

Growing Healthy Tomatoes



David Cook

Country of Origin

- The tomato is native to western South America and Central America
- Cultivated tomatoes apparently originated as wild forms in the Columbia-Ecuador-Peru-Bolivia area of the Andes.
- In its native habitat, the tomato grows as a perennial, but in temperate climates it is grown as an annual.



The Wild Tomato

- For more than 200 years after 1554, when the first known record of the tomato was written, it was being gradually carried over the globe.
- European writers mentioned seeing it in far places, but not in what is now the United States.
- Italians first grew the tomato about 1550 and apparently were the first Europeans to eat it.
- Not until after the Declaration of Independence do we find any record of the tomato as being grown by white men in this country.

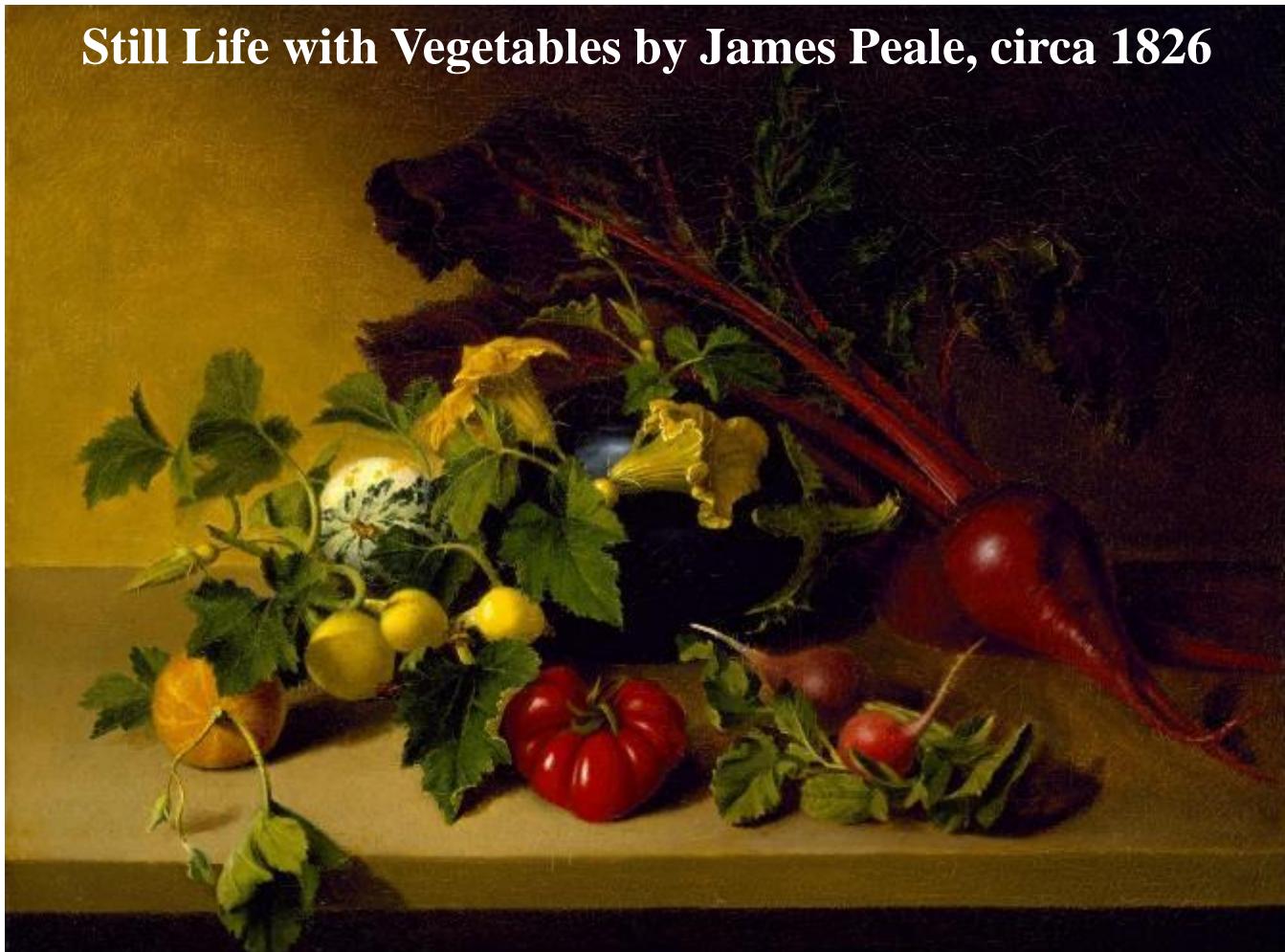
The Original Tomato

- Small, $\frac{1}{2}$ in diameter, green, yellow, or red and hairy



- Perhaps the best way to tell what early tomatoes looked like is to examine illustrations in paintings.
- Some of the oldest types of cultivated tomatoes include those with prominent ribs.

