American Vineyard Foundation
California Competitive Grant Program for Viticulture and Enology

Final Report
March 2002

Project Title: **Evaluation of Winegrape Clones**

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Summary:
This project evaluates 20 Pinot noir and 13 Chardonnay clones for their viticultural and enological attributes in production of base wines for sparkling wine production and five Merlot clones for their viticultural and enological attributes for production of red wine. Replicated plots of Pinot noir and Chardonnay clones have been established at Gloria Ferrer in Sonoma and of Merlot at the Department's Oakville Experimental Vineyard.

Chardonnay mean harvest °Brix was 21.1 in 2001. Yield in 2001 was consistent with the four-year averages. Clone 4 and the Wente clone had the highest and lowest yields respectively. The yield range was approximately 2x for the four-year data and in 2001. The Wente clone has had the lowest yield in each year of the trial and in both 2001 and the four-year data the Wente clone stands out as for its extremely low yield. The four-year mean data show differences in yield were driven by cluster weight through both berries per cluster and berry weight. Clone 4 had heavier clusters due to significantly more berries per cluster. The Wente clone had both the fewest berries per cluster and the lightest clusters. Interestingly, the clone 4 clusters were large enough to make up for the fact that it had the fewest number of clusters in 2001 and in the four-year data.

In Pinot noir, as with the Chardonnay clones, harvest was determined on a Brix basis. Yield ranged from 5.3 (clone 13) to 8.7 (clone 13) kg vine^{-1} for the three-year data. The data showed significant differences for all yield parameters. While no one yield parameter (Fig. 5) can be shown to be the driving force of yield differences, cluster number is the best correlated. Clusters per shoot on the other hand varied by clone from 1.5 to 2.2 and did have a significant correlation to yield ($r = 0.59$). Cluster berry number was also positively and significantly correlated to yield.

As in preceding years, Merlot clone FPMS 8 had the lowest yield (6.3 tons/acre) in the 2000 growing season compared to the other clones (9.2 to 10.3 tons/acre). The primary contributing yield component was berries per cluster (103 for clone FPMS 8 versus 151 to 164 for clones 1, 3, 6, 9) this was also consistent with past data. In 2000 clone FPMS 8 produced the smallest berries and second lowest number of clusters per shoot. Averaged over six years, clone FPMS 8 has produced approximately two thirds the yield of the other four clones due to smaller

clusters caused by reductions in both number of berries per cluster and berry size.

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Objective of the Proposal:

1. To evaluate 20 Pinot noir and 13 Chardonnay clones (Table 1) for their viticultural and enological attributes in production of base wines for sparkling wine production.

2. To evaluate five Merlot clones their viticultural and enological attributes for production of red wine.

Experiments Underway or Completed to Accomplish Objective(s):

1. Separate replicated plots of Pinot noir and Chardonnay clones have been continued at Gloria Ferrer in Sonoma.
2. A plot of Merlot is underway at the Department's Oakville Experimental Vineyard.

SIGNIFICANT RESULTS AND ACCOMPLISHMENTS TO DATE:

Merlot Results:

Objective 1: Determine crop yield and yield components of five Merlot clones.

Relative to preceding years, crop yields in 2001 were reduced on all clones due to reduced set and smaller berries. The greatest reductions were noticed in the two normally lowest yielding clones, FPMS 8 and 9. Clone FPMS 8 has yielded the least crop in all seven years. In 2001 it produced 3.8 tons/acre compared to 6.4, 6.5, and 6.9 tons per acre for FPMS 1, 3, and 6. Crops on clone FPMS 9, which have fluctuated form year to year, were low in 2001 at 4.8 tons per acre (Table 1). As in previous years, the primary

responsible component was the number of berries per cluster (83 and 97 for clones FPMS 8 and 9 versus 123 to 130 for clones 1, 3, and 6). In 2001 clone FPMS 8 again produced the smallest berries and second lowest bud fruitfulness, i.e. the number of clusters per shoot. Averaged over seven years, clone FPMS 8 produced approximately two thirds the tonnage of the other four clones due to smaller clusters caused by reductions in both number of berries per cluster and berry size (Table 2).

Significant interactions between year and clone were observed for yield and all of its components except the number of shoots retained (an imposed value) and berry weight (Table 2, Figure 1). Relative to the other clones, clone FPMS 8 exhibited substantially reduced bud fruitfulness in 1996 and 2001. Because shoot number was held constant in this experiment, the bud fruitfulness directly correlated with number of clusters per vine.

Seasonal interactions affecting berry set were noted for clone FPMS 9. In three of the seven years studied (1996, 1998, and 2001), clone FPMS 9 produced fewer than average berries per cluster. With little compensation in berry size or clusters per shoot, the reduced number of berries per cluster resulted in smaller than averaged cluster size and total yield.

Over seven years, clones FPMS 1, 3, 6, 8, and 9 have averaged 7.1, 7.4, 7.4, 4.8, and 6.8 tons/acre on a 9ft x 6 ft planting density.

Objective 2. Determine the effect of clone on fruit composition of Merlot grapevines.

Fruit composition varied by clone in 2001 (Table 3). Clone FPMS 8 produced fruit with the highest pH (3.35 compared to 3.24 to 3.28 for the other clones). This trend has been consistent in each of the seven years studied.

