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Cooperative Rootstock Trials: Research Update

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ABSTRACT

Five replicated rootstock trials established in Oregon's three main viticultural regions were evaluated for the effect of rootstock on Pinot noir performance. All the trials except Alpine included the following seven rootstocks: ungrafted Pinot noir, 3309 Couderc, 101-14 Millardet et De Grasset, 44-53 Malegue, 420 A Millardet et De Grasset, 5 C Teleki, and Harmony. At Alpine, the rootstock selection included ungrafted Pinot noir, 3309 Couderc, 101-14 Millardet et De Grasset, Riparia Gloire, Selection Oppenheim 4 (SO 4) and Kober 5BB.

Rootstock effect on scion performance varied greatly with site, and the responses typically were not consistent from site to site. At Newberg, Pinot noir grafted to 420 A had the best yields and ungrafted vines, the lowest. Vines grafted to 101-14 had the highest must soluble solids. At Lafayette, no rootstock differences in soluble solids in the juice could be observed but yields were better with 3309 C. At Umpqua, the most vigorous site, vines grafted to 45-53 had the best yields and when grafted to 101-14 had the lowest fruit production. There was no difference on must soluble solids at this site. At Eagle Point, a site with very shallow soil and low vigor, yields were better when vines were grafted to 3309 C and lower when grafted to Harmony or 5C. Must soluble solids did not respond to rootstock. At Alpine, with a different selection of rootstocks, yields were better when the stock was SO 4 but there was no rootstock effect on Brix.

INTRODUCTION

The advent of phylloxera in Oregon led to an urgent need of evaluating viticultural characteristics of rootstocks with potential adaptation to different sites in Oregon, a cool climate grape production zone. Five replicated rootstock trials established in Oregon's three main viticultural regions were evaluated for the effect of rootstock on canopy development, fruit set, yield, and fruit composition. During this second year of evaluation, results varied slightly as vines become established.

MATERIALS AND METHODS

Experimental design

The following rootstock trials, planted in 1992, were followed in this study: Winters Hill Vineyard (Lafayette), Whistling Ridge Vineyard (Newberg), Woodhall Vineyard (Alpine) Henry Estate Vineyard (Umpqua), and Ousterhout Vineyard (Eagle Point). All OF the trials except Alpine include five replicated blocks of five Pinot noir vines grafted onto the following seven stocks: Pinot noir, 3309

Couderc, 101-14 Millardet et De Grasset, 44-53 Malegue, 420 A Millardet et De Grasset, 5 C Teleki, and Harmony. At Alpine, the rootstock selection includes ungrafted Pinot noir, 3309 Couderc, 101-14 Millardet et De Grasset, Riparia Gloire, Selection Oppenheim 4 (SO 4) and Kober 5BB. All of these rootstocks except Harmony are characterized by a high resistance to phylloxera. Harmony has *V. vinifera* in the parentage (which is usually associated with insufficient phylloxera resistance) and showed low resistance to phylloxera in Australia (Cirami *et al.*, 1984) and South Africa (Southey, 1992).

Site description

Table 1 summarizes geographical, climatic and pedological information as well as choice of trellis systems and spacing of each site included in this study. Soil samples were taken at each vineyard at full bloom in 1996 and were analyzed for macro and micronutrients. Results are shown in table 2.

Table 1: Geographical and pedological characterization and cultural choices of the vineyards under study.

Location & County	Soil Series and Type	Topo-graphy	Rows	Exposure	Training System	Spacing	Overall Vigor	Irrigation
Newberg, Yamhill	Willakenzie silty clay loam	Hill	N-S	South	Double Guyot	5 x 7'	Moderate	No
Lafayette, Yamhill	Jory clay loam	Hill	N-S	South	Double Guyot	5 x 8'	Low	No
Umpqua, Douglas	clay loam	Valley floor	N-S	—	Scott Henry	6 x 12'	Vigorous	No
Eagle Point, Jackson	Agate and Carney clay	Hill	N-S	N	Lyre	6 x 12'	Low	Yes
Alpine, Benton	Bellpine, Jory silty clay loam, clay loam	Hill	N-S	South	Double Guyot	6 x 9'	Moderate	No

Table 2: Soil pH, macro and micronutrient content at 0-30 cm depth in five vineyards. Samples were collected at full bloom in 1996. Values underlined are lower than desirable and values in italics, higher than necessary.

