

Pursuing the Perfect Tomato



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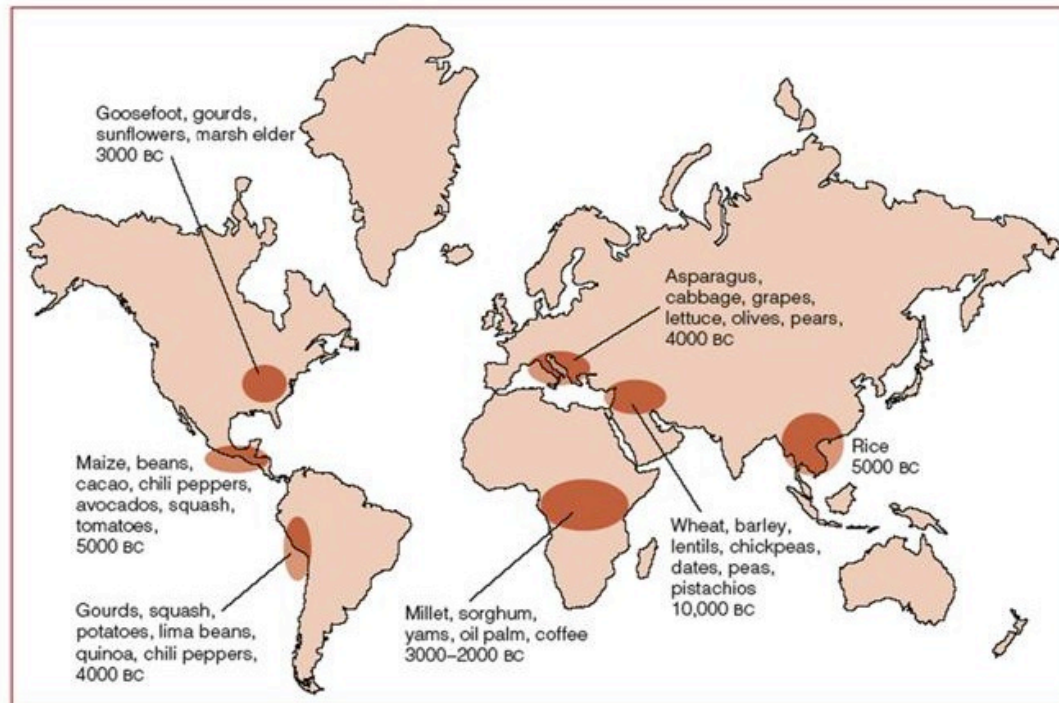


It is not impossible to grow great tomatoes in Tucson. Here of some photos of Beth's harvest.

Tomatoes – Geographical origin

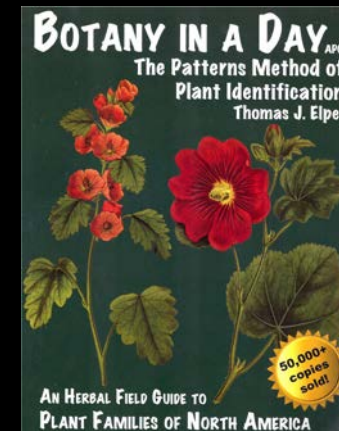
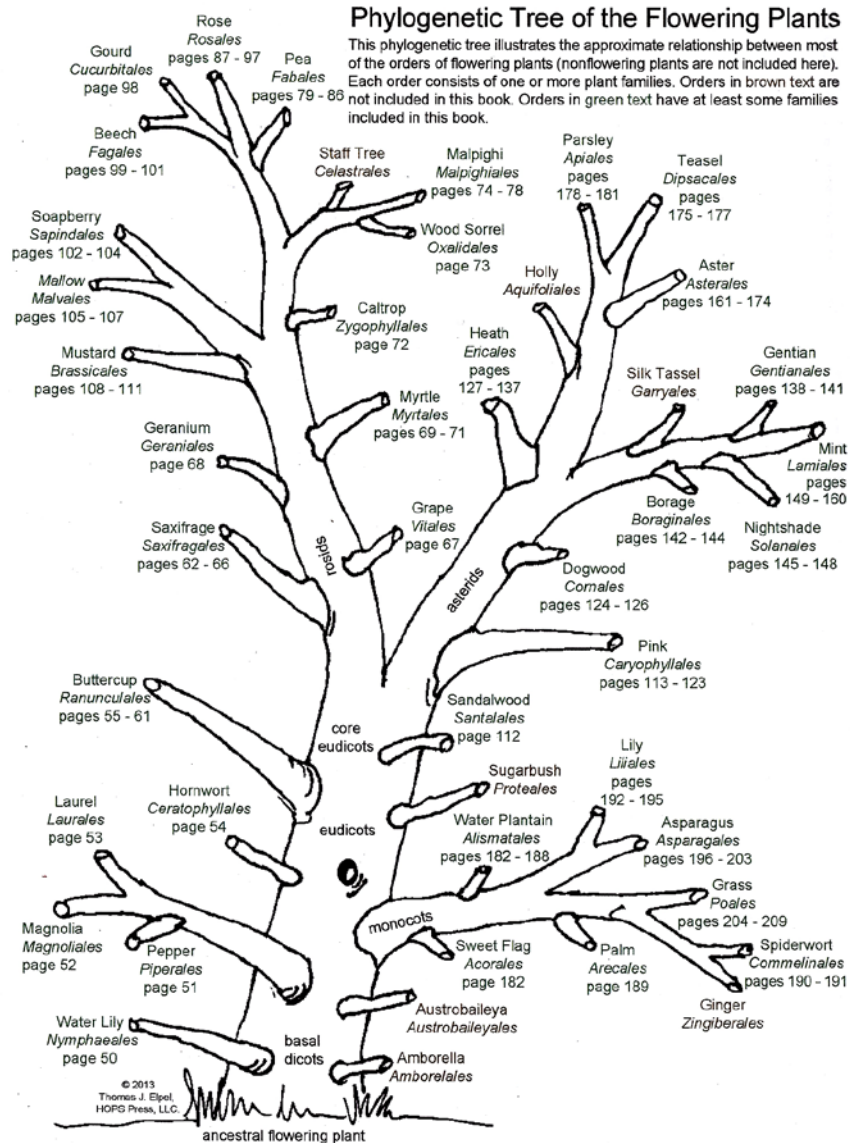
Tomato plants are thought to have originated in coastal areas of Central and South America, but it was in ancient Mexico that they were first domesticated for food. The name of the plant is derived from “tomat’l” which means something like “wet, fat thing” in an Aztec dialect of Central America.

