VINEYARD MEASUREMENT AND BERRY SENSORY ANALYSIS FOR SHIRAZ

GROWING SEASON 2005/2006

Report prepared by

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Table of Contents

EXECUTIVE SUMMARY **3**

1.0 BACKGROUND TO PROJECT **3**

2.0 PROJECT OBJECTIVES **4**

3.0 PROJECT METHODOLOGY **4**
- **3.1 Canopy Assessment at veraison** **4**
- **3.2 Block Details** **4**
- **3.3 Canopy and Berry Sensory Analysis at Harvest** **5**
- **3.4 Berry Analytical Assessment** **5**
- **3.5 Wine Making** **5**
- **3.6 Wine Evaluation** **6**

4.0 FINDINGS **7**
- **4.1 Veraison Canopy Characteristics** **7**
- **4.2 Harvest Canopy Characteristics** **8**
  - 4.2.1 Canopy Leaf Condition 9
  - 4.2.2 Fruit Environment within the Canopy 9
- **4.3 Fruit Characteristics (Vineyard Assessment)** **10**
  - 4.3.1 Berry size, colour and seed ripeness and berry shrivel 10
  - 4.3.2 Pulp description and sugar / acid balance 11
  - 4.3.3 Flavour Intensity & Description 12
  - 4.3.4 Tannin Intensity and Description in the Field 13
- **4.4 Fruit Characteristic (Analytical Assessment)** **14**
- **4.5 Wine Assessment** **16**

5.0 CONCLUSIONS **18**

Appendix 1 Block Details - Management Practices

Appendix 2 Photographs of the six Vineyards at veraison

Appendix 3 Vineyard Assessment Sheet

Appendix 4 Results: Canopy Characteristics – Vineyard Assessment

Appendix 5 Results: Fruit Characteristics – Vineyard Assessment

Appendix 6 Results: Fruit Characteristics – Analytical Assessment

Appendix 7 Results: Wine Assessment

References

Acknowledgements

EXECUTIVE SUMMARY

This project assessed six Shiraz blocks in the McLaren Vale region over the two seasons of 2004/05 and 2005/06, and achieved its objective of using vineyard canopy assessment, berry sensory and analytical assessment to differentiate between the blocks.

As a small scale investigation, inferences were noted, rather than statistical relationships determined.

In the 05/06 season differences in canopies were less obvious than in 04/05, but it was still evident that moderate vigour canopies with reasonably exposed fruit generally lead to greater intensity, length and complexity of fruit flavours.

The canopy characteristics that appeared to be most differentiating as possible indicators of potential fruit quality in both seasons were fruit exposure, leaf layer number and periderm development.

Results from both seasons indicate that duplex soils in the region, under appropriate management, tend to consistently produce vines with moderately open canopies and, potentially, fruit of high flavour intensity, length and complexity.

Assessment of the wines found that in the small number of vineyards addressed there were correlations between canopy and fruit characteristics in the vineyard and the final wine quality but they may be affected by vineyard variability and were not always absolute.

The 05/06 results also showed, in one instance, that greater intervention on a site of inherent high potential can achieve a more open canopy, and a reasonable wine score.

The extension component of the project was limited over the harvest time, and will be undertaken at an open session in Spring 2006, to discuss the project and potential for improving and evaluating management based on these assessments.

1.0 BACKGROUND TO PROJECT

The growing season 05/06 is year two of the project. Shiraz is the predominant variety grown in the McLaren Vale Region with many of the plantings around 10 years of age. In the current wine industry climate there is significant emphasis on being able to manage vines to achieve a desired end use to meet winery specifications.

This project investigated Shiraz vineyards in McLaren Vale to see if any correlation could be drawn between canopy and fruit characteristics and the resulting wine quality in order to benchmark blocks within this region. Wine made from each block was kept separate, and then assessed by a sensory panel to see if a correlation could be made between vineyard and fruit characteristics, and the resultant wine quality.

The project involved a small working group of grower liaison officers and viticulture sub-committee members, the Winegrowers Development Group's Viticulture Officer, winemakers and some growers from the selected vineyards. The project was facilitated by Libby Tassie from Davidson Viticultural Consulting Services (DVCS)

A workshop is to be held to outline the findings of the project.

2.0 PROJECT OBJECTIVES

The project was designed primarily as an extension exercise, with the following three aims.

1. To use canopy assessment, berry sensory and analytical assessments of Shiraz to benchmark blocks within the McLaren Vale Region.
2. To involve growers and winemakers in the vineyard assessment process in order to stimulate discussion and facilitate learning, whilst providing guidelines for fruit assessment in the vineyard.
3. To stimulate discussion and to generate ideas for altering vine management, based on the outcomes of the assessments.

3.0 PROJECT METHODOLOGY 05/06

3.1 Vineyard canopy assessment of the six vineyards at veraison

The six vineyards had been selected in 04/05 to represent a difference in end use i.e. each of the three companies - Wirra Wirra, Fosters Wines (formerly Southcorp Wines) and Hardy Wine Company selected two vineyards, one with fruit typically producing high quality wine, and one which produced lower quality wine. All vines were approximately 10 years of age, (with the exception of vineyard D which is 35 years old), as are the majority of Shiraz plantings in the district. The blocks selected are scattered throughout the Region on a range of differing soil types.

Vineyard locations were:

Block A - McLaren Vale
Block B - Willunga
Block C - McLaren Flat
Block D - McLaren Flat
Block E - McLaren Flat
Block F - Blewitt Springs

In 05/06 the six vineyard blocks were visually assessed at veraison as well as at harvest, in order to obtain a picture of the relative canopies at this earlier stage A small group comprising the relevant grower liaison officer, the grower (where possible or practical) and the viticulturalist from DVCS undertook this assessment. Photographs were taken for a comparison at this stage; see appendix 2.

3.2 Block details

Management practices for 05/06 were summarised, (see Appendix 1). For details of soil types and data see the 04/05 report.

3.3 Canopy and Berry Sensory Assessment at Harvest

Three sites were selected within each vineyard, after consultation with the grape grower and the grower liaison officer, in an attempt to account for variability within the vineyard. Each site consisted of 2 groups of 20 vines in adjoining rows. As only six vineyards were involved in this study, statistical analysis was not possible, but differences and tendencies were noted.

Vineyard assessment and berry sensory analyses were undertaken just prior to harvest (see Table 3.3.1) by the small team of viticulturalists, growers and winemakers. A group of 2 viticulturalists and one or two wine makers assessed all vineyards; other wine makers when this was possible. A modified version of the Southcorp vineyard assessment sheet was used (see Appendix 3). Assessments were made at each of the 3 assigned sites at each vineyard.

Table 3.3.1 Pre Harvest Assessment Dates

Vineyard	Date of Assessment
A	9/3/06
B	9/3/06
C	17/3/06
D	17/3/06
E	21/3/06
F	6/4/06

3.4 Berry Analytical Assessment

As in 04/05, the fruit from each vineyard was sampled at two different times and analysed by the Australian Wine Research Institute (AWRI), for Brix, pH, Titratable Acidity, phenolics, and anthocyanins. The first sampling was at a similar, or "target baumé" for all sites, in this case 13.5º $\pm$ 0.5º, so that comparisons could be made between the different vineyards at a similar stage of ripeness. The second sampling was at harvest. Samples were taken from each site at each vineyard, i.e. 3 samples per vineyard, 2 x 200 berries per site from 40 bunches per site.

A second composite sample (2 x 200 berries) was taken as close as possible to harvest, to be as representative as possible to the resultant wine.

3.5 Winemaking

In 05/06 the wine making was undertaken by Provisor . The fruit was picked from each of the three sites at each vineyard and combined to form the harvest sample of 50 kilograms, and then taken to Provisor where each vineyard's fruit was crushed and vinified separately.

3.6 Wine Evaluation

In 05/06 the wines were bottled and assessed early, to try to detect any fruit quality characteristics which could be attributed to vineyard influences.

The wines were evaluated and assessed by an experienced panel of the Region's winemakers, using a method based upon Patrick Iland's suggestion, and a final evaluation sheet compiled by Leigh Francis, AWRI and Jane Paull with some minor changes from the 04/05 version (see Appendix 7). It was specifically designed to pick up aroma and palate characteristics which could potentially correlate with the vineyard fruit sensory assessment. A linear scoring system was used for those characteristics.

A scoring system for assessing relative wine quality was also utilised.

4.0 FINDINGS

This study was only of six vineyards, with three sites within each vineyard, so basic observations and overall trends were observed rather than data collated for statistical analysis.

There was some variation between vineyards, and within vineyards, and there were some differences and some similarities compared to last years results.

The winemaking batches similarly were non-replicated, so again data was not collected for statistical analysis.

In order to compare and graph the vineyard characteristics, the actual assessment scores, have been graded from 0 to 6.

