DEMONSTRATION OF BEST PRACTICE BOTRYTIS CONTROL STRATEGIES ON A VINEYARD IN THE YARRA VALLEY REGION OF GREATER VICTORIA



FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: RT **02/38-3**

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Research Organisation: **BOTRYTIS R&D COMMITTEE OF THE YARRA VALLEY GRAPEGROWERS ASSOCIATION INC.**

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A final report to the Grape and Wine Research Development Corporation

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EXECUTIVE SUMMARY

Botrytis is one of the most important sources of economic losses in Yarra Valley vineyards. This project was one of three similar RITA funded projects (in three different regions) all having the same objectives, to demonstrate, assess and refine best practice Botrytis management strategies in a vineyard. The Greater Victoria Wine Grape Industry Development Committee (IDC) instigated as a two-year project the Best Practice Botrytis Initiative by the IDC, GWRDC, Monash University and the Department of Primary Industries, along with the three regional associations, as co-investors. The aims of the broader project are, by June 2004, to develop and extend best practice Botrytis management strategies to all wine grape growers across Greater Victoria.

This project successfully adapted the latest national research on Botrytis to vineyards in the Yarra Valley in the management of Botrytis. Growers were involved in commenting upon, and adding to, a checklist of prompts that highlighted actions that could be implemented in the vineyards in the Yarra Valley where Botrytis is a major problem. Growers from the three regions expressed a need for a document to accompany the checklist explaining more fully the reason(s) for the actions suggested. The checklist and the accompanying document and CD were available in early 2004.

Information days held at Lusatia Park vineyard allowed data to be presented by the researchers and growers to be actually involved in assessing the checklist and providing feedback on its relevance to them.

This site had very little management and developed a heavier than normal Botrytis load most seasons. Significant management changes needed to be made. Open canopy by shoot thinning, bunch thinning and leaf plucking on the eastern side of the canopy were used as the management protocols during the experimental seasons.

The drought during the summer of 2002-2003 was instrumental in lower than normal expression of Botrytis, so management strategies implemented on the Lusatia Park vineyard have not been tested under high disease pressure conditions. However, all berry samples taken from this vineyard at harvest were Botrytis *infected*. Because of the dry weather there was little Botrytis *expression* and the harvest was acceptable. This outcome provides evidence that it is Botrytis *expression*, rather than Botrytis *infection* that is a key issue at harvest.

Acknowledgements and further information:

The Yarra Valley Wine Growers Association Inc. gratefully acknowledges the funding support provided by GWRDC, Greater Victoria Wine Grape Industry Development Committee Monash University and the Department of Primary Industries, Victoria.

Technical questions about this project can be directed to Mr. Damien de Castella, Producer Contact, of the Yarra Valley Wine Growers Association, email Damien.deCastella@Beringerblass.com.au)

Administrative questions can be directed to Andrea (info@yarravalleywine.com or Chris Keyes at Fergusson Winery (info@fergussonwinery.com.au) for the YVWGA Technical committee.

For further information, you could obtain copies from GWRDC of reports on two similar projects:

- Demonstration of Best Practice Botrytis Control Strategies in a Vineyard in the Alpine Valleys Region of Greater Victoria (RT 02/40-4); and
- Demonstration of Best Practice Botrytis Control Strategies in a Vineyard in the Mornington Peninsula Region of Greater Victoria (RT 02/38-4).

Project Team

- Mr Andrew Smith Vineyard manager cooperating in project
- A small grower reference group being established by Mr Damien de Castella
- Monash University
    - Dr Mary Cole, Director, Wine , Food and Agribusiness, Faculty of Business & Economics, Monash University, Peninsula campus, Frankston, Mr Steve Whitmore and Dr Tonya Weichel.
- DNRE –
    - Mr John Whiting, Senior Viticulturalist
    - Ms Natalie Laukart, On Farm Trials Coordinator
- VitiSolutions (consultancy)
    - Mr David Braybrook

1.0 BACKGROUND

Botrytis is one of the most important sources of economic losses on Yarra Valley vineyards. This project was one of three similar RITA funded projects (in three different regions) all having the same objectives that is, to demonstrate, assess and refine best practice Botrytis management strategies in a vineyard. The Greater Victoria Wine Grape Industry Development Committee (IDC) instigated as a two-year project the Best Practice Botrytis initiative was instigated as a two year project by the IDC, GWRDC, Monash University and the Department of Primary Industries, along with the three regional associations, are all as co-investors. The aims of the broader project are, by June 2004, to develop and extend best practice Botrytis management strategies to all wine grape growers across Greater Victoria.

The greatest economic losses from Botrytis occur in cool climate viticultural regions that include much of Greater Victoria, including the Yarra Valley. Growers and wineries in this region regard Botrytis as the most important source of yield and quality losses (excluding issues relating to fruit set).

Feedback from growers at Grapecheck and Research–to-Practice workshops revealed that they are dissatisfied with the efficacy of current management practices available for Botrytis bunch rot. They are interested in a more holistic approach that incorporates cultural management options suitable for their regional and vineyard environment. Growers are increasingly frustrated because incidence monitoring for Botrytis infection at flowering does not indicate potential losses at harvest in most districts. Research by Cole *et al* (unpublished) shows that Botrytis *infection* at flowering or later does not necessarily result in loss of crop. Rather, weather conditions suitable for Botrytis *expression* to occur, determine whether growers experience crop losses. Dense bunch canopies restrict the penetration of the fungicide. When bunches have closed and berries are mature, most bunches receive less than the lethal dose of fungicide. This is because the fungicide cannot penetrate nor access the reverse side of bunches.

The Greater Victoria Wine Grape Industry Development Committee (IDC) has co-invested with GWRDC, Department of Primary Industries, Monash University, and regional associations to assist growers to improve crop yield and grape quality by applying the latest available research results for Botrytis management.

Dr. Balasubramanean (2000) emphasised that an understanding of the host-pathogen interaction with vineyard conditions is crucial to the development of ‘whole vine’ management. The complex interaction of the many host, pathogen, environment and management factors that influence disease incidence and severity, make the knowledge from these regional projects important in the

understanding of the influence of the total vineyard environment on Botrytis *expression* at harvest. This work draws on the improved understanding of Botrytis biology (e.g. CSU99/3 Cole. Latency and Strain Variation).

Many factors make Botrytis difficult to manage in grapevines. Even after decades of systematic agronomic and biochemical research (Dubbos, 1999), Botrytis and its interactions in the vineyard environment and management are not well known. Currently, key international and Australian research is focussing on pathways of infection, disease epidemiology, and biochemistry of the causal agent (Cole *et al,* 1999; Holz, Pert, Veret, 2001; Wiechel and Cole, 2001; Veret *et al* 2002). Past research (DAV 95/1) has focussed on chemical control, epidemiology and the effects of environmental (eg canopy management) and biological (e.g. insect herbivory) factors on Botrytis rot severity. An outcome from GWRDC DAV 92/1 showed that small loose, well separated berries on open canopies reduced expression of Botrytis rot (Emmett *et al*, 1994). GWRDC DAV 95/1 showed that light brown apple moth actually increased Botrytis incidence. Warren *et al*, 1999 and Warren *et al, 2001* developed a bunch inoculation technique that can be used to evaluate chemical, biochemical and cultural treatments for Botrytis management.

Grape growers contributed to the development of a checklist where prompts assist the growers in their assessment of the cultural practices necessary to minimise Botrytis expression in their individual vineyards. It is a promising development in the difficult problem of managing this pathogen that is ubiquitous in and around the environment of all vineyards. The checklist and its accompanying management document and CD will provide a framework from which other growers groups can design protocols to suit their own regions.

2.0 PROJECT AIMS

To demonstrate, assess and refine best practice Botrytis control strategies on a vineyard in the Yarra Valley region of Greater Victoria.

Year	Activities	Funding
2002/03	Establish best practice protocols on 3 regional demonstration sites (Mornington Peninsula, **Yarra Valley**, Alpine Valleys); monitor and review	IDC – $45,000 Monash – $14,000 **RITA** – $15,000 at each site; 3 regional groups, Mornington Peninsula, **Yarra Valley** and Alpine Valleys
2003/04	Implement best practice outcomes from year 1. Expand grower reference group and extend results widely via Grapecheck.	IDC – $45,000 Monash – $5,000 RITA - $15,000 at each demonstration site - 3 expanded regional groups

Botrytis has been researched extensively but it still confounds all attempts to manage it successfully. By applying different management techniques in the vineyards that have low to high Botrytis pressure in most years, protocols that reduce Botrytis expression may be established.

3.0 OBJECTIVES and PERFORMANCE TARGETS

1. **Develop protocol incorporating latest recommendations on botrytis management:** The protocol was drafted jointly by Mr David Braybrook and Dr Mary Cole (Monash University) in consultation with other project team members. A draft is to be negotiated with Botrytis Technical Committee and Lusatia Park, the Yarra Valley region vineyard where the demonstration site is to be established. The protocol will be implemented from the start of the 2002/03 season.

2. **Establish demonstration site**
   This vineyard has two blocks, situated on either side of a large Eucalyptus tree below a dam and sloping gently to a wooded pasture. Both blocks are Botrytis hotspots. Twenty vines in each block were selected and tagged.

3. **Establish monitoring procedures from which best practice controls strategies can be developed**
   Discussions between research team members and the vineyard owner/manager will include the identification of monitoring procedures to be put in place by the owner/manager, to enable accurate assessment of agreed control strategies set in the vineyard protocol.

4. **Establish grower reference group to provide for broader grower interaction on demonstration site**
   Growers in the area are being invited (a number have already agreed) to form an observation/discussion group to assist in the design of most efficient and practical strategies incorporating protocol best practice requirements. This will improve level of grower interest, ownership and level of adoption of strategies shown to be effective in control of Botrytis.

5. **Implement pilot monitoring procedures and management strategies**
   From as early as possible in the current season, a pilot program of monitoring procedures and management strategies will be implemented by the vineyard owner/manager. This will incorporate procedures used and experience gained in the CRCV on-farm trials program. Regular meetings with research staff and the grower reference group will be held to evaluate progress and deal with any developments not envisaged in the protocols. Research

staff will monitor and test Botrytis incidence and trends on a regular basis. Adjustments to control strategies, if deemed necessary by test results and agreed by project team members, will be made and recorded.

6. **Review outcomes – BY 30 MAY 2003:** At the end of the season, testing will be done to measure Botrytis incidence on the demonstration and control sites. A meeting of growers and research staff will be held to assess the outcome of best practice control strategies and determine what refinements are required for implementation in the following season.

7. **Final report to GWRDC – BY 30 SEPT 2003:** A brief progress report will be forwarded by 30 June 2003 and final by 30 September 2003.

8. **T**his completed final report to be used in association with the workshops report prepared by John Whiting forms part of the total project that also contains the Botrytis Rest Practice Protocols CD and Checklist. The Protocols and Checklist will be available from the printer for distribution to IDC participating growers in September 2004.

These projects are the first time in Victoria such a careful attempt at relating management protocols with Botrytis expression has been carried out. A checklist for growers was an important outcome of the research process. The process used should facilitate adoption of the most recent research findings by grape growers. These checklists can be applied to other states with only the addition of regional differences.

4 MATERIALS AND METHODS

Drawing on latest national research results, the research team led by Dr Mary Cole initially developed a draft best practice protocol for the control of Botrytis.

4.1 Trial site

Sampling was carried out at Lusatia Park vineyard. This vineyard has two blocks (G & H), situated on either side of a large Eucalyptus tree below a dam and sloping gently to a wooded pasture. Both blocks are Botrytis hotspots. Twenty vines in each block were selected and tagged. Samples were collected at flowering, shatter, pre-bunch closure, veraison, harvest and post harvest. The management undertaken was to leaf thin on the eastern side one block. However, both blocks were leaf thinned by the vineyard staff and no control was left. Therefore, it was not possible to assess the management statistically.

Fig 1. Experimental blocks at Lusatia Park.

