



Using Precision Viticulture as a Vineyard Management Tool at Penfold's Robe Vineyard

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Background

The tools of Precision Viticulture have been used on Foster's Vineyards for well over 10 years as an aid to management decisions relating to meeting target yield and quality specifications. Plant Cell Density (PCD) images created using the ratio of infra-red to red reflectance have been the most commonly used form in Foster's vineyards to date. These PCD images highlight areas of differential vigour in the vineyard, attributed to many underlying factors, some of which include changes in soil type, soil depth, salinity, vine health, water table depth (waterlogging) and past site use. Once these differentially vigorous areas are ground-truthed, Vineyard Managers can choose to zonally manage economically viable areas. That is, they apply specific management techniques to these zones within a larger block boundary, in order to maximize the grape quality of these zones and therefore the overall block. It is important to note that the expected quality (vine performance) of identified management zones relative to the remainder of the block is likely to vary on an annual basis due to seasonal influences on the underlying factors creating this variation in vine vigour.

Use of Precision Viticulture for General Vineyard Management

Penfold's Robe Vineyard has successfully applied precision viticulture for at least 6 years to aid production of its premium quality grapes. Management of the vineyard is tailored to each variety and quality grade, with many blocks zonally managed. This vineyard is located approximately 15km south-east of the township of Robe, South Australia. It has a cool, maritime climate, influenced by its proximity to the Southern Ocean and nearby

large salt lakes – Lake Eliza and Lake Hawdon. The western side of the vineyard on foothills of the Woakwine Range is gently undulating, whilst the land on the eastern side of the property is quite flat. The soil profile is generally very shallow (5cm – 45cm) loamy sand over limestone, with smaller areas of Terra Rossa over limestone and deep sandy loam. This variation in soil type and depth, often occurring down the vine rows, adds complexity to managing the vineyard.

To handle the existing variability in soil type and depth and the resulting effects on vine vigour and grape quality, Plant Cell Density images are utilised to facilitate zonal management for the following functions:

- Irrigation – taps have been installed to shut off water to sections of dripper lines down rows for vines growing in deep soils where elevated vine vigour is negatively impacting grape quality.
- Pruning – sacrificial canes have been employed as a devigourating technique for vines growing in deep soils. Without intervention, these vines traditionally have relatively dense canopies and large berries. For this technique, vines are spur pruned (as per traditional pruning method) but canes are also retained during pruning to vastly increase bud numbers per vine. These sacrificial canes are then removed later in the season (assuming fruit set has been successful) leaving remaining bunches with smaller berries, concentrating colour and flavour and a balance of fruit to canopy growth.
- Covercrops – Lucerne, a deep rooted perennial, has been planted in the midrows of deep sandy soils as another method of devigourating vine growth.

- Compost application – the shallowest soils commonly occurring on the rocky ridges show the lowest vine vigour and lightest crop loads. Compost has been strategically placed undervine in these areas in the vineyard to successfully increase vine vigour, overall vine health and crop load.
- Harvest – blocks are harvested according to zonal management to fully realise the potential of these zones differentially managed throughout the season. These zones are separately maturity sampled due to their often different ripening rates, expected qualities and yield. Winemakers taste the fruit from these zones separately in the vineyard and batch ‘like’ zones together to produce minimum 10T batches of fruit. These zones are ‘split picked’ out of the remainder of the block, either by using tractors towing two bins, one for each zone of fruit to be harvested, or by harvesting out one zone and then waiting for the remainder of the block to reach optimum ripeness and re-harvesting the block.

New Plant Cell Density images are obtained by the vineyard every few years in order to visualize changes in relative vine vigour, attributed to the above management techniques employed by the vineyard manager.

Use of Digital Elevation Modelling to position frost fans

Penfold’s Robe Vineyard utilized another Precision Agriculture technique, Digital Elevation Modelling, to assist in pinpointing the most suitable locations for installing frost fans in the vineyard. A series of three-dimensional images of the site were produced – a base map of the vineyard, a map indicating air movement through the vineyard and a map showing frost damaged areas from the previous season’s damaging frosts. The information from each of these images was overlaid and used together with the frost fan manufacturer’s specifications to identify the most suitable placement of the frost fans to protect the maximum area of high frost risk vineyard. In addition, sections of tree lines were also identified for removal, to enhance drainage of cold air away from the site during a frost event.

The successful placement of the frost fans was realized the following season after installation, with the four fans protecting the crop from frost, resulting in payback for this project at just over one year.

Conclusions

Zonal management aided by precision viticulture tools such as PCD imagery, facilitates detailed management of a vineyard, allowing small parcels of premium fruit that would otherwise be absorbed into a large batch to be isolated and harvested with ‘like’ batches to maximize the quality grade of the vineyard.

Plant cell density images often do not reveal variations in vine vigour that a good manager is not already aware of. However, these variations in vine vigour once ground-truthed, allow the manager to pinpoint with accuracy, the shape of a zone to be differentially managed within a block and the apparent differences in fruit quality between these variations in vine vigour. The manager is therefore provided with more confidence that the zone may be of a size to warrant zonal management.

Digital Elevation Modelling can be a useful tool for Vineyard Managers who require a detailed topographical model of their property in order to fully assess impacts of various installations such as frost fans on their site. Vines growing in cooler, lower elevations can produce enhanced quality with Chardonnay for example, and this can merit split picking in some circumstances. Other uses for this tool include mapping of water movement through a site pre-installation of drains or drainage bores, or to map movement of saline water through a property and its future impacts on vine health.