UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

DEPARTMENT OF VITICULTURE AND ENOLOGY
UNIVERSITY OF CALIFORNIA
DAVIS, CALIFORNIA 95616
(916) 752-0380

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
TELEX: 910-531-0785

FAX: (916) 752-0382
13 April 1993

John and Steve Kautz
John Kautz Farms
5490 E. Bear Creek Road
Lodi, CA 95240

Dear John and Steve:

Enclosed is a copy of our progress report to the Lodi-Woodbridge Winegrape Commission for the 1992 - 1993 fiscal year.

Note that the treatment of 24, three-node spurs produced the highest crop yield (Table 2) and the highest wine tasting score (Table 6) for Cabernet Sauvignon. The Chardonnay data we have completed to date are presented in Tables 7, 8, and 9. This data was not included in the Commission's report, since they funded only work for Cabernet Sauvignon. We still have to compile the wine sensory evaluation of Chardonnay so these data are not included in the report.

Since the yields were so high in the Sheldon ranch in 1992, I would guess the crop will be down some this year. I have about 400 pounds of new potassium and phosphorus fertilizer that has recently been developed in Israel called monopotassium phosphate (KH_2PO_4). This material is quite soluble and developed to put on through drip irrigation systems without adding nitrogen at the same time. Would you be interested in experimenting with this new fertilizer on your Sheldon ranch? If so, please give me a call and we can talk about setting it up.

Last year there was obvious potassium deficiency symptoms showing up during the final ripening period. This would be the time where you would want to add potassium (and perhaps phosphorus?), but no nitrogen. With only 400+ pounds to work with, the number of vines treated would be limited. I suggest adding about 100 to 200 pounds of actual potassium per acre through the drip system over the season. Please let me know if you are interested in testing this new fertilizer. It is scheduled to be commercially available in California in 1994.

Sincerely,

W. Mark Kliewer
Professor of Viticulture

WMK/de
Enclosure

LODI-WOODBRIDGE WINEGRAPE COMMISSION
PROGRESS REPORT
1992 - 1992 Fiscal Year

PROJECT TITLE: Evaluation of different severities of mechanical and hand pruning of Cabernet Sauvignon and Chardonnay grapevines for productivity, fruit composition and wine quality.

PRINCIPAL INVESTIGATORS: W. Mark Kliewer, Professor of Viticulture
Department of Viticulture & Enology
University of California, Davis

Paul Verdagaal, Farm Advisor
San Joaquin County Cooperative Extension
Stockton, CA

OBJECTIVES:

1. To determine the maximum amount of crop that can be produced per acre without detrimental effects on fruit composition and wine quality.

2. To compare productivity and fruit and wine composition and quality of mechanically pruned grapevines to different levels of hand pruned grapevines.

3. To compare the effects of hand pruning and mechanical pruning on canopy microclimate, vegetative growth characteristics, and amount of bunch rot of Cabernet Sauvignon and Chardonnay grapevines.

SUMMARY:

Nine different pruning level treatments were imposed in 1992 on four-year-old Cabernet Sauvignon vines trained to a quadrilateral cordon GDC type trellis-training system with a distance of 36 inches between fruiting wires. Pruning severities ranged from 24 to 96 buds per vine on vines spur pruned and between 100 and 250 buds per vine on vines hedged and minimally pruned. The amount of shoot growth and pruning weights was inversely related to the number of buds retained per vine at pruning. Crop yields ranged from 13 to 19.5 tons/acre, with vines pruned to 24, three-node spurs producing the highest crop yield. This treatment also scored the highest in wine quality. Vines from all treatments were judged to carry an excessive amount of crop in relation to the amount of leaf area per vine. This was especially apparent in vines hedged and minimally pruned, in which the crop yield/pruning weight ratio exceeded 20, more than twice the rates of what "normal" crop vines should have. It is concluded that the young wines used in this trial did not have sufficient capacity to accommodate the amount of buds that were retained by hedge or minimal pruning. The crop yield/pruning weight ratio ranged from 12 for vines pruned to 24 one-node spurs to 28.8 for long, hedged vines. Generally, fruit from vines that had the greatest number of buds and crop per vine had the lowest level of sugar, titratable acidity, malic acid and potassium in fruits at harvest. The harvest of hedge, minimal, and spur pruning to 96 buds per vine was delayed by two or more weeks compared to vines pruned to 24 to 72 buds/vine.

