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Farm specific apple scab information with your private virtual station

Meteoservices provide highly local short-term weather predictions with increasing accuracy. This information is used in RIMpro to make pest and disease predictions without the need of a weather station on the farm.
In 2016 the use of these 'virtual data' for scab predictions was evaluated on large scale. The conclusion is that infection calculations based on virtual weather data lead to the same decisions in scab management as when using an 'on-farm' weather station, at considerably lower costs.

## Info

Practical use of virtual data
Virtual weather data are already in use for pest and disease warning systems. E.g. in northern Italy for grape diseases, in France for apple (MeteoFrance), and in the USA for several crops (SkyBit).

The RIMpro models for pest and disease management are used worldwide by growers and consultants to optimize their decisions in crop protection. Until now, the data to feed these models were collected by weather stations in orchards. However the costs for investment, maintenance,

Virtual Apple scab infections in central Netherlands. The infection moments are identical to the infections calculated with an orchard weatherstation.
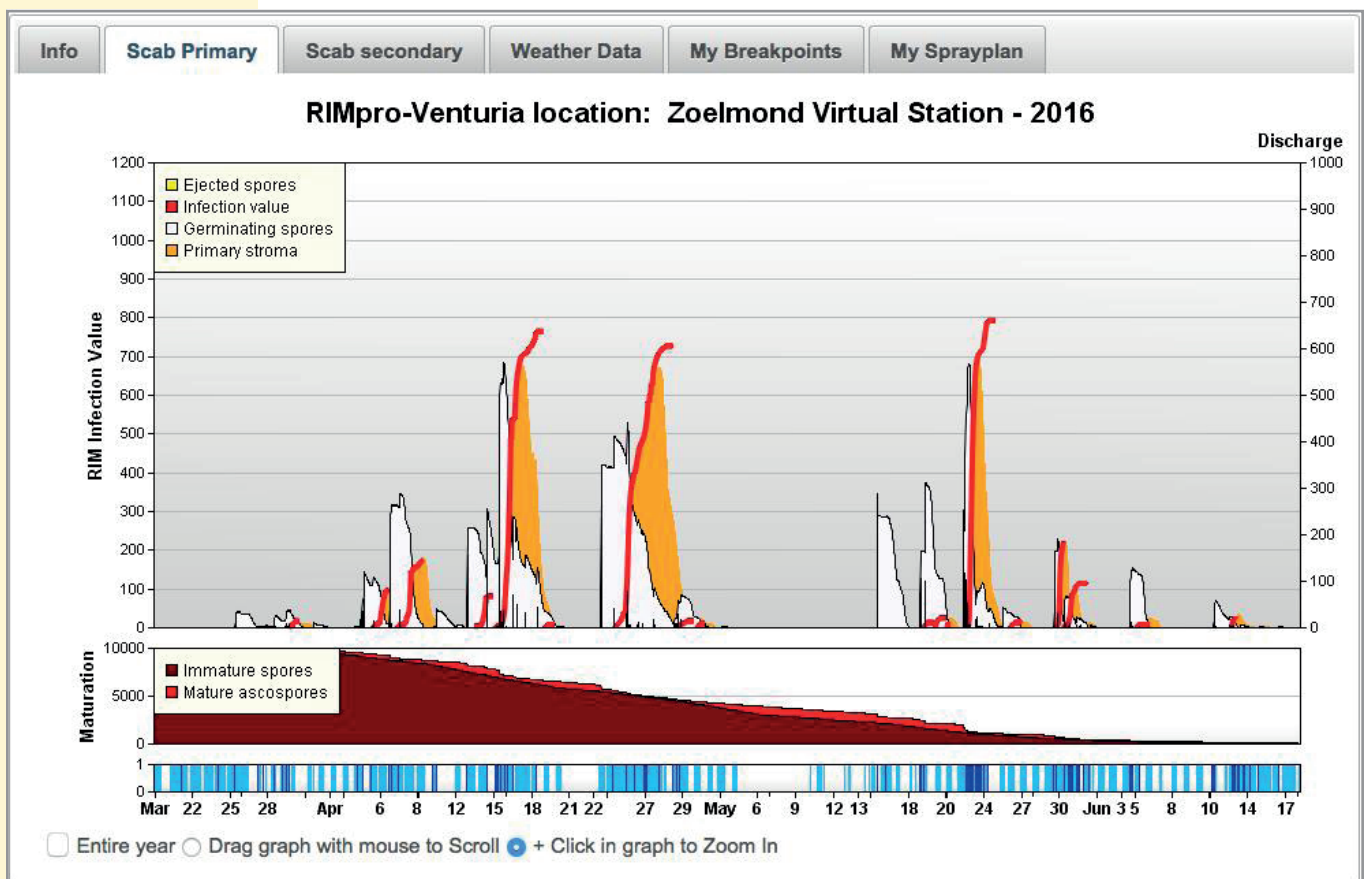
and use of a private weather station are high, and for a variety of reasons the completeness and accuracy of the data is not always as expected. For growers depending on a regional warning system, the nearest station might be at considerable distance, and therewith the value of the warning system for their orchard doubtful.

