Questions and Answers to Citrus Management

Third Edition

by
Peggy A. Mauk, Ph.D.
and
Tom Shea

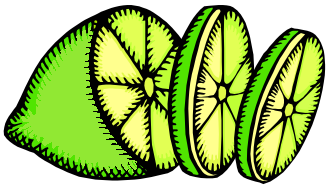
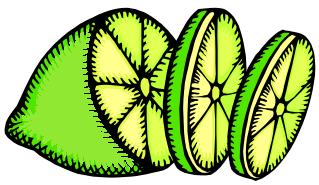
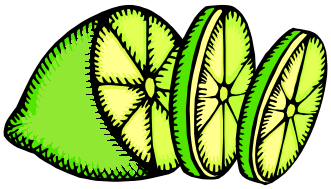

Table of Contents

To simplify our information, it is sometimes necessary to use trade names of products or equipment. No endorsement of named products is intended nor is criticism implied of similar products that are not mentioned.

Questions and Answers to Citrus Management

by

Peggy A. Mauk, Ph.D.

Subtropical Horticulture Farm Advisor

and

Tom Shea

University of California Cooperative Extension

21150 Box Springs Road, Suite 202, Moreno Valley, CA 92557-8718

Revised from: F. F. Laemmlen, and G. W. Witney. 1994. Some answers to common questions asked by backyard citrus growers. In house publication, UCCE Riverside County.

I. VARIETIES, PLANTING AND TREE CARE

1. Which citrus varieties do best in Southern California?

A. Grapefruit - Depending on the variety, fruit mature starting as early as November. Depending on the location, some fruit can hold on the tree until September.

1. Marsh Seedless is white fleshed, juicy with fine flavor. High summer temperatures produce best flavor.
2. Ruby Red is light pink to red in warm summer climates. Juicy with fine flavor.
3. Rio Red has a deep red internal color, excellent flavor and is juicy. Needs summer heat. Does well in lower desert valleys.
4. Star Ruby has the deepest colored of the red grapefruit with a less acidic fine flavor. Needs some heat to develop the best flavor but it is **not** suitable for the desert. This variety is characterized by white to yellow flecks in the leaves. It ripens in early summer.
5. Flame is red fleshed and has a red blush on the skin like the other red/pink grapefruit. It ripens in late summer in the Riverside area.
6. Oroblanco, a UCR bred grapefruit-pummelo cross, is very sweet, juicy and low in acid. It ripens in January and holds well into early summer.
7. Melogold, a UCR bred sibling to Oroblanco, is white fleshed, seedless like Oroblanco but juicier. Ripens similar to Oroblanco.
8. Cocktail, a pummelo-mandarin hybrid developed by UCR, very sweet and juicy. Great for juice. Ripens in late-December in Riverside.

B. Lemons

1. Lisbon lemon: Has some cold resistance, very heat tolerant, vigorous and thorny tree. Highly productive, high quality fruit. Fruit mature mostly in fall to winter. On the coast, trees can bear some fruit year round.
2. Eureka lemon: Cold sensitive, nearly thornless, very attractive tree, productive - high quality fruit. Tree bears year round on the coast, fall and winter in the low desert valleys, and winter to spring production in the inland Riverside areas.
    a. Variegated Pink- a sport or mutation of Eureka that has variegated (green-and-white striped) leaves and immature fruit striped green and cream, mature flesh is light pink plus the tree itself is smaller making it very garden-friendly.
3. Improved Meyer lemon: Although it is considered to be a lemon, it is probably a lemon-sweet orange hybrid. Thus it is fairly cold resistant, similar to sweet orange. Fruit are round, thin skinned, and almost orange in color. Very juicy, with less acid than other lemons. Bears year round.

C. Limes

1. Bearss Lime (Tahitian-type Lime): Seedless fruit, much larger and milder flavor than the Mexican lime. Not as cold hearty as a lemon. Of the limes, this is the most suitable to Southern California.
2. Mexican Lime (Key Lime): Very frost sensitive and is only suited to more tropical areas that do not receive any frost (coastal areas). Thornless Mexican Lime is also available and is equally frost sensitive.
3. Limequat (lime X kumquat hybrid): Lime-like flavor that can substitute for a lime. This tree is more frost tolerant and can be planted in areas that receive an occasional frost.

D. Oranges

1. Navels:
    a. Washington: Large seedless fruit, most commonly eaten fresh (not juiced). Suited to cooler production areas, does not produce high quality fruit in the desert. Produces well in San Diego County, Orange County, Riverside, San Bernardino, and Redlands areas. Fruit splitting in the fall and winter is a common problem and often related to irrigation practices weather conditions (see Q. 38). Harvested from January through April in home gardens. This navel is the standard by which all other navels are judged.
    b. Cara Cara: this navel orange has reddish pink flesh. The pink color is similar to that of the red grapefruits, however, it is similar to the Washington navel in taste and harvest time (February through March).
    c. Lane Late: ripens late in the season, extending the harvest of navels into early summer.
2. Valencia orange: Often called "juice" oranges. Thin skinned, smaller fruit with very juicy pulp. Tends to alternate bear (see Q. 10). Ripens later than Navel (early summer through fall) - fruit store well on the tree but may re-green in the summer. Seedless variety is Delta.
3. Blood oranges: Moro (better color) and Tarocco (better flavor) do well in inland and coastal areas. Almost seedless fruit with a deep red coloration. Flavor is berry-like. Attractive spreading tree.