Several additional years of data will be needed before valid conclusions can be made as to what the optimum pruning level per vine should be and whether mechanical hedge or minimal pruning can produce acceptable wine quality.

RESULTS:

The results of the nine different pruning level treatments for the 1992 season are presented in Tables 1 through 6.

The four-year-old Cabernet Sauvignon vines grown at Sheldon were very fruitful and produced exceptionally high crops, ranging in yield from 13 to 19.5 tons/acre (Tables 1 and 2). The very large crop limited the amount of shoot growth, with pruning weight ranging from 0.89 to 1.43 kg/vine and average dormant cane weight ranging between 6.5 to 35.1 g/cane. The highest crop yield was obtained from vines pruned to 24 three-bud spurs or a total of 72 buds per vine, producing a yield of 27.2 kg/vine or 19.5 tons/acre. Vines pruned to this level averaged 170 berries per cluster, the highest of the nine treatments and also had the greatest number of clusters per shoot, which averaged 2.16 (Table 2). The crop yield/pruning weight ratio ranged between 12 for vines pruned to 24 one-bud spurs, to 29 for vines hedge pruned long (Table 1). Generally vines with a yield/pruning weight ratio of 4 to 10 indicate a good balance between vine growth and crop yield, whereas vines with a ratio above 10 indicate excessive crop for the amount of vine growth. The hedge and minimal pruned vines had yield/pruning weight ratios greater than 20, indicating severe overcropping.

Average shoot weight of these vines ranged from 1.3 g (minimal pruned) to 13.5 g/shoot for short hedge pruned, again indicating that crop was excessive and severely limiting the amount of shoot growth. Dormant cane weight per vine should average between 25 to 50 g to be in the optimal range. It is concluded that hedge and minimal pruning for these young four-year-old vines left far too many buds to have sufficient shoot growth and leaf area to produce a balanced canopy.

The composition of the fruit sampled on September 29 and at harvest (September 29 to October 13) of the various pruning level treatments is presented in Tables 3 and 4. The level of sugar (°Brix) on September 29 ranged from 19.9 to 22.7 (Table 3) and at harvest from 20.7 to 22.7 °Brix (Table 4). The level of sugar in the fruits was inversely related to the amount of crop and number of buds left per vine at pruning. The pH of fruit on a given date was also influenced by the amount of crop per vine. The pH of fruit was generally highest in vines pruned to the fewest number of buds per vine, whereas titratable acidity was lowest (Table 3). At harvest, fruits did not differ significantly in pH between pruning level treatments, however the harvest of the various treatments ranged over a period of 16 days (Table 4). However, at harvest, titratable acidity and malic acid were lowest in the hedge and minimal pruned vines which had the largest number of buds per vine (Table 4). This reduction in acidity and malic acid reflected the two extra weeks that it took for hedge and minimal pruned fruits to ripen. The level of potassium in fruits at harvest was also generally significantly lower in hedged and minimal pruned vines compared to the one, two, and three-node spur pruned vines (Table 4).