Looking and planning ahead

Many farms are too large to react instantly on pest and disease developments. And our most important fungicides are protectants which must be applied ahead of infections. From 2010 RIMpro uses local weather forecast to predict infection development and depletion of fungicide residues. This information is useful to plan next fungicide applications effectively.

Local short-term weather information is getting ever more accurate, and is used for many purposes. Meteorologists speak of 'nowcast'. They can tell accurately how on THIS moment the weather conditions on a certain location are. If we store this information every hour, we build a data file like we would do for a weather station in that orchard. In this way we can use the meteodata to calculate pest and disease development in the past, and make predictions for the coming days.

MeteoBlue nowcast

MeteoBlue (Basel, Switzerland) provides a worldwide weather service based on NMM technology. For central Europe the information on precipitation for the next 2 hours is updated every 15 minutes based on rain radar observations. This makes the MeteoBlue nowcast very accurate. The resolution of the predictions for Europe is 1-3 km.

www.RIMpro.eu
Growers can create an account on www.rimpro.eu , and setup a virtual station for their farm. The costs for RIMpro + MeteoBlue data are 250 euro per year.
For help or additional information:
marc@rimpro.eu

Apple scab *EFM*

RIMpro uses the MeteoBlue forecast, and will use the MeteoBlue weather to supply early season data previous to the setup of new virtual stations.

Leafwetness has to be calculated

Meteorological data contain e.g. information on a temperature, air humidity, rain, wind, and global radiation, but not information on how long apple trees stay wet.

Crop wetness has to be derived from the other meteo data. Simple methods as the assumption trees are wet as long as relative humidity is over 85% are not accurate enough.

From 2014 Vincent Philion and Alexandre Leca at IRDA in Québec worked on a model that simulates wetting and drying of apple leaves of different age and position, even for different apple varieties. This model has been implemented in RIMpro, and has been validated on large scale in 2016.

'Crowd validation' of virtual leaf wetness

Each time a RIMpro user viewed an apple scab graph in 2016, he/she was asked in a popup window if the apple trees were wet or dry at that moment. In this way 120.000 answers were collected that can be used to validate and improve the model.

NMM
NMM is short for 'Nonhydrostatic Meso-Scale Model'. With this technology it is possible to provide very accurate short term weather forecast by including the effects of geology and landscape on the local weather in the calculations.

Table1: Wetness as indicated by the weather station, and virtual leaf wetness, compared to the growers observation. (79124 observations on 74 locations in Europe in 2016)

	True wet	True dry	False wet	False dry	Accuracy = % True
Leafwetness sensor	37%	44%	8%	11%	81%
Virtual leafwet	39%	34%	18%	9%	73%

For 74 locations in central Europe both virtual data and orchard station records were available, and a considerable grower feedback was collected. For these locations each observation was combined with the station leaf wetness record, and the virtual wetness indication.

Scab on Jonagold leaves *EFM*

Scab on Jonagold fruits *EFM*

Conclusions
- The virtual wetness simulations are on the safe side.
- Not the accuracy of the leaf wetness model, but the accuracy of the information on precipitation is the critical factor in the system.
- The calculated infection events based on orchard station data or virtual data are comparable.
- The use of virtual weather data leads to the same decisions in apple scab management as the use of an orchard weather station.
- Virtual data can replace 'on-farm' weather stations for scab management.

This evaluation was made using MeteoBlue weather data for locations in central Europe, the area where the MeteoBlue nowcast is optimized by rain radar integration. Using weather data provided by other weather services can yield other results.

