



THE UNIVERSITY OF
MELBOURNE

Advancement of Grape Maturity

Comparison between contrasting regions and varieties

Wendy CAMERON¹, Paul R. PETRIE², E.W.R BARLOW¹, Kate HOWELL¹
and Sigfredo FUENTES¹

¹ University of Melbourne, Faculty of Veterinary and Agricultural Sciences, VIC 3010, Australia

² South Australian Research and Development Institute, Waite Research Precinct, Urrbrae, SA 5064, Australia

Introduction and Objective

Grape phenology is advancing as a result of global warming (Petrie and Sadras, 2008, Webb et al, 2011). In order to adapt to climate change more information is needed to understand differences in varietal responses to temperature increases.

Materials and Methods

This research utilized an historical data set, covering 20 years, 23 varieties and four vineyard sites located in different climatic zones in Victoria, Australia (Figure 1). The data were analysed using mixed models to understand temporal changes of the day of year maturity (DOYM) and to understand the relationship between DOYM and seasonal Growing Degree Days ($GDD_{Sep-Mar}$).

Results

Dolcetto at both Central Victoria and Lower King Valley were found to have had a significant DOYM advancement ($P < 0.05$) of 1.7 and 1.1 days respectively per year. In contrast Orange Muscat at Swan Hill was found to have a delayed DOYM of 1.2 days per year (results not shown). DOYM was found to be advancing as a function of $GDD_{Sep-Mar}$ for all varieties at all vineyards (Figure 2). A mixed model analysis with an interaction term showed that there were significant differences between the rate of advancement of DOYM between varieties at 3 of the vineyards: Swan Hill, and Upper and Lower King Valley (indicated by the different letters in Figure 2). Plotting mean DOYM figures against these changes in DOYM advancement indicated a trend that later ripening varieties were advancing DOYM at a faster rate than earlier ripening varieties (Figure 3). Yield was found to have a significant positive association with DOYM in some cases but this was not at the expense of the temperature effect. When the rate of DOYM between varieties common to different vineyards was compared it was found that the cooler vineyard had a faster rate of DOYM advancement than the warmer vineyards (results not shown). This suggests that the rate of DOYM advancement may plateau as temperatures continue to increase.

Conclusion

Grape varieties responded to temperature increases differently indicating that there is diversity which may assist in our adaptation to climate change. Some varieties are very responsive to higher seasonal temperatures with large advancements in DOYM where others appear quite resistant. The results provide some explanation for the phenomenon of vintage compression in Australia, where varieties ripen over a shorter period placing pressure on harvesting and processing infrastructure.

