Key Lime Growing in the Florida Home Landscape[1]

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Scientific name: *Citrus aurantifolia* Swingle.

Common names: Key lime, West Indian lime, Mexican lime (Limón Mexicano), dayap (Filipino), manao (Thai), chanh (Vietnamese), limão galego (Portuguese), tilleul clé (French).

Family: Rutaceae

Origin: Citrus originated in Southeast Asia including east and northeastern India, north Burma, southwest China, and eastward through the Malay Archipelago (Moore 2001). Key lime is probably a tri-hybrid intergeneric cross (a three-way hybrid involving three plant species and at least two different genera) of citron (*Citrus medica*), pummelo (*Citrus grandis*), and a microcitrus species, *Citrus micrantha*.

History: The Key lime was carried by the Arabs across North Africa into Spain and Portugal and was brought to the Americas by Spanish and Portuguese explorers in the early part of the sixteenth century (Ziegler and Wolfe 1961). The lime became naturalized throughout the Caribbean, the east coast of Mexico, Central America, tropical areas of South America, and the Florida Keys. Commercial production in Florida in Orange and Lake Counties was evident by 1883. Later, small commercial plantings occurred in the Florida Keys (~1913 to 1926) and Miami-Dade County (1970s to early 2000s). Today, there is little to no commercial Key lime production in Florida, although it remains a popular home landscape fruit tree.

Figure 1. Key lime.
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Distribution: Key limes are grown in warm subtropical and tropical regions of the world. Major producing countries are India, Mexico, Egypt, and various countries in the West Indies.

Importance: The commercial Key lime industry is based in areas other than the United States. Mexico is the largest producer in the western hemisphere, followed by Brazil (Roy et al. 1996). Egypt is also a major producer, and Haiti periodically exports the fruit.

Invasive potential: According to the IFAS Assessment of Non-Native Plants in Florida's Natural Areas (IFAS Invasive

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Plant Working Group 2007), Key lime (*Citrus aurantifolia*) is not considered a problem species at this time and may be recommended by IFAS faculty for planting.

Caution: Two diseases may limit or eliminate the potential for successful Key lime growing in the home landscape. Citrus canker, caused by *Xanthomonas campestris* pv. *Citri*, infects leaves and causes defoliation. The disease reduces tree vigor and production and causes disfiguring blemishes on the peel of the fruit (Spann et al. 2008a). Citrus greening (Huanglongbing/yellow shoot disease), caused by the bacterium *Candidatus* Liberibacter spp. and transmitted by the citrus psyllid (*Diaphorina citri*), infects a tree's phloem conducting tissues, killing sections of the tree canopy and causing general decline, loss of fruit production, and eventually the death of the tree (Spann et al. 2008b).

Description

Tree

Key lime is a small, bushy tree, rarely taller than 12 feet (4.1 m). It has slender branches armed with short to medium length thorns. Spineless selections are more compact and upright in growth, have darker green foliage, and are characterized by low fruit production.

Leaves

The dense foliage consists of small, pale green, blunt-pointed leaves with narrowly winged petioles (leaf stalks).

Flowers

The flowers are held in axillary clusters (cymes) along the stems. The flowers are fragrant and small with white petals, a superior ovary, and 9 stamens. Flowering occurs throughout the year but mainly in the spring.

Fruit

Fruit are small, 1 ½ to 2 inches (38–51 mm) in diameter, round to oval with 10–12 segments around a small, solid axis. The peel is thin, smooth and leathery, and greenish yellow to yellow at maturity. The pulp is greenish yellow, juicy, and highly acid with a distinctive aroma. There are 10 to 15 seeds, which are highly polyembryonic (two or more plants identical to the mother plant may be produced from one seed) (Davies and Albrigo 1994).

Pollination

Key lime and a new selection, 'Giant' Key lime, do not require cross pollination to set fruit.

