GOA trial site report

Impact of application timing, spray quality and water rates to control weeds using glyphosate in retained stubble systems.

Trial code:	GAWE079
Season/year:	Summer 23/24
Property name:	The Wilgas
Location:	Wongarbon
Co-operator:	Maurie Street

Keywords

GAWE072, fallow weeds, resistance, glyphosate, spray quality, water rates, application timing

Take home messages

- Spraying early with a higher rate of water can be less effective than lower water rates and/or later timing.
- When applications are delayed, the use of coarser droplets was just as effective as the less coarse droplets.

Background

During recent Grain Orana Alliance (GOA) research into controlling glyphosate resistant weeds, populations with assumed resistance were controlled with label herbicide rates. In some of these trials, resistance was assumed due to a spray failure. This led to the need to better understand the reasons behind spray failures.

Contributing factors to weed control failure include:

• inappropriate water rates (too high or too low)

• poor water quality

• incorrect droplet size for the target weed (weeds too small or large a target)

• poor spray timing

• antagonism with other herbicides

• poor weather conditions.

This is not to suggest that herbicide resistance is not real or not the sole reason for failure in some circumstances.

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Grain Orana Alliance, with support of the Grains Research and Development Corporation (GRDC), has undertaken several trials to understand how these factors influence spray efficacy in the Central West of NSW.

Aims

Determine the effects of application timing, water rate or spray quality/droplet spectrum has on the control of fallow weeds using glyphosate as the sole herbicide for control of ARG.

Methodology

Trial design		
	Type	Small plot (~12m x 2.5 m)
	Design	Randomized complete block
	Replications	4
	Analysis	ASREML
	Confidence interval	95%

Treatments

All treatments received 285ml AI/ha glyphosate (as Roundup Ultramax®).

Plots were sprayed using a ute mounted boom with 4 by 2.5 m sections where nozzles could be rotated to change spray quality. On each section different nozzles were used to apply 3 differing spray qualities and an untreated control plot (Table 1).

Application timing and water rate were applied as split plot (or main plot) treatments. All spray qualities were applied at the subplot level in the same pass using the same pressure, ground speed and environmental conditions.

Two water rates were applied by varying the ground speed. Nozzle size and operating pressures remained constant and rainwater was used:

- low = 50 L/ha (approx. 16 km/hr)
- high = 100 L/ha (approx. 8 km/hr).

Two application timings were used:

- early: targeting smaller weeds earlier in the application window (1/12/2023)
- delayed: targeting larger target weeds in the applications window (9/12/2023, 8 days after the early application).

Spray water quality and nozzles used are listed in Table 1.

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Table 1: Nozzles used and spray quality/droplet size

Nozzle	Spray quality
AIXR	Medium (M)
Hardi InJet	Very coarse (VC)
TTi	Extremely coarse (XC)

Results

Grass weeds

- The main grass weed species present was barnyard grass.
- XC treatments at the early timing were no different to the control.
- The early low and delayed high VC were no different to the control.
- The M delayed high was not different to the control (Figure 1).

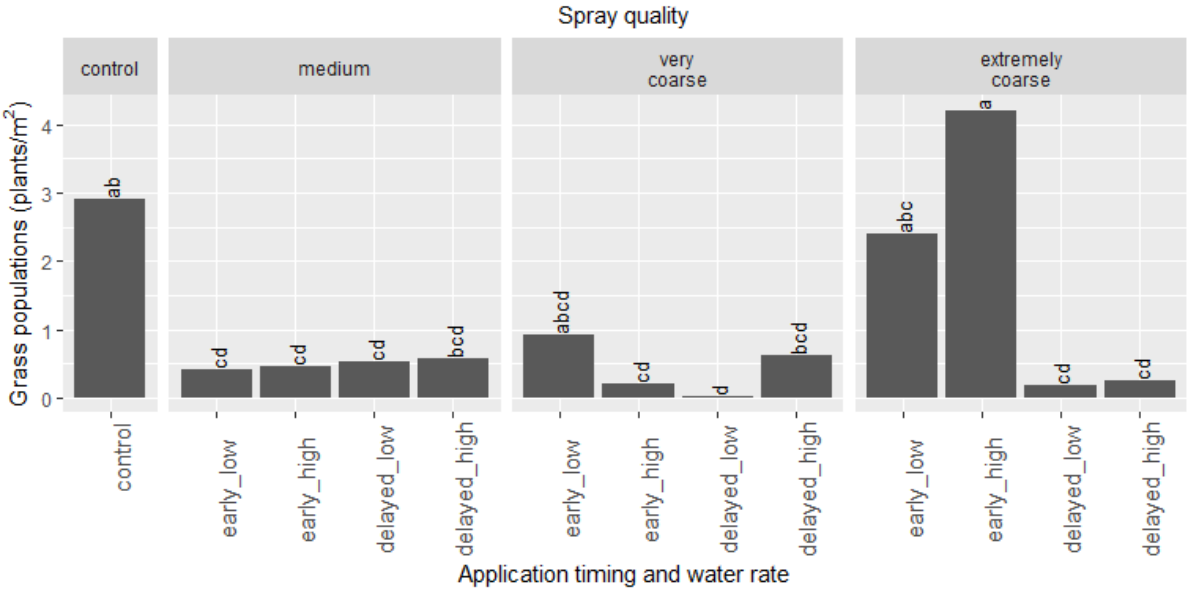

Figure 1: Number of surviving grass weeds (plants/m^2) assessed 18 days (early) and 11 days (delayed) after application. Results with the same letter are not significantly different.

