Management of wine grapes with limited water in North East Victoria

FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **RT 03/18-3**

Principal Investigator: **Paul Blackshaw**

Research Organisation: **Winemakers of Rutherglen**

Date: **23 September 2004**

1. Executive Summary.

Wine grape growers consider efficient water management an essential component of their vineyard management. This has been highlighted by the recent dry seasons and growers are increasingly aware of their need to improve irrigation practices, especially water management for their individual vineyards and local climate.

Two workshops were presented by the Victorian Department of Primary Industries (DPI) in collaboration with the Winemakers of Rutherglen. Ian Goodwin from DPI Tatura was engaged as technical specialist and Paul Blackshaw, DPI Rutherglen, facilitated the workshops.

The workshops provided participants with the knowledge and skills to effectively manage risks associated with limited water availability and to improve their water management techniques. It enabled participants to benchmark their vineyard against others with respect to water management, and participants had the opportunity to share knowledge, experiences and ideas with their peers.

Twenty two growers attended the first workshop, and six attended the follow up workshop. Activities included examining a soil pit for soil texture and root distribution, and discussion of the influence on irrigation management. Growers also discussed evaporation levels, crop factors, readily available water (RAW), deficit available water (DAW), water budgeting and irrigation scheduling. Growers were provided with a worksheet to take home and collect information, and practical examples using this information were discussed at the second meeting.

Evaluation of the workshops indicated that growers had gained new knowledge and had learnt specific new approaches, skills and techniques that they will utilise in their future irrigation management strategies. Future workshops could be improved by attracting more growers to the second day and by completing the Irrigation Recording Sheet on the day to provide better benchmarks.

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grapecheque

Department of Primary Industries

2. Background

Following a tough season where many regions experienced dramatic reductions in yields in combination with severe water shortages, grape growers continued to identify efficient water management as an essential component of effective business management.

For Victorian vineyards, the diverse range of climates means that different areas need to implement various water management scenarios, ranging from minimising yield losses by managing reduced water allocations, to maximising quality via managed water deficit. Feedback from growers involved in the Winemakers of Rutherglen Viticulture Sub Committee has highlighted that water management was a priority issue for the 2003-04 season. Many growers in the region experienced severe water shortages last season and wanted to ensure that their current irrigation management strategies allow vines to return to optimum performance as quickly as possible. Therefore monitoring, scheduling, water budgets and regulated deficit irrigation (RDI) have been identified as areas where training and more information would be desirable.

Building the capacity of wine grape growers in water management has major direct and indirect economic, social and environmental benefits for individual businesses, the communities they are a part of, the wineries they supply and the industry as a whole. The Rutherglen Region, although well established, has seen some major growth in the past five years. It remains one of the largest industries in the region. Water available for irrigation is in high demand and many newer growers rely on catchment water. It is therefore imperative that growers become good managers of water to ensure this water is used efficiently.

Improving grape quality through RDI or maintaining yields during drought translates into economic and social benefits for growers, wineries, community and the industry. Information on water use efficiency and drainage fractions are scant in the grape growing regions by comparison with the Murray River Irrigation Schemes.

3. Objectives

The project objectives were to build the knowledge and capacity of wine grape growers in water management by providing them with a series of sessions combining the provision of information, discussion, demonstrations and practical exercises in a mixture of classroom and vineyard environments.

More specific aims were:

- To provide participants with the knowledge and skills to effectively manage risks associated with limited water availability and to improve their techniques in water management.
- To enable participants to benchmark their vineyard against others with respect to water management.
- To provide participants with the opportunity to share knowledge, experiences and ideas with their peers.

4. Method

Surveys of practice change by Grapecheque have demonstrated that the grower group model is effective in getting practice change. Growers who have participated in Grapecheque have significantly improved some aspects of irrigation management compared to non-Grapecheque growers who have not changed significantly. Hence the workshops were coordinated by Grapecheque to maximise opportunities for practice change.

Ian Goodwin, DPI Tatura, was engaged as the technical specialist for delivering information on water management. Ian has the most extensive experience and research background of anyone on water management in horticulture in Victoria. Ian's work has covered grapes and orchards, and he was involved with the team that developed regulated deficit irrigation (RDI) at Tatura.

Paul Blackshaw, Grapecheque Facilitator, was involved to ensure the activities were structured to optimise learning outcomes. Paul has had a solid grounding in facilitating groups in north east Victoria.

Two workshops were conducted, the first prior to harvest and a follow up after vintage. The original application had the provision for other workshops to be run through the growing season, but as the application approval was delayed due to the Christmas/New Year break only two workshops were possible. The workshops were promoted through the Department of Primary Industries Grapecheque mailing lists, Border Mail newspaper in Albury/Wodonga and the ABC Goulburn Murray Rural radio program.