Differences in maturation were small, amounting to no more than 0.5 °Brix in any year. In 2001, fruit from FPMS 8 was most delayed in spite of lighter crops. This trend has not been consistent from year to year. Seasonal interactions were observed in which the heaviest yielding clones have been delayed relative to FPMS 8 in large crop years and ahead of FPMS 8 in lightly cropped years. Averaged over the seven years, maturities were 24.3, 24.4, 24.4, 24.4, and 24.7 °Brix for clones FPMS 1, 3, 6, 8, 9 respectively (Table 4).

Juice potassium concentration was not measured in 2001. In each of the preceding six years, however, fruit from FPMS 8 was significantly higher than that of the other clones. It averaged 1870 PPM vs. a range of 1730 to 1760 PPM for the other clones. (Figure 2).

Objective 3. Determine vegetative growth of five Merlot clones .

Pruning weights from the 2001growing season were reduced by 25% for all clones relative to their long term averages (Table 5). Averaged over the seven years 1995-2001, pruning weights were 1.47, 1.62, 1.69, 1.88, and 1.55 kg per vine for clones 1, 3, 6, 8, and 9 respectively (Table 6). The order among the clones has been consistent in each year. Clone FPMS 1 produced the least vegetative growth, followed by FPMS 9, FPMS 3, and then FPMS6. Clone FPMS 8 produced the most prunings in each year.

Differences in the average crop to pruning weight ratios were primarily caused by the low crops of FPMS 8 rather than differences in vegetative growth (Table 6, Figure 3).

Table 1: Components of yield for five Merlot clones. Oakville, CA. 2001.

	Shoots per Vine	Clusters per Shoot	Clusters Per Vine	Berries Per Cluster	Berry Weight (gm)	Cluster Weight (gm)	Crop Yield	
							Kg/ Vine	Ton/Ac
Clone								
FPMS 01	21.8	1.79	39	123	1.35	166	6.4	6.4
FPMS 03	21.7	1.78	38	128	1.34	171	6.5	6.5
FPMS 06	21.7	1.79	39	130	1.38	179	6.9	6.9
FPMS 08	21.9	1.61	35	83	1.29	107	3.7	3.7
FPMS 09	21.8	1.75	38	97	1.32	127	4.8	4.8
Signif. Level	NS	NS	NS	0.0001	0.05	0.0001	0.0001	0.0001

Table 2: Components of yield for five Merlot clones grown at the Oakville Experimental Vineyard, Oakville, CA. Data are the mean of seven years (1995-2001)

	Shoots per Vine	Clusters per Shoot	Clusters Per Vine	Berries Per Cluster	Berry Weight (gm)	Cluster Weight (gm)	Crop Yield	
							Kg/ Vine	Ton/Ac
Clone								
FPMS 01	21.7	1.74	38	135	1.46	197	7.1	7.13
FPMS 03	21.7	1.77	38	137	1.44	199	7.4	7.37
FPMS 06	21.8	1.75	38	135	1.46	199	7.4	7.38
FPMS 08	21.9	1.69	37	97	1.39	136	4.8	4.82
FPMS 09	22.1	1.75	39	127	1.41	180	6.8	6.76
Signif. Levels								
Clone	NS	0.02	NS	0.0001	0.0002	0.0001	0.0001	0.0001
Year*Clone	NS	0.0001	0.0007	0.0004	NS	0.0001	0.0001	0.0001

Table 3: Fruit composition at harvest of five Merlot clones. Oakville Experimental Vineyard, Oakville. CA. 2001.

Clone	Soluble Solids (°Brix)	pH	Titratable Acidity (gm/L)
FPMS 01	24.9	3.27	6.26
FPMS 03	25.0	3.24	6.44
FPMS 06	25.0	3.27	6.42
FPMS 08	24.4	3.35	6.30
FPMS 09	24.7	3.28	6.36
Signif. Level	0.02	0.0004	NS

Table 4: Fruit composition at harvest of five Merlot clones grown at the Oakville Experimental Vineyard, Oakville, CA. Data are the mean of seven years (1995-2001).

Clone	Soluble Solids (°Brix)	pH	Titratable Acidity (gm/L)	Potassium (ppm)
FPMS 01	24.3	3.39	5.9	1730
FPMS 03	24.4	3.39	6.0	1750
FPMS 06	24.4	3.41	6.0	1740
FPMS 08	24.4	3.49	5.8	1870
FPMS 09	24.7	3.42	5.9	1760
Signif. Levels				
Clone	0.005	0.0001	NS	0.0001
Year*Clone	0.0001	0.02	NS	0.006

Table 5: Influence of clone on pruning weight and average weight of dormant canes of Merlot. Oakville Experimental Vineyard, Oakville. CA. 2001.

Clone	Shoots Per Vine	Shoot Weight (gm)	Pruning Weight (kg/vine)	Yield : Pruning Ratio
FPMS 01	21.8	53	1.16	5.82
FPMS 03	21.7	57	1.23	5.49
FPMS 06	21.7	60	1.29	5.60
FPMS 08	21.9	71	1.56	2.47
FPMS 09	21.8	57	1.23	4.15
Signif. Level	NS	0.0002	0.0003	0.0001

Table 6: Influence of clone on pruning weight and average weight of dormant canes of Merlot grown at the Oakville Experimental Vineyard, Oakville, CA. Data are the mean of seven years (1995-2001).

