IPM and Organic Techniques for Vegetable Garden Crops, Vegetable Families and Specialized Techniques

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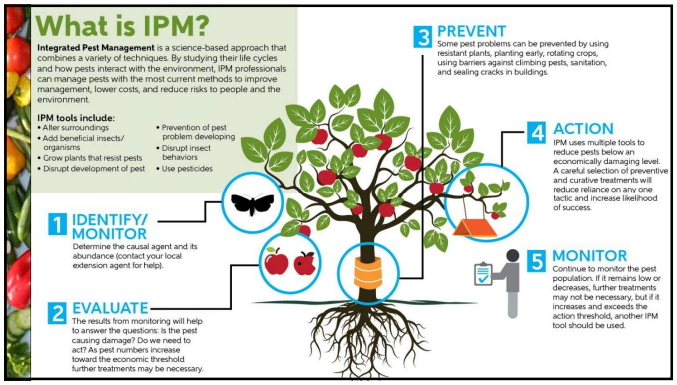
IPM, Vegetable Families and Special Techniques

- Overview
  - Good gardening practices using Integrated Pest Management (IPM) and organic techniques
  - Family/Crop specific tips
  - Specialized gardening techniques



Organic Techniques

Gardening Best Practices: Avoiding/Preventing Pests & Diseases

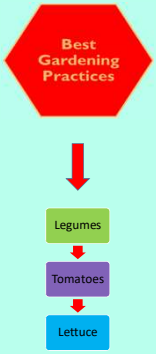
- Many issues can be avoided with:
  - Healthy soils and crop rotation
  - Scouting, trapping and monitoring
  - Using resistant plant material or grafted plants
  - Proper cultural methods
  - Floating row cover/exclusion strategies
  - Companion planting
  - Preventive or curative treatments (organic or traditional)
- The bad news
  - If insect/disease pressure is high enough, above methods may not be enough to prevent problems

Gardening Best Gardening Practices: Healthy Soils

- Healthy Soils
  - Add compost, composted manure, incorporate cover crop residue or other organic amendments on an annual basis
    - Wisconsin Horticulture Site: Organic Soil Conditioners (A2305)
  - Don't over-till
  - Don't over-fertilize with traditional fertilizers

Gardening Best Practices: Crop Rotation

- Crop Rotation
  - Prevents build-up of insects and diseases that result from growing one type of crop or crop family in the same place year after year
  - 3 or 4 year rotation recommended between crop families of plants
  - Can be hard to do in a small garden
  - **Tip:** Take photos or make drawings to keep track of where you planted your crops



PLANT FAMILY	VEGETABLE
Onion Family (Alliaceae)	Onions, leeks, garlic, shallots, scallions, chives
Carrot Family (Apiaceae)	Carrot, celery, parsley, parsnip
Asparagus Family (Asparagaceae)	Asparagus
Lettuce Family (Asteraceae)	Artichoke, chamomile, chicory/endive, dandelion, lettuce, sunflower, tarragon, marigolds
Mustard Family (Brassicaceae)	Broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, collard, kale, kohlrabi, mustard greens, radish, rutabaga, turnip
Goosefoot Family (Chenopodiaceae)	Beet, spinach, Swiss chard
Cucurbit Family (Cucurbitaceae)	Cucumber, muskmelon, pumpkin, summer squash, watermelon, winter squash,
Pea Family (Fabaceae)	Bush bean, kidney bean, lima bean, pea, pole bean, soybean
Nightshade Family (Solanaceae)	Eggplant, pepper, potato, tomato

USE A 3-4 YEAR ROTATION BETWEEN PLANT FAMILIES

Gardening Best Practices: Mulch

- Mulch
  - Conserves and keeps consistent moisture
  - Keeps temperature consistent
  - Discourages weeds
  - Prevents erosion
  - Protects plants from soil-borne diseases such as early blight
  - Adds fertility to the soil as it decays
  - Easier to harvest

Photo credit: Tomatodirt.com

Gardening Best Practices: Disease Resistant Plants

- Use disease resistant plant varieties when possible (lists here):

CORNELL Vegetable MD Online — Department of Plant Pathology, Ithaca, NY 14853

Johnny's Selected Seeds

- Use disease resistant seeds if possible – check seed packet for disease resistance codes

V - Verticillium Wilt
F - Fusarium Wilt (FF - Races 1 & 2; FFF - Races 1, 2, & 3)
N - Nematodes
T - Tobacco Mosaic Virus
A - Alternaria Stem Canker
St - Stemphylium Gray Leaf Spot
TSWV - Tomato Spotted Wilt Virus

Gardening Best Practices: Disease Resistant Plants

- Example:
  - Late blight of tomato and potato
  - Caused by the fungus-like water mold *Phytophthora infestans*.
  - Tomato late blight resistant varieties: 'Defiant PHR', 'Iron Lady', 'Jasper', 'JTO-545', 'Lemon Drop', 'Matt's Wild Cherry', 'Mountain Magic', 'Mountain Merit', 'Mr. Stripey', 'Plum Regal', 'Pruden's Purple', and 'Wapsipinicon Peach.'

