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<p>Bud Fertility Assessments, 2004 shiraz and chardonnay, Robinvale and Swan Hill</p>
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*Ross Polglase, July, 2004*

Bud differentiation usually occurs from mid spring to early summer in winegrape varieties. Dissecting buds in winter provides the first indication of yield potential; by that time, buds will either have the potential to produce fruit or not.

### **Procedure**

40 spurs were sampled from each block, each with three clear buds. Some growers left more than three buds per spur. However, this is my usual procedure, allowing me to look at a relatively high number of spurs per block. Using a standard procedure allows blocks to be compared; blocks which show high fertility at buds 1, 2 or 3 will generally show high fertility in buds further along the canes. Blocks with poor fertility at buds 1, 2 and 3 will rarely be highly fertile further out along their canes.

Six chardonnay and six shiraz samples from Swan Hill and four shiraz and three chardonnay samples from Robinvale were dissected, giving a total of 720 shiraz and 720 chardonnay buds from Swan Hill and 480 shiraz and 360 chardonnay buds from Robinvale.

During the course of my dissections I record the number of:

- Primary buds with one bunch
- Primary buds with two bunches
- Primary buds that are alive but infertile (do not contain primordia)
- Buds suffering from Primary Bud Necrosis (PBN)
- Number of bunches contained in fertile secondary or tertiary buds which are dissected only where the primary bud is dead

### **Results**

#### *Explanation of terms used in tables*

*Fertile bud percentage* is the percentage of nodes that contained one or more primordia. This therefore refers to secondary and even tertiary buds as well as primary buds. Samples that have high percentage of buds that are fertile are usually regarded as highly fertile blocks.

*Fertility* is number of primordia divided by the number of nodes dissected. A fertility of 100% means that on average every bud contains one primordia.

*Buds with 2 primordia as % fertile buds* is determined as the number of buds that contain two primordia divided by the number of buds that contain one or more primordia. Blocks that have a high value for this characteristic are usually highly fertile.

*Sec. bud fertility as % of PBN* is determined as the number of primordia in secondary buds divided by the number of buds affected by PBN. Secondary bud fertility varies between varieties. However, samples that are highly fertile usually have higher values for this characteristic than less fertile blocks.

*Infertile bud %* refers to the percentage of primary buds are viable (not suffering from primary bud necrosis) but do not have any primordia.

*PBN %* refers to the percentage of nodes where most of the primary bud is dead. Some primary buds are dead in small areas. These are not described as being affected by PBN. Shiraz generally suffers much high levels of PBN than chardonnay.

## Average values for Swan Hill and Robinvale

The tables show averages for each variety in each district.

### 1. Shiraz in Swan Hill

	<i>Fertile bud %</i>	<i>Fertility %</i>	<i>Buds with 2 primordia as % fertile buds</i>	<i>sec. bud fertility as % of PBN</i>	<i>Infertile bud %</i>	<i>PBN %</i>
Bud 1	68	104	50	41	10	39
Bud 2	71	119	67	18	10	26
Bud 3	71	119	67	16	5	28
<b>Average</b>	<b>70</b>	<b>114</b>	<b>61</b>	<b>25</b>	<b>8</b>	<b>31</b>

#### Comments

Many grape growers have felt that bud fertility would be poor to moderate this winter compared to last season, following generally high fertility in the lead up to the 2004 harvest. However, the shiraz samples in Swan Hill show high fertility for the variety.

There are several contributing factors to this.

- A high percentage of fertile buds contain two primordia
  - A low percentage of buds are viable but infertile
  - Secondary bud fertility is high, especially at bud 1.
  - PBN may look high, but it is not especially high for shiraz
- Buds 2 and 3 have very similar characteristics, which is unusual.

### 2. Chardonnay, Swan Hill

	<i>Fertile bud %</i>	<i>Fertility %</i>	<i>Buds with 2 primordia as % fertile buds</i>	<i>sec. bud fertility as % of PBN</i>	<i>Infertile bud %</i>	<i>PBN</i>
Bud 1	67%	92%	36%	18%	12%	26%
Bud 2	73%	103%	40%	14%	14%	16%
Bud 3	78%	134%	72%	8%	7%	17%
<b>Average</b>	<b>73%</b>	<b>108%</b>	<b>48%</b>	<b>12%</b>	<b>11%</b>	<b>20%</b>

#### Comments

The value for bud fertility is lower than expected. However, there are some interesting trends.

