



Finding a happy medium for effective spraying

Achieving pest control without blowing the farm budget is important when it comes to agchem use.

As an industry, we want to guarantee pest and disease control without leaving residues.

However, we also need to do that on a viable budget, and demonstrate environmental stewardship! It's a big ask, because those goals can sometimes seem incompatible (much like the conundrum below).

When chemicals are phased out, growers are forced to use newer, and usually more expensive alternatives. That increases production costs, unless we can apply less chemical.

In some situations chemical use can be reduced by reducing spray volumes.

In October 2019, Citrus Australia, Bayer Australia and Southern Cross Farms hosted visiting spraying gurus from New Zealand (Dr David Manktelow) and Canada (Dr Jason Deveau).

On a Southern Cross farm in Nangiloc, Victoria, we asked: "Can we reduce the cost of labour and chemical in this orchard without compromising control of pest and disease".

A simple way to compare spray deposits after different applications is

Key points

- ❖ Get inside canopy
- ❖ Use paper cards
- ❖ Don't fall into old habits

by using water sensitive papers.

The papers can be clipped to poles, or pinned to leaves. It's very useful to compare the outer canopy (five folded papers) to the inner canopy (another five folded papers).

When we did exactly that, in a patch of mature navels in Nangiloc (3m tall, 6.5 m row spacing, well managed and relatively open), we achieved interesting results.

For the first run the sprayer travelled at 1.5 km/hr and applied 4000 L/ha. The sprayer was a Silvan Radak fitted with pink ceramic discs and stainless steel core nozzles - these are old school disc and core nozzles that put out a wide range of droplet sizes.

For the second run we shifted up a gear. Travelling at 3.7 km/h halved the sprayer output per hectare. Now we were applying 2000 L/ha using the same nozzles as before.

For the third run we stayed at 3.7 km/h, but flipped the nozzles to Red ATR 80° hollow cones. The ATR nozzles reduced the volume to just 1000 L/ha, and produced finer droplets which changed the spray pattern and would be expected to give better coverage than the coarser droplets produced by the other nozzles.



Water sensitive papers (WSP) are pinned to leaves inside and outside the canopy.

The conundrum can look like this:

I need optimum pest and disease control

Wetting trees thoroughly gives me good control

The chemical I used last year was cheap, and I was happy to waste a bit in the interests of good coverage.

I am seriously worried about compromising pest control if I apply lower volumes.



...but I need to reduce costs

...but labour costs would be lower if I sped up a gear

...but some of the new chemicals are very expensive! I can't afford to waste any. I need to reduce run-off.

Can I avoid wastage by applying a lower volume, but still get control?

Before each test run, Water Sensitive papers were folded in half and five papers were pinned to branches in both the outer or inner foliage zones.

Wherever water lands on the yellow water sensitive papers they turn blue.

How did deposits on the outer canopy compare?

The proportion of surfaces wet to run-off was similar on the outer

canopy after spraying at 4000, 2000 or 1000 L/ha. [See Figure 1]

How did deposits on the inner canopy compare?

On the inner canopy, 1000 L/ha using the ATR cones did not provide wetting to run off. However the deposit patterns after using 4000 l/ha and 2000 l/ha were similar, with four of the 10 inner canopy surfaces at both 2000 and 4000 l/ha showing significantly

lower deposits than the rest. [See Figure 2]

How would these deposits affect pest control?

If the spray is an oil, we need full wetting and coverage for efficacy. The inner canopy was not thoroughly wet in any of the test runs. David was asked what he would do to get more thorough wetting of the inner canopy.

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Figure 1: Deposits on the outer canopy