Iron Lady Tomato
Photo credit: Marylandgrows.umd.edu

Gardening Best Practices: Disease Avoidance

- Hot Water Seed Treatment
  - If you have had bacterial issues, this can be helpful
  - Works best for small untreated seed
  - Use a water bath ("water oven") with precise temperature & timing control if possible or 2 large pans and a precise thermometer

Factsheet XHT1261:
https://pddc.wisc.edu/fact-sheet-listing-all

Gardening Best Practices: Disease Avoidance

- Hot Water Seed Treatment
  - Wrap seed in cheesecloth and soak (to remove air) in 100°F tap water
  - Submerge pre-warmed seed in water oven or pan at prescribed temperature & duration for constant, uniform temperature
  - Visit https://pddc.wisc.edu/ for fact sheet XHT1261 with prescribed temperatures by crop

https://extension.usu.edu/pests/ipm/notes_orn/list-flowers/seed-treatment-home-gardens

Gardening Best Practices: Disease Avoidance

- Hot Water Seed Treatment
  - Too hot injures seeds; too cold won't kill pathogens.
  - Place seed in cold tap water for 5 min to quickly end the heat treatment
  - Spread seed on a paper towel or screen to dry
  - Works especially well for bacterial diseases

https://extension.usu.edu/pests/ipm/notes_orn/list-flowers/seed-treatment-home-gardens

Gardening Best Practices: Disease Avoidance

- Grafted Plants
  - Typically tomatoes, but can be other crops:
  - What are grafted tomatoes?
    - Resistant rootstock (one variety is 'Maxifort') and the scion of desired plant
    - Many diseases have resistant rootstocks, but may not be broad-spectrum; know what disease you want to prevent

www.rootsimple.com

Gardening Best Practices: Insect Avoidance

- Avoiding insect pests using timing, scouting and trapping
- Scouting for insect eggs, adults
- Timing, Science of Phenology
  - Uses degree days or indicator plants to predict insect developmental stages
  - 'Field Notes' free online report tracks degree days statewide across WI, weekly April-early September.

Growing Degree Days Jan 1 - August 31, 2016

LOCATION	50°F	2015	NORM	48°F	40°F
Dubuque, IA	2564	2399	2421	2695	3684
Lone Rock	2510	2318	–	2644	3597
Beloit	2640	2420	2463	2852	3820
Sullivan	2278	1978	2333	2489	3354
Madison	2501	2290	2345	2718	3624
Juneau	2227	2113	–	2462	3328
Racine	2449	1936	–	2670	3546
Waukesha	2186	1978	–	2308	3174
Milwaukee	2478	1937	2267	2691	3553
Hartford	2190	1978	–	2314	3180
Appleton	2180	2040	–	2416	3260
Green Bay	2152	1931	2110	2380	3211
Big Flats	2344	2164	–	2540	3392
Hancock	2544	2164	2274	2540	3392
Port Edwards	2320	2084	2229	2517	3384
La Crosse	2708	2409	2562	2943	3893
Eau Claire	2384	2175	2311	2604	3513
Cumberland	1956	1936	2167	2064	2915
Bayfield	1776	1628	–	1977	2701

DATCP's 'Field Note' Degree Days Season-long Accumulations

Gardening Best Practices: Insect Avoidance

- For vegetable insect phenology, visit
  - https://vegento.Russell.wisc.edu/crops
- Uses Degree Days to guide delaying planting or applying protective measures

Gardening Best Practices: Insect Exclusion

- Excluding Insect Pests
  - Floating row covers
  - Spun-bonded or woven plastic, polyester or polypropylene material placed over plants to exclude pests but allow in light, water and air. Install at planting.
  - Works for many insects but don't use over a known infested area
  - Best for plants not needing pollination
  - Remove row covers from insect-pollinated crops, like squash and cucumbers during bloom for pollination

