AMERICAN VINEYARD FOUNDATION
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Project Title: Clonal Testing of Wine grapes in the San Joaquin Valley

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Objectives:

1. To determine wine grape clonal testing needs and objectives in the San Joaquin Valley relative to cultivars of need, availability of suitable plant material, and desired vine, fruit and wine characteristics.
2. To develop and maintain a program for testing clones of important and promising cultivars for the warmer viticulture districts.
3. To ultimately select preferred disease-free clones of major and potential wine grape cultivars and facilitate their availability to industry.

Research Timetable:

1989-95 French Colombard, Chenin blanc, and Barbera cultivar trials were completed in 1995.

1995-99 Grenache, Muscat blanc, and Muscat of Alexandria cultivars trials were completed in 1998. Sangiovese was completed in 1999 with crop load adjustment comparisons.

1997-02 A second year of data collection was conducted in the Chardonnay, Cabernet Sauvignon, Merlot, and Zinfandel/Primitivo trials in 2000; a new Barbera trial was planted in 2000.

Executive Summary:

This is an ongoing study to evaluate promising, virus disease-free FPMS clonal material for the San Joaquin Valley. Completion dates for past trials were: French Colombard and Chenin blanc (1994), Barbera (1995), and Muscat of Alexandria (1997), Grenache (1998), and Muscat blanc (1998). The Sangiovese trial was completed in 1999 with crop level comparisons. Data collection continued (2nd fruiting year in 2000) with the Chardonnay, Cabernet Sauvignon, Merlot, and Zinfandel/Primitivo trials. These trials were planted with 6 clones each in 1997 in order to evaluate clonal differences in a warm climate region. A new Barbera trial was planted in 2000

Cabernet Sauvignon. Clones 2 and 24 again produced smaller berries and clusters than the others, as in 1999. This corresponded with lower yields and earlier fruit maturation. These characteristics tend to be more prevalent in Clone 2. The other clones – 8, 10 ,21 and 22 – were all similar.

Merlot. The Merlot clones showed significant differences in fruitfulness, berry weight, total vine yields, and fruit composition. Mostly, the differences were small. Some noteworthy responses included: heavier berries of lower pH in Clone 11; and lower vine yields from Clone 14 due to fewer clusters and smaller berries than some of the others. In contrast, Clone 10 produced 40% more yield than Clone 14 and with similar berry weight and fruit composition. Overall, Clone 10 performed very well, similar to Clones 3 and 9, except that it also produced smaller berries.

Zinfandel/Primitivo. Clonal differences were not as distinct as they were in 1999 when the Primitivo clones had smaller berries, fewer berries/cluster and clusters of lower mass and earlier ripening and less rot as compared to the Zinfandel clones. The Primitivo clone vine yields also tended to lower than those of Zinfandel in 1999. In contrast, the Primitivo clones tended to produced higher harvestable yields than those of Zinfandel in 2000, possibly due to less rot per cluster. Fruit soluble solids were higher in P3 and P6 as compared to 1A and 3. This is similar to the 1999 data showing earlier fruit maturation in the Primitivo clones as compared to Zinfandel. Titratable acidity was also higher in several of the Primitivo clones (P5 and P6) as compared to Zinfandel 2 and 3. Overall, clonal differences within the Zinfandel and Primitivo clone groups were small; they were greater between the two groups.

Chardonnay. Significant clonal differences were again measured in 2000, but the data is too preliminary to demonstrate important or consistent effects. For example, Clone 4 of outstanding performance in 1999, was of lower yield in 2000, the result of fewer clusters per vine. Vine yields were highest with Clones 15, 18, and 20 and lowest with Clones 4, 6, and 37. Yield differences could be largely attributed to differences in clusters/vine and/or cluster weight. Fruit maturation was largely influenced by total fruit weight. Clone 20 again produced the heaviest berries while Clone 6 produced the lightest clusters.

The 2000 results of these trials are preliminary. They represent two years of data collection, the first of which was the 3rd leaf vine data in 1999.

Research Accomplishments

Four trials comparing six clones each of Chardonnay, Cabernet Sauvignon, Merlot, and Zinfandel/Primitivo were planted in 1997. All of the trials were designed as single-vine plots, replicated 10 times in randomized complete blocks. Vine and row spacing is 7.5 x 10 feet. The vines were trained to bilateral cordons at a 53" height in 1998. The vertical trellis system has a single foliar catch wire at 64", a standard or common practice in the San Joaquin Valley. The site is too vigorous for a VSP system in this warm region. The vines first fruited in 1999. Vine yield parameter and fruit composition and quality comparisons were conducted in 2000, the first year of mature-vine production.

