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South West Slopes Vignerons Association field days

Ross Polglase, April 2005

Project title:

Field day schedule

Date of field day	Number of attendees

Format for the field days

Timing	**Activity**	**Purpose**
Before first meeting	Survey	To develop a better understanding of viticultural knowledge, skills and problems in the area
Before each meeting	Notes on seasonal conditions prior to the meeting sent out to SWSVA	To get participants to think about how seasonal conditions may be affecting their vineyards
During each meeting	Find out and discuss two key issues; walk and talk in the vineyard; review the two key issues and what we saw in the vineyard	Ensure that participants discuss matters that are important to them
After each meeting	Notes following up on the last meeting sent out to SWSVA	Provide members of SWSVA with notes
Last meeting	Review of the season; find out what worked and what didn't work during the field day series; what further information is required by grape growers in the district	Review

Survey

All members of the SWSVA were emailed or handed a survey form (Appendix 1) before the first field day. The form was designed to provide me with information on

what the group perceived to the important viticultural issues in their area. Unfortunately only three people returned their form.

In future I would simplify the survey form so that it could be completed in less than ten minutes. It could then be filled out during the first field day session.

Selecting sites for the field days

We chose two vineyards as the locations for all the field days. I new both of these vineyards and the people who run them, which made it easier to structure the field days. One is a small vineyard (under30 ha) on a property where viticulture is an important but minor part of the farm's agricultural activities and the other, which is a 240 ha vineyard. The two properties were selected to highlight differences in approach to growing grapes. Both have shiraz. One property concentrates on producing grapes of the highest possible quality. The other concentrates on profitability first.

We visited both vineyards during the first field day. This was a very long field day, as we "set the scene" for the series of field days, before moving into the vineyard. We then drove to the next property, where we had lunch then moved into the vineyard. The entire field day lasted about 8 hours, which was too long.

Finding out about "the two key issues"

Bring together most grape growers in a "small" district and you will have a heterogeneous group of people. Individuals will have different levels of knowledge and different attitudes. This can make it almost impossible to guess what all growers hope to get out of meetings or field days.

A technique that works well when working with small groups and which I used with the South West Slopes Vignerons Association is to ask each person at the start of each meeting to raise two key issues which are important to them. Each person's concerns are written on a whiteboard or butchers' paper. We would then spend 45 minutes to one hour discussing these issues, before moving out into the field.

Some of the issues can only be discussed "inside", such as frost recovery management, nutrition and disease management strategies. Other issues such as assessing stages of vine growth and vine stress and pest monitoring are most easily demonstrated in the field.

At the end of every session we would gather back where we started, and quickly review our list of "the two key issues" to ensure that these were all covered satisfactorily.

The "two key issues" approach works well because it ensures that each person will (hopefully) have their concerns addressed. Some of issues were discussed over more than one session. An example was identifying changes in the extent of water stress in grapevines. This system provided me with guidance for the group, allowing to cover issues that ranged from the very general, such as identifying stages of vine health and canopy, to the highly specific, such as how to handle grapevines that have been affected by frost.

Subjects covered in the field

- Assessing bud and spur numbers after pruning
- Soil type and vine vigour relationships
- Soil type and water availability

- Pruning and vine vigour
- Identifying Light Brown Apple Moth egg masses
- Assessing water stress in grapevines

The end of session "wrap up"

At the end of each session, we adjourned back to the shed or meeting room. We would then refer back to our "two key issues" list, ticking them off where we had dealt with them satisfactorily in the field, or further discussing them when necessary. Participants were also asked if there were any issues arising from the field sessions that needed to be clarified. The wrap ups usually took between 30 minutes and one hour.

Conclusion

The South West Slopes Vignerons Association consists of mainly inexperienced producers with small vineyards. Our approach worked well because we took the attitude that any question relating to production would be discussed, no matter how "simple" or obvious the answers may have been. The focus was always on putting producers at ease. This enabled us to discuss a very broad range of production issues.

Inevitably, there were some issues that were so complex that we were unable to deal with them fully, such as more detailed examinations on "reading grapevines". However, I felt that the program would have improved the understanding of viticulture for most of the participants.

Acknowledgements

I would like to thank the GWRDC for funding the project.

The South West Slopes Vignerons Assiciation were always co-operative in helping to set the program, and coming along to meetings as active and willing participants. I would particularly like to thank Pete Morath and Judy Boyton of Gundagai Vineyards, and Simon Locke of Kyeamba Creek Vineyard for letting me loose on their vineyards and "bearing their viticultural souls" to their visitors. They were always completely frank about what they were doing on their vineyards, making my job both easy and enjoyable.

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South West Slopes Field Day Program

Ross Polglase, August 2004

We will visit two properties, Kyeamba Creek and Gundagai Vineyards, on three occasions, August, November and February, over the next season. This will allow us to follow the progress of various sites as the season progresses.

The two properties are different in the scale of operations, plantings and goals. This is not to say that one vineyard is much better than the other. Rather, it is a clear reflection of the fact that how we design and then manage a vineyard is often a matter of personal choice.

Kyeamba Creek

Plantings

Kyeamba Creek currently has 21 ha of vines. A further 5 ha will be planted during early spring 2004.

Varieties	**Area**	**Purchaser**	**Approx .yields 2004**
Shiraz	15 ha, + 5 ha to be planted in 2004	Southcorp	7 t/ha
Tempranillo	5 ha	Bidgeebong	5.5-6 t/ha
Touriga	1 ha	Bidgeebong	5-6 t/ha

Irrigation

Water is pumped directly from a bore.

Dripper spacing: 1 metre
Dripper flow rate: 2 litres/hour
Dripper flow rate per vine: 4 litres/hour
Application/ha, Ml, 2004: 0.2-0.25

Irrigations are scheduled using a combination of data from gypsum blocks and observations of the grapevines.

Simon considers pre budburst, flowering and veraison to be the critical times for irrigation.

Several sections of the shiraz will be grown under dry land conditions this season, to see if quality can be further improved.

Goals of the vineyard

To produce Southcorp B Grade fruit from the shiraz

To produce high quality fruit for Bidgeebong

Gundagai Vineyards

Plantings

Gundagai Vineyards has 200 ha of vines. The planting program commenced in 1998 and was completed by 2001

Varieties	**Area**	**Purchaser**	**Yield targets (approx)**
Shiraz	100 ha	Southcorp, some to Casella	12-15 t/ha
Cabernet sauvignon	60 ha	Southcorp	12-15 t/ha
Merlot	30 ha	Southcorp	10-12 t/ha
Chardonnay	2.5 ha	Southcorp, some to Casella	15-18t/ha
Verdelho	2.5 ha	Southcorp	15-18t/ha

Irrigation

Water is pumped from the Murrumbidgee River to a small dam, then onto the vineyard.