Still Life with Vegetables by James Peale, circa 1826



Fruit or Vegetable

- The **Tariff Act of 1883**, passed by the United States Congress, set a 10% tax on imported vegetables. A few years later, a vegetable importer took steps to exempt tomato from the tax based on botanical grounds since the tomato is a fruit, not a vegetable. The case went before the Supreme Court in 1893 [Nix vs Hedden, 149 U.S. 304 (1893)]. **Justice Gray wrote**, “botanically speaking, tomatoes are fruits of a vine, just as are cucumbers, squashes, beans, and peas. But in the common language in kitchen gardens, and which, whether eaten cooked or raw, are, like potatoes, carrots, parsnips, turnips, beets, cauliflower, cabbage, celery, and lettuce, usually served at dinner in, with or after the soup, fish or meats which constitute the principal part of the repast, and not, like fruits generally, as dessert.”
- The court rejected the botanical truth that the tomato is in fact a large sized berry, and deferred to the culinary vernacular of vegetable to describe it.

Heirloom Varieties

- An heirloom is generally considered to be a variety that has been passed down through several generations of a family because of its valued characteristics.
- An heirloom tomato is an open-pollinated heirloom cultivar of tomato.



Domestication & Breeding

- Wild tomato species have tiny fruits made to propagate the species and not to feed human beings.
- Domestication has transformed the once small wild tomato into the present-day cultivars.
- Until the 1920s, genetic improvement of tomato depended on selection of variants arising from spontaneous mutation, accidental outcrossing, or re-assortment of existing variation.
- Resistances to at least 44 major diseases has been identified in wild relatives, and at least 20 of these have been bred into horticultural tomatoes.
- An obvious feature of tomato domestication is the massive increase in fruit size.

Tomato Culture

- Tomato plants need at least **8 hours** of direct sunlight.
- Tomatoes grow best in nearly neutral soil with **pH of 6.5 to 7.0**.
- Set tomatoes in the garden when the weather has warmed and **soil temperatures are above 60 degrees F**.
- A week of cool daytime temperatures (below 55°F) will stunt plants, reducing yields.
- Most varieties will not set fruit if nighttime temperatures fall below 50° F or if daytime temperature stay above 90° F.
- Tomato foliage is damaged by frost, and freezing temperatures will kill the plant.
- Anyone that comes in contact with tomato plants or any materials used in growing tomatoes **should not smoke**.

Cold Weather Injury

- Frost damage is only a threat at the beginning of the growing season, and at the end.
- Always plant when danger of frost is over.
- Freezing causes a darkening of the leaf or stem tissues with damaged areas later wilt and turn brown.

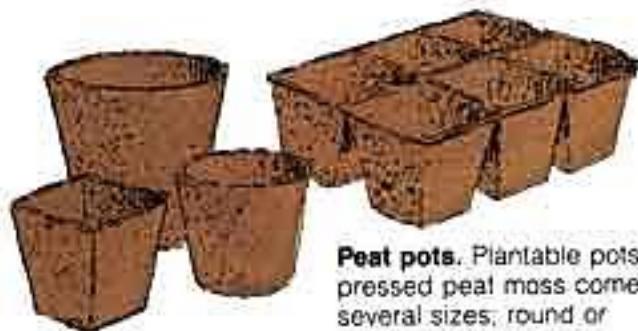


Seed Germination

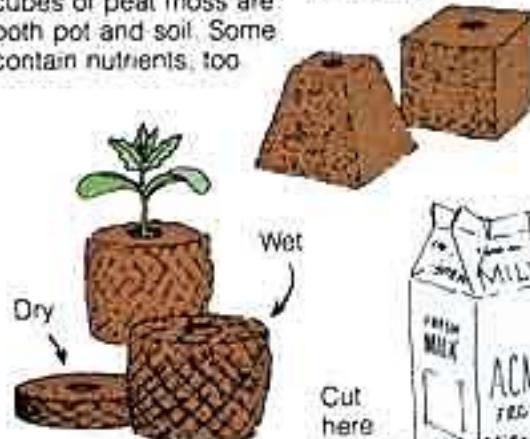
- Seeds should be started in a sterile soilless mix that moistens easily and stays fluffy.
- Seeds germinate best when media temperatures are 70° to 80° F.
- A heat mat will speed up germination by providing a constant temperature.
- Keep the soilless mix consistently moist.
- Direct light is not essential for germination, but once the seedlings emerge, light become critical.
- Fluorescent tube lights will work will for started plants.
- Keep the lights directly over the seedlings for 10 to 12 hours.

