GOA trial site report

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

Trial code:	GAWE079
Season/year:	Summer 2023/24
Property name:	The Wilgas
Location:	Wongarbon
Co-operator:	Maurie Street

Keywords

GAWE079, fallow weeds, resistance, glyphosate, paraquat, spray quality, water rates, application timing

Take home messages

- For grass weeds, the delayed application, regardless of spray quality, gave the best weed control.
- Spray timing had a greater effect on weed control than spray quality and water rate.

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
- poor spray timing (weeds too small or too large a target)
- antagonism with other herbicides
- poor weather conditions.

This is not to suggest that herbicide resistance does not exist or is not the sole reason in some cases for spray failure.

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GOA has undertaken several trials to better understand the influences of some key parameters of spray application[1].

Aims

Determine the effects of application timing, water rate or spray quality on the control of numerous weed species using paraquat.

Methodology

Trial design		
	Type	Small plot (~12 m x 2 m)
	Design	Randomized complete block
	Replications	4
	Analysis	ASREML
	Confidence interval	95%

Treatments

All treatments received 2L/ha paraquat.

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 three differing spray qualities and an untreated plot, detailed in 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 rain water was used:

- low = 60 L/ha (approx. 14 km/hr)
- high = 120 L/ha (approx. 7 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 are listed in Table 1.

[1] Is our ryegrass really getting harder to kill through our over reliance on glyphosate? - GRDC https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2020/02/is-our-ryegrass-really-getting-harder-to-kill-through-our-over-reliance-on-glyphosate

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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 2 main grass weeds present were barnyard grass *(Echinochloa sp)* and black grass *(Eragrostis sp)*.
- All applications lowered the weed population when compared to the UTC.
- The delayed application, regardless of quality, had the lowest remaining weed populations.
- The early low M and VC had more surviving weeds than all the delayed applications, except for the XC delayed high (Figure 1).

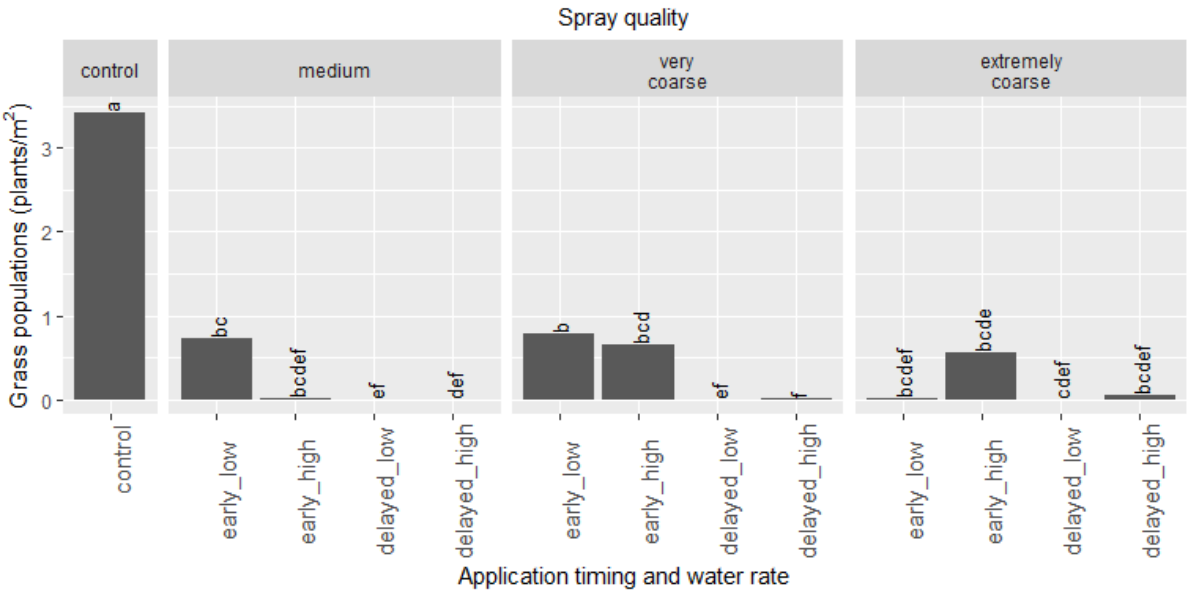

Figure 1: Number of surviving grass weeds (plants/m^2) assessed 18 days (early) and 11 days (delayed) after application. Treatments with the same letter are not significantly different.

