Viticultural performance of four Petite Sirah clones, and determination of their respective wine characteristics

Authors: Raul C. Girardello[1], Andrew Walker[1], S. Kaan Kurtural[1], Daniele Zaccaria[1] and Anita Oberholster[1]*
[1]Department of Viticulture & Enology, University of California Davis, One Shields Avenue Davis CA, 95616 USA.
*Corresponding author: aoberholster@ucdavis.edu

UCDAVIS

Introduction and Background

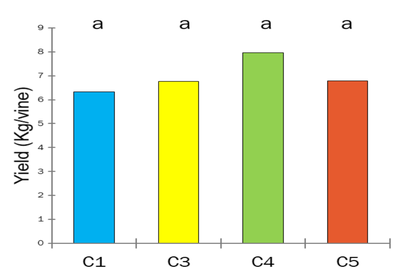
- Grapevine cultivars and their clones are not genetically homogeneous.
- The clonal evaluation and selection are traditional practices among scientists, grape growers and winemakers over the centuries (Myles et al., 2011).
- Clones of each cultivar may vary for specific viticultural and enological characteristics such as yield, cluster and berry size, disease resistance, environmental adaptability, ripening development, berry composition and others (Dai et al., 2011).
- The need to evaluate grapevine phenotypical variability, grape composition and the resulting wines is crucial in the current era of environmental changes.
- Petite Sirah, also known as Durif, originates from the crossing between *Vitis vinifera* L. cv Syrah and Pelourisin made around 1880 in France (Reynolds, 2015) and has become an important component of red wines in California (Meredith et al., 1999).
- However, little research has been done on viticultural and enological traits of Petite Sirah clones.

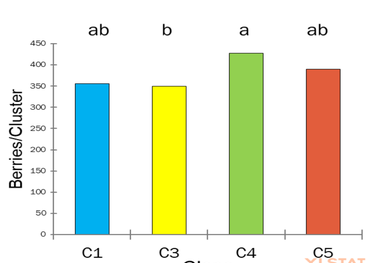

Figure 1: Leaf (leaf) and cluster (right) of Petite Sirah (Bettiga, 2003).

This study aims to evaluate phenotypical and enological traits of four clones of *Vitis vinifera* L. cv Petite Sirah grapevine grown in California

Results

YIELD COMPONENTS





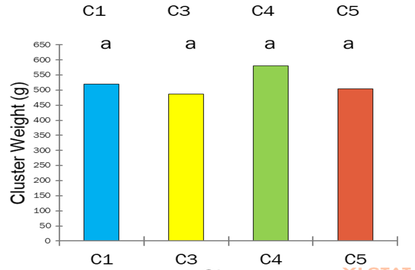


Figure 2: Photo of a Petite Sirah cluster, average yield, berries/cluster and cluster weight for each Petite Sirah clone. C1 = FPS 01, C3 = FPS 03, C4 = FPS 04 and C5 = FPS 05. Different letters indicate significant differences in LSD test ($p < 0.05$, $n = 4$).

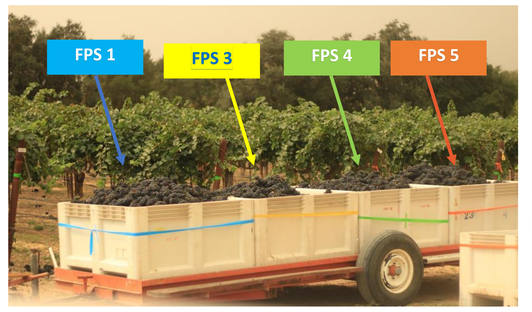
Material and Methods

THE VINEYARD

Location: Robert Mondavi Institute - UC DAVIS (2020)

Petite Sirah clones evaluated: DURIF FPS 01, 03, 04 and 05 (80 vines/clone – complete block design)

Grafted onto 420A rootstock
Vertical shoot positioned – spur pruned



VITICULTURAL EVALUATIONS

For each clone, four biological repetitions composed of five grapevines (data vines, n=20) were used for the following phenotypical measurements at harvest: number of clusters/vine, cluster weights, number of berries/cluster, berry weights, yield, pruning weight.

