Oregon Wine Advisory Board
Research Progress Report

1997 - 1998

Evaluation of varieties, clones, and rootstocks:

II. & III. Performance of Pinot noir and Chardonnay clones

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INTRODUCTION

Pinot noir and Chardonnay are the two main winegrape varieties in Oregon. In 1997, they comprised approximately 58% of the Oregon winegrape acreage, and 60% of the total production for a value of $14,171,000 (66% of total) (1). Internationally, clonal selection of Pinot noir and Chardonnay have made available, for each variety, an array of clones with wide ranging levels of productivity and fruit quality. In the Champagne region, clones were selected for increased yields; in Burgundy, the main criterion was high fruit quality; and in Switzerland, the Pinot noir clone Mariafeld was selected for disease resistance. In the U.S., clones selected here and elsewhere continue to be evaluated for their suitability to local growing conditions. The Pinot noir clones included in the trial at Woodhall III Vineyard (Table 1) include representatives of diverse types loosely classified into four groups: 1) Pinot fm, typically characterized by having small clusters and prostrate growth habit; 2) Mariafeld, most noted for having loose clusters; 3) Upright, known for their erect growth habit; and 4) Fertile, typically having large clusters and prostrate growth habit (2). The Chardonnay clones at Woodhall III Vineyard (Table 2), although not as numerous as clones in the Pinot noir trial, also represent a range of types with different levels of productivity and fruit quality.

Table 1. Pinot noir clones included in the trial at Woodhall III Vineyard, Alpine, OR.

Type	Clone	Name	Origin
Pinot fin	FPMS 2A	Wädenswil	Switzerland
	FPMS 4	Pommard	Burgundy
	FPMS 10	Beba	Spain
	FPMS 29	Jackson	France via California
	DJN 113	CTPS 113	Burgundy
	DJN 114	CTPS 114	Burgundy
	DJN 115	CTPS 115	Burgundy
Mariafeld	FPMS 17	Mariafeld	Wädenswil
	FPMS 23	Mariafeld	Wädenswil
Upright	FPMS 22	Gamay Beaujolais	California
	ESP 374	Espiguette 374	ENTAV, Espiguette
	DJN 60	Dijon 60	Burgundy
Fertile	FPMS 16	Jackson	France via California
	FPMS 31	CTPS 236	Roederer, Chouilly
	FPMS 32	CTPS 386	Roederer, Chouilly
	FPMS 33	CTPS 388	Roederer, Chouilly
	ESP 236	ENTAV 236	ENTAV, Espiguette
	DJN 375	CTPS 375	Burgundy
	DJN 10/18	CTPS 1018	Alsace
	COL 538	CTPS 538	Alsace

Table 2. Chardonnay clones included in the trial at Woodhall III Vineyard, Alpine, OR.

	Clone	Name	Origin
France	DJN 75	CTPS 75	Burgundy
	DJN 76	CTPS 76	Burgundy
	DJN 78	CTPS 78	Loire
	DJN 95	CTPS 95	Burgundy
	DJN 96	CTPS 96	Burgundy
	ESP 352	ENTAV 352	ENTAV, Espiguette
United States	FPMS 4	Olmo # 66	Martini Vineyard, California
	FPMS 5	Olmo # 69	Martini Vineyard, California
	FPMS 6	Olmo # 68	Martini Vineyard, California
	FPMS 14	Olmo # 65	Martini Vineyard, California
	FPMS 15	Prosser	Washington

Abbreviations used are as follows:
COL = Colmar
CTPS = Committee Technique Permanent de la Selection
DJN = Dijon
ESP = Espiguette
ENTAV = Etablissement National technique pour l'Amelioration de la Viticulture
FPMS = Foundation Plant Materials Service, Davis, CA

Vines in the Woodhall III Vineyard Pinot noir and Chardonnay clonal trials were in the ninth leaf in the 1997 season. Both trials consist of own rooted vines, planted on a 1.8 in x 2.7 in (6 ft x 9 ft) spacing, and trained to an upright vertical trellis. At harvest in 1997, yield components and juice composition were measured in both trials. Additionally in the Pinot noir clones, fruit set, vegetative growth parameters, cluster architecture, and skin anthocyanins were measured. During budbreak, bloom, and veraison, the Pinot noir clones were rated for their stage of development, and starting at veraison, a ripening survey was conducted with sampling at two week intervals until harvest.

MATERIALS AND METHODS

Pinot noir clones

Canopy development and vine vigor - The Pinot noir clonal trial was pruned in March 1997. Pruning weights were measured, and 30 buds per kilogram of one year old wood were left. Shoot length, diameter, and leaf number were measured on three shoots per replicate on 20 June, prior to hedging.

Bud burst, bloom, and veraison phenology - Prior to budbreak, five canes per replicate were selected for estimating bud burst, bloom, and veraison phenology. During budbreak, the five uppermost buds of each cane were scored three times per week using the scale proposed by Johnson and Howell (3). At bloom, 25 clusters per replicate were rated three times per week for percentage of fallen caps. During veraison, the same clusters were scored three times per week for percentage of dark colored berries.

Fruit set and cluster architecture - Prior to bloom, three clusters per replicate were enclosed in mesh bags to retain all shed flowers. The bags were removed approximately four weeks after full bloom and all abscised flowers and fruitlets were counted. The previously bagged clusters were picked separately at harvest. The number of flowers was calculated as the sum of shed flowers and berries. Percent fruit set was calculated as the quotient of berries at harvest and total number of flowers per inflorescence. Cluster length and volume were measured and the clusters were frozen for later determination of berry number.

Ripening survey - On August 11, at the onset of veraison, and at two week intervals until harvest, a three cluster sample was collected per replicate. Cluster weight was measured, and berry and skin weights were measured on a 100 berry subsample randomly selected from the three clusters. The remaining berries were crushed for determination of soluble solids, pH and titratable acidity.

Yield and firuit quality - The Pinot noir clonal trial was harvested on October 7. A sample of 25 clusters per replicate was crushed for determination of soluble solids, pH, and titratable acidity. A sample of five clusters per replicate was used to estimate number of berries per cluster. Cluster weight was calculated by averaging the pooled 3 0 cluster sample weight. Berry and skin weights were measured on a 100 berry subsample randomly selected from the five clusters. Skins were extracted in acidulated methanol. Anthocyanins were determined by absorbance at 520 run and concentration was calculated using an extinction coefficient of E 1% = 380 (4,5). Sugar per vine was calculated by multiplying must sugar concentration (°Brix/100) by total yield per vine.

Chardonnay clones

Pruning - The Chardornnay clonal trial was pruned in March 1997. Pruning weights were measured, and 30 buds per kilogram of one year old wood were left.

Yield and fruit quality - The Chardormay clonal trial was harvested on October 14. A sample of 25 clusters per replicate was crushed for determination of soluble solids, pH and titratable acidity. Berry weights were measured on a 100 berry subsample randomly selected from a five cluster sample from each replicate. Cluster weight was calculated by averaging the pooled 30 cluster sample weight. Sugar per vine was calculated by multiplying must sugar concentration (°Brix/100) by total yield per vine.

RESULTS AND DISCUSSION

Pinot noir clones

Yield of the Pinot noir clones ranged from a high of 3.92 t/ac (FPMS 4) to a low of 1.08 t/ac (FPMS 17) (Table 3). FPMS clones 2A, 4, and 10, Pinot fin type clones, had above average yields, as well as above average juice soluble solids (Table 4; Figure 1A). Clones DJN 114 and 115, and FPMS 29, also Pinot fin type clones, had below average yields but above average Brix. Other clones with above average yields were DJN 10/18, COL 538, FPMS 31, and FPMS 33 (all Fertile type clones). These four clones, however, all had below average Brix. The three Upright clones (FPMS 22, ESP 374, and DJN 60) had average to below average yields, and below average Brix. The Mariafeld clones FPMS 17 and FPMS 23 were among the three lowest yielding clones, but had the two highest juice soluble solids, respectively. The overall average yield for the Pinot noir clones was 2.30 t/ac in 1997. This represents a 20% increase over that of 1996 (1.92 t/ac). Fifteen of the twenty clones had higher yields in 1997 than in 1996, but all had lower soluble solids.

