Downy mildew infection events in Western Australian viticulture regions

FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **RT 01/06**

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Research Organisation: **The Wine Industry Association of WA**

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Executive summary

The first component of this project was to use historic weather data to identify the risk of downy mildew infection in grape growing regions of Western Australia and the months when infection was most likely. Two climatic models were used, examining both long-term average weather data and using real daily climatic data from 1990 until 2001. The Margaret River region was identified as having an extreme risk of downy infection, the Pemberton region had a high risk and the Albany region had a medium risk of downy mildew infection. All other wine growing regions in the state had a low or negligible risk of downy mildew infection.

The second component of this project was to investigate the feasibility of the Bureau of Meteorology (BOM) using real time climatic data to predict the likelihood of both primary and secondary infection events in the next 24 hours. In the 2003/04 season the accuracy of the predictions from the BOM were verified using weather station data collected in the Margaret River and Manjimup regions. Verification, and if necessary modification of the BOM predictive model will continue in 2004/05. If the BOM model can accurately predict downy mildew weather events, then a downy mildew page will be created on the BOM web site with the prediction for the next 24 hours. If an infection event is very likely (about 80% chance) then a downy mildew weather alert will be issued to the press. This information can then be used by growers to plan strategic applications of pre and post infection fungicides. The service may also be expanded to include other regions in Western Australia.

Background

Downy mildew is still a relatively new disease in Western Australia. Many growers are uncertain about how frequently their region experiences downy mildew infection events. Knowledge of the probability of downy mildew infection events will help growers determine whether a preventative spray program, post infection spray program or a combination of these two approaches is the best method of control.

In South Australia the Primary Industries and Resources, South Australia works in conjunction with the Bureau of Meteorology to put out downy mildew weather alerts in the press. There is no such service in Western Australia and growers are keen to see if the similar system can be applied to Western Australia.

Objectives

Objective 1 (Use historic weather data to predict downy mildew disease risk for regions in WA)
Objective 1 is to review long term weather data for each major viticulture region in WA to determine the probability of downy mildew events occurring in each month of the growing season. This will help growers define their fungicide spraying strategy.

Objective 2 (Downy mildew alert service)
In South Australia the Primary Industries and Resources, South Australia works in conjunction with the Bureau of Meteorology to put out a downy mildew weather alert in the press if weather conditions conducive to downy mildew are likely to occur in the next 24 hours. The Western Australian industry would like to develop a similar program in WA. This would involve developing a close relationship with the Bureau of Meteorology so that when a high chance of a primary or secondary event is likely to occur a downy mildew alert is broadcast. This approach should reduce fungicide use by allowing strategic applications of pre and post infection fungicides when required.

Method

Use historic weather data to predict downy mildew disease risk for regions in WA
Two meteorological models were used to assess the risk of downy mildew in grape growing regions in Western Australia. In the first model long term average climate data was used to assess the suitability for the disease. The second model used daily climatic data from 1990 until 2001 to determine the risk of primary and secondary infection by downy mildew. As a comparison both models were also applied to five sites in eastern Australia and five sites in the south west Cape, South Africa.

The likelihood of establishment of downy mildew in Western Australia was analysed for nine grape growing regions: Geraldton, Swan Valley, Vasse, Margaret River, Bridgetown, Manjimup, Pemberton, Mt Barker and Albany. The five sites analysed in eastern Australia were: Loxton, Nuriootpa, Coonawarra, Yarra Valley and the Hunter Valley.

Three assumptions were made when applying the modeling methods. They were:

- To meet the minimum temperature requirement for primary infection the average of the daily minimum and daily maximum temperatures needed to reach 10 degrees +/- 1 degree.
- To meet the minimum temperature requirement for secondary infection the minimum temperature must be greater than 11.5 degrees.
- To meet the moisture and humidity requirements for secondary infection the maximum humidity must exceed 94.5% and the rainfall must exceed 0.5 mm.

Downy mildew alert service

For the 2003/04 season the Bureau of Meteorology (BOM) predicted the incidence of primary and secondary events, 24 hours in advance, for the Margaret River and Manjimup regions. BOM used a probability forecast of:

0 unlikely to occur (near 0%)
1 small chance but not expected (about 10 %)
2 good chance (about 30%)
3 very likely (about 80%)

The 10:10:24 rule was used to determine whether a primary infection event would occur (10 mm of rain with a temperature above 10 degrees for at least 24 hours. The 98:13:4 rule was used to determine whether a secondary infection event would occur (greater than 98% humidity, with a temperature above 13 degrees and at least 4 hours of darkness).