E. Mandarins (Tangerines) and Tangelos

1. Satsuma Mandarin

    Satsuma mandarins produce easy-to-peel and seedless fruit. The varieties, Dobashi beni, Okitsu wase and Owari all thrive in cooler parts of Southern California. Satsuma is sensitive to high temperature and thus there are no Satsuma varieties suitable to plant in the lower desert valleys. Satsuma's are the most cold hardy citrus trees of commercial importance. They are also the earliest fruit to ripen. Fruit from both Dobashi beni and Okitsu wase mature at the end of October. Owari ripens a month later. If fruit are left on the tree they rapidly becomes puffy and insipid, however, fruit store well off of the tree. Some Owari strains have degenerated into poor trees due to its ability to sport readily producing new strains that are not productive. Most Satsuma varieties tend to alternate bear (see Q. 10).

2. Other Mandarins
    a. Dancy, the Holiday tangerine, is rich, juicy with seeds, and often, sold with leaves attached.
    b. Seedless Kishu has small fruit slightly larger than a golf ball, mild, sweet, truly seedless, quite juicy and extremely easy to peel. The fruit matures in November and holds until January.
    c. Gold Nugget is a seedless variety, developed and released by UCR that has a sweet, rich flavor with a somewhat bumpy skin that peels easily. Ready in March and holds well through August.
    d. Pixie, also developed by UCR, has a sweet, mild flavor, without seeds, holds well and peels easily. In the inland area, fruit can be harvested as early as mid-February and go through early June.
    e. Clementine (Algerian) has bright orange, juicy flesh with sweet, very rich flavor. Bears from December through February. Must have Dancy pollinator for good fruit production.
    f. Fairchild is very juicy with richly sweet flesh and seeds. Needs Temple (Royal) pollinator.
    g. Shasta Gold™ (TDE #2) was recently developed and released by UCR. The flesh is seedless, bright orange and juicy. The flavor is richly sweet. In the inland are, the season is mid-February to mid-March and holds well on the tree into April or May.

h. Tahoe Gold™ (TDE #3) another new release by UCR. The flesh of the fruit is seedless, bright orange, finely-textured and juicy. The flavor is rich and sweet. Its season is mid-January to mid-February.

i. Yosemite Gold™ (TDE #4) also from UCR's citrus breeding program. The flesh is seedless, bright orange, finely-textured and juicy. The flavor is richly sweet. The season is January to mid-March and holds well on the tree into April.

3. Tangelos (a cross between grapefruit and mandarins)

a. Orlando tangelo: Fruit ripen in November-January. Fruit peels poorly and it contains many seeds. May need pollinator for more fruit production. (See Q. 7).

b. Minneola tangelo: Large, red-orange fruit; peels well; few seeds; rich tart flavor. Fruit ripen in December-February. May need pollinator for better fruit production. (See Q. 7).

F. Kumquats

Meiwa and Nagami

These are the most cold-hardy of all citrus types. Tree foliage can withstand temperatures below 20º F and therefore can be grown in areas that are too cold for most citrus. Fruit, however, are more cold-sensitive. Trees are small, less than 12 ft tall. Fruit are eaten whole, peel and all. Meiwa have round fruit with a sweet rind and flesh, excellent for eating. Nagami have oval-shaped fruit with a sweet rind and tart flesh. Nagami is the most common variety found in grocery stores. Nordman Seedless Nagami, a new release, has really nice fruit 1 to 1½ inches long without seeds, therefore, especially easy to eat or preserve.

2. When should I plant, how deep should I plant and how big a tree should I plant?

The best planting time is after frost danger (after February 15 in the Riverside area) and before the onset of hot weather. Although fall planting can be successful it is generally better to wait until spring. Always choose a location that has full sun throughout the day.

It is best to plant in well-drained soil (see Q. 3). Dig the planting hole as deep as the root ball and as wide or wider than the root ball. Be certain that the tree is not buried below the graft union. The graft union (slight dogleg shape in the trunk) should be located several inches above the soil level. Trees buried too deep may not survive. It is always best to fill the planting hole with the same soil that was removed when digging the hole. Do not add any mulch or potting soil into the tree hole. These materials retain more water and may increase the chances of root rot.

The best size of tree to plant is a tree with a trunk that is approximately ½ inch in diameter. Trees in pots larger than 5 gallons may not grow as vigorously as trees in 5 gallon or smaller pots. In general, trees that are container grown for long periods may have compromised roots systems. Additionally, there is a substantial savings in purchasing small trees versus large container grown trees. Commercial growers plant trees with less than a 1.5 inch diameter trunk. (See also Q. 5).

3. What soil is best for citrus?

Well-drained loam or sandy loam soils is best for citrus. High salinity, heavy clay and/or poorly drained soils are detrimental to citrus.

In western Riverside County, many of the soil types have a limited amount of topsoil and often times there is a hard pan below the topsoil. Desert soils generally have several clay lenses (layers) under the top sandy soil. In order to ensure proper drainage and good root penetration, homeowners should loosen compacted soils and mix the soil layers. For desert soils, dig a 6 ft. X 6 ft. X 6 ft. pit and refill with the same soil. This will minimize the clay layers under the sandy top soil.