Clone	Shoots Per Vine	Shoot Weight (gm)	Pruning Weight (kg/vine)	Yield : Pruning Ratio
FPMS 01	21.7	69	1.47	5.20
FPMS 03	21.7	75	1.62	5.09
FPMS 06	21.8	79	1.69	4.87
FPMS 08	21.9	87	1.88	2.88
FPMS 09	22.1	71	1.55	4.73
Signif. Levels				
Clone	NS	0.0001	0.0001	0.0001
Year*Clone	NS	NS	NS	0.0001

Figure 1: Seasonal interaction of five Merlot clones for components of yield. Data is presented as percent deviation from the seasonal mean. Clone FPMS 08 exhibited reduced bud fruitfulness in 1996 and 2001. It has consistently set the fewest berries per cluster resulting in the lightest crops. For three of the seven years studied (1996, 1998, and 2001), clone FPMS 09 exhibited reductions in total yield caused by reduced berry set.

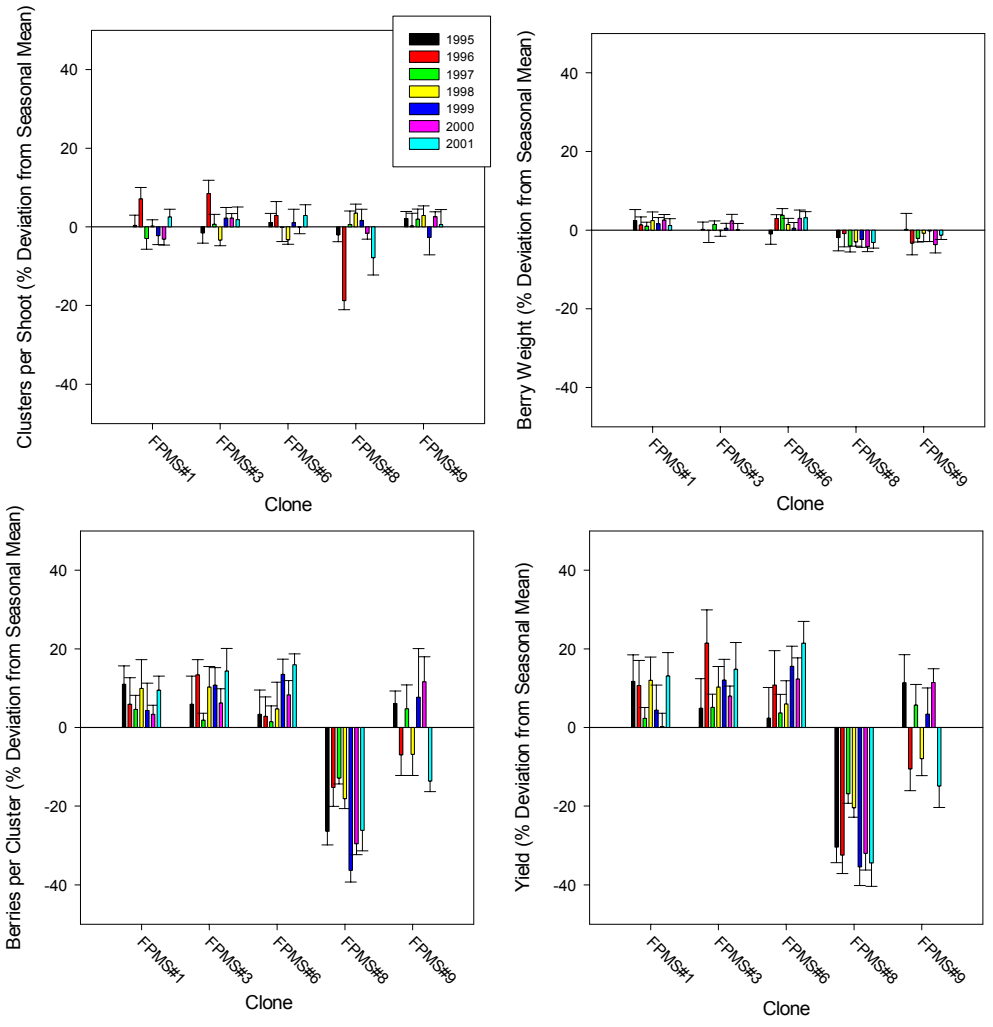


Figure 2: Seasonal interaction of five Merlot clones for fruit composition. In years of heavy crop (1996, 1997, and 2000), maturities for clones FPMS 01, 03, and 06 were delayed relative to that of FPMS 8. Clone 08 has consistently produced fruit with the highest pH and potassium concentration.