Dripper spacing: 0.75 metre
Dripper flow rate: 2.4 litres/hour
Dripper flow rate per vine: 6.4 /hr (shiraz), 4.8 l/hr (merlot)
Application/ha, Ml, 2004: 2.4 Ml/ha (reds), 4 Ml/ha (whites)

Irrigations are scheduled using a combination of data from C Probes and observations of the grapevines.

Goals of the vineyard

To supply customers (wineries) with grapes that meet their specifications while optimizing economic returns.

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Assessing the Moisture Status of Grapevines

South West Slopes Vignerons Association Field Day, Oct 31, 2004

"There is no substitute for footprints in the vineyard" – Roger Magarey, Plant Pathologist, 1992

Roger's statement is an invitation to monitor, initially referring to checking grapevines for pests and diseases. However, it applies to all forms of viticulture, including assessing the need for water.

Monitoring involves making observations, recording your observations, interpreting them and then finally acting (or not) on your interpretations. All four activities need to be carried out for monitoring to be useful.

One important technique for checking how grapevines are using water is to "read" your vines. Anyone can do this with a little practice.

Reading grapevines

There are some clear physical indicators, most of which are visual, of the water status of grapevines. These include:

- Leaf temperature
- Leaf condition
- Petiole condition
- Tendril condition
- Tip condition
- Extent and rate of cane lignification

Examining these characteristics helps indicate the extent to which vines can access soil water.

(a) Leaf temperature

Leaves transpire, which means that they "pump" water from roots through pores on the underside of the leaves, known as stomata. These stomata may be either open or closed, depending on temperature and the availability of water in the vines' root zones. If the day is hot, say above 35°C, the pores will largely close, irrespective of how much water is in the soil. However, stomata will remain open when the temperature is less than 30°C, especially in leaves that are in the shade. They will close when water is limiting.

Think of transpiration as evaporative cooling: leaves that are transpiring will feel cooler at a given shade temperature than leaves that are not transpiring.

Feel healthy leaves that are not indirect sun, preferably when the shade temperature is less than 32°C. If the leaves:

- *feels cool, the vines are currently transpiring*
- *feel warm, transpiration has ceased. Consider the need for irrigation, depending on variety*

Healthy leaves will feel hot on very hot days, irrespective of how much water is in the soil. If the vines have access to enough moisture, they will cool down by sunset on all but the very hottest of days. If leaves still feel very warm near sunrise and sunset, assume that the vines have access to little water.

(b) Leaf condition

This refers to leaf colour and leaf turgidity (the extent of wilting).

Shiraz leaves wilt readily when the weather is very hot or the vines lack water. The "shoulders" of shiraz leaves that wilt roll over, exposing the delicate undersides of the leaves. These exposed undersurfaces can be irreversibly damaged, even killed, by exposure to hot sun. Leaves that are shaded will wilt if the temperature is less than about 32°C only if the vines don't have access to enough water. Healthy leaves of vines that are mildly stressed will regain turgor once the sun goes down. Leaves of severely stressed vines remain wilted long after the sun goes down.

(c) Petiole condition

The petiole is the leaf stem. Leaves that are healthy, growing on vines that are well watered are usually straight. Petioles on obviously stressed vines droop.

(d) Tendril condition

Tendrils have a purpose, other than being annoying at pruning. They anchor vines, which are after all a climbing plant. In spring time, tendrils are produced progressively along the shoots as they grow. It is normal for there to be at least five tendrils per shoot. Eventually tendrils age, and those that have failed to attach themselves drop off. However, the time and rate at which they fall is influenced by the growth rate of the shoots and the extent of moisture stress.

Tendrils on vines that are growing well in spring will be "curly" in nature. Tendrils on vines that are stressed feel distinctly rubbery and hang vertically, in parallel lines along the cane.

Note the condition of the tendrils and average number of tendrils per cane.

(e) Tip condition

Shoots that are growing strongly in spring have tips that are bent over. Tips straighten out as the rate of shoot growth slows down. The tips may eventually die, which normally indicates that the vines have been over stressed.

Tip condition provides an indication of how much water the vines are accessing. If you are a shiraz grower who is trying to limit berry size, you should not have excessive soil moisture level during the first three or four weeks after set. Therefore, you should not see too many shoots at that time with bent-over tips.

(f) Extent and rate of cane lignification

Canes change in colour and physical characteristics as they age. They start off a shiny, bright green, then turn olive-green, then yellow-green, finally turning brown.

Canes that are brown show good "periderm development". (Most of us call brown canes "lignified canes"). This happens in canes that are growing in conditions of good light intensity which have virtually stopped growing, on vines that are not excessively stressed. Shiraz vines that produce good quality grapes generally have at least 50% full cane lignification by veraison and 80% full cane lignification by harvest.

Cane lignification commences when shoot growth slows down. Expect to see the first signs of cane lignification by early to mid December.

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Some factors that influence vine growth in the South West Slopes during early spring

Ross Polglase, August 19, 2004

A number of factors influence how your vines will grow between budburst and flowering. These include:

- Carbohydrate levels stored by vines by leaf fall
- Pruning levels and systems
- Soil water levels at budburst
- Nutritional status of the vines
- Extent of competition from weeds for water and nutrients
- Soil types
- Pest status of the vines, particularly pest associated with grapevines roots

The importance of carbohydrates

Grapevines survive on stored carbohydrates during early spring, because leaves are net users rather than producers of carbohydrates until they are half to two thirds expanded. Vines that have:

- Been overcropped
- Experienced premature defoliation after harvest
- Experienced canopy damage due to heat or water stress
- Produced excessive late season shoot growth

generally enter dormancy with low levels of carbohydrates.

Vines in this condition have a lower than normal percentage bud burst, show highly uneven rates of shoot growth, produce small clusters and flower unevenly.

Pruning

Cane pruning is considered to be a devigourating method of pruning. Apical dominance causes strong growth to occur near the ends of canes that have been cut, with poorer growth in the mid sections of canes.

The more "severe" cuts that are made in spur pruned vines usually results in more even and stronger shoot growth compared to what we see in cane pruned vines. However, the type of growth we see in spur pruned vines often depends the type of cuts that we make. In general, large pruning cuts to one year old wood result in stronger growth than smaller cuts.

Increasing bud numbers per vine leads to:

- An increase in shoot number and therefore shoot density

- An increase in bunch and berry number per vineyard
- A reduction in the percentage of buds that burst
- A reduction in bunch weight
- A reduction in berry weight
- A reduction in bunch size
- The production of looser clusters

Soil water level at budburst

Grapevines use very little in water in the first moth after budburst. However, they still need some water. The South West Slopes region generally experiences enough winter rain fall to encourage vines to produce adequate growth in early spring. However, the amount of water that vines need during early spring depends on soil types, variety, root stock and yield expectations.

