Dr James F Harbertson elucidates the growing field of oenology and explains how collaboration with industry can help to highlight and solve the problems associated with the production of wine.

Your studies concern the Washington wine industry. Why have you focused efforts on this region?

Washington State University gets a portion of its budget from the Washington State Government and as such I am mandated to work on issues in this state. The Washington wine industry helped to fund my position at the university and thus has directed my research and extension on wine.

What metrics do you consider when assessing the composition and quality of grapes?

We evaluate the fruit visually (berry size, damage, variation) and measure sugar and acids, and if the fruit is red we measure tannins and pigments. We also taste the fruit but it very rarely tastes anything like the wine as the flavours are trapped as precursors (bound to sugar) that are only released during the winemaking and ageing process. There are some exceptions to this of course, several of the more aromatic white cultivars like Muscat or Riesling have some of the flavours found in the fruit. Vegetable aromas are sometimes found in red and white grapes and are usually associated with less ripe fruit.

Oenology is a growing scientific field. How is research benefiting the wider community of wine producers?

As wine is quite complex, chemical science has helped deconstruct some of that complexity to provide more tools to help winemakers make better decisions and hopefully better products. I don’t think scientists seek to demystify wine, but instead to better understand its elemental parts. One of the interesting aspects of this is that it encourages winemakers around the world to heed other breakthroughs in other locations and work out how to utilise them in the most unexpected, and in many cases unintended, ways.

Has climate change had an impact on the yield and quality of harvest? What have you observed?

We have not felt the impacts of climate change in Washington as severely as others, but the danger here is still fairly high. Most of the irrigation water is gained from snow that falls in the Cascade Mountains. In years of drought the snowpack is limited and all of the farmers (hops, cherries, apples and wine and juice grapes) dependent upon its water suffer. On the other hand, many grape growers in Washington are keen to point out that the more favourable harder-to-grow grapes that take longer to ripen and/or are less cold tolerant (Cabernet Sauvignon, Merlot, Syrah) are now easier to grow in the region. So it seems there are both dangers and opportunities from the impacts of climate change.

What are the benefits and pitfalls of blending wines?

There are many benefits of blending different grape cultivars together or even blending different wines of the same cultivar produced by different winemaking methods. The most obvious improvements come in the form of changes in every aspect of the wine from the flavour, colour, mouthfeel and acidity, to the more esoteric terms like balance, and the dynamic nature of wine when it is tasted. Some of the most important things learnt about blending almost seem the most obvious. Wine is not just the sum of its parts; the perception of it is multidimensional and its complex nature would fit very easily into gestaltism philosophy. There are some pitfalls to blending as well, which are the converse of every benefit just described, plus stability issues.

Is there an ideal blend?

It is hard to say if there is an ideal blend. Some very famous winemaking areas have laws about which grapes can be blended together, which have been broken elsewhere to wonderful effect. This coupled with the advent of more grape cultivars and less restrictive rules suggests we may have new blends in the future. Some may be bad and some may be good. The market will likely dictate some of this, but I for one look forward to it.
Quality control

Though not as wasteful as most crops, vineyards consume large amounts of water for comparatively little return. Researchers at Washington State University are showing how changes in efficiency can be made at all levels of production without compromising quality.

Although the global recession has damaged many industries, there are numerous instances where trade has grown. In 2007 the total value of winemaking in the US stood at $4.7 billion, and by 2011 it had risen to a staggering $14.9 billion. According to a report released a year later on strategic solutions for the wine industry undertaken by Stonebridge Research (The Economic Impact of Washington State Wine and Grapes), the sharp upsurge in figures is partly attributable to the sheer detail of the study. With almost every conceivable aspect of the wine industry’s minutiae taken into account, it is probably the most comprehensive assessment yet. No amount of detail, however, can account entirely for such a huge difference and consumer demand and improved practice must have been a substantial contributor.

In Washington State, the total impact of wine production almost tripled in the same period from $3 billion to $8.6 billion and the number of wineries grew from 534 to 739, supporting the employment of 1 per cent of Washington’s working citizens in winemaking activities. As the Washington wine industry expands and its products become increasingly fashionable in foreign markets such as the UK, it is important to maintain and improve levels of production quality whilst working toward greater sustainability. Changes to production methods from growing to bottling, however, can have both positive and negative effects on a wine’s character. Working closely with Washington’s wine industry, researchers at Washington State University (WSU) are therefore conducting studies into a diverse range of factors that may or may not have a detrimental effect on one of the region’s most profitable commodities.

With expertise in the phenolic compounds found in grapes and wine, Dr James F Harbertson studies their composition with a focus on the biochemical and chemical changes that occur as ripening, winemaking and ageing takes place. Associate Professor at WSU’s School of Food and Science, Harbertson also heads a laboratory located within a fully operational research winery at WSU’s Irrigated Agriculture Research and Extension Centre (WSU-IAREC) in Prosser. Having made substantial contributions already with a tannin database of over 1,300 red wines and a method of tannin analysis, called the Adams-Harbertson tannin assay, with former colleague Dr Doug Adams at the University of California, Davis, Harbertson’s current research aims to elucidate the effects of industry processes such as rootstock grafting, irrigation and cofermentation on wine composition.