Varieties

There are few selections of Key lime because trees come true from seed. However, there are spineless selections that unfortunately bear poorly. More recently, the USDA developed a variety with fruit about twice the size of normal Key lime trees and named it 'Giant' Key lime (this variety may not be readily available from citrus nurseries).

Climatic Adaptation

The Key lime is very sensitive to cold temperatures, which limits its production to warmer areas of southern Florida. Damage to the foliage may occur at 30°F (-1°C) to 32°F (0°C), and wood damage or death will occur with temperatures below 29°F (-2°C) (Davies and Albrigo 1994). There are some warm locations outside of extreme south Florida that may be suitable for Key lime in the home landscape. Trees should be planted in full sun but in locations sheltered from cold northerly winds. The best fruit production and fruit quality occur in the warmest locations.

Propagation

Key lime is frequently propagated from seed since it is true-to-type due to its high degree of polyembryony (multiple maternal embryos in each seed). Key lime may also be propagated by hard wood cuttings, air-layers, or as budded or grafted trees. Sometimes Key lime is budded onto rootstocks selected for specific local soil conditions and/or rootstocks resistant to foot rot (*Phytopthora cinnamomi*) and tristeza. In extreme south Florida, select trees propagated onto rootstocks tolerant of high-pH, calcareous soils. Rootstocks suitable for Key lime grown in calcareous soils include alemow (*C. macrophylla*), rough lemon (*Citrus jambhuri*), Volkamer lemon (Volk) (*C. volkameriana*), and Rangpur lime (*C. limonia*). New rootstocks that impart tolerance to citrus greening (Huanglongbing) may be available in the future.

Fruit Production

Key lime trees propagated from cuttings or air-layers may produce some fruit within a year of planting. Budded and grafted trees usually produce fruit within three years, whereas seedling trees require another year or two before fruiting. Vigorous, mature trees may produce 30 to 50 lbs (13–23 kg) of fruit per year.

Season

Some fruit mature on the tree year-round. However, the principal season is early summer in south Florida and late summer further north.

Placement in the Landscape

Planting distances depend on soil type and fertility and expertise of the homeowner. Key lime trees in the home landscape should be planted in full-sun, 12 to 20 feet or more (4.1 to 6.1 m) away from buildings and other trees. Trees planted too close to other trees or structures may not grow normally or produce much fruit due to shading.

Soils

The Key lime is well adapted to a variety of soils. Seedling and air-layer-propagated trees are well suited to the rocky, calcareous soils of the Florida Keys and extreme southern Miami-Dade County. However, salt damage from salt water intrusion and or wind-blown sea-salt is a frequent problem for trees in the Keys. The tree grows vigorously in deep, sandy soils but tends to produce fewer fruit. The fruit produced are typically larger and less juicy and have a thicker peel. Key lime trees require good drainage and do not tolerate flooded conditions.

Planting a Key Lime Tree

Proper planting is one of the most important steps in successfully establishing and growing a strong, productive Key lime tree. The first step is to choose a healthy nursery tree. Purchase only disease-free certified trees propagated under the rules and regulations of the Florida Budwood Certification Program. Commonly, nursery Key lime trees are grown in 3-gallon containers, and trees stand 2 to 4 feet from the soil media. Large trees in smaller containers should be avoided as the root system may be "root bound." This means all the available space in the container has been filled with roots to the point that the tap root or major roots are growing along the edge of the container in a circular fashion. Root-bound root systems may not grow properly once planted in the ground. Inspect the tree for insect pests and diseases, and inspect the trunk of the tree for wounds and constrictions. Select a healthy tree and water it regularly in preparation for planting in the ground. The preferred time to plant is early spring or summer, although potted trees may be planted any time in warm locations.

Site Selection

In general, Key lime trees should be planted in full sun for best growth and fruit production. Select a part of the landscape away from other trees, buildings and structures, and power lines. Select the warmest area of the landscape that does not flood (or remain wet) after typical summer rains. Make sure it has good air circulation and is protected from cold north winds.