Major Hearths of Agriculture



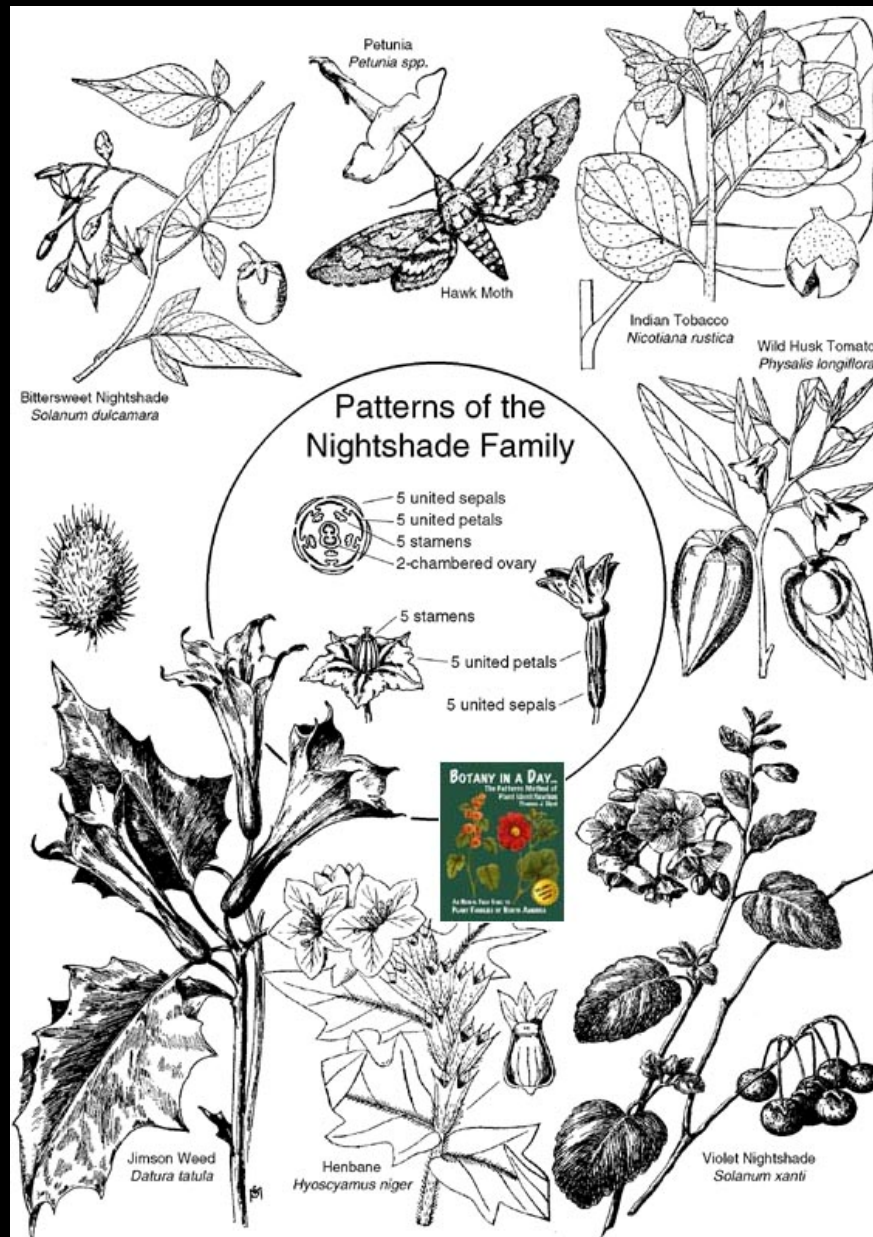
Tomatoes and Their Relatives

Botany in a Day Tutorial