Table 3. Yield components of Pinot noir clones at Woodhall III Vineyard.

	Clone	Yield (kg/vine)	±	Yield (t/ac)	±	Berries/ cluster	±	Berry wt. (g)	±	Cluster wt. (g)	±	Shoots/ vine	±	Clusters/ vine	±
Pinot fin															
	FPMS 2A	3.37	0.60	3.00	0.53	90	6	1.23	0.05	110.8	11.1	20	2	31	5
	FPMS 4	4.41	1.34	3.92	1.19	84	5	1.28	0.10	106.6	4.8	20	1	41	12
	FPMS 10	2.91	0.19	2.59	0.17	98	6	1.06	0.06	104.8	9.8	18	1	28	2
	FPMS 29	1.71	0.12	1.52	0.10	72	4	1.14	0.06	80.6	2.9	14	1	21	1
	DJN 113	2.75	0.71	2.44	0.63	102	13	1.11	0.07	112.2	11.5	16	3	24	4
	DJN 114	2.36	0.47	2.10	0.42	82	1	1.10	0.05	90.7	4.3	17	3	26	6
	DJN 115	1.89	0.34	1.68	0.30	79	3	1.08	0.06	85.6	7.3	14	2	22	2
Mariafeld															
	FPMS 17	1.22	0.21	1.08	0.18	58	5	1.16	0.07	67.3	4.4	12	1	18	2
	FPMS 23	1.58	0.27	1.40	0.24	66	5	1.12	0.04	74.6	8.0	14	1	21	1
Upright															
	FPMS 22	2.65	0.04	2.36	0.04	68	4	1.31	0.06	89.1	1.1	19	1	30	0
	ESP 374	1.57	0.33	1.40	0.30	73	5	1.14	0.04	83.1	7.0	14	1	18	3
	DJN 60	2.64	0.29	2.34	0.26	89	5	1.16	0.06	102.9	8.2	18	1	25	2
Fertile															
	FPMS 16	2.42	0.09	2.15	0.08	87	5	1.17	0.01	102.1	5.8	17	1	24	2
	FPMS 31	2.92	0.49	2.60	0.44	94	11	1.13	0.08	105.8	12.0	19	1	27	3
	FPMS 32	2.34	0.14	2.08	0.13	67	2	1.27	0.04	84.8	2.0	18	1	28	1
	FPMS 33	2.99	0.51	2.65	0.45	88	6	1.15	0.08	100.5	4.6	19	3	30	5
	ESP 236	2.13	0.26	1.89	0.23	87	3	1.14	0.03	99.6	3.9	14	2	21	2
	DJN 375	2.62	0.64	2.33	0.57	86	10	1.11	0.08	94.5	9.8	17	2	27	5
	DJN 10/18	3.84	0.78	3.41	0.70	115	3	1.06	0.08	122.7	11.7	21	1	30	3
	COL 538	3.83	0.38	3.41	0.33	103	6	1.10	0.09	111.9	7.6	22	1	34	1
	Significant F	**[1]		**		***		*		***		**		*	

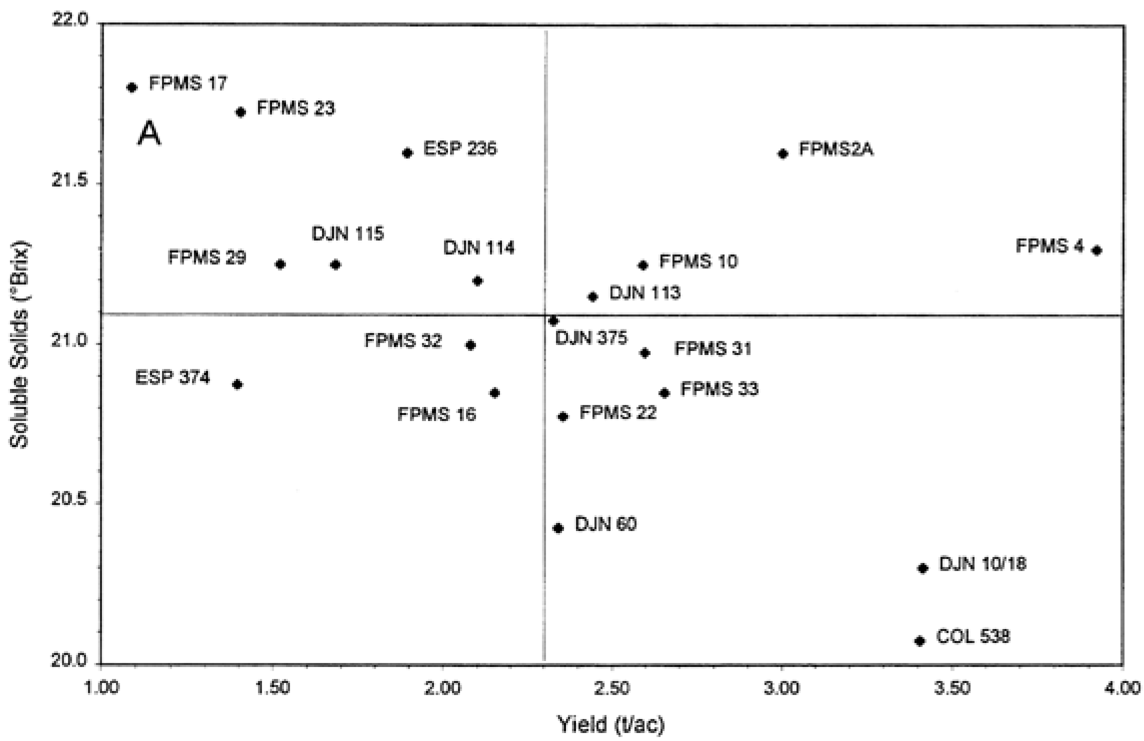
[1] *, **, and *** indicate statistically significant at the 0.05, 0.01, and 0.001 levels of probability, respectively.