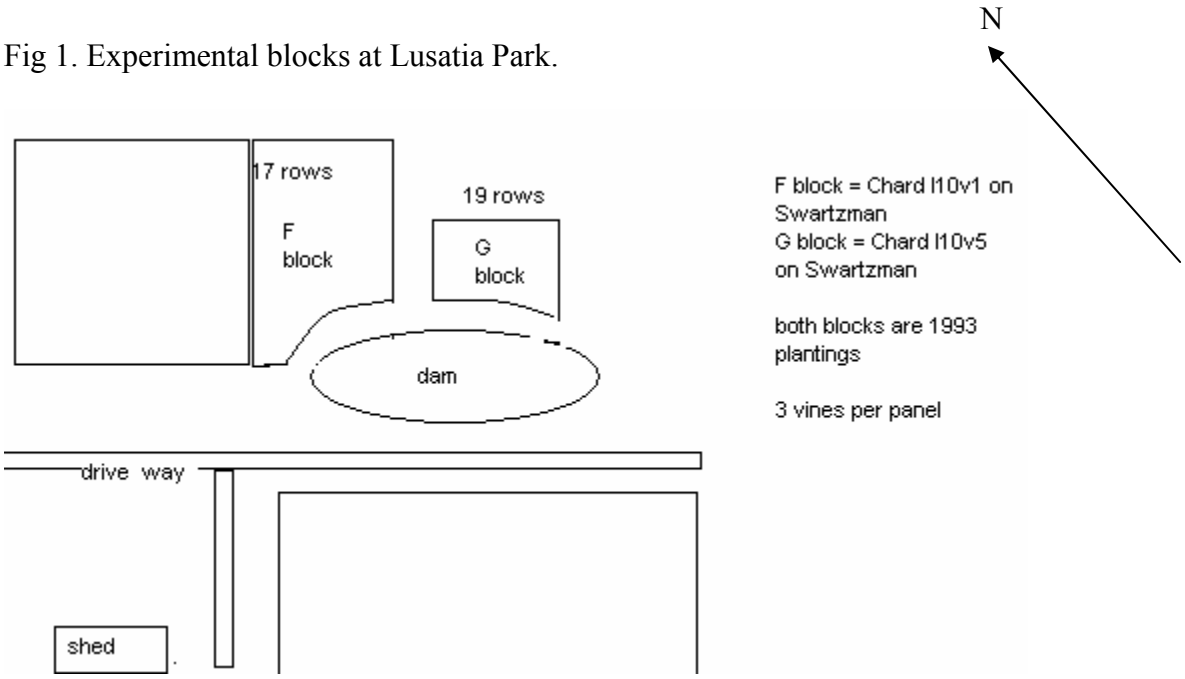


Table 1. Timing and Type of Sample Collected

Growth Stages	Tissues to be collected if present
Flowering	Inflorescences; vine shoots, apical, bunch zone and abasal leaves; mid row weed

	leaves and flowers; surrounding vegetation leaves and flowers
Shatter	Bunch; vine shoot, apical, bunch zone and basal leaves; mid row weed leaves and flowers; surrounding vegetation leaves and flowers
Pre bunch closure	Bunch; vine shoot, apical, bunch zone and basal leaves; mid row weed leaves and flowers; surrounding vegetation leaves and flowers
Veraison	Bunch; vine shoot, apical, bunch zone and basal leaves; mid row weed leaves and flowers; surrounding vegetation leaves and flowers
Harvest	Bunch; vine shoot, apical bunch zone and basal leaves; mid row weed leaves and flowers; surrounding vegetation leaves and flowers
Post harvest	Bunch remnant; vine shoot, apical, bunch zone and basal leaves; mid row weed leaves and flowers; surrounding vegetation leaves and flowers

The research team members and the vineyard manager jointly identified and put in place monitoring procedures, to enable accurate assessment of agreed control strategies set in the vineyard protocol and assess progress.

Growers in the area were invited to form an observation/discussion group to assist in the design of the most efficient and practical strategies incorporating protocol best practice requirements. The vineyard owner implemented a pilot program of monitoring procedures and management strategies. This incorporated procedures used and experience gained in the CRCV on-farm trials program. Regular meetings between research staff and the grower reference group were held to evaluate progress and deal with any developments not envisaged in the protocols.

Extensive sampling of vine parts, mid row weeds and surrounding vegetation was carried out from budburst through to post harvest. Samples were sent to Monash University for *Botrytis* testing and analysis. . Adjustments to management strategies were made as necessary, guided by test results and as agreed by project team members. The grower reference committee met with project staff and discussed the draft protocols at meetings held in 2003.

A meeting of growers and research staff (total attendance was near 50) was held to assess the outcome of best practice control strategies, determine what refinements were required for implementation in the following season, and gain feedback on the draft best practice checklist.

Similar demonstration sites and methodology were established on vineyards in the Mornington Peninsula and the Alpine Valleys, as reported in projects RT 02/25-3 and RT 02/40/4 separately funded under the RITA project. The results collectively from the three sites were used to develop and refine the best practice protocols in the form of a draft checklist, a copy of which is provided to GWRDC with this report.

4.2 Botrytis assessment

The disease incidence (percentage of infected clusters) and disease severity (percentage of infected berries per cluster) was estimated on 20 clusters from each vineyard.

The samples were incubated at room temperature and assessed for Botrytis and other mycoflora after 10 days. The occurrence of Botrytis and other mycoflora was noted and all Botrytis was plated onto PDA (mechanical damage and infection).

To induce latent expression, all samples were frozen overnight and assessed after 10 days. The occurrence of Botrytis and other mycoflora was noted and *Botrytis* was plated onto PDA.

Petri dishes containing Potato Dextrose Agar (PDA) were incubated at room temperature for ten days. Then the plates were assessed for all mycoflora, with particular reference to Botrytis and other potential bunch rots.

4.3 DNA Fingerprinting

Mycelia for DNA extraction were grown on liquid V8 medium on the lab bench at room temperature for four days. The mycelia were transferred to a 2 ml tube and freeze dried. The freeze-dried mycelia were ground to a fine powder in the 2ml tube with a plastic micro pestle and mixed with 600µl. of extraction buffer. The aqueous phase was extracted twice with Chloroform: isoamyl alcohol (24:1). The nucleic acids were precipitated with 0.6 µl of isopropanol and 0.1 µl sodium acetate. The nucleic acids were dissolved in 100 µL of water. This method yielded ng/L. They were diluted to a working solution of 40 ng/5 µL.

4.3.1 Identification of *Botrytis vacuma* and *Botrytis transposa*

These subspecies were identified by the presence or absence of the transposable element, Flipper. (Lewis, 1997) determined for each of the *Botrytis* isolates collected. This was done using the protocol described in the GVWCIDC project (2002).

4.4 Sensitivity to iprodione Rovral ®) and Scala®

The fungicides used were commercial formulations Rovral® and Scala®. All fungicide concentrations were expressed as active ingredient (ppm).

4.4.1 Fungicide sensitivity testing:

To test the fungicide sensitivity of each isolate *in vitro,* the inhibition of mycelial development was assessed by measuring the radial growth on PDA plates in 90mm Petri dishes that contained

fungicide concentrations 2ppm and 5ppm of the active ingredient. The tests were conducted in 90mm Petri dishes that were incubated with agar plugs cut from the margin of 3-day-old cultures. The agar plugs were plated mycelium face in direct contact with the medium in the centre of the Petri dish of PDA agar. Three replicates were used for each treatment. Incubation was carried out at 22^{o}, at 12:12 light:dark photoperiod. After 3 days the four radial measures were taken for each replicate and the percentage inhibition was calculated. Isolates were resistant if the percentage inhibition was less than 90% of the control (without fungicide) and isolates were susceptible if the percentage inhibition was greater than 90% of the control (without fungicide).

4.4.2 Checklist and management information publication

Drawing on latest national research results, the research team led by Dr Mary Cole initially developed a draft best practice protocol for the management of Botrytis. The draft was implemented from the start of the 2002/03 season on a selected demonstration site (consisting of Chardonnay I10v5 vines on Shwartzman root stock –a highly Botrytis susceptible variety) on a Yarra Valley vineyard, Lusatia Park, managed by Mr Murray Lyons and Mr. Andrew Smith.

The research team members and the vineyard manager jointly identified and put in place monitoring procedures, to enable accurate assessment of agreed control strategies set in the vineyard protocol and to assess progress.

Growers in the area were invited to form an observation/discussion group to assist in the design of the most efficient and practical strategies incorporating protocol best practice requirements. The reference group comprised a grower co-coordinator (Mr Damien deCastella), the vineyard managers and other grape growers drawn locally from the Yarra Valley Winegrowers Association, Inc.

The vineyard owner implemented a pilot program of monitoring procedures and management strategies. This strategy incorporated procedures used and experience gained in the CRCV on-farm trials program. Regular meetings between research staff and the grower reference group were held to evaluate progress and deal with any developments not envisaged in the protocols.

Extensive sampling of vine parts, mid row weeds and surrounding vegetation was carried out from budburst through to post harvest. Samples were sent to Monash University for Botrytis testing and analysis. Adjustments to control strategies were made as necessary, guided by test results and as agreed by project team members. The grower reference committee met with project staff and discussed the draft protocols at meetings held at Lusatia Park Vineyard in early 2003.

5.0 RESULTS/DISCUSSION

5.1 The Protocols:

The Botrytis Committee of the Yarra Valley Grapegrowers Association considered a number of drafts of the checklist. Drafts were circulated widely to Association membership for comments and suggestions and this process assisted greatly in refining the checklist. Meetings of the Botrytis Committee included leading growers from Yarra Valley vineyards and members of the research team drawn from Monash, Department of Primary Industries and VitiSolutions.

5.2 Management Technique in the Vineyard

Isolates of Botrytis were collected at Budburst, Pre flowering spray and post flowering spray, pre spray at pre bunch closure and post spray at pre bunch closure, Veraison, Harvest and post harvest from the experimental rows in both blocks.

All Botrytis isolates collected, were noted and added to a culture collection, which enables further study of these isolates in the future. Resistance testing was carried out for Rovral and Scala at rates of 2ppm and 5ppm.

5.3 Botrytis incidence

Both G and H Blocks showed low level Botrytis at pre-flowering from latent infection. This means the infection expressed only after moist incubation as no isolations were made from washings indicating no environmental incidence at the sampling. Tables 2 & 3, and Figs 2-4 show the number of isolations, the type of infection and the growth stage at which they were collected.

Higher levels in infection were found in both blocks from veraison to harvest. Again the expression required moist incubation and freezing. These results indicate that Botrytis would have expressed at harvest after rain, however, in the absence of wet weather, the infections would have remained dormancy or latent and not affected the quality of the fruit harvested.

Table 2. Data for Botrytis incidence Lusatia Park H Block

Lusatia Park H block	Environmental	Moist incubated	Post freezing
Budburst	No samples		
Pre-spray Flowering	1		
Post-spray Flowering			
Pre-spray PBC			2
Post-spray PBC			2
Veraison	8		8
Harvest	3	17	20
Post harvest	7	1	1

Table 3. Data for Botrytis incidence Lusatia Park G Block

Lusatia Park G block	Environmental	Moist incubated	Post freezing
Budburst	No samples		
Pre-spray Flowering	1		
Post-spray Flowering			
Pre-spray PBC			
Post-spray PBC	2		2
Veraison		14	10
Harvest	8	15	17
Post harvest	8	4	3

