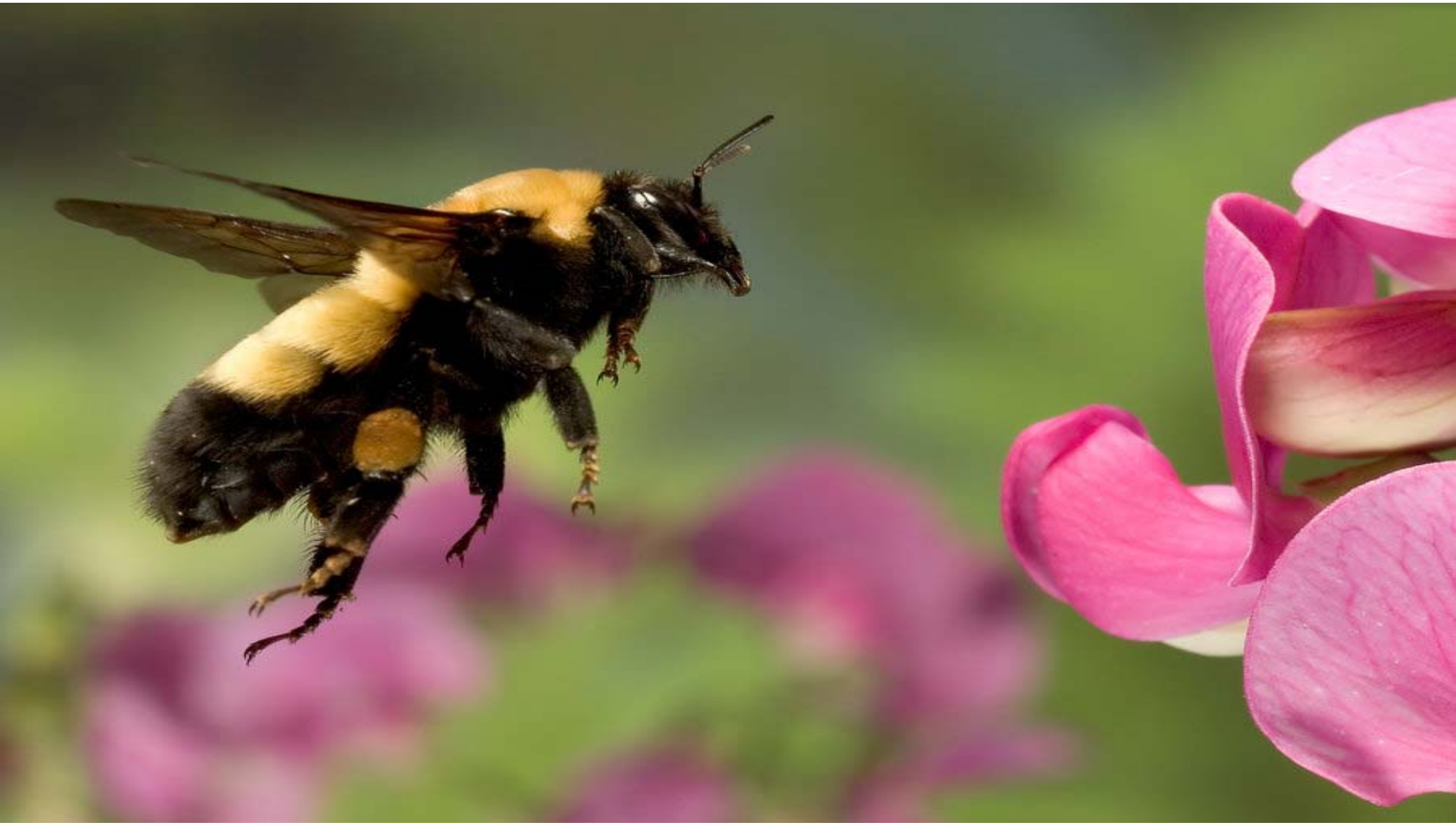
Grow companion plants

Avoid chemicals whenever possible



Work with Nature – *Not Against It*

- Avoid chemicals
- Plant vegetable friends together
- Plant to attract pollinators



Break

Understanding Soil is Job #1

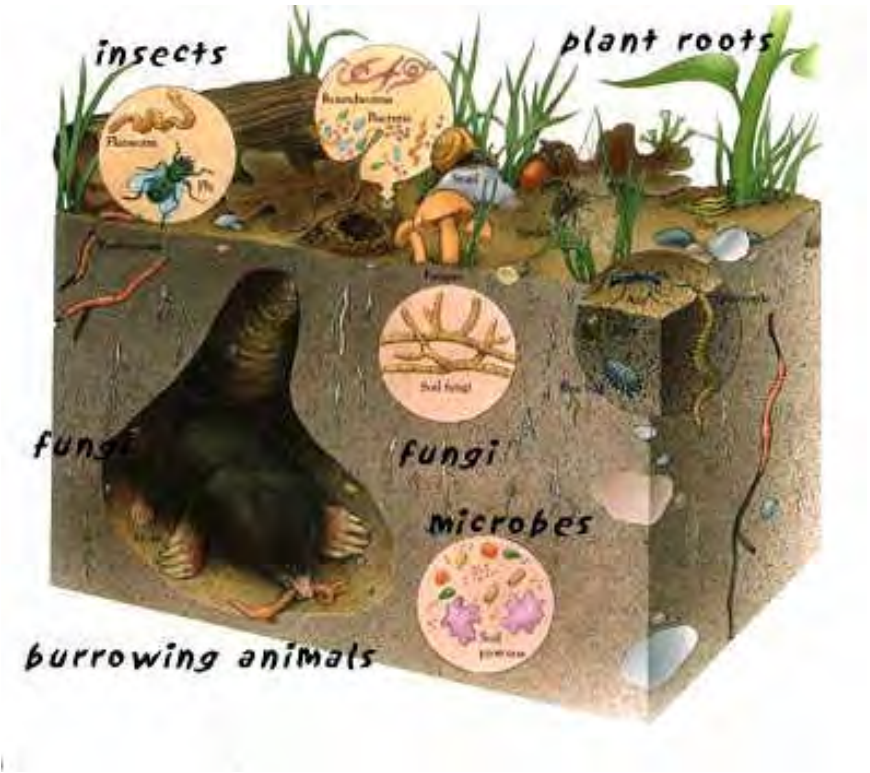
It's all about the soil biology. Our job is to protect and nurture it.

What is Not Soil - Commercial Potting Mix

- Sterile
- May or may not have fertilizer
- Designed for structure, not biology
- Can be a useful tool for starting seeds but not ideal for growing vegetable plants to maturity
- Usually peat based and may also include ground pine bark, coconut husks, perlite, vermiculite and/or sand
- Not a sustainable medium

What is Soil?

Soil is not just dirt, not just a place to plant vegetables



Soil is a community
A complex system of living and non-living things

- **Inorganic**: particles of sand, silt and clay, macro and trace minerals
- **The Micro Herd**: bacteria, algae, fungi, and protozoa
- **The Not So Micro Herd**: Insects, arthropods, mollusks, small mammals
- **Plant roots**
- **Soil organic matter**: humus, decaying plant and animal material

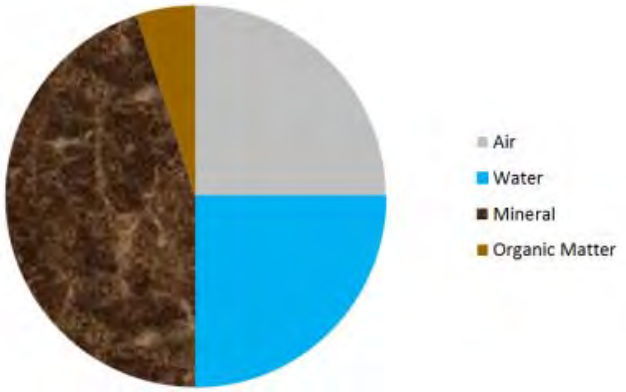
What Makes "Good" Soil?

- High organic matter content
- Good structure – macro and micro pores
- Significant water infiltration
- Significant plant available water
- Good habitat for soil organisms
- Root mass
- Appropriate pH
- Low salinity
- Low in toxic elements
- Balanced fertility – fertilizer is NOT the source of fertility in natural systems

The common thread is that all of these are made possible by a living, biologically active soil.

Ideal Composition of Garden Soil

- **50 % Gasses/Fluids - Pore Space**
  - 20 to 30 % air
  - 20 to 30 % water



- **50 % Soil Solids**
  - 45 % inorganic minerals
    - Sand, clay, silt; good mix is loam
  - 5 % soil organic matter

Microbial Life in One Gram of Soil

Bacteria	3,000,000 to 500,000,000
Actinomycetes	1,000,000 to 20,000,000
Fungi	5,000 to 1,000,000
Yeast	1,000 to 1,000,000
Protozoa	1,000 to 500,000
Algae	1,000 to 500,000
Nematodes	10 to 5,000

1 gram of soil is the approximate weight of a standard paper clip.

"Big guys:" burrowing insects, microarthropods, earthworms

CES, NC State; Soil & Crop Sciences,Texas A&M

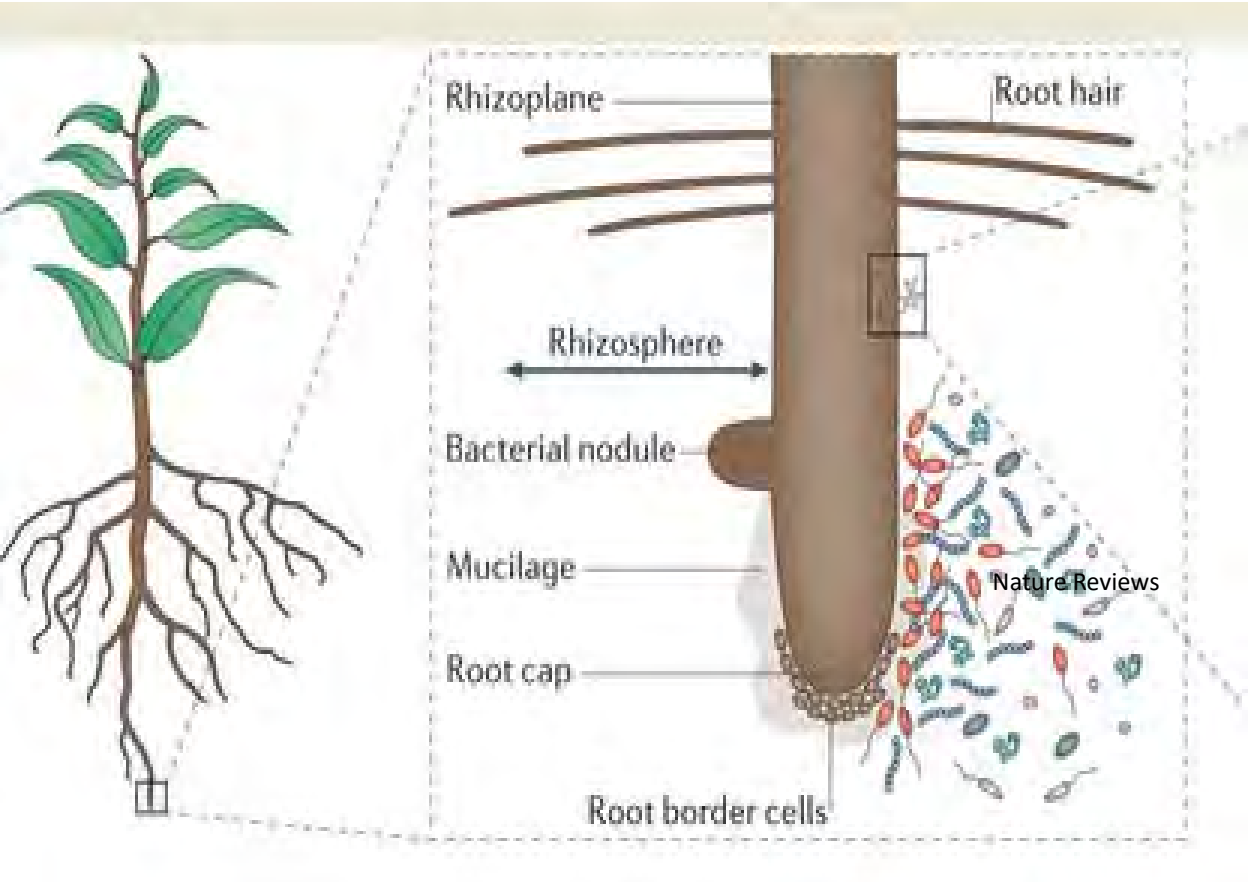
Bacteria

- Preferred by turfgrass, vegetables, and non-native ornamentals
- Mineralize nutrients
- Bacterial slime for soil structure and alkalinity
- Food for other microbes
- Nitrogen fixing bacteria
  - Rhizobia (legumes)
  - Actinomycetes (non-legumes)

