

# Grafting Citrus

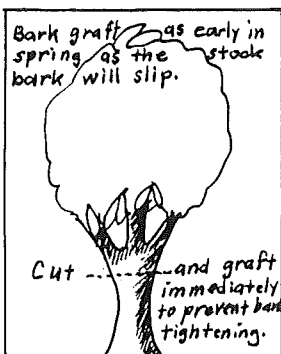
Information gathered by Florence Strange from talk given by Lemar Timmers to the CRFG in June, 1986 and from THE CITRUS INDUSTRY, Vol.III, edited by Walter Reuther U. of CA, 1973.

Graft citrus in March or April when cambium is active, causing bark to slip. Fall graft in September or early October.

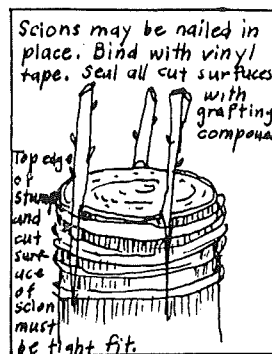
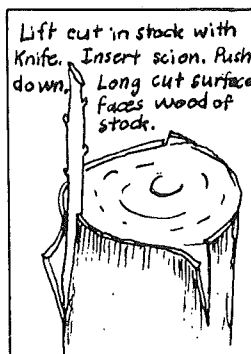
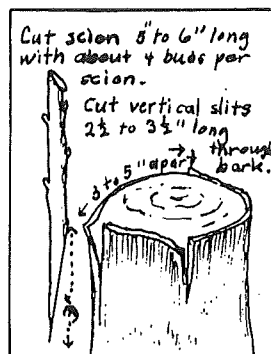
Take bud sticks in spring or summer before wood is 18 months old. Store in zip lock bag in refrigerator till ready to use. Most budwood is used within a few days after cutting. Select thornless budwood. Buds taken from high in the tree are more precocious.

Troyer and Carrizo citranges are the most used rootstocks for standard citrus for grafting oranges, grapefruit, Lisbon lemon mandarines and tangelos. Seedlings from sweet orange can be used for sweet orange. Trifoliolate root stock can be used for dwarf for all but Meyers lemon. Meyers lemon and Ponderosa lemon are naturally dwarfing. Flying dragon is the only true dwarf root stock.

## TOPWORKING - GRAFTING

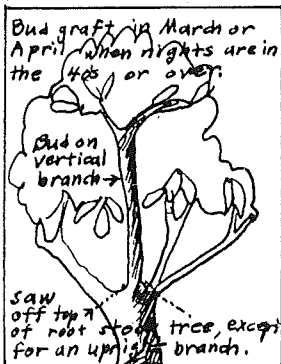


Bark graft for large old trees.

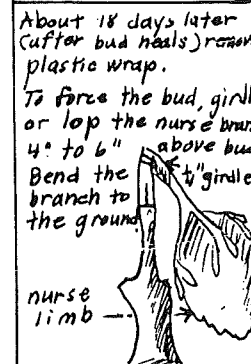
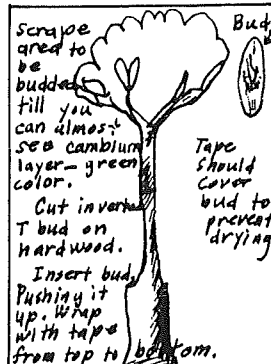


For sun and wind protection, paint over entire stump and scion with light thin latex paint.

## TOPWORKING - BUDDING



White wash the trunk.

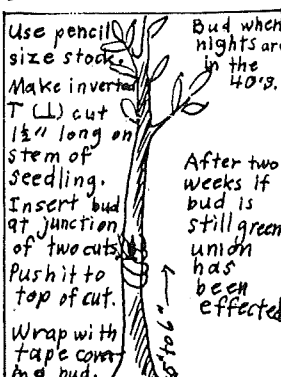


Fall buds are forced just before growth starts in spring.

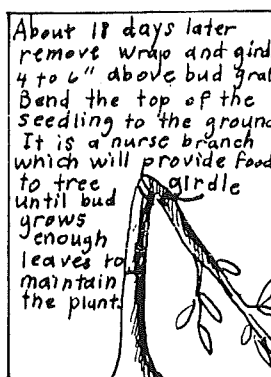


If bud has not produced a shoot within six weeks after girdling, force by cutting off top above bud.

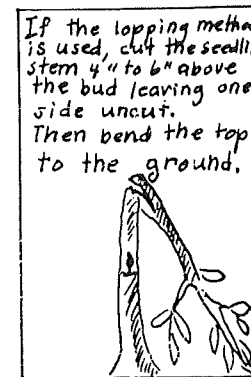
## BUDDING SEEDLINGS



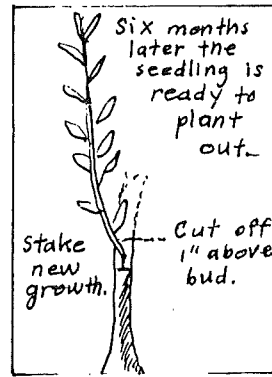
Begin wrap at point where you force bud gently against stock.



Girdle method For fall budding buds are wrapped for one month to six weeks.