Starting with Seed

Containers for seed starting



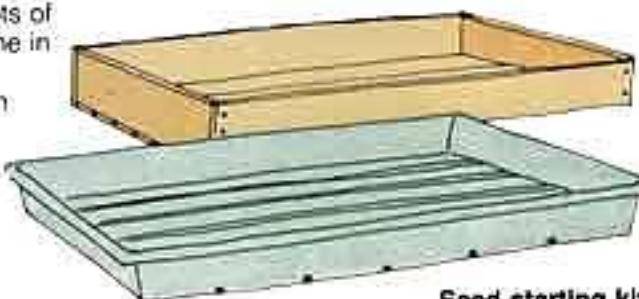
Peat cubes. Plantable cubes of peat moss are both pot and soil. Some contain nutrients, too.



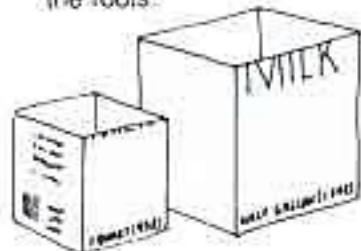
Jiffy-7 pellets. Improved peat cubes. Small and dry until ready to use, expand to 2" when dampened. They're reinforced with plastic netting.

Soil mixes. Sterilized packaged potting soil is a scientifically formulated medium that provides proper water retention and drainage for your new plants. Having strong, healthy seedlings with no insects and no damping-off or other diseases is well worth the extra cost.

Flats. New plastic flats and the old-fashioned wood ones are still used extensively for seed starting



Milk cartons. Quart or half-gallons, when cut about 3" high, make excellent pots for seed starting. Tear the carton from soil ball when transplanting to avoid disturbing the roots.



Seed starting kits. All the equipment you need to start seeds is available in kit form from several manufacturers. Some include a warming cable or plastic greenhouse.

