Pear Scab

Dynamic model (Bèta)

This model calculates the infection risk from the number of spores produced by wood scab cankers and distributed by rain splash, and their opportunity to germinate and infect pear fruits.

Manifestation of sporulating lesions on twigs

Most new lesions on pear twigs manifest early spring, and can continue producing conidia for three years. There is no information available on what factors rule the incubation period of scab infections on shoots, and the manifestation of new lesions in spring. The model needs to know when in spring the new lesions start sporulating, and what the variation between the lesions is.

In default settings 50 % of the lesions is already actively sporulating at green tip.

Remind you have to set the date of green-tip for pear in the local parameters for each station to allow this simulation to be accurate.

Duration of seasonal activity of wood scab lesions

Under practical orchard conditions the number of wood scab lesions is stable from spring till July. Some observations suggest that spore production diminishes in July. There is no information on what factors cause this reduction in activity of the scab lesions. In the default settings twig scab lesions stay active for on average 150 days after their manifestation in spring.

Production of conidias

The production of conidia by the wood scab lesions is depending on temperature and humidity. The model uses detailed information on the relation between temperature and spore production published by Saccas in 1944.

There is no quantitative information available on the effect of humidity on spore production.

Detached, not dispersed spores in lesions, lose their viability in time. In default settings they survive on average 5 days. Probably they survive a much shorter time.

Splash dispersion of conidia

Conidia are removed and dispersed from the wood scab lesions by rain splash.

Splash distribution increases with increasing rain intensify and duration. The number of conidia dispersed per mm of effective rain splash is depending on the concentration of remaining spores in the water film on the scab lesions.

Distribution of spores by rain splash, runoff and drip, and the remaining spore population, is modelled as a negative exponential decline with total rainfall during the rain event.

Rain intensity below the minimum rain intensity (0.3mm/30min) to create splash is ignored, and does not contribute to spore distribution in the model.

Germination and infection

Venturia pyrina spores germinate in free water on the plant surface. The germination and infection rate is depending on temperature and wetness duration.

A function for the minimum infection requirements for Venturia pyrina was derived from pooled data published by Villalta (2000) and Spotts (1991). At optimum temperature (20 °C) the required leaf wetness duration for start of infection is 10 hours. In the model 50% of the spores infect after 1.4 * minimum wetness duration under the prevailing weather conditions.

Effect of a dry interval during the infection process on the infection severity

When the canopy gets dry, a mortality process is started on the germinating spores. When the canopy is rewetted, the mortality process stops, and the remaining spores continue their germination/infection process.

From data published by Villalta in 2000 can be interpreted that in the pool of germinating spores the spores survive on average 8 dry hours. To be sure, in the model the default average survival time is set to 12 dry hours. With the default relative dispersion 0.2 applied, the spore mortality follows a continuous sigmoid decline of surviving spores, starting after 6 dry hours, and the last spores die after 18 dry hours.

When germination and infection is at low temperature and takes a long time, the severity of the infection is considerably lower than at higher temperatures. Even under wet conditions, not all spores stay viable for such long time.

Development of ontogenetic resistance in pear fruits

Young pear fruits are highly susceptible to infections by Venturia pyrina, even before bloom. This susceptibility declines as fruits develop. Our field trials have shown that after 60-70 days post bloom, fungicide applications do not longer contribute to the control of pear scab on fruits (variety Conference).

As ontogenetic resistance develops in the maturing fruits, a smaller fraction of the spores that pass the infection process can actually infect the fruits.

Default value is 60 days post bloom (usceptibility of the fruits has declined to 50%) with a standard deviation of 8 days.

Remind you have to set the date of full-bloom for pear in the local parameters for each station to allow this simulation to be accurate.

Incubation and symptom development

We have not yet implemented a module for the simulation of symptom development on fruits. From our observations, and the little published on this subject, it seems that the later in the fruit development the infections occur, the longer the incubation time is. Lesions from infections late in summer appear shortly before harvest, or during storage, even when fruits are stored below 0°C.

Action threshold infection value

The red RIM-infection lines indicate the relative severity of the infection. The RIM-infection value is relative to the disease pressure (=spore pressure= inoculum) in the orchard.

In pear orchards with a low inoculum (little/no scab the previous year), a low RIM-infection could be tolerated when there is some cover left from a previous fungicide application.

In orchards with a high inoculum, even low RIM-infections represent an infection by many spores, and should be taken serious in disease management.

In the local parameters you can set an indicative infection value above which sufficient fungicide cover or curative action is necessary. Your action threshold is shown as a horizontal dashed line in the infection graph.

If you set the threshold to 0, no action threshold line is shown.

The threshold you set has no effect on the calculations.

Static model (Basic)

This model only shows the germination conditions for pear scab spores based on research data published by Spotts 1991, 2010, and Villalta 2000.

A function (“infection curve”) for the minimum infection requirements for Venturia pyrina was derived from pooled data published by Spotts 1991, 2010, and Villalta 2000. Conidiospores of pear scab need little more time to infect than spores of apple scab.

Before the spores can start germinating, they have to be splashed from wood scab cankers or other scab lesions to susceptible tissue. the default minimal amount of rain necessary to start the infection calculations is 0.4 mm.

As in a traditional Mills-like calculation, the infection calculation is stopped after the crop is dry for some hours. The default dry period to terminate the infection calculation is 480 minutes=8 hours.