Focus Orchard & Trial Update - Western and South Australia
February 2021
Prepared by Steve Spark (AgFirst)

Acknowledgements
A big thank you to the FLA’s Susie Murphy White of Pomewest and Paul James of Lenswood Cold Stores Cooperative Ltd for providing the data, and for their continued support for the Future Orchard program. These trials can be read in full on the APAL website.

Trial Update WA - Bud dissection to determine fruitfulness
Determining whether a bud will bear fruit next year under warmer climates (and after heavy crop load) can be quite nerve wracking. Susie and her team in Western Australia have carried out some interesting work on bud analysis to see if the fruitfulness can be established before critical pruning decisions are made. As you will read in this report, some very useful tools are now proving their worth.

In several apple cultivars, vegetative growth and flower bud formation are considered to be antagonistic processes. This means that high crop load inhibits flower induction in apples, leading to poor return bloom in the following year and, hence, crop load. Moreover, mobile signals formed by developing fruit or specifically the seed within those fruit (e.g., plant hormones such as gibberellins), or lack of certain nutrients (e.g., carbohydrates) inhibit the nearby bud meristem. It is therefore postulated that heavy cropping delays the onset of flower bud initiation to such an extent that floral bud differentiation is poorly advanced prior to endodormancy, leading to little return bloom.

It is often hard to determine which buds in winter are going to produce fruit. This “percentage of fruitfulness” can have major implications on plans for winter pruning and thinning and therefore the final crop load. Therefore, the earlier you can determine the fruitfulness of the buds on a tree the easier it becomes to make accurate and appropriate management decisions. Many growers back themselves in being able to determine whether a bud is floral or not just by a quick glance, however it can often be a lot more difficult than that.

It has been reported that the fruitfulness of a tree or the percentage of buds which are floral is anywhere between 70 and 90 per cent during what we call an ‘on year’. If a grower is able to determine the floral percentage of their blocks before pruning in winter, they can adjust their pruning and thinning plan depending on the result. If fewer than 70 per cent buds of buds are floral some adjustment might be required (a lighter prune, leave more buds) and if fewer than 50 per cent of buds are floral, it may be necessary to prune after the flowers are visible to ensure there are enough sites to capture the trees fruit growing potential.
To accurately determine the proportions of floral and vegetative buds (Figure 1), throughout an orchard, a sample of winter buds can be collected and observed underneath a microscope. Therefore, to decide whether a crop is on or off, make more accurate winter pruning decisions and compare the fruitfulness of the Western Australia-specific variety Bravo to others in Australia and New Zealand a bud dissection program was completed in the winter of 2020. Performing winter bud dissection enables growers to see if there are lots of buds, to determine the proportion of buds that have the potential to produce fruit and therefore decide how many buds need to be kept or removed. It also provides management, supervisors and pruners confidence in their decisions.

The bud dissection program above was trialled on a block of Bravo, a cross between Royal Gala and Cripps red, at the Manjimup Horticulture Research station in WA. It was repeated on a block of Kanzi in Manjimup WA. The methodology below was followed and repeated three times for each block just before winter pruning.

1. Sample 50-100 buds per treatment (Figure 2).
2. Selected 5 spurs per tree, 10 trees randomly selected across the block.
3. Only selected buds that might be floral spurs (i.e., avoid the very small narrow shaped buds; these are typically 5-10 per cent of the population)
4. Count the number of buds per spur, do not count the small arrow shaped buds.
5. Only sample spur buds, don’t sample terminal or lateral buds.
6. Make a longitudinal cut through each bud using a razor blade and tweezers.
7. View each bud under a microscope at 40x to determine if it is floral or vegetative.

Under a microscope it was very obvious whether a bud was floral or not. As shown in Figure 3 a floral bud has clearly defined flower parts even at the early stage pre-winter pruning. Remember that buds are initiated in the growing season prior to dormant winter pruning.
Of the buds sampled from the Manjimup Bravo block, 76 per cent of those sampled were determined to be floral, while 81 per cent of the Kanzi buds sampled were determined to be floral. These percentages of floral buds would suggest that both these blocks are in an ‘on’ year. From these percentages growers are able to determine how many buds (floral and non-floral) to leave after precision pruning based on the desired final crop load. For example, if the trees of the sampled Bravo block started out with 200 apparent flower buds, and desired crop load is 60 apples per tree, $1.5 \times 60 = 90$ buds, but because only 76 per cent are floral, then we need to leave around 118 buds after pruning (ie. remove around 80 buds). If there are the same number of apparent flower numbers and final crop load for the sampled Kanzi block which has an average floral percentage of 81 per cent pruners should leave around 111 buds/tree (remove around 90 buds). Remember that if the percentage of floral buds is below 50 per cent you should wait until bud burst or the trees have reached pink tip.

The Kanzi block counted was revisited post prune and it was observed that the bud dissection was a good reflection of the block, there were lots of buds of which most were floral, and this resulted in a lot of fruit. Also, to note is that there is no biennial bearing in this block. This indicates that the bud analysis trials gave a very good indication of the flowering in Spring.