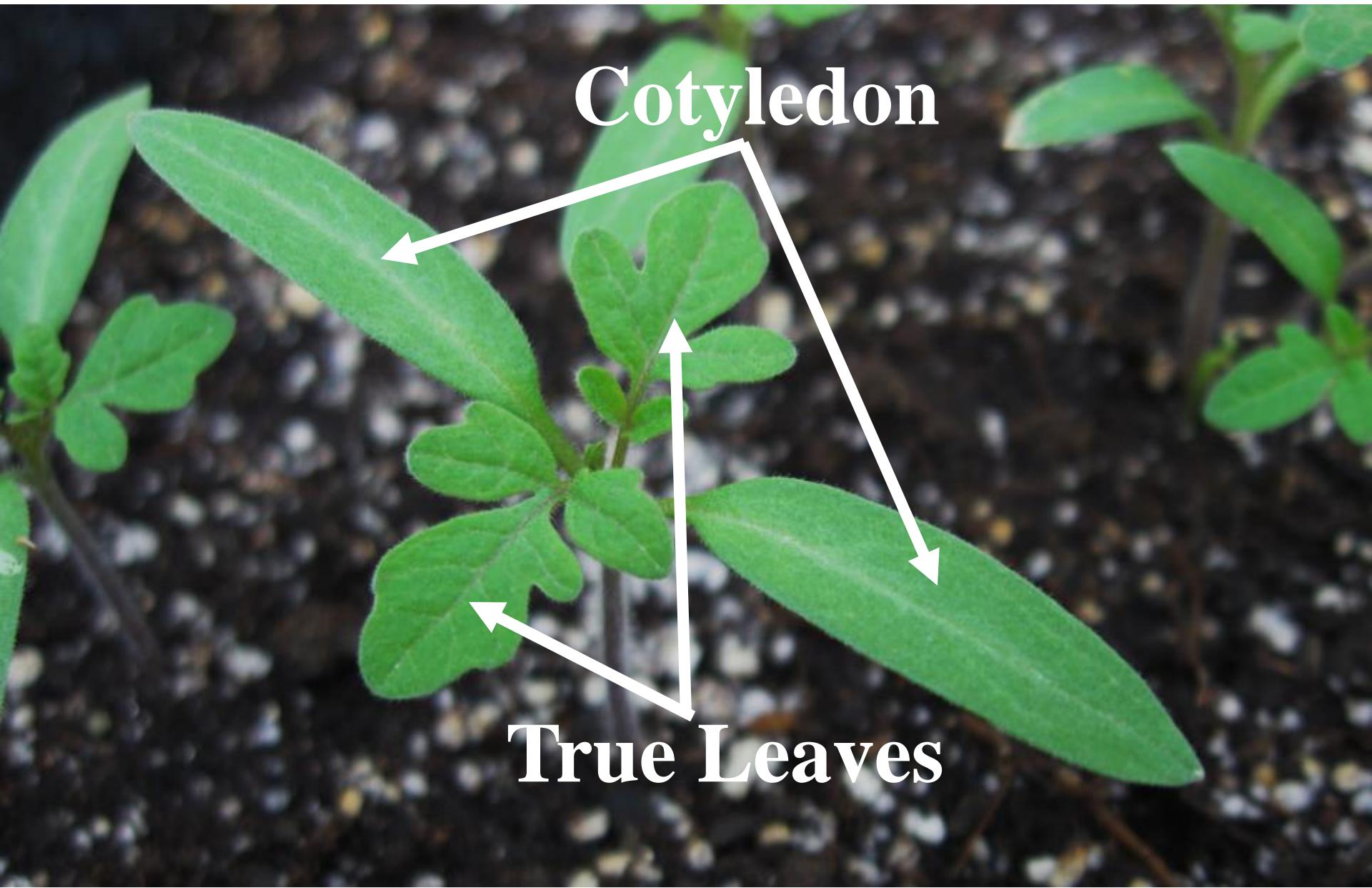




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Tomato Seedling



Hardening Tomato Plants



- Growers should harden plants slowly by letting them acclimate to new conditions, beginning about 1 week before transplanting.
- Harden plants by withholding water. Allow plants to wilt slightly between light waterings.
- Do not harden transplants by withholding fertilizer.
- Cool temperatures (60° to 65° F/day and 50° to 60° F/night) for a week or more causes catfacing.
- Set transplants into the garden on a **cloudy day or late in the afternoon**.
- Extremely large transplants are more likely to suffer transplant shock.

Planting Tomato

- They should be planted only after all danger of frost has passed.
- Tomato plants will develop roots along the stem and should be set deeply at transplanting.



Mulching Tomato Plants

- As with any crop, surface mulch is recommended to conserve soil moisture, manage weeds, and reduce disease.
- Mulching helps reduce the splashing of Early Blight fungal spores from the soil onto the leaves.
- It also helps stabilize soil moisture levels, reducing the incidence of blossom end rot.



Pollination

- Tomato pollination is temperature dependent.
- If nighttime temperatures drop below 55°F, pollen fails to develop and flowers that open the following morning will not set fruit.
- Blossom set sprays help set fruit even with cool nights.
- If the daytime temperature reaches 90° F by 10 a.m., blossoms that opened that morning abort. Blossom set sprays are not effective under high temperatures.
- The anthers of tomato flowers only release pollen when vibrated. Bumblebees are able to achieve this through ‘buzz pollination’.

Bumble Bee Pollinating Tomato





Tomato Color

- **Red** tomatoes have crimson (pink) or red interiors with yellow skin.
- **Pink** tomatoes have pink interiors and clear skin.
- **Green** tomatoes exhibit at least two variants, yellow-green colored created from yellow skin over green interior and the bright-green color is from fruit with nearly clear skin over green interior.
- **Black, Brown, and Purple** tomatoes retain some chlorophyll (green pigment) during ripening. This green color combined with a crimson ripe interior produces a darker red coloration.
- **Cherokee Purple** have clear skin over this dark interior.

Tomato Flavor

- Flavor is a balance of acidity and sugar, plus the influence of elusive volatile compounds for aroma and flavor.
- The tomatoes that taste the most acidic, or sour, have higher level of acids combined with low level of sugars.
- A tomato high in sugars and low in acids has a sweet taste.
- If a tomato is low in both acids and sugars, it has a bland taste.

Tomato Flavor Guide

Red or
Pink

"The Classic"

Balanced Sugar
Balanced Acidity

Orange

"The Fruity"

Medium Sugar
Medium Acidity

Yellow or
White

"The Mild"

High Sugar
Low Acidity

Green

"The Tangy"

Low Sugar
High Acidity

Black

"The Smokey"

High Sweetness
High Acidity

Slicers

"Burgers and
Salad"

High Water
Meaty Texture



Plums

"Sauce"

Low Water
Chewy Texture



Minis

"Snacking"

