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Biological facts for integrated control of apple canker

Info

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Late pruning avoids canker infections
Pruning wounds stay susceptible even longer than leaf scars. Therefore pruning of orchards that suffer from canker should be done as late as possible when the temperature warms again. It's likely that mechanical pruning during pink bud stage doesn't favour infections because rising temperatures limit the wound susceptibility. Also, at that time of year any long wet period is covered by fungicide treatments against apple scab.

Integrated management of apple canker involves variety selection, soil water management, moderate nitrogen supply, sanitation, late pruning, and the application of fungicides during infection events. The new RIMpro-*Neonectria* model forecasts infection events and helps growers and consultants optimize the application of fungicides.

Apple Canker *(Neonectria galligena)* is present in most apple production regions worldwide. The fungus is a wound parasite that enters the tree trough natural and artificial wounds. Fruit trees can be weakened by this disease and even killed. The economic importance of the disease depends on the climate, apple variety and cultural practices. The warm climate of southern Europe favours the defence mechanisms of the plant, and restricts the development of the fungus. When the climate is unfavourable for the disease, infections hardly lead to disease expression, and infected trees may even heal. Conversely, the maritime climate of northwest Europe with frequent rainfall, moderate autumn temperatures and mild winters, is optimal for the development of the disease. Under these conditions, apple canker limits the economic life of orchards, and restricts the possibility to grow highly susceptible varieties like Gala and Nicoter.
The relation between soil, climate, apple tree and disease is complex and research results are not always consistent. Over 100 year research on apple canker however showed many useful details on the infection biology, development of canker in orchards, and the control of the disease.

The susceptibility of the apple tree

Commercial apple varieties differ in their susceptibility to apple canker, but most modern varieties are highly susceptible to the disease.
Susceptibility of apple trees is further increased by the rich supply of nitrogen and any other factor that promotes excessive growth. When an orchard is transformed from IPM to organic management, the importance of apple canker declines despite the fact that in organic production, no effective fungicides are available. The reduced growth and moderate organic fertilisation are the most obvious reasons for this.
A high soil water table and water-logging increase susceptibility and favour disease expression. Temporary inundation of trees during winter can lead to extreme canker development in the following year. When growing high susceptible varieties like Gala and Nicoter under unfavourable climatic conditions, nitrogen fertilisation should not exceed what is really needed, and routine application of foliar nitrogen fertilizers should be omitted. Effective drainage should prevent water logging during any time of the year.

Differences in susceptibly trough the year

Natural and artificial wounds (hail, pruning etc.) serve as potential entry places for canker. The number of wounds on the tree, and the infection risk vary throughout the year. Fruit drop in June, hand thinning, picking and pruning lead to a few hundred wounds per tree yearly. But during leaf fall alone, several thousand wounds arise within a month time.
Because the healing process is faster when the temperature is warm, fresh wounds are only susceptible for one or two weeks during the vegetation season. However, when temperature drops in autumn wounds stay susceptible for

much longer time. Below 8°C the wounds stay susceptible for more than 6 weeks, and below 5°C even longer. Leaf scars arising in November may still be susceptible in January. When it stays really could, this does not matter as below 5°C no canker infections occur. The combination of a high number of wounds that stay susceptible for a long period and frequent rainfall at moderate temperature, explain why in northwest Europe most canker infections occur during autumn and early winter.

Trials and practical spray programs with standard treatments scheduled at 10%, 50% and 90% leaf fall often have disappointing results most likely because the leaf scars stay susceptible for a considerable time after all leaves have fallen. Effective treatments should be aimed against all infection events occurring from the start of leaf fall until at least the end of December.

The importance of disease pressure

Several scientists observed that the number of canker spores involved in an infection event is more important for the infection risk than the temperature or wetness duration. This is confirmed by practical observations that effective control of canker in or near an orchard with many existing canker wounds is very difficult.

Canker wounds produce conidiospores from April till October, and ascospores from October till spring. Frequent rain stimulates the formation of spores by the cankers. Rain triggers the ejection of ascosspores in the air, but most ascospores and conidiospores are splash distributed over the tree. The rainwater running along the branches and trunk is literally 'loaded' with canker spores.

For apple scab most spores are released in the first hours of a rain event, but for apple canker spores can be produced at a constant rate as long as the wetness period continues. The longer a rain period continues the more spores land on wounds, and the more severe the infection gets. Therefore sanitation by cutting out existing cankers is the first condition to allow fungicide treatments to be effective. It is difficult, but ideally this work should be done before autumn leaf fall starts.

Effective timing the canker treatments

Fruit growers and consultants can use the new RIMpro- *Neonectria* model to find the most critical moments for canker control in fall, and plan effective management.

The simulation model uses all available information on the production, distribution and germination of canker spores to calculate infection severity. The model also estimates how long wounds on the apple tree stay susceptible for infections. When users enter their fungicide treatments, the program shows the estimated remaining cover by protective fungicides, copper or lime. This combined information allows the best possible decisions on apple canker management. (figure 1)

In northwest Europe apple canker restricts the possibility to grow highly susceptible varieties like Gala and Nicoter.

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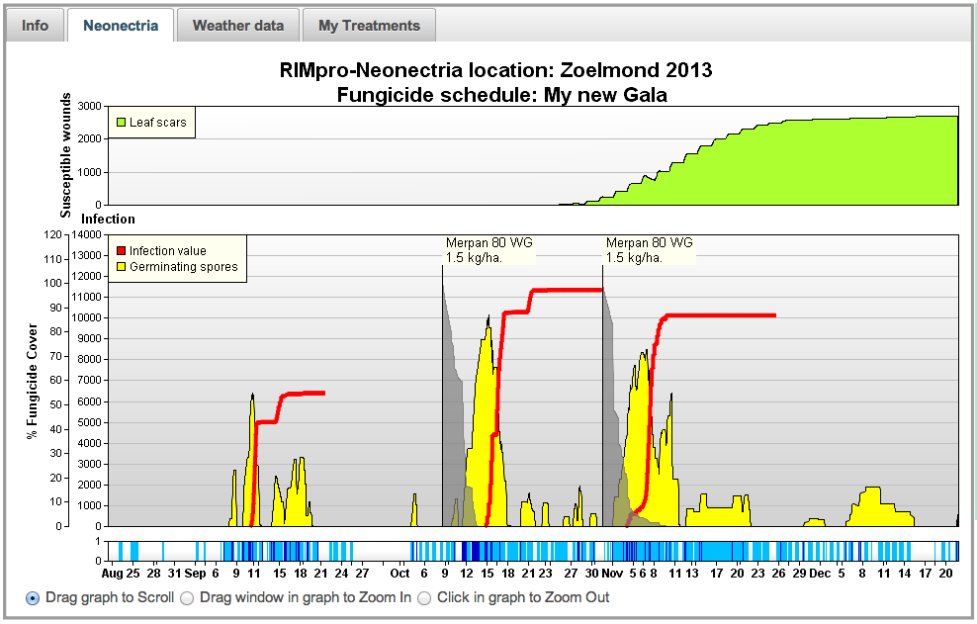

Figure 1: Canker infections autumn 2013. The first infection occurred in September and could have infected picking wounds. The second infection occurred before leaf fall started, and was therefore probably harmless on most varieties. The third infection event was the most dangerous hitting the centre of the leaf fall period. Both Captan treatments were insufficient as they were washed away before the end of the infection event. They should have been repeated. Later in December weather conditions did not allow for infections to occur.