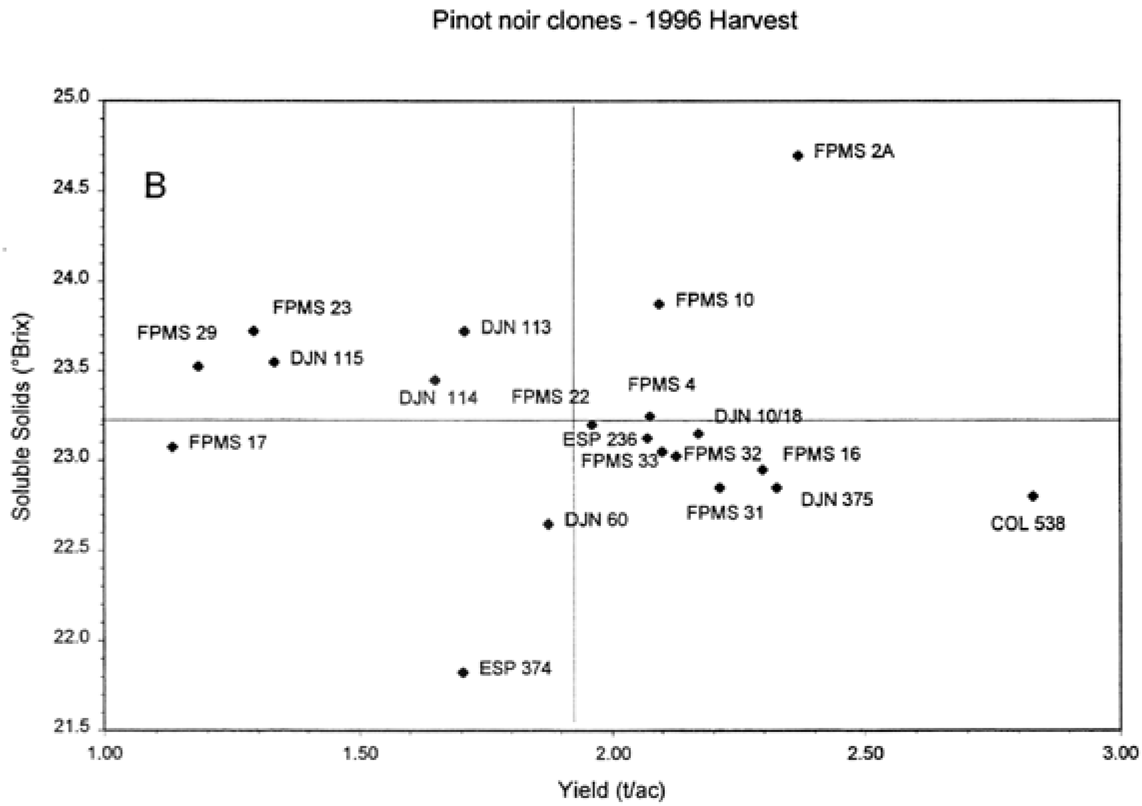
Table 4. Fruit composition of Pinot noir clones at Woodhall III Vineyard.

	Clone[1]	Soluble Solids (°Brix)	±	pH	±	Titratable acidity (g/L)	±	Sugar (kg/vine)	±	1996 Skin Anthocyanin (mg/berry)	±	1996 Skin Anthocyanin (mg/g skin)	±	1997 Skin Anthocyanin (mg/berry)	±	1997 Skin Anthocyanin (mg/g skin)	±
Pinot fin																	
	FPMS 2A	21.6	0.3	2.98	0.05	7.52	0.45	0.73	0.13	1.33	0.08	10.40	1.46	1.51	0.10	8.68	0.88
	FPMS 4	21.3	0.2	3.14	0.02	5.67	0.08	0.94	0.28	1.06	0.10	7.88	0.90	1.23	0.04	6.45	0.34
	FPMS 10	21.3	0.1	3.10	0.03	5.72	0.17	0.62	0.04	1.10	0.08	8.15	1.04	1.34	0.03	8.40	0.32
	FPMS 29	21.3	0.1	3.10	0.04	5.98	0.33	0.36	0.03	1.16	0.11	10.11	0.70	1.50	0.20	8.04	1.66
	DJN 113	21.2	0.1	3.12	0.02	6.17	0.25	0.58	0.15	1.00	0.07	7.72	1.26	1.21	0.07	6.49	0.40
	DJN 114	21.2	0.2	3.12	0.02	5.91	0.21	0.50	0.10	1.15	0.18	8.33	1.47	1.24	0.07	7.63	0.50
	DJN 115	21.3	0.3	3.14	0.03	5.80	0.30	0.40	0.07	1.19	0.20	10.25	0.71	1.36	0.08	7.56	0.77
Mariafeld																	
	FPMS 17	21.8	0.2	3.02	0.03	6.73	0.28	0.27	0.04	1.87	0.06	14.89	1.49	1.99	0.11	10.46	1.41
	FPMS 23	21.7	0.2	3.01	0.03	7.01	0.23	0.34	0.06	1.91	0.08	12.65	0.79	1.97	0.14	11.10	1.24
Upright																	
	FPMS 22	20.8	0.1	3.01	0.03	7.43	0.18	0.55	0.01	1.24	0.14	9.53	2.43	1.52	0.23	8.08	1.28
	ESP 374	20.9	0.2	3.06	0.04	6.89	0.39	0.33	0.07	1.10	0.13	11.52	3.19	1.43	0.08	8.27	0.84
	DJN 60	20.4	0.1	3.06	0.01	6.74	0.18	0.54	0.06	1.12	0.10	8.87	1.49	1.31	0.07	7.24	0.74
Fertile																	
	FPMS 16	20.9	0.2	3.07	0.04	6.49	0.22	0.51	0.02	0.99	0.06	8.77	0.48	1.33	0.06	8.20	0.58
	FPMS 31	21.0	0.3	3.00	0.03	7.55	0.24	0.61	0.10	1.30	0.15	9.25	1.47	1.43	0.14	8.87	1.40
	FPMS 32	21.0	0.1	3.13	0.01	5.72	0.04	0.49	0.03	1.34	0.14	9.77	0.31	1.49	0.06	8.75	1.16
	FPMS 33	20.9	0.3	3.03	0.01	6.99	0.17	0.62	0.10	1.15	0.12	8.36	1.68	1.38	0.07	8.03	0.70
	ESP 236	21.6	0.4	3.04	0.01	7.11	0.06	0.46	0.05	1.12	0.03	9.24	1.37	1.50	0.13	8.80	1.23
	DJN 375	21.1	0.2	3.03	0.02	7.26	0.26	0.55	0.13	1.11	0.19	8.50	1.70	1.39	0.10	8.77	1.12
	DJN 10/18	20.3	0.2	3.01	0.01	7.17	0.17	0.79	0.17	1.21	0.21	9.15	1.88	1.22	0.11	7.84	1.11
	COL 538	20.1	0.3	3.06	0.03	6.64	0.26	0.77	0.08	1.01	0.08	7.88	0.66	1.15	0.07	6.97	0.13
	Significant F	***[1]		***		***		**		***		**		***		ns	

[1] ns, **, and *** indicate not significant, and statistically significant at the 0.01, and 0.001 levels of probability, respectively.

Pinot noir Clones - 1997 Harvest





Figures 1 A & B. Juice soluble solids vs. yield of Pinot noir clones at Woodhall III Vineyard in 1997 and 1996, respectively. Horizontal and vertical lines indicate overall seasonal average of soluble solids and yield, respectively.

Juice pH and titratable acidity at harvest (Table 4) were inversely correlated ($R^2 = 0.84$). Neither pH nor titratable acidity, however, was ' significantly correlated to Brix. With the exception of FPMS 2A, (Wadenswil) the Pinot fin type clones tended to have relatively high juice pH and correspondingly low titratable acidity levels compared to those of the other clones.

On August 11, at the beginning of veraison, soluble solids ranged from 4.8 to 5.7 °Brix (COL 538, and DJN 375 and FPMS 23, respectively) (Table 5). pH ranged from 2.33 to 2.44 (FPMS 17 and FPMS 16, respectively). Titratable acidity, ranged from 43.31 to 53.28 g/L (FPMS 4 and FPMS 23, respectively). Juice composition of cluster samples on August 25, September 8, and September 22 are summarized in Tables 6 - 8. Different clones appeared to accumulate sugar at different rates during ripening (Figure 2). FPMS 4 (Pommard) accumulated sugar at a higher rate early on, but was slower than the other clones later in the season. Also, at the beginning of ripening, this clone lost acids at a higher rate than did the other clones (Figure 3). FPMS 2A had opposite patterns of sugar accumulation and acid loss compared to those of FPMS 4. FPMS 22 (Gamay Beaujolais) was one of the slowest clones in ripening. Between September 22 and October 7, many clones showed reductions in sugar concentration in response to heavy rains.

Table 5. Fruit composition of Pinot noir clones at Woodhall III Vineyard on August 11, 1997.

