

Planning, Tips, Tricks & Techniques, Cultural Practices

- Choose the right tomatoes to grow for your area
 - Zone 5a, 5b (average 120 growing season in a good summer, usually ~ 100 days)
 - Ave. last Frost Date: 3rd week of May
 - Ave. first Frost Date: 3rd week of Sept.
 - Zone 4a, 4b (usually < 90 days growing season)
 - Match tomato variety's average maturity date to the length of growing time
 - Grow only cherry tomatoes and / or small tomatoes (≤ 6 Oz.) with early maturity < 65 days if:
 - Persistent foggy areas (valleys) before burn-off, persistent cloudy / overcast areas during the day, smog
 - ≤ 6 hours daylight (9AM – 3PM, 10AM – 4PM)
 - Near the coast that is generally cooler and windy
 - Higher elevation > 3-4K feet
- Grow your own tomato plants from seed (wider choices of varieties to grow)
- If shopping / buying tomatoes, choose the best seedling plants
 - 4/6" pots, with dark green stout stem, no blossom / fruit set
 - Don't buy leggy plants, plants w/yellow leaves (N deficiency), purple leaves (P deficiency), curled/tip burn (K deficiency)
 - Check descriptions, maturity date, growth habit, etc. (in concert to your space, soil condition, pots, environmental factors)



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- When and where to plant

- When the soil temperature reaches $> 60^{\circ}\text{F}$
- Generally after last average frost $\sim 3^{\text{rd}}$ week of May
- When night-time temps. consistently $> 50^{\circ}\text{F}$

- Use light weight floating row covers, low / high tunnels, raised beds w/covers, Cold Frames, Cloches, Wall-O-Waters, Hot-Caps, Bottom-cut water bottles (anything) to warm the soil up and / or retain heat against chilly night-temps.



- Plant on a cloudy / overcast day, not when it is hot, rainy or windy
- Plant in a sunny location with > 8 hours sunlight / day
 - Less sun – generally smaller fruit, takes longer to mature, less healthy / susceptible to disease pressures
 - More sun – Less diseases, early & bigger fruit, less insect problems, higher vitamin C and lycopene content

Planning, Tips, Tricks & Techniques, Cultural Practices

- Prepare the ground / soil where the tomatoes will be planted ahead of time
 - Pre-heat the ground
 - Solarize the soil for a few days with black poly
 - Low Tunnel w/clear Poly lets sun's energy thru & traps heat
 - Pick a sunny spot with minimal winds
 - 8 Hours minimum, 10 hours optimal, 12 hours awesome
 - Get a soil test done, 6.5 pH optimum (6.2 – 6.8 OK)
 - Plan to plant in a North-South direction
 - Springtime soil elixir (wake up the soil biology)
 - Apply 3-4 weeks before planting per 1000 ft², 20 Lbs. Hi-Calcium Lime, 100 Lbs. compost
 - Mix the following and apply as a soil drench



Ingredients / 5 Gallon

- 2 ½ - 3 cups liquid fish fertilizer w/kelp
- 2 qt. raw milk
- 1 cup molasses
- 2 – 12 oz. cans of beer (optional)
- 1 qt. 100% cranberry juice

What It Does / Adds

- Trace micronutrients, enzymes, amino acids, growth hormones
- Amino acids, proteins, enzymes and natural sugars
- Unsulphured Blackstrap molasses for high mineral content, sugars
- Adds B-vitamins, sugar feeds resident microbes
- Vitamins, minerals, amino acids , also acts as an anti-bacterial agent