Floating Row cover
Photo credit: https://gardenerspath.com/

https://www.tastergardener.com/

Gardening Best Practices: Insect Exclusion

- Excluding Insect Pests
  - 'Collars' (cylindrical barriers of plastic or metal around seedlings.
  - Sink into the ground 1" and several inches above ground to protect from cutworms
  - Some species can climb, most can't
  - They feed at night, damage can be mistaken for rabbit feeding
  - Create collars from plastic containers, plastic or Styrofoam cups, soup cans, etc.

https://www.essentialhomeandgarden.com/cutworms/

https://extension.unr.edu/yard-and-garden-insects/cutworms#what-to-do-if-you-observe-damage-or-larvae-1991101

Gardening Best Practices: Insect Exclusion

- Trap crops on edges of gardens
  - –Trap crops are meant to be either sprayed or cut down with pest insects on them and plants disposed of (in plastic bags)
- Ideally, not too close to crops you want to protect

https://ipm.missouri.edu/MEG/2017/3/Trap_cropping/

Gardening Best Practices: Support Beneficial Insects

- Create refugia to shelter and feed beneficials
- Refugia plantings include herbs, flowers and grasses mixed together
- Refugia are usually planted in strips around the edges of fields or mixed in between crop rows
- Can also mix trap crops on field edges mixed with refugia

https://morningchores.com/flowers-you-shouldnt-plant-near-vegetables/

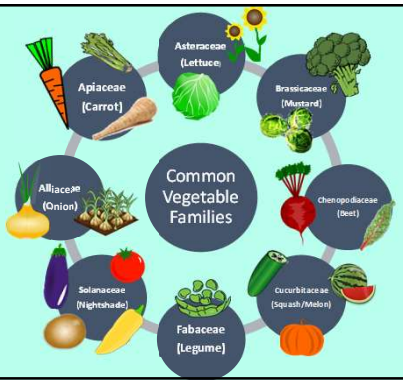
Gardening Best Practices: Companion Planting

- Studies indicate can deter pests.
  - Hiding or masking a crop from pests
  - Producing odors that deter or confuse pests
  - Providing trap crops to draw pests away
  - Providing 'nurse plants' for shade, weed control, biochemical benefits, etc.
  - Providing food for beneficial insects
  - Creating a habitat for favorable creatures.
- See Jessica Walliser's book: 'Plant Partners: Science-based Companion Planting Strategies for the Vegetable Garden'

https://foodgardening.mequoda.com/get-free-guide/

Gardening Best Practices: Organic Treatment Products

- Kaolin Clay and Diatomaceous Earth
  - Desiccants and abrasives work on exoskeleton
  - Reapply after a heavy rainfall or periodically
- Many organic products are contact poisons and are only active while still wet and in contact with the insect, or may have a short residual effect.
- Oils, soaps: 'Horticultural Oils- What Gardeners Need to Know https://extension.unr.edu/publication.aspx?PubID=3029
- Some organic products are microbial (Bt, spinosad, Beaveria bassiana etc.)
- Some are volatile compounds that deter or repel or confuse insects
- Botanicals like neem, natural pyrethrin (don't overuse pyrethrin to protect beneficials)
- Remember that just because a product is organic, it is not necessarily 'safe'



Alliaceae Crops

- Onions
- Leeks
- Garlic
- Shallots
- Scallions
- Chives

Onion Culture

- Use seeds (transplants) or onion 'sets'
- Start seeds indoors 8-10 weeks before plant out date
- Clip off transplant tops to 3-4"; prevents drying out
- Temps should be 50°F outside as they may bolt if below that for too long
- Harden off transplants before planting outside
- Plant transplants 1" deep

Onion transplants from seed

Onion Culture

- If planting outside as sets, plant 4-6 weeks before last frost, but temps should be 50°F outside as they may bolt if below that for too long
- Sets are from second year growth (bulbs)
- Plant sets 2" deep

Onion sets

Garlic Culture

- Plant large cloves from last season's bulbs
- Plant in fall, early October in southern WI
- If plant too early in warm soil, they may sprout, but if too late they may not root well before winter
- Plant 2-3" deep, 4-6" apart
- Mulch with 4" straw after the ground freezes (prevents heaving) and remove in early spring

Fall clove planting

Garlic Culture

- Hardneck varieties have a milder flavor, do better in winter.
- Cut hardneck flower scapes when they circle. Afterwards, the base of the scape hardens.
- Softneck varieties have a stronger flavor, and if survive winter, can produce higher yields.
- Softnecks are better for storage and have stems that can be braided