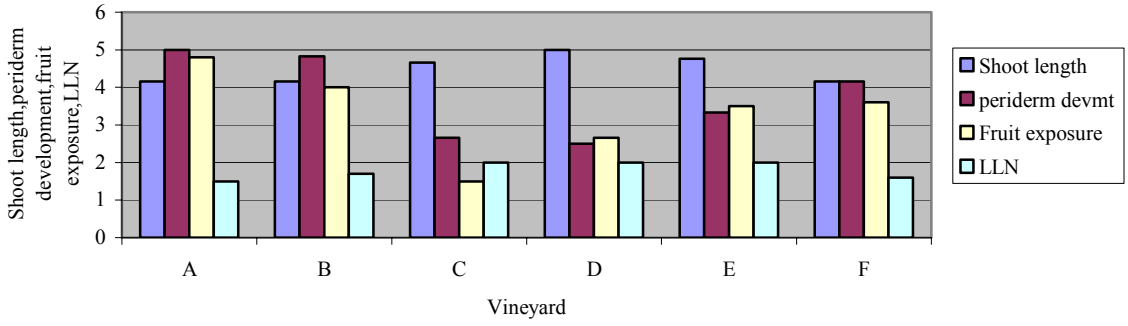
4.1 The Veraison Canopy Characteristics

This assessment focused upon the canopy characteristics of **shoot length**, **lateral growth**, **shoot maturation** (periderm development), **physical leaf condition**, **fruit exposure** and **leaf layer number** (LLN). This data highlighted some differences between vineyards at this time.

- **Shoot length** was greater than 120 cm (grade of 4 on the graph) in all vineyards, greatest in C, D and E. Vineyard D had very few shoots per vine (old vines reworked in 04/05), and C was the machine pruned vineyard.
- **Shoot maturation (periderm development)** at veraison was already advanced in vineyards A, B and F – less so in C, D and E.
- **Fruit exposure** was similarly greatest in A, B and F, significantly less in C and D (less than 50%).
- **LLN** was 2 or more in vineyards C, D and E.

Vineyards D and E had been reworked recently and the canopies were nonpositioned, so rolling had occurred resulting in two distinct subcanopies, one exposed, one shaded. This feature was not captured by the assessment numbers.

Figure 4.1 Veraison canopy characteristics of the six vineyards for the 2005/06 season



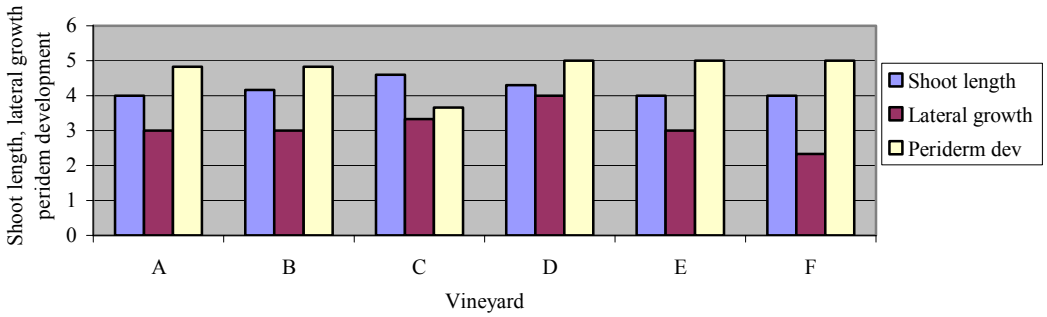
4.2 Harvest Canopy Characteristics

Shoot length, lateral growth and **periderm development** (lignification) give an indication of vine vigour and shoot maturation stage.

Shoot length averages of 120 - 160cm are graded as 4, (see graph); in 05/06 all vineyards had shoot lengths of at least this length. There was less difference between vineyards in these characteristics at harvest, compared with the assessment at veraison. There was some variation in shoot length in vineyards B, C, E and F, which was not picked up with this averaging, and may be the reason for the shoot length at harvest being assessed in some cases as less than that post veraison.

There was little difference in the average shoot length with Vineyard C being the greatest and A, E and F (machine pruned) the shortest. In vineyard B one of the three sites was significantly more vigorous, so this skewed its result.

Figure 4.2.1: Shoot length, lateral growth and periderm development assessed in the vineyard at harvest in the 2005/06 growing season



Considering **lateral growth** in conjunction with shoot length gives a better idea of vine vigour. Lateral growth was greatest in vineyard D, which had been reworked, and had a lower number of shoots per vine. Vineyard C had more laterals than the other four vineyards which together with the greatest shoot length, points to greater overall vigour.

Periderm development (shoot lignification) was less in vineyard C, and relatively advanced on other vineyards indicating a generally good level of cane maturation in those five vineyards at the time of berry maturity.

Shoot length, lateral shoot growth and shoot maturation were generally greater in the 2005 /06 season than in the previous season.

4.2.1 Vine Leaf Condition

The vineyards showed varying degrees of leaf loss at harvest, with vineyard A showing the greatest loss (73% left) compared with B, C, and D having a maximum of 5% less (see Appendix 4). Vineyard E and F had 85 and 83% respectively remaining. The vines with the greatest leaf loss also had riper fruit, with higher Baume levels.

There were no growing tips evident on any of the vineyards at harvest.

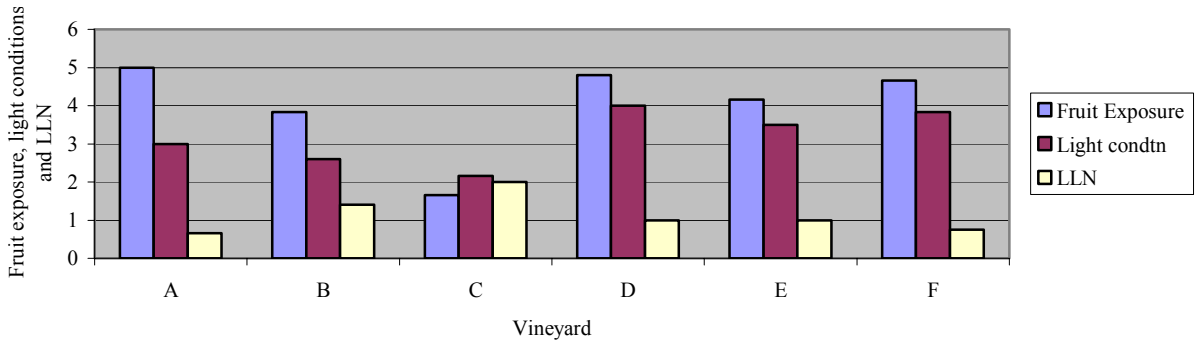
4.2.2 Fruit Environment within the Canopy

Fruit exposure, Leaf layer numbers and **Light conditions**, gave an idea of the light environment created by the canopy and experienced by the fruit at each vineyard.

A very shaded canopy developed in vineyard C, with fruit exposure of less that 40% (2 on the graded score) and LLN of 2 or more. The other vineyards had fruit exposure of 80% or more, (4 on the graded scale), except vineyard B, which was influenced by one site on the block being more vigorous than the other two sites. Similarly, LLN of vineyards A, D, E and F was one, or fewer.

This year, light condition was assessed as being low for shaded conditions, high for direct light and moderate for dappled light, the most favourable. As seen on the graph, vineyard A had a moderate level, C low (shaded) and D most direct. Vineyard E almost had two distinct fruit zones due to rolling of the canopy as it had been reworked, (top cordon removed). It had no foliage wire, so one side of the canopy was exposed and the other more shaded.

Fig 4.2.2 Fruit exposure,light conditions and leaf layer number within the canopy at harvest in the 2005/06 growing season

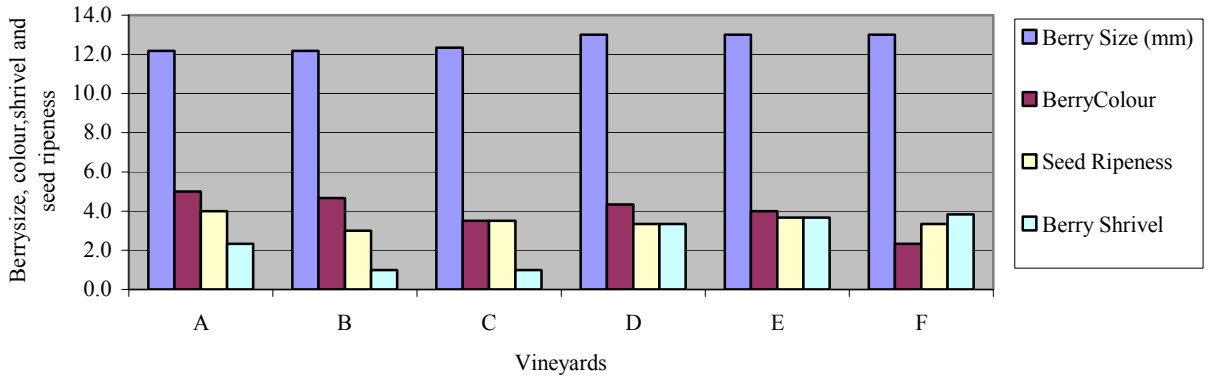


4.3 Fruit Characteristics (Vineyard Assessment)

The fruit was assessed in the vineyard, selected randomly from the 40 vines at each site in the vineyards.