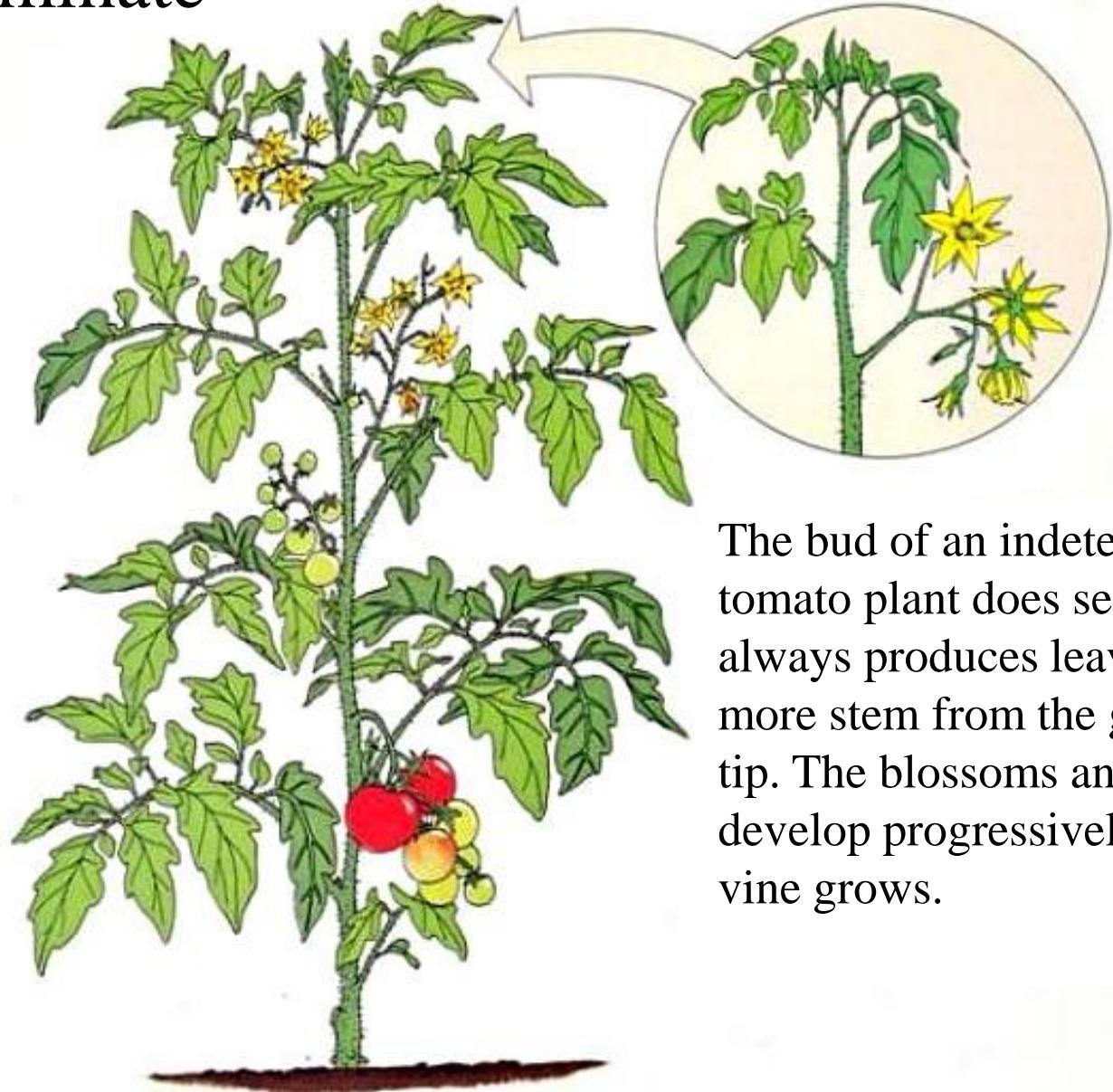
High Water
Smaller = Sweeter



Tomato Flavor

- **Size of fruit.** Cherry and grape tomatoes reach higher sugar concentrations than full-size tomatoes, so they taste sweeter.
- **Color of fruit.** Different pigments in tomatoes tend to produce different balances of sugars and acids.
- For example, **orange or yellow tomatoes** often taste milder and less acidic than red tomatoes.
- Some **black tomatoes**, created from the mixture of green and red pigments, have a reputation of having complex flavor.
- **Foliage.** A lot of leaves can capture a lot of sunlight, so a plant with dense, healthy foliage can convert more sunlight into sugars and other flavorful components.

