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# FR *ui* TROP

English version

CLOSE-UP:  
GRAPEFRUIT

Mediterranean citrus:  
HLB, a new threat

Sea freight: reefer market  
heads for the rocks

<http://passionfruit.cirad.fr>



## Cultivation of grapefruit

### The plant

The grapefruit tree has broad, evergreen leaves and is one of the most vigorous of the genus *Citrus*. It requires the lowest planting density. When adult and fruiting, the fruit-bearing branches acquire a falling habit enhancing the growth of new shoots on the curves. This means that the species can reach fairly naturally an equilibrium in branch renewal without drastic mechanical intervention.



### Climatic requirements and effect of the environment

The climatic requirements of grapefruit are fairly similar to those of other citrus but with a high temperature requirement. Low temperatures limit the cultivation area. Fruits sustain damage when the temperature falls below -1 or -2°C and the aerial parts of the tree are damaged from -3 or -4°C. Among environmental factors, temperature certainly has the greatest influence on fruit characteristics: shape, pulp and peel colour and organoleptic characteristics.

When production zone extremes are considered, it is easy to distinguish between 'tropical' quality and 'Mediterranean' quality. Tropical grapefruit have specific features because temperatures are at a steady high and day/night temperature amplitude is small. These conditions favour more intense internal and external fruit colour. Steadily high tropical temperatures enhance the development of lycopene, the red pigment found in the pulp and peel of coloured varieties. Chromatic potential is fully expressed in tropical grapefruit, with colours ranging from white to red via pink, depending on the case. These conditions also reduce bitterness and acidity and increase juice and sugar contents. The peel is often thinner and the fruit pear-shaped.

In a Mediterranean climate, except during the summer, day/night temperature amplitude is very marked and spring and autumn are cool to very cool. Here, grapefruit requires a warm exposition and plenty of sunshine. However, only the varieties with a very high lycopene content can become coloured. This is the case of comparatively recent cultivars bred in the last 25 years such as 'Star Ruby', 'Rio Red', 'Flame', etc. The production of pigmented fruits has become classic in a Mediterranean climate thanks to these varieties. Other varieties that are potentially coloured in the tropics, such as 'Thomson' (pink), 'Ruby', 'Red Blush' and 'Henderson' (red) acquire little or no colour.



The gentle, sweet taste characteristics of grapefruit were long closely associated with coloured varieties because of their exclusively tropical origin. We still have the habit of associating, a priori, sweetness and absence of bitterness with colour when this is not at all the case.

Cumulated heat in northern zones is not sufficient for the fruits to ripen fully before the winter. The production cycle may then last for 12 months or even more. The fruits must remain on the trees before completing their development in the following spring. They are exposed to rain and low temperatures and this can cause physiological damage to peel or internal damage in case of frost.





Grapefruit diseases	<b>Tristeza</b> Virus: <i>Citrus Tristeza Closterovirus</i>	<b>Canker</b> Bacterium: <i>Xanthomonas axonopodis</i> pv. <i>citri</i>	<b>Huanglongbing (Greening)</b> Phloem bacteria: <i>Liberibacter africanum</i> , <i>L. asiaticum</i>
<b>Symptoms</b>	Decline of varieties budded on sour orange, paling of leaf veins, stem-pitting	Corky pustules on leaves, fruits and shoots	Yellowing shoots, leaf marbling, small poorly coloured fruits, decline
<b>Part attacked</b>	Young, growing organs (shoots, flowers)	Aerial parts: young organs, wounded organs	Aerial parts
<b>Cause</b>	Presence of infected plants in the field or nearby	Bacteria released from lesions, infection enhanced by mechanical or weather (hurricanes) wounds or the citrus leaf miner ( <i>Phyllocnistis citrella</i> )	Presence of infected plants in the field or nearby
<b>Transmission</b>	Aphids: <i>Aphis gossypii</i> and <i>Toxoptera citricida</i> , budding	Via air and water	Psyllids: <i>Diaphorina citri</i> and <i>Trioza erytreae</i> , budding
<b>Measures to be taken</b>	Control of vectors (chemical, biological control, etc.)	Application of products containing copper or Kasugamycin, removal of infected trees in case of light attack, watering at soil level	Control of vectors using chemical, biological methods, etc.
<b>Prevention</b>	Use of healthy plant material, cross-protection (measure subject to discussion)	Use of healthy plant material, tolerant varieties, protection of young organs	Use of healthy plant material
<b>Economic impact</b>	Loss of trees and decreased production, EU quarantine organism (control of movements)	Harvest loss by fruit fall, EU quarantine organism (control of movements)	Decline of trees, shorter orchard life, EU quarantine organism (control of movements)
<b>Distribution</b>	All regions except for certain countries in the Mediterranean area	Asia (including the Middle East), South America, Florida, small presence in Africa	Asia, tropical and subtropical Africa, the Middle East, Brazil, Florida