4.3.1 Berry size, colour and seed ripeness and berry shrivel

Figure 4.3.1 Berry colour, berry shrivel, seed ripeness and berry size assessed in the vineyard at harvest 2006



This season, **berry size** in all vineyards was over 12mm, with vineyards D, E and F being greater than 13. This could not be verified by the data of the weighed samples this year as it was lost. The two vineyards with the lowest assessed berry size this year, were also the lowest last year.

Berry colour was highest in vineyards, A, B, D, and E, with F and C the lowest, a similar ranking to 04/05.

Seed ripeness was most advanced in vineyard A (all 3 sites 100% brown) and lowest in B.

Berry shrivel was least in B and C (about 10% shrivel), and most developed in D, E and F (more than 50% shrivel).

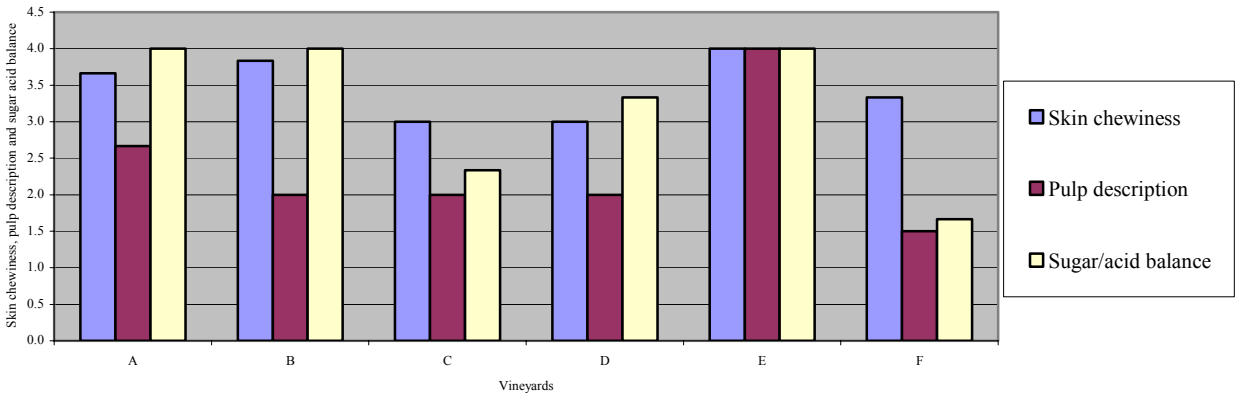
4.3.2 Pulp description and sugar / acid balance

In 05/06, as in 04/05, the fruit from all vineyards had medium **skin chewiness**, with vineyard E having the highest scoring in both vineyards.

Vineyard E fruit also stood out with a **pulp description** of dry; others were assessed as moderately firm and vineyard F tended to be watery.

Sugar / acid balance was generally assessed as balanced or moderately balanced. Vineyard C was assessed as low acid (lowered by the one very vigorous site), whilst vineyard F had the lowest acid.

Figure 4.3.2.Skin chewiness, pulp description and sugar acid balance assessed in the vineyard at harvest 2006



4.3.3 Flavour Intensity & Description

The flavour intensity was assessed in the field; five possible levels were given a numerical equivalent, i.e. very intense level of 5 down to intense, medium, low and very low. These were then graphed to give a comparison. (See figure 4.3.3)

In the same order as 04/05, the vineyards E, B and A had the greatest assessed **flavour intensity**, with D next and then C and F vineyards lowest.

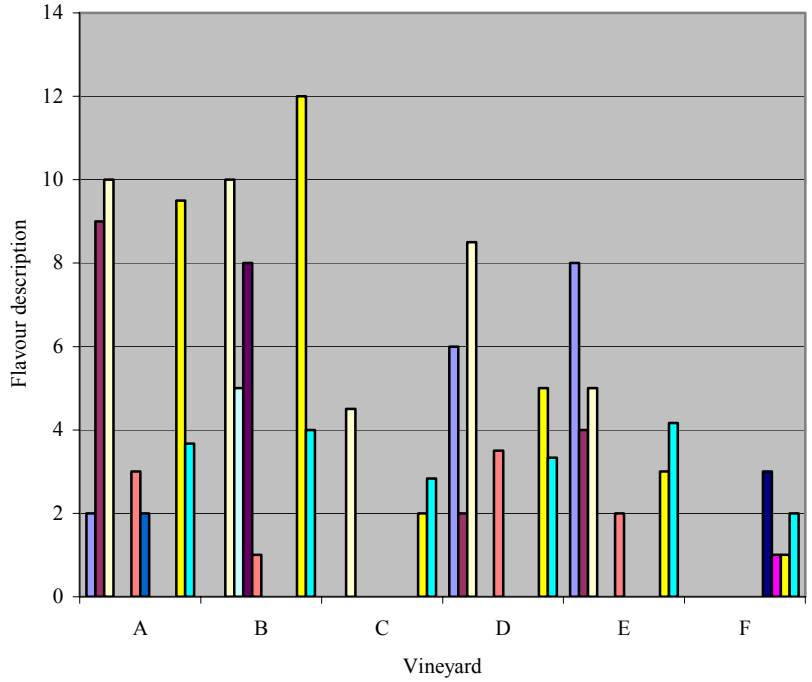
Similarly, four vineyards A, B, D and E had a greater number of flavour descriptors present than the other two vineyards.

This year **flavour length** was also included. Vineyard B and A showed much greater length of flavour, then D and E, with C and F the two lowest.

In the 05/06 general flavour profiles, there were some similarities to the previous season:

- **A** showed chocolate, plums, fruit conserve with some cherry and black pepper – very similar to 04/05, but this year plums were more prominent than chocolate.
- **B** showed mainly plums, blackberry, black pepper and fruit conserve as 04/05, but blackberry being more predominant this year.
- **C** showed primarily plum characters.
- **D** showed mainly plums and raisin (very shrivelled) with some fruit conserve and plum characters.
- **E** showed mainly raisin with some plums, chocolate and fruit conserve. None of the raspberry lolly character found in these two blocks 04/05 was evident, but the raisin was much stronger this year.
- **F** showed raspberry lolly and some herbal leafy characters (last year jammy and plum)

Fig. 4.3.3 Fruit flavour characteristics assessed in the vineyard at harvest 2



4.3.4 Tannin Intensity and Berry Description in the Field

Tannin intensity and berry characteristics were assessed and scored, as zero, low, moderate or high. The vineyards A, B and E were moderate, F low, and C and D were low to moderate. The descriptors are in table 4.3.1, and the vineyards A, B, E and D appear to have a greater and richer tannin profile.

Table 4.3.1. Tannin Intensity and description of berries assessed at harvest 2006

	Tannin intensity	Mouthfeel description
A	5.5	rich, supple, talc, fine
B	5.5	grainy, chalky- chewy, green
C	4	chewy,green
D	4	powdery, fine grainy
E	6	chewy,chunky, slight green
F	3	chewy

4.4 Fruit Characteristics (Analytical Assessment)

4.4.1 Target baume samples

Berry samples were to be taken at a set 'target' baume of 13.5° +/-.5° and the actual range was 12.0° - 13.2° baume. pH varied from 3.45 - 3.75, and total acidity from 4.16 - 4.93.

The anthocyanin levels ranged from 1.65 - 2.24 mg/g , but were generally lower than those of the previous vintage. The highest in 05/06, vineyard A, at 2.24mg/g was also the highest in 04/05. The other vineyards were grouped, B and E just slightly higher (about 1.8 mg/g) than C, D and F at around 1.7 mg/g. Vineyard A did not have higher baume associated with the higher colour, although there appears to be a trend with the other five vineyards in this case.

Phenolic levels generally appear to follow anthocyanin levels, except F, where the phenolics level does not follow the trend line.

Figure 4.4 1 Berry Analysis at 'set' Baume (13.5+/-0.5) in harvest 2006 showing baume, pH, TA, anthocyanins and phenolics.

