THE EFFECT OF CROP LOAD AND EXTENDED RIPENING ON WINE QUALITY AND VINE BALANCE IN *VITIS VINIFERA* CV. CABERNET SAUVIGNON

By

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ABSTRACT

Crop load reduction and extended ripening are two practices commonly required for wine grape growers with intention to improve wine quality; however, both cause significant yield loss. Studies on crop load have been conflicting and limited studies exist on extended ripening—warranting further research. The aim of this study was to investigate the interaction of crop load and extended ripening on yield components, wine and fruit composition and to increase understanding of the synchronization of flavor ripeness with sugar ripeness through optimal vine balance. In 2005, 2006 and 2007 a commercial vineyard of clone 8 Cabernet Sauvignon located in Paso Robles, CA was adjusted to four crop levels post fruit set. Each crop level was harvested at five target °Brix levels from 22.5-28.5 °Brix and fermented into wine. Yield components, growth, wine and fruit composition, and wine sensory were measured and assessed on all replicated treatments. A second experiment was conducted in 2006-2007 to investigate the effects of crop load and late season irrigation on extended ripening.

Grapevines exhibited self regulation in growth and yield component compensation. Yield components were reduced from both crop thinning and extended ripening. Pruning weight per vine increased in treatments thinned to lower crop loads in all three seasons, indicating changes in vegetative growth from the crop thinning. Consequently, the light environment within the fruiting zone was effected. Average berry weight, cluster weight and berries per cluster were inversely related to crop load. Extended ripening increased wine color density and anthocyanins each year. Additionally, the lowest crop loads consistently had the lowest color density.

Results from the descriptive analysis characterized the wines, and showed opposing differences between treatments harvested early (22.5-24.0 °Brix) versus those which underwent extended ripening and were harvested at the 27.0-28.5 °Brix target. Consumer acceptability ratings and expert grading demonstrated that in general, wines from higher °Brix levels in all crop load treatments were preferred. However, the best wines were from treatments with the combination of higher crop load and higher target °Brix at harvest. These results suggest that wine quality can be improved with extended ripening, although significant yield is lost. Additionally, lowest crop load does not always produce highest wine quality. Crop thinning had a detrimental effect on wine quality by disturbing the natural balance of the vine, increasing vegetative growth and negatively affecting the light environment within the fruiting zone. Furthermore, crop thinning did not improve wine quality enough to justify the associated economic losses. Extended ripening proved to be an effective remediation tool for increasing wine quality; however, extended ripening to a target °Brix of 28.5 is not always necessary for well balanced vines. Increased irrigation late in ripening maintained significantly more berry weight and yield relative to the control, and had limited effects on wine quality—although careful monitoring is suggested to avoid wine quality reduction.

STATEMENT

This thesis contains no material which has been previously accepted for an award of any degree or diploma in any University and, to the best of my knowledge and belief, contains no material previously published or written by another person except where due reference is made in the text.

I give my consent to this copy of my thesis, when deposited in the University of Adelaide Library, being available for loan or photocopying.

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List of Abbreviations

Abbreviation	*Explanation and Units*
°	degrees
A	Absorbance
AOV	analysis of variance
BB	bud break
CD	color density—Absorbance (420nm) + Absorbance (520nm)
cl	crop load (clusters/vine)
$CuSO_4$	Copper sulfate
DAA	days after anthesis
DAV	days after veraison
DI	double the standard irrigation
EMS	error mean squares
ETc	evapotranspiration rate of the crop—grapes
ETOH	ethyl alcohol
g	grams
g/L	grams per liter
ha	hectare
HCL	Hydrochloric acid
IBMP	3-isobutyl 2-methoxy pyrazine
Kc	crop coefficient
kg	kilogram
L	liter
LAI	leaf area index
LSD	least significant difference

LWP	leaf water potential (MPa or negative bars)
µL	microliter
mg	milligram
mL	milliliter
mm	millimeter
MPa	megapascal
MOG	material other than grapes
nm	nanometer
N	normality
NaOH	Sodium hydroxide
ng	nanogram
ng/L	nanograms per liter
$NH4^+$	Ammonium
NOPA	alpha amino nitrogen (ppm)
PAR	photosynthetically active radiation (µmol photons (400-700 nm) $m^{-2}s^{-1}$)
PCA	principle component analysis
pH	measurement of acidity
pml	post malolactic fermentation
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
P value	statistical significance
QDA	quantitative descriptive analysis
r	correlation coefficient
R^2	coefficient of determination

rpm	revolutions per minute
SD	standard irrigation
SO_2	Sulfur dioxide
t	tonne(s)
t/ha	tonnes per hectare
TA	titratable acidity (g/L)
TSS	total soluble solids
TH	thinned
UN	unthinned
VA	volatile acidity
VSP	vertical shoot position
wt	weight
YAN	yeast assimilable nitrogen (ppm)
Y/P	yield to pruning ratio

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