An Evaluation of 7 Cabernet Sauvignon Clones in Lake County

by

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Summary

Seven clones of Cabernet sauvignon were grafted into an irrigated divided canopy vineyard on the Holdenreid Ranch near Kelseyville, California in 1994. Clones were selected on the basis of their potential to produce high quality fruit suitable for ultra-premium wines produced in the North Coast American Viticultural Area of California. The clones included FPMS clones #2, #4, #5, #6, #8, #10, and #21. Comparisons were made between clones on their growth and performance including budbreak, flowering, veraison, yield, fruit chemistry and pruning weights. Measurements were made for the 1998, 1999, and 2000 vintages. For the three harvests, significant differences were found in the yield of clones, ranging from 14.6 kg/ vine high for Clone # 4, to a low of 8.3 kg/ vine for Clone #6.
Clusters per vine were also significantly different, ranging from a high of 115 clusters for Clone #4, to a low of 97 clusters for Clone #6. Cluster weights also differed significantly, ranging from a high of 130 grams/ cluster to a low of 97.3 grams/ cluster. Yield to pruning weight ratios were also significantly different, ranging from a high of 6.6 to a low of 2.6. Not surprisingly, clones with the lower yields produced riper fruit with better acidity and more favorable pH's. It appears that the clones tested in this trial offer growers different options for yield and quality that can be tailored to specific wine program needs.

Introduction

Lake County is the smallest, youngest and fastest growing subappellation of the famous North Coast AVA of California. The area presents an interesting terroir due to its high elevation (400 meters (1300 feet) +), its soils formed from uplifted marine sandstones, pyroclastic and igneous rocks, and its continental climate. Since 1995, there has been a large increase in vineyard area, to nearly 3000 hectares (7500 acres) today. Cabernet sauvignon is the most important red wine grape cultivar, and it was planted on nearly 810 hectares (2000 acres) by 1999. Most of this fruit is sold to wineries in neighboring North Coast counties, where it is often blended to extend more expensive fruit from prestigious appellations as it is fermented into wine. Growers in Lake County are committed to producing high quality fruit, and wish to build the reputation of the region by planting vineyards that are both profitable and capable of delivering produce that wineries need to make ultra-premium wine. This trial was initiated in 1994 to evaluate the available clonal material reputed to be the best in terms of wine quality and vineyard profitability.

Materials and Methods

Seven clones of Cabernet sauvignon were selected for evaluation from the University of California Foundation Plant Material Service. These clones include the following:

FPMS #	Source	Yield Potential	Quality Potential
02	UC Oakville Field Station	low	very high
04	Mendoza, Argentina	average	medium to high
05	Mendoza, Argentina	medium	medium
06	Jackson, California	low	very high
08	Concannon, California	high	medium
10	Neustad, Germany	high	medium
21	Chile	medium	medium to high

In spring of 1991, 5C rootstock was planted in the Holdenreid Vineyard on Merrit Road in Kelseyville, and budded the following year. A randomized complete block design was used, consisting of 5 replications of 7 vines per plot, for a total of 35 vines per clone. Vines were trained onto a divided canopy trellis system. The vineyard has both an overhead frost protection system, and a drip system for irrigation. Water was applied to the vines so as not to be a limiting yield factor. Standard grower cultural practices were used on all of the vines, and the trial was farmed similarly to the rest of the surrounding vineyard.

In spring, 1998, data gathering began, with observations on bud break, flowering, veraison noted. Sugar testing was done on a weekly basis beginning in late September, and continued until harvest. Plots were harvested when commercial harvest of the surrounding vineyard was made.
100 sample berries were taken from each 7 vine plot and analyzed for % brix, total titratable acidity, and pH. Each vine was harvested by cutting each cluster by hand, counting, collecting and weighing the fruit for individual vines. Data were analyzed by an ANOVA, and mean comparisons made.

RESULTS

There was little difference in budbreak or flowering times of the different clones. Since we only harvested at one time, there were some differences in the degree of ripeness, mostly determined by crop load.

