Growing High Quality Fruit - Mid-Growing Season Management

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Last month, Ross Wilson identified one of the key profit drivers as setting the optimum crop load for the orchard block. This optimum crop level is that which maximises the amount of grade one fruit in the higher paying size range, not the largest gross crop.

Optimum crop level differs from block to block and is determined by variety, canopy volume and uniformity, availability of irrigation water and nutrient supply.

Historical block performance is a good guide for established mature orchards where tree size is uniform across the block. Where there is variable tree size, further yield increase is likely as the weaker growing areas increase their canopy volume.

Immature orchards will show increasing yield potential up to 10 to 12 years of age, even when planted at relatively high tree densities.

Hand Thinning

Irrespective of the chemical thinning result, nine times out of ten significant hand thinning is necessary to maximise fruit quality and packout.

The hand thinning goal has to be to have all the fruit on the tree by harvest capable of meeting grade one quality specifications and this includes the fruit size range too.

By early December, the relative fruit size potential of individual fruits becomes obvious so thinning by fruitlet size is possible.

In orchard blocks for which there is good historical data on fruit sizing rates, it is possible to forecast harvest fruit size with reasonable confidence, so hand thinners can be given minimum fruit sizes to thin to. As fruit size increases rapidly through the December period, usually by about 3 to 4 mm, and sometimes 5 mm or more in diameter per week, minimum fruit size instructions to the thinners need to be adjusted every two or three days to maintain a uniform minimum fruit size at harvest.

Regular fruit size measurement, generally on a weekly basis, will track fruit sizing, and if input into an industry database such as our OrchardNet® programme, will enable the block to be easily tracked and compared with other blocks as well as state or Australian average growth rates.
Fruit size data we collected last year showed that there can be large variation in fruit sizing from week to week depending on weather conditions so keeping track of fruit size, and having the ability to compare growth rates with other orchard blocks will show whether fall off in fruit sizing rate, should it occur, is due to a district weather factor where similar fall off in fruit sizing rate occurred over a wide area, or is due to growing conditions on that particular orchard block.

![Figure 1: Royal Gala size curves. Note the effect the mid-January heat wave in 2009 had on fruit sizing.](image)

Regular fruit size monitoring enables fruit size to be tracked, and any problems affecting fruit sizing to be identified early and rectified. Heavy crop load does not have much influence on fruit sizing until around 90 days after full bloom, then if the crop load is excessive for the tree or the growing conditions the rate of fruit sizing will suddenly stall. Where crop loads are excessively heavy, good fruit growth rates prior to this stage can lull you into a false sense of security, so it is important to check crop loads by doing fruit counts prior to this stage to make sure that crop load is in the right range for tree size.

In orchard blocks where there is irregular tree size and vigour, it is very difficult to get crop loads correct without careful monitoring of hand thinning, particularly where the thinners are being paid on a contract rate per tree. Vigorous trees are more responsive to chemical thinners, as well as setting less fruit to begin with, so these trees will not need as much hand thinning effort as the weaker growing trees that naturally set heavier crops and are less responsive to chemical thinners. Weaker growing areas of the orchard, therefore, need more hand thinning effort and will also have a much thicker carpet of thinned fruit on the ground under them. When checking thinning, the critical thing is to look at the fruit spacing up in the tree, not what is on the ground under the tree.

If the rate of fruit growth shows signs of stalling and fruit sizing behavior in a particular block is out of step with other blocks being measured, this probably indicates that crop load is excessive for the trees or the growing conditions they are experiencing. Immediate re-thinning, by fruit size, to remove the
smallest fruit that have dipped below the minimum acceptable harvest size growth curve will recover the situation and restore acceptable growth for the remaining crop.

Figure 2: Weekly growth rates jump around a bit and individual blocks are sometimes out of step with district averages.

Water stress and inadequate irrigation supply is a frequent problem for many Australian orchards so managing crop load becomes a key factor in growing high quality fruit of satisfactory size when soil moisture becomes limiting. A study done in Israel on Golden Delicious to investigate the interaction between irrigation and crop load in regard to fruit size distribution indicated that trees given irrigation levels at 0.42 of Class A pan evaporation coefficient, compared to 0.75 evaporation coefficient were able to produce comparable fruit size range when crop loads, expressed as fruit numbers per tree, were halved.

Where irrigation supply is short and soil moisture likely to become limiting, aggressive reduction in crop load by thinning of small fruit, damaged fruit and exposed fruit likely to suffer excessive sunburn will improve the fruit size and quality of the remaining crop and improve the chances of getting high value fruit at harvest.

**Other Thinning Considerations**

In addition to thinning to crop load, the way the crop is set up will have a huge influence on its quality and ease of harvest.

In the ideal world, the easiest crops to manage at harvest are those where the crop has been carefully thinned to singles and spaced so that each fruit can mature without contact with adjacent fruit.
This approach is only possible where initial fruit set is uniform, well-distributed over the tree, and there were sufficient good fruiting sites to enable the fruit to be singled without dropping crop load below optimum.

From the logistics point of view, being able to thin down to spaced singles is a huge advantage too, because it makes thinning instructions easy to follow and removes the need for unskilled labour to make value judgements about which fruit to leave in multiples. Our experience is that often once thinners are allowed to thin down to twos or threes, it is not long before the whole crop is in twos or threes, rather than mainly ones with a few multiples to make up numbers.

For certain varieties, notably partial red varieties, those with short stems, or large fruited varieties thinning in spaced singles gives by far the best harvest outcome, even if it means sacrificing a little yield. Fuji is a good example of a variety that should be thinned down to spaced singles.

Red strains of Cripps Pink, or the Royal Gala group on the other hand, perform well when left in twos and sometimes threes to make up numbers.

