Hardy Citrus Sources

McKenzie Farms
2115 Olanta Highway
Scranton, SC 29591
Phone: 843.389.4831
E-mail: citrusman99@hotmail.com
Web site: www.mckenzie-farms.com
Hardy varieties

Woodlanders, Inc.
1128 Colleton Avenue
Aiken, SC 29801
Phone: 803.648.7522
E-mail: woodland@scbn.net
Web site: www.woodlanders.net
Seedlings of hardy varieties

Pacific Tree Farms
4304 Lynwood Drive
Chula Vista, CA 91910
Phone: 619.422.2400
Web site: www.lyburg.com/ptf
Grafted commercial varieties

Flying Dragon Citrus Nursery
3973 Loretto Road
Jacksonville, FL 32223
Phone: 904.880.5026
E-mail: mbarwald@yahoo.com
Commercial varieties grafted on Trifoliate rootstock

Louisiana Nursery
5853 Highway 182
Opelousas, LA 70570
Phone: 337.948.3696
E-mail: dedurio@yahoo.com
Web site: www.durionursery.com
Commercial and hardy varieties

Seedlings of hardy varieties

Just Fruits and Exotics
30 St. Francis Street
Crawfordville, FL 32327
Phone: 850.926.5644
E-mail: justfruits@hotmail.com
Web site: www.justfruitsandexotics.com
Commercial and hardy varieties grafted on Trifoliate rootstock

Bibliography

Some of the additional hardy citrus varieties and hybrids listed were found at the Bureau of Citrus Budwood Registration, Winter Haven, Florida (www.doacs.state.fl.us/pi/budwood), and the Citrus Variety Collection of the University of California Riverside (www.citrusvariety.ucr.edu)

Photo Credits
Photographs were contributed by Southeastern Palm Society members and were taken in the Southeast north of Florida.

Front Cover
Jeff Stevens

Pages 9
Joe LeVert: leaf miners and white flies; Tom McClendon: sooty mold.

Pages 18 & 19
Keith Endres: US 119; Gary Hollar: Dunstan citrumelo; Joe LeVert: Changsha mandarin, Flying Dragon trifoliate orange; Tom McClendon: Kinkoji grapefruit, Rusk citrange, pruimquat, Meyer lemon, Benton citrange, Thomasville citrangequat (close-up of fruit), Sinton citrangequat, Mowai kumquat, Hamlin sweet orange; Stan McKenzie: Juanita tangerine; Ned Rahm: Nagami kumquat; Jeff Stevens: Ichang lemon, yuzuquat, Chinotto sour orange, Ichang lemons (arrangement by JoAnn Inhulsen), citrumelo (tree with Dr. Christopher Inhulsen), Owari satsuma, Swingle citrumelo x Smooth Flat Seville; Will Taylor: Citrumelo USDA 80-5; George Weaver: Citrange in bloom; Jim Wilkinson: Grapefruit.

Back Cover
Joe LeVert: Yuzu; Tom McClendon: Seville Sour Orange; Jeff Stevens: Satsuma, citrus harvest from Montezuma, Georgia.

Hardy Citrus for the Southeast

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Key to back cover photo

HARDY CITRUS
FOR THE SOUTHEAST
INTRODUCTION

Citrus culture is usually associated with Florida, south Texas, and other areas where commercial production is centered. Many people outside these areas attempt to grow the familiar oranges, grapefruits, lemons and limes. While readily available, commercial citrus freeze and discourage further attempts.

In the southeastern United States, various kinds of citrus trees can be grown successfully in home landscapes well north of where they are usually seen. Though less familiar, less readily available, and often less palatable than commercial types, there are many citrus species and hybrids which can be grown outdoors in the Deep South, particularly the northern portions of Florida, the coastal regions of North Carolina, South Carolina, Georgia and Texas, and the lower regions of Alabama, Mississippi, and Louisiana. Some are reliable even well inland of these areas. The hardier citrus have attractive evergreen foliage, fragrant white flowers, and colorful fruit which can be used in various ways.

Woodlanders, Inc., an international rare plant mail-order nursery in Aiken, South Carolina, began propagating and offering the hardier citrus after noting the occasional citrus tree in various southern locations and further observations at the Florida Citrus Arboretum at Winter Haven in early 1980. In late December of 1989 a severe and prolonged freeze devastated commercial groves in the area, and many trees in the arboretum’s large collection were killed or severely damaged. Still, there were other trees which received little or no damage. Propagules from these hardier types have now been growing outdoors in Aiken in Zone 8 for a number of years with minimal winter injury. In November of 2003, fruits of 16 different types of hardy citrus fruiting outdoors in Aiken were exhibited at the first annual Southeastern Citrus Exposition in Columbia, South Carolina.

You will find information in this publication on many types of hardy citrus including names, descriptions, and culture, plus characteristics and uses of the fruit.

Hardy Citrus for the Southeast

By Tom McClendon

Design and layout: Jeff Stevens

Additional material on Chang Shou kumquat by Bob Snyder

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Photographs were contributed by Southeastern Palm Society members Keith Enders, Gary Hollar, Joe LeVert, Tom McClendon, Stan McKenzie, Ned Rahn, Jeff Stevens, Will Taylor, George Weaver and Jim Wilkinson. See page 34 for a full listing of photographic credits.

Proceeds from this publication benefit the Southeastern Palm Society.

The Southeastern Palms Society (and Subtropical Plants)

The Southeastern Palms Society is the southeastern United States (north-of-Florida) chapter of the International Palm Society. The society provides information on how to select and grow hardy palms and subtropical plants, including hardy citrus, maintains public display gardens to promote the use of these plants in the landscape, and conducts horticultural research, including trials of new species and varieties.

The Southeastern Palms Society is open to all. Our members share an enthusiasm for growing palms and many other subtropical plants and include beginning gardeners, serious hobbyists, nursery owners and academics. Members enjoy quarterly meetings and a subscription to our quarterly journal Southeastern Palms.

The Southeastern Citrus Exposition

The first annual Southeastern Citrus Exposition was held in November 2003 at Riverbanks Zoo and Garden in Columbia, South Carolina. Organized by Southeastern Palm Society member Stan McKenzie of Scranton, South Carolina, it featured a citrus fruit competition, expert speakers who explained how to choose and care for hardy citrus, and the opportunity to purchase hardy citrus trees and other subtropical plants.

Originally called the South Carolina Citrus Expo, the unexpectedly high attendance from both South Carolina and other states in the region inspired a name change to reflect the widening interest in growing citrus north of Florida.

The Expo may be the best source of rare species and cultivars for the home gardener.
Ruby Red Grapefruit (*Citrus paradisi*) is the most highly colored grapefruit that can be grown in the Southeast. When fully ripe it is a clear gemstone red and beautiful to behold. One limitation of this type is that it does not reach full flavor until late December or early January. It can be eaten as early as October but the fruit has quite a bit of acidic bite at that time.

**Flavor:** Sweet grapefruit, no off flavors, excellent quality.

**Uses:** Dessert.

**Bloomsweet or Kinkoji Grapefruit** (*Citrus paradisi* hybrid) is sometimes given the Latin binomial *Citrus obovioda*, and is called Kinkoji in Japan. It resembles a sour orange in its upright growth habit, but the large, yellow fruit looks just like a grapefruit, though with a thinner peel. The brightly-colored fruit is easy to peel, much like a mandarin. Inside, the fruit is coarser and drier than grapefruit, but sweeter and with no bitterness. It’s probably a hybrid of the pummelo with something (or somethings) else. Bloomsweet appears to be fully hardy to Zone 8a, enduring 14°F in Montezuma, Georgia with negligible leaf damage.

**Flavor:** Sweet grapefruit, no off-flavors, very good quality.

**Uses:** Dessert.

**Sanbokan Grapefruit** (*Citrus paradisi* hybrid) has excellent grapefruit-type fruit and is sometimes given specific status as *Citrus sulcata*. The tree is large and spreading like a grapefruit, but the yellow fruit is oblong with a slight neck and shaped more like some of the tangelos. Sanbokan has juicy fruit with a delicious lemony-grapefruit flavor. It doesn’t appear to be as hardy as Bloomsweet, but should be hardy in most areas of Zone 8b. A grafted unprotected plant withstood 14°F with no damage, but succumbed to 9°F the following winter.

**Flavor:** Sweet lemon-grapefruit, no off-flavors, excellent quality.

**Uses:** Dessert.

**Meyer Lemon** (*Citrus limon* hybrid or *Citrus meyeri*) was introduced to the United States about a century ago from China by the plant explorer Frank Meyer. It has a number of traits that point to lemon ancestry, such as lemon-scented foliage, a serrated leaf edge, reddish new growth and purple-tinged blossoms. The fruit, however, has characteristics that indicate that Meyer lemon may be a hybrid with a sweet orange. Fruit initially turn yellow but then continue changing color to a deep yellow and in some plants, a rich orange. Inside, the flesh is a pale orange color with a good lemon flavor, but the fruits tend to be a bit sweeter than typical lemons and not as highly flavored. Still, Meyer lemon makes a good lemon on coastal sections of the Southeast. It is only about as hardy as a sweet orange but grows well on its own roots and recovers rapidly from a freeze.