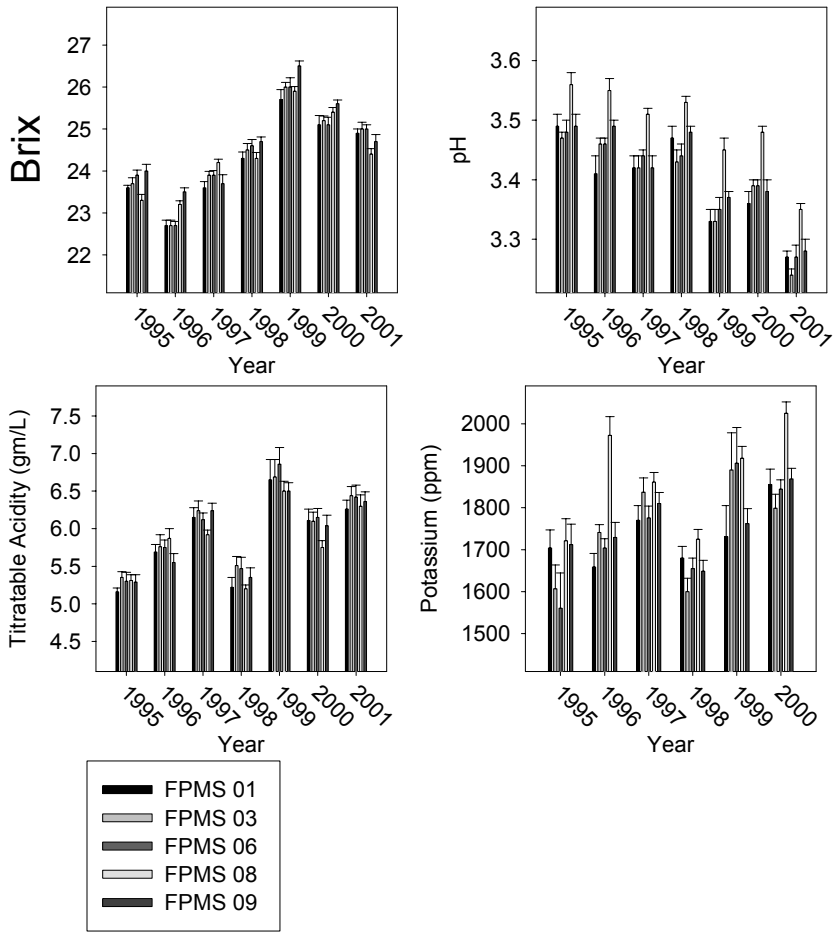
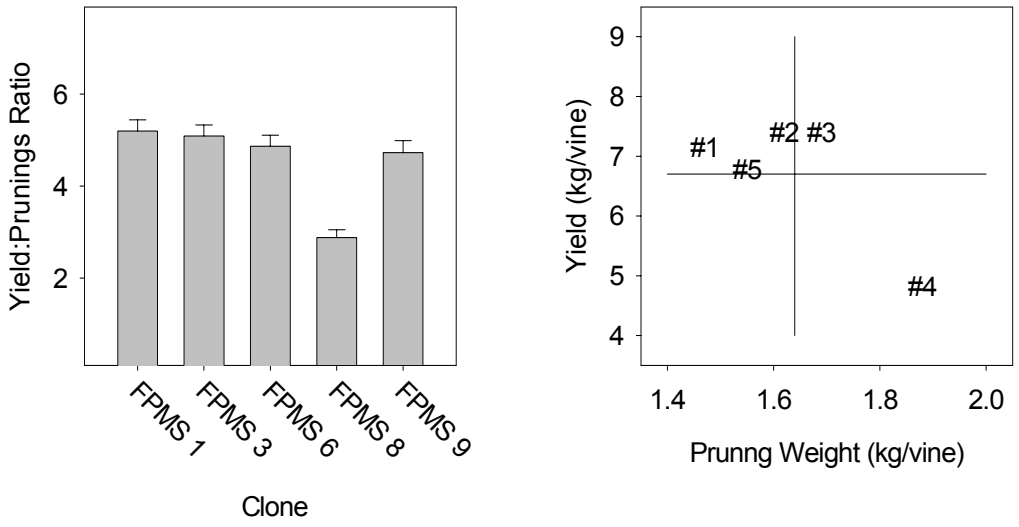


Figure 3: Distribution of average yield and pruning weights for five clones of Merlot. Data is the average of seven years 1995-2001. Differences in yield to pruning weight ratios were primarily due to lower than average crops for FPMS 08.



Significant Results and Accomplishments to Date:

Pinot noir and Chardonnay

Table 1. **Clones of Pinot noir and Chardonnay clones used in this trial:**

Pinot noir clones or selections	Chardonnay clones or selections
Standard Clones	**Standard Clones**
UCD 2A	UCD 4 (Olmo 66)
UCD 4	Wente (formerly UCD 2A)
UCD 13	Esp 352
UCD 17	CTPS 75 Dijon
UCD 22	CTPS 76 Dijon
UCD 31	CTPS 78 Dijon
UCD 32	CTPS 96 Dijon
UCD 33	
	New Champagne Clones
New Champagne Clones	CTPS 118
CTPS 389	CTPS 121
CTPS 521	CTPS 124
CTPS 665	CTPS 130
CTPS 666	CTPS 131
CTPS 668	CTPS 132
CTPS 743	
CTPS 779	
CTPS 780	
CTPS 870	
CTPS 871	
CTPS 872	
CTPS 927	

Chardonnay Clones

Throughput the course of this trial all clones were harvested on a Brix basis with consideration of acid levels. The mean harvest Brix was 21.1 in 2001 and did not vary by more than 0.7 °Brix from the mean with the exception of 352 that was harvested 1.2 °Brix above the mean. This compares with the four-year average (1998 – 2001) that shows a mean harvest Brix of 20.9 and no clone being more than 0.7 °Brix from the mean. This data suggests that overall the clones were successfully harvested at a similar sugar levels. The four-year data shows that clone 4 and the Wente clone were harvested at the highest Brix, 21.2 and 21.5 respectively but that they also had the highest titratable acidity, 1.21 and 1.17 g l^{-1} respectively. This could pose a problem for sparkling producers who would often have to accept higher than optimal Brix levels in order to have acceptably low acidity. Conversely, if this relationship holds true at higher Brix levels clone 4 and the Wente clone may provide an opportunity for still wine producers who may be seeking higher acidity.