Clone	Solids (°Brix)	±	pH	±	Titratable acidity (g/L)	±
Pinot fin						
FPMS 2A	5.1	0.2	2.40	0.05	45.72	1.17
FPMS 4	5.4	0.2	2.40	0.04	43.31	1.99
FPMS 10	5.5	0.2	2.41	0.03	50.78	1.56
FPMS 29	5.6	0.3	2.44	0.01	48.50	1.21
DJN 113	5.3	0.1	2.38	0.01	46.97	2.31
DJN 114	5.4	0.2	2.37	0.01	45.72	1.24
DJN 115	5.7	0.2	2.41	0.04	45.25	1.83
Mariafeld						
FPMS 17	5.7	0.4	2.33	0.04	46.56	3.20
FPMS 23	5.7	0.2	2.36	0.04	53.28	3.14
Upright						
FPMS 22	4.9	0.1	2.35	0.03	46.81	1.26
ESP 374	5.3	0.2	2.39	0.03	47.97	1.46
DJN 60	5.3	0.3	2.40	0.04	51.22	3.40
Fertile						
FPMS 16	5.0	0.2	2.45	0.03	44.66	0.43
FPMS 31	5.4	0.2	2.41	0.04	46.22	1.17
FPMS 32	5.0	0.2	2.34	0.03	51.28	2.66
FPMS 33	5.2	0.3	2.43	0.03	47.38	1.70
ESP 236	5.3	0.1	2.36	0.02	47.88	1.33
DJN 375	5.7	0.4	2.37	0.03	47.28	1.66
DJN 10/18	5.5	0.3	2.43	0.04	45.22	1.50
COL 538	4.8	0.2	2.41	0.04	44.50	1.21
Significant F	*[1]		ns		*	

[1] ns and * indicate not significant and statistically significant at the 0.05 level of probability, respectively.

Table 6. Fruit composition of Pinot noir clones at Woodhall III Vineyard on August 25, 1997.

	Clone[1]	Solids (°Brix)	±	pH	±	Titratable acidity (g/L)	±
Pinot fin							
	FPMS 2A	10.7	0.4	2.52	0.01	33.17	1.00
	FPMS 4	13.9	0.6	2.73	0.04	20.80	1.47
	FPMS 10	13.1	0.7	2.73	0.03	24.09	2.03
	FPMS 29	11.3	0.5	2.64	0.03	31.28	2.43
	DJN 113	12.2	0.3	2.65	0.03	26.80	1.44
	DJN 114	12.5	0.4	2.74	0.04	24.70	0.88
	DJN 115	13.3	0.5	2.71	0.02	24.38	1.68
Mariafeld							
	FPMS 17	12.0	1.2	2.56	0.05	31.77	4.24
	FPMS 23	10.4	0.4	2.61	0.03	32.55	2.29
Upright							
	FPMS 22	9.1	0.6	2.57	0.02	38.50	1.85
	ESP 374	11.2	0.7	2.63	0.03	32.06	1.70
	DJN 60	11.7	0.3	2.59	0.02	29.00	1.18
Fertile							
	FPMS 16	10.8	0.4	2.60	0.02	31.72	1.72
	FPMS 31	11.4	0.7	2.58	0.05	31.86	2.71
	FPMS 32	10.0	0.5	2.57	0.01	34.72	1.57
	FPMS 33	11.7	0.2	2.59	0.02	30.13	0.90
	ESP 236	12.6	0.1	2.66	0.01	27.16	0.60
	DJN 375	13.7	0.6	2.65	0.02	24.11	1.09
	DJN 10/18	12.7	0.8	2.66	0.04	25.63	1.83
	COL 538	11.1	0.9	2.60	0.03	30.70	2.01
	Significant	***[1]		***		***	

[1] *** indicates statistically significant at the 0.001 level of probability.

Table 7. Fruit composition of Pinot noir clones at Woodhall III Vineyard on September 8, 1997.

	Clone[1]	Solids (°Brix)	±	pH	±	Titratable acidity (g/L)	±
Pinot fin							
	FPMS 2A	17.9	0.3	2.64	0.03	16.01	0.56
	FPMS 4	18.1	0.3	2.81	0.03	11.36	0.35
	FPMS 10	19.2	0.4	2.77	0.03	10.46	0.94
	FPMS 29	18.5	0.4	2.72	0.03	13.42	1.20
	DJN 113	18.3	0.3	2.77	0.04	12.83	0.89
	DJN 114	18.5	0.2	2.83	0.04	12.16	0.68
	DJN 115	18.9	0.3	2.82	0.05	11.63	0.32
Mariafeld							
	FPMS 17	19.5	0.2	2.69	0.03	13.56	0.62
	FPMS 23	19.1	0.2	2.73	0.01	14.91	0.53
Upright							
	FPMS 22	16.9	0.7	2.68	0.02	17.47	1.41
	ESP 374	17.2	0.2	2.71	0.02	15.21	0.86
	DJN 60	17.1	0.3	2.68	0.02	15.09	1.28
Fertile							
	FPMS 16	17.5	0.3	2.68	0.03	15.08	0.75
	FPMS 31	17.9	0.2	2.67	0.02	15.55	0.81
	FPMS 32	17.8	0.3	2.77	0.01	13.99	0.38
	FPMS 33	17.1	0.4	2.66	0.03	15.84	0.48
	ESP 236	17.8	0.6	2.70	0.03	15.79	0.94
	DJN 375	17.7	0.3	2.70	0.01	14.54	0.66
	DJN 10/18	17.8	0.2	2.66	0.02	14.08	0.46
	COL 538	16.9	0.4	2.73	0.03	14.50	0.80
	Significant	***[1]		***		***	

[1] *** indicates statistically significant at the 0.001 level of probability.

Table 8. Fruit composition of Pinot noir clones at Woodhall III Vineyard on September 22, 1997.

	Clone[1]	Solids (°Brix)	±	pH	±	Titratable acidity (g/L)	±
Pinot fin							
	FPMS 2A	21.8	0.4	2.85	0.02	8.91	0.67
	FPMS 4	19.9	0.9	2.98	0.06	7.43	0.47
	FPMS 10	21.8	0.4	2.95	0.02	6.67	0.36
	FPMS 29	20.9	0.4	2.96	0.07	8.01	0.73
	DJN 113	21.5	0.2	3.00	0.08	7.31	0.52
	DJN 114	21.8	0.1	3.04	0.02	6.43	0.22
	DJN 115	21.7	0.8	3.08	0.07	7.36	0.92
Mariafeld							
	FPMS 17	21.6	0.3	2.98	0.06	8.96	0.24
	FPMS 23	22.3	0.4	3.02	0.05	8.23	0.51
Upright							
	FPMS 22	20.3	0.1	2.83	0.01	9.87	0.37
	ESP 374	21.1	0.7	2.97	0.08	7.60	0.62
	DJN 60	20.9	0.8	2.92	0.06	8.25	0.88
Fertile							
	FPMS 16	21.4	0.3	2.95	0.05	7.62	0.52
	FPMS 31	20.5	0.2	2.86	0.03	8.76	0.34
	FPMS 32	20.5	0.1	2.98	0.04	8.64	0.40
	FPMS 33	20.6	0.3	2.94	0.04	8.42	0.20
	ESP 236	21.2	0.2	2.91	0.05	8.07	0.23
	DJN 375	20.8	0.3	2.88	0.03	9.05	0.36
	DJN 10/18	20.4	0.4	2.90	0.06	8.50	0.19
	COL 538	20.1	0.4	2.92	0.03	8.31	0.77
	Significant	*[1]		*		*	

[1] * indicates statistically significant at the 0.05, level of probability.

