

## Sustainable Vegetable Gardening Part 2 - Planning

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## Organic Gardening

- Gardening without synthetic fertilizer, pesticides, herbicides, fungicides
- A method, using nature as a guide, to grow plants without synthetics. Plants are part of a whole system within nature that starts with the soil and includes water, air, wildlife, insects, people. Working in harmony with nature, conserving resources, improving health.
- Stewardship, close connection to nature
- Chemistry vs. Certified vs. Backyard

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## Sustainable Gardening

- Organic, environmentally sound,
  - Manage ecological and biological processes
- Reduce reliance on external input (chemical, organic)
- Get renewable resources locally or from garden
  - Grow materials for compost, save seeds
- Acceptable nutrition, protection from pests, disease
- Conserve non-renewable resources (soil, energy, minerals) (e.g. peat, greensand, petroleum)

*Scientific systems approach: understand the parts, how they work, the connections and dependencies among them, and harmonize them. Depends on feedback e.g. soil testing.*

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## Soil is Job #1

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



A community – A complex system of living and non-living things

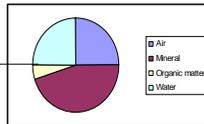
1. Inorganic particles of sand, silt and clay
2. Macro and trace minerals
3. Microorganisms: bacteria, algae, fungi, and protozoa
4. Insects
5. Plant roots
6. Soil organic matter

**Job 1: Feed the soil to feed the plant** by increasing soil organic matter, increasing biological activity and providing nutrients.

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## Ideal Composition of Garden Soil

- **50 % Fluids - Pore Space**
  - 20 to 30 % air
  - 20 to 30 % water
- **50 % Soil Solids**
  - 45 % inorganic minerals
    - Sand, clay, silt; good mix is loam
    - Macro minerals: N, P, K
    - Micro minerals: Ca, Mg, S, Fe, Cu, Mn, Zn, B, Cl, Mo
  - 5 % soil organic matter: the remains of plants and animals



Typical unimproved soil:

- Majority is inorganic soil solids: clay, sand, silt
- Soil organic matter: less than 1 percent, only in top couple inches
- Top soil is very thin
- Very limited pore space for air and water

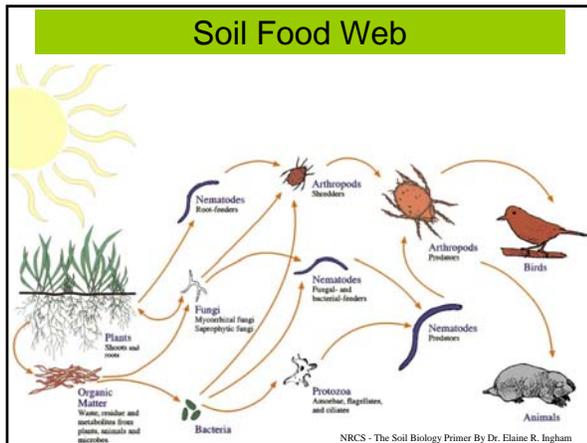
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## Who lives in/near good garden soil?

And what do they do?

- **Bacteria**
- Archaea
- Fungi
- Algae and slime molds
- Protozoa
- Nematodes
- Arthropods
- Earthworms
- Gastropods
- Birds, Reptiles, Mammals
- The earth's 2<sup>nd</sup> primary decomposers. Root exudates are a favorite.
- They take in, decompose, lock up and release nutrients, e.g., nitrogen
- Other members of the web get their energy and nutrients by consuming bacteria
- In healthy soil, good bacteria "inoculate" soil and keep pathogenic bacteria in check

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### Sustainable Vegetable Gardening 1 Review

#### Recommended Practices – Fertility

- Periodically test and amend the soil
- Build and maintain garden soil organic matter through compost and cover crops.
- Rotate crops; companion plant; right plant, right place
- Irrigate as needed to maintain moisture
- Keep the garden covered year round: succession, mulches, cover crops
- Till and aerate properly and avoid compression

"Give back to nature more than you take and She will provide for you abundantly!" – Alan Chadwick

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### Sustainable Vegetable Gardening 1 Review

#### Recommended Practices - Tillage

- Use French intensive tillage methods – deeply dig with hand tools (24 inches)
- Concentrate large amounts of organic matter, minerals into permanent beds
  - 200 lbs/100sq ft / 50 -100 lbs/100 sq ft, maintenance
- Properly time tillage according to moisture (50-75%), texture, season, cropping system, and tilth (quality)
- Maintain permanent beds and pathways

