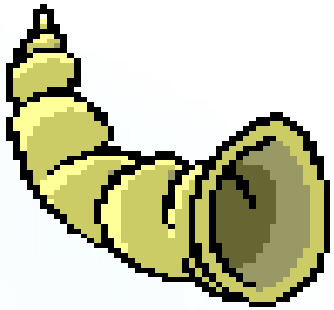


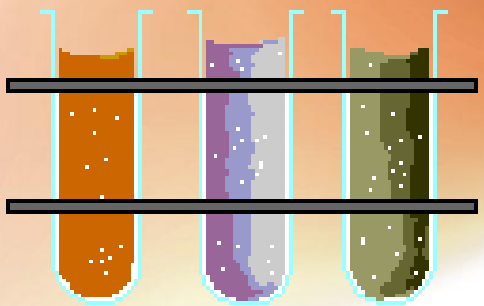
Gardening Organically

Catherine Wissner

UW Extension

Laramie County

Master Gardener Program



Growing Season in Cheyenne

- 90 to 141 growing days per season.
- Cool nights.
- About every 10 years a severe drought.
- Average highs: May 65° June 74° July 84° August 82° Sept. 73°

Watering

- **Deep.**
- **Use a small can to measure watering amount.**

Be Consistent.

Soil is.

Air, water, decayed plant residue, organic matter, minerals, sand, silt, and clay.

Increasing soil organic matter typically improves soil health.

Healthy soils are porous, which allows air and water to move.

A balance ensures a suitable habitat for soil organisms that support growing plants.

Soil a vital natural resource

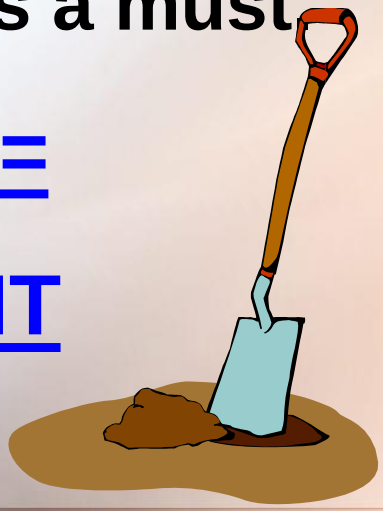
- More than one million organisms in a single teaspoon of Earth, soil is the starting point for plant, animal and human life.
- the Soil Health Institute.
  - safeguard and enhance the vitality and productivity of the soil.
  - provide research funding to better understand soil.
  - www.soilhealthinstitute.org.

Soil - the Basics

- Work only when dry to avoid compaction.
- Add organic matter.
- Good drainage is a must

HEALTHY SOIL =

HEALTHY PLANT



Soil Salinity

- Measured in electrical conductivity (EC), or mmhos cm.
- Non-saline 0-2
- Very slightly saline 2-4
- Slightly saline 4-8
- Moderately saline 8-16

Salt Index

Fertilizer Material Relative Salt Index

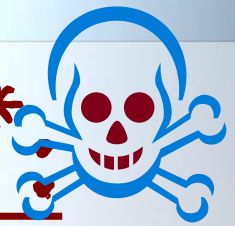
- **Sodium Nitrate 100.0** bench mark
- **Ammonium Sulfate 69.0**
- **Diammonium Phosphate 29.9**
- **Monoammonium Phosphate 34.2**
- **Potassium Chloride 116.2**
- **Potassium Nitrate 73.6**
- **Potassium Sulfate 46.1**
- **K-Mag, Sul-Po-Mag 43.2**

Soil - Do's and Don'ts

- Intense tillage physically disrupts the soil, increases aeration, which accelerates the decomposition of crop residues and soil organic matter.
- Resulting in a net loss of organic matter.

Soil – Don’ts

NEVER USE*



- Lime (calcium).
- Wood ash, fireplace ash, barbeque ash.
- Lawn fertilizer in your vegetable garden.
- Raw or fresh manures.

