Achieving and maintaining winegrape quality improvements

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Introduction
The wine and wine grape industries in Australia are in a dynamic mode. We are in our fifth major cycle in the industry's history, this time driven overwhelmingly by exports. Branded products are well established in the market place and the quality of wine has been lifted to a new level. Wine grape businesses on the ground are changing dramatically, employing new irrigation technology, mechanical pruning and harvesting and putting in place quality assurance programs. The vineyards are highly geared with young, vigorous, unpredictable, unbalanced, 'teenage vines', taking all we can throw at them but displaying far from perfect behaviour. The industry is constantly being fed with research information and is, at times, bombarded and distorted by philosophies or theories. Disagreements between wineries and growers range from minor misunderstandings to major fracas.

In amongst this dynamism, a shift toward quality is happening. This shift however appears to be random, occurring rapidly in some quarters and slowly in others. Winegrape growers now need to take stock of the current information base and apply this knowledge sensibly to a management methodology. The challenge is to achieve and maintain grape quality improvements using a wide range of technical and business management skills.

Knowledge of soils and vines and an understanding of the influences of climate
Soils, vines and climatic influences are the factors that become fixed once a site is selected and the vines are planted. There is a need for growers to gain an understanding of the general relationship and interactions between these factors, for their specific situation. A lack of knowledge in this area leads to 'guesswork management' of water, nutrients, vine canopy and fruit development. The following information should be accessible to the grower and used in decision-making through the season.

Soils
- Depth of root zone
- The amount of water held in this zone
- The fertility and chemical status of the soil
- Variations within the property

Vines
- Vigour of the stock
- Vigour of the scion (variety)
- Performance in specific soil types

Climate
- Heat accumulation and length of growing season
- Evapotranspiration, humidity and rainfall
- Diurnal temperature range

Determine crop levels
The benefits of annual crop estimation are twofold. Firstly, the wineries know more accurately what their intake will be for each variety, making their processing far more efficient. Second, the grower can align management inputs such as water and nutrients, to suit the crop level and canopy vigour. In some cases, growers can reduce their crop levels if they feel they are too high. The two questions that the growers must address are:

- 'What crop level have I got this season (for each variety)'
- 'What do I want this season (or what can my canopy ripen?)'

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Most of this information needs to be collected only once but acknowledged continuously as part of the management process.

Target yield
With the knowledge of soils, canopy capacity and past fruit quality records, the grower can decide whether the annual season's crop is too high (a likely scenario in the irrigated regions). If crop estimates indicate levels lower than desirable, then management strategies can be put in place to lift the yields for the following season.

A adjusting crop levels down
Physical removal of fruit to reduce crop levels can be done by hand or mechanically. The former method is costly and difficult to justify in the irrigated regions. Mechanical removal of crop, by skirting after berry set, can be done if there are bunches low in the canopy. Minimally-pruned vines will have fruit positioned right through the canopy and as low down as 0.5 metre from the ground. The degree of crop removal is set by the height of the cutter bar. Vines that have been spur-pruned back to two-three buds will have the vast majority of its fruit within 20–30 cm from the wire. This fruit is not accessible with mechanical pruning equipment and it is therefore hard to remove fruit economically.
Canopy management
This topic has been documented extensively over the past decade and is the essence of fruit quality management.

Control of vigour
The vigour of a vine essentially relates to the soil, rootstock, water and nitrogen. By using the variables of water and nitrogen, a desirable canopy structure can be achieved, not necessarily in one season but over a period of time.

Fruit and foliage balance
Controlling the size of the canopy must be done in line with the amount of fruit in that canopy. Botting, Dry and Iland (1996), in their work on Shiraz canopy architecture in the Riverland, concluded that ratio of fruit weight to leaf area was an important factor in determining quality. To make use of this observation, an efficient method of measuring effective leaf area of the canopy would need to be developed, then benchmark ratios for each variety could be determined.

Leaf efficiency
A vine can have a well-structured canopy, with a good fruit to foliage balance but still lack the ability to ripen the fruit between veraison and harvest. Leaf efficiency can be reduced through stress from pest and disease, too much or too little water in the soil profile, a nutrient imbalance or adverse climatic conditions late in the season. Most of these are controllable.

Fruit development
What is meant by fruit development? Sugar, acid, flavours and pH are the major ingredients that determine fruit quality. Work done by Coombe and Iland in the mid-1980s tracked the concentrations of grape components over a season. The rate and degree to which the ingredients evolve in the fruit is very much dependent on canopy management and the prevailing climatic conditions. The position of the fruit within the canopy and the degree to which it is exposed also contributes to its development. The difference between fruit position in minimally pruned vines and hard spur-pruned vines has already been stated. Work done in irrigation management and nutrition over the past decade suggests that the following principles need to be followed to optimise fruit development.

• Minimise stress coming into flowering
• Control vegetative growth post flowering and make sure canopy growth has ceased by veraison.
• Control berry size with water and nutrition management
• Optimise the rate of sugar accumulation after veraison.

Winegrowers in the district will tell you that Shiraz, for example, harvested early in the season at 13.5°Be makes better wine that Shiraz harvested at 13.5°Be three to four weeks later in the same district; however this observation has not yet been supported by research.

Uniformity in the vineyard
An aspect of wine grape quality that is not often mentioned is consistency. Winegrowers will not get excited about fruit with wonderful flavours if it accounts for only 25% of the patch that is about to be harvested and submitted as one parcel of grapes. Wine is made from the average of the quality range, unless it is easy to segregate at harvest. Bramley and Proffitt (1999) carried out some yield-mapping in Coonawarra and Padthaway last season. Sensors were placed on the harvesters to record accurately yield per vine, using GPS. The average yield for the block was 7 t/ha, but within the block the yield ranged between just over 0 to 16 t/ha. Lack of uniformity in a patch essentially comes from variations in:
• Soil and topography
• Planting material
• Inefficient irrigation systems

By identifying variations and implementing management practices that reduce the variability, the average quality of the grapes can be lifted.

Measure and record inputs and outputs to help manage quality
Managing the variables associated with the vineyard, the seasonal climate and management practices is not easy. The process of management starts with the measuring and recording of information that describes what goes into the vineyard system and what comes out.

How to manage variables:
Record all inputs in the vineyard.
• Water: ML/ha
• Nutrients: Units of nutrient and timing.
• Pruning: describe severity of pruning.
• Climatic data: ideally weather station but at least rainfall, temperatures over spring and evapotranspiration rates.
• Sprays: chemical, rate, timing, conditions, mixtures etc.
• Dates, rates and conditions.

Record outputs:
• Crop estimation
• Canopy size and vigour
• Fruit position (different pruning techniques)
• Maturity coming in to harvest and harvest date.
• Baume, pH and acid (TA) at harvest
• Berry size and colour
• Tonnes/ha
• Response from winery

This degree of data collecting may not sit well with many growers; however if a grower is to achieve and maintain grape quality improvements, then some analysis must be done at the end of each season to answer the following:

• Was the target yield achieved?
• Can the canopy architecture be improved?
• Can fruit characteristics be improved?
• Is the existing production system profitable and sustainable?

References