Shiraz vines growing in deep, well structured soils have high vigour potential. Ensuring that they have all the water that they need at bud burst may lead to uncontrollable shoot growth. In contrast, shiraz growing on very rocky soils generally need extra water in spring to ensure that they produce adequate shoot growth.

Merlot and cabernet sauvignon generally have lower vigour potential than shiraz, so they often need more water in early spring than shiraz.

White varieties need less fruit exposure than red varieties, so they often need more water to ensure an acceptable level of fruit exposure.

The importance of nutrition

Vineyards in the South West Slopes may experience deficiencies of zinc, magnesium and nitrogen and possibly phosphorus.

Zinc deficiency is normally associated with soils that are rich in phosphorus. It is most commonly encountered in young vineyards which have received heavy pre planting applications of zinc. It becomes less important once the vines have developed extensive root systems. The deficiency usually shows up on new leaves after the end of November.

Magnesium deficiency is common. It generally occurs in soils that have high levels of potassium, especially in cool and wet soils. Magnesium and potassium are taken into vine roots via an active process (one that requires energy). Most vines grow out of magnesium deficiency once soils warm up and begin to dry out.

Nitrogen moves into roots via a passive process; it simply moves into the vines as they take up water. Deficiencies associated with shortages of nitrogen in the soil do occur, but it much more common to see the symptoms of nitrogen deficiency in vines that have been "starved" of water from mid spring through summer.

Phosphorus deficiency may be seen in old vineyards or those that have been planted on soils with low phosphorus levels, without pre planting additions of the nutrient.

In general, a lack of water will be have a greater effect on shoot growth than relatively low nutrient levels.

Competition from weeds

Weeds and other plants in the vineyard use nutrients and water. The significance of competition depends very much on the site and the ambitions of the manager. There

are may sites in Australia where interrow and even under vine growth is encouraged as a way of putting a brake on vine growth. However, there are also may sites where competition needs to be minimized, so that vine growth is not adversely affected by competition.

Your attitude to the growth of plants other than vines in a vineyard depends on your attitude to competition and how much you value biodiversity in the vineyard.

In general, weed competition is more of a concern in vineyards which set high yield targets but have low intrinsic fertility and soil structural problems.

Soil types

The importance of the soil to grape vine performance must not be underestimated. Soil holds nutrients and water for grapevines

There are three fundamental aspects of the soil. The first is soil texture.

Soil texture refers to the distribution of primary particles in the soil. The primary particles are sand, silt, clay and also gravel or rock. Grapevines are grown in soils that vary from loamy sands, through to clays, and soils with very high clay contents.

Soil structure refers to the arrangement of primary particles. Sandy soils are often said to "structureless", where the soils are largely present as individual particles.

Clays are poorly structured where they disperse. This means that the individual particles repel each other when wet. Such soils are very poor for vine root growth; vineyards in such soils will produce poor growth. On the other hand, clays that are stable with a good "crumb" structure may favour excessive growth. Clay particles generally have an excellent ability to hold positively charged nutrient such as magnesium, potassium, calcium and ammonium nitrogen. Clays also have the ability to hold plenty of water, but how much of the stored water is available to plants depends on the stability of the soil and the distribution of pore sizes in the soil.

Poor vine growth is more likely to be associated with soil structural issues than nutrition (in my experience).

Pest status

A vineyard should be regarded as a complex system involving many organisms other than grapevines. The vast majority of organisms in a vineyard are of little significance, individually, to grapevines. A minority of organisms are significant to vineyards in the South West Slopes.

Powdery mildew is probably the most important disease in the region, though downy mildew, bunch rots, pathogenic nematodes, Light Brown Apple Moth and various mites are also likely to occur sporadically.

Severe infections of downy and powdery mildews may restrict vine growth in the season following infection. Severe infestations of bud mite can also affect shoot growth, though such infestations are actually quite rare. Rust mite, which is much more common, may also reduce early season shoot growth.

Most soils have various nematodes associated with plant roots. Very high levels of root lesion and root knot nematodes can severely restrict root growth and therefore vine growth. On the other hand, low to moderate levels of these and other nematodes often occur in vineyards without any adverse effect on vine performance.

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Following up August meeting, South West Slopes Vignerons Association field day

Ross Polglase, August 25, 2004

1. Which were the key issues raised by the group?

Irrigation: scheduling, budgeting, strategies, RDI, budgeting for water shortages
Nutrition
Soil management
Canopy management
Increasing vine vigour
Decreasing vine vigour

I will address these areas of concern as the need arises.

2. Irrigation

(a) Scheduling

Scheduling refers to the systems that can be used to decide when, and how much, you need to irrigate.

There are numerous tools that an be used for irrigation scheduling, including the use of gypsum blocks, tensiometers, gypsum blocks and capacitance systems such as the Diviner, C Probes and Enviroscan.

Checking soil moisture levels by feel is often used, with an auger, dig stick or shovel used to get soil samples.

Some people use evaporation data, combined with the use of crop coefficients, to predict how much water vines are using from day to day. This approach provides some indication of how much water plants use, but can lead to escalating, unplanned water deficits on the one hand or gross over irrigation on the other if crop coefficients are selected inappropriately.

A tool for irrigation scheduling that lets you determine when to irrigate without leaving the comfort of your office does not exist. Use scheduling equipment in conjunction with observations of soil moisture (by feel) and reading the vines to determine when to irrigate.

(b) Factors affecting water movement in the soil and water use by grapevines

Water moves into the root zones of grapevines directly through irrigation, rainfall, through the influence of water tables, or surface or sub surface runoff. Deep sandy loams and well-structured clay and clay loam soils can hold a considerable amount of water that is available to plants. Poorly structured clays and clay loams and soils with a high

percentage of rock or gravel are able to hold less water for the plants. Grapevines growing in well-structured soils that allow the vines to develop extensive root systems tend to more 'drought-proof" than those growing in shallower or more poorly structured soils.

Water is lost from the soil by drainage, evaporation or transpiration through plants.

Losses due to evaporation can be controlled through the use of mulches. These are often applied as straw, or can be gradually built up by slashing a planted cover crop or volunteer mulch onto the undervine area. Be aware that mulching grapevines can increase the risk of frost damage to the vines. Mulching is not universally applicable to all grape growers; I have seen a grower using undervine mulch in a high vigour site in the King Valley. All he was going to achieve was a further increase in unwanted vigour. Be sure that you actually need mulch before using it.

Transpiration occurs through grapevines or other plants in the vineyard or near the vines. Water losses due to transpiration can be reduced by eliminating plant growth under the vines or by controlling plant growth between the rows. Interrow plant growth can be most easily controlled by the use of knockdown herbicides. Some growers prefer to use rates of herbicides that suppress rather than kill weeds, but chemicals used for this purpose must be chosen carefully, to minimize the risk of weeds developing resistance to herbicides. Slashing or mulching can also be used, but some growers get behind in their mulching or slashing programs in spring. Remember that interrow and undervine plant growth increase the risk of frost damage in spring.