ANALYSIS PERFORMED

Grapes

- Basic chemical composition for grape samples collected during ripening and at harvest.
- Phenolic Profile (HPLC) (Peng et al., 2002). Phenolic compounds extracted from berries with ethanol (50%) and acetone (70 %) (Panprivech et al., 2015)

Wines

- For each clone, 80 vines were harvested when grapes reached optimal maturity (~25°Brix)
- Wines made at UC Davis Teaching and Research Winery in triplicate in 200 L stainless steel research fermentors
- Temperature of fermentation: 28°C. Pump-over regime: 2x day (one tank volume)
- Similar analysis to the berries
- Volatile compounds (Hendrickson et al., 2016)

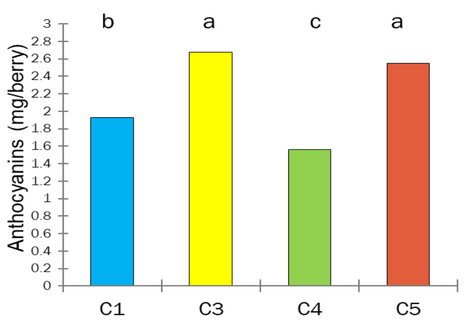
Descriptive Analysis (DA)

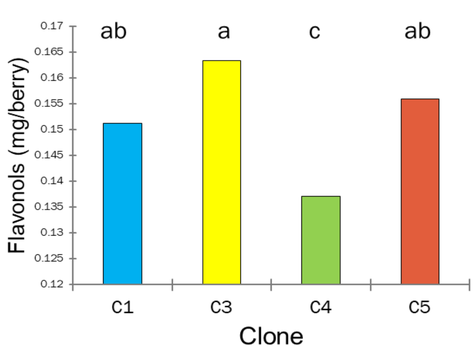
Results cont'd

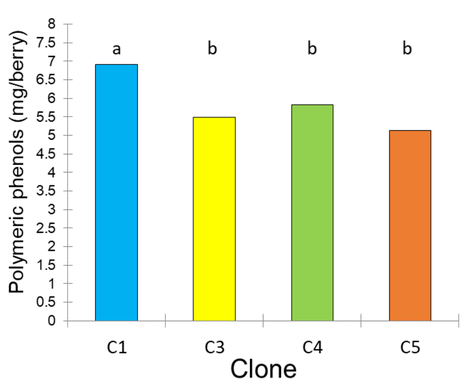
BERRY COMPOSITION AT HARVEST

Clone	Brix	pH	TA (g/L)	Malic Acid (mg/L)
C1	26.7	4.08	3.48	2719.75
C3	26.5	4.08	3.10	2264.25
C4	26.7	4.02	3.40	2552.5
C5	25.9	4.06	3.21	2458.75
	NS	NS	NS	NS

Table 1: Berry basic chemical composition at harvest for each clone of Petite Sirah at harvest. C1 = FPS 01, C3 = FPS 03, C4 = FPS 04 and C5 = FPS 05. NS = statistical differences were not significant among the clones ($p<0.05$, $n=4$).







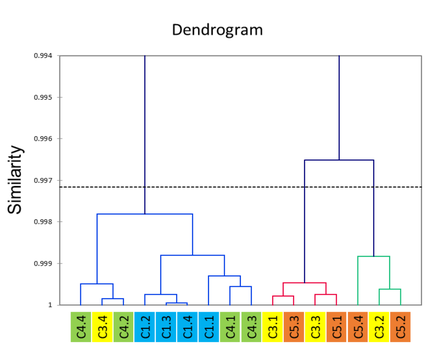


Figure 3: Anthocyanins, flavonols and polymeric phenols content for each Petite Sirah clone at harvest. C1 = FPS 01, C3 = FPS 03, C4 = FPS 04 and C5 = FPS 05. Different letters indicate differences in LSD test ($p < 0.05$, $n = 4$). Dendrogram shows similarity among the clones based on 31 phenolic compounds analyzed.