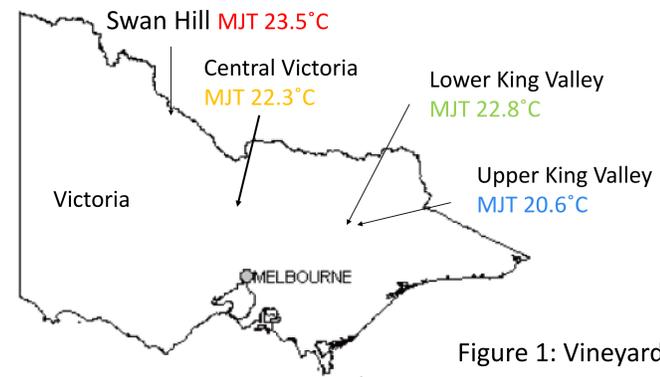


Figure 1: Vineyard locations

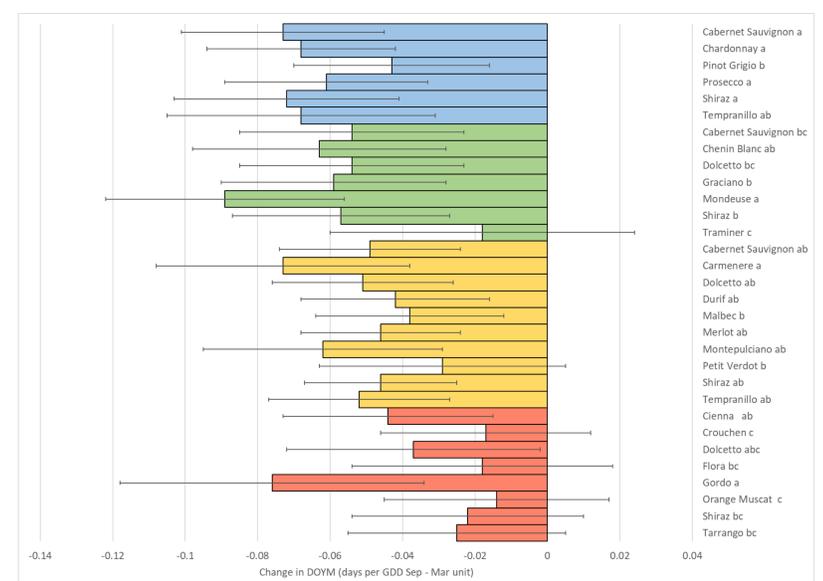


Figure 2: Change of Day of Year Maturity as a function of $GDD_{Sep-Mar}$. Swan Hill (■) Central Victoria (■) Lower King Valley (■), Upper King Valley (■). Mixed model was used (Response: DOYM, Random Factors: Block, Vintage Year, Covariate $GDD_{Sep-Mar}$, Interaction term $GDD_{Sep-Mar} * Variety$. Black lines are confidence intervals. Where these cross zero on x-axis result is not significant. Varieties with different letters are significantly different within each vineyard. NB: Despite different letters, there were NOT significant differences between DOYM advancement for the varieties at Central Victoria.

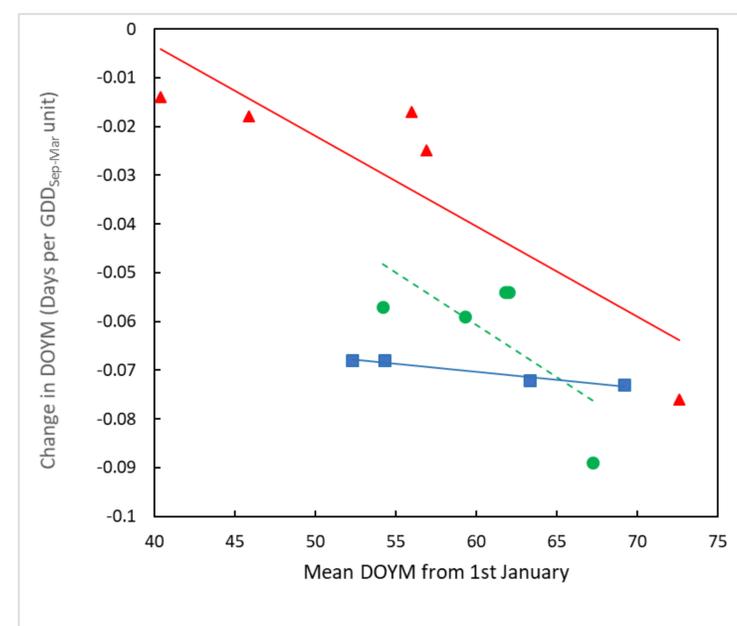


Figure 3: The relationship between time of ripening (Mean DOYM) and Rate of Change of DOYM as a function of $GDD_{Sep-Mar}$. Swan Hill (▲) Lower King Valley (●) Upper King Valley (■). Each point represents a variety with the same designated maturity. Solid lines indicate significant trends ($p < 0.05$).

References

Petrie, P. R. & Sadras, V.O. 2008. Advancement of grapevine maturity in Australia between 1993 and 2006: putative causes, magnitude of trends and viticultural consequences. *Australian Journal of Grape and Wine Research*, 14, 33-45.
Webb, L.B., Whetton, P.H. & Barlow, E.W.R. 2011. Observed trends in winegrape maturity in Australia. *Global Change Biology*, 17, 2707-2719.

Acknowledgements: Supported by Australian Government Research Training Program Scholarship provided by the Australian Commonwealth Government and the University of Melbourne.