Scapes ready to cut

Apiaceae Crops

- Carrot
- Celeriac
- Celery
- Cilantro
- Dill
- Fennel
- Parsley
- Parsnip

http://www.starrenvironmental.com/ photo by Forrest and Kim Starr

https://commons.wikimedia.org/wiki/File:Carrots_Lake_Forest_Market_Farmer.jpg https://commons.wikimedia.org/wiki/User:D and cropped photo cropped for size

Carrot Culture

- Grow best in spring & fall with cooler temps 59-65°F; soil temperature needs to be over 45°F for seed germination
- Remove stones/debris from soil to prevent irregular growth
- 1-2" apart, in wide rows, will need to thin
- Cover carrot tops if protruding to prevent 'green shoulders'
- For fall crop, plant 10-12 weeks before first frost; they take light frost
- Wash & dry after harvest, before storage to prevent dark spots

https://web.extension.illinois.edu/veggguide/grow_carrot.cfm

Asteraceae Crops

- Artichoke
- Chamomile
- Chicory/Endive
- Dandelion
- Lettuce
- Sunflower
- Tarragon
- Marigolds

https://extension.umd.edu/resource/lettuce

Lettuce Culture

- Semi-hardy, cool season plants
- Thrive in 60-70°
- Higher temperatures and long days cause
  - stunted growth
  - bitterness in leaves
  - bolting
- Direct seed or transplants (for earlier harvest), re-seed in August for fall crop, soil temp
- Seed in rows 12-18 inches apart
- Shallow roots; weed carefully
- Lightly & frequently water for fast, high quality leaf growth

Bolting lettuce

Lettuce Types

- Leaf (Looseleaf)
  - Most commonly planted
  - Loosely arranged leaves
- Cos (Romaine)
  - Upright elongated head
- Butterhead Bibb
  - Small, loose-heading; tender leaves

Asparagaceae

- Wait to plant roots or potted plants until soils are over 50°F
- Add organic matter pre-planting to dry or sandy well-drained soils
- Plant crowns in a trench 5-6" deep (no deeper) and cover – no need to cover in layers over time
- 18" apart, 4-5' between rows

Asparagus Harvest

- Don't harvest till 2nd year; harvesting the year after planting stimulates more bud growth than waiting to harvest the 3rd year
- Cut or snap off 7-9" spears at or a bit below soil surface.
- Stop harvest when ¾ of spears have pencil-size diameters; most productive for 10-15 years (can last 20-30 years)
- Harvest in morning when cooler.
- Leave fern foliage up over winter to protect the crown

Brassicaceae Crops: (Mustard, Cole, Crucifers)

- **Broccoli**
- **Brussel sprouts**
- **Cabbage**
- **Cauliflower**
- **Collards**
- **Kale**
- **Kohlrabi**
- **Mustard greens**
- **Radishes**

Brassicaceae Crops General Culture

- Cool season annuals or biennials with white or yellow flowers
- Broccoli, cauliflower, cabbage, Brussels sprouts and kale evolved from a single species *Brassica oleracea* (wild cabbage)
- Cold tolerant: can withstand frosts and some are even better as fall crops than spring crops
- Some may be overwintered: kale, collards, Brussels sprouts
- A number of insect pests plague them

https://www.udel.edu/academics/colleges/canr/cooperative-extension/first-state-impacts/cole-crops-processing-veg/

Broccoli Culture

- Sprouting & heading varieties
- Start seeds indoors 6-8 weeks before last frost or use transplants
- Sow seed directly for fall crops 10-12 weeks before killing frost.
- Buttoning can occur in young plants when overcrowded or exposed to temps below 40-45°F or in over-mature transplants

Heading

Sprouting

Buttoning

Harvesting Broccoli

- Harvest when heads are firm and 4-6" or larger, before florets begin to open.
- Retain 2-4 inches of stem when cutting.
- Cut sprouting broccoli just below the floret to stimulate new shoots.

Harvesting main heads

Side Heads

Cabbage Culture

- Start seeds indoors 6-8 weeks before the last frost
- Acclimate transplants before setting outside permanently
- Space plants 12-24" apart
- Sow seed directly for fall crops 10-12 weeks before first frost

Cabbage Harvest

- Harvest when heads are firm and before heads split
- Cut just above the root crown
- Don't wash prior to storage.
  - Leads to rot; can remove some of the outer leaves

Cauliflower Culture and Harvest

- Start seeds indoors 6-8 weeks before last frost.
- Needs a long, cool (but not cold) growing season.
- Tie cauliflower leaves together to blanch the curds.
- Heads develop in 3-14 days after tying depending on the temperature so check every other day.
- Harvest while curds are still compact and surrounded by leaves

