Using weather tools to make vineyard management decisions

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Prevailing weather conditions affect both the growth and health of vineyards. Following weather forecasts is a critical step to planning vineyard activities. It is also valuable to review past weather conditions and their effect on vineyard management.

A weather station is an invaluable tool to help understand seasonal conditions and their impact on the vines in a particular location. The most important measures for grape growing include:

The recording of temperature: Monitoring of extremes as an indication of what is happening on the vineyard. For example readings close to and below 0 °C are critical for frost protection systems. Equally, monitoring periods of extreme heat is important in planning irrigation to minimise heat damage to vines.

Monitoring rainfall: Rainfall recording is also an integral part of planning of irrigation schedules. This is also critical to managing downy mildew and *Botrytis* infection periods.

Humidity: This is another critical measure, providing indication of the likelihood of downy mildew and *Botrytis* infections maintaining active growth.

Leaf wetness: A useful tool, that is not available from Bureau of Meteorology stations, is a measure of leaf wetness. This sensor provides information critical to knowing whether or not a downy mildew infection period has occurred.

Wind speed and direction: Wind impacts particularly on fungicide spray programs, as it helps optimise the timing of spray applications to match expected conditions. This measure has not previously been integral in vineyard owned weather stations. However in some countries it is mandatory to record weather conditions at the time of spraying.

Like all tools the usefulness of the information that it provides is enhanced by its accuracy. Bureau of Meteorology sites provide detailed, accessible and accurate data within the district, however data from an onsite weather station is the most useful as it indicates how the vineyard site is responding to the local prevailing weather conditions. Being even a small distance from a Bureau of Meteorology site can significantly change the nature of the data collected. Similarly the usefulness of weather station data is enhanced by careful siting within a vineyard to ensure it measures representative data. In large vineyards weather conditions can vary considerably and is affected by topography (height above sea level, aspect, windbreaks etc.) as well as by other factors such as the method of application of irrigation (dripper as compared to overhead sprinkler). All of these factors need to be taken into account when deciding on where to place a weather station

The accuracy or weather data is also enhanced by the number of years of past data that can accessed to compare the influences of the current season on expected vine growth and fruitfulness.

Comparison of this data with a local network (such as the NSW DPI networks at Griffith and Mudgee) also provides a good indication, particularly where the vineyard in question has been calibrated against other stations in the district.

NSW DPI weather station networks at Griffith and Mudgee

NSW DPI installed 5 stations each at Griffith and Mudgee in July 2014 as part of the Skills Development Program in order to provide growers with regional information on weather conditions. This network provided the basis for the fortnightly VineWatch Bulletins produced for the 2014 –2015 growing season **www.awri.com.au/industry_support/viticulture/vine-watch**

The data is available at all times at **www.awri.com.au/industry_support/weather-nsw.** This website shows current conditions, as well as a summary of the current day's conditions, the previous day's conditions and weekly, monthly and annual summaries. Most importantly it is possible to download data from each of the 10 sites; with the ability to select information from any period of interest (e.g. daily, weekly or monthly data which may then be manipulated in a spreadsheet).

An example of this is shown in Table 1. Rainfall data from the 5 Mudgee stations is compared with the Bureau of Meteorology Mudgee Airport station **www.bom.gov.au/climate/data.** For the period from September 2014 to April 2015 the Mudgee Airport station recorded significantly less rain than the other stations (329 mm as compared to a range of 413 – 445 mm for the five stations).

Comparison of the monthly rainfalls shows considerable variation across Mudgee, highlighting the value of monitoring weather events in relation to a particular vineyard site. This can be from a weather station on the vineyard or by utilising resources such as a nearby Bureau of Meteorology station or from a local network such as those installed at Mudgee and Griffith.

When installing a weather station on a vineyard it is useful to retrieve data from the local Bureau of Meteorology network in order to compare the readings from other stations with the new station. This calibration then provides an indication of how the vineyard relates to local conditions. As an example it would seem that the Bureau of Meteorology station at Mudgee Airport is a drier site as compared to the five stations in the local network. This then allows understanding of what a regional forecast means for a particular vineyard, by comparison to the readings gathered from the vineyard.