**Sunburn**

In hot climates sunburn can be a major defect, so summer crop management needs to consider adopting strategies to minimize sunburn.

Fruit thinning plays an important role. Fruit on over-cropped trees with poor leaf cover suffers more sunburn injury than where thinning has been well done, and there is good leaf cover.
Priority needs to be given to thinning off overexposed fruit that has little leaf cover. Auxiliary bud of one year wood fruit, as well as being small, tends to suffer more sunburn injury than fruit on spurs or terminals with good bourse shoots.

Heavy cropping, weak, flexible branch fruit that alters its position as fruit sizes, thereby exposing sheltered fruit to direct sun during the heat of summer, usually results in bad sunburn. Stabilising these branches to prevent movement, or shortening them to stiffen and stimulate a bit more leaf cover for their fruit helps reduce sunburn.

Where hand thinning has got behind schedule and has to be done in hot weather increases sunburn risk unless thinning is carefully done to avoid exposing the sheltered fruit to direct sunlight. In these situations, taking out whole clusters to lighten crop loads is often the best strategy.

Although some leaf cover is desirable to protect fruit from excessive sun exposure that will cause sunburn, it is also necessary that fruit receives adequate light for colour development and satisfactory growth. The trick is to grow the fruit in dappled light where the fruit is exposed to light for short periods then shaded again with leaf cover before its skin reaches temperatures that will burn it. Open, rather than dense canopies are required to achieve this and the canopies should not have large gaps in them that allow direct sunlight penetration into lower tree fruit for long periods of time during the heat of the day.

Upper tree fruit which has been exposed to high light levels for most of the season becomes conditioned to sun exposure, so burns less readily than more sheltered fruit that is further into the canopy, but will still burn under extreme conditions, so still needs some leaf cover protection, such as that given by a bourse shoot.

Judicious summer shoot rubbing in the lower canopy to maintain light penetration through the tree is necessary to give sufficient light for fruit colour. Summer pruning is best done early before high temperatures occur, and should not be too aggressive, because opening up shaded fruit to direct sunlight in hot weather can lead to sunburn.

High fruit colour ranks very high in the buyer perception of fruit quality, particularly at the wholesale and retail level. High fruit colour is also a key factor in initial consumer purchase, but unless the fruit meets consumer expectation in regard to eating quality, repeat purchase becomes less likely.
Consumers expect their fruit to be crisp, juicy and flavoursome. These are not the attributes of fruit that has become over-mature while waiting for satisfactory colour development.

High quality fruit, therefore, needs to attain satisfactory fruit colour before advancing maturity passes the optimum harvest maturity stage.

Management practices during the growing season that lead to good early fruit colour development are essential to ensure that high quality fruit is harvested.

As already discussed, good thinning and canopy management practices play a key role in growing high coloured fruit.

Other techniques that can be used to improve colour include:

- Reflective mulches.
- Avoiding excess nitrogen levels.
- Avoiding water stress near harvest.
- Maintaining healthy foliage.
- Trunk girdling.

In recent years, reflective mulches have been widely used to improve fruit colour development in the lower canopy. The reflective mulch is normally laid out three to four weeks before harvest, then if it is a removable cloth type of mulch removed at start of harvest to prevent excess wear and tear. Sometimes the mulch is dragged aside while the fruit is being picked, then put back if significant crop remains after the first pick to enhance colour in the later pick fruit, or moved to a later harvest variety and used again in the same season. Partial red varieties such as Royal Gala, Fuji and Cripps Pink can be very responsive to reflective mulches. Also in recent years there has been a trend to use reflective mulches in high colour strains to even up their colour development in order to reduce the need for selective colour picking and make harvest more efficient.

Occasionally, we have seen some problems with more sunburn if reflective mulch is laid out under particularly hot, sunny weather conditions, so it is suggested that it is best to try and avoid laying out reflective mulch when exceptionally hot sunny weather is forecast. Once reflective mulch has been down for several days, the fruit has had time to acclimatize to high light levels so hot sunny weather a few days after the mulch has been laid out does not usually cause problems. Where there is concern Figure 6: Reflective mulch is a very effective tool for advancing colour development.
about sunburn from reflective mulch, if exceptionally high temperatures occur, unhitching one side of the mulch and dragging it under the shaded side of the tree row during the heat of the day will lower sunburn risk.

Figure 7: The apple on the right shows the effect of reflective mulch on fruit colour development after only ten days with reflective mulch. The one on the left had no reflective mulch, and was in a similar position on the tree.

Fruit with high nitrogen levels is often slow to colour. Fuji and Cripps Pink are particularly sensitive to colour suppression by high fruit nitrogen, so need careful nitrogen management. High fruit nitrogen is difficult to deal with in the short term, because it is usually due to high soil fertility and not easily influenced by altering fertiliser use. Trunk girdling and root pruning are techniques that can be used to reduce nitrogen availability and improve fruit colour.

Root pruning is not a practical short term treatment that can be used mid-growing season to reduce nitrogen uptake due to the risks of increasing moisture stress problems in hot, dry climates and the adverse effects on tree health that could occur. Trunk girdling, on the other hand, is a tool that could be used to limit nitrogen supply and enhance fruit colour development. Fuji is particularly responsive to trunk girdling for improving fruit colour, even when implemented as close as four to five weeks prior to harvest.

Summer Disease Control

Warm, humid rains through December, January and February increase the risk of summer rot fungal infection in fruit. In locations where periods of warm summer rain can occur, generally unlikely in most Australian pomefruit districts, summer rots often cause problems during storage if robust broad spectrum fungicide protection was lacking during wet humid weather.