GOA Trial Site Report

The impacts of application timing, spray quality and water rates to control weeds using paraquat.

Grain Orana Alliance

2022-09-16

Trial code:	GAWE07922-3
Season/year:	Summer 2022
Location:	Spicers Run, Wellington
Trial partners:	Joe and Sam Mason
Trial establishment date:	21/03/2022

Keywords

GAWE072, annual ryegrass, resistance, glyphosate, paraquat, spray quality, water rates, application timing, Wellington

Key findings

- Increasing the water rate or delaying sprays by a week improved the level of weed control.
- At both spray timings and both water rates, the medium spray quality gave had the best reduction in plant population

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.

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 split plot
	Replications	4
	Analysis	ASREML
	Confidence interval	95%

Treatments

All treatments received 2L/ha paraquat. Surviving weeds were assessed 30 days (early application) and 22 days (recommended application) after paraquat application.

Plots sprayed using a ute mounted boom with 4 by 2.5 m sections where nozzles could be rotated to change spray quality.

Two water rates (varied using ground speed)

- Low = 60 L/ha (~14 km/hr).
- High = 120 L/ha (~7 km/hr).

Two application timings (recommended: >3 leaf to early rosette)

- Early 21/3/2022: smaller weeds.

- Recommended 29/3/2022: larger weeds (8 days after the early application).

Spray quality and nozzles used are listed in Table 1.

Table 1: Nozzles used and spray quality/droplet size

Nozzle	Spray quality
AIXR	Medium
InJet	Very coarse
TTi	Extremely coarse

Results

Sow thistle

Medium spray quality gave the best control. At an early timing, low water rates and very or extremely coarse spray quality resulted in more surviving plants than the medium quality at the same water rate (Figure 1).

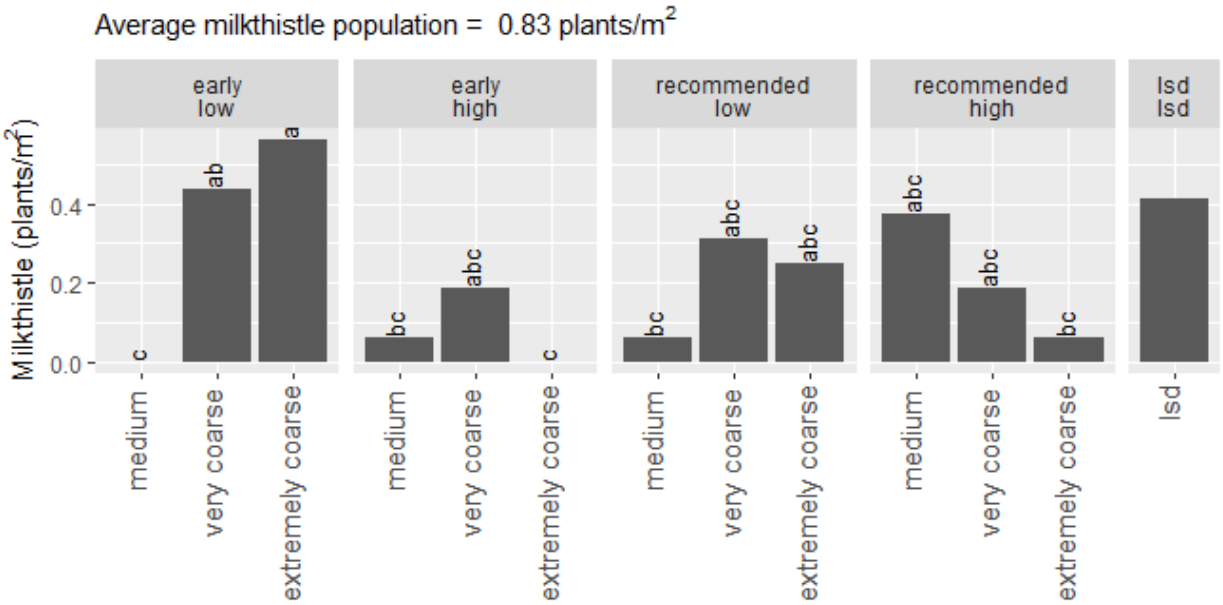

Figure 1: Number of surviving sow thistle assessed 30 days (early) and 22 days (recommended) after application with a low and high water rate. Treatments with the same letter are not significantly different.

