# CAN THE USE OF ROOTSTOCKS ENHANCE TERROIR?

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***Abstract***

Rootstocks are an essential l management tool for diverse viticultural challenges. However, studies that combine sensory evaluation and compositional analysis of berries and wine, to determine whether the use of a particular rootstock in a terroir can influence wine quality are sparse. The aim of this study was to determine the influence of different rootstocks and own roots control on sensory and compositional differences in grape berries and resultant wines

Descriptive Sensory Analysis and compositional measures including GCMS were conducted on berries and wines of *Vitis vinifera* L. cv Shiraz vines grown on own roots or grafted to three different rootstocks (110 Richter, 1103 Paulsen, Schwarzmann). The study was conducted in an experimental rootstock vineyard in the Barossa Valley, South Australia, during two growing seasons (2009/10-2010/11).

Sensory and compositional differences were found in berries and wines from the rootstock treatments and the own roots control that were reflected in the wine quality scores.

## 1 INTRODUCTION

Rootstocks have been reported to be an essential tool to manage viticultural challenges such as nematodes, phylloxera, salinity among others (Whiting 2012). The use of rootstocks has also been reported to influence scion vigor, fruit set and ripening rate (Keller, Mills et al. 2012). Previous rootstock research has been able to identify differences in grape and wine compositional parameters such as pH, K and phenolic compounds between different rootstocks and non-grafted vines (Walker, Blackmore et al. 2010, Kodur 2011, Walker and Blackmore 2012). However, studies showing how compositional changes in grapes and wines from different rootstock treatments and non-grafted vines influence sensory characteristics are scarce. In an earlier study, the assessors found no significant differences in wine quality scores from Chardonnay wines produced from

different rootstock treatments and ungrafted vines (Ewart, Gawel et al. 1993). However, in a later study, wine flavor and aroma intensity scores of Cabernet Sauvignon wines produced from vines grafted on 5C Teleki, were found to be higher than the scores of wines from vines grown on their own roots (Gawel, Ewart et al. 2000). Although these studies provided valuable information, evaluated sensory characteristics were limited to quality score and general flavor and aroma intensity attributes. As terroir is a multi-factor concept it offers a unit to evaluate the effect of rootstocks berry and wine chemical compositional and sensory characteristics.

This study aimed to evaluate the chemical composition and sensory properties of berries and wines produced from Shiraz vines grown on own roots or grafted on three different rootstocks.

## 2 MATERIALS AND METHODS

Berry samples were sourced from a Shiraz (clone BVRC30) rootstock trial vineyard planted in 2001 at the South Australian Research and Development Institute (SARDI) Station located at Nuriootpa, Barossa Valley, South Australia. Three rootstocks were selected; 110 Richter, 1103 Paulsen and Schwarzmann and an own roots treatment was included as a control.

**Berry Chemistry.**

Samples of 100 berries were randomly taken from each of the treatment replicates to conduct measures of TSS, pH and TA using the methodology by Iland et al. (2004) and also to analyze elemental concentration using Inductively Coupled Plasma Atomic Emission Spectrometry (ICPAES). The concentrations of flavan-3-ol monomers and tannin subunits in grape skins and seeds were determined by High Performance Liquid Chromatography (HPLC), following the procedure of Kennedy and Jones (2001). Quantification of flavan-3-ol monomers, terminal and extension units was conducted as previously described in Ristic et al. (2007).

**Wine Chemistry.**

**i) Basic Measures and Ionic Composition.** Basic chemical measurements ($SO_2$, pH, titratable acidity (TA), volatile acidity (VA), alcohol and residual sugar) were performed on the wines at the time of sensory evaluation, following the methodologies described in Iland et al. (2004). Wine trace elements were analyzed by Waite Analytical Services (University of Adelaide, Adelaide, Australia) using ICPAES.

**ii) Phenolic Compounds.** Anthocyanin, tannin and pigmented polymer concentrations of the wines from both seasons were determined using HPLC following the methodology by Eglinton et al. (2004), as previously described in Olarte Mantilla et al.(2015).

**iii) Aroma Compounds.** The wines were analyzed using a non-targeted solid phase micro extraction (SPME) gas chromatography (GC) mass spectrometry (MS) method, to determine and semi-quantify the aroma compounds present in the head space using the same equipment and methods as described in Keyzers and Boss (2009).

**Sensory Evaluation**. Sensory evaluation of the berry and wine samples was conducted for all the treatments in both seasons using Descriptive Analysis. Training and formal evaluation sessions were conducted following the procedures described for berries in Olarte et al. (2013) and in wine as described in Olarte Mantilla et al. (2015).

**Wine Quality Evaluation.** Quality evaluation of all wines from both seasons was conducted using the Australian wine show 20 point scoring system (Rankine 1990, Dunphy and Lockshin 1998) by eight person wine expert panel.

**Statistical Analysis.** ANOVA and PCA were conducted to determine differences between the treatments and to identify relationships between the different sensory and compositional measures in berries and wines. ANOVA and PCA analyses were performed using the statistical package XLSTAT version 4.02, 2012 (Addinsoft SARL, Paris, France).

## 3 RESULTS AND DISCUSSION

Wines produced with fruit from vines grown on their own roots were characterized by red berry aroma, whereas wines produced using grapes grown on vines grafted to either 110 Richter or Schwarzmann rootstock had a darker rim and more intense body color, dark berry aroma, red berry flavor and more intense and coarser tannins (Figure 1). In the 2011 season berries from 110 Richter were more difficult to detach from the pulp than those from 1103 Paulsen. Pulp sweetness in 2010 and pulp acidity in the 2011 sensory ratings were significantly different between 110 Richter and own roots berries (Figure 1).

The elements Mn, Mg and B were higher in juice and wines from rootstock treatments, whilst Na was higher in juice and wines produced from vines grown on their own roots across both seasons. The majority of the acetate esters were higher in the wines made from vines on their own roots in both seasons. In both seasons the highest wine quality scores were obtained for 110 Richter wines and the lowest for own roots wines (Figure 1).

## 4 CONCLUSION

This study demonstrated that the use of rootstocks can have a positive effect on wine composition, sensory properties and wine quality. It also shows that the choice of rootstock is an important decision when establishing a vineyard in a particular terroir.

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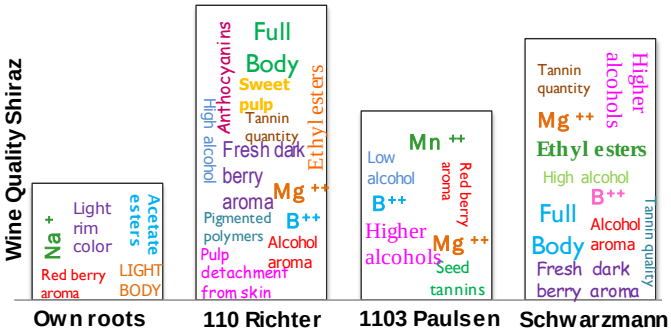


Figure 1: Summary of berry and wine sensory and compositional data from the rootstock treatments and the own roots control that influenced quality score levels.