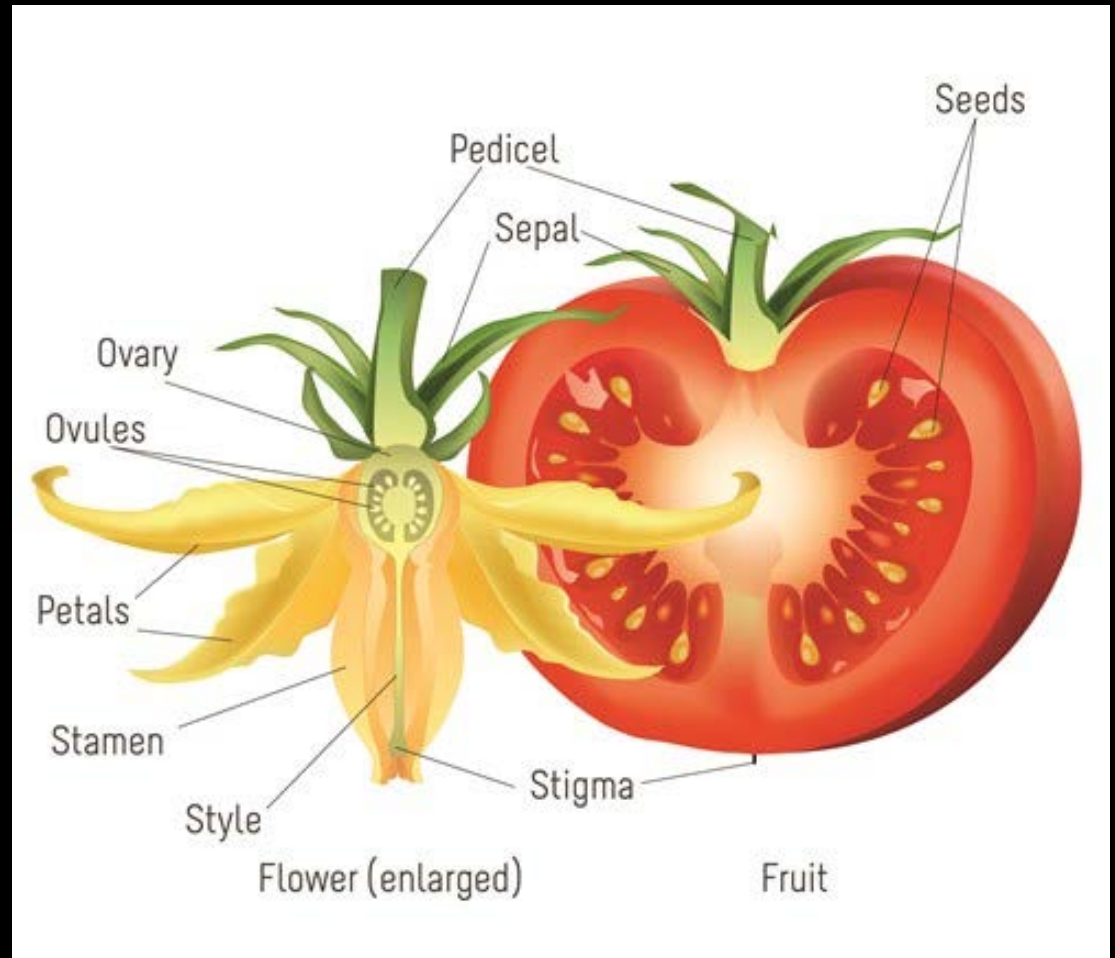
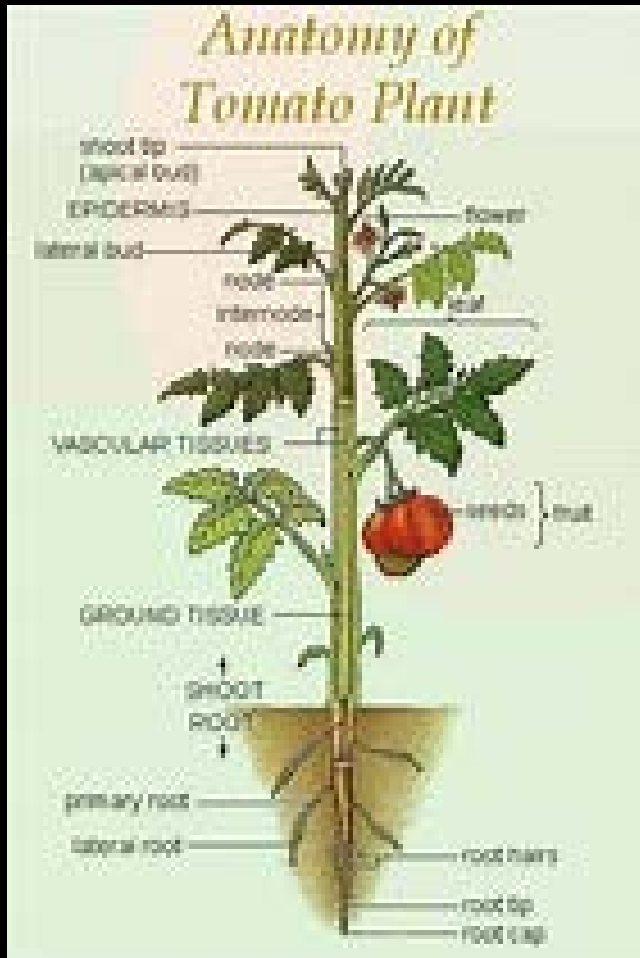
Phylogenetic Tree of Flowering Plants
From Thomas J. Elpel's *Botany in a Day*

