

Watercore of apples

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WHAT IS WATERCORE?

Watercore is a physiological disorder of apple fruit characterised by water-soaked tissue around the vascular bundles or core area due to the spaces between cells becoming filled with fluid instead of air. Affected tissue is water-soaked and glassy looking. Generally damage is not visible on the skin, and it is only when fruit are cut that the damage is seen. In severe cases flesh can be affected right up to the skin, which then darkens over affected areas.

Some varieties are more susceptible to the disorder than others. These include Braeburn, Sundowner, Fuji and Lady Williams. Red Delicious and Granny Smith also are susceptible.

Fruit with watercore are more likely to develop internal breakdown and alcoholic off flavours during mid to long term storage.

CAUSE

Whilst the cause of the disorder is only partially understood, it is thought to be linked to changes in membrane integrity associated with maturation and ripening. Apples with watercore have high levels of the sugar sorbitol in the intracellular spaces. There are several theories as to how this occurs, as sorbitol is not present in normal tissue.

CONTRIBUTING FACTORS

Watercore is more of a problem in arid and semi-arid areas. Low night temperatures in autumn and high day temperatures when apples are nearing

maturity favour watercore. Low fruit calcium and high levels of nitrogen may increase the chance of watercore in susceptible varieties such as Braeburn, Red Delicious and Fuji. Over maturity at harvest and light crops of large fruit also favour the disorder.

SYMPTOMS

There are two main types of watercore, each having a different range of symptoms. Block watercore occurs during summer on immature apples and radial watercore occurs on mature fruit.

BLOCK WATERCORE is characterised by translucent tissue, which originates from the conducting tissues near the core itself. It forms continuous flooded areas of flesh, which may extend to the skin (plate 1). Badly affected fruit can be recognised by darkening of the green skin or a darkening and high polish of red fruit. The lack of air in affected tissues may cause the cells to die, due to interference with respiration. If the tissues survive, they may recover whilst the fruit is still on the tree.



Plate 1: Watercore in a mature Granny Smith apple, with damage extending to the skin



RADIAL WATERCORE occurs in ripening fruit. When affected fruit are cut across the centre, a number of strips of watercore affected tissue can be seen radiating from the centre like spokes of a wheel (plate 2). These strips run along the conducting tissue of the apple. The affected areas are often on the sunny side of the fruit, where there is more direct heat.

In Japan, fruit with radial watercore command a premium price and are known as “honeyed apples”. They are specially graded and sold quickly.



Plate 2: Radial watercore in Fuji apples, with a range of severity.

Note – holes on the edges of the apples were caused by pressure testing the sample before it was cut.

CONTROL

There are no known cures for affected fruit. Picking fruit before watercore develops and at the correct stage of maturity will help reduce losses. Adequate calcium nutrition and careful use of nitrogen fertilisers can minimise damage in susceptible varieties.

POST HARVEST

Fruit with moderate to severe watercore should not be put into controlled atmosphere storage as internal breakdown may occur. In Fuji apples high levels of watercore prevent the use of oxygen in atmospheres of less than 2% O₂ and CO₂ greater than 2.5%. The watercore tissue turns brown and off-flavours develop. In fruit with slight to moderate watercore, symptoms may disappear during storage.

In the last 40 years there has been research into non-destructive detection methods for watercore and other storage disorders. Several methods have been developed such as light transmittance devices (developed 1964), X-ray absorption devices, mass density sorting (1988) and Magnetic Resonance Imaging (MRI).

ACKNOWLEDGMENTS

Thank you to the staff at the Batlow Fruit Co-operative, who allowed us to photograph fruit being quality tested during the apple intake process of 2005.

FURTHER READING

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ISSN 1832-6668
JOB NUMBER 6105
REPLACES AGFACT H4.AB.5

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