- In Wyoming or western soils.

Organic Matter Benefits

- Improves “buffering” capacity of soil: that is, keeps soil from “over-reacting”.
- Supports the soil’s micro-biological activity (or the “life of the soil”).
- Contributes nutrients, both minor and major.

Organic Matter Benefits

Improves:

- **Tilth.**
  - Soil that has the proper structure and nutrients to grow healthy crops.
- **Condition.**
- **Structure of soil.**
- **Water and nutrients holding ability of the soil.**

Organic Matter Benefits

- Acids arising from the decomposition of the organic matter help to convert insoluble natural additives such as ground rock into plant-usable forms.
- Releases nutrients slowly.
- Helps vegetables survive stress, as from nematodes, heat, drought.

Organic Matter

What it Should Do

Provides adequate ground cover to protect against soil erosion.

Have a high rate of nitrogen fixation and good biomass production.

What's it takes: you need 460 pounds of O.M. for a 1000 sq. ft. garden to raise the soil O.M. by 1%.

Soil pH

- The pH of a soil is a measure of its alkalinity or acidity, a scale of 1 to 14.
- 7 is neutral.
- 1-<7 is acid >7 to 14 is alkaline.
- Examples: lye 13., ammonia 11., baking soda 8.5., milk 6.6., wine 4.0., lemon juice 2.0.

Soil Microorganisms

- Microorganisms are found in large numbers in soil.
- Plaster (1992) estimates that one teaspoon of fertile soil (about one ml.) contains:
  - 50 nematodes
  - 62,000 algae
  - 72,000 protozoa
  - 111,000 fungi
  - 2,920,000 actinomycetes
  - 25,280,000 bacteria

Soil Microorganism

- Transformation of organic materials.
- Release nutrients.
- Enhance nutrient uptake.

- Almost every chemical transformation taking place in soil involves soil microorganisms.

- Play an active role in soil fertility (carbon and nitrogen).

Soil Microorganism

- Without microorganisms nutrients stay in cover crops and compost.

- Soils would lose their porosity and water holding capacity, soil erosion would increase.

Soil Bacteria

- Switch hitter of the soil: enzymatic transformers, oxidize or reduce.
- Used for salt remediation and breakdown of petroleum based products in the soil.
- Growing beans and peas.
- ***Rhizobium*, *Azobacter*, *Nitrosomonas*, *Nitrobacter*...**

Soil Microorganism - Fungi

- **Workhorse: bind soil particles, soil tilth.**
- Fungi **are responsible for most of soil fertility.**
- **Decompose just about anything and release the nutrients contained within the materials back to the plant.**

Mycorrhizae

- Live in and around the root zone of plants, extending far out from the plant's roots with their own network of thread-like filaments known as hyphae.
- Evolve in association with plants.
- Increase the ability of plants to take up water and certain nutrients.
- Protect associated plants from pests and diseases.

Mycorrhizae

- Cannot survive long in bare-soil conditions.

- Cannot thrive in conditions where soluble fertilizers have been used continually for many years.

Mycorrhizae

- **Strategies for improving mycorrhizae activity in your soil.**

- Use green plow down plants and mulch.
- Refrain from using chemical fertilizers, w/high levels of phosphorus.
- If the soils are degraded, consider adding quality compost.
- For degraded sites, inoculate with commercially-available mycorrhizae.

- **Agroforestry Net, Inc. P.O. Box 428 Holualoa, Hawaii 96725 USA**

Soil and Fertilizers

- **Three major plant nutrients contained in packaged fertilizers (N.P.K.).**

- **(Ca), (Mg), (Fe), (B), (Mn) and (S), which plants need in lesser amounts.**
- **Packaged fertilizers contain other substances such as organic matter or filler.**

Most Fertilizers are Salts.