The fruit was whole-cluster pressed by Gloria Ferrer, according to their pressing protocol. Juice was settled overnight, racked into 60 L stainless steel containers, shipped to Davis and divided into three replicate lots for fermentation. The triplicate fermentations will be bench tasted and those found to have defects discarded. The remaining lots will be combined and bottled for industry tasting.

Data from the Chardonnay trial are presented as 2001 data as well as four-year averages. In 2001 all clones were harvested within 7 days. The four-year data show all clones harvested within 8 days. In both cases clone 4 was the last clone harvested. The mean data show clone 4 harvested 8 days after the first clone and the penultimate clone harvested 3 days earlier.

Yield in 2001 was consistent with the four-year averages. Clone 4 and the Wente clone had the highest and lowest yields respectively. The yield range was approximately 2x for the four-year data and in 2001. The Wente clone has had the lowest yield in each year of the trial and in both 2001 and the four-year data the Wente clone stands out as for its extremely low yield. The four-year mean data show differences in yield were driven by cluster weight through both berries per cluster and berry weight. Clone 4 had heavier clusters due to significantly more berries per cluster. The Wente clone had both the fewest berries per cluster and the lightest clusters. Interestingly, the clone 4 clusters were large enough to make up for the fact that it had the fewest number of clusters in 2001 and in the four-year data.

For the majority of clones harvest date was correlated to vine yield (Fig. 1). The Wente clone stands out as an exception. The Wente clone with the lowest yield has a much later harvest date than the other clones lead us to predict. These observations hold for both the 2001 and four-year data.

The pruning weight data once again show the Wente clone as the outlier. For both the 2001 and the four-year data the Wente clone has the largest pruning weight. This coupled with its low yield gives the Wente clone the lowest yield : pruning weight ratio (only 2.0 for the four-year data). The four-year data for shoot number show that the vines were pruned to very similar levels. Only 2 shoots per vine (24 to 26) separate the high and the low shoot number.

Figure 1. Relationship of crop load to harvest date.

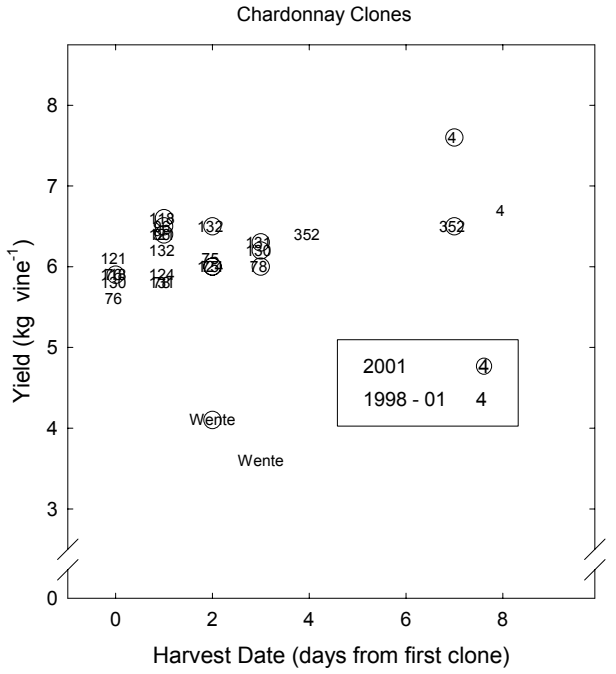
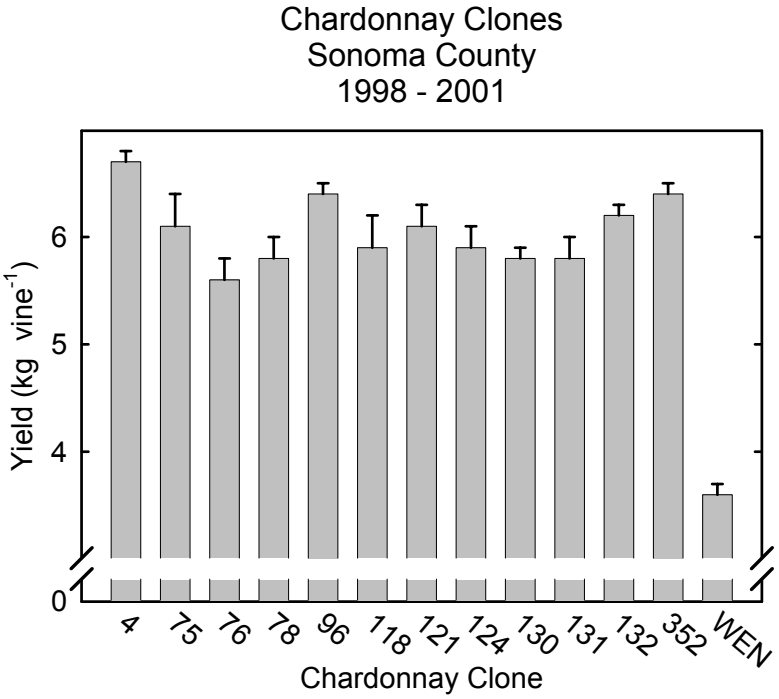


Figure 2. Yield of Chardonnay clones over time.



