Summary 202

VITICULTURE & ENOLOGY
UNIVERSITY OF CALIFORNIA DAVIS

Interactive effects of deficit irrigation and crop load on Cabernet Sauvignon in an arid climate

By: M. Keller, R. Smithyman, and L. Mills

In: American Journal of Enology and Viticulture. 59: 221-234. 2008

• Often times, winemakers focus on maximizing grape quality, whereas growers tend to focus on strategies to maximize both crop and quality. According to the current authors, these two goals clash frequently enough to warrant further scientific attention. The goal of this study was to explore the interaction between amount and timing of **deficit irrigation**, on the one hand, and cluster thinning –or **crop load**-, on the other.

• The experimental vines were 15-year-old own-rooted Cabernet Sauvignon growing on a loamy fine sandy soil in Columbia Valley, Washington. The *irrigation treatments* tested were:

- **mild deficit irrigation throughout (60-70%ET_V)* = standard winery practice= control**
- **severe deficit irrigation pre -veraison, or early (30-50%ET_V)***
- **severe deficit irrigation post-veraison, or late (30-50%ET_V)***

*100% ET_V = full vine evapotranspiration. Exact % ET_V applied varied depending on the trial year – see original text for details

The *crop load treatments*, imposed within each of the irrigation treatments above, were:

- **low crop load = thinned to a target 6.7 tons/ha (2.7 tons/acre)**
- **high crop load = unthinned = control**

The experiment had a split-plot design, with irrigation treatments as the main plots, and crop-load treatments as subplots. There were 4 replications per main treatment, with ~1800 vines per replication – each further divided among subplots. The trial ran for 5 years (1999-2003).

• **Effects on soil and vine water status**. The trial period covered a wide range of weathers, with 1999 unusually cool for the region (1,532 growing degree days, or GDD), and 2003 unusually warm (1,857 GDD). Whereas the *irrigation treatments* affected soil moisture and water potentials, the *crop load treatments* never influenced either parameter. 1) The more severe water-deficit treatments maintained the soil moisture just above the permanent wilting point. As expected, the early severe deficit resulted in the driest soil between set and veraison, whereas the late severe deficit maintained the driest soil from veraison through harvest. Fall irrigations refilled the soils to field capacity. 2) Mid-day stem water potentials mirrored this soil moisture pattern.

• **Effects on vine growth.** 1) Even though, in this study, irrigation and crop load had a small effect on vigor, shoot length, canopy density, leaf area and vine size, the early severe deficit did significantly reduced pruning weights (3 years out of 5) and leaf size (2 years out of 4). 2) Shoot numbers increased – and shoot growth decreased- in the last 3 years of the study, but this was a vintage effect, with the same values across treatments for any given year.

• **Effects on yield and yield components**. 1) *Cluster numbers per shoot* and *flower numbers per cluster* were unaffected by treatment – they also showed small fluctuations year-to-year. As the authors point out, this implies that neither irrigation nor crop load had an effect on cluster initiation and cluster differentiation. 2) As for the trickier subject of *berry size*, early severe deficit produced smaller berries only 2 years out of 5. On the other hand, the early severe deficit also tended to produce more berries per cluster (even though this was significant only in 2000). Thus, the authors found it to be generally true that **clusters with fewer berries tended to have larger berries**. But this was not the case with the early severe deficit: if a year was characterized by few berries per cluster, berries remained smaller with the early severe deficit, whereas they "compensated" –showed larger size- with the remaining irrigation treatments.

• 3) *Yields* fluctuated little year-to-year: The average yield of the high-crop treatment was 10 tons/ha, with a standard error of only 0.1 tons/ha; whereas the average yield of the low-crop treatment was 6.7 $\pm$ 0.1 tons/ha. However, irrigation did affect yields in a not necessarily expected way: in 3 out of 5 years, the crop load of the early severe deficit was *higher* than that of the other two irrigation treatments. Even though the late severe deficit led to lower yields than the other two treatments, the differences with the standard deficit were remarkably small.

• **Effects on fruit composition**. 1) Neither irrigation nor crop-load affected the date of veraison or harvest of any of the treatment in this study, which were harvested on the same day for a given year, at a target sugar of 24^{o}Brix. (The only exception was the first year, which was very cool, and sugars only reached 23.5^{o}Brix). 2) TA was only significantly different in the very cool year (1999) and in the very warm year (2002), when it was highest and lowest, respectively, but not necessarily different across treatments. As the authors point out, the more severe water deficit treatments did not result in any gains in terms of fruit quality. On the contrary, the early severe deficit tended to decrease juice color, compared to the standard deficit or the late severe deficit.

• **Effects on cold hardiness.** Neither severity and timing of deficit irrigation nor cluster thinning had any effects on cold hardiness of buds and cane tissues.

In conclusion, a *deficit irrigation* consisting of replacing as little as 30% of ETv - either before or after veraison- did not lead to further decrease in shoot growth and berry size, and had only minor effects on fruit composition of own-rooted Cabernet Sauvignon growing in Washington, compared to the standard winery practice of replacing 60% ET_v. On the other hand, cluster thinning reduced crop loads and yields, but had little effect on growth, fruit composition, and cold hardiness. According to these authors, in the sunny climate of southeastern Washington, temperature is more important than soil moisture or crop load when it comes to determining quality. Therefore, they believe that growers:

_ could be using much less water without sacrificing vine growth, yield or cold hardiness;
_ could be using less cluster thinning –as long as the season is long- since they question whether the slight advancement of grape maturity compensates for the yield loss and the cost of the operation.

Author: Bibiana Guerra, Editors: Kay Bogart, Matthew Fidelibus. This summary series funded by J. Lohr Vineyards & Wines.