McLaren Vale
Grape, Wine
& Tourism

Managing Irrigation to Improve Water Use Efficiency and Grape Quality



FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **RT 03/07-2**

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EXECUTIVE SUMMARY

The series of vineyard sessions directed at managing irrigation to improve water use efficiency and grape quality were well attended and generated a lot of interest among Mclaren Vale growers. This reflected a strong demand from growers for extension exercises addressing irrigation management and growing winegrapes to quality specifications. The reason for this demand is threefold:

1. Irrigators in the region are restricted to 1.1 ML/ha of water for irrigation under the current water allocation plan,

2. Wineries are requiring growers to meet higher quality specifications.

3. There has been a lack of practically focused extension work carried out in the region since the rapid expansion of the industry over the last five years (planted area in McLaren Vale has doubled in the last five years seeing many new growers becoming involved in the industry.).

The sessions enabled growers to develop tools to address management issues in their own vineyards. Presentations from managers, owners and consultants at the three vineyards provided participants with an insight into how decisions on irrigation and quality management can be made. The practical, in-field approach encouraged participation and discussion and enabled the growers to relate the concepts and ideas presented to their own vineyard. The field sessions were held at flowering, veraison and just before harvest to ensure that responses to management practices and climatic influences could be observed. A number of growers reported they had implemented changes in their vineyard practices to meet with winery requirements and/or restrictions on water availability as a result of the sessions.

The focus on efficient use of water in different soil types and varieties provided important information for growers looking to conserve water. This has a direct benefit to the local environment as reduced water use will help to conserve the underground water resources, and indirectly, more efficient water use will limit environmental damage caused by irrigating with saline water.

Information sessions to further develop soil moisture monitoring skills and visual assessment of grapevine attributes as they relate to water use and quality are needed to enhance skills already obtained at these workshops. Future extension work needs to reinforce what has already been done in a way that is not repetitive but also does not exclude growers who did not participate in past sessions. It is important that growers continue to have the opportunity to learn from others' experiences and the networks established through these first sessions are encouraged and developed.

BACKGROUND

A restriction of 1.1ML/ha/year for grape growers in the McLaren Vale region was implemented for the 2003/04 growing season. Experience from the three previous growing seasons under restrictions of 1.5 ML/ha/year has shown that whilst in some cases/seasons this volume of water was sufficient in other instances significant loss in yield and quality was sustained. For example in the 2002/03 season extended periods of hot dry weather caused heat stress and consequential loss of leaf function leading up to harvest in a significant number of vineyards in the region. This had an adverse impact on ripening and therefore fruit quality.

Reduction in tonnages was also observed, partially due to insufficient water from veraison to fruit set (approximately 40% reduction in reds and 20% reduction in whites from the previous wetter year). In 1991 the region's grapes were worth $93 million compared with $70 million in 2002, whilst a number of factors contributed to this decline in total fruit value water restrictions coupled with a dry season had a considerable influence. Avoiding economic losses such as those described for the previous drought year under new lower water restrictions poses a challenge to McLaren Vale growers.

Given the situation outlined above a clear need for the transfer of information on efficient irrigation was identified. The aim of the project was to equip growers to better manage their limited water resource through developing a better understanding of the requirements of different varieties and soil types and the impact of different irrigation scheduling techniques on water use efficiency. Quality parameters are closely linked with irrigation management and an understanding of the impact of irrigation scheduling on quality across varieties and soil types is also imperative if grower returns are to be maximised.

OBJECTIVE

To equip growers with the skills necessary to identify and manage risks to both quality and yield under current reduced water allocations over different varieties and soil types.

Critical factors for achieving objective

- Identification of major soil types in the region and their characteristics as they relate to irrigation management.
- Development of networks for delivery of 'in time' guidance.
- Monitoring the impact of climatic and soil influences on vine water use.
- Attention to different growth stages through the season to ensure water is applied at critical times.
- Ensuring the participation of a diverse group of growers in the region to ensure flow of information to all subgroups within the grower community.
- Utilisation of different types of soil moisture monitoring techniques to demonstrate how information about soil water status can be used to schedule irrigation efficiently.

