DEFICIT IRRIGATION AND MECHANICAL CANOPY MANAGEMENT AFFECT BERRY AND WINE PHENOLIC AND AROMA COMPOSITION OF SYRAH IN CENTRAL CALIFORNIA

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Abstract:

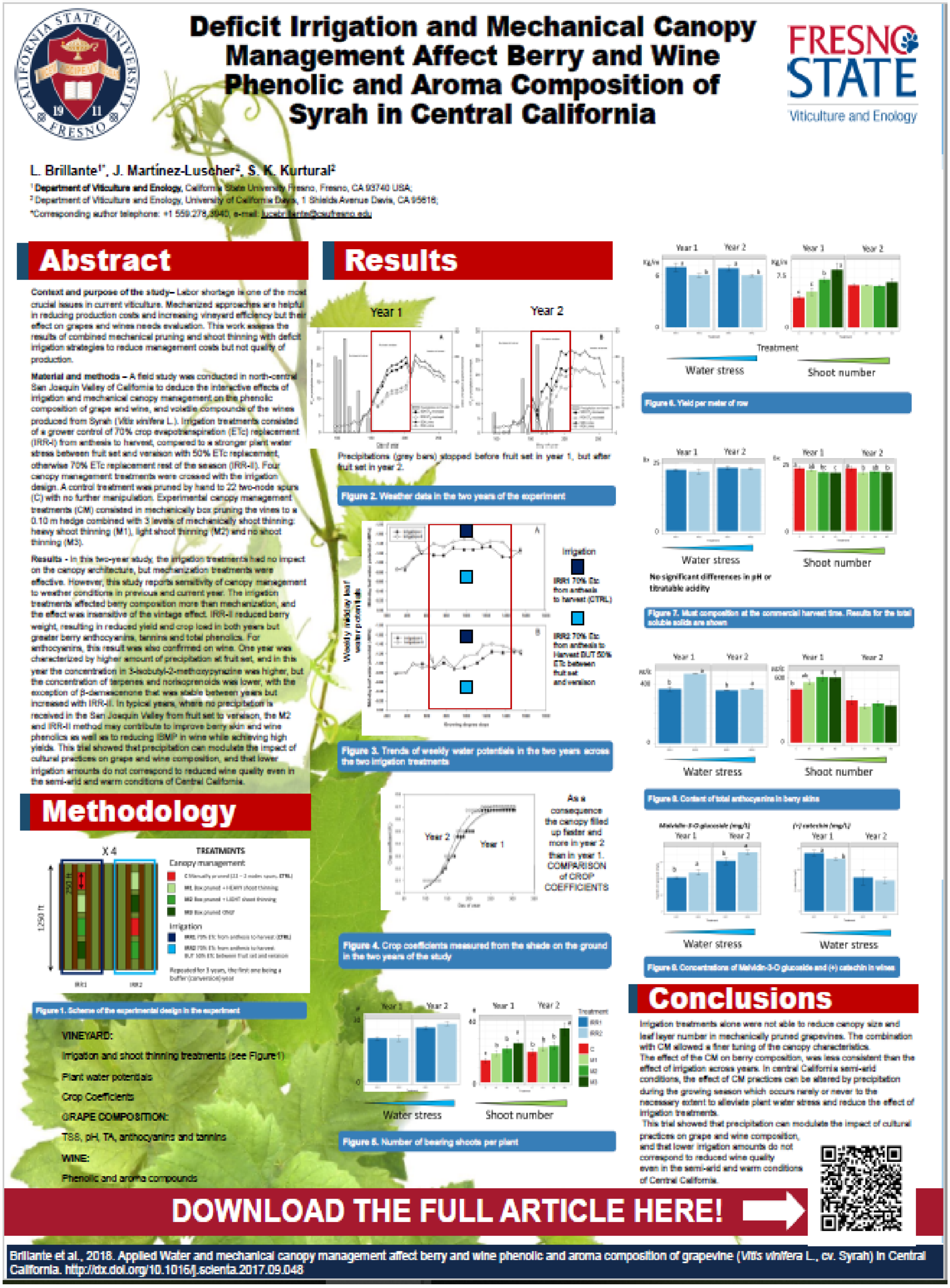
Context and purpose of the study– Labor shortage is one of the most crucial issues in current viticulture. Mechanized approaches are helpful in reducing production costs and increasing vineyard efficiency but their effect on grapes and wines needs evaluation. This work assess the results of combined mechanical pruning and shoot thinning with deficit irrigation strategies to reduce management costs but not quality of production.

