How can I balance my crop?

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Introduction
The Australian wine industry has been in an accelerated development phase for the past 10 years in response to sustained strong demand for winegrapes and wine at most quality points. More recently, with oversupply emerging in some winegrape varieties at several quality points (e.g., Cabernet Sauvignon currently) and consolidation of domestic and international wine retailers, there has been a clear shift to a stronger emphasis on continuing improvements in grape quality.

Many grape growers are simultaneously facing downward pressure on grape prices, restriction on yields, and in some cases, increased costs for additional vineyard operations (e.g., shoot removal and bunch removal). This paper discusses issues associated with determining and achieving appropriate yield targets particularly where these targets may require management of surplus vine capacity and surplus yield potential. Its focus is on proactively measuring and adjusting yield potential where necessary throughout the growing season to meet a defined target rather than relying on winter pruning alone as the only intervention to set yield potential.

Setting reasonable yield targets
There are a number of factors to consider when determining what the appropriate yield target should be for a particular vineyard. The final yield target is highly dependent on the capacity of the vines, the vineyard site and the intended grape quality target.

Theoretical vine balance
Previously there has been a greater emphasis on achieving vine balance rather than on a particular yield potential per se. By measuring various components such as canopy leaf area, fruit weight and pruning weight, and applying these to several standard ratios or indices, it is theoretically possible to determine if a particular vine or vineyard is in or out of balance. (An out of balance vine may, for example, be defined as being over cropped and requiring fewer retained buds, or excessively vigorous and requiring more buds, shoots and bunches.)

Essentially vine capacity is the main determinant of yield potential under this approach. If relied upon exclusively, vine capacity may indicate a particular target cropping level that, according to other factors or criteria, is inappropriate (e.g., too large as a result of attempting to achieve theoretical vine balance in large capacity vines).

Historic vine performance
Adequate records or experience of the long-term performance of a mature vineyard may alone be sufficient to determine its appropriate future cropping level. This is dependent on the consistent achievement of ripening level. However, it is inevitable that arbitrary limits such as these will not be appropriate in all circumstances. Despite this, a grape grower may agree to be bound by such limits in the interest of establishing and maintaining a long-term relationship with a particular grape buyer.

Risk management
In the absence of records or experience of the long-term potential of the particular vineyard, an analysis focussing on weather conditions during grape ripening and harvest may indicate that a lower yield than otherwise indicated by soil potential and vine balance is appropriate to ensure adequate grape ripening is achieved in most, if not all, seasons.

Generic guidelines
Rightly or wrongly, arbitrary maximum yield limits are now often being set by winegrape buyers in new or re-negotiated grape purchase agreements. However, it is inevitable that arbitrary limits such as these will not be appropriate in all circumstances. Despite this, a grape grower may agree to be bound by such limits in the interest of establishing and maintaining a long-term relationship with a particular grape buyer.

The bottom line
The bottom line is that the viability of the vineyard business should of course not be overlooked when considering an appropriate yield target. Yield targets are essentially determined by grape value and the requirement for reasonable returns on the considerable investment in the grape-growing business.

Ideally an appropriate yield target will be determined equally by considering most, if not all, of the above factors. While such equal determination would be ideal, it would normally require perfect site selection, consistently favourable weather conditions, the adoption of best vineyard practices at all times, and a satisfied grape buyer/wine maker. Such an outcome is not always possible, and some compromise is usually inevitable.

Adopting the correct strategies
Assuming that an appropriate yield target has been determined, it is then necessary to adopt the correct strategy to retain sufficient yield potential at the beginning of the season (i.e., at pruning), and to efficiently adjust or manage this yield potential throughout the growing season to achieve the targeted yield at harvest.
Retaining extra buds in winter (Scenario 1)

In some circumstances it may be necessary to retain an initially high, or above target, yield potential at winter pruning. These circumstances may include using surplus crop to manage excessive vine capacity, or retaining a higher than usual number of buds at pruning to compensate for anticipated poor bud fruitfulness or poor flowering and set. Such a scenario is set out in figure 1.

Retaining extra buds at pruning is relatively straightforward, however, care needs to be exercised to avoid compromising already established vine structure (e.g. permanent cordon arms with well defined spur positions). Also, any “extra” buds retained must allow quick removal if necessary during the growing season.

Some examples of this strategy are listed below.

• A mid-height Sylvos system is being used successfully in a range of varieties in several regions to avoid the possibility of below target yields. This system incorporates up to four canes per vine tied down to a dripper wire or similarly placed separate wire, in addition to the normal 2-bud spur pruned permanent cordon arms. This provides the initial retention of up to 40 “extra” buds per vine. These buds (and any resulting shoots) can be fully or partially removed quickly and efficiently during the growing season as required. At the same time the structure and future pruning of the established permanent cordon arms are not compromised. Retaining these extra buds or canes in this manner typically increases pruning costs by $0.15–$0.20 per vine. The cost of removal of these canes during the growing season is usually in the order of $0.10 per vine. The total cost then is substantially less than the likely $0.30–$0.70 per vine to remove a similar number of bunches by bunch thinning.