Cultivation can also be used to control interrow vine growth. However, it must be avoided during to frost risk period as freshly cultivated soil considerably increases the likelihood of frost damage compared to having bare, relatively compacted soil.

Choosing bare or cultivated soil may not be appropriate in sites where soil erosion is a potential problem.

The rate of water usage by grapevines is influenced by interactions between environmental factors including temperature, sunlight, wind speed, evaporation rate, and grapevine factors including leaf area, leaf efficiency, crop load and the stage of development of the crop. Generally, vines with a high leaf area and large crop use more water each day than vines with smaller crops and lower leaf area.

(c) Water budgeting

How do you decide on a strategy for irrigation for a season when you have access to very limited water? You need to develop a water budget, based on an understanding of the annual cycle of vine growth.

From budburst to flowering, grapevines produce strong growth. Ideally, vines should have produced 70-80% of their canopies by the start of flowering. During flowering, grapevines need access to enough water to ensure that berry set occurs. A severe shortage of water over flowering often leads to a reduced percentage of berries that set. It may also lead to the development of "hen and chicken", which occurs when the seed number per berry is highly variable within bunches. The smallest berries are seedless; larger berries have one or two seeds per berry. The effect at harvest is that bunches have highly variable berry size. Between set and veraison, berry growth occurs almost exclusively through cell division. This is a time when water inputs can be

deliberately reduced in shiraz especially to control berry size (this can be called RDI). Berry growth virtually ceases during veraison, when seeds begin to mature and berries soften. From veraison to harvest, berries increase in size due to cell expansion. Sugar accumulation and flavour development occur. Between harvest and leaf fall, the vines are "in recovery". They are replenishing stores of carbohydrates, which will be utilized during the early part of the next spring.

Every season, your aim as grapegrowers is to grow grape vines that are able to mature their crop, and then grow satisfactorily during the following season.

The first step when water is limiting is to estimate how much water you have access to over the whole season. Secondly, work out how much crop your vines will carry. Thirdly, decide on the critical times for irrigation.

(i) Budburst to flowering

In most seasons, vineyards in the South West Slopes have enough water at the end of winter in the soil to ensure reasonable growth during early to mid spring. Where water is expected to be very limited for the rest of the season, reduce cropping potential by pruning, or by bunch and shoot thinning after budburst. This reduces the amount of water that the vines will need to mature their crop. It also assists the vines to produce canes with enough leaves to mature the crop. Vines that are likely to experience water stress between set and harvest are likely to need a higher leaf area to fruit weight ratio than "healthier" vines. This is because the stressed vines will have leaves that produce of sugar at a slower rate than those that grow in conditions of good light intensity and have access to enough water.

Reduce water losses from competitive plants by hard slashing between the rows, the use of herbicides or cultivation.

Consider the use of mulch under the vines to reduce water losses due to evaporation.

(ii) Flowering

Ensure that the vines have enough water to flower and set an adequate percentage of the flowers. The flower clusters generally begin to point downwards about 10-14 days before flowering. Use this information to get ready for your preflowering irrigation.

(iii) Set to veraison

Once berry set has been completed, the effect of reducing water inputs is to reduce the rates of cell division in the berries and shoot growth. This is acceptable, providing the vines have been able to produce sufficient leaf area for their crops by the start of flowering.

(iv) Veraison

Vineyards that move through veraison relatively quickly have less variability in maturity at harvest than blocks that experience prolonged veraison. If possible, ensure that vines have a reasonable amount of water as they are about to enter veraison.

(v) Veraison to harvest

By now, berries are filling with water, sugar and flavour compounds. Vines need enough water so that the leaves continue to produce sugar for the crop. Do not be tempted to "turn the taps off" after veraison. Doing this may delay harvest and put the vines in poor condition for the following season.

(vi) Harvest to leaf fall

It is important to ensure that the vines retain leaves in healthy condition, especially those towards the end of the canes. These leaves are the youngest leaves on the vines and therefore they are the ones that will be the most productive. Hopefully you will have enough water left after harvest to provide your vines with at least one and preferably two irrigations before leaf fall.

In summary:

- Most vines will not need much water before flowering, providing competition for water from other plants is minimized
- You may need to water before flowering. We will talk at our next meeting about how to decide when you should first irrigate.
- Plan to irrigate at least once before veraison.
- Irrigate once or twice between veraison and harvest, to ensure that the leaves hold their condition
- Apply at least one irrigation after harvest, to assist the vines for the next season.

Note that these are suggestions only; they are likely to be inappropriate for vineyards which crop at higher levels.

3. Nutrition during spring

The most common nutritional disorders seen in grapevines during spring are magnesium, potassium and nitrogen deficiencies.

(a) Magnesium and potassium

Magnesium and potassium move into grapevines roots through the same active pathway. This means that energy is required for their uptake. Most soils in the South West Slopes are likely to contain clays that have a relatively high percentage if available potassium. This can suppress magnesium uptake, especially in cool, wet springs. Because magnesium and potassium are mobile within the plant, their deficiencies usually show up on the first six leaves on affected canes. Deficiencies cease to be a problem once soils warm up, assisting the plants to take up the nutrients.

It is highly unlikely that you will need to apply potassium to grapevines in your area. Magnesium applications may be needed. Foliar applications of magnesium sulphate are effective, as magnesium deficiencies are short lived.

(b) Nitrogen

Nitrogen moves into plant roots through the process of "mass flow". This means it moves into the roots in the water stream, as the plants take up water. Grapevines use water at a very low rate in the first 4-6 weeks after budburst. Most of the nitrogen that they use at this time comes from nitrogen that has been stored with the plants from the previous season.

Grapevines that are subjected to severe water stress from late spring onwards take up little nitrogen, even if at is present in the soil. This is because such vines will be transpiring at a reduced rate compared to "well watered" vines.

The ability of grapevines to respond to applied nitrogen is also affected by how the vines come out of dormancy. Grapevines that were in poor condition at the end of autumn 2004 will probably show poor and uneven growth this season. They will not be responsive to applied nitrogen. Vines that were in very good condition all through last season are likely to highly responsive to nitrogen.

We will talk about how to determine the need for nitrogen at the next meeting.

4. Canopy management

There is no single best system of canopy management in Australian viticulture. The choice is affected by the yield and quality expectations of the individual, preferences by the winery who takes the fruit, and often by the availability of labour. The South West Slopes has a generally warm to hot climate. Most vineyard sites are likely to have moderate rather than high vigour, which should make canopy management relatively easy.

A key to 'successful" canopy management will be to manipulate growth through controlling cropping levels, pruning, nutrition and soil management.