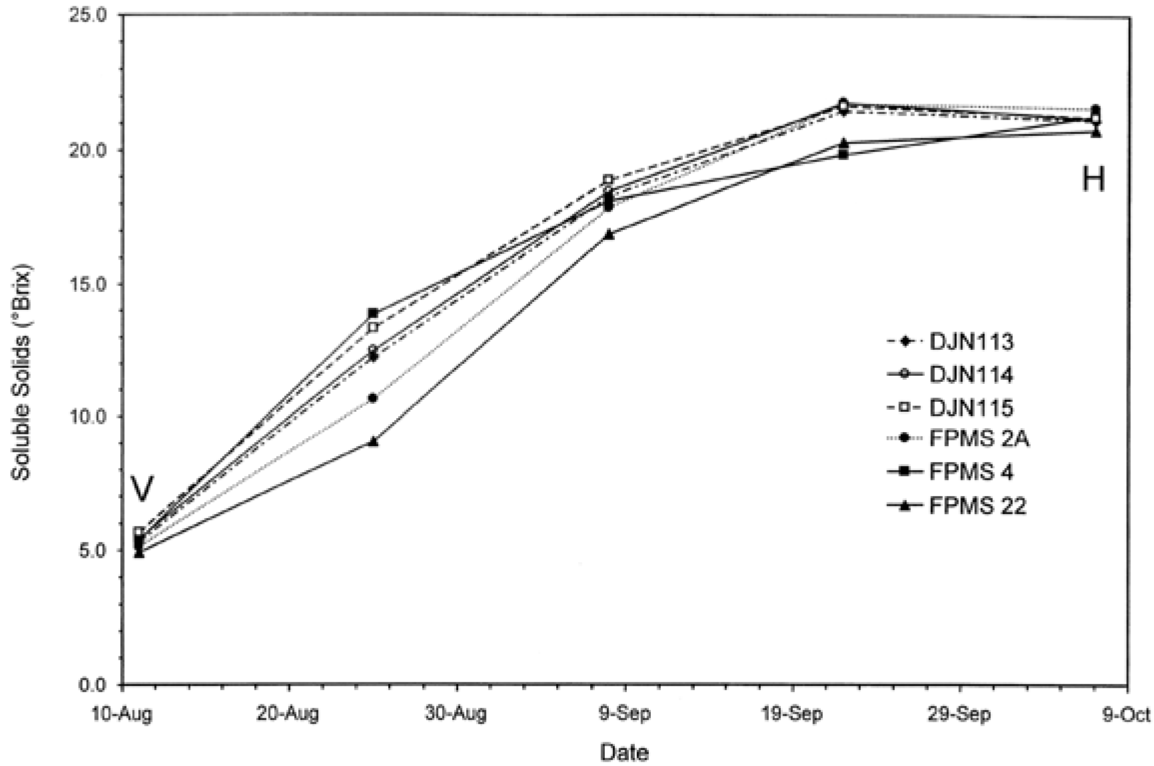


Figure 2.Trends in sugar accumulation during ripening of selected Pinot noir clones at Woodhall III Vineyard.
V = veraison; H = harvest.

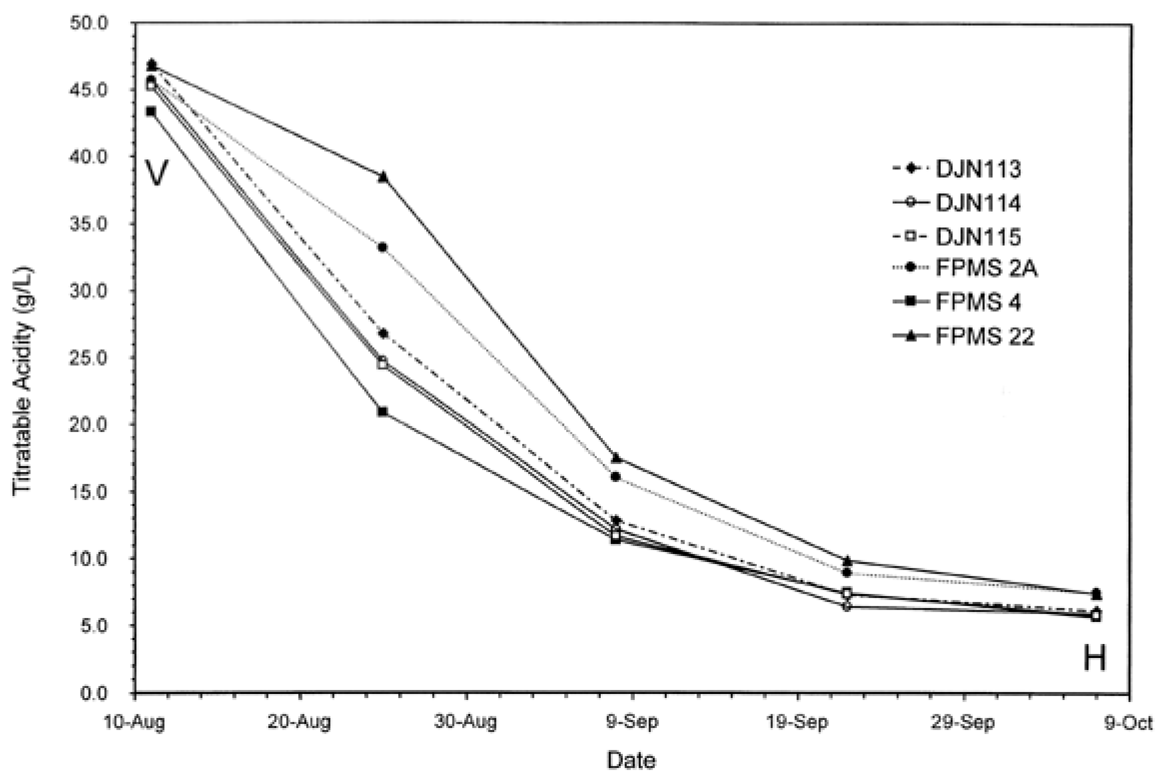


Figure 3. Changes in titratable acidity during ripening of selected Pinot noir clones at Woodhall III Vineyard.
V = veraison; H = harvest.

Fruitset was generally inversely correlated with flowers per inflorescence (Table 9). Pinot fin type clones tended to have relatively few flowers per inflorescence, but moderate to high fruit set. The Fertile type clones tended to have relatively high flower counts and moderate fruit set. The Mariafeld clones had high flower counts and the lowest fruit set percentages. The overall average of flower counts per inflorescence was higher in 1997 than in 1996 (394 vs 352, respectively). Fruitset overall, however, was 29.3% in 1997 compared to 35%, the average for 1996.

Table 9. Cluster architecture, skin and berry characteristics, and fruit set of Pinot noir clones at Woodhall III Vineyard.

