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# Vegetable Gardening Class

Colorado State University

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COLORADO MASTER GARDENER<sup>SM</sup>

May 7, 2017

# Welcome!



- Soils, amendments and fertilizers
- Garden design, planning and season extension
- Lunch & Grand Community Gardens Meeting
- What and how to grow vegetables in Grand County
- Garden maintenance
- Harvesting and Preservation
- Open Forum Questions & Answers



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# Soils, Amendments and Fertilizers

# Soil Attributes



SOIL =

- Dynamic Living Organism
- Foundation of healthy, productive garden
- 80% of Plant Problems are Soil Related

# Soil Attributes



**TILTH = Suitability of Soil to Support Plant Growth**

- **Function** of:
- Texture
- Structure
- Fertility
- Interplay of Organic Content and Soil Organisms

# Soil Attributes



**TEXTURE = Particle Size**  
**(sand, silt, clay)**

- Colorado soils are dominated by clays, sand, decomposed granite
- Clay Predominant in Grand County

# Soil Attributes



## STRUCTURE = Pore Space

- Ideal Soil has 25% for Air and 25% for Water Circulation
- Good Structure = loose, crumbly, can push finger into
- PEDS = Clusters of soil particles of different sizes  
Want pea-size peds in garden seed bed
- COMPACTION = Reduces pore space  
Problem/concern with clay soils

# Soil Attributes



**FERTILITY** = Natural Presence of  
17 Chemical Elements

- Carbon, Hydrogen, Oxygen from Air and Water
- **Nutrients**– Nitrogen, Phosphorus, Potassium  
Calcium, Magnesium, Sulfur, Iron, Zinc,  
Molybdenum, Manganese, Boron, Copper,  
Cobalt, Chlorine from soil



# Soil Attributes



## PH = Measurement of Soil Acidity or Alkalinity

- Affects –availability of nutrients  
–activity of soil microorganisms
- On PH Scale 7.0 = Neutral  
(below is acid, above is alkaline)
- Range of 6.0 to 7.5 Acceptable for Most Plants
- Colorado Soils on Alkaline Side (7.0 to 7.8)

# Soil Attributes



## ORGANIC MATTER =

Any Material from Living Organisms in Various Stages of Decomposition

- FUNCTION = Food Source for Living Soil Organisms
  - Improves Soil Tilth
- Colorado Soils Naturally Low in Organic Matter
  - Amend annually

# Soil Attributes



## SOIL ORGANISMS =

### Nature's Primary Recyclers

Includes: Bacteria, Fungi, Protozoa, Nematodes, Arthropods (insects, spiders, mites) and Earthworms

- Turn organic matter into nutrients, energy, carbon dioxide and water
- Most active in moist, warm (70–100 degree) soil
- Add organic matter to nurture existing communities

### Earthworms =

- Best to Find and Transplant Local Worms
- Prefer moist soils between 40–70 degrees

# Soil Amendments



**AMENDMENT** = Any Material Mixed Into Soils

- TWO CATEGORIES: Organic and Inorganic

**INORGANIC** = Mined or Man-Made Materials

- Improves Soil Texture, Structure, Water and Nutrient-Holding Capacity
- Does Not Affect Fertility or Soil Organism Function  
Includes: Vermiculite (mica)  
Perlite (volcanic rock)

# Soil Amendments



**ORGANIC** = Materials Derived From  
Something that Is or Was Alive

- Improves Soil Tilth So Add Annually
- Goal is to Achieve 4–5% Organic Content Gradually (3–5 years)
- Provides Low Levels of Nutrients But Legally Not a Fertilizer

# Soil Amendments



## Organic Soil Amendments Include:

Sphagnum peat

Compost

Aged Manure

Biosolids

Straw

Aged Sawdust

Grass Clippings

Wood Chips

Dead Healthy Leaves

Worm Castings

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# Soil Amendments



**COMPOST = Soil Amendment  
Created by Human–Manipulated  
Breakdown of Organic Waste**

- Gold Standard for Adding Organic Matter to Garden Soils
- Add: First 3 Years: 2–3 inches (plant–based) or 1 inch (animal–based)
- Fourth Year Plus: 1–2” (pb) or 1 inch (ab)

# Soil Amendments



## How to Determine Compost Quantities

1. Calculate Square Feet (Area) of Bed (length x width)  
**Example:**  $4' \times 12' = 48$  square feet
2. Calculate Cubic Feet of Compost Needed  
(area x depth of compost in feet)  
**Example:**  $48$  square feet x  $0.25$  (3 inches deep) =  
 $12$  cubic feet
3. Divide cubic by 27 to get cubic yards (if buying in bulk)
4. Bagged commercial compost is typically 1, 1.5 or 2 cubic feet per bag