Planning, Tips, Tricks & Techniques, Cultural Practices

- “Harden Off” (condition) your tomato seedlings before planting
 - Gradually expose your tomatoes to 1 hour sunlight / day for 7 – 10 days
- Prepare the holes where the tomatoes will be planted
 - Add 2 - 3 Quarts Nutrient rich finished organic compost
 - Add 1 Tbs. Epsom Salt, 1 Tbs. Hi-Calcium Lime (calcium carbonate)
 - Add 2 Tbs. extra bone meal for extra root development / growth
 - Add ½ cup fish, kelp or alfalfa meal
 - Add 2 cups earthworm castings
- Water the seedlings well 1 - 2 hours before transplanting
- Take transplant out of their containers one at a time (don’t take all of them out of the containers and place next to the holes waiting to be transplanted and exposed to sun and wind
- Place your hand over the pot with the stem between your two middle fingers, invert the pot upside down, gently squeeze the container sides, and remove the tomato plant
- Plant it 5 - 6 “ deep, backfill with soil mixture w/amendments, gently firm soil around the plant
 - Don’t pinch side shoots and plant (potential disease entry), pinch off side shoots 3 -4 days before planting & let wound heal
 - Water deeply to the root zone with fish, kelp, seaweed extract (use tepid sun-warmed water, not cold water from garden hose)
 - Put down some weed-free straw around the plant to protect plant from soil splashing up onto the leaves
- Snip off blossoms / fruit set for 2 - 3 weeks which helps promote strong root development, you want all the energy going to the plant’s roots – more roots, healthier plant, more water / nutrient uptake



Protect the Soil and Mulch your Tomatoes

- Major Benefits of Mulching:

- Protects the soil from erosion, and water loss by evaporation
- Reduces compaction from heavy rains, weed growth (if applied thick enough to prevent germination)
- Prevents soil (possibly containing soil-borne diseases) from splashing up on to plants
- Maintains the soil temperature and moisture more evenly and consistent throughout the summer
- Prevents crusting of the soil surface thus improving the absorption and movement of water into soil
- **Organic mulches** break down and gradually improves soil structure & provides nutrients to the plants
- Mulched plants generally have more roots than un-mulched plants, particularly with **organic materials**
- Adds beauty and a “finished” look to your garden
- Keeps fruits and vegetables clean

Types of Mulches

Inorganic / Synthetic

- **Plastics**
 - Black
 - Clear
 - Red
 - Brown
 - Green
 - Silver
- **Woven Weed Mats**
- **Felted Woven Fabrics**
- **Woven Plastic Mesh**

Must use drip irrigation to supply water and fertilizer to the plants

Organic

- **Leaves**
- **Leaf Mold**
- **Grass Clippings (untreated)**
- **Wood Chips / Sawdust (best composted)**
- **Straw / Salt Marsh Hay**
- **Newsprint (no glossy colored inserts)**
- **Pine Needles / Bark chips**
- **Compost**
- **Biodegradable Mats (recycled paper)**
- **Coffee Grounds**
- **Seaweed**

Cover Crop

- **Legumes**
 - Clovers
 - Field Peas
 - Hairy Vetch
- **Non-Legumes**
 - Grains

Use generous amount of mulch around tomato plants

Straw, Pine Needles, Grass Clippings, Chopped Leaves, Newspapers, Ewe, Bark Chips, etc

Helps control weeds, conserve soil moisture, moderate soil temperature, and provide food for soil-dwelling organisms like earthworms

Straw Mulch



Chopped Leaves



Multi-ingredient all-purpose mulch



Lucerne Farms heat-treated special blend of chopped straw, timothy hay and alfalfa hay, grass clippings, chopped leaves / leaf mold, potting mix, compost, Alfalfa meal, bone meal, organic low-input N-P-K fertilizer (Chickity Doo Doo, Cockadoodle Doo, Espoma Plant / Garden Tone), Azomite (naturally mined product containing a broad spectrum of 70 minerals / trace elements excellent for re-mineralizing soils)



Why Support Your Tomatoes?

- Advantages

- Space
- Bigger Fruit
- Earlier Fruit
- Healthier Fruit
- Better full-circle plant/fruit sun exposure
- Better Air Circulation
- Accessibility

- Disadvantages

- Time
- Cost
- Mulching for water retention
- More frequent watering (transpiration (water) loss from sun & wind)

Supporting your tomatoes has many more benefits than drawbacks

Overhead String / Trellis



Florida Weave



Ladders, Towers / Pens, Cages



Hard Wood Stakes, Bamboo, Rebar



Fence



Spirals



Grow Bags



Some Basic Tomato Plant Physiology

• Photosynthesis

- The process of capturing light energy and converting it to sugar energy, in the presence of chlorophyll using carbon dioxide (CO₂) and water (H₂O)

