



## Pepper flavour in wine



### Background

There are only a few major flavour compounds in wine that come directly from the grape berry. One of the most important to Shiraz wine flavour is the 'pepper' compound rotundone, which was identified in wine relatively recently.

### Rotundone in wine

AWRI researchers originally pinpointed rotundone as the cause of black or white pepper flavour in Shiraz grapes, developed an analytical method to quantify it, and determined its potency. Rotundone has one of the lowest detection thresholds of any aroma compound, meaning that only a tiny amount (around 16 ng/L) is required to give a peppery character in red wine. This is equivalent to a few drops in an Olympic-sized swimming pool. Interestingly, around 25% of

the population are blind to rotundone, unable to perceive it even at very high levels.

When looking beyond wine, AWRI researchers were the first to recognise rotundone as the impact aroma compound in peppercorns (*Piper nigrum*) and to identify it in many culinary herbs. Current work, in collaboration with CSIRO, involves mapping vineyards to assess spatial differences in rotundone, and seeks to increase understanding of environmental factors affecting its formation.

### Rotundone in the vineyard

While Shiraz is the main red wine variety where high concentrations of rotundone have been found, other varieties such as Gamay, Graciano, Duras and Durif can have substantial levels. It is generally not an important flavour compound in Cabernet Sauvignon, Merlot or Pinot Noir grapes, or most white varieties. Rotundone is most



prevalent in grapes from vineyards in cooler regions and in cooler seasons, with cool growing conditions from veraison to harvest likely to be important. There can be more than a 40-fold difference in rotundone between seasons for the same vineyard. Typically, later harvested grapes have a much higher concentration than earlier picked grapes.

In Shiraz berries rotundone has been found almost entirely in grape skins rather than in the pulp or seeds. Sun exposure on bunches is a major influence reducing the level of rotundone. Shaded bunches, and berries on shaded parts of bunches or from less exposed rows, have the highest levels. Leaf removal around the bunch zone, especially at veraison, has a major effect on lowering rotundone concentration. Vine water status also has an effect, with wetter conditions enhancing its concentration in berries.

Large differences within vineyards have been found, with considerable spatial variation, which can be stable across seasons depending on the site. Selective harvesting could be an option to separate sections of vineyards with higher and lower rotundone, with blending of wines to adjust the level of pepperiness then possible. Rotundone can be easily tasted in berries, but winemakers should ensure that they are not part of the population who are blind to this character.

## Effects due to winemaking

Winemaking has only a small effect on rotundone, with extraction during fermentation on skins being the critical step. The techniques of extended maceration and pre-ferment maceration have only a marginal effect, if any. Rosé style wines have dramatically lower rotundone concentrations than equivalent wines fermented on skins. Rotundone is a very stable compound and is

little affected by yeast. It remains at a constant level during post-fermentation processes and is largely unchanged in bottled wine over extended ageing periods.

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## Further reading

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