



Advancement of grapevine maturity in Australia between 1993 and 2006: putative causes, magnitude of trends and viticulture consequences

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- The objective of this study was to gather as much data from Australian wineries as possible to determine the impact of recent global warming on the rate of change of 3 important enological parameters:

1. Date when fruit reached 21.8°Brix, referred to as “designated maturity”
2. Date of harvest
3. Sugar concentration at harvest

The authors looked at 3 key varieties: Cabernet Sauvignon, Chardonnay, and Syrah (Shiraz). The data was collected from 18 major Australian wine regions, covering quite different climates. In contrast to long-term European records, the Australian industry has relatively short-term reliable records and, therefore, the data presented here is somewhat limited (1993 to 2006).

- The authors were able to obtain daily average temperature for each reference location from the Australian Bureau of Meteorology. The phenological and harvest data obtained from wineries in each of the regions was collected with the help of a vineyard and winery management software database. Once *vine response data* and *temperature data* were available, the authors explored the relationship between the two using regression analysis.

• Results .

- 1) Between 1993 and 2006, the **date of designated maturity** (day fruit reached 21.8°B) **advanced between 0.5 and 3.1 days per year.**
- 2) The change in maturity was strongly correlated to seasonal changes in temperature. This correlation was strongest for Cabernet Sauvignon and Chardonnay, whereas it was weak for Syrah.
- 3) Between 1993 and 2006, **yield** trends in Australian vineyards **increased up to 1.8 tons/hectare in warm regions** (Murray Darling, Riverland, Swan Hill), and **decreased on average 0.5 tons/hectare in cool regions** (Yarra Valley, Coonawarra, Padthaway).
- 4) Interestingly, the date of designated maturity was not found to be affected by crop load. In other words, whether the vine was carrying 5 or 10 tons/hectare, the date the fruit reached 21.8°Brix was unaffected. *[This seems remarkable, however the authors are not reporting individual data, but rather overall trends].*
- 5) Between 1993 and 2006 **Australian wineries have been accelerating their date of harvest between 0.4 to 2.5 days each year.**
- 6) Because both maturity and harvest date advanced, but not necessarily at the same rate, the impact on sugar levels at harvest was different depending on variety. In Chardonnay, both maturity and harvest day advanced at the same rate, therefore, **sugar concentration at harvest for Chardonnay remained the same**. In contrast, in Cabernet and Syrah, the natural advancement of maturity was stronger than the advancement of harvest date. Therefore, berry **sugar concentration at harvest for Cabernet and Syrah increased systematically.**

- In their discussion, the authors mention how the rates of change in designated maturity found in this study were much larger than those reported for several phenological stages in North America and France. The authors present the comparative data of all these studies, classified by variety, in a clear and comprehensive table (Table 5 of original text).

- As for the possible causes for these changes, the authors conclude that the main driver of the earlier maturity of grapevines in Australia since 1993 is likely the increased temperature trends (*see Summary #109 at <http://wineserver.ucdavis.edu/content.php?id=702>*). However, they feel that more detailed data on the effect of temperature on budbreak and other phenological stages is needed to prove this statement. Additionally, other non-investigated factors, such as an increase in diffuse radiation, may be playing a role.

- The authors discuss that the rate of change in maturity and the rate of change in temperature they found were very similar for Chardonnay and Cabernet Sauvignon, but not for Syrah, whose maturity seemed rather independent of temperature changes. Even though they are unable to offer a full explanation for this varietal difference, they mention that Syrah is known to be able to maintain higher stomatal conductance than other varieties in response to water deficits, and perhaps, this may contribute to a “decoupling” of Syrah’s canopy temperature from ambient temperature.

In conclusion, the authors show that grapes in Australia are maturing earlier, at a rate from half to three days earlier per year, depending on variety and region. They also present change rates for each specific variety and region, thus providing a benchmark for the Australian wine industry. The changes in maturity date reported here are of greater magnitude than those found in other studies on a “days-per-year” basis. However, when expressed as “days per temperature degree”, the changes are comparable to those found in the northern hemisphere. These earlier and earlier maturities are expected to have important consequences for vineyard managers and winemakers.

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