

A GUIDE TO THE COMMON POSTHARVEST DISEASES & DISORDERS OF NAVEL ORANGES AND MANDARINS GROWN IN INLAND AUSTRALIA



Authors:

Peter Taverner, Barry Tugwell and Brian Wild.

This guide should be used to identify disorders when fruit arrives at overseas markets and to provide useful feedback to the industry when a problem occurs. It is aimed to assist growers, packers, wholesalers and exporters that may be present at outturn. As such, the information provided focuses on the most common problems occurring on citrus sent to our major export markets. It does not show defects, such as wind blemish, that should be sorted out before packing.

To the untrained eye, many postharvest symptoms can be confused. When in doubt, seek advice before committing to costly and perhaps inappropriate corrective treatments.

The following comprehensive compendiums of postharvest diseases and disorders can be used to confirm your diagnosis:

Snowden A.L. 'A Colour Atlas of Post-Harvest Diseases & Disorders of Fruit & Vegetables. Volume 1. General Introduction & Fruits' Wolfe Scientific. 1990.

Beattie B.B. McGlasson W.B. & Wade N.L. 'Postharvest Diseases of Horticultural Produce. Vol. 1. Temperate Fruit' CSIRO Publications. 1989.

Offers J.A. 'Citrus Diseases and Defects Found in the Marketplace. C. Chevalier BV, Holland. 1987.

ANTHRACNOSE

CAUSE Infection by the fungus, *Colletotrichum gloeosporioides*.

SYMPTOMS

- Superficial leathery appearance
- Silver/grey to dark lesions.
- Tear-staining pattern common.
- Pink tinge (spores) under humid conditions.

OCCURRENCE

- Infection occurs by rain-splash during autumn.
- ethylene degreening increases sensitivity to anthracnose.

CONTROL

- Dead wood should be pruned as the fungus harbours in dead branches.
- Field sprays of copper-based fungicides should be applied prior to autumn rains.
- Postharvest treatment with Benzimidazole fungicides may reduce fruit losses.



SEPTORIA SPOT

CAUSE The fungus, *Septoria depressa*.

SYMPTOMS

- Dark brown collapsed lesions, with a purple tinge.
- Black specks develop in decayed area.

OCCURRENCE

- Mainly inland citrus regions.
- Infection occurs in autumn but remains dormant until cool conditions.
- Fruit more susceptible after frosts.

CONTROL

- Field application of copper-based fungicides.



BLUE & GREEN MOULD

CAUSE Fungal infections of *Penicillium digitatum* (green mould) and *P. italicum* (blue mould).

SYMPTOMS

- Softening of damaged tissue.
- White fungal growth, which progressively turns blue or green as spores develop.
- Postharvest fungicides (Imazalil) can arrest spore development resulting in white only fungal growth.

OCCURRENCE

- Infections develop from damaged areas.
- The growth of mould increases with storage temperatures (up to an optimum of 27°C).
- Late season fruit more susceptible.
- Damaged rind is more susceptible.

CONTROL

- Careful handling reduces damage to rind.
- Good hygiene and sorting reduces spore load and infection rates.
- Sanitation destroys spores in recirculating water and packingline equipment.
- Postharvest fungicides should be applied within 24h of harvest.
- Lower storage temperatures slow down fungal development.



SOUR ROT

CAUSE The fungus, *Galactomyces citri-aurantii* (formally, *Geotrichum candidum*).

SYMPTOMS

- Very soft, watery decay.
- Distinct margin between decayed and healthy tissue.
- Sour odour detectable.

OCCURRENCE

- Infection occurs in damaged fruit.
- Fungicide used to control blue & green moulds may not control Sour rot. (eg., USA accepted fungicides).
- Sour rot spores in soil can accumulate in recirculating water in dips and drenches.
- Spreads by contact after packing creating nests of infected fruit in boxes.

CONTROL

- careful handling reduces rind damage.
- apply Guazatine fungicide within 24hrs of harvest.
- Strong emphasis of sanitisers when Guazatine fungicide not approved for use.

OLLEOCELLOSIS

CAUSE Impact causing oil glands to rupture and 'burn' the rind.