\* A region harbouring an EU quarantine organism (listed in Council Directive 2000/29EC) may only export fresh produce to the EU under strict conditions.



Grapefruit pests	<b>Fruit flies</b> Diptera Tephritidae, various species of the genera <i>Ceratitis</i> , <i>Anastrepha</i> , <i>Dacus</i> , <i>Bactrocera</i> , etc.	<b>Citrus leafborer</b> Lepidoptera: <i>Gracillariidae</i> , <i>Phyllocnistis citrella</i>	<b>Aphids</b> Hemiptera: <i>Aphididae</i> , <i>Toxoptera</i> spp., <i>Aphis gossypii</i> , etc.
<b>Symptoms</b>	Pricking caused by females laying eggs in the fruits. The larvae develop in the pulp and cause fruit fall	Characteristic meandering larval mines beneath leaf epidermis	Colonies on young shoots. Wilt caused by viruses (tristeza)
<b>Part attacked</b>	Fruit	Leaves, fruits in very rare cases	Young shoots
<b>Measures</b>	Monitoring of populations. Patch treatments. Male Annihilation Technique (MAT), mass trapping	Monitoring of populations. Biological control by acclimatisation of exotic parasitoids	Monitoring of populations (visual inspection). Conservation of beneficials. Spraying on a threshold basis
<b>Prevention</b>	Destruction of fallen fruits		
<b>Economic impact</b>	Harvest losses	The larval mines limit photosynthesis	Growth flushes limited. Weakening or wilting caused by viruses
<b>Distribution</b>	American continent: <i>Anastrepha</i> . Africa: <i>Ceratitis</i> , <i>Dacus</i> . Asia-Pacific: <i>Bactrocera</i>	Cosmopolitan	Variable according to species. <i>Toxoptera citricida</i> in tropical zones; <i>T. aurantii</i> in the Mediterranean area

## Varieties

**Grapefruit and shaddock—frequently confused cousins.** Grapefruit and shaddock are frequently confused in common or trade usage. But the two fruits have different characteristics as the grapefruit (*Citrus paradisi* Macfad.), pomelo in French, is not the same botanical species as the shaddock (*Citrus maxima*).

Shaddock, called pamplemousse in French and chadèque in the French West Indies, may be called Chinese grapefruit on European market. But it should not be called grapefruit and vice versa.



Fruit characteristics	Grapefruit	Shaddock
Size (diameter)	8 – 15 cm	10 – 30 cm
Weight	250 to 500 g	400 g to 2 kg
Shape	flattened to pear-shaped	flattened to pear-shaped
Peel	fine to medium thickness	thick to very thick
Central axis	open, little or medium-developed	open or closed, well developed
Seeds	few or none	from none to numerous
Pulp colour	pale, yellow, pink or strong red	pale yellow, pink or strong red
Pulp texture	juicy	firm or even crunchy
Bitterness	weak to strong	none to weak

## Guangximi you

This variety originated in Fujian Province ('Guangxi' in Chinese), where it is still widely grown in the Pinghe region. It forms a large proportion of Chinese production. The fruit is medium-sized to large (from 1 to 2.5 kg) with a typical oboval shape. The yellow skin is of medium thickness (about 0.8 cm). The flesh is white and pale with some green lights, soft and medium to fairly juicy. The flavour is sweet and slightly acidulous. The fruits have excellent keeping qualities. The variety is usually sold commercially under the name 'Honey Pomelo'.



