

Future Orchards Article for the Australian Fruitgrower June 2013

Mechanisation: A strategy to stay competitive.

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Why Mechanise?

Everywhere in the world where apples are grown, growers are finding it harder and harder to find workers to do the job, to do it efficiently, and to do it correctly. Australia is no exception. Work schemes are making some changes to the supply of labour but even these are becoming more competitive and will only be part of the solution in the coming years, as yields increase, and more plantings continue to increase the demand for labour.

No matter what situation you currently find yourself in, you have to agree, quality labour is going to become a scarcer resource. You are going to have to find new and improved ways of attracting workers and you are going to have to become more efficient with what you have.

In the complex business of orcharding, how can you improve your ability to **get the job done, completed on time and executed to a high standard?**



Figure 1 Road side signs appear when the pressure is on.

Where should you focus?

In highly productive orchards (production greater than 55 tonnes per hectare) the breakdown of labour is generally split:

- harvesting 45%,
- pruning 16%,
- thinning 16%,
- other labour 23%.

Although timing is important, some tasks such as pruning, thinning and other labour (tree training, planting, mowing, spraying etc.) do have some flexibility as to when they must be completed. By compromising the “right time” with many of these jobs, you will still be able to grow a marketable crop, albeit not the best achievable.

Harvesting is by far the largest labour cost in modern orchards and is the most difficult to fully mechanise. It is the most “time critical” component on the orchard. If you don’t have a skilled productive workforce for harvest, the ability to pick the crop on time is compromised, crop and quality are lost, and marketable yield diminishes.

Harvesting

There is a wide range of picker assist platforms on the market e.g., conveyer bin filling systems, 2 and 4 wheel drive, self-leveling dedicated or multi-function. The list goes on. If you have the money then any option is possible.

The goal with all these machines is to increase productivity by increasing the number of bins picked per person and in most orchards, but not all, this is being achieved. The following are key factors to maximise the benefits of picker assist machines:

- Machines have greater overall efficiency of supporting tractors when picking machines work in pairs.
- Having the varieties to allow full season use of the machine, as the increase in bins picked per season per machine means lower per unit capital cost.
- SNAP (*simple, narrow, accessible and productive*) canopies.
- Consistent cropping: within the tree and within the orchard

Picker assist machines have two other major benefits; firstly, the potential workforce is increased with a less physically demanding job. Secondly, on a number of machines there is an ability to field sort to some degree. The ability to increase the pack out saves a range of downstream costs.



Figure 2 Picking machine in action

Platforms

A number of studies from Holland to the USA have shown the use of platforms can increase labour efficiency by 25-105 %.

Table : 1 Platform Efficiency

Activity	Efficiency gain for the use of platforms over ladders
Pruning	+ 25-40%
Tree Training	+ 40-60%
Bloom Thinning	+ 20-35%
Fruitlet Thinning	+ 20 -25%

Source: K Lewis WSU: *Labour Management in Modern Orchards*

Without doubt platforms can improve labour efficiency in many tasks across the orchard. The key obstacle in integrating platforms into modern orchards is tree canopy. Once you start down a path with platforms, many changes will occur in the orchard. Big heavy branches are soon removed, canopy consistency within the tree and within the row will improve, especially if the benefits of your machinery investment are to be maximised. Again and again, SNAP canopies are critical to achieve the most from any investment in mechanisation.

Orchard Systems

“The most important thing you can do to manage your labour-related risks in tree fruit production is to commit to simple, narrow, accessible and productive orchard systems (SNAP) Orchard operations that have at least a portion of their acreage planted to SNAP blocks are more competitive for labour, contract services and warehouse relationships.” Karen Lewis, WSU

All orchard systems can be productive. The goal is to implement a canopy that is also simple, narrow and accessible. Working with narrow, simple canopies allows the efficient use of platforms over the whole canopy not just in sections.

My initial experience with the mechanically pruned fruiting wall systems was of a system that had simple rules to create a narrow canopy type. At first I was shocked by the pruning style but have become more confident as I become more familiar with this system. Initially, if not managed properly, the fruiting wall system can become a dense complex canopy that can produce much less than manually well-pruned trees. Also there may be no saving in pruning labour costs, as it was often just shifted from the winter to summer.

As all systems evolve and improve, the current iterations of the fruiting wall systems have now created a narrower, simpler canopy, with high productivity and with savings of up to 50% in pruning costs. The fruiting wall is now a SNAP canopy with associated benefits this system brings.

My experience with two dimension (2D) canopies has also showed me that simple canopies (SNAP) create benefits without mechanisation. Pruning and thinning can become very systemised and simple. Figure 3 shows a SNAP canopy that has just been blossom thinned. This task is probably only really achievable because it is a SNAP canopy.

In these SNAP systems the efficiency of pickers has been shown to improve 15-20% more than compared to similar, high producing three dimension (3D) trees in the same orchard. When we show these 2D orchards to mechatronics wizards they assure me they can develop a robot to pick all the fruit, whereas they may only be able to pick 30% with robotics from a 3D orchard. Promises of some new technology sometime into the future are one thing but competitive gains you can bank on today are few and far between. Currently no other technology at harvest can give you the same return on capital as a SNAP canopy.



Figure 3 SNAP Canopy (2D V trellis) after blossom thinning



Figure 4 Harvesting an upright 2D canopy

SNAP canopies can be formal (training to specific wires) or informal random architecture, horizontal or pendant branches, vertical or V trellis structures. They just need to have the following:-

Simple: canopies attract workers, the work can be less demanding and staff know they can be more productive.

Narrow: less than the reach of an arm in width, allows mechanisation for pruning and thinning,

Accessible: to the human arm without too much wasted movement, allows excellent canopy texture for consistent light interception maximising fruit quality

Productive: my benchmark is 65 marketable tonnes per hectare. A successful orchard system shouldn't aim to achieve less.

Capitalisation

Mechanisation almost by definition means more investment, more capital. Labour is a relatively flexible resource when you can get it, you can gear up quickly if your yield is suddenly higher than expected, or employ less if your yield is lower due to biennial bearing or if frost took a proportion out. If you've invested in platforms and harvest assist machines and the crop is less than expected for any reason, you still pay the interest. Growers with platforms soon become excellent growers (they have to be to manage all the risks) or they are as quick to sell them as they were to purchase them.

Therefore the key to increasing productivity and reducing costs is the greater the area of SNAP canopies you have, the more efficient you can become. A simple example of this is if you have one harvest assist machine you will also require one supporting tractor to shift bins, whereas if you have two picking machines working alongside each other, then mostly you would need only one supporting tractor to shift the combined bins, therefore producing a saving of one tractor and one labour unit.

Summary Goals

- Try to be as efficient as you can day to day with your labour resource but within your business plan, focus and develop labour strategies that create a long term competitive position.
- Transitioning towards SNAP canopies is a key to maximising the integration of mechanisation, it also improves efficiencies directly and orchards become more attractive to workers.
- As you substitute labour for fixed capital you will need to become excellent at managing crop variation. The cost of capital tied up in machinery that's not working efficiently can be an enormous burden on the orchard enterprise.