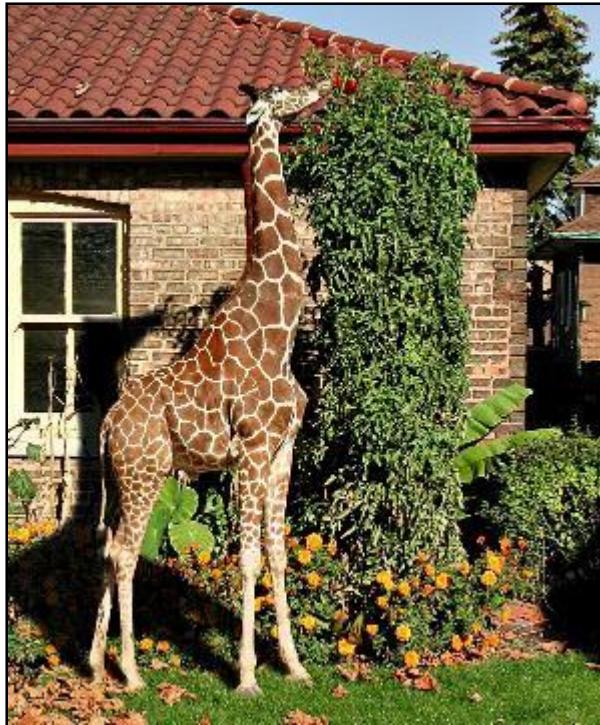
Indeterminate



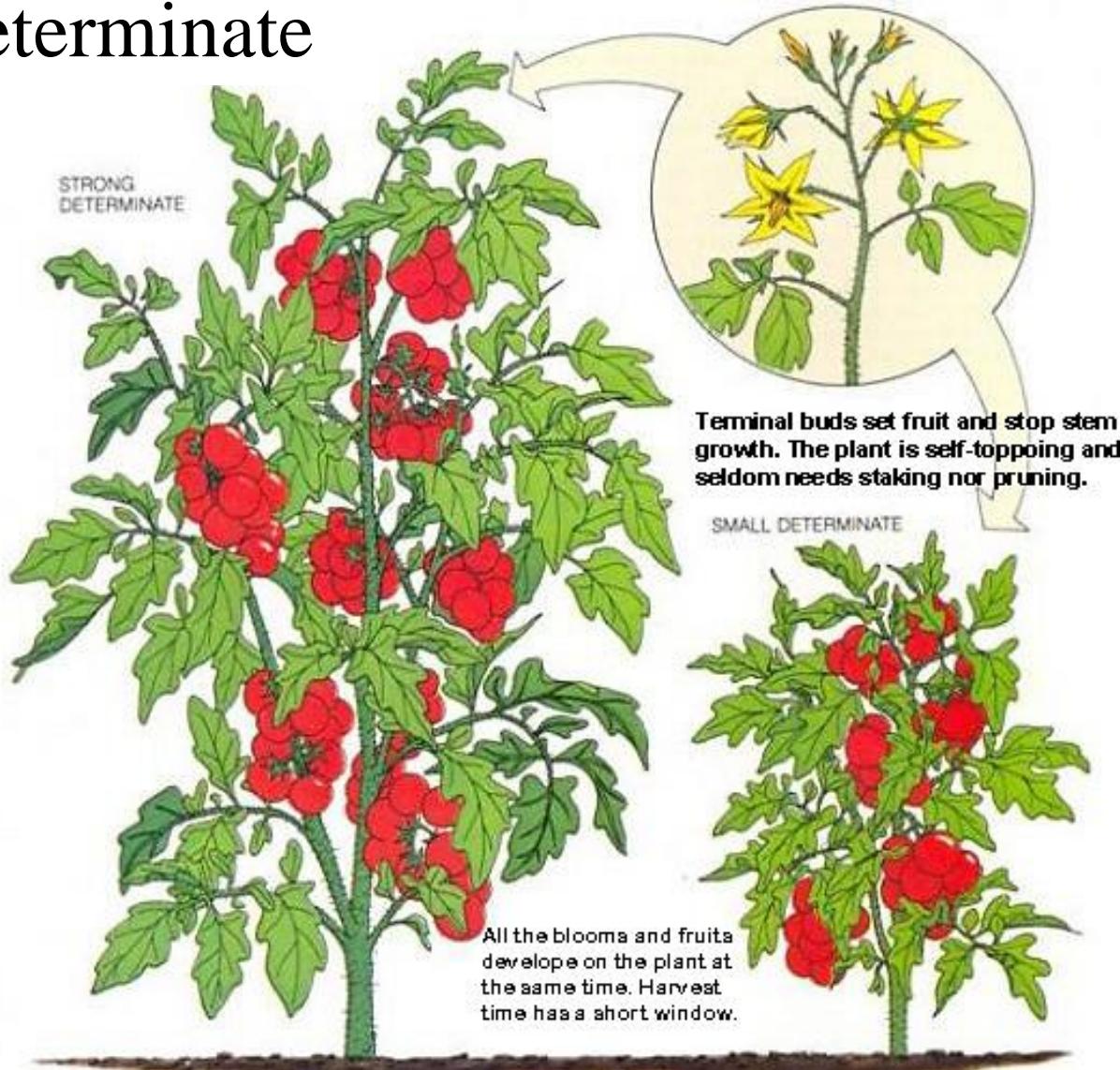
The bud of an indeterminate tomato plant does set fruit. It always produces leaves and more stem from the growing tip. The blossoms and fruit develop progressively as the vine grows.

Tomatoes (Indeterminate)

- Indeterminate tomatoes will grow and produce fruit until killed by frost and will require substantial staking for support.
- They can reach heights of up to 12 feet, although 6 feet is normal.
- Indeterminate tomatoes will bloom, set new fruit, and ripen fruit all at the same time throughout the growing season.