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### Tonight Planning

- Situating the garden
- Preparation of the beds
- Crop and variety selection
- Arranging the crops
- When to start it, plant it, harvest it
- What goes in next
- Using sustainable practices

NOTE BOOK

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### Situating the garden

- Sun – 6 hours (ideally between 10 am and 4 pm)
- Orientation – N-S, E-W
- Water – is it nearby, is there too much
- Garden size, bed size, pathways
  - Width for access (3 to 5 ft); equal size for rotation (100 sq ft)
  - Permanent beds, permanent pathways; avoid compaction
- Sketch it, name the beds
  - Plan: proposed – actual – amendments
- Options: Raised & Bordered, Containers

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## Garden layout 5x20 beds NS, 12-18 in path, water



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## Raised Beds, with and without borders



Raised beds warm up faster and dry out faster; curved top surface allows more planting area

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## Preparing / Planning the Beds

- New beds – first class: fertility and tillage
  - Double dig, soil test, amend as indicated
- Continuing beds –
  - Till as soil needs; and incorporate soil organic matter and nutrients as appropriate
- Crop Legacy
  - What was there last year influences what is appropriate for next planting (crop rotation)
  - What is there now influences when the next crop can go in
    - incorporation of cover crops around pollination, before seeding, 2 weeks before planting
    - Or cut (or pull) cover crops just before planting

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## Crop and Variety Selection

- What vegetables do you like to eat? Also expand your diet to healthy selections
- What grows well here? Where can I get it?
- What do they like to grow with?
- When do they grow best?
- To get started:
  - A. Pick a couple varieties to learn
    - Beans: Bush, Pole
    - Tomatoes: Determinate, Indeterminate
    - Garlic: nine month crop, Sept 15 – June 15
    - Grains: sustainability – cover, compost, mulch
  - B. Jump in with both feet: [The Sustainable Vegetable Garden](#), Jeavons and Cox

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## Vegetable Families

- |                                   |                              |
|-----------------------------------|------------------------------|
| • Legumes *                       | • Alliums                    |
| • Crucifers *                     | – onions, garlic, shallot    |
| – broccoli, radish                | • Chenopods                  |
| • Cucurbits *                     | – spinach, beet, chard       |
| – cuke, squash                    | • Composites                 |
| • Solanaceous *                   | – lettuce, artichoke, endive |
| – tomato, pepper                  | • Grasses                    |
| • Umbels                          | – corn, cover crop grains    |
| – carrot, parsnip, cilantro, dill |                              |
- \* Rotate every year, 4 year cycle<sup>17</sup>

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## What grows well here?

- "Local" can be good for finding varieties
  - VCE Vegetables recommended for Virginia <http://pubs.ext.vt.edu/426/426-480/426-480.pdf>
  - MCE: Recommended Vegetable Cultivars for Maryland Home Gardens <http://www.hgic.umd.edu/media/documents/RecommendedVegetableCultivarsHG70pfv.pdf>
  - Check local growers / providers, e.g. Southern Exposure, Mineral, VA at [www.southernexposure.com](http://www.southernexposure.com)
- Or "phone a friend," ask a Master Gardener or nearby farmer, call the horticulture help line at 703-792-7747

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## Where can I get seeds/plants?

- From a reputable source, in store or on line
- From a seed exchange
- From catalogs (paper or on-line)
  - [www.bountifulgardens.com](http://www.bountifulgardens.com) Willits, California
  - [www.southernexposure.com](http://www.southernexposure.com) Mineral, Virginia
  - [www.ronnigiers.com](http://www.ronnigiers.com) Austin, Colorado
  - [www.johnnyseeds.com](http://www.johnnyseeds.com) Albion, Maine
  - [www.seedsofchange.com](http://www.seedsofchange.com) El Guique, N. Mexico
  - [www.burpee.com](http://www.burpee.com) Warminster, Pennsylvania

There's nothing better than a printed catalog!<sup>19</sup>

## What should I consider?

- **Get Information: Ask the seller, Read the label:** planting and harvest period, days to maturity, spacing, planting instructions. Go on line, too.
- **Genetically modified seed** - look for The Safe Seed Pledge if you want to avoid them
- **Open-pollinated vs. hybrid seed** -
  - For sustainable growing, open-pollinated preferred - a must to harvest your seed. Heirlooms are open-pollinated.
  - Hybrids are bred for desirable traits (F1); they do not grow true to seed
- **Organically grown seed** is desirable because manufactured pesticides, herbicides and synthetic fertilizers have been avoided in growing them.
- Select and **buy** seeds in plenty of time to sow them