4. When should I prune a citrus tree?

In general, citrus trees do not require frequent or severe pruning. Removal of deadwood and very weak shoots or suckers is the only pruning required. Avoid pruning grapefruit because of the potential development of Rio Grande gummosis disease (see Q. 34). In general, no pruning is required for the first 15-20 years except for the removal of deadwood. Lemons are an exception and they require thinning and heading back to keep control of vigorous shoot growth. Light pruning can be done any time, heavy pruning should be done during the winter months so that tree limbs are not sunburned (December-January). Manage the tree's size so that it easy for you to harvest.

5. Should I protect the trunk and large limbs from sunburn?

Yes, particularly lemon trees and newly planted trees. Wrap the trunk of the newly planted tree with newspapers or tree wraps and tie loosely. The trunk and exposed branches can be painted with a white wash; white flat water-based non-enamel paint (diluted 1:1 with water). In the lower desert, you must control the ants that feed on the tree trunk under the tree wrap. If left uncontrolled, the ants can girdle the new tree and kill it.

6. Do citrus trees need cross-pollination?

Some tangelos and mandarins need cross-pollination. For example, Minneola tangelo, Orlando tangelo, Clementine mandarin and Fairchild mandarin need a cross pollinator for best fruit production (see Q. 7).

7. What is a good pollinator for Minneola, Orlando and Fairchild?

- Minneola: Temple, Dancy, Kinnow, or Clementine
- Orlando: Temple, Dancy, or Kinnow
- Fairchild: Orlando, Clementine, Kinnow, or Temple (Royal)

8. My Temple tangors are dying. Why?

There may be a number of causes. Temple tangors (a mandarin-orange cross) are sensitive to frost. A freeze may "set back" the tree for years. Poorly drained, heavy soils can kill Temples (also see Q. 30). Over-production for two or more consecutive years may also cause dieback or tree death. To reduce the stress of over-production, thin excess fruit early (before they reach the size of marbles).

9. Should fruit be left on the tree after maturing?

No. Leaving fruit on the tree after maturing may contribute to a smaller crop and perhaps, more fruit drop for the next crop. Most citrus will store on the tree for a short time, however, pick all mature fruit before the weather turns hot. See also Q. 10

10. Why does my tree produce heavily one year and almost nothing the next?

Certain citrus types such as Valencia oranges or some mandarins have a tendency to have a year with heavy fruit production followed by a year with sparse production. This is called alternate bearing. You can reduce the potential of a tree to alternate bear by reducing the fruit load on a heavy fruit set year by thinning out some of the fruit. Pruning the tree will also help to offset alternate bearing. Also, fertilize less in light years and more in heavy years so that the trees needs are met according to the demands of the fruit load. Lastly, do not allow the old fruit to stay on the tree longer than necessary. Despite using these strategies, some varieties will just alternate bear.

11. How can I control weeds under citrus?

YOUNG TREES: To encourage good growth, a weed or grass-free area of at least 4 feet diameter should be maintained around young trees. Landscape fabric covered with bark or rock around the young tree will help. Careful and proper use of the herbicide glyphosate (Roundup®) can control weeds but must be kept off the trunk and leaves. Do not use glyphosate near Star Ruby nor Flame grapefruit trees. MATURE TREES: a grass-free area out to the drip-line is desirable but not essential (see Q. 25). Read all pesticide/herbicide labels carefully, and use according to the manufacturer's directions for best results.

12. Should I sprinkle citrus foliage?

Spraying the foliage occasionally to wash off the dust is okay, but it is best to keep the tree trunks dry (see Q. 32, 33). Also, citrus foliage is sensitive to salt. Colorado River water contains fairly high concentrations of salts and may harm the leaves if they are wetted regularly.

13. Should pruning wounds be treated?

Research has shown that you should never use a tree seal. Small pruning wounds (1 inch or less) need not be treated. Tree seals tend to seal in disease and interfere with the tree's natural ability to callous the wound. For large pruning cuts lower in the canopy you may treat with Bordeaux mixture (See recipe in Q. 33).

14. Should I spray the trees with 2,4-D? When?

This chemical is used at times in commercial citrus groves, but it is not recommended for backyard tree use. Incorrect use could result in severe injury to the trees or other nearby plants.

15. How close together can I plant my citrus trees?

Mature trees on well drained soil will have a canopy diameter of 18 to 30 feet depending on the variety. Lemons and grapefruit are the largest and mandarins are the smallest.

Commercial groves generally plant trees on 12 x 24 ft. spacing. That is, 12 ft. between trees going down the row and 24 ft. between rows. When the tree size causes too much shading for the lower limbs (excessive shade reduces production), trees are pruned and/or hedged.

"Dwarf trees" are regular scion varieties grafted onto 'Flying Dragon' rootstock. In general, trees grown on 'Flying Dragon' rootstock are much smaller than the same varieties on other rootstocks. Spacing for these trees can be as close as 6 x 12 ft. Also, trees planted on heavy soils will not grow as large as trees planted on well-drained soils.

16. When can I bud graft my trees?

Bud grafting is most successful when the trees are naturally pushing new growth. Preferably in the spring when temperatures are warm (February-May), growth "is on" and the bark "slips" easily. Scion to rootstock grafting may be done any time but it is best to avoid times when temperatures are low and there is a risk of frost.