METHOD

Three key vineyard sites were identified with the following attributes, according to the original specifications:

For site details refer to attachment 1

One from each soil type (Sands, black cracking clays, red/brown loams) to illustrate variation in soil characteristics, root zone volume, water holding capacity, and infiltration rates:

- Blocks chosen represented medium sandy loam over red limey clay,, Blewitt Springs sand, biscay over limey clay and sandy loam over poorly structured red clay.

Inclusion of Shiraz and one other white variety at each site

- Varieties included Shiraz (3 blocks), Chardonnay (3 blocks) and Cabernet (2 blocks), Cabernet was included as an addition ensure three major varieties in the region were represented.

The selected vineyards have the potential to attract other growers, who would not normally attend field days

- Growers were selected who were respected by other growers in the region. One grower who consistently produced super premium fruit was selected as it was thought this would be a draw card for generating interest in the field visits.

Potential to improve practices through the field session process to meet quality and/or yield targets

- It was considered very important that thegrowers chosen had management practices in place that other growers could use as examples. It was also important that growers chosen had good irrigation records that could be referred to during the sessions.

Grower's vineyard is an example of good practice in relation to efficient irrigation scheduling.

- All growers selected had moisture monitoring devices installed and were actively monitoring irrigation practices.

Delivery of Field Sessions

Consultant input

Scholefield Robinson Horticultural Services were employed to deliver three field sessions at flowering, veraison and before harvest. In order to deliver the sessions the following plan was followed:

- Background research on all three sites (eg. soils, irrigation system, cultural practices, yield and quality targets, effective root volume, environmental and social considerations.)
- Delivery of information on climatic influences and how they related to irrigation scheduling in the region, through pre-meeting news letters and field sessions as appropriate.
- Identification of objectives, discussion points and learning outcomes relevant to growth stages, environmental conditions, varieties and soil type for each session. This included analysis and discussion of soil pit information.
- Delivery of field sessions.
- Assistance with reviewing the success of the field sessions and compilation of a report detailing outcomes at the conclusion of the project.

Grower input
Lulu Lunn of Tintookie Vineyards, Don Oliver of Taranga Vineyards and Trevor Benson of Barrocup Vineyards allowed us to use their vineyards for the sessions. Detailed information on soil moisture monitoring, irrigation scheduling and soil type was gathered and presented to growers. Discussions centred on the observations seen in the vineyards and how individuals were managing irrigation in their vineyards.

Local irrigation consultants:
Two of the vineyards were using local irrigation consultants (Landmark and Yandilla Park). These consultants contributed to the field sessions providing information on soil moisture data and its interpretation for the specific vineyard.

Communication:
Growers were notified of the event through CropWatch SA McLaren Vale reports, and the McLaren Vale Grape, Wine and Tourism data base using email/fax and post. Background information leading into the first session and follow up information where relevant was also delivered. Approximately 300 growers, viticulturists and grower liaison officers were invited to the workshops. The wider community was made aware of the project through articles in the local paper (On the Coast) as well as Australian Viticulture and Grape Grower and Winemaker magazines. A number of growers unable to attend the sessions registered to receive information from the sessions via email and fax.

Workshop Format

Session 1: Knowing Your Soil
Tuesday December 2nd 2pm – 6pm
Introduction – 2pm
Welcome
Overview of the aims and expected outcomes of this session and future sessions
The relationship between soil, water use efficiency and wine quality
Tintookie Vineyard – 2.30pm
Split into two groups to view soil pits in Cabernet Sauvignon and Chardonnay
Gypsum block data interpretation
Discussion points
Vigour, soil type, soil moisture status and current climatic conditions and their influence on irrigation scheduling.