Fungi

- Preferred by hardwood trees, most native ornamentals and shrubs, blueberries, and azaleas.
- Powerhouse soil builders
- Decomposers
- Mycorrhizae
- Tend to acidify the soil

The Rhizosphere is the Key

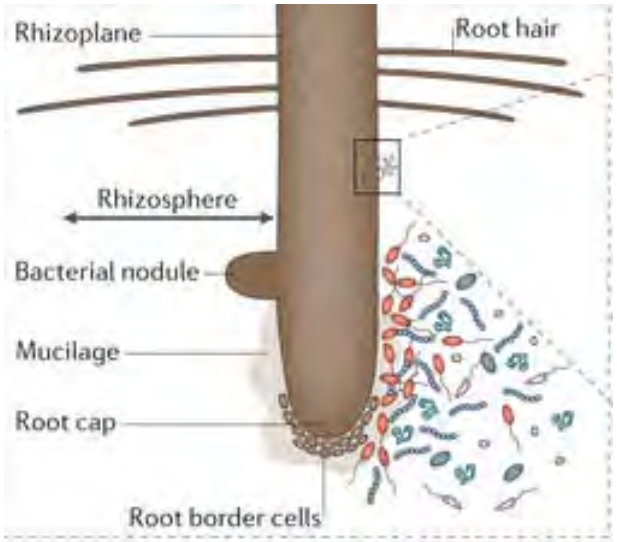


1. Plants make sugars and complex compounds that microbes need.

2. Microbes break down organic material (which plants can't use) into inorganic material (which plants can use).

3. Plants and microbes meet in the rhizosphere to exchange material.

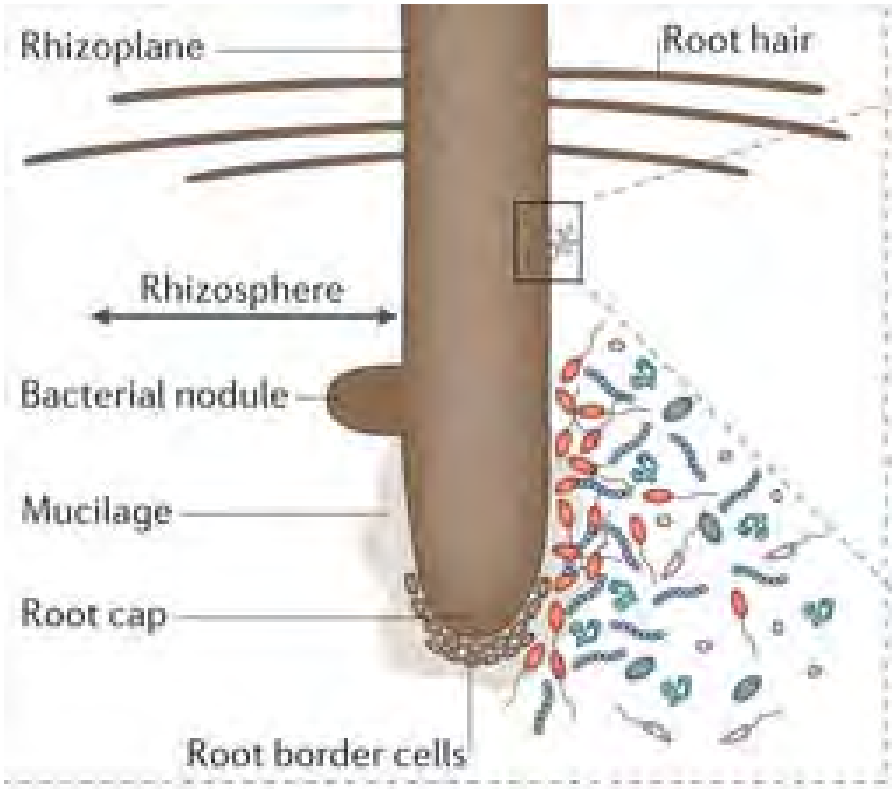
The Rhizosphere



1. Bacteria feed on organic material and sugars provided by plants.
2. Larger microbes eat and excrete the bacteria to form inorganic nutrients.
3. Nutrients delivered to the plant via ionic exchange or mycorrizae.

1. Plants actively manage the rhizosphere. They devote 10-30 percent of their energy (sugar) production to maintaining their microbial colonies.
2. Plants build individually tailored colonies based on their species, variety, and individual needs.
3. Thick colonies of microbes form a barrier that makes it difficult for disease and other undesirable micro-organisms to penetrate to get to the root.
4. **Organic Gardeners** use organic fertilizers and add organic matter which encourage these plant-microbe relationships

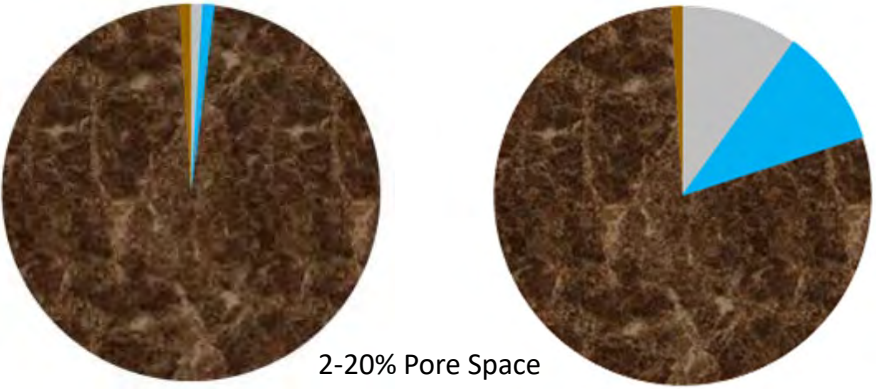
The Rhizosphere



1. **<u>Conventional gardeners</u>** use inorganic fertilizers to feed the plant directly.
2. Plants don't need to give sugars to microbes so the plants grow larger and faster.
3. But, microbial colonies die out, leaving pests easier access to the roots and the plant entirely dependent on the gardener for nutrient and water needs.
4. Conventional gardeners should apply inorganic fertilizers according to label instructions, replenish microbial communities with compost and employ good gardening practices.

Typical Unimproved Soil

- Mix of grass and weeds
- Heavily compacted
- Minerals there but not available
- Soil organic matter is less that 1 percent
- Little to no sign of earthworms or other life
- **Favors anaerobic conditions**
- Most water runs off, not in



2-20% Pore Space

Ways to Inhibit Healthy Soil

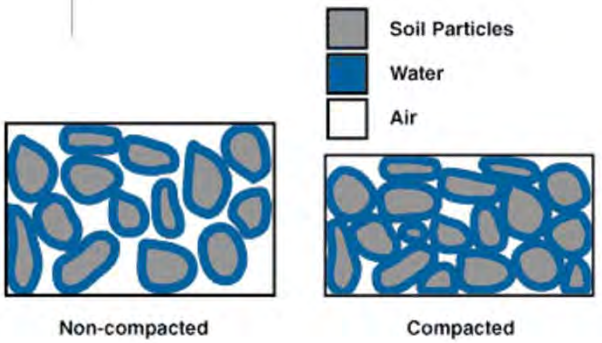
- Working Wet Soil
  - Destroys soil structure
  - Causes compaction
  - Restricts Root Growth
- To Test
  - Form a handful of soil into a ball
  - If it retains its shape with light pressure, delay soil tillage until the water content diminishes
  - If the ball crumbles when pressed with your thumb, it is ready to work

Ways to Inhibit Healthy Soil

- Soil compaction
  - Limits root growth
  - Limits space for water
  - Reduces space for soil organisms to live
  - Reduces oxygen in the soil which is needed by roots and beneficials
  - Limits water infiltration

Compacted

Not Compacted



This is what happens when water can’t infiltrate

- This is a field in Arkansas that has to be irrigated to produce crops even though Arkansas gets 55 inches of rain annually
- Why?

Photo: Ray Archeleta, USDA, NRCS

Ways to Inhibit Healthy Soil

- Tillage
  - Destroys soil structure
  - Disrupts/Kills soil organisms
  - Brings weed seeds to the surface
  - Sometimes tillage is necessary - use minimally and cautiously

←Tilled soil, powdery

Compacts and erodes easily, decreases infiltration

←No-Till soil, aggregated

Resists compaction, increased water infiltration

- **Tillage when preparing a new bed**
  - Use this opportunity to add organic matter

← More damaging

Less damaging →

Conventional Plowing

Rototilling

Double Digging

Lasagna Gardening/
Sheet Mulching

Remove Turf

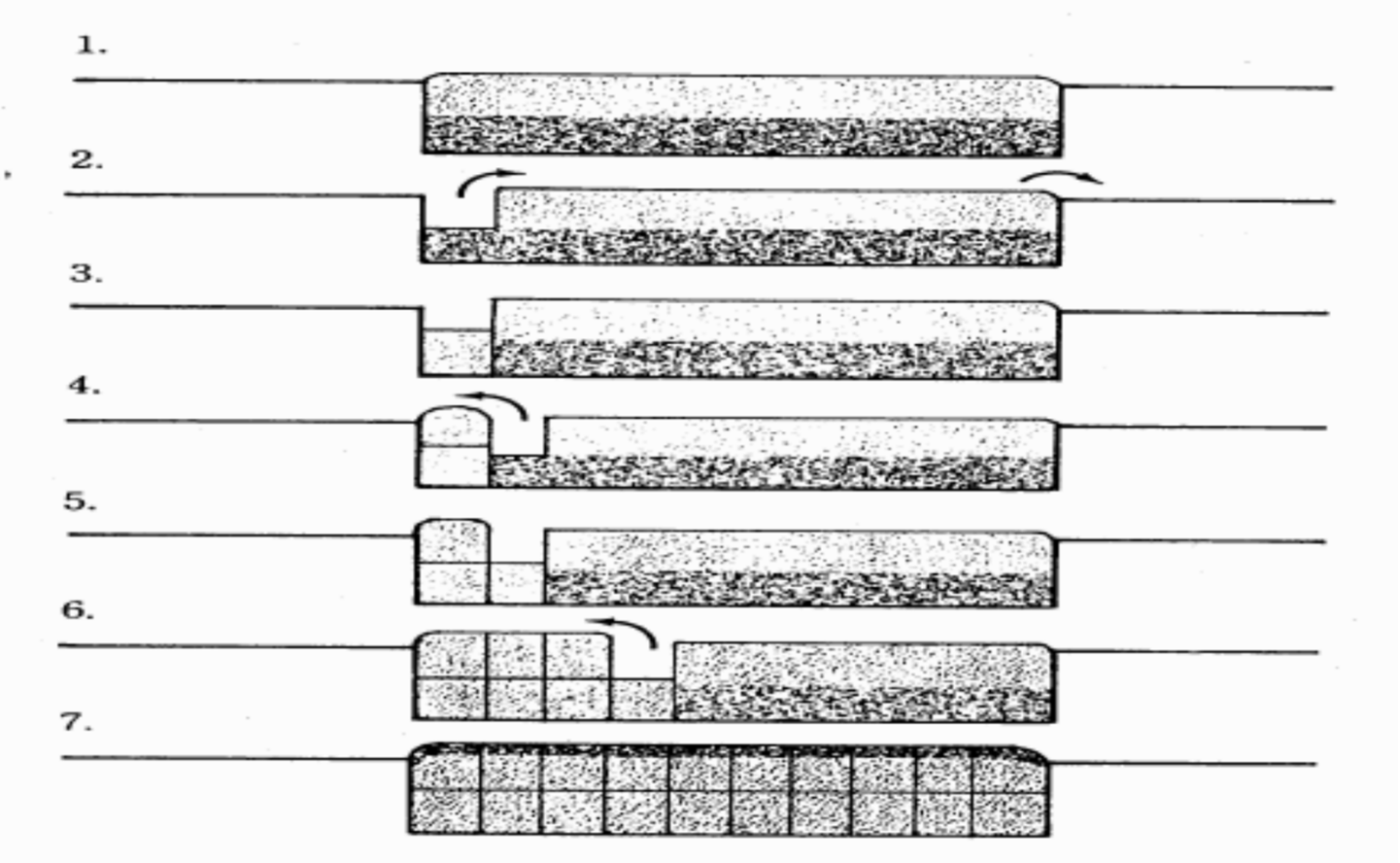
Dig Trench

Loosen Trench

Amend Trench

Fill Trench

Double Digging



Mulch or Compost with Cover Crop

Brown Layer shredded leaves, paper, etc.