Sonoma County - Gloria Ferrer Chardonnay - (1998 - 2001)

Chardonnay Clone	Yield ($kg \cdot vine^{-1}$)	Pruning Weight ($kg \cdot vine^{-1}$)	Shoots per Vine	Yield: Pruning Weight	Shoot Weight (g)
4	6.7 ± 0.1	1.5 ± 0.1	24 ± 0	4.9 ± 0.2	63 ± 3
75	6.1 ± 0.3	1.4 ± 0.1	25 ± 0	4.7 ± 0.2	57 ± 5
76	5.6 ± 0.2	1.7 ± 0.1	25 ± 0	3.5 ± 0.3	70 ± 6
78	5.8 ± 0.2	1.8 ± 0.1	26 ± 0	3.3 ± 0.1	72 ± 2
96	6.4 ± 0.1	1.8 ± 0.1	26 ± 0	3.7 ± 0.2	71 ± 4
118	5.9 ± 0.3	1.3 ± 0.1	24 ± 1	5.0 ± 0.3	54 ± 5
121	6.1 ± 0.2	1.5 ± 0.1	25 ± 0	4.2 ± 0.2	62 ± 2
124	5.9 ± 0.2	1.4 ± 0.1	25 ± 0	4.4 ± 0.3	58 ± 4
130	5.8 ± 0.1	1.4 ± 0.1	24 ± 0	4.5 ± 0.3	58 ± 5
131	5.8 ± 0.2	1.5 ± 0.1	25 ± 0	4.2 ± 0.3	60 ± 4
132	6.2 ± 0.1	1.5 ± 0.1	25 ± 0	4.5 ± 0.3	60 ± 5
352	6.4 ± 0.1	1.6 ± 0.1	25 ± 0	4.3 ± 0.3	64 ± 4
Wente	3.6 ± 0.1	1.9 ± 0.1	25 ± 0	2.0 ± 0.2	78 ± 5

Chardonnay Clone	Clusters per Vine	Cluster Weight (g)	Berries per Cluster	Berry Weight (g)
4	40 ± 1	167 ± 3	115 ± 2	1.4 ± 0.0
75	47 ± 1	131 ± 6	96 ± 3	1.4 ± 0.0
76	45 ± 0	125 ± 4	86 ± 3	1.5 ± 0.0
78	48 ± 1	121 ± 2	87 ± 1	1.4 ± 0.0
96	43 ± 1	149 ± 2	100 ± 2	1.5 ± 0.0
118	45 ± 1	132 ± 5	88 ± 2	1.5 ± 0.0
121	45 ± 1	137 ± 3	90 ± 1	1.5 ± 0.0
124	47 ± 1	126 ± 3	88 ± 2	1.4 ± 0.0
130	45 ± 1	128 ± 2	86 ± 1	1.5 ± 0.0
131	44 ± 0	131 ± 4	86 ± 2	1.5 ± 0.0
132	46 ± 1	135 ± 2	90 ± 1	1.5 ± 0.0
352	48 ± 0	131 ± 3	91 ± 2	1.5 ± 0.0
Wente	46 ± 1	77 ± 2	80 ± 2	1.0 ± 0.0

Sonoma County - Gloria Ferrer Chardonnay - (1998 - 2001)

Chardonnay Clone	Harvest Date (days after earliest clone)	°Brix at Harvest Date	TA ($g \cdot l^{-1}$)	pH
4	8	21.2 ± 0.2	1.21 ± 0.01	3.12 ± 0.01
75	2	20.9 ± 0.1	1.07 ± 0.01	3.11 ± 0.01
76	0	20.7 ± 0.1	1.10 ± 0.03	3.13 ± 0.01
78	1	21.0 ± 0.1	1.09 ± 0.02	3.14 ± 0.01
96	1	20.5 ± 0.1	1.07 ± 0.02	3.17 ± 0.00
118	0	20.6 ± 0.1	0.99 ± 0.04	3.14 ± 0.01
121	0	20.5 ± 0.1	1.04 ± 0.01	3.18 ± 0.01
124	1	21.0 ± 0.1	1.05 ± 0.01	3.17 ± 0.01
130	0	20.9 ± 0.1	1.03 ± 0.02	3.18 ± 0.01
131	1	21.0 ± 0.1	1.04 ± 0.02	3.18 ± 0.01
132	1	20.8 ± 0.1	1.00 ± 0.03	3.16 ± 0.01
352	4	21.0 ± 0.1	1.06 ± 0.02	3.14 ± 0.00
Wente	3	21.5 ± 0.2	1.17 ± 0.03	3.18 ± 0.01

Sonoma County - Gloria Ferrer Chardonnay - (2001)