Lopping method



# Growing Seasons Chart

These periods include desert, inland valleys and coastal citrus regions

## NAVELS

Parent Washington  
Robertson  
Cara Cara

## VALENCIAS

Olinda  
Seedless Valencia

## BLOOD ORANGES

Moro  
Sanguinelli  
Tarocco  
Sangre Double Fina

## SWEET ORANGES

Hamlin  
Pineapple  
Trovita

## TANGELOS AND TANGORS

Minneola  
Temple (Temple Orange)  
Ortanique

## MANDARINS

Clementine  
Dancy  
Fairchild  
Honey  
Fortune  
Page  
Pixie  
Satsuma

## LEMONS

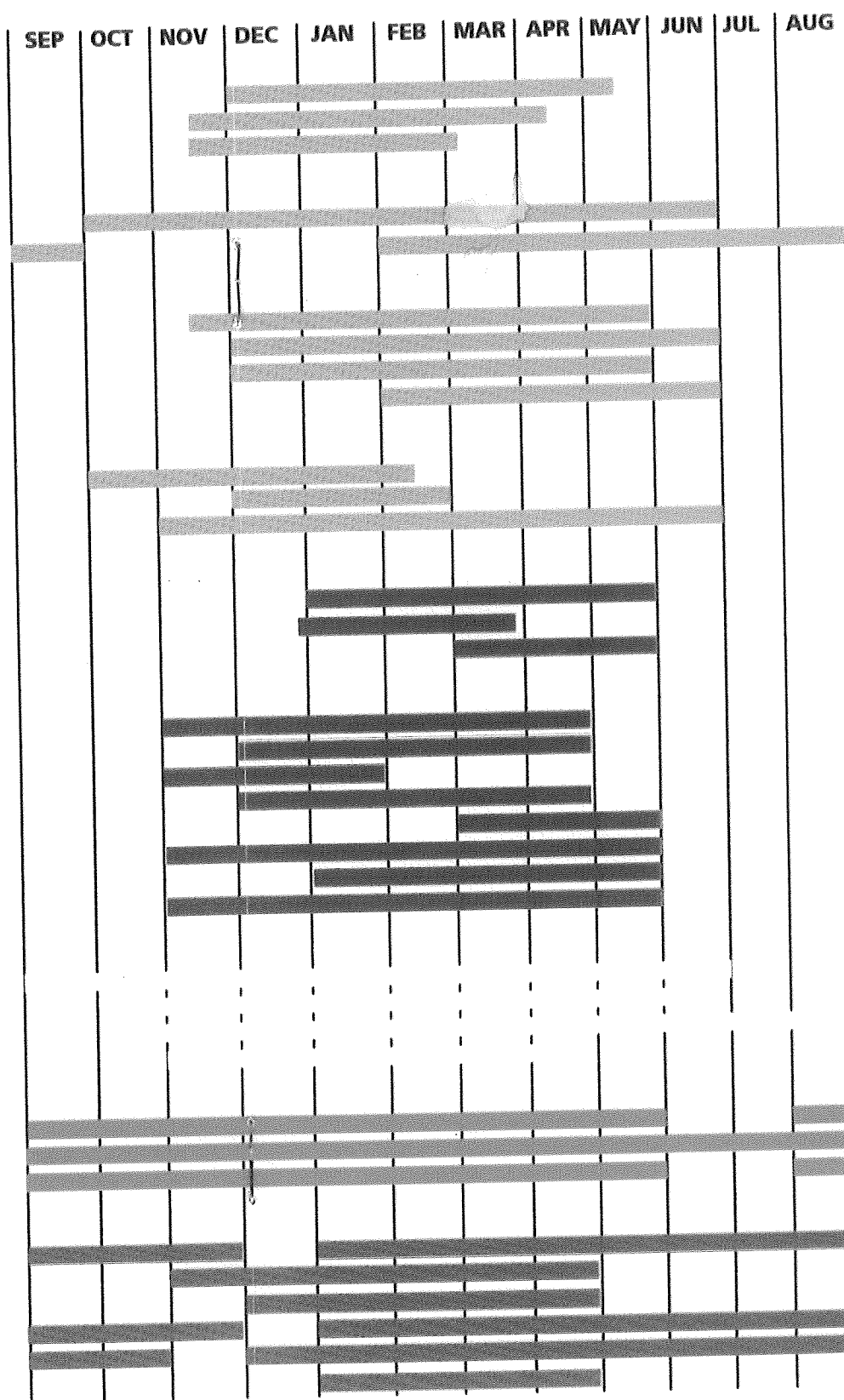
Eureka  
Lisbon  
Improved Meyer  
Variegated Pink Eureka

## LIMES

Bearss  
Mexican  
Indian Sweet

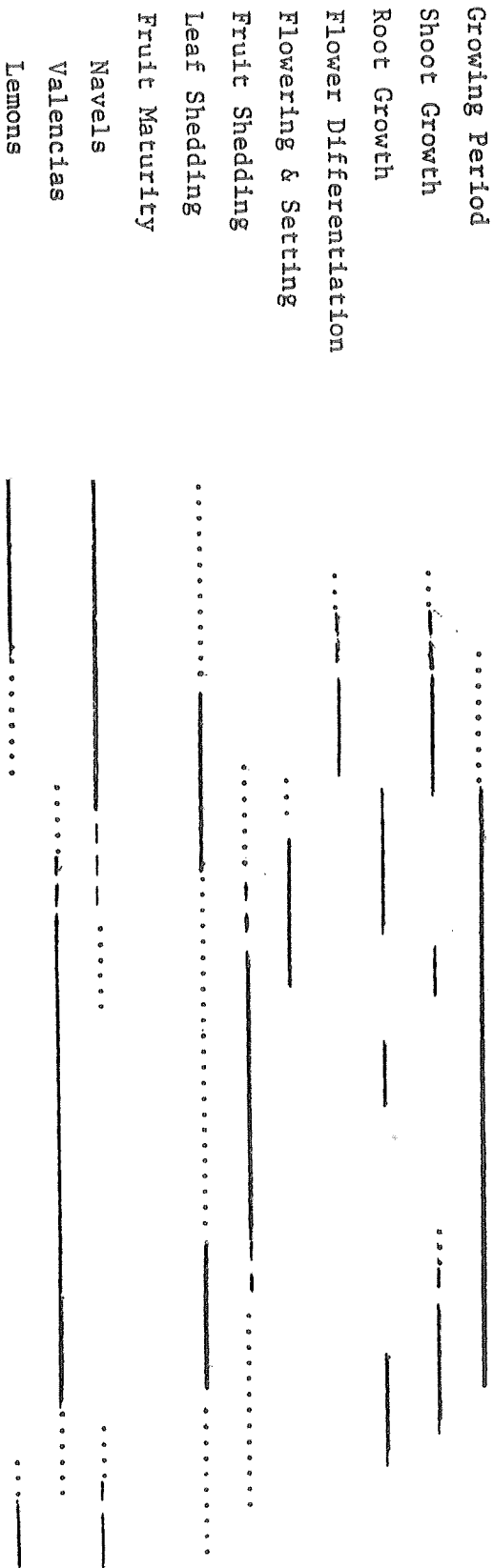
## GRAPEFRUITS

White Grapefruit  
Oroblanco  
Melogold  
Pink  
Red  
Orange Grapefruit Cocktail



The curves in the figures to the right describe the temperature in the Central San Joaquin Valley. The citrus plants have optimum growth between 70° and 85° F. Growth practically comes to a halt below 55° or over 95° F.

The chart below describes the calendar periods when certain activities take place in the plant. The solid lines represent main periods of activity, the dotted lines are periods of less activity.



## IF I COULD ONLY PLANT A FEW!

### Oranges

The navel orange dominates the winter into spring season. It's flavorful, easy to peel, and seedless. Choose good old Washington navel orange (still the gold standard) or for novelty, try Cara Cara navel orange, a mutated Washington navel orange that produces pink-fleshed fruit.

Reserve the Valencia orange for summer harvest and juice. You may not have a choice of variety, but Midnight and Delta are seedless selections that are becoming very popular.

You may want to try a blood orange for novelty. Both the flesh and juice are red, like a raspberry. Moro is the most common variety and most highly colored, but Tarocco has the best flavor.

### Mandarins (Tangerines)

Choose Seedless Kishu for very early season harvest. The golf ball size seedless fruits are tender, sweet and juicy. Very easy to peel; most everyone who tries it likes it.

