Organic Vegetable Gardening

2020 Master Gardener Training

Weston Miller

Preview of presentation

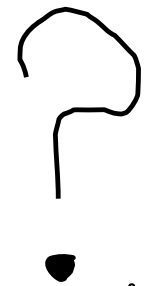
- Soils, compost, fertilize
- Bed preparation
- Crop planning
  - Crop family exercise
- Planting
  - Seed and transplant
- Intensive techniques
- General management
- Common problems
- Cover cropping

Vegetable Resources!

- Sustainable Gardening- Chapter 7
- Maritime Northwest Guide- Seattle Tilth
- How to Grow more Veggies- John Jeavons
- Gardening West of the Cascades- Steve Solomon
- Four Season Harvest- Eliot Coleman

Some Questions to Ask

- Who
- What
- When
- Where
- Why



Why Grow Veggies?

Location, Location, Location

- 8 + hours of sun
- Slope and drainage
- Air drainage
- Wind
- Water supply
- Convenient
- Avoid airborne pollution and soil toxins

Summit Springs Woodside, CA

BUFA at Learning Gardens

Seven tips for growing veggies

1. Know this information:
   - Planting dates
   - Days to first harvest
   - Length of harvest (first to last)

   } Time in Bed
2. Allocate ½ garden space for cool season crops
3. Maintain excellent soil fertility

Seven tips for growing veggies

4. Use transplants where possible
5. Use space creatively
6. Use a crop rotation plan
7. Extend your season

Site Planning

- Size
  - Space, Time
- Sun, Shade
- Drainage
- Ease of use
- Oh, Deer!

Garden Layout

Garden layout

- Kitchen garden
- Flow of people and materials
- Plan for crop rotation
- Increments of 100 sq. ft.
- 2 ‘ – 4’ wide beds
- Mulch paths for formal raised beds
- Know shade patterns
  - Heat lovers in full sun
  - Shady spots for summer greens

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Why do chemical analysis of soils?

- Establish baseline nutrient status
- Determine application rates
- Assess pH and need for liming
- Measure changes over time
- Avoid excess nutrient application or build up of salt

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OSU soil testing resources

Keyword search “OSU small farms soil test”

- How to take a sample
- List of labs
- How to interpret results

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How to take a soil test

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Determine management units

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Sample where the crop will be planted

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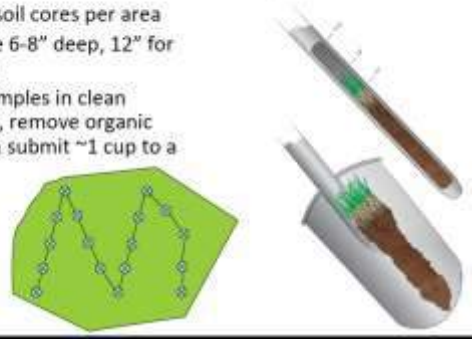
Soil Sampling

For Home Gardens & Small Acreages (EC 628)

- 15-20 soil cores per area
- Sample 6-8" deep, 12" for nitrate
- Mix samples in clean bucket, remove organic layer & submit ~1 cup to a lab



NUTRIENT MANAGEMENT guide

EM 8677
Revised May 2008

Laboratories Serving Oregon

Soil, Water, Plant Tissue, and Feed Analysis

J. Hart

Oregon State University Extension Service

What to test for

- pH (acidity-basicity)
- SMP buffer (ease of change of pH)
- Organic matter (OM)
- Cation Exchange Capacity (CEC)
- Phosphorus (P)
- Potassium (K)
- Calcium (Ca)
- Magnesium (Mg)
- Sodium (Na)- salts
- Texture?

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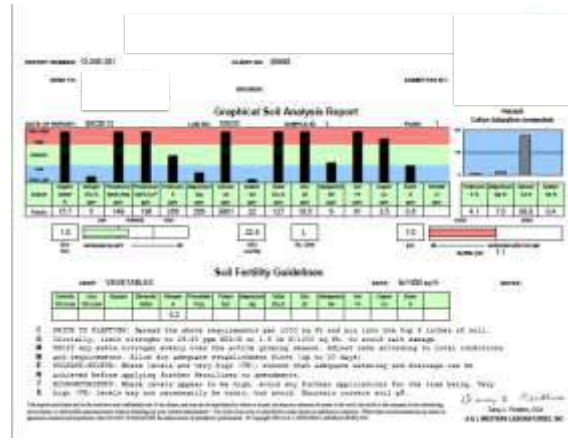

