Summary 3

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Title: **"Tannin in skins and seeds of Cabernet sauvignon, Syrah, and Pinot noir berries during ripening"**

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Tannins are the most abundant type of phenols in grapes. Because they include a vast collection of chemical structures, measuring them is a huge task. But fortunately, it may not be necessary to know how much of each species of tannin is there in a wine. It would seem sufficient, for practical purposes, to be able to know how much of that tannin plays a role in a wine's astringency. This is what Dr. Adams and his team achieved in this study. They started out with an old method of precipitation of tannin with protein (Hagerman and Butler, 1978), and were able to adapt it so it could be used with grapes. The result is a relatively simple assay that can be used in the winery to estimate the amount of tannin in both grapes and wines. Once the method was optimized, they used it to study how tannin levels in the skins and seeds of three major varieties change during ripening. They also analyzed the tannins in the corresponding wines. Their main findin gs follow.

• First, a quick overview of the principle of the assay. A known volume of wine, or of skin or seed extract, is mixed with a known amount of protein (in this case BSA, or bovine serum albumin). The protein binds to the tannin in the sample, forming a protein-tannin complex that is easy to precipitate. It is then possible to reveal how much tannin precipitated by washing the precipitate with a ferric chloride solution, which forms a colored complex that can be read on a spectrophotometer at 510 nm. The amount of color is proportional to the amount of tannin in the original sample. Because we use a tannin species called catechin to calibrate the correlation between absorbance and concentration, the measured amount of tannin is expressed as **catechin equivalent** units.

• **Cabernet sauvignon**. The authors found that the amount of tannin they observed in seeds of this variety is almost twice the amount of tannin they observed in the skins, on a per berry basis. As for its behavior during berry growth, seed tannin content showed a peak around veraison and then declined gradually from veraison to harvest. In contrast, skin tannin stayed fairly constant. As a result, by harvest time, **the amount of tannin in both skins and seeds was about the same** . This convergence occurred earlier in 1998, when both seed and skin tannin reached the same value 4 weeks before harvest, than in 1999, when both levels converged right at harvest.

• **Syrah**. The pattern in Syrah was somehow similar to Cabernet, because a peak of seed tannin was also observed around veraison. But the difference was that the seed tannin levels never declined enough to actually match the levels observed in the skins. The result was that by harvest, the **tannin levels recorded in Syrah seeds remained more than twice as high as the tannin levels in the skins** .

• **Pinot noir**. A similar pattern to Cabernet was also observed in Pinot Noir. In this variety, seed tannin levels peaked right after verasion, then declined. Skin tannin levels remained constant throughout ripening. However, both seed and skin tannin levels observed showed an unexplained higher variability compared to the other varieties.

• **Wines**. The authors went on to explore whether the amount of tannin observed in the grapes correlated with the tannin levels in the corresponding wines. To achieve this, they looked at four wines made from the 1999 fruit: one Cabernet sauvignon, one Syrah, and two Pinot noirs. The two Pinot noir wines represented fruit from two neighboring vineyards, planted to the same rootstock and clone, yet producing wines with very different tannin profiles. Interestingly, they observed **no relationship between the total tannin per berry and the amount of tannin in the resulting wine** . Not only that, they found that the Pinot noir fruit from the two neighboring vineyards differed remarkably in tannin levels, both in seeds and skins, and so did the corresponding wines.

• What could be causing this difference in tannin concentration between the two similar Pinot Noir sites? The authors observed that the berries in the two sites had different amounts of seeds: 2 seeds per berry on average in vineyard A, and 1 seed per berry in vineyard B. Their data showed that the amount of tannin in each seed was the same in both vineyards, so it was actually only the number of seeds which was determining the difference in seed tannin per berry! Because the tannin level per seed was the same across the varieties studied, not just Pinot Noir, the authors were able to state that **the dominant factor determining the amount of seed tannin in berries appears to be the number of seeds per berry.**

• In the discussion, the authors point out a strange sharp decline in the concentrations of seed tannin in both Cabernet and Syrah taking place about four weeks after veraison. Normal concentrations were restored one week later. When they looked further into this unusual pattern, they found that the decline in protein-precipitable tannin did not correlate with the tannin concentrations measured with a spectrophotometer or a HPLC (High Pressure Liquid Chromatograph), instruments designed to capture more qualitative differences. It was also noted that these changes happened somewhere during the single hottest day of the season, followed by a week of very hot days. Although the precise cause of the decline remains unclear, it soon became evident that the change was a qualitative one - involving changes in the species of tannin - rather than a change in the actual concentration of tannin.

Wouldn't it be interesting to know more about the irrigation regimes of vineyards A and B above to better understand the differences in tannin concentrations? Or were any other farming practices remarkably different between the two vineyards? How about the impact on yields? Learning more about how to affect seed number, without negatively affecting berry size, might help us understand how to minimize extraction of undesirable seed tannins.

It would also be of interest to expose fruit to very extreme temperatures and then explore how seed and tannins are affected. Could we be finding that high temperatures not only have an impact on sensory, but that they also affect how much tannin gets extracted into the wine? Furthermore, could the latter be part of the explanation why excessive heat in the vineyard reduces quality? With the tool that the authors give us in this article, addressing these questions no longer seems an impossible task.

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