Gold Nugget is my personal favorite. It matures in March and holds on the tree through the summer, if you can resist eating them all right away. It's seedless, easy to peel, with a rich, sweet flavor.

### Grapefruit

Oroblanco is a grapefruit-pummelo hybrid that usually ripens in late December. It's white-fleshed, seedless, mild and sweet. No sugar needed. This is the grapefruit for people who don't like grapefruit.

Star Ruby grapefruit is the reddest of the red grapefruit if you insist on a red grapefruit, but its flavor is no where near as sweet as Oroblanco.

Cocktail "Grapefruit" is not a grapefruit at all; it is a hybrid of Siamese Sweet pummelo and Frua mandarin. The large yellow fruits are wonderfully sweet and very juicy. Cocktail has lots of seeds, but it is my first choice for juice from December to March.

### Lemons and Limes

If you must have a lemon, choose the Variegated Pink-fleshed Eureka lemon, sometimes sold under the name 'Pink Lemonade'. It is pretty with its marbled leaves, striped fruit, and pink flesh. No, it won't make pink lemonade, but it is a perfectly fine lemon.

If your taste runs more to the exotics, perhaps the Meyer lemon is for you. Meyer lemon is really a hybrid of lemon and orange. The tree tends to be small and quite attractive in the garden. The fruit has a smooth, yellow-orange rind and a distinctive aroma. It is not a perfect substitute for a lemon, but many people prefer its milder, less acidic juice.

Bearss lime is the conventional lime you find in the supermarket. It's seedless and a little more-cold hardy than the Mexican (Key) lime. If you must have the Mexican lime, which is smaller, seedy, and more pungent in flavor, select the thornless Mexican lime. You won't be sorry; lime thorns are nasty.

CITRUS VARIETIES  
Ottillia J. Bier  
University of California Riverside  
Citrus Variety Collection

CULTIVAR	SEASON
<u>Oranges</u>	
Washington navel	Dec-Apr
Cara Cara Pink navel	Dec-Apr
Lane Late navel	Jan-May+
Valencia	Mar-Aug
Moro blood	Jan-Mar
Tarocco blood	Jan-Mar
<u>Mandarins and Hybrids</u>	
Seedless Kishu	Oct-Jan
Clementine	Jan-Mar
Owari Satsuma	Dec-Jan
Dancy	Feb-Mar
Honey (Murcott)	Jan-May
Minneola tangelo	Feb-Apr
Gold Nugget	Feb-Jul+
*Ortanique tangor	Feb-Aug+
<u>Grapefruit, Pummelos and Hybrids</u>	
Marsh grapefruit	Feb-Aug
Rio Red grapefruit	Feb-Aug
Star Ruby grapefruit	Feb-Aug
Oroblanco hybrid	Dec-May
Melogold hybrid	Dec-May
Chandler pummelo	Jan-May
Cocktail 'Grapefruit'	Dec-Apr
<u>Lemons</u>	
Eureka	all year
Lisbon	all year
Variegated Pink (Pink Lemonade)	all year
Meyer	all year
Ponderosa	all year
<u>Limes</u>	
Mexican	Jul-Dec
Bearss	Sept-Dec
*Sweet	all year
* <i>C. hystrix</i> (Kuffre lime)	all year (leaves only)
<u>Miscellaneous</u>	
Nagami kumquat	Nov-May
*Nordmann Seedless Nagami	Nov-May
Meiwa kumquat	Nov-May
*Indio mandarinquat	Nov-May
Fingered citron	all year
Calamondin	all year
*Tavares limequat	all year

\* Varieties not commonly found in area nurseries and garden centers

CITRUS BUDDING-the short story  
Ottillia J. Bier  
Citrus Variety Collection  
University of California, Riverside

How to  
Support  
the  
Collection

1. Select nice healthy budwood.
2. Select appropriate rootstock.
3. Sterilize your fingers and your knife.
4. Cut bark of rootstock to receive the buds.
5. Cut buds. Don't lose track of which end is up.
6. Insert the bud correct end up.
7. Wrap the bud tightly, either closed or open.
8. Put tree in a protected location. Give tree good care.
9. Wait 3-4 weeks for healing.
10. Remove the tape. Greed bud = success; brown bud = bud died.
11. If unsuccessful, rebud.
12. If successful, bend top of rootstock down to reduce apical dominance.
13. Keep all new growth from rootstock picked off.
14. When new bud is about 12 inches long, cut the rootstock  $\frac{1}{2}$  inch above the bud.
15. Stake new shoot to a bamboo stake to protect it from accidental breakage.
16. Tree is ready to plant when the scion has produced its second flush (branching).

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CITRUS PROPAGATION  
By: Ottillia J. Bier

Main methods of citrus propagation for the amateur grower:

- seed
- cuttings
- grafting

pencil-thickness rootstock is best (1 year old)  
bark must be slipping

Supplies:

- clean towel
- razor-sharp knife
- budding tape
- bleach
- plant tags

Sanitation:

- sterilize fingers and knife
- 1 part bleach to 9 parts water

Cut bark to receive the bud:

- make cut vertically
- make cut horizontally, 1/3 down
- loosen bark along cut with knife

Cut buds:

- hold knife almost parallel to the budstick
- cut sliver with bud about 1/2 to 1 inch long
- bud should be slightly above the middle of the sliver

Insert the bud:

- insert the bottom of the bud at the horizontal cut
- slide bud down into lower part of bark pocket
- lift top of bud pocket to accept top of bud
- be sure bud was inserted right side up

Wrap the bud:

- pull tape tightly to ensure good bud-rootstock contact
- bud may be wrapped exposed or covered

Healing:

- give tree good care
- if buds turn brown within 2 weeks, rebud
- after 4 weeks, buds are healed
- remove tape after 4 weeks

Aftercare:

- bend top of rootstock over to reduce apical dominance
- keep tree "suckered"
- when new bud is at least 12 inches long, cut top of rootstock off
- stake new shoot
- plant tree when tree has developed some bark

Topworking:

- changing over an existing tree to a different variety
- can be done by grafting or by budding
- budding gives a higher success rate

Multiple scions:

- can be done
- choose scions with similar growth rate and ultimate size
- usually requires routine pruning



# Four Winds Dwarf Citrus



## ORANGES

**Robertson Navel** - Best selling winter-ripening variety. Early and heavy bearing. Cultivar of Washington Navel.

**Washington Navel** - California's famous winter-ripening variety. Fruit ripens in ten months.

**Jaffa (Shamouti)** - Fabled orange from Middle East. Very few seeds. Spring to summer ripening. Good Flavor.

**Trovita** - Spring ripening. Good for coastal areas to desert. Few seeds, heavy producer, excellent flavor.

**Valencia** - Summer-ripening orange. Fifteen months to ripen. Grow your own orange juice.

**Seville** - Essential for authentic English marmalade. Used fresh or dried in Middle Eastern cooking.

**Moro** - Deep blood coloration, almost purple-red, even in California coastal areas. Very productive, early maturity, distinctive aroma, exotic berry-like flavor.