Soils, Compost, Fertilizer

- Test your soil!
  - pH = 6.2 – 6.8
  - 5-8% organic matter
- Aged compost
  - Structure
  - Drainage
- Lime
- Nutrients (nitrogen)

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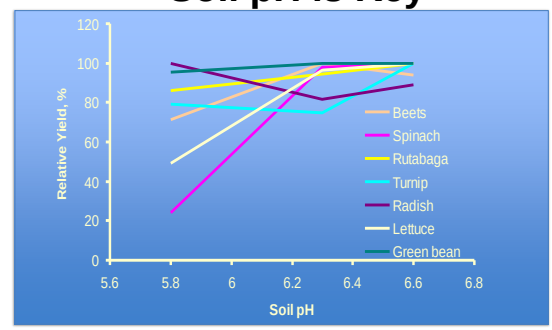
Soil pH is Key



Courtesy John Hart, OSU Crop & Soil Science

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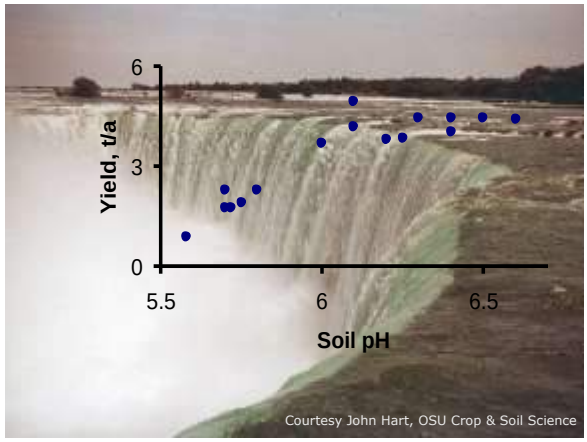
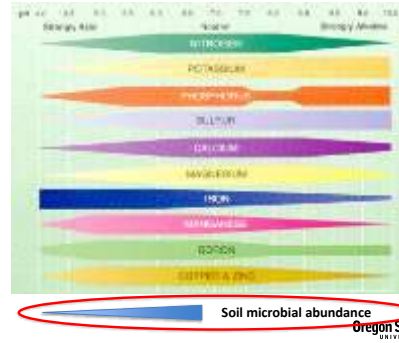


Soil pH and nutrient availability



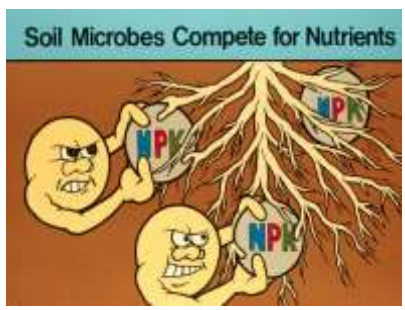
To Increase Soil pH

- Lime (Calcium carbonate)
  - Per soil test recommendations
  - Or 5 # / 100 sq. ft.
  - Dolomite also has Mg
  - Apply in fall, if possible

Compost Tips

- Organic matter helps with:
  - Water retention, drainage, structure
- Look for well decomposed with manure or food scrap feedstock
- Small amounts slow-release nutrients
- Fosters long-term fertility

Carbon-rich Organic Matter



Nitrogen is generally limiting nutrient in metro area soils

http://www.microsoil.com/

Synthetic Fertilizer

- Follow instructions
- Incorporate in soil at planting
- Side dress during growing season
- Most cost-effective
- Potential to burn

Organic Fertilizers (pg 51)

- Mostly slow release (3-4 months) depending on soil temperature
  - N- many choices
  - P- soft rock phosphate, bone meal
  - K- green sand, kelp meal
- Blood meal, fish, and other animal products can burn
- Compost builds nutrients long-term

Organic Fertilizers (pg. 51)

Material	% N	% P	% K
Cotton seed meal	6-7	2	1
Blood meal	12-15	1	1
Alfalfa	2	0.5	2
Bat guano	10	3	1
Fish meal	10	4	0
Fish emulsion	10	4	0
Bone meal	1-4	12-24	0
Rock phosphate	0	25-30	0
Greensand	0	0	3-7
Kelp meal	1	.1	2-5

Sustainable Gardening, Pg 51

Feather meal and blood meal

- 12-13% Nitrogen (13-0-0)
- $35-40 / 50# bag
- Most cost-effective organic N fertilizers
- Does not have P and K
- Little potential for burning
  - Some with blood meal

Water-in with Soluble Fertilizer

Plant Nutrition Needs (pg 142)