Lemons and Lemon Variants

Lemons (*Citrus limon*) are among the most cold-tender citrus, and true lemons grow well only in parts of California and central and southern Florida. However, the two “lemons” listed here grow well along the coastal sections of the Southeast. Lemons exhibit variable hardiness, and are generally the least hardy of citrus that can be grown in the Southeast. Meyer lemon and Ujukitsu may be hardy to about 20°F.
**GROWING CITRUS IN THE SOUTHEAST**

**Citrus North of Florida**

Along with palms, bananas and bold flowering plants, citrus help define the subtropics. With deeply hued evergreen leaves, fragrant blossoms, and ornamental and usually edible fruit, few other plants are as handsome and useful. The beauty and utility of these plants have helped them spread around the world. Originating in Asia, citrus were slowly dispersed to Europe during the Roman Empire and the Crusades. Christopher Columbus carried citrus on his second voyage to the New World, and later explorers spread citrus throughout the Americas and beyond. It's not much of an exaggeration to say that citrus carry within their genes the very history of the world.

This history is no less storied in the southeastern United States than elsewhere. Here, citrus have been grown outside of Florida for more than 300 years. The first English settlers in South Carolina carried with them citrus from Barbados and other Caribbean islands, reasoning that Charleston's climate would be milder than that of Spain, which lay farther north. In Georgia, General James Oglethorpe ordered that oranges be planted in Savannah and at Fort Frederica on St. Simon's Island, and these trees thrived for more than 100 years. At one time or another, nearly every coastal Southern state has had commercial plantings of citrus, and some, including Alabama and Louisiana, still do.

It should come as no surprise that commercial plantings of citrus have been devastated periodically by cold in the Southeast, just as they have been in Florida. It's also true that few areas are suitable for commercial plantings outside of the Sunshine State, southern Louisiana, and Texas. However, that does not mean that all areas of the Southeast are unsuitable for commercial plantings, and we certainly do not want to discourage gardeners from planting citrus in the home garden—far from it. Now more than ever, gardeners should include citrus in their landscape. In the last decade there has been a flurry of interest in hardy citrus.

**The Citrus Family Tree**

Citrus have been cultivated for so long that the origins of many types are unknown. As a result, there are several different ways of classifying citrus. Some researchers use the Swingle method, which recognizes fewer types as species. The Japanese researcher Tanaka recognized nearly every cultivar as a species, including those that have since been demonstrated to be clear hybrids (such as Yuzu, which Tanaka described as *Citrus junos* but which researchers demonstrated to be a hybrid between *Ichang papeda* and a mandarin). It has been suggested that all of the mainstream commercial citrus types are intermediates between two basic types, the pummelo and the mandarin.

For our purposes, we recognize the following as valid species or stable horticultural forms:

- **Trifoliata Orange** *Poncirus trifoliata*
- **Ichang Papeda** *Citrus ichangensis*
- **Kumquat** *Fortunella spp.*
- **Soue Orange** *Citrus aurantium*
- **Mandarin** *Citrus reticulata*
- **Sweet Orange** *Citrus sinensis*
- **Grapefruit** *Citrus paradisi*
- **Lemon** *Citrus limon*
- **Pummelo** *Citrus maxima*
- **Lime** *Citrus aurantifolia*

**The Grapefruit and Its Hybrids**

Grapefruit (*Citrus paradisi*) originated in the Caribbean and are believed to be either hybrids of pummelo with another variety or a mutation of the pummelo. Most botanists do not distinguish between the two, but there are some pronounced differences. Like pummelos, grapefruit trees are large and spreading to accommodate the large fruit, with huge green leaves and a pronounced winged petiole. Grapefruit, also like pummelo, come in white, red, and pink forms. Grapefruit is much juicier than pummelo, however, and nearly all varieties have some bitterness that contrasts with the sweet flavor. And grapefruit are markedly polyembryonic, but their cousins the pummelos are monoeembryonic. Hardiness varies by cultivar. Most standard types are hardy to about 20°F, making them essentially a Zone 9 tree.

I thought it came from the Hesperides, for there they say the golden apples grow.

—A young man in Antiphanes' *The Boestina Girl,* upon presenting a citron to his mistress. The Hesperides, daughters of Herperis and Atlas, crossed the Mediterranean from Africa to Italy in a giant shell.

**The Grapefruit and Its Hybrids**

- **Marsh Grapefruit and Pink Marsh Grapefruit**
  - **Flavor:** Sweet grapefruit, no off-flavors, excellent quality.
  - **Uses:** Dessert, juice.

- **Navel Orange** (*Citrus sinensis*), like Hamlin, is another old cultivar from Florida. Parson Brown oranges are somewhat larger than Hamlin, with a rougher peel and more seeds. They ripen a little after Hamlin but otherwise are excellent. Parson Brown is also used as a juice orange in Florida. Trees are similar to Hamlin and other sweet oranges.
  - **Flavor:** Sweet orange, no off flavors, excellent quality.
  - **Uses:** Dessert, juice.

- **Duncan Grapefruit** (*Citrus paradisi*) is the oldest variety of grapefruit, its name arising from Florida, where it was the standard for many years. A white grapefruit, Duncan is very seedy and sweet. Though one of the sweetest cultivars, it is not often found in grocery stores because of its seediness. It is still grown in Florida and is used for canning purposes. Commonly found in discount nurseries along the coast, it is a good choice there because it is one of the earliest ripening cultivars, edible as early as mid-October.
  - **Flavor:** Sweet grapefruit, no off-flavors, excellent quality.
  - **Uses:** Dessert, juice.

- **Marsh Grapefruit and Pink Marsh Grapefruit** (*Citrus paradisi*) are two very closely related cultivars similar in form and taste to Duncan. The principal difference between them and Duncan is the lack of seediness. They are not as flavorful as Duncan, though they are still very sweet.
  - **Flavor:** Sweet grapefruit, no off-flavors, excellent quality.
  - **Uses:** Dessert, juice.
15°F, perhaps a bit lower.

Flavor: Semi-sweet orange, no off-flavors, fair to good quality. Uses: Dessert. Note: Surprisingly good for a sour orange, in contrast with the rind, which is excessively bitter, as in all sour oranges.

Smooth Flat Seville Sour Orange (Citrus aurantium hybrid) is an Australian variety that may be a hybrid, possibly with grapefruit. foliage is typically sour orange with large leaves and a smallish petiole base, but the yellow fruit is very large, up to 8 inches or more, in diameter. When fully ripe they make an excellent grapefruit substitute. Hardiness is unknown, but should be comparable to other sour oranges. A grafted plant in metropolitan Atlanta endured lower teens with minimal leaf damage. Flavor: Semi-sweet grapefruit, no off-flavors, good quality. Uses: Dessert. Note: Surprisingly good grapefruit substitute when fully ripe.

Nansho Daidai Sour Orange (Citrus taitanica) is a very hardy tree and an upright, vigorous grower with long, narrow leaves and huge spines. The fruit is large, oblate spherical, and bright yellow. It is no myth that growing sweet oranges in colder winters. Many of these will be deciduous, or hardy to about 20°F. Generally speaking, if you live in an area that has winter minimums that commonly drop below 10°F, you will be able to grow only the hardiest varieties of citrus, and some of these will have to be protected in extreme weather. Many of these will be deciduous, or nearly so, in colder winters. Immediately southward are areas that commonly stay above 10°F but will drop lower every five years or so.

The environs around Raleigh, North Carolina south to Atlanta, Georgia and Birmingham, Alabama fall into this category. These areas can grow the hardest weather. Many of these will be deciduous, or hardy to the ground at their home in suburban Atlanta. Then at the end of winter, all that remain are frozen leaves and dead twigs. “Citrus won’t grow here,” becomes the official pronouncement. The fact is that there are several factors that need to be considered before deciding that a particular species or cultivar is suitable. First, the cultivar needs to be generally hardy for your area. There’s not much sense in trying key limes in Atlanta, unless you want to grow citrus in a container. Second, the source of the plant needs to be reliable; you want to know that what’s planted in the ground is what you think you are growing. Third, the tree needs to be generally healthy and well fertilized before winter sets in. Fourth, decide if possible whether or not to grow a tree on its own roots or to get a tree that has been grafted on a rootstock. Some varieties cannot survive on their own roots and must be grafted. Lastly, be prepared to take basic steps to protect any marginally hardy trees in winter.

