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"Influence of irrigation on vine performance, fruit composition, and wine quality of Chardonnay in a cool, humid climate"

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Is irrigation necessary in humid, continental climates? Will irrigation increase yield but adversely affect fruit quality? This trial was designed to address these questions.

• Vineyard irrigation in the Niagara Peninisula (Ontario) and northwestern United States is not widespread because of historical natural rainfall, but since 6 of the last 10 vintages had prolonged drought, growers have been considering irrigation for premium winegrape production. The authors' hypothesis is that "short-duration, early-season irrigation of Chardonnay would moderate water stress in dry seasons, leading to improved vine growth and berry composition".

• So, from 2001 through 2004, in a randomized complete block design with 5 replications per treatment, they compared the following 5 irrigation treatments applied to an 8-yr-old Chardonnay/3309 vineyard. Water amounts were applied weekly and varied based on ETo, using a fixed crop coefficient (0.75).

1) ***non-irrgiated control***
2) ***early season cut-off*** *(irrigation until berry set)*
3) ***midseason cut-off*** *(irrigation until berry touch, equivalent to berry growth lag phase)*
4) ***late season cut-off*** *(irrigation until veraison)*
5) ***full season irrigation***

• The authors measured a number of soil and plant water status parameters, as well as yield and vigor components. They also performed sensory evaluation of the wines (20 liter size) made from each type of irrigation, for three the seasons (2001-2003). To help interpret the results, let's keep in mind the most relevant weather differences between the years in the trial:

2001 : drier, high ETo late in the year
2002 : drier, high ETo early in the year
2003 : wet, low ETo
2004 : wet, low ETo

• **Vine water status.** Not unexpectedly, **leaf water potential** became more negative throughout the season for those treatments that were not irrigated or had been cut-off. Leaf water potential values for these treatments (no irrigation, and all three cut-offs) were the most negative near the end of the growing season (-10 bars). The authors also report that irrigation cut-offs imposed at berry set and at lag phase reduced water status more than those imposed at veraison. The authors only present the graphs for 2003 and 2004, and in this latter year in particular, leaf water potentials for every single treatment –including the unirrigated control- look very similar (both are wet years, with low ETo). As for **transpiration** rates

(measured using a porometer), the non-irrigated treatment and the treatments that received a cut-off also showed reduced transpiration, consistent with increased water stress. .

• **Soil water status.** Also not unexpectedly, soil moisture (measured with a Theta probe in the root zone weekly) was higher in the irrigated treatments, with the full-irrigation consistently showing the highest moisture. The authors present graphs of soil moisture (%) just for 2003 and 2004. When one looks at the graph for 2004, once again, all treatments show practically the same moisture levels throughout the year.

• **Yield.** Substantial yield increases were noted in 2001 and 2002 in the later cut-off treatment and the full irrigation (with the exception of the mid-season cut-off, which had lower yield than the unirrigated control). In 2004, none of the treatments exceeded the un-irrigated control in yield. Clusters per vine and berries per cluster were unaffected by treatment in 2001, but not in 2002. (2001 was the first year of the trial, so this result is not totally unexpected). However, berry weight increased with increased duration of irrigation (3 years out of 4). Berry weight was also consistently the main driver of higher yields.

• **Fruit composition.** Brix was highest in both the un-irrigated control and the full-season irrigation (2001 and 2002), and in the mid-season cut-off (2003 and 2004). The authors emphasize the importance of the 2% increase in Brix of the full irrigation, compared to the control, observed in 2001. As the authors point out, as little as a 0.4 Brix increase is sufficient to provide a bonus payment to a grower in Ontario. *[But what about the remaning years?]* As the graphs indicate, the full irrigation had the same Brix as the unirrigated control in 2001 and 2002; and *lower* Brix than the unirrigated control in 2003. So irrigation was not able to increase yields consistently. Changes in pH and TA also showed important fluctuations across years.

• **Sensory evaluation.** A panel of 11 trained judges was presented with pairs of the 2002 wines, and asked to rate each of the wines as *"higher in intensity than the control"* or *"lower in intensity than the control"* for each of the flavor and aroma attributes that they had previously selected (apple, floral, citrus, earthy, and acidity). The later cut-offs (mid-season and veraison) and the full irrigation wines were judged as having more fruity aroma and less earthiness than the early cut-off (even though the early cut-off was lower in earthiness than the control in 2001). The judges deemed that the wines in 2003 were too similar to be analyzed.

It seems to me that in this study the authors encountered a large amount of unexpected variability. One of their main goals was to find out "Can we still improve yield in humid climates if we irrigate, but not at the expense of quality?" Their chemical and sensory results seem to indicate that this was possible, but only in certain years. We also need to interpret the sensory results with caution, as the attributes that best describe small-lot winemaking are not always those that best apply to the equivalent large-scale wines. In my opinion, the season variability encountered in this study is excessive to be able to draw any solid conclusions.

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