Heavy Feeders	Light Feeders	Soil Builders
Asparagus	Onion Family	Legumes
Most Broccoli, Cucumber, Tomato Families	Carrot, parsnip	Green manures •Grasses •Buckwheat
Corn	Chenopod family	Daikon radish
Lettuce family	Potato, turnip, rutabaga	

Bed Establishment

- Strip off sod layer and dig
- Rototill
- Herbicides?
- Raised beds
- Mulching
  - Lasagna
  - Straw bale

Drainage

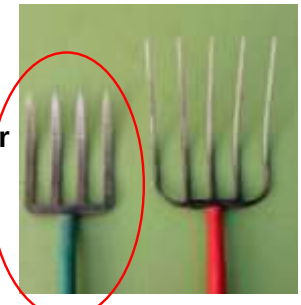
1. Avoid low areas
2. Raised beds
3. Organic matter

Bed Preparation

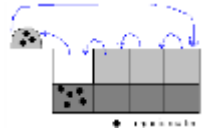
Method	Time	Resources
Hand digging	High	Low
Lasagna or sheet mulching (think ahead)	Low	High
Permanent raised beds	High initial	High
Rototiller or tractor	Low	High

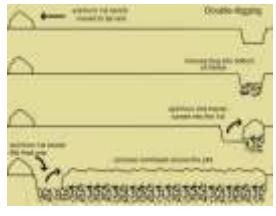
Preferred Hand-digging tools

- Spade
- Spading fork
- Broad fork/ U-bar
- Rake
- Digging board



Double Digging





Digging Board

Notice head trench

Broad Fork or U-bar

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Walk Behind Tractors

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Avoid tillage pan

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Front-tine Rototiller

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Newer tools

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Tractor

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Permanent Raised Beds

Materials for Raised Beds

- Natural lumber
  - Cedar, juniper, redwood
- Treated lumber
  - EPA says copper-based products OK
  - Pre 2002: caution arsenic
  - No contact with crops per USDA Organic
- Plastic lumber
- Rocks, bricks, keystone blocks, etc
- Informal (no border)

Why Practice Crop Rotation?

Prevent Pest Build Up

Pests- flea beetles, carrot rust fly, cut worms, imported cabbage worms

Disease- Fusarium wilt, powdery mildew, Mosaic virus, white rot

Annual Vegetable Plant Families

ACTIVITY

Online research, plant family worksheet

Annual Vegetable Plant Families

- **Brassicaceae (Mustard Family)** Cabbage, broccoli, cauliflower, Brussels sprouts, kohlrabi, turnip, radish, Chinese cabbage, kale, collards, rutabaga, arugula, mustard, etc.
- **Chenopodiaceae (Goosefoot Family)** Beet, Swiss chard, spinach, orach
- **Asteraceae (Composit Family)** Lettuce, endive, salsify, Jerusalem artichoke
- **Cucurbitaceae (Gourd Family)** Cucumber, muskmelon, watermelon, squash, pumpkin, gourd

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- **Solanaceae (Nightshade Family)** Tomato, pepper, eggplant, potato, husk tomato
- **Liliaceae (Onion)** garlic, leek, shallot, chive, scallions, bulbing onions
- **Apiaceae (Carrot Family)** Carrot, parsnip, parsley, celery, celeraic
- **Fabaceae (Pea Family)** Garden pea, snap bean, lima bean, soybean
- **Poaceae (Grass Family)** corn

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For the adventurous

- Convolvulaceae (Bindweed Family)

Sweet potatoes

- It's all about heat units and timing
- Season extension is key
- Varieties from north of 45th parallel
- Sand Hill Preservation

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Crop Rotation System

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Leaf, Root, Flower, Fruit

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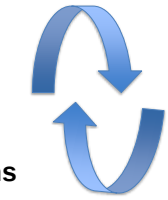
Leaf, Root, Flower, Fruit

- October 2016- Garlic
  - (bulb = modified leaf)
- July 2017- Beets, carrots
- March 2018- Cilantro, greens
- June 2018- Squash



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Crop Rotation Bottom Line

- Don't grow the same crop (family) in the same place 2 x in a row
- Leaf-Root-Flower-Fruit (*Maritime NW*)
- Use quick-growing summer cover crops
  - Buckwheat, phacelia, clovers

What to Grow

- Easy to grow
- Like to eat
- Adapted to climate
- Interesting
- Propagation method
  - Seed
  - Transplant
- Soil temperature