No matter where you live, choose varieties that ripen fruit as early as possible. The better cultivars for our area will ripen fruit before December 1. All parts of the Southeast are susceptible to extreme freeze events, and it’s no fun trying to harvest five bushels of fruit as the temperature plungers. (After all, you will need that time for protecting any experimental palms!) For example, even though Valencia orange trees grow well in coastal Georgia, they are not recommended because Valencia oranges do not ripen until mid-March, and a hard freeze any time before then will destroy the entire crop. Better to pick earlier sweet oranges and buy Valencias at the grocery store.
Sun, Soil, Water

Citrus are subtropical or warm-temperate plants adapted to growing in sandy alluvial soils along floodplains. Soils can be infertile sands, but citrus grow best in medium fertile, well-drained sands or clays of neutral to slightly-acid pH. A few species, particularly kumquats, prefer highly fertile volcanic soils. Most citrus species in the wild function as understory plants, and William Bartram in the 1770s reported that feral groves of citrus in colonial Florida grew well underneath the native magnolias, live oaks, and Sabal palmetto. Rainfall in the areas of Asia to which citrus is native is plentiful and evenly distributed.

To a degree, many parts of the Southeast greatly resemble the native habitat of citrus. Soils along floodplains in the Southeast tend to be sandy, though fertility can be low. Rainfall patterns are similar to Southeast Asia, but distribution in the Southeast can be very sporadic, and each growing season will have dry spells. In some years the terms “growing season” and “drought” can seem downright synonymous. Moreover, inland parts of the Southeast tend to have rainy winters and drier summers, which can stress subtropical plants during both seasons. Periodic droughts are the norm.

Like many plants, citrus prefer well-drained, loamy soil, tolerating light sands with ample fertilizer. Citrus can succeed in heavier clays as long as they are well drained, thought most citrus will do better if irrigated to maintain an ample fertilizer. Along certain parts of the Atlantic coast, winter is the drier season and special attention will need to be given even moisture. Fruit set and retention will be much higher with what drought tolerant depending upon variety, all will do much better if given even moisture. Fruit set and retention will be much higher with what drought tolerant depending upon variety, all will do much better if given even moisture. Fruit set and retention will be much higher with what drought tolerant depending upon variety, all will do much better if given even moisture.

Citrus need to be well watered at all times. While they can be some what drought tolerant depending upon variety, all will do much better if given even moisture. Fruit set and retention will be much higher with what drought tolerant depending upon variety, all will do much better if given even moisture. Fruit set and retention will be much higher with what drought tolerant depending upon variety, all will do much better if given even moisture.

Drought Stress

One of the interesting habits of citrus is that they will often bloom heavily after a period of drought stress. This inclination was used by France’s Louis XIV, who was particularly fond of the fragrance of orange blossoms. His gardeners induced orange trees into continuous bloom by drought-stressing them almost to the point of death and then watering them, which caused the trees to burst into bloom. In the same manner, large juvenile citrus trees can sometimes be tricked into blooming for the first time. It has been observed that maturing seedling citrus often will bloom for the first time after a rainy period immediately following a summer dry spell.

I returned to my camp, where I had left my fish broiling, and my little bed of rice stewing; and having with me oil, pepper, and salt, and excellent oranges hanging in abundance over my head, I sat down and regaled myself cheerfully.

—William Bartram, in Travels (1775), describing the area around Lake George, Florida

Fertilization and Pest Control

It goes without saying that healthy trees are easier to maintain than sickly, disease-ridden ones. A balanced fertilizer that contains micronutrients will go a long way toward this end. Citrus are a little tricky to fertilize. They appear to be more sensitive to deficiencies, and if nutrients are low when they enter a flush of new growth, the new growth will immediately show the deficiencies. Correcting them is a challenge after that, so it’s best to apply a consistent level of fertilizer during the growing season to promote strong, healthy growth. Slow-release fertilizers with a ratio of 8-8-8 are excellent, particularly if the fertilizer contains micronutrients such as iron, magnesium, and manganese. There are commercial “Citrus Special” fertilizers available, and these work very well on sandy soils. Before applying any fertilizer, it will be in your best in-

The Sour Orange and its Hybrids

Citrus aurantifolia (for the most part) greatly resemble sweet oranges, but are larger in most respects. Sour orange trees tend to be very large and somewhat spreading, with larger leaves than sweet oranges. Leaves on standard sour oranges have a winged petiole much like grapefruit, though not as large. Sour orange fruit are highly colored and are arguably one of the most beautiful citrus fruit. Their deep orange color is much prettier and much sweeter oranges, which have a muted yellow-orange skin. It appears that most sour oranges are almost as hardy as the hardier mandarins, tolerating temperatures in the upper teens with no damage.

of the tree is shrubby with many small branches, prodigious quantities of fruit can be produced. The fruit are small and seedy, about 2 inches in diameter, resembling miniature Dancy tangerines. They are easy to peel and have a very good sweet-tart taste. The Kat is probably about as hardy as Satsuma—around the upper teens.

Flavor: Sweet tangerine, no off-flavors, good quality.
Uses: Dessert.
Note: Too small to be of much use commercially, but an interesting citrus.

Satsuma (Citrus reticulata) is really a class of mandarins, within which there are several cultivars. Among them are Kimbough, Owari, and Early St. Anne, which differ primarily in the time of ripening. As a class, Satsumas ripen very early, with most having best quality before the peel turns orange, and all nearly finished by Thanksgiving. Fruit do not hold well on the tree, becoming large and puffy. However, they do store well once picked. The fruit are easy to peel and have a rich tangy flavor when fresh, though not as much as some other mandarins. Satsuma does very well along the coast in the Southeast, and commercial groves have existed, and still do, in southern Mississippi, Alabama and Georgia. While Satsuma has a reputation for being the most cold-hardy commercial citrus, it isn’t hardy much below 18°F and anything below 15°F for prolonged periods will severely damage it.

Flavor: Sweet tangerine, no off-flavors, excellent quality.
Uses: Dessert.
Note: One of the best all around cold-hardy citrus for the Southeast.

Seville Sour Orange (Citrus aurantium) is the standard sour orange. It produces a fruit that superficially resembles a common sweet orange. The peel is a brighter orange color and is thicker than a sweet orange, only ten to fourteen percent as sweet, and not as thick. One reason why the sour orange is the very best fruit for marmalade, with Dundee marmalade being produced from sour oranges. Internally, the pulp of a sour orange is coarser than the pulp of a sweet orange, and is juicy and sour. Sour orange flowers are perhaps the most fragrant of all citrus. Standard sour oranges are hardy to around 18°F and will grow well on the Southern coasts and inland to Augusta, Georgia.

Flavor: Sour orange, no off flavors, excellent quality.
Uses: Cooking, juice, preserves.
Note: Sour oranges are excellent used in cooking Cuban-style pork as well as in fajitas and other Latin dishes.

Chinotto Sour Orange (Citrus aurantium var. myrtifolia) is also called the myrtle leaf orange for its tiny leaves that are densely packed on the twigs. Chinotto produces small fruit about the size of a grocery store tangerine. The fruit are moderately sweet and Chinotto is worth growing for the unusual foliage, fragrant flowers and thornless stems. Tests in Augusta indicate that this cultivar is about as hardy as Satsuma—so

Hardy Citrus for the Southeast

Hardy Citrus for the Southeast
This cultivar demonstrates the value of trying seedlings of more common orange color, tender, and very sweet. It also ripens in the Southeast by oblate and with small radial furrows at the stem end. The pulp is a rich typical for Dancy; a rich orange tangerine about three inches in diameter, branches and twigs and few thorns, especially on bearing wood. Fruit is and continues to bear about five bushels of fruit annually. The tree and was planted outdoors. The resulting tree amazingly survived 0°F in 1985 South Carolina. The original plant came from a seed planted in a pot a supermarket tangerine planted by Juanita Barrineau of Barrineau, clones are worth seeking out. Juanita Tangerine (Citrus reticulata) arose from a chance seedling from a supermarket tangerine planted by Juanita Barrineau of Barrineau, South Carolina. The original plant came from a seed planted in a pot with a houseplant. The houseplant died, but the seedling flourished and was planted outdoors. The resulting tree amazingly survived 0°F in 1985 and continues to bear about five bushels of fruit annually. The tree and fruit resemble Dancy tangerines. The tree is upright with numerous branches and twigs and few thorns, especially on bearing wood. Fruit is typical for Dancy; a rich orange tangerine about three inches in diameter, oblate and with small radial furrows at the stem end. The pulp is a rich orange color, tender, and very sweet. It also ripens in the Southeast by Thanksgiving, well ahead of Dancy, and is more desirable for that reason. This cultivar demonstrates the value of trying seedlings of more common fruit. Flavor: Sweet tangerine, no off-flavors, excellent quality. Uses: Dessert.

Keraji Mandarin (Citrus reticulata) produces a 2-inch fruit too small to be commercially viable, but nevertheless is an excellent tree for the garden. Growth is upright and narrow, with almost no thorns, even in seedlings. The fruit are small, yellow, flattened tangerines that have a sweet lemonade taste unlike any other citrus fruit. The peel is puffy and very easy to remove. Keraji may be almost as hardy as Changsha. A tree in Augusta, Georgia has performed very well since 1997, tolerating short drops to the upper teens with no leaf drop or twig damage. Flavor: Sweet lemon-tangerine, no off-flavors, very good quality. Uses: Dessert.