Figure 1 shows comparison of average monthly humidity data from the NSW DPI network at Griffith (data downloaded from **www.awri.com.au/industry_support/weather-nsw.** Whilst there is some variability with the data there is a definite trend, with Hanwood being the most humid site and Nericon the least humid. Although the differences are small (4 – 9%) they are significant as the readings are the average for a whole month. The differences may be related to the siting of the weather station, eg. a grassed area as compared to bare ground. This needs verification as the higher humidity at Hanwood may indicate a greater susceptibility to *Botrytis* under some conditions.

Figure 2 shows comparison of average monthly leaf wetness data from the NSW DPI network at Griffith. The Yenda data shows significantly higher leaf wetness than the other sites. This may be related to a number of causes and needs careful verification as what factors are making the leaf wetness readings higher at this site. Issues that may cause such a significant difference, as compared to other sites, include the density of the canopy at the point where the leaf wetness sensor is placed. Alternatively it may be that the vineyard is watered by overhead irrigation, increasing the relative humidity in the canopy and maintaining higher levels of leaf wetness. Examination of the data for October at Yenda, suggest this is the case with several periods during the month where there was no rainfall but the leaf wetness sensor recorded high levels of leaf wetness. Regardless this is important information for interpreting weather station data as compared to your own vineyard siting. This is particularly important when checking whether there has been a downy mildew infection period.

Figure 3 shows data from the Yenda site during a rainfall event of 11.2 mm. This figure helps determine whether or not there was a downy mildew infection event during this period. For a downy mildew primary infection to occur there is a requirement for '10:10:24' conditions to be met. This means that to have an active primary infection, temperatures must be greater than 10 °C with rainfall over 10 mm and a 24 hour period of 100% leaf wetness. Figure 3 plots this data from 14:00 on 12 October, 2014 until 14:00 the next day. During this period there was 11.2 mm of rain but there were extended periods when leaf wetness was 0% as the rainfall occurred in two main periods. The nine hours of leaf wetness at 0% clearly indicates that this was not a downy mildew primary infection period at Yenda.

Weather forecast services

There are many weather websites that provide forecast information across Australia. Provided your vineyard is close to a major town, forecasts are available with a forecast period of up to seven days. To determine which forecast best matches your vineyard site it is worthwhile choosing a couple of sites and then evaluating them for their accuracy in relation to your vineyard. The data sets available to meteorologists allow the majority of these forecasts to be reasonably accurate for up to four days and providing forewarning of changes in conditions over seven days.

The recent introduction of MetEye, on the Bureau of Meteorology website (see Figure 4), has taken this a step further by providing data from existing automated weather stations which is integrated with local forecasts **www.bom.gov.au/australia/meteye.**

MetEye data is then interpolated to provide a seven-day forecast for your current location (see Figure 5 for Mudgee data for 19 May 2015).

The data for this service is stored in the Australian Digital Forecast Database (ADFD) with a 6 km^2 grid from which maps are generated and forecasts overlaid. This means that each forecast is fine tuned to a 6 km^2 area and takes into account factors including height above seas level and the surrounding topography. Comparison of your own station's data with that from Bureau of Meteorology sites and live MetEye data will help calibration of your station against future forecasts.

For example, with frost forecasting, the elevation of your vineyard and its surrounding topography will influence the behaviour of pools of cold air. Once you have determined whether your site is equivalent, cooler or warmer than the Bureau of Meteorology forecasts this calibration will aid decision making in response to frost warnings.

Comparison of rainfall data at Mudgee (Bureau of Meteorology) 2014 – 15

Table 1: Comparison of rainfall data at Mudgee; the Bureau of Meteorology station at Mudgee airport, green highlighted data) is compared with the five weather stations installed by the New South Wales Department of Primary Industries (NSW DPI) in July 2014.