We will have more detailed discussions concerning canopy management in subsequent meetings.

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South West Slopes Vignerons Association Meeting at Gundagai Vineyards
Sunday December 12, 2004
Ross Polglase

1. Can Gundagai Vineyards meet its quality-yield targets?

During early spring, Southcorp, the contracting winemaker, announced that it wanted Gundagai Vineyards to produce 80% D grade and 20% C grade fruit for the 2005 vintage. Southcorp D grade equates to Lindemans Bin series wines (such as Lindemans Bin 65 chardonnay or Lindemans Bin 50 shiraz). Southcorp C grade equates to such labels as Koonunga Hill and Rosemount Diamond label wines.

The South West Slopes region should have no trouble growing D grade standard fruit at the yield targets of 15 t/ha for red varieties and 16 t/ha for chardonnay and verdelho. Grapes would have to be either of poor quality or unwanted varieties to be classified as E grade or lower. The announcement was made after pruning, which is of course later than desirable. However, the vines were pruned according to wood quality, spur position and vine capacity, rather than simply to a predetermined spur number per vine. This has ensured that most blocks will meet their yield targets.

There is a common perception in viticulture that yield and quality are closely linked. We have serious doubts about this, because our graphs of yield versus Southcorp grade show a very poor correlation between the two. It is possible to grow poor quality grapes at any yield; simply reducing yield need not enhance quality, and may in fact reduce quality by stimulating excess vigour and forcing vines to produce very large berries.

2. Implications of weather to vine and fruit growth

Wet weather during spring and summer have favoured cell division in berries. This will be a difficult season for growers who want to try to restrict berry size in red varieties.

On the other hand, vines that are well established and growing in soils that have high Readily Available Water (RAW) values will not have needed much irrigation to date.

Vines that grew well last season and were in good condition after harvest in 2004 have probably grown well this season. Vines with large canopies will experience a dramatic increase in daily water requirement through the rest of December to harvest.

3. Getting ready for veraison

Veraison is a critical stage in berry development. It marks the onset of seed development and the beginning of berry softening and sugar accumulation. Batches of fruit are reasonably uniform if they all pass through veraison relatively quickly and at a

similar time. Subjecting vines to excessive water stress at veraison often leads to veraison occurring over a long time, contributing to considerable variation in maturity at harvest.

Ensure that your vines have enough water by the start of veraison.

Veraison in will probably occur in the second week of January for shiraz and the first week of January for chardonnay. By this time, shiraz vines should have at least 50% cane lignification (the percentage is based on the length of the canes). Failure to achieve this degree of lignification indicates that the canes are excessively shaded or vigorous or the vines have been overstressed. It is acceptable to allow two or three leaves to drop from fruit bearing shiraz canes due to water stress, but losing more leaves probably indicates that the vines have been overstressed. A lower level of lignification is acceptable for chardonnay, but chardonnay vines should not be encouraged to lose leaves due to water stress.

4. Disease pressure and wet weather during late spring-early summer

Downy mildew

Has the weather favoured downy mildew during spring and early summer? This question can be answered by understanding the conditions that favour downy mildew primary infections. These infections are initiated when the "10:10:24" criteria have been met. This means that there needs to have been at least 10 mm of rain; the minimum temperature during the wet period needs to exceed 10°C; and that vine tissues (and soil under the vines, where spores reside) need to be wet for at least 20-24 hours.

Primary infections are generally very hard to find; they usually occur at the rate of no more than one spot per 50 metres of row, and frequently at much lower rates than that. Very few grape growers ever see a primary infection. Rather they see the disease after the second or third infections.

However, just because conditions may have favoured a primary infection doesn't necessarily mean that the infection will have occurred. Primary infections are water-borne. Spores that lead to primary infections are found on the framework of the vines or in the soil under vines. It is extremely unlikely that a vineyard that has never had an infection of downy mildew can ever develop a primary infection of the disease, because the spores will be absent. Vineyards that have never experienced downy mildew infections may develop infections from air borne spores that give rise to secondary infections. A secondary infection occur only at night, when there has been any rainfall, susceptible tissues remain wet for at least two hours and the minimum overnight temperature exceeds about 12°C. Secondary infections can only occur during seasons when a primary infection has occurred and than sporulated somewhere in your district.

Botrytis

Few grape diseases promote as much discussion, much of it ill-informed, as *Botrytis*. *Botrytis* is a curious disease, because it is present in every vineyard in every season, and it may lead to serious crop loss, even rejection by wineries, or it may not appear in vineyards that are harvested on time.

Wet weather at flowering this season will undoubtedly mean that many if not all bearing blocks in your area have developed some level of latent infections of *Botrytis*. This means that the disease is present but inactive, existing either in the fallen flower parts that are trapped within the clusters or in or on scars left by fallen flower parts on the

berries. Whether these latent infections actually give rise to the symptoms of the disease at harvest remains to be seen. Symptoms will develop only if weather and the environment around the clusters favour disease development close to harvest.

Vineyards that have low vigour vines, with well-spaced shoots and bunch, are unlikely to show the symptoms of *Botrytis*.

Gundagai Vineyards has never sprayed for *Botrytis* and has never suffered visible infections of the disease.

QUESTIONNAIRE: South West Slopes Vignerons Association, August 2004

Responses to questionnaire

1. Varieties and their areas

Ha

Sh	Ch			
2	2			
	5.7			

Vine - row spacings

Variety	Row	Vine
sh	3	1.66
ch	3	1.66
ch	3	2

Training systems	ch	sh
1 fruiting wire, no foliage wires		
1 fruiting wire, full foliage lift, both sides		
1 fruiting wire, foliage wire lift, 1 side (specify which side)	1(E)	
1 fruiting wire, foliage wire lift, partial, both sides	1	1

Irrigation Drip

Spacings	Output (l/hr/dripper
0.75	2.2
0.75	2.4

Timing of 1st irrigation

Aug	1	Ch
Sept	1	Sh,ch
Oct		
Nov		
Dec		

Scheduling

How do you schedule irrigations (tick)

guesswork

tensiometers

gypsum blocks

C Probes

Enviroscan 1

"reading" the vines 1

feeling the soil 1

do what I did last season

Other (specify)

Knockdown herbicides (e.g. glyphosate, Spray.Seed, Basta) 1, 1

Residual herbicides (eg Stomp, simazine)

Manual weeding (eg shovel!)

Mechanical weeding (eg Merbein plough, knife)

Applied mulch

Undervine slashing 1

Do you:

try to keep the undervine area clean at all times?

allow some weeds to grow at certain times of the season? 1, 1

not concerned about weed growth under the vines?

Inter row management (tick)

Do you:

use "scorched earth" (no growth, any time of the year)? 1, 1

slash or mow the inter row area?

cultivate when weeds get out of hand?

let weeds grow out of control?