Long Huang Kat Mandarin (Citrus reticulata) is a Chinese cultivar and small tree similar to Changsha. Thorns are minimal, even on small plants. The growth habit is upright, like most other mandarins, with narrow leaves. Fruit is held singly at the end of branches, but because the habit terest to have a soil analysis done to determine where your soil is deficient. (And if you live in the Southeast, your soil will be deficient in something.) Again, slow and steady is the key to fertilizing citrus. In the Southeast north of Florida, it is best to begin fertilizing just before growth initiates in spring. This will range from late February in the extreme Lower South and as late as the beginning of April farther north. In all areas it is best to fertilize no later than July 1. The intent is to promote healthy, vigorous growth early on and then allow the tree to slow down as much as possible before fall. Very often, late summer can bring strong thunderstorms and tropical systems after a dry spell, and the sudden availability of water can trigger late flushes of growth in citrus, particularly if there is abundant fertilizer available as well. This late growth is particularly prone to freeze damage. When compared to other fruit trees such as peaches and apples, citrus are practically carefree. They will tolerate a surprising amount of neglect and still fruit reliably, and the amount of maintenance required is low compared to other fruit trees. However, keeping citrus in optimal health will require some vigilance, because citrus are prone to a host of pests. Scale insects, spider mites, aphids, Asian leaf miners and whitetees all attack citrus. Fortunately, most are easy to control. The most reliable tools, besides using good cultural practices, are horticultural and dormant oils and insecticidal soaps. The important thing to remember is never to use a systemic pesticide on any plant that you intend to eat. Scales are white, brown or orange stationary insects that suck plant juices. They are most common on the undersides of leaves. Scale can be controlled with horticultural oil and a non-systemic insecticide. Oil sprays are most effective when the scale is in the crawling stage in spring and early summer. Once the insects become adults, they become immobile and form a hard shell, making them hard to kill without resorting to extreme measures. Usually two applications are necessary to bring them under control. Spider mites are tiny red or orange arachnids that also feed on plant juices. Once a citrus plant has an infestation, the population of spider mites can quickly explode. The effect of spider mites usually is evidenced by yellow or orange speckles on the leaves and a severe infestation can discolor the entire leaf and severely stress the plant. The best prevention of spider mites is
adequate water, as the pests usually attack heat- and drought-stressed plants. You can try “spraying” water at low volume and high pressure to knock spider mites off the tree; this preserves the species that prey on spidermites. They can be controlled with horticultural oil and insecticidal soaps. Dormant oil must be used in fall and winter to kill the eggs. If you use a type of pesticide, make sure the label reads “miticide.” Because they are arachnids, spider mites are not affected by any insecticides.

Aphids are another type of sucking insect. They are attracted to young, tender shoots and can severely deform emerging growth in the spring. They are usually associated with ants (as are scale insects), which “farm” aphids and feed on the sticky secretions called honeydew. Controlling ants would go a long way toward controlling aphids, but because controlling ants in the Southeast is about as easy as herding cats, your best bet is going to be controlling aphids. The most effective method is also the most environmentally friendly: insects such as ladybugs find aphids particularly toothsome and are the best method of control. Asian leaf miner is a recent introduction to the United States, but it has spread quickly. This pest is a small caterpillar about 3 millimeters long that feeds on the undersides of young citrus leaves. The biting parts leave a squiggly, shiny trail as the caterpillar moves along the leaf. (The trail is snake-like, apparently to avoid the spider mites which are also sucking on the leaves.) This activity can severely deform new leaves, but otherwise does not seem to affect fruiting, and once leaves are mature they are immune to attack.

Pruning Citrus

Hard freezes can damage citrus trees. How much damage any particular freeze causes does not only depend on the severity and duration of low temperatures, but also on actions taken afterward. While it may be tempting to lop off frozen and apparently dead wood immediately after a freeze, the best time to prune cold-damaged citrus plants is after the first flush of growth in spring. Though dead or damaged wood is unsightly, pruning too early causes even more damage and may retard new growth. Researchers in Florida have found that trees pruned after the first flush of growth recover more quickly and grow more vigorously than those pruned immediately after a freeze.

Many types of citrus send out rapidly growing winter sprouts in mid-summer after heavy rains. Winter sprouts are particularly common on seed grown trees. While winter sprouts are the bane of most fruit growers, they often will mature normally on citrus and seem to present no problems. Unless these limbs cross other limbs and prevent otherwise normal growth, it’s probably best to leave them. Juvenile citrus must grow to a certain point before they begin blooming, and excessive pruning of young limbs can keep them in a

Best Citrus for Marmalade

The very best citrus for marmalade is the Seville type of sour orange, used so extensively in Great Britain to make the famous Dundee products. A number of other citrus make very good marmalade, though. Some have a distinct advantage over sour oranges because they have a sweet albedo (kumquats and citrusquatss) or because they are easy to prepare (Rusk citrange). Below are some types that will make a very good, useful marmalade.

- Rusk Citrange
- Thomasville Citrangequat
- Nippon Orangquat
- Sunquat
- Marmaladequat

More Hardy Citrus

The Most Familiar Citrus

These citrus comprise many of the varieties with which people are most familiar: oranges, lemons, grapefruit, and others. As a rule, they are not nearly as hardy as the citrus trifoliate and citrus ichangmum hybrids, though several are hardy in the upper parts of Zone 8 if given a good microclimate and/or protection in winter.

Calamandarin (Citrus reticulata hybrid) is a cultivar that may be a hybrid with the Calamandin (itself purportedly a kumquat-mandarin hybrid) and another, unknown type of mandarin. The tree is large, vigorous and bushy, with the fruit held at the ends of the tips of twigs like all other mandarins. Consequently the tree produces an abundance of small, brightly colored fruit. Fruit quality is only average, though. This variety is hardy at least to Aiken, South Carolina, so to 10° F to 15° F.

- Flavor: Semi sweet tangerine, some off-flavors, fair to good quality; varies with individual plants.
- Uses: Dessert, preserves.

Changsha Mandarin (Citrus reticulata) is a very old Chinese cultivar. Such plant characteristics as a pointed leaf tip, extreme cold hardiness and a skunky odor to the fruit peel point to the possibility that Changsha is a hybrid with Citrus ichangensis. There is quite a bit of variability within the Changsha group, both in growth habit and fruit quality. Most specimens of Changsha have a very upright growth habit like other mandarins, but there are forms of Changsha that are spreading like Satsuma. Leaves are medium sized and similar to other mandarins with a prominent drip tip. Fruit, which ripen in late September, are medium tangerine size and very easy to peel. Inside, the flesh is bright orange and seedy, with four to six seeds per section. Some cultivars of Changsha are very good, almost as good as Satsuma, whereas others are

suma, with large pointed kumquat-like leaves. It makes a very handsome ornamental plant and is hardy to at least 10° F.

- Flavor: Sour tangerine, no off-flavors, good quality.
- Uses: Juice, preserves.

Note: Becomes sweeter as season progresses but fruit must be overwintered to become sufficiently sweet to enjoy out of hand.

Sunquat and Marmaladequat are among the more promising hybrids of the last decade, the chance seedlings between a Meiwa kumquat and either a Meyer lemon or a Clementine mandarin. (The seedlings were discovered underneath a Clementine tree.) The Marmaladequat is named for the case in which marmalade is made from the fruit, having a peel so soft that it doesn’t need to be precooked. Both are thorny, upright trees that produce yellow fruit with a sweet juice and are completely edible, peel and all. Marmaladequat is reportedly more vigorous and comes back quickly from the roots if a freeze kills it to the ground. Both are probably hardy to 15° F.

- Flavor: Sweet kumquat, no off-flavors, good quality.
- Uses: Dessert, preserves.
Southeastern conditions, but the plant should be reliably hardy to 15°F.

**Flavor:** Sweet kumquat, excellent quality.

**Uses:** Dessert.

**Hong Kong Kumquat** (Fortunella hindsii) also called the golden bean kumquat is grown mostly as a novelty or as a parent for hybrids, the fruit are a mere one-half inch in diameter and are essentially inedible, with very little juice and large seeds. It does make a handsome ornamental or container plant. This species apparently grows wild on the sides of volcanic mountains in China. In the United States it must be grafted.

**Flavor:** Bitter kumquat, persistent off-flavor, poor quality.

**Uses:** Ornamental only.

**Eustis Limequat** (Fortunella japonica × Citrus aurantifolia) was one of several limequats developed by Walter T. Swingle of the United States Department of Agriculture in the early 1920s in an effort to develop a more cold-hardy lime. In this, he succeeded admirably. Eustis makes a small, kumquat-sized yellow fruit that is very juicy with an excellent, powerful lime taste. The fruit looks like a key lime but is much more cold hardy, thriving in Southeastern coastal areas. It also makes an excellent container tree. Because it has the tendency to re-bloom during warm periods, over-wintered fruit can be especially appreciated the next summer.