Chardonnay Clone	Yield ($kg \cdot vine^{-1}$)	Pruning Weight ($kg \cdot vine^{-1}$)	Shoots per Vine	Yield: Pruning Weight	Shoot Weight (g)
4	7.6 ± 0.3	1.1 ± 0.1	25 ± 0	7.3 ± 0.8	42 ± 3
75	6.0 ± 0.3	1.1 ± 0.1	26 ± 1	5.4 ± 0.3	44 ± 2
76	5.9 ± 0.2	1.4 ± 0.1	27 ± 0	4.5 ± 0.3	51 ± 5
78	6.0 ± 0.2	1.5 ± 0.0	28 ± 1	4.2 ± 0.2	52 ± 1
96	6.5 ± 0.2	1.4 ± 0.1	26 ± 1	4.7 ± 0.3	55 ± 3
118	6.6 ± 0.4	1.1 ± 0.1	26 ± 0	6.4 ± 0.4	41 ± 4
121	6.4 ± 0.1	1.2 ± 0.1	26 ± 1	5.3 ± 0.2	47 ± 1
124	6.0 ± 0.3	1.1 ± 0.1	26 ± 0	5.3 ± 0.3	44 ± 2
130	6.2 ± 0.2	1.1 ± 0.1	25 ± 1	6.1 ± 0.8	43 ± 5
131	6.3 ± 0.2	1.2 ± 0.1	25 ± 0	5.4 ± 0.3	47 ± 4
132	6.5 ± 0.3	1.2 ± 0.1	26 ± 0	5.4 ± 0.6	49 ± 4
352	6.5 ± 0.1	1.3 ± 0.1	26 ± 1	5.3 ± 0.4	48 ± 3
Wente	4.1 ± 0.3	1.7 ± 0.1	27 ± 1	2.5 ± 0.3	63 ± 3

ChardonnayClone	Clusters per Vine	Cluster Weight (g)	Berries per Cluster	Berry Weight (g)
4	46 ± 1	166 ± 5	112 ± 7	1.5 ± 0.1
75	53 ± 1	114 ± 7	82 ± 4	1.4 ± 0.0
76	51 ± 1	115 ± 2	72 ± 2	1.6 ± 0.0
78	54 ± 0	112 ± 3	72 ± 2	1.6 ± 0.0
96	48 ± 1	137 ± 2	83 ± 2	1.6 ± 0.0
118	51 ± 1	129 ± 4	79 ± 2	1.6 ± 0.0
121	51 ± 1	126 ± 1	76 ± 2	1.7 ± 0.0
124	53 ± 1	113 ± 4	70 ± 2	1.6 ± 0.1
130	49 ± 1	126 ± 2	76 ± 1	1.7 ± 0.0
131	49 ± 1	129 ± 5	77 ± 2	1.7 ± 0.0
132	51 ± 1	128 ± 5	76 ± 2	1.7 ± 0.0
352	53 ± 1	123 ± 2	85 ± 2	1.5 ± 0.0
Wente	51 ± 3	80 ± 3	79 ± 4	1.0 ± 0.0

Sonoma County - Gloria Ferrer Chardonnay - (2001)

Chardonnay Clone	Harvest Date (days after earliest clone)	°Brix at Harvest Date	TA ($g \cdot l^{-1}$)	pH
4	7	21.7 ± 0.3	1.10 ± 0.01	3.16 ± 0.01
75	2	21.0 ± 0.1	0.95 ± 0.02	3.16 ± 0.01
76	0	20.9 ± 0.2	1.07 ± 0.03	3.14 ± 0.01
78	3	21.3 ± 0.1	1.03 ± 0.01	3.20 ± 0.03
96	1	20.6 ± 0.1	0.99 ± 0.02	3.18 ± 0.01
118	1	20.6 ± 0.1	0.99 ± 0.02	3.16 ± 0.02
121	1	20.4 ± 0.1	1.00 ± 0.02	3.21 ± 0.01
124	2	21.2 ± 0.2	0.98 ± 0.02	3.23 ± 0.01
130	3	21.1 ± 0.2	0.96 ± 0.02	3.20 ± 0.01
131	3	20.9 ± 0.1	1.03 ± 0.02	3.19 ± 0.01
132	2	20.6 ± 0.2	0.99 ± 0.01	3.23 ± 0.01
352	7	22.3 ± 0.0	0.96 ± 0.03	3.20 ± 0.01
Wente	2	21.6 ± 0.1	1.05 ± 0.02	3.25 ± 0.02

Pinot noir

As with the Chardonnay clones harvest was determined on a Brix basis with consideration of acid levels. When compared to the past two seasons (1999 and 2000) harvest was compressed in 2001 and was completed in 12 days. The three-year data (1999-2001) shows clone 4 as the latest and clones 389 and 780 last, 15 days later. Mean harvest °Brix for 2001 was 20.4 and the range was from high to low was 1.52.3 °Brix. This was a big improvement over 1999 and 2000 when the range was 2.4 and 2.3 °Brix respectively. Time of ripening was largely determined by crop load (Fig. 4), larger crops extended the time to harvest.