6. A QUESTION OF BALANCE?

Rate the vigour of your vines, by percentage of vineyard area:

Percentage that are undervigorous	10	n/a
Percentage that have adequate or acceptable vigour	80	n/a
Percentage that have excessive vigour	10	n/a

7. PEST PROBLEMS

In the last five seasons, list pests which:

have caused economic losses?	AG	rabbits
have you seen, but have not caused losses?	powdery mildew	
you would like to learn more about?	AGY	rabbits

8. LIST THE 3 AREAS OF GRAPE PRODUCTION THAT MOST CONCERN YOU

water management	quality v yield	nutrition	vine care	Interrow, uv management
2	1	2	1	1

9. WHAT ASPECTS OF GRAPE PRODUCTION WOULD YOU LIKE TO LEARN MORE ABOUT?

Optimizing trellis design for yield
Biodiversity in the vineyard
Ensuring efficent nutrient uptake
Using water efficiently
Frost avoidance

Thank you for completing this survey
Ross Polglase

QUESTIONNAIRE: South West Slopes Vignerons Association, August 2004

Ross Polglase, Swan Hill

Name:

Address:

1. PLANTINGS

Block	Block ID	Varieties	Area (ha)	Year of planting	Vine spacing (m)	Row spacing (m)
1						
2						
3						
4						
5						
6						

2. TRELLIS SYSTEM *(tick appropriate box)*

1 fruiting wire, no foliage wires

1 fruiting wire, full foliage lift, both sides

1 fruiting wire, foliage wire lift, 1 side (specify which side)

1 fruiting wire, foliage wire lift, partial, both sides

Scott Henry

Smart Dyson

Other (specify)

3. SOIL TYPES

(describe range of types)

Topsoil

Subsoil

4. IRRIGATION SYSTEM AND WATER USE

none

drip

If drip:

dripper spacing (m)

flow rate per dripper (litres per hour)

Timing of first irrigation of season, last 3 seasons

2001

2002

2003

Approximate water applied per hectare last season (Ml/ha)

Don't know how much I applied

How do you schedule irrigations (tick)

guesswork	
tensiometers	
gypsum blocks	
C Probes	
Enviroscan	
"reading" the vines	
feeling the soil	
do what I did last season	
Other (specify)	

5. SOIL MANAGEMENT

Undervine management (tick)

Knockdown herbicides (e.g. glyphosate, Spray.Seed, Basta)	
Residual herbicides (eg Stomp, simazine)	
Manual weeding (eg shovel!)	
Mechanical weeding (eg Merbein plough, knife)	
Applied mulch	
Undervine slashing	

Do you:

try to keep the undervine area clean at all times?	
allow some weeds to grow at certain times of the season?	
not concerned about weed growth under the vines?	

Inter row management (tick)

Do you:

use "scorched earth" (no growth, any time of the year)?	
slash or mow the inter row area?	
cultivate when weeds get out of hand?	
let weeds grow out of control?	

6. A QUESTION OF BALANCE?

Rate the vigour of your vines, by percentage of vineyard area:

Percentage that are undervigorous	
Percentage that have adequate or acceptable vigour	
Percentage that have excessive vigour	

7. PEST PROBLEMS

In the last five seasons, list pests which:

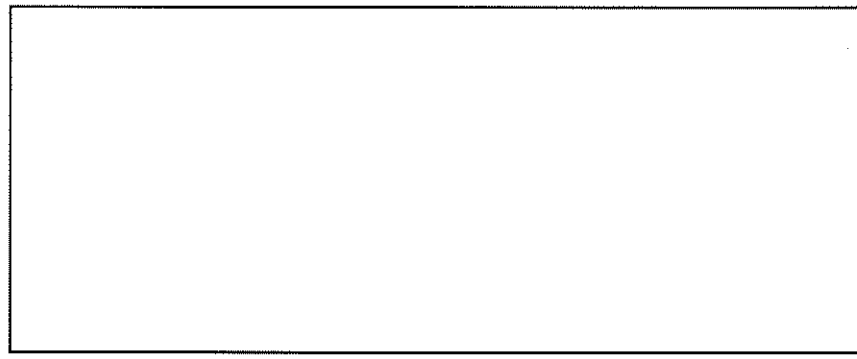
have caused economic losses?	
have you seen, but have not caused losses?	
you would like to learn more about?	

8. LIST THE 3 AREAS OF GRAPE PRODUCTION THAT MOST CONCERN YOU

1	
2	
3	

9. WHAT ASPECTS OF GRAPE PRODUCTION WOULD YOU LIKE TO LEARN MORE ABOUT?

Thank you for completing this survey
Ross Polglase



Thank you for completing this survey

Ross Polglase

Bud and spur numbers: SWSVA, August 2004

Sheet 2 was provided to growers as a handout

Grower: Gundagai Vineyards	Block: S3, north east corner
Variety: Shiraz	Date: 20/8/04

	No. of buds/spur					
Vine no.	1	2	3	4	Buds on canes	Buds/vine
1	21	44	18	0	0	*163*
2	23	39	20	0	0	*161*
3	20	42	2	0	0	*110*
4	14	41	11	0	0	*129*
5	20	40	4	0	0	*112*
6	29	30	1	0	10	*102*
7	21	53	15	1	0	*176*
8	20	42	23	1	0	*177*
9	11	20	8	0	12	*87*
10	20	38	6	0	0	*114*
11	16	34	5	0	0	*99*
12	28	35	7	0	0	*119*
13	18	36	11	2	0	*131*
14	14	29	1	1	0	*79*
15	8	43	18	0	0	*148*
16	7	39	10	1	0	*119*
Av.	***18.1***	***37.8***	***10.0***	***0.4***	***1.4***	***126.6***

Av. No spurs/vine: 66.3 ***Av buds/spur*** 1.9

1.9 66.3 18.1 64.9

125.2 37.8 64.9

10.0 64.9

0.4 64.9

125.3

Av. % 1 bud spurs 28%
Av. % 2 bud spurs 58%
Av. % 3 bud spurs 15%
Av. % 4 bud spurs 1%

No. of buds at each bud position

Bud position	No. of buds	%
1	66.3	53%
2	48.2	38%
3	10.4	8%
4	0.4	0%

Buds/vine	
163	79
161	87
110	99
129	102
112	110
102	112
176	114
177	119
87	119
114	129
99	131
119	148
131	161
79	163
148	176
119	177
	126.625

Av. No spurs/vine:	66.3
Av. % 1 bud spurs	28%
Av. % 2 bud spurs	58%
Av. % 3 bud spurs	15%
Av. % 4 bud spurs	1%

Buds/vine	
lowest	79
highest	177
median	119
average	127

Average bud no/vine:	126.6
Lowest no. buds/vine	79
Highest no. buds/vine	177
Median no. buds/vine	119
Average no. buds/vine	127