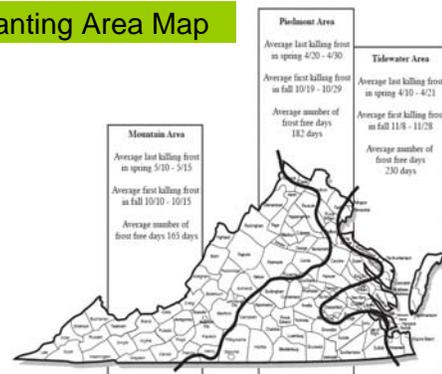
Can I use seeds from last year? Yes, sometimes, and you can test them

## When to start it, plant it, harvest it

- Identify your growing season: (VA Piedmont)
  - Spring last frost date: 4/20-4/30
  - Fall first frost date: 10/19-10/29
  - Our growing season: 182 days
- Gather crop/variety information
  - When to start, plant out, harvest
  - Days to maturity, e.g., potatoes: 60-80-100-130
- Vegetable Planting Guide and Recommended Planting Dates <http://pubs.ext.vt.edu/426/426-331/426-331.pdf>. Also how much to plant for desired yield and planting distances in and between rows
- Fall Vegetable Gardening <http://pubs.ext.vt.edu/426/426-334/426-334.pdf>. Also cover crops, preparation of soil for winter, crop care.

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## Planting Area Map



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## Planting Calendar (partial)

Month	March				April			May			June		
	1	11	21	31	10	20	30	10	20	30	9	19	29
<b>Crop</b>													
Collards	P									H			
Onion, set	P				P&H						H		
Peas, garden	P						H						
Radish	P		P&H				H						
Spinach	P				H								
Turnips	P				H								
Potatoes		P										H	
Beets			P						H				
Cabbage*			P						H				
Carrots			P						H				
Lettuce, bibb			P							H			
Lettuce, leaf			P					H					
Broccoli*				P							H		
Brussels sprouts*				P								H	
Cauliflower*				P					H				

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## Other Sustainable practices

- Cover Crops
- Crop Rotation
- Companion Planting
- Interplanting
- Succession Planting
- Beneficial Insect Gardening (Farmscaping)
- Composting
- Growing Compost Crops
- Seed Saving

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## Cover Crops

- Cover crops are essential for preventing erosion, protecting life in the soil, increasing nutrients, holding and releasing moisture
  - Warm weather examples – clovers, rye grass, buckwheat
  - Cold weather – winter or spring wheat, cereal rye (grain); hairy vetch, fava beans (hearty), Austrian winter peas (legumes), forage radish (Daikon)
  - Perennial – alfalfa
- “Green manure” – turned under 2 weeks before planting
- Can also perform as compost crops
- Can support “no till/drill” method of farming

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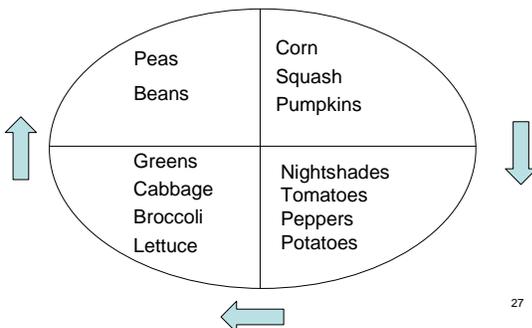
## Crop Rotation

- Movement of crops from place to place in a planned sequence
  - Interrupts pest-host cycles; avoids buildup of pests, weeds, pathogens; access nutrients from different soil depths
1. Rotate plants and plant families to break pest and disease cycles; solanaceous (don't plant tomatoes followed by tomatoes or potatoes)
  2. Try to avoid rotation of crop species that share similar pests and diseases. E.g. tomatoes and corn
  3. Rotate to distribute nutrient demand, e.g. follow heavy N feeder with light, e.g. corn with beans or beets
- Fallow periods with cover crop to restore soil properties

What 4 plant families should always be rotated every year?