Green Layer – grass clippings, vegetable scraps, etc.

Brown Layer shredded leaves, paper, etc.

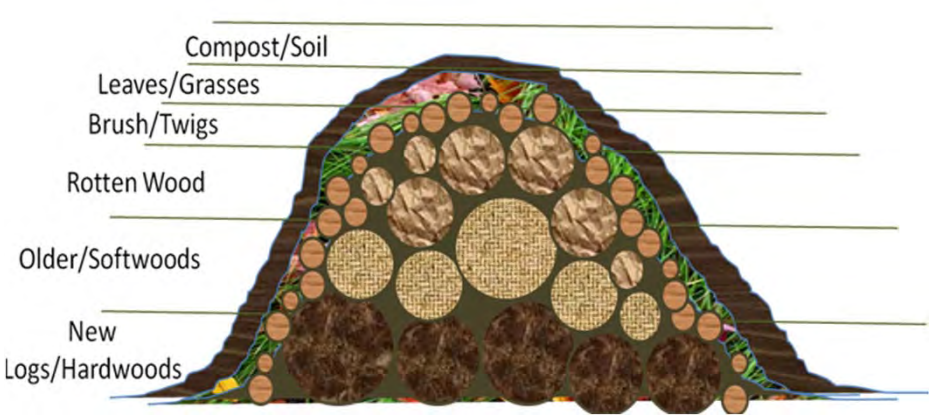
Green Layer – grass clippings, vegetable scraps, etc.

Brown Layer shredded leaves, paper, etc.

Green Layer – grass clippings, vegetable scraps, etc.

Cardboard

Time Stacking with Hugelkulture




3 Green, 2 Brown
3 Green, 3 Brown
3 Green, 3 Brown,
Compost + Cover Crop

Slide 49

BT1 Bolles, Thomas, 11/27/2017

- **Tillage and existing beds**
  - Use this opportunity to replenish organic matter

Rototilling

Strip Tilling

No Till-Drill/Minimal Disturbance

← More damaging

Less damaging →

Ways to Inhibit the Soil Health

- Bare Ground
  - Increases soil loss to wind and water erosion
  - Reduces benefical microbial activity (25-45% of carbohydrates a plant makes goes to feeding soil microbes)
  - Reduces organic matter in the soil
    - 2/3^{rds} of soil organic matter input comes from roots
    - Exposed soil organic matter is lost to opportunist bacteria
  - Without plants capturing sunlight, the energy is “lost” and never enters the system
  - Encourages nutrient losses

Ways to Inhibit Soil Health

- Pesticides (insecticides, fungicides, etc.)
  - Kill beneficial organisms
  - Can add salt

- Inorganic fertilizer
  - Adds salt
  - Can affect pH
  - Makes plants dependent on fertilizer by retarding natural nutrient cycling
  - 90% of nutrient cycling is **biological!**

Soil Chemistry in a Nutshell

- In a functioning ecosystem, the plants thrive in soil without outside fertilizer inputs
- **Nitrogen** – green growth, protein
- **Phosphorous** – root growth
- **Potassium** – plant health, tolerance of extremes
- The amount of these needed depends on the plant, production intensity and growing conditions
- Adding excessive nutrients can be detrimental to plant health and water quality

Soil Chemistry in a Nutshell

- **It doesn't matter what nutrients are in the soil, if the pH is off those nutrients can be locked up in non-available forms**
- pH is a measure of acidity/alkalinity
- Most soils in our area are in the 4.0-5.5 range
- Most vegetables prefer a soil pH in the 6-6.5 range
- Test your soil for pH regularly (every 3 years) through a lab
- If you have questions about taking a soil test or interpreting a soil test report, call the extension office

Fertilizer

- “Organic” fertilizers
  - Plant by-products (cotton seed meal)
  - Animal by-products (blood meal)
  - Minerals (rock phosphate)
- Synthetic fertilizers
  - Chemically derived products (MiracleGro)
  - Usually are in the form of salt
  - Can shift the pH
- Organic vs Synthetic
  - 90% of nutrient cycling is biological
  - Almost all N taken up by plants is in the form of nitrate (NO_3)

Choosing Fertilizer

- All fertilizers have a “Guaranteed Analysis” more detail but we’re mostly concerned with the ‘Big 3’ on the label (N-P-K)
  - %Nitrogen-%Phosphorous-%Potassium by weight
  - 0.36 lbs. N in the blood meal

NET WEIGHT 25 LBS (11.33 kg)

Garden-tone

4-6-6

GUARANTEED ANALYSIS

Total Nitrogen (N)	4.0%	Boron (B)	0.02%
2.5% Ammoniacal Nitrogen		Chlorine (Cl)	0.1%
0.3% Other Water Soluble Nitrogen		Cobalt (Co)	0.0005%
1.2% Water Insoluble Nitrogen		Total Copper (Cu)	0.05%
Available Phosphate (P_2O_5)	6.0%	Total Iron (Fe)	1.0%
Soluble Potash (K_2O)	6.0%	Total Manganese (Mn)	0.05%
Calcium (Ca)	3.0%	0.01% Water Soluble Manganese (Mn)	
Total Magnesium (Mg)	0.5%	Molybdenum (Mo)	0.0005%
0.3% Water Soluble Magnesium (Mg)		Sodium (Na)	0.1%
Sulfur (S)	5.0%	Total Zinc (Zn)	0.05%
5.0% Combined Sulfur (S)			

Derived from: Dehydrated Manure, Feather Meal, Crab Meal, Cocoa Meal, Corn Gluten, Bone Meal, Cottonseed Meal, Dried Blood, Sunflower Meal, Kelp Meal, Alfalfa Meal, GreenSand, Rock Phosphate, Sulfate of Potash, Sulfate of Potash Magnesia, Humates, Ammonium Sulfate, and Triple Super Phosphate.

Choosing Fertilizer

- Using organic fertilizers
  - Select products that have a nutrient analysis
  - Most options are slow release
  - Have few, if any salts
  - Microbe friendly
  - Available is several forms

Choosing Fertilizer

- Organic Fertilizers to Avoid
  - Raw Manure
  - Composted manure that are **not** fully composted and cured
    - Composed manures should cure for 2-4 months before use on edibles
  - Bio-Solids that are **not** “Class A, Exceptional Quality”

- Potential Issues with Manure-Based Products
  - Too “hot” – will burn plants
  - Pathogens
  - Weed seeds
  - Herbicide residue
  - Odor

Okay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A Specialty Fertilizer Rich in Organic Matter
For all landscaping, garden and potting applications.
GOOD SOIL.®
BETTER EARTH.


IRON RICH
SLOW-RELEASE
Milorganite
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ABUNDANT GARDENS
TRUSTED FOR OVER 90 YEARS


BLOOM GOOD SOIL.® BETTER EARTH.
Now Available in PA, VA, MD and DC!
Source of Organic Matter and Nutrients
Bloom® is a rich soil conditioner ideal for improving water holding capacity and overall soil structure. It is also an excellent source of both macro and micronutrients, essential in improving plant vigor.
Why Use Bloom®?
• Nutrient-rich soil conditioner
• Excellent source of organic matter
• Provides slow-releasing nitrogen
• Provides iron for darker grass and green leaves
• Weed seed free
• Cost-effective
Price (BULK DISCOUNTS AVAILABLE)
Pickup ..... $3.50 per cubic yard
Delivery ..... $3.50 per cubic yard plus an extra $4.00 per load per one-way mile
Pickup Details
Truck Size ... Any size truck up to tractor trailer, loaded via overhead crane
Location ..... 5000 Overlook Avenue SW Washington DC 20032
NUTRIENT ANALYSIS
Bloom 1.5-1.5-0 guaranteed analysis
Total Nitrogen (N) 1.5%
1.25% water insoluble nitrogen
0.25% water soluble nitrogen
Available Phosphate (P_2O_5) 1.5%
Calcium (Ca) 1%
Iron (Fe) 2%
A recycled product made from EPA-certified Class A Exceptional Quality biosolids
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BLACK GOLD COMPOST COMPANY

No Way

Choosing Fertilizer

- Synthetic fertilizers
  - Are salts
  - Highly water soluble
  - Nitrogen is mostly in quick-release form
  - Some coated products mitigate solubility and release rate
- Plants can only take up N as nitrate (NO_3) or ammonia (NH_4)
  - Regardless of source, organic or synthetic, most N is converted to nitrate by biological action before being taken up by plants
- Excessive N in plant tissues ↑ pests