Determinate



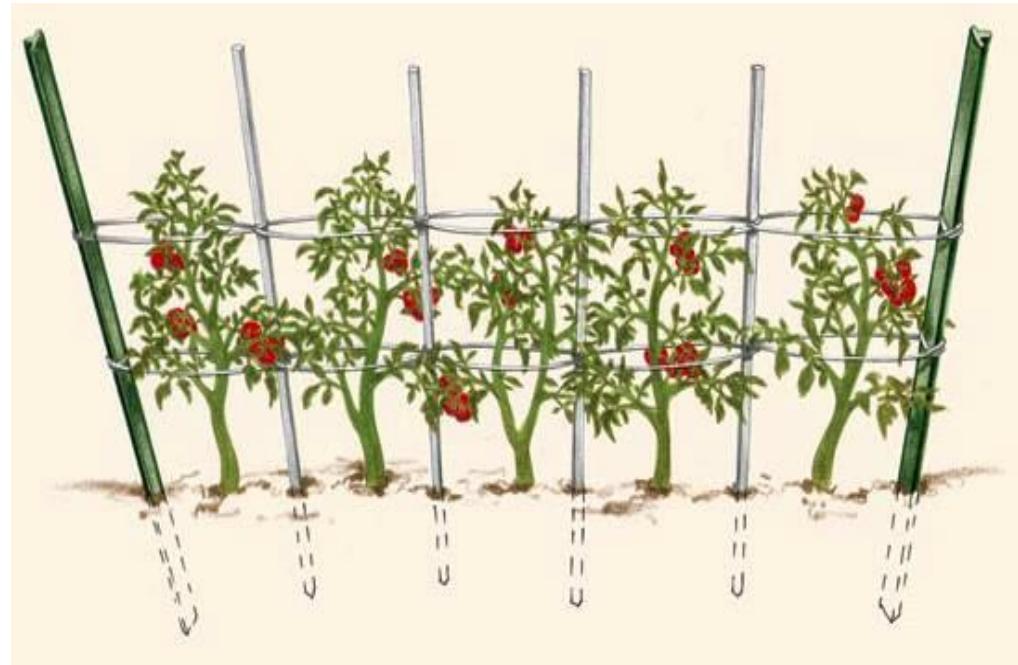
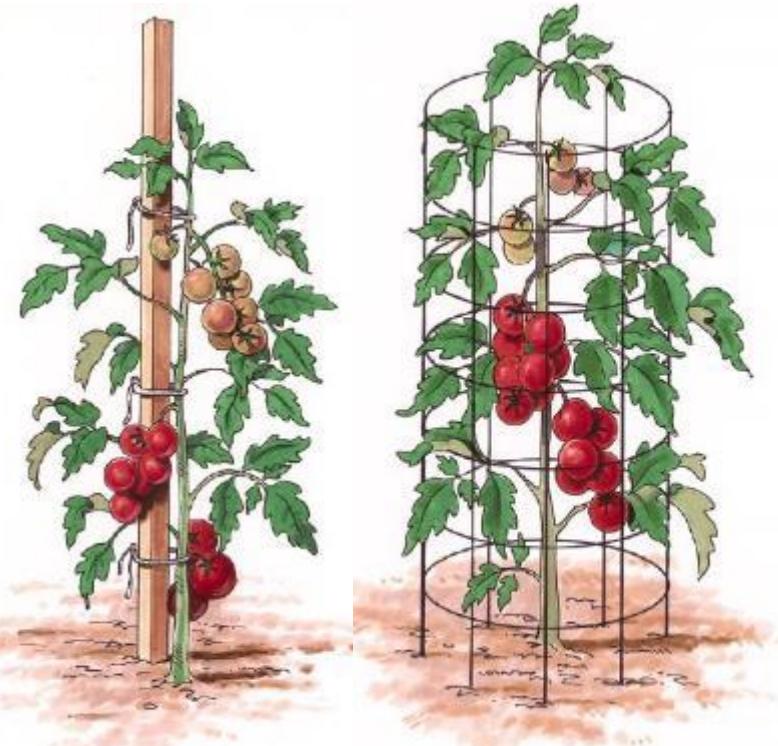
Tomatoes (Determinate)

- Determinate tomatoes, or "bush" tomatoes, are varieties that grow to a compact height (generally 3 to 4 feet).
- All the tomatoes from the plant ripen at approximately the same time (usually over period of 1- 2 weeks).
- They require a limited amount of staking for support and are perfectly suited for container planting.



Staking Tomato Plants

- The main reason for staking and supporting tomato plants is to keep plants and fruit off the ground.
- This reduces losses from fruit rots when fruit touch the soil and from sunburn when fruit are not shaded by foliage.



A Sucker Born Every Day

- Tomato suckers, or side shoots, are the growth that appears in the crotch between the stem and a branch.
- If left to grow, they will become another main stem with branches, flowers, fruit and more suckers of their own.
- If suckers are not removed the plant will produce more tomatoes, but the fruits will generally be smaller in size.
- Removing suckers will result in fewer, but larger fruits.