• Respiration

- The process of metabolizing (burning) sugars to yield energy for growth, reproduction, and other life processes

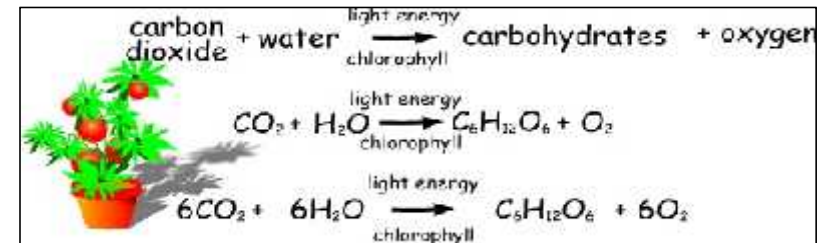
• Transpiration

- The loss of water vapor through the stomata (pores) of the leaves

• Evaporation

- The loss of water from the surface of leaves and/or moisture from the ground

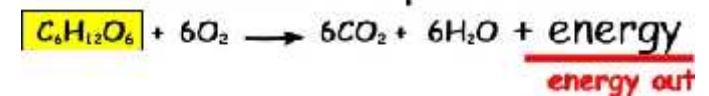
Plants manufacture their own food



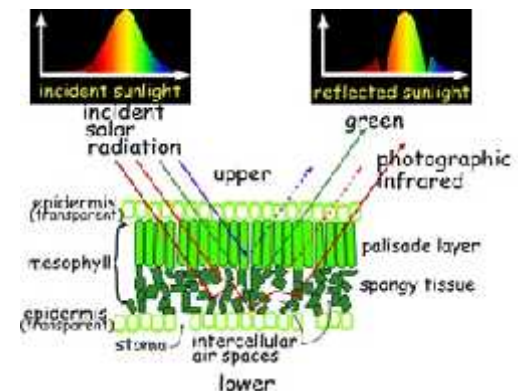
A light reaction in which the energy from absorbed sunlight is used to split water molecules into hydrogen and oxygen (photolysis)

A dark reaction whereby hydrogen from the light reaction combines with carbon dioxide to form carbohydrates.

aerobic respiration

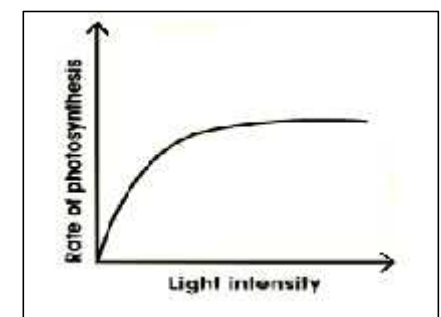
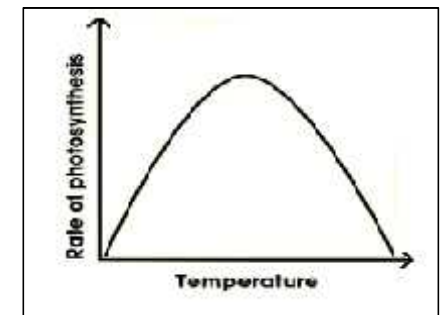
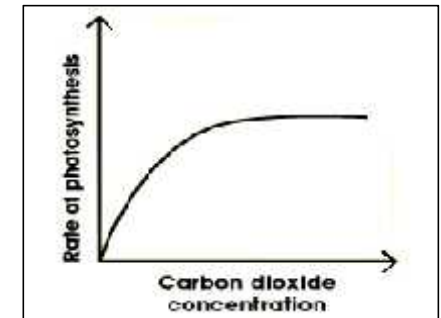
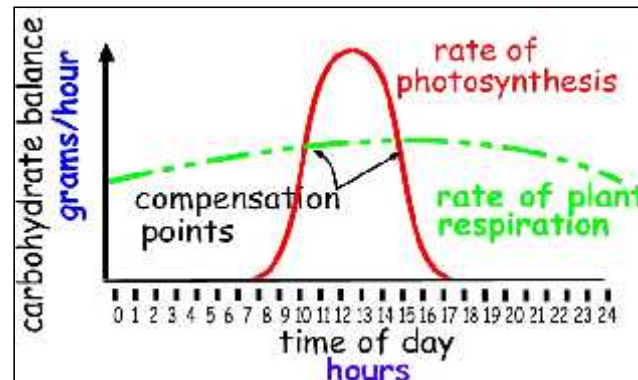
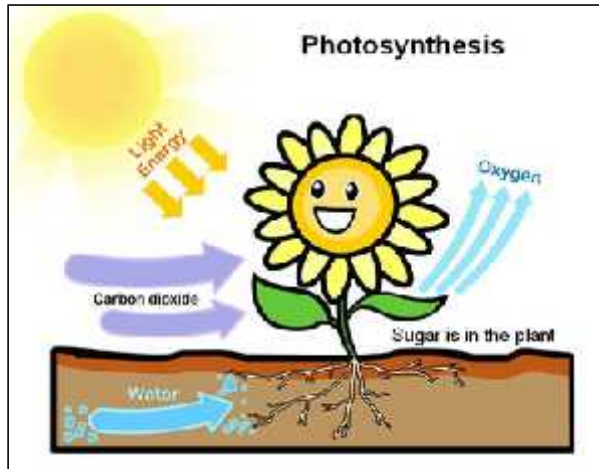


