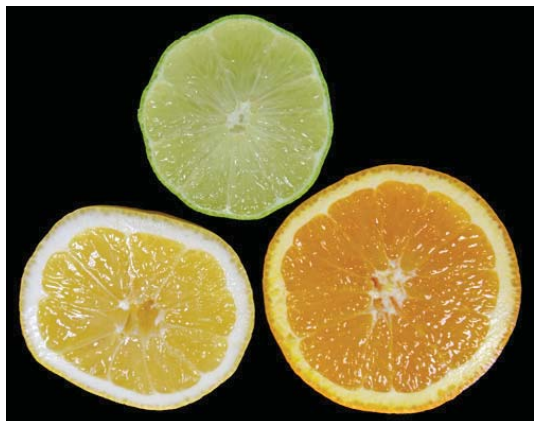


Growing Citrus Indoors



Most citrus is descended from four ancestral species.

The oldest known reference to citrus is in the *Vajasaneyi Samihita*, a collection of devotional texts written in Sanskrit prior to 800 BC. The first Chinese references date to perhaps 776 BC, although they may actually refer to conditions well before that time. Citrus accompanied travelers along the Silk Road, migrating to the Middle East and, eventually, Europe. Citron, sanctified in India, was dispersed to the Near East, becoming an important part of Jewish culture. For a long time the only citrus in Europe was the citron which was brought to Calabria, Italy by the Jews around AD 70, and is still grown there. But citrus eventually spread all around the world as a consequence of travel, exploration, war, and politics. During the heyday of the Roman Empire, new varieties of fruit trees came flooding into Europe from all over the world, including probably in order, sour oranges, lemons and sweet oranges. But many of these citrus groves were lost when the empire disintegrated, and the next wave of introductions came with the rise of Islam and the Arab empire, with citron, sour orange, lemon and pummelo found in North Africa and Spain by 1,150 AD. The Crusades introduced feudal Europeans

Most cultivated citrus seems to be descended from four core ancestral species: citron, *Citrus medica*, from Northern India; mandarin, *C. reticulata* from China; pomelo (*C. maxima*, a grapefruit-like fruit) from Malaysia; and papeda (a sub-genus of Citrus) native to tropical Asia. Citrus is very promiscuous and will cross-pollinate with any other kind of citrus fruit – today's lemons, limes, grapefruits, and oranges are natural or artificial hybrids of these species – and in combination with a possible polyphyletic origin, there is still considerable confusion on the classification of these fruit trees.

The oldest known reference to citrus is in the *Vajasaneyi Samihita*, a collection of



A backyard orange tree in San Diego.



Orange trees are still grown in southern California.

to lemons, lime and sour oranges, and citrus soon became the fashion of the nobility and rich merchants. By the 16th century, sweet oranges were a well-established commercial crop in southern Europe. The mandarin was first brought to England in 1805, and spread from there to Malta, Sicily and Italy. From Europe citrus spread to the New World, with seeds brought to Haiti on Columbus' second voyage in 1493. By 1518 the orange reached Mexico, and Spanish settlers brought citrus to Florida in about 1565. By the early part of the citrus had spread to Arizona and California, where they became an important commercial crop.

Many types of citrus can grow more than 20 feet tall in the ground, but dwarf types can be kept at 3-5 feet tall in containers. These trees have ovoid to elongate, glossy, dark green leaves. On many types of citrus the leaf has a small flange along the petiole. There are some cultivars with variegated foliage.



Citrus leaves (L) often have a flange on the petiole (LC) and may be dark or light green (RC) or variegated (R).

Citrus often has thorns at the nodes, especially on new grafts and fruiting wood; these can be cut off if desired (if the thorns are on shoots that originate from the rootstock, below the graft union, the entire shoot should be removed). Thorns evolved for protection from herbivores, especially of the young foliage which is most delicate, so many types only have thorns as juveniles but outgrow them as the tree matures. Lemons and limes generally have sharp thorns, although thornless cultivars are available – but they supposedly have less flavor and are not as productive. Some orange cultivars only have small, blunt thorns at the base of the leaves.



Many types of citrus have sharp thorns.

Clusters of fragrant white flowers are produced at the ends of the stems. Depending on variety, most citrus trees bloom in spring to set fruit that are ready to harvest in fall and winter. Others may flower and fruit off and on year-round (especially lemons, limes and kumquats), and specific pruning and



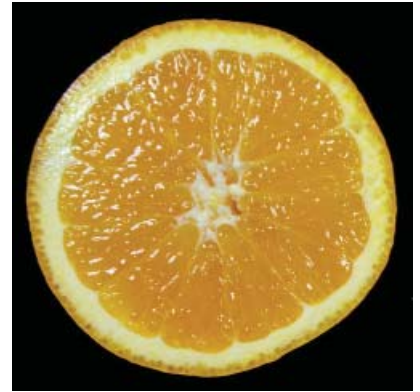
Clusters of buds (L), which may be white or pink (LC) open to white petals and yellow stamens (C, RC and R).