Taranga Vineyard – 3.45pm
Split into two groups to view soil pits in Shiraz and Chardonnay
Using capacitance probes – discussion and interpretation
Discussion points
Vineyard attributes and their influence on irrigation scheduling as outlined above.
How do we manage the risks, which varieties and/or soil types require more/less water,etc.

Barrocup Vineyard – 5pm
Split into two groups to view soil pits in Cabernet and Chardonnay
Using Diviner information for monitoring.
Discussion points
Vigour, soil type, soil moisture status and current climatic conditions and their influence on irrigation scheduling
Managing variations in soil depth

Session 2: Monitoring Soil Moisture
Tuesday January 20th 2pm – 5pm

Tintookie Vineyard – 2.00pm
Welcome
Overview of the aims and expected outcomes of this session
Split into two groups, assessment of growth stage and condition of vines in Cabernet and Chardonnay.
Discussion of outcomes of group work and review of soil moisture data and irrigation applications in both varieties
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Taranga Vineyard – 3.15pm
Split into two groups, assessment of vines in Shiraz and Chardonnay.
Discussion of outcomes of group work and review of soil moisture data and irrigation applications in both varieties
Barrocup Vineyard – 4pm
Split into two groups for assessment of vines in Chardonnay and Shiraz and viewing of soil pit in Shiraz.
Discussion of outcomes of group work and review of soil moisture data and irrigation applications in both varieties

Session 3 : Pre-Harvest Vineyard Assessment
Thursday 26th February 3pm – 4pm

Taranga Vineyard
Welcome
What has happened since we last met?
Irrigation scheduling at Taranga
Flavour/aroma development
Pre-Harvest vineyard Assessment
Summary of the workshop series
Questions/Feedback

The handouts provided at the sessions are attached to this report and are referred to in the Results/discussion section. Soil moisture information and irrigation information has not be included but is referred to in general terms in the text.

RESULTS/DISCUSSION

Attendance at the session:

Overall approximately 115 people attended at least one of the sessions. Of these 25 attended two sessions and 15 attended all three. The participants consisted mostly of small to medium growers however winery viticulturists and Grower Liaison Officers from both smaller and larger companies, consultants and large growers were also represented. In all approximately 70 growers attended session 1, 60 attended session 2, and 40 attended session 3.

The number of people following all three sessions through the season was lower than we hoped for a number of reasons: Time commitments prevented some growers from attending all sessions, others were interested in only soils for example and didn't feel it was necessary to attend all three sessions. Attendance at the final workshop was reduced due to harvest commitments. In addition some participants at the first session found the information lacking the technical detail they expected, however this was intentional as the target audience may have been discouraged by such content.

The large number of growers attending sessions 1 and 2 presented us with the problem of how to encourage interaction and discussion with a group of this size. To overcome this, after an initial introduction, growers were split into two groups and rotated between the different varieties at each vineyard site. This worked well.

Summary of field sessions

Session 1 - Knowing you soil

December 2nd 2003 2pm-6pm



Growers view soil pit in Cabernet at Tintookie Vineyards

Background information on each of the blocks was prepared and circulated to growers with the original invitation (see Attachment 1). Introductory information was made available in handouts detailing water use efficiency, soil moisture monitoring, visually assessing vine water status, irrigation risk management and relationship between growth stages and a vine water requirements (see Attachment 2.).The purpose of this was to generate interest in the workshops, the information was referred to and built on during the sessions. Following the session

soil pit information and descriptions (see Attachments 3&4) were distributed to all growers in the region along with an invitation to the second workshop in January.

Soil pits were viewed at each of the properties for each variety. Readily Available Water (RAW) values were given for each of the three soil types and the relationship between RAW values and irrigation scheduling were discussed. Concepts such as effective root zone, water holding capacity and drainage were discussed and easily visualised through use of the soil pits. Soil moisture data was presented to growers and compared to vine vigour and physical inspection of the soil. The variability between all blocks in soil moisture information, vigour and effective root zone demonstrated clearly the importance of knowing you own soil type and its limitations.