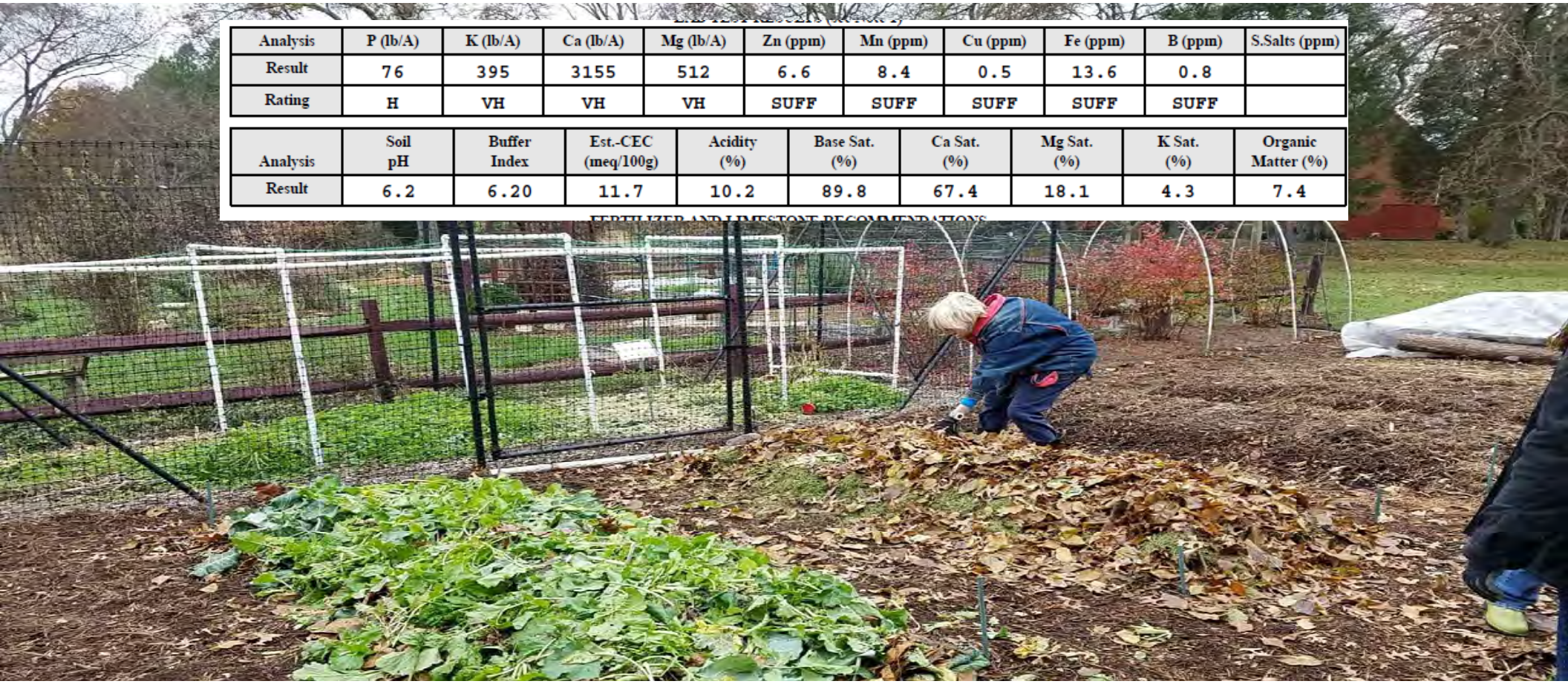
Fertilizer

- The more biologically active the soil, the less fertilizer you will need to add
- Soil test new beds to see where you might be deficient
- Regular soil testing of existing beds will help you monitor your soil chemistry and usually will help get ahead of potential nutrient issues


Virginia Cooperative Extension

Virginia Tech
Soil Testing Laboratory
PUBLICATION 452-125

Soil Sample Information Sheet for
Home Lawns, Gardens, Fruits, and Ornamentals



Analysis	P (lb/A)	K (lb/A)	Ca (lb/A)	Mg (lb/A)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)	B (ppm)	S.Salts (ppm)
Result	76	395	3155	512	6.6	8.4	0.5	13.6	0.8	
Rating	H	VH	VH	VH	SUFF	SUFF	SUFF	SUFF	SUFF	

Analysis	Soil pH	Buffer Index	Est.-CEC (meq/100g)	Acidity (%)	Base Sat. (%)	Ca Sat. (%)	Mg Sat. (%)	K Sat. (%)	Organic Matter (%)
Result	6.2	6.20	11.7	10.2	89.8	67.4	18.1	4.3	7.4

One reason to add fertilizer is an obvious <u>nutrient deficiency</u>.

We thought we had enough baseline nutrition and had added enough organic matter in our beds, but…

Soil tests don’t test for nitrogen.

We thought we added the same amount of organic matter in the same ratio of green and brown material to all our new beds.

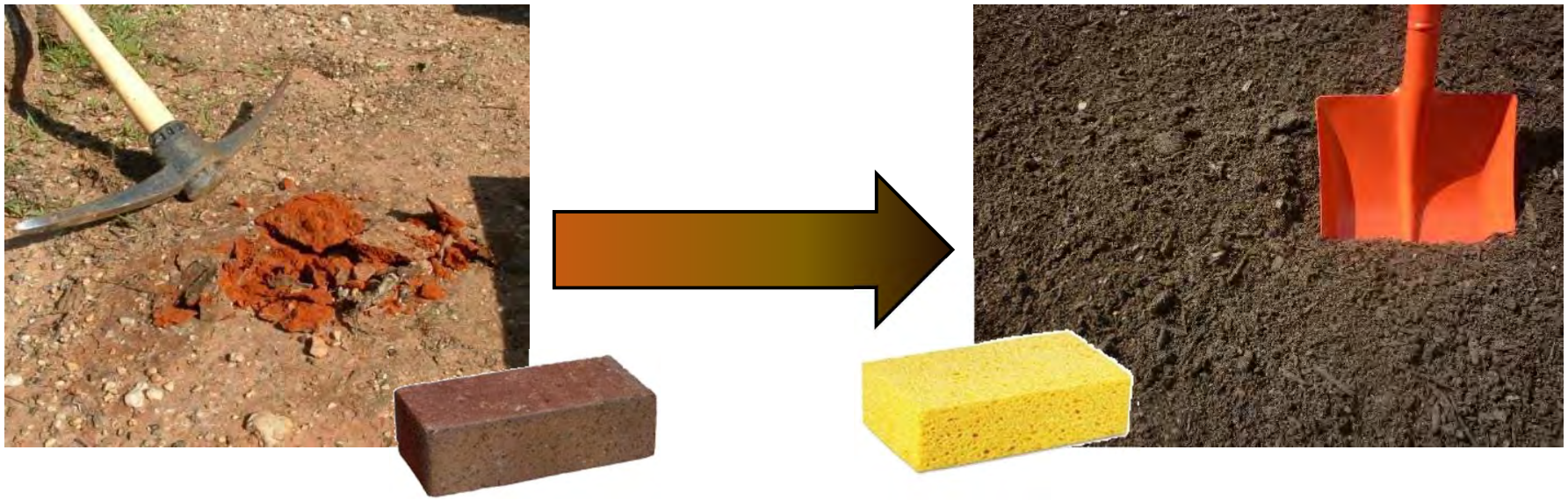
5 weeks after blood meal was applied, Bed 5 has made up a lot of growth, but is still less mature than Bed 4

Heavy nitrogen feeders can sometimes benefit from fertilizer even in good soils, but the timing needs to be right to ensure higher yield, not excessive green growth.

Break

Soil Building: Turning Brick into Sponge

- Improve Your Soil by:
  - Reducing Disturbance – physical and chemical
  - Mixing Plant Species
  - Covering the Soil
  - Maximizing Living Roots



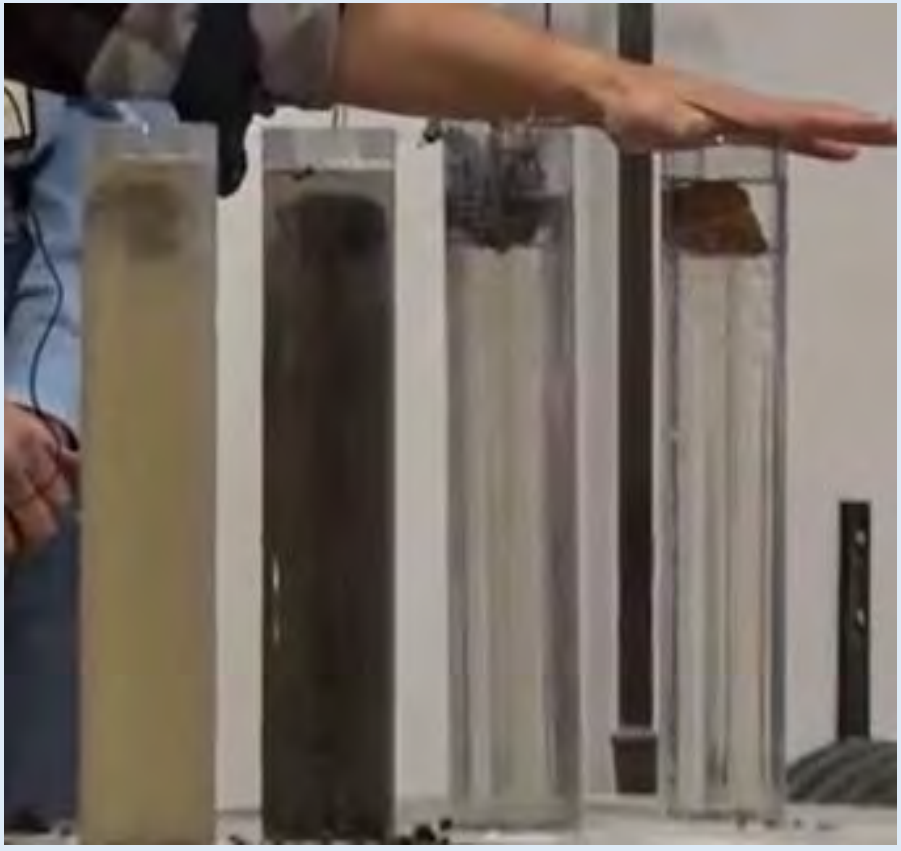
Recommended Practices

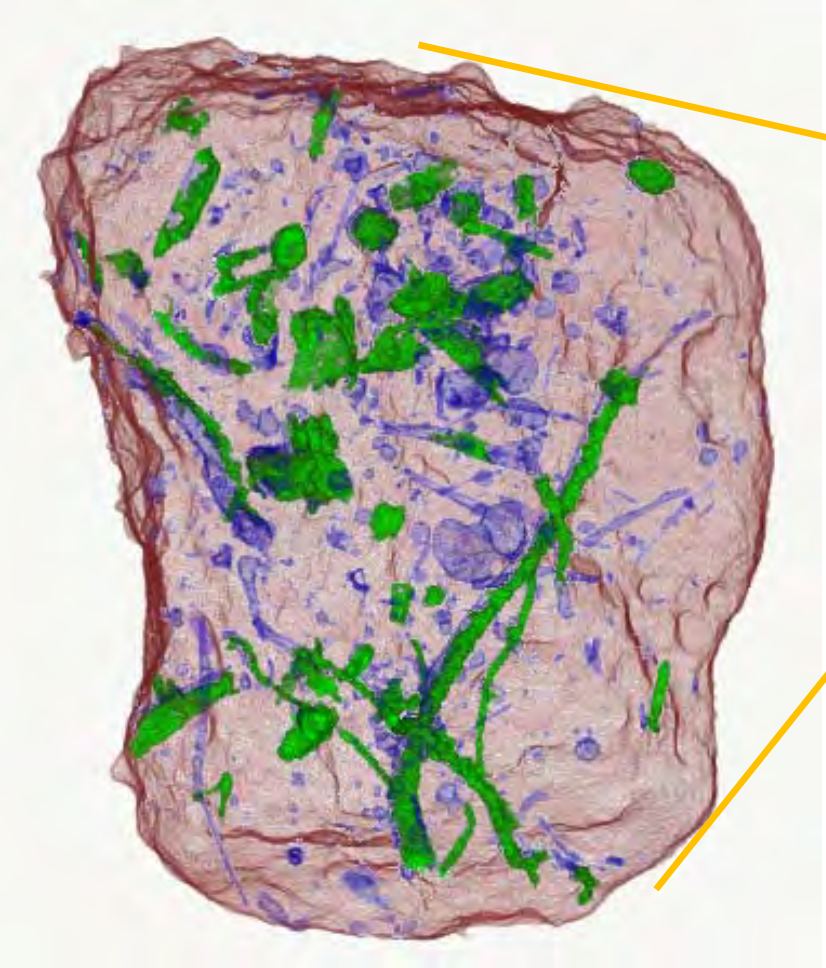
- Periodically test and amend the soil as needed
  - Soil test every 3-4 years
  - If you don't understand it, extension staff will go over it with you

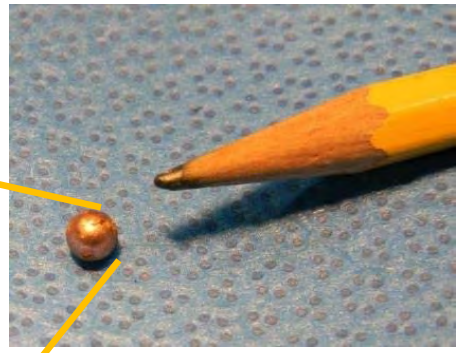
- Look at your soil:
  - Can you easily penetrate the soil to 8 inches?
  - How quickly does water infiltrate?
  - How many animal species can you find?
  - Are there many fine roots throughout the root zone?
  - Is the soil friable (readily breaks into 1 cm crumbs)?
  - Will soil aggregates remain intact when swirled in water?
  - Are you getting appropriate vegetative coverage?