Young fruits develop after the flowers.

fertilization techniques can promote flowering in the off season. These are followed by a fruit technically called a hesperidium, a specialized type of berry with a leathery rind called a pericarp. Because most citrus doesn't require cross pollination to be productive (although it may increase fruit size), they will set fruit on a single plant indoors. Potted trees often set much more fruit than the tree can support, so fruit drop is very common. The time from blossom to

fruit harvest varies by type and variety. In general, most lemons and limes ripen in six to nine months, while oranges take about a year. Citrus fruits ripen only on the tree, but can remain on the tree in good condition long after they are mature.



Citrus fruits are a hesperidium, a specialized type of berry with a leathery rind.

Once the exotic fruit was brought to the attention of the wealthy, it began to be grown in nearly every European palace and garden either for culinary use, medicine or just for decoration. Since citrus is not frost hardy, in cold climates, including central and northern Italy and France, trees had to be grown in containers and spend the winter in the shelter of a purpose-built structure called an *orangerie* (orange house) in French and *limonaia* (lemon house) in Italian. These special structures are intended



Part of the citrus collection at Villa Medici di Castello.

to protect the citrus

from freezing and provide reasonable light, keeping them cool so they don't grow too much during the winter. The orangery at the gardens of Versailles, with more than 1,000 potted plants, might be the world's most famous showcase of citrus trees, indoors or out. During the Renaissance it was fashionable among rich families to collect rare mutations of citrus trees. Villa Medici di Castello in Florence, Italy has part of the original Medici citrus collection, with a genetic line that goes back hundreds of years. Some of these unusual cultivars, such as "fingered lemons", can still be seen in Tuscan gardens.



An assortment of citrus fruits, including fingered lemons (second from right).



Citrus growing in a large container in Italy.

Even without an *orangerie* or *limonaia*, citrus is easily grown in containers in cold climates. The plants can remain outdoors during the growing season, but must be brought indoors when temperatures approach freezing. In Italy and France citrus often need to be sheltered in the relatively dim light of orange or lemon houses only for a few months, but in harsher climates the plants will need to remain indoors for longer and will need bright light to thrive.

For the best success growing citrus as a houseplant, place the container where the plant will receive as bright light as possible, such as in a south or southwest facing window. Citrus trees do not go dormant like many other plants, so they need sufficient light and some humidity during the winter (although their growth will slow during this time). Supplemental light will be needed for fruit production if the plants do not receive at least 6 hours of direct light daily (the foliage can adapt to the relatively low light levels typical in a home, but plants are

very unlikely to flower). Citrus grow best between 55°F and 85°F. They can tolerate warmer or cooler temperatures (down to about freezing or below depending on the variety) for very short periods of time, but avoid abrupt temperature shifts. They require a 5-10 degree difference in day and night temperatures for flowering.

Once temperatures are consistently above 50°F citrus trees can be moved outdoors for the growing season. Acclimate them over a period of one to two weeks, gradually moving from a sheltered, partly shaded spot into full sun (leaves will sunburn if moved too quickly from low light conditions in a house to full sun; drastic changes of environment can also cause leaves, flowers and young fruit to drop). Choose a sunny location that isn't too windy and where the containers will not be standing in water or receive frequent, shallow watering (such as near a lawn with a sprinkler system). Warmer microclimates, such as near a building or where there is reflected heat from a patio or walkway, are good choices. Move them back indoors before night temperatures drop into the 40s.



Citrus in containers are best moved outside once the weather is warm.

Grow all types of citrus in a slightly acid, well-drained potting medium, such as cactus mix. Amending regular commercial potting medium with up to 1/3 small pea gravel, pumice, turkey grit and/or other inorganic materials will improve the drainage. Avoid using growing media formulated for moisture retention. Clay, plastic or decorative containers are all suitable, as long as there are sufficient drainage holes. Start plants in smaller pots and move to a larger size as they grow so that there isn't too much potting medium relative to the amount of foliage (or the soil will remain too wet after watering, making root rot more likely). A deep pot is better than a shallow one, as it will balance the tree when it gets larger and more top-heavy. Citrus can be kept in 10-12 inch pots for several years. Larger containers will allow the tree to grow bigger and more productive, but these may be harder to move. Plants should be repotted every year or two.



Grow citrus in well-drained potting medium and keep it moist, but not wet.

on the size of the container and plant, they potting medium, temperature, humidity and other factors. Cupped or yellowed leaves can be a symptom of excessive watering. Reduce watering in winter when plants are not actively growing.

Citrus trees require soil that is moist but never soggy. Water regularly as needed to keep the potting medium moist, but not wet, allowing it to dry slightly between waterings. Infrequent, deep watering is preferable to frequent, shallow applications. The amount and frequency needed will depend

Citrus are heavy feeders and need more nitrogen than phosphorus or potassium. Specialized citrus/avocado fertilizers are available, but any all-purpose or acid-loving plant fertilizer that supplies at least a 2-1-1 ratio can be used. Trace minerals including iron, zinc and manganese may need to be added (most multipurpose fertilizers contain these minerals). Granular, slow release formulations are best, but frequent, dilute applications of soluble fertilizer can be made when plants are actively growing (April through September). Yellowing leaves may indicate a need for more fertilizer.