For 35 locations in The Netherlands, Belgium, France, Germany and Switzerland all primary infections as calculated with the orchard station data or virtual data were compared.

There are limits to the accuracy of this validation. Some users might be annoyed by the repeated question, and have provided random answers. Several weather stations provided inaccurate data for some time due to blocked rain gauges of other technical issues. Leaf wetness caused by irrigation is not included in the calculations. Data are used as they are and have been used to run warningsystems in 2016.

Virtual leaf wetness little to wet

The results in table 1 show that for 81% of the nearly 8.000 observations the weather station readings agreed to the growers observation. The accuracy of the virtual leaf wetness is 8% lower. The virtual system is little more conservative: more False Wet indications = model says wet, but grower observed dry.
The impression is that particularly under slow drying conditions the model overestimated the leaf wetness time.

Indicated infection events comparable

Eventually the question is whether the difference in leaf wetness estimation leads to differences in infection calculations, and to different decisions in apple scab management.
For the 35 locations, the period of ascospores maturation, and the general trend in the calculated infection events was almost identical using orchard station data or virtual data. From all 417 potential infection events, 88% were calculated with both data types. 9% of the infection events were only indicated with orchard station data, and 3% of the potential infection events were only calculated using virtual data.
The data showed notable differences in calculated infection severity between different types of weather stations on the same location. These differences were more important than the difference with the virtual station.
For 65% of the infection events the severity class (trace = RIM<10, light = RIM 10-100, medium = RIM 100-300 or severe = RIM>300) was the same for station and virtual data.

BELGIUM:
POTATO PEEL AS A SOURCE OF CROP PROTECTION PRODUCT

It is possible that in the future the foliage of tomatoes, leek, rests of garden herbs, potato peel and chicory roots may serve as a source for the production of biostimulantia and green crop protection products. Researchers at Gent University, Belgium, are going to investigate these waste products from agriculture and horticulture for the presence of natural substances with protecting or growth promoting characteristics. Biostimulants are natural molecules promoting plant growth or protecting

the plant from all sorts of stress such as drought and heat. In the case of green crop protection products, researchers are looking for molecules protecting the plant from infections caused by bacteria, fungi, insects or nematodes.

Professor Danny Geelen of the Plant Production Department of Gent University coordinates the project. He is hopeful of finding new bioactive substances: "Plants produce a lot of substances that keep them healthy and protect them from natural enemies.

Of course, these substances are also present in harvest waste and can be extracted and purified from these." These extracts are first screened in the laboratory for their activity. Promising extracts will be tested for their effectiveness during field trials in the second phase of the project.

The research will be carried out in close cooperation with companies that market biostimulants and green crop protection products. (*source: Gent University.*)

GERMANY:
LITTLE MONEY TO BE MADE FROM COST REDUCTION

Almost everywhere in Western Europe apple prices have been under pressure for some years now. The question is whether it is possible, and if possible where, to reduce costs. Another question is what the production costs are. This last data makes it possible for the fruit grower to know what selling prices are necessary to be able to continue as a fruit grower, also in the long term. The organisers of the Bundeskernobstseminar on 10 January this year in Bonn, Germany, had asked German fruit growing consultant Wolfgang Jäger, to answer both questions. Jäger works as a private consultant for the POB consultancy (Private Obstbauberatung Bodensee), situated on the Bodensee.

Few words are needed on further cost reduction: not much is to be gained here. Production has a significant influence on production costs and the yield (in euros) has a much greater influence on business results than the costs. From an analysis of the business results of 136 fruit farms with indirect marketing (through marketing organisation or trading company) in North Germany, it appeared that the differences in cost

structure between the farms were slight. On the other hand, the 33% best performing farms had € 5,000 more yield per hectare than the 33% least well performing farms. The difference in labour productivity between the two groups was even € 30,000 per employee.

Jäger also carried out a cost price calculation for a 15-hectare fictitious family fruit farm on the Bodensee with market-

ing through the cooperative. Jäger's calculation at a production of 35 tons per hectare resulted in a price of 42.5 cents per kilo. At a production of 50 tons per hectare costs fell to 32 cents per kilo. For a 20-hectare farm Jäger calculated production costs at 40 cents at a production of 35 tons per hectare and 30 cents at a production of 50 tons per hectare, (*EFM, GP*)

According to Wolfgang Jäger, raising yields has a much greater influence on business results than reducing costs. *EFM*