	Clone[1]	Cluster Length (cm)	±	Cluster Volume (cm^3)	±	Cluster Compactness (berries/cm)	±	Skin wt./ Berry wt. (%)	±	Flowers/ Inflorescence	±	Fruit Set (%)	±
Pinot fin													
	FPMS 2A	11.9	0.5	115	17	9.5	0.8	14.6	1.4	389	16	29	2
	FPMS 4	11.1	0.2	125	9	12.3	1.1	15.3	1.5	295	21	46	2
	FPMS 10	12.2	0.4	118	17	10.9	0.4	15.2	1.2	319	14	42	3
	FPMS 29	11.6	0.4	88	8	8.3	0.6	17.1	0.8	333	16	29	3
	DJN 113	11.4	0.3	106	21	11.1	1.8	16.8	0.3	303	33	41	4
	DJN 114	11.1	0.3	100	9	10.5	0.5	15.1	1.5	354	27	33	1
	DJN 115	10.7	0.2	117	4	12.7	0.3	16.9	0.7	277	20	50	3
Mariafeld													
	FPMS 17	13.3	0.3	59	11	4.0	0.2	17.1	1.5	457	41	12	1
	FPMS 23	14.9	0.6	64	5	4.8	0.4	16.2	1.4	496	67	15	3
Upright													
	FPMS 22	12.4	0.5	86	7	6.0	0.6	14.4	0.3	374	17	20	2
	ESP 374	12.1	0.3	85	11	7.2	0.9	15.6	1.0	388	23	23	2
	DJN 60	12.4	0.3	119	5	9.1	0.4	16.1	1.4	350	4	32	1
Fertile													
	FPMS 16	10.8	0.6	104	12	9.2	0.8	13.9	0.5	289	12	34	3
	FPMS 31	12.0	0.7	93	11	7.7	0.4	14.8	1.2	511	78	19	2
	FPMS 32	11.3	0.2	85	6	7.3	0.7	14.0	1.2	430	14	19	2
	FPMS 33	12.8	0.3	102	9	9.9	1.5	15.2	0.8	509	40	26	5
	ESP 236	12.7	0.2	114	13	8.8	1.3	15.3	1.0	513	23	22	3
	DJN 375	12.4	0.5	125	7	11.3	1.0	14.7	0.6	456	27	31	2
	DJN 10/18	12.7	0.2	116	8	9.6	0.5	15.2	1.2	436	41	29	2
	COL 538	11.7	0.4	125	6	12.0	1.0	15.2	0.7	412	26	35	3
	Significant F	***[1]		***		***		ns		***		***	

[1] ns and *** indicate not significant and statistically significant at the 0.001 level of probability, respectively.

Low fruit set resulted in generally fewer berries per cluster in 1997 (Tables 9 and 3), but berry weights tended to be relatively high. Cluster weights tended to be positively correlated with yields; those clones noted above as having above average yields generally had higher cluster weights. The two Mariafeld clones, FPMS 17 and FPMS 23, had very low weight, low volume clusters (Table 9). They had relatively long clusters with few berries, resulting in characteristically loose clusters (low cluster compactness).

Bloom time shoot length (measured on June 20) varied among the clones (Table 10). The Pinot fin and Upright groups tended to lead the other two types, although there was some variation among the clones within the two groups. There was not a significant correlation between shoot length at bloom and fruit set (data not shown).

Table 10. Vegetative growth, pruning weight and cane weight of Pinot noir clones at Woodhall III Vineyard.

	Clone[1]	Shoot Length 20 June (cm)	±	Shoot Diameter 20 June (mm)	±	Leaves/ Shoot 20 June	±	Pruning wt.[2] (kg/vine)	±	Cane wt.[3] (g)	±	Ravaz Index[4]	±
Pinot fin													
	FPMS 2A	112	6	7.78	0.11	24	1	0.72	0.10	48.5	5.7	4.39	1.89
	FPMS 4	119	12	7.21	0.62	27	1	0.72	0.06	48.4	6.8	3.35	0.57
	FPMS 10	122	4	7.32	0.09	30	2	0.61	0.02	45.0	5.9	3.84	0.72
	FPMS 29	126	7	7.34	0.24	32	1	0.42	0.02	44.5	4.8	3.21	0.96
	DJN 113	118	2	7.65	0.11	32	3	0.61	0.10	47.5	3.6	2.99	0.45
	DJN 114	110	7	7.65	0.15	30	2	0.57	0.10	46.0	4.5	3.34	0.35
	DJN 115	123	9	7.58	0.41	29	3	0.46	0.06	44.4	2.8	3.19	0.35
Mariafeld													
	FPMS 17	112	9	8.48	0.33	31	4	0.40	0.05	53.8	5.9	3.17	0.23
	FPMS 23	110	10	7.77	0.27	24	3	0.46	0.05	56.5	4.9	3.11	0.26
Upright													
	FPMS 22	121	7	7.39	0.20	26	1	0.75	0.05	48.1	4.0	3.00	0.39
	ESP 374	111	8	7.94	0.09	26	1	0.50	0.05	38.2	2.1	3.78	0.64
	DJN 60	127	8	7.85	0.50	27	1	0.63	0.05	45.1	2.7	3.27	0.31
Fertile													
	FPMS 16	119	11	7.36	0.44	30	4	0.58	0.05	39.5	2.1	4.47	0.51
	FPMS 31	91	4	7.85	0.22	25	2	0.61	0.05	49.3	3.9	3.96	0.44
	FPMS 32	108	7	7.98	0.31	29	2	0.61	0.03	44.7	3.2	3.92	0.44
	FPMS 33	107	6	8.18	0.29	26	1	0.70	0.14	46.6	2.3	3.58	0.37
	ESP 236	99	6	8.23	0.20	24	2	0.48	0.05	38.4	3.0	4.99	0.51
	DJN 375	108	2	8.36	0.20	27	1	0.55	0.12	38.9	6.9	5.30	1.05
	DJN 10/18	103	8	7.02	0.22	24	1	0.66	0.04	45.4	2.5	3.68	0.13
	COL 538	110	7	7.13	0.26	24	1	0.79	0.07	41.9	1.9	4.01	0.32
	Significant F	**[1]		**		*		**		*		ns	

[1] ns, *, and ** indicate not significant, and statistically significant at the 0.05, and 0.01 levels of probability, respectively.

[2] Pruning weight from March 1997.

[3] Cane weight from March 1997.

[4] The Ravaz Index is the ratio of yield from October 1996 to pruning weight from March 1997.

Bud burst of the different clones took place from Julian day 115 to 121 (April 25 to May 1) (Table 11). There were no significant differences among clones for the timing of bud burst. The range in days to reach full bloom was narrower than that for bud burst. Full bloom occurred on Julian day 166 (June 15) for all but the two Espiguette clones (ESP374 and ESP236) which reached full bloom on the following day. The time elapsed between bud burst and bloom ranged from 46 (ESP 374) to 51 days (FPMS 4), averaging 49 days.

Table 11. Julian days to bud burst, full bloom, and veraison for 20 Pinot noir clones at Woodhall III Vineyard, Alpine, Oregon.

	Clone	Bud burst	Full bloom	Veraison		Bud burst to bloom	Bloom to veraison	Bud burst to veraison
Pinot fin								
	FPMS 2A	118	166	238	abc	48	72	120
	FPMS 4	115	166	233	j	51	66	117
	FPMS 10	116	166	234	ij	50	68	117
	FPMS 29	117	166	237	cdef	49	71	119
	DJN 113	118	166	235	ghi	48	68	116
	DJN 114	119	166	234	hi	47	68	115
	DJN 115	118	166	234	hi	48	68	116
Mariafeld								
	FPMS 17	117	166	238	abcd	49	72	120
	FPMS 23	116	166	238	abc	50	72	122
Upright								
	FPMS 22	117	166	239	a	49	73	122
	ESP 374	121	167	237	bcde	46	71	116
	DJN 60	118	166	237	bcde	49	71	120
Fertile								
	FPMS 16	118	166	236	def	49	70	119
	FPMS 31	117	166	237	bcde	49	71	120
	FPMS 32	118	166	238	ab	49	72	121
	FPMS 33	117	166	237	cdef	49	71	120
	ESP 236	118	167	236	efg	49	69	118
	DJN 375	119	166	237	cdef	47	70	117
	DJN 10/18	117	166	236	fgh	49	69	118
	COL 538	118	166	237	bcdef	49	71	119
	Significant	ns[1]	ns	***				

[1] ns, and *** indicate not significant, and statistically significant at the 0.001 level of probability, respectively.