The most common pests on citrus trees in the Midwest are brown soft scale and two-spotted spider mite, and occasionally aphids, mealybugs, or whiteflies. Washing the foliage periodically can help deter these pests. Insecticidal soap or synthetic insecticides can be used against all of these, although physically wiping the scales off the leaves and branches may also be needed as any sprays will only kill the crawler stage of that insect. Light horticultural oil may also be effective against scales. With all of these pests, multiple applications may be required to achieve control.

Although citrus can be grown from seed, those plants will be different from the parents, so it is best to purchase a known variety. Cultivars can also be propagated from semi-soft stem cuttings taken in the spring or summer – commercial varieties are almost also grafted as well, with a rootstock that is different from the cultivar grafted on top. Any suckers (shoot growth below the graft union – a diagonal scar between 4 and 8 inches from the soil) should be removed immediately to prevent vigorous growth that will detract from fruiting wood. Citrus can be pruning any time to shape and balance the tree. Lemon trees can even be trained as bonsai specimens. Most varieties of commercial oranges and other citrus grown outdoors in warm climates are too large to be grown indoors. Dwarf cultivars – or those on dwarfing rootstocks that keep the plant small – are especially suited for growing in containers.



Cottony cushion scale is an important pest of citrus, but in the Midwest brown scale and spider mites are the most common pests.



Citrus grown from seed is unlikely to produce the same type of fruit as the parent.

Citrus can be pruning any time to shape and balance the tree. Lemon trees can even be trained as bonsai specimens. Most varieties of commercial oranges and other citrus grown outdoors in warm climates are too large to be grown indoors. Dwarf cultivars – or those on dwarfing rootstocks that keep the plant small – are especially suited for growing in containers.

Sweet citrus – such as oranges and tangerines – need a lot of heat to ripen, whereas the acid citrus – lemons and limes – need much less, so are more easily grown indoors. These types not only ripen their fruit much faster, but also tend to be nearly ever-blooming. Some of the easiest include:

- Bearss lime (*C. x latifolia*) – also known as Tahitian lime and Persian lime, is a vigorous, thornless tree that produces bigger fruit than Mexican limes.
- Calamondin (*Citrofortunella microcarpa* or *Citrus madurensis*) – is grown primarily as an ornamental, producing small, round, orange, sour fruit. ‘Peters’ is a variegated form.
- Citron (*Citrus medica*) – has yellow fruit with a rough and bumpy surface, very thick and fleshy rind, little juice, and sweet flavor.
- Kaffir lime (*C. hystrix*) – is grown for the leaves that are used in Thai and other Southeast Asian, but it does produce a small, bumpy fruit.
- ‘Eureka’ lemon – is a thornless cultivar with full size, striped fruit
- Kumquat (*Fortunella* spp.) – has flowers with a pungent sandalwood-like scent followed by small, elongate, tart orange fruits good for marmalade. Meiwa kumquat (*F. crassifolia*) has round and sweet fruits.
- Limequat – a hybrid of Mexican lime and kumquat (*C. aurantiifolia* x *F. crassifolia*) with a shrub-like habit and yellow, egg-sized fruit with edible skin.



Variegated calamondin.

- Mandarin or satsuma oranges (*C. reticulata*) — aren't really oranges at all but tangerines noted for their abundant fragrant flowers and which require far less heat to ripen the sweet fruit than true oranges.
- 'Meyer' lemon – a lemon-orange hybrid brought from China in 1908 that produces very juicy, medium-sized, seedless fruits with a very thin skin and sweeter pulp than other types of lemons. The Improved Meyer Lemon is virus-free (the original was a symptomless carrier of certain viruses, particularly tristeza).
- Tahitian orange (*Citrus limonia* 'Otaheite') – a dwarf, thornless tree that should be properly regarded as an acidless or sweet form of the Rangpur lime.
- 'Trovita' orange (*C. sinensis*) – is fast-ripening with medium-small, few-seeded juicy fruit, but tends toward alternate bearing.

– Susan Mahr, University of Wisconsin – Madison

Additional Information:

- Growing citrus indoors in Minnesota – University of Minnesota Extension article H106C at <http://www.extension.umn.edu/garden/yard-garden/houseplants/growing-citrus-indoors-in-minnesota/>
- Growing Citrus Indoors in Cool Climates – Purdue University Consumer Horticulture at <https://hort.purdue.edu/ext/citrus.html>
- Citrus Trees: an Ideal Indoor Plant Selection – by a MGV for Colorado State University Cooperative Extension at <http://www.coopext.colostate.edu/4dmg/Plants/citrus.htm>
- Growing Indoor Citrus – by GrowOrganic on YouTube at https://www.youtube.com/watch?v=tNivqIKI_9g
- Indoor Citrus and Fruit trees – a commercial site at <http://www.indoorcitrustrees.com/>
- University of California Riverside Citrus Variety Collection – for citrus variety characteristics, hardiness and harvest seasons at <http://www.citrusvariety.ucr.edu>