Fig 2. % Botrytis incidence H Block

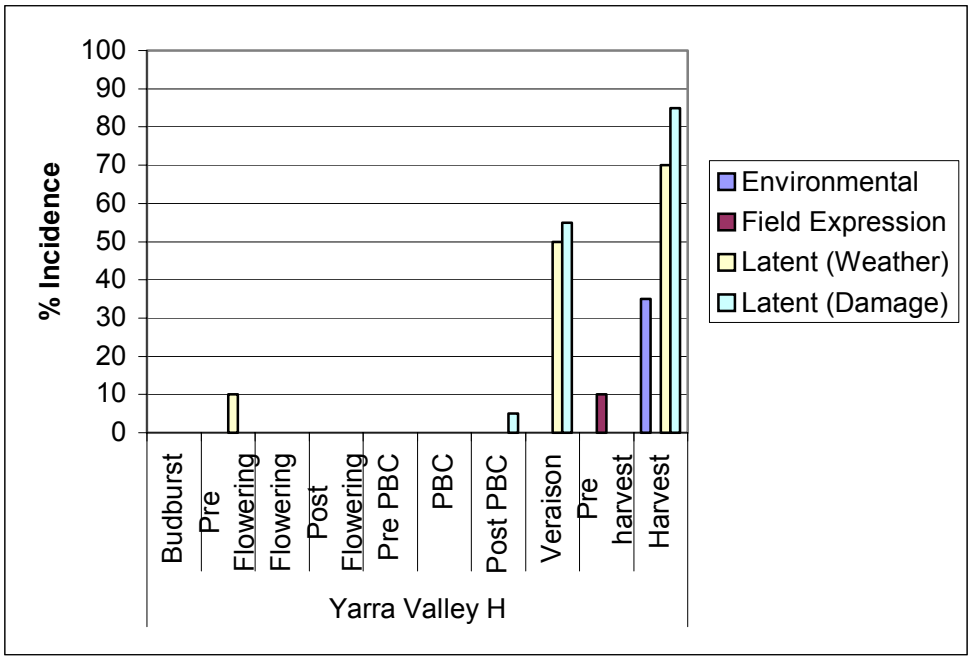


Fig 3. % Botrytis incidence in G Block

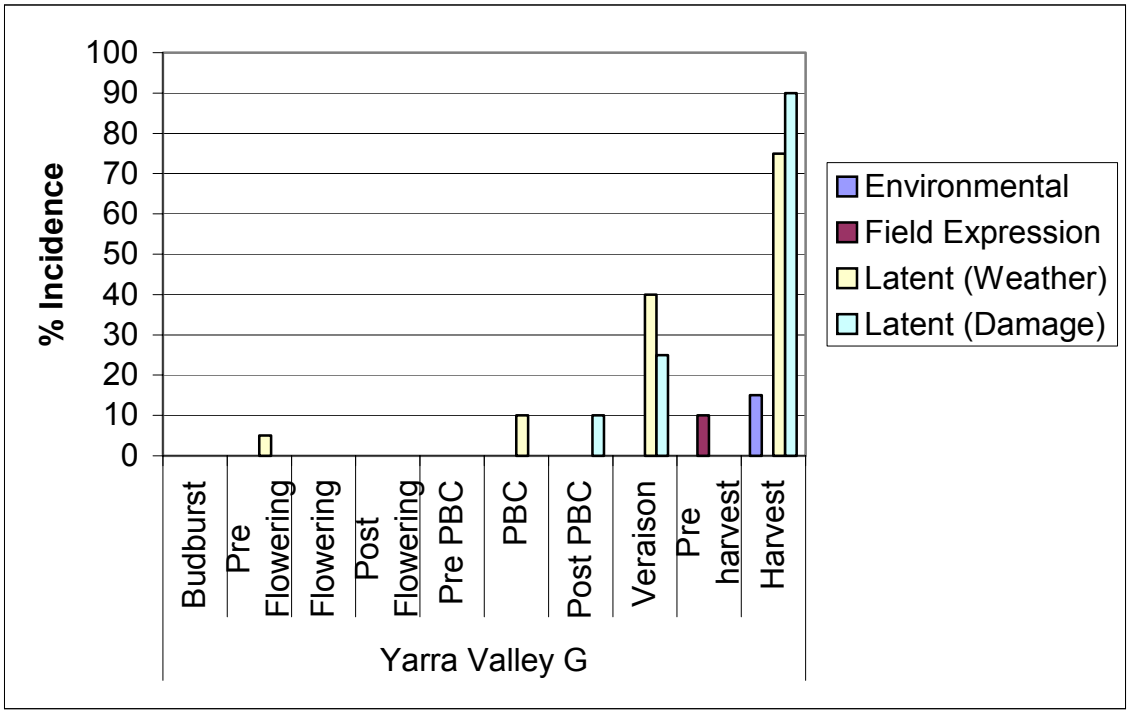
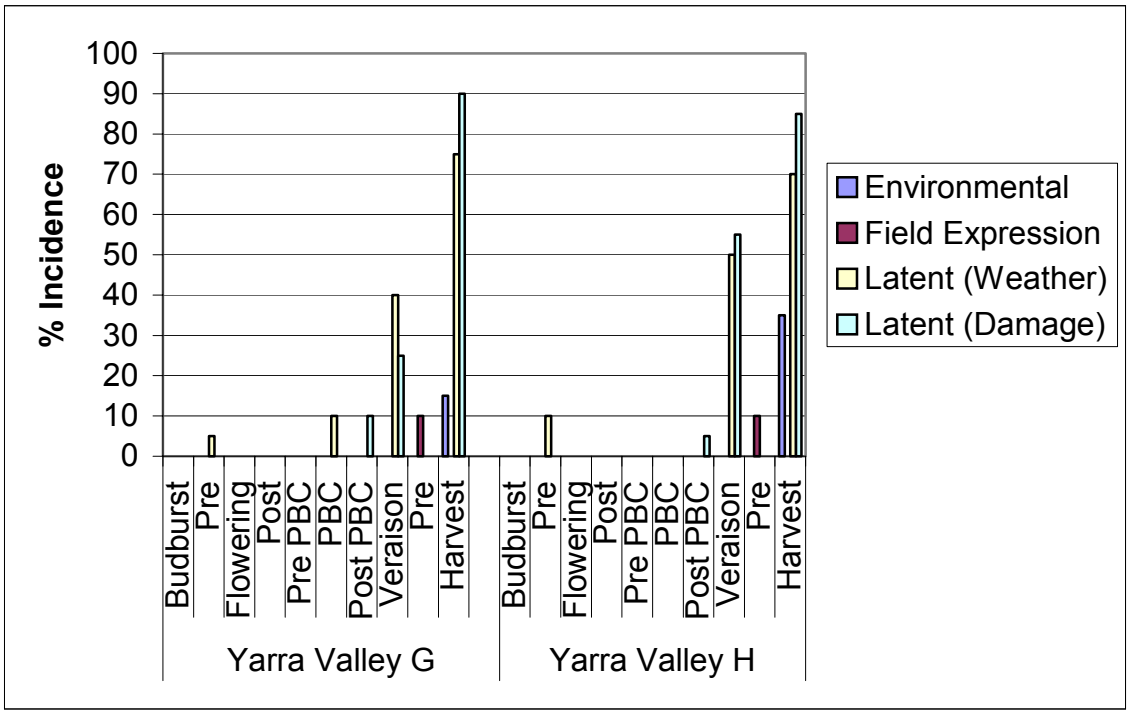


Fig 4. Comparison of % Botrytis incidence



5.4. Fungicide Resistance

G and H Block isolates were tested for Rovral and Scala resistance and 2 and 5 ppm active ingredient (Tables 4-7).

In H and G Blocks, resistance to Rovral increased at both 2 and 5ppm active ingredient as the season progressed. Resistance at both concentrations was high. Although some resistance to Scala was observed, it was very low and, again, increased as the season progressed (Figs 5-8)..

Table 4. **Lusatia Park G block**: number of isolates showing sensitivity and resistance to **Rovral** at 2ppm and 5ppm

Number of isolates	2ppm Resistant	2ppm Sensitive	5ppm Resistant	5ppm Sensitive	Total
Budburst	No sample	0	0	0	0
Pre spray at flowering	1	0	1	0	1
Post spray at flowering	0	0	0	0	0
Pre spray at pre bunch closure	0	2	0	2	2
Post spray at pre bunch closure	2	0	2	0	2
Veraison	14	10	11	13	24
Harvest	18	22	2	38	40
Post harvest	8	7	8	7	15

Figure 5. Lusatia Park G block: number of isolates showing sensitivity and resistance to **Rovral** at 2ppm and 5ppm

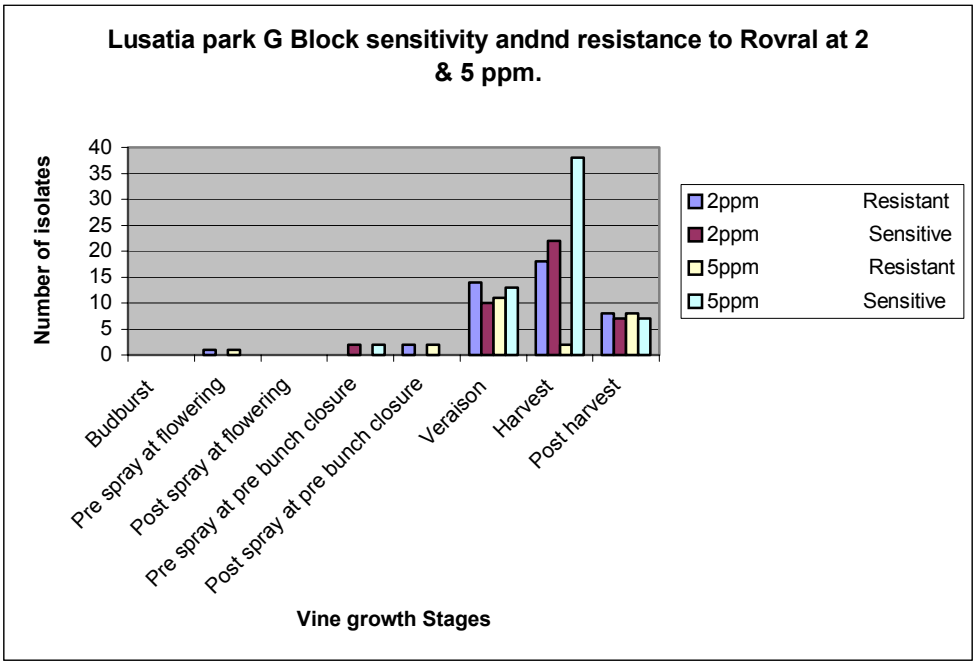


Table 5**. Lusatia Park G block**: number of isolates showing sensitivity and resistance to **Scala** at 2 ppm and 5 ppm

Number of isolates	2ppm Resistant	2ppm Sensitive	5ppm Resistant	5ppm Sensitive	Total
Budburst	No sample	0	0	0	0
Pre spray at flowering	0	1	0	1	1
Post spray at flowering	0	0	0	0	0
Pre spray at pre bunch closure	0	2	0	2	2
Post spray at pre bunch closure	0	2	0	2	2
Veraison	4	20	0	24	24
Harvest	1	39	1	39	40
Post harvest	0	15	0	15	15

Figure 6 Lusatia Park G Block isolates sensitive or resistant to Scala at 2 & 5 ppm

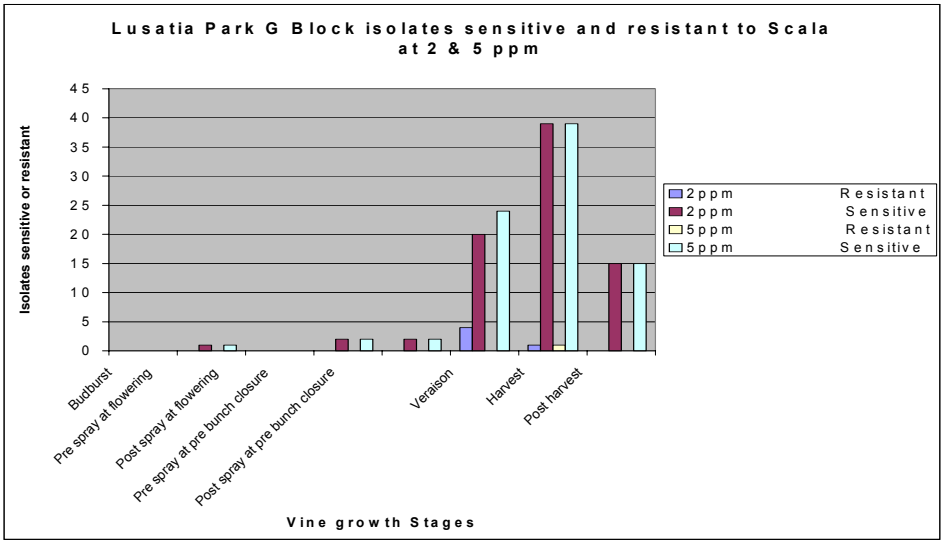


Table 6. **Lusatia Park H block**: number of isolates showing sensitivity and resistance to **Rovral** at 2ppm and5ppm

Number of isolates	2ppm Resistant	2ppm Sensitive	5ppm Resistant	5ppm Sensitive	Total
Budburst	No sample	0	0	0	0
Pre spray at flowering	0	1	0	1	1
Post spray at flowering	0	0	0	0	0
Pre spray at pre bunch closure	0	0	0	0	0
Post spray at pre bunch closure	2	0	2	0	2
Veraison	11	5	5	7	16
Harvest	17	23	8	32	40
Post harvest	3	5	2	6	8

Figure 7 Lusatia Park H block: number of isolates showing sensitivity and resistance to **Rovral** at 2ppm and5ppm