**Sanquinella** - A deep blood red juice and rind. Tart, spicy flavor. Stores well on tree.

## MANDARIN ORANGES

**Dancy** - The best-known Mandarin type. On fruit stands at Christmas time.

**Owari Satsuma** - Hardest of all mandarins. Ripens in November, December. Seedless.

**Clementine (Algerian)** - From North Africa. Ripens about a month after Satsuma.

**Fremont** - Bright reddish-orange. Flavor rich and sprightly. Tender and juicy. Heavy bearing winter ripening.

**Kara** - Hybrid. Fruit larger than Satsuma parent. March-June. Juicy, sprightly flavor. Rich color.

**Kinnow** - Spring-ripened fruit lasts for months. Beautiful willow-like foliage.

**Murcott** - In Florida called Honey. Flesh orange colored. Tender, very juicy, rich tangerine flavor. Spring ripening.

## LEMONS

**Eureka** - Produces large crops of best "Sunkist" quality. Easy to espalier.

**Lisbon** - Fruit quite similar to Eureka. Thornier, dense foliage. Ample year-round crop. Good inland.

**Improved Meyer Lemon** - California state tested, virus-free clone. Not as tart as Eureka. Prolific bearer. Much mid-winter fruit.

**Ponderosa** - Real lemon flavor. Impress your friends and neighbors with gigantic, aromatic fruit, flowers and tropical foliage.

## GRAPEFRUIT

**Oro Blanco** - Produces sweet fruit even in areas of low summer heat. Huge, intensely fragrant flowers.

**Marsh Seedless** - Best in hot areas. An especially beautiful tree. Good espalier type.

**Rio Red** - Popular red-fleshed sport recently introduced from Texas. Needs summer heat.

**Star Ruby** - Reddest of all Texas varieties. Foliage may bleach in winter. Needs summer heat.

## LIMES

**Bearss Seedless** - True lime of Tahiti type. Fruit larger than Mexican lime. Good in cool areas. Year round.

**Mexican** - (Key lime) Small, sometimes seedy fruit with genuine tropical flavor year-round. Frost sensitive.

**Rangpur** - Not a lime (a sour Mandarin). Dwarf if on Four Winds True Dwarf rootstock. Orange colored fruit at Christmas.

## TANGELOS / KUMQUATS

**Minneola** - Deep reddish-orange colored fruit in winter. Leave fruit on tree for rich tangerine-like flavor in late spring through summer.

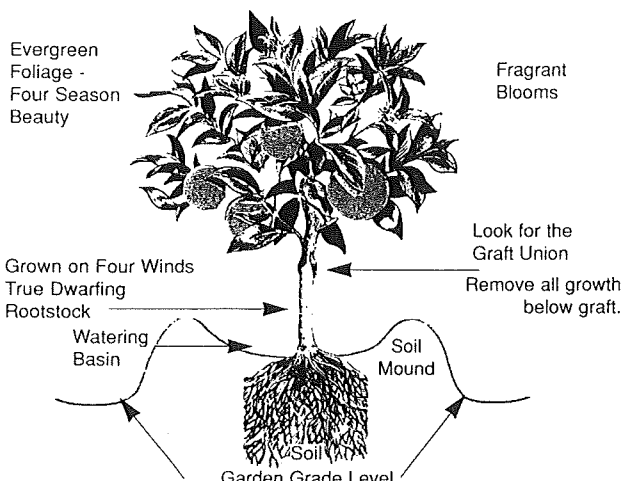
**Nagami Kumquat** - Olive size and shape, bright orange fruit, fruits best in warmer areas. Late spring ripening.

**Meiwa** - Sweet round fruit, prized flesh. Candied or in marmalade. Grows best in hotter locations.

**Eustis Limequat** - A Lime X Kumquat hybrid. Year round. Prolific bearing, most areas. Erratic branching.

**Calamondin** - (Kalamansi; Philippine lime) Prolific fruit production. Zesty acid juice. Handsome compact habit.

## FOUR WINDS TRUE DWARF CITRUS



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# HOW TO GROW

*Plant Anytime*  
*We offer more than 31 varieties so*  
*you can enjoy your own fresh*  
*citrus fruit year-round.*



## WHAT ARE FOUR WINDS DWARF CITRUS?

They are orchard-proven fruit-producing varieties, grafted on cultivar specific dwarfing rootstocks. Grown in the ground, they create a highly productive tree averaging eight feet tall depending on variety. They will be smaller grown in a container.

## PLANTING LOCATION

A sunny, wind-free, southern exposure is best. Allow room for the tree's ultimate size. It is best to avoid lawns which receive frequent shallow waterings. Microclimates are created by reflected heat from houses or walkways, providing heat for frost protection or summer growth if needed in your area.

## GOOD DRAINAGE IS THE KEY

Check the drainage by digging a hole 30" deep and filling with water to saturate the soil. The next day refill the hole with water. Drainage is OK if water drops 2" in two hours. If drainage is poor, plant in a raised bed or container.

## PLANTING IN THE GROUND

Plant rootball high so that when finished it will be slightly above garden grade. First(upper) roots may be visible. Stake may be needed. Provide a generous watering basin. Do not allow soil or mulch to fill in to cover the trunk. Fill the basin slowly and let it soak in. Water (thoroughly), weekly, more or less depending on your soil and climate conditions. **KEEP THE SOIL MOIST.**

## PLANTING IN A CONTAINER

Use a light , well-drained mix. Be sure there are numerous drainage holes. Upper roots may be exposed. Water thoroughly, then fertilize after a week or two. Water weekly or more often if necessary in the summer months. **DON'T LET THE TREE DRY OUT.**

## FERTILIZING

Citrus are **HEAVY** feeders. It is best to use a balanced fertilizer which contains nitrogen, potassium and phosphorus (18-6-6 ratio) with trace minerals such as iron, zinc, and manganese. Fertilize following label instructions. **WE FERTILIZE LIGHTLY ALL YEAR.** Yellowing leaves are usually an indication of lack of fertilizer or poor drainage. **FOLIAR FEEDING** of trace minerals is effective on maturing flushes of growth.

## SUCKERING

Know where the **GRAFT** is on your tree. Remove all growth below the graft. Suckers take vitality from the top of your tree. They are generally very vigorous and some varieties are thorny, some have a different shape leaf than the scion (top stock).

## PRUNING

Trees may be pruned to any desired shape. They will look fuller with occasional pruning to shape leggy branches. Pinching back tips of new growth will help trees to round out. Some trees may develop erratic juvenile growth above the graft. If so, cut it back. Pruning can be done any time of year except the winter.

