

## Impact of application timing, spray quality and water rates to control weeds using paraquat

Grain Orana Alliance

2022-09-01

**Trial code:** GAWE07922-1  
**Season/year:** Summer 2022  
**Location:** Ardmona, Gilgandra  
**Trial partners:** Roger and George Pagan  
**Trial establishment date:** 8.2.22

### Keywords

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

### Key messages

- An extremely coarse spray quality at the low water rate had the highest numbers of surviving weeds regardless of spray timing.
- A medium spray quality gave the best control of sow thistle.
- A medium spray quality at the high water rate offered the best control of sow thistle.

### 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:

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- 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.

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 paraquat as the sole herbicide for control.

## Methodology

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

## Treatments

- All plots: 2L/ha paraquat.
- Plots sprayed using a ute mounted boom with four 2.5 m sections. On each section, different nozzles were used to apply 3 different spray qualities (Table 1) to create a split plot trial design.
- All nozzles were run at the same pressure in one pass so to minimize the risk of changing environmental conditions or other differences such as ground speed etc.
- Two water rates were used by varying ground speed. Nozzle size and operating pressure remained constant:
  - Low = 60 L/ha (~14km/hour ground speed)

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- High = 120 L/ha (~7 km/hour ground speed).

Two application timings:

- Early (T1): targeting smaller weeds in the application window
- Delayed (T2): targeting larger weeds (8 days after the early application).

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

- Weeds were assessed at <2 leaf at the first application, and 3+ leaf and second application.

For a full list of application details, refer to Appendix 1.

Table 1: Nozzles used and suggested spray qualities (GRDC Spray quality chart, January 2021).

Nozzle type	Spray quality
AIXR	Medium
InJet	Very coarse
TTi	Extremely coarse

## Results

The trial site was dominated largely by 2 key weeds:

1. fleabane: 1.8 weeds/m<sup>2</sup>
2. sow thistle: 1.7 weeds/m<sup>2</sup>.

Figure 1 below details the remaining populations following herbicide applications.

### Fleabane:

- The medium spray quality at both the early high water rate, and the recommended high water rate had no surviving fleabane
- The medium quality at the recommended timing and low water rate had the highest surviving population of fleabane (~0.5 plants/m<sup>2</sup>).

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