Warm-season Crops

- Beans
- Corn
- Tomato family
- Cucumber family

Cool-Season Crops

Plant both early and late

- Greens-many kinds
- Broccoli, etc.
- Beet
- Carrot
- Green onion
- Turnips
- Radish
- Peas, fava beans
- Onions, garlic
- Potatoes

Scale of Relative Value of Garden Vegetables

- Fresh herbs
- Parsley
- Carrots
- Beets
- Parsnips
- Lettuce
- Scallions
- Spinach
- Kale
- Chard
- Leeks
- Kohlrabi
- Potatoes
- Rutabagas
- Summer squash
- Tomatoes
- Cucumbers
- Peppers
- Cantaloupe
- Beans
- Broccoli
- Cauliflower
- Cabbage
- Brussels sprouts
- Onions
- Winter squash
- Corn
- Watermelon
- Pumpkin

Created by Steve Solomon
Based on economic value at season of harvest, time in ground, and space it takes up.

Economical?

Choosing Varieties

- OSU Recommended Vegetable Varieties
- Look for disease and pest resistance
- Look for adapted to NW conditions (shorter season for cool nights)
- Many, many choices

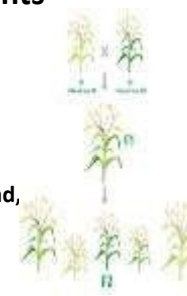
Starting from Seed

Choosing seeds and transplants

- Heirloom and open pollinated
  ~ True breeding; often cultural heritage
- Locally sourced, or choose from companies above 45th parallel .

Choosing seeds and transplants

- F1 Hybrid
  - Traditional plant breeding
  - Two separate parent lines cross pollinated
  - Hybrid vigor
  - Convey certain desirable traits- disease resistance, compact head, slow-bolt, etc.
  - Broccoli, cabbage, carrot, beet, onions, corn



Direct seeding

- Ideally, soil temp = 70°F +
- Direct seed crops
  - Beans, peas
  - Beets
  - Radish, daikon
  - Lettuce (cutting)
  - Scallions
  - Carrots, parsnips
  - Sunflowers, calendula
  - Greens: Cilantro, arugula, mustard
  - Spinach
  - Corn (also can TP)
- Succession crops
  - Radish, beets, carrots, cilantro, greens

Timing is Everything!

- Varies for different crops (pg. 132)
- Monitor Soil and air temps

Soil temperature is critical

- Too cool leads to disease, insect, other damage from slow emergence
- Raised beds, row covers, transplants
- Damping off
- PATIENCE
- Treated seed (not for organic gardens)

Direct Seeding

- Ensure adequate moisture (daily)
- Row cover
- Weeding
- Thinning
- Stale seed bed

Stale seed bed for direct seed

Stale/False seedbed method

1. Plough or spade
2. Prepare seedbed
3. Irrigation or rain then wait 1-2 weeks
4. Light cultivation, flame weeder, contact herbicide like acetic acid
5. Repeat if possible
6. Plant or sow seed

A stale seed Bed would have prevented this…

Seeding depth

- Read seed packet directions
- General rule: 4x diameter of seed

Soil Crusting

- Crust forms in clay-rich soils from rain impact and sun drying
- Carrots, lettuce, cole crops and other small seeds can't penetrate soil crust.
- Improve soil over time with compost and cover crops.
- Cover seeds with peat moss, sand, potting soil.
- Row covers prevent rain impact
- Use transplants

Growing your own transplants

- Bottom heat for germination
- Enough light for compact growth
  - Greenhouse, south facing window*, supplemental light
- Sterile flats and medium
- Water

Damping off

Damping Off

- Soil-borne fungal disease
- Over watering can contribute
- Pre-emergence, seen as poor germination
- Post-emergence, seedling falls over
- Sterilize potting medium, sanitation
- Buy transplants
- Treated seeds (not for organic growers)

Flats and Pots

- Flats
- Pop-out trays
- Peat / coir pots
- Newspaper pots
- Plastic pots
- Drainage!!!

Quality of potting soil matters!

Seed Saving and Storage

- Keep stored seeds in a cool, dry place
- Purchase only what you need each year
- Saving your own seeds takes space and practice…
- Seed to Seed By Suzanne Ashworth

Timing is crucial for success!

- Let's check out your Handout!

Plan next season's vegetable garden to maximize harvest

Planning out the season…

Plan out approximately 50% of your garden space for summer crops.

Plan the other 50% toward cool season crops.

This type of rotation can happen on any scale!

