

CBS inoculum management

Citrus black spot (CBS), caused by the fungus *Phyllosticta citricarpa*, is a critical disease of citrus in SA because of its phytosanitary status. By Providence Moyo, Elma Carstens, MC Pretorius, Andre Combrink, Jan van Niekerk, Paul Fourie and Vaughan Hattingh (CRI)

The primary inoculum (ascospores) produced in leaf litter on the orchard floor, after the leaves have been exposed to suitable environmental conditions, is discharged during wet periods. These ascospores then land on susceptible leaves and fruit. If, during the fruit susceptibility period, the leaves or fruit are wet long enough and the temperature is conducive to ascospore germination, primary infection of fruit and leaves occurs. Lesions later develop on the leaves and fruit (**Figure 1**), which then produce pycnidiospores (conidia). Under conducive conditions, the pycnidiospores can be washed down within trees and can contribute to the build-up of the disease.

CBS epidemics build up gradually, and in the case of orchards with their annual harvesting, infected leaves that remain up to three years on trees cause disease build-up. Therefore, CBS is hardly a problem in younger orchards.

In SA chemical control of CBS is aimed at protection of fruit during the fruit susceptibility period, from 80% petal fall until four to five months later. Leaves, however, remain susceptible for 10 to 12 months, protected only by the fungicides during the fruit protection period. Leaves can, therefore, be infected for longer periods during conditions suitable for infection. Although fungicide spray programmes (**Figure 2**) remain essential for effective CBS control on fruit, growers can benefit greatly from investing in inoculum management practices to delay the rate of epidemic increase in orchards and to contribute to annual CBS

control. Inoculum management practices aim to remove leaf litter and pruning debris in which ascospores can be produced, to reduce the build-up of inoculum. Under lower inoculum pressure conditions, growers should experience improved efficiency of CBS control programmes.

Research has shown that leaf litter management comprising leaf litter removal between August and October, as well as mulching, can lead up to 97% CBS control. These practices



Figure 1



Figure 2



Figure 3



Figure 4

Figure 1. Citrus black spot symptoms on Valencia orange fruit Figure 2. Fungicide spray programs remain the foundation for effective CBS control on fruit Figure 3. Pruning debris should be finely chopped before being left between the rows to allow it to dry out and decompose quickly Figure 4. Citrus leaves (leaf litter) on the orchard floor represent a source of ascospore inoculum and should be removed from the orchard

were as effective in reducing CBS on fruit as the fungicide control programme (Truter, 2010).

Management practices to reduce the amount of inoculum, and to support CBS chemical fruit protection programmes, include:

- Pruning – improves aeration in the tree canopy and the orchard, potentially reducing the number of infection periods because the foliage and fruit dry more quickly. It also improves fungicide spray coverage and light penetration of the canopy. Remove as much dead wood from the tree canopy as possible, as the pycnidiospores can be produced from spore structures on dead twigs.
- Removing pruned material from the orchard, promptly after pruning, then burning or composting it.
- Finely chopping or shredding pruning debris in the orchard (**Figure 3**). Chopped or shredded pruning debris left between the rows (not underneath trees) will dry out and decompose much faster.
- Mulching leaf litter with non-citrus material over citrus leaf litter will accelerate the decomposition of the leaves bearing the fruiting bodies, and should be done after leaf fall from August to September. The mulching material should cover the entire orchard floor. (Schutte and Kotzé, 1997; Truter, 2010).



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- Removing leaf litter completely from the orchard (**Figure 4**) between August and early October provided up to 97% control of CBS in the absence of fungicide sprays (Truter, 2010). Removal of leaf litter before petal fall will significantly reduce

the inoculum load in the orchard, thereby improving the efficiency of other CBS control programmes. The leaf litter can be burnt, shredded, composted, or buried.

- Maintaining tree vigour and health, to mitigate CBS infection.
- Removing diseased and declining trees from orchards, or even removal of the entire high-risk orchard.

Importantly, these practices don't replace the need for fungicide applications in commercial orchards destined for export to CBS sensitive markets but will significantly improve the efficacy of the CBS fruit protection programme by reducing the inoculum load.

References

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