Nitrogen

- Nitrogen **is necessary for many functions including growth, fruit bud formation, fruit set, and fruit size.**
- **Loss of N from high temperatures, runoff, de-nitrification. Mobile in soil.**
- **Soil pH of 5.5 to 8.5.**
- **Temps of 65 degrees.**

Nitrogen

- **Nitrates and nitrites are nitrogen-oxygen chemical units, which combine with various organic and inorganic compounds.**
- **Very soluble and does not bind to soils.**
- **Has a high potential to migrate to ground water.**

Nitrogen

- On a molecular basis, nitrogen is taken up more than other nutrients.
- Nitrogen type has a bigger effect on soil pH than other nutrients.
- Nitrate nitrogen (NO3-N) can cause the soil-pH to increase, but only if it is taken up by the plant.
- If plants are small, or stressed and not growing, nitrate has little influence on soil pH.

Nitrogen

- **<u>Does not</u> evaporate in water.**
- **Nitrates/nitrites are likely to remain in water until consumed by plants or other organisms.**

Phosphorus P205:

- An essential ingredient of all cell protoplasm.
- Important in fruit, flowers, and root growth.
- Needs nitrogen to work best, pH of 6-7.
- Moves from old leaves to new.
- Soil moisture and temperature dependent.
- Will increase the soil pH over time.

Soil – Phosphorus cont….

- Phosphorus moves very little in the soil.
- Too much can cause the fruit/vegetable to be bitter.
- Vegetables typically remove 10-15 pds., of P., per acre per year.
- Soil will retain excess phosphate for next year’s crop.
- Compost and Vermi-compost best sources.
- C.W. Basham CSU CES

Phosphorus - Facts

- Phosphorus has no substitute.
- It is **not** a renewable resource.
- The vast majority of the world's mineable phosphorus is in the North African country of Morocco.

Potassium or Potash

- Potassium (K) fertilizer is often referred to as "pot-ash," a term coined by early American settlers who produced potassium carbonate by evaporating water filtered through wood ashes.
- The ash-like crystalline residue remaining in the large iron pots was called "pot ash," and was used in making soap.
- This process of making potash is registered as U.S. Patent No. 1.

Potassium what it does for Plants

- Increases root growth.
- Improves drought resistance.
- Helps retard crop diseases.
- Reduces water loss and wilting.
- Increases protein content of plants.
- Aids in photosynthesis.
- Regulates production of high energy plant growth compounds.
- Activates more than 60 enzyme systems.

http://sanangelo.tamu.edu/agronomy/mg/potash.htm

- **Products on the Market.**

Urea 46-0-0

- **Produced through the reaction of ammonia (NH_3)and carbon dioxide (CO_2) +CO(NH 2) 2.**
- **The area around a dissolved urea particle becomes a zone of high pH and ammonia.**
- This area is toxic **to seed and seedling roots by the free ammonia that has formed.**
- **Lost to the atmosphere if it remains on the soil surface.**
  - Curtis J. Overdahl, George W. Rehm and Harvey L. Meredith **U of M**

Rock Phosphate

- 25 to 30 % phosphate, but only about 3 % is available to plants.
- Depends upon how finely ground the material is, the pH and the biological activity of the soil.
- It is less effective in soils that are too alkaline or have a low level of biological activity.
- Colloidal phosphate, obtained from rock phosphate, has similar properties.

- ***In Laramie County Soils and most western soils it stays a rock*.**

Potassium Chloride KCL

(aka, Muriate of Potash) One source of K

- Most of the world reserves of K were deposited as sea water from ancient inland oceans evaporated, and the K salts crystallized into beds of potash. New Mexico, Utah, California.
- An excess amount of potassium can lead to deficiency of magnesium (Mg), and high soil salt.
- pH 6 on up.
- Is mobile in plants.
- <u>High Salt Index</u>.