Spring Crops: Sowing schedule

- **Bulbing onions, leeks, & shallots:**
  Sow 10-12 weeks prior to transplant
- **Heading Brassicas:**
  Sow 6 weeks before transplanting
- **Kale, chard, lettuces:**
  Sow 5 weeks prior to transplant.

Summer Crops: Sowing schedule

- **Tomatoes**: 6 weeks prior to transplant
  - pot up at week 2-3
- **Peppers**: 8 weeks prior to transplant
  - Pot up at week 2-3
- **Basil**: 4 weeks prior to transplant
- **Squashes**: 3 weeks prior to transplant
- **Corn**: 10-12 days prior to transplant,

Fall Crops: Sowing Schedule

- Heading Brassicas, lettuce, leafy greens, bok choi, kohl rabi, etc.
  - About 3 weeks prior to transplant
- **Fall Factor!**

Transplanted Row Crops

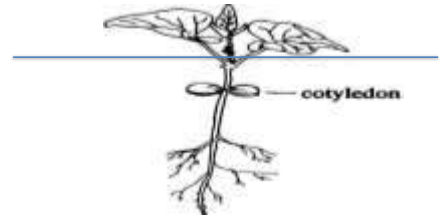
Transplantability (pg 138)

Easy	Need Care	Difficult
Tomato Family	Cucumber Family	Pea Family
Broccoli family	Corn	Radish
Lettuce family	Chenopod family	Carrot
Onion Family sets		

Transplanting

- Hardening off
- Be careful of the stem!
- Be careful of the roots!
- Correct depth
  - Rosette- to first true leaves
  - Tomatoes: only 1 set of leaves above soil
  - Leeks- use dibbler
- Don't step on soil

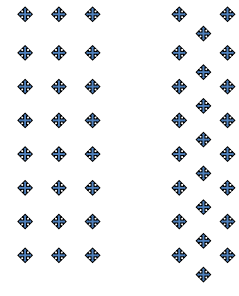
Correct transplant depth



http://sciencebetter.com/dicot.jpg

Leeks!

Planting Pattern Efficiency



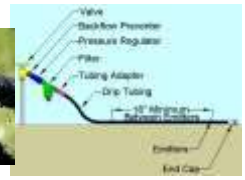
Water-in with soluble fertilizer

Irrigation

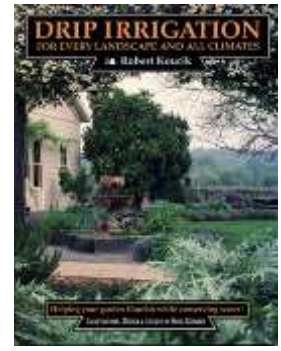
- 1” water per week from April to Sept.
  - 1” over 100 ft. sq. = 65 gallons!
- More may be needed for hot weather
- Deep watering 1-2 x per week for established plants.
- Seedbeds, seedlings need daily care during warm weather

Irrigation Methods

- Water soil, not plant
- Hand
- Oscillator
- Other sprinklers
- Soaker hose
- Drip



Drip System Basics



Watering Tips/ Conservation

- Check top few inches of soil…
- Water early in the morning
- Add organic matter to improve moisture holding capacity of soil.
- Use intensive plant spacing
- Avoid letting the soil dry out!
- Mulch: compost, plastic, burlap, row cover

Intensive Veggie Gardening Techniques

Intensive Gardening

- Season Extension
- Vertical Gardening
- Interplanting
- Successional Planting
- How to Grow More Vegetables- John Jeavons
- The Market Gardener- Jean-Martin Fortier

Season Extension

- Plan year-round
- Greenhouse
- Cold frame
- Cloche (Milk jugs)
- Row covers (remay)
- Plastic Mulch
- Thermal mass
  -wall of water
- Four Season Harvest
- by Eliot Coleman

Cold Frame

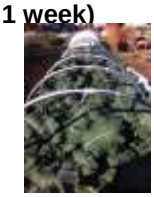
Considerations

- Temperature
- Humidity
- Soil moisture
- Air movement
- When in doubt, vent!

Row cover

Row Cover Facts

- WSU Community Fact Sheet #19
  - Early yields (brassica, leeks, endive 1-3 weeks early; melons 1 week)
  - Increase yields up to
    - 25% for cucurbits
    - 42 % for onions
    - 47% for peas
    - 60% lettuce
  - Frost protection (4-7°F)



More Row Cover Facts!