Planting in Sandy Soil

Many areas in Florida have sandy soils. Remove a 3- to 10-foot-diameter ring of grass sod. Dig a hole 3 to 4 times the diameter and 3 times as deep as the container the Key lime tree came in. Making a large hole loosens the soil next to the new tree, making it easy for the roots to expand into the adjacent soil. It is not necessary to put fertilizer, topsoil, or compost in the hole. If you wish to add topsoil or compost to the native soil, mix it with the excavated soil in no more than a 50-50 ratio.

Backfill the hole with some of the native soil removed to make the hole. Remove the tree from the container and place it in the hole so that the top of the soil media in the container is level with or slightly above the surrounding soil level. Fill soil in around the tree roots and tamp slightly to remove air pockets. Immediately water the soil around the tree and tree roots. Staking the tree with a wooden or bamboo stake is optional. However, do not use wire or nylon cord to tie the tree to the stake because they may eventually girdle and damage the tree trunk as it grows. Use a cotton or natural fiber string that will degrade slowly.

Planting in Rockland Soil

Many areas in Miami-Dade County have a very shallow soil with hard, calcareous bedrock several inches below the soil surface. Remove a 3- to 10-foot-diameter ring of grass sod. Make a hole 3 to 4 times the diameter and 3 times as deep as the container the Key lime tree came in. To dig a hole, use a pick and digging bar to break up the rock or contract with a company that has augering equipment or a backhoe. Plant the tree as described for sandy soils.

Planting on a Mound

Many areas in Florida are within 7 feet or so of the water table and experience occasional flooding after heavy rains. To improve plant survival in areas of the landscape that occasionally flood, consider planting the fruit tree on a 2- to 4-foot-high by 4- to 10-foot-diameter mound of native soil. After the mound is made, dig a hole 3 to 4 times the diameter and 3 times as deep as the container the tree came in. In areas where the bedrock nearly comes to the surface (rockland soil), follow the recommendations for the previous section. In areas with sandy soil, follow the recommendations from the section on planting in sandy soil.

Care of Key Lime Trees in the Home Landscape

A calendar for Key lime production in the home landscape is provided to outline the suggested month-to-month cultural practices (Chart 1).

Fertilization

Key lime is not demanding in its fertilizer requirements. Fertilize sparingly (less than you would other citrus) to avoid disease problems associated with luxuriant growth. After planting, when new growth begins, apply 1/4 lb (113 g) of a young tree fertilizer such as a 6-6-6-2 (6% nitrogen–6% phosphate–6% potash–2% magnesium) with minor elements. Twenty percent to 30% of the nitrogen in the fertilizer should come from organic sources (Table 1). Repeat this every 3 to 4 months for the first year, and as the tree grows, gradually increase the amount of fertilizer to 0.5, 0.75, and 1.0 lb (227 g, 341 g, 454 g). For mature trees, 1.5 to 2.0 lbs of fertilizer per application 3 to 4 times per year is recommended. For Key lime trees growing on calcareous soils, use 2 to 4 nutritional (magnesium, manganese, and zinc) foliar sprays per year from April to September. For Key lime tree growing in neutral to acid-pH soils, magnesium, manganese, and zinc may be applied to the soil or applied to the foliage.

Key lime trees may develop iron deficiency symptoms, especially when grown on the rocky, calcareous, high-pH soils of Miami-Dade County. If iron deficiency symptoms appear (chlorotic leaves with green veins), apply iron. For trees growing on acid to neutral soils, apply iron chelate formulated for acid to neutral soils at 0.25 to 1 oz per tree to the soil 2 to 3 times per year; water the iron into the ground (Zekri and Obreza 2003a). In alkaline soils with a high pH, drench the soil next to the tree trunk with 1 to 4 oz. of iron chelate formulated for alkaline soils 2 to 3 times per year sometime from June through September.