Kelp

- **All-natural, provides more than 70 minerals, plant growth regulators, vitamins, hormones, and enzymes.**
- **<u>Provides a supply of naturally chelated nutrients</u>.**
- **1 - 0.1 - 2.**
- **Work 1 lb. of kelp meal into each 100 sq. ft.**

What's in Kelp Analysis of Dry Kelp Feed Grade Aseophyllum Nodosum

- Specs Provided By A.M.P.I.(Canada)
- Moisture Content 12.93+or-0.27%

Copper (ppm) 3.00
Mineral Coateat 16.75+or-0.51%
Iron (ppm) 102.26
Oil Content 5.46+or-0.25%
Fat 5.42%
Crude Protein 5.93+or-0.19%
Ash 24.71%
Carbohydrate 58.93%
VitaminE (mgl00g) 6.40
Alginic Acid ~14.0%
VitaminA (IU/100g) +10

- Total Nitrogen 1%

Ascorbic Acid 10.70(mg/100g)
Phosphoric Acid 1%
Cyanocbaiamin B12 0.02 (mg/kg)
Soluble Potash 4%
Pyridoxine B6 +0.03(mg/100g)
Crude Fiber 3.70%
Niacin B3 (mg/kg) 8.40
Calcium 1.32%
Riboflavin B2 0.04(mg/100g)
Phosphorus 0.13%
Thiamine B1 0.06(mg/100g)
Potassium 2.58%
Iodine (mg/kg) 730.00
Magnesium 1.00%
Chromium (ppm) 1.49
Sodium 3.80%
Fluoride(mg/kg) 22.00
Zinc (ppm) 35.40
Manganese(ppm) 4.00

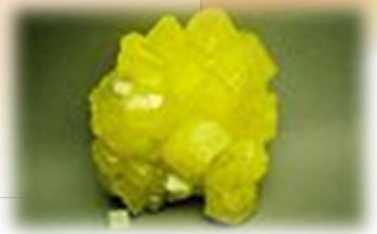
Coffee Grounds

- pH of 6.9.
- C:N 20:1.
- Add directly to the garden soil, filter too.
- For composting purposes, consider coffee grounds "green" material similar to grass clippings.
- 1.5%N, 0%P, .5%K.

Bob Smith, WSU Master Gardener Program Manager, Thurston County

Soil Sulfur

- Essential element in supporting protein, enzymes, vitamins, and chlorophyll in plants, and nodule development in legumes.
- Soil that is; low OM, cold, too hot and/or wet or sandy can produce sulfur deficiencies.
- Is needed by plants in about the same quantities as phosphorus.
- Sulfur is quite soluble and moves in the soil.



Soil Sulfur

- To drop the pH of 100 square feet.

Amounts of elemental S to decrease soil pH.

Initial soil pH	Desired soil pH	S per 100 ft^2	
		(lb.)	(cups)
7.5	6.5	1.5	3
8.0	6.5	3.5	7
8.5	6.5	4.0	8
9.0	6.5	6.0	12

- To much - toxic to the soil micro-life.
- 1 - 4 lbs. per 100 sq. ft.
- Sulfur sources: ammonium sulfate, gypsum, soil sulfur.
- **http://www.uidaho.edu/wq/wqfert/cis922.html**
-

Cottonseed Meal

- By-product from the extraction of oil from whole cottonseed.
- 7 – 2.5 – 1.5
- Slow release of nutrients.
- Used as an all-purpose fertilizer for plants that require a lower soil pH.
- Potatoes and Roses, any acid loving plants.
- Use approximately 10 - 15 lbs. per 100 sq. ft.