Veraison took place between Julian day 233 and 239 (August 21 and 27, respectively), depending on clone. The first to reach veraison was FPMS 4. Several other Pinot fin type clones, including FPMS 10, and DJN 113, 114, and 115, started to ripen earlier than the other clones. These clones generally had fewer days between bloom and veraison, and between bud burst and veraison. An average of 70 days was required between anthesis and the onset of fruit ripening. 115 to 122 days were required from bud burst to veraison, with an average across all clones of 119 days. The last clone to reach veraison was FPMS 22. This clone typically ripens later than other Pinot noir clones.

Pruning weights are an index of vine vigor and may help to explain some of the differences in yield. Clones noted earlier as having higher yields, tended to have higher pruning weights (Table 10). Clones FPMS 2A and 4 (Wadenswil and Pommard) and COL 538 each had high pruning weights and were high yielding. FPMS 22, however, had relatively high pruning weights but below average yield. The Mariafeld clones FPMS 17 and 23 both had very low pruning weights and low yields. The Ravaz index is the ratio of yield to pruning weight. It is an estimate of the efficiency of fruit production, with higher values indicating greater efficiency. Ravaz index values ranged from 2.99 (DJN 115) to 5.30 (DJN 375) (Table 10). These differences, however, were not significant.

Skin anthocyanin concentrations from the 1996 harvest are reported here because they were not available at this time last year (Table 4). They tended to be slightly lower than the values from 1997. In 1997, skin anthocyanins concentrations ranged from 1.15 mg/berry (COL 538) to 1.99 mg/berry (FPMS 17). The values reported here for the different clones are generally correlated with those reported by Price and Watson (2) for wines produced in 1994 from the Pinot noir clones at Woodhall.

Juice soluble solids vs. yield of the Woodhall III Vineyard Pinot noir clones for the 1997 and 1996 harvests are shown in Figures 1A and B, respectively. As discussed above, overall yields were higher in 1997 than in 1996, but average soluble solids was higher in 1996. Some clones show more consistency from year to year in their performance in relation to the others. Clones FPMS 2A and 10 are consistently located in the quadrant of above average yield and above average Brix. Clones FPMS 23 and 29, and DJN 114 and 115 are regularly located in the quadrant of below average yield and above average Brix. Clone DJN 113 consistently has above average Brix, but varies around the mean yield from year to year. COL 538 tends to be well above the average yield, and below average Brix. Several of the other clones appear to be more responsive to factors that contribute to year to year fluctuations in yield and soluble solids.

Chardonnay clones

Yields of the Chardonnay clones ranged from a high of 4.40 t/ac (FPMS 6) to a low of 0.81 t/ac (FPMS 15) (Table 12). Yield components were wide ranging as well. Higher yielding clones such as DJN 75, DJN 78, ESP 352, and FPMS 6 tended to have more shoots and more clusters per vine and moderate to high cluster weights.

Table 12. Yield components of Chardonnay clones at Woodhall III Vineyard.

Clone[1]	Yield (kg/vine)	±	Yield (t/ac)	±	Shoots/ vine	±	Clusters/ vine	±	Berries/ cluster	±	Berry wt. (g)	±	Cluster wt. (g)	±
DJN 75	3.95	0.44	3.51	0.39	18	1	30	3	124	13	1.08	0.06	131.8	7.6
DJN 76	3.79	0.72	3.37	0.64	20	2	31	3	108	5	1.09	0.07	119.1	11.1
DJN 78	3.96	0.32	3.52	0.28	20	0	34	3	107	2	1.09	0.02	117.3	4.0
DJN 95	1.32	0.50	1.17	0.45	10	2	13	4	85	11	1.03	0.04	88.5	13.8
DJN 96'	2.80	0.28	2.49	0.25	16	1	24	1	109	6	1.08	0.03	118.2	7.8
DJN 96"	2.67	0.53	2.37	0.47	15	2	22	2	104	9	1.12	0.05	116.5	12.3
ESP 352	4.59	0.65	4.08	0.58	19	1	35	3	104	9	1.25	0.05	130.0	14.6
FPMS 4	4.07	0.54	3.62	0.48	15	1	23	2	156	8	1.12	0.02	173.9	9.6
FPMS 5	3.24	0.55	2.88	0.49	14	1	19	1	143	20	1.20	0.03	169.5	20.6
FPMS 6	4.95	0.69	4.40	0.61	23	0	39	4	105	6	1.20	0.05	126.6	8.5
FPMS 14	1.80	0.07	1.60	0.06	8	0	11	1	170	10	0.94	0.02	159.3	8.9
FPMS 15	0.91	0.08	0.81	0.07	8	0	10	1	52	3	1.73	0.05	90.2	5.0
Significant F	***[2]		***		***		***		***		***		***	

[1] Clones DJN 95 and DJN 96" were planted in 1991. All others were planted in 1989.

[2] *** indicates statistically significant at the 0.001 level of probability.

Juice soluble solids were less variable than yields (Table 13). Several clones had relatively high yields and high Brix (Figure 4A). DJN 75, 76, 78, and ESP 352 each had higher than average yields and Brix. Although they were high yielding, the FPMS clones 4, 5, and 6 had the lowest soluble solids. Both juice pH and titratable acidity varied among the different clones, and tended to reflect sugar development. Clones with higher Brix tended to also have higher pH and lower titratable acidity. These results support the general observations that the Dijon and Espiguette Chardormay clones tend to ripen earlier.

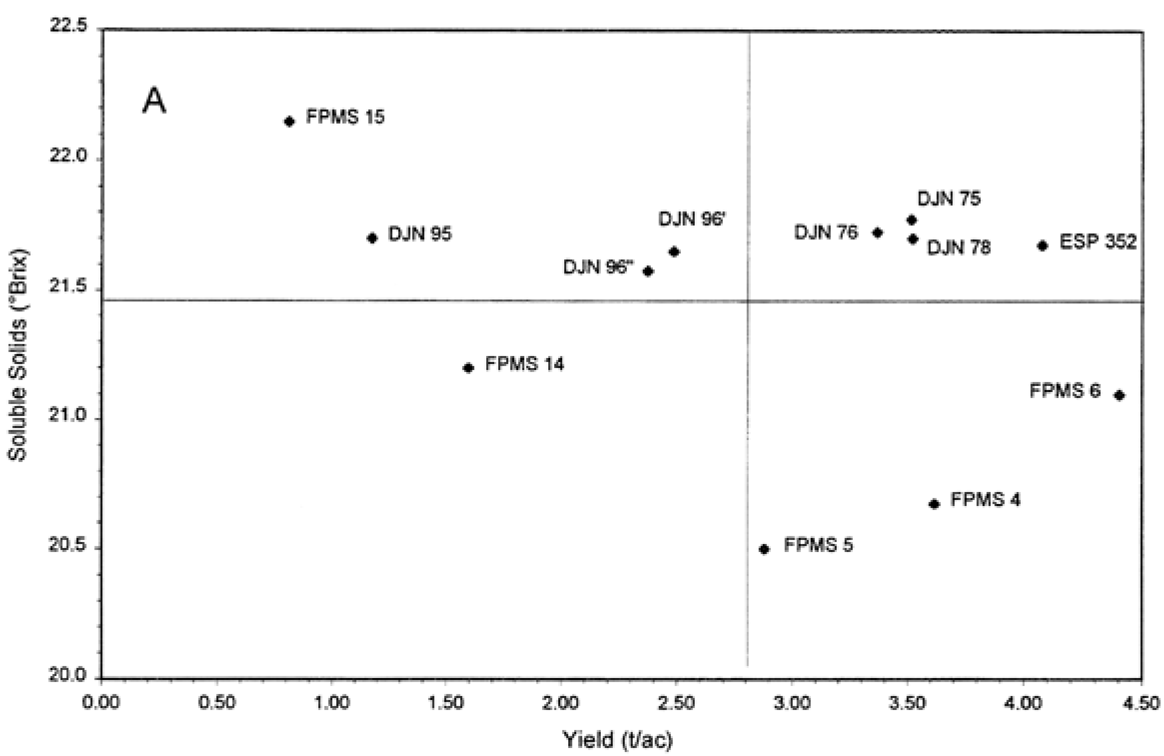
Table 13. Fruit composition of Chardonnay clones at Woodhall III Vineyard.

