Impact of Grapevine Red Blotch Disease and Irrigation Treatments on Grape/Wine quality

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Introduction

Grapevine red blotch disease (GRBD) is caused with *Grapevine red blotch virus* (GRBV), which is a single-stranded DNA virus belonging to the genus *Grablovirus* in the family *Geminiviridae*. It was firstly found in the Cabernet Sauvignon in California, 2008, and is widely spread in North America. GRBV causes an annual economic cost ranging from $2000/ha to $8000/ha in US vineyards. A typical symptom is the red discoloration of leaves that began at véraison in the basal leaves and progressed toward upper canopy leaves by late season. The disease delays grape sugar accumulation and berry maturity process and may have a great impact on final wine quality.

Materials & Methods

Pinot noir wine (W+/W-/D+/D-, 2018-2020)

A field experiment was established with wet and dry irrigation treatments on red blotch infected and non-infected grapevines. "Wet" (W) vines were irrigated at 100% of estimated crop evapotranspiration (ET_c), while "dry" (D) vines were irrigated at 50% ET_c.(Fig. 1). Wines were labeled as W+, W-, D+ and D- based on the irrigation and health status.

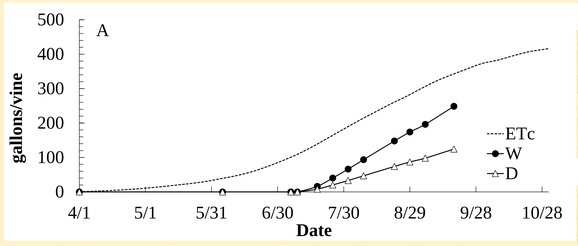
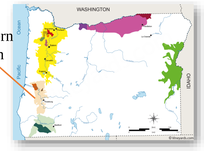


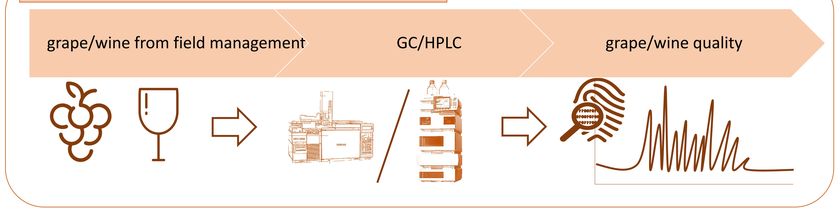
Fig 1. Cumulative applied water amounts for "Wet" (W) and "Dry" (D) treatments and estimated crop evapotranspiration (ET_c) in 2018 (A). W vines were irrigated at 100% ET_c from treatment imposition to harvest, and D vines were irrigated at 50% ET_c from treatment imposition to harvest. Healthy (B) and red blotch infected (C) vines just prior to harvest.

Pinot noir grape (RB+/RB-, 2018-2020)

Clusters from red blotch infected (RB+) and non-infected (RB-) vines were sampled weekly beginning from just before veraison to harvest/one week after harvest.