Tomatoes and Their Relatives



Patterns of the Nightshade Family (Solanaceae)
From Thomas J. Elpel's *Botany in a Day*

Tomato Anatomy



The stem of the tomato plant is **pubescent**, or hairy and the hairs are called trichomes. An older botanical name for the wild tomato was in fact *Solanum hirsutum*. The wild tomato species are more hirsute (hairier) than the domesticated tomato, *Solanum lycopersicon*, and heirloom varieties are hairier than hybrid varieties. The hairs probably protect the plants from harsh sun and reduce evaporation.



The tomato plant has five kinds of trichomes, two of which bear glands on their tips. The glands secrete essential oils and crystals that give tomato vines their

characteristic aroma. These aromatic compounds serve to deter insects and other herbivores.

Many old canning recipes suggest you make use of these aromatic compounds by including a tomato leaf in your preserved tomatoes to deepen the flavor.

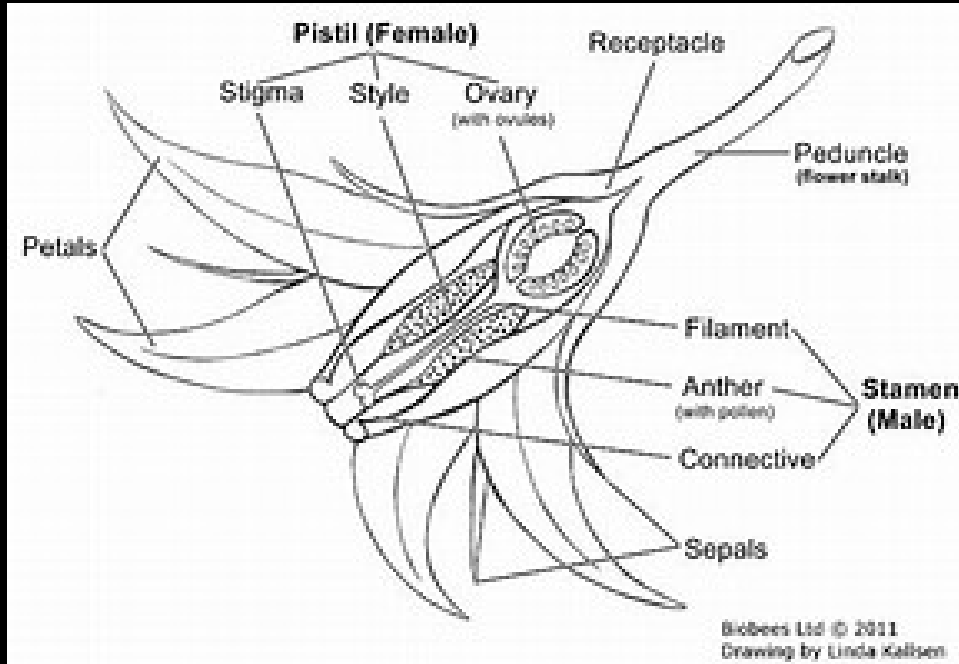
How are tomato flowers pollinated?

Tomato plants have perfect flowers (having both male and female parts) and are considered self-fertile, but that does not mean that they are self-pollinating. Which of the following is the major pollinator of the tomato flower?

1. Hummingbird
2. Honeybee
3. Native bees
4. Beefly



Answer: The tomato flower is “buzz pollinated” by native bees including solitary bees and bumblebees.