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## Penn State Rotation



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## Crop Rotation the Year After TSVG Ref Chart #13

**2011 (Proposed)** Beets, carrots, onions and radishes can be planted anywhere

Cucurbits & Corn	Cruciferous (Greens)	Solanaceous (Nightshades)	Legumes
Corn Squash Cucumbers Pumpkins	Cauliflower Cabbage Broccoli Lettuce	Tomato Pepper Potato Eggplant	Peas Beans

**2012** – Rotate each crop set to the right; legumes start over on the left

Don't forget to add in winter cover crops!

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## Companion and Interplanting

- Companion Planting - Plant crops together which assist each other; avoid planting antagonists close to each other
- Interplanting - Interplant ornamentals, soil-builders,
  - Break-up big blocks of same plant
  - Interplant compatibles: cabbage and lettuce; onions and carrots; radishes and squash
- Both practices reduce the risk of insect and disease damage and the need for pesticides

*Biodiversity strengthens plants and the ecosystem*

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## Traditional Companion Plantings

Vegetable	Friends	Foes
Asparagus	Tomato, Parsley	
Beans	Most others	Onions
Beets	Cabbage onion lettuce	Pole beans
Carrots	Peas lettuce onion tomato	Dill
Crucifers	Herbs beets onions spinach	Dill pole beans tomato
Corn	Potato legumes cucurbits	Tomato
Cucurbits	Legumes corn nasturtium sunflower	Potato
Tomato	Onion asparagus carrot cucumber	Fennel crucifers

National Sustainable Agriculture Information Service ATTRA

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## Interplanting

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## Succession Planting

Covering the bed from late winter to early winter plus

<ul style="list-style-type: none"> <li>• <b>Crop:</b> <i>Can be planted, days to maturity</i></li> <li>• Radishes               <ul style="list-style-type: none"> <li>– 3/1, 21-30 days</li> </ul> </li> <li>• Lettuce               <ul style="list-style-type: none"> <li>– 3/21, 45-65 days</li> </ul> </li> <li>• Snap beans               <ul style="list-style-type: none"> <li>– 4/20, 50 days</li> </ul> </li> <li>• Carrots               <ul style="list-style-type: none"> <li>– 3/21, 58-70</li> </ul> </li> <li>• Winter cover crops</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Variety, Plant next crop as prior one is harvested</b></li> <li>• Cherry Belle               <ul style="list-style-type: none"> <li>– Harvest starting 3/28</li> </ul> </li> <li>• Butterhead, Looseleaf               <ul style="list-style-type: none"> <li>– Harvest starting 5/15</li> </ul> </li> <li>• Contender, green filet               <ul style="list-style-type: none"> <li>– Harvest starting 7/15</li> </ul> </li> <li>• Napoli, Chantenay               <ul style="list-style-type: none"> <li>– Harvest 9/15 into winter</li> </ul> </li> <li>• Winter rye</li> </ul>
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## Plan for Succession, Cover crops, Rotation

July 2009

Spring Wheat  
Corn for Compost  
Composted in place

May 2010

SS Peas 3/1 -5/15  
Tomatoes, Peppers 5/15 – 10/1  
Circle with carrots and onions  
Rye and vetch or 4 combo 10/1

Bio Bed C

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## Insects in Your Garden

- “Good” insects help your plants
  - Pollination
  - Protection
- Balance limits population growth
- Cleaning up
  - Organic material to soil
- Practice companion planting to attract, repel
- Use organic and mechanical treatments for undesirables; be selective and careful
- Can’t tell good from bad without a “program”

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Good Insect or Bad Insect?

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## Beneficial Insect Gardening Farmscaping

- Attract pollinators and predators
- Devote about 5 percent of landscape area to beneficials
  - Dedicated area, Interplant, Cover crop
- Plants for Beneficials ([www.drncbug.com](http://www.drncbug.com))
  - Spring
    - Wild mustard, radish (flower), yarrow, umbels, buckwheat, clover, vetch (hairy not crown)
  - Summer
    - Wild or seed carrots, parsnip (flower), bronze fennel, cilantro, sweet potato, anise hyssop
  - Fall
    - Autumn Joy sedum, goldenrod, yarrow and comfrey (for overwintering, too)
- In addition to plants your garden needs the prey (the "bad") to attract the beneficial predator

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## Extending the Seasons

- Plant crops that like colder weather
  - Carrots, fava beans, greens, garlic, crucifers
  - Some varieties of crop are heartier: winter spinach
- Use protective devices to modify thermal climate
- Cloche, wall o' water
- Row covers
- Cold frame, Hot box
- Hoop houses
- Green houses, Orangerie