Grape and Wine composition analysis



Results

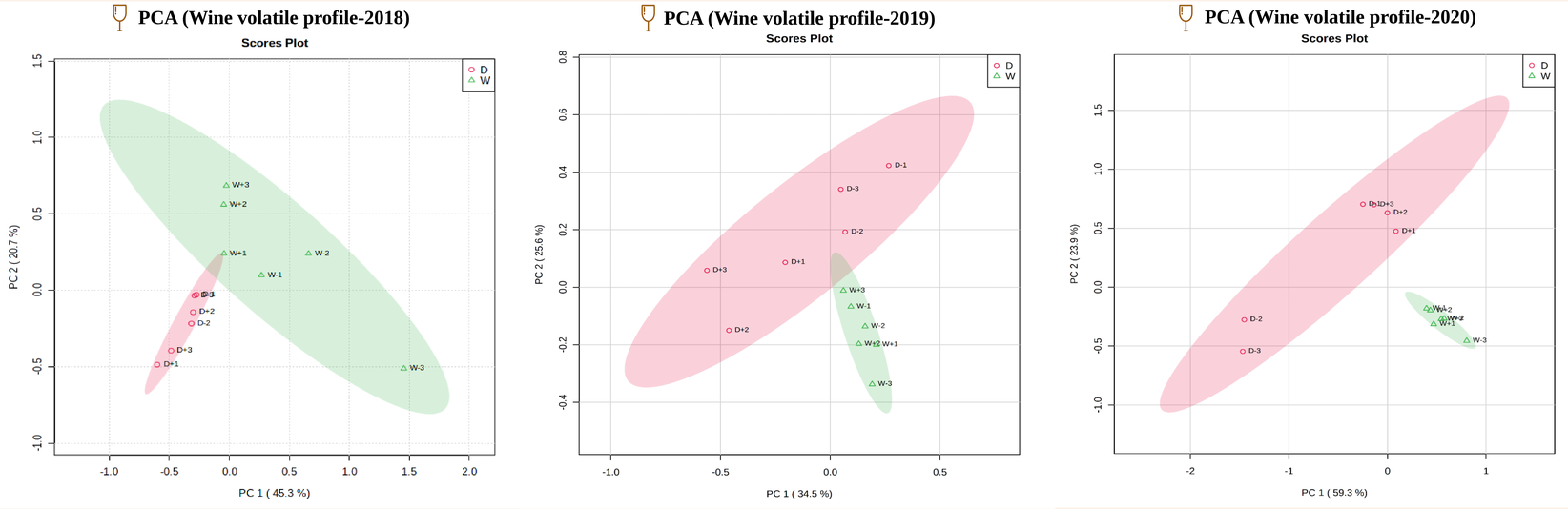


Figure 2. Principle component analysis of wine volatile aroma compounds. Samples are best separated by irrigation treatment (W, green; D, red). 2018 W treatment and 2019 D treatment are spatially resolved, additionally, for GRBD+/- conditions. The GRBD conditions are not separated for all other year/irrigation treatment combinations.

Table 1. Wine Monomeric Anthocyanin and Total Phenolic Content

Year	Treatment	Monomeric anthocyanin (mean±SD, mg/L)	Total phenolic content (mean±SD, mg/L)
2018	W-	70 ± 4 B	1410 ± 141 B
	W+	27 ± 5 A	1041 ± 52 A
	D-	42 ± 12 a	1181 ± 33 a
	D+	31 ± 4 a	1084 ± 33 a
2019	W-	139 ± 5 B	1497 ± 9 B
	W+	102 ± 14 A	1272 ± 52 A
	D-	121 ± 29 a	1412 ± 91 a
	D+	129 ± 10 a	1583 ± 95 a

Determined concentrations of monomeric anthocyanin and total phenolics in final resulting wines from two years data of W and D treatment groups.
Different letters represent significant difference in means ($P < 0.05$, n=3). Capital letters denote comparison of W treatments and lowercase letters denote comparison of D treatments.

Conclusions

- Contents of volatile compounds in wines were affected by the both irrigation treatments and health status of vines, but no consistent trend was found across the years.
- Significant lower anthocyanin and phenolics content can be observed in RB+ affected wines under wet treatment rather than dry treatment.
- RB+ grapes showed lower Brix and malvidin-3-glucoside during berry development. No significant difference was observed on organic acids between RB+/- grapes.

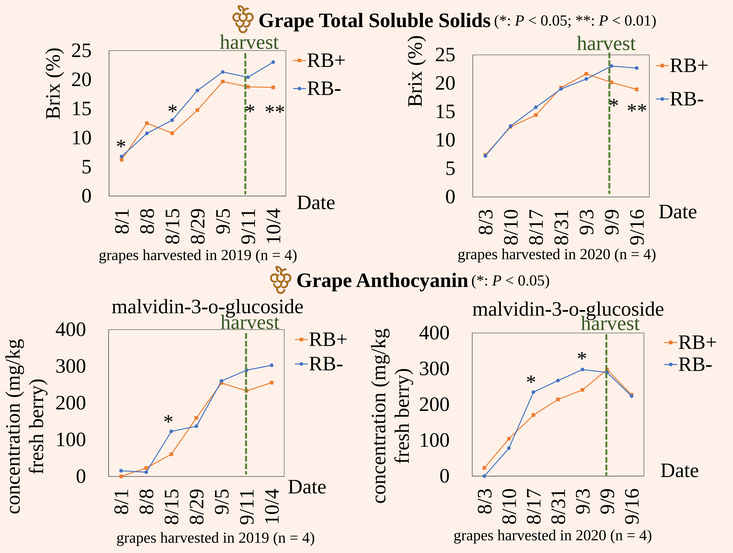


Figure 3. Grape total soluble solids (TSS, brix) and malvidin-3-o-glucoside (Mal) content. TSS and Mal are observed to increase with berry maturation. Several significant differences in concentrations of TSS and Mal are observed between RB+ and RB- grape berries, denoted with significant levels (* and **), throughout berry development.