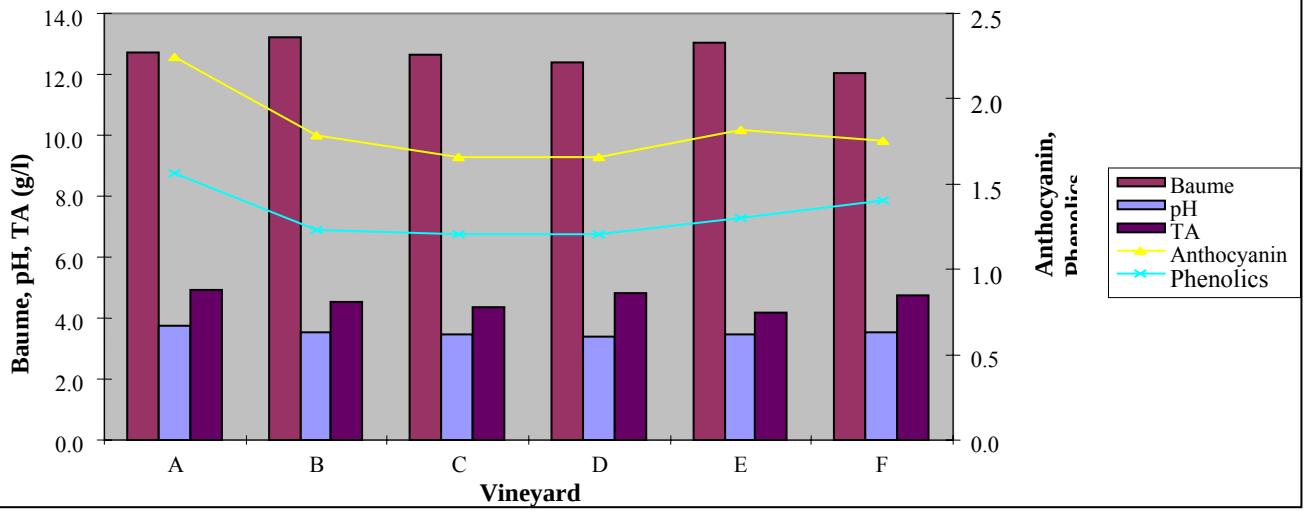
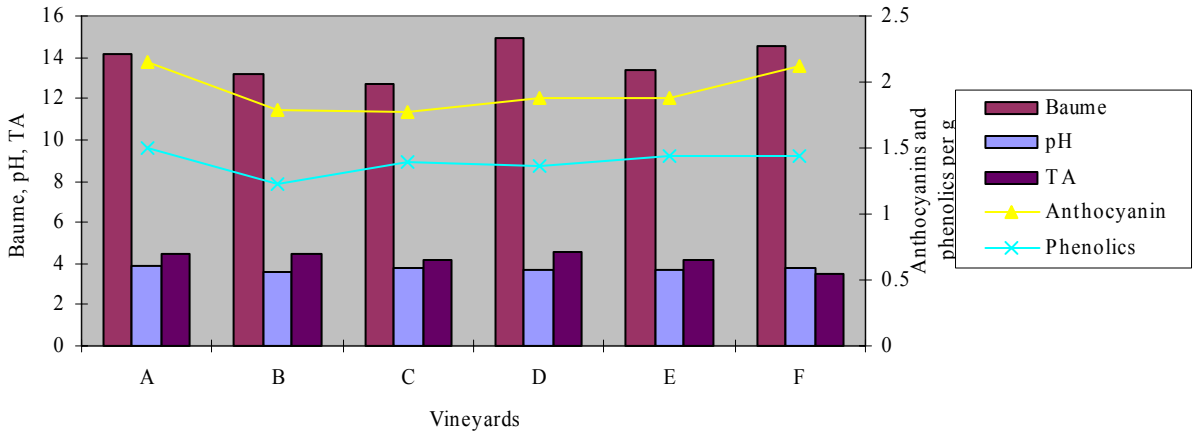


Figure 4.4.2 Berry analysis at harvest 2006 showing baume, pH TA, anthocyanins and phenolics



In the harvest sample, once again anthocyanin levels were lower than 04/05 results, with the highest vineyards in 04/05 being A and B, on 2.42 and 2.41 mg/g. In 05/06 vineyards A and F at 14.16 Baume and 14.5 Baume had the highest anthocyanin levels (2.15 and 2.12 mg/g) with vineyards D and E both a little lower (1.88 mg/g), although D was riper then E (14.9 Be compared with 13.4 Be).

In 05/06, vineyards B and C had both the lowest anthocyanin and Baume levels, which for C was consistent with its position in 04/05, although B in 04/05 had one of the higher anthocyanin levels.

These measured results are also slightly at odds with the values assessed in the field, (see Figure 4.3.1) where vineyards A, B, D and E were assessed as higher in colour then F and C. This may be due to the effect of one very vigorous site in B skewing the results.

4.5 Wine Assessment

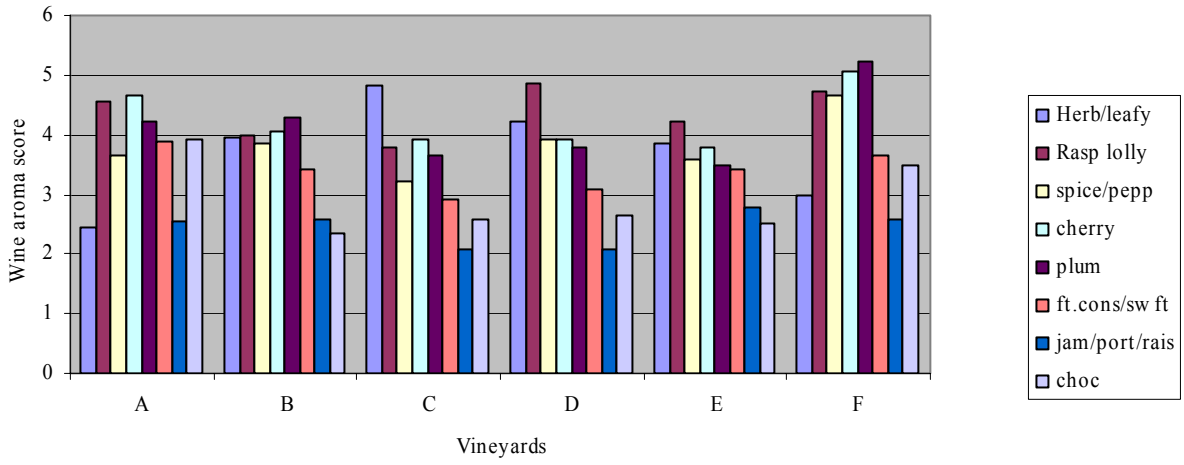
The wine assessment of the six non replicated wines was a randomised tasting in triplicate by an experienced sensory panel from the McLaren Vale region (see Acknowledgements). The scoresheet used was a slightly altered version of that used in the 04/05 season (see Appendix 7).

The wines had undergone primary fermentation and only one (wine B) had completed malolactic fermentation. The bottle wine analyses are shown in table 7.2 in Appendix 7, showing some variation in malic acid. Alcohol levels were all relatively high - from 15.5% v/v (wine B) to 16.4% v/v (wine E), and Titratable Acidity after acid adjustments, TA, ranged from 6.9g/l to 7.9g/l. Among the panel of tasters there was a small variation between tasters but good repeatability between flights. The tasting scored the wines from 0-10 (low to high) and addressed three areas –

- wine aroma characteristics that looked at those specific aromas also addressed in the vineyard fruit assessment.
- palate characteristics
- quality, or ranking, of the wines

The results of the wine aroma characteristics are shown in Fig.4.5.1. It is useful to briefly consider these in relation to the flavour profiles of the vineyard (see Fig 4.3.3) All wines showed a more complex array of aromas than were picked up in the vineyard. The herbal leafy characteristic was prominent in wine C, as it was in the vineyard assessment. Wine F showed up as much more complex than the vineyard fruit assessment with the highest plum and cherry component of all wines. The jammy/port/ raisin component of the fruit obvious in the vineyard assessment of D and E primarily as a raisin characteristic, showed up as prominent in wines from all vineyards, possibly due to the very ripe fruit characteristics.

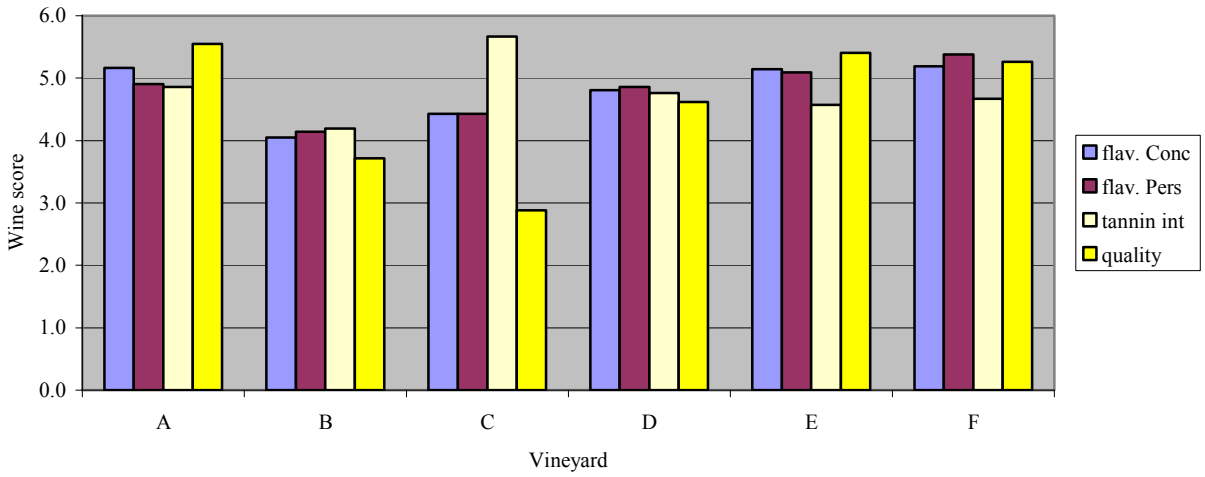
Fig 4.5.1 Wine aroma characteristics judged by the wine sensory panel for the 2006 season



The wine palate characteristics are shown in Fig.4.5.2. The flavour concentration and persistence were slightly greater in the four wines F, A, E, and D in that order, with C and B slightly lower. Wine C had the highest tannin intensity.