17. Should I water at blooming time?

Drought during bloom causes flowers to drop and results in poor fruit set. To optimize fruit set and minimize fruit drop, always maintain good irrigation practices throughout the year.

18. How do I protect my citrus from frost?

Frost risk is defined as conditions when winter temperatures fall to 29°F for 30 minutes or longer. These conditions can cause some damage to tender plants. Citrus varieties vary in their sensitivity to cold. Satsuma mandarins and kumquats are among the cold-hardiest. Oranges, grapefruit and mandarin hybrids are intermediate in their tolerance to frost. Limes and lemons (except for Meyer lemon) are most susceptible to frost damage. Healthy trees that are well supplied with water are better able to withstand frost than weak, dry trees. Avoid placing citrus in the lowest areas of the garden, as cold air flows downhill to the lowest point (in the same way that water flows downhill). To protect young frost-sensitive trees wrap them with insulating material, such as palm fronds, corn stalks, or cardboard. Cover the trunks from the ground level up to the main branches. When frost is expected, keep the soil surface below the tree clean and wet as this will act as a heat sink. When severe frost is anticipated small outdoor holiday lights can be strung in the tree. Frost will rarely kill a mature citrus tree. If the leaves or twigs show signs of frost damage, be patient and wait until the spring flush of growth to determine what to prune off.

II. FERTILIZATION and IRRIGATION PRACTICES

19. When should I fertilize citrus trees?

Apply one application of nitrogen (ammonium nitrate, ammonium sulfate, or urea) in late December to February. Alternatively, fertilizers can be applied in several applications. Many commercial growers apply 1/3 of the total nitrogen needed in February, July, and September. Using a balanced citrus food may help to correct mineral deficiencies as well as provide a more complete nutrition. Manure should be applied in the fall (October-November) so that the winter rains can leach the salts (see Q. 23). Steer and chicken manure should be used sparingly because they are high in salt and may burn the trees. Mature citrus trees use 1-1.5 lb. of actual nitrogen (N) per tree per year (see Q. 21).

20. How much phosphorus do citrus trees need?

Phosphorus requirements for fruit trees are small. About 1 ¾ cup of phosphate fertilizer should be mixed with the planting soil when the tree is planted. Then every 3 to 4 years, add about 1 pound of phosphate to the soil around the root system of the tree. Work the phosphate into the top 1 inch of soil. Be careful to avoid excessive root damage. Citrus feeder roots are primarily within the top 6-8 inches of soil. Root injuries weaken the tree and may introduce root diseases. For best results, phosphorus should be applied to the soil and not the foliage.

21. How should trees be fertilized; how much fertilizer should be applied?

A. YOUNG TREES (2-3 YEARS): Two tablespoons of nitrogen spread under the tree prior to irrigation. Repeat 3-4 times each year. Double this amount the third year. About one gallon of good, composted manure can also be used in place of chemical fertilizer. Mix the manure with the soil under the tree. Remember that manure can be high in salts (see Q. 23).

B. MATURE TREES: One to 3 pounds of actual nitrogen/tree/year. Scatter over root area of tree (under tree and 1-2 feet outside the drip-line). Then water it into the soil. Annual applications of ½ inch of well composted manure in the trees drip-line may be used in place of commercial fertilizers.

General nitrogen (N) requirements for main citrus types:

Mandarins and oranges: 1-1.5 lb N/year
Grapefruit: 1-1.5 lb N/year
Lemons: 2-3 lb/year

To calculate the amount of nitrogen the first number in the parenthesis following the fertilizer name is the percent nitrogen in the fertilizer. For example, ammonium sulfate (21-0-0) has 21% N. Therefore, for every 5 lb of ammonium sulfate applied, the tree receives 1.05 lb of actual nitrogen.

Here is a list of fertilizer formulations and the amount needed:

5-10 lb. per tree of ammonium sulfate (21-0-0) = 1 to 2 lb. actual N
3-6 lb. of ammonium nitrate (33-0-0) = 1 to 2 lb. actual N
2-4 lb. urea (46-0-0) = 1 to 2 lb. actual N

22. There are a considerable number of small fruits dropping. Why?

This is frequently referred to as “June drop”. Young fruit (smaller than 1 inch in diameter) may drop in May, June and/or July. Some fruit drop is natural. Excessive drop may be due to drought stress, sudden high temperatures, low humidity, or nitrogen deficiency. Heavy pruning, thrips, mites, or spray injury can also cause fruit to drop. Keep trees in good health and well irrigated to minimize fruit drop. Fruit drop is a self-regulating mechanism in citrus trees. Too much fruit set will cause small fruit size. Additionally, excessive fruit set can also be damaging to trees (see Q. 8).

23. I applied manure to my citrus tree. A few days later the foliage turned yellow and a number of shoot tips died. What happened?

Manure can be high in salts. Salt can be damaging to the roots and can result in yellow leaves, leaves with the leaf margins that are necrotic (dead), or in shoot tip death. When manure is applied over the root system the salts are carried into the root zone with the water and cause injury to the tree. Irrigate the soil thoroughly to leach the salts out of the root zone. Use manure sparingly (see Q. 19). Manure that is not well composted may release ammonia that may cause direct injury to the roots. Always use well-composted manure and apply it the fall so that the salts can be leached by winter rains while the roots are less actively growing.