# Fertilizers



**FERTILIZATION** = Application of Fertilizers to Supplement Soil Nutrients

- **Goal** = Meet Plant Needs Without Excess Nutrients (Rich soil is best food)
- Will Not Compensate for Inadequate Soil Management or Cultural Care
- Will Not Enhance Desired Growth if Nutrients Applied are Not Deficient

# Fertilizers



**FERTILIZER** = Soil Amendment That By Law Guarantees the Product's Minimum Percentages of:

N = Nitrogen

P = Phosphate (phosphorus)

K = Potash (potassium)

- Uniform Labeling is in Percentages, such as 20-10-5
- Percentages = Comparative Ratio  
(% 15-10-5 = 3-2-1 ratio)

# Fertilizers



## ORGANIC vs SYNTHETIC Fertilizers

Organic = made from natural sources  
(plant and animal)

Synthetic = manufactured through chemical  
processes

- Nutrients from either are the same to plants
- Difference = speed at which nutrients are available to plants

# Fertilizers



## APPLICATION RATE =

Amount of Fertilizer to Apply Depends On:

- Nutrient Needs of a Soil
  - Nitrogen needed most
- Amount of Organic Matter in Soil
- Percent of Nutrients in Fertilizer Product Used

Based on nitrogen content for products with multiple nutrients

# Fertilizers



- Type of Fertilizer Used
  - organic vs synthetic
  - water-soluble vs granular
  - rapid release vs timed-release
- Crop Being Grown – Plant Needs Vary

**Read the Product Package Carefully!**

# Fertilizing the vegetable garden



## WHEN AND HOW TO FEED

### Feed As You Plant

- Broadcast and work dry fertilizers into top 1–2 inches of soil just before planting.
- Read product labels to compute proper amount to apply.
- Do not place fertilizers in seed rows or root injury may occur.

# Fertilizing the vegetable garden



## Use Starter Fertilizers for Transplants

- Use water-soluble fertilizers (MiracleGro, Peters, Schultz, organics, etc.)
- Treat newly planted transplants.  
Water foliage and soil.
- Signals hardened-off transplants to resume growth.
- Promotes early growth.

# Fertilizing the vegetable garden



## Give Booster Feedings

- Timing and frequency throughout the season is crop-specific.
- Use dry fertilizers to side-dress row crops.
  - Work fertilizer into top 1 inch of soil next to but not touching plants.
- Use liquid fertilizers (water-soluble) to feed block and/or row crops.
  - Water foliage and soil.



# Soil Mangement



- Understand and manage soil as a living ecosystem.
- Raised beds require better than average soil due to high plant density.
- Concentrate on improving soil tilth with organic matter.
- Avoid unnecessary tilling.
- Avoid working soil when wet – damages soil structure.
- Protect soils from compaction – damages soil structure.

# Soil Mangement



- Use organic mulch.
- Avoid excess fertilization.
- Water efficiently to avoid overly dry or waterlogged soils.
- Avoid making drastic changes to soil PH.
- Avoid unwarranted pesticide application.
- Avoid adding calcium-type amendments not needed in Colorado soils.

(Lime, wood ash, gypsum, sulfur)

- Do not add sand to clay soils – makes a brick.



# Questions?

## 10 Minute Break

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# Garden Planning and Design

# Types of Vegetable Gardens



## Considerations when planning a vegetable garden:

- **Sunlight** – Vegetables need 6–8 hour direct sunlight.
- **Water availability** – How far is the source?  
– Possibility of irrigation?
- **Soil Quality** and ability amend the soil.  
– Soil testing

# Types of Vegetable Gardens



## In Ground vs Raised Beds:

### In ground beds:

- Uses existing soil
- Costs less to establish
- Can be less startup work
- Lower water usage
  - Doesn't dry out as quickly as a raised bed.
- Less permanent
  - Can be allowed to return to former state.

# Types of Vegetable Gardens



## Raised Beds:

- Ideal for smaller spaces
- Better drainage
- Reduced soil compaction
- Soil warms faster in the spring
- Easier to use season extenders
- Can be expensive to build
- More possibilities for soil amendment

# Types of Vegetable Gardens



## Raised Beds:

- Should be no more than 4' wide, but as long as you'd like!
- Should be a minimum of at least 12" deep
- Can be made from a variety of materials.
  - Be cautious when using older treated wood or newer rail road ties!