The first workshop had two components. The first was a vineyard demonstration using a soil pit dug at Stanton and Killeen Vineyard. Viticulturist Paul Geddes provided some background of the soil type and their irrigation strategy and Ian Goodwin demonstrated root distribution and soil types. Growers were able to examine soil texture and moisture as part of a practical exercise. The second part of the workshop moved indoors and involved presentation of information on water stress management and water budgeting. Growers were also provided with the book "Irrigation of Vineyards" written by Ian Goodwin.

An input sheet was provided at the first workshop that growers took home to keep their own records during the irrigation season. These completed sheets were returned to the consultant for analysis prior to the final session.

At the final session growers were debriefed as to how they felt they went with their irrigation management since the first session. Through facilitation they could share their learnings with the remainder of the group. The growers also discussed their data in relation to the group's data with the consultant. The session concluded with a question and answer session.

The first workshop was attended by Kim Woods of the Weekly Times Newspaper who wrote a comprehensive article which appeared on February 11 2004. The workshops were also featured in Grapecheque News in July 2004.

Session Plan Day One (30 January 2004).

8.30 am	Overview of program and introduction of Ian Goodwin.
8:40 am	Group exercise to establish expected outcomes, prior experience and general introduction.
9:00 am	Soil Pit – Ian to cover root distribution, soil texture and their implications on irrigation management.
10:00 am	Morning tea and social interaction.
10:30 am	Ian – Explain theory behind Water Budgeting and Irrigation Scheduling. Run through examples on PowerPoint. Explain Irrigation recording sheet and how it is to be filled in for Session Two.
11.45 am	Summing up and Questions (Ian & Paul).
12 noon	Finish

Session Plan Day Two (21 June 2004).

9am	Group session to reveal irrigation issues encountered since Day Two. Ascertain how participants found spreadsheets.
10am	Revision of Water Budgeting and Irrigation Scheduling and updates on current crop factor research.
10.45am	Morning tea.
11.15am	Working through participants spreadsheets. Group discussion on results.
12.15pm	General Questions, summing up and completion of evaluation sheet.
12.30pm	Finish.

5. Results/Discussion

Twenty two growers attended the first workshop from a total mail out to 56 local vineyard operations. This response rate of around 40% compares favourably with the 23% response for the first session of a series of irrigation management workshops in McLaren Vale (RITA Final Report RT 03/07-2). Six growers supported the follow up day, which was a lower response rate than in McLaren Vale, however it did coincide with the commencement of pruning in the area.

Day One (30 January 2004).

A soil pit was dug to a depth of 1.5 metres depth in the “Francis” Muscat block at Stanton and Killeen. The technical specialist, Ian Goodwin, explained to the growers the benefits of digging a soil pit in their vineyards and what could be learnt from the exercise. It was established that the block examined had a root zone of 800mm. Ian demonstrated a practical method to determine soil texture, and the participants established that the soil was a “sandy loam” to a depth of 300mm and a “loamy clay” from 300mm to 800mm. Back in the winery Ian explained that by using accepted RAW (readily available water) values for different soil types and dripper outputs, that the soil had a reserve capacity of 58mm. They were then able to calculate a water budget using a range of crop factors. This information was then used to determine an irrigation schedule using evaporation data.

Ian explained that a weakness of this method is the use of crop factors. These could be influenced by stage of growth, vineyard floor management and other management practices such as RDI. Current research is examining more accurate ways of determining crop factors using effective canopy cover (ECC) and effective area of shade (EAS). This method of

scheduling also rellies on accurate, relevant (ie local) and up to date evaporation data. Ian spoke of the possibility of frequently updated and very localised web based evaporation data becoming available in the future. Class A pan evaporation data is currently freely available fro nearby Hume Reservoir on www.bom.gov.au/climate/dwo/index.shtml at Albury-Wodonga. A major positive of this type of scheduling is that there is no need for soil moisture monitoring equipment, which is often expensive and sometimes unreliable. Ian did explain, however, that the more data available to the vineyard manager the easier and more accurate scheduling becomes. He also stressed that the condition of the vines should also be taken into account before irrigating.

Growers were presented with an Irrigation Recording Sheet to fill out for the remainder of the growing season. Growers could choose to either use this sheet to schedule their irrigation or just record their actual irrigation run times for later comparison.