Radishes

- Edible leaves arising from a basal rosette.
- Roots can be round, oval, cylindrical, or icicle-shaped.
- Plants bolt under long day conditions.
- Plant before the last frost in spring and successively plant every 10-14 days
- Plant 1" apart in the row for spring radishes and 2" apart in the row for winter radishes.
- Consider inter-planting spring radishes with later maturing crops like lettuce, spinach, or carrots

Chenopodiaceae: (Goosefoot, Beet family)

- Beet
- Spinach
- Swiss chard

Beets

- Semi-hardy; plant 30 days before last frost
- Grow well during hot weather, but establish better in cool, moist conditions
- Best to direct-seed; 'seeds' are dried berries, so pre-soaking is a good idea
- 'Seeds' will grow into a clump of plants
- Thin to 3 inches apart (when 1-3" tall)
- They compete poorly with weeds; frequent, shallow cultivation may be necessary

Photo credit: Susan Mahr, Used with permission

Swiss Chard

- Essentially a beet selected for leaf production
- Direct seed mid-spring after last frost ideally
- If using transplants, plant after last frost
- Plant in single row
- Harvest outer leaves & stems 1½" above ground
- Careful not to damage terminal bud at center when harvesting

Spinach

- Hardy, cool season
- Plant soon after soil thaws or winter broadcast seed
- When 1" tall, thin to 2-4" apart for (whole plant harvest) or 4-6" apart (single leaf harvest)
- Plant successive crops through mid-June; wait until late August to seed for fall – often does better as a fall crop
- Long days and heat cause bolting
- Savoy & crinkle-leaf varieties less easy to wash off soil; flat-leaf washes easier

Savoy; crinkle-leaf

Flat-leaf

Cucurbitaceae: (Gourd, cucurbit, vine crop family)

- Cucumber
- Muskmelon
- Pumpkin
- Summer squash
- Watermelon
- Winter squash

Cucurbitaceae

- Vining crops
- Warm season, herbaceous annuals
- Extensive, shallow root systems
- Tendrils on leaf axils allow vines to "crawl"
- Require full sun, heat, and long growing season

https://plants.ces.ncsu.edu/plants/cucurbita/

Cucumber Culture and Harvest

- Grow best in 60-75˚
- Do not transplant well
- Can trellis with strong wire mesh if need to save space
- Harvest 45-55 days after planting seeds
- Harvest up to 3x weekly

Melon Culture and Harvest

- Require 90-125 days to harvest
- Use transplants
- Allow only 1-2 fruits to set per plant
- Will become bitter if:
  - too hot
  - too much or little water
  - cloudy during ripening
- Cantaloupe rind turns from green to tan/yellow when ripe
- Watermelon 'ground patch' turns from white to cream or yellow

http://www.davidwolfe.com/?s=watermelon

Squash Culture

- Direct seeding
  - ~May 15
- Planting transplants
  - ~May 25
- Seeds will rot if soil is too cold <60˚
- Plant seed 1" deep
- For harvest use a scissors or knife to cut fruit off the vine
  - For pumpkins, leave a 3-4" stem

Summer squash

Winter squash

Fabaceae

- Bush bean
- Kidney bean
- Lima bean
- Peas
- Pole bean
- Soybean

Pea Culture

- Ideally, prepare soil in fall for early spring planting ~April 15-20
- Can also plant late summer for a fall crop
- Plant 1" apart, 1"deep
- Trellis 3-5 feet high
  - Nylon netting
  - Chicken wire
  - Twine - Ladder style
  - Twine - Drop down style

Beans

- Sensitive to cold; plant after last frost, around Memorial day or first week in June in most of Dane County
- Bush types
  - Stand without support
- Pole types
  - Climb using twining stolons; must trellis
- Harvest 14-18 days after bloom unless growing for seed
- Some grown as ornamentals

Solanaceae (Potato or Tomato family)

- **Tomato**
- **Potato**
- **Peppers**
- **Eggplant**
- **Tomatillo**

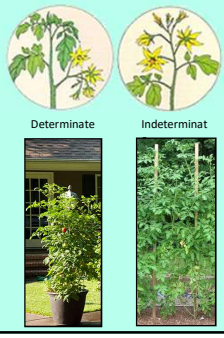
Tomatoes

- Origin: South America
- Introduced to Europe in 1500s as an ornamental
- Tender, warm season annual
- Start seeds indoors 3-6 weeks before last frost date for planting out around May 15-20 (same date for transplants purchased at a
- Do not put out too early; can lead to stunting
- Susceptible to a number of diseases, especially heirlooms

Determinate vs. Indeterminate

Determinate
- 3-4' tall
- Flower buds at branch ends (terminal)
- All fruits ripen mostly at the same time

Indeterminate
- 7-15' tall
- Plant "never ends", remains vegetative
- Flowers form in leaf axils; remove suckers up to the first flowering branch
- Produces fruit all season



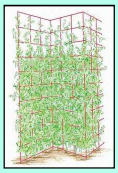
Tomato Types

- **Cherry, Pear, 'Currant'**
  - ➢**Smaller (½" dia.), sweeter tomatoes**
  - ➢**Produce about 100 fruit/plant**
    - **Sweet 100**
    - **Yellow Pear**
    - **Sweet Million**
- **Roma**
  - ➢**Paste/processing**
    - **Roma VF**
    - **San Marzano**
    - **Viva Italia**
    - **Amish Paste**

Beefsteak
- ➢**Larger tomatoes for fresh slicing**
- ➢**Higher ratio of cell wall to pulp & short, soft core**
  - **Big Boy**
  - **Better Boy**
  - **Early Girl**

Heirloom
- ➢**Older, open pollinated varieties**
  - **Brandywine**
  - **Black Krim**
  - **Hungarian Heart**

Staking and Trellising



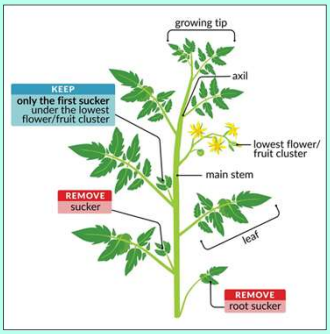


Basket Weave, Stake and Weave Trellis Method

Add rows of string to support as plants grow

Tomato Pruning

- Prune the suckers off <u>indeterminate</u> tomatoes for larger fruits, earlier harvest, reduced disease susceptibility
- Suckers are at the leaf/stem axil and suckers produce their own stems/fruits
- First pruning in late June or early July; 2nd & 3rd prunings do every 10-14 days after the first pruning.



https://hort.extension.wisc.edu/articles/tomato-pruning/

Tomato Pruning

- Remove all suckers but the one under the lowest flower/fruit cluster
- Don't confuse with a root sucker at the base -- keep that one
- Stop pruning suckers 1-2 weeks before the first harvest to allow canopy to shade fruits
- Also prune off lower leaves of indeterminate and determinate tomatoes (be more conservative on determinate varieties) to protect plant from soil-borne disease

https://bonnieplants.com/gardening/how-to-prune-tomatoes/

Harvesting Tomatoes

- Only keep ripe, well-formed, blemish free fruits
- Twist off or cut, don't yank
- Heirloom & beefsteak tomatoes will be irregular in shape
- Never refrigerate tomatoes – won't fully develop flavor after harvest
- Ripen green fruit in a paper bag out of direct sunlight

Peppers

- Warm season plants, intolerant of cold
- Herbaceous perennials grown as annuals.
- Lance-shaped leaves & perfect, white flowers.
- Capsaicin is the chemical that causes 'hotness'. Measured in Scoville heat units

Pepper Culture

- Start seed indoors 6-8 weeks before the last frost –seeds start best with warm media --bottom heat works well
- Best 70-80°F day & 65-70°F night.
- Night temps below 55°F cause blossom abortion, poor fruit set, shortened fruit, lack of color if day temps above 90 along with night temps over 75°F or under 55°F.
- Harden off transplants before planting in ground.
- Do not plant out in Dane County before May 20, plant 18-24" apart

Pepper Harvest

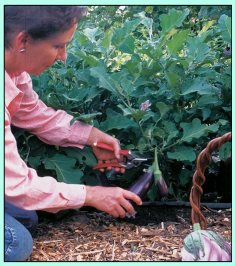
- Harvest immature or mature.
- Hot peppers have the strongest flavor if they stay on the plant till fully ripe.
- Cut or snap off, don't yank
- Chili or cayenne peppers can be dried.
- Avoid harvesting peppers with sunken brown spots.
- Store fresh peppers in the vegetable crisper in the refrigerator.

