

# Storage and Market Diseases of Fruit. XX

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Supplement to *CSIRO Food Research Quarterly*

Volume 34, Number 3, September 1974

## MARKET AND STORAGE DISEASES OF CITRUS FRUITS

### Ethylene-gas Burn

Citrus fruits may be quite palatable although unattractively greenish in colour. Early in the season Navel oranges and mandarins may become ripe enough for eating before the skin is fully coloured, Valencia oranges commonly regreen late in the season, while citrus grown in semi-tropical areas never take on their full yellow or orange colour. Such fruit may be degreened by exposure to ethylene gas at suitable temperatures and high humidity.

During this procedure the rind of the fruit may be 'burned' by ethylene if the concentration of ethylene or the temperature of the air is too high, or if the fruit is in a very susceptible condition. Navel oranges are readily injured if picked early in the season in cold wet weather, when the risk of

rupture of oil glands and consequent oleocellosis (see Supp. XVIII, Fig. 74) is great.

Ethylene-gas burn is a grey-to-brown or slightly purplish injury to the skin that shows as irregular more or less sunken patches (Fig. 82). It appears during the degreening treatment which may take up to six days, and may continue to develop afterwards. Affected fruit may be so unsightly as to be valueless and severely affected fruit may have an unpleasant flavour.

The trouble can be avoided by ensuring that the recommended conditions are maintained during degreening. For mandarins the ethylene concentration should not exceed 10 p.p.m.

#### Further reading

Hall, E.G., Leggo, D. and Seberry, J.A. (1968). Ethylene degreening of citrus fruit. *Agric. Gaz. N.S.W.* **79**, 721-8.

### Fumigation Injury

It is often necessary to give citrus fruits a post-harvest disinfestation treatment so that they can be marketed in areas or countries free from fruit fly. The treatment consists either in storing the fruit at low temperatures for about 14 days or fumigating it with ethylene dibromide (E.D.B.) for two hours; as fumigation is quick it is generally preferred. However, there is always a risk of injury, and with some kinds of fruit the risk is so great that treatment is not practicable. In laboratory trials of treatment by fumigation Ellendale mandarins and Marsh grapefruit were frequently injured.

Injury by E.D.B. (Fig. 83) is a rind burn which may vary in appearance, sometimes looking like storage spot (see Supp. XIII, Figs 49-54) and sometimes more like ethylene-gas burn.

It is usually the result of fumigating susceptible fruit or of having failed to maintain the correct conditions of gas concentration, temperature, duration of exposure and load of fruit in the chamber. Immature or overmature fruit is more likely to be injured and there is considerable risk of damage if the fruit was picked while wet early in the season or was affected by frost.

#### Further reading

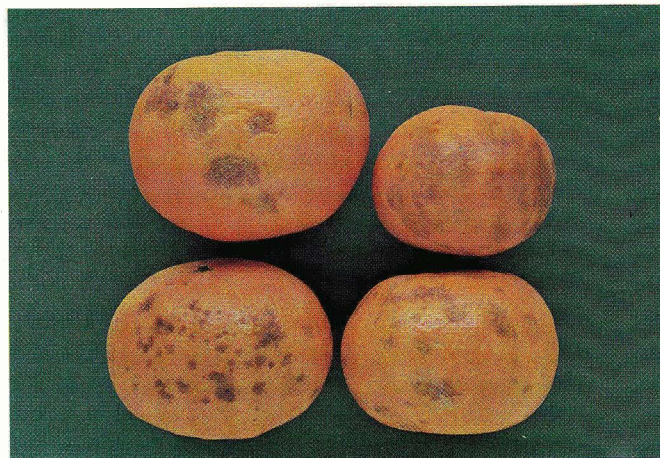
Fresh Fruit Disinfestation Committee (1969). The Design, Construction, Testing and Operation of Chambers for the Fumigation of Citrus Fruits with Ethylene Dibromide'. (CSIRO Division of Food Research: North Ryde.)

82



Ethylene-gas burn.

83



Fumigation injury.



### Brown Rot

This rot starts as a slight surface discoloration which extends rapidly, the fruit becoming drab, and slightly greenish brown in colour (Fig. 84). It is a firm somewhat leathery rot not easily ruptured by finger pressure and, unlike stem-end rots caused by *Diaporthe* or *Alternaria* (see Supp. XV, Figs 63–64), has a characteristic pungent odour. It is caused by fungi of the genus *Phytophthora*, commonly *Phytophthora citrophthora*.

The disease is only important under wet conditions in the orchard, the fruit usually being infected by spores produced by the fungus in wet soil and splashed by rain onto lower fruit on the tree.

The rot develops quickly on infected fruit and may develop a delicate white surface growth of mycelium, and by this means may spread to adjoining fruit.

It can be controlled in the orchard by application of Bordeaux mixture or similar sprays, following the recommendations of the Departments of Agriculture. The lower parts of the tree and surrounding soil should be sprayed as soon as the first sign of brown rot is seen on the tree. In the packing house the only effective treatment is by dipping the fruit in hot water, which is difficult to do effectively without injuring the fruit. Brown rot is not controlled by the benzimidazole compounds (T.B.Z. and benomyl) which are so effective against the common green and blue moulds.

#### Further reading

Kiely, T.B. and Long, J.K. (1960). Market diseases of citrus. *Agric. Gaz. N.S.W.* **71**, 132–5, 157, 187–92.

### Frost Injury and Secondary Septoria

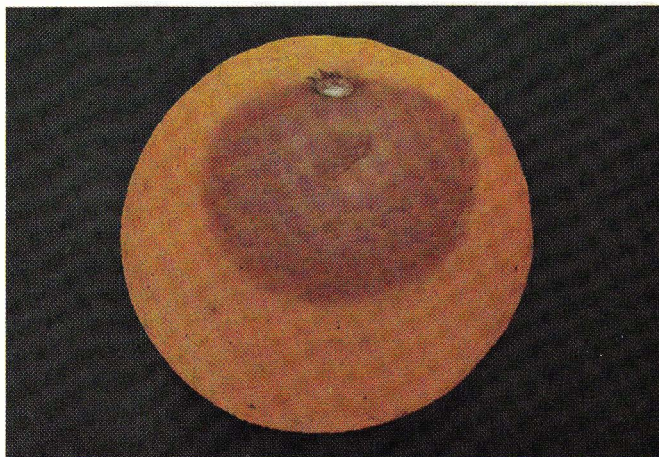
In inland areas during winter, freezing temperatures may occur in the orchard. If the fruit freezes it causes collapse of the rind and drying out of the juice sacs. Rind injury is much more common on the exposed face of the fruit as it hangs on the tree and the collapsed rind usually discolours and develops oleocellosis. The weakened tissue is commonly invaded by fungi, especially *Septoria*.

Crystals of the bitter principle, hesperidin, are often present as white

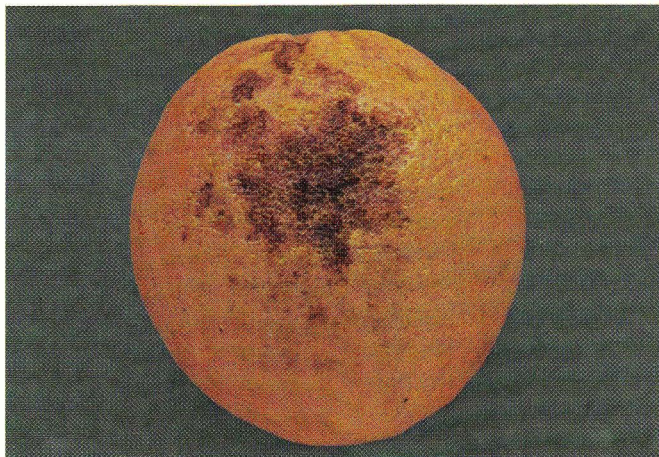
spots in affected pulp and the fruit may develop a bitter flavour. Lemons are more susceptible to frost injury than other citrus.

Frost injury infected by *Septoria* develops the reddish brown to purplish colour commonly associated with septoria spot (Fig. 85) and as the fruit ages the infected area becomes increasingly dark in colour and leathery in texture. However, under moist conditions at low temperature, as in cool storage, invaded tissue may become soft and rotten.

Control is in the orchard by adopting frost protection methods and spraying to control *Septoria* infection.



Brown rot.



Frost injury and secondary *Septoria*.