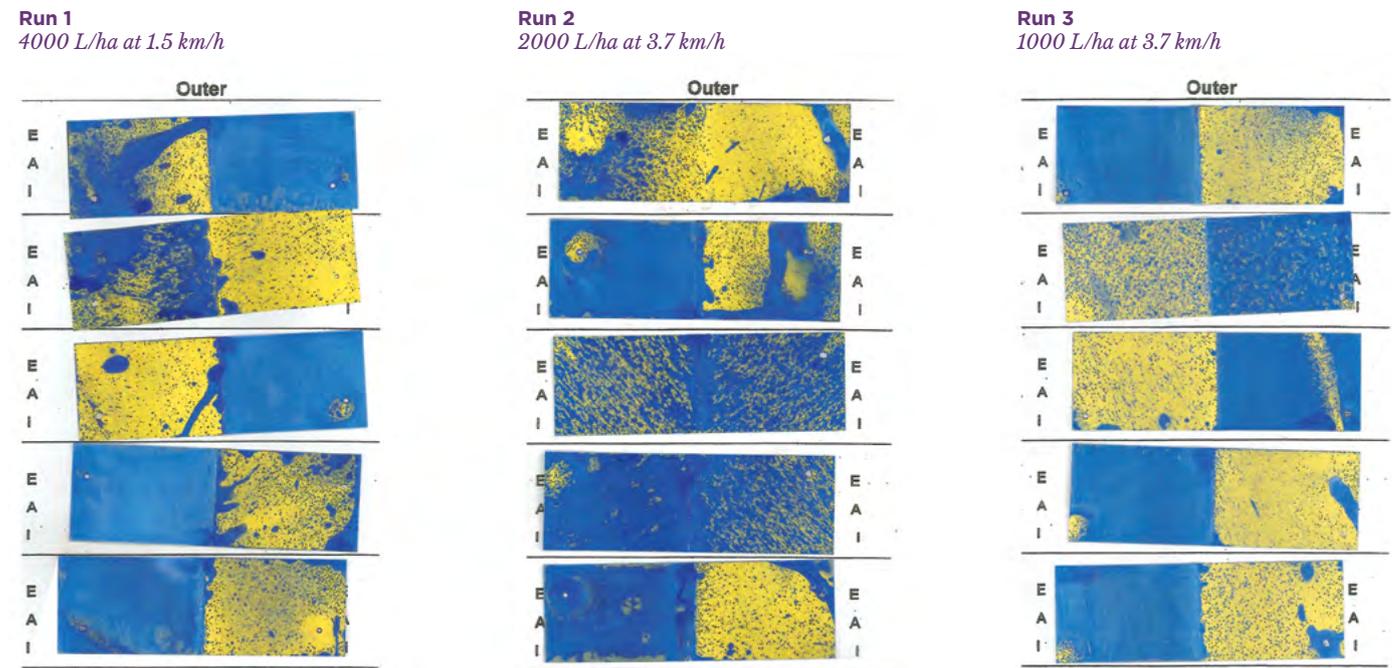
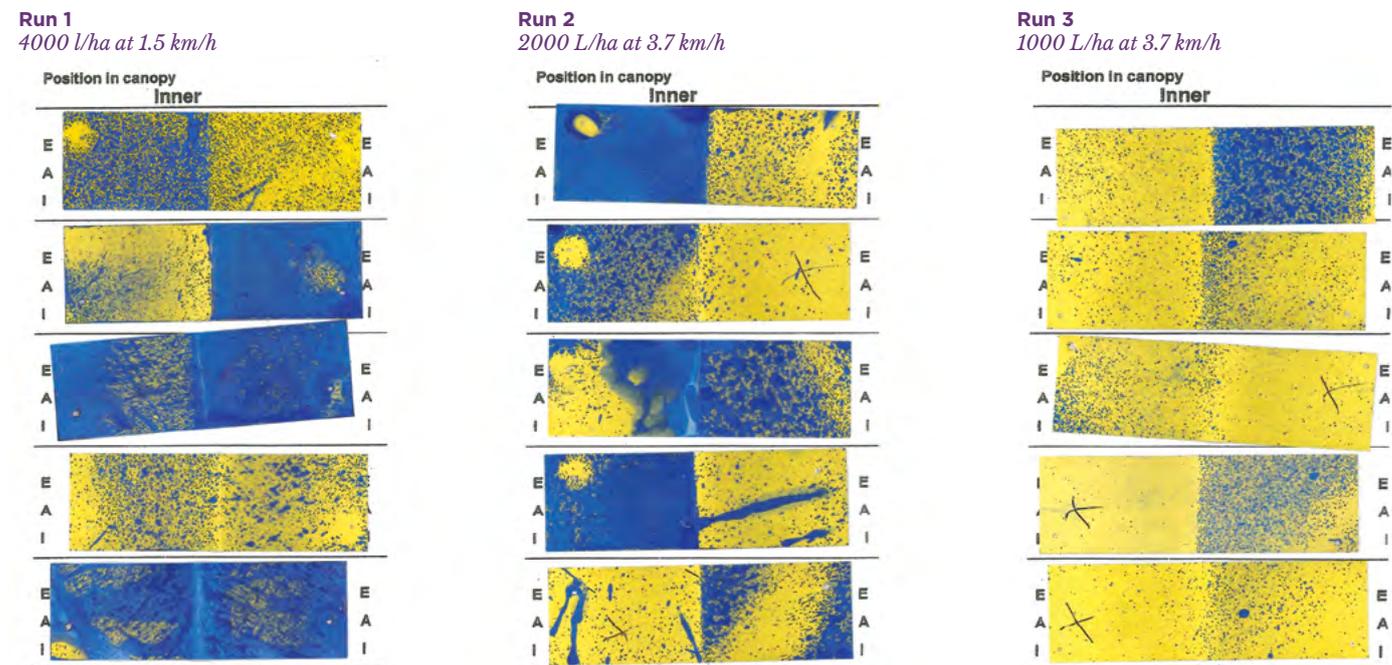