# Types of Vegetable Gardens

## Container Vegetables



[www.wasatchgardens.org](http://www.wasatchgardens.org)



[www.no-dig-vegetablegarden.com](http://www.no-dig-vegetablegarden.com)

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# Types of Vegetable Gardens

## Container Vegetables



- Great for small spaces with a minimum of 6 hours of sun.
- No site preparation but use a quality potting soil.
- Make sure the container has drainage holes.
- Make sure the container is large enough.  
Most vegetables need at least a 12” deep pot.

# Types of Vegetable Gardens



- Containers dry out quickly – check them daily or use “self watering” containers



Garden Patch Grow Box



Self Watering Kit

# Types of Vegetable Gardens



## Vegetables that do well in containers :

- Lettuce & salad greens
- Carrots – ball or finger types
- Potatoes
- Herbs
- Radish
- Strawberries
- Tomatoes & Peppers (Protection from frost required)

For more information:  
**CMG GardenNotes #724**



# Styles of Vegetable Gardens



## Traditional Single Row Style



[www.gardenguides.com](http://www.gardenguides.com)

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# Styles of Vegetable Gardens



## Traditional Single Row Style

### Pros:

- Easy to plant, weed and harvest
- Good air flow around plants = less disease

### Cons:

- Challenging to amend soil (quantity)
- Requires lots of space
- Lower crop output per square foot
- Increased soil compaction

# Styles of Vegetable Gardens



## Block, Close or Wide Row Style





# Styles of Vegetable Gardens



## Block, Close or Wide Row Style

### Pros:

- Spacing allows for 5 times more plants than traditional single row
- Desirable plants shade the soil surface = less weeds and watering

### Cons:

- Growing plants closely together can lead to decreased airflow & more disease problems.



# Styles of Vegetable Gardens



## Block Style Planting



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# Styles of Vegetable Gardens



## Square Foot Gardening



[www.melbartholomew.com](http://www.melbartholomew.com)

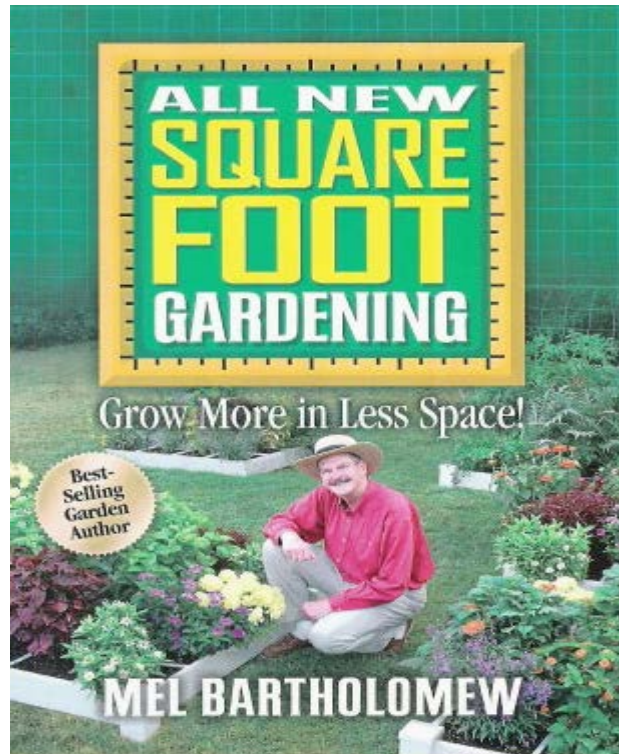
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# Types of Vegetable Garden Layouts



## Square Foot Gardening



- Mel Bartholomew coined the term in 1981
- Method of gardening utilizing 4' x 4' x 6" beds filled with 1/3 compost, 1/3 peat and 1/3 vermiculite.
- Beds are planted on a square foot grid layout.
- Similar to French or Biointensive gardening

# Square Foot Gardening



## Pros:

- Great for limited space.
- Maximizes harvests (intensive plantings).
- Limits weed growth.