For the quality ranking, the wines A, E and F scored closely and, in that order, as the most preferred wines – and wine C was least preferred. On an individual breakdown, wine A was most preferred in six instances, wine E in four and wine F most preferred in three instances.
There was bitterness on the palate of wine C that may have affected the ability to pick up other positive attributes.

Fig 4.5.2.Wine palate characteristics as judged by the sensory panel for the 2006 season



5.0 CONCLUSIONS

As in the 04/05 growing season, results from the vineyard assessment section of this Project in 05/06 indicate some differences between the six Shiraz vineyards, although fewer than last season. The canopy assessment indicates variability in vigour characteristics providing a picture of each vineyard's canopy and fruit exposure. There were some differences in fruit characteristics and, it appeared, some indication of potential quality from this assessment. The most significant characteristics from both seasons are summarised in Table 5.1. The wine assessments appeared to correlate with the vineyard canopy and fruit assessments in some instances, but showed some discrepancies in two of the vineyards

The canopy growth differences at veraison indicated that vineyards A, B and F had lower vigour, and more open canopies. At harvest, the more common time to assess the vineyards, there was not such a clear difference between vineyards. However, vineyard C showed up as the more vigorous via slightly greater shoot length and less lignification than the other vineyards. Shoot lengths were generally greater than 04/05. Differences were less obvious this year, with vineyard F appearing less vigorous than in 04/05, vineyard E more so due to reworking and canopy rolling, vineyard B seemed to be more compromised from the one outlying, more vigorous sample site.

The fruit environment characteristics in 05/06 showed up more differentiation between vineyards than the straight canopy characteristics. Vineyard C had a very shaded canopy with very low fruit exposure of less than 40%, and LLN of greater than 2. Other vineyards had more open canopies with fruit exposure of 80 – 100%, and LLN of 1 or less, (B slightly more than 1). Vineyard A appeared to have the most dappled light, with the others experiencing more direct light, C shaded, with D, E and F most open.

For the fruit characteristics, berry size was assessed in all vineyards as greater than 12mm, with D, E and F slightly more (and generally more than last year).
Colour measurement (anthocyanins) in 05/06 was generally lower than 04/05. The vineyard assessments of colour however were higher in 05/06 than 04/05 in four of the vineyards, with F and C again the lowest in colour, and A slightly higher in colour than the other three vineyards. This may indicate the difficulty of accurate vineyard assessment from one year to the next in a relative sense and the usefulness of an analysed sample, although the relativity in any one year is easier to maintain. Berry shrivel was greatest in E and F, with a degree of shrivel in all vineyards, mostly greater than last year. Seed ripeness was highest in A and lowest in B, with little difference between the others.

For fruit mouth feel analysis, vineyard E was the chewiest for the second year, with also the firmest texture and vineyard F was the least chewy with a juicy / watery texture. The sugar / acid balance was assessed as low acid in C and F vineyards, which is the same as in 04/05.

Flavour intensity in 05/06 was assessed as higher than in 04/05, except for vineyard F, with the same relativity between vineyards i.e., greater in vineyard E, B and A, and lowest in F and C. Length of flavour was also included in the assessment this year and vineyards B and A scored significantly higher than the other four vineyards, with C and F the lowest. These scores would seem to indicate a greater quality potential for the fruit in vineyards A and B, and a lower potential quality for vineyards F and C.

Anthocyanin measurements from the analytical samples in 05/06 were not as distinctive as the indications from the vineyard colour assessments, except for vineyard A which was the highest in both the set baume and harvest samples. Vineyard F was actually the second in anthocyanin level for the harvest sample; in the assessment it had the greatest degree of shrivel that may have contributed to that level. Phenolics levels generally followed anthocyanin levels.

Table 5.1 A comparison of some of the vineyard canopy and fruit characteristics from the six vineyards over the two seasons, 04/05 and 05/06.

Assessed Characteristic	*Vineyard*											
	A		*B*		*C*		*D*		*E*		*F*	
	04/05	**05/06**	**04/05**	**05/06**	**04/05**	**05/06**	**04/05**	**05/06**	**04/05**	**05/06**	**04/05**	**05/06**
Shoot length	4.2	4	3	4.2	2.8	4.6	4	4.3	3	4	4.8	4
Lateral Growth	2.3	3	2.3	3	2	3.3	2.7	4	2.7	3	4	2.3
Periderm development	5	4.8	4.3	3.7	3	5	4.5	5	5	5	5	4.3
Fruit exposure	4.7	5	4.3	3.8	3.3	1.7	4.3	4.8	5	4.2	3.7	4.7
Leaf Layer number	1.16	0.66	1.33	1.41	1.5	2	1.3	1	1	1	1.3	0.75
Berry size	11.3	12.2	11	12.2	12.7	12.3	13	13	12	13	13	13
Seed Ripeness	3.7	4	3.7	3	2.4	3.5	3.5	3.3	3.5	3.7	4	3.3
Flavour intensity	3.3	3.7	3.7	4	1.7	2.8	2.8	3.3	3.8	4.2	2.7	2
colour -assessed	3.7	5	4	4.7	3	3.5	3.3	4.3	4	4	3	2.3
Anthocyanin(mg/g)	2.42	2.15	2.41	1.79	1.96	1.78	2.27	1.88	2.55	1.88	2.16	2.12
Harvest Baume	14.6	14.16	14.8	13.2	13.5	12.72	14.7	14.9	15.6	13.4	13.9	14.5
Yield t/ha	6.2	5.75	10.2	9.88	15	12.35	8.3	5.32	8.4	6.74	8.6	12.1

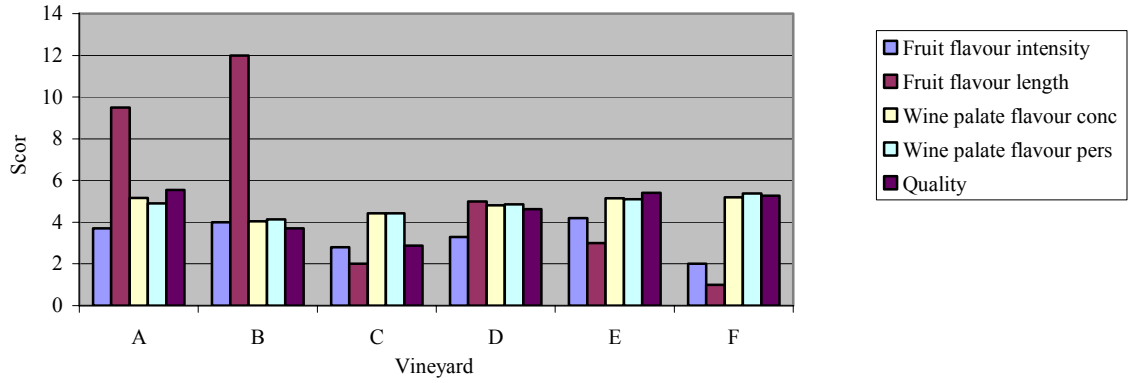
Results from the initial year of the project indicated that there were a number of canopy measurements that could be potential fruit and hence wine quality indicators, and thus a useful tool for growers in their vineyard assessments. These were periderm development, fruit exposure / leaf layer number and maybe light conditions. Results from the 05/06 season confirm this. Vineyard C in 05/06 has lowest periderm development, highest LLN, (indicating a denser canopy) and then the lowest intensity and length of berry flavour. The resultant wine had the lowest score for quality, with a predominance of a herbal leafy characteristic, that would seem to follow the canopy and fruit indications from the vineyard assessment.

Consideration of berry characteristics indicated that in 05/06, berry size was not as discriminatory as in 04/05, but berry colour assessed in the vineyard appeared to be a reasonable indicator of fruit flavour characteristics in both years. These are relatively objective assessments that can be carried out by growers in their vineyards.