Broadleaf weeds

- The main broad leaf species present were melons, catheads, heliotrope skeleton weed, radish and marshmallow.

- The broadleaf population was low with the population at ~1 plant/m^2.
- Both the early high VC and XC had a higher number of remaining weeds than the VC early low, VC delayed high and the M delayed low (Figure 2).

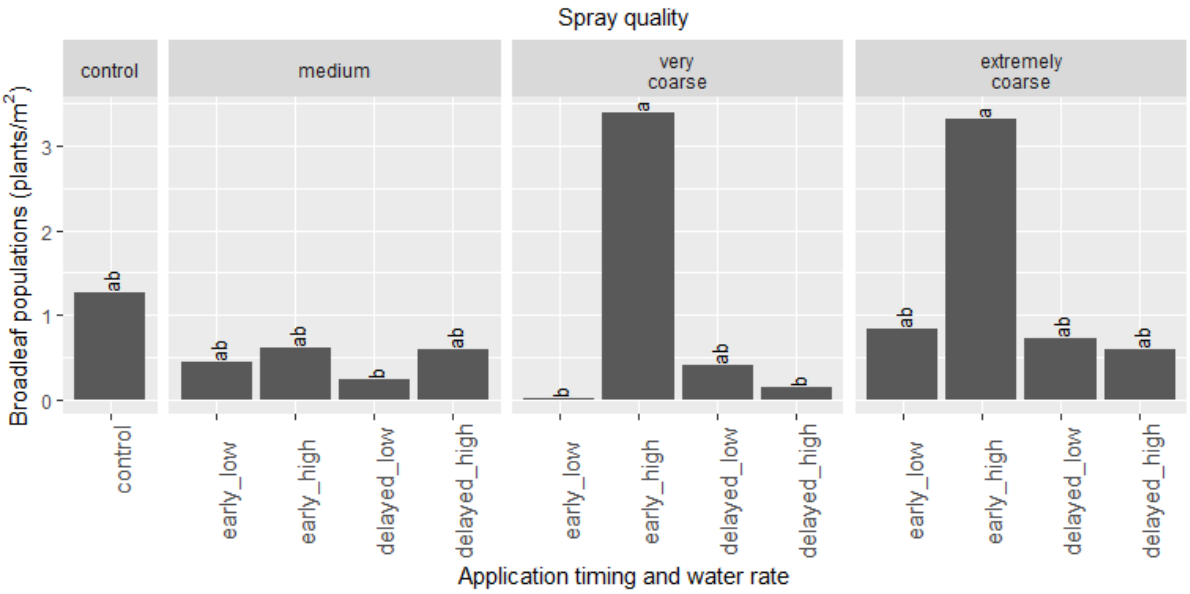

Figure 2: Number of surviving broadleaf weeds (plants/m2) assessed 18 days (early) and 11 days (delayed) after application. Results with the same letter are not significantly different.

All weeds

- Is the combined broadleaf and grass weed populations described above.
- Seven treatments reduced the weed population when compared to the control, including the early and delayed low M, the VC early low and both delayed XC (Figure 3).

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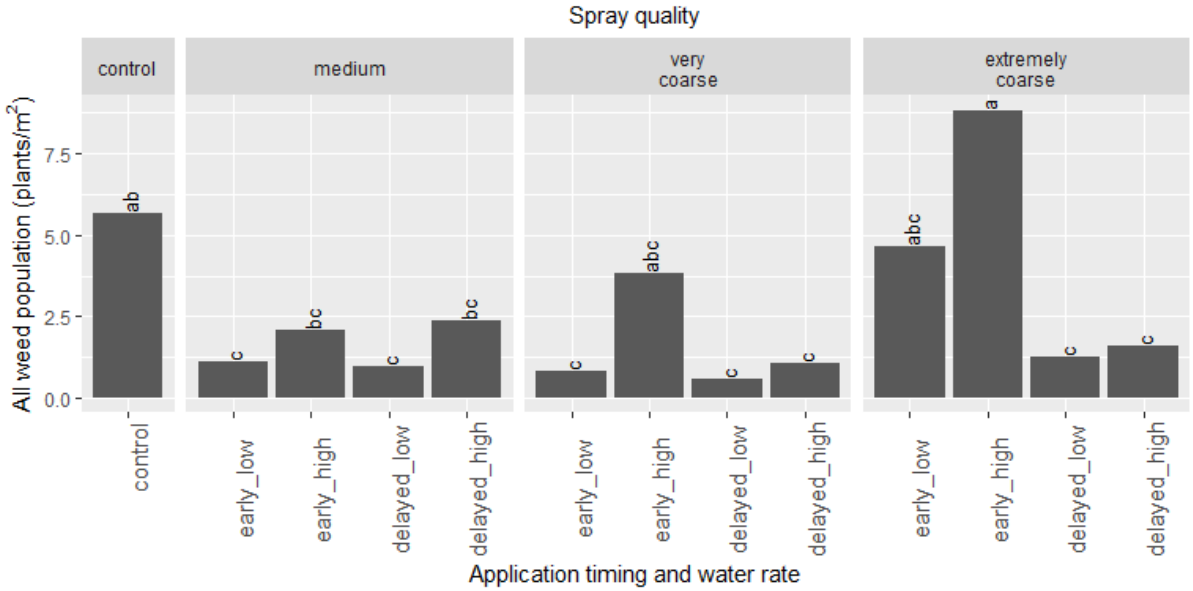