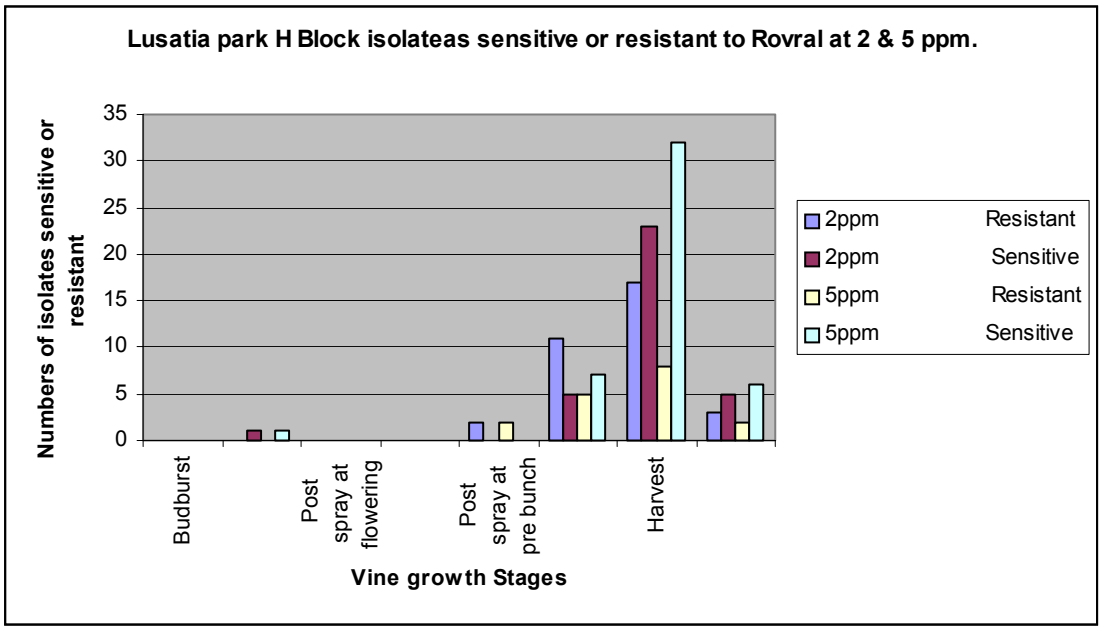


Table 7. **Lusatia Park H block**: number of isolates showing sensitivity and resistance to **Scala** at 2ppm and5ppm

Number of isolates	2ppm Resistant	2ppm Sensitive	5ppm Resistant	5ppm Sensitive	Total
Budburst	No sample	0	0	0	0
Pre spray at flowering	1	0	1	0	1
Post spray at flowering	0	0	0	0	0
Pre spray at pre bunch closure	0	0	0	0	0
Post spray at pre bunch closure	0	2	0	2	2
Veraison	3	13	3	13	16
Harvest	7	33	7	33	40
Post harvest	0	8	0	8	8

Figure 8 Lusatia Park H block: number of isolates showing sensitivity and resistance to **Scala** at 2ppm and5ppm

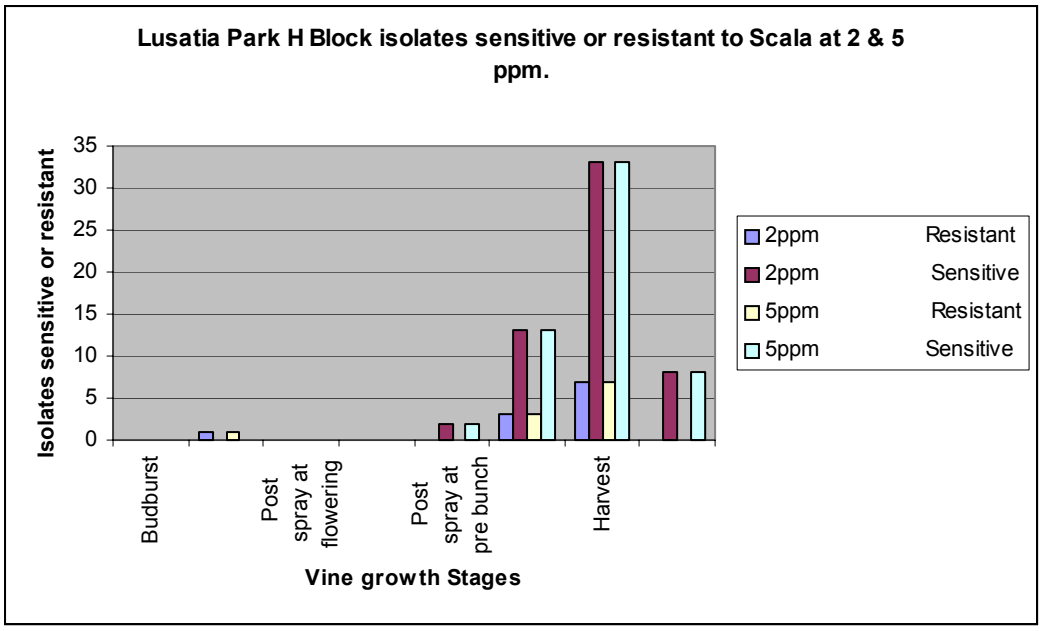


Figure 5. Total Rainfall per Month July 02-June 03

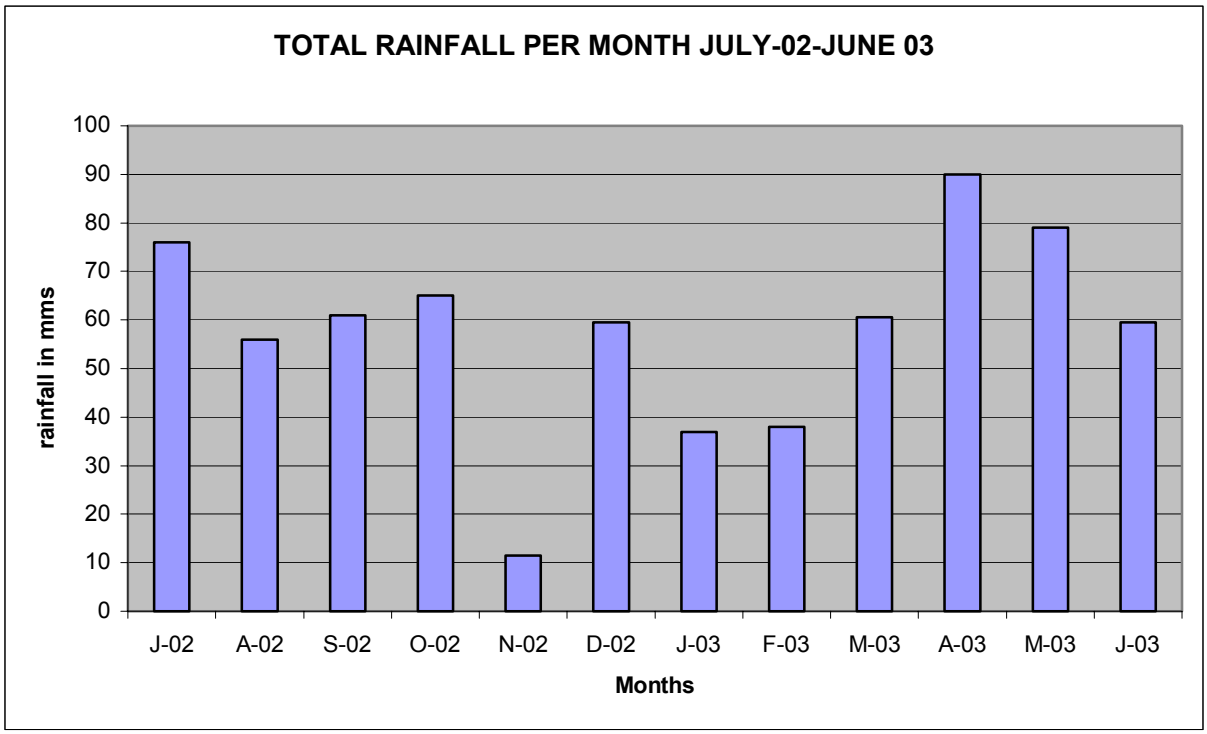


Figure 6. Average Minimum Temperature per Month

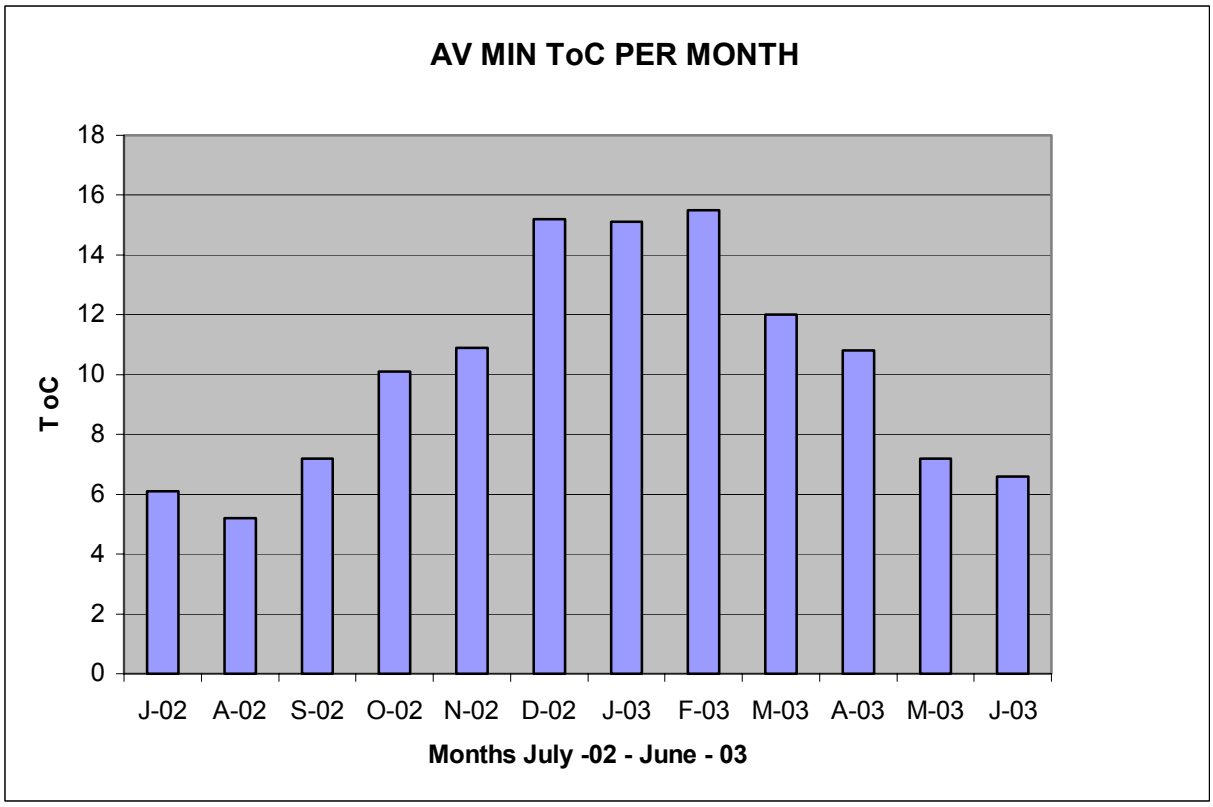
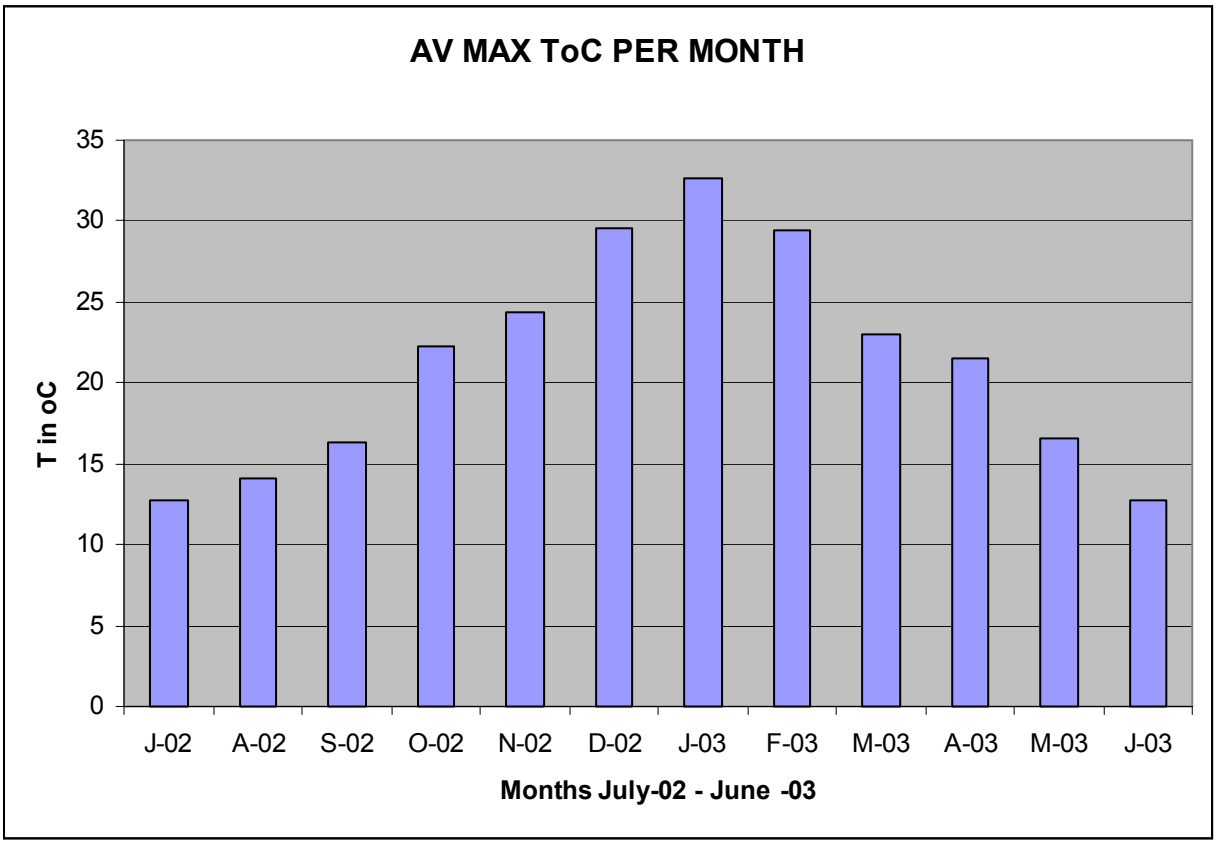