- Water conservation!
- Must support in windy areas as movement can damage plants
- How long to cover?
  - 4-5 weeks for cool-weather crops
  - Longer for warm season; must remove for pollination
- Black plastic helps less frequent weeding
- Pest protection…

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Protects from flea beetles…

Image: http://www.hort.purdue.edu/rhodcv/hort410/8001.jpg

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Carrot Rust Fly…

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Cabbage moths…

But not the slugs!

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Row cover tips

- Great for transplants with hoop support
- Great for direct-seeded crops- floating (slack)
- Always secure edges with brick/boards
- Perform weeding and "bug" control regularly!!
- Don't need to harden off if transplant warm-season crops under cover

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Vertical Support

Vertical space benefits

- Some need support
  - Peas, pole beans, tomatoes, tomatillos
  - Cucumbers
  - Quinoa
  - Pumpkin!
- Maximize surface area
- Conserve space in beds

Create A Micro-Climate

- Create shade
- For cool-weather plants
- East-west orientation

Succession Planting

- Lettuce, radish, arugula, and cilantro
  - plant every 10-14 days
- Scallions, mustard greens, beans
  - Plant every 2-3 weeks
- Leafy greens like kale and chard
  - Plant 2-3 waves per growing season (April, June, and August)
- Summer Squash plant first week of June and again First week of July

Summer squash succession

Interplanting

Interplanting

- Above ground growth pattern
  - Broccoli with beets
  - Carrots/spinach with peas
  - Tomato with lettuce
- Time to maturity
  - Carrots and radish
- Trap crops
  - Radish with broccoli
- Three sisters
  - Corn, beans, squash

Container Vegetable Gardening

- Safety first!
- Planting medium
- Watering
- Drainage!

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The Drainage Myth!

http://inspiringtheeverydaydotcom.files.wordpress.com/2011/05/potting-pot-section-2011.jpg

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Container planting medium

(From WSU Community Horticulture Fact Sheet #39)

- Purchased potting soil (2.5 cu.ft.)
  - Check fertility on label
  - Add 1 cup dolomite lime
  - 1 cup cottonseed or alfalfa meal or 2/3 cup blood meal
  - 2 cups bone meal or soft rock phosphate
  - 1 cup kelp meal
- Can add good loamy soil,
  - no more than 1/3 of volume

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Good crops for containers

- Culinary herbs
- Cutting greens: cutting greens like lettuce, arugula, mustard and scallions
- Larger container (5 gallons or more)
  - Tomato
  - Zucchini
  - Cucumber
  - Peas/beans

Herbs in the Garden

- Annual Herbs
  - Anise, basil, caraway, chervil, cilantro, fennel, parsley, calendula, borage
- Perennial Herbs
  - Chives
  - Mint Family
    - Mint, lavender, sage, rosemary, thyme, hyssop, oregano, marjoram, savory
  - Tarragon (aster family)

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Hymenoptera order insects like bees and wasps love flowering cilantro and parsley.

GENERAL MAINTENANCE

Harvesting/Preserving/Eating

- Stay on top of harvesting
  - Greens and onion family anytime
  - Beans, squash, cucs pick regularly
- Harvest at peak ripeness
- Preserve what you can
- Distribute surplus
- Compost crops and food scraps
- A-Z Guide: Cornell University:
- http://nysipm.cornell.edu/organic_guide/stored_fruit_veg.pdf

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Harvest and post harvest care

- Lettuce and heading brassicas and tough greens like kale and chard remove field heat by dunking in water
- Tender leafy greens cilantro and basil, keep dry and refrigerate ASAP
- Root crops spray off dirt and refrigerate
- Tomatoes, peppers, eggplants, beans, corn keep in shade

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Clean-up and Rotation

- Clean beds after crops
- Compost disease-free material
- Add 1”+ compost and fertilizer as needed
- Prepare soil
- Rotate crops
- Cover soil in winter

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Some Common Problems

Nutrient deficiencies

Pests

Diseases

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Steps of IPM

- Diagnose problem- research
- What is your tolerance?
- Understand options
- Implement control measures
  - Cultural: Right plant, right place,
  - Physical: Hand picking
  - Biological: Beneficial insects- Habitat!
  - Chemical- Least toxic!
- Monitor effect

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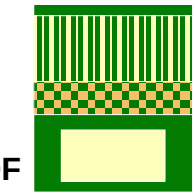
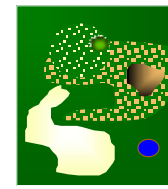
Look for PATTERNS OF DAMAGE to determine cause