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## Starting Seeds Indoors

- See individual instructions with seeds
- **Cabbage, Cauliflower, Brussels Sprouts, Broccoli**  
Start in flats 4 to 6 weeks before planting out in Spring and Fall (e.g. start in Feb, Jul)
- **Tomato, Eggplant, Pepper**
- Start in flats 6 to 8 weeks before and transplant into deeper flats (6 in) or pots midway
- **Many other plants: onions, corn, wheat, melon, herbs**, etc. can be started in flats to save space in the garden: They are easier to care for, require less water and have less risk of damage than planting out directly

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## Extending the Seasons

- Plant crops that like colder weather
  - Carrots, fava beans, greens, garlic, crucifers
  - Some varieties of crop are heartier: winter spinach
- Use protective devices to modify thermal climate
  - Cloche (bell jar), wall o' water
  - Row covers
  - Cold frame
  - Hot box
  - Hoop houses
  - Green houses, Orangerie, Conservatory

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## Seed Saving

- Why? Sustainability, improvement / adaptation, conservation of resources, self-reliance
- Viability of most crop seeds is 2 to 6 years; easy test
- Pollination
  - Save open-pollinated, not hybrid (F1)
  - Self or cross pollinated – wind or insects
    - Only cross within species
  - Separation distances
- Life Cycle: annual, biennial, perennial
- Selection Factors: flavor, size, disease, timing, diversity
- Storage conditions: dry seed, store cool/dry, glass, refrig.
- Start easy: peas, beans, watermelon, tomatoes

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## What to do next?

- Plan Your beds
  - Sketch / chart out the beds
  - Select crops and varieties
  - Figure how many plants, how much space
  - Use recommended organic and sustainable practices
- Keep a notebook
- Develop your calendar
- Get your seeds; start some varieties indoors or in a coldframe
  - Last year's seeds probably viable
- Implement your plan
  - Use recommended practices for fertility and tillage

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March – Planting Yukon gold after double dig

## Questions?

Horticulture Help Line 703-792-7747

### Credits

- Virginia Cooperative Extension On-Line Research References for Vegetable Gardening (Jan 24, 2011) attached to this package especially #1, 2, 3, 6, 18.
- Teaching Organic Farming and Gardening, Center for Agroecology & Sustainable Food Systems, UC Santa Cruz
- Teaming with Microbes, The Organic Gardener's Guide to the Soil Food Web, Jeff Lowenfels and Wayne Hughes, Timber Press, 2010
- The Sustainable Vegetable Garden, John Jeavons and Carol Cox, Ten Speed Press
- Develop a Sustainable Vegetable Garden Plan (DVD), Cindy Conner, Homeplace Earth
- Vegetable Gardening (.ppt) Jeff Schneider
- Soil Biology for Your Landscape (.ppt) Duane Mohr

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## Crop Profile - Garlic

- Soft-neck and hard-neck; hundreds of varieties
- Fall planted, easy to grow organically, 6-9 month cycle, Sept-Nov to Jun-Jul. Check farmers markets to buy.
- Soil – moderate organic matter, well drained
- Biggest cloves produce biggest bulbs. Separate cloves, plant 4 – 6 in apart, 2 in deep; mulch well to control weeds & frost heaves.
- Rake straw in spring to prevent rot; top dress w/compost
- Stop watering 2 weeks before harvest. Harvest when tops partially die. Remove soil, do not wash; dry whole plant on screens or hang; cure 4-6 weeks in dry warm, ventilated room. Trim roots, stems to 1 inch & remove dirty skins. Softnecks store longer.

<http://pubs.ext.vt.edu/2906/2906-1347/2906-1347.pdf>; AHS Article

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## Garlic – scapes and hardneck cloves



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## Crop Profile – Summer Squash

- Full sun; rich, well-drained, humusy soil (Rotate)
- Sow outside after danger of frost or inside in individual pots 2 to 3 weeks ahead. Plant bush types 1.5-2 ft apart; vine types in hills of 3 or 4, up to 4 ft apart, can grow vertically. Mulch. Plant again 30 days later. Days to maturity 42-65. Male and female blossoms (edible)
- Pests: cucumber beetles, squash borers / bugs
- Use row covers until bloom; remove for pollination. Interplant with radishes or basil; remove bugs. Slice open invaded stems, remove borers, cover with soil.
- Pick small and often
- Tip: dig pit, fill with compost, “plant” plant pot for watering

What's the difference between summer squash and winter squash?

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