Yield ranged from 5.3 (clone 13) to 8.7 (clone 13) kg vine^{-1} for the three-year data. The data showed significant differences for all yield parameters. While no one yield parameter (Fig. 5) can be shown to be the driving force of yield differences, cluster number is the best correlated. The three-year data show that cluster number ranged from 38 (clone 743) to 61 (clone 927). Cluster number is the result of shoot number and clusters per shoot. Our goal was to prune to an equal number of shots per vine and shoot number varied by only 4 shoots per vine (26 – 30) and had no correlation to yield ($r = 0.02$). Clusters per shoot on the other hand varied by clone from 1.5 to 2.2 and did have a significant correlation to yield ($r = 0.59$). Cluster berry number was also positively and significantly correlated to yield. Of note is clone 743 that had by far the most berries per cluster and the heaviest clusters and also had the fewest clusters per vine.

Pruning weight for the three-year data never exceeded 1.5 kg vine-1 and ranged from 0.6 (clone 780) to 1.4 (clones 521 and 870). For some of the clones these values were rather low given their yield. As a result of the 20 clones in the trial 8 had yield : pruning weight ratios above 10.

Wines were made from the Pinot noir fruit as described for the Chardonnay clones.

Figure 3. Yield of Pinot noir clones 1999 – 2001.

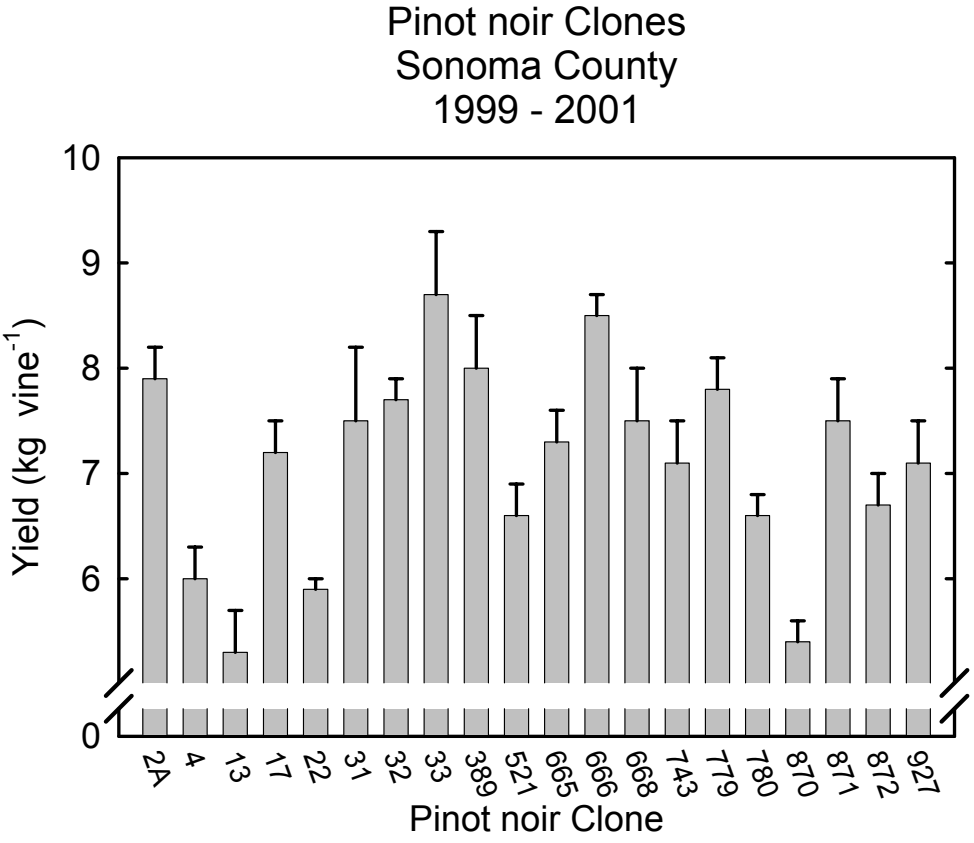


Figure 4. Relationship of crop load to harvest date.

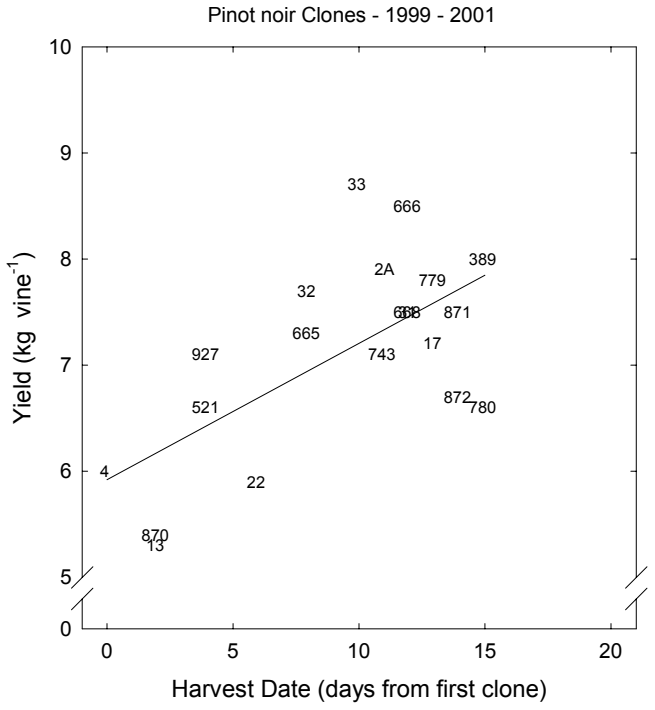


Figure 5. Effect of several yield parameters on total yield.