**Flavor:** Sour lime, no off-flavors, excellent quality.

**Uses:** Juice.

**Procimequat** (Fortunella hindsii × Eustis limequat) produces tiny yellow to orange fruit on a dwarf tree. Procimequats are excellent ornamentals as they are precocious—seedlings as young as a year old have been known to bloom and fruit in a 4-inch container. The fruit are generally sour but have an interesting hint of lime. They are also very hardy for a citrus with no trifoliate parentage. Mature plants have taken upper single digits with minimal damage. The procimequat is hardy to 20°F and probably to 15°F or lower if hardened off.

**Flavor:** Sour lime-kumquat, a few off-flavors, fair quality.

**Uses:** Flavoring bottles of Mexican beer. The tiny fruit fit easily through the neck of the bottle.

**Nippon Orangequat** (Fortunella crassifolia × Citrus reticulata) is a cross between the Meiwa kumquat and the Satsuma mandarin orange. The resulting tree is very cold hardy and specimens in protected sites have easily withstood upper single digits with no protection. Characteristics are intermediate between the two parents; the egg-shaped fruits are bright orange inside and out with an edible peel. They’re sour and juicy, making an excellent marmalade and drink. Nippon orangequat bears reliably and abundantly under Southeastern conditions and rarely fails to make a crop. The plant is fairly low and spreading, reminiscent of Sat-

More **Kumquats**
- Centennial Kumquat (variety in both leaves and fruit)
- Marami or Round Kumquat (Fortunella japonica)
- Malayam Kumquat (Fortunella japonica)
- Lakeland Limequat
- Tavares Limequat
- Lemonquat (Citrus limon × Fortunella japonica)
- Razzlequat (Kumquat × Eremocitrus glauca)

More **Kumquat Hybrids**
- Tavares Limequat
- Lemonquat (Citrus limon × Fortunella japonica)
- Razzlequat (Kumquat × Eremocitrus glauca)

The **Sex Life of Citrus**

**Citrus Hybridization**

Early hybridizers in the citrus industry included Dr. Walter T. Swingle, responsible for developing the original trifoliate hybrids and for classifying and clarifying so many other citrus types and species. A huge debt in the field of hybridization is also owed to Dr. John Brown of Texas. Dr. Brown is a doctor by profession but a citrus breeder by avocation, and it was through his efforts that many of the interesting hybrids presented here were developed. Among his contributions are the Clem-Yuz 3:3, ten degree kumquat, CiClem #10, SanCitChang, Yuzuquat, and a host of others.

**Uses:**
- **Flavor:** Sour, no off-flavors, fair quality.
- **Color:** Bright orange inside and out with an edible peel.
- **Texture:** Very juicy with an excellent, powerful lime taste.

**Citrus** are very easy to grow from seed, and in some cases this may be the only way to obtain a variety you are looking for. It’s possible simply to take the seeds from a grocery store citrus, push them into the soil of a houseplant, and watch them come up. As a class, citrus have low heat requirements for germination, though bottom heat will hasten this process and help the seeds germinate more evenly.

But how do you know that the seedling that sprouts up is true to type with the original? In a word, you don’t. All citrus can, at least theoretically, produce hybrids, and even flowers that are self-pollinated can vary somewhat from the original. But there are some unique features about the sex life of citrus that make this less of a guessing game than you might imagine.

Most flowering plants reproduce sexually. That is, a flower is pollinated and the resulting seed will produce a plant that is a combination of the two parents. A seed from most plants will contain a single embryo that will develop into a plant, and as a result, most plants are called monoeembryonic.

Citrus are different. Many types will fertilize regularly, but instead of a seed with just one embryo, citrus seeds often have two or more produced by normal sexual reproduction and a second that is produced wholly from genetic material of the mother plant. This is known as a juvenile type with the original. In a word, you don’t. All citrus can, at least theoretically, produce hybrids, and even flowers that are self-pollinated can vary somewhat from the original. But there are some unique features about the sex life of citrus that make this less of a guessing game than you might imagine.

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Most common citrus such as oranges, grapefruit, lemons and most mandarins are polyembryonic and will come true to type. Because most citrus have this trait, hybridization can be very difficult to achieve. In the late 19th Century, when the first attempts at controlled hybridization were attempted by the United States Department of Agriculture in Florida, Walter T. Swingle reported that more than 1,100 sweet orange seeds pollinated with trifoliate orange pollen were required to produce the first citranges, and seven of these came from a single fruit. The good news is that polyembryony helps stabilize varieties, which allows seeds to be passed around with little chance of spreading diseases such as viruses. This unique characteristic allows amateurs to grow citrus from seed, something you can’t do with, say, apples.

If you decide to grow citrus from seed, it’s worth knowing that seed-
ling citrus can be very thorny, especially as juveniles. Many types lose this thorny tendency as they grow and mature, and flowering branches will have fewer thorns. Also, all seedling citrus will take some time before blooming. How much time is required depends upon the type; grapefruit can take up to 10 years before blooming, whereas procimequats (a cross between a Eustis limequat and the wild Hong Kong kumquat) can bloom in less than a year from seed. As a general rule, citrus require four to seven years before blooming.

**Grafted Trees Versus Own Roots**

Many citrus varieties are remarkably compatible with each other, and there is a wealth of rootstocks to choose from for grafting. Sweet orange can be grafted onto sour orange, kumquats onto trifoliate orange, and so on. However, all of them have their problems. Some are too dwarving, others are disease prone, and still others have delayed failure of the graft. There is an old saying among Florida citrus growers that you choose a rootstock based upon how you want your tree to die.

Having said this, an important decision to make is what rootstock to choose, or whether you should grow the citrus on its own roots. Our advice is to grow citrus on their own roots where feasible simply because if the tree is knocked back to the roots by bitter cold but survives, it will return true to type the next year. Most trifoliate hybrids are used as rootstocks and tolerate diverse soils very well, so they are a logical choice to grow on their own roots.

Other species and cultivars cannot grow on our soils on their own roots and must have a rootstock. Kumquats in particular do not grow well on their own roots in most Southeastern soils. And some cultivars, most notably hybrids that involve Citrus ichangensis as a parent, seem to flower and fruit more reliably on a rootstock. In these cases, we unequivocally recommend the trifoliate orange (*Poncirus trifoliata*). Trifoliate rootstock is extremely cold hardy and dwarfs the tree while ensuring exceptional fruit quality.

**About Cold Hardiness**

A question which everyone has but is the hardest to answer is: “How hardy is my plant?” With citrus, this can be even more difficult to answer than for other plants. Although citrus, like all plants, have definite limits to how much cold they can take, where that line is drawn depends upon not only the lowest temperature reached but also the duration of the freeze, the size and health of the plant, how well watered the plant is preceding the freeze, microclimates, and what mechanical protection is used in the landscape.

The harder types of citrus (*Poncirus trifoliata* hybrids and *Citrus ichangensis* hybrids) are surprisingly hardy during short freezes during which the temperature does not fall below 15°F. Hardy citrus will be essentially unaffected by these types of freezes, which are the most frequent types of freezes throughout the Southeast. The real killers are those freezes that bring temperatures that have a distinctive wavy shape. Fruit are essentially seedless kumquats of the trifoliate orange rootstock. Hardiness is unknown under these conditions.

One of the easiest methods of cold protection for citrus is to choose a variety that is well adapted for your area. It’s always easier to care for a plant that is thriving to begin with. The good news about citrus and the Southeast is that for most areas, there will be at least one type of citrus that you can grow. Edibility, however, may be a challenge, but our advice for most of the Southeast inland from the immediate coast is to grow citrus for their ornamental and culinary qualities and to buy dessert-quality fruit at the grocery store or local farmer’s market.

A statement such as “hardy to 10° degrees” is helpful, but only tells part of the story. It’s a fact that no two freezes are ever exactly alike. Not only do slight variations in temperature make a difference, but also conditions before and during a freeze can dramatically affect the damage to citrus. A daytime high of 45°F followed by a quick dip to 10°F, with a freeze duration of less than 24 hours, will damage citrus far less than a daytime high of 70°F followed by a lengthy freeze of 48 or 72 hours. So weather conditions before a freeze can determine success or failure.

**Hardy Citrus for the Southeast**

**Hardy Kumquats and Their Hybrids**

**Kumquats and Dormancy**

While not as hardy as the trifoliate orange (*Poncirus trifoliata*) or the Ichang papeda (*Citrus ichangensis*), kumquats (*Fortunella spp.*) go completely dormant in the winter and are slow to resume growth in the spring, waiting until temperatures consistently reach 65°F. This gives them an enormous advantage during the roller-coaster winters of the Southeast. If they are frozen back, they can also bloom on old wood, a helpful trait after severe freezes. Kumquats differ from most other citrus in that the peel is sweet, whereas the juice is often sour or bitter. Because of their sour juice, the best kumquats are those with the least juice.

Most kumquats are difficult to grow on their own roots but are excellent shrubs or small trees on trifoliate orange rootstock.

All kumquats make shrubs or small trees that rarely exceed 15 feet in height, and they can be kept smaller by budding onto Flying Dragon trifoliate rootstock, and by judicious pruning. Kumquats are generally hardy to about 15°F.

