



Gardennote

Citrus disorders

By Harald Hoffmann, Biosecurity Communications; Kevin Lacey, Horticulture and Peter Wood, Plant Pathology



Clockwise from top left: Albedo breakdown or creasing, granulation, frost damage (Photo by Steven Falivene, NSW DPI), fruit splitting

This *Gardennote* describes the most common physiological disorders of citrus trees occurring in home gardens in Western Australia.

Albedo breakdown or creasing

Creasing is a major rind disorder of mature navel oranges in particular, but other fruits can be affected. It shows up as an irregular pattern of grooves and furrows in the rind, and is worse on the shaded side of the fruit.

Creasing is caused by excessive loss of cohesion between albedo cells (the white layer under the skin) stressed by expansion of the pulp. Factors that may contribute are rind mineral levels (e.g. low calcium or high magnesium), rootstock (higher

incidence on rough lemon), water relations, tree age, nutritional conditions and tree health. Creasing can be reduced with pre-harvest sprays of gibberellic acid as well as calcium sprays (see *Farmnote* 149 for more information).

Dry fruit or granulation

Granulation is a condition in which the juice sacs shrivel because of gel formation. It is often associated with fast growth. It occurs more in large fruit, on young trees, in humid climates and on trees growing on sandy soils.

On oranges it is commonly seen on young, vigorously growing Valencia orange trees on rough lemon rootstocks. The fruit develop a flat, insipid

Important disclaimer

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

taste as they lose some of their sugar and acid. On Imperial mandarins, granulation also leads to low juice levels and loss of taste.

To minimise the dryness, sufficient water (see *Gardennote* 38) and correct nutrition should be applied, and fruit should be harvested early.

In sandy soil it may also help to build up the soil with soil conditioners such as loam and organic matter.

Frost injury

Frost injury usually occurs after nights with clear skies and little wind causing temperatures below minus 2.2 °C for more than 4 hours. Damaged fruit may show drier juice sacs and separated segments without injury to the rind. Longer term injury includes fruit drop, bark splitting (in young trees), foliage curling and bleaching, and you may find rust on the leaves.

Frost injury can be prevented through selection of warmer planting sites (elevated ground where cold air can drain away), selection of more cold-tolerant scion/rootstock combination (consult your local nursery), wrapping the trunks of young trees, supplying sufficient water to the roots and turning on overhead reticulation during periods of frost.

Fruit splitting

Fruit splitting is often seen in navel oranges, lemons and other citrus fruits when temperatures drop and relative humidity increases with the approach of winter. Splits occur longitudinally starting at the navel end, where the rind is thinnest.

Fruit splitting might be caused by great climatic and soil moisture irregularities. It has been speculated that internal pressure developed by the pulp causes the rind to split.

Regular application of fertiliser and water to provide smooth, uninterrupted growth might reduce the problem. For more details see *Gardennote* 38.

Mutations, chimaeras or bud-sports

Sometimes, abnormally shaped, textured or coloured leaves and/or fruit are found on fruit trees. The whole fruit or just a segment may be affected. This is caused by genetic alterations of the fruit, or the section on which the fruit is growing. Some fruit may also be a combination of two different genetic constitutions (chimaeras). Chimaeras may be related to the original bud-wood that was used. The tree might have to be replaced or re-budded.

If the abnormally shaped fruit is on an undesirable sport, prune it out.

Nutrient deficiencies

Citrus trees are demanding feeders and are prone to many disorders related to mineral nutrition. On the sandy soils of the metropolitan area, citrus suffer frequently from deficiencies of nitrogen, magnesium, zinc, manganese, iron and copper.

Citrus species are also sensitive to an excess of certain elements in the soil or the irrigation water, especially chloride, sodium, boron and manganese, which can injure the tree. In the home garden this can be easily rectified by the monthly application of a complete fertiliser (1 handful per m²) to the area



Clockwise from top left: Leaf mutations, pH induced iron deficiency in citrus, oleocellosis, navel orange with sunburn

covered by the canopy. Make sure the complete fertiliser contains magnesium and all essential trace elements.

In some parts of the metropolitan area closer to the coast, alkaline soil (high pH) may cause nutrient deficiency, such as lime induced chlorosis (an iron deficiency). This condition is corrected by applying iron sulphate which will also reduce the soil pH (for more details see *Gardennote* 174).

Oleocellosis

Oleocellosis is a skin injury caused by oil released from the oil glands in the skin after they have ruptured. The damage can be caused by physical means (poor handling or abrasion) or climate. The symptoms are greenish or brownish, firm, irregular patches or spots on the skin. Fruit is particularly susceptible to damage during cool wet periods early in the season when the rind is very turgid.

Damaged areas typically darken and become sunken with time. The disorder is sometimes called green spot because the affected areas do not colour at ripening.

Oleocellosis can be avoided by careful handling and avoiding harvesting wet fruit early in the morning or after rain.

Puffing

Puffing occurs in some varieties when fruit are left on the tree too long and become over-mature. It is mainly observed in mandarins, particularly the easy peel varieties. The peel separates from the pulp and continues to grow after the pulp growth

has ceased. The condition is more prevalent on vigorous trees and can be associated with too much nitrogen. Twigs with luxuriant foliage are more pre-disposed to produce puffy, oversized fruits.

As puffing is mainly caused by over-maturity, earlier picking of fruit will minimise the problem.