Key learnings:

- Root zone depth and soil texture are major influences on irrigation scheduling.
- Growers can make important observations about their vineyards by digging a soil pit.
- Choosing a crop factor to use in calculations is a difficulty in using Water Budgets and Irrigation Scheduling Plans.
- Use of soil moisture measuring devices is not essential when scheduling irrigation, but desirable.
- Use as many tools as possible to assist irrigation decision making, including vine appearance.

Day Two (21 June 2004).

The growers revisited the Vineyard Water Budget and Irrigation Scheduling Plan discussed on Day One. Ian Goodwin led the discussion on the relevance of the approaches and how they performed in practice. Participants felt that the tables were useful, but especially so at the beginning of a season when deciding when to begin irrigating and during the design stage of an irrigation system.

Two growers completed the Irrigation Recording Sheet from the Day One and submitted them to Ian for his evaluation. Ian discussed these sheets with input from the group and the growers concerned. There were major differences between the two sheets. It appeared that the first vineyard had been under-watered and the grower was able to confirm that the vines probably indicated this. The sheets for the second vineyard also indicated under-watering although the

second grower didn't feel that the vines suffered. The group highlighted that due to the irrigation infrastructure at the second vineyard they had to water less often, but with greater volume. Ian discussed the implications of this with the group. It was also stressed that there is no one "right" way to irrigate in the same conditions, as practical considerations, personal preference and quality outcomes all influence irrigation scheduling.

Both growers who completed the record sheets said that the process was not as difficult as they first feared and got an enormous amount out of the exercise, especially having the group review their irrigating. Following the workshop all participants felt confident that they would use the recording sheets for the next season and were presented with a CD copy of the spreadsheet to allow them to conduct the exercise on their own computers.

Key learnings:

- Growers tend to underwater their vines.
- Crop factors were the weak link in the calculations.
- Practical considerations, personal preference and quality outcomes all influence irrigation scheduling.
- Irrigation scheduling and recording was not as daunting as feared.

An evaluation was completed at the conclusion of the workshops (a copy is attached). All growers agreed that they obtained new knowledge that was beneficial, and that they learnt specific approaches, skills and techniques that they can apply on their own properties. They also agreed that the sessions changed their attitudes to irrigation management.

Comments on the evaluation sheets included:

"*Excellent value to have my own data analysed and discussed."*

"I have gained heaps of knowledge to help me better meet my irrigation needs."

"*This is a necessary aspect of viticulture in a dry environment."*

On average growers rated the overall training as 4.6 out of 5. With 4 being "good" and 5 "excellent".

6. Outcome/Conclusions.

Given the high representation of local growers, the workshop filled a need for the growers. They gained a better understanding of their own soils and the impact they have on root distribution and water holding capacity. The booklet that participants received during the course is a fantastic resource, providing them with extra information at their fingertips. The feedback sessions allowed growers to assess the effectiveness of their own programs and also to benchmark themselves against other local growers.

The main outcomes of providing information and developing skills of growers to better understand the implications of every irrigation are:

- Growers are using water more efficiently, resulting in possible economic savings in terms of water purchases and pumping costs.
- Growers are helping to save a valuable resource.
- Increased likelihood of growers achieving the target quality of product or grapes.

The workshop was written up in the Grapecheque News – a newsletter that is distributed to approximately 1600 growers in Victoria.

Given the level of interest in these workshops, further pressure for growers to increase their water use efficiency and the ongoing interest in using irrigation as a tool to manipulate quality, there is a place for further workshops. These may focus more on the production of quality grapes, which also generally involve more efficient water use. The groups would be keen to apply for RITA funding for these workshops in upcoming seasons.

Budget	Funding required from GWRDC	Local/Regional Contribution	Actual Expenditure
Workshop presentation	2,800.00		2,150.00
Venue hire	300.00		200.00
Workshop preparation and support (incl collation of input sheets)	2,100.00		2,100.00
Speakers' transport and accomodation	750.00		750.00
Advertising and administration	950.00		520.00
Workshop participation 20 participants @ 8 Hours x $25/hour		4,000.00	
Workshop materials (irrigation booklet and input sheets)	150.00		220.00
Organisation and facilitation of workshops	750.00	4,200.00	110.00
Total	7,800.00	8,200.00	
Add 10 % GST	780.00		
Total funds requested from GWRDC	8,580.00		
Funds Approved rom GWRDC (Incl GST)	**6,050.00**	**Total Expended**	**6,050.00**
		(Incl GST)	
Funding from other sources (eg. DPI)		4,200.00	

Appendix 1: Examples of hand out material.