	Goree Park	Logan	Stein	Woodbrook	Yeates	Mudgee Airport
September	18.8	22.6	26.4	33.2	24.2	26.8
October	19.8	24.2	25.0	20.2	21.8	22.6
November	36.4	43.2	47.8	30.2	32.8	14.6
December	97.0	97.2	105.8	104.8	113.8	60.4
January	96.0	122.0	71.4	81.4	75.6	74.6
February	41.2	14.0	57.2	36.2	30.0	23.4
March	17.8	14.8	27.2	25.2	31.0	13.6
April	98.2	91.4	52.6	114.0	93.4	93.6

The five new stations– rainfall in each month

lowest highest

Mudgee Airport data rainfalls that fall outside the range of the five new stations

Griffith average humidity

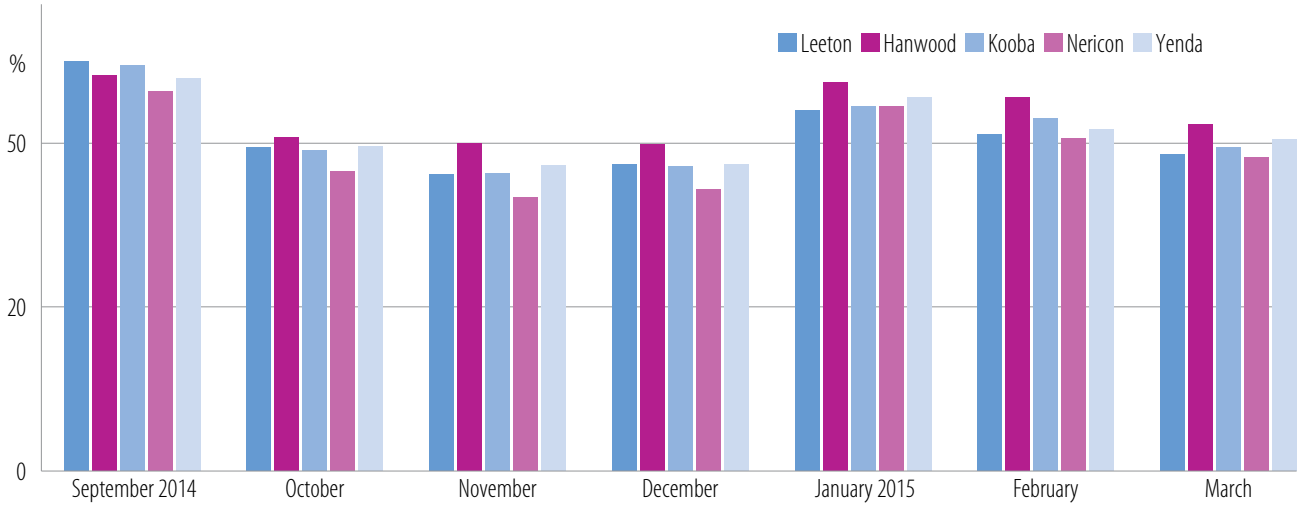

Figure 1: Comparison of monthly average humidity figures at Griffith. The data is from the NSW DPI network and may be accessed at **www.awri.com.au/industry_support/weather-nsw**

Griffith average leaf wetness

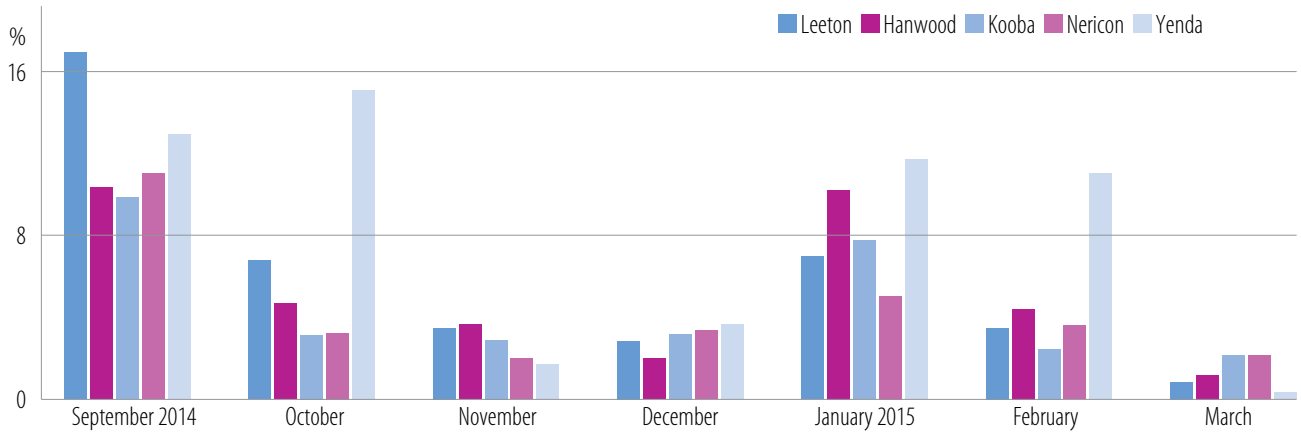

Figure 2: Comparison of monthly average leaf wetness figures from the Griffith weather stations. The data is from the NSW DPI network and may be accessed at **www.awri.com.au/industry_support/weather-nsw**