A number of both positive and negative comments have been made by those who have used this as a method of planning. Firstly, that bud analysis is a very good indicator of whether a block is ‘on’ or ‘off’, if it is demonstrating biennial bearing. Also, it can be effectively used as a training tool to help supervisors and pruners understand and identify in the field what is a floral or a vegetative bud. It can also help growers allocate labour more effectively e.g., if a bud analysis shows a very high percentage of floral buds they may bring this block to the front of their pruning plan, whereas if a block has a very low floral bud percentage they can wait until pink tip to prune this bud.

However, because it is harder to tell the difference between a floral and vegetative bud in some varieties compared to others there can be some problems with consistency and repeatability. Furthermore, most growers do not have access to a microscope, nor do they all have 20-20 vision. Therefore, bud dissection should never be used as a be-all-and-end-all solution to pruning planning, instead it should be used as a general indicator and if extreme situations are found >90 per cent floral buds or <70 per cent floral buds, further investigation and a rethinking of the pruning plan may be warranted.
Trial Update SA – Leader Management Trial 2017-20

Ascertain the impact on leader growth of mature Pink Lady trees using several different pruning techniques and timings.

On an orchard walk in South Australia I was fortunate enough to discuss with Paul James and his growers the various methods to reduce tree growth in the tops. Paul and his team put together this orchard trial to find ways to reduce the amount of vigour in the tops of trees and this trial continues to offer valuable insights into how to better manage the tops of trees.

In 2017 growers were concerned about how to restrict shoot growth in the tops of trees. It was agreed to start a trial to assess and compare many of the current industry practices in a settled mature block of Rosy Glow growing in the Adelaide Hills. The trees were all pruned by the grower in accordance with their normal pruning practices except for the leaders. They were pruned or set up for pruning at a later date using one of several different techniques/timings.

These different techniques used included:

1. “Click” pruning - leaders cut back to 3-4 buds above the most recent growth ring; leaders basically headed (winter pruned)
2. Summer pruned to weaker horizontal branch at summer solstice time.
3. Growers Own Practice – leaders pruned to a weaker shoot as a replacement leader (winter pruned).
4. Horizontal fruiting branch – leaders cut back to smaller horizontal fruiting branch (terminal bud) at desired height (winter pruning).
5. Growers own practice—leaders cut back to 3-4 buds above the most recent growth ring and NAA applied (winter pruning)
6. Growers option – winter pruned, NAA applied, root pruned and girdled
7. Leaders pruned at full bloom
8. Leaders autumn pruned after harvest

A series of photos were taken at pruning, during the growing season and at harvest. An observation of the leader growth was undertaken just after harvest at the time of the post-harvest pruning.

Results Summary

Prior to the postharvest pruning in autumn 2020 the shoot growth in the top 50 cm of the trees in each treatment was counted and measured. The results are shown in the following graphs (Figure 1)
Figure 1. Number of vertical shoots per tree in top 50 cm of the tree (average figures) measured in Autumn 2020.

The graph in Figure 1 shows considerable variation between the treatments. The summer cut treatment (undertaken at or around the summer solstice) had the least number of vertical shoots, followed by “The works” which is a combination of several tree vigour reducing treatments. The major winter pruning leader treatments “grower own practice” (GOP), cut to “horizontal fruiting branch”, “grower own practice and NAA” used by growers all stimulated twice as many shoots as the Summer cut. From a commercial perspective “The works” treatment, whilst comparatively effective in reducing the number of shoots is also considerably more expensive requiring more individual treatments per tree.

In addition to counting the shoots per treatment the length of each shoot was also measured and the average vertical shoot length is presented in Figure 2.

Figure 2. Average length (mm) of shoot measured in autumn 2020.
These results show that the “Summer cut” and “The works” were the most beneficial treatments in reducing vertical shoot growth.

The “Postharvest” treatment had the longest average shoot length, but it must be pointed out that the shoot growth in this treatment was the result of the whole season’s growth whereas the other treatments had less time to develop because they were applied later. It is surmised that if these measurements were taken when fully dormant the other treatments may also have been longer.

Overall, the summer pruning treatment appears to be the most cost-effective way to deal with managing leader growth in a height restricted system. Trees to which the summer pruning treatment was applied had the least number of shoots, the shortest shoots and the highest proportion of shoots that did not need pruning.

The cuts to a horizontal fruiting shoot created the most problems in managing the leader growth due to the number, strength and erratic shoot development in the top of the tree.

No comparison of fruit quality between treatments was undertaken this season but No obvious differences were observed.

The results show some obvious outcomes.

1. Pruning of leaders in the winter dormant period is not an effective way to manage leader growth.
2. If pruning leaders in winter, then additional tree growth regulation techniques need to be used in conjunction with the pruning, resulting in higher costs.
3. Summer pruning around the summer solstice (late December) was the most effective method of managing leader growth.

Before this trial, tops looked like the photos (3-6) below.

*Figure 3. Rosy Glow top growth summer.*  
*Figure 4. before winter prune.*
Trees pruned using the summer prune (Solstice) had less shoot growth at the top, were not as crowded (calmer) and wood wasn’t as big as other treatments. It is expected these trees will be quicker and easier to prune next time.

This report can be found on the APAL website and further photos and information of the remaining treatments can be found.