Holdenreid 1998	Phenology					
Clone	Bud Break	Avg Cum Degree-Days	Bloom	Avg Cum Degree-Days	Full Ripen	Avg Cum Degree-Days
Clone 2	4/22-24	111.17	6/26-30	792.43	23-Oct	2941.47
Clone 4	4/22-24	111.17	6/26-30	792.43	23-Oct	2941.47
Clone 5	4/22-24	112.88	6/26-30	792.43	23-Oct	2941.47
Clone 6	4/22-24	111.17	6/28-30	813.38	23-Oct	2941.47
Clone 8	4/22-24	111.17	6/26-30	778.65	23-Oct	2941.47
Clone 10	4/22-24	111.17	6/26-30	792.43	23-Oct	2941.47
Clone 21	4/21-24	108.82	6/26-30	792.43	23-Oct	2941.47

Holdenreid 1999	Phenology					
Clone	Bud Break	Avg Cum Degree-Days	Bloom	Avg Cum Degree-Days	Full Ripen	Avg Cum Degree-Days
Clone 2	4/25-29	128.43	6/13-18	648.688	10/23	2951.37
Clone 4	4/25-28	124.93	6/15-18	668.22	10/23	2951.37
Clone 5	4/25-28	125.40	6/11-18	663.80	10/23	2951.37
Clone 6	4/25-28	127.23	6/13-20	694.99	10/23	2951.37
Clone 8	4/25-28	123.28	6/16-20	712.84	10/23	2951.37
Clone 10	4/23-28	119.59	6/15-20	705.18	10/23	2951.37
Clone 21	4/24-28	117.33	6/16-20	712.84	10/23	2951.37

Holdenreid 2000	Phenology					
Clone	Bud Break	Avg Cum Degree-Days	Bloom	Avg Cum Degree-Days	Full Ripen	Avg Cum Degree-Days
Clone 2	4/20-22	32.05	6/7-11	569.858	10/31	2989.52
Clone 4	4/19-22	33.27	6/9-10	572.862	10/31	2989.52
Clone 5	4/20-22	34.01	6/7-10	567.562	10/31	2989.52
Clone 6	4/21-22	36.93	6/8-10	571.008	10/31	2989.52
Clone 8	4/20-21	29.16	6/7-10	567.562	10/31	2989.52
Clone 10	4/16-22	25.49	6/6-10	565.888	10/31	2989.52
Clone 21	4/17-22	24.83	6/7-10	569.534	10/31	2989.52

Following are the phenological data:

It is interesting to note that the degree days necessary to ripen fruit is surprisingly similar between the three seasons, right around 2960 hours on the average. It is also interesting that the calendar dates for ripening are similar for 1998 and 1999. The 2000 season actually started earlier, and ended later than

the other two seasons.

Yields and Vine Performance

Average Vine Yield in kg/ vine

Clone #	1998	1999	2000	3 year av.
2	7.75 cd	13.77 b	12.25 b	11.26 c
4	11.91 a	15.92 ab	16.0 a	14.61 a
5	9.12 bc	14.74 ab	14.86 a	14.05 a
6	6.13 d	9.06 c	9.29 c	8.28 d
8	9.67 bc	16.67 a	15.22 a	14.05 ab
10	11.07 ab	16.68 a	15.30 a	14.35 ab
21	9.49 bc	16.72 a	15.46 a	13.89 ab

*within columns, means followed by the same letter are not significantly different at the.05% level as tested by Duncan's Multiple Range Test

There are significant differences in yield between the clones, with #6 yielding the least, and #4 yielding the most.

Average Number of Clusters Per Vine

Clone #	1998	1999	2000	3 year average
2	89 a	122 a	115 ab	109 ab
4	95 a	119 a	132 a	115 a
5	93 a	119 a	125 a	112 a
6	85 a	101 a	103 b	97 b
8	80 a	120 a	120 ab	109 ab
10	88 a	113 a	123 a	108 ab

21	86 a	124 a	129 a	113 a

*within columns, means followed by the same letter are not significantly different at the.05% level as tested by Duncan's Multiple Range Test

There is a slight difference in cluster numbers between the clones, with #6 having significantly fewer clusters than the other clones.