Figure 7. Average Maximum Temperature per Month



6.0 OUTCOME/CONCLUSIONS

- The key outcome is the draft checklist that was available in September 2004.
- Results from the addition of bunch blowing to the general high quality Botrytis management carried out in this vineyard were not significant because the seasons being assessed were particularly dry with little Botrytis expression in the field at harvest.
- Spur pruning stimulated faster shoot growth prior to flowering, and created a more open canopy and less botrytis bunch rot. Increasing the growth rate up to flowering may create a more open bunch zone.
- New management strategies have been shown to reduce damaging Botrytis expression.
- Regional grower groups have attended seminars to hear and question the latest research data. They have been involved in trialing a Botrytis Management Checklist published in 2004.
- Demonstration vineyards have been visited and commented on by grower groups at regional seminar days.
- Monitoring procedures and management strategies have been piloted.
- As a consequence of this project there is much improved awareness among Yarra Valley growers involved to date in the project of the extremely wide range of factors that influence the initial infection and subsequent development of Botrytis. They are now more actively looking for solutions other than purely chemical control – eg, considering canopy management, crop loads and the influence of irrigation and fertilising.

Although the results from the bunch blowing were not measurable this year, anecdotal evidence collected during the workshops from other areas of higher disease pressure, has shown that this practice allows the inside of the bunches to be clean of potentially infected trash when they close. It has been well documented now by Cole *et al* (2004), Viret *et al* (2003, 2004) that the necrotic flower caps and stamen can carry Botrytis from flowering infection weather events. It is, therefore, logical to accept, that bunch blowing will reduce the potential for bunch rot if weather conditions are conducive to its expression at harvest.

Cool and warm temperatures favour botrytis infection and expression, high humidity, which may lead to long periods of free moist on berries. In some seasons in cool climate vineyards these conditions are present much of the season.

It is important to note that the measured Botrytis expression in this project is attributed to artificial expression through laboratory incubation. This does not directly equate to natural field expression.

Managing bunch wetness:

Avoid compact bunches by producing bunches with loosely packed berries.

In warm climate vineyards or in years when rain is deficient in cool climate vineyards, irrigation scheduling can have an effect on the bunch architecture that results in loose bunches with small berries. However, in wet seasons where irrigation scheduling is not necessary, other methods are required to reduce the size of berries.

Reduce canopy density and fruit congestion, increase fruit exposure:

It is now known that Botrytis is endemic in the vineyard and will always be a potential threat from veraison to harvest so one management regime is to accelerate ripening. Factors that delay ripening are high rainfall, high altitude, heavy cropping and large canopy (excessive shading reduces light levels and temperature in the bunch zone). In most cases, the grower is already established at a site so it is not possible to control the rainfall and temperature of the site. Therefore, management of cropping levels and canopy density is necessary.

Excessive shading also promotes a thinner cuticle on the berry that increases the fruit susceptibility to Botrytis.

Growers can start to manage their Botrytis problem as early in the season as pruning. Too many buds left after pruning may increase yield and delay maturity, however, leaving a large number of buds at pruning can increase competition among clusters for assimilates and reduce compactness by reducing berry set. Post fruit set thinning can correct the yield and accelerate ripening. Post fruit set thinning also enables growers to create a more open bunch zone that can reduce the bunch wetness and increase spray penetration.

The benefits of this project, as described in the original grant application, have been fulfilled, although further work is required before full implementation of a management plan is possible. This is because recent vintages have been extremely dry, thus not allowing the improved practices to be tested under conditions of high disease pressure

6.1. RECENT RELEVANT **COMMUNICATIONS**

The results of the Best Practice will be presented at the international Cool Climate Symposium in Christchurch, New Zealand, Feb 5-11th 2006.

The results of this project were communicated at the International Botrytis workshop, Christchurch, New Zealand, February 2-3, 2003. The posters were also presented at the International Congress for Plant Pathology, Christchurch, February 4-7, 2003.

1. Cole, M.(2003) Distribution and compatibility of *Botrytis cinerea* isolates. Workshop proceedings, 8th International Congress of Plant Pathology, Christchurch, NZ. 1-2 February 2003.
2. Cole, M., Agarwal, A., Whitmore, S., Wiechel, T. (2003) Phyloplane Fungi in Victorian vineyards. Conference proceedings, 8th International Congress of Plant Pathology, Christchurch, NZ. 1-2 February 2003. Poster presentation.
3. Keller, M., Viret, O., Cole, M(2003) *Botrytis cinerea* in grape flowers: defence reaction, latency and disease expression, *Phytopathology* **93:** 316-322.
4. Wiechel, T. (2003) The occurrence of *Botrytis cinerea* subspecies *transposa* and *vacuma* in Australian vineyards. Workshop proceedings, 8th International Congress of Plant Pathology, Christchurch, NZ. 1-2 February 2003.
5. 8th International Congress of Plant Pathology, Christchurch, NZ., February 1st & 2nd 2003. Proceedings of the 2-day workshop. Convened by Dr Mary Cole.
6. Cole ,M. 2003 Other Bunch Rots: Invited presentations and research design. Northern Tasmanian Grapegrowers Association, Launceston, Sept 1.
7. Cole, M. 2003 Other Bunch Rots: Invited presentations and research design. Southern Tasmanian Grapegrowers Association, Hobart, Sept 2.
8. Cole, M. 2003 *Botrytis* and other Bunch Rots: Invited presentation to Technical Working Group of Tumbarumba Grapegrowers Association, Tumbarumba, 6-8 August.
9. Cole, M. Wiechel, T. 2003 Botrytis workshop for North-eastern region grapegrowers, June.
10. Cole, M. Wiechel, T. 2003 *Botrytis* workshop for Alpine region grapegrowers, June.
11. Cole, M 2003 Other Bunch Rots: Invited presentation to Technical Working Group of Yalumba Winery, Barossa Valley, 15-17 July.
12. Cole, M. Growers seminar series, Wangaratta, 2000. Management of Botrytis
13. Australasian Plant Pathology Society,12th Biennial Conference, Canberra, September 27th - 30th, 1999. Proceedings of the Botrytis Workshop. Monday, September 27th, 1999, Convened by Dr Mary Cole

Demonstration of Best Practice Botrytis Control Strategies on a Vineyard in the Yarra Valley Region of Greater Victoria

14. Cole, M. Seminar - The latest understanding of *Botrytis cinerea* in grapevines - Melbourne University - August 2001;
15. Cole, M. Seminar - The latest understanding of *Botrytis cinerea* in grapevines Flinders University - October 2001.
16. Cole, M. Botrytis Workshop at Wine technical Conference, Adelaide, October 2001.
17. Cole, M. Grapecheck Disease Management Seminar, Bairnsdale, Victoria, May 2002.
18. Cole, M. Grapecheck Growers Meeting, Myrtleford, Alpine region, October 2002.

6.2.Oral presentations

F. M. Cole *et al,* Distribution & compatibility of *Botrytis cinerea* isolates.

T.J. Wiechel *et al*. : The occurrence of *Botrytis cinerea* subspecies *transposa* and *vacuma* in Australaian vineyards

6.3.Posters

Cole, M., Whiting, J., Braybrook, D. (2006). Botrytis Best practice management in Cool Climate Victoria.

Whiting, J. (2006) Beating Botrytis - Grower reactions to regional workshops

F.M. Cole *et al.,* Phylloplane fungi in Victorian vineyards

T.J. Wiechel *et al.*: A survey of *Botrytis cinerea* from budburst to post harvest in regional vineyards in Victoria

Following these conferences, papers will be written for the major viticulture journals and newspapers, refereed scientific journal, and presentation to growers at regional workshops.

6.4 Published Papers/Book

Cole, M., Whiting, J & Braybrook, D. (2004) Botrytis Best Practice Protocols, Publ. Monash University.

Cole, M., Whiting, J., & Braybrook, D. (2004) Botrytis Best Practice Check List. Publ. Monash University

Cole,M.,Weichel,T Ford,C., Horsnell,J., Whitmore,S., Peter Leeton (2004) Botrytis and its place in the vineyard. Part 2: Distribution of Botrytis in the vineyard, Australian & New Zealand Grapegrower & Winemaker **482**:15-18.

Cole, M. (2003) Botrytis and its place in the vineyard. Part 1: History' Australian & New Zealand Grapegrower & Winemaker **480**: 22-24.

Keller, M., Viret, O., Cole, M (2003) *Botrytis cinerea* in grape flowers: defence reaction, latency and disease expression, *Phytopathology* **93:** 316-322.

7.0 DATA

Mornington Estate 2003 vintage Rovral Resistance and subspecies

	Number of isolates	Number of isolate with some resistance to Rovral	Flipper + or -
Budburst	1	1	p
Pre-spray Flowering	1	1	p
Post-spray Flowering	0		p
Pre-spray PBC	0		
Post-spray PBC	0		p
Veraison	19	19	p-n
Harvest	14	14	p-n
Post Harvest	20	20	p-n

Mornington Estate Number of isolates showing sensitivity and resistance to **Rovral** at 2ppm and 5ppm

	2ppm Resistant	2ppm Sensitive	5ppm Resistant	5ppm Sensitive	Total
Budburst	0	1	0	1	1
Pre spray at flowering	1	0	1	0	1
Post spray at flowering	0	3	0	3	3
Pre spray at pre bunch closure	2	0	2	0	2
Post spray at pre bunch closure	1	0	1	0	1
Veraison	9	10	7	12	19
Pre harvest	No sample				
Harvest	10	7	7	10	17
Post harvest	0	20	0	20	20

Mornington Estate Number of isolates showing sensitivity and resistance to **Scala** at 2ppm and 5ppm

Number of isolates	2ppm Resistant	2ppm Sensitive	5ppm Resistant	5ppm Sensitive	Total
Budburst	1	0	0	1	1
Pre spray at flowering	1	0	1	0	1
Post spray at flowering	0	3	0	3	3
Pre spray at pre bunch closure	0	2	0	2	2
Post spray at pre bunch closure	0	1	0	1	1
Veraison	3	16	3	16	19
Pre harvest	No sample				
Harvest	4	13	1	16	17
Post harvest	3	17	2	18	20

Mornington Estate:

Vine numbers in bold are spur pruned; no bold numbers are cane pruned

Botrytis incidence: Budburst

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bud	**1**			
bud	**2**			
bud	**3**			
bud	**4**			
bud	5			
bud	6			
bud	7			
bud	8			
bud	9			

Pre-spray at flowering

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	**1**			
bunch	**2**			
bunch	**3**			
bunch	**4**			
bunch	5			

bunch	6			
bunch	7			
bunch	8			
bunch	9			
bunch	10			
bunch	11			
bunch	12			
bunch	**13**			
bunch	**14**			
bunch	**15**			
bunch	16			
bunch	17			
bunch	**18**			
bunch	**19**			
bunch	**20**			
bunch	21			
bunch	22			
bunch	23			
bunch	**24**			
bunch	**25**			

Mornington Esatate
Botrytis incidence:
flowering

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	**1**			
bunch	**2**			
bunch	**3**			
bunch	**4**			
bunch	5			
bunch	6			
bunch	7			
bunch	8			
bunch	9			
bunch	10			
bunch	11			
bunch	12			
bunch	**13**			
bunch	**14**			
bunch	**15**			
bunch	16			
bunch	17			
bunch	**18**			
bunch	**19**			
bunch	**20**			
bunch	21			
bunch	22			

bunch	23			
bunch	**24**			
bunch	**25**			

Mornington Estate
Botrytis incidence
Shatter (post-spray at flowering)(pre spray at PBC)