Wines were made from all the pruning level treatments except the hedged, long treatment. Two of the treatments, i.e., those pruned to 24, one and two-bud spurs, had wines made from fruits harvested on two different dates, September 29 and October 13, to determine if wine quality was influenced by fruit maturity. The single wine that stood out as having the highest wine score (14.1 points out of a total of 20 possible points) was made from vines pruned to 24, three-bud spurs (Table

6). Vines pruned to this level had the highest amount of crop of the nine treatments. The pH of fruits from this treatment at harvest was the lowest of the nine treatments, however, it was only slightly lower than several of the other treatments (Table 5). The reason why vines pruned to 24 three-node spurs produced the highest quality wine is not known, however, wine color and berry size may have contributed to the higher score that this wine received. Wines made from vines pruned to 24, one and two-node spurs harvested on October 13 with °Brix level of 23.5 to 23.6 did not appear to improve quality compared to these same treatments but harvested two weeks earlier when °Brix of fruits averaged 22.0 to 22.4 (Tables 5 and 6).

BUDGET:

Personnel	% Time On Project	Requested Amount 1993 - 1994	Projected Amount 1994 - 1995
W.M. Kliewer	10	-0-	-0-
Jason Benz (SRA IV)	5	2,200	2,200
Research Assistant	20	5,100	5,400
Employee Benefits		220	250
Supplies			
Chemicals, glassware, maintenance of equipment		700	800
Travel (28 trips @ $35/trip		1,000	1,000
TOTAL		9,220	9,650

TABLE 1: Influence of pruning level per vine on vine growth, pruning weight, crop yield and yield/pruning weight ratio of Cabernet Sauvignon grown at Sheldon, CA, 1992 season.

Pruning Level	Total Nodes per Vine	# Shoots per Vine	Average Weight per Shoot (g)	Pruning Weight per Vine (kg)	Crop Yield		Yield
					kg/vine	Tons/ac	Pruning Weight Ratio
24, 1 bud spurs	24	45	35.1	1.38	18.5	13.3	12.1
24, 2 bud spurs	48	57	26.1	1.43	20.6	14.8	14.3
24, 3 bud spurs	72	69	22.9	1.40	27.2	19.5	18.2
24, 4 bud spurs	96	87	19.9	1.40	25.1	18.0	15.8
16, 3 bud spurs	48	54	25.3	1.34	23.4	16.8	18.7
16, 4 bud spurs	64	65	25.0	1.43	23.1	16.6	15.3
Hedge, short	--	113	13.5	1.25	25.5	18.3	20.8
Hedge, long	--	153	6.5	0.89	26.2	18.8	28.8
Minimal	--	229	1.3	0.14	26.3	18.9	--
Signif Level	--	0.0001	0.0001	0.0001	0.06	0.06	0.0001

TABLE 2: Influence of pruning level on crop yield and yield components of Cabernet Sauvignon grown at Sheldon, CA, 1992 season.

Pruning Level	Crop Yield		# Clusters per Vine	# Berries per Cluster	Berry Weight (g)	Cluster Weight (g)	# Clusters per Shoot
	kg/vine	Tons/ac					
24, 1 bud spurs	18.5	13.3	91	164	1.25	204	2.04
24, 2 bud spurs	20.6	14.8	110	148	1.27	188	1.95
24, 3 bud spurs	27.2	19.5	147	170	1.10	187	2.16
24, 4 bud spurs	25.1	18.0	171	139	1.09	151	2.00
16, 3 bud spurs	23.4	16.8	122	159	1.21	191	2.29
16, 4 bud spurs	23.1	16.6	126	154	1.22	186	1.96
Hedge, short	25.5	18.3	238	113	0.98	110	2.11
Hedge, long	26.2	18.8	278	105	0.91	95	1.84
Minimal	26.3	18.9	350	80	0.96	77	1.55
Signif Level	0.06	0.06	0.0001	0.0001	0.0001	0.0001	0.08

TABLE 3: Influence of pruning level on fruit composition of Cabernet Sauvignon sampled on September 29, 1992, Sheldon, CA