**Meiwa Kumquat**

*M. meiwa* (*Fortunella margarita*) is probably a hybrid between Nagami and Marumi kumquats. Fruit are nearly globose, about 1.5 inches in diameter, with a tender peel and very little juice. It is one of the better kumquats for eating out of hand. There are seedling selections available that do well on their own roots, and these seedling trees will sometimes grow to about 15 feet tall, almost twice the size of a Meiwa on trifoliate orange rootstock.

**Uses:** Desert.**

**Nagami Kumquat**

*M. nagami* (*Fortunella margarita*) appears to be a true species as it readily sets hybrids when used as a female. This is the kumquat most often found in grocery stores, having a very attractive oval fruit about an inch wide and two inches long. Each fruit usually has about four seeds. Even though it is the most commonly grown commercial kumquat, Nagami is quite sour and there are other selections that are better. However, it pickles exceptionally well and makes an excellent marmalade.

**Uses:** Desert, preserves.

**Ten-Degree Kumquat**

(M. crassifolia) is an open-pollinated form from Dr. John Brown of Texas. It makes an exceptionally handsome ornamental tree, with deep green leaves. The leaves are typical kumquat shape, small and pointed, but the ten-degree kumquat has leaves that have a distinctive wavy shape. Fruit are essentially seedless and small and kumquat size, about 1 inch long and oblong, with a spicy taste with little juice. The tree is so named because the original survived 7°F and more than 60 hours below freezing in Texas. When grafted on trifoliate orange rootstock it eventually grows to about 12 feet tall, making a large globose shrub or small tree.

**Uses:** Semi-sweet kumquat, no off-flavors, good quality.

**Chang Shou Kumquat**

*Fortunella obovata* is a rather obscure and found only in nurseries that specialize in citrus. However, it is worth seeking out because it has a tender, almost melting peel, in contrast with most other kumquats which have tough peels. Chang Shou has very tasty, semi-sweet flesh with little juice. Fruit are a medium-orange color about the shape and size of a ping pong ball. Fruit have from 1 to 3 seeds per fruit, and the seeds are generally monoembryonic. Unlike most kumquats, which have long, pointed leaves, Chang Shou has medium-sized, rounded leaves. The tree otherwise is typical for kumquats, with a shrubby habit and small stature, which is accentuated when the plant is grafted onto trifoliate orange rootstock. Hardiness is unknown under...
ing a mandarin (Citrus reticulata) of one type or another. They are included here because they illustrate the fact that hybrids with Citrus iugans can be quite tasty without sacrificing cold-hardiness. Both of the hybrids described here are better than any trifoliate orange hybrid. ClemYuz 3-3 produces small, bright-orange tangerines of market quality. Best of all, it’s marketed in Texas as the ten-degree tangerine because it is hardy, wind, and that the enclosure should be vented on warm days. Even on a relatively protected tree, wind can make it very cold. For example, the terrible freeze of 1989 dropped temperatures to about 17°F in the Orlando, Florida area and wreaked havoc on citrus, killing some trees outright and knocking others to the ground. The same temperature in Aiken, South Carolina will scarcely cause citrus to drop a leaf. Why? In part, it is because different cultivars are grown, but even the same types of citrus will be damaged far less by cold in areas where the freeze is preceded by cooler air and soil temperatures. Excessively warm temperatures before a freeze can induce citrus to break dormancy and make them vulnerable to temperatures that would leave them otherwise unaffected. Of course, all plants have a threshold temperature, below which they will die. Citrus are no exception. But before that limit is reached, it is best to keep things cool and quiet during the winter. Aside from extreme cold, wind is perhaps the greatest enemy of citrus in winter. Cold accompanied by high winds will rapidly desiccate citrus leaves and will result in leaf drop after the weather warms. While this is not a total disaster for the hardest hybrids, which possess the ability to bloom after defoliation, part of the charm of citrus is the fact that they are evergreen. A bare citrus tree is no more attractive than a maple or oak in winter. It’s best to keep citrus well watered in the winter months. This is not usually a problem in areas away from the immediate coast, where winter cold fronts are typically preceded by plenty of rain during the winter. Along the Southeastern coasts, however, cold fronts typically weaken and winter is often the dry season. This situation becomes more pronounced the farther south you go. If you want a citrus cultivar that is marginal for your area, you will need to consider planting it in a favorable microclimate and count on protecting it during extreme cold spells. The easiest type of protection is heavy mulch around the base and perhaps a mound of earth to protect the main trunk, or in the case of grafted trees, the bud union. If you decide to do this, be sure to remove the soil after the weather warms. Frost cloth draped over the whole of a tree and touching the ground can add up to 6°F to the inside. A very effective low-tech approach is to place 50-gallon plastic barrels full of water around the tree and then cover the whole thing with frost cloth. Some people have decided that it’s worth the trouble to build a PVC frame around the citrus and cover the whole tree with plastic, heating the temporary greenhouse with light bulbs or portable heaters. Most people who do this are interested in overwintering the fruit rather than merely protecting the tree. Two important considerations here are to remember that the plastic should not come into contact with the leaves, and that the enclosure should be vented on warm days. Even on a relatively cool day when temperatures outside are in the 50s, the inside of a greenhouse can soar into the 80s or even higher. Exposure to high temperatures such as these can stress the tree or at the very least induce it to break dormancy, making it even less hardy than otherwise.
### How Hardy Are They?

Citrus hardiness is harder to predict than palm hardiness. Factors affecting hardiness are minimum temperature, freeze duration, conditions before the freeze, soil moisture and wind protection. Citrus are usually harder if they’re healthy, well watered and fully dormant when cold arrives. Temperatures listed here and with the descriptions of each variety are approximate, and indicate where fully dormant plants begin to experience significant damage.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Hardiness Range</th>
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<tbody>
<tr>
<td>Ten-degree Kumquat</td>
<td>Page Hardy to about -15°F (-9°C)</td>
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<tr>
<td>Nippon Orangequat</td>
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<td>Smooth Flat Seville Sour Orange</td>
<td>Page Hardy to about 15°F (-9°C)</td>
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</tbody>
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### The Very Hardy: The Ichang Papeda and Its Hybrids

**Ichang Papeda Hybrids**

Unlike hybrids between the trifoli-ate orange and other citrus, Ichang papeda (Citrus ichangensis) hybrids tend to have a better balance of the two parents. When hybridized with more desirable citrus, fruit quality vastly improves. For example, the Yuzu, which is an Ichang papeda and mandarin (Citrus reticulata) cross, has a sour but not bitter fruit that makes a very acceptable lemon substitute. Second generation hy-brids have even better fruit, with some of the Yuzu hybrids producing fruit of tangerine quality with little loss of cold-hardiness. So there is hope yet for a hardy, tasty citrus hybrid.

A characteristic of nearly all hybrids involving Citrus ichangen-sis is the prevalence of large, pointed seeds. Nearly all of the hybrids have them, though not always in the quantity of the parent. A few other cold-hardy citrus (notably Keraji and Changsha mandarins) also have these large seeds, which indicates that they too may be a hybrid of some kind involving Citrus ichangensis. Hybrids using Citrus ichangensis tend to be very hardy even into the second and third generation. Like the trifoli-ate orange and its hybrids, Citrus ichangensis hybrids can still flower and fruit after being defoliated. One peculiarity of Citrus ichangensis and its hybrids is that they all seem to flower and fruit more freely if grated onto the trifoli-ate orange rather than grown on their own roots.

**Ichang Papeda** (Citrus ichangensis) is the most cold-hardy evergreen cit-rus, withstanding temperatures down to 0°F. In shape and character this species is much like the trifoli-ate orange, and like the trifoli-ate orange it produces a fruit that is essentially inedible. Citrus ichangensis has long, straight thorns. Its leaves are uniquely shaped, with a flared petiole base that is so wide that the leaf often appears to be a double leaf. The leaves have pointed “drop tips” that are typical of plants from high-rainfall ar-eas. This wild species is grown only as a curiosity because its fruit is bumpy, dry, and filled with huge, thick seeds. The Ichang papeda is adapted to steep hillsides and prefers well-drained soil to thrive. Like the trifoli-ate orange, Citrus ichangensis makes a handsome ornamental tree.

**Flavor:** Bitter lemon, some off-flavors, poor quality.

**Uses:** Hybridization, ornamental.

**Ichang Lemon** is an Ichang papeda crossed with a pummelo (Citrus ichangensis × Citrus maxima). It originated in China, where it was called Shanggwan, which means “fragrant ball.” This vigorous, spreading tree is very ornamental, resembling a grapefruit with large, wide leaves with a flared petiole. It produces clusters of large, bumpy, seedy, yellow grapefruit-like fruits, which can be used like lemons. The fruit are extremely juicy with each one producing as much as a half-cup of juice. When overripe, it tastes like a grapefruit and is quite edible with sugar. The Ichang lemon also is very hardy, enduring temperatures down to 10°F and below with no permanent damage as long as it is protected from wind.