	Newberg	Lafayette	Umpqua	Eagle Point	Alpine
pH	5.32	6.07	5.61	6.47	5.00
P (ppm)	12	21	44	22	7
K (ppm)	141	*209*	175	125	130
Ca (meq/100g)	3	8	10	15	3
Mg (meq/100g)	0.9	1.3	2.2	4.8	0.6
B (ppm)	0.8	0.8	0.8	1.5	0.4
Fe (ppm)	132	74	217	274	86
Cu (ppm)	3	2	3	4	1
Zn (ppm)	1.5	2.4	1.4	3.5	0.8

Fruit set

Prior to bloom, 105 inflorescence clusters in three of the vineyards (three per replicate) were enclosed into pollination bags to retain all shed flowers. The bags were removed at the end of July, four weeks after full boom and all the abscised flowers and fruitlets were counted. At harvest, these clusters were picked separately and frozen and the number of berries was counted. Number of flowers was calculated as the sum of shed flowers and berries. Percent fruit set was calculated as the quotient between number of berries at harvest and the total number of flowers per inflorescence.

Yield and fruit quality

The vineyards were harvested at commercial ripening. The vineyard at Eagle Point was harvested on September 18, at Umpqua on October 1, at Lafayette on October 3, at Alpine on October 11, and at Newberg on October 12.

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 berry weights and number of berries per cluster. Cluster weight was calculated averaging the pooled 30 cluster sample. Number of clusters was calculated using yield per replicate and average cluster weight. Sugar per vine was calculated multiplying must sugar concentration (Brix/100) by total yield per vine.

Canopy development and vine vigor

Five shoots per replicate were collected during ripening at each location for growth analysis. Shoot length and diameter were measured, number of main and lateral leaves were counted, and primary and lateral leaf area was measured. Weight of the one year old prunings, including woody laterals, was recorded in February 1996. Cane weight was obtained by dividing pruning weight by number of canes.

Wood carbohydrate reserves

Three 3 cm long sections of two-year old wood per replicate were collected at pruning during February of 1996. These samples were pooled per replicate, dried at 60°C until constant weight and ground to pass through a 40 mesh screen. Soluble sugars and starch were extracted and analyzed as described by

Candolfi-Vasconcelos and Koblet (1990).

RESULTS AND DISCUSSION

Yield and yield components

Table 3 summarizes the rootstock effect on yield and yield components of Pinot noir grapevines at the 5 different sites. At Newberg, Pinot noir grafted to 420 A had larger clusters and higher yields than other rootstocks, particularly ungrafted vines. At Lafayette, yields were higher on vines grafted to 3309 C, reflecting the higher cluster weights and higher number of clusters per vine. At Umpqua, vines grafted to 45-53 had the best yields and when grafted to 101-14, the lowest. At Eagle Point, yields were better when vines were grafted to 3309 C and lower when grafted to Harmony or 5C. SO 4 induced better yields than the other rootstocks, particularly Riparia Gloire at Alpine. Fruit set was 32% in Newberg, 31% in Lafayette and 37% in Alpine. There was no difference in fruit set and final number of berries per cluster among rootstocks. Mean berry weight was 1.13g in Newberg, 0.71g in Lafayette, 0.88g in Umpqua and 0.92g at Eagle Point. There was no rootstock difference in berry weights at these sites but at Alpine, berries from vines grafted to 5BB were the heaviest and Riparia Gloire produced the smallest berries. Vines grafted to SO 4 had more and heavier clusters than grafted to other stocks. Riparia Gloire produced the smallest number of clusters per vine and they were much smaller compared to other rootstock selections.

Table 3: Effect of rootstock on yield and yield components of Pinot noir grapevines at five different locations in Oregon.

Vineyard Location	Rootstock	Fruit Yield (Ton/acre)	Fruit Set %	Berry wt. g	Berries/ Cluster	Cluster wt. (g)	Clusters/ m^2	Skin: Berry Wt (%)
Newberg	Harmony	2.73 c	33.31	1.11	80	88.0 bcd	7 a	16
	5C	2.66 cd	30.58	1.17	72	84.0 cd	7 a	15
	420A	4.09 a	33.71	1.26	88	110.7 a	9 a	14
	3309C	3.07 bc	32.11	1.10	84	91.3 bc	7 a	14
	101-14	2.79 c	32.33	1.08	84	90.7 bcd	7 a	16
	44-53	3.53 b	31.32	1.14	91	103.3 ab	8 a	14
	Ungrafted	2.18 d	27.40	1.09	67	73.3 d	7 a	14
		***	ns	ns	ns	**	ns	ns
Lafayette	Harmony	0.49 c	28.21	0.63	56	37.6 c	2 b	18
	5C	0.6 bc	29.60	0.64	52	35.0 c	3 ab	17
	420A	0.38 c	33.97	0.68	48	35.2 c	2 b	17
	3309C	1.26 a	37.25	0.81	80	64.0 a	4 a	14
	101-14	0.58 bc	29.94	0.67	51	38.1 bc	3 ab	16
	44-53	0.97 ab	32.74	0.75	67	53.0 ab	3 ab	16
	Ungrafted	0.97 ab	24.77	0.78	63	49.7 abc	4 a	15
		**	ns	ns	ns	**	*	ns
Umpqua	Harmony	3.71 b		0.86	112	96.0 a	9 a	21
	5C	4.78 ab		0.85	122	102.9 a	10 a	20
	420A	4.74 ab		0.91	102	92.6 a	12 a	19
	3309C	4.16 b		0.86	109	93.2 a	10 a	17
	101-14	3.57 b		0.92	98	89.9 a	9 a	17
	44-53	5.83 a		0.90	118	104.1 a	13 a	20
	Ungrafted	4.44 b		0.84	119	99.7 a	10 a	20
		*		ns	ns	ns	ns	ns
Eagle Point	Harmony	0.59 c		0.88	90	79.3 a	2 c	12
	5C	0.68 c		0.89	115	102.5 a	2 c	13
	420A	0.85 bc		0.98	107	111.4 a	2 c	13
	3309C	1.45 a		0.90	116	104.2 a	3 ab	13
	101-14	1.03 abc		0.95	106	101.3 a	2 bc	13
	44-53	1.31 ab		0.93	109	101.6 a	3 a	12
	Ungrafted	1.23 ab		0.92	113	103.1 a	3 abc	14
		**		ns	ns	ns	**	ns
Main Effects								
Vineyard		***	ns	***	***	***	***	***
Rootstock		***	ns	ns	ns	*	***	ns
Vineyard x Rootstock		***	ns	ns	ns	**	*	ns
Alpine	SO 4	4.32 a	39.45 a	0.82 ab	155 a	123.7 a	8 a	20 a
	5BB	2.63 b	33.48 a	0.96 a	115 a	109.9 ab	6 ab	16 a
	3309C	1.45 bc	42.13 a	0.85 ab	118 a	99.1 bc	3 bc	20 a
	101-14	1.84 bc	35.95 a	0.81 b	120 a	96.4 bc	5 bc	19 a
	Riparia	0.96 c	37.97 a	0.65 c	129 a	82.8 c	3 c	22 a
	Ungrafted	2.15 bc	33.40 a	0.94 ab	109 a	101.5 b	5 abc	19 a
		**	ns	**	ns	**	*	ns

[1] ns, *, **, *** indicate not significant and statistically significant at the 0.05, 0.01, and 0.001 levels within location. Values followed by the same letters within column sections (vineyards) do not differ significantly.

Fruit composition

Fruit composition varied more from site to site than in response to rootstock (Table 4). At Newberg, vines grafted to 101-14 had the highest and ungrafted vines the lowest must soluble solids. There was no difference on must soluble solids at Lafayette, Alpine, Umpqua, or Eagle Point. Total sugar produced per square meter of ground, which encompasses yield and soluble solids, is a good estimate of vine performance. Once again, there was considerable interaction between site and rootstock on the total amount of sugar produced. At Alpine, vines grafted to SO 4 produced more sugar, more than four fold of the amount produced by vines grafted to Riparia Gloire. At Newberg, grafting to 420 A resulted in more sugar exported with fruit harvest. At Lafayette, 3309C outperformed the other rootstocks. At Umpqua, 44-53 did better than other rootstocks. At Eagle point, ungrafted vines and rootstocks with Rupestris and Riparia in the parentage, gave the best results. There was no rootstock site interaction for juice pH and titratable acidity, indicating that rootstock responded similarly in all sites (Table 4 and 7). Across the vineyards, Harmony produced the highest pH values and the lowest titratable acidity and for 420 A, the reverse was true (Table 7). Juice potassium content differences were observed at Lafayette and Umpqua but the tendencies observed were not consistent. High levels of potassium uptake have been shown to cause grape juice to have higher than desirable pH, leading to wine instability and to color problems in red wines. At Lafayette, must from ungrafted vines had the lowest K content and 101 -14 induced higher juice K content. At Eagle Point, ungrafted vines had again the lowest Juice K but 44-53 had the highest content. It is interesting to note that Harmony did not stand out in terrns of juice potassium, since it has been reported that rootstocks of Vitis Champinii parentage (Harmony, Freedom, Ramsey, Dogridge) tend to increase potassium concentration and pH of juice above the levels of own-rooted vines (Hale, 1977).

Table 4 : Effect of rootstock on total sugar accumulated in the fruit, soluble solids, titratable acidity, pH, and potassium in the juice of Pinot noir grapevines at five different locations in Oregon.

Vineyard Location	Rootstock	Soluble Solids °Brix		Sugar (g/m^2)		pH		Potassium ppm		Titratable Acidity (g/L)	
Newberg	Harmony	22.7	b[1]	138	cd	3.18	a	873	a	8.33	c
	5C	23.2	ab	138	cd	3.12	bc	796	a	10.01	ab
	420A	22.7	b	208	a	3.09	dc	709	a	10.44	a
	3309C	22.7	b	156	c	3.13	b	879	a	9.60	ab
	101-14	23.5	a	150	c	3.15	ba	701	a	9.17	bc
	44-53	23.0	ab	182	b	3.06	d	935	a	9.80	ab
	Ungrafted	23.3	ab	114	d	3.13	bc	789	a	9.41	b
	Significant F	*		***		***		ns		**	
Lafayette	Harmony	23.2	a	25	c	3.23	a	2184	ab	9.23	a
	5C	22.1	a	30	bc	3.18	a	1783	ab	9.74	a
	420A	23.4	a	20	c	3.20	a	1920	ab	9.48	a
	3309C	23.0	a	66	a	3.20	a	1503	b	9.14	a
	101-14	23.7	a	31	bc	3.20	a	2474	a	10.12	a
	44-53	23.6	a	51	ab	3.25	a	1599	b	8.90	a
	Ungrafted	24.3	a	54	ab	3.28	a	1464	b	8.42	a
	Significant F	ns		**		ns		*		ns	
Umpqua	Harmony	25.6	a	212	b	3.24	a	742	a	7.36	a
	5C	25.7	a	274	ab	3.20	a	547	a	8.05	a
	420A	25.4	a	268	ab	3.17	a	572	a	8.26	a
	3309C	25.7	a	238	b	3.22	a	595	a	7.77	a
	101-14	26.0	a	210	b	3.22	a	592	a	7.66	a
	44-53	25.9	a	334	a	3.15	a	630	a	8.11	a
	Ungrafted	25.4	a	254	b	3.21	a	552	a	7.72	a
	Significant F	ns		*		ns		ns		ns	
Eagle Point	Harmony	22.2	a	30	b	3.37	a	666	bc	6.79	a
	5C	21.6	a	34	b	3.32	a	799	ab	7.07	a
	420A	21.1	a	38	b	3.31	a	645	bc	7.18	a
	3309C	22.4	a	74	a	3.33	a	749	ab	7.49	a
	101-14	23.0	a	52	ab	3.36	a	660	bc	6.75	a
	44-53	22.5	a	66	a	3.33	a	882	a	7.14	a
	Ungrafted	21.8	a	62	a	3.34	a	540	c	7.43	a
	Significant F	ns		**		ns		*		ns	
Main Effects											
Vineyard		***		***		***		*		***	
Rootstock		ns		***		**		***		**	
Vineyard x Rootstock		ns		***		ns		***		ns	
Alpine	SO 4	22.9	a	220	a	3.08	c	471	a	7.57	a
	5BB	23.0	a	135	b	3.12	bc	410	a	7.43	a
	3309C	23.5	a	75	bc	3.18	abc	502	a	6.59	a
	101-14	23.6	a	98	bc	3.20	ab	522	a	6.28	a
	Riparia	23.3	a	50	c	3.25	a	470	a	5.72	a
	Ungrafted	23.7	a	113	bc	3.17	abc	483	a	6.83	a
	Significant F	ns		**		*		ns		ns	

[1] ns, *, **, *** indicate not significant and statistically significant at the 0.05, 0.01, and 0.001 levels within location. Values followed by the same letters within column sections (vineyards) do not differ significantly.

Table 7: Effect of rootstock on juice pH, titratable acidity and leaf area of Pinot noir grapevines averaged across five different locations. There was no significant interaction between rootstock and site for these parameters.

	Juice pH		Titratable Acidity g/L		Leaf Area Index m^2/m^2	
Harmony	3.25	a[1]	7.93	c	1.04	b
5C	3.20	bcd	8.72	ab	1.30	ab
420A	3.19	d	8.84	a	1.06	b
3309C	3.22	abcd	8.50	ab	1.29	ab
101-14	3.23	abc	8.42	abc	1.20	ab
44-53	3.20	cd	8.48	ab	1.16	b
Ungrafted	3.24	ab	8.24	bc	1.58	a
	**		**		*	

[1] * and ** indicate statistically significant at the 0.05 and 0.01, levels. Values followed by the same letters do not differ significantly.

Canopy development

Vegetative growth seems to depend more on the site than on the rootstock (Table 5). At Alpine, the Riparia x Berlandieri hybrids had the largest leaf area and Riparia Gloire, the smallest. The percentage of leaf area arising from lateral shoots was independent of site and rootstock. Shoot diameter during mid-ripening did not vary with rootstock except for Eagle Point where the rootstock response was clearly separated into two groups: stocks with Riparia x Rupestris parentage or ungrafted vines had larger shoot diameters and Riparia x Berlandieri crosses or Harmony had smaller diameters. At this vineyard, shoot length followed the same pattern. At Umpqua, Harmony induced the highest shoot length and 3309C the lowest. No differences were observed at the other sites.

Table 5: Effect of rootstock on vegetative growth and leaf area of Pinot noir grapevines at five locations in Oregon.

Vineyard Location	Rootstock	Leaf Area Index (m^2/m^2)		Lateral Leaf Area % of total		Shoot Length (cm)		Shoot Diameter (mm)		Shoots/ Vine	
Newberg	Harmony	1.26		47.12		140	a	8.85	a	16	bc
	5C	1.46		50.87		125	a	9.17	a	17	ab
	420A	1.39		37.64		127	a	9.27	a	18	a
	3309C	1.42		44.49		112	a	8.93	a	17	abc
	101-14	1.30		37.58		117	a	9.30	a	16	bc
	44-53	1.26		35.98		116	a	8.76	a	16	bc
	Ungrafted	1.53		45.97		124	a	9.22	a	15	c
	Significant F					ns		ns		*	
Lafayette	Harmony	0.53		56.05		160	a	8.53	a	8	a
	5C	0.73		43.80		160	a	8.72	a	10	a
	420A	0.68		51.80		170	a	9.19	a	9	a
	3309C	0.91		46.93		169	a	8.93	a	11	a
	101-14	0.64		50.44		164	a	8.80	a	10	a
	44-53	0.69		45.35		158	a	8.64	a	10	a
	Ungrafted	1.77		43.71		162	a	8.89	a	19	a
	Significant F					ns		ns		ns	
Umpqua	Harmony	1.99		50.96		190	a	9.27	a	34	a
	5C	2.45		59.40		158	ab	9.62	a	38	a
	420A	1.77		37.08		167	ab	8.79	a	38	a
	3309C	1.45		40.43		135	b	8.93	a	35	a
	101-14	2.02		52.90		157	ab	9.58	a	36	a
	44-53	1.78		44.49		144	b	8.83	a	37	a
	Ungrafted	1.86		43.10		143	b	8.88	a	35	a
	Significant F					*		ns		ns	
Eagle Point	Harmony	0.53		53.81		72	c	5.77	b	34	a
	5C	0.71		46.32		76	bc	5.71	b	32	a
	420A	0.50		43.27		62	c	5.15	b	27	a
	3309C	1.45		36.53		131	a	7.43	a	29	a
	101-14	0.96		49.24		107	ab	6.72	a	32	a
	44-53	0.77		46.27		115	a	6.95	a	31	a
	Ungrafted	1.14		47.52		128	a	7.57	a	28	a
	Significant F					***		***		ns	
Main Effects											
Vineyard		***		ns		***		***		***	
Rootstock		*		ns		ns		**		ns	
Vineyard x Rootstock		ns		ns		***		***		*	
Alpine	SO 4	1.62	a	35.98	a	142	a	9.60	a	22	a
	5BB	1.18	ab	36.03	a	143	a	9.31	a	17	ab
	3309C	0.77	bc	36.85	a	142	a	9.05	a	11	bc
	101-14	0.90	bc	36.72	a	151	a	9.69	a	13	bc
	Riparia	0.41	c	38.25	a	127	a	8.73	a	9	c
	Ungrafted	0.92	bc	39.43	a	140	a	9.18	a	15	b
	Significant F	*		ns		ns		ns		**	

[1] ns, *, **, *** indicate not significant and statistically significant at the 0.05, 0.01, and 0.001 levels within location. Values followed by the same letters within column sections (vineyards) do not differ significantly.

Vine vigor as assessed by pruning weight varied considerably with rootstock and site but there were no consistent trends (Table 6). Mean cane weight and yield to pruning ratio did not respond to rootstock except at Alpine where vines grafted to SO 4 or own-rooted had heavier canes.

Table 6: Effect of rootstock on pruning weights and yield : pruning ratios of Pinot noir grapevines at five different locations in Oregon. Vines were pruned in February 1996.

Vineyard Location	Rootstock	Pruning wt (kg/vine)		Pruning wt (g/m2)		Cane wt (g)		Yield : Pruning wt	
Newberg	Harmony	0.71	a	218	a	41		2.1	
	5C	0.94	a	289	a	49		2.2	
	420A	0.82	a	253	a	46		2.7	
	3309C	0.65	a	201	a	34		2.4	
	101-14	0.80	a	247	a	45		1.8	
	44-53	0.84	a	257	a	38		2.9	
	Ungrafted	0.74	a	228	a	40		2.3	
	Significant F	ns		ns		ns			
Lafayette	Harmony	0.07	c	19	c	6		8.1	
	5C	0.09	bc	23	bc	7		7.5	
	420A	0.07	c	20	c	6		9.2	
	3309C	0.11	ab	29	ab	8		10.0	
	101-14	0.09	bc	24	bc	7		9.5	
	44-53	0.08	bc	23	bc	6		10.6	
	Ungrafted	0.12	a	31	a	9		6.7	
	Significant F	**		**		ns			
Umpqua	Harmony	2.34	c	350	c	98		1.8	
	5C	3.19	a	477	a	123		1.5	
	420A	3.10	ab	464	ab	111		1.5	
	3309C	2.71	bc	418	bc	116		1.4	
	101-14	3.19	a	477	a	119		1.1	
	44-53	2.78	abc	416	abc	133		1.3	
	Ungrafted	2.53	c	378	c	120		1.5	
	Significant F	**		**		ns			
Eagle Point	Harmony	0.40	cd	60	cd	13		13.8	
	5C	0.34	d	51	d	10		16.5	
	420A	0.30	d	45	d	9		21.6	
	3309C	0.74	a	111	a	24		10.3	
	101-14	0.58	b	87	b	18		10.9	
	44-53	0.44	bcd	66	bcd	14		17.5	
	Ungrafted	0.55	bc	83	bc	18		11.3	
	Significant F	**		**		ns			
Main Effects		***		***		***		***	
Vineyard		***		***		ns		ns	
Rootstock		***		***		ns		ns	
Vineyard x Rootstock									
Alpine	SO 4	0.85	a	169	a	55	a	4.0	a
	5BB	0.55	ab	110	ab	46	ab	3.7	a
	3309C	0.37	b	73	b	35	b	3.1	a
	101-14	0.41	b	81	b	37	b	2.5	a
	Riparia	0.26	b	52	b	34	b	2.6	a
	Ungrafted	0.54	ab	108	ab	50	a	2.5	a
	Significant F	*		*		**		ns	

[1] ns, *, **, *** indicate not significant and statistically significant at the 0.05, 0.01, and 0.001 levels within location. Values followed by the same letters within column sections (vineyards) do not differ significantly.

Carbohydrate reserves

The effect of rootstock on the carbohydrate reserves in the permanent scion wood is shown in Fig. 1. Except for Ousterhout vineyard, located at Eagle Point, there were no rootstock differences in either sugars or starch in the permanent wood of the surveyed vineyards. At Eagle Point, vines grafted on 3309C had the highest total non-structural carbohydrate content in the permanent wood and 5C the lowest. Not surprisingly, vines grafted to 3309 C had the highest yields in the following season at this vineyard.

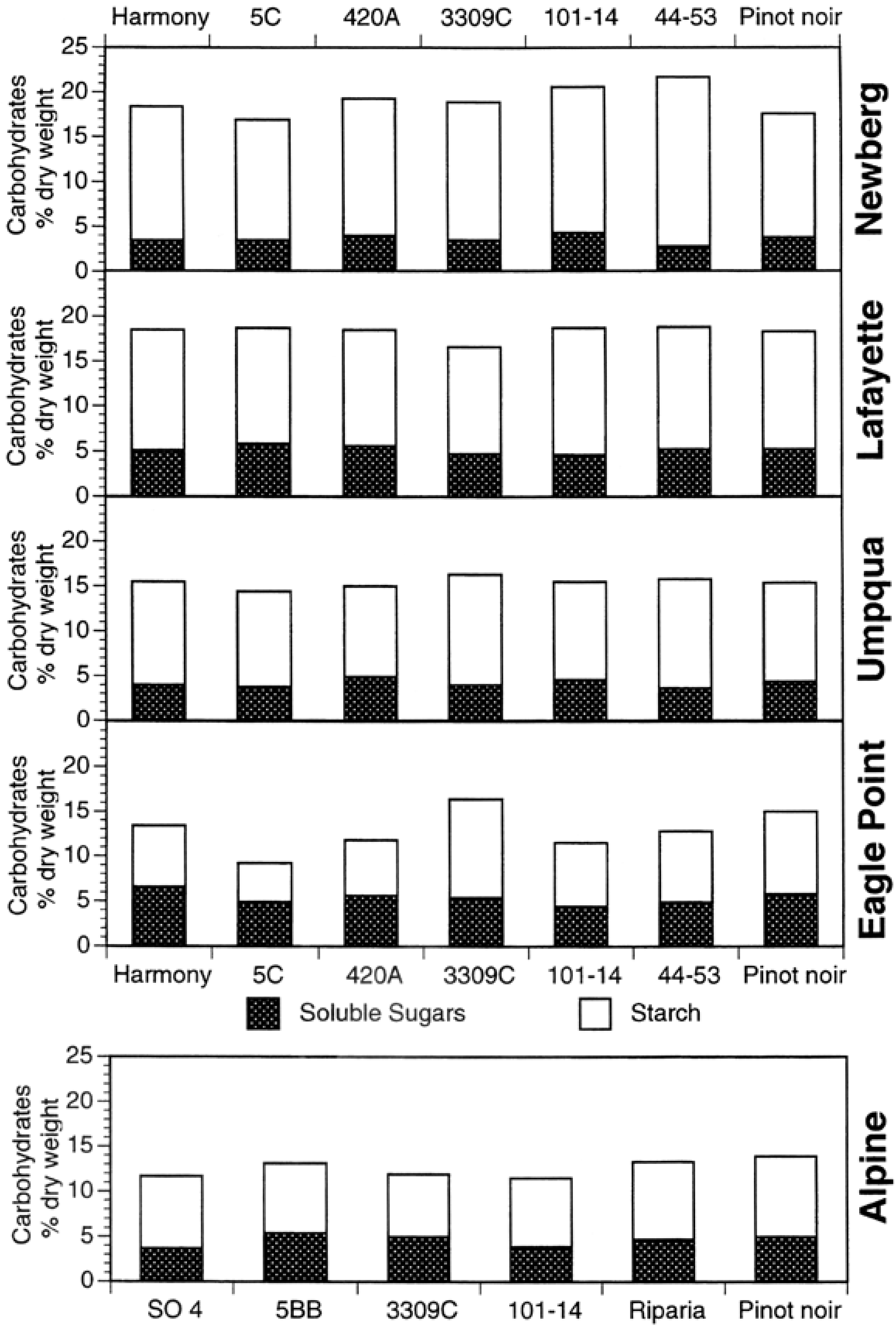

Figure 1: Effect of rootstcock on carbohydrate content of two year old wood

CONCLUSIONS

Rootstock effect on scion performance varied greatly with site and typically, the responses were not consistent from site to site. Another important observation from these trials is that at each site, ungrafted vines were never the best performers in yield or fruit quality. This implies that post-phylloxera Oregon viticulture has great potential for improvement by using appropriate rootstocks.

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