Pruning Level	Berry Weight (g)	TSS (°Brix)	pH	TA (g/L)	Malic Acid (g/L)	K (ppm)
24, 1 bud spurs	1.25	22.4	3.42	5.6	1.26	1441
24, 2 bud spurs	1.27	22.0	3.41	5.7	1.20	1430
24, 3 bud spurs	1.10	22.1	3.34	5.9	1.12	1406
24, 4 bud spurs	1.15	21.0	3.36	6.2	1.42	1422
16, 3 bud spurs	1.21	22.7	3.45	5.6	1.17	1517
16, 4 bud spurs	1.22	22.2	3.35	5.7	1.10	1382
Hedge, short	1.06	20.2	3.29	6.6	1.24	1339
Hedge, long	1.01	19.7	3.30	6.2	1.29	1367
Minimal	1.00	19.9	3.29	6.7	1.26	1377
Signif Level	0.0001	0.0001	0.0001	0.0001	NS	NS

TABLE 4: Influence of pruning level on fruit composition of Cabernet Sauvignon sampled at harvest, 1992 season, Sheldon, CA

Pruning Level	Harvest Date	Berry Weight (g)	TSS (°Brix)	pH	TA (g/L)	Malic Acid (g/L)	K (ppm)
24, 1 bud spurs	9/29	1.25	22.4	3.42	5.6	1.26	1441
24, 2 bud spurs	9/29	1.27	22.0	3.41	5.7	1.20	1430
24, 3 bud spurs	9/29	1.10	22.1	3.34	5.9	1.12	1406
24, 4 bud spurs	10/7	1.09	21.5	3.41	6.9	1.42	1745
16, 3 bud spurs	9/29	1.21	22.7	3.45	5.6	1.17	1517
16, 4 bud spurs	9/29	1.22	22.2	3.35	5.7	1.10	1382
Hedge, short	10/13	0.98	21.6	3.44	4.6	1.03	1306
Hedge, long	10/13	0.91	20.7	3.40	4.9	0.94	1329
Minimal	10/13	0.96	21.5	3.42	4.8	1.01	1317
Signif Level		0.0001	0.009	NS	0.0001	0.02	0.0001

TABLE 5: Influence of pruning level on fruit composition Cabernet Sauvignon sampled at harvest, 1992 season, Sheldon, CA

Pruning Level	Harvest Date	Crop Yield (kg/vine)	TSS (°Brix)	pH	TA (g/L)	Malic Acid (g/L)	K (ppm)
24, 1 bud spurs	9/29	18.5	22.4	3.42	5.58	1.26	1440
24, 1 bud spurs	10/13	17.0	23.6	3.51	4.35	0.91	1349
24, 2 bud spurs	9/29	20.6	22.0	3.40	5.70	1.20	1430
24, 2 bud spurs	10/13	21.0	23.5	3.53	4.38	1.27	1436
24, 3 bud spurs	9/29	27.2	22.1	3.34	5.87	1.12	1406
24, 4 bud spurs	10/7	25.1	21.4	3.40	6.92	1.42	1745
16, 3 bud spurs	9/29	23.4	22.7	3.45	5.60	1.17	1516
16, 4 bud spurs	9/29	23.1	22.2	3.35	5.72	1.09	1381
Hedge, short	10/13	25.5	21.6	3.44	4.56	1.02	1305
Minimal	10/13	26.3	21.5	3.41	4.85	1.02	1316
Signif Level		0.003	0.0001	0.0001	0.0001	0.0001	0.0001

Table 6: Influence of pruning level on wine composition and wine tasting scores of Cabernet Sauvignon, 1992 season, Sheldon, CA.