SYMPTOMS

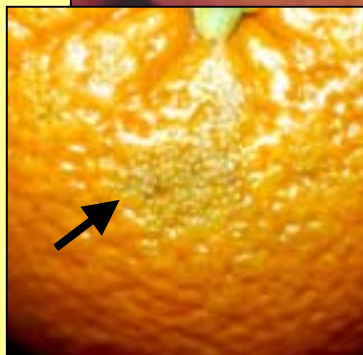
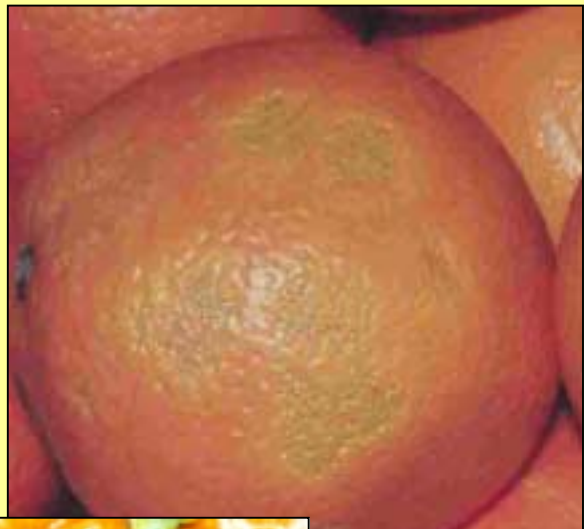
- Mild injury results in light yellow patches.
- Severe injury results in dark, sunken patches.
- Cells collapse around intact oil glands creating a 'dimpled' appearance.

OCCURRENCE

- Oil glands rupture easily when fruit is turgid. ie., harvested during cold or damp conditions.
- Rough handling during harvest, transport and in packingsheds.

CONTROL

- Field treatment with a growth regulator (eg. GA) will delay aging and reduce sensitivity to mechanical damage.
- Avoid picking in cold, damp conditions.
- Maintain packingline to eliminate high impacts and rough surfaces.



BRUSH BURN

CAUSE Damage to rind by abrasion.

SYMPTOMS

The appearance can vary:

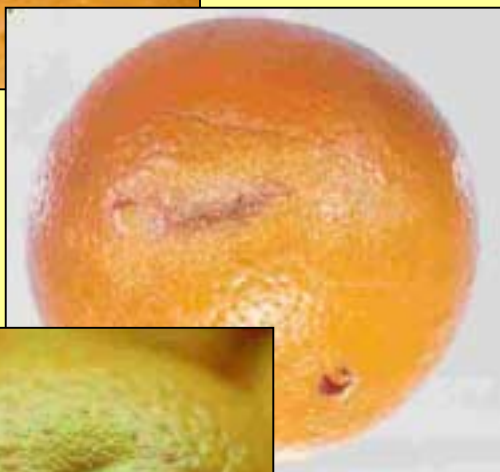
- Superficial red/brown staining of the rind. (often referred to as 'rind staining')
- Reddish/brown marks associated with raised surfaces on the rind.
- Scuffing marks can be seen on close examination.

OCCURRENCE

- Soft rind (eg., mandarins) are more susceptible.
- Late season fruit are more susceptible.
- More common in new packinglines.
- Waxy knobs build up on rollers to abrade fruit.

CONTROL

- Field treatment with a growth regulator (eg. GA) will delay aging and reduce sensitivity to mechanical damage.
- Reduce number of brushes &/or brush speed (to < 100rpm).
- Install sweeper bars .
- Remove abrasive waxy deposits.
- Use purpose-built mandarin grading equipment



MECHANICAL INJURY

CAUSE. Damage by direct impact with sharp or blunt object.

SYMPTOMS

- Well defined cuts or rubbed areas.
- Reddish/brown depressed and dried out areas.
- Sometimes surrounded by a lighter coloured 'halo' of oleocellosis.

OCCURRENCE

- caused by long stems, fingernails, damaged bins and protruding objects in packinglines.
- Small injuries and impacts become more obvious during storage due to dehydration or development of oleocellosis.

CONTROL

- Careful harvesting and transport.
- Sort out small injuries and blemishes.
- Maintain grading equipment.

ZEBRA SKIN

CAUSE Damage to highly turgid mandarin rind by mechanical abrasion .

SYMPTOMS

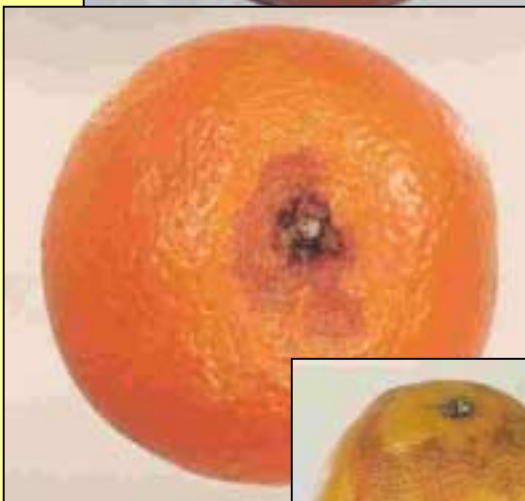
- Reddish/brown stripes of the rind associated with the segments.

OCCURRENCE

- Increased turgor of rind after heavy rains or irrigation prior to picking.
- Brushing exacerbates the problem.
- Full coloured fruit are more susceptible.

CONTROL

- Delay harvest for 5-7 days after rain.
- Pack fruit on gentle mandarin grading equipment.



AGE-RELATED BREAKDOWN

CAUSE Rind collapse due to cell weakening and dehydration of mature fruit.

SYMPTOMS

The symptoms can vary:

- Discoloured, dried out and extensive collapse of rind.
- Dehydration or wilting at the stem end where the rind is thinnest. (*Do not confuse with, Stem End Rind Breakdown or SERB, which is most prevalent in Valencia oranges that have been subject to water stress late in spring*)

OCCURRENCE

Navels are more likely to show symptoms at the end of the season. However, some conditions can accelerate the incidence:

- Heavy rains plus high humidity, then followed by a frost.
- Dehydration of fruit in the orchard by hot conditions.
- Holding fruit too long between harvesting and packing (low humidity storage in shed).
- Warm, dry conditions when trees are under water stress. This leads to dehydration of stem end of fruit .

CONTROL

- Be cautious marketing fruit later in the season. It is not suitable for long storage despite the best postharvest treatments.
- Field treatment with a growth regulator (eg. GA) will delay aging and prolong marketing period.

CHILLING INJURY (CI)

CAUSE Rind discolour or collapse due to low storage temperatures.

SYMPTOMS

There are several forms of CI:

- Superficial light grey/brown blemish (cold scald).
- Dark brown collapsed areas, with irregular boundaries (storage spot).
- Brown 'halo' effect can surround collapsed tissue.

OCCURRENCE

- The incidence of CI on oranges is greatly increased when storage temperatures are below 10°C for periods of 6 weeks or more.
- Early season fruit is more susceptible to CI.
- Damaged rind is more susceptible to CI.

CONTROL

- Stepped storage temperature regimes. eg., 2-3 weeks @ 10°C, followed by 3 weeks @ 5°C.
- If fruit is held below 3°C then they should be at markets within 6 weeks from harvest.
- Postharvest fungicide application may reduce the incidence of CI. eg., TBZ.



Storage spot



Cold scald



POSTHARVEST PITTING

CAUSE oil gland collapse associated with mechanical damage or reduced gas exchange.

SYMPTOMS

- The collapse of many small circular pits.
- Pits can coalesce to form irregular patches.
- Bronze/brown to black blemishes.

OCCURRENCE

- Pits may be associated with oleocellosis damage.
- Damage may be associated with reduced gas exchange after waxing with high solids content wax.
- Highest incidence within first 2 weeks after harvest.
- Higher risk of pitting with shellac-, resin- and polyethylene-based waxes compared to carnauba-based waxes.
- Larger sizes more susceptible.

CONTROL

- Field treatment with a growth regulator (eg. GA) will delay aging and reduce sensitivity to pitting.
- Careful harvesting and handling.
- Rapid chilling after waxing reduces pitting
- Waxing with lower solids or carnauba-based waxes.