## FROST PROTECTION

The age, location, variety and condition of the tree, degree and duration of cold determine frost damage. Healthy, well-fertilized trees can tolerate brief dips into the upper twenties. Limes and lemons are more sensitive to cold than mandarins, kumquats, and oranges. Anti-transpirant sprays give a few degrees of protection. Christmas lights and or drop cloths will add warmth for unusually cold nights.

## CITRUS FERTILIZER PROGRAM

It is best to use a **slow release** balanced fertilizer ( 18-6-12) that contains trace elements such as iron, zinc and manganese. I use a good lawn fertilizer that has the word **links** or **osmocote** as these are two slow release fertilizers that are dependable and should not burn any of your plant's roots if applied to healthy plants that have been watered the day before to insure that the plant is not stressed from the lack of water.

**Fertilizer and Prune using the following holidays as a guide:**

**Valentine's Day**  
**Memorial Day**  
**Fourth of July**  
**Labor Day**

Usually a healthy citrus plant will need about one pound of nitrogen per inch of diameter trunk measured at 4 feet above the ground level. Apply ¼ of the amount required at each of the dates shown above. Remember that the nitrogen level in the stem of the plant determines the amount of flowers that are retained as fruit.

Lightly prune the plant as needed on the dates shown above. Remember that the new wood must be from 3 to 6 months old in order for the flowers to form on the stem. Do not cut all this aged wood from the plant prior to the flowering period.

### Recommended Fertilizer Rates for Mature Citrus Trees Planted in the Landscape

Element Needed	Fertilizer	Amount/ Tree	When to Apply	Comments
Nitrogen	Ammonium sulfate (21-0-0)	5 lbs	½ in January, February, and March	Mature tree needs 1½ lbs elemental nitrogen per year.
	Ammonium nitrate (34-0-0)	4 lbs		
	16-16-16	6 lbs		
	Special purpose fertilizers ("Citrus Food," etc.)	As per label		May contain other elements.
	Animal Manures Poultry or rabbit Steer or cow	30-50 lbs 60-100 lbs	Fall or early winter	Spread uniformly within drip line; work into soil.
Zinc	Zinc sulfate (36% zinc)	1 oz/gal H <sub>2</sub> O (plus 1 oz washing soda or ½ oz hydrated lime)	Late winter or early spring	Foliar sprays
	Zinc oxide	1 oz/gal water		
Iron	Iron chelates (Sequestrene 138-Iron)	¼-½ lb	Spring	Rake material into soil around tree; irrigate immediately.

## Chart I: Rootstock-Scion Combinations

(C = Compatible I = Incompatible U = Uncertain because observed less than 10 years — = No information)							
Rootstock	Kumquat	Navel orange	Valencia orange	Grapefruit	Mandarin <sup>1</sup>	Lisbon <sup>2</sup> lemon	Eureka <sup>2</sup> lemon
<b>Lemon types</b>							
Macrophylla	—	—	C	C	—	I <sup>3</sup>	I <sup>3</sup>
Rough lemon	—	C	C	C	C	C	I
Volkameriana <sup>4</sup>	—	U	C	C	U <sup>5</sup>	C	C
Yuma ponderosa <sup>4</sup>	—	U	C	—	U	C	C
<b>Mandarin types</b>							
Cleopatra mandarin <sup>6</sup>	—	C	C	C	C	I	I
Rangpur <sup>4</sup>	—	C	C	C	U	C	C
<b>Orange types</b>							
Taiwanica	—	U	C	C	U	— <sup>7</sup>	— <sup>7</sup>
Sour orange	I <sup>8</sup>	C	C	C	C	C	I
Sweet orange	—	C	C	C	C	C	C
Trifoliate orange	C <sup>9</sup>	C <sup>10</sup>	C	C	C <sup>11</sup>	C	I
<b>Trifoliate hybrids</b>							
C-35 citrange	—	C	C	U	C	C	—
C-32 citrange	—	C	C	U	C	C	—
Carrizo citrange	—	C	C	C	C <sup>11</sup>	C	I
Troyer citrange	—	C	C	C	C <sup>11</sup>	C	I
Swingle	—	C	C	C	U	C	I

<sup>1</sup>Compatibility of mandarins varies with cultivar. <sup>2</sup>See Chart II. <sup>3</sup>Rootstock necrosis often develops. <sup>4</sup>Information presented is based on limited observations. <sup>5</sup>With Satsumas this combination develops a bud union overgrowth. <sup>6</sup>Especially good for cultivars with larger fruit sizes; Temple, Nova, Murcott, Orlando tangelo, and grapefruit. <sup>7</sup>Bud unions weak, often break. <sup>8</sup>Slow-growing, unhealthy-looking combination. <sup>9</sup>Good production with this combination. <sup>10</sup>With some scions, particularly Frost nucellar navel, trifoliates decline after 20 years due to bud union abnormalities. Rich 16-6, an experimental trifoliate, does not display this decline. <sup>11</sup>Sometimes a short-lived combination.

## Chart II: Lemon Compatibility Status

(C = Compatible <sup>1</sup> I = Incompatible <sup>2</sup> U = Uncertain because observed less than 10 years — = No information)					
Rootstock	Eurekas, all	Limoneira 8A	Monroe	Prior	Strong
<b>Lemon types</b>					
Macrophylla (Alemow)	I (5-12)	I (16-21)	I (15)	—	I (15)
Rough lemon	I (11)	C (20)	—	—	—
Volkameriana	—	C (20)	—	—	—
Yuma ponderosa	C (20)	C (20)	C (20)	C (20)	C (20)
<b>Mandarin types</b>					
Rangpur	—	C (20)	—	—	—
<b>Orange types</b>					
Taiwanica	—	—	—	—	—
Sour orange	I (12-15)	C (20)	I (12-15) <sup>3</sup>	C (20)	C (20)
Sweet orange	C (20)	C (20)	C (20)	C (20)	C (20)
Trifoliate orange	I (4)	C (20)	—	—	C (20)
<b>Trifoliate hybrids</b>					
Troyer citrange	I (2-8)	C (20)	C (20)	C (20)	—
Swingle	—	C <sup>4</sup>	—	—	—

SOURCE: Schneider and Sakovich 1984, and additional information.

<sup>1</sup>"C (20)" is used to indicate freedom from necrotic tissue at the bud union of trees more than 20 years old.

<sup>2</sup>Following "I" the numbers indicate the age in years when delayed incompatibilities were first observed.

<sup>3</sup>Trees affected were on Seville bitter orange in the 1940 strain plot at Riverside, CRC project 1134 (1951-1954). However, 25-year-old Ledig and Monroe Lisbons on Bradbury sour oranges at Limoneira appeared to be free of sour orange rootstock necrosis.

<sup>4</sup>The oldest trees sampled were less than 20 years old.

