ADVANCEMENT OF GRAPE MATURITY – COMPARISON BETWEEN CONTRASTING VARIETIES AND REGIONS

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Abstract:

Context and purpose of the study - Grapevine phenology has advanced across many regions, nationally and internationally, in recent decades under the influence of increasing temperatures, resulting in earlier vintages (Jones and Davis, 2000, Petrie and Sadras, 2008, Tomasi et al., 2011, Webb et al., 2011. Earlier vintages have several ramifications for the wine industry. There are direct implications on quality, due to the fruit ripening during the hotter conditions of summer and early autumn, which then impacts grape composition and wine style (Sadras et al., 2013, Buttrose et al., 1971, Mira de Ordũna, 2010). There are also indirect implications where the fruit is perceived to ripen at a faster rate and the crop reach optimum maturity over a shorter period (Coulter et al., 2016). This can result in the grapes being harvested according to the winery processing schedule rather than when they are optimally ripe. This study aims to advance our understanding of the response of different varieties and regions to warming temperatures.

Materials and Methods - This research utilized an historical data set, covering 18 years, multiple varieties and four separate vineyard sites located in different climatic zones in Victoria, Australia. The data were analysed using mixed models to understand differences in the day of year maturity changes between varieties and vineyard sites.

Results - The data analysis suggested that the rate of advancement of day of maturity as a function of seasonal Growing Degree Days (September to March) varies significantly between varieties with some varieties being quite resistant to the temperature increases being experienced. There is some evidence that later ripening varieties are advancing their day of year maturity at a more rapid rate than earlier ripening varieties which helps to explain the vintage compression being observed in Australia. While yield had a significant association with the day of year maturity for some varieties, this was found to be an additional effect and not at the expense of the response to temperature indices.

An understanding of how different varieties are responding to changing climates will assist in future planting decisions and determine how to best adapt to climate change. It will also demonstrate the degree of genetic variation available in modern grape varieties in response to changing vineyard climates, which varieties are the most resilient and how they may best be managed.

Keywords: day of year maturity, growing degree day, spring index

1. Introduction.

Advancement of Grape Maturity

Comparison between contrasting regions and varieties

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Introduction and Objective

Grape phenology is advancing as a result of warmer temperatures (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 18 years, 23 varieties and four separate vineyard sites located in different climatic zones in Victoria, Australia (Figure 1). The data were analysed using mixed models to understand relationships between the day of the year when the fruit reached maturity (DOYM) and seasonal Growing Degree Days ($GDD_{Sep\text{-}Mar}$).

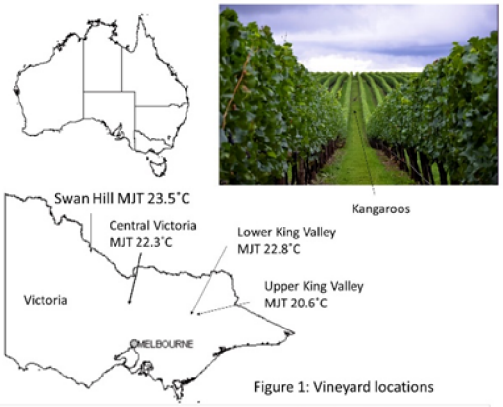
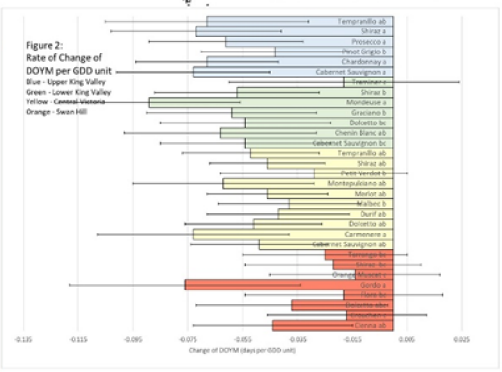


Figure 1: Vineyard locations

Results

The only significant changes in DOYM as a function of vintage were for Dolcetto which was ripening earlier at Central Victoria and Lower King Valley and Orange Muscat which was ripening later at Swan Hill (results not shown). DOYM was advancing as a function of $GDD_{Sep\text{-}Mar}$ for all varieties at all vineyards, although few of these advancing trends were significant at the warmest vineyard at Swan Hill (Figure 2). Significant differences were found in the rate of DOYM advancement between varieties at each of the vineyards at Swan Hill, Upper and Lower King Valley (see letters Fig 2). There were no significant differences found in the rate of DOYM advancement between the varieties at Central Victoria. Yield was found to have a significant positive association with DOYM in some cases but this was not at the expense of the temperature effects. There was some evidence that later ripening varieties were advancing their DOYM more rapidly than earlier ripening varieties (Figure 4).



Conclusion

Grape varieties responded to temperature increases differently with some varieties appearing to reach a plateau at which their DOYM no longer advanced in response to temperature. This indicates there is some diversity within grape varieties which might assist in our adaptation to climate change. The results provide evidence for vintage compression where varieties ripen over a shorter period placing pressure on harvesting and processing infrastructure.

Legend:
Different letters next to varieties (Figure 2) indicate that the trends are significantly different.
Mixed model used with interaction factor GDD*Variety.

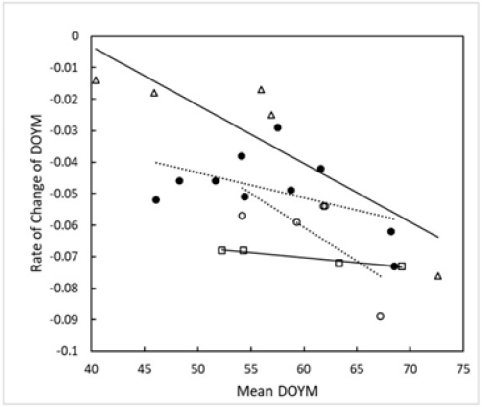


Figure 4: The relationship between time of ripening (Mean DOYM) and Rate of Change of DOYM:GDD. Swan Hill (△) Central Victoria (●) Upper King Valley (○), Lower King Valley (□). Each point represents a variety. Solid lines indicate significant negative trends.

References
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