Average Cluster Weights in Grams per Cluster

Clone	1998	1999	2000	3 year average
2	86 dc	111 c	105 bc	101 c
4	125 a	134 ab	122 ab	127 a
5	98 bc	123 bc	119 ab	114 ab
6	75 d	89 d	90 c	85 d
8	122 a	137 ab	127 a	128 a
10	123 a	145 a	123 a	130 a
21	108 ab	137 ab	120 ab	121 ab

*within columns, means followed by the same letter are not significantly different at the.05% level as tested by Duncan's Multiple Range Test

There were significant differences between clones in cluster weights between clones, with #6 having the lightest clusters, and # 10 having the heaviest.

Average Yield to Pruning Weight Ratios

Clone #	1998	1999	2000	3 year average
2	2.6 cd		5.0 c	3.8 c
4	4.7 a		7.5 ab	6.1 a
5	3.5 bc		6.5 bc	5.0 b
6	1.8 d		3.0 d	2.6 d
8	4.1 ab		8.1 ab	6.6 a

10	4.6 ab	8.7 a	6.6 a

Holdenreid 1998	Chemistry			
Clone	AVG Berry Weight (g)	Percent Brix	pH	Total Acidity
Clone 2	1.09	23.4	3.558	0.822
Clone 4	1.20	22.4	3.51	0.73
Clone 5	1.04	22.9	3.60	0.75
Clone 6	0.99	23.0	3.52	0.85
Clone 8	1.20	22.9	3.60	0.73
Clone 10	1.15	22.0	3.47	0.74
Clone 21	1.18	23.0	3.53	0.79

Holdenreid 1999	Chemistry			
Clone	AVG Berry Weight (g)	Percent Brix	T A	pH
Clone 2	1.09	23.40	0.82	3.56
Clone 4	1.20	22.36	0.73	3.51
Clone 5	1.04	22.86	0.75	3.60
Clone 6	0.99	23.00	0.85	3.52
Clone 8	1.20	22.90	0.73	3.60
Clone 10	1.15	22.00	0.74	3.47
Clone 21	1.18	23.00	0.79	3.53

21	4.3 ab	8.2 a b	6.2 a

*within columns, means followed by the same letter are not significantly different at the.05% level as tested by Duncan's Multiple Range Test

The ideal yield to pruning weight ratio is considered to be around 5. Numbers higher can indicate overcropping (especially above 7), and numbers below can indicate excessive vegetative growth. Both situations can affect wine quality with off flavors, lack of extraction, high pH, and other problems.

Wine Grape Chemistry

The 2000 Vintage was definitely the ripest of the last three year. In 1998, and 1999, not all of the clones were fully ripe, especially the ones with fairly large crops, such as Clones #8 and #10.

Conclusions

Overall, Cabernet sauvignon has performed well in this vineyard. The clones tested have significant differences in yield, clusters per vine, cluster weights, and yield to pruning weights. The selection of a clone should be based on the growers objective, and the intended quality of the end product. Clones #8, #10, and #21 are high yielders, and would be good choices for medium quality wines where the grower is being paid a moderate price for his fruit. Clones # 2 and #6 are better choices for wine programs in which intense fruit and limited yields are desired for an ultra-premium product.

The lower yielding clones tend to ripen sooner and more dependably in cooler locations, and would be a better choice for a grower in a cool site. This is due to a smaller crop which is easier for the vines to ripen.

Holdenreid 2000	**Chemistry**			
Clone	**AVG Berry Weight (g)**	**Percent Brix**	**pH**	**Total Acidity**
Clone 2	56.96	25.28	3.62	0.63
Clone 4	58.05	24.80	3.65	0.62
Clone 5	55.10	25.32	3.60	0.69
Clone 6	51.22	25.52	3.64	0.69
Clone 8	55.33	25.23	3.63	0.66
Clone 10	55.33	25.23	3.63	0.66
Clone 21	55.01	25.22	3.63	0.66

There is no one single clone that gives the grower every possible best attribute. In the final analysis, it is best to plant a mixture of clones in your vineyard to create diversity and a mixture of vines that are likely to perform well under a wide range of conditions.