Uniform => Nonliving



Nonuniform => Living

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Non-Living (Abiotic) Causes

- Weather: heat, cold, wind, water
- Mechanical damage
- Nutrient deficiencies or toxicities
- Toxins: pesticides, soil or air pollutants

From http://www.pioneer.co.nz/

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Living (Biotic) Causes

- Vertebrate pests
- Insects & mites
- Nematodes
- Fungi
- Bacteria
- Viruses

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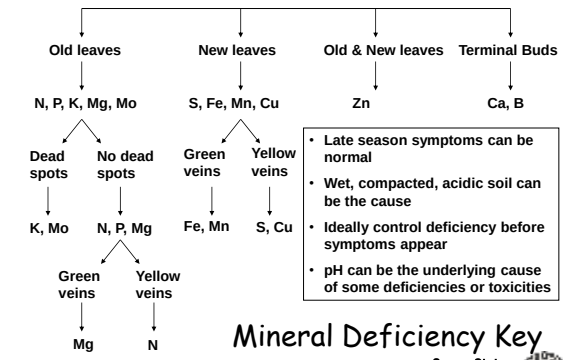

Mineral Deficiency Key

Reddy, T.Y. and Reddi, G.H.S. 1997. Mineral nutrition, manures and fertilizers. In Principles of Agronomy. pp. 204-256. Kalyani Publishers, Ludhiana, India

http://www.plantstress.com/Articles/min_deficiency_ilfmpact.htm

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From http://www.pioneer.co.nz/

- Old leaves
- No dead spots
- Yellow veins

N deficiency

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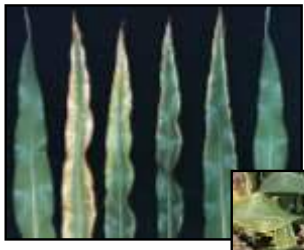
Potassium (K) deficiency



- Old leaves
- Dead spots

Courtesy of Lindsey DuToit

Tomato & Corn Mg deficiency

- Old leaves
- No dead spots
- Green veins

Courtesy of Lindsey DuToit

From http://www.soils.wisc.edu/

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Boron deficiency

- **Shows inconsistently throughout crop!**
- **Reddish leaves**
- **Hollow broccoli**
- **Black corky beets**

Tomato- Abiotic Problems

Blossom-end rot

Sunscald

- Ca deficiency in fruit
- Ensure adequate moisture especially on small fruit
- Check soil Ca level amend with lime if needed

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Slugs n' Snails

- **Spotted garden slug**
- **Reticulated Slug**
- **What do they need to live?**
- **Encourage predators**
  - **Birds, snakes,**
  - **ground beetles**
- **Eliminate habitat**
- **Beer and board traps**
- **Chemical (baits)**
  - **Iron phosphate (slower acting, effective)**
  - **Metaldehyde (danger to kids and pets!)**

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Kill slugs and their eggs!

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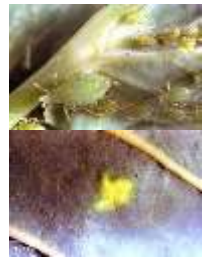
Aphids

- Beans, brassica, artichoke
- Life cycle:
  - many generations/ year
- Biological
  - Attract beneficials
- Cultural
  - Avoid excess N
  - Washing w/ water
  - Row cover
- Chemical (O)
  - insecticidal soap , neem (broad spectrum)



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Aphids come in all sizes and colors

http://extension.umass.edu/landscape/sites/landscape/files/fact-sheets/images/aphids4.jpg

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Powdery Mildew

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Cucurbit Powdery Mildew IPM

- Cultural
  - 2-year rotation (spores overwinter)
  - Resistant varieties (marketmore, etc.)
- Biological
  - Serenade (bacteria) apply at first sign of disease, somewhat effective
- Chemical (usually not advised)
  - Copper-based
  - Horticultural oils
  - Kaligreen- KCO3

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Flea beetles

- Severe in hot, dry weather
- Young plants susceptible, after 6-8 leaves plants compensate for damage
- Larvae may damage root brassicas

Image: http://www.hort.purdue.edu/rhodcv/hort410/8001.jpg

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More on flea beetles

- 75 beetles/plant can damage mature cabbage
- Waxy leaved varieties more tolerant

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Flea Beetle Control

- Delayed planting for fall crops
- Row covers
- Trap crops (radish)
- Products:
  - predatory nematodes
  - spinosad
  - Neem

Crop Rotation!!