24. What is iron chlorosis of citrus and how can it be corrected?

Iron deficiency is rarely found in Riverside, San Bernardino or San Diego Counties, see Q. 26. Iron chlorosis is characterized by a yellowing of leaf tissues between the veins. The veins usually stay green except when the deficiency becomes severe, then the new leaves turn completely yellow and dieback may occur. Alkali and excess salinity contribute to iron deficiency. Iron deficient trees grow poorly and production suffers. Proper irrigation may promote more vigorous growth and therefore may be the best treatment (Q. 29). Rootstocks vary considerably in their ability to pick up iron. In the desert, trifoliate orange typically will have iron deficiency and therefore other rootstocks are better suited under these conditions. Zinc and manganese deficiencies are much more common and one deficiency may actually mask another. Therefore, the best course of action for backyard citrus is to treat for all micronutrients. (See also Q. 26.)

A. Use a micronutrient spray that contains iron, zinc, and manganese. Follow the directions for use on the label. Foliar nutrients are not taken up through the older leaves and therefore sprays must be applied to a new flush of leaves that are at two-thirds of their full size in spring and late summer.

B. There are several foliar sprays that contain iron that may be used to cure iron chlorosis. The addition of a wetting agent to the spray is helpful in promoting good coverage. Use caution with foliar sprays. Chelated iron is very acidic and can cause leaf burn. Several sprays of a dilute solution may be preferable to one at full label rate.

C. Chelated iron or sequestrene iron may be spread on the soil under the tree and cultivated or watered in. Desert soils tend to bind up iron, so results from this treatment are slow and may be poor.

25. My trees grow in a lawn. Do they get enough nitrogen when I fertilize the grass?

Probably not. The area under the tree should be fertilized more often than the lawn to ensure adequate nutrition for the tree. The grass uses most of the nitrogen applied. When leaves of the trees show a slight yellowing (paler green) they can be sprayed with one ounce (2 heaped tablespoons) of urea (46-0-0) or low biuret urea (formulated for foliar application) in one gallon of water. Do not exceed this amount or you may burn the foliage. Also do NOT spray urea during HOT weather. It is better not to grow citrus trees within a lawn area - it is difficult to irrigate and fertilize both adequately, and generally the tree will suffer (see Q. 11).

26. The leaves on my tree have green veins and are yellow between the green veins. Is this iron chlorosis?

The most common nutrient deficiencies in Southern California are zinc and manganese. Iron chlorosis is rarely a problem, especially in Western Riverside County (see Q. 24). Zinc deficiency causes “mottleleaf” or “little leaf” with small terminal leaves and yellow mottling between the large leaf veins. Dieback of twigs may occur in severe zinc deficiencies. Manganese deficiency is similar to zinc, however, the area between the veins is a pale green with darker veins. These deficiencies are easily corrected with a zinc/manganese spray to the foliage whenever there is a new leaf flush. For best absorption, apply when the new flush of leaves is at two-thirds of full expansion. There are several commercially available zinc/manganese combination fertilizer products that can be used to treat both zinc and manganese at the same time. Be sure to treat for zinc deficiency at least 6 weeks before or after any phosphate fertilizer is

applied. Zinc and phosphate cannot be absorbed by the plant at the same time and therefore, the zinc treatment will not be effective if the plant has been recently fertilized with phosphorus. Carefully read and follow label directions.

27. Why does the pulp of some citrus fruit dry out?

A. Developing and mature fruit are a source of water for the tree. Therefore, if the plant is water stressed, it may withdraw water from the fruit causing it to dry up (granulation). Keep trees adequately watered while the fruits are developing. Fairchild mandarin is very susceptible to granulation, particularly with the larger fruit sizes.

B. Frost injured fruit will dry out on the tree.

C. Fruit that is mature and allowed to hang on the tree into the summer will tend to dry out and get tough.

28. The limes on my tree have turned yellow. Are they really lemons?

Limes turn yellow when they are fully ripe (mature). There is nothing wrong with the fruit. Consumers expect limes to be green and thus they are picked green. All limes will turn yellow when ripe. They are still very good. Limes are best picked for that unique lime flavor when just a blush of yellow shows on the skin of the fruit.

29. How much water does my tree need per day?

Table 1. Riverside Area

Canopy Diameter (ft)	Average Irrigation Water Requirements** (Gallons/Day)											
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
18	12	12	17	23	28	32	37	37	32	23	15	9
16	12	12	16	21	27	31	36	36	31	21	15	9
14	11	11	15	19	23	27	31	31	27	19	12	8
12	9	9	12	16	20	24	27	27	24	16	11	7
10	8	8	11	13	17	20	23	23	20	13	9	7
8	5	5	8	11	12	15	17	17	15	11	7	4
6	5	5	7	9	11	13	15	15	13	9	5	4
4	4	4	5	7	8	9	11	11	4	7	4	3

**Assumed application efficiency of 75% with values based on long term average water use. Figures in Table 1 may be higher during hot and windy weather.

Table 2. Desert Area

Canopy Diameter (ft)	Average Irrigation Water Requirements** (Gallons/Day)											
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
20	16	27	36	51	63	74	74	61	54	36	22	13
18	15	26	34	49	61	71	71	59	52	34	21	13
16	14	24	31	45	55	64	64	53	47	31	19	11
14	12	20	26	38	47	55	55	45	40	26	16	10
12	9	16	21	31	38	44	44	36	32	21	13	8
10	7	12	16	23	28	33	33	27	24	16	10	6

**This table represents the average daily water requirements for citrus in the Riverside and San Diego County desert areas. Irrigation system emission uniformity is NOT included in these figures. These figures are intended to be used as a GUIDE and are based on average weather conditions.