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	**1**			
bunch	**2**			
bunch	**3**			
bunch	**4**			
bunch	5			
bunch	6			
bunch	7			
bunch	8			
bunch	9			
bunch	10			
bunch	11			
bunch	12			
bunch	**13**			
bunch	**14**			
bunch	**15**			
bunch	16			
bunch	17			
bunch	**18**			
bunch	**19**			
bunch	**20**			
bunch	21			
bunch	22			
bunch	23			
bunch	**24**			
bunch	**25**			

Mornington Esatate
Botrytis incidence:
Post spray at Pre-bunch closure

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	**1**			

bunch	**2**			
bunch	**3**			
bunch	**4**			
bunch	5			
bunch	6			
bunch	7			
bunch	8			
bunch	9			
bunch	10			
bunch	11			
bunch	12			
bunch	**13**			
bunch	**14**			
bunch	**15**			
bunch	16			
bunch	17			
bunch	**18**			
bunch	**19**			
bunch	**20**			
bunch	21			
bunch	22			
bunch	23			
bunch	**24**			
bunch	**25**			

Mornington Estate
Botrytis incidence
Veraison

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	**1**			
bunch	**2**			80%
bunch	**3**			10%
bunch	**4**			
bunch	5			
bunch	6			50%
bunch	7			
bunch	8			
bunch	9			
bunch	10			
bunch	11			
bunch	12			
bunch	**13**			
bunch	**14**			
bunch	**15**			1%
bunch	16			
bunch	17			
bunch	**18**			80%

bunch	**19**			10%
bunch	**20**			80%
bunch	21			100%
bunch	22			
bunch	23			10%
bunch	**24**			
bunch	**25**			

Mornington Esatate
Botrytis incidence:
Harvest

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	**1**			
bunch	**2**			
bunch	**3**			
bunch	**4**			
bunch	5			50%
bunch	6			
bunch	7			
bunch	8			100%
bunch	9			
bunch	10			5%
bunch	11			
bunch	12			
bunch	**13**			25%
bunch	**14**			50%
bunch	**15**			100%
bunch	16			
bunch	17			
bunch	**18**			
bunch	**19**			
bunch	**20**			
bunch	21			
bunch	22			
bunch	23			
bunch	**24**			
bunch	**25**			

Demonstration of Best Practice Botrytis Control Strategies on a Vineyard in the Yarra Valley Region of Greater Victoria

Mornington Estate
Botrytis incidence:
Post Harvest

sample	Vine	Environmental washings	Surface sterilised and Moist incubated	Latent – post freezing
bunch	1			
bunch	2			
bunch	3			
bunch	4			
bunch	5			
bunch	6			
bunch	7			
bunch	8			
bunch	9			
bunch	10			
bunch	11			
bunch	12			
bunch	13			
bunch	14			
bunch	15			
bunch	16			
bunch	17			
bunch	18			
bunch	19			
bunch	20			
bunch	21			
bunch	22			
bunch	23			
bunch	24			
bunch	25			

Botrytis incidence in bunches cane vs spur.

Pruning type	Budburst	Prespray flowering	Flowering	Post spray flowering (shatter)	Post-spray pre-bunch closure	Veraison Mostly latent	Harvest	Post harvest
Cane	0	0	0	1	1	4 (10-100%)	3(5-100%)	6 MI
Spur	0	0	0	0	1	7 (10-80%)	3 (25-100%)	

8.0 BUDGET RECONCILIATION

Show actual against original budget

Budget	Funding required from GWRDC $	Actual $
Travel & personal expenses for research team	1,500	1,500
Testing for Botrytis incidence	5,000	5,000
Other related testing	0	
Laboratory & vineyard consumables	3,000	1500
Casual labour	2,500	2,500
VitiSolutions consultancy	1,000	1,000
Meeting expenses (planning, review)	2,000	
Grower participation	0	
Grower management	0	
Technician (30% of FTE)	0	
Project administration	0	
Total	**15,000**	11,500
Add 10% GST	1,500	1,150
Total funds requested from GWRDC	**16,500**	**12650**

9.0 APPENDICES

APPENDIX 9.1 : Report from John Whiting.

Botrytis control – a best practice approach

Final Report to Greater Victoria Wine Grape Industry Development Committee and Grape and Wine Research and Development Corporation

Publication and workshop component only

Executive summary

In the first year of this project, which has been reported previously, three trial sites were established and monitored, and a draft management checklist was developed. In 2003-04 funds were provided by the Grape and Wine Research and Development Corporation (GWRDC) for the publication of two booklets on Botrytis management. The Greater Victoria Wine Grape Industry Development Committee (GVWGIDC) provided funding to 'road-test' a checklist on Botrytis management at three sites in Greater Victoria. It also provided funds for conducting a series of workshops to enhance adoption of improved Botrytis management strategies, incorporating the services of David Braybrook of VitiSolutions. Monash University and the Department of Primary Industries, Victoria, provided in-kind support for the project.

The draft Botrytis management checklist, developed in the 2002-03 season with GWRDC and GVWGIDC support, was released to groups of growers for review. These grower groups were based around three demonstration sites in the Yarra Valley, Mornington Peninsula and Alpine Valleys. Feedback from those groups resulted in a revised version of the checklist. The checklist is designed so that growers can, at particular stages of the season, assess the risk of Botrytis developing and then, if action is needed, refer to a series of suggested management strategies.

During 2003-04 the project team prepared a publication documenting some of the essential aspects of the biology of Botrytis along with proposed management strategies. This booklet is in full colour with supporting photographs. The checklist will be included inside the back cover in CD format. The booklet was mailed to all GVWGIDC levy payers in late August 2004.

A series of four workshops were conducted across Greater Victoria utilising the publication materials developed with GWRDC funds. The workshops were structured so that the participants i) were provided with some relatively technical information, ii) they were given an opportunity to reflect on the key issues, and then iii) they were asked to use the information by working through some prepared scenarios in small groups. Each group then shared their workings with all the participants and any further issues discussed as a group. The workshops were attended by 91 participants, at an average of 23 per workshop.

Part of the structure of the workshop was to get participants to assess their own level of knowledge and how much of a problem Botrytis was to them. The workshop also monitored participants' confidence in managing Botrytis before and after the workshop to assess change. There was some variation between workshop groups in their perceived knowledge of Botrytis and the extent to which it was a problem to them. All groups showed an improvement in confidence in managing Botrytis.

Most participants picked up new knowledge, skills and an improved understanding of Botrytis management. The mix of technical and practical components was favourably received by the attendees. Participants nominated numerous aspects of Botrytis management they would do

differently as a result of the workshops. Some suggestions were made about improving the workshop but by and large they were happy with the content and format. Participants also identified aspects of Botrytis management they would like to learn more about. Where there are knowledge gaps, areas for further research and extension were identified.

The changes in attitude to the management of Botrytis recorded at the workshop had clear environmental and social consequences. There was a distinct move away from relying on chemicals to control Botrytis, to interest in systems that i) minimise the conditions favouring development of the disease, eg. canopy management, pruning, and light brown apple moth control, ii) that encourage biological control of Botrytis and iii) more judicious use of chemicals.

11 Background

Botrytis cinerea is a disease of great economic significance to the wine grape industry, resulting in major reductions in yield and losses in grape quality. Justifiably, very significant R&D aimed at developing best practice control and prevention is being done at both national (GWRDC, CRCV) and state levels.

11.4 The greatest economic losses from Botrytis occur in cool climate viticultural regions which include much of Greater Victoria. In recent years, Botrytis control has been identified by the industry as high priority in R&D planning workshops convened by the Department of Primary Industries (DPI). In grower voting on 2002/03 projects proposed by the Greater Victoria Wine Grape Industry Development Committee, the Botrytis project was second most popular, with just under 90% of growers voting in support.

This project draws on the experiences of the first year of a GVWGIDC supported project developing best practice Botrytis control strategies and applying them on three large vineyard demonstration sites in Greater Victoria. Latest findings from national and state R&D programs were applied on the three sites, and responses assessed and refined through monitoring and testing.

11.4.1 The best practice management protocols developed in year 1 of the project were pre-tested with a small group of growers. This enabled modifications to be made before being released to the wider industry. At each location a reference group was used in conjunction with the local GVWGIDC representative. Interactive group meetings in each region gave those attending hands-on involvement in the application of the best practice protocols. The project incorporates participatory active learning, with feedback and review sessions being used to modify the protocols. Broader grower awareness of the project through a series of workshops further spread the best practice approach to Botrytis control.

The benefits of this project were anticipated to be:

- Reduction in serious economic and grape quality losses in regions where Botrytis incidence are high risk;
- More rapid adoption of latest research results with regional grower group involvement.

The project was undertaken by members of a project team consisting of:

John Whiting, DPI Bendigo (Team Leader)
Dr Mary Cole, Monash University
David Braybrook, VitiSolutions
Steve Whitmore, Monash University
Tonya Wiechel, Monash University
Vanessa Hood, DPI Box Hill
Paul Blackshaw, DPI Rutherglen
Natalie Laukart, DPI Knoxfield
Spencer Field, GVWGIDC
Peter Hayes, GVWGIDC

Objectives

To improve producer awareness and enhance adoption of best practices for the management of Botrytis by:

1. Enabling practical demonstration on three vineyards in Greater Victoria of latest best practices control strategies.
2. Extending the package of best practice Botrytis control strategies developed on the three demonstration sites to other regions.

Methodology

Based on feedback from several meetings with the grower reference groups, modifications to the proposed information package were made by the project team. The proposed protocols were divided into two booklets. The first, 'Understanding Botrytis Management in Greater Victoria', contained basic information on the disease and control options based on the biology of the disease. The second publication, 'Botrytis Management Checklist' was set out so that growers could follow a decision making process in developing their approach to managing Botrytis.

Workshop preparation

The project team developed the workshop program. The aim of each workshop was to present technical information on Botrytis; reflect on the information and then for participants to work through some aspects of the checklist, with time for feedback and questions at the end of the workshop.

Workshops were located to cover regions at most risk from Botrytis. Knoxfield was a central location for the Yarra Valley, Mornington Peninsula and Gippsland regions. Beechworth is located central to the Rutherglen, Beechworth, Alpine Valleys, King Valley, Glenrowan and Strathbogie wine regions. Macedon was central to Seymour, Heathcote, Bendigo and Macedon Ranges regions. Ballarat provided access from the Geelong, Henty, Grampians, Pyrenees and Ballarat regions.

To optimise time available from the presenters, the workshops were conducted within a seven-day period. The dates of the workshops were held on 30th June (Knoxfield), 2nd July (Beechworth), 5th July (Macedon) and 6th July (Ballarat).

Dr Mary Cole, Monash University, presented the technical session at all workshops. John Whiting, DPI Victoria, presented the checklist section at three workshops and David Braybrook, VitisSolutions, at one workshop. The DPI Grapecheque team facilitated the workshops: Cynthia Mahoney (Knoxfield), Paul Blackshaw (Beechworth) and Louise Wood (Macedon and Ballarat).



Awareness of the workshops was provided by direct mail to each GVWGIDC member (appendix 1), through a press release targeted at regional newspapers (appendix 2), and radio 3WE.

Materials prepared for the workshop included a copy of Mary Cole's powerpoint presentation, a hardcopy of the 'Botrytis Management Checklist' (it will be released in CD format in conjunction with the booklet on 'Understanding Botrytis Management in Greater Victoria'), a series of scenarios for attendees to work on (appendix 3), and a feedback sheet (appendix 4).

Workshop program

The general program used for the workshop included:

1. a warm-up segment to get people mixing and talking about Botrytis
2. a presentation on the 'Biology of Botrytis' and results from the research component of the GVWGIDC project
3. a review of Mary's talk after a break to recall the main highlights
4. a group activity to work through the approach used in the checklist
5. general discussion and evaluation of the workshop.

The session plan used for the workshop is attached in appendix 5.

Results/Discussion

Key points about Botrytis from Dr Mary Cole's talk (grower feedback)

- It is everywhere, and there all the time
- Can only manage it, not eradicate it
- Infection does not necessarily result in expression
- Canopy management is one of the main means of managing it
- Important to control light brown apple moth
- Healthy soils help reduce background levels of Botrytis
- The most important spray is at 80% capfall
- Monitoring should be undertaken regularly
- It needs continued R&D funding
- Should remove old mummified bunches
- Botrytis grows on flowers of grasses and other plants in and around vineyards
- Long flowering periods cause problems
- Scars from flower caps (calyptras) are very susceptible to Botrytis and trap spores
- Need to minimise damage to the canopy, eg. from wire lifting, leaf plucking, etc..