Irrigation (Watering)

Newly planted Key lime trees should be watered at planting and every other day for the first week or so and then 1 to 2 times a week for the first couple of months. During prolonged dry periods (e.g., 5 or more days of little to no rainfall), newly planted and young Key lime trees (first 2 years) should be watered periodically. Once the rainy season arrives, watering frequency may be reduced or stopped. Watering Key lime trees that are 4 or more years old will be beneficial to plant growth and crop yields only during very prolonged dry periods during the year. Mature Key lime trees do not need frequent watering, and over watering may cause trees to decline or be unthrifty.

Insect Pests

ASIAN CITRUS PSYLLID (*Diaphorina citri*)

The Asian citrus psyllid attacks the young leaves and young stems of Key lime trees, severely weakening the tree (Mead 2007; Spann et al. 2008). The adult psyllid is 3 to 4 mm long with a brown mottled body and light brown head.

The nymphs (young) are smaller and yellowish orange. The nymphs of this psyllid produce a characteristic white, waxy excretion with a ribbon-like shape. Foliage attacked by this psyllid is severely distorted. There are treatments to control the psyllid, but preventing infestation by the psyllid in a home landscape is difficult at best because of presence of alternative hosts (e.g., orange jasmine) and lack of control in neighboring properties. Unfortunately, this psyllid may transmit a deadly bacterial disease called citrus greening disease (Huanglongbing/yellow shoot) (Yates et al. 2008). See below for more information on citrus greening. Please contact your local agricultural Extension agent for current recommendations.

BROWN CITRUS APHID (*Toxoptera citricida*)

Adult wingless forms are shiny black, and nymphs (young) are dark reddish-brown (Halbert and Brown 2008). This aphid may be confused with several other dark colored aphids. Wingless and winged forms of the brown citrus aphid feed on new growth, causing distortion and, when populations are very high, stem dieback. The brown citrus aphid is a vector of citrus tristeza virus, which causes tree decline and death of citrus on susceptible rootstocks (e.g., sour orange). Purchase and planting of certified disease-free citrus trees under the Florida Citrus Budwood Program will help reduce the spread or introduction of this disease into your landscape. Controlling the brown citrus aphid is not practical.

CITRUS LEAF MINER (*Phyllocnistis citrella*)

The citrus leafminer adult moth is small (4 mm wingspan), with white and silvery colored wings with several black and tan markings (Heppner 2003). The larvae of this moth usually infest the lower leaf surface, forming meandering mines. Their mining causes leaf distortion, which reduces the functional surface area of the leaf. The immature leaves of Key lime trees in the home landscape are commonly attacked by the citrus leafminer during the warmest time of the year and less so during the winter months (Browning et al. 1995). Their feeding may severely damage the leaves and this may weaken young, newly planted trees. Application

of horticultural oil in a ½ to 1% solution to a new flush of leaves (when ½ to 1 inch in length) will usually protect them sufficiently as they mature. Once trees are three years old or more they can withstand the damage to the leaves by the citrus leafminer. In general, leaf flushes that develop during the cool temperatures of late fall and winter avoid attack by the citrus leafminer.

MITES

Several mites may attack Key lime leaves, stems, and fruit.

Citrus Red Mite (*Panonychus citri*)

The red mite usually attacks the upper leaf surface, causing brown necrotic areas. Severe infestations may cause leaf drop (Browning et al. 1995; Jackson 1991). The red mite is deep red to purple and has a round body. Red mite infestations are greatest during the dry winter months but may occur from November to June (Childers and Fasulo 2005). When heavy infestations occur, foliar applications of sulfur will control red mites. Caution: *never* apply a sulfur spray and an oil spray within three weeks of each other.

Rust Mite (*Phylocoptruta oleivora*) and Broad Mite (*Polyphagotarsonemus latus*)

The rust and broad mites may attack leaves, fruit, and stems but are primarily a fruit pest (Pena and Campbell 2005). Rust mites are very hard to see because of their small size (0.1 mm long) and light yellow color (Jackson 1991). Broad mites are 0.2 mm long with color varying from light yellow to dark green (Fasulo 2007). Feeding by these mites results in russetting (browning) of the fruit peel, but this, unless it is severe, does not affect internal fruit quality. When heavy infestations occur, foliar applications of sulfur will control red mites. Caution: *never* apply a sulfur spray and oil spray within three weeks of each other.