Yenda 24 hour rainfall (x50) and humidity

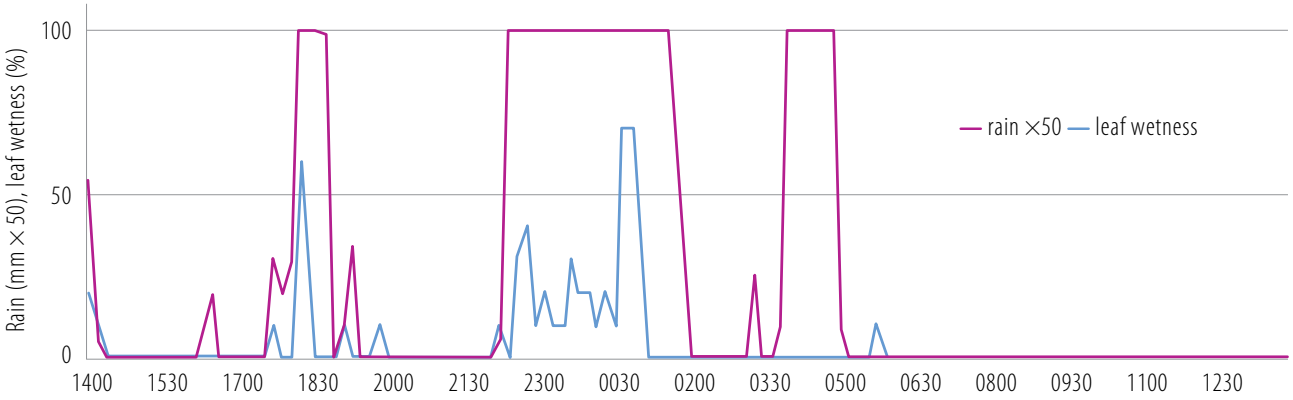

Figure 3: Rainfall and leaf wetness recorded at Yenda from 1400 on 12 October until 1400 the next day. Rainfall data in mm is multiplied by 50 and leaf wetness as % leaf wetness.