Chlorophyll



Photosynthesis & Respiration

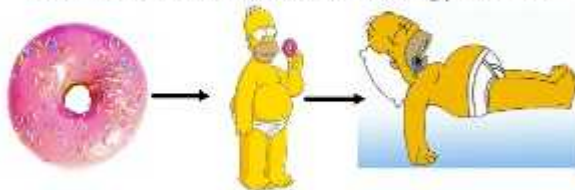
Plants take in water, carbon dioxide and light energy from the Sun and make food (glucose) to store & release oxygen



Comparison of Photosynthesis and Respiration	
Photosynthesis	Respiration
Produces sugars from energy	Burns sugars for energy
Energy is stored	Energy is released
Occurs only in cells with chloroplasts	Occurs in most cells
Oxygen is produced	Oxygen is used
Water is used	Water is produced
Carbon dioxide is used	Carbon dioxide is produced
Requires light	Occurs in dark and light

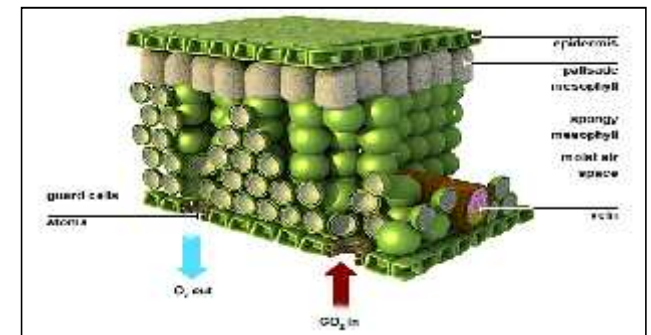
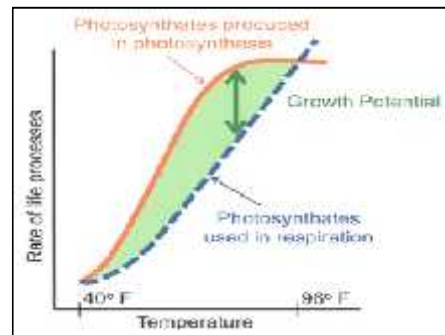
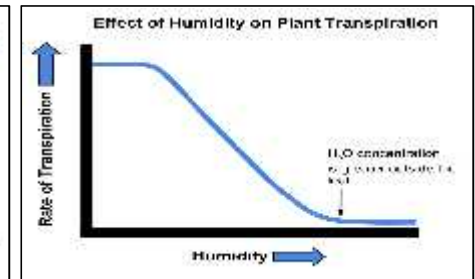
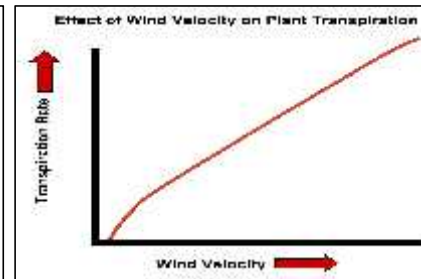
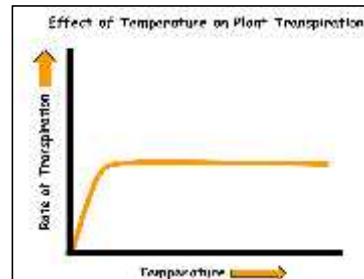
Cellular Respiration

The process in which sugars (glucose) are converted into usable energy (ATP).