Figure 2: Deposits on the inner canopy





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“Every spray coverage test we have done in different crops shows significantly improved coverage when the target spray volume is split between two applications from opposite travel directions,” he said.

“That means the coverage and efficacy would be improved if an oil spray was applied as a double pass, each at 2000 l/ha, compared to the 4000 l/ha single pass application – and two passes at 3.7 km/hr would be a faster spraying job than a single pass at 1.5 km/hr”.

If the spray is modern chemistry that does not rely on total wetting to runoff for efficacy, the inner canopy deposits at 2000 L/ha in this canopy should provide effective control, especially if the travel direction down the rows is reversed from application to application, minimising the risk of repeated underdosing of particular inner canopy areas.



David Manktelow and Jason Deveau sticking WSP onto a sheet for the record.

The 1000 L/ha application produced quite low deposits in the inner canopy, and efficacy would probably be compromised.

If an adjuvant was added to the 1000 l/ha application, the spread of droplets would improve, but the amount of chemical on each leaf would not increase.

We can't expect spray adjuvants to deliver efficacy from low initial deposits.

The coverage we saw on inner surfaces sprayed at 1000 l/ha was typical of deposits from a concentrate spray,



Alison MacGregor, David Manktelow, Danny Sullivan of Southern Cross Farms and Jason Deveau on the Nangiloc farm.

where spray concentration in the tank has been increased above the label dilute mixing rates.

How did the volumes and travel speeds affect spraying work rates?

Assuming a 6.5m row spacing, a 3000 litre tank and a refill time of 20 minutes from emptying the tank to getting spraying again;

- 4000 L/ha at 1.5km/hr = 0.6 ha sprayed per hour
- 2000 L/ha at 1.5km/hr = 0.7 ha/hr (a 17% improvement in work rate)
- 2000 L/ha at 3.7 km/hr = 1.4 ha/hr (a 218% lift or more than double the work rate)
- 1000 L/ha at 3.7 km/hr = 1.6 ha/hr (a 260% lift in work rate).

A fundamental question here is how do you work out how much spray volume and chemical is required for canopies of different sizes and densities?

In this canopy 4000 L/ha appeared to be approximately twice the volume needed to adequately cover the trees to the point of runoff.

There are some good and simple calculation tools available now – for example the Nufarm Spraywise calculators.

Spraywise recommends application volumes of around 40-50 litres of spray per 100 metres of row per metre of tree height to wet to the point of outer canopy runoff, and up to 70 L/100m/m of height to fully wet the canopy with oil sprays.

In 3m tall trees that relates to around 140 L/100 m of row, or something around 2000 L/ha (and about 3500 L/ha for oil sprays).

It is always possible to improve sprayer and spraying performance when you look in detail at a particular canopy and sprayer interaction.

The challenge is to make safe and sensible decisions to optimise spraying efficiency and efficacy across large and varied orchard plantings.

This is not as hard as it might first appear – break the different canopies into three or four different management groups and use travel speed and nozzle choice and pressure to adjust spray volumes for different blocks (to deliver different chemical application rates to different trees by adjusting base application volumes).

Then monitor coverage to confirm that you are achieving similar levels of coverage – and adjust your settings as required.

“Spraying is something of a black art, with far too little immediate feedback,” David said. “Water sensitive papers are really useful coverage assessment tools – learn to use them!” ●

For more information, contact **Alison MacGregor**, Agrichemical Manager, Citrus Australia on (03) 5023 6333.

For tools, articles and videos, visit the website **sprayers101.com**

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