SE Arizona has hundreds of species of native bees. It is easy to attract a good population to your garden by providing native flowering plants and bee nesting boxes.

The structure of the tomato blossom is such that the pollen needs to be blasted from the lower situated anthers onto the stigma. This can be done by wind or much more efficiently by buzz pollination, aka “sonication” when the bee vibrates its wings 24,000 times per minute.



What you need to know in December (or November!) for planting in February

When to start seed if growing your own starts

Which varieties grow best in Tucson

Which varieties best suit your needs or wants

Where will you plant your tomatoes?

When to start seeds?

To figure out when to plant seeds work backwards from the time that you intend to plant them. A few years ago local garden experts starting recommending that we put our tomato plants in the ground starting **February 15**. That is a month earlier than the March 15 date recommended previously. You need to get your tomato plants in early so that you get a good harvest before the plants shut down production for the summer. You will want to allow 6-8 weeks for your starts to grow before transplanting outdoors. Taking all that in consideration you should be sowing your seed indoors about NOW!

If you read local online gardening blogs you will find that some Tucson-area gardeners are now starting their tomato seedlings in November!

Selecting Varieties

Selecting the tomato variety that suits your growing situation and your particular needs is important. You will need to consider:

- Climate – Of the approximately 7500 varieties out there only a relative few will produce in our hot arid climate.
- Assess your own growing space – Do you have room for large sprawling plants, do you intend to trellis, or do you need to search for small varieties because you will be growing in containers?
- What are you intending to do with your tomatoes? Do you want to grow a lot for canning or are you intending to grow for fresh eating for as long into the season as possible?
- Gardening Philosophy – Are you a strong proponent of heirloom and open-pollinated crops, or will you grow hybrids when you think that is your best option?

Types of Tomatoes: Determinate vs. Indeterminate

- Determinate types are more compact. They will grow to a certain height and then stop. They also tend to produce all their fruit within a period of about three weeks. This is useful if you are growing tomatoes for canning.
- Indeterminate types keep growing all season and can get quite large. They also tend to keep producing fruit throughout the season so long as temperatures are within the acceptable range. Most heirloom tomatoes are indeterminate.

Types of Tomatoes: By Color

- Red – Rich in the anti-oxidant pigment, “lycopene.” A color we associate with the standard tomato. Birds are more likely to peck at, and spoil, your red tomatoes.
- Pink – A pastel tint of red.
- Orange- There are many varieties, and can be quite pretty
- Yellow- the yellow pear is one of the most prolific in Tucson. Birds are less likely to be attracted to yellow tomatoes.
- Green – Heirloom varieties, usually with some striping and complex flavor.
- Blue – Newer varieties, rich in anti-oxidant anthocyanins. Try Indigo Rose.
- Purple – Cherokee Purple is an heirloom that grows well in Tucson.
- Black – Usually a combination of red overlaid with iridescent dark green that gives the impression of black. Some have a rich flavor.
- Striped – Can be a combination of any of the above colors. Very showy and some of them also good eating.

Types of Tomatoes: by flavor

- Tomatoes can be complex in flavor and a single tomato can sport flavors such as sour, sweet and “umami” or “mouth feel.” That complexity accounts for much of the appeal of a tomato. Tomatoes differ in flavor, and some, regrettably, are almost flavorless. Make sure to read customer reviews when choosing varieties unfamiliar to you.
- Americans like sweet flavors and we have been breeding our tomatoes to be sweeter (high brix) for years. This is not good news for those who like to can their tomatoes. Bacteria like sugar too, and many home canners need to look for more acidic, old-fashioned varieties that are considered safe to can.



Types of Tomatoes: Fruit Size

- Berry/Cherry/Pear – Very small to small in size.
- Plum or Roma – Considered paste tomatoes though you can eat them fresh
- Large – Beefsteak, Brandywine.

The long-accepted wisdom is that in Tucson it is easier to raise the small varieties such as cherry, pear and plum, than the larger ones. One reason for this is that the small varieties have thicker skins and are less prone to cracking. There are Tucson gardeners who beat the odds and successfully grow large varieties. To avoid cracking make sure to water consistently. Providing light shade during the hottest time of day may also help.

Note: The smaller cherry, grape and pear tomatoes tend to be usually indeterminate, even the hybrid varieties, and grow vines 6-8 feet long. Prepare to use long stakes!

Types of Tomatoes: Heirloom, Open-Pollinated or Hybrid?

- **Open-Pollinated:** Plant varieties produced by natural pollination methods, such as by insects, birds, bats or the wind. Open-pollinated plants reproduce basically true to form, but since pollination is random, plants will develop some genetic diversity. This means that open-pollinated varieties are apt to adapt slowly to their local growing conditions.
- **Heirloom:** Open-pollinated varieties that have been passed from one generation of gardener to the next
- **Hybrid:** Plants that have been cross-pollinated for desired characteristics such as flavor, color, growing habit, and most especially for disease resistance. In areas prone to disease, tomato growers will seek out productive hybrids coded with letters indicating which diseases the variety is resistant to.