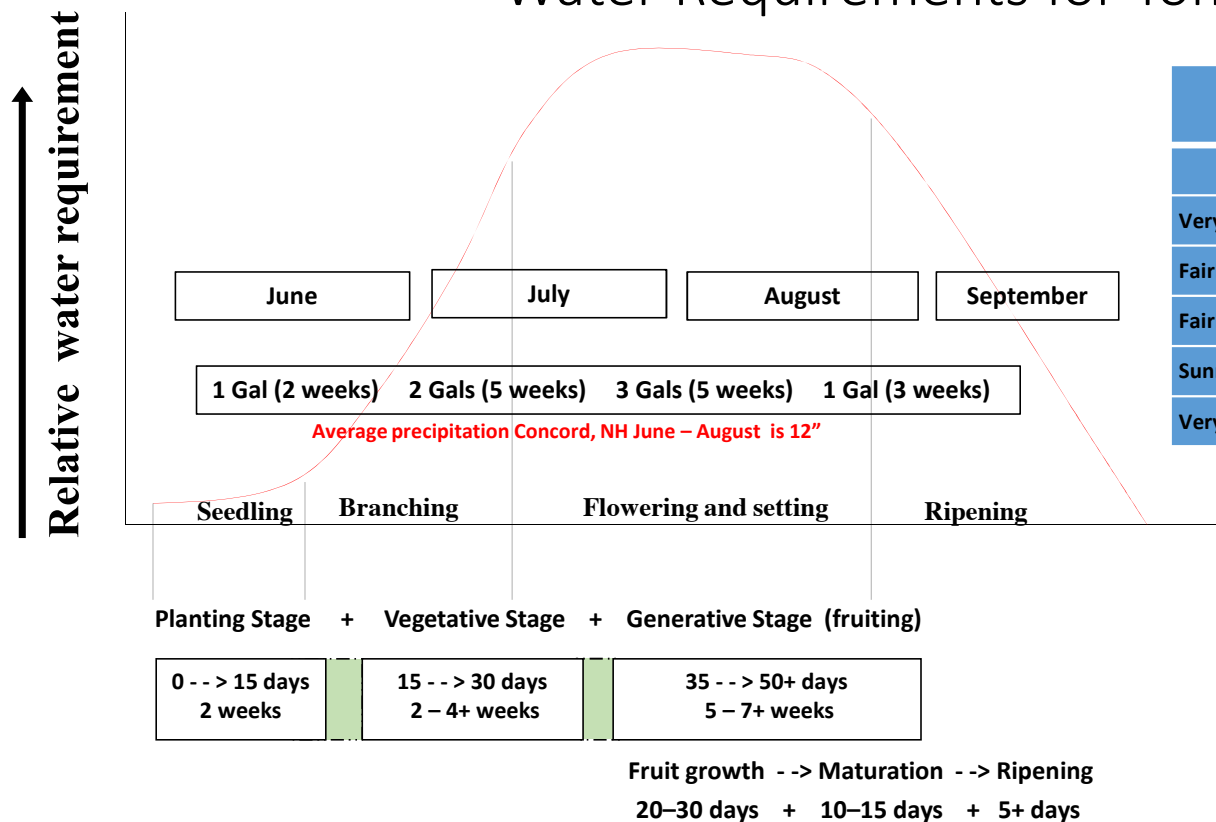
What affects water requirements of tomatoes?