**Flavor:** Sour grapefruit, some off-flavors, fair quality.

**Uses:** Dessert, cooking, juice.

**Yuzu** is an ancient, natural hybrid (Citrus ichangensis × Citrus reticulata) that originated in Japan, where it was often used as a rootstock for Satsuma. Yuzu produces a narrow, upright, thorny tree, similar to a trifoli-ate orange. The fruit is yellow and the size of a medium-sized tangerine with a lemon-like taste and an easily-peeked but rough skin. It’s used in Japan like a lemon and the peel is used in spicy dishes. It’s very resistant to cold, and like many Citrus ichangensis hybrids, can go deciduous during cold spells with no loss to fruiting wood. When fully dormant it can toler-ate temperatures as low as 10°F and perhaps lower.

**Flavor:** Sour lemon, some off-flavors, good to excellent quality.

**Uses:** Cooking, juice.

**Note:** Yuzu peel is edible, and the albedo is distinctly sweet, much like a kumquat.

**Clementine-Yuzu hybrids** were developed by Dr. John Brown, and are only one quartet Citrus ichangensis, with the other three quarters be-
There have been numerous crosses with the first generation of trifoliate hybrids with other common citrus in an attempt to make the fruit more palatable without sacrificing cold hardiness. Unfortunately, the opposite seems to occur: cold hardiness leaves long before flavor returns. However, the forms listed below do represent important breakthroughs and suggest that with further work, it could be possible to have a sweet Zone 7 citrus...maybe.

Uses: Juice, preserves.

Glen Citrange is an interesting cross between a citrange and an orange. It is closely related to PONCIRUS trifoliata, Citrus reticulata, and Fortunella sp. Glen Citrange is interesting as well because it carries a mixture of unifoliolate, bifoliolate, and trifoliolate leaves. The fruit is orange and about the size of a Calamondin, and reportedly just as sour, though most of the trifoliolate taste is gone. This cultivar should be hardy to about 10°F.

Uses: Preserves, juices.

SanCitChang #10 Roundleaf is a very attractive plant with an unusual leaf shape unlike any other citrus listed here. Instead of the usual elliptical leaf with a pointed tip, this hybrid between the Sanford Citrange and Changsha mandarin has a leaf that is nearly round. It produces a bumpy orange fruit that looks like a tangerine and is reputed to be sweet. It has proven hardy as far north as Dallas, Texas but there are no fruiting specimens yet in the Southeast. There are several other SanCitChang cultivars, but the #10 appears to be the best tasting. All should be hardy in Zone 8.

Uses: Dessert.

Note: The other SanCitChang cultivars differ widely in taste. One form with a large yellow fruit has an aftertaste that is strongly reminiscent of ketchup.

U.S. 119 is a citrangeo crossed with a sweet orange cross ([Poncirus trifoliata x Citrus paradisi] x Citrus sinensis) with large grapefruit-like leaves and orange fruit. The tree has a mixture of unifoliolate, bifoliolate, and trifoliolate leaves, with trifoliolate dominating. The fruit is very attractive, with a deep orange color and smooth peel. Inside, the fruit is very attractive with a rich orange color and few to no seeds. The taste is sweet with just a touch of trifoliolate aftertaste. While U.S. 119 has been touted as hardy to 10°F, it remains to be seen if this is true. Young plants have been injured by temperatures in the lows 20s.

Uses: Dessert.

More Citrangequats

• 19-15-7
• Tellfair

Complex Hybrids of the Trifoliate Orange

There have been numerous crosses with the first generation of trifoliate hybrids with other common citrus in an attempt to make the fruit more palatable without sacrificing cold hardiness. Unfortunately, the opposite seems to occur: cold hardiness leaves long before flavor returns. However, the forms listed below do represent important breakthroughs and suggest that with further work, it could be possible to have a sweet Zone 7 citrus...maybe.

Uses: Preserves, juices.

Page 28 Long Huang Kat Mandarin

Page 29 Satsuma

Page 30–31 Sweet Oranges

Page 32–33 Duncan, Marsh and Ruby Red Grapefruits

Page 33 Ujikitsu Lemon

Page 26 Eustis Limequat

Page 27 Fortunella japonica x Citrus aurantifolia

Page 28 Long Huang Kat Mandarin

Page 29 Satsuma Citrus reticulata

Page 30–31 Sweet Oranges Citrus sinensis

Page 32–33 Duncan, Marsh and Ruby Red Grapefruits Citrus paradisi

It’s a Matter of Taste

At the end of each citrus cultivar’s description in the following section, a few comments are made about its relative merits. To give some consistency of comparison, the author has evaluated the flavor of each cultivar according to the chart below.

Each fruit was judged according to its most logical use, ranging from “dessert,” meaning edible out-of-hand, to “only good for throwing at people.” To give an example, if a fruit such as key lime were evaluated, it should not be judged as a sweet fruit but rather as a sour fruit. It would be classed as sour lime, no off-flavors, excellent quality, and useful for cooking and juice. Someone attempting to eat it as a dessert fruit, however, probably would be disappointed at best.

Taste is highly subjective. If you are someone who demands the very sweetest of fruit, then many of the cultivars listed in this publication will be unsatisfactory. The author enjoys many different flavors and doesn’t mind even a few off-notes, drinks coffee without sugar, eats muscadines—skin, seeds and all—and holds Goody’s powder under the tongue when a headache strikes.

The reader is encouraged to use the chart below to complete his or her own analysis.

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>TYPE</th>
<th>CHECK A DESCRIPTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. 119</td>
<td>sweet</td>
<td>□ sweet □ semi-sweet □ sour □ bitter</td>
</tr>
<tr>
<td>TASTES LIKE</td>
<td>orange</td>
<td>□ orange □ tangerine □ grapefruit □ kumquat □ lemon □ lime</td>
</tr>
<tr>
<td>OFF FLAVORS</td>
<td>none</td>
<td>□ none □ insignificant □ moderate □ strong □ persistent</td>
</tr>
<tr>
<td>QUALITY</td>
<td>excellent</td>
<td>□ excellent □ good □ fair □ poor</td>
</tr>
<tr>
<td>USES</td>
<td>dessert</td>
<td>□ dessert □ juices □ cooking □ preserves □ target practice</td>
</tr>
</tbody>
</table>

Uses: Desert.
Trifoliate Orange (Poncirus trifoliata) is the hardest true citrus, easily withstanding temperatures well below 0°F and thriving as far north as Cape Cod, Massachusetts and as far inland as St. Louis, Missouri. Unlike any other citrus, it has a marked winter dormancy and resumes growth in the spring only after days are greater in length than nights. It is native to river floodplains in China, and as a result can tolerate a variety of soil types and conditions as long as the soil is well drained. The trifoliate orange has widely naturalized in many areas of the Southeast, mainly in old pastures and along the banks of streams and rivers. Poncirus trifoliata is an upright tree with a strong central leader and branches that grow at narrow angles to the trunk. With spines as long as 4 inches, it’s one of the thorniest cultivated plants, and can be used as a formidable security hedge. Still, Poncirus trifoliata and its variants, ‘English Large’, named for its larger blossoms, and the contorted cultivar ‘Flying Dragon’, make handsome ornamentals.

The trifoliate orange differs from other citrus in several important ways. It is deciduous, has three leaflets (technically called trifoliolate), and produces bud scales that protect the next year’s growth and flowers. The fruit are yellow to orange and have a typical citrus hesperidium shape, meaning that they’re divided into sections. The fruit are edible, meaning that you won’t die from eating them, but they are exceedingly bitter and gummy. The addition of kumquat blood to produce a bewildering array of hybrids. In most of its hybrids, Poncirus trifoliata tends to dominate, with its progeny usually having trifoliate leaves that are more or less evergreen, and small, sour fruit that is dominated by the bitter taste of the trifoliate parent. There are a few exceptions, but the rule holds. The silver lining is that trifoliate hybrids are the hardiest of the lot.

There are hundreds of hybrids between the trifoliate orange and just about any other known citrus. The few listed here are representative rather than inclusive, and discussion does not include some of the rarer forms.

**Flavor:** Bitter lemon, persistent off-flavors, poor quality.

Uses: Hybridization, target practice, ornamental.

**Dragon Lime (Poncirus trifoliata hybrid)** is a cultivar that arose as a chance seedling in a planting of Flying Dragon trifoliate orange seeds. It is remarkable in a number of respects, the foremost being that trifoliate orange as a rule is highly polyembryonic and is usually used only for pollen. The pollen donor of the trifoliate orange is considered to be the dragon lime. This easily makes the golden lime. When diluted with an equal amount of water the juice makes a good limeade drink. The tree is spreading and large with few thorns on bearing wood.

**Flavor:** Sour lime, some off-flavors, fair to good quality.

Uses: Juice.