Seed from hybrid plants may be sterile, or if it does germinate, will probably produce inferior and non-productive plants. If you wish to save seed use open-pollinated varieties.

Which should I choose for raising Tomatoes in Tucson?

Heirloom and Other Open-Pollinated Varieties

Advantages: superior flavor, wonderful colors and shapes, breeds true for seed saving (tomatoes are “self-pollinating”)

Disadvantages: plants may grow too large for your growing space, fruit has short shelf life and does not travel well

Hybrid Varieties

Advantages: F1 (first generation hybrids) are vigorous and have predictable growing habits, productivity and quality of fruit. Fruit has greater shelf life and will travel well. Bred for resistance to specific common diseases. Refer to codes listed on seed packets or catalogs.

V Verticillium Wilt

F Fusarium Wilt

FF Fusarium, races 1 and 2

FFF Fusarium, races 1, 2, and 3

N Nematodes

A Alternaria

T Tobacco Mosaic Virus

St Stemphylium (Gray Leaf Spot)

TSWV Tomato Spotted Wilt Virus

Disadvantages: Cannot save seed. Flavor rather ordinary (supermarket tomatoes are mostly hybrid varieties)

Tomato Varieties Recommended for Tucson's Hot and Dry Climate

These are some of the old standbys (open-pollinated or heirloom unless indicated):

Celebrity (**hybrid**) VFFT – large red

Early Girl (**hybrid**) VF and VFF – medium, red, indeterminate

Heatwave (**hybrid**) red 6-7 oz. fruit

Large Red Cherry – possibly the best producing tomato of all for Tucson

Pearson – heirloom developed for semi-arid regions, red globe, medium

Porter Improved – heat and drought tolerant, 4 oz. red globe

Roma types – San Marzano the standard, but try a few others

Sungold (**hybrid**) – VFFNT – sweet, fruity, productive, yellow orange cherry

Sweet 100's – VFN – indeterminate, very sweet and prolific red cherry

Yellow Pear – prolific and will produce over a long period

Photos of tomatoes grown by TOG members



Morgan's Purple Cherokee



Beth's tomatoes



Melody's Helsing Junction Blues



Beth's Wild Cherry from Native Seed Search

More of Beth's Tomato Harvest



Beth's seed packets



More Tomato Varieties Recommended for Tucson

Alicante

Brandywine

Cherokee Purple

Chocolate Stripes

Chocolate Stripes

Costoluto Genovese – heat loving Italian, red and strongly fluted, full-flavored and somewhat tart. Makes rich sauce.

Dr. Wyche

Garden Peach

Golden Jubilee

Golden Oderosa

Goose Creek Homestead

Green Sausage

Green Zebra

Hawaiian Tropic

Heatwave

Indian Moon – Navajo heirloom, yellow orange, medium sized

Even More Tomato Varieties Recommended for Tucson

Indigo Rose

Juliette

Kellogg's Breakfast -- large yellow but tends to crack

Marglobe – Medium sized red globe, resistant to end rot

Motomaro

Mr. Stripey

Mule Team

Neves Azorean Red

Oaxacan Jewel – pre-Columbian heirloom, yellow and red beefsteak, marbled flesh, fruity flavors, ½ pound,

Prudens Purple

Sioux – Red, semi-determinate, organic seeds, heirloom, prolific, 2 1/2 inches

Stupice

Super Sioux – Red, crack-free large, thick skin, heat tolerant, high acid and tart

Texas Star –yellow with red stripes outside and inside, large

Tomato Tumbler

Resources for Tomato Seed

Local:

Native Seed Search – An organization devoted to preserving food crop biodiversity by preserving seeds traditionally grown by indigenous peoples of the SW region, but they sell a limited range of standard garden seed, including tomato varieties Black Cherry, Punta Banda, and Nichol's Family Heirloom (an heirloom from Tucson!)

Westwind Seed -- owner Reggie Smith sells her seeds at farmers' markets and at our TOG Fairs. She also fills orders online but if you can find an opportunity to speak with her personally, you can get some excellent growing tips. Reggie's seed varieties all grow well in Tucson.

The Food Conspiracy, EcoGro and Ace Hardware all carry an organic brand of seed called Botanical Interests.

Online:

Annie's Organics

Baker's Creek Heirloom – Unusual varieties of edible plants from around the world, including amazing looking tomatoes.

Johnny's Seed – large selection of seed for both hybrid and heirloom varieties. You pay extra for organically grown seed.

Tomatofest -- an enormous selection of heirloom tomato seed, but not all organic.