30. The leaves have been gradually dropping from my tree, the leaves on the tree are yellow, the canopy is so thin I can see the sky through it and the leaves tend to be very small. What is going on?

Phytophthora spp. can cause a root rot. Phytophthora root rot causes a slow decline of the tree. The leaves turn a light green or yellow color and may drop, depending on the amount of infection. The fungus decays the roots making them unable to take up sufficient water and therefore causing water stress and nutrient deficiency symptoms. As the tree is wilting more water is often added causing the fungus to infect more roots. Roots infected by *Phytophthora* spp. are brown (healthy roots are light tan). The outer portion of the root sloughs off easily leaving the central portion (stele) of the root intact. When digging up the roots (top 6 inches of soil) of a tree infected with *Phytophthora* spp. it will be difficult to find roots. One indication of root health is to lightly scrape your fingernail along the root. On infected roots, the root cortex (outer covering) is easily separated from the stele (central core). Provide adequate soil drainage and avoid over-irrigating (see Q. 29). If destruction of feeder roots is minimal, corrective action may include irrigating more frequently with less water so that the soil does not become oversaturated. For other questions related to *Phytophthora* or gummosis caused by *Phytophthora* spp., see Q. 33.

31. Should soil accumulate around the trunk?

No. The base of the trunk should be exposed to the air and kept dry. If the trunk is allowed to stay wet, this predisposes the tree to a fungal disease, Phytophthora root rot and Phytophthora gummosis (see Q. 30, 33). These diseases may kill the tree. Rodent injury is also common to tree trunks where soil and refuse have accumulated. This may also predispose the tree to dry root rot. (See Q. 36).

32. Should irrigation water come in contact with the base of the trunk?

No. Water in direct contact with the base of the trunk may encourage root and trunk diseases (see Q. 30, 31, 33). One of the better methods of irrigating citrus is to use two microsprinklers with half-circle to three-quarter emitters. Make certain that the emitters are adjusted so that the trunk is kept dry. If microsprinklers are not an option, then dig an irrigation circle (doughnut or moat) 2-3 inches deep around the base of the tree, a few feet from the trunk, and water outside this ring but be sure not to expose or damage roots when making the basin.

33. The base of the trunk or lower limbs secretes clear gum. The bark dries upward, hardens and cracks. What is this and what can I do?

This may be gummosis, a fungal disease caused by *Phytophthora* spp. It can be controlled, if diagnosed early (before 50% of the circumference of the tree has a canker). Remove soil from base of trunk so the tissue can dry. Do not allow irrigation water to come in contact with the trunk (see Q. 32) and do not over-irrigate (see Q. 29). Be certain that the graft union (the point where the scion or cultivar is grafted onto the rootstock) is not in contact with the soil. The graft union can be identified by looking for a line around the trunk of the tree with a slight dogleg shape or bulge just below the line. The graft union should be several inches above the soil level. Most scions are very susceptible to gummosis and will quickly succumb to this disease if in direct contact with the soil. Apply Subdue®, Ridomil® or Aliette® to the lesion or canker. Another approach is to remove dead bark and/or paint the lesion area with Bordeaux paint. Garden stores may have a prepared Bordeaux mixture. If not, you may prepare Bordeaux mixture paint by mixing equal parts of copper sulfate and hydrated lime with enough water to make a slurry. Read and follow label directions carefully. Keep the trees growing as vigorously as possible with regular watering (do not over water). Also, proper fertilization will promote growth.

34. Some of the limbs on my tree are oozing copious amounts of sap and are declining. Small areas of bark dry up and flake off leaving wounds on the trunk and lower limbs. What causes this and can it be controlled?

One possible cause is Rio Grande Gummosis. The cause of this disease is unknown but is thought to be caused by a fungus (see Q.35). This disease is most common in Imperial and Coachella Valleys on grapefruit and lemon trees. It is often associated with pruning of large branches. To help control the disease, remove the dead bark, clean the wounds and paint the trunk and lower limbs with Bordeaux mixture (see recipe Q. 33). Use a paintbrush to apply the slurry to the cleaned wounds.

35. Some branches on my citrus tree dry up. When the bark is examined a black, sooty powder is seen. What causes this disorder?

The branches may have branch wilt. This is not common and is a disease caused by a fungus which usually attacks trees that are in poor health or are under some form of stress (drought, salt injury, poor nutrition). There is no chemical control. Infected limbs should be cut off and destroyed (burned). Trees should be fertilized and watered to maintain healthy, vigorous growth. If soil is high in salts, select tree species that are tolerant to salty conditions.

36. The bark on the trunk at or near the soil line dries out and cracks. The wood under the affected bark is stained grayish brown to purple. What is the problem?