## Marsh

'Marsh' was bred from a sowing of 'Duncan' seeds in about 1860 near Lakeland, Florida. The variety was the first to be practically seedless (two or three seeds per fruit) and it developed very strongly. 'Marsh' is still the most commonly planted cultivar and the most widespread in the world, even though a general trend towards coloured varieties is observed. Furthermore, it is extremely suitable for canning. Its taste qualities are satisfactory although acid and sugar contents are lower than those of 'Duncan'. However, a few problems are noted at the beginning (high acidity) and the very end of the season (loss of aroma). The fruits are medium-sized to small—not as large as 'Duncan'—and are pale yellow in colour. The skin is medium thick, regular and very smooth. The flesh is soft and very juicy.

## Flame

A natural mutation of 'Ruby Red', 'Flame' was discovered by H.K. Wutsher in 1973. The fruits are attractive. They are spherical and larger than those of 'Star Ruby' and of a similar size to those of 'Ruby Red'. Suitability for keeping on the tree is good. The skin is particularly fine and smooth. The basic colour is a light bronze similar to that of 'Star Ruby', differing from the pale yellow of 'Ray Ruby' and 'Ruby Red'. Large areas pigmented with as intense a red as that of 'Ray Ruby' can be observed but this colouring is nevertheless not as marked as that of 'Star Ruby'. The flesh is a uniform red similar to that of 'Rio Red'. The fruit is juicy and firm. The variety is planted in significant quantities in Florida and Argentina. It is marginal elsewhere.



## Ruby

(Redblush, Ruby Red, Henninger)

'Ruby', a bud mutation of 'Thompson', was discovered in Texas by A.E. Henninger in 1926. It differs from the parent by the stronger pigmentation of skin and flesh. Its other characteristics are very similar to those of 'Thompson'. However, the sugar and acid contents are sometimes slightly lower. 'Ruby' is still the most widely planted coloured variety in the world and forms a large proportion of new plantings in Florida. In contrast, it is losing momentum in Israel and South Africa.

## Star Ruby

This recently developed variety (released in 1970) was obtained by irradiating 'Hudson' seeds. It has numerous good features. The flesh is the most strongly coloured of all the varieties currently grown. The skin is fine and smooth with strongly red faces. The fruits are practically completely seedless and finally the flesh is firm and juicy with high acid and sugar contents. The juice is intensely coloured. However, irradiation has reduced plant resistance to diseases and to excessive sunshine. Management is more delicate, especially because of its susceptibility to certain herbicides. Yields are generally smaller. The variety is therefore tending to lose ground in some countries to the benefit of hardier cultivars ('Rio Red' and 'Flame').



## Coloured varieties

A marked switch to coloured varieties has been observed in consumer expectations in the last 20 to 25 years. The change is almost total in Europe. Even Japan, the world's leading market and traditionally a consumer of white grapefruit, has been affected by the change.

**Grapefruit — Intensity of the pigmentation of the skin and flesh of various varieties**  
(after James Saunt in *Citrus Varieties of the World*, Sinclair Publishing)

Varieties	Skin	Flesh
Burgundy	-	★★★★
Thompson (Pink Marsh)	-	★
Ruby (Ruby Red, Redblush)	★★	★★
Henderson	★★★★	★★★
Ray Ruby	★★★★	★★★
Rio Red	★★★★	★★★★
Flame	★★★★	★★★★
Star Ruby	★★★★★	★★★★★

★ = weak      ★★★★★ = very strong