**Citsuma Citrangequat** is probably a hybrid with Satsuma. It makes a fairly large, spreading tree with large, very dark green trifoliate leaves that are almost totally evergreen. One tree owned by the author produces wildly divergent fruit; some are rounded but slightly flattened at the top and bottom and nearly as large as a typical grocery store tangerine. Others are smaller and more rounded, and still others are heavily fingered, almost as much as Buddha’s Hand citron. All are richly colored inside and out, with a deep orange peel and golden flesh. The juice is sweet, though unmistakably tinged with trifoliate orange, but it takes very little dilution to remove the unpleasant trifoliate aftertaste. The tree appears to be very hardy, tolerating brief dips to the upper single digits Fahrenheit with no loss to foliage or wood.

**Uses: Semi sweet orange-tangerine, some off-flavors, fair quality.**

Uses: Juice.

**Thomasville Citrangequat** is a very old cultivar developed by the USDA that crossed a Willits citrange with Nagami kumquat. It is the best citrangequat yet developed, with egg-shaped, egg-sized fruit that make a good lime substitute in summer and become edible out-of-hand by Christmas. By then the fruit taste like a slightly unripe orange. Because the fruit have a thin, sweet albedo (the white inner peel), they make excellent marmalade. The tree is very upright, usually with several leaders that shoot for the sky before branching. Juvenile plants have characteristic trifoliate foliage and wicked thorns, but leaves on bearing wood are usually unfoliate, with thorns much reduced. Thomasville citrangequat is among the most precocious of citrus; individual plants have been known to flower in four years from seed.

**Flavor:** Sweet orange-lime, no off-flavors, good quality.

Uses: Dessert, juice, preserves. Note: Thomasville citrangequat makes an excellent lime substitute from mid-July onward, but isn’t sufficiently sweet to eat out of hand until December.

**Sinton Citrangequat** is a cultivar arising from the same parentage as Thomasville, but Sinton is markedly different in a number of ways. For one thing, Sinton always has unfoliate leaves, even as a seedling.
though taller and not quite as thorny. It tends to be semi deciduous in the open and will lose about half its leaves each winter, and in exposed locations can totally defoliate. This does not seem to affect the fruiting habit of the plant, however. Rusk produces fruits about two inches in diameter that ripen to a rich orange color. The fruits are thin-skinned and as brightly colored as some mandarins. Inside, the fruit is golden yellow with up to 6 seeds. It is perhaps the sweetest citrange, though again the off-flavor of the trifoliate parent persists. The fruit reportedly makes a good marmalade.

**Flavor:** Semi-sweet orange, some off-flavors, fair quality. 
**Uses:** Juice, preserves.

**Dunstan Citrumelo** may be the best overall hybrid with 50 percent trifoliate parentage. The tree is initially upright but becomes more spreading as it matures, much like its parent the grapefruit. This grapefruit hybrid produces 4-inch yellow fruit, which if sprinkled with sugar, smell and taste like an ordinary grapefruit, harvested perhaps a bit too early. Unfortunately, this cultivar is extremely hard to find, but worth seeking out. Dunstan citrumelo appears to be extremely hardy. A speci- men in Mt. Olive, North Carolina endured the below-zero temperatures of the 1980s that wiped out all other citrus in the area.

**Flavor:** Sour grapefruit, some off-flavors, fair to good quality. 
**Uses:** Dessert.

**Swingle Citrumelo** is a more common citrumelo. It is more commonly found not because it tastes better, but because it is more often used as a rootstock on which other more desirable citrus are grafted. When the graft is killed back by cold or otherwise succumbs, Swingle will often grow to tree form. The fruit is more pear-shaped than Dunstan but is of a diameter that ripen to a rich orange color. The fruits are thin-skinned and as brightly colored as some mandarins. Inside, the fruit is golden yellow with up to 6 seeds. It is perhaps the sweetest citrange, though again the off-flavor of the trifoliate parent persists. As the tree is generally upright but becomes more spreading as it matures, much like its parent the grapefruit. This grapefruit hybrid produces 4-inch yellow fruit, which if sprinkled with sugar, smell and taste like an ordinary grapefruit, harvested perhaps a bit too early. Unfortunately, this cultivar is extremely hard to find, but worth seeking out. Dunstan citrumelo appears to be extremely hardy. A speci- men in Mt. Olive, North Carolina endured the below-zero temperatures of the 1980s that wiped out all other citrus in the area.

**Flavor:** Sour grapefruit, persistent off-flavors, poor quality. 
**Uses:** Ornamental. Large size and granule shape make it excellent for throwing.

**Changsha x English Large Citrandarin** is reportedly the hardiest citrus hybrid of all. It seems to be hardy to 5°F and specimens growing in areas completely exposed to wind and cold partially defoliate but are otherwise unharmed. The tree is large and upright, much like the trifoli- ate parent, and fruit is variable in size and texture. Some are large and smooth, others are smaller and somewhat fuzzy. All are nearly round and universally sour, though the trifoliate taste is blunted.

**Flavor:** Sour lemon, some off-flavors, fair quality. 
**Uses:** Ornamental, cooking.

### A Rare Citrange Hybrid

- **Troyer Citrange**
  - Cross: *Citrus x rangpur lime*
  - The fruit should carry a warning label: Caution, you are not really being poi- soned—it just tastes that way.
  - Stewart Nagle, in *Citrus for the Gulf Coast*, describing Phelps cup-leaf citrange

### Citrange

Citranges are crosses between the trifoliate orange and the sweet or- ange (*Citrus reticulata*). None of the early hybrids pro- duced a commercial-quality fruit, and subsequent crosses made in the 20th Century have produced a diz- zy array of hybrids, almost all with bad-tasting fruit. Apparently, Poncirus trifoliata is a true species, while most cultivated citrus are combinations of several forms. True species tend to dominate hybrids, and the bad flavors and leaf characteristics of the trifoliate orange tend to persist.

If none of the trifoliate hybrids produce a dessert-quality fruit, all make handsome ornamental trees with attractive fruit that can be used for a variety of culinary pur- poses. Cooking and dilution of the juice tends to eliminate the undesir- able flavors of the trifoliate orange parent. One cultivar worth seeking out is CI Temple Edible, a cross with a Temple orange that reportedly has almost no trifoliate off-flavors. To our knowledge it is not currently being grown anywhere in the Southeast. Citranges are hardly to around 5°F.

### More Citrange Variet- ies

- **Carrizo**
  - US 80-5 (a 10-foot specimen planted against a home in Athens, Tennessee easily survived 2°F in 2003)

### More Citrange Varieties

- **#146**
- **C 32**
- **C 35**
- **CI Temple Edible**
- **Cunningham**
- **Cup Leaf**
- **Sanford**
- **Savage**
- **Uvalde**
- **Willits**
- **Yuma**
- **Trifoliate X Spanish sweet orange**
- **Hamelin X Flying Dragon**

The seed parent may result in better-tasting hybrids. Hardiness of this cultivar is unknown, but should be comparable to other trifoliate hybrids.

**Flavor:** Sweet lime, no or very little off-flavor, good quality. 
**Uses:** Dessert fruit.

**Morton Citrange** is one of the best of the early hybrids developed more than a century ago by the United States Department of Agricul- ture. It makes a large, upright tree that looks much like a sweet orange. Morton citrange leaves are quite large and tend to be more evergreen than some of the other citranges, making the tree very ornamental. It also has the largest fruit of any of the citranges, fully the size of an orange and just as brightly colored, with a thick peel that adheres tightly to the flesh. The fruit does have a fair amount of sweet, but like almost all of the trifoliate hybrids still has an off flavor. The fruit is large enough to eat like a grapefruit and with some sugar it is quite edible.

**Flavor:** Sour grapefruit, some off-flavors, fair quality. 
**Uses:** Dessert, juices, preserves.

**Troyer Citrange and Carrizo Citrange** are crosses between the trifoliate orange and a navel orange. And the navel orange parent shows through in its highly attractive fruits, which do indeed resemble mini- ture navel oranges. The tree looks much like Morton citrange, though somewhat spreading, and even in the lower Piedmont Plateau will grow as large as a Natchez crape myrtle. Troyer has one of the largest flowers of any hardy citrus, which can be as much as an inch in diameter. The cultivar Carrizo is indeed a different type, but the fruit produced by both are identical and so they are included here together. Both produce attrac- tive, sour, extremely juicy fruits that make a good orangeade drink if you have a large bag of sugar. The juice also can be used to make excellent “lemon” pies.

**Flavor:** Sour orange, much off flavor, fair quality. 
**Uses:** Juice, cooking. 
**Note:** Cooking drives away the cloying and persistent trifoliate taste, as does dilution 2:1 with water—and lots of sugar.

**Benton Citrange** was developed in Australia as a rootstock. It pro- duces a somewhat spreading tree with medium-sized, mostly evergreen trifoliate leaves. The fruit resembles Troyer citrange, but lacks much of the trifoliate bitterness, being merely sour. Fruit are fairly large, up to 2 inches in diameter, and are highly colored, looking like small sweet or- anges.

**Flavor:** Sour orange, some off-flavors, fair quality. 
**Uses:** Juice.

**Rusk Citrange** is a trifoliate cross with Ruby blood orange. Rusk makes a strongly upright tree, looking much like the trifoliate orange,