Concepts such as active tip growth, internode length, leaf turgidity, tendril condition, bunch and berry size were explained using vines at each site as examples. At this point all vines were actively growing and no symptoms of water stress were evident. Growers were able to compare vigour between blocks and use the information to begin/continue visual monitoring in their own vineyards leading into veraison.

At each block the amount of water applied up to December was discussed, it was interesting to compare this information to the soil moisture monitoring data and vine growth. All three growers involved had applied minimal water to Shiraz and Cabernet at this point, however all Chardonnay blocks had been irrigated. The difference in irrigation amount was evident between varieties and soil types and helped to further illustrate the importance of understanding soil and soil/water relations for each variety and soil type in the vineyard.

Key take-home messages from Session 1

- Find out as much about your soil as you can.
- Know the depth of the rootzone and how much water it can hold.
- Where possible, keep similar soils in the same irrigation units.
- Water to the part of a block that needs the least amount of water in the rootzone to look after all the vines and not waste water, or create drainage problems.
- Don’t panic if your vineyard cannot be irrigated perfectly
- Know what compromises you are making.
- Look at the vines, they are the best indicator of soil moisture status.

Session 2. Monitoring soil moisture
Jan 26th 2pm-5pm



Growers assess Shiraz canopy at Taranga Vineyards

Growers visited the same three properties as in Session 1. The Session focused on two topics; monitoring soil moisture and visual assessment of vines.

Monitoring soil moisture

By veraison soil moisture was beginning to decline and growers were able to compare data from December with that collected in January. As in Session 1 soil moisture data were made available to growers and discussed whilst viewing relevant blocks. Gypsum blocks, Diviner and Enviroscan technology were represented. The advantages and limitations of each device were considered.

Soil moisture data indicated that soil profiles had started to dry out by veraison. This was backed up by physical assessment of the soil and visual assessment of the vines.

Irrigation in Chardonnay had commenced in all blocks as growers attempted to maintain soil moisture and some water had been applied to the Cabernet blocks. Varieties at all sites showed no visual symptoms of stress and some still had active tip growth. This was consistent with the soil moisture data and irrigation scheduling information.

Small irrigations to 40mm had been applied to Shiraz on the medium sandy loam over red limey clay and the soil moisture data indicated that the profile was steadily drying out down to 1m. For this block the concept of increasing the refill point to minimise stress leading into veraison was discussed and the grower had scheduled in a longer irrigation in the week of the Session to achieve this. In another Shiraz block on the sandy loam over poorly structured red clay, two 4hr and one 6hr irrigations had been applied which were clearly observed on the Diviner graph. Irrigations did not infiltrate below 60cm (consistent with the depth of the poorly structured red clay), however the profile appeared to be drying down to 1m. A result of the drying of the profile was that growth had slowed in both Shiraz blocks.

The Shiraz in the Blewitt Springs Sand had some active tips despite only receiving minimal irrigation.

The session clearly demonstrated the usefulness of soil moisture monitoring in making scheduling decisions and the importance of backing up soil moisture information with visual inspections.

Visual Assessment of Vines

Notes on visual assessment and vine balance were provided at the Session and they were discussed in detail. The annual growth cycle was considered in this context (see attachment 5 and 6). The aim was to provide growers with a tool to assess their own vineyards as well as vineyards during the session. A simple score card (see attachment 7) was used to assess each block and variety and the information was discussed with the group. The use of the score card encouraged active participation by growers in the session and generated lots of discussion.

Take home messages from Session 2

- It doesn't matter which method is used to monitor soil moisture as long as it gives you good information on which to make irrigation decisions.
- If you know the rootzone depth of the vines you can place the sensors in the right place.
- No two seasons are the same so build up a memory bank of your experiences.
- Use the vines as the best indicator of soil moisture monitoring. Look for early stress symptoms. Know the parts of your vineyard that dry out first.
- Watch the weather cycles carefully and if hot weather is forecast for the next few days, irrigate ahead of time as when it arrives you will not be able to keep up.
- Check the performance and output of the drip irrigation system regularly. Do not assume it will always operate at original specifications.