SCALE INSECTS

Various scale species may infest and damage bark, leaves or fruit.

Florida Red Scale (*Chrysomphalus aonidum*)

This armored scale is circular (1.5-2.2 mm in diameter) with a prominent central nipple. It varies in color from reddish-brown to reddish-purple (Browning et al. 1995; Fasulo and Brooks 2004; Jackson 1991). This pest mostly attacks leaves, but occasionally fruit as well. Leaf symptoms appear as reddish to reddish brown stippling, especially along the central main vein. Application of horticultural oil in a ½ to 1% solution to the leaves will usually control this pest.

Snow Scale (*Uaspiscitri*)

The clustering of the white male scales along the limbs and tree trunk look like white flecking or snow (Browning et al. 1995; Fasulo and Brooks 2004). The female scales range from brown to purple. The scale feeding causes the bark to split and weakens the tree, sometimes killing limbs. Several applications of horticultural oil in a ½ to 1% solution to the affected limbs and trunk will usually control this pest.

Diseases

ALGAL DISEASE (RED ALGA)

Caused by *Cephaleuros virescens*, red alga infects leaves and bark, and can cause leaf drop and girdling of branches, which results in stem dieback. Algal disease may be controlled by 1 to 2 copper-based sprays during mid- to late summer.

CITRUS CANKER (*Xanthomonas campestris* pv. *citri*)

Key lime trees are highly susceptible to citrus canker (Spann et al. 2008a). Citrus canker is caused by bacteria, which may be spread by wind-driven rain and contaminated equipment, clothing, animals, and humans. Young leaves, shoots, and fruit are susceptible to infection (Browning et al. 1995). Pinpoint spots on leaves and fruit appear first. These are followed by raised, brown spots on leaves, stems, and fruit. The spots can be circular or irregular. They are surrounded by a yellow halo. Heavy infestations may result in defoliation and weakening of the tree. Plant trees in full sun with good air movement and avoid wetting the foliage during watering to help reduce the severity of this disease. Timely applications of copper-based fungicides to newly emerging leaves will also lessen the impact of this disease.

CITRUS GREENING (HUANGLONGBING/ YELLOW SHOOT DISEASE)

Key lime appears to be moderately tolerant to citrus greening (Spann et al. 2008b). Citrus greening is caused by the bacterium *Candidatus* Liberibacter spp. The bacterium is spread by the Asian citrus psyllid (*Diaphorina citri*). Citrus greening symptoms include sections of the tree showing symptoms that resemble severe nutrient deficiencies (e.g., yellow blotching and yellow veins on the leaves, and reduced leaf size). Other symptoms include corky main veins, and stem and limb dieback. Any fruit produced may be small, lopsided, and bitter. Eventually stems, limbs, and the entire tree decline and die (usually within 5–8 years) (Spann et al. 2008b). At present, there is no treatment for the disease. Only removal of infected trees will help

to decrease the spread of the disease to other citrus trees. Purchase and planting of certified citrus trees under the Florida Citrus Budwood Program will help reduce the spread or introduction of this disease on to your landscape. Removal of infected trees will prevent their spreading the infection to nearby citrus trees.

CITRUS SCAB (*Elsinoe fawcetti*)

This disease is most prevalent during the spring. Young leaves, stems, and fruit are most susceptible to infection. The major symptom is development of corky outgrowths in infected tissues (Browning et al. 1995). Usually not a major disease on limes, this disease is typically controlled by the same foliar treatments used for greasy spot and melanose.