WINE COMPOSITION

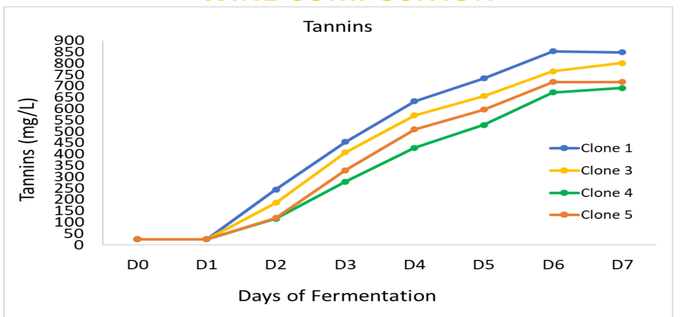


Figure 4: Tannin extraction profile during fermentation for each Petite Sirah clone. C1 = FPS 01, C3 = FPS 03, C4 = FPS 04 and C5 = FPS 05.

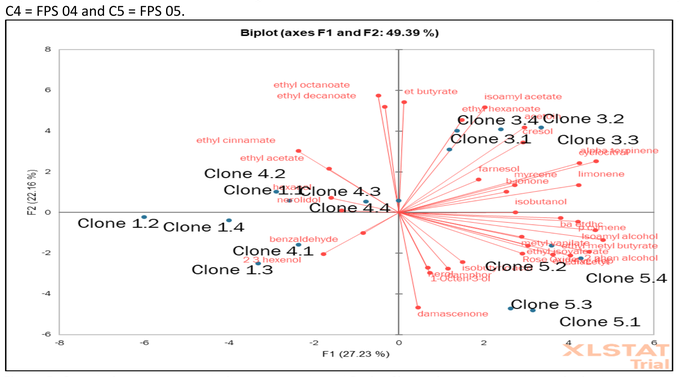


Figure 5: Correlation between volatile compounds and Petite Sirah wines evaluated by principal component analysis. C1 = FPS 01, C3 = FPS 03, C4 = FPS 04 and C5 = FPS 05. Data from 2019 season (n=4). 2020 wine volatile compounds data is currently being analyzed.

Conclusions

- **No major differences were found among the clones regarding yield components and basic chemical composition at harvest (Figure 2/Table 1).**
- **Grapes from clone FPS 03 (C3) and FPS 05 (C5) were similar and presented higher content of anthocyanins and flavonols at harvest, demonstrating a higher color potential when compared to FPS 01 (C1) and FPS 05 (C5) (Figure 3).**
- **Wines made from C3 and C5 were more similar and highly correlated with most of volatile compound when compared to C1 and C4 (Figure 5).**
- **Sensory evaluation is underway and will demonstrate whether wine chemical differences are perceived by consumers.**

References

- Myles, S., A. R. Boyko, C. L. Owens, P. J. Brown, F. Grassi, M. K. Aradhya, B. Prins, A. Reynolds, J.-M. Chia and D. Ware (2011). "Genetic structure and domestication history of the grape." Proceedings of the National Academy of Sciences **108**(9): 3530-3535.
- Dai, Z. W., N. Ollat, E. Gomès, S. Decroocq, J.-P. Tandonnet, L. Bordenave, P. Pieri, G. Hilbert, C. Kappel, C. van Leeuwen, P. Vivin and S. Delrot (2011). "Ecophysiological, Genetic, and Molecular Causes of Variation in Grape Berry Weight and Composition: A Review." American Journal of Enology and Viticulture **62**(4): 413-425.
- Reynolds, A. G. (2015). 4 - Grapevine breeding in France – a historical perspective. Grapevine Breeding Programs for the Wine Industry. A. Reynolds. Oxford, Woodhead Publishing: 65-76.
- Meredith, C. P., J. E. Bowers, S. Riaz, V. Handley, E. B. Bandman and G. S. Dangl (1999). "The Identity and Parentage of the Variety Known in California as Petite Sirah." **50**(3): 236-242.
- Peng, Z., P. G. Iland, A. Oberholster, M. A. Sefton and E. J. Waters (2002). "Analysis of pigmented polymers in red wine by reverse phase HPLC." Australian Journal of Grape and Wine Research **8**(1): 70-75.
- Panprivech, S., L. A. Lerno, C. A. Brenneman, D. E. Block and A. Oberholster (2015). "Investigating the effect of cold soak duration on phenolic extraction during Cabernet Sauvignon fermentation." Molecules **20**(5): 7974-7989.

Acknowledgements

BOGLE VINEYARDS
V&E Viticulture & Enology UNIVERSITY OF CALIFORNIA DAVIS
UCDAVIS UNIVERSITY OF CALIFORNIA
WINE X RAY