Broadleaf weeds

- The main broad leaf species present were melons, catheads, heliotrope, skeleton weed, radish and marshmallow.
- The broadleaf population was low at approximately 1 plant/m^2.
- All delayed treatments (except for the XC delayed high) reduced the number of weeds compared to the control (Figure 2).

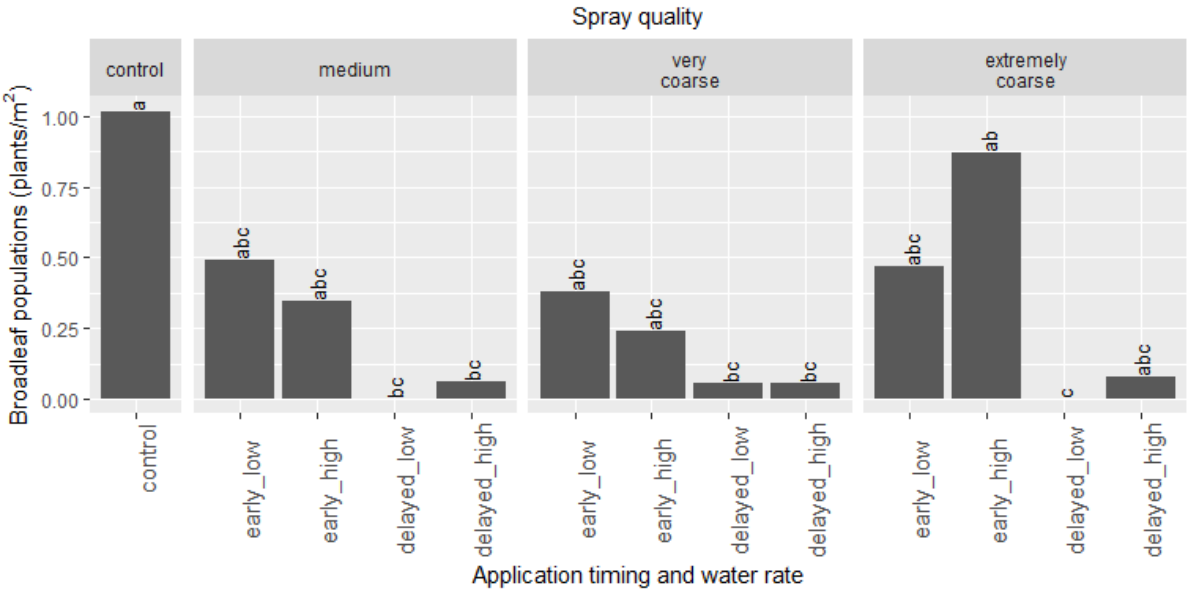

Figure 2: Number of surviving broadleaf weeds (plants/m^2) assessed 18 days (early) and 11 days (delayed) after application. Treatments with the same letter are not significantly different.

All weeds

- Is the combined broadleaf and grass weed populations described above.
- All treatments reduced the weed population when compared to the UTC.
- The early low M treatment had more weeds than both the delayed M treatments and the early high XC had more weeds than the delayed XC low treatment (Figure 3).