Material and methods – A field study was conducted in north-central San Joaquin Valley of California to deduce the interactive effects of irrigation and mechanical canopy management on the phenolic composition of grape and wine, and volatile compounds of the wines produced from Syrah (*Vitis vinifera* L.). Irrigation treatments consisted of a grower control of 70% crop evapotranspiration (ETc) replacement (IRR-I) from anthesis to harvest, compared to a stronger plant water stress between fruit set and veraison with 50% ETc replacement, otherwise 70% ETc replacement rest of the season (IRR-II). Four canopy management treatments were crossed with the irrigation design. A control treatment was pruned by hand to 22 two-node spurs (C) with no further manipulation. Experimental canopy management treatments (CM) consisted in mechanically box pruning the vines to a 0.10 m hedge combined with 3 levels of mechanically shoot thinning: heavy shoot thinning (M1), light shoot thinning (M2) and no shoot thinning (M3).

Results - In this two-year study, the irrigation treatments had no impact on the canopy architecture, but mechanization treatments were effective. However, this study reports sensitivity of canopy management to weather conditions in previous and current year. The irrigation treatments affected berry composition more than mechanization, and the effect was insensitive of the vintage effect. IRR-II reduced berry weight, resulting in reduced yield and crop load in both years but greater berry anthocyanins, tannins and total phenolics. For anthocyanins, this result was also confirmed on wine. One year was characterized by higher amount of precipitation at fruit set, and in this year the concentration in 3-isobutyl-2-methoxypyrazine was higher, but the concentration of terpenes and norisoprenoids was lower, with the exception of β-damascenone that was stable between years but increased with IRR-II. In typical years, where no precipitation is received in the San Joaquin Valley from fruit set to veraison, the M2 and IRR-II method may contribute to improve berry skin and wine phenolics as well as to reducing IBMP in wine while achieving high yields. This trial showed that precipitation can modulate the impact of cultural practices on grape and wine composition, and that lower irrigation amounts do not correspond to reduced wine quality even in the semi-arid and warm conditions of Central California.

Keywords: Mechanical pruning; Mechanical shoot thinning; Deficit irrigation; 3-Isobutyl-2-methoxypyrazine; β-Damascenone; *Vitis vinifera* L.

1. Introduction.


Deficit Irrigation and Mechanical Canopy Management Affect Berry and Wine Phenolic and Aroma Composition of Syrah in Central California
FRESNO STATE
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Methodology
X 4
TREATMENTS
Canopy management
Irrigation
Figure 1. Scheme of the experimental design in the experiment
VINEYARD:
Irrigation and shoot thinning treatments (see Figure 1)
Plant water potentials
Crop Coefficients
GRAPE COMPOSITION:
TSS, pH, TA, anthocyanins and tannins
WINE:
Phenolic and aroma compounds
Results
Year 1
Year 2
Precipitations (grey bars) stopped before fruit set in year 1, but after fruit set in year 2.
Figure 2. Weather data in the two years of the experiment
Weekly midday leaf water potentials
Irrigation
IRR1 70% Etc from anthesis to harvest (CTRL)
IRR2 70% Etc from anthesis to Harvest BUT 50% ETc between fruit set and veraison
Figure 3. Trends of weekly water potentials in the two years across the two irrigation treatments
As a consequence the canopy filled up faster and more in year 2 than in year 1. COMPARISON of CROP COEFFICIENTS
Figure 4. Crop coefficients measured from the shade on the ground in the two years of the study
Water stress
Shoot number
Figure 5. Number of bearing shoots per plant
Treatment
Figure 6. Yield per meter of row
No significant differences in pH or titratable acidity
Figure 7. Must composition at the commercial harvest time. Results for the total soluble solids are shown
Figure 8. Content of total anthocyanins in berry skins
Figure 9. Concentrations of Malvidin-3-O glucoside and (+) catechin in wines
Conclusions
Irrigation treatments alone were not able to reduce canopy size and leaf layer number in mechanically pruned grapevines. The combination with CM allowed a finer tuning of the canopy characteristics.
The effect of the CM on berry composition, was less consistent than the effect of irrigation across years. In central California semi-arid conditions, the effect of CM practices can be altered by precipitation during the growing season which occurs rarely or never to the necessary extent to alleviate plant water stress and reduce the effect of irrigation treatments.
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DOWNLOAD THE FULL ARTICLE HERE!
Brillante et al., 2018. Applied Water and mechanical canopy management affect berry and wine phenolic and aroma composition of grapevine (Vitis vinifera L., cv. Syrah) in Central California. http://dx.doi.org/10.1016/j.scienta.2017.09.048