- Sunlight
 - Intensity, duration
- Type of plant, growth habit
- Pruning vs. no pruning
- Temperature ($\uparrow T$, $R > \text{Photo}$)
- Transpiration ($>90\%$ H_2O loss)
- Wind
- Plant size, Leaf area, # Stomata
- Water stress
- Root pressure (guttation)
- Cool, Rain, Dryness, Fog
- Humidity



Plants	Number/ epiderm (mm ²)		Size(μ) Length × width	Single area (μ ²)	Total area /leaf area (%)
	The upper	The lower			
Wheat	33	14	387	209	0.52
Maize	52	68	19×5	75	0.82
Oat	25	23	38×8	239	0.98
Sun flower	58	156	22×8	136	3.13
Tomato	12	130	13×6	61	0.85
Bean	40	281	7×3	17	0.84
Apple	0	400	14×12	132	5.28
Lotus	46	0	-	-	-

Water Requirements for Tomatoes



Water Requirements of Tomatoes

Weather Conditions	Liters / Day	Pints / Day
Very dull, cloudy or dull for most of the day	0.14 -0.28	0.25 - 0.50
Fairly dull, overcast for most of the day	0.28 -0.42	0.50 -0.75
Fairly sunny, cloudy at points with bright periods	0.71 - 0.85	1.25 - 1.50
Sunny, just occasional cloud cover	1.10 -1.20	2.00 -2.25
Very sunny, clear blue skies all day.	1.50 -1.80	2.75 -3.25

Typical Transpiration Loss

• Large Tree	• > 500 Gals. / Day
• Corn	• 50 Gals. / summer
• Tomato	• 32 Gals. / summer
• Wheat	• 25 Gals. / summer
• Potato	• 25 Gals. / summer

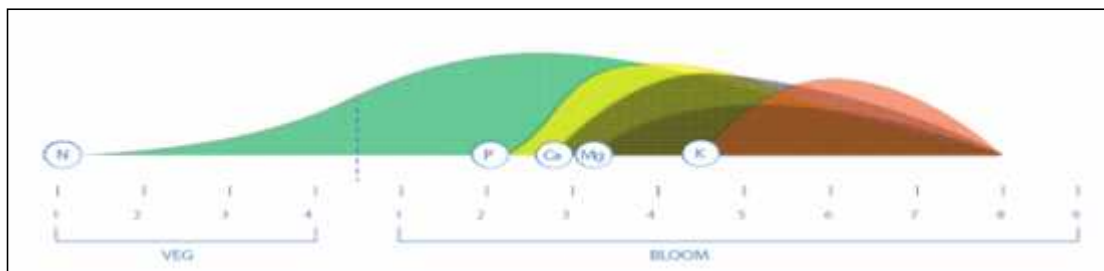
1 US Gal = 0.1337 ft³

1 US Gal = 231 in³

1 Gal = 15" x 15" x 1"

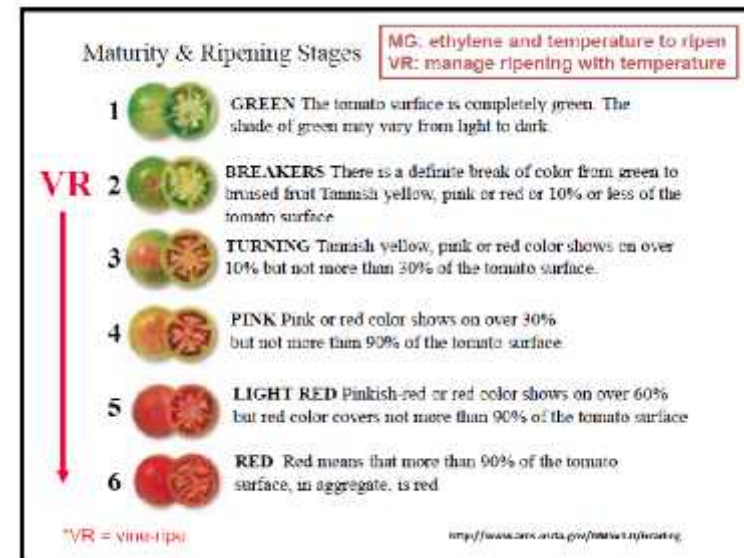
2 Gal = 15" x 15" x 2"