# Chart III: Disease, Virus, and Nematode Susceptibility

Rootstock	Phytophthora <sup>1</sup>			Citrus nematode <sup>2</sup>	Controlled by budwood certification			
	Root rot	Gummosis	Armillaria		Tristeza <sup>3</sup>	Exocortis	Cachexia	Woody gall
Lemon types								
<u>Macrophylla</u>	tolerant <sup>4</sup>	tolerant	susceptible	susceptible	susceptible	tolerant	susceptible	tolerant
Rough lemon	susceptible <sup>5</sup>	susceptible	susceptible	susceptible	tolerant	(?) <sup>6</sup>	tolerant	(?)
Volkameriana	susceptible	susceptible	— <sup>7</sup>	—	tolerant	tolerant	—	susceptible
Yuma ponderosa	tolerant	susceptible	—	susceptible	tolerant	—	—	—
Mandarin types								
Cleopatra mandarin	susceptible	susceptible	—	susceptible	tolerant	tolerant	(?)	tolerant
Rangpur	susceptible	susceptible	susceptible	susceptible	tolerant	susceptible	susceptible	—
Orange types								
Taiwanica	susceptible	tolerant	tolerant	susceptible	susceptible	tolerant	—	—
Sour orange	intermediate	tolerant	susceptible	susceptible	susceptible	tolerant	tolerant	tolerant
Sweet orange	susceptible	susceptible	—	susceptible	tolerant	tolerant	tolerant	tolerant
Trifoliate orange	tolerant	tolerant	—	tolerant	tolerant	susceptible	tolerant	—
Trifoliate hybrids								
C-35 citrange	tolerant	tolerant	—	tolerant	tolerant	—	—	—
C-32 citrange	tolerant	tolerant	—	susceptible	tolerant	—	—	—
Carrizo citrange	intermediate	tolerant	susceptible	susceptible	tolerant	tolerant <sup>4</sup>	tolerant	tolerant
<u>Troyer citrange</u>	intermediate	tolerant	susceptible	susceptible	tolerant	tolerant <sup>4</sup>	tolerant	tolerant
Swingle	tolerant	tolerant	—	tolerant	tolerant	tolerant	tolerant	—

<sup>1</sup>Root rot and gummosis are caused by both *Phytophthora citrophthora* and *P. parasitica*. Root rot is caused by *P. parasitica* in summer and *P. citrophthora* in winter. Susceptibility to the two pathogens varies among rootstocks but within a rootstock responses are similar. <sup>2</sup>(*Tylenchulus semipenetrans*) Biotypes 1,2,3 (McCarty et al. 1979).

<sup>3</sup>Widespread and naturally transmitted in southern California, consequently not controlled by budwood there.

<sup>4</sup>Produces some dwarfing but no cracking or scaling.

<sup>5</sup>Variation among cultivars.

<sup>6</sup>Contradictory evidence.

<sup>7</sup>No information available.

## Chart IV: Responses of Rootstocks to Soil and Climate

(good = best performance    acceptable = intermediate    poor or unsatisfactory = noneconomic performance    — = no information)

Rootstock	Soil factors							Climate
	Chlorides <sup>1</sup>	Boron	Calcareous soils	Poor drainage	Sand	Loam	Clay	Cold hardness
<b>Lemon types</b>								
<u>Macrophylla</u>	acceptable	good	acceptable	(?) <sup>2</sup>	good	acceptable	unsatisfactory	poor
Rough lemon	acceptable	acceptable	(?)	unsatisfactory	good	acceptable	unsatisfactory	unsatisfactory
Volkameriana	acceptable	—	—	—	good	acceptable	—	(?)
Yuma ponderosa	—	—	—	poor	—	acceptable	—	—
<b>Mandarin types</b>								
Cleopatra mandarin	good	(?)	good	unsatisfactory	(?)	acceptable	acceptable	good
Rangpur	good	acceptable	good	—	acceptable	acceptable	acceptable	(?)
<b>Orange types</b>								
Taiwanica	acceptable	acceptable	acceptable	—	acceptable	acceptable	acceptable	acceptable
Sour orange	acceptable	acceptable	acceptable	acceptable	unsatisfactory <sup>3</sup>	acceptable	acceptable	good
Sweet orange	(?)	acceptable	poor	unsatisfactory	acceptable	acceptable	acceptable <sup>4</sup>	acceptable
Trifoliate orange	poor	unsatisfactory	poor	acceptable	unsatisfactory	acceptable	good	good
<b>Trifoliate hybrids</b>								
C-35 citrange	—	—	—	—	—	—	—	—
C-32 citrange	—	—	—	—	—	—	—	—
Carrizo citrange	unsatisfactory	acceptable	unsatisfactory	unsatisfactory	acceptable	acceptable	acceptable	acceptable <sup>5</sup>
<u>Troyer citrange</u>	unsatisfactory	acceptable	unsatisfactory	unsatisfactory	acceptable	acceptable	acceptable	acceptable <sup>5</sup>
Swingle	acceptable	acceptable	unsatisfactory	—	acceptable	acceptable	unsatisfactory	good

<sup>1</sup>In soil or irrigation water.

<sup>2</sup>Conflicting evidence; extremes of performance have been observed.

<sup>3</sup>Poor fruit production.

<sup>4</sup>Sweet orange grows well on clay but overirrigation can render it susceptible to phytophthora.

<sup>5</sup>Troyer and Carrizo are cold hardy during cold weather but can easily be stimulated to flush by periods of warm weather.

## Chart V: Effects of Rootstocks on Horticultural Traits

(High, medium, and low, or large, medium, and small = relative rankings  
— = no information)

Rootstock	Tree characteristics			Fruit quality					
	Tree vigor	Tree size	Drought tolerance	Peel	TSS	Acid	Juice %	Fruit size	Yield
<b>Lemon types</b>									
<u>Macrophylla</u>	high	med	—	coarse/ thick	low	low	low	large	high <sup>1</sup>
Rough lemon	high	med	high	coarse/ thick	low	low	low	large	high
Volkameriana	high	med/ large	low <sup>2</sup>	coarse/ thick	low	low	low	large	high
Yuma ponderosa	high	large <sup>2</sup>	—	coarse/ thick	low	low	low	large	high
<b>Mandarin types</b>									
Cleopatra mandarin	med	large	med/ low	med	med	high	high	small	med <sup>3</sup>
Rangpur	var <sup>4</sup>	var <sup>4</sup>	high	med	low/ med	low/ med	low/ med	med	high <sup>1</sup>
<b>Orange types</b>									
Taiwanica	med	med	—	—	low	low	low	med	low
Sour orange	med	med	high	smooth, thin	high <sup>5</sup>	high <sup>5</sup>	high <sup>5</sup>	med <sup>6</sup>	med
Sweet orange	med	large	low <sup>7</sup>	—	high	high	high	med/ small	med/ high
Trifoliate orange	low	var <sup>4,8</sup> med/ small	low <sup>7</sup>	smooth, thin	high <sup>5</sup>	high <sup>5</sup>	high <sup>5</sup>	small/ med	med
<b>Trifoliate hybrids</b>									
C-35	low	small <sup>9</sup>	—	med	high	high	high	med	med
C-32	high <sup>10</sup>	large	—	med	high	high	high	med	high
Carrizo citrange	med <sup>11</sup>	med	med	med <sup>12</sup>	high	high	high	med	med
<u>Troyer citrange</u>	med	med	med	med <sup>12</sup>	high <sup>13</sup>	high	high	med	med
Swingle	low	small <sup>9</sup>	high	med <sup>12</sup>	high <sup>14</sup>	high <sup>14</sup>	high <sup>14</sup>	med	med <sup>14</sup>

<sup>1</sup>Particularly in early years.