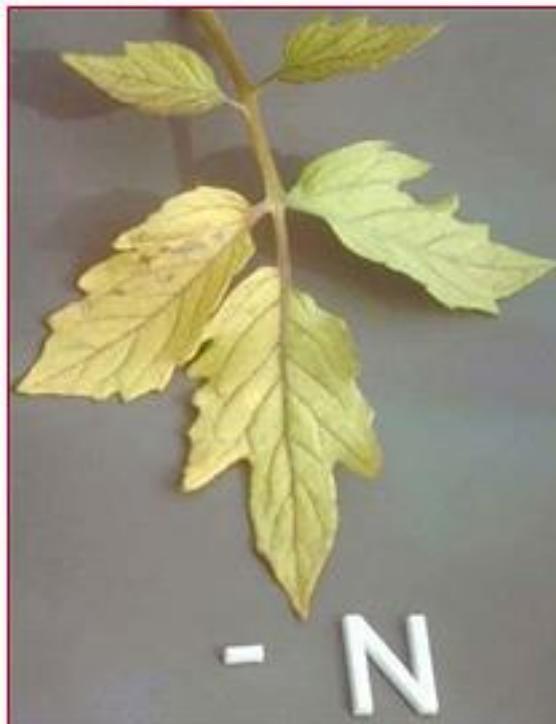
Determinate Tomato Pruning

- Removing all suckers up to the one immediately below the first flower cluster is adequate for most determinate cultivars.
- Removing the sucker immediately below the first flower cluster or pruning above the first flower cluster can result in severe leaf curling and stunting of the plant.
- Prune when the suckers are no more than 2 to 4 inches long.



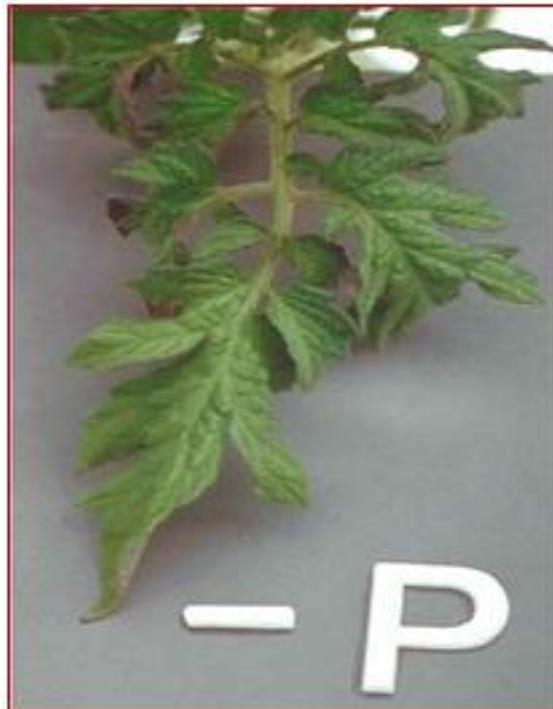
Nitrogen Deficiency

- Under nitrogen deficiency, older mature leaves gradually change from green to a much paler green progressing to uniformly yellow.
- The young leaves at the top of the plant maintain a green but paler color and tend to become smaller in size. As the deficiency progresses, the older leaves also show more of a tendency to wilt under mild water stress and senesce much earlier than usual.



Phosphorus Deficiency

- Necrotic spots on leaves are a typical symptom of (P) deficiency.
- A major visual symptom is that the plants are dwarfed or stunted.
- A distinct purpling of the stem, petiole and the lower sides of the leaves develops.
- Under severe deficiency conditions there is also a tendency for leaves to develop a blue-gray luster.



Potassium Deficiency

- The onset of potassium deficiency is generally characterized by a marginal chlorosis, progressing into a dry leathery tan scorch on recently matured leaves.
- As the deficiency progresses, most of the interveinal area becomes necrotic, the veins remain green and the leaves tend to curl and crinkle.



Largest Tomato Plant

- A massive "tomato tree" growing inside the Walt Disney's World Resort's experimental greenhouses may have been the largest single tomato plant in the world.
- Yong Huang, Epicot's manager of agricultural science, discovered the unique plant in Beijing, China.
- Huang brought its seeds to Epcot and created the specialized greenhouse for the fruit to grow.
- 32,000 golf ball-sized tomatoes were harvested from the plant.
- Unfortunately, the tomato plant developed a fatal disease and was removed in April 2010 after approximately 13 months of life.



The plant had been recognized as a **Guinness World Record Holder**, with a harvest of more than 32,000 tomatoes. Unfortunately, the tomato plant eventually died of a fungal disease.



Summary

- Diagnosing plant problems is a learnable skill that gets easier with experience.
- Knowing the host plant and the type of damage is the first step in determining the cause of the problem.