Average no. spurs/vine	66.3	
Average bud no/spur	1.9	
Average no. 1 bud spurs/vine		18.1
Average no. 2 bud spurs/vine		37.8
Average no. 3 bud spurs/vine		10
Average no. 4 bud spurs/vine		0.4
Average % 1 bud spurs/vine	28	
Average % 2 bud spurs/vine	58	
Average % 3 bud spurs/vine	15	
Average % 4 bud spurs/vine	1	

125.3
125.3
125.3

No. of buds at each bud position

Bud position	No. of buds	%
1	66.3125	53%
2	48.1875	38%
3	10.375	8%
4	0.375	0%

Buds/vine	
163	79
161	87
110	99
129	102
112	110
102	112
176	114
177	119
87	119
114	129
99	131
119	148
131	161
79	163
148	176
119	177
	126.625

	Buds/vine
lowest	79
highest	177
median	119
average	127

Av. No spurs/vine:	66.3
Av. % 1 bud spurs	28%
Av. % 2 bud spurs	58%
Av. % 3 bud spurs	15%
Av. % 4 bud spurs	1%

No. of buds at each bud position

Bud position	No. of buds	%
1	66.31	53%
2	48.19	38%

3	10.38	8%	
4	0.38	0%	

Buds/vine			Buds/vine
163	79	lowest	#REF!
		highest	#REF!
		median	#REF!
		average	#REF!

```
%-12345X@PJL
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@PJL USTATUS JOB = ON
@PJL USTATUS PAGE = OFF
@PJL USTATUS DEVICE = ON
@PJL USTATUS TIMED = 30
```

BUD AND SPUR COUNTS: Gundagai Vineyards
Ross Polglase 2004

Shiraz

The group counted spurs and buds per spur after pruning in a shiraz block on Gundagai Vineyards
The purpose of the exercise was to show grape growers that:
(a) bud number per vine varies when you prune to vine vigour and capacity
(b) spur number per vine also varies
(c) bud number per spur also varies

The message is that while it is important to have overall pruning targets,
we should still prune each vine according to its merits.

	Per-vine figures Gundagai Vineyards
Average bud no	126.6
Lowest no. buds	79
Highest no. buds	177
Median no. buds	119
Average no. spurs	66.3
Average bud no/spur	1.9
Average no. buds from canes	1.4
Average no. 1 bud spurs	18.1
Average no. 2 bud spurs	37.8
Average no. 3 bud spurs	10
Average no. 4 bud spurs	0.4
Average % 1 bud spurs	28
Average % 2 bud spurs	58
Average % 3 bud spurs	15
Average % 4 bud spurs	1

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Follow up to South West Slopes Vignerons Association Field Day, Oct 31, 2004

Ross Polglase

1. Vine growth

The Lockes finished pruning close to bud burst, which has delayed the rate of early season growth. However, this has no long-term consequence to vine growth. They may flower slightly later than usual, but there is unlikely to be any difference in harvest date compared to what would have happened had the vines been pruned during winter.

The shiraz vines were pruned to about 40 buds per vine, with the expectation that this bud number would give a 5-7 tonne/ha crop. The past history of this block indicates that this a realistic expectation. However, blocks that have a history of higher water and nutrient inputs would produce more like 10-14 t/ha at the same bud number.

Simon's shiraz vines had relatively short, well spaced shoots. The canopy will remain open until harvest, creating conditions of moderate to high light intensity around the bunches. Expect this block to produce grapes with high levels of colour, flavonols and phenolics. (I'll talk more about these grape components during later meetings).

2. Soil type variation and vine growth

There is some variability in vine growth within the block, which makes it typical of virtually all vineyards in Australia. Most of the variability is due to changes in soil type. One area of reduced vigour coincided with a slight gully. We often expect to find vines in gullies being slightly more rather than less vigorous than vines away from the gullies, due to the effects of extra water from rain fall run off. In this instance, vine vigour deceased in the gully due to the effects of poor drainage. This showed up in the soil as a mottled clay layer at a depth of about 40-50cm. Vines in the gully have shallow root systems which are affected by water logging during periods of prolonged rainfall and which dry out more quickly than vines growing in deeper soils.

The property has areas where the soil contains a high percentage of rock. Water that is available to plants resides in pores in the soil. Obviously, soils which contain considerable rock have a poor ability to hold water, so shallow rocky soils normally support low vigour vines. However, rocky soils are often very well drained and aerated; deep rocky soils therefore can sustain moderate to highly vigorous vines. Vines in such conditions make up for the "sparseness" of their root systems by producing very extensive root systems.

Very rocky soils are generally not particularly fertile, because of their low clay contents. Such soils become more rapidly depleted of nutrients, especially nitrogen and magnesium than soils with higher clay percentages.

3. Soil moisture

At the time of the field day, the soils were obviously drying out, even though the vines are currently using water at only about 10-20% of the average daily January rate. Water is being lost due to the effects of evaporation from the soil surface and due to transpiration from grapevines and interrow and undervine weeds, thought the latter were well under control at the time of the field day.

Shoot tips were all mostly bent over, indicating that there was still enough water for the vines to continue growing. Growth rates would be greater if the soil had more moisture, although this is not necessary considering the relatively yield expectations for this block. Of greater importance is that the vines will need more water by flowering. This may come in the form of rainfall, or more likely it will need to be applied as one or more irrigations. Failure to provide these vines with enough water by flowering will result in reduced berry set and an increased incidence of "hen and chicken" and increased percentage of shot berries.

Where do grapevines source their water in spring?

As a general rule, the density of grapevine root systems declines with increasing depth from the surface. As a consequence, the soil usually dries out progressively from the surface downwards. When vines become moderately to severely stressed, they begin using water from below the bottom of the root system. This occurs because a soil moisture gradient occurs from the damper depths below the roots to the drier soil around the root zones. It can be extremely difficult to rewet the dried out subsoil.

Some soils develop cracks as they dry out. This can severely limit the volume of soil that the vines can exploit, in addition to physically damaging roots.

Comparing irrigation to rainfall

It is extremely difficult to accurately determine the correlation between the amount of water applied as irrigation and water inputs into the vineyards as rain fall. There are two main factors that make predicting the impact of rainfall compared to irrigation difficult: roots are not distributed evenly, either vertically down the profile or across the row; and the extent of lateral (sideways) spread of irrigation water varies.

The root distribution of a grapevine is affected by such factors as:

- how water is distributed in the profile
- the presence of physical barriers to root growth
- the presence f chemical barriers to root growth

Soil compaction provides the main physical barrier to root growth. It most commonly occurs under wheel tracks, but it can spread laterally into the undervine area. Compaction under the wheel tracks generally causes at least 80% of the vines roots to be located in the area bounded by the wheel tracks, irrespective of rainfall or irrigation patterns. Deep cracks or fissures in the soil also prevent roots from developing far into the rows. Rock layers also obviously restrict the extent of root growth.