Figure 3: Number of surviving weeds (plants/m2) assessed 18 days (early) and 11 days (delayed) after application. Results with the same letter are not significantly different.

Discussion

The weed density at this site was low. The average weed population (untreated) was about 5.7 plants/$m^{2.}$ The average level of control across all treatments was 60%. The control provided by the M quality treatments was 72%, regardless of water rate or timing.

There were instances where spraying early was not as effective as the later spray timing. It may be because at the early timing weeds were either too small or not fully emerged (germinated). Where the weeds were very small, a spray quality with smaller droplets might offer a more effective or consistent result, as was the case in this trial with the M quality treatments.

While treatment controlled all weeds, 7 treatments reduced the population (when compared to the control) and were on average 82% effective. These treatments were across the M, VC and XC spray qualities.

Other factors that may have contributed to the performance of the trial include stubble intercept, water rate, herbicide rate, and weather. The site had standing cereal stubble 40-50 cm height that supported a better than expected barley crop in 2023. This may have interfered with herbicide contact, particularly in the chaff trail. While there was no effect of water rate in this trial, the label recommendation for broadacre application is 'in a spray volume of 80 L/ha or less[1]', as glyphosate works better at a 'higher concentration in the spray solution'. It might have been expected that the higher rate may not have been as effective as the lower rate; however, this was not the case. Roundup ULTRAMAX® at 500 mL/ha is in the range of the registered label rate for the control

[1] https://www.crop.bayer.com.au/-/media/bcs-inter/ws_australia/use-our-products/product-import-files/1071/roundup-ultramax-product-label.pdf

of volunteer cereals and for a range of small broadleaf weeds up to 5 true leaves and should have controlled the very small weeds present. The weather at the time of application was very warm (28-30^{o}C), but not outside of label recommendations.

Conclusions

- Spraying early with a higher rate of water can be less effective than lower water rates and/or later timing.
- When applications are delayed, the use of coarser droplets was just as effective as the less coarse droplets.
- Ensure weeds, particularly grasses, have completely germinated and are big enough to 'hit' with the spray quality and water rate that you are using.
- More generally, when targeting smaller weeds or using lower water rates, a medium spray quality may be more effective (if conditions and label restrictions permit).
- If conditions or label restrictions dictate the use of coarser spray quality, a VC may be more effective than an XC and use higher water rates if possible.

Acknowledgements

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DISCLAIMER — TECHNICAL

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Appendix

Results

Timing	Rate	Quality	Broad leaf		Grasses		Total weeds	
			(plants/m2)					
Control	Control	Control	1.3	ab	2.9	ab	5.7	ab
Early	Low	Medium	0.5	ab	0.4	cd	1.1	c
	Low	Very coarse	0.0	b	0.9	abcd	0.8	c
	Low	Extremely coarse	0.8	ab	2.4	abc	4.6	abc
	High	Medium	0.6	ab	0.4	cd	2.1	bc
	High	Very coarse	3.4	a	0.2	cd	3.8	abc
	High	Extremely coarse	3.3	a	4.2	a	8.8	a
Delayed	Low	Medium	0.2	b	0.5	cd	1.0	c
	Low	Very coarse	0.4	ab	0.0	d	0.6	c
	Low	Extremely coarse	0.7	ab	0.2	cd	1.2	c
	High	Medium	0.6	ab	0.6	bcd	2.4	bc
	High	Very coarse	0.1	b	0.6	bcd	1.1	c
	High	Extremely coarse	0.6	ab	0.3	cd	1.6	c
lsd	lsd	lsd	1.3		1.2		1.4	

Spray application details

Spray application	Timing 1	Timing 2
Date Applied	1/12/2023	8/12/2023
Start time	11:50am	8:30am
Finish Time	12:25pm	9:00am
Water rate (l/ha)	60/120	60/120
Speed (km/hr)	7/14	7/14
Pressure (bar)	4	4
Equipment	Ute mounted boom	Ute mounted boom
Temp (oC)	30	28.7
Wind velocity (km/hr)	5-8	10-12
Wind direction	NW	NE
Humidity (%)	46	54
Δt	9	7
Nozzle	Various	Various
Cloud cover (%)	80	75