Cabernet Sauvignon

Procedure: All of the bilateral cordon vines were pruned to eighteen 2-node spurs. The number of flower clusters per vine was counted after bud break in April, 2000. Harvest was performed on September 22, 2000 for total fruit yield per vine. Berry samples (100 per vine) were taken at harvest for mean berry weight, soluble solids (degree Brix), titratable acidity, and pH analyses. The number of clusters with rot was recorded, as well as their total weight. Clusters were scored as 'rot present' if 4 or more adjoining berries showed decay. Mean cluster weight per plot was calculated from total per vine yield and cluster numbers; number of berries per cluster were calculated from cluster weight and berry weight means per plot.

Results (Table 1): Harvest yields were similar for all of the clones, except Clone 2, which was of significantly lower yield. This lower yield could be attributed to a combination of fruit parameter effects -- fewer clusters, smaller berries, and lighter clusters than most of the other clones. Clone 24 had similar yield parameters and fruit composition to Clone 2 but was of higher yield, probably as the result of a trend toward more and heavier clusters than Clone 2. Clones 2 and 24 had the smallest berries of all 6 clones and tended to be of earliest fruit maturation -- higher fruit soluble solids and pH at harvest. There were no significant differences among Clones 8, 10, 21, and 22; Clones 2 and 24 were more similar to one another and tended to be different from the others. There were no differences among all of the clones in titratable acidity, incidence of bunch rot and number of berries per cluster.

It is interesting to note that the 1999 and 2000 data show similar differences. Clones 2 and 24 had smaller berries and clusters than the others; this corresponded with lower yields and earlier fruit maturation with these clones. These effects were not influenced by crop level differences in 1999 when cluster numbers per vine were similar among the clones. Thus, these preliminary findings suggest that Clones 2 and 24 may consistently produce smaller berries and clusters, lower yield and earlier fruit maturation. These characteristics have been most prevalent in Clone 2. Both clones are California vineyard selections (Clone 2 = Concannon, heat-treated 168 days and Clone 24 = Laurel Glen vineyard, no heat treatment) while the others represent California vineyard and foreign imported selections.

Merlot

Procedure: Vine management and data collection were similar to the Cabernet Sauvignon trial. Harvest and fruit data collection were performed on September 7, 2000.

Results (Table 2): Clone 9 produced significantly more clusters per vine than Clone 14; the others were intermediate in fruitfulness and not different from one another. Berry weight was heaviest in Clones 3 and 11 and lightest in Clones 1, 10 and 14; Clone 9 was intermediate in berry weight. Cluster characteristics -- cluster weight, berries per cluster and rot incidence -- showed no clonal differences. Clone 14 had the least total vine yield, although not significantly different than Clones 1 and 11.

Fruit maturation was earliest (higher fruit soluble solids) in Clone 14 when compared to Clones 1 and 3. Clone 1 was latest in maturation as compared to the others, except Clones 3 and 9. Fruit pH was significantly higher in Clone 11 than the others. Titratable acidity was lowest in Clones 1, 3 and 9 and highest in Clones 10, 11 and 14, although the differences were small.

Overall, the Merlot clones showed differences in fruitfulness, berry weight, total fruit yield and fruit composition. Mostly, the differences were small, but several characteristics are worth noting at this point: Clone 11 has produced the heaviest berries with the highest pH in 1999 and 2000, both of which are undesirable characteristics for the San Joaquin Valley. While Clone 14 produced smaller berries than some of the others, vine yields were 35% higher in Clones 3, 9 and 10. It should be noted that Clone 10 yielded 40% more fruit than Clone 14 and with similar berry weight and fruit composition. Thus, Clone 10 showed good characteristics while Clone 11 showed several unfavorable characteristics for warm climate conditions.

Zinfandel/Primitivo

Procedure: Vine management and data collection were similar to the Cabernet Sauvignon trial. Harvest and fruit data collection was performed on September 5, 2000.

