Weather Forecast Accuracy : Part 4
Predicting Disease Risk

Andrew Hodson
HortPlus
andrew@hortplus.com

So far we have looked at forecasts of temperature, rainfall, medium term regional weather but how good are forecasts at predicting disease infection risk? As already stated the forecasts cover the period 2004 to 2008 and were produced at about 11am each day and cover the whole country. This information has been used to compare predicted and actual Mills blackspot risk. I could have used other disease models but this one is widely used by apple growers and uses most of the forecast elements.

The first task we have is to predict leaf wetness. For those of you that haven't seen one, an example is shown in Figure 1. They are an essential part of predicting the outbreak of wet weather diseases. This variable is not in the weather forecast and needs to be derived. A system was developed by HortPlus staff using weather variables from historical information. In the end we have settled on a rule based system using rainfall, humidity, temperature, wind speed, wind direction and time of day. Using actual data we found that leaf wetness could be derived from other weather variables 97 out of 100 times. The first rule of the system is very simple. If it is raining it is wet. This rule shows 75% forecast accuracy. The other rules are more complex and they revolve around the wind speed and time of day. Leaf wetness sensors tend to dry out more quickly when it is hot with a strong wind during the day and tend to dry out more slowly on a calm night with high humidity. By adding the other rules the forecast accuracy moves to 82%. The accuracy is very similar to the rainfall situation. Big events are rarely missed but showers of rain are difficult to predict. The increase in accuracy for leaf wetness forecasts is mainly due to the other factors like humidity. These factors may be forecast even though a shower doesn't occur in a particular area.

Figure 1 : A Leaf Wetness Sensor

Next on to the prediction of Mills periods. These are based on temperature and duration of a wet period according to the following formula:

wetness for "Marginal" = 6.0 + 103 x 0.735t hours
wetness for "Light" = 9.0 + 103 x 0.735t hours
wetness for "Moderate" = 12.4 + 137 x 0.735t hours
wetness for "Heavy" = 19.1 + 202 x 0.735t hours,

where t = mean temperature during the wet period.

The colour coding for Light and Severe events is shown from HortPlus Metwatch Online in Figure 2. The Nil events are how close it came to a Marginal event. Growers can take the events literally. 99% of the way to a Marginal event is probably close enough to a marginal event, particularly early in the season when flower clusters are quite dense. They will probably dry out slower than the leaf wetness sensor predicts.

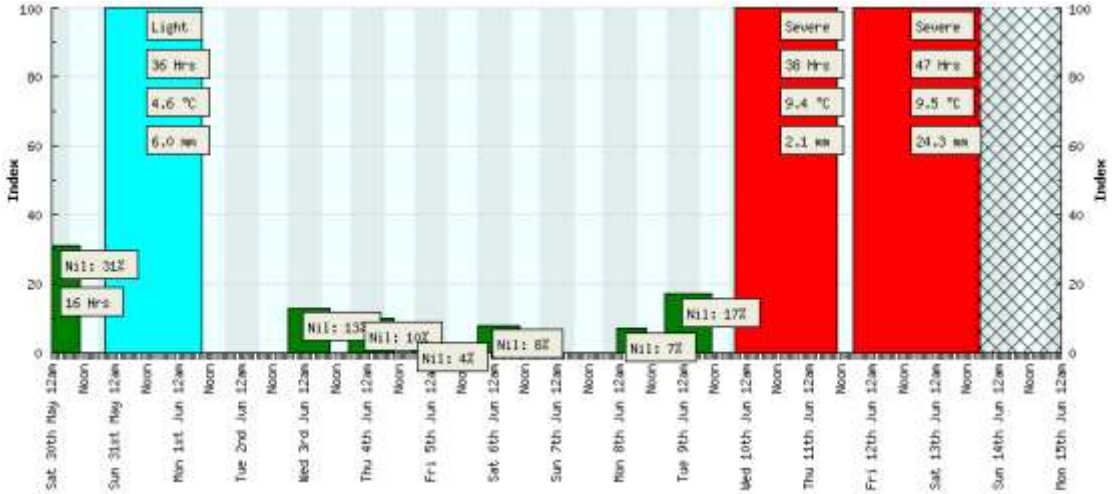

Figure 2 : Metwatch Online display of Mills periods

For the analysis I have ignored events already in progress and small leaf wetness events of less than 4 hours. Also I have included predicted infection events at any time of the day or night and from any station. In practice these are important rules but don't upset this analysis. The canopy dry out time has been set to 4 hours. The issue here is if we get a short wet period followed by a short period of drying then another wet period. In practice they are all treated as one infection event.

Table 1 shows how an overall summary of infection events. The forecast seems to underestimate what will actually happen for the Marginal and Light classes but over predict the occurrence of No Event and Severe event.

Table 1 : A comparison of actual versus forecast Mills periods

Risk Level	Forecast	Actual
No Event	1520	897
Some Wetness but no Event	11690	13308
Marginal	1619	2524
Light	1672	2041
Moderate	1425	1607
Severe	1412	1355

If we look at individual forecasts I was surprised how sensitive the model was. Minor changes in parameter values lead to big result changes. For example changing the dry out period from 4 hours to 5 hours lead to many more marginal events being produced. For that reason I have joined infection levels together. The No Event, Some Wetness but No Event and the Marginal groups have been combined [Group A] and the Light, Moderate and Severe groups have been combined [Group B]. Under that regime, 75% of the forecasted Group A events actually occurred while 70% of the forecasted Group B events occurred. Not a bad effort but I am not sure I would use any predicted events as my sole source of information in deciding whether to spray or not. At a 70% prediction accuracy, three in ten times the forecast will be wrong.

Other sources of information would include the time of year and the number of spore that would be released in the next rain event. Dr Robert Beresford has done a fantastic job of producing the Integrated Blackspot Model. As far as I am aware, this is a world first and should be a valuable reference source for all apple growers. As well as these tools, I would also look at the extended forecast. The accuracy of this was explored in a previous article.

Over the last few months, the forecasts produced by the Met Service and made available through various HortPlus products have been scrutinised to answer the question "How good are the forecasts?" Over 11,000 forecasts all up from all over the country. I am not aware of any other service provided to growers doing this. Lots of people claim theirs is best but from now on I will be demanding that they prove their claim. Until that happens the claim will be treated as wishful thinking. As usual you can test drive Metwatch Online by sending an email to support@hortplus.com and send any comments to me at hortplus@gmail.com