March Photo Wheat/Crimson Clover Field from 2018 King's AgriSeed Calendar

Biology Effects Soil Structure





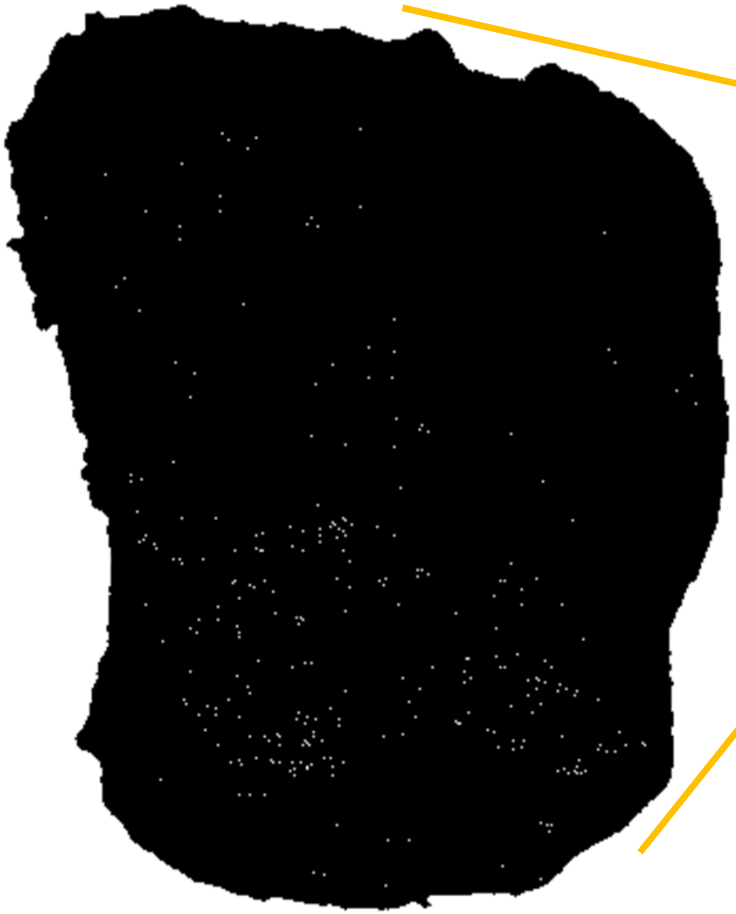


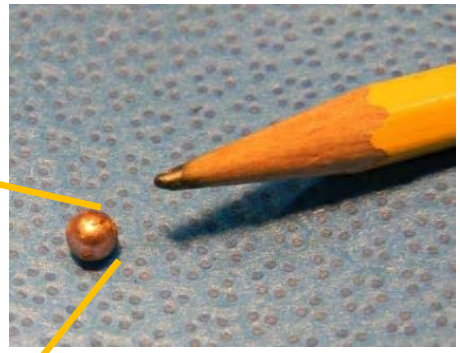
This c. 5-6 mm sized aggregate is from an organically managed soil with the use of cover crops. Intra-aggregate pores are in blue and particulate organic matter is green.

This is biologically active.

This structure helps hold the soil against compaction.

Aggregate Picture Courtesy of Dr. Sasha Kravchenki, Michigan State University from the Article "A Tale of two (Soil) Cities", by Susan Fisk, The American Society of Agronomy, https://www.agronomy.org/science-news/tale-two-soil-cities, 2015.



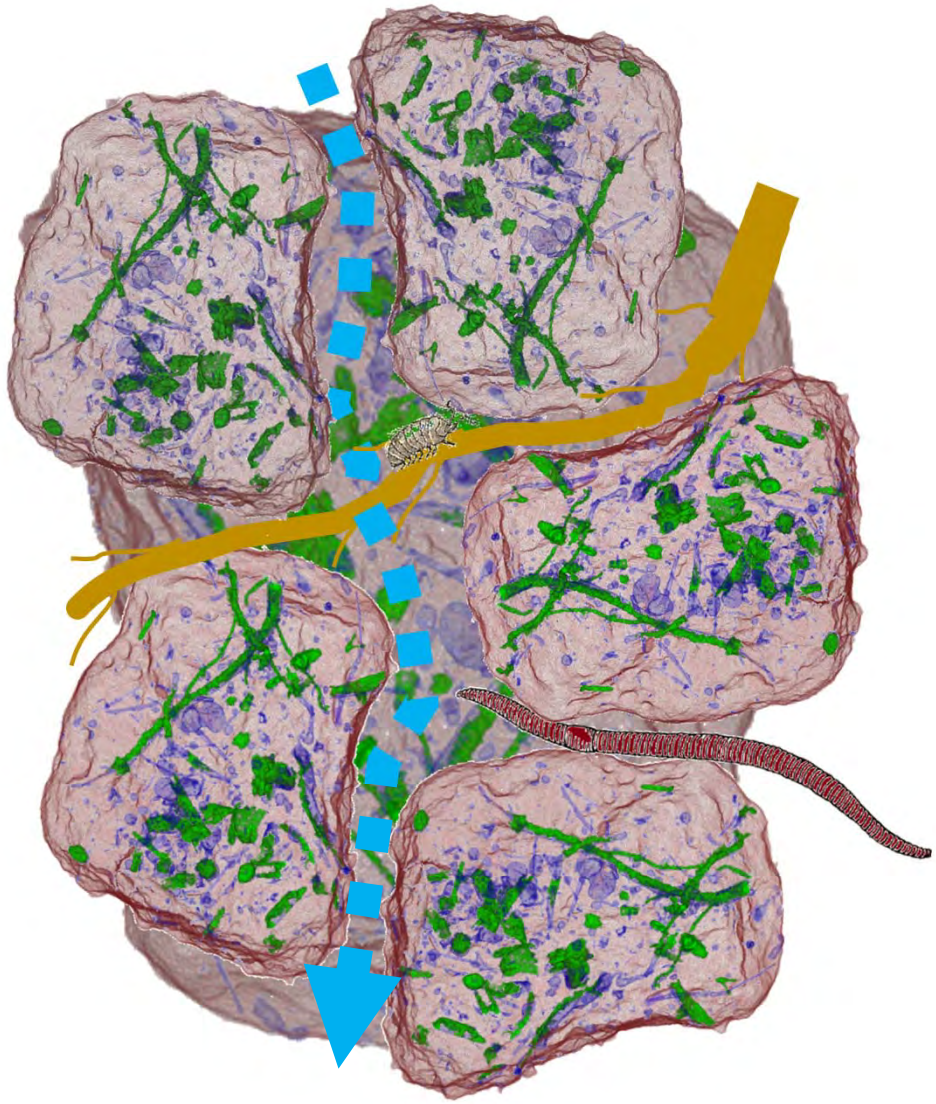


This c. 5-6 mm sized aggregate from a heavily worked/compacted soil

The voids are filled with air and some water. Air doesn't hold much weight.

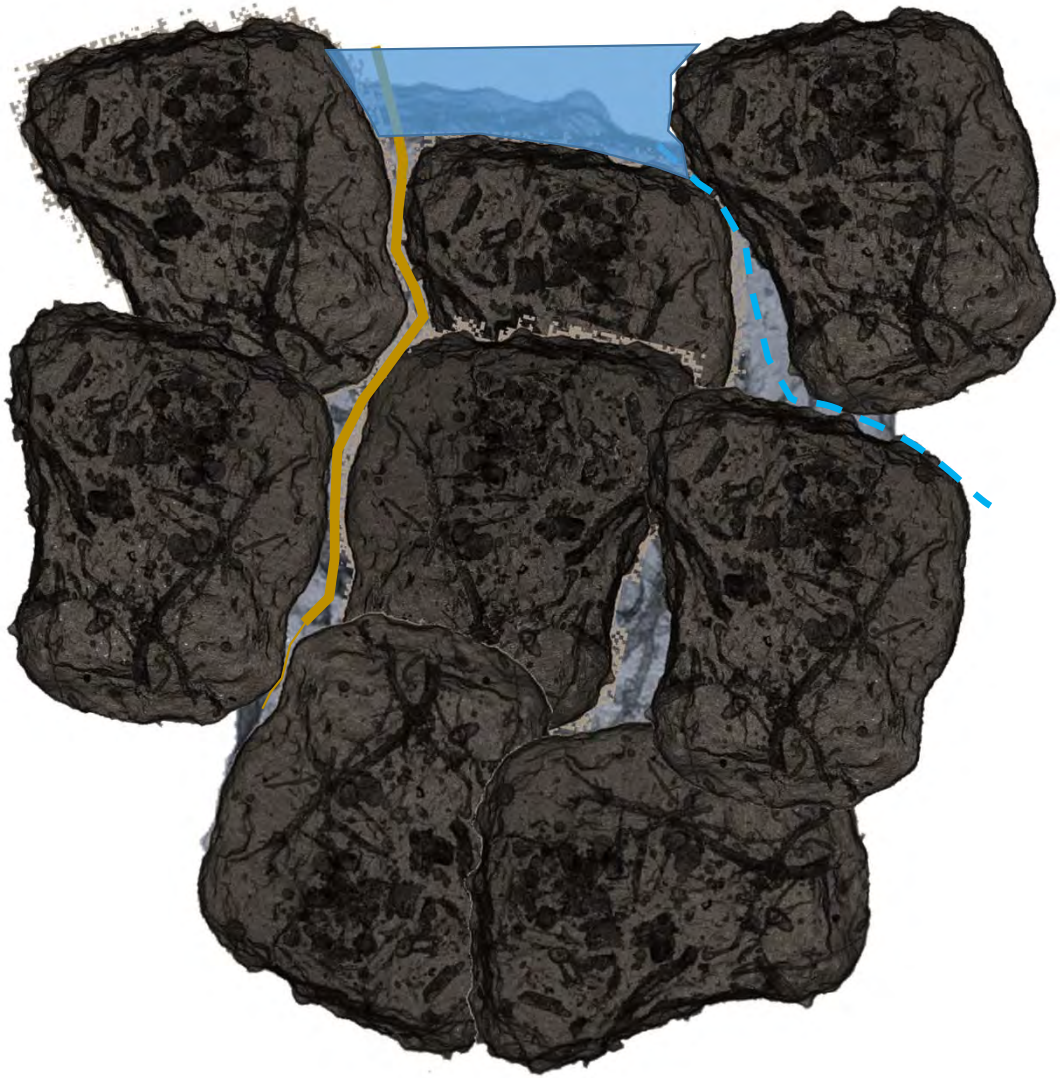
Without the biologic glues, it breaks apart easily under physical pressure and in water.

Aggregate Picture Courtesy of Dr. Sasha Kravchenki, Michigan State University from the Article "A Tale of two (Soil) Cities", by Susan Fisk, The American Society of Agronomy, https://www.agronomy.org/science-news/tale-two-soil-cities, 2015.



Soil organisms use organic matter as food and secrete glues to turn small aggregates together to make clods. The space between aggregates in a clod (macro pores) allows for

- Gas exchange – most of the beneficials are aerobic
- Water infiltration
- Space for roots to grow
- Habitat for soil organisms
- Biological glues are hydrophobic and help keep water from destroying the structure



Without glues, soil particles compact on each other:

- restricts root penetration and root access to phosphorous
- reduces space for water and gas exchange
- reduces infiltration
- reduces capacity of soil to hold nutrients
- limits pathways for invertebrates
- creates voids cut off from air and water.

Less air means less beneficial microbes

The more biologically active the soil, the healthier the soil

Soil Health

It's All About the BIOLOGY

Support the **Soil Ecosystem** and It will Control Most Problems

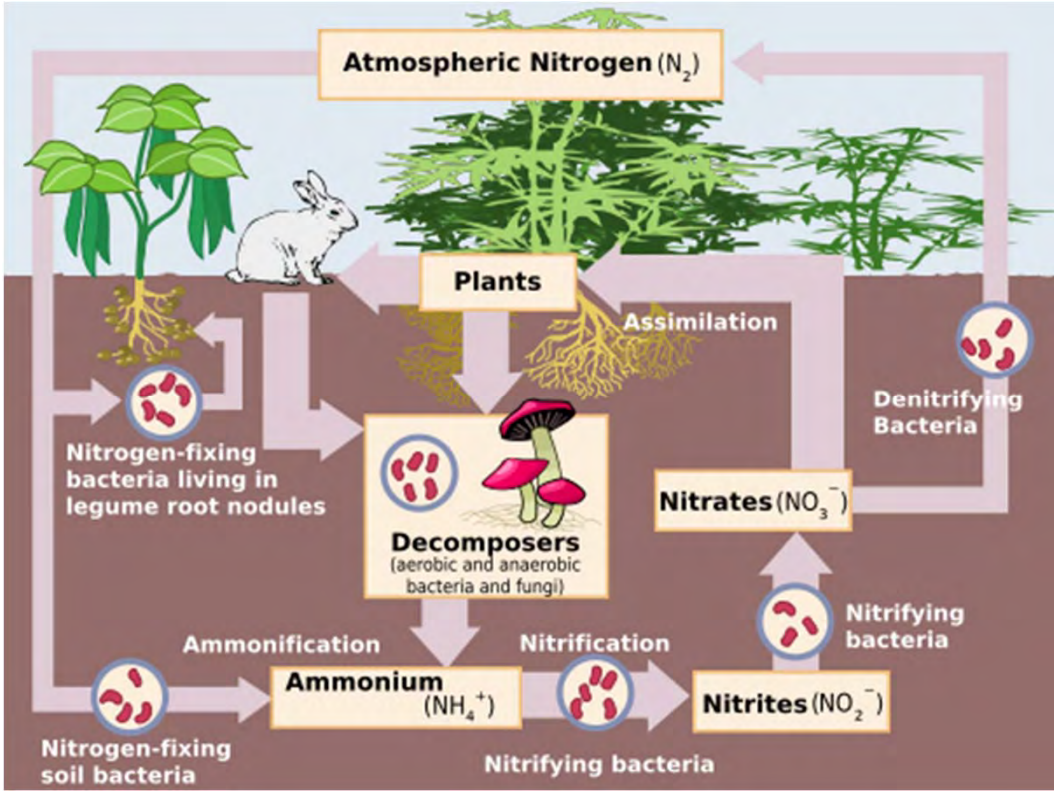
The More We can **Mimic Nature**, the Better our Plants Grow

Regularly Amend the Soil with Organic Matter

- Amend with compost
  - 200 lbs. per 100 sf at establishment
  - 50-100 lbs. per 100 sf annually
  - 5 gallon bucket ≈ 20 lbs. of compost
- Add compost whenever you till
- About 2/3^{rds} of the organic matter naturally added to soil comes from plant roots so keep living roots in the soil year round
- Adding raw (non-composted) organic matter *can* be a problem
  - Plant matter added into the soil can sometimes temporarily pull nitrogen from the system
  - Raw manures and immature composted manures can be tricky to apply

Regularly Amend the Soil with Organic Matter

- Compost has some nutrients but it is not fertilizer
- Provides carbon (=energy) for soil organisms
- In a healthy soil ecosystem, fertilizer is rarely needed because soil organisms have the energy to cycle nutrients
- Helps retain moisture in the soil



Irrigate as needed to maintain moisture

- Consistent watering is key
  - Fruiting veg need more water at flowering, fruiting and seed set
  - Leafy greens are drought sensitive throughout their growing season
  - Heading veg need more water when heading
  - Root crops are most sensitive when roots/tubers begin to enlarge
  - Too much water can cause problems like blossom end rot
  - Frequent, light watering reduces root growth and drought tolerance
- Water the base of the plant to reduce disease pressure
- Water early in the morning (6-10 am)
- Mulch to help retain soil moisture

Containers/pots and raised beds heat up more quickly than in-ground beds so there is greater water loss.

← Water More Frequently

Water Less Frequently →

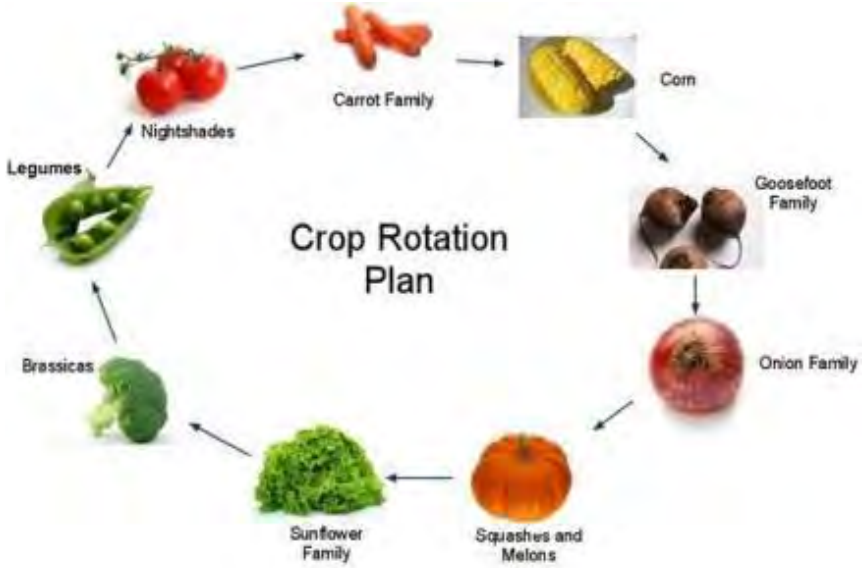
Pots/Containers

Raised Beds

In-Ground Beds

- Avoid walking in/on garden beds
  - Use permanent paths to keep compaction out of the garden

- Minimize tillage and till properly to avoid compaction



- Rotate crops; companion plant; right plant, right place (More on this in Vegetable Gardening II)

- Keep the garden covered:
  - Mulches
    - Straw, wood-based
    - Plastics don't allow infiltration
  - Succession planting (more in Vegetable Gardening II)
  - Cover crops

Cover Crops

- Act as armor to protect the soil
- Act as a reservoirs for nutrients
- Add nutrients
- Concentrate nutrients
- Suppress pests
- Improve soil structure
- Insulate the soil
- Keep microbes more active throughout the year

Cereal Rye – Spring 2015

Cover Crops

- The sun puts energy into the garden all year long.

- **It's All About the Biology** – Cover Crops will:
  - Support the soil ecosystem throughout the year and foster the symbiotic relationships between plants and microbes
  - Build soil throughout the year
  - Protect nutrients from leaching and/or washing away
  - Add nutrients to the soil

Cover Crops

- Start simple
  - Any crop can be a cover crop
  - Single species are often easier for beginners
- Different plant families bring different things to the soil
  - Legumes add more N when ground with grasses
- Multiple species means feeding the system throughout the soil profile
  - More plant species = more soil species = more balanced ecosystem
  - Can be more of an art than a science dealing with mixes

Some Cool Season Cover Crops

Cover	Use	
• Barley	Scavenge N	Low biomass
• Cereal Rye	Scavenge N	Flexible
• Crimson Clover	Adds N	Pollinator friendly
• Daikon Radish	Concentrates nutrients, breaks up clay	Winter kills
• Oats	Scavenge N	Usually winter kills
• Vetch	Adds N	Hairy or Common - Not Crown; Pollinator friendly; Extrafloral nectararies

Some Warm Season Cover Crops

Cover	Use	
• Buckwheat	Scavenge N, Adds P	Pollinator friendly; Really a cool season plant but excellent short period summer cover
• Sorghum	Scavenge N	
• Sunflower	Scavenge N	Pollinator friendly
• Sunn Hemp	Adds N	
• Various Flowers	Scavenge N	Pollinator friendly

Cereal Rye ↑ Crimson Clover ↓

Daikon/Forage/Tillage Radish ↑

Vetch ↑ Buckwheat ↓

7-Way Mix – October 2015 (Planted September 2015)

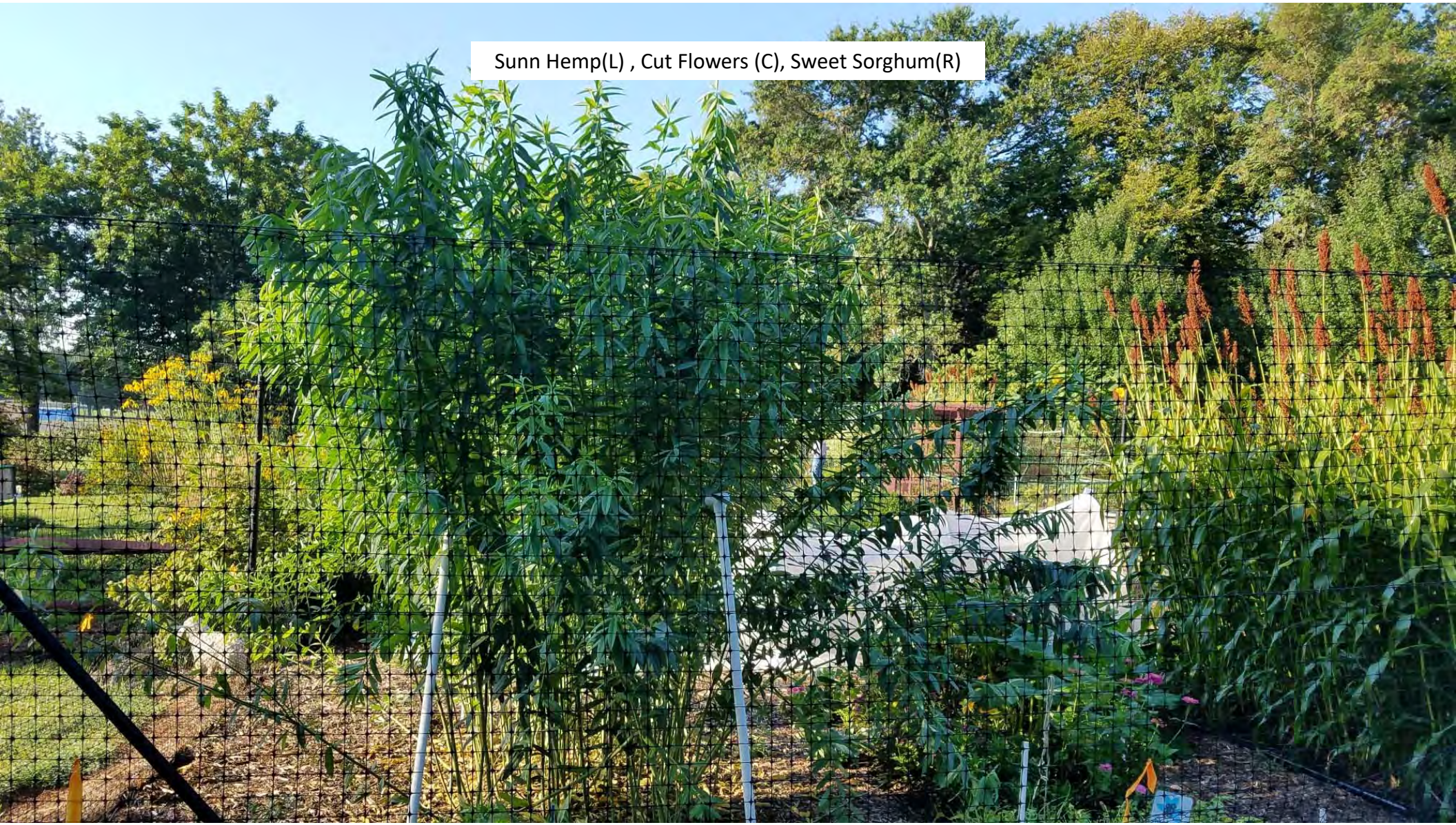
Crimson and Red Clovers

Daikon Radish and Dill

3-Way Mix of Crimson Clover, Daikon Radish and Hairy Vetch

Cereal Rye-Crimson Clover Mix
[2/4/19]