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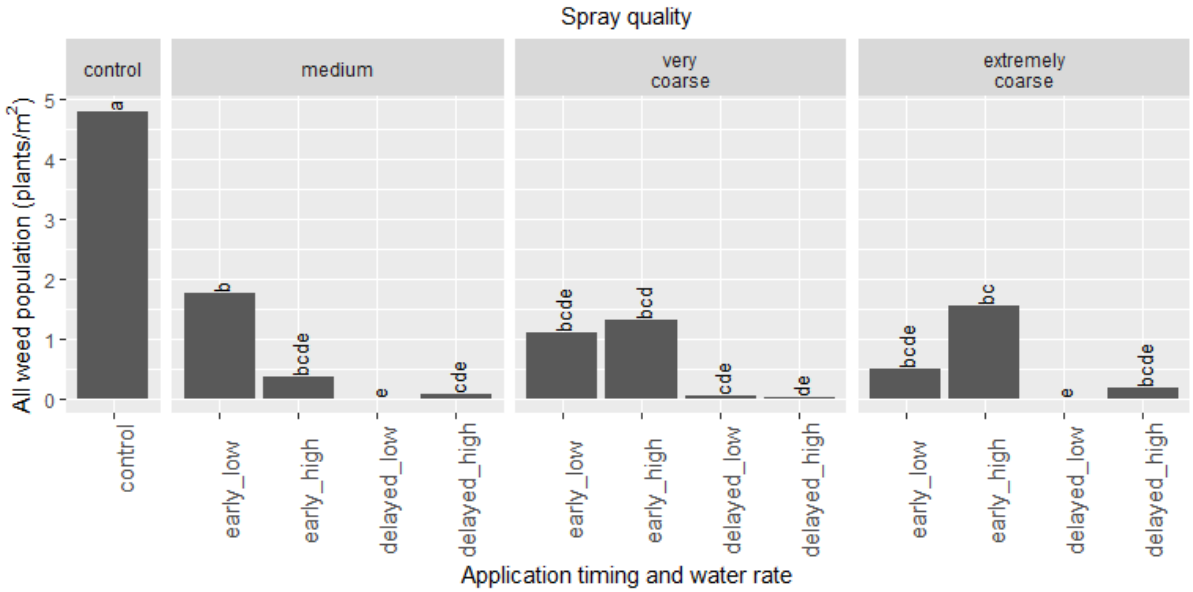

Figure 3: Number of surviving weeds (plants/m2) assessed 18 days (early) and 11 days (delayed) after application. Treatments with the same letter are not significantly different.

Discussion

The weed density at this site was low. The average weed population (untreated) was about 4.8 plants/m^2. The average level of control across all treatments was 88%.

Two treatments had no weeds present: M and XC quality at the delayed timing with low water rates.

In this trial the spray quality and water rate had little effect on weed control; however, timing was important. Delaying the application by 8 days improved weed control, and in some instances ended up with complete control (more so for the grasses, which may be an artifact of the higher grass weed populations).

The later timing may have been more effective due to weeds being either too small or still germinating at the earlier timing. The level of control provided by the M quality at the early timing with the higher water rate would indicate that weeds were present and were too small for the coarser spray qualities to be effective.

Conclusions

- Ensure that application timing is such that weeds, particularly grasses, have completely germinated and are big enough to 'hit' with the spray quality and water rate that you are using. If using coarser droplet sizes this may require delaying application.
- 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

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC. The authors would like to thank them for their continued support. Special thanks go out to Maurie Street who hosted this trial.

DISCLAIMER — TECHNICAL

Appendix

Results

			Broad leaf		Grasses		Total weeds	
Timing	**Rate**	**Droplet size**	**(plants/m^2)**					
Control	Control	Control	1.0	a	3.4	a	4.8	a
Early	Low	Medium	0.5	abc	0.7	bc	1.8	b
		Very coarse	0.4	abc	0.8	b	1.1	bcde
		Extremely coarse	0.5	abc	0.0	bcdef	0.5	bcde
	High	Medium	0.3	abc	0.0	bcdef	0.4	bcde
		Very coarse	0.2	abc	0.7	bcd	1.3	bcd
		Extremely coarse	0.9	ab	0.6	bcde	1.6	bc
Delayed	Low	Medium	0.0	bc	0.0	ef	0.0	e
		Very coarse	0.1	bc	0.0	ef	0.0	cde
		Extremely coarse	0.0	c	0.0	cdef	0.0	e
	High	Medium	0.1	bc	0.0	def	0.1	cde
		Very coarse	0.1	bc	0.0	f	0.0	de
		Extremely coarse	0.1	abc	0.1	bcdef	0.2	bcde
		lsd	0.9		0.8		1.0	

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Spray application Details

Spray application	Timing 1	Timing 2
Date applied	1/12/2023	8/12/2023
Start time	11.50am	9.15am
Finish Time	12.25pm	9.35am
Water rate (L/ha)	60/120 L	60/120 L
Speed (km/hr)	7/14	7/14
Pressure (bar)	4	4
Equipment	Ute mounted boom	Ute mounted boom
Temp (^{o}C)	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