<sup>2</sup>Evaluation based on limited or preliminary data.

<sup>3</sup>Slow to begin bearing.

<sup>4</sup>Conflicting reports; characteristic may depend on scion and location.

<sup>5</sup>Good rootstock for cultivars of low internal quality.

<sup>6</sup>Not suggested for small-fruited cultivars; sour orange accentuates this characteristic.

<sup>7</sup>Sweet orange and trifoliate are particularly drought sensitive on sandy soils.

<sup>8</sup>Varies with soil.

<sup>9</sup>Varies with scion.

<sup>10</sup>Higher vigor than Troyer.

<sup>11</sup>Under some conditions (Florida) displays higher vigor and bears earlier than Troyer.

<sup>12</sup>This rootstock exacerbates creasing with a sweet orange scion.

<sup>13</sup>Troyer can produce acid fruit in cool areas.

<sup>14</sup>In arid climates, produces better yields and higher quality of "Redblush" grapefruit and "Orlando" tangelo than most rootstocks, including sour orange.

# Recommended Citrus Varieties for the Northern California Coast

## Oranges

**TROVITA**—This excellent juice orange is also referred to as "Arizona Sweets". Medium sized fruit is orange color and nearly seedless. The taste is pleasantly sweet and juicy. Medium-Large tree is moderately vigorous, productive and cold hardy. *Harvest Season: February to June*

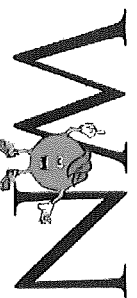
**VALENCIA**—This standard juice orange is the most widely planted orange in the world. Medium size fruit is orange in color and nearly seedless. Fruit is sweet and juicy. Often called the "Summer Orange". *Harvest Season: April to October*

**WASHINGTON NAVEL**—This important variety was introduced into California from Brazil in 1873. The standard eating orange is seedless and easy to peel and separate. Large fruit has deep orange color and rich, sweet flavor. Medium-Large tree with round shape and attractive dark green foliage. *Harvest Season: January to May*

**MORO BLOOD ORANGE**—This Italian variety is the earliest ripening blood orange. Medium size fruit has reddish-orange rind and deep burgundy flesh. Juicy fruit has rich orange-raspberry flavor, a distinctive aroma and few seeds. Medium size tree produces fruit in clusters. An attractive ornamental. *Harvest Season: February to May*

**SANGUINELLI BLOOD ORANGE**—This mid-season variety is the most popular in blood orange in Spain. Small-medium oblong shaped fruit is blushed deep red and has juicy, red streaked flesh. Fruit has distinctive flavor with raspberry overtones and contain few seeds. Small-Medium size tree active and productive. *Harvest Season: April to June*

**TAROCCO BLOOD ORANGE**—This mid-season variety is very popular in Italy. Medium-Large fruit has orange exterior with red blush and deep orange to red flesh. Internal color varies with climate. Juicy fruit has sweet distinctive flavor and few seeds. Medium size tree with open growth makes ideal espalier. *Harvest Season: March to May*



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# Recommended Citrus Varieties for the Northern California Coast

## Mandarins

**CLEMENTINE**—This early-season variety, from the Mediterranean region, is also known as "Algerian Tangerine". Small-Medium size fruit is deep orange-red in color and easy to peel. Juicy fruit has rich, sweet flavor and few seeds. Fruit holds on to tree very well. attractive medium size tree with dense foliage. *Harvest Season: January to mid-April*

**DANCY**—This mid-season mandarin variety, popular in Florida, is known as the traditional Christmas tangerine. Small-Medium size fruit is bright red-orange in color and easy to peel. Moderately juicy fruit has rich, tart flavor and many seeds. Medium-Large upright tree with erect branches makes good espalier. *Harvest Season: February to mid-April*

**HONEY**—This is a sweet-tasting mandarin grown primarily in California. This variety is small sized with yellow-orange rind. Very sweet and juicy and has many seeds. Peels very easily and holds well on tree. Medium-Large; spreading tree with good vigor. Highly productive. *Harvest Season: February to April*

**KINNOW**—This late-ripening variety with sweet, aromatic flavor. Selected in California, resulting from a cross of Mediterranean and King mandarins. Attractive tree with compact, weeping habit. Medium size with a smooth, orange rind. Sweet, aromatic, juicy and peels easily. Has many seeds and holds well on tree. *Harvest Season: February to April*

**W. MURCOTT**—This is the Honey tangerine of Florida, although it is thought to be a mandarin-orange hybrid. Medium size with a thin, bright orange rind. Rich flavor with many seeds. Fairly easy to peel and holds on tree very well. Bears heavily in alternate years. Medium size, upright tree. *Harvest Season: March to May*

**NOVA**—This variety is an excellent, rich flavored, selected in Florida from a cross of Clementine mandarin with Orlando Tangelo. Medium-Large fruit with deep orange-red color. Rich, aromatic flavor and very juicy. Fairly easy to peel seedless if grown without cross-pollination. Medium size tree and thorny. *Harvest Season: January to February*

**PAGE**—This variety is a wonderfully rich and flavored. This fruit is extremely small to medium size with orange-red color. Often seedless and peels fairly easy. Excellent for juicing and holds well on tree. Medium-Large tree with full, round head and few thorns. Highly ornamental with much of the fruit visible. *Harvest Season: February to May*



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# Recommended Citrus Varieties for the Northern California Coast

## Mandarins (continued)

**PIXIE**—This late-season variety, a hybrid developed in California, is gaining popularity in home garden and fruit stands. Small-Medium size fruit is yellow-orange color, seedless and easy to peel. Moderately juicy fruit has mild and pleasant flavor. Medium-Large erect tree with open dark green foliage. *Harvest Season: March to May*

**SATSUMA**—The ease of peeling, hardness, early ripening and seedless fruit make Satsumas one of the most popular mandarins. Small, bright orange fruit, often with bumpy rind. Mildly sweet, sprightly flavor and seedless. Easy to peel, puffs and dries out quickly if left on tree too long. Slow-growing, spreading tree. Extremely hardy. *Harvest Season: December to April*