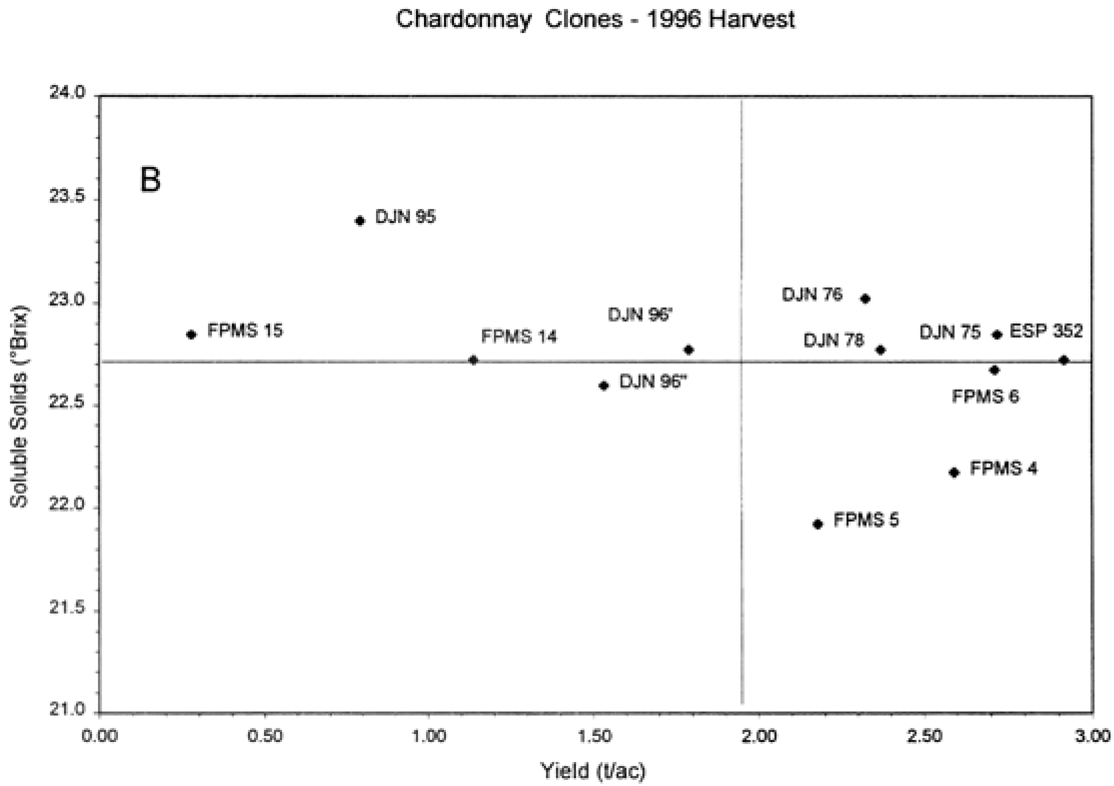
Clone[1]	Soluble Solids (°Brix)	±	pH	±	Titratable acidity (g/L)	±	Sugar (kg/vine)	±
DJN 75	21.8	0.2	3.10	0.02	5.74	0.11	0.86	0.09
DJN 76	21.7	0.1	3.05	0.02	5.97	0.15	0.82	0.15
DJN 78	21.7	0.2	3.04	0.01	6.20	0.06	0.86	0.07
DJN 95	21.7	0.1	3.10	0.01	5.52	0.13	0.29	0.11
DJN 96'	21.7	0.1	3.09	0.01	5.69	0.15	0.60	0.06
DJN 96"	21.6	0.2	3.08	0.01	5.71	0.19	0.57	0.11
ESP 352	21.7	0.3	3.02	0.02	6.62	0.22	0.99	0.12
FPMS 4	20.7	0.3	2.94	0.02	7.92	0.15	0.84	0.10
FPMS 5	20.5	0.3	2.92	0.02	8.43	0.47	0.66	0.11
FPMS 6	21.1	0.2	2.98	0.01	6.95	0.19	1.04	0.14
FPMS 14	21.2	0.2	2.99	0.01	7.03	0.12	0.38	0.01
FPMS 15	22.2	0.2	3.19	0.01	6.54	0.15	0.20	0.02
Significant F	***[2]		***		***		***	

[1] Clones DJN 95 and DJN 96" were planted in 1991. All others were planted in 1989.

[2] *** indicates statistically significant at the 0.001 level of probability.

Chardonnay Clones - 1997 Harvest





Figures 4 A & B. Juice soluble solids vs. yield of Chardonnay clones at Woodhall III Vineyard in 1997 and 1996, respectively. Horizontal and vertical lines indicate overall seasonal average of soluble solids and yield, respectively.

March 1997 pruning weights indicate differences in vine vigor among the clones (Table 14). Most of the high yielding clones had relatively high pruning weights, and relatively moderate or high yield to pruning weight ratios (Ravaz Index). FPMS 6, with high yield and pruning weights, had a relatively low Ravaz Index. FPMS 15 was the least efficient in fruit production, showing the lowest Ravaz Index.

Table 14. Pruning weight, cane weight, and yield to pruning weight ratio of Chardonnay clones at Woodhall III Vineyard.

Clone[1]	Pruning wt.[2] (kg/vine)	±	Cane wt.[3] (g)	±	Ravaz Index[4]	±
DJN 75	0.75	0.09	55.39	6.21	4.22	0.40
DJN 76	0.76	0.09	56.40	2.11	3.34	0.45
DJN 78	0.80	0.02	55.59	1.87	3.34	0.18
DJN 95	0.36	0.08	56.81	5.30	2.22	0.44
DJN 96'	0.63	0.04	53.33	1.97	3.21	0.32
DJN 96"	0.59	0.09	75.08	8.65	2.78	0.51
ESP 352	0.83	0.08	56.68	1.42	4.03	0.26
FPMS 4	0.68	0.04	59.80	1.22	4.33	0.33
FPMS 5	0.58	0.06	59.56	3.01	4.11	0.52
FPMS 6	1.10	0.13	69.44	7.72	2.88	0.47
FPMS 14	0.32	0.02	65.79	3.47	4.01	0.39
FPMS 15	0.32	0.01	76.20	6.74	0.99	0.14
Significant	***[5]		**		***	

[1] Clones DJN 95 and DJN 96" were planted in 1991. All others were planted in 1989.

[2] Pruning weight from March 1997.

[3] Cane weight from March 1997.

[4] The Ravaz Index is the ratio of yield from October 1996 to pruning weight from March 1997.

[5] **, and *** indicate statistically significant at the 0.01, and 0.001 levels of probability, respectively.

Juice soluble solids vs. yield of the Chardonnay clones for the 1997 and 1996 harvests is shown in Figures 4A and B, respectively. As was the case for the Pinot noir clones, the overall yield for Chardonnay also was higher in 1997 than in 1996; average brix was higher in 1996. The relative performance of the Chardonnay clones in 1997 and 1996 are quite similar, more so than for the Pinot noir clones, suggesting that these Chardormay clones, although relatively diverse, behave similarly in their responses to factors causing year to year fluctuations affecting yield and Brix.

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