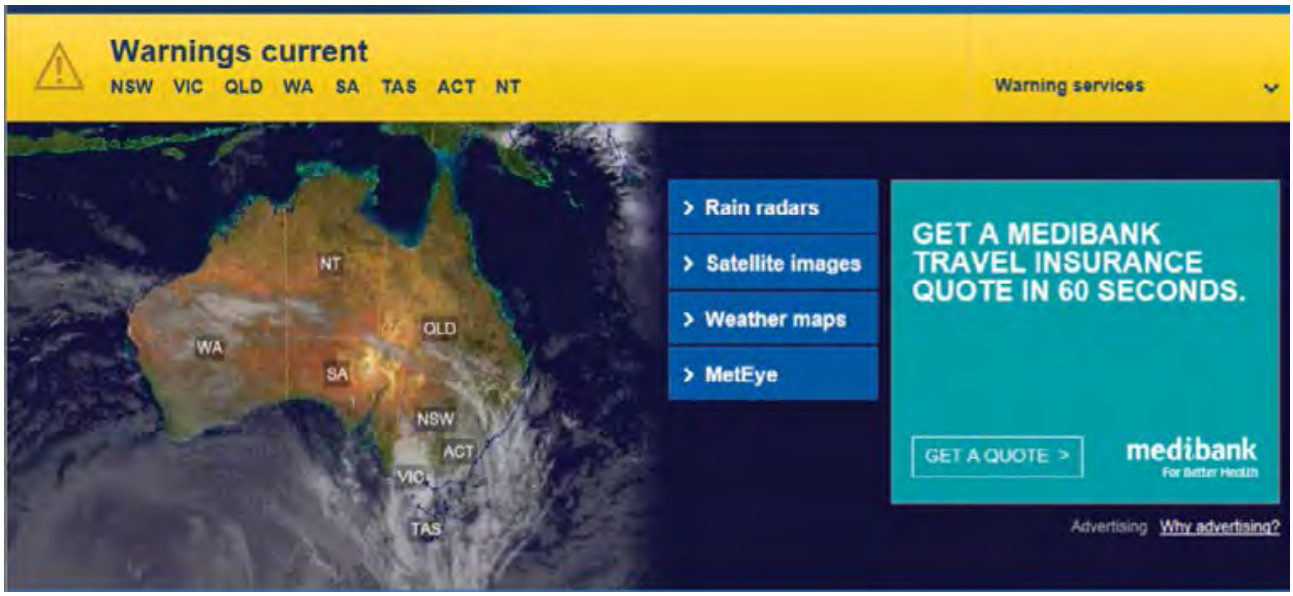

Figure 4: The location of the MetEye tab on the Bureau of Meteorology website **www.bom.gov.au**

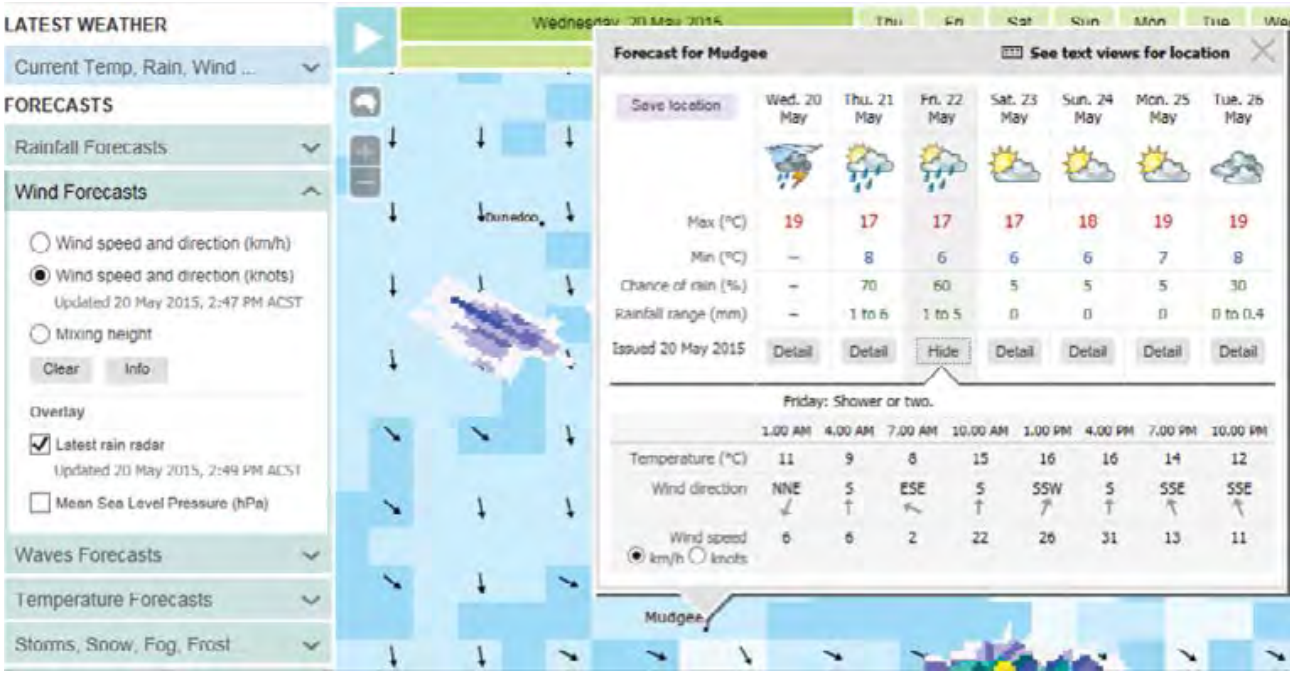

Figure 5: A snapshot of the details of MetEye data, from the Bureau of Meteorology website, for forecasts for Mudgee from 19–26 May 2015. Clicking on the detail tab (22 May) brought up 3 hourly forecasts for temperature, wind direction and wind speed.