

RIMpro as a Tool for Management of Apple Scab

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RIMpro is an apple scab prediction program that was developed in Europe by Marc Trapman with assistance from many European apple scab experts who collected the data required for model development and validation. RIMpro has been used in Europe for more than 15 years, but in North America it has not been used very much except in Quebec. Thanks to some prodding and considerable assistance from several colleagues (Vincent Phillion in Quebec, Dan Cooley and Jon Clements in MA), I was able to access RIMpro for the past two years and have used it to monitor scab development for three different locations in eastern New York (Highland, Peru, Chazy).

RIMpro contains a proprietary apple scab model that is useful for (i) identifying the start of the scab season, (ii) quantifying risks associated with key infection periods between green tip and first cover, and (iii) determining the end of the primary scab season. RIMpro will provide more accurate information on apple scab infection risk than the traditional pseudothecial squash mounts that have been used for many years to assess apple scab ascospore maturity in spring.

What you should know about RIMpro:

- Users will need to pay an annual fee: A subscription to RIMpro (www.rimpro.eu) will cost a grower \$200 Euros (currently about \$220) per year. An “advisor” license is available for consultants who wish to monitor multiple sites and provide their clientele with web links to the simulation results in real time.
NOTE: Marc Trapman has graciously agreed to provide free access to RIMpro for the 2016 season for anyone attending an introductory meeting to be held in Hyde Park, NY on March 14th. Register at (<http://www.redtomato.org/summit/>).
- Users will need to identify a source for the weather data that will drive the program. Several different options are available, as described below.

Why I believe RIMpro has value:

- RIMpro is currently the most sophisticated program available for predicting apple scab risk in spring.
- Unlike previous apple scab models that simply estimate how many apple scab spores are mature at any given point in the season, ***the RIMpro model interfaces with weather forecasts to predict not only how many spores are mature, but also how many spores are likely to be discharged during rains and how many ejected spores are likely to cause infections in unsprayed trees.*** To do this, it uses the forecasted temperature, rainfall pattern, duration of wetting, and differences between daytime and nighttime spore discharge. Thus, spore discharges during cool or nighttime wetting periods (when fewer mature spores are discharged) are automatically discounted compared to warm daytime wetting periods when a high percentage of mature spores are discharged.
- RIMpro is useful not only for predicting when sprays are needed early in the season, but also for identifying which wetting events are likely to account for most of the scab infections during the middle of the ascospore season. It also indicates when the ascospore supply has been depleted after bloom and seems to accurately account for dry periods when ascospore development slows or stops.
- Although it may appear confusing at first glance, the output is easy to interpret: a red line in a graph indicates the RIM value on a scale of 0 to 1000. A RIM value of 1000 would mean that 10% of the total season’s ascospores could be expected not only to discharge, but also to cause infections, during that infection period. Events with low RIM value (< 300) at the beginning and end of the primary scab season generally will not cause economically significant infections in orchards that were scab-free the previous year but may still pose a threat in high-inoculum orchards.
- RIMpro is a cloud-based system that runs equally well on Mac and Windows operating systems.

Weaknesses of RIMpro:

- Lack of documentation: Currently, there is no documentation available to explain how the model works, so users must learn how to use it from those who already have experience with it or by spending some time looking at outputs and the underlying data tables used to generate the graphic outputs. The developers have

focused their time on producing a good model and have not yet produced an “owners manual” for the product.

- Model predictions are no better than the weather forecasts: Thus, RIMpro may predict a major infection event four days from now, but that infection period may never materialize if the weather forecast changes prior to the event or if the weather forecast is wrong. The RIMpro prediction is updated with each change in the weather forecast, so the RIMpro forecast will be adjusted just as soon as weather forecasts are adjusted. After wetting events are over, the RIMpro graphs will show what actually happened (based on weather records from whatever source is used), so the historical record never changes after the event, but the forecasted values can vary as weather forecasts are updated.
- RIMpro still needs a biofix to start the model: RIMpro’s accuracy can be improved by knowing when the first mature scab ascospore is released from overwintering leaves, but that can be determined only by having a trained observer collect scabby leaves and run discharge tests in spring starting about a week before the green tip bud stage is anticipated. In the absence of information on when the first spore is released, RIMpro uses the green-tip date (as entered by the user) as the biofix for first spore release. However, in years when spores are ready before green tip, using green tip as biofix can lead to an underestimate of actual risk for early scab events. In the absence of a biofix, one can make early-season outputs from the model more conservative by entering a green tip date that is 7-10 days earlier than actually observed, thereby reducing risks associated with early spore maturity if the actual date for first mature spores is not known. Determining the date of first spore release is much easier than performing a traditional squash mount assessment of ascospore maturity, but it still requires a skilled observer with access to a microscope and time to conduct regular leaf assessments over a 10-14 day interval in spring. After the first mature spore is detected, no further leaf assessments are needed.