Soil Additives - others

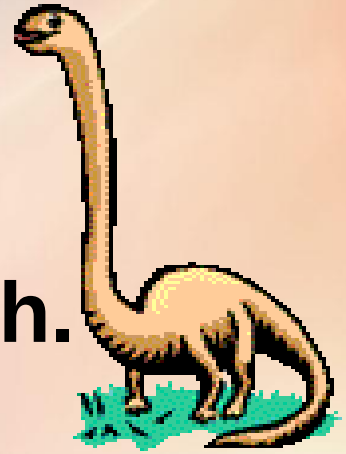
- Gypsum **(calcium sulfate) will keep the soil pH the same.**
- Limestone **(calcium carbonate) will raise the soil pH.**
- *Epson salts* **(magnesium sulfate) for Magnesium deficiency.**

Peat Moss

- pH of 3.5 to 4.5.
- **In a garden, work 2" of peat into the top 6" of soil.**
- **Aerates plant roots by loosening heavy clay soil.**
- **Adds body to sandy soil.**
- **Saves water by absorbing and holding moisture.**

Humates

- Humates are developed from decomposed prehistoric deposits found in the western United States.
- Natural compost piles first become peat, then humate, then lignite and eventually coal.
- Not a lot of detailed research.



Humates

The humic acids (humic, ulmic and fulvic) are essential to plants in three basic ways:

1. **Humic acid enables plants to extract nutrients from the soil.**
2. **Ulmic acid stimulates and increases root growth.**
3. **Fulvic acid helps plants overcome stress, enhances the bio-availability of important trace minerals and their uptake.**

Lignite, (a. k. a.) leonardite,

- Low rank coal between peat and sub-bituminous.
- Some qualities as a fertilizer due to its high humic acid.
- 3 to 45 pounds per 1000 sq. ft.
- pH determinate?

Fish

- Fish emulsion is a concentrated liquid made from fish scraps.
- The content may vary with the manufacturer.

- A source of slow-release (water-insoluble) nitrogen and trace elements.
- It can be used as a foliar fertilizer.

Fish Bone Meal

- **Contains dried and ground fish scraps, crab meal and fish manure.**
  - **It contains about 6 to 10 % nitrogen, 4 to 10 % phosphate and about 1% potassium.**

Fish bone meal also supplies other minor and micronutrients important for plant growth.

Blood Meal

- **Obtained from slaughterhouses.**
- **Contains 12 % nitrogen, 2 % phosphate and 0.6 % potassium**
  - **12-2-.6.**
- It is very soluble, excessive amounts will burn plant foliage.
- **Use 5 lbs., per 100 sq. ft.**

Bone Meal

- A white powder obtained from ground, raw, or steamed animal bones.
- About 22 % phosphate. 0-22-0.
- Raw bone meal will release nutrients more slowly than steamed bone meal.

Soybean Meal

- N 7% -P 2% - K1% slow releasing.
- Best to work in prior to planting.
- Use from 5 - 15 lbs. per 100 sq. ft.
- More soybeans are grown in the U.S. than anywhere else in the world.

Natural Weed Control

Corn Gluten Meal

- Iowa State University researcher Nick Christians.
- Protein part of the corn: corn-gluten meal (CGM), a corn milling byproduct-could inhibit root growth.
- Contains 9 - 10% nitrogen by weight, ideal "weed and feed" product. *
- Applied pre-emerge in spring and fall, applied at 1 lb./100 sq. ft. * CSU soil lab recommendation.

Grape Pomace

- ***Improves alkaline soils.***
- **By-product of wine.**
- **Very acidic, pH 3.0.**
- **N 3%- P 1%- K2%.**
- **Reduction of nematode population on plant roots and in the soil?** ISHS Acta Horticulture 532: International Symposium on Chemical and Non-Chemical Soil and Substrate Disinfestation .