Vineyard Water Budget

Month	Pan Evaporation (mm) *A*	Crop Factor *B*	Water Use (mm) *C=AxB*	Effective Rainfall (mm) *D*	Soil Reserve (mm) *E=SR-(C-D)*	Irrigation (mm) *F=C-D-E*
September	78	0.5	39	22	41	0
October	125	0.5	63	25	3	0
November	179	0.2	36	16	0	16
December	250	0.2	50	14	0	36
January	269	0.3	81	13	0	68
February	221	0.3	66	12	0	54
March	177	0.3	53	16	0	37
April	102	0.2	20	17	0	3
TOTAL (mm)			**408**			**215**
TOTAL (ML/ha)			**4.1**			**2.2**

Soil Reserve (mm) in root-zone

Layer	Depth (mm) *A*	Texture	RAW (%) *B*	Soil Reserve (mm) *C=AxB/100*
1	300	sandy loam	6	18
2	500	loamy clay	8	40
3				0
TOTAL	**800**			**58**

Effective Rainfall (mm) = 0.75 x (Average Rainfall - 10)

100 mm = 1 ML/ha

Irrigation Scheduling Plan

Month	Vine Growth Stage	Irrigation Amount (litre/vine) *A*	Pan Evaporation (mm/day) *B*	Crop Factor *C*	Vine x Row Spacing (square m) *D*	Daily Water Use (litre/vine) *E=BxCxD*	Irrigation Frequency (day) *F=A/E*
September		24	2.6	0.1	7.2	1.9	13
October		24	4.0	0.1	7.2	2.9	8
November		24	6.0	0.2	7.2	8.6	3
December		24	8.1	0.2	7.2	11.6	2
January		24	8.7	0.3	7.2	18.8	1
February		24	7.9	0.3	7.2	17.1	1
March		24	5.7	0.3	7.2	12.3	2
April		24	3.4	0.2	7.2	4.9	5

Irrigation Amount (litre/vine) for 0.5 m wetting depth

= Run Time (h, see table) x Dripper Output (litre/h) x Vine Spacing (m) / Dripper Spacing (m)

Soil Type	Dripper Output (litre/h)		
	2	4	8
Sand	0.5	0.5	0.5
Sandy Loam	2.5	2	2
Clay Loam	9	6.5	5.5

e.g. 9 hour x 2.2 litre/hour x 2 m / 0.75 m = 53 litre/vine

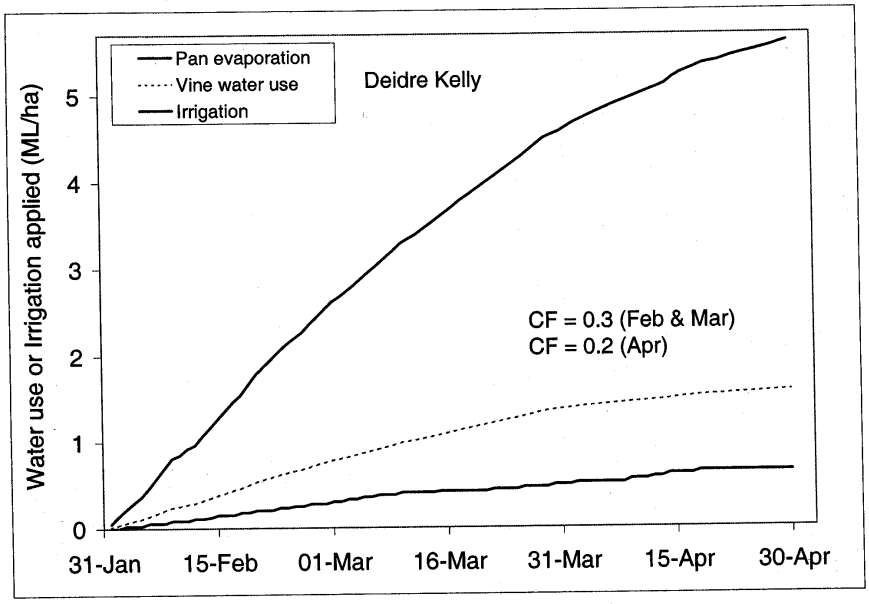
Irrigation Recording Sheet

Location	Deidre Kelly
Block	1
Variety	Shiraz
Clone	PT23
Rootstock	SO4, Teliki 5C

Vine Spacing (m)	2
Row Spacing (m)	3
Number of Rows in Block	35
Row Length in Block (m)	300