Session 3 – Pre-Harvest Assessment
February 26th 3pm-4pm

This session was held just before harvest of Shiraz in the Taranga vineyard. This vineyard was chosen as it had the most detailed irrigation information (continuous logging of soil moisture information), the fruit was consistently making super premium grades and it was centrally located.

At this session information on the influence of irrigation on flavour development between veraison and harvest was provided and discussed (see attachment 8).

Canopy condition was also assessed. Tip growth had stopped, and there was some loss and yellowing of basal leaves, but enough functional leaves remained for ripening fruit and fruit was dispersed evenly through the canopy in dappled light. Soil moisture monitoring information was reviewed and it was interesting to note that despite the longer irrigations applied after veraison, the profile was not wetting up to the same depth it did after a similar irrigation the previous season. This was discussed and it was agreed that the possible reason included the hot dry weather in January and February and a larger crop this season.

Take home messages from session 3

- In January the vines were coping well but it was a cool month. The vines were not “heat hardened”.
- February has been very hot and some vines have not been able to cope with the conditions, even with lots of water applied.
- Sunburn, bunch collapse, leaf burn, and early senescence are all symptoms of stress.
- Flavour and aroma development occurs in the period close to harvest and too much stress can affect these important development processes.

Finally all three session were summarised (see Attachment 9)





These photos of Shiraz vines were taken at Barrocup and were displayed at the final session to allow growers to observe changes in the canopy from veraison to late February.

Feedback from participants

Feedback forms were distributed following the final session. Only 19 growers responded. Of these 4 attended only one session, 11 attended two and 6 attended all three. Most respondents reported that all session were equally useful, although session 2 (Monitoring soil moisture) was identified as most useful by 4 growers as was session 3. Three respondents reported that they did not feel comfortable to ask questions but all reported that the information was easy to understand. Sixteen of the respondents indicated that they intended to implement changes in their vineyard as a result of the workshop series. Some growers specified these

changes and they are listed below. It is worth noting also that as a result of the sessions the grower at Tintookie Vineyards (Lulu Lunn) has had capacitance probes installed to fine tune her own irrigation scheduling.

Specific comments

Irrigation scheduling, canopy condition and how to identify and manage it
Review gypsum blocks
Have made changes- greater knowledge of soil type & properties, watering procedures/monitoring
Visual assessment practices
Started to collect soil samples to determine root depth & develop a soil profile of property
More visual monitoring of vine characteristics
Closer soil moistures monitoring, less more often due heavy soil
Soil moisture monitoring
Targeting canopy relations
Haven't changed any thing but found it of value knowing what other people did
Monitoring of vines for stress (visual) longer, less frequent irrigation
Less watering needed in our heavy clay soil
There is a wide range of people with various degrees of knowledge and expertise that some inexperienced winegrowers may feel inadequate in responding to discussions.

Growers were asked to comment on the sessions and provide ideas/suggestions for improvement. Growers were also asked for ideas for future sessions.
The following comments were provided by growers via email and on the feedback forms:

- *I handed you in a feedback form but I would also like to add that I think that one of the most valuable things about the workshops was the fact that we were seeing and hearing the experience of other growers. I would love to do the same again at other growers' vineyards. The workshops also provided a great opportunity for discussion and networking. Thank you once again,*

- *We found the field visits very educational….growers for only 6 years I guess we wouldn't want to do the exactly the same thing again but a progressional learning curve if that is possible.*

- *Having no moisture reading equipment on our property we wouldn't mind a cost verse benefits seminar. How much and how often to water in the last 4 weeks before harvest… If you ask five growers you will get five different answers.*

- *New to vines – confirmed what advice been received and now able to translate what and why I am being told – useful – thank you Lucy and others, all very useful and helpful.*