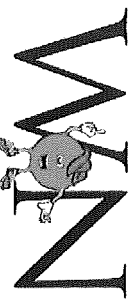
## Lemons

**EUREKA**—This standard market variety originated in California and is known more as a coastal lemon. Medium oblong shaped fruit is yellow in color and nearly seedless. Juicy fruit has highly acidic flavor. Fruit ripens throughout the year but mainly during Winter and Spring. Large, vigorous, open tree has few thorns. *Harvest Season: Year round*

**LISBON**—This standard market variety originated in Portugal and is known more as the desert lemon. Medium oblong shaped fruit has yellow rind color and few seeds. Juicy fruit has tangy, tart flavor. Fruit ripens throughout the year but mainly during Winter and Spring. Large, vigorous, upright tree is cold and heat tolerant. *Harvest Season: Year round*

**IMPROVED MEYER**—This hybrid, originally from China, is a cross between a lemon and a mandarin or orange. Medium size fruit has smooth yellow-orange rind and golden yellow flesh. Juicy fruit is sweeter than a true lemon but still acidic. Fruit ripens throughout the year but mostly during Winter and Spring. Small-Medium size tree with round shape. *Harvest Season: Year round*

**PONDEROSA**—This variety is a lemon-citron hybrid, Ponderosa produces large, citron like fruit with thick rind and moderate juice. The huge fruit—sometimes over two pounds—has thick, bumpy rind. Acidic and very seedy. practically impossible to peel. Holds well on tree. Grows about half the size of a true lemon. *Harvest Season: Year round*



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# Recommended Citrus Varieties for the Northern California Coast

## Limes

**MEXICAN**—This variety often called the "Bartender's Lime", is also known as "West Indian" or "Key Lime". Very small fruit is greenish yellow in color and highly aromatic. Juicy fruit has good acid lime flavor and few seeds. Small, round tree sensitive to frost. Good container plant for patios. *Harvest Season: Year round*

**BEARSS**—This variety is believed to be a seedling of "Tahitian" lime, this California discovery is also known as "Persian" lime. Small fruit has smooth pale yellow rind in color and greenish yellow flesh. Juicy fruit has true acid lime flavor, and is nearly seedless. Fruit ripens throughout the year but mostly during Winter. *Harvest Season: August to March*

## Grapefruits

**RIO RED**—Often through out of as the "Breakfast Citrus", grapefruits as also valued for ornamental purposes. Clusters of large red-blushed fruit are seedless and juicy. Fruit are deep red inside and sweet when mature. Compact medium size tree with glossy, deep green leaves. Requires less heat to color and ripen. *Harvest Season: April to September*

**MELOGOLD**—This hybrid, developed by the University of California, is a cross between a grapefruit and a pummelo. Very large pummelo shaped fruit is golden-yellow in color, seedless and juicy. Fruit has yellow-white flesh and sweet pummelo-like flavor. Large vigorous spreading tree with glossy, deep green leaves. *Harvest Season: February to April*

**OROBLANCO**—This hybrid, developed by the University of California, is a cross between a grapefruit and an acidless pummelo. Large round fruit is light yellow in color, seedless and juicy. Fruit has yellow-white flesh and sweet pummelo-like flavor. Large vigorous tree with glossy, dark green leaves. *Harvest Season: January to April*

## Pummelos

**CHANDLER**—This hybrid, developed by the University of California at Riverside, is a cross between "Siamese Pink" and "Siamese Sweet" pummelos. Large round fruit has thick yellow rind and pink flesh. Firm flesh is moderately juicy, tender and flavorful. Medium-Large vigorous spreading tree. *Harvest Season: January to April*



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# Recommended Citrus Varieties for the Northern California Coast

## Tangelos

**MINNEOLA**—The result of cross between "Dancy" tangerine and a white grapefruit, this is the best tangelo for home gardens. Large fruit, with prominent neck, is brilliant orange-red in color, easy to peel and moderately seedy. Fruit is juicy, richly flavored and tart. Attractive round shaped tree with large leaves. *Harvest Season: March to May*

## Kumquats

**FUKUSHU**—Also known as Changshou in Japan, the Fukushu Kumquat is a unique member of the citrus family. The small round fruit are eaten whole and are popular in Marmalades and candies. These plants are very cold hardy, able to withstand Temperature below 20° F with little damage. The small compact growth habit of this tree make this variety a wonderful ornamental and patio tree. *Harvest Season: November to March*

**NAGAMI**—Nagami (Fortunella margarita) is the oval-shaped kumquat, compared to Meiwa's round shape. It is the most commonly sold variety in supermarkets. The rind is sweet and the flesh is tart. The tree is an exceptional ornamental with a compact habit, small leaves and highly visible fruit. Entire fruit edible. *Harvest Season: January to April*

## Specialties

**EUSTIS LIMEQUAT**—A hybrid between West Indian or Mexican lime and Marumi kumquat, Eustis is probably the most widely grown limequat. Small, oval with greenish yellow fruit that turns yellow when fruit is fully ripe. Acidic, lime-like flavor. Few to many seeds. Small open tree somewhat wiry appearance. *Harvest Season: December to July*

**CALAMONDIN**—This variety is of unknown parentage. Valuable ornamental and kumquat-like. Fruit is small, bright orange-red, and often borne in clusters. Acidic, lime flavor. Tree is compact fine textured, with small, closely spaced leaves. Cold hardy. Calamondin makes an excellent container plant indoors or out. *Harvest Season: December to August*



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# Recommended Citrus Varieties for the Northern California Coast

## Specialties (continued)

**ETROG CITRON**—This variety produces medium-small fruit in comparison with other citron varieties, but nevertheless can still attain a large size. Roughly lemon shaped and the rind is reasonably smooth and normally very firm. The trees are smaller, less vigorous and productive than other citron varieties and leaves are rounded and cupped. *Harvest Season: January to April*

**BUDDHA'S HAND**—As the name implies, the fruit is split down its length into a number of finger-like sections, resembling a human hand. Much esteemed in China and Japan, where it is used for perfuming rooms and clothing. Small and not particularly attractive, it is a popular garden shrub. *Harvest Season: January to April*

**INDIO MANDARINQUAT**—This attractive ornamental tree is a hybrid of Nagami Kumquat and Dancy Mandarin. The fruit can be eaten whole (rind & all), however, they are extremely tart and not particularly good to most peoples tastes. The dark orange oblong fruit and the shapely tree join together to create a pleasant backyard tree. *Harvest Season: October to December*

**CITRUS HYSTRIX**—Also known as Kieffer Lime, this frost sensitive variety is not a true lime and is grown primarily for its uniquely shaped leaves. The leaves are used to flavor curries, soups and salads in Southeast Asian cuisine. It imparts a strong citrus flavor and aroma to the foods. The fruit is harvested green and has an unusual and distinctive shape and bumpy rind texture. The fruit is very aromatic and has little juice. *Harvest Season: December*



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