Emitter Output (litre/hour)	2
Emitter Spacing (m)	0.75

Date	Rainfall (mm) *A*	Effective Rainfall* (litre/vine) *B*	Pan Evaporation (mm/day) *C*	Crop Factor *D*	Vine x Row Spacing (square m) *E*	Daily Water Use (litre/vine) *F=CxDxE*	Soil Water Deficit (litre/vine) *G=SumF-B-H*	Predicted Irrigation Run time (h)	Irrigation Run Time (hour)	Irrigation Amount (1) (litre/vine) *H*
1/2/04		0.0	5.3	0.3	6.0	9.5	9.5	1.8		0
2/2/04		0.0	9.0	0.3	6.0	16.2	25.7	4.8		0
3/2/04		0.0	7.8	0.3	6.0	14.0	39.8	7.5	3	16
4/2/04		0.0	7.7	0.3	6.0	13.9	37.6	7.1		0
5/2/04		0.0	7.0	0.3	6.0	12.6	50.2	9.4		0
6/2/04		0.0	10.3	0.3	6.0	18.5	68.8	12.9	4	19
7/2/04		0.0	11.2	0.3	6.0	20.2	70.3	13.2		0
8/2/04		0.0	11.2	0.3	6.0	20.2	90.4	17.0		0
9/2/04		0.0	11.2	0.3	6.0	20.2	110.6	20.7	3	16
10/2/04		0.0	4.0	0.3	6.0	7.2	101.8	19.1		0
11/2/04		0.0	7.4	0.3	6.0	13.3	115.1	21.6		0
12/2/04		0.0	4.2	0.3	6.0	7.6	122.7	23.0	3	16
13/2/04		0.0	10.5	0.3	6.0	18.9	125.6	23.5		0
14/2/04		0.0	9.8	0.3	6.0	17.6	143.2	26.9	1.5	8
15/2/04		0.0	9.8	0.3	6.0	17.6	152.9	28.7	3	16
16/2/04		0.0	9.8	0.3	6.0	17.6	154.5	29.0		0
17/2/04		0.0	10.1	0.3	6.0	18.2	172.7	32.4		0
18/2/04		0.0	8.0	0.3	6.0	14.4	187.1	35.1	3	16
19/2/04		0.0	12.0	0.3	6.0	21.6	192.7	36.1		0
20/2/04		0.0	12.0	0.3	6.0	21.6	214.3	40.2	3	16
21/2/04		0.0	8.7	0.3	6.0	15.7	213.9	40.1		0
22/2/04		0.0	8.7	0.3	6.0	15.7	229.6	43.0		0
23/2/04		0.0	8.7	0.3	6.0	15.7	245.3	46.0	3	16
24/2/04		0.0	8.0	0.3	6.0	14.4	243.7	45.7		0
25/2/04		0.0	7.2	0.3	6.0	13.0	256.6	48.1	2	11
26/2/04		0.0	6.3	0.3	6.0	11.3	257.3	48.2		0
27/2/04		0.0	9.4	0.3	6.0	16.9	274.2	51.4	3	16
28/2/04		0.0	8.7	0.3	6.0	15.7	273.9	51.4		0
29/2/04		0.0	8.7	0.3	6.0	15.7	289.5	54.3		0


Pan evaporation
Vine water use
Irrigation
Deidre Kelly
CF = 0.3 (Feb & Mar)
CF = 0.2 (Apr)
Water use or Irrigation applied (ML/ha)
0
1
2
3
4
5
31-Jan
15-Feb
01-Mar
16-Mar
31-Mar
15-Apr
30-Apr

Appendix 2: Evaluation Sheet.

Evaluation form

Training: Irrigation Management _____ Date: _____
Name (optional) _____

	Yes	No
1. Do you feel there was sufficient time and opportunity for questions and discussion?	❑	❑
2. Were the questions that were raised dealt with appropriately?	❑	❑
3. What benefits were gained from the training:		
• New knowledge that is beneficial?	❑	❑
• Specific approaches, skills or techniques that I can apply on my property?	❑	❑
• Changes of attitudes I will utilise in my management?	❑	❑

4. For items a through to h make your response using these codes:
   4. Strongly Agree. ***3. Agree.***
   2. Disagree. ***1. Strongly Disagree.***

a. The training content has been valuable for my professional or personal development.	❑
b. The topic was covered comprehensively.	❑
c. The training was well organised.	❑
d. The training was well paced.	❑
e. The objectives set at the beginning of the training were met.	❑
f. The handout materials were useful.	❑
g. The leader was knowledgeable.	❑
h. The leader was motivating.	❑

3. Please add comments about any aspect of the training (trainers, materials, topics covered, etc.).

_____

_____

_____

_____

4. Please indicate your overall evaluation of the training by placing a circle around a number.

Excellent	Good	Satisfactory	Fair	Unsatisfactory
5	4	3	2	1