Feathers

- **Feather meal is made of dried and ground chicken feathers and contains about 11-15 % nitrogen (only).**
- **Hydrolyzed feather meal is steam-treated to make its nitrogen more soluble.**
- **10-15 lbs. per 1,000 sq. ft.**

Alfalfa

- **Alfalfa pellets, available as an animal feed from farm suppliers.**

  2.7 % nitrogen

  0.5 % phosphate

  2.8 % potassium

Dry, use at 5 pounds

Per 100 square feet.* **CSU soil lab recommendation.**

Alfalfa

- **Very high in vitamins, plus Ca, Mg, and other valuable minerals.**
- **Includes sugars, starches, proteins, fiber and 16 amino acids.**
- **Contains plant growth regulators.**
- **use around; roses, iris, vegetables, trees, or shrubs.**
- Make alfalfa tea by soaking 1 pound of alfalfa meal per 5 gallon of water**.**

Iron Additives

- Miller's FerriPlus (distributed by Jirdon's $15 a lb.+/-).
- KEREX Sequestrine 138 Fe Super Iron concentrate.
- Becker Underwood Sequestrine 138.
- Sequestar 6% iron chelate WDG.
- Ferrous sulfate is 30% to 20% Fe.

Greensand and Granite Dust

- Very slowly **available and less effective in soils that are alkaline or have a low level of biological activity.**
- **If the rock powders are finely ground, they will break down faster.**
- **Greensand contains 5 to 7 % potassium, a large quantity of magnesium and many trace minerals.**
- **Granite dust contains 3 to 5 % potassium, It also supplies trace minerals.**

Molasses

- **3 types - unsulphured, sulphured and blackstrap.**
- **Blackstrap molasses is from the third boil and only has a commercial value in the manufacture of cattle feed and other industrial uses.**
- **Has more complex sugars which help the beneficial fungi.**

Molasses

- **Feeds fungi** and/or **bacteria in the soil.**
- **Better resistance to many insect pests as well as exhibit higher stress tolerances.**
- Use rate from 3-5% solution for more bacteria in the soil.
- 5 +% for more fungi in the soil.
- Use liquid molasses, not dried feed stock grade.
- Dr. Elaine Ingham, Soil Food Web

Mushroom Compost

- High in soluble salts, **which can kill germinating seeds and harm salt- sensitive plants.**
- **Mushroom compost varies from company to company.**
- 2-1-1.
- pH 6.8 (?)

- **John Hart, soil scientist, Oregon State University Extension**

Animal Manure- and organics

- §205.203 Soil fertility and crop nutrient management practice standard.
- (1) Raw animal manure, which must be composted unless it is:
- (i) Applied to land used for a crop not intended for human consumption;
- (ii) Incorporated into the soil not less than 120 days prior to the harvest of a product whose edible portion has direct contact with the soil surface or soil particles; or
- (iii) Incorporated into the soil not less than 90 days prior to the harvest of a product whose edible portion does not have direct contact with the soil surface or soil particles.

Animal Manures

- Pathogens can be transferred from animal manures to humans.
- Salmonella, listeria and E.coli 0157:H7, as well as parasites, such as roundworms and tapeworms, have been linked to applications of manure to gardens.
- Bacteria can live in soil for up to 1 year or more, depending on temperature and soil conditions.

- Never apply fresh manure after the garden is planted.
- Thoroughly wash raw vegetables before eating.

- http://gardening.wsu.edu/stewardship/compost/manure/manure2.htm
- http://www.gaps.cornell.edu/Educationalmaterials/Samples/FSBFEngMED.pdf

Chicken manure

- Should be dry and composted/pasteurized to kill off pathogens.
- 5-3-2 plus calcium.
- Typically slow release.

Sawdust, Wood Shavings, Horse Bedding Pellets.

- Caution:
  - C/N ratio 22:6.
  - Salts EC 2.56.
  - pH 5.5 to 7.5.
  - N 14, P 4, K 20. (varies on age of sawdust).
  - Some trace elements.
  - Organic Matter 68.6%.
  - Can very greatly from tree to tree and over time and from Pine and Spruce
  - Pacific Soil Analysis Inc. Dr. WA Herman P.Ag
  - http://scholar.lib.vt.edu/ejournals/JARS/v29n1/v29n1-orr.htm

Earthworms

- A typical nutrient analysis of Earthworm casts is:
- C:N ratio 12–15:1;
- 1.5%–2.5% N, 1.25%–2.25% P_2O_5 and 1%–2%, K_2O
- Slow-release structure of earthworm casts allows nutrients to be released in sync with plant needs.