Totally Tomatoes

Starting Seed Indoors

- If you intend to plant around February 15th start your seed around the time of the Winter Solstice. (or earlier!)
- Use a good seed starting mix, not soil. You can add mycorrhizal fungi to a sterile mix. If you are starting lots of seed make your own seed starting mix.
- Sow seeds in your favorite seed starting set-up, which should include a clear plastic dome. If growing more than one variety make sure to label your seeds.
- Set seed tray with clear plastic dome on a heat mat and use grow lights to assure your seeds get a minimum of 12 hours of balanced light a day. Make sure to keep the lights close to the plants or they will get leggy.
- Depending upon your variety seeds should start germinating in 5 to 10 days.
- Keep watered, but not soggy.
- Monitor for insects. Crickets and fungus gnats are probably the most common pests you can expect. Treat organically as soon as you notice a problem.



DYI Seedling Mix

recommended by Eco-Gro

70 % Coco Peat

30% Perlite

To a dishpan-full of the above mix this I add about a teaspoon of mycorrhizal fungi and mix well before filling cells of self watering seedling tray. I'll sow up to 10 seeds per cell.

Potting up seedlings

When first true leaves emerge you can start potting up your seedlings.

1. Separate seedlings gently. Hold them by their leaves (not by their stems) and shake off loose soil while at the same time pulling them apart.
2. If you have let several sets of leaves grow, trim off the lower ones with sharp scissors.

Tomato stems are pubescent, or hairy. When the stem is buried these hairs transform into roots!



3. Using a rich rather than sterile potting mix, transplant into individual pots, burying as much as 2/3's of the seedling's stem. If you follow this crucial step the hairs on the stem will become roots and the root system of your starts will be greatly enlarged, resulting in a more robust plant.
4. Water, feed (I use actively aerated compost tea) and continue to provide your plants with plenty of light and adequate warmth.

Hardening up your tomato starts

- A week, or preferably two weeks, before transplanting in the garden start hardening up your starts. Move them to a warm sunny location. (If the weather is unseasonably warm monitor your plants to make sure you don't fry them.) If nights are chilly it cover at night and remove covers when the day starts to warm. Bring the plants inside at night if frost is forecast.
- Continue to feed and water starts and monitor for pests.

Transplanting Outdoors

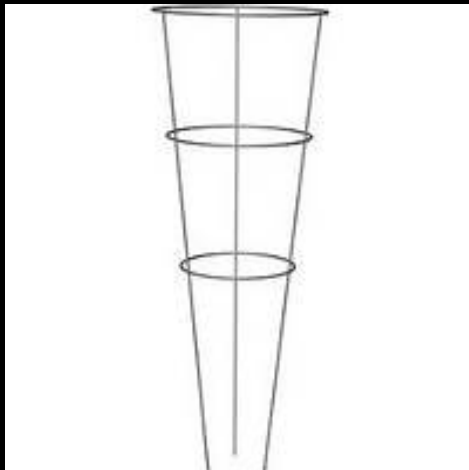
- Before planting decide whether you will be use supports for your plants and get those in place.
- You can transplant your tomato starts once your soil has warmed to 50 degrees F. **Warning: If you do this in February make sure to keep an eye on the weather. You will have to cover your plants with an insulating blanket (frost cloth, not plastic!) if there is any danger of frost in your area.**
- Tomatoes don't like having "wet feet" so it is critical that your soil drains well. If you have caliche, knock a hole through the caliche shelf to provide drainage. If your soil has too much clay (or too much sand) you can remedy this situation somewhat by incorporating lots of organic matter.
- Before setting your plants in the ground trim off bottom sets of leaves with sharp scissors or shears. Bury the denuded stem in the ground (1/2 to 2/3's of the stem can be buried). Additional roots will grow from the buried portion of the stem.
- It is best to put your supports, if you are using them, in place before planting or at least shortly thereafter. Trying to cage a tomato plant with lots of side shoots can be aggravating and could also result in damage to your plant.

Spacing and Use of Supports?

- Spacing your plants: Tomatoes need air circulation to prevent disease. You will find different recommendations on how much space should be left between plants. Some say as many as four to six feet and others recommend two feet.
- To use supports or not? Some gardeners prefer to let their tomato plants sprawl in a big mound so that the foliage mass protects fruit from sun damage and perhaps somewhat from marauding birds. Others like to keep their plants upright with lots of space between them.

Styles of Tomato Supports

- Tomato cages – cheap and ready-made. They tend to be tippy so it's a good idea to steady them with a stake
- Fencing – Concrete reinforcing mesh comes in 4' by 7' pieces and has 4-inch openings. You will have to support this with vertical stakes and perhaps even make a frame for it. The 4-inch openings allow you to harvest with ease.
- Boutique cages, spirals and towers let you to garden with style. They can come in pretty colors and intriguing shapes, but depending on the style you might have to compromise the beauty of your purchase with an ugly stake if the structures can't bear the weight of mature fruiting plants.