Other weeds

Other weeds present included caltrop, marshmallow, wild oats, shepherd's purse, wild mint, volunteer canola, medics and fleabane.

An early application at the low water rate and very coarse spray quality had a higher weed population than other treatments (with the exception of the early application at a high water rate using the extremely course spray quality). See Figure 2.

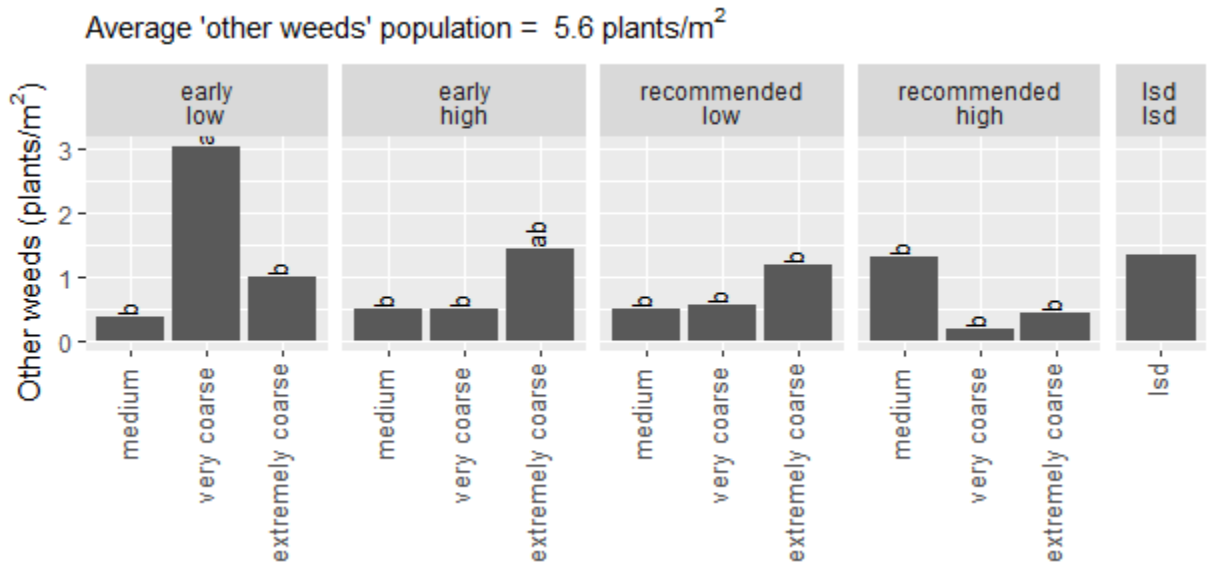

Figure *2*: Number of surviving weeds (other than sow thistle) assessed 30 days (early) and 22 days (recommended) after application with a high and low water rate.

All weeds:

When looking at all weeds combined (other weeds and sow thistle), the early application at the low water rate and very coarse spray quality had a higher weed population than other treatments (Figure 3)