Weather data options for RIMpro:

RIMpro forecasts for any location around the world are based on weather models and forecasts from a Norwegian weather service. This forecast sometimes differs from local forecasts from other sources, but my subjective evaluation over the past two years suggests that it is no more or less accurate than weather from the National Weather Service or other US-based weather services. RIMpro uses a separate feed for actual meteorological records (i.e., weather data as it actually occurs hour by hour). This meteorological data feed can come either from on-the-ground weather stations or from “virtual” data as described below.

OPTION 1: Those who want to run RIMpro with data collected from a weather station in the NEWA mesonet (www.newa.cornell.edu) will be able to do so. Work is under way to develop a webpage on a server to provide NEWA data in RIMpro format. There will be a modest charge to run RIMpro with data from NEWA weather stations to help support NEWA, which otherwise provides free, open access to any user.

A word of caution about on-the-ground weather stations: The RIMpro output will be no more accurate than the calibration of the on-farm weather station. Thus, on-farm weather stations must be maintained and monitored if they are to provide accurate outputs for RIMpro and other pest management models.

OPTION 2: RIMpro can be run for any location in the world using virtual weather data. Virtual weather data are generated for specific GPS coordinates and elevations using weather algorithms and publicly available weather data (e.g. National Weather Service, etc.). These weather algorithms have been used for many years to generate weather forecasts. The current consensus is that data from a well-calibrated on-the-ground station are probably more accurate than virtual weather data for that specific location, but virtual weather data may be just as accurate as an on-ground station that is located at some distance from the site of interest, especially if the ground-based station is not being properly maintained. Thus, RIMpro users whose farms are some distance from NEWA stations may find that virtual data are just as accurate as data from the closest on-the-ground weather station.

If one chooses to run RIMpro using virtual data, then the next decision concerns the source of virtual data to be used:

OPTION 2A: RIMpro users anywhere in the world can access virtual data from MeteoBlue based in Switzerland. There is a modest additional charge for this weather service over and above the cost of subscribing to RIMpro. In Europe, virtual data and ground station data match reasonably well, detailed comparisons are not available for North America.

OPTION 2B: Canada has a virtual data network called HRDPS. In 2016, Vincent Phillion in Quebec will

run a server that provides free weather data to RIMpro users for 75 coordinates in ME, NH, MA, NY, CT, RI, and Quebec as part of a large scale test. A map of stations and instructions on how to connect to the data will be provided soon. More stations might be added in the future.

How to get connected with RIMpro:

- To learn how to get connected and use RIMpro, consider attending the meeting in Hyde Park, NY on 14 March (<http://www.redtomato.org/summit/>).
- If you cannot attend the Hyde Park meeting, you can find more info on the RIMpro fee structure at (<http://rimpro.eu>).
- For info on connecting to RIMpro from weather stations other than NEWA stations, send your inquiry via e-mail to: marc.trapman@biofruitadvies.nl

Other functions of RIMpro:

- A model for predicting fire blight infections during bloom has been developed, but it will require more field validation before it can be considered as a replacement for or supplement to MaryBlyt or Cougar Blight.
- RIMpro also includes models for codling moth and European apple sawfly, and by summer of 2016, it will also have a model for predicting sooty blotch and flyspeck. I can't comment on the usefulness of these models as I have never attempted to use them.
- Fungicide depletion model: RIMpro includes a function for estimating how many scab infections will survive based on the history of fungicide applications. However, that part of the model is not functional in the U.S. because no one has entered the necessary data on U.S. fungicides, rates (in English units), and depletion curves for the various fungicides. Even if data were entered for U.S. fungicides, accuracy of the fungicide depletion model might be questionable due to the lack of data needed to generate depletion curves for every fungicide on the market.

An example of RIMpro output showing the major scab events at Highland in spring of 2015:

