

Effect of Mechanical Leafing on Ruby Cabernet Grown in the San Joaquin Valley of CA

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Abstract

Basal leaf removal has been studied extensively in the warm climate to improve fruit quality. Previous studies have proven that berry anthocyanin accumulation can be increased by improving the cluster-zone light exposure and upregulating its biosynthesis. Berry anthocyanins and green flavor are the two most important quality parameters for Ruby Cabernet grown in the San Joaquin Valley (SJV), and Ruby Cabernet is an excellent warm climate variety (*V. vinifera*, Cabernet Sauvignon × *V. vinifera*, Carignan) with high yield potential and dark berry color. In order to improve the color and other berry composition under high production system in the southern SJV, a field trial in 2018 and 2019 was initiated to study the effect of various timings of mechanical leafing, e.g., bloom, berry set, and veraison, under the standard deficit irrigation regime on its yield and berry composition. Our two years' results indicated that the bloom and berry set leafing increased the berry anthocyanins with no effect on yield, while veraison leafing has little effect on berry anthocyanins.

Introduction

San Joaquin Valley (SJV) has 40% wine grape acreage and crushes 70% grape in CA. Industry has focused on production historically to produce value priced wine (≈\$5/bottle). However, the strong demand for premium wine (>\$9/bottle) and sluggish demand for value priced wine have motivated industry to improve the berry quality to meet the demand of premium wine. Berry anthocyanins are key quality parameters for red cultivars besides total soluble solids (TSS) and organic acids. However, hot climate in the SJV tends to promote the degradation of berry anthocyanins and acids at harvest. In order to improve berry quality, we conducted a field trial in 2018 and 2019 using mechanical leafing at different timings of the season under the standard deficit irrigation regime at a commercial vineyard in Fresno Co., CA.

Method

- Ruby Cabernet on Freedom rootstock at a commercial vineyard near Fresno was used in 2018 and 2019. Fresno is a hot climate growing region (>4000 GDD, based 50 ° F).
- Row x vine space: 10'x4' with East-West row orientation. Vines were trained with spur-pruned quadrilateral cordons under the sprawling system.
- Randomized complete block design (RCBD) with four timings of mechanical leafing, replicated in 5 times, and 6 vines were designated as an experimental unit.
- Mechanical leafing was applied only on the north side of the canopy at bloom, berry set and veraison coupled with no leafing. Fruit-zone PAR (%) were measured weekly after the onset of bloom until veraison (Figure 1 and 2).
- Standard deficit irrigation was applied: 80% ETC from berry set to veraison and 60% ETC from veraison to harvest.

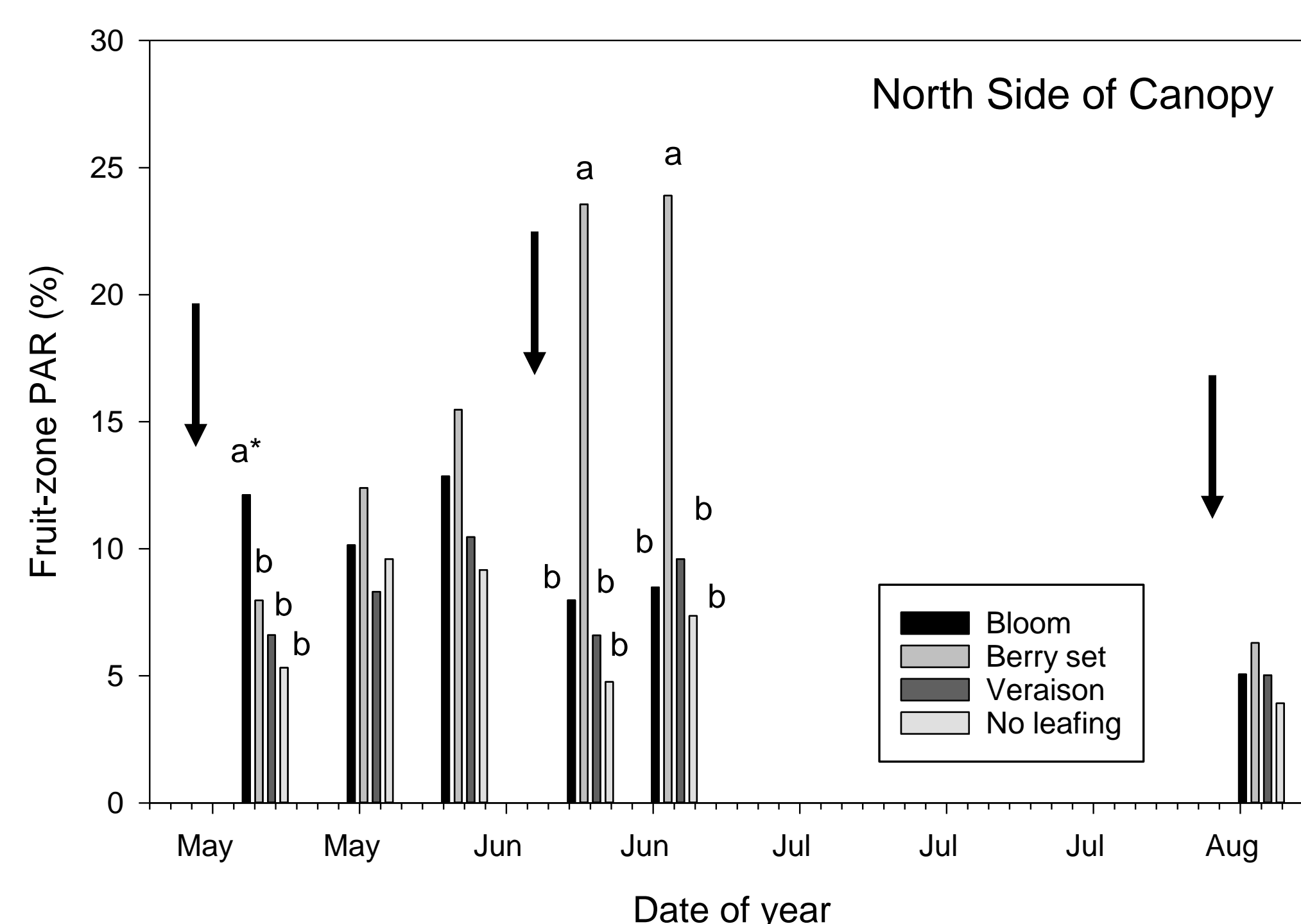


Figure 1. Fruit-zone PAR (%) on north side of canopy. Arrows indicate the timing of bloom, berry set and veraison

*Letters indicate a significant difference in means based on Tukey's honest significant difference test at $p < 0.05$.

Table 1. Harvest Yield Components from 2018 and 2019

Timing of leafing	Yield (kg/vine)	Cluster no./vine	Berry weight (g)	Berry No./cluster	Pruning weight (kg/vine)	Ravaz Index (kg/kg)	Shoot no./vine
2018							
Bloom	15.9 ab*	90	1.5	119 a	1.3	12	53
Berry set	14.5 b	89	1.5	109 bc	1.2	13	54
Veraison	15.6 ab	100	1.5	102 c	1.2	13	53
No leafing	16.8 a	94	1.5	114 ab	1.3	13	53
<i>Pr >F</i>	0.05	0.34	0.096	0.0003	0.24	0.7	0.87
2019							
Bloom	13.6	140	1.2	78	0.6	23	64
Berry set	14.5	150	1.3	78	0.6	24	60
Veraison	14.4	145	1.3	77	0.6	25	60
No leafing	15.3	152	1.2	82	0.7	23	64
<i>Pr >F</i>	0.153	0.32	0.074	0.52	0.62	0.4	0.16
<i>Year (Pr >F)</i>	0.002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

*Letters indicate a significant difference in means based on Tukey's honest significant difference test at $p < 0.05$.

Table 2. Harvest Berry Chemistry from 2018 and 2019

Timing of leafing	TSS (Brix)	pH	TA (g/L)	Anthocyanins (mg/g of FW)
2018				
Bloom	25.8 b*	4.0	5.8 a	1.65 a
Berry set	26.9 a	4.0	5.6 b	1.58 b
Veraison	25.4 b	3.9	6.0 a	1.50 c
No leafing	25.7 b	4.0	6.0 a	1.42 d
<i>Pr >F</i>	0.05	0.73	<.0001	<.0001
2019				
Bloom	24.8	3.8 bc	4.1	1.39 a
Berry set	24.0	4.2 a	4.0	1.36 ab
Veraison	23.5	3.8 c	4.0	1.29 c
No leafing	24.2	4.0 ab	4.0	1.31 bc
<i>Pr >F</i>	0.16	0.0003	0.36	0.009
<i>Year (Pr >F)</i>	<.0001	0.97	<.0001	<.0001

*Letters indicate a significant difference in means based on Tukey's honest significant difference test at $p < 0.05$.



Figure 2. Mechanical leafing on the north side of canopy at bloom

Results

- Bloom leafing had no significant effect on yield in comparison of no leafing (-5% in 2018 and -11% in 2019), while berry set leafing had significant effect on yield in 2018 but not in 2019 (-14% in 2018 and -5% in 2019) (Table 1).
- Bloom leafing was the best option to increase the berry anthocyanins in comparison of no leafing (+16% in 2018 and +6% in 2019), and berry set leafing was the second-best option (+11% in 2018 and +4% in 2019), while veraison leafing had little effect on berry anthocyanins (+6% in 2018 and -2% in 2019) (Table 2).
- Bloom leafing was the best option in our two years' study to improve berry anthocyanins with little effect on yield. Further vineyard economic studies might help to guide growers on its cost and benefit (6%-16% anthocyanins increase vs. 5%-11% yield loss).

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