Crimson Clover – Common Vetch Mix
[2/4/19]


Sunn Hemp(L) , Cut Flowers (C), Sweet Sorghum(R)

Sweet Sorghum(L) , Sweet Sorghum (C), Mammoth Sunflower (R), Cut Flowers (far R)

Sweet Sorghum(L) , Mammoth Sunflower (R)

Mammoth Sunflower over sown with Cereal Rye and Crimson Clover

What to do with Cover Crop

- Turning the cover crop under
  - Kills crop and returns organic matter/nutrients to the soil
  - Need to wait 2 weeks to replant
  - Can bring weed seeds to surface
  - Moves residues from surface to subsurface, less O2 = much slower nutrient break down
- Mowing
  - Crop termination depends on stage of growth
  - Residue can be left on the soil or taken and dried for straw
  - Young plants can be mowed and covered in plastic to kill

Mowing rye w/ string trimmer (L) or a clover mix with a mower (R)

Hand turning vetch

Rototilling rye


Nitrogen-Filled Nodules on the Roots

Managing Cereal Rye to follow with spring crops (L) and summer crops (R)



What to do with Cover Crop

- Winter Kill
  - Allow nature to kill the crop for you and allow the residues to return nutrients to the soil
  - Some crops reliably winter kill in some areas, but not in others

← Late Summer/Fall

Freeze Kill – Early Feb (L), Early Spring – March (R)

[07/31/18]

Post-Storm [09/11/2018]

Cutback [09/11/2018]
Over Sown with Common Vetch

Regrowth [10/02/2018]

Frost Damage [10/30/18]

Freeze Killed [12/10/18]

Common Vetch Growing Through
Freeze Killed Sorghum [Winter 2018-19]

Common Vetch Growing Through
Freeze Killed Sorghum [12/10/18]

Cover Crop Residues

- Retain soil moisture
- Keep soil cooler in the summer
- Protect soil from high intensity storm events
- Suppresses weeds
- Provide habitat for beneficials
- Breaks down and returns nutrients and organic matter to the soil

Field with rye residue after a 3” rain event slowing the rate of runoff and holding the soil

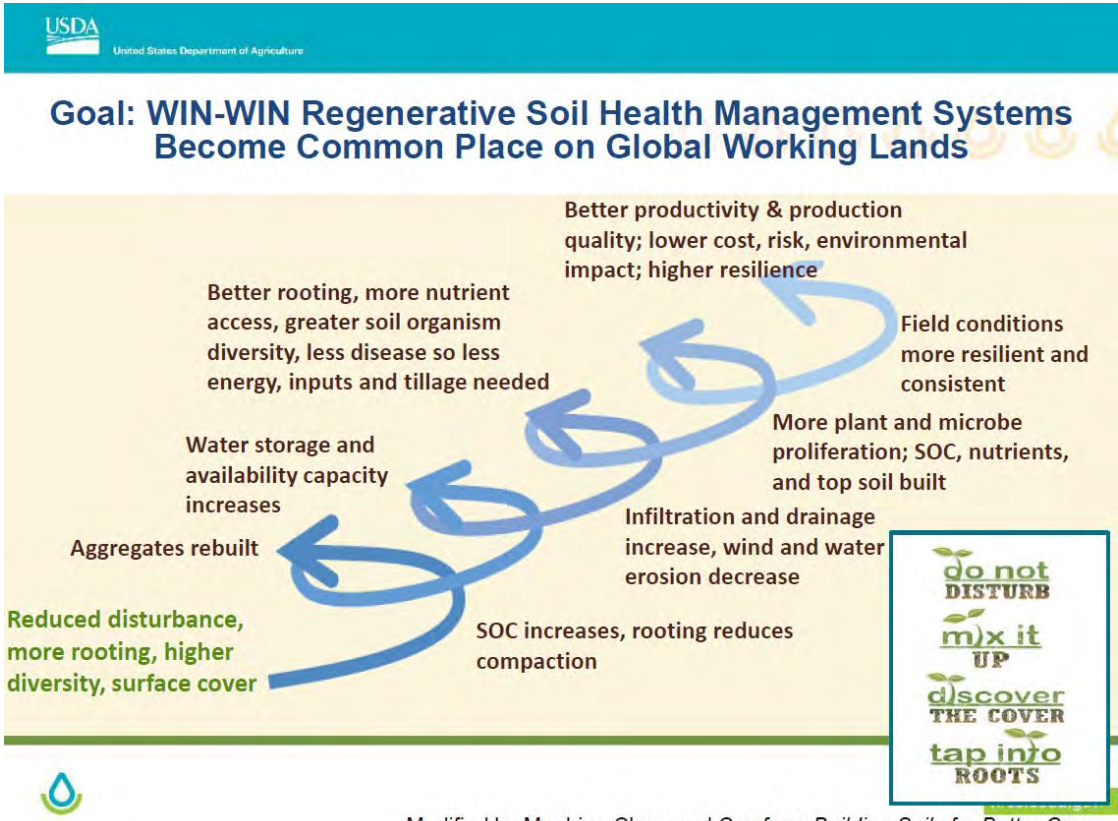
Black Ground Beetle

Spider in rye residue

Young Cotton with minimal thrip damage in Wheat Residue

Summary

- **Work With Nature**
- **Build and Protect Soil**
- **Check Your Soil Regularly**
- **Nurture the Soil Ecosystem**
- **Use Cover Crops to Invigorate Your Soil Year Round**



Modified by Moebius-Clune and Cox from *Building Soils for Better Crops*

Virginia Cooperative Extension

PUBLICATION HORT-45P

Backyard Composting

Ed Rishell, Master Gardener, Virginia Cooperative Extension

What Is Composting?

Composting, through manipulation and control, speeds up the natural decomposition of organic matter. It requires optimizing the conditions favorable to the mixed population of microorganisms (mainly bacteria, fungi, and actinomycetes) responsible for the decomposition. These microbes, normally found on the surface of leaves, grass clippings, and other organic materials, thrive in a warm, moist, aerobic (oxygen-rich) environment. Large amounts of organic kitchen, garden, lawn, and landscape refuse can be reduced in a relatively short time to a pile of dark, crumbly, humus-like material that makes an ideal soil amendment.

Benefits of Composting

Regularly adding compost to soil will benefit the soil in a number of ways.

- The soil's structure will improve because compost contains substances that cause aggregation (sticking together) of soil particles.
- Fine-textured soils (i.e., clay-like) have many tiny pores that hold water tightly and limit air exchange. Such soils hold much water that is unavailable to plants and drain slowly.
- Coarse-textured soils (i.e., sandy) have fewer, but larger, pores that promote rapid drainage and provide little plant-available, water-holding capacity. Water and accompanying nitrogen fertilizers leach quickly from sandy soil, requiring frequent fertilizer applications.
- The organic matter in compost can benefit both soil types by increasing pore size and plant-available water in fine-textured soils or by increasing

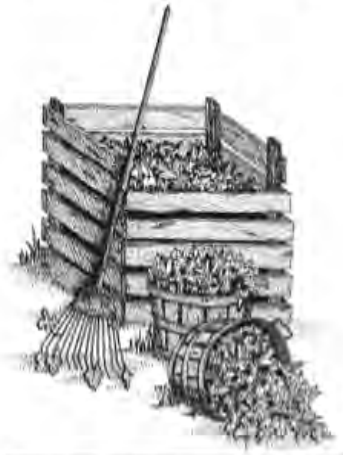
www.ext.vt.edu

Produced by Communications and Marketing, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2013

Virginia Gardener

Making Compost From Yard Waste

Ed Rishell, Extension Master Gardener, Virginia Cooperative Extension Prince William County Office



Virginia Cooperative Extension

Composting with Worms

EM 9024 • October 2011

Sam Angima, Michael Nisack, and Sally Nisack

What is composting with worms?

Composting with worms (also called vermicomposting) is usually done with the common red wiggler worm (Eisenia fetida). This worm's specialized digestive system converts food waste and other organic materials to a nutrient-rich compost called vermicast or worm castings. It thrives in an aerobic (with air) environment. It is able to process large amounts of food waste and rapidly reproduce in a confined space.

What is the difference between conventional composting and vermicomposting?

Conventional or "hot" composting depends on the heat generated by a wide range of microorganisms, largely bacterial, that help convert organic waste to compost. The carbon-to-nitrogen ratio of the composting materials, combined with a balance of moisture and air, are very important factors in producing the heat that promotes composting and kills weed seeds. If done correctly, it is a very fast process (about 6 to 8 weeks under optimum conditions).

Vermicomposting is considered a "cold" composting process. There is no noticeable heat generated by bacteria during the decomposition process. Vermicomposting materials (food scraps and bedding) are generally lower in the carbon-to-nitrogen ratio than "hot" compost. Instead of heat, the vermicomposting process relies on micro- and macroorganisms, including worms. It is a relatively slow process (it can take up to 6 months for finished worm compost), and it does not destroy weed seeds. It provides up to 4 percent more nitrogen in the final compost than conventional "hot" compost and can be done inexpensively, in a small space, with little effort.

Why should I vermicompost?

Most food waste in the United States is sent to landfills and makes up 20 percent (by weight) of all landfill materials. When this food decomposes in a landfill, it produces methane gas. Methane is a greenhouse gas (a gas

Contents

Sam Angima, Extension agriculture faculty, Lincoln County, Oregon State University; Michael Nisack, OSU Extension Master Composter and Master Gardener, and Sally Nisack, OSU Extension Master Composter and Master Gardener, both of Seal Rock, Oregon.

Oregon State University | Extension Service

"For the United States to succeed, we need to become better farmers."- George Washington

Backyard Composting

Benefits of Composting

- **Saves money while protecting the environment**
  - Recycles plant material and extends the life of landfills
  - Reduces the need for fertilizer and soil amendments
  - Reduces soil erosion
- **Improves soil structure**
  - Reduces soil compaction and crusting
  - Improves water infiltration and drought tolerance
  - Improves nutrient holding capacity
- **Increases beneficial microbial and earthworm populations**
  - Promotes healthy plants that resist disease and insects

Compost This

Plant Material

- Grass clippings (if not treated with herbicides or other pesticides)
- Leaves
- Yard trimmings, flowers and house plants
- Hay & straw
- Wood chips & sawdust

Food scraps

- Fruit, vegetable scraps, egg shells
- Coffee grounds and tea bags

Misc Natural Materials

- Animal manure (e.g., horse, cow, chicken)
- Small amounts of shredded, uncoated paper or cardboard
- Fireplace ashes
- Dryer lint (e.g., cotton or natural fibers only)
- Cotton and wool rags
- Hair and fur

Don’t Compost

Proteins and Fats Attract Pests and Can Cause Odors

- Meat, grease, bones
- Cheese, sour cream, butter, salad dressing
- Eggs yolks
- Peanut butter
- Carnivore manure (cat/dog)

These may cause problems in your garden

- Diseased or insect ridden plants
- Grass or plants treated with pesticides
- Coal or charcoal ash
- **Troublesome weeds - seed heads, rhizomes…**
- Pressure-treated wood, shavings or sawdust

Compost Recipe

- 3 Parts Browns (Carbon)
  - Sticks, Wood Shavings
  - Dry Leaves
  - Dry Grass
  - Straw
  - Shredded Paper
- Air
  - Turn Pile
  - Build a loose pile

- 1 Part Green (Nitrogen)
  - Green Grass
  - Food Scraps
  - Manures (herbivore only)
  - Coffee Grounds
  - Plant Material
- Water
  - Wrung Out Sponge