Water Use Efficiency

With vineyards in the Columbia Valley (an American Viticulture Area) experiencing much drier climates than the western regions of Washington, irrigation has become an essential part of grape growing. However, although looser restrictions are apparent in a few of the Old World wine-producing countries (namely those in Europe and the Mediterranean basin), irrigation is frowned upon and in some cases prohibited as having a damaging effect to the quality of the grape, whilst purists believe it to have an adulterating effect on a terrior’s characteristics. Nonetheless, as the average rainfall for many of Washington’s wine-producing areas is only around 200 mm per year, irrigation from rivers like the Columbia are indispensable to the industry’s fortunes.

In the vineyard, between 100 and 1000 litres of water are needed for one litre of wine with an additional one-20 litres used in the subsequent winemaking process. In a bid to reduce the strain on water supplies, and potentially improve grape and wine quality, Harbertson worked with industry collaborator Russell Smithyman at Ste Michelle Wine Estates and WSU colleague Dr Markus Keller to evaluate the use of regulated deficit irrigation whereby the supply of water can be fine-tuned to match the demands of the vineyard while constraining growth of the vine. Testing separate batches from 2011 and 2012, they have shown that regulated deficit irrigation has a large, positive impact on a grape’s red pigmentation, aroma, bitterness, astringency and colour. “The timing of irrigation has proven to not only show benefits from lowering water usage but it also yields smaller grapes,” states Harbertson. With greater pigmentation and tannins as a result.
INTELLIGENCE
VITICULTURAL AND WINEMAKING PRACTICES THAT IMPACT WINE QUALITY AND STABILITY

OBJECTIVES
• To evaluate the impacts of regulated deficit irrigation on grape and wine quality
• To compare own-rooted to different cultivar rootstock combinations in arid eastern Washington where plants are primarily own rooted and deficit irrigated
• To evaluate the impact on wine colour of adding small amounts of white grapes to red prior to fermentation, which is widely believed to enhance red wine

KEY COLLABORATORS
Dr Markus Keller, Chateau Ste Michelle Distinguished Professor of Viticulture at Washington State University (WSU). He received his PhD in Natural Sciences from the Swiss Federal Institute of Technology (Switzerland) and has conducted research in North and South America, Europe and Australia. He is the author of The Science of Grapevines.

Dr Russ Smithyman received his PhD in Horticulture from WSU, and his MS in Horticulture from Michigan State University. He is currently Director of Viticulture for Ste Michelle Wine Estates in Prosser, Washington. Prior to this, he held the position of Director of Research at Ste Michelle.

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JAMES F HARBERTSON is Associate Professor of Enology at WSU. His research interests are focused on the phenolic compounds found in grapes and wine and their biochemical and chemical changes during grape ripening, winemaking and ageing. Harbertson has worked on a variety of projects including understanding the variability of tannin found in red wine cultivars and the ultimate relationship between tannin, polymeric pigments and astringency. He works with wineries to solve problems, and is located in the wine-grape growing region at the WSU Prosser IAREC.

Working closely with industry, many of the findings from Harbertson’s lab are helping to implement practises that prevent wasteful activities and improve quality of reduced berry size, a far more sustainable approach to water use is clearly in the industry’s best interests.

Of the water used in the winemaking process, the majority is consumed in cleaning. Clean-in-place (CIP) systems are far more water efficient but are currently reserved to the larger wineries in Washington, of which the state only has a few. As most wineries are small-scale enterprises, if this method becomes affordable for smaller producers, a large amount of water could be saved each year.

COLOURATION INFATUATION
Working closely with industry, many of the findings from Harbertson’s laboratory are helping to implement standards that prevent wasteful activities and improve quality. In Washington, cofermentation is practised with a widely held belief that it results in a greater strength and stability of colour. With large amounts of anecdotal evidence but no solid facts about blending percentages, Harbertson sought to study a Syrah-Viognier blend, the most common for cofermentation, and showed that almost the exact opposite was true. With a control wine of 100 per cent Syrah and three blends of five, 10 and 20 per cent additions of Viognier, next to no basic compositional changes were observed. Blends of 10 per cent had lower flavonol and anthocyanin concentrations and caused a perceptible dilution of colour intensity in the 20 per cent mix. As these results were found at the higher end of the blending scale Harbertson’s research is not conclusive, but a strong indication that the anecdotal evidence of old is no longer a valid source of information.

PHYLLOXERA
Though the Great French Wine Blight occurred in the mid-19th Century, vineyards still take caution against the possibility of phylloxera wreaking devastation on their crops. Originating in North America, it was discovered that by grafting their rootstocks to North American variants which are, to a large degree, naturally resistant to the pest, European wine grapes could survive. In eastern Washington, a rarity among vineyards exists in that they consist mostly of own-rooted vineyards. Harbertson teamed up with Dr Markus Keller, Distinguished Professor in Viticulture at WSU-IAREC, to study the differences between own-rooted and different rootstock combinations under the arid conditions of eastern Washington that restrict vine growth (see earlier discussion on water use). Their results not only allay fears about grafted rootstocks causing degradation in grape quality, they also offer vineyards several alternative growing options. As Harbertson states: “We found we could restrict some of the negative aspects without impacting wine composition”.

This is important news for wine grape growers as it provides an opportunity to change their crops if they so wish. Having to replant because of crop eradication is a costly business and for smaller enterprises potentially ruinous. While the wine industry in Washington continues to contribute significantly to its economy, research conducted in Harbertson’s laboratory demonstrates that wasteful activities can be reduced without detriment to the quality of its wines. Benefiting Washington’s economy and the producers and consumers of a well-established business, Harbertson’s work is evidence that huge improvements can be made in the effectiveness and sustainability of the wine industry.