Results (Table 3): The early harvest of lower fruit soluble solids was performed to interrupt the rapid development of sour rot in the clusters. Bunch rot incidence was high and with no significant differences among the Zinfandel and Primitivo clones; cluster number per vine and berry weight were also not different. Clone P3 yielded the highest, although not significantly different than Clone P5. There was a tendency for all of the Zinfandel clones to be of lower yield as compared to the Primitivo Clones, especially Clone P3. This appears to have resulted from lighter clusters of the Zinfandel clones as compared to Primitivo, especially P3. These differences were probably because of an overall lower level of bunch rot in the Primitivo selections as compared to Zinfandel which was clearly demonstrated in 1999.

The method of assessing bunch rot was to count all of the clusters that have 4 or more adjoining berries showing decay. The percent clusters with rot is then calculated from the total cluster

count. While this method determines 'incidence' of rot in the cluster population, it does not address the overall severity or total percent of berries showing decay. Thus, overall severity of bunch rot will be included in the 2001 by scoring the percent rot in each cluster.

Fruit soluble solids were higher in Clones P6 and P3 as compared to 1A and 3. This is similar to the 1999 data that showed higher fruit maturation in the Primitivo clones as compared to those of Zinfandel. Titratable acidity was also higher in several of the Primitivo clones (P5 and P6) as compared to Zinfandel 2 and 3. Fruit pH differences were minor.

Overall, clonal differences in 2000 were not as distinct as they were in 1999 when the Primitivo clones had smaller berries, fewer berries/cluster and clusters of lower mass and earlier ripening (~2 ^{o}Brix) and less rot (~3x less). Primitivo clone vine yields also tended to be less than those of Zinfandel in 1999. In contrast, Primitivo clone yields tended to be higher than those of Zinfandel in 2000, possibly the result of heavier clusters due to less rot per cluster.

The experience in 2000 indicates that bunch rot severity on a per cluster basis should be scored in the future. Scoring cluster rot on a presence/absence basis (clusters showing some rot, scored as 4 or more adjoining berries) did not show any significant differences, although visually the Primitivo clones appeared to have less overall rot as compared to those of Zinfandel. Also, harvest should be early enough to avoid the level of rot severity experienced in 2000.

Chardonnay

Procedure: Vine management and data collection were similar to the Cabernet Sauvignon trial. Harvest and fruit data collection were performed on August 25, 2000.

Results (Table 5): Vine yields were highest with Clones 15, 18, and 20 and lowest with Clone 4, 6 and 37. Yield differences could be largely attributed to differences in clusters/vine and/or cluster weight. Clone 20 produced significantly more clusters than Clones 4 and 18. Clone 6 had lighter clusters than the others, the result of fewer berries/cluster. Berry weight was highest in Clone 20 and lowest in Clone 15. Fruit maturation was largely influenced by total fruit weight. Soluble solids were highest in Clone 4 and lowest in Clone 20. Clone 4 also had the highest fruit titratable acidity and the lowest pH. There were no differences in bunch rot incidence among the clones.

It should be noted that some of the clones responded differently in 2000 as compared to 1999. Clone 4 was highest yielding in 1999, the result of more and heavier clusters. This high yield in 1999 may have contributed to an alternate bearing response. Lowered vine yields in 4th leaf following a large crop in 3rd leaf is a common vine response.

Several multiple-year consistencies in clonal response can be noted: Clone 20 produced the heaviest berries and Clone 6 produced the lightest clusters (fewer berries per cluster) in both 1999 and 2000.

While significant clonal differences in most of the parameters were measured in 2000, the data are too preliminary to show important or consistent effects. For example, Clone 4, of outstanding

performance in 1999, was of lower yield in 2000, the result of fewer clusters per vine. However, the more consistent berry and cluster weight responses of Clones 6 and 20 suggest that some clonal characteristics may be consistently different over time.

TABLES 1-4. WINE GRAPE CLONAL SELECTION COMPARISONS, 2000
UNIVERSITY OF CALIFORNIA, KEARNEY AGRICULTURAL CENTER
SUMMARY OF ANOVA PROBABILITIES, CLONE PER VINE MEANS

TABLE 1.