## Cons:

















- Expensive for initial construction.
- More watering and nutrients needed.
- 6" depth limits crops possible.
- Reduced air flow (increased disease potential)
- Requires careful planning



# Square Foot Gardening



4 ft x 4 ft  
Square Foot Garden

 1 Cabbage	 9 Green Beans	 1 Pepper	 16 Onions
 1 Broccoli	 9 Green Beans	 4 Lettuce	 32 Green Onions
 1 Cauliflower	 16 Beets	 4 Lettuce	 16 Carrots
 1 Cherry Tomato	 9 Spinach	 16 Carrots	 32 Radish

# Creating a planting plan



- **Make a list of vegetables you like to eat.**  
Prioritize according to preference & value.
- **Choose varieties suitable for our climate:**  
Short days to maturity  
Cold / frost tolerance  
Disease resistance
- **Choose planting style:**  
Block planting  
Square Foot  
Single Row  
Containers

# Creating a planting plan



## Determine plant spacing

- Found on seed packages & in catalogs, hand outs & online resources.
- Don't over crowd plants!  
Leads to:     Shading,  
                  Smaller plant size,  
                  Increased water and nutrient needs,  
                  Increased disease potential
- Determine if plants are direct seeded, transplanted or can be either
  - Information also found in seed catalogs or on seed packages, handouts, & online

# Creating a planting plan



## Create planting layout plan

- Draw on paper
- Use online garden planners

Growveg.com – free for 30 days

Vegetable-gardening-online.com

Gardeners.com – Kitchen Garden Planner

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# Creating a planting plan



rdners.com/on/demandware.store/Sit Sites-Gardeners-Site

Soil Calculator









**Your Garden Name**

























1. Select your size:  
Width:  Length:

2. Drag and drop item onto bed

Save Print Load Edit Plan Start Over Email

Previous Next

 Calendula	 Cauliflower	 Hot peppers	 Leaf Lettuce	 arugula	 basil	 beans	 beets
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# Creating a planting plan



## Create a planting calendar.

Based on last frost date – June 25

Local gardening lore = Father's Day (June 15)

- **Determine seed starting and transplant dates**
  - <http://www.johnnyseeds.com/e-dgseedstart.aspx>
  - <http://bioarray.us/Skipppy's%20planting%20calendar.html>
  - CMG GardenNotes #72
  - Handout, seed packages and catalogs

# Succession Planting



Succession planting extends crop harvests by utilizing planting methods:

- Planting a second crop after harvesting and removing the first crop.

This method is most suitable for areas with 3 growing seasons.

Try with fast growing crops – radish, baby lettuce

- Stagger seed planting times by 2– 3 weeks

# Crop Rotation



Crop Rotation is practice of alternating plant families grown in the same location each year.

## Benefits:

- Balance soil fertility and nutrient use.  
Example: leafy crops and root crops
- Prevent the build up of plant specific insects and diseases.

**Harder to do practice in small scale gardening!**

- Keep records of where you plant which crops.
- If you have insect or disease problems=ROTATE!

# Crop Rotation



PLANT FAMILY	VEGETABLE
Carrot Family (Apiaceae)	carrot, celery, parsley, parsnip
Goosefoot Family (Chenopodiaceae)	beet, spinach, Swiss chard
Gourd Family (Cucurbitaceae)	cucumber, muskmelon, pumpkin, summer squash, watermelon, winter squash
Grass Family (Poaceae)	ornamental corn, popcorn, sweet corn
Mallow Family (Malvaceae)	okra
Mustard Family (Brassicaceae)	broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, collard, kale, kohlrabi, mustard greens, radish, rutabaga, turnip
Nightshade Family (Solanaceae)	eggplant, pepper, potato, tomato
Onion Family (Alliaceae)	chives, garlic, leek, onion
Pea Family (Fabaceae)	bush bean, kidney bean, lima bean, pea, pole bean, soybean
Sunflower Family (Asteraceae)	endive, lettuce, sunflower

# Companion Planting



The idea that growing certain types of plants together can be mutually beneficial or hinder growth.

## Benefits:

- Shelter – shade for beets, lettuce, spinach, arugula, Swiss chard, pac choi.
- Support – the Three Sisters (Corn, Beans & Squash)
- Encourage beneficial insects that prey on undesirable insects and provide pollination.  
Aster family, Sweet Alyssum, Mint, Nasturtium
- Repel or trap unwanted insects.  
Sage, thyme & oregano repel cabbage moths  
Nasturtium repels aphids and attracts beneficials

# Companion Planting



Some vegetables seem to be more compatible with certain pairings and less with others.

## Examples:

Lettuce grows well with most vegetables but especially carrot, garlic, onion, radish.

Carrots grow well with beans, brussels sprouts, cabbage, lettuce, radish, onion, peas but NOT celery, dill or parsnip.

Peas grow well with beans, carrot, parsley, potato, radish, spinach and strawberry but NOT garlic and onion.



# Season Extension



**Average frost free growing season is 64 days!**

There are practices that can help to extend the growing season.