The fruit flavour intensity, length and complexity may often also indicate potential wine quality, which is an assessment that has typically relied on winemakers, but could become more accessible to growers with exposure and experience in this area.

Previous studies (including Rolley, L. 2003) have suggested that a moderately open canopy with healthy leaves is more desirable for quality production than a densely shaded canopy. The final step of the wine assessment for each vineyard provided some ideas on whether there was a correlation between the vineyard canopy and fruit assessments, and then the final wine quality. It appeared to hold in some, but not directly in all instances (see Fig 5.1 and 5.2).

Fig 5.1 A comparison of the intensity and length of fruit flavours assessed in the vineyard and those assessed in the wines in the 2006 season, and the wine quality ranking.

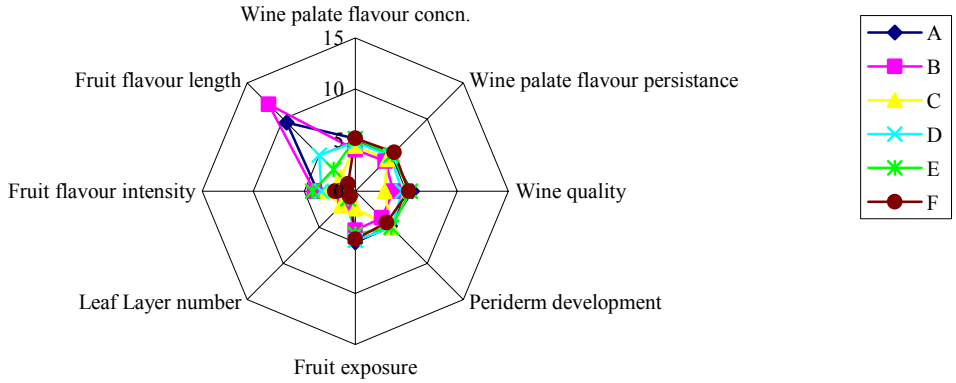


Both vineyard C and F are situated on high potential sites, with deep light textured soils overlying heavier soils. F had more canopy interventions to create a better fruit environment, particularly in 05/06 and was assessed as lower vigour than last year, but these results did not appear to carry through to better berry assessments, with flavour characteristics on the lower side in the group of vineyards, and conflicting colour assessments between the visually assessed and measure values.

However, the wine assessment scored the wine form vineyard F in the top 3 or 4 wines with complex fruit flavours and high flavour concentration and persistence. In this case, the fruit assessment in the vineyard was not an accurate predictor of the potential wine quality, although the canopy characteristics were indicative of a reasonable potential wine quality. The yield in the two vineyards was 12.35t/ha on C and 12.1t/ha on F, the two highest of the six vineyards (see Table 5 1), and in fact almost double the yield of vineyards A, D and E. Yields were slightly lower for the vineyards in 05/06 than in 04/05, except for vineyard F that had a higher yield by approximately 40% This increase in yield coincided with the improvement in canopy, with greater fruit exposure and lower leaf layer number (see table 5.1), that would appear to have helped in the favourable wine result.

The wine from vineyard C, that was least preferred, did appear to correlate with the potential shown by the fruit in the field that was among the lowest in colour and flavour complexity, length and intensity, as shown in Fig 5.2.

Fig. 5.2. Vineyard canopy and friuit characteristics and wine flavour and quality scores



As in 04/05, it appears that the duplex soils of vineyards A and B produced a more moderate vigour vine in 05/06 which may be easier to manage to obtain a moderately open canopy, thereby potentially producing fruit with greater flavour intensity, complexity and colour. The influence of the one vigorous site in B in skewing some assessments highlights the possible advantages of segregating within-vineyard variability for harvest. The yield of vineyard B was the third highest at 9.8t/h, and has been managed with a large spread out canopy (divided) that achieved a very good flavour intensity, length, and complexity of flavour profile in the berry assessment. The wine for vineyard B however, did not appear to correlate with the indications from the canopy and fruit assessment, with a relatively high score in the vineyard, but among the lowest of the wine flavour scores, (see Fig 5.1). Seed ripeness was marginally lower in this vineyard, and the one vigourous site may be contributing to the lower wine score, again highlighting the advantage of minimising variability in the vineyard.

The final wine score for vineyard A was high for flavour and quality and correlated with the vineyard assessment, with an open canopy of moderate vigour, and high fruit flavour, intensity and length.

With the reworking of the vineyards D and E in the previous two seasons, it is difficult to draw a valid conclusion from the canopy assessments or soil effects, as these vineyards were on a different soil type again, loamy with some gravel and ironstone components. Both canopies this year showed some variability, which was not easy to capture with the assessment sheet, nor to then make any prediction of potential fruit quality. Both wines scored will in the assessment, but it is difficult to draw any substantial conclusion form them.

In summary in the 05/06 season, there were correlations shown between vineyard canopy and fruit characteristics and the resulting wine quality, however, the correlation can be affected by vineyard variability and may not always be absolute. This project looked at only a small number of vineyards and the results should be taken as indicative.

Assessment of vineyard canopies and fruit characteristics does appear to have a useful place in the vineyard as possible indicators of wine quality, and for evaluation of changed management practices. The effectiveness of this practice appears to rely on good sampling selection, low vineyard variability and adequate experience of the assessors.

APPENDIX 1

BLOCK DETAILS – MANAGEMENT PRACTICES

SUMMARY OF SOME MANAGEMENT PRACTICES IN THE SIX SHIRAZ VINEYARDS

	A	B	C	D	E	F
Yield 2006 average	5.75t/ha	9.88t/ha	12.35t/ha	5.32t/ha	6.74t/ha	12.1t/ha
Trellis	Single fruiting wire	Spit system, top vine at 1.40m, lower vine at 90cm	2 wire vertical	Single wire	Was a 2 wire split canopy, reworked and top cordon removed in winter 2005	Single wire
Foliage Wires	Single fixed, lazy VSP	1 fixed wire half way between vines –anti-roll	Fixed	Catch wire	None	Pair of movable wires
Pruning	2 bud spur to vigour , 24 buds/m	2 bud spur, 60 buds/vine – 15/ linear m	Machine 45- 50 buds/vine	Reworked 2004/05 Cane pruned	2 bud spur	2 bud spur, average 40 – 45 buds per vine
Canopy management	Light skirting on southern side	Hedged once – mid Dec Bunch thin – veraison, green bunches and then for removal of small no. sunburnt fruit	Shoot trimming once/ season	Crop thinned post veraison	Light crop thinning Light shoot trim	Shoot thin Shoot trim- twice/season Leaf pluck once
Nutrition	Respond to petiole testing, no fertiliser	Fish emulsion – 1l/h, low N,P,K Small amount of foliar Mg.Zn	1 – 2g/vine N twice until flowering. Zn, Mn foliar Soil and petiole analysis	None applied	None applied	None applied
Irrigation	0.525 meg/ha from end Dec	0.73 meg/ha from late Dec	40 – 50 litres/vine/week Gypsum blocks diviner	One irrigation eastern end only	Eastern end – a couple to keep going, Western end – regular, less than last year (less than 626 litres_	Variable shifts, taps, valves for variable blocks. Started in early February. Monitors according to canopy appearance
Spray programme	Cu and S only up to every 10 days. No DMI's No BT	S early, Barrack, Captan. S, Cu, Echo, Avatar, S & Cu later.	Basic programme of Sulphur & Mancozeb every 14 days. Other dependent on monitoring	Cu & S, one DMI	Cu & S, one DMI	Early sprays every 7 days to cover wet period, mainly Copper & Sulphur. One Acrobat early, one Cabria
Soil Management	Basta applied at beginning of season Slashed midrow grasses, side threw to undervine. Undervine weeder & chipping	Slashed growth, applied glyphosate in Sept., & Basta in Nov.	No cultivation, permanent sward	Slashed Permanent sward	Slashed Permanent sward	Permanent Sward rye grass and fescue, slashed & mulched with mulching mower
Age	8yo	8yo	17yo	36yo	11yo	9yo