• Alternatively, so called “kicker canes” can be retained on a second cordon wire (fixed or temporary) directly above established cordon arms. Typically an extra 20–25 buds can be retained at pruning for a relatively low additional cost. However, excessive shoot density and crowding of fruit zones may become a problem, and the cost of future pruning may be unavoidably high. Subsequent removal and replacement of canes can be time consuming and mechanical pre-pruning of established spurs is often not possible.

• Retaining “finger and thumb” or “hare’s ear” spurs on permanent cordon arms can also provide a short term increase in bud number without compromising established permanent cordon arms and spur positions. Instead of pruning to the normal single 2-bud spurs at each established spur position, an extra 4–6 bud long bearer is retained on 4–6 spur positions per vine providing an extra 20–25 buds per vine. Shoot density and canopy management may be partially compromised and any necessary removal of surplus bunches will usually be relatively expensive. However, if done correctly, regaining normal spur setup should be relatively straightforward during pruning in the following winter.

Adjusting crop levels during the growing season (Scenario 2)

In situations where, despite pruning to achieve a predetermined harvest yield target, yield potential becomes excessive during the growing season, strategic removal of shoots or bunches at one or more times during the growing season may become necessary. This usually occurs when vine capacity exceeds that required for a particular yield target and, typically, excessive budburst, excessive yield potential and/or excessive shoot vigour may occur. Timing of any intervention is critical in terms of maximising beneficial responses and minimising costs. Also accurate
early yield forecasting is essential. In general the cost of intervening early is usually relatively low, however, the certainty of achieving the ultimate yield target is also relatively low. Conversely, late intervention usually costs substantially more while the certainty of achieving the ultimate yield target is usually higher.

Figure 2 shows the timing of several operations aimed at reducing excessive yield potential during the course of the growing season.

• Shoot removal made necessary by excessive budburst (greater than 100%) may result in some reduction in the number of bunches and yield potential if fruitful secondary and tertiary shoots are removed in the process. If shoot removal is completed early in the season, the cost should be relatively low (typically $0.08–0.12 per vine at 10–15cm shoot length, compared with $0.15–0.20 per vine or higher later in the season).

• Inflorescence removal is not often carried out, however, it may be very effective in reducing excessive yield potential in highly fruitful varieties (i.e. three or more inflorescences per shoot) and/or those with large berries or bunches (e.g. young Semillon or Grenache). This operation can be combined with shoot removal passes and involves removing all but one or two inflorescences from highly fruitful shoots. If excessive shoot vigour cannot be controlled early in the growing season, any positive response to early shoot removal or bunch removal may result in compensatory increases in bunch weight.

• Regulated Deficit Irrigation (RDI), if applied immediately after flowering is usually the most effective method of controlling excessive shoot vigour, and in some cases, surplus yield potential, through a reduction in berry size. This irrigation strategy should be used in preference to bunch removal wherever possible.

• Removal of whole bunches after flowering and berry set can reliably achieve a reduction in yield potential. The cost of this operation escalates as it is delayed and, conversely, the strongest potential for berry weight compensation in vigorous vines exists soon after berry set and usually diminishes through to veraison. In particularly vigorous situations therefore, it may be preferable to initially reduce the number of surplus bunches in one or more operations later in the season (e.g. commence bunch removal several weeks before veraison, and carry out final adjustments during or soon after veraison).

Ideally all necessary reduction of the surplus number of bunches should be done in the one operation soon after veraison commences. At this time the following benefits will occur:

• the slowest developing bunches should be obvious and can be selectively removed;

• potential for berry weight compensation should be reduced;

• sufficient time should remain for increased ripening and flavour development; and

• the likely cost of the operation should be relatively low compared with late season bunch removal.

Late bunch removal (i.e. within 2–3 weeks of harvest) should be avoided if at all possible. The cost of late bunch removal often approaches that of normal harvesting of the whole crop, and substantial removal of bunches (greater than 50%) is often required at this time to achieve any positive benefits in terms of improved ripening and grape quality.

Conclusion

In response to changing winegrape specifications, it is necessary to focus on measuring and adjusting yield potential throughout the growing season. This adjustment may include strategies such as shoot removal, inflorescence removal, bunch removal and regulated deficit irrigation. It is critical that the correct strategy be applied for the specified fruit target.

Winter pruning alone is insufficient as a strategy to set yield potential and crop loads.