Chemical barriers to root growth include aluminium toxicity in acid soils and salinity.

Infiltration due to rain is rarely constant in all areas of a vineyard. The depth and rate of infiltration are affected by soil moisture level before rain or irrigation and soil structure. A common structural problem at the soil surface is that of slaking. Soils slake when the individual particles fall apart on wetting, causing the soil to "seal". This greatly reduces the rate of infiltration and increases the extent of runoff.

Slaking is remedied by increasing the organic matter content at the soil surface. Organic matter binds small aggregates together, ensuring that large gaps (pores) remain open during irrigation or rainfall, ensuring that water easily moves through the soil surface. Mulching, allowing weeds to grow under the vines or planting an undervine cover crop all help to increase the organic matter content of the soil. However, consideration needs to be given to potential undesirable competition from undervine plant growth. This can be overcome by allowing undervine plant growth to occur in winter rather than during the vines' growth season.

Drip irrigation is based on applying water from point sources spaced 0.5 – 1 metre apart on dripper lines. Once in the soil, water moves both downwards and outwards. The extent of sideways movement depends largely on soil structure, output rate from drippers and the duration of irrigation.

Lateral movement is normally least in very sandy soils, increasing with increasing clay content. Deep sands usually show a wetting pattern that is essentially a narrow cylinder. Sands overlaid on clay show minimal spread of water until it reaches the less permeable clay layer. Water begins to spread out once it hits the clay layer, ultimately creating the classic "onion shaped" wetting pattern. Deep cracks or fissures restrict lateral movement of water.

The duration of irrigation and frequency also affect the wetting pattern following irrigation. A common practice amongst many growers is to apply reasonably frequent irrigation of very short duration. Some growers will irrigate for one or two hours only at a time, with an output of only about 4 litres per metre per hour. Doing this repeatedly during times of peak water demand (January to February) may lead to an escalating deficit, often with less than 20% of the full root system receiving adequate water. Vines in this condition may suffer irreversible damage during heat waves.

4. Frosts

You are growing grapevines in an area where frost risk is relatively high, depending on how your vineyard is located. Unfortunately we cannot eliminate severe frosts, but there are things that can be done to minimize the impact of mild frosts.

During the day, soils take in heat, then radiate much of it back into the atmosphere at night. Frosts generally occur when the soil has failed to take in enough heat during the day, so that the heat radiating out of the soil at night fails to prevent the temperature to fall to a damaging level at night. Clouds provide an insulating layer in the atmosphere, ensuring that the atmosphere retains enough heat to prevent frosts from occurring. Frosts are therefore most likely to occur on clear still nights.

Frost management therefore centres on maximizing heat retention in the soil during day time.

Ignoring soil microflora and micro and macrofauna, soil essentially consists of soil particles, aggregates, often rocks and pores which are filled either with air or water. Soil porosity, and what is in the pores during periods of frost risk, is one of the key determinants of a site's frost risk. Air has a lower heat capacity and poorer heat conductivity than water, so soils that contain a relatively high level of air are more likely to favour frosts than soils with a higher water content. Growers in some frost prone areas choose to kill or at least suppress interrow plant growth just before budburst to slow down the rate at which soil dries out.

Under no circumstances should soils be cultivated during the frost risk period.

Shade reduces the amount of heat that soils take into the soil during the day, so it is important that the soil should be relatively clear of trash during the frost risk period. Interrows need to be cut short or even eliminated during this period.

Frosts sometimes occur when cold air either banks up into a vineyard or moves into it. Avoid barriers to air movement such as windbreaks below the vineyard in vineyards that are in a high frost risk situation.

Kate mentioned a good technique to attempt to limit the amount of cold air that moves into vineyards. This is to plant a windbreak above the vineyard. The idea is that the cold air will follow the windbreak rather than move into the vineyard. The windbreak would need to be dense enough to restrict air movement. The river sheoak, *Casuarina cunninghamiama* (I think that's how it is spelt) is endemic to your area and makes an excellent windbreak. It should be planted 3 metres apart.

Ross Polglase

QUESTIONNAIRE: South West Slopes Vignerons Association, August 2004

Ross Polglase, Swan Hill

Name:

Address:

1. PLANTINGS

Block	Block ID	Varieties	Area (ha)	Year of planting	Vine spacing (m)	Row spacing (m)
1						
2						
3						
4						
5						
6						

2. TRELLIS SYSTEM *(tick appropriate box)*

1 fruiting wire, no foliage wires

1 fruiting wire, full foliage lift, both sides

1 fruiting wire, foliage wire lift, 1 side (specify which side)

1 fruiting wire, foliage wire lift, partial, both sides

Scott Henry

Smart Dyson

Other (specify)

3. SOIL TYPES

(describe range of types)

Topsoil

Subsoil

4. IRRIGATION SYSTEM AND WATER USE

none

drip

If drip:

dripper spacing (m)

flow rate per dripper (litres per hour)

Timing of first irrigation of season, last 3 seasons

2001

2002

2003

Approximate water applied per hectare last season (Ml/ha)

Don't know how much I applied ☐

How do you schedule irrigations (tick)

guesswork ☐

tensiometers ☐

gypsum blocks ☐

C Probes ☐

Enviroscan ☐

"reading" the vines ☐

feeling the soil ☐

do what I did last season ☐

Other (specify) ☐

5. SOIL MANAGEMENT

Undervine management (tick)

Knockdown herbicides (e.g. glyphosate, Spray.Seed, Basta) ☐

Residual herbicides (eg Stomp, simazine) ☐

Manual weeding (eg shovel!) ☐

Mechanical weeding (eg Merbein plough, knife) ☐

Applied mulch ☐

Undervine slashing ☐

Do you:

try to keep the undervine area clean at all times? ☐

allow some weeds to grow at certain times of the season? ☐

not concerned about weed growth under the vines? ☐

Inter row management (tick)

Do you:

use "scorched earth" (no growth, any time of the year)? ☐

slash or mow the inter row area?

cultivate when weeds get out of hand?

let weeds grow out of control?

6. A QUESTION OF BALANCE?

Rate the vigour of your vines, by percentage of vineyard area:

Percentage that are undervigorous

Percentage that have adequate or acceptable vigour

Percentage that have excessive vigour

7. PEST PROBLEMS

In the last five seasons, list pests which:

have caused economic losses?

have you seen, but have not caused losses?

you would like to learn more about?

8. LIST THE 3 AREAS OF GRAPE PRODUCTION THAT MOST CONCERN YOU

1

2

3

9. WHAT ASPECTS OF GRAPE PRODUCTION WOULD YOU LIKE TO LEARN MORE ABOUT?