APPENDIX 2

VERAISON 2006 PHOTOGRAPHS OF THE SIX VINEYARDS

VINEYARD A



View of canopy



View along row

VINEYARD B

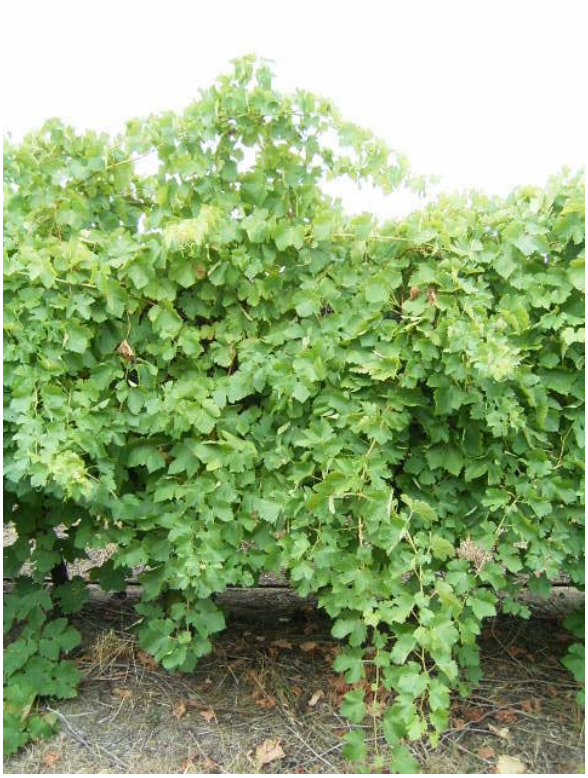


View of canopy



View along row

VINEYARD C

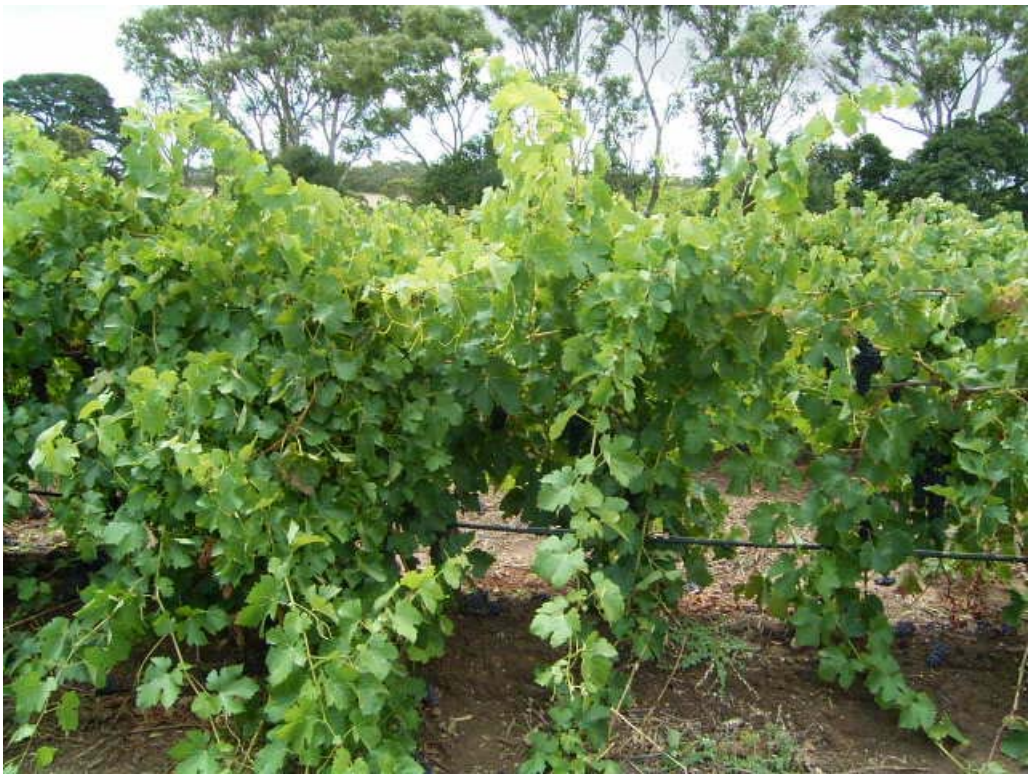


View of Canopy



View along row

VINEYARD D



View of canopy



View along row

VINEYARD E



View of canopy



View along row

VINEYARD F



View of canopy



View along row

APPENDIX 3

VINEYARD ASSESSMENT SHEET

ASSESSOR'S NAME (please print) ..... **Vineyard.....** **Site VH / H / HM / ML / L / VL**

DATE ...../...../..... **Field Grade.....** **CURRENT BAUME ..... pH..... TA.....**

Ave No of Bunches / Vine ..... **SITE END USE: High Quality / Low Quality**

CANOPY CHARACTERISTICS		tick ✓		FRUIT CHARACTERISTICS		tick ✓
Shoot length				***Berry Size (visual)***		
<40cm				very small (mm) < 9		
50-75cm				small 10		
80-110cm				small/ medium 11		
120-160cm				medium / large 12		
>170cm				large > 13		
Shoots trimmed (circle)		yes / no		***Degree of Berry Shrivel***		
Lateral growth (>10cm)		1st 8 nodes	Last 8 nodes	firm (no shrivel) No. 0		
low (=10cm) (No. of laterals) 0-3				flaccid (< 10% shrivel) No. 1		
moderate (>15cm) 5				flaccid with shrivel (10-20%) No.2		
high (> 20cm) 8-10				shriveling (> 20-50%) No. 3		
Shoot periderm development				extensive shrivel (> 50%) No. 4		
fully lignified (80-100%)				***Pulp description***		
extensive (60-80%)				dry		
moderate (40-60%)				firm		
low (20-40%)				moderately firm		
zero - little (<20% of shoot)				juicy / watery		
Small green shoots (>10% present)				***Flavour intensity*** →		
LEAF CONDITION: Estimate % leaves remaining		.....		very intense		
Physical leaf condition (**of majority remaining**)		**tick description**		intense		
green/healthy growing tips present				medium		
green/healthy tips stopped growing				low		
green/healthy leaves lose tugor, backs visible				very low		
green/healthy basal leaf yellow from stress				***Sugar / acid balance***		
green/healthy basal leaf yellow from shading				balanced		
pale green leaves wilting				moderate balance		
yellowing (autumnal senescence)				unbalanced / acidic		
yellowing/ browning due to stress /dying off				unbalanced / low acid (soapy)		
Other leaf symptoms (record) eg: salt, nutrient		.....		***Skin chewiness***		
Fruit exposure				very thick/chewy		
80-100%				chewy		
60-80%				medium		
40-60%				thin		
20-40%				very thin (splits easily)		
<20%						
Light condition at fruit zone : (circle) (full sun) **direct** 1 - 2 - 3 - 4 - 5 (filtered) **dappled**				***Tannin intensity*** →		
Leaf layer number at fruit zone				High		
> 2				Medium		
2				Low		
1.5				None		
1				***Colour in berries***		
0.5				very high (vibrant)		
0				high		
				medium		
				low		
				very low		
				Seed Lignification		

Berry size (mm):

9

10

11

12

13

Flavour description ✓	1	2	3	4	5
jammy / porty/ raison (-)					
chocolate (+)					
plums (+)					
spice - black pepper (+)					
fruit conserve / sweet fruit (+)					
cherry					
spice - white pepper (-)					
raspberry / lolly					
herbal /leafy (-)					
other					
other					

Mouthfeel description	L	M	H
soft, rich, supple			
powdery, talc, fine			
grainy/ chalky			
chewy			
hard /harsh /green /unripe			
other			
other			

Fruit condition	SEVERITY RATING		
assessment	TRACE	MODERATE	HIGH
Botrytis			
Powdery Mildew			
LBAM damage			
Other rots/moulds.....			
.....			
Other insects			
.....			

Notes:

NOTE: If disease present, complete disease assessment report

APPENDIX 4

RESULTS: CANOPY CHARACTERISTICS: VINEYARD ASSESSMENT

4.0 CANOPY CHARACTERISTICS

Table 4.1 Veraison Canopy Characteristics

Vineyard	Shoot length	Periderm Devmt	Fruit exposure	LLN
A	4.16	5	4.8	1.5
B	4.16	4.83	4	1.7
C	4.66	2.66	1.5	2
D	5	2.5	2.66	2
E	4.76	3.33	3.5	2
F	4.16	4.16	3.6	1.6

Scales for descriptors: average of three sites, with scale of 1 – 5 assigned for graphical and relative comparison of descriptors from vineyard assessment sheet.

1. Shoot length: 1-5 represent range of shoot length (cms)
   - 1 < 40cm
   - 4 120 – 160 cm
   - 5 > 170 cm
2. Periderm Development: 1 – 5 represent amount of lignification
   - 1 < 20% lignified
   - 5 fully lignified (80 – 100%)
3. Fruit Exposure: 1 – 5 represents % of fruit exposure
   - 1 < 20%
   - 5 80 – 100%
4. LLN: Leaf layer number, absolute leaf layers from outside of canopy to fruit zone.

Table 4.2: Harvest Shoot Length, Lateral growth and Periderm development

Block	Shoot length	Lateral growth	Periderm dev
A	4	3	4.83
B	4.16	3	4.83
C	4.6	3.33	3.66
D	4.3	4	5
E	4	3	5
F	4	2.33	5

1. Shoot length: 1-5 represent range of shoot length (cms)
   - 1 < 40cm
   - 4 120 – 160 cm
   - 5 > 170 cm

2. Lateral growth – given as an average over the first eight and last eight nodes, so out of a possible six: 2 low, 4 moderate and 6 high.

