Unravelling the complex pattern of ‘pepperiness’ in cool-climate Shiraz

Sheridan Barter¹, Rob Bramley², Mark Krstic¹, Tracey Siebert¹, Markus Herderich¹

¹ The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia, ² CSIRO, Waite Campus, Locked Bag 2, Glen Osmond, SA, 5064 Australia

Corresponding author’s email: sheridan.barter@awri.com.au

Background

• Rotundone is the extremely potent aroma compound responsible for the desirable ‘black pepper’ flavour in many cool-climate Shiraz wines.
• The putative rotundone precursor, α-guaiene, has no aroma and can be converted to rotundone by simple enzymatic or aerial oxidation.
• Grape rotundone concentrations vary greatly between growing seasons, across regions, and even within a single vineyard.
• This research seeks to determine the critical final step for rotundone formation: is it the presence of α-guaiene, or the oxidation reaction from α-guaiene, that defines grape rotundone concentration?

Results

The variation of rotundone and α-guaiene concentrations in grape samples collected at maturity in 2017 from 141 vines across a 3.21ha vineyard in the Adelaide Hills planted with two Shiraz clones, 1127 and 2626.

• Grape rotundone in this Adelaide Hills vineyard is clearly spatially structured, as seen before in the Grampians.
• Grape rotundone is independent of clone on this site.
• The spatial structure of the putative precursor, α-guaiene, matches the rotundone map closely.
• The NE-zone with the highest rotundone/α-guaiene yield (>0.3) is at a different location compared to the areas with highest overall rotundone concentration (>120 ng/kg), therefore the yield from α-guaiene oxidation is not the limiting factor.

Availability of precursor α-guaiene is key to explaining the grape rotundone concentration.

α-guaiene can be confirmed as precursor of rotundone, and the onset of α-guaiene and rotundone formation are highly synchronised.

Delaying harvest could be a way to increase peppery characteristics in cool climate Shiraz.

Identification of environmental factors which trigger α-guaiene formation are key to understanding grape rotundone and pepperiness in Shiraz wine.

• No rotundone and α-guaiene are present until after veraison.
• Rotundone is formed at the same time as α-guaiene becomes available, and its formation is ongoing.

Formation of precursor α-guaiene and harvest date are key to understanding grape rotundone concentration.

α-guaiene accumulation

rotundone accumulation

Comparison of the ratio of rotundone to α-guaiene in Shiraz grapes from multiple sites and vintages.

Rotundone formed reflects approximately one-third to one-sixth of α-guaiene present in grapes.

• The rotundone to α-guaiene ratio (rotundone yield) is broadly consistent across sites and vintages
• The rotundone to α-guaiene ratio is consistent with aerial oxidation of α-guaiene, although other reaction mechanisms cannot be ruled out.