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"Response of fruit growth and ripening to crop level in dry-farmed Cabernet Sauvignon on four rootstocks"

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In: American Journal of Enology and Viticulture, 57(3):314-324. 2006

The goal of this study was to determine how much crop a vine can ripen when irrigation water is not available, and whether the time of maturity could be manipulated through rootstock and crop level choices.

• Plants with *indeterminate* growth habit, such as grapevines, allow vegetative growth –or shoot growth- to compete with reproductive growth- or flowering and fruiting. This is in contrast to plants with *determinate* growth, where such competition does not exist (corn, sunflower).

• In vineyards, we can manipulate this partitioning between vegetative and reproductive growths mainly through pruning and inflorescence/cluster thinning. Researchers have shown that reproductive growth is more responsive than vegetative growth to pruning. Current evidence also points out that, in contrast, vegetative growth is more responsive to vine water status than reproductive growth, suggesting yet a third mechanism to manipulate vine balance.

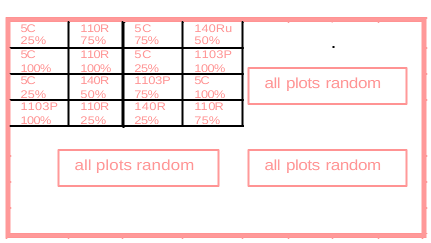
• To determine how dry-farmed Cabernet Sauvignon vines respond to different crop levels, the authors started with bilateral-cordon-trained vines pruned to six 2-bud spurs per meter of cordon (12 shoots/m) and imposed the following 4 thinning treatments at veraison (always by dropping the most apical clusters):

1) 100% = all clusters retained = 2X standard crop
2) 75% = 75% of clusters retained = 1.5X standard crop
3) 50% = 50% of clusters retained (one cluster per shoot) = **standard crop** (grower practice)
4) 25% = 25% of clusters retained (leave one cluster every two shoots) = half standard crop

The authors also compared Cabernet vines grafted to 3 rootstocks:

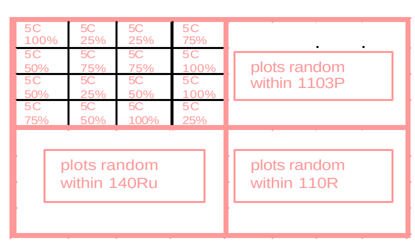
1) 5C (V. berlandieri x V. riparia)
2) 1103P (V. berlandieri x V. rupestris)
3) 140 Ru (V. verlndieri x V. rupestris)
4) 110 R (V. berlandieri x V. rupestris)

The trial ran for 2 years (1997-1998) at the University of California's Oakville Experimental vineyard (Napa Valley) and was a split-plot design with 4 replications.



4 rootstocks x 4 crop loads x 4 replications = 64 plots

Completely-randomized block design



4 rootstocks x 4 crop loads x 4 replications = 64 plots

Split-plot design

• If the authors had wanted to compare their results in two extreme years, they couldn't have chosen better, since the two years of this trial happened to be the hottest (1997) and the coolest (1998) of the decade. So results fluctuated, and factors interacted (please see original text for details), but here are the main highlights.

• **Effect of thinning on:**
1) **yield components:** When the thinning treatments were imposed at veraison, the 25% thinned vines were left with 4 times less crop than the unthinned vines (100% treatment). However, by harvest, the yields were only 150% higher in the unthinned than in the heavily thinned vines. Cluster weights were not significantly affected by thinning. But the authors did find that berry size on the unthinned vines (100%) was significantly smaller than berries of the 50% thinned vines.
2) **vegetative growth:** Thinning the clusters at veraison had no effect on vegetative growth.
3) **fruit composition:** The time required to reach a target Brix was a linear function of the yield carried on the vines. The slope of this relationship was 1.1-1.2 days per ton (it took 1.1-1.2 more days to ripen each additional ton of grapes, regardless of whether the target was 23.5, 24.0, or 25.0 °Brix). But when the authors calculated the *sugar yield* (fruit yield x Brix), this accumulation of sugar was dramatically different and positively proportional to the crop level (more crop, more sugar yield), with unthinned vines producing 120% greater sugar yield than 25% thinned vines. In general, 50% and 75% thinned vines had higher TAs (good thing), higher pHs (not so good), and, interestingly, lighter color, than vines with higher crop levels. The highest cropping levels always had lower pHs than the thinned vines.

• **Effect of rootstock on:**
1) **yield components:** Even though there were differences in yield among rootstocks, they were not consistent. Rootstock made a significant difference in cluster weight, with cluster weight significantly higher in 5C. Berry size also varied among rootstocks, with 1103P generally having the smallest size, while 5C and 140 Ru had the largest.
2) **vegetative growth:** In both years, 140 Ru produced significantly more vegetation than 5C. When coupled with the resultant high yields of 5C, this translates into 5C having the highest yield/pruning weight ratios, whereas 1103P had the lowest. Interestingly, 5C also showed a significantly lower midday leaf water potential than the other roostocks.
3) **fruit composition:** Even though sugar accumulation was significantly lower for 5C than for the other rootstocks, sugars (Brix) at harvest were similar for all rootstocks. When we consider, once again, the parameter *sugar yield*, vines grafted on 1103P yielded about 40% less sugar than those on 5C. In general, 110P tended to have higher pH, and 5C tended to have lower TA.

• **Effect of year:** Yields were pretty consistent on both years: between 3.5 (25% retained crop) and 8.2 tons/acre (unthinned vines) in the hot season of 1997, and between 3.0 and 7.3 tons/acre, respectively, in the wet season of 1998.

In summary, adjusting crop level can change the timing of ripening in a dry-farmed Cabernet Sauvignon vineyard, whereas the type of rootstock did not have an effect on ripening. In both years, thinning clusters at veraison considerably reduced yields, and reduced total sugar produced per vine (*sugar yield*). In the authors' opinion, cluster thinning in Cabernet Sauvignon should be considered carefully, since it does not ensure a quality improvement (fruit quality in this study did not change), and the only compensation observed was a slight advance in maturity (one day per additional ton).

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