Clone Performance Under Different Environmental Conditions in California

James A. Wolpert

Department of Viticulture and Enology

University of California

Davis, CA 95616

Introduction

Clonal evaluation of winegrapes in California has not been extensive. Early selection work by Alley (1977), Olmo (unpublished data) and Goheen (personal communication) resulted in the current collection of virus-tested clones in Foundation Plant Materials Service (FPMS) at the University of California, Davis. However, release of these certified selections was generally not accompanied by publication of viticultural performance or wine sensory attributes. A present day effort to characterize differences among clones of several cultivars has begun (Wolpert et al, 1995), with the objective of determining the viticultural and enological characteristics of winegrape clones. Research to date has centered on certified selections of Cabernet Sauvignon, Chardonnay, Pinot noir (for sparkling wine) and Zinfandel. In this paper, Cabernet Sauvignon and Chardonnay performance will be examined in greater detail.

Cabernet Sauvignon

Cabernet Sauvignon is California's second most important red winegrape cultivar, having increased from 6,700 ha to 20,000 ha in the past 10 years. Many of the selections used by wineries in the At Davis, Alley identified three clones that showed low, moderate and high yields. Those clones showed the same yield relationships in a trial at Oakville (W. M. Kliewer, unpublished data). Data are presented here from three more recent northern California trials from Oakville (Aiken et al, 1995), Howell Mountain (D. Johnson, Beringer Vineyards, personal communication) and the Lodi appellations (Wolpert et al, 1995).

Chardonnay

Only two commercial Chardonnay vineyards are thought to have survived Prohibition. One of these, the Wente Brothers Vineyard in Livermore, was responsible for much of the budwood used for later vineyard expansion in California. Harold Olmo completed his early preliminary experiments in the Martini vineyard based on selections from Wente. Then he took these advanced selections to the Oakville Experimental Vineyard of UC Davis. There he compared the Martini selections to ones imported from France. Olmo (unpublished data) found that the advanced Martini selections included in these trials yielded as much as up to twice as much fruit as the imported selections.

In 1960, California plantings of Chardonnay were estimated at only 70 hectares. Lack of interest in the variety can be attributed, in part, to the fact that available selections were often exceptionally low in yield. By 1998, California had more than 28,500 hectares of Chardonnay, placing it first among all wine cultivars. The dramatic increase in plantings in recent years can be attributed in large measure to improved yields resulting from successful clonal selection.

Materials and Methods

The plant materials utilized in clonal comparisons are listed: Chardonnay (Table 1), Cabernet Sauvignon (Table 2). An abbreviated description of the sites (Table 3) is presented. More detailed

information can be found in published work of Aiken et al, 1995; Wolpert, 1995; Wolpert et al, 1994; Wolpert et al, 1995.

Results

Cabernet Sauvignon (CS)

The three CS clones compared here performed similarly from site to site, however the sites themselves were quite different (Fig. 1). Pruning weight values were low for Cabernet Sauvignon vines at Howell Mountain, about 1 kg/vine, moderate in the Lodi-Woodbridge district trial, ranging from 2 to 3 kg/vine, and high at the Oakville trial, 3 to 5 kg/vine. Location variability is likely due to differences in soil depth, rootstock choice and vine spacing. In all three locations, CS 6 had less yield and responded with greater pruning wts, while CS 8 had the highest yield and lowest pruning weight.

Pruning weight appears to be inversely correlated with yield (Fig. 2A) and this relationship seemed to be strongest at the highest site capacity (Oakville). Yield differences were correlated more with cluster wt (Fig. 2C) than with cluster number (Fig. 2B). Although heavier clusters increase concern about Botrytis bunch rot susceptibility (Vail et al, 1998), there is no such concern in Cabernet Sauvignon, a bunch rot resistant variety. Pruning levels were set at identical numbers of buds/vine. No allowance was made for the heavier pruning wt of CS 6. Application of a balance pruning concept, and retention of more nodes per wt of cane prunings, could possibly have improved the yield of CS 6 and raised its yield:prunings ratio to a value considered more desirable.

Chardonnay (CH)

Yield of clones CH 4, CH 5, CH 6 and CH 14 were higher than that found by Olmo (unpublished data). This is not surprising considering that the Olmo trial was non-irrigated and grafted onto St. George rootstock, which is reported to reduce yield in small-clustered varieties. The relationship of Chardonnay clone yield to pruning wt, cluster number and cluster wt was examined (Fig. 3). Yield was more closely correlated with cluster wt ($r^2 = 0.79$) than cluster number ($r^2 = 0.34$), probably because cluster wt incorporates both berries/cluster and berry wt.

Yield was not correlated with pruning wt, indicating that growth was not significantly affected by crop load in these clones, i.e. over- or under-cropping was not occurring. It further suggests that yield differences were genetic and not cultural, i.e. bud number retained at pruning. Additional study of bud numbers retained versus pruning wt at different vine spacings would be needed in order to clearly establish the relationship of growth and yield components of the various clones.

Future Prospects

The future for clonal evaluation in California is uncertain because of several complicating factors. Firstly, more than 14 varieties contribute significantly to the state's economy (>1000 ha). This is a significant number of varieties under our responsibility. Furthermore, even for fine wine varieties of small acreage (Tempranillo, Malbec, Viognier, Syrah, Nebbiolo), clonal performance is significant issue. In other countries, regions can usually concentrate on the few varieties of importance in a way that focuses their resources for efficiency.

Secondly, fine wine production in California spans 800 km, north to south, across a wide variety of climatic regions, elevations and soil types. For the major varieties (Chardonnay, Cabernet Sauvignon,

Merlot, Zinfandel, Pinot noir), multiple trials would be needed to understand the possible genotype by environment (site) interactions, as has been seen with Pinot noir (A. Ewart, personal communication). And as more clones are continually added to the certified lists, either identified locally or introduced from abroad, new sets of trials must be added.

Literature Cited

Aiken, J. W., A. A. Bell, G. C. Hansen and T. B. Selfridge. 1995. Comparison of fourteen selections of Cabernet Sauvignon. *In:* Proceeding of the International Symposium on Clonal Evaluation, J.M. Rantz (Ed.) pp. 81-83. American Society for Enology and Viticulture, Davis, California.

Alley, C. J. 1977. An update on clone research in California. Wines Vines 58(4):31-32.

Anon. 1999. California Grape Acreage. California Agricultural Statistics Service, Sacramento, CA. 33p.

Bowen, P.A. and W.M. Kliewer. 1990. Influence of clonal variation, pruning severity, and cane structure on yield component development in 'Cabernet Sauvignon' grapevines. J. Amer. Soc. Hort. Sci. 115:530-534.

Vail, M. E., J. A. Wolpert, W. D. Gubler, and R. M. Rademacher. 1998. Effect of Cluster tightness on Botrytis bunch rot in six Chardonnay clones. Plant Disease 82:107-109.

Wolpert, J. A. 1995. Evaluation of winegrape clones in coastal California: Current activities and future prospects. *In:* Proceeding of the International Symposium on Clonal Evaluation, J.M. Rantz (Ed.) pp. 74-80. American Society for Enology and Viticulture, Davis, California.

Wolpert, J. A., A. N. Kasimatis and E. Weber. 1994. Field performance of six Chardonnay clones in the Napa Valley. Amer. J. Enol. Vitic. 45:393-400.

Wolpert, J. A., A. N. Kasimatis and P.S. Verdegaal. 1995. Viticultural performance of seven Cabernet Sauvignon clones in the northern San Joaquin Valley, California. Amer. J. Enol. Vitic. 46:437-441.

Table 1. Clone numbers, sources and heat treatment days for Chardonnay selections, Foundation Plant Materials Service (FPMS), University of California, Davis

FPMS Clone #	Source	Heat treatment (days)
4	Martini 5V21, Olmo #66	90
5	Martini 6V11, Olmo #69	90
6	Martini 3V4, Olmo #68	164
14	Martini 1V20, Olmo #65	111
15	Prosser, WA; LR2V6	173
16	PI 364283, Rutherglen, Australia	60

Table 2. Clone numbers, sources and heat treatment days of Cabernet Sauvignon selections, Foundation Plant Materials Service (FPMS), University of California, Davis.

FPMS Clone #	Source[z]	Heat treatment (days)
2	Oakville 11V1	0
4	PI 296424 Mendoza, Argentina	0
5	PI 296435 Mendoza, Argentina	0
6	Jackson, CA G8V10	0
8	WAK3V15, Concannon 34V2	168
10	PI 258587, Neustadt, W. Germany	148
21	PI 364302, Cachapoal, Chile	141

[z]PI = Plant Introduction number

Table 3. Summary of clonal trial site characteristics .

Cultivar	Location	Climatic Region [z]	Approx. Elevation (m above sea level)	Spacing vine x row (m)	Training/ pruning	Rootstock	Irrigation
Chardonnay	Napa, Napa Valley	II	50	2.4 x 3.0	Head/Cane	AXR#1	Sprinkler and drip
Chardonnay	Yountville, Napa Valley	II	50	2.4 x 3.6	Cordon/Spur	AXR#1	Sprinkler
Cabernet Sauvignon	Oakville, Napa Valley	II-III	70	2.4 x 3.6	Head/Cane	AXR#1	Drip
Cabernet Sauvignon	Howell Mountain, Napa Valley	III+	500	2.0 x 2.4	Cordon/Spur	110R	Drip
Cabernet Sauvignon	Lodi-Woodbridge	IV	30	2.1 x 3.3	Cordon/Spur	Harmony	Furrow <1990 Drip > 1990

[z] Based on Winkler et al (6)

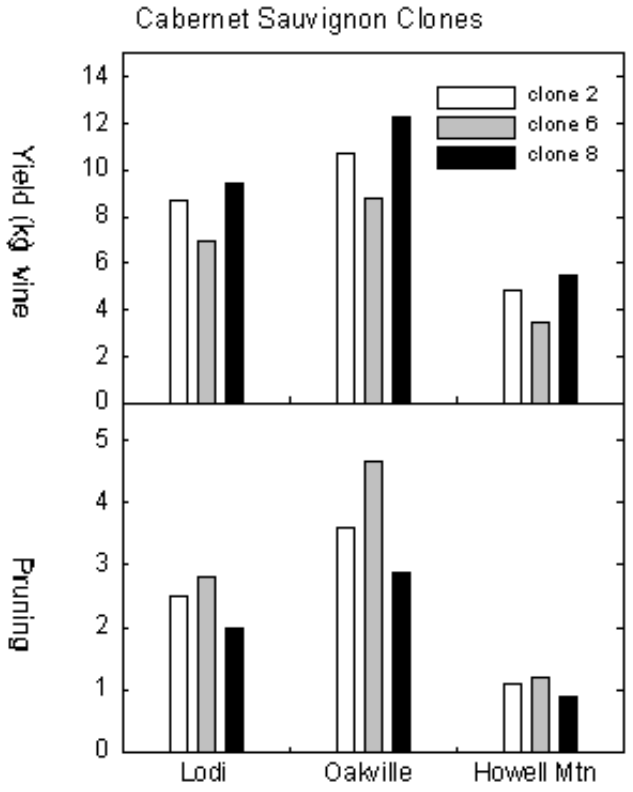

Figure 1. Yield and pruning wt of three Cabernet Sauvignon clones from Foundation Plant Materials Service: 2, 6, and 8.

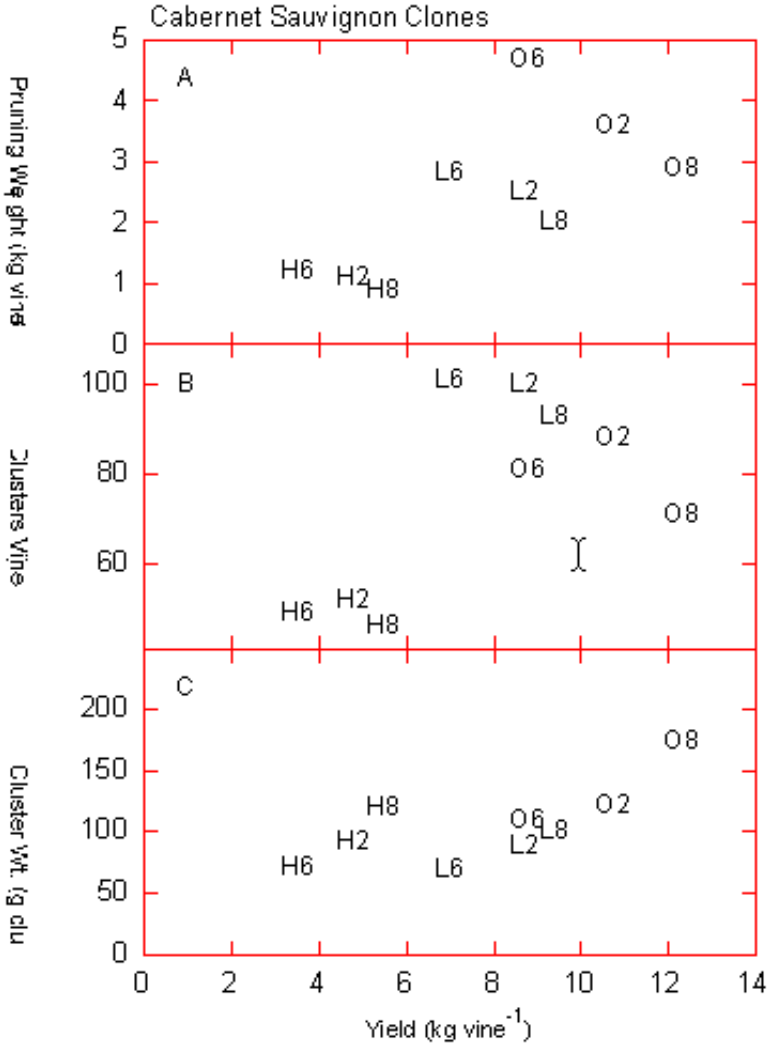

Figure 2. Influence of pruning wt (A), cluster number per vine (B) and cluster wt (C) on yield of three Cabernet clones from Foundation Plant Materials Service: 2, 6 and 8, in three locations: Howell Mountain (H), Lodi (L) and Oakville (O).

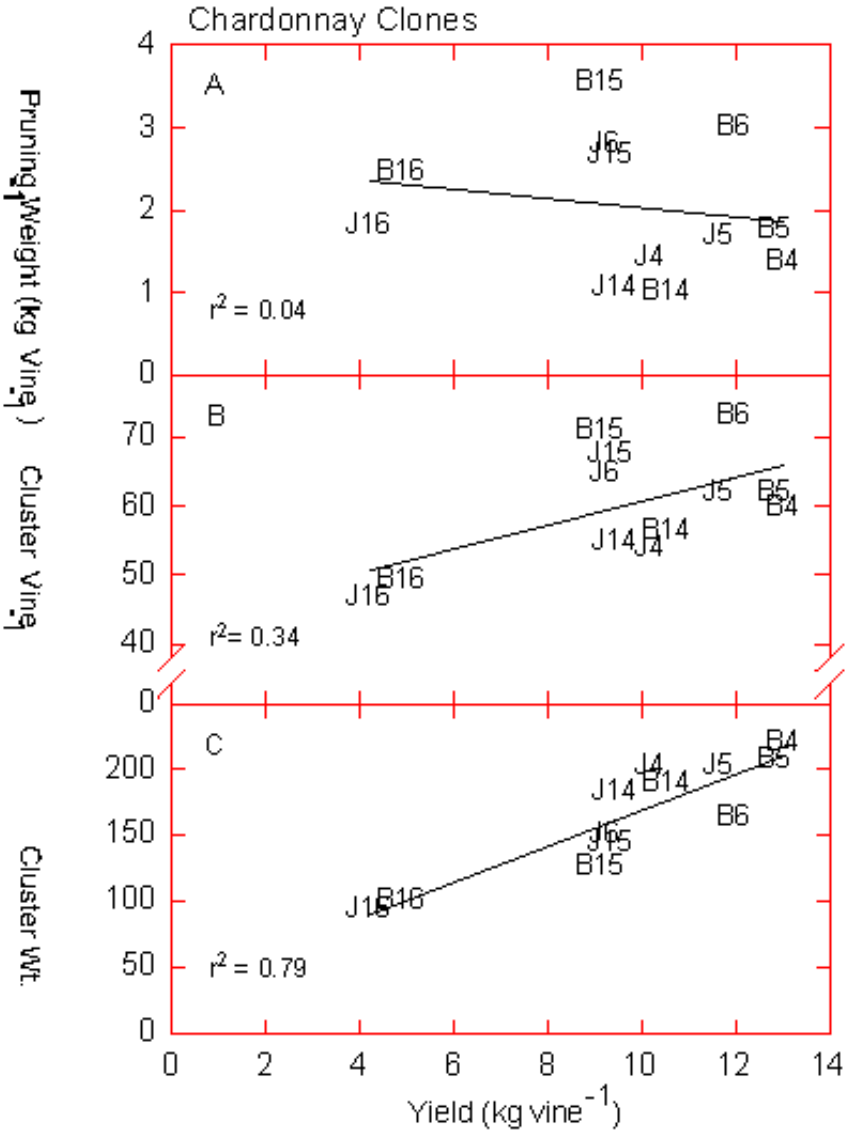

Figure 3. Influence of pruning wt (A), cluster number per vine (B) and cluster wt (C) on yield of 6 Chardonnay clones from Foundation Plant Materials Service: 4,5,6, 14, 15, and 16, in two locations: J = Jaeger (Napa) and B = Beringer (Yountville).