- Cannot rely on chemicals to control Botrytis
- Not necessary to remove prunings – mulch them



Grower feedback on scenarios

Growers enjoyed the opportunity to discuss the scenarios. Whilst they had good guidelines to follow in the Botrytis Management Checklist, discussion after turned to what they did or had tried on their own vineyards. It was often difficult to get them to stop discussion in the small groups.

The main points provided during feedback from the groups for each scenario (appendix 3) were:

Scenario 1

The main cause of the problem was a combination of high vigour, high nitrogen and high crop load. During pruning and early season growth the growers would:

- Do some assessments of vine growth to compare after any changes
- Reduce bud numbers provided vine balance was not unduly affected
- Prune to evenly space the shoots to prevent clumping of fruit
- Consider use of sacrificial canes to reduce growth, and reduce crop later
- Re-trellis to a system that allows more cordon area, eg Scott-Henry, Lyre,
- Decrease nitrogen inputs
- Undertake shoot thinning to reduce crop
- Do a crop estimate to see how much crop could be removed
- Retain/develop an inter-row sward to compete with vines
- Reduce irrigation inputs
- Long term – change variety, clone, rootstock, or, if all fails, location,

Scenario 2

The main cause of the problem was incorrect chemical usage.
During the flowering period the growers would:

- Sample bunches and test for chemical resistance
- Monitor the flowering period to determine optimum application time (80% capfall)
- Use the right chemical and implement a resistance management strategy
- Double check application rates to ensure not under-spraying
- Check coverage to ensure penetration is adequate.

Scenario 3

The main cause of the problem was light brown apple moth.
During the berry set to veraison period the growers would:

- Control the broad leaf weeds in the vineyard
- Monitor for LBAM earlier in the season
- Eliminate broad spectrum insecticides
- Introduce and encourage development of LBAM predators
- Select LBAM spray treatments that do not harm predators
- Reduce bunch and canopy congestion to improve spray coverage and penetration

Scenario 4

The main cause of the problem was berry damage from leaf plucker and birds.
During the pre-harvest to harvest stages the growers would:

- Adjust leaf plucking equipment and undertake staff training to minimise berry damage
- Check Botrytis incidence and severity using sampling procedure outlined in Checklist
- Netting or improved procedures for bird control
- Identify cause of Botrytis, eg. cut bunches open to check for LBAM
- Check with winery regarding their tolerances for Botrytis infection
- If winery tolerance likely to be exceeded, remove infected bunches prior to mechanical harvesting, or instruct pickers to leave behind infected bunches
- Late season chemical application could be considered in consultation with winery
- Bring harvest date forward if possible to prevent disease blow-out
- Improve canopy openness if necessary

Scenario 5

The main cause of the problem in one part of the vineyard was excessive vigour.
After harvest a plan was developed which would:

- Take some measurements of vine vigour to compare with following season
- Consider the reasons for that part of the vineyard being different
- Change pruning or trellis system during the winter to open up the canopy
- Reduce inputs into that section of the vineyard
- Consider drainage for that part of the vineyard
- Plant a more active inter-row sward, providing frost is not an issue.
- Long term – change variety, clone or rootstock



Evaluation

Several methods of evaluation were used during the workshops. At the start of each workshop, a sociometric line was used to assess the level of knowledge and how much of a problem Botrytis was to them. Growers were invited to discuss their positioning on the line. At the end of that, growers rated their current (pre-workshop) level of confidence in being able to manage Botrytis by placing a coloured dot on a scale from zero (no confidence) to 5 (total confidence).

After the completion of the workshop growers filled out an evaluation sheet to assess what benefits they thought they had gained from the workshop and to make any comments. In addition before the workshop closed, participants re-visited the 'level of confidence' scale, and, with a different coloured dot, determined their level of confidence in managing Botrytis.

Whilst the sociometric line was rated zero to ten, the growers' self-ratings were split into three groups of low (score 0-3), moderate (4-7), and high (8-10) for level of knowledge and level of problem in the vineyard. The 'level of confidence' chart was also divided into three groupings of low (0-1.5), medium (1.6-3.5), and high (3.6-5).

How much do growers know about Botrytis?

The percentage of participants in each category at the four workshops is presented in Table 1.

Table 1. Self rating of workshop participants for their level of knowledge about Botrytis

Workshop location	Number in group	Self Rating - % of group		
		Low	Medium	High
Knoxfield	35	14.3	74.3	11.4
Beechworth	24	50.0	50.0	0
Macedon	13	53.8	46.2	0
Ballarat	14	50.0	50.0	0
Overall	86	36.0	59.3	4.6

The Knoxfield group tended to rate themselves higher in their level of knowledge of Botrytis. This was partly due to the inclusion of some resellers and researchers in the group who deal with Botrytis on a regular basis. In Beechworth, Macedon and Ballarat around 50% of the participants rated themselves as having a low knowledge of Botrytis.

How much of a problem is Botrytis in your vineyard?

The group that believed that Botrytis was more of a problem to them was Knoxfield. In the Macedon group nearly one quarter believed it was a high problem. Only 7-8% of the people in the Beechworth and Ballarat groups rated Botrytis a high problem (Table 2). Attendees at the Knoxfield and Macedon workshops were primarily from regions where Botrytis is recognised as an issue. The Ballarat and Beechworth groups included people from outside the immediate area in drier regions less conducive to Botrytis.

Table 2. Self-rating of workshop participants for the level of problem Botrytis was in their vineyard.

Workshop location	Number in group	Self Rating - % of group		
		Low	Medium	High
Knoxfield	35	31.4	37.1	31.4
Beechworth	24	41.7	50.0	8.3
Macedon	13	15.4	61.5	23.1
Ballarat	14	57.1	35.7	7.1
Overall	86	36.0	44.2	19.8



How confident are growers in managing Botrytis?

This question was asked before and after the workshop to assess change in grower confidence based on what was presented at the workshop. Results are summarised in Table 3.

Table 3. Self-ratings of workshop participants for the level on confidence they have in managing Botrytis, before and after the workshop.

Workshop location	Number in group		Self rating - % of group						Mean self rating score		Change in score
			Low		Medium		High				
	Before	After	Before	After	Before	After	Before	After	Before	After	
Knoxfield	34	24	5.9	0	47.1	33.3	47.1	66.7	3.2	3.7	0.5
Beechworth	24	22	29.2	0	70.8	36.4	0	63.6	2.4	3.5	1.1
Macedon	14	11	35.7	0	28.6	18.2	35.7	81.8	2.3	4.0	1.7
Ballarat	13	13	46.2	0	46.2	46.2	7.7	53.8	2.0	3.4	1.4
Overall	85	70	23.5	0	50.6	34.3	25.9	65.7	2.5	3.6	1.1

Prior to the workshops, the Knoxfield group had the greatest confidence in managing Botrytis, despite it also being a greater problem among participants (Table 2). At the start of the Macedon workshop participants were relatively evenly split between low, medium and high confidence. At Beechworth nobody claimed to have high confidence in managing Botrytis, but most (70%) recorded medium confidence. The Ballarat group had least confidence in managing Botrytis, and it is interesting that they rated Botrytis as a lower problem for them.

After the workshops nobody rated themselves as having low confidence in managing Botrytis. The mean rating score showed positive increases in confidence at all workshops. The least improvement in confidence was at Knoxfield but they had the highest confidence before the workshops. Also at Knoxfield a number of people left the workshop prior to the end (perhaps they were very confident in managing Botrytis!) so the participant group before and after was not exactly the same and the change was not measured accurately. The greatest rating improvement was at Macedon with over 80% of participants being highly confident of managing Botrytis after the workshop.

What did growers gain from the workshop?

Whilst this question was answered by each group the differences between groups were not striking. In general a lower proportion of the Knoxfield participants gained new knowledge or skills, and had least change in attitudes. The Macedon group gained most in knowledge, a change of attitude and an increased understanding of Botrytis issues.

The areas where most gained were in new knowledge and an increased understanding of Botrytis (around 85% of participants) (Table 4). Just over 50% believed they gained new skills and techniques to apply to managing Botrytis. Just under one third had a change in attitude towards Botrytis, and around one quarter considered they had an increased understanding of other people's opinions and time to think about the issue.

Table 4. Percentage of participants that gained from the workshop across all groups.

Benefits	Percentage across all groups (68 responses)
New knowledge that is useful	84
New skills/techniques to apply	56
A change of attitude	29

Increased understanding of issues	85
Increased understanding of other people's opinions	25
Time to think	22
Little or no benefit	0

Other benefits that participants described were that they:
i) were able to listen to the observations of other growers,
ii) had confidence that they were doing the right thing,
iii) were able to see that they could apply the knowledge and skills learnt at the workshop,
iv) understood management and cultural practices were more important than relying on sprays,
v) considered Botrytis to be very manageable, and,
vi) were now much better able to understand and apply principles to management.

Most participants considered they got most benefit from the technical information session, but quite a few commented that the combined technical/practical approach gave them most benefit.

Some comments provided by participants were:

"The session was informative. The accompanying booklet is very useful to growers and students in this area"

"All really good. The management checklist is an excellent tool. Mary Cole's work is very good and her ability to teach fantastic"

"An excellent, very understandable experience"

"The lecture/workshop approach is ideal"



Will growers do anything differently as a result of the workshop?

Participants were able to identify aspects they would do differently as a result of the workshop. Most of them involved using a wider range of techniques to manage Botrytis, particularly in reconsidering how they use chemicals. A summary of the participants comments and the number who made the comment (if more than one) follows:

- No change (7) – mainly from participants who do not have a problem.
- Canopy management (10)
- Monitor and treat for light brown apple moth (9)
- Re-assess the chemicals they use (7)
- Monitoring and assessing damage (7)
- Mulch the prunings (5)
- Increase the airflow (5)
- Spray timing (4)
- More care moving foliage wires (4)
- Check the pruning (4)
- Re-assess whole approach (3)
- Use the checklist approach (2)
- Be more pro-active (2)
- Inter-row management
- Only in a bad year
- Reduce cropping levels
- Remove mummified bunches
- Ripen fruit earlier
- Attention to flowering infection control
- Review all inputs such as fertilisers

Any changes to the workshop?

Many participants commented that the workshop did not need changing, but some did make comments.

- Need to allow more time for the workshop (6)
- Start on time (2)
- Stick to time
- Participants to do all scenarios
- Encourage more discussion from participants
- More group activities
- Capture grower comments and circulate after the workshop



Botrytis management issues growers wish to learn more about.

Participants were given an opportunity to suggest ideas for addressing other issues arising from the workshop.

- More information on spray treatments – rates, chemicals, efficacy, etc. (13)
- Annual workshop to share knowledge (2)
- Influence of irrigation and nutrition (2)
- Follow-up to this workshop
- Winemaking techniques to handle Botrytis
- Increasing the natural resistance of grapevines
- Crop level management
- Similar structured workshops on powdery, downy and phomopsis
- Light brown apple moth control
- Introducing predators to the vineyard
- Winery attitudes to acceptable Botrytis levels
- Effect of solvents and wetters on wax layers
- Berries pushing-off the pedicels
- Persistence of pre bunch-closure sprays
- Climatic monitoring to assist management
- Continued research
- Regular reviews of spray application techniques

Outcome/Conclusion

This project has produced two publications on the management of Botrytis and conducted four workshops across Greater Victoria. Whilst the response rate to the workshops was good (average of 23 per workshop) there were still many growers in high Botrytis pressure areas that did not attend. The project certainly had an impact on those that attended the field plot meetings and the workshops, but with all the publicity provided about the workshop, it demonstrates the difficulty in getting widespread impact with just a two-year project.

In general terms the project has achieved its objectives as far as can be assessed at this stage. The longer-term improvements in Botrytis management will not be known for several seasons and it is beyond the scope of the current project to determine that. Evaluation of the workshops have demonstrated the main outcomes were:

- Participants have shown an increase in confidence in their ability to manage Botrytis due to attendance at the workshop

- Most participants (around 85%) gained new knowledge and had a greater understanding of the issues concerning management of Botrytis.
- Just over one half of participants developed new skills at the workshops.
- One quarter to one third had a change in attitude towards Botrytis, had an increased understanding of the opinions of others, and had time to think about Botrytis management.
- Other benefits the growers gained related to confidence in what they were doing, hearing other grower's stories, and being able to apply knowledge and skills in a practical exercise.
- Growers were able to recall the key points of a technical presentation on the biology of Botrytis.
- Some participants (10%) said they would not do anything differently, either because they did not have a Botrytis problem, or, the workshop reinforced that were managing it well enough.
- Participants mentioned a range of activities they would do differently as a result of the workshop. The main ones were:
    - Canopy management
    - Monitor and treat for light brown apple moth
    - Re-assess the chemicals they use
    - Monitor and assess Botrytis damage
    - Mulch the prunings, and
    - Increase the airflow.
- Comments on the workshop itself related to allowing more time to conduct the workshop, more group activities and discussion, capturing grower comments, and the lecture/workshop approach was ideal.
- Participants identified quite a number of further learning opportunities, but the main ones were more information on spray treatments (chemicals, rates, efficacy), the influence of irrigation and nutrition on Botrytis, and annual workshops to share knowledge. These, and the other topics identified, offer opportunities for GWRDC RITA funding.