- Fertility increases steadily from bud 1 through to bud 3.
- Bud 3 has a much higher percentage of buds with two primordia than buds 1 and 2.

- (c) Secondary bud fertility is low
- (d) The percentage of buds that are viable but infertile is low
- (e) PBN % is high for chardonnay

### 3. Shiraz, Robinvale

	<i>Fertile bud %</i>	<i>Fertility %</i>	<i>Buds with 2 primordia as % fertile buds</i>	<i>sec. bud fertility as % of PBN</i>	<i>Infertile bud %</i>	<i>PBN %</i>
Bud 1	68%	98%	44%	31%	10%	32%
Bud 2	63%	97%	51%	18%	13%	29%
Bud 3	71%	106%	53%	21%	5%	29%
Average	67%	100%	49%	23%	9%	30%

#### *Comments*

The Robinvale shiraz blocks can be described as being moderate to highly fertile for the variety.

There is little difference in fertility from bud 1 to bud 3.

The average percentage of fertile buds that contain two primordia is moderate rather than high, preventing overall fertility from being very high

Secondary buds are moderately rather than highly fertile

The percentage of buds that are viable but infertile is low

The PBN % is satisfactory for shiraz

### 4. Chardonnay, Robinvale

	<i>Fertile bud %</i>	<i>Fertility %</i>	<i>Buds with 2 primordia as % fertile buds</i>	<i>sec. bud fertility as % of PBN</i>	<i>Infertile bud %</i>	<i>PBN %</i>
Bud 1	76%	116%	54%	10%	10%	12%
Bud 2	78%	134%	69%	0%	7%	15%
Bud 3	79%	141%	78%	14%	3%	20%
Average	78%	130%	67%	8%	7%	17%

#### *Comments*

The Robinvale chardonnay blocks have high fertility.

The percentage of buds that are fertile is relatively constant from bud 1 through to bud 3.

There is a steady increase in fertility from bud 1 through to bud 3, due to the increasing percentage of buds with two primordia from bud 1 through to bud 3.

Secondary bud fertility is low

The percentage of buds that are infertile bud viable is low

The percentage of PBN is low

### **Discussion**

#### *The value of information from bud dissections*

Bud fertility is a major determinant of yield. However, it should be used as the main method for yield determination with great care. Bud dissections do not tell us which buds will burst, how large bunches will be and what weight berries will attain at harvest.

Furthermore, we should consider values from bud dissection to be underestimates of true fertility. Inevitably, some primordia are not seen during dissections. There are several possible explanations for this. Sometimes the “gap” between consecutive scalpel

cuts may be excessive. This is especially possible in samples where the average primordia size is unusually small. This occurred in some of the chardonnay samples from Swan Hill particularly and one shiraz sample from Robinvale. Primordia in secondary buds can be very small, leading to some these being “missed” during the course of dissections.

Pruning systems during winter 2003 and the way in which vines grew in the 2003/4 season affect bud fertility. In general, vineyards that were spur pruned, and which did not produce excessive shoot growth during the 2003/4 season had higher fertility than vines which had much higher bud numbers left at pruning last winter.

Chardonnay and shiraz in Robinvale were sampled from blocks that had been spur, hedge and minimal pruned.

#### *Bud fertility in shiraz*

The shiraz blocks in Swan Hill were more fertile than the blocks in Robinvale. This may reflect the fact the Robinvale blocks had a higher average bud number per vine than the Swan Hill blocks, causing the Robinvale blocks to “self-regulate” by reducing bud fertility. However, the Robinvale blocks still had good fertility, considering the way that most of them had been pruned.

However, the actual bunch numbers will vary from block to block, as will berry number per cluster and berry weight.

#### *Bud fertility in chardonnay*

I suspect that the fertility assessments in chardonnay are considerable underestimates. Furthermore, chardonnay normally produces heavier clusters than shiraz. I would be reluctant to deliberately prune to higher than normal bud numbers on the basis of these chardonnay values.