The BOM predictions were faxed to the Department of Agriculture staff daily. Department staff compared the BOM predictions with actual weather station data from the regions (the climatic data had been interpreted using the AUSVIT model to determine whether a downy mildew event had occurred).

The BOM data will be validated for the rest of 2003/04 and 2004/05. Some minor changes to the modeling conditions may be required. If the model proves accurate it will be made public in 2005/06. A downy mildew page will be created on the BOM web site with the prediction for the next 24 hours and if an infection event is very likely then a downy mildew weather alert will be issued over the radio. The service may also be expanded to include other regions in WA.

Results/Discussion

Use historic weather data to predict downy mildew disease risk for regions in WA

A scientific paper on this work was submitted to the 'Phytopathology' journal. The recommendation from the editorial panel was "accept after major revision." The paper is now being revised by DR Chris Stansbury and will be resubmitted.

The risk assessment model developed by Chris Stansbury used the following categories to describe the likelihood of a downy mildew outbreak in grape growing regions:

Risk	Disease noticeable	Disease impact
Negligible	Unlikely	Not likely to be significant
Low	Likely	Likely to be significant 1 – 2 years in 5
Medium	Likely	Likely to be significant 2 – 3 years in 5
High	Yes	Likely to be significant 3 – 4 years in 5
Extreme	Yes	Likely to be significant 4 – 5 years in 5 and may also affect economic viability of grape production in the region

The following shows the risk calculated from the model for grape growing regions in Western Australia.

Region	Risk
Geraldton	Negligible
Swan Valley	Low
Vasse	Low
Margaret River	Extreme
Bridgetown	Negligible
Manjimup	Low
Pemberton	High
Mt Barker	Low
Albany	Medium

The months with the greatest risk of downy mildew occurring were also determined from long term data for each region (see table below). Margaret River has the longest period of risk. The factors limiting the risk of infection for months not listed were low overnight temperatures early in the season and hot, dry conditions later in the season.

Region	Period of greatest risk (Sept – Jan)
Geraldton	Generally too hot and dry
Swan Valley	mid October – early November
Vasse	October – early November
Margaret River	Early September – end November
Bridgetown	Generally too cold overnight
Manjimup	November - December
Pemberton	November - December
Mt Barker	November - December
Albany	November - December

Downy mildew alert service

Department staff compared the BOM predictions with actual weather station data from the regions. In many cases the BOM did not successfully predict downy mildew events in the regions. A meeting was held between Department staff and the BOM in February 2004 to re examine the BOM predictive criteria and adjust them to make the predictions more accurate.

The aim is to continue validating the BOM data for the rest of 2003/04 and 2004/05. If the model proves accurate it will be made public in 2005/06. A downy mildew page will be created on the BOM web site with the prediction for the next 24 hours and if an infection event is very likely then a downy mildew weather alert will be issued over the radio. The service may also be expanded to include other regions in WA.

Outcome

- The risk of infection by downy mildew in each grape growing region is now more clear and the months when the grapes are most at risk has been identified. Information on the risk of downy mildew infection for different regions in the state was presented to growers at the Margaret River Field day and seminars in 2002. Articles on the research have also been written in local industry newsletters.
- The downy mildew alert service is likely to be introduced to the public in 2005/06.

Recommendations

- Develop downy mildew page on the BOM web site and for the BOM to inform the press when there is a very likely (about 80%) probability of a downy mildew infection event occurring (provided the BOM alert service can accurately predict primary and secondary downy mildew infection events).

References

Stansbury, C.D., Pilbeam, R., Botha, J.H., Fisher, D. and McKirdy S.J. (in prep). Forecasting the risk of downy mildew of grapevine using meteorological models.

Budget Reconciliation

Budget	Funding required from GWRDC	Actual expenditure
Money returned to GWRDC		1,897.50
Car hire	1,400.00	2,000.00
Statistics		302.50
Printing costs	2,000.00	1,740.00
Bureau of meteorology costs	2,000.00	
Total	5,400.00	5,940.00
Add 10 % GST	540.00	
Total funds requested from GWRDC	5,940.00	