Sunburn

Sunburn of fruit is worse in varieties which produce their fruit on the outside of the trees such as Murcott tangor, Afourer and Satsuma mandarins. It can affect citrus trees in various ways, burning the fruit, leaves and bark. It may be due to direct sunlight or hot drying winds coupled with inadequate moisture uptake.

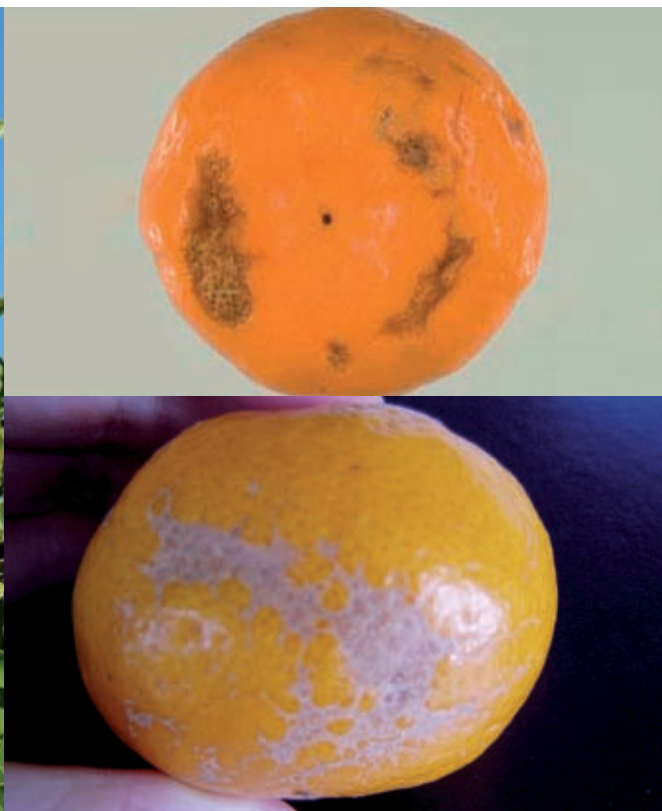
To minimise sunburn, do not over-prune citrus trees and paint the stems of young trees or exposed limbs with a white, water-based paint.

Twig dieback

There are a number of forms of twig dieback which can be caused by a range of factors.

In some instances leaves of seemingly healthy twigs die and dry up on the tree and gum appears in the wood; in other cases leaves drop before they are completely dry and there is no gum present.

Another form of twig dieback occurs in spring and may affect navel oranges. Some of the new shoots which develop during the early warm periods may wilt and die back later. These dry shoots stand out among the green foliage of the tree. Spring twig



Clockwise from left: Twig dieback, watermark, wind damage

dieback is often worse on the western side of the tree.

Some of the causes of twig dieback are:

- Damage to the root system by fungi, nematodes, salt injury, excessive fertiliser application and periods of excessive dryness
- Low soil temperatures
- Low soil moisture
- Dry winds and low humidity
- Frost injury
- Melanose fungus

If twig dieback has killed young branches, prune them out to avoid fruit damage.

To control twig dieback, maintain optimum soil water content, particularly in late autumn and winter.

Watermark

Watermark mainly occurs on Imperial mandarins when a turgid area at the base of the fruit stays water-soaked for a prolonged period in damp, overcast conditions when the fruit is fully coloured.

Earlier harvesting as well as treatment with gibberellic acid will minimise watermark (see *Farmnote 149* for more details).

Wind damage

Wind damage occurs, when foliage or fruit is blown against thorns, branches or older leaves. Newly planted trees are especially vulnerable because of their exposure. Fruits develop characteristic ridges and irregularly shaped, raised areas on the surface, which enlarge and darken as the fruit matures. Young foliage and fruits are particularly delicate.

To minimise wind damage, provide natural or artificial windbreaks and prune out dead branches and thorny twigs to limit injury.

Winter yellows

Winter yellows is a disorder of citrus trees which is common when good growing conditions continue late into autumn.

Immature foliage goes yellow at the onset of cold weather, but re-greens and develops normally with the return of warm weather in spring. In some seasons it affects mature, functional leaves. Winter yellows usually begins between late March and early April and develops rapidly as the days shorten. Yellowing on a leaf starts adjacent to the midrib and spreads along the lateral veins until most or all of the leaf is involved.

The amount of yellowing can affect all or part of a limb, just the late flush or all the leaves on a young tree. In severe cases the leaves may fall and there may be some out-of-season blossoming.

Physiologically, the yellowed leaves have excess starch and the root system is depleted of starch and parts of it may die.

Once warmer temperatures and longer days set in, the tree gradually recovers but it will be retarded if the root system has been damaged.

The cause of winter yellows is uncertain; it may be the depleted carbohydrate reserves of the root system.

Hickson mandarin and Eureka lemon are particularly susceptible to winter yellows.

Winter yellows can be minimised by:

- discouraging late autumn growth of two to five year old trees (reduce water and fertiliser)
- leaving a few fruit on young trees to avoid excess vegetative growth



Winter yellows

Further reading:

- Improving citrus fruit quality using gibberellic acid (GA). *Farmnote 149*
- Citrus fruit loss in the home garden. *Gardennote 38*
- Soil pH and plant health in the home garden. *Gardennote 174*

Specimen identification requirements

When sending or delivering samples, the following information is required:

- Collector's name, location (where the specimen was found), full address, telephone number and e-mail address, description of the damage and date collected.

Department of Agriculture and Food
Pest and Disease Information Service
3 Baron Hay Court, South Perth WA 6151
Freecall: 1800 084 881
E-mail: info@agric.wa.gov.au