The disease is "dry root rot", caused by the fungus *Fusarium solani*. Unlike Phytophthora gummosis, dry root rot does not produce gumming on the trunk and the lesion extends deep into the wood. The initial infection may occur at the time of planting or at any time during the life of the tree, however, aboveground symptoms may appear several years after the initial infection when the crown of the tree has been girdled. Once the crown is girdled, the tree collapses. The wood below the dead bark is dry, hard and stained grayish brown to purple. Infection occurs through injured tissue caused by gophers, *Phytophthora* spp., mechanical injury, or root burn (caused by a large overdose of fertilizers or herbicides). All common rootstocks are susceptible to dry root rot. To prevent dry root rot, keep base of trunk free of soil and dry. Control gophers. Keep trees adequately fertilized and in good vigor to suppress this disease.

37. Why are my fruit dropping just before harvest? The fruit appear normal from the outside but there is black rot extending from navel to the center of the fruit.

This is a fungus disease called *Alternaria* black rot. The fungus causes premature drop of nearly mature fruit, mainly Navels, but can occur in grapefruit and other citrus. The fungus enters through the navel in Navel oranges, or though the button in other varieties. It is wind-borne and tends to be a problem when the trees are stressed (i.e., during Santa Ana wind conditions). It occurs more frequently when warm rains follow severe winds. There is no control.

38. Why are my fruit splitting just before they are ripe?

Fruit splitting is most common on thin-peeled fruit such as Navel oranges. It generally occurs following stresses such as extreme hot weather combined with high winds or drought stress followed by heavy irrigation. In both cases, the tree becomes drought stressed and begins to withdraw water from the fruit. When the tree is irrigated the dehydrated fruit swell causing them to split. The best remedy is to irrigate evenly (Q. 29). When severe winds or high temperatures are anticipated irrigate before the weather change occurs. Following the hot winds irrigate lightly for a few days and then resume a normal irrigation schedule.

39. My orchard is on recently cleared land. The trees began growing well but have developed bark damage at the base with a white film under the bark and a distinct "rotting" odor. There are ants present at the base of the tree. Mushrooms grow from the ground in the grove after rain. What is happening?

This disease is called Oak root rot, or Armillaria root rot and is caused by the fungus, *Armillaria mellea* or the honey fungus. The fungus occurs naturally where oaks were native. When clearing the land, remove as much of the roots and debris from native vegetation as possible. Leave the land fallow for a year or more and then plant the trees. There is no control once the tree is infected. If the tree is infected with *Armillaria* do not replant with citrus.

40. What causes leaves to become yellow?

There are several causes. The most common cause is nitrogen deficiency (see Q. 21). Additionally, excessive watering leaches nitrogen fertilizer so that the tree is unable to take up the fertilizer. High lime content in the soil can cause iron, zinc, and manganese deficiency (see Q. 24, 26). Girdling of the trunk by rodents as well as Phytophthora root rot (Q. 31, 33). Sunburned leaves appear yellow. Sunburning of the leaves occurs when the tree is under irrigated, causing the leaves to cup, exposing the more sun sensitive lower leaf surface. Some grapefruit trees develop a yellow color in the early spring months (called spring or winter chlorosis), common in young 'Rio Red' grapefruit trees. Grapefruit trees with winter chlorosis will outgrow the problem. Star Ruby grapefruit have a yellow streaks in the leaves. This is a characteristic of the variety.

41. Why is the bark of the lower trunk missing?

Field mice or gophers may be the culprits. However, where trees are planted in a lawn, string trimmers (weed whackers) can beat the bark off of young trees and may kill them. Lawn mowers may also cause similar damage. Keep the area around young trees free from grass for at least one foot (preferably 4 feet) from the trunk to avoid these problems (see Q. 11, 33).

42. Why are wide areas of the trunk or limbs dried up and cracked? Furthermore, why has the bark became detached?

Frost and sunburn are common causes for this type of damage. Sunburn usually occurs on the south and southwest side of limbs and the trunk. Use whitewash to prevent damage (see Q. 5). Frozen plant parts will also dry, crack and have peeling bark. Navels, Temple tangors and lemons are very frost sensitive. See Q. 18, 48.

43. Which are the most common physiologic, disease, and insect problems?

- Leaf yellowing due to excessive soil salts or excessive irrigation (Q. 24, 26, 40).
- Dieback and leaf death due to frost or salt injury (Q. 12, 23, 30, 35, 40).
- Death of tree due to frost (i.e., Temple tangors and Navel oranges in some cases, Q. 8) and Phytophthora gummosis (Q. 30, 33).
- Iron and zinc chlorosis (Q. 24, 26, 40).
- Fruit drop and splitting due to irregular irrigation and hot weather (Q. 22, 38).
- Phytophthora root and trunk rot (Q. 30, 33).
- Rio Grande gummosis of grapefruit. Pruning cuts or damaged limbs ooze excess frothy gum (Q. 34).
- Leaf and fruit scars due to citrus thrips, mites (Q. 45, 46).
- Dry-rot trees suddenly die and when cut the wood is stained grayish brown to purple (Q. 36).
- Red scale (ask for circular 127, see Q. 44).
- Termites which enter through dead limbs and then damage live wood.

44. What should be applied to control red scale and when should it be applied?

Spray with Malathion® or Sevin® follow directions on the label. Apply sprays after bloom is completed or in July. Do not apply any sprays during bloom. Apply light grade 415 or 440 oil in August to September.

Biological control may be possible with the release of insects that are parasitize red scale. These parasites can be purchased from insectaries. The best parasite for red scale is *Aphytis melinus*.

45. How do I control mites and when?

Apply sulfur before trees bloom, usually mid to late February. 415 or 440 oil petroleum spray applied in August will also help suppress mites. Do not use vegetable oil.