Make your own tomato supports with concrete remesh



Concrete remesh (above comes in panels approximately 4' by 7' with 4" opening to allow that allow for easy tending of plants and fruit harvesting. Support with T-stakes To make a fence-like support.

To make cylindrical cages, cut remesh off roll (right). If the diameter is wide enough it will need no further staking.



Companion Planting

- Borage – will attract bees and other beneficial insects. Deters hornworm. Leaves are edible and eaten raw taste like cucumbers. Use flowers as edible garnish.
- Basil --- Said to deter tobacco hornworms. Flowers attract pollinators and other beneficial insects. Tastes great in tomato recipes!
- Dill, mint, parsley – improve tomato flavor **but mature dill can inhibit tomato growth.**
- Marigold -- French varieties deter harmful nematodes
- Zinnias and Golden Crownbeard – Attract pollinators and other beneficial insects.



Do not plant the following near your tomato plants

Brassicas – stunt the growth of tomato plants

Corn – the corn earworm and the tomato fruit worm are one and the same

Other Solanum – eggplant, peppers and potatoes could make all more susceptible to disease such as blight (this is a disease we do have in relatively disease-free Tucson)

Beth's Tomato Growing Tips



Fertilizing

Some organic gardeners don't believe in feeding plants with amendments, even organic ones. They say that plenty of good quality compost is all your vegetable garden needs. Other gardeners give regular supplemental feeding regularly from the time seeds emerge until the plants shut down in the summer and then resuming again at summer's end to encourage a fall harvest.

There are many organic fertilizer mixes formulated especially for tomatoes. Many of these are diluted in water and then applied to the leaves of your tomato plant for a "foliar feeding." If you regularly make compost tea you can simply add spoonful of a high (potassium? Phosphorus?) form of bat guano to your compost tea and use that for foliar feeding.

Other single ingredient options include:

Bloodmeal, Bonemeal, Fishmeal, kelp and bat guano for foliar feeding.



To Prune or Not to Prune?

- Determinate types usually require no pruning.
- Most gardeners recommend removing dead leaves for the purpose of hygiene.
- Many, but not all, local gardeners prune indeterminate types prior to the monsoon so that plants will produce a second flush of fruit in the fall. Pruning directs growth to what remains of the plant.
- Some gardeners enthusiastically argue for removing suckers and others don't.



Tomato Diseases and Problems in the Desert

Tomatoes grown in arid conditions suffer from few diseases relative to those grown in humid ones. Some notable exceptions to this rule are:

Diseases

Early Blight

Curly Top – virus spread

Fusarium wilt

Verticillium Wilt

Late Blight

Other Problems

Blossom Drop

Blossom End Rot

Low Pollination and Fruit Set Rate

Sunscald

Cracking

Tomato diseases tend to be caused either by fungi or viruses. Once you have identified your disease you can decide whether you want to pull up the plant and put it in the trash (not the compost pile!) or whether it's worth trying to rescue your plant. Arbico Organics has a good range of products to treat fungal and viral diseases.

Tomato Diseases

growgardentomaotes.com is a good resource for gardeners. The web site has a section on growing tomatoes has a very good section on tomato diseases, including photos for quick diagnosis, names and causes of the diseases and remedies. Below are photos. Visit the site if you have need of this information: <http://www.growgardentomatoes.com/tomato-diseases.html>



Blossom End Rot



Photo: Susan Romanoff

Description: A Brown soft spot at the bottom (blossom end) of your ripening tomato.

Causes:

Usually occurs early in the season when cool weather inhibits the uptake of nutrients, specifically calcium. (Tomatoes perform best in the range between 70 and 90 degrees F.)

Prevention

Water plants regularly.

Epsom Salts to improve calcium uptake. Put one tablespoon in bottom of hole when planting. Side dress established plants with a tablespoon per foot of height every 2-3 weeks.

Remedy

The problem will usually disappear as the weather warms but if you are impatient for results you can treat with an organic spray



Tomato Diseases and Problems in the Desert

Problems other than disease caused mostly by weather/climate conditions

Blossom Drop – stress such as weather that is too cold or too hot

Blossom End Rot – Usually early in the season and due to cold temperatures or calcium deficiency.

Low Pollination and Fruit Set Rate – usually due to temperatures that are too high. Some say misting the tomato blossoms will help pollen to stick to stigma, and others say that you can mimic buzz pollination with an electric toothbrush (be sure to remove the brush head)

Sunscald – provide shade

Cracking – inconsistent watering



Be like a bee with your electric toothbrush

Insect Pests on Tomatoes

Most insect pests that you will encounter on your tomato plants are problematic because they are disease vectors, not because they devour your plants, e.g. the beet leafhopper which spreads the Curly Top virus. Some notable exceptions to that rule are:

Tobacco Hornworm – pick it off and destroy or treat with organic insecticide

Tomato Fruit Worm (same as Corn Ear Worm)

Whitefly – will suck juices