### **The importance of dissecting secondary buds**

The Swan Hill and Robinvale shiraz blocks had an average of 28% and 29% PBN respectively at bud 3. Yet observations suggest that cutting shiraz to 3 bud spurs will result in at least 90 % of the terminal buds on the spurs. The reason for this is that most nodes will have at least one and often two buds that are viable, lying next to necrotic primary buds.

Primary bud necrosis occurs to some degree in all varieties, though shiraz generally shows higher levels of this disorder than most commonly grown winegrape varieties. The consequences of having what seem to be high levels of PBN, often in the order of 30-45%, can be offset if enough of the attendant secondary and/or tertiary buds are fertile. It is for this reason that when a bud has PBN, I dissect the next largest viable bud of the bud complex, or node. During the course of this project, I identified many secondary buds which had two primordia.

It is common for grapevines to produce two or even three canes from one node. This occurs when more than one of the primary, secondary or tertiary buds burst. Shiraz may produce four or five bunches per node when this happens. The percentage of buds that shoot, and where shoots arise from, cannot be predicted in winter.

Ignoring secondary buds where the primary bud is suffering from necrosis can result in significant underestimates of fertility. The following table shows the difference in fertility where only primary buds are examined

**Difference in fertility of each block where fertility is assessed only on primary buds.**

Block no.	Chardonnay			Shiraz			
	Swan Hill	Block no.	Robinvale	Block no.	Swan Hill	Block no.	Robinvale
2	-2%	2	-3%	1	-3%	1	-6%
4	-8%	5	-1%	3	-22%	3	-8%
5	-3%	6	-1%	6	-21%	4	-9%
7	-2%			8	-7%	7	-6%
9	-1%			11	-11%		
10	-3%			12	-6%		

The differences in fertility are relatively minor in most of the chardonnay blocks. However, two of the shiraz blocks experienced reductions in fertility of 21% and 22% when the fertility of secondary buds was ignored. These blocks had overall fertilities of 148% and 130% when the secondary bud fertility values were included.

**Variability in bud characteristics**

While it is true that some seasons favour higher fertility than others, it is equally true that considerable variability occurs between blocks in any and every given year. The data shows this clearly.

***Shiraz, Swan Hill, Bud 1***

Block	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
<b>Average</b>	<b>68%</b>	<b>104%</b>	<b>50%</b>	<b>41%</b>	<b>10%</b>	<b>39%</b>
Lowest	55%	70%	22%	25%	5%	17%
Highest	85%	133%	77%	79%	17%	50%

***Shiraz, Swan Hill Bud 2***

Block	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
<b>Average</b>	<b>71%</b>	<b>119%</b>	<b>67%</b>	<b>18%</b>	<b>10%</b>	<b>26%</b>
Lowest	58%	85%	36%	0%	3%	15%
Highest	83%	149%	88%	30%	23%	38%

***Shiraz, Swan Hill Bud 3***

Block	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
<b>Average</b>	<b>71%</b>	<b>119%</b>	<b>67%</b>	<b>16%</b>	<b>5%</b>	<b>28%</b>
Lowest	50%	75%	50%	0%	0%	15%
Highest	88%	160%	83%	40%	20%	38%

***Shiraz, Swan Hill, averages***

	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
<b>Averages</b>	<b>70%</b>	<b>114%</b>	<b>61%</b>	<b>25%</b>	<b>8%</b>	<b>30%</b>
Lowest	55%	78%	43%	15%	3%	19%

Highest	84%	148%	75%	42%	17%	42%
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**Comments**

The least fertile block has low to moderate fertility, whereas the most fertile block is highly fertile. As expected, some blocks are highly fertile whereas other blocks have low fertility.

**Chardonnay, Swan Hill, Bud 1**

	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
Averages	66%	90%	36%	19%	14%	25%
Lowest	55%	79%	18%	0%	8%	18%
Highest	75%	113%	50%	45%	26%	35%

**Chardonnay, Swan Hill, Bud 2**

	Fertile bud %	Fertility %	Buds with 2 primordia %	sec. bud fertility as % fertile buds	Infertile bud as % of PBN	PBN %
Averages	74%	106%	42%	12%	12%	16%
Lowest	65%	80%	14%	0%	5%	10%
Highest	80%	128%	65%	33%	18%	23%

**Chardonnay, Swan Hill, Bud 3**

	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
Averages	77%	129%	66%	5%	6%	18%
Lowest	73%	118%	55%	0%	3%	15%
Highest	83%	148%	79%	17%	10%	20%

**Chardonnay, Swan Hill, averages**

	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
<b>Averages</b>	<b>73%</b>	<b>108%</b>	<b>48%</b>	<b>12%</b>	<b>11%</b>	<b>20%</b>
Lowest	66%	86%	29%	4%	5%	17%
Highest	78%	123%	58%	32%	14%	23%

**Comments**

Chardonnay bud characteristics also show considerable variation.

