Spray technology

The aim of this trial was to investigate the effect of water rate and nozzle type on grass herbicide efficacy.

Summary of Trial
This trial has demonstrated the impact poor nozzle selection and water rates can have on herbicide efficacy. Farmers generally only use one nozzle type for all post emergent herbicide applications and water rates tend to be lower than optimal. It was found that increasing the water rate and selecting a nozzle with a fine droplet pattern and good coverage gave best results for contact herbicides and those poorly translocated within the plant (Group A herbicides eg. Verdict 520). For herbicides that move readily through the plant, coverage is not as essential allowing larger droplet size nozzles to be used without losing efficacy. For smaller grass targets it is even more important to have the correct water rate and nozzle type. Understanding how herbicides work, modes of action and movement within the plant will allow for better water rate and nozzle selection leading to more cost effective weed control and less off target impact.

Why it was conducted:
Optimum weed control is critical to the success of modern farming practices. As farm acreage increases effective and timely herbicide application becomes a greater issue. It has become common practice to reduce water rates and increase ground speed to meet this demand. These practices may jeopardise target-plant coverage leading to a reduction in herbicide efficacy and weed control unless water rate, nozzle selection and operating pressure is carefully considered.

Knowing how herbicides, with different modes of action, enter, move and act within plants allows an understanding of what level of coverage is necessary to achieve acceptable control. Nozzle selection can then be made to suit the herbicide and prevailing spray conditions.

How it was conducted:
Two trials, one at Birchip and one at Rupanyup, were conducted during 2002 to look at the effect of water rate and nozzle selection on herbicide efficacy.

Northfield lentils were sown at 40kg/ha and over sown with Gairdner barley at 10kg/ha. Gairdner barley was sown to provide grass weed pressure. The trial was sown with Mallee Mix 1 at 80kg/ha and Urea was pre-drilled at 40kg/ha.

On the 20th August, at Birchip, and 21st at Rupanyup, all treatments were sprayed with Verdict 520 at 60ml/ha + Uptake oil. Five different nozzle types and three water rates (30L/ha, 60L/ha and 90L/ha) were used:

Nozzle description:

- Hardi FF 110-02 (Yellow) – 110° Standard flat fan nozzle
- Hardi LD 110-015 (Green) - 110° Low drift nozzle
- Hardi Injet 110-015(Green) – 110° Air inclusion spray tip nozzle
- TeeJet Turbo Tees 110-015 (Green)- 110° Wide angle flat spray tip nozzles
- TeeJet Twin Jet 110-02 (Yellow) – 110° Twin Flat spray tip

Table 1: Nozzle description

Treatment	Nozzle	Water rate(L/ha)	Pressure(bar)	Speed(km/hr)	Droplet size
1	FF-110-02	30	3	32	Fine
2		60	3	16	Fine
3		90	3	11	Fine
4	LD-110-015	30	3	25	Medium
5		60	3	12	Medium
6		90	3	8	Medium
7	InJet-110-015	30	4	27	Very Coarse
8		60	5	15	Very Coarse
9		90	5	10	Very Coarse
10	TurboTee-110-02	30	3	32	Medium
11		60	3	16	Medium
12		90	3	11	Medium
13	TwinJet-110-02	30	3	32	Very Fine
14		60	3	16	Very Fine
15		90	3	11	Very Fine

Birchip spraying conditions were overcast and dry, with a 3km/hr westerly wind. The ambient temperature was 15°C. At Rupanyup 6km/hr WSW winds were experienced. The ambient temperature was 15°C with overcast conditions, the soil was moist and consisted of 80% stubble cover.

Barley, being the target grass, was visually scored for herbicide effects 6 weeks after application of all treatments.

Trials were conducted using a fully replicated randomised block design.

Results of the trial:

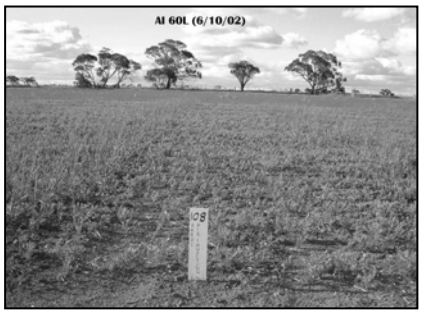
Visual phytotoxicity scores indicate that water rates affected the level of barley controlled at both Birchip and Rupanyup. The lentil crop was not harvestable, due to the poor season, however the visual effect of herbicide efficacy on barley was significant. At a 30L/ha water rate little barley was controlled when comparing all spray nozzles. At 60L/ha most of the barley was controlled. However, there was still a small amount of barley found predominantly in the wheel tracks of the spray bike. At 90L/ha water rate all the barley was controlled when using the different spray nozzles.

Table 2: Phytotoxicity scores of barley grass at Birchip and Rupanyup using different nozzle types and water rates.

Treatment	Water rate	Phytotoxicity score Birchip	Phytotoxicity score Rupanyup
1	30	5.5	6
2	60	9	7
3	90	9	8
4	30	5.5	5
5	60	9	9
6	90	9	8
7	30	6.0	6
8	60	9	8
9	90	9	8
10	30	5.3	6
11	60	9	8
12	90	9	8
13	30	5.5	6
14	60	9	9
15	90	9	8

Figure 1. HardiInjet 30L/ha water rate

Figure 2. HardiInjet 60L/ha water rate



Interpretation:
Verdict 520, a Group A herbicide, was the herbicide used on all treatments. Group A herbicides move slowly within the plant so rapid absorption in the plant is essential for good efficacy. This is the reason why a wetter, or adjuvant, is used for most Group A herbicides. Good coverage is essential for Group A herbicides. To achieve good coverage nozzles that have a finer droplet size are recommended, however these nozzle types are also at risk of spray drift. In this trial water rate rather than nozzle type and droplet size tended to be the influencing factor on weed control.

Barley is a large target with a relatively large, flat leaf. Herbicide contact is therefore easier than when targeting small, shiny leaves. The label rate for Verdict 520 is 50ml/ha for controlling cereals, the BCG used 60ml/ha of Verdict 520 and barely was only controlled when using at least 60L/ha water rate. This is an important observation. When chasing a smaller target such as annual ryegrass, which has a shiny, erect leaf, the water rates and travelling speeds will likely need to be adjusted.

Key Message:
For Group A herbicides, which are dependent on good coverage, spray volume was more critical than nozzle selection. Past research by BCG suggests that nozzle selection is important for maximising herbicide efficacy with contact herbicides, and herbicides that enter the plant slowly.

Commercial practice:

Hardi Flat Fan F-110: All rounded flat fan nozzle. Recommended for all types of pesticide application where optimum coverage is demanded. This nozzle type produces a fine droplet (50 micron at 3 bar pressure)

Hardi LowDrift LD-110: Low drift nozzles are recommended when optimum spraying conditions cannot be achieved due to risk of drift. Medium droplet size produced (100 micron) at 3 bar pressure.

Hardi Air inclusion: The Hardi INJET nozzle can be used for spraying at sub-optimal weather conditions, or when spraying can not be postponed. Very Coarse droplets produced (400 microns) at 3 bar pressure. Not recommended for contact herbicides or when targets are small

TeeJet Twin Jet: Twin flat spray tip nozzles. Used for penetrating dense foliage and for good coverage. Very fine droplets produced (<50 micron) at 3 bar pressure. Very fine droplets are prone to drift

TeeJet Turbo Jet: Wide angle spray tip. Recommended for all types of pesticide application. Medium droplets produced (100micron) at 3 bar pressure.