46. The leaves on my tree are deformed, thick, and small. There are rings of scars on the fruit. What is causing this damage?

Thrips can severely damage citrus causing deformed leaves and scars on the fruit. Mandarins and oranges are most severely affected. Additionally, younger trees are more susceptible to damage and are more attractive to thrips. Organically acceptable methods of control are: Sabadilla (Veratran D), Ryania, or biological control with *Euseius tularensis* or *Anystis agilis*. Thrips do not hurt mature trees but can cause scarring on fruit. Scarred fruit are blemished yet edible.

47. How do I control snails?

Snails can cause severe damage to the trunk, fruit and foliage of a tree. In the desert, snails may be unsightly but generally do not harm the tree. A good snail management program relies on a combination of methods.

A. Use copper barriers such as copper flashing, screens, foil or paint. Copper reacts with the slime that the snail secretes, causing a flow of electricity that becomes the barrier to the snail.

B. Biological control with decollate snails is also very effective. Decollate snails are effective predators of juvenile snails, so that brown snail adults cannot be replaced as they die off. Once established, decollates will nearly eliminate the brown garden snail population in four to six years. Decollate snails are only legal to use in the eight Southern California counties. For effective control introduce decollates in as high a number as financially feasible. The best time to release decollates is when the temperatures are above 50 F°. Decollates will establish best in moist environments and can flourish if they have sufficient food in the form of leaf litter and fallen fruit.

48. Why is the bark on the trunk of my tree scaly and flaking off?

Psorosis is a graft transmissible disease, caused by a viroid (virus-like), most often found in old citrus plantings. It is transmitted in infected budwood or possibly with contaminated grafting tools. This disease generally occurs on trees planted before the University of California Riverside Citrus Clonal Protection Program was initiated to provide disease-free budwood (early 1960's). Infected trees, mostly orange and grapefruit, slowly decline. The trees gradually become unproductive. The most distinguishing field symptom is scaling and flaking of the bark on the trunk. Clear gumming may appear on the branches. Eventually main scaffold branches will die. Where an old tree shows symptoms, scrape away the infected bark area to stimulate the formation of wound callus, this results in temporary recovery. Eventually the tree becomes non-productive and should be removed. There is no cure for an infected tree.

49. All of a sudden my citrus tree dropped all its leaves and died. What caused this?

Most trees are not planted on susceptible rootstock, however, if your trees are grafted on a rootstock, such as sweet orange, it may have quick decline. Quick decline is caused by a virus, Citrus Tristeza virus, which can be fatal to citrus. The leaves curl up along the length of the midrib and take on a dull ashen color before suddenly falling to the ground. There is no known cure for Citrus Tristeza virus. This disease is not common because nurseries typically use resistant rootstocks. Other potential causes for sudden tree death are dry root rot (See Q. 36) and Phytophthora root rot (See Q. 30, 33). Also, some mandarins and mandarin hybrid crosses can die suddenly after a heavy fruit set (See Q. 8).

50. Any further questions?

Call the Master Gardener Program Hotline at (909)683-6491 – Monday through Friday, 9 to 12 noon.

IV. REFERENCES

Integrated Pest Management for Citrus, Second Edition. 1991. University of California Division of Agriculture and Natural Resources, Publication 3303. 144 pgs.

Walheim, Lance. 1996. Citrus – Complete guide to selecting and growing more than 100 varieties for California, Arizona, Texas, The Gulf Coast, Florida. Ironwood Press, Tucson, AZ. 112 pgs.

Useful UC websites:

UC Integrated Pest Management: http://www.ipm.ucdavis.edu

Alternative subtropical crops: http://ucceventura.xlrn.ucsb.edu/Avocado/AvoHome.htm

UC Citrus Clonal Protection Program: http://www.ccpp.ucr.edu

UCR Citrus Variety Collection: http://www.citrusvariety.ucr.edu

UC Pest Notes: http://www.ipm.ucdavis.edu/PMG/selectnewpest.home.html

UCR Entomology – Biocontrol: http://www.biocontrol.ucr.edu

UC Fruit & Nut Center: http://fruitsandnuts.ucdavis.edu

UC Postharvest Information: http://postharvest.ucdavis.edu

UC Small Farm Center: http://www.sfc.ucdavis.edu

UC Sustainable Ag Res. & Ed.: http://www.sarep.ucdavis.edu

UCR Botany & Plant Sciences: http://cnas.ucr.edu/~bps/homepage.htm

UCR Plant Pathology: http://cnas.ucr.edu/~ppath/plantpath.html

UC ANR catalog: http://anrcatalog.ucdavis.edu

UC Ag Economics Cost studies: http://coststudies.ucdavis.edu

UC Cooperative Extension – Riverside County: http://ceriverside.ucdavis.edu/

12/18/02 TS/pm

INDEX (referenced by page number)

University of California
Cooperative Extension Riverside County

Moreno Valley: 21150 Box Springs Road, Suite 202
Moreno Valley, CA 92557-8718
(909) 683-6491
Fax: (909) 788-2615

Indio: 82-675 Highway 111, Room 118
Indio, CA 92201-5635
(760) 863-8293
Fax: (760) 775-0600

Blythe: 290 Broadway
Blythe, CA 92225-1649
(760) 921-7884
Fax: (760) 921-7887