Building the Pile

Batch = Hot or Cold Compost

- Composts faster
- Need lots of material
- 3 brown+1 green+ water
- 3'x 3'x 3' minimum
- Turn every 2 weeks, add water as needed

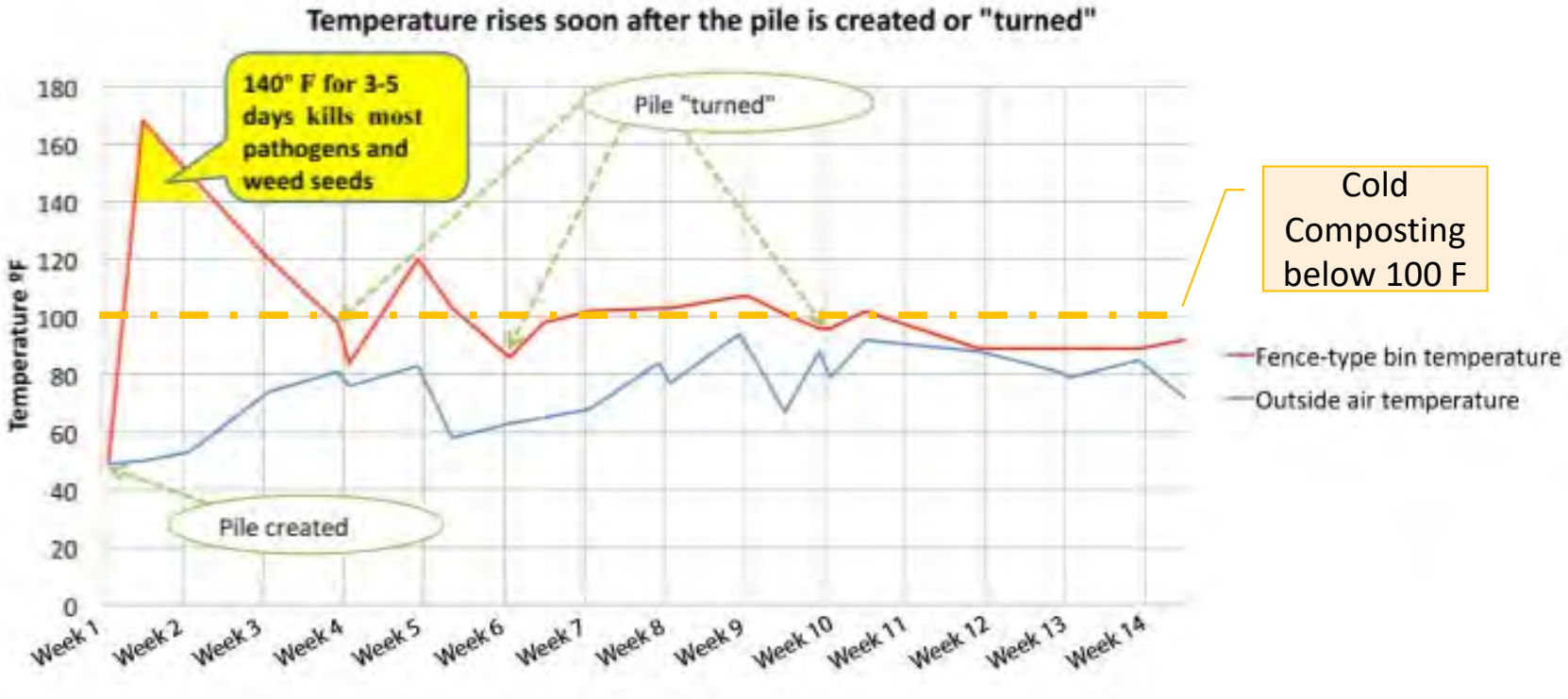
"As you go" = Cold Compost

- Minimal effort
- Composts slower
- Doesn't kill weeds/diseases
- Add as you get material
- May develop odors
- Add water and green or browns

Batch	"As You Go"
	

Temperatures rise soon after creation and after the pile is “turned”

- Critical temperature for killing pathogens is 131° F
- Temperature for killing weed seeds is 145° F



Shredded, Never Turned…1 Year Later


Bin started out filled to top, ended up with one third

Kitchen Scraps, Never Turned

Troubleshooting

- Pests
  - Never add protein or fats (meats, cheese)
- Odor
  - Ammonia - Too much nitrogen (greens) add carbon (browns)
  - Musty smell - Anaerobic conditions (too wet), add browns and turn pile to add oxygen
- Slow – Too little nitrogen, carbon, air or water
- HOAs

Commercial Prefabricated Composters

Lift off the composter, move to new location and “turn” pile into it

Custom-built wooden bins

Create pile in one bin and “turn” it into another bin

Large Bins or Piles

“Turn” pile from one location to another nearby

Fence-Style Composter

To "turn" the pile, remove the fence, move to new location and "turn" pile into it

Presto Geobin Compost Bins

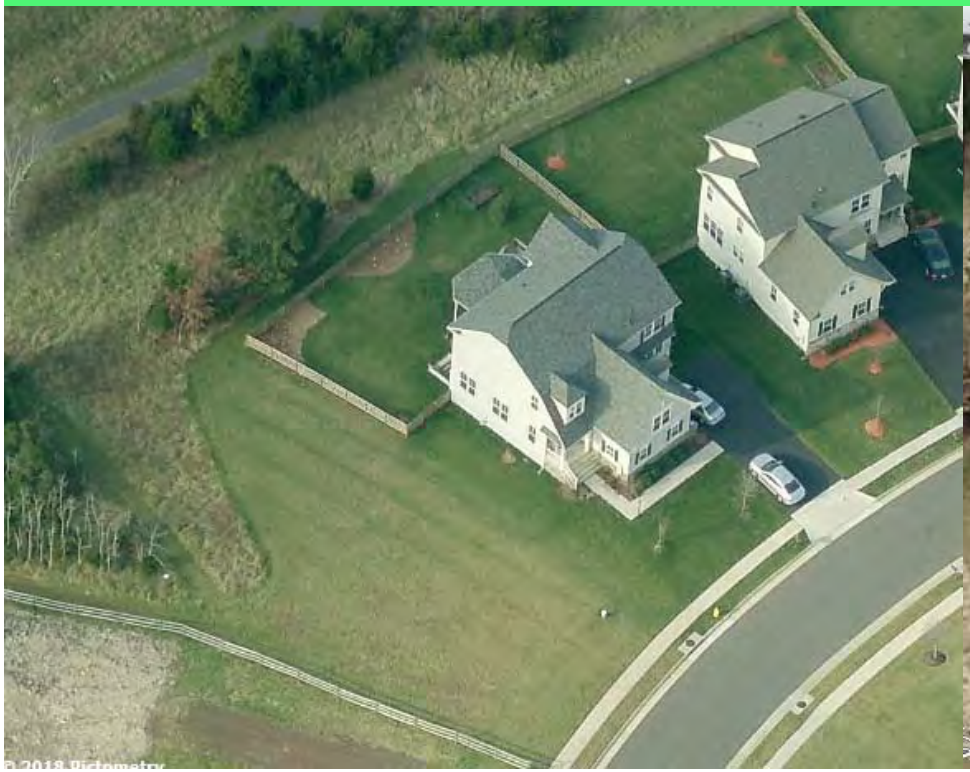
The Back Yard

The Back Yard 2002

The Back Yard

The Back Yard

The Back Yard



The Back Yard

The Back Yard

Vermicompost

Vermicompost

Vermicompost

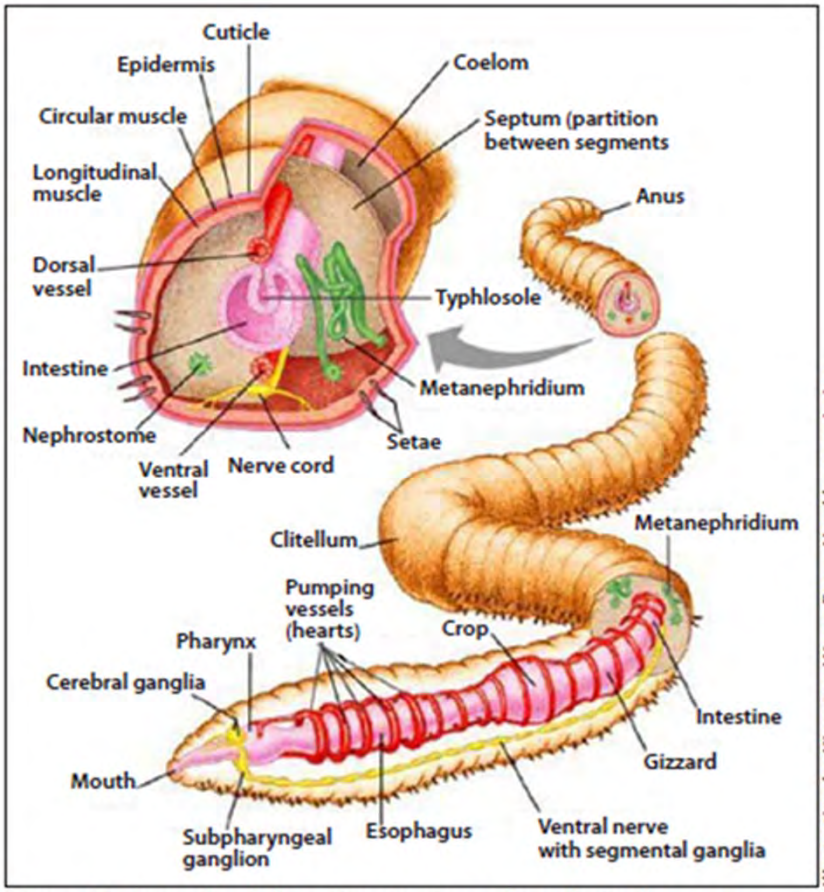


Figure 11. Specialized digestive structure of a red wiggler worm (*Eisenia fetida*).

Vermicompost

For More Information on Composting

Compost Publications:

pubs.ext.vt.edu/HORT/HORT-49/HORT-49-PDF.pdf

pubs.ext.vt.edu/426/426-703/426-703_pdf.pdf

pubs.ext.vt.edu/442/442-005/442-005_pdf.pdf

(Vermiculture)

Prince William County Compost

www.pwcgov.org/government/dept/publicworks/trash/Pages/Compost.aspx

Call 703-335-8181 for pricing

Prince William Compost Awareness Day

Saturday, April 27, 2019

Sean T. Connaughton Community Plaza

1 County Complex Court, Woodbridge, VA

10:30 a.m. — 1:30 p.m. demonstrations:

Container Gardening **Building Soil** **Tree Planting /Mulching** **Small Space Gardening**

Free Compost Samples and Coupons, Compost Exhibits, Rain Barrel Demonstrations, Compost Bin and Plant Sales, Door Prizes and more...

Visit www.pwcgov.org/trashandrecycling for more details.

Prince William County
Public Works Solid Waste Division

COMMUNITY SHREDDING

NEW LOCATION

SATURDAY, MAY 4, 2019

9 a.m.—1 p.m. *

Chris Yung Elementary School
12612 Fog Light Way
Bristow, VA 20136

Prince William County Landfill
14811 Dumfries Rd.
Manassas, VA 20112

free

ACCEPTABLE

- Confidential documents
- Bank statements
- Tax returns
- Paper clips (regular size) and staples do not have to be removed

Up to four (4) boxes
(18"x12x15" or smaller)

UNACCEPTABLE

- Junk mail
- Newspapers/Magazines
- Metal binder clips/ folders
- Jumbo paper clips
- Redweld Accordion Files
- 3 ring binders
- CDS/other media
- Electronics

*Services provided until 1 p.m. unless trucks reach capacity
These events are open to *residents only*. No business or commercial shredding accepted.
For more information, call 703-792-4670, or visit www.pwcgov.org/trashandrecycling

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