Providing more workshops at a greater number of venues would have encouraged greater total attendances since participants would have had less travel and saved possible overnight expenses. However, the budget and availability of presenters limits a more expansive series of workshops across a grape growing area of roughly 640km (east-west) x 300km (north-south). Having the workshops located in vineyards and doing a field walk, and using the experience of other viticulturists in a more structured presentation could have enhanced the outcomes.



The printing of the booklet on understanding the biology of Botrytis was not completed at the time of the workshops, so there would have been extra benefit to participants to have that with the 'take-away' information. However it was sent out at the end of August, and it may in fact act as a prompt

for participants to re-examine their Botrytis management strategy after they have had some time to digest the information presented at the workshops.

This project would appear to have created a change in attitude towards the application of chemicals for Botrytis control, and perhaps other diseases. Many participants aim to look at other aspects of Botrytis management, such as canopy management, activities that improve vineyard floor microflora, and increasing the airflow through canopies. Participants seemed keen to be less reliant on chemicals. This was evident in comments relating to taking more care in their choice of chemical, optimising the timing of application, improving the spray coverage, and, a desire to encourage the development of beneficial organisms. These changes in attitude will be of benefit to the environment and the community.

Economic benefits were evident in the field sites used to 'road-test' the management guidelines. One vineyard with a past history of Botrytis was able to produce a crop without expression of Botrytis, whereas a neighbouring vineyard was riddled with Botrytis, ie. the result was not just a one-off due to the season. Some of the management practices described at the workshops may incur greater cost to the producer, eg. extra canopy management, more monitoring, reducing cropping levels, etc., and they will have to be weighed up against the anticipated improvement in grape quality and price.

The results of this project will be summarised for publication in an industry journal.

Whilst the GWRDC funds were directed towards the printing of the two publications, they alone do not seem to satisfy the need to get adoption of the information. Numerous comments about the workshops related to combining the technical information (essentially the GWRDC publications) with the practical exercise of getting growers to use the information and go through a process, in this case using the checklist to deal with different Botrytis management situations.

The process of combining technical information with practical activities is one that GWRDC is encouraged to develop in many of its projects. The adoption of knowledge and skills derived from research projects and promulgated in publications, should be provided to industry along with an associated process for enhancing adoption of the information. The adoption enhancing process needs to be developed by people experienced in facilitating adoption, it needs to be developed in conjunction with the research project that is generating the information (not after the information is published), and it should be funded by GWRDC as part of the full project process from research to adoption, if getting adoption is one of the objectives of the project.

A number of future projects for research and extension were identified by the growers (see results/discussion section). The major ones were:

- Demonstrating the value of encouraging natural predators of Botrytis and improving the vineyard microflora to reduce Botrytis levels.
- The impact of aspects of vineyard management such as crop thinning, irrigation and nutrition on the management of Botrytis.
- Developing confidence in the chemicals and surfactants that are registered through independent testing of efficacy, persistence and rates of application, etc.
- Similar structured workshops for other diseases and pests.
- Climatic monitoring to assist with Botrytis management.

IDC
Greater Victoria Wine Grapes

The Greater Victoria Wine Grape Industry Development Committee
invite you to attend a:

11.4.2

Best Practice Botrytis Control Workshop



The Greater Victoria Wine Grape Industry Development Committee (GVWGIDC) has funded a project to improve the control of Botrytis.

In conjunction with Monash University, Vitisolutions and The Department of Primary Industries, the GVWGIDC invites you to attend a workshop to provide up-to-date information on the best management options for Botrytis control.

Workshops will be conducted at:



- **DPI Knoxfield**, 30th June, 1.30pm – 4.30pm
(621 Burwood Highway, Knoxfield, Melways Ref. 73 C1)

- **Beechworth,** 2nd July, 9am – 12pm
(LaTrobe University, Albert Rd, Beechworth,
Vicroads Map 325 O9- P10)

- **Macedon,** 5th July, 1.30pm – 4.30pm
(Parks Victoria, Nursery Rd, Macedon,Vicroads map 285 N8)



- **Ballarat,** 6th July, 9.00am – 12.00pm
(Central Highlands Regional Library, 178 Doveton St, North Ballarat,

See over for program

Please RSVP (for any queries):
Louise Wood, Grapecheque Facilitator
Ph (03) 5430 4670 or 0408 335 027
Email: louise.wood@dpi.vic.gov.au

Victoria

grapecheque

PROGRAM

- **Dr Mary Cole, Monash University-**

Speaking about the biology of Botrytis and results from IDC project work

- **David Braybrook (Vitisolutions)/ John Whiting (DPI)-**

Taking growers through the checklist approach to Botrytis Management

- **Group Activity**

Working through some scenarios to determine best course of action, and feeding back to rest of group

Morning / Afternoon tea provided

"Your opportunity to prepare best practice Botrytis management strategies for the season ahead"

9.3 APPENDIX

Media release

From the Department of Primary Industries

DATE: 23 June 2004

KEEPING UP WITH BOTRYTIS MANAGEMENT IN GRAPEVINES

Botrytis disease of grapevines can be a serious problem in some seasons in the wine industry, with the potential to decrease yields and negatively impact on grape and wine quality.

The recent dry seasons have reduced the development of Botrytis, and it has not been such a serious issue, which has led to a certain degree of complacency among grape growers.

In an increasingly competitive market for grapes, growers need to produce high quality, Botrytis free grapes, in order to maintain grape sales to wineries.

Grape growers need to prepare management strategies early in the season to maximise control of the disease.

The Department of Primary Industries, in conjunction with the Greater Victoria Wine Grape Industry Development Committee, Monash University, VitiSolutions, and the Grape and Wine Research and Development Corporation, are providing an opportunity for growers to attend a series of workshops on Botrytis management.

The workshops will be held at:
- DPI Knoxfield, Wednesday 30th June, 1.30pm
- La Trobe University Beechworth, Friday 2nd July, 9am
- Parks Victoria, Nursery Road, Macedon, Monday 5th July, 1.30pm
- Central Highlands Regional Library, Ballarat, Tuesday, 6th July, 9am

Workshop coordinator, John Whiting from DPI, says the workshops will provide the latest information to assist producers develop the best management strategies.

“Recent research by Dr Mary Cole, Monash University, on the biology of Botrytis and potential management options will be presented,” Mr Whiting said.

Demonstration of Best Practice Botrytis Control Strategies on a Vineyard in the Yarra Valley Region of Greater Victoria

"There will also be a session on using a checklist approach for determining the best management strategies, and plenty of time for discussion of alternative approaches."

"The workshop is aimed at grape growers in Greater Victoria who wish to optimise their Botrytis management methods."

The workshops have been funded by the Greater Victoria Wine Grape Industry Development Committee and growers should register their interest in attending with Louise Wood at DPI Bendigo on 03 5430 4670.

Media inquiries to: John Whiting, DPI Senior Viticulturist, ph 03 5430 4455.

9.4 APPENDIX

Botrytis Scenarios – GVWGIDC Workshops

Scenario 1

The high cropping, vigorous vineyard is well managed with regular nitrogen applications. Botryticides are regularly changed and there are no signs of resistance to the chemicals. Pests and diseases are also well controlled, yet there is a substantial Botrytis problem.

Identify the likely major cause of the Botrytis problem?
What can be done during the pruning and early season growth stages to manage Botrytis?

Scenario 2

The vineyard has moderate cropping and vigour, and water and nutrition inputs are controlled. There are no pest and disease issues apart from Botrytis, which has not been controlled by repeated applications of procymidone (eg Sumisclex) in the past.
Identify the likely major cause of the Botrytis problem?
What can be done during the flowering stage to manage Botrytis?

Scenario 3

The vineyard has moderate cropping and vigour with controlled water and nutrition inputs. Diseases are well controlled and there has been no physical damage to berries. Broad leaf weeds have been a problem and Botrytis is regularly detected in the bunches at harvest, but no resistance to chemicals is found.
Identify the likely major cause of the Botrytis problem?
What can be done during the berry set to veraison stages to manage Botrytis?

Scenario 4

Generally the vineyard is well managed with good growth and moderate water and nutrition inputs. Some berry damage has been incurred through equipment used to remove leaves along the fruit zone, and from birds. Pre-harvest rain has produced a Botrytis outbreak and you may well exceed the wineries Botrytis severity limit.

What can be done during the pre-harvest and harvest stages to manage Botrytis and come in under the winery limits?

Scenario 5

Botrytis management has been generally good over the vineyard but not in one low lying section of the vineyard on deep soils. Fruit was rejected by the winery.

Identify the main factor(s) responsible for the problem?
What strategy should be developed after harvest to improve the management of Botrytis in the following season?





Australian Government
Grape and Wine Research and Development Corporation



MONASH UNIVERSITY

VitiSolutions



BEST PRACTICE BOTRYTIS MANAGEMENT WORKSHOP

FEEDBACK SHEET

Which session did you get most benefit from and why?

_____

_____

_____

What did you gain from attending this workshop? (please tick those that apply to you)

- ☐ **New knowledge that is useful**
- ☐ **New skill/techniques you can apply**
- ☐ **A change of attitude**
- ☐ **Increased understanding of the issues**
- ☐ **Increased understanding of other people's opinions**
- ☐ **Time to think**
- ☐ **Little or no benefit**
- ☐ **Other**_____

_____

_____

Will you do anything differently on your vineyard as a result of attending the workshop?

_____

_____

Are there any changes that could be made to the workshop?

_____

_____

Are there any issues on Botrytis management that have not been covered today that you wish to learn more about?, or do you have any suggestions for future events?

_____

_____

Thank you very much for your attendance and feedback

P.T.O if you need more

Demonstration of Best Practice Botrytis Control Strategies on a Vineyard in the Yarra Valley Region of Greater Victoria

Appendix 5

9.6 APPENDIX program for GVWGIDC Botrytis workshops

Welcome and Introduction – GVWGIDC rep. (5 mins)

Activity Grapecheque Facilitator (15 min)

Firstly ask people to find out from the person sitting next to them what impact Botrytis had on their vineyard last season (introduce themselves if they don't know each other).

Then get people up into an open part of the room for a Sociometric line (0=nil, 10=high)

-how much do you know about Botrytis? (supplementary questions – those who know a lot, where do you get your information? Those who don't know a lot, how would you like to access information?)

-how much of a problem is Botrytis in your vineyard? (supplementary questions – where is your vineyard and why do you think you have/haven't a big problem)

-how confident are you that you can manage Botrytis? - use coloured stickers on a line on a wall chart.

Biology of Botrytis and research update – Dr Mary Cole (45 mins + 15 mins questions)

Break (20 mins)

Review of previous session and pre-view of checklist – David Braybrook/John Whiting (20 mins)

Group activity – Grapecheque facilitator (50 mins)

-divide people into 4 or 5 groups

-provide different scenarios of vineyard situations. Groups to read through them, discuss, and using the checklist, devise a management strategy. Document the strategy on an acetate sheet.

-get feedback from each group on the strategy adopted. Each group needs to briefly describe the scenario. Discuss the responses as a group.

-general discussion on Botrytis – what are the gaps, further research, further extension, (prompt people)

Evaluation – Grapecheque facilitator (10 mins)

-written feedback sheet

-revisit wall chart using different coloured stickers.

Close – John Whiting - further discussion if necessary

Timetable

Morning session	Afternoon session
09.00 Welcome	13.30 Welcome
09.05 Warm up activity	13.35 Warm up activity
09.20 Mary Cole	13.50 Mary Cole
10.20 Break	14.50 Break
10.40 Checklist	15.10 Checklist
11.00 Group activity	15.30 Group activity
11.20 Feedback from groups & discussion	15.50 Feedback from groups & discussion
11.50 Evaluation, further discussion	16.20 Evaluation, further discussion
12.00 Close	16.30 Close

9.7APPENDIX

BEST PRACTICE BOTRYTIS MANAGEMENT AN INTEGRATED APPROACH

PUBLICATION AVAILABLE TO ALL PARTICIPATING GRAPEGROWERS AND ASSOCIATIONS.