Eggplant Culture

- A.K.A. Aubergine
- Tender, warm-season perennial grown as an annual
- Indeterminate, erect bush
- Flowers borne singly or in clusters in leaf axils
- Start seed indoors 4 weeks before last frost
- Very susceptible to chilling
- 75-85°F day & 65-75°F night
- May be best if planted on black plastic mulch in cold areas

Harvesting Eggplant

- Harvest eggplant approximately 25-40 days after pollination.
- Cut to remove from stem
- Mature fruit: glossy and deeply colored and feel heavy for its size.
- Over-mature: dull skin and flesh will be bitter.
- Clip fruit from the plant to avoid damage



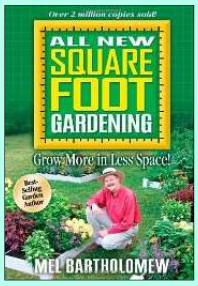
Potato Culture & Harvest

- Tuberous cool season, tender perennial
- Plant certified 'seed', (tubers or pieces)
- Cool season
- Needs well-drained soil, prefers low pH
- Skin set occurs after vines die—harvest after vines die
- Solanine in green potatoes is mildly toxic, so store in the dark

Specialized Gardening Techniques

Square Foot Gardening

- Mel Bartholomew created the idea as an intensive cropping system to produce more food in smaller spaces than traditional row-based gardens
- Based on 4'x4' raised beds with 1-foot-square grids that can produce as much as a row garden 5 times its size.
- No tilling needed



Square Foot Gardening

- Can use weed barrier fabric underneath the beds
- Grids can be removable or fixed
- Build frames no wider than 4', with boards 6-10" inches wide – can have multiple 'stories' of boards
- If growing tomatoes; a depth of at least 18" is preferred
- Length is not critical, but for new gardeners, a 4'x4' frame is recommended.

bestgardenbeds.com

Square Foot Gardening

- Deck screws work well to fasten the boards together
- Rotate or alternate corners to end up with a square inside.
- You can also use a corner 4x4 inside the two pieces to anchor and bring them together.

Bestgardenbeds.com

Square Foot Gardening

- On each frame, place a permanent grid dividing the box into 16 1'x1' squares for a 4'x4' box.
- Grids can be made from string, wood, plastic strips, old venetian blinds, etc.
- Use screws or rivets to attach them where they cross.
- Cut the grid to fit across the top of the box or cut shorter to lay on the soil inside the box.

everybodysson.com

albertahomegardening.com

Square Foot Gardening

- SFGF recommends 'Mel's Mix', (1/3 compost, 1/3 peat moss, and 1/3 coarse vermiculite)
- SFGF suggests a blended compost & no extra fertilizer
- I recommend Mel's Mix OR a bagged potting soil (soil-less mix) mixed in a 1:1 ratio with composted manure or bagged topsoil.
- May need to use traditional or organic fertilizers depending on crop

https://italigrows.wordpress.com/2011/09/25/mels-mix-in-my-square-foot-raised-bed/

Square Foot Gardening

SFGF recommends planting crops in grid in 1, 4, 9 or 16 plants per square foot as follows:

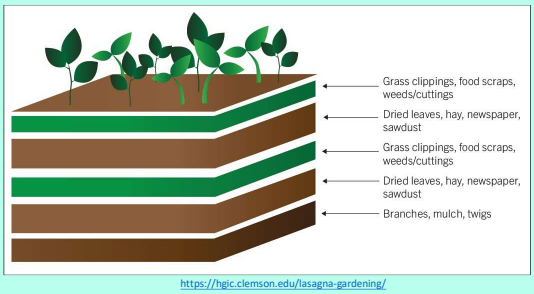
Extra Large	Large	Medium	Small
1 plant 12" apart	4 plants 6" apart	9 plants 4" apart	16 plants 3" apart
Broccoli Cabbage Pepper	Leaf Lettuce Swiss Chard Marigolds	Bush Beans Spinach Beets	Carrots Radishes Onions

Extension recommends planting larger crops such as indeterminate tomatoes, tomatillos and vine crops in large containers, un-gridded raised beds, or in the ground, not in square foot garden beds

Pizza Gardens

- Pizza garden in kiddie pool with wood slats or old venetian blinds to delineate the 'slices'
- Don't forget to drill drainage holes before adding media!
- Use same mix as for square foot beds

Lasagna Gardening: Building Beds From the Ground Up



https://hgic.clemson.edu/lasagna-gardening/

Start prep work in fall before; takes 4 months to be ready for planting

Lasagna Gardening

- **1st Layer on top of ground:** A loose layer of twigs, branches that won't compress. Allows air to circulate through the layers and aids decomposition.
- **2nd Layer "Brown Layer":** This layer is 2-6" of dry leaves, hay, wood chips, sawdust, shredded newspaper**,** or cardboard. They act as the first layer of earthworm food; worms are critical to decomposition
- **3rd Layer "Green Layer":** Composed of 1-2" food scraps (don't use meat, dairy, fats, or bones), grass clippings, manure, coffee grounds, plant cuttings, etc**.**
- **Continue to Alternate:** Keep layering the brown and green layers on top of each other. End with a brown layer to deter pests and scavengers.
- Over the next 4-5 months, layers will decompose into rich, healthy soil.