**Variability in shiraz, Robinvale**

Block	Shiraz, Robinvale			Bud 1		
	Fertile bud %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %
Averages	<b>68%</b>	<b>98%</b>	<b>44%</b>	<b>31%</b>	<b>10%</b>	<b>31%</b>
Lowest	61%	85%	38%	22%	5%	23%
Highest	75%	115%	53%	43%	17%	41%

Block	Shiraz, Robinvale			Bud 2		
	Fertile buds %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	PBN %

Averages	<b>63%</b>	<b>97%</b>	<b>51%</b>	<b>18%</b>	<b>13%</b>	<b>29%</b>
Lowest	46%	61%	32%	14%	3%	24%
Highest	74%	110%	63%	20%	34%	35%

Block	Shiraz, Robinvale			Bud 3		PBN
	Fertile buds %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	
Averages	<b>70%</b>	<b>109%</b>	<b>53%</b>	<b>21%</b>	<b>5%</b>	<b>29%</b>
Lowest	56%	80%	43%	7%	0%	13%
Highest	85%	146%	73%	40%	10%	37%

Block	Shiraz, Robinvale			Averages		PBN
	Fertile buds %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	
Averages	<b>67%</b>	<b>101%</b>	<b>49%</b>	<b>23%</b>	<b>9%</b>	<b>30%</b>
Lowest	54%	76%	38%	18%	3%	27%
Highest	74%	116%	56%	30%	20%	33%

Block	Chardonnay Robinvale			Bud 1		PBN
	Fertile buds %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	
Averages	<b>76%</b>	<b>116%</b>	<b>54%</b>	<b>10%</b>	<b>10%</b>	<b>16%</b>
Lowest	68%	100%	46%	0%	5%	10%
Highest	85%	125%	67%	20%	15%	25%

Block	Chardonnay Robinvale			Bud 2		PBN
	Fertile buds %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	
Averages	<b>78%</b>	<b>134%</b>	<b>69%</b>	<b>0%</b>	<b>7%</b>	<b>15%</b>
Lowest	73%	103%	41%	0%	2%	8%
Highest	83%	144%	88%	0%	10%	20%

Block	Chardonnay Robinvale			Bud 3		PBN
	Fertile buds %	Fertility %	Buds with 2 primordia as % fertile buds	sec. bud fertility as % of PBN	Infertile bud %	
Averages	<b>79%</b>	<b>141%</b>	<b>78%</b>	<b>14%</b>	<b>3%</b>	<b>20%</b>
Lowest	73%	123%	72%	0%	2%	17%
Highest	85%	156%	83%	29%	5%	25%

Chardonnay Robinvale Averages

<i>Block</i>	<i>Fertile buds</i> %	<i>Fertility</i> %	<i>Buds with 2 primordia</i> as % fertile buds	<i>sec. bud fertility</i> as % of PBN	<i>Infertile bud</i> %	<i>PBN</i> %
Averages	<b>78%</b>	<b>130%</b>	<b>67%</b>	<b>8%</b>	<b>7%</b>	<b>17%</b>
Lowest	71%	109%	54%	3%	9%	12%
Highest	84%	141%	78%	16%	10%	23%

**Comments**

Both shiraz and chardonnay blocks in Robinvale show considerable variation.

**Conclusions**

Bud dissections in winter 2004 have shown considerable variation between blocks. Average bud fertilities for both chardonnay and shiraz range from low to high.

On average, bud fertility in shiraz has not “crashed” following the relatively good yields of 2004. However, this information can not be used to predict yields for all blocks in 2005. As ever, there will be some blocks that crop poorly and some blocks that yield heavily during the coming season.