3. Periderm Development: 1 – 5 represent amount of lignification
   - 2 < 20% lignified
   - 5 fully lignified (80 – 100%)

Table 4.3: Fruit Exposure, Light Condition, LNN, % Leaf Loss

Block	Fruit Exposure	Light Condition	LLN	% leaf loss	% leaves left
A	5	3	0.66	26.67	73.33
B	3.83	2.6	1.41	5.67	94.33
C	1.66	2.16	2	4	96
D	4.8	4	1	2	98
E	4.16	3.5	1	15	85
F	4.66	3.83	0.75	16.67	83.33

Scales for descriptors:

1. Fruit exposure: 5 - 80→100%; 1 - 0%→20%
2. Light Condition: Scale: 1 - Shade; 3 – Dappled; 5 - Full sun
3. Leaf layer number: 0 to greater than 2

APPENDIX 5

RESULTS: FRUIT CHARACTERISTICS: VINEYARD ASSESSMENT

Table 5.1 Berry size, colour and seed ripeness

Vineyard	Berry Size (mm)				Berry Colour (VL,L,M,H,VH)				Seed Ripeness (1-4)			
	Site 1	Site 2	Site 3	Average	A	B	C	Average	A	B	C	Average
A	12	11.5	13	12.2	5	5	5	5.0	4	4	4	4
B	12	11.5	13	12.2	5	5	4	4.7	3	3	3	3
C	12	12	13	12.3	4	3.5	3	3.5	4	3.5	3	3.5
D	13	13	13	13	4	5	4	4.3	3	4	3	3.3
E	13	13	13	13	4	4	4	4.0	4	4	3	3.7
F	13	13	13	13	2	2	3	2.3	4	3	3	3.3

1. Berry size – visual estimation in mm.
2. Berry colour – visual assessment range Very High – Low (5 very high, 1 – very low)
3. Seed ripeness – visual assessment of seed colour; 4 – 100% brown, 3 – 50% brown, 1 – 100% green

Table 5.2 Berry Shrivel, Chewiness

Vineyard	Degree of berry shrivel,0-4				Skin Chewiness 1-5			
	site 1	site2	site 3	Average	site 1	site 2	site 3	Average
A	3	2.5	1.5	2.3	4	4	3	3.7
B	1	1	1	1.0	4	4	3.5	3.8
C	1	2	0	1.0	3	3	3	3.0
D	4	2	4	3.3	3	3	3	3.0
E	4	4	3	3.7	4	4	4	4.0
F	4	4	3.5	3.8	4	3	3	3.3

1. Degree of Berry Shrivel – 0 – firm (no shrivel)
   4 – extensive shrivel (>50%)
2. Skin Chewiness 5 – very thick / chewy
   1 – very thin (splits easily)

Table 5.3 Fruit flavour characteristics assessed in the vineyard at harvest in the 2005/06 growing season: range of 0 - 15

Vineyard	Jammy /porty /raisin	Chocolate	Plums	Spice-Black pepper	Black-berry	Fruit conserve	cherry	Spice-white pepper	raspberry/ lolly	Herbal /leafy	Flavour length	Flavour Intensity
A	2	9	10	0	0	3	2	0	0	0	9.5	3.7
B	0	0	10	5	8	1	0	0	0	0	12	4.0
C	0	0	4.5	0	0	0	0	0	0	0	2	2.8
D	6	2	8.5	0	0	3.5	0	0	0	0	5	3.3
E	8	4	5	0	0	2	0	0	0	0	3	4.2
F	0	0	0	0	0	0	0	0	3	1	1	2.0

APPENDIX 6

RESULTS: FRUIT CHARACTERISTICS: ANALYTICAL ASSESSMENTS

Table 6.1 Berry analysis at 'target' baumé

Block		Baumé	pH	TA	Anthocyanin	Phenolics
A	A	13.17	3.85	4.80	2.22	1.54
	B	12.61	3.82	4.70	2.37	1.66
	C	12.38	3.60	5.30	2.14	1.48
	Ave	12.72	3.76	4.93	2.24	1.56
	stdev	0.40	0.14	0.32	0.12	0.09
B	A	13.61	3.62	3.90	2.06	1.42
	B	13.89	3.62	4.10	2.08	1.32
	C	12.11	3.38	5.60	1.22	0.96
	Ave	13.2	3.54	4.53	1.79	1.23
	stdev	0.96	0.14	0.93	0.49	0.24
C	A	13.22	3.47	4.40	1.71	1.19
	B	12.56	3.33	4.40	1.81	1.34
	C	12.16	3.59	4.30	1.45	1.09
	Ave	12.65	3.46	4.37	1.66	1.21
	stdev	0.54	0.13	0.06	0.19	0.13
D	A	12.61	3.39	5.00	1.74	1.22
	B	12.16	3.5	4.40	1.62	1.23
	C	12.38	3.33	5.10	1.61	1.16
	Ave	12.38	3.41	4.83	1.66	1.20
	stdev	0.23	0.09	0.38	0.07	0.04
E	A	14.4	3.46	4.20	1.85	1.37
	B	12.55	3.42	4.20	1.80	1.24
	C	12.16	3.48	4.10	1.81	1.30
	Ave	13.04	3.45	4.17	1.82	1.30
	stdev	1.20	0.03	0.06	0.03	0.07
F	A	12.5	3.54	4.20	1.84	1.49
	B	11.30	3.50	5.60	1.60	1.31
	C	12.3	3.53	4.4	1.82	1.41
	Ave	12.03	3.52	4.73	1.75	1.40
	stdev	0.64	0.02	0.76	0.13	0.09

Table 6.2 Berry analysis at "harvest"

	Baumé	pH	TA	Anthocyanin	Phenolics
A	14.16	3.88	4.5	2.15	1.50
B	13.20	3.54	4.5	1.79	1.23
C	12.72	3.75	4.2	1.78	1.40
D	14.90	3.72	4.6	1.88	1.36
E	13.40	3.65	4.2	1.88	1.44
	14.50	3.79	3.5	2.12	1.44

APPENDIX 7

RESULTS: WINE ASSESSMENTS

Figure 7.1 Tasting Sheet used in Wine Assessment

McLaren Vale Shiraz benchmarking project 2006 wines

Aroma

	low									high
herbal / leafy	|	|	|	|	|	|	|	|	|	|
raspberry lolly	|	|	|	|	|	|	|	|	|	|
spice / pepper	|	|	|	|	|	|	|	|	|	|
cherry	|	|	|	|	|	|	|	|	|	|
plum	|	|	|	|	|	|	|	|	|	|
fruit conserve / sweet fruit	|	|	|	|	|	|	|	|	|	|
jammy / port / raisin	|	|	|	|	|	|	|	|	|	|
chocolate	|	|	|	|	|	|	|	|	|	|
other	|	|	|	|	|	|	|	|	|	|
other	|	|	|	|	|	|	|	|	|	|

Palate

	low									high
acidity	|	|	|	|	|	|	|	|	|	|
flavour concn	|	|	|	|	|	|	|	|	|	|
flavour persistence	|	|	|	|	|	|	|	|	|	|
tannin intensity	|	|	|	|	|	|	|	|	|	|

Tannin

fine	☐	medium	☐	coarse	☐
mouthcoating	☐	drying	☐		
green	☐	ripe	☐		

Overall quality

	low									high
(as an unfinished wine)	|	|	|	|	|	|	|	|	|	|

Comments

……
……
……

Table 7.1 Analysis of fruit on receival at Provisor..

Vineyard	Be	pH	TA g/lH2T
A	15.2	3.94	4.6
B	14.2	3.70	5.6
C	14.9	3.60	4.0
D	14.5	3.65	4.5
E	15.0	3.65	4.1
F	14.2	3.72	3.6

Table 7.2 Final Analysis of wine after acid adjustment and incomplete malolactic fermentation.

Treatment	pH	T.A. (g/L tartaric)	Total SO_2 (ppm)	% Alcohol v/v	V.A. (g/L acetic)	Glucose + Fructose (g/L)	Malic Acid (g/L)	Number of bottles
A	3.41	7.9	Adjusted to 80	15.9	0.23	0.72	0.91	21
B	3.33	7.1	Adjusted to 80	15.5	0.23	0.65	0.07	20
C	3.42	6.9	Adjusted to 80	16.4	0.22	0.96	0.70	19
D	3.40	6.9	Adjusted to 80	16.1	0.26	0.18	0.54	21
E	3.39	6.9	Adjusted to 80	16.0	0.28	0.34	0.75	21
F	3.44	6.7	Adjusted to 80	15.6	0.23	0.06	0.52	19
					Total number of boxes			12

REFERENCES

Rolley Luke “Vintage 2003 Report”

Wine Grape Quality Measurement and Benchmarking, GWRDC, Southcorp Wine, National Wine and Grape Industy Centre, Lake Marmanl Vineyards, UniSA.

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