No-till and Low-till

- Build basically a compost pile on top of soil berm, allow to decompose, then plant into it.
- Add organic matter annually
- If you use leaves, grass clippings or straw, you might need as much as 8-10". If you use cardboard or newspaper as mulch, you'll need less of it.
- Then add 3-4" topsoil over the compost pile so it decomposes
- When you plant initially, mulch the plants and add a cover crop or mulch in fall
- Oats work well as an end of season crop you can plant into next season
- Keep soil covered at all times with crops, marsh hay or cover crops
- Use a broad fork or potato fork lightly in spring if it gets compacted

No-till and Low-till

- Soils need to have good physical and chemical fertility to start; not good in compacted clay
- Organic amendments for structure, fertility and micro-organisms
- Minimizing tillage helps to maintain soil structure
- If growing in-ground, create permanent beds and pathways to reduce compaction
- Works best with transplants as opposed to seeds, unless large seeds

No-till gardening
https://www.growveg.com/

Straw Bale Gardening

- Use a rectangular straw bale that is wheat or alfalfa **not hay**.
- Place on a pallet or driveway for drainage with cut ends of bale facing up like drinking straws
- Use bales that are free of weed seed
- Leave the 2-3 strands of string or twine intact. Twine should be oriented parallel to the ground and bound tightly.
- Put in an area that gets at least 6-8 hours of direct sunlight daily.
- May need to rebar into ground if growing tall crops

https://hgic.clemson.edu/factsheet/straw-bale-gardening/

Straw Bale Conditioning

- ***Days 1-3:*** Position the bale in its location. Water it daily (once or twice), keeping it evenly moistened until water runs out the bottom.
- ***Day 4:*** Evenly scatter 2 cups of dolomitic lime (Ag lime or pelletized lime) on top of each bale and add either ½ cup of urea (46-0-0) **OR** 1 cup of ammonium sulfate (21-0-0). Use the chosen fertilizer for the rest of conditioning at recommended rate. Water in lime and fertilizer until dissolved. From now on, keep moist but don't need to have runoff as in Days 1-3.

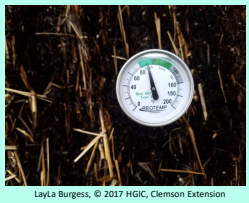
https://chapelboro.com/town-square/playing-in-the-dirt-try-straw-bale-gardening

Straw Bale Conditioning

- ***Days 5-6:*** Sprinkle top evenly with ½ cup of urea (46-0-0) each day OR one cup of ammonium sulfate (21-0-0) each day. Water bale thoroughly after application of fertilizer but not to runoff
- ***Days 7-9:*** Reduce the fertilizer per bale by half, so ¼ cup of urea (46-0-0) OR ½ cup of ammonium sulfate (21-0-0) each day. Water each bale thoroughly after application of fertilizer, but not to runoff.
- ***Day 10:*** Addition of a complete fertilizer is required. Per bale, evenly sprinkle top with 1½ cup of 8-8-8 or 1 cup of 10-10-10 fertilizer. Water in thoroughly.

Straw Bale Conditioning

- Once the bale(s) are conditioned (it takes approximately 2 to 3 weeks), it is time to plant.
- Prior to planting (Day 11), make sure the bale(s) have cooled down inside to 99°F or below (around body temperature or lower).
- Feel the top of the bale(s) for heat or use a compost thermometer to measure the temperature.
- If too warm, continue to water daily to retain moisture until internal temperature lowers. Once bale(s) have cooled, it is safe to plant.



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Straw Bale Planting

- **Method 1**: Put 2-4" of soil across the top of the conditioned bale and water to wet for direct planting of larger seeds, such as beans; plant seeds at their recommended planting depth
- It may be best to use transplants. Don't use seed for small seeded crops
- **Method 2:** Plant in holes made in the bale. This method is ideal for transplants. Dig about 6×6" holes into the bale spaced for whichever size crop you are planting.
- A small handheld pruning saw or garden trowel works. Once planted, fill remaining hole space with soil.

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UW-Extension Resources

- WI Horticulture
  - https://hort.extension.wisc.edu/
- Plant Disease Diagnostic Lab
  - https://pddc.wisc.edu/
- Dane County Extension Horticulture Helpline
  - horticulture@countyofdane.com
  - 608-224-3721
  - April-October staffed by Dane County Extension Volunteers

Questions?

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