**To get a head start on the growing season:**

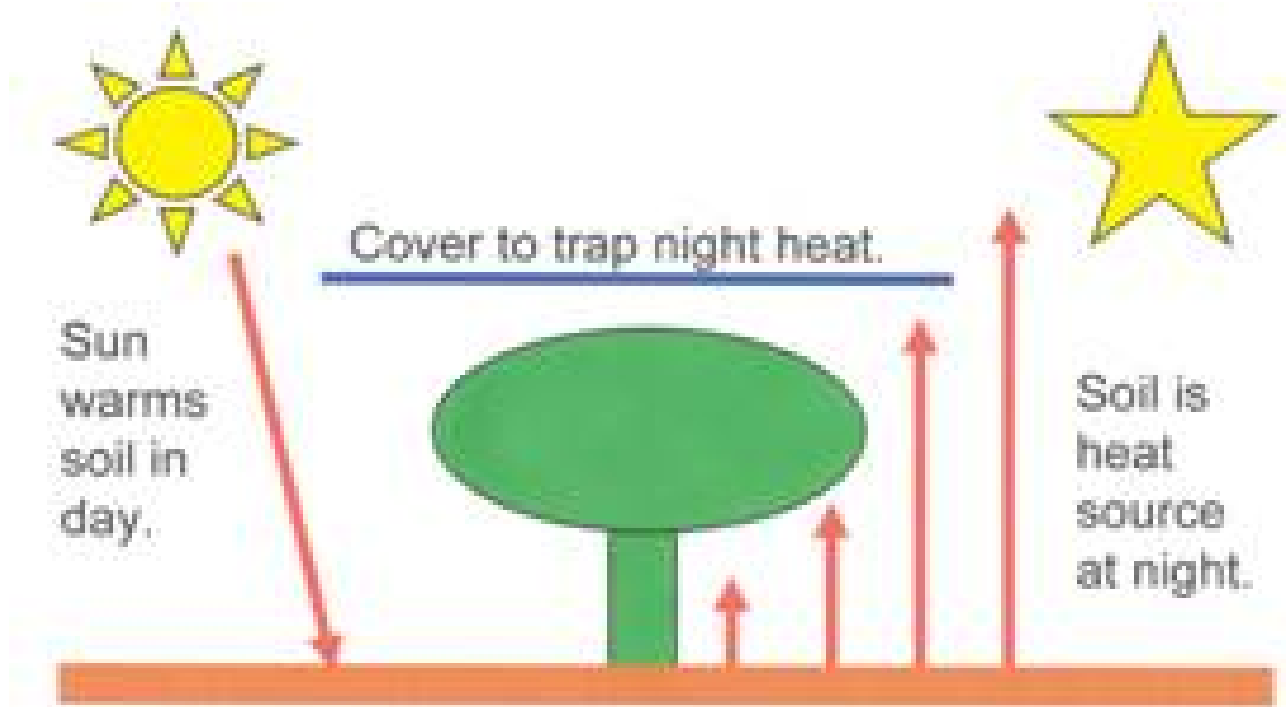
- Warm the soil by placing plastic over the garden bed.
- Start seeds indoors for transplants.
- Use raised beds.



# Season Extension



## Take advantage of radiant heating



From CSU Garden Notes #722

# Season Extension



Take advantage of microclimates.

Areas such as South facing buildings.

**Build a cold frame or greenhouse.**



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# Season Extension



## Wall O Water



[www.burpee.com](http://www.burpee.com)

## Hot Kaps



[www.gurneys.com](http://www.gurneys.com)

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# Season Extension



## Cloches



<http://americangardenhistory.blogspot.com/2012/03/beautiful-glass-cloche.htm>



<http://doorgarden.com/03/starting-early-in-the-garden/milk-jug-cloches>

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# Season Extension



## Floating row cover

A polyester fabric placed directly on crops.

- Can provide 2–8 degrees of frost protection.
- Allows air and water movement – doesn't have to be removed.
- Can provide insect protection.



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# Season Extension



## Low tunnel

- Made from hoops spread over the garden at 3–5 foot intervals and covered with plastic.
- Can provide 2–4 degrees of frost protection.
- Must be opened for ventilation during the day
- Additional layers such as an aluminum space blanket can add extra frost protection.

# Season Extension



## Low tunnel



The addition of C7 incandescent lights can add 6–18 degrees frost protection.  
Christmas lights plus space blanket can add 18–30 degrees!

From CMG Garden Notes #722



# Questions?

# Lunch Break

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