- *There is a wide range of people with various degrees of knowledge and expertise that some inexperienced winegrowers may feel inadequate in responding to discussions.*

- *Good value, look forward to next season*

- *Got to figure out how to get that fantastic colour in Shiraz*

- *Suggestions for future research: Study of shrivel in shiraz, wind and problem/benefits, methods of pruning for quality, winter vine nutrition, wind management, (that should keep you going Lucy)*

- *Great session- thanks*

- *I found that the sessions I attended were well run and very informative. Networking with other growers was also a very important part of the session.*

- *Effects of mulching on various soil types*

- *I thought your sessions were excellent. The opportunity to see and have explained current irrigation thinking in the vineyards was excellent. All presenters were very suitable. Well organised too.*

- *Well done*

- *Pruning*

- *Workshop on pruning needed*

- *Well done the way it was conducted, thanks to all.*
- *Got to figure out how to get that fantastic colour in the Shiraz*

- *If you ran the same session again, I would probably get more details and greater understanding out of it. If the sessions could be changed I would like more time/info on determing water holding capacity of soils.*

- *My husband attended the irrigation session and found it extremely valuable and had lots of new ideas to pass on to me. He does not have anything to add to what you are doing but we will certainly be attending the next session.*

- *I was unfortunately unable to attend the fist two sessions; I thought the session attended was informative and non-technical.*

OUTCOME/CONCLUSION

The soil moisture monitoring data and irrigation scheduling strategies provided by the three growers involved in the session have given a good insight into how growers make decisions on when to irrigate. The attendance levels and the enthusiasm sustained during and between workshops reflect a real interest in developing skills and accumulating knowledge among both new and more experienced growers.

The value of having on-site sessions with vineyard owner/managers relaying their experiences to other growers was made clear in the comments above and in verbal feedback received during the session. Growers enjoyed the opportunity to network and discuss the challenges, innovations and management strategies on different vineyards.

Holding the workshop in a non threatening, vineyard environment with lots of visual examples enhanced the learning process. It also encouraged more growers to attend and participate than if the sessions were held in a seminar style environment.

The messages presented in simple terms, were concept-focused rather than being too specific. The use of three vineyards with different soil types and management practices was a strength of the workshop series as it enabled growers to discuss and compare these differences and relate them to their own situation. The sessions provided a cross section of McLaren Vale viticulture, emphasising the point that whilst there are some general principles, how they are applied is site specific.

The objective 'To equip growers with the skills necessary to identify and manage risks to both quality and yield under current water restrictions over different varieties and soil types' was ambitious and was met for some growers but not others. A number of growers reported that they intended to implement changes in their vineyards in response to the sessions and others reported that they found the sessions informative. This feedback suggests that despite growers being on very different levels the majority were able to apply information to their own situations and therefore work towards improving current practices.

The sessions generated an awareness and appreciation of the principles involved in irrigation scheduling, soil moisture monitoring and their relationship to the quality/quantity of fruit. More in-depth information about fine-tuning soil moisture monitoring and visual assessments are needed to enhance skills obtained at these workshops. Future extension work needs to reinforce and build on what has already been done in a way that is not repetitive but also does not exclude growers who did not participate in past sessions.

It is intended to provide a vintage summary of the three blocks involved in the McLaren Vale Grape, Wine and Tourism Association's newsletter 'The Grower's Voice' in June.

Budget reconciliation:

Consultancy in vineyards	9,000.00	9,000.00	
Consultancy - site reports		2,000.00	
Organisation of project events		3,600.00	
Newsletter production - 7 issues		500.00	
Preparation of project report		2,000.00	
Review and evaluation of success		1,000.00	
Soil pit excavation		847.00	
In kind contribution of growers time		1,000.00	
In kind contribution of local consultants time		2,000.00	
Total	9,000	**21,947**	
Add 10 % GST	900.00		
Total funds requested from GWRDC	9900		
Funding from other sources		21,947.00	