3 Gal = 15" x 15" x 3"



Some Organic Strategies to Minimize Soil-Borne Diseases

- Rotate vegetable crops (minimum of 3-5 years recommended)
 - Tomatoes, Peppers, Potatoes, Eggplant in Nightshade family
 - Avoid contiguous successive plantings of same family crops
- Mulch heavily to prevent soil from splashing up onto the bottom leaves after heavy rains / watering
- Ideally, tomato plant spacing should be 2 Ft for determinate plants, 3 Ft for indeterminate plants
 - Promotes more light for photosynthesis and air circulation
- Trim all lower leaves to 1st fruit set, at least 2 Ft. from the ground
- Don't overhead water using sprinklers, water at the ground level
 - Other than natural rain, strive to keep leaves as dry as possible
- Add lot of compost / organic matter- suppress diseases
- Never, ever work in the garden when it is wet or rainy
- Check plants every day for signs of foliar diseases / problems
 - Cut off affected leaves and destroy, use clean tools (10% bleach)
 - Wash hands to prevent spores from ovulating & spreading to healthy plants
 - If pervasive, pick tomatoes at "breaker stage", pull / destroy plant
 - "Breaker Stage": partially turned / ripe tomato from the blossom end
 - Try not to smoke around tomato plants – potential Tobacco Mosaic virus (more applicable to greenhouse and confined spaces)



Other Beneficial Actions and Strategies

• Companion planting

- **Borage** deters the monster of garden pests – tomato hornworm
- **Marigolds** to
 - deter squash bugs, tomato hornworms, whiteflies, thrips.
 - Known to repel root knot nematodes that attack tomatoes, potatoes, and strawberries
- **Nasturtiums** attracts predatory insects
- **Opal Basil** helps to repel hornworms
- **Parsley** attracts parasitic wasps (**parsley & mint aren't compatible**)
- **Horehound** attracts braconid & ichneumonid wasp, stachnid & syrphid flies (also stimulates and aids fruiting in tomatoes)
- **Mint flowers** attract hoverflies / predatory wasps (& earthworms)



• Attract predators, parasites and pathogens

- Parasitic wasps, Lady Bugs, Green Lacewings (prey on eggs / larvae)
- Birds (Cat Bird) – birds like to perch on top of stakes
- Grow diversity of plants / flowers with large blooms producing nectar to promote / attract beneficial insects, predators.
- Mating disruption pheromones (tomato pinworms)
 - CheckMate TPW lure



• Some OMRI products (Organic Materials Review Institute)

- SAFER Garden Fungicide (sulfur-based product)
- Serenade (Bacillus subtilis, copper-based fungicide) – natural bacterium
- BT (Bacillus Thuringiensis) – soil bacteria toxins with insecticidal activity

• Misc.

- 10% milk solution spray (1 part milk , 9 parts water)
- Many advocate compost tea spray as having antifungal properties
- Oils and anti-transpirants
 - Neem oil, Mint oil (Fungastop) and Rosemary oil (Sporan)



Maintenance

- Do some homework / Take some time to make yourself aware of:
 - Some common diseases and pests that can get to your tomato plants
 - Cornell Vegetable MD On-line (Tomato Diagnostic Key) <http://vegetablemdonline.ppath.cornell.edu/DiagnosticKeys/TomKey.html>
 - http://vegetablemdonline.ppath.cornell.edu/factsheets/Tomato_List.htm
 - Know the difference between good bugs and bad bugs (>90% of insects are good guys)
 - Acquire some working knowledge of what a healthy tomato plant should look like, how to care for
 - Dwarfs, Determinate, Semi-determinate, Indeterminate
- Take daily walks in the garden



- Do visual inspections of your plants
- Note changes of growth habit
- Wilted vice turgid (stiff) branches & leaves
 - Note: most ox-heart tomatoes have the wilt gene trait
- Healthy green defect-free plants - - stems, branches, leaves
- Any leaf edge curl / distortion, leaf tip burns, discoloration (yellowing, browning, purple, etc.), callus growth / bumps, chlorosis
- Any spots, holes, eaten / missing leaves
- Any (rabbit like) droppings (indicates tomato hornworm present)