FOOT ROT (*Phytophthora parasitica*)

Resistance to foot rot (root rot) varies by rootstock with Trifoliate orange immune; Swingle citrumelo, Cleopatra mandarin, and sour orange resistant; Troyer and Carrizo citranges and Rangur lime tolerant; and sweet orange and rough lemon highly susceptible (Browning et al. 1995). Symptoms of foot rot include bark peeling in the crown, roots, and trunk at the soil level; gumming at the wounded area; leaf chlorosis; stem dieback; tree decline; and death. The best way to avoid this disease is to grow Key lime on resistant rootstocks, avoid trunk damage, avoid wetting the trunk when watering, and keep mulch away from the base of the tree trunk.

GREASY SPOT (*Mycosphaerella citri*)

A leaf disease, manifests initially when yellow spots appear on the upper leaf surface. Brown, irregularly-shaped blisters with a greasy appearance then develop on the lower leaf surface (Browning et al. 1995). Eventually, brown blisters appear on the upper leaf surface. The disease may lead to defoliation, which weakens the tree. Greasy spot is prevalent during the rainy season (May to September) and easily prevented and controlled with 1 to 2 copper or copper plus horticultural oil sprays.

KEY LIME ANTHRACNOSE (*Colletotrichum gloeosporioides*)

Key lime is highly susceptible to lime anthracnose (also called withertip and blossom blight), whereas 'Tahiti' lime appears to be immune (Browning et al. 1996). This disease results in lower fruit production due to infection of flower buds and blossoms. Young shoots may die back, and young fruits shed prematurely. Young fruit may develop small, round areas of dead tissue (necrotic lesions). Leaves may develop brown, dead areas and holes where dead tissue has withered away. Reduce the incidence of this disease by irrigating with care and attention. Do not wet trees with sprinklers when watering, especially in the evening and when they are blooming. Another way to reduce the incidence of the disease is to plant trees in full sun in an area of the landscape with good air movement. Finally, avoid fertilizing with too much nitrogen.

MELANOSE (*Diaporthecitri*)

Immature leaves, stems, and young fruit are most susceptible to melanose (Browning et al. 1995). Early leaf symptoms appear as small, brown, sunken spots that later become raised and that have a sandpaper rough feel. Fruit symptoms appear as raised, irregularly shaped, brown spots surrounded by white/off-white halos caused by cracking of the peel. This disease is most prevalent during the spring. Usually not a major disease on limes, melanose is typically controlled by the same foliar treatments for greasy spot.

POSTBLOOM FRUIT DROP (*Colletotrichum acutatum*)

Occurrence of this disease is most prevalent during the rainy season when flowers are present; overhead watering may increase the incidence of this disease in the home landscape. The initial symptoms of this disease include brown to orange, water-soaked lesions on the flower petals. The petals then turn orange and dry up (Browning et al. 1995). Next, the pistil and young fruitlets drop off, leaving the floral disk and calyx (button), which may remain attached to the stem for a number of years. Strategies to minimize the incidence of this disease include planting the tree in full sun in an area of the landscape with good air movement, periodically pruning the canopy to facilitate sun and air penetration, and not watering the tree foliage during bloom time. Do not apply copper to the foliage and flowers during bloom as this aggravates postbloom fruit drop.

TRISTEZA

Key limes are susceptible to tristeza virus regardless of rootstock. Tristeza is transmitted by the brown citrus aphid (*Toxoptera citricida*). Purchasing certified disease-free trees under the Florida Budwood Registration Program will greatly reduce the chances of purchasing a tree with this disease.

Physiological Disorders

OLEOCELLOSIS (OIL SPOTTING)

This disorder is caused by rupturing of the oil glands in the peel; the released oil is toxic to the surface cells. Peel symptoms appear as irregularly shaped light brown to brown sunken areas. This disorder occurs when fruit are

fully turgid (full of water). Avoid it by handling fruit gently during harvest and waiting until the afternoon to harvest.