Beneficial nematodes

Apply when temperatures are > 55 degrees

Nematodes on larvae

Leaf miner (chenopod)

Other common pesky critters

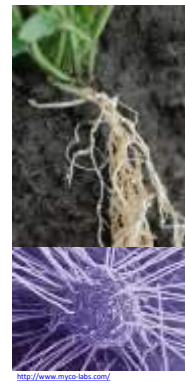
- Imported cabbage moth

Tomato late blight

Cover Crops

Image: http://www.mccc.msu.edu/images/covercrops/ToddMartin/crimson-1.jpg

Cover Crop Benefits



http://www.myco-labs.com/

- Reduce erosion
- Protect soil structure
- Fix N and improve nutrient availability
- Reduce nitrate leaching
- Increase soil organic matter
- Improve mycorrhizal winter survival
- Reduce weed pressure
- Provide nectar & pollen for beneficial insects

Selecting cover crops

- **To reduce leaching use grasses**
- **To increase, organic matter use grasses and buckwheat**
- **To reduce weeds, over-seed and plant early**

Selecting cover crops

- **To increase N, use legumes**
- **To feed beneficial insects, incorporate after flowering**
- **To combine benefits, use mixtures of cover crops**

Nitrogen fixation

- **Atmosphere contains 78% N_2 but it is unavailable to plants**
- ***Rhizobia* spp. colonize legume roots and convert N_2 to NH_3**
- **They exchange NH_3 for carbohydrates**

www.agnet.org

Nitrogen fixation specifics

- N-fixation is highest when:
  - pH is near neutral,
  - N is low,
  - other nutrients are plentiful.
- *Rhizobia* must be fresh – inoculate just before seeding with sugar water
- Be sure to use *Rhizobia* that are compatible with your crop

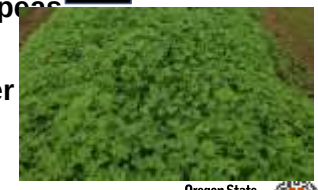
  -clover group, pea & vetch group, etc.
- Incorporate into soil before flowering

Make Sure to Inoculate

Winter Cover Crop Choices

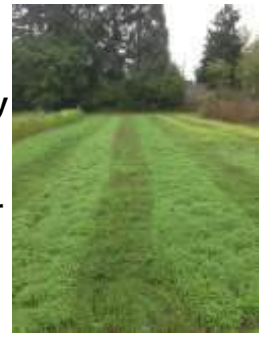
- Annual rye
- Common vetch
- Austrian field peas
- Crimson clover

3-way mixture



Winter Cover Crop Timing Guideline

- Late August/ Early Sept is best
- End of September at latest



Winter Cover Crop Practicality in Garden Setting?

Extreme measures to deal with winter cover crops

- Cut down with scythe or weed whacker
- Chop in as best you can
- Add slow-release fertilizer
- Cover with black plastic for 4-6 weeks

Then What?!?!

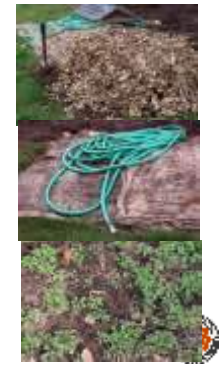
After incorporation in spring:

Wait 2-3 weeks for debris to break down before planting.

Recommended for Gardens

Winter Veggie Beds

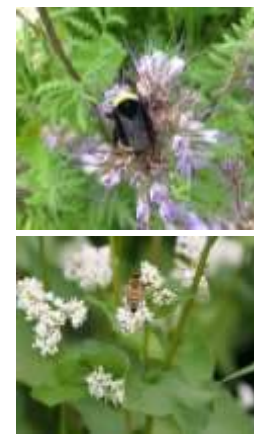
- Thick layer of leaves
  - Put in paths in spring
- Coffee sacks
- Fallow = weeds



Warm Season Cover Crops: Buckwheat and Phacelia

Phacelia and buckwheat

- Early May- mid August
- Seasonal place holder
- Fast growing
  - 35-40 days!
- Great insectary plants
- Quick decomposition
- Winter kill



Additional Resources!

- Maritime Northwest Guide- Seattle Tilth
- How to Grow more Veggies- John Jeavons
- Gardening West of the Cascades- Steve Solomon
- Four Season Harvest- Eliot Coleman

Review of presentation

- Soils, compost, fertilize
- Bed preparation
- Crop planning
  - Crop family exercise
- Planting
  - Seed and transplant
- Intensive techniques
- General management
- Common problems
- Cover cropping