- http://www.omafra.gov.on.ca/english/engineer/facts/10-009.htm

Earthworms

- The earthworm has no lungs and takes in oxygen through its moist skin – it is a skin breather. If it dries out, it will suffocate.
- They cannot tolerate heat and sun and so during the summer they come up to the surface only at night.
- Pesticides applied to control turf diseases or insect pests may severely affect earthworms.
- https://vimeo.com/110880643

Leaves

- Amended into the soil they contain calcium, phosphorus, potassium, Boron, Iron, Zinc and magnesium
- Slow release of nutrients. But may need to add additional N.
- No change in soil pH

- **http://www.spectrumanalytic.com/support/library/ff/Plant_Nutrients_in_Municipal_Leaves.htm**

Biochar

- produced through gasification — processes that heat biomass in the absence (or under reduction) of oxygen.
- The carbon in Biochar resists degradation and can hold carbon in soils for hundreds to thousands of years
- Amendment to improve yield**, <u>but</u> only for plants that require high potassium and elevated pH.**

Bagged Manure Compost

- May vary from bag to bag.
- Tends to be very salty.
- Can contain high levels of plant-available N.
  - can inhibit flowering and fruit set.
- Apply 2-3” and mix into the top 6-8” of soil
- 1 part compost to 3 parts soil.

Jean Reeder, PhD CSU, March 2011

Green Manure

- **What?**

- Are a biological source of nitrogen that reduces the amount of fertilizer required for the following crop.

- Increase in soil organic matter increases nutrient availability to plants.

Green Manure Benefits

- Field studies have shown between 10 - 20% of the total annual nitrogen added to the soil as green manure is used by the first crop.
- An additional 64% of the nitrogen can be found in the top soil 14 months after green manuring.

- Nitrogen becomes available as plant residues continue to decompose.

Green Manure Crops, Season of Growth, Amount of Seed, and Type.

Crop	Season	Seed (lbs./acre)	Type	Nitrogen (lbs./ton dry material)
Buckwheat	**Summer**	**75**	**Nonlegume**	**14**
Crimson clover	**Winter**	**15**	**Legume**	**45**
Rye	**Winter**	**75**	**Nonlegume**	**21**
Southern pea	**Summer**	**90**	**Legume**	**60**
Soybean	**Summer**	**75**	**Legume**	**46**
Sudan grass	**Summer**	**25**	**Nonlegume**	**28**
Vetch	**Winter**	**30-50**	**Legume**	**62**
Wheat	**Winter**	**75**	**Nonlegume**	**20**

Composting

- Green matter, **like grass clipping, kitchen waste, high in nitrogen.**
- Dry ingredients **to prevent clumping, like leaves and straw, rich in carbon.** Soil.
- **Add** water**, compost pile should remain damp but not wet.**
- Air: **stir by turning or moving the pile occasionally. Oxygen helps the microbes work better. Should be turned every 3 to 10 days.**

Items NOT to Be Used in the Compost Pile

- Meat
- Dairy
- Colored paper
- Coal
- Charcoal and fireplace ash

Items NOT to Be Used in the Compost Pile

Always know where your compost materials are coming from.

- **Picloram (Tordon and Grazon) can remain in the soil for 3 years or more, very persistent, highly soluble, and easily moved by rainfall. Used by commercial operations to control weeds.**

How to Build a Compost Pile and How Big to Build It.

- Convenient size to work with, about 5’x3’, should not get below one cubic yard in size.
- The top should be left flat or with a slight depression in the center to catch rain or added water.
- Keep it moist, but not wet.
- Compost will begin to heat after 2 or 3 days.
- After 10 days, fork it over, mixing the parts to obtain uniformity.