STYLAR-END BREAKDOWN (STYLAR END ROT)

More of a concern with 'Tahiti' lime than Key lime, stylar-end breakdown appears as a breakdown of tissues at the stylar ends of fruit. It eventually causes decay of the entire fruit (Browning et al. 1995; Davenport et al. 1976). Usually, stylar-end breakdown occurs when fruit are fully turgid (full of water) in the morning during hot weather, July through September. Stylar-end breakdown is caused by rupture of the juice sacs when the fruit is harvested and handled roughly. Large, mature fruit are most susceptible. The incidence of stylar-end breakdown may be decreased by handling fruit gently when harvesting and waiting until afternoon to harvest.

Nutritional Disorders

NITROGEN DEFICIENCY

Nitrogen deficiency first appears on the older leaves. With prolonged deficiency younger leaves are affected as well (Zekri and Obreza 2003b; Futch and Tucker 2008). In the mild deficiency, the foliage will be light green; however, as the deficiency intensifies, the light green turns completely yellow. Nitrogen-deficient trees may be stunted, with sparse canopies and little fruit production.

PHOSPHORUS DEFICIENCY

Like nitrogen deficiency, phosphorus deficiency appears first in older leaves, with more severe deficiency also appearing in young leaves (Zekri and Obreza 2003b; Futch and Tucker 2008). Symptoms begin with a loss of green color. New leaves are small and narrow and may have a purplish or bronze discoloration. Fruit from deficient trees have a rough, thick rind and a hollow core.

POTASSIUM DEFICIENCY

Potassium deficiency first appears on older leaves as a yellowing of the leaf margins and tips; subsequently the yellow areas broaden (Zekri and Obreza 2003b; Futch and Tucker 2008). If the deficiency persists and becomes severe, leaf spotting and dead areas may develop.

MAGNESIUM DEFICIENCY

Magnesium deficiency occurs first in older leaves. The first symptom of magnesium deficiency appears on mature foliage as a yellowish green blotch near the base of the leaf and between the midrib and the outer edge (Zekri and Obreza 2003b). The yellow area enlarges until the only green parts remaining are at the tip and base of the leaf as an inverted V-shaped area on the midrib. With acute deficiency, the leaves may become entirely yellow and eventually drop.

MANGANESE DEFICIENCY

Manganese deficiency appears first on younger leaves. The deficiency appears as dark green bands along the midrib and main veins surrounded by light green interveinal areas (Zekeri and Obreza 2003a). As the severity increases, the light green interveinal areas develop a bronze appearance.

ZINC DEFICIENCY

First symptoms occur in young leaves. In the early stages, zinc deficiency appears as small blotches of yellowing occurring between green veins in the leaf (Zekri and Obreza 2003a). Severely deficient leaves may become entirely yellow except for the green veinal areas, and leaves will also be smaller and have narrow pointed tips. This deficiency has been referred to as "little leaf" and "mottle leaf." The distance between leaves (internodes) becomes reduced, giving the shoot a rosette appearance.

IRON DEFICIENCY

Iron deficiency symptoms first appear in young leaves with the leaf veins darker green than the interveinal areas (Zekri and Obreza 2003a). If the deficiency persists, the yellow in the interveinal areas expands until eventually the entire leaf turns yellow. Leaf size is also reduced. Trees may become partially defoliated.

Key Lime Trees, Lawn Care, Mulch, and Pruning

Key lime trees in the home landscape are susceptible to trunk injury caused by lawn mowers and weed wackers. Maintain a grass-free area 2 to 5 or more feet (0.5–1.5 m) away from the trunk of the tree. Never hit the tree trunk with lawn mowing equipment and never use a weed wacker near the tree trunk. Mechanical damage to the trunk of the tree will weaken it, and, if severe enough, can cause dieback or kill the tree.

Roots of mature Key lime trees spread beyond the drip-line of the tree canopy. Heavy fertilization of the lawn next to a Key lime tree is not recommended and may reduce fruiting and/or fruit quality. The use of lawn sprinkler systems on a timer may result in over watering and cause Key lime trees to decline. Too much water too often applied causes root rot.