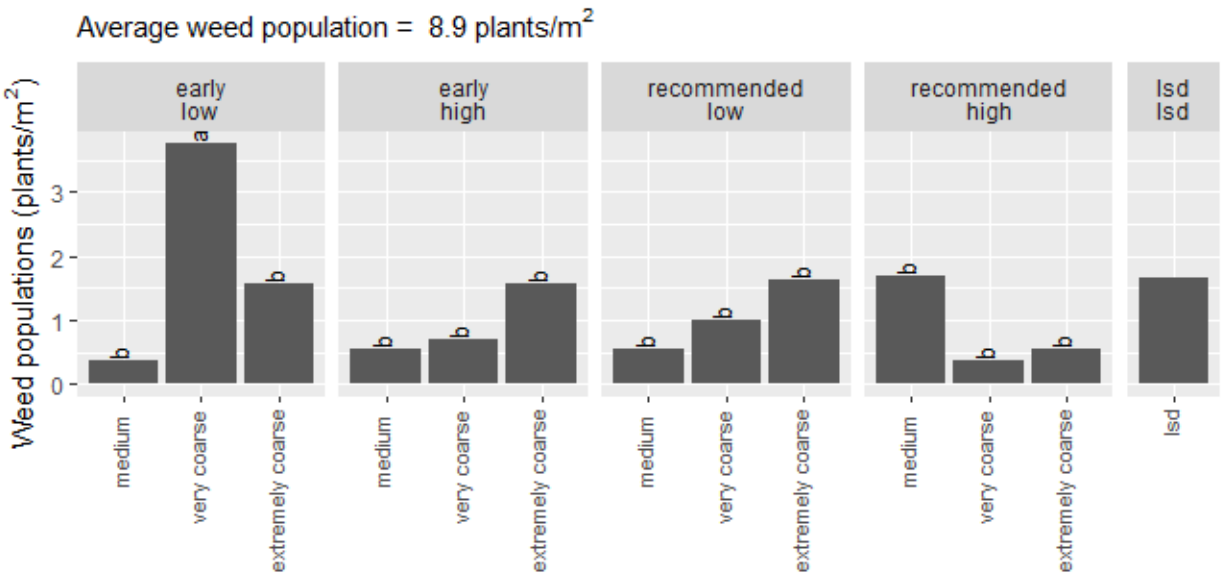

Figure 3: Number of surviving weeds assessed 30 days (early) and 22 days (recommended) after application with a low and high water rate. Treatments with the same letter are not significantly different.

Discussion

The weed species at this site included milk thistle, marshmallow, wild oats, shepherd's purse, wild mint, volunteer canola, medics and fleabane. The average weed population (untreated) was about 8.9 plants/m^2. The average level of control across all treatments was below the acceptable level of control of 90%. Using a higher water rate when spraying early (regardless of quality) gave more consistent results than spraying with a low water rate early. A medium quality spray gave more consistent results when spraying early than the coarse qualities. Waiting 8 days to spray the weeds *regardless of water rate or spray quality) resulted in fewer (total) weeds surviving that spraying early with low water rates (

Milk thistle was one of the dominant species present. At both timings and water rates, the medium spray quality gave the best control, however at the early timing both coarser spray qualities had more surviving plants possibly a result of the lower coverage on a small er target. Increasing the water rate or delaying spray application by a week improved weed control.

- Paraquat can provide good levels of control the spray quality and water rates match the target weed size.
- A medium spray quality gave better results when targeting smaller weeds including, sow thistle.

Conclusions

If targeting smaller weeds or using lower water rates, a medium spray quality may be more effective (if conditions allow)

If conditions or the label dictates, the use of or 'very' or 'extremely' coarse droplets may be as effective as a 'medium' spray quality, however it is critical to match water rates and timing to ensure adequate coverage of weeds

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 Grains Research and Development Corporation (GRDC), the authors would like to thank them for their continued support. Special thanks go out to Joe and Sam Mason who hosted this trial.

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Appendix

Results

Timing	Rate	Quality	Other weeds		Milk thistle		Total weeds	
			(plants/m2)					
Early	Low	Medium	0.4	b	0.0	c	0.4	b
	Low	Very coarse	3.0	a	0.4	ab	3.7	a
	Low	Extremely coarse	1.0	b	0.6	a	1.6	b
	High	Medium	0.5	b	0.1	bc	0.6	b
	High	Very coarse	0.5	b	0.2	abc	0.7	b
	High	Extremely coarse	1.4	ab	0.0	c	1.6	b
Recommended	Low	Medium	0.5	b	0.1	bc	0.6	b
	Low	Very coarse	0.6	b	0.3	abc	1.0	b
	Low	Extremely coarse	1.2	b	0.3	abc	1.6	b
	High	Medium	1.3	b	0.4	abc	1.7	b
	High	Very coarse	0.2	b	0.2	abc	0.4	b
	High	Extremely coarse	0.4	b	0.1	bc	0.6	b
lsd	lsd	lsd	1.4		0.4		1.7	

Spray application Details

Spray application	Timing 1	Timing 2
Date applied	21/03/2022	29/03/2022
Start time	8:15 AM	8:15 AM
Finish time	9:00 AM	8:50 AM
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)	17	18.5
Wind velocity (km/hr)	8-10	0-3
Wind direction	NE	SE
Humidity (%)	87	81.3
Δt	1.5	2.1
Nozzle	various	various
Cloud cover (%)	0	100