Carbon and Nitrogen

Microorganisms get their energy from:

- **Carbohydrates such as cellulose, lignin and complex sugars in plant residues, high in carbon.**

- **Nitrogen from manure, kitchen vegetables, and fruit scraps.**

Carbon and Nitrogen

- If there is too little N the microbial population will not grow to an optimum size and decomposition will slow down.
- Too much N allows rapid microbial growth and speeds up decomposition, it can result in depleted oxygen and odors as the excess N is given off.

- The optimum C:N ration is about 30:1

Finished Compost

- Can take a couple of weeks a month or a year depending on the materials, time of year, and moisture.
- Broken down into a homogenous mixture and no un-decomposed leaves or other material may be seen, it is ready for use.
- Should have a sweet, earthy smell.
- Use-Half inch to ¼ inch deep.

Compost Tea

- Must be very well aerated to work.
- **Soaking compost in a bucket creates problems.**
- **Anaerobic vs. aerobic.**

Compost Tea

Compost tea is not:

- **A pesticide, but reduces the use of pesticides.**
- **A fertilizer, but can reduce the use of fertilizers.**
- **An herbicide, but can reduce the use of weed killers.**

Mulching

- Conserves water.
- Controls weeds.
- Moderates soil temperatures.
- Reduces compaction.
- Reduces crusting of soil.

Mulch

- **Grass clippings, shredded leaves, crushed corn cobs, pine needles,**
- **straw and hay**

wood products - chips, bark, sawdust,

Synthetic Mulches

Plastic – black*, clear

Newspaper, rock, and pebbles

Landscape fabric

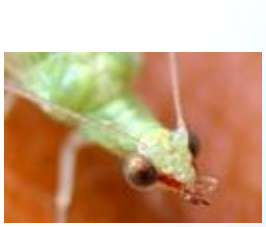
Disease and Pest Control

- **Use disease resistant veggies, perennials, trees.**
- **Mulch.**
- **Water at base of plant.**
- Good sanitation, **don't leave last year's debris to over winter in the garden.**
- **Keep your tools clean,** sanitize **if necessary.**
- Do rotate **veggies / annuals on a 3-year plan.**
- Soil test.
- Don't **over feed your plants.**
- Don't **over water your plants.**

HEALTHY SOIL = HEALTHY PLANT

Beneficial Insects and Non-Toxic Solutions

- Ladybugs
- Green lacewings
- Big-eyed bug
- Praying mantis



- These are generalists, attack pest in all stages of development.

Pest Control

- Safer soap or a homemade soap mix.
- Bacillus thuringiensis (Bt).
- Diatomaceous earth (DE).
- Plant based insecticides.
- Tobacco products.
- Flowers.
- Garlic.
- Flour.

Pest Control

- Pheromone traps.
- Sticky traps.
- Fly and yellow jacket traps.
- Boric acid, borates, borax.
- Horticultural oils.

Neem Oil

- Derived from the Azadirachta indica tree.
- Flies, mosquitoes, caterpillars, true bugs, locusts, grasshoppers, aphids, weevils, moths, roaches.
- Rust, powdery mildew.

Natural Weed Control - Vinegar

- Horticultural vinegar 20% acetic acid (difficult to handle).
- A staple in organic weed control.
- Some add a yucca extract in their vinegar, which increases effectiveness by acting as a spreader–sticker.
- Is a non–selective product used for spot weed control, will kill any green material it comes in contact with. **APPLY CAUTIOUSLY!**

Tips for the garden

- Check the fertilizer analysis on the bag or container.
- Apply the fertilizer at the rates given on the fertilizer container.
- Work fertilizer well into the soil.
- Don't guess at rates; measure or weigh the fertilizer product.
- Healthy Soil = Healthy Plant.

Happy Gardening