Mulch

Mulching Key lime trees in the home landscape helps retain soil moisture, reduces weed problems under the tree canopy, and improves the soil near the surface. Mulch Key lime trees with a 2- to 6-inch (5- to 15-cm) layer of bark, wood chips, or similar mulch material. Keep mulch 8 to 12 inches (20–30 cm) away from the trunk. Mulch placed against the tree trunk may result in trunk rot.

Pruning

Generally, Key lime trees need only limited pruning. Prune only to shape trees, to remove dead wood and to limit tree height to 6 to 8 feet high and 10 to 12 feet wide. Large trees are more difficult to care for and more prone to wind damage (e.g., falling over).

Harvest, Ripening, and Storage

Key lime trees may have fruit at different stages of development at the same time. Harvest only mature fruit, which have a yellow peel color (Figure 2). The fruit may be stored in polyethylene bags in the refrigerator for several days to a week.

Figure 2. Picture of Key lime fruit.
Credits: UF/IFAS

Uses and Nutrition

Key lime juice has no cholesterol and is a source of vitamin A and vitamin C (Table 2). Key lime is used fresh in limeade, mixed drinks, pies, and iced tea, and is squeezed onto seafood or other foods (e.g., papaya and avocado) to bring out the flavor. Key lime is also used in bottled lime juice and carbonated beverages. The principle by-product is lime oil, used in cosmetics and flavoring.

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Chart 1. Cultural calendar for Key lime production of mature (bearing) trees in the home landscape.

Operation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry fertilizer[1]			The period from March through September is generally the best time to apply granular mixes containing nitrogen-phosphate-potash-magnesium (N-P-K-Mg).									
Nutritional sprays			Apply 2 to 4 nutritional sprays to the leaves any time from March through October. These sprays should include magnesium, manganese, zinc, molybdenum, and boron.									
Iron fertilizer				The period from April through September is generally the best time to apply iron materials to the soil.								
Watering			Water trees only during prolonged dry periods. Watering during the summer may be unnecessary unless drought conditions prevail. Water less during the winter (Nov. –Feb.).									
Insect control[2]	Monitor the tree throughout the year for insect infestations. Some insect pests, such as citrus red mite, are more prevalent during the dry season (fall/winter), whereas others, such as the citrus leaf miner, are more prevalent during late spring and summer.											
Disease control[2]					During the rainy season monitor for citrus canker, algal disease, greasy spot, and Key lime anthracnose, and if necessary control these problems.							

[1] Dry fertilizer mix, which includes nitrogen, phosphate, potash, and magnesium. See text for makeup of nutritional sprays and iron soil drenches

[2] See text for more information on these insects and diseases. Contact your local agricultural Extension agent for more information and current recommendations.

Table 1. Key lime fertilizer recommendations.[z]

Year	Times per year	Amount/tree/ application (lbs)	Total amount/tree/ year (lbs)
1	2–4	0.25–0.5	0.75–2.0
2	2–4	0.5–1.0	1.5–4.0
3	2–4	0.5–1.0	1.5–4.0
4	2–3	1.0–1.5	2.0–4.5
5	2–3	1.5–2.0	3.0–6.0

[z] Typical fertilizer material formulations include 6-6-6-2, 8-3-9, 4-2-12, etc. For higher analysis fertilizer materials (e.g., 15-15-15), reduce the rate applied per application.

Table 2. Nutrient value of raw key lime fruit (3.5 oz or 100 g of fruit).[z]

Constituent	Approximate value
Water content	89–94%
Total dietary fiber	0.1–0.5 g
Protein	0.07–0.112 g
Fat	0.04–0.17 g
Calcium	4.5–33.3 mg
Phosphorus	9.3–21.0 mg
Iron	0.19–0.33 mg
Vitamin C	30.0–48.7 mg
Vitamin A	0.003–0.40 mg

[z] Morton (1987)