



Climatic region and vine structure: Effect on Pinotage wine phenolic composition, total antioxidant capacity and colour

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In: South African Journal of Enology and Viticulture, 27(2)151-166. 2006

- Both growers and winemakers often speculate whether head-trained vines (what the authors call bush vines) or trellised vines (VSP) are preferable for making high-quality wine. Similarly, it is also not clear whether cool or warm climatic conditions work best for growing high-quality red wine.
- The authors studied a total of 20 vineyard sites located in 3 climatic regions (summer temperatures of 19-20.9°C, 21-22.9°C, or 23-24.9°C), and trained to one of 4 training systems (bush vines with 20 cm trunk height, bush vines with 30 cm trunk height, trellised vines with 30 cm trunk height, and trellised vines with 60 cm trunk height). Different vineyard sites trained to the same system and in the same climatic region represented “repetitions”. That is, the authors tried to make up for the difficulty of getting “true replications” in the same location by looking at many different vineyards and analyzing the trends. They carried the trial with their local variety –Pinotage- for 3 years (2001-2003).
- In each vineyard, the authors measured a large set of wine parameters, with an emphasis on phenolic compounds (see original text for specific methodologies used for each):

1) °Brix

2) Spectrophotometric measurements:

- total phenols
- total anthocyanins (pH shift)
- total flavanols

3) HPLC measurements:

- individual monomers
- polymers (5 units or more)

4) Total antioxidant capacity

5) Visual color:

- colorimetric color
- CIELab parameters: *a** (red-green chromaticity, measured)
*b** (yellow-blue chromaticity, measured)
*L** (lightness, measured)
*h** (hue angle, calculated)
*C** (chroma, calculated)

- **Effect of vintage.** There were vintage influences. Wines of the 2001 vintage had the highest total phenols, highest total anthocyanins, and highest monomeric and polymeric phenol content. In contrast, 2002 had the lowest. Year 2003 was in between, being the lowest year for flavanols. This means that there

is already an influence in phenolic composition solely due to seasonal differences. (The authors do not provide information about weather patterns for these different years).

- **Effect of climate.** Of the 5 parameters measured, 1) °**Brix** did not differ significantly across climatic regions. 2) In contrast, climatic region had an effect on **phenolic composition** as measured *spectrophotometrically*, which was confirmed by *HPLC* analysis of individual compounds. Briefly, total phenols, total anthocyanins, and monomeric and polymeric phenol contents were lowest in the warmest climatic region. Flavanols were also lowest in the warmest region (Vintages 2001 and 2002). 3) The regions with the two lower temperatures had significantly higher **antioxidant capacity** than the region with the highest temperatures. (The authors talk at length about antioxidant capacity and the two methods used to measure it, for which you are referred to the original text). 4) Finally, regarding **visual color**, the cooler climatic regions produced wines generally darker (lower L*), with higher color saturation (higher C*), and with a magenta-red hue, close to pure red (higher h*), compared to the wines from the warmer regions.

- **Effect of vine structure .** 1) Once again, °**Brix** did not differ significantly between vine structures for any of the vintages. 2) **Total phenol** content was lower for wines from trellised vines than from bush vines (even though only statistically significantly in 2003). Vine structure had little effect on total anthocyanin content. The only component that was higher in the trellised vines was monomeric anthocyanin concentrations. [*In case you are totally confused, the difference between “monomeric anthocyanin” and “total anthocyanin”, as measured by the authors, is that this latter measurement is a less specific one, based on a pH shift, and includes, besides monomers, some colored material that is actually polymeric*]. 3) For all vintages, wines produced from bush vines had higher **antioxidant capacity** than those produced from trellised vines (even if the difference was only significant in 2003). Trunk height did not have an effect on antioxidant capacity. 4) **Visual color:** Wines from bush vines showed significantly higher hue (h*) and blue chromaticity values (b*), compared to wines from trellised vines. Red chromaticity (a*) and color saturation (C*) were not affected.

In brief, these authors found that phenolic composition, antioxidant capacity, and objective color were significantly affected by climate and vine structure, whereas trunk height had little effect. *Cooler regions* produced darker-colored wines with higher antioxidant capacity, mainly due to higher total phenol content. *Bush vines* produced darker wines with higher antioxidant capacity. To achieve higher antioxidant-capacity Pinotage wines, the authors recommend cultivation as bush vines in cooler regions. Because vintage variations were observed, they admit more vintages need to be analyzed. This is a long and rather detailed paper that you may choose not to read unless you have time on your hands.

	COOL	WARM	BUSH	TRELLIS
Brix	Not affected		Not affected	
Total phenols	?	?	?	?
Total anthocyanins	?	?	Not affected	
Monomeric phenol fraction	?	?		?
Polymeric phenol fraction	?	?		
Antioxidant capacity	?	?	?	?
Wine color	Darker, closer to pure red		Higher hue, higher blue (red unchanged)	

Only main trends presented.

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