Pruning Level	Harvest Date	EtOH (%)	TA (g/L)	pH	A_{420}	A_{520}	Color Density A_{420+} A_{520}	Hue A_{420}/A_{520}	Wine Tasting Score
24, 1 bud spurs	9/29	11.8	5.77	3.47	1.78	3.01	4.79	0.60	13.6
24, 1 bud spurs	10/13	12.2	5.97	3.42	1.82	3.13	4.95	0.58	13.6
24, 2 bud spurs	9/29	11.8	5.87	3.38	1.65	2.79	4.44	0.59	13.7
24, 2 bud spurs	10/13	12.5	5.48	3.44	1.47	2.41	3.87	0.61	13.4
24, 3 bud spurs	9/29	11.6	6.21	3.25	1.74	3.21	4.94	0.55	14.1
24, 4 bud spurs	10/7	11.9	5.82	3.36	1.42	2.36	3.78	0.60	13.4
16, 3 bud spurs	9/29	12.1	5.96	3.37	1.39	2.23	3.62	0.62	13.0
16, 4 bud spurs	9/29	11.3	6.16	3.33	1.73	3.15	4.88	0.55	13.6
Hedge, short	10/13	11.6	6.21	3.26	1.48	2.67	4.15	0.55	13.7
Hedge, long	10/13	11.0	6.74	3.21	1.26	2.24	3.50	0.56	---
Minimal	10/13	11.0	7.13	3.14	1.53	2.77	4.30	0.55	13.4
Signif Level		0.02	0.0001	0.0001	0.008	0.03	0.02	0.001	0.0001

Table 7: Influence of pruning level on crop yield and yield components of Chardonnay grapevines grown at Sheldon, CA, 1992 season.

Pruning Level	Crop Yield		# Berries per Cluster	# Clusters per Vine	Berry Weight (g)	Cluster Weight (g)
	kg/vine	Tons/ac				
24, 1 bud spurs	21.4	15.4	179	86	1.41	252
24, 2 bud spurs	26.9	19.3	192	112	1.27	243
24, 3 bud spurs	26.8	19.2	172	119	1.36	233
24, 4 bud spurs	25.1	18.0	165	104	1.42	234
16, 3 bud spurs	23.5	16.9	173	99	1.38	239
16, 4 bud spurs	25.0	18.0	183	107	1.31	240
Hedge, short	34.3	24.6	159	181	1.23	196
Hedge, long	35.6	25.6	166	162	1.34	223
Minimal	31.1	22.4	146	159	1.36	198
Signif Level	0.002	0.002	0.005	0.0001	0.02	0.008

TABLE 8: Influence of pruning level on fruit composition of Chardonnay at harvest, 1992 season, Sheldon, CA

Pruning Level	Berry Weight (g)	TSS (°Brix)	pH	TA (g/L)	Malic Acid (g/L)	K (ppm)
24, 1 bud spurs	1.41	23.3	3.34	8.1	2.23	1760
24, 2 bud spurs	1.27	23.6	3.32	8.0	2.19	1712
24, 3 bud spurs	1.36	23.3	3.34	8.0	2.21	1749
24, 4 bud spurs	1.42	22.8	3.34	8.1	2.55	1748
16, 3 bud spurs	1.38	23.6	3.34	8.2	2.34	1736
16, 4 bud spurs	1.31	22.7	3.35	7.9	2.28	1757
Hedge, short	1.23	22.9	3.29	7.8	2.19	1648
Hedge, long	1.34	23.3	3.31	8.1	2.26	1676
Minimal	1.36	23.3	3.36	8.1	2.45	1710
Signif Level	0.02	NS	NS	NS	NS	NS

Fruit composition data is the average of fruit sampled August 28 and August 31, 1992. Vines were harvested on August 31, 1992.

TABLE 9: Influence of pruning level on pruning weight and yield/pruning weight ratio of Chardonnay grown at Sheldon, CA, 1992 season

Pruning Level	Pruning Weight (kg/vine)	Yield/Pruning Weight (ratio)
24, 1 bud spurs	0.94	24.3
24, 2 bud spurs	0.93	29.3
24, 3 bud spurs	0.76	36.8
24, 4 bud spurs	0.84	30.8
16, 3 bud spurs	0.93	25.5
16, 4 bud spurs	0.93	27.3
Hedge, short	0.77	45.7
Hedge, long	0.71	53.7
Minimal	--	--
Signif Level	0.0001	0.0001