

Part one of a series

Organic production of black spot-resistant apples

By ALLAN MCWATERS,
ALDO ZEPPA AND SIMON MIDDLETON
Queensland Department of Primary Industries and Fisheries

The Queensland Department of Primary Industries and Fisheries (DPI&F) is trialling new black spot-resistant apple varieties suitable for organic orchard systems, in a project also supported by Horticulture Australia Ltd (HAL), Apple and Pear Australia Ltd (APAL) and the Rural Industry Research and Development Corporation (RIRDC).

A key part of this project has been the establishment of a one-hectare commercial orchard block (1100 trees) in the Stanthorpe district of Queensland to certified organic standards. To reach this stage has involved:

- Planting the block with a Queensland-bred black spot-resistant apple variety;
- The cooperating orchardists undertaking organic certification with Australian Certified Organic (ACO); and,
- Trialling organic pest, disease and weed control measures.

This year the planting will produce Australia's first organically grown crop of a new, high-quality, Queensland-bred black spot-resistant apples.

QUEENSLAND-BRED BLACK SPOT-RESISTANT APPLE

The DPI&F disease-resistant apple breeding program has developed superior black spot-resistant varieties through pollination by crossing black spot-resistant apple varieties from the United States (with the Vf resistance gene) with high-quality commercial varieties. Superior selections must successfully pass through two stringent screening phases – glasshouse screening for black spot resistance then field evaluation for fruit quality. In the second phase, selections are also assessed for desirable tree characteristics, fruit eating quality, shelf life and storage characteristics.

Trees of one of the superior black spot resistant selections have been established in the commercial organic orchard trial, which also includes a row of 80 trees of the black spot-susceptible variety, Galaxy. Fruit and leaves on the Galaxy trees have had some infections of black spot, whereas the resistant variety has remained disease-free.

DISEASES AND ORGANIC CONTROL MEASURES

BLACK SPOT (*Venturia inaequalis*) is a serious fungal disease of apples, affecting both leaves and fruit. Fruiting bodies

(perithecia) contain the primary spores, and over-winter on the affected leaves, which fall from the tree in autumn and remain on the orchard floor over winter.

The release of the primary spores (ascospores) is triggered by rain and warmer temperatures in the following spring. The spores are spread by wind and rain to emerging apple leaves on the new-season growth. These spores germinate under suitable conditions of light, temperature and leaf wetness to form primary infections (olive green spots about 3mm in diameter).

The spots darken with age and turn black. Subsequent secondary infections caused by summer spores (conidia) then occur, affecting both leaves and fruit. In conventional production systems effective control measures are based on preventative sprays, which inhibit spore germination on the leaves, and curative sprays, which actively kill the fungal infection.

In the commercial organic trial, no black spot has been found to date on the new disease-resistant variety. However, the disease pressure has been sufficient for the Galaxy trees to succumb to low levels of infection (4.6% of fruit numbers were affected in 2004-05).

Sulphur and copper are the only two available chemical control measures for organic use but are both undesirable. Sulphur is slightly phytotoxic and may reduce photosynthesis, while copper can cause fruit russet and is a restricted input. Copper use is constantly under review and may not be allowable in the future. The Australian apple industry must have a locally adapted black spot-resistant apple variety if organic apple production is to continue or expand.

Kocide was used as a single green tip spray, and wettable sulphur was subsequently applied as a preventative spray at 14- to 21-day intervals. The interval between sprays is shorter early in the season to ensure that newly emerging leaves and shoots are protected. Lime sulphur was also used as a curative spray after significant rain events which would trigger the release of spores. The lime sulphur rate is reduced to as low as 800ml per 100 litres during active shoot growth (October to November), compared to the first sprays applied at a higher rate of up to 4 litres per 100 litres for powdery mildew control.

POWDERY MILDEW (*Podosphaera leucotricha*) is a fungal disease that affects the tips of shoots, leaves and buds, causing shoot death.

Organic control relies on two approaches. First, the early-season lime sulphur sprays described above have a dual purpose in both black spot and powdery mildew control.

Copper use is constantly under review and may not be allowable in the future.

Second, orchard hygiene is critical and removing diseased shoots from the orchard during pruning reduces disease inoculum. This practice of physical removal of affected leaves and shoots should be continued regularly during the growing season.

ALTERNARIA LEAF BLOTCH (*Alternaria mali*) is a relatively new apple disease problem in the Stanthorpe district and in other apple growing regions of Australia. Symptoms appear on the leaves as brown spots 2-5mm in diameter, with a purplish black border. As the spots enlarge they coalesce to form large necrotic areas. Defoliation may take place with severe infections. Symptoms appear on fruit as black spots 1-3mm in diameter on the lenticels and may become more apparent after harvest and during cold storage.

At harvest in March 2005, just over 2% of fruit was affected by alternaria. Leaf infections were also prevalent at this time and some defoliation occurred. No effective organic sprays are available for alternaria control. However, removing diseased leaves from the orchard floor and destroying them is an effective management tool. In the organic trial block, a leaf blower was used to blow fallen leaves into the inter-row and a flail mower was used to mulch the leaves.

Removal of leaves using a tractor-mounted leaf sweeper is also part of an effective strategy for black spot control. The Sadie leaf sweeper (see picture) has rotating brushes with long bristles that sweep the tree row clean of leaves and into the inter-row. Follow-up mowing with a flail mower helps to break the leaves up and destroys the over-wintering black spot spores.

Part two of this research will appear in the next issue of Australian Organic Journal. The second part will feature findings on weed control, nutrition, insect pest control, biodiversity and references.



The Sadie leaf sweeper mounted on the front of a tractor. The rear-mounted flail mower mulches the leaves, thereby reducing over-wintering black spot and alternaria spores



The Australian apple industry must have a locally adapted black spot-resistant apple variety if organic apple production is to continue or expand.

A black spot-resistant apple bred by DPI&F and suitable for organic orchards. It is a sweet, crisp and juicy mid-season apple with good shelf life and storage characteristics