CABERNET SAUVIGNON

Clone #	Harvest Date	Weight / Berry (gms)	Soluble Solids (brix)	pH	Titratable Acidity (g/100ml)	Number of Clusters/ Vine	Total Yield/Vine (lbs.)	% Clusters with Rot	Cluster Wt. (lbs.)	Berries/ Cluster
2	22-Sep	1.30 b	21.8 a	3.72 a	0.450	101 b	32.55 b	0.00 a	0.33 b	112 a
8	22-Sep	1.47 a	21.2 ab	3.64 b	0.449	108 ab	43.61 a	0.00 a	0.41 a	125 a
10	22-Sep	1.38 a	20.7 b	3.63 b	0.448	111 ab	41.62 a	0.56 a	0.38 ab	124 a
21	22-Sep	1.46 a	20.8 b	3.66 ab	0.446	114 a	44.43 a	0.49 a	0.39 a	120 a
22	22-Sep	1.44 a	21.4 ab	3.65 b	0.451	114a	45.99 a	0.98 a	0.41 a	126 a
24	22-Sep	1.32 b	21.9 a	3.69 ab	0.442	113 ab	41.46 a	0.23 a	0.37 ab	126 a

Means within columns with like letters are not significantly different at the 5% level

TABLE 2.

MERLOT

Clone #	Harvest Date	Weight / Berry (gms)	Soluble Solids (brix)	pH	Titratable Acidity (g/100ml)	Number of Clusters/ Vine	Total Yield/Vine (lbs.)	% Clusters with Rot	Cluster Wt. (lbs.)	Berries/ Cluster
1	7-Sep	1.46 c	22.88 c	3.65 b	0.44 bc	48 ab	39.11 ab	3.77 a	0.83 a	263 a
3	7-Sep	1.60 a	23.21 bc	3.63 b	0.44 bc	52 ab	42.32 a	7.64 a	0.78 a	222 a
9	7-Sep	1.54 b	23.34 abc	3.65 b	0.43 c	56 a	44.12 a	6.54 a	0.84 a	248 a
10	7-Sep	1.48 c	23.64 ab	3.65 b	0.46 a	55 ab	45.80 a	2.20 a	0.87 a	261 a
11	7-Sep	1.62 a	23.61 ab	3.70 a	0.46 a	51 ab	38.36 ab	8.25 a	0.76 a	216 a
14	7-Sep	1.43 c	23.82 a	3.63 b	0.45 ab	45 b	32.83 b	4.97 a	0.83 a	256 a

TABLE 3.

ZINFANDEL / PRIMITIVO

Clone #	Harvest Date	Weight / Berry (gms)	Soluble Solids (brix)	pH	Titratable Acidity (g/100ml)	Number of Clusters/ Vine	Total Yield/Vine (lbs.)	% Clusters with Rot	Cluster Wt. (lbs.)	Berries/ Cluster
1A	5-Sep	2.41 a	17.88 c	3.39 ab	0.60 abc	78 a	49.86 b	53.52 a	0.63 b	119 b
2	5-Sep	2.39 a	18.62 abc	3.39 ab	0.59 c	75 a	51.67 b	59.79 a	0.70 ab	134 ab
3	5-Sep	2.54 a	18.00 c	3.41 a	0.60 bc	75 a	47.85 b	55.16 a	0.64 b	113 b
P3	5-Sep	2.47 a	19.19 ab	3.37 ab	0.62 ab	78 a	62.78 a	51.87 a	0.80 a	145 a
P5	5-Sep	2.55 a	18.27 bc	3.37 ab	0.63 a	73 a	55.52 ab	58.10 a	0.76 a	146 a
P6	5-Sep	2.56 a	19.74 a	3.36 b	0.63 a	76 a	53.02 b	59.34 a	0.69 ab	122 b

TABLE 4.

CHARDONNAY

Clone #	Harvest Date	Weight / Berry (gms)	Soluble Solids (brix)	pH	Titratable Acidity (g/100ml)	Number of Clusters/ Vine	Total Yield/Vine (lbs.)	% Clusters with Rot	Cluster Wt. (lbs.)	Berries/ Cluster
4	25-Aug	1.44 b	23.9 a	3.46 b	0.60 a	73 c	30.93 c	4.7 a	0.43 a	136 abc
6	25-Aug	1.41 bc	23.17 bc	3.54 a	0.55 bc	93 ab	33.50 bc	5.6 a	0.36 b	115 c
15	25-Aug	1.31 e	23.16 bc	3.54 a	0.57 b	89 ab	38.49 ab	5.9 a	0.43 a	148 ab
18	25-Aug	1.35 de	22.75 bc	3.52 ab	0.54 c	80 bc	37.80 ab	9.2 a	0.47 a	157 a
20	25-Aug	1.49 a	22.53 c	3.52 ab	0.55 bc	95 a	41.43 a	8.2 a	0.43 a	131 bc
37	25-Aug	1.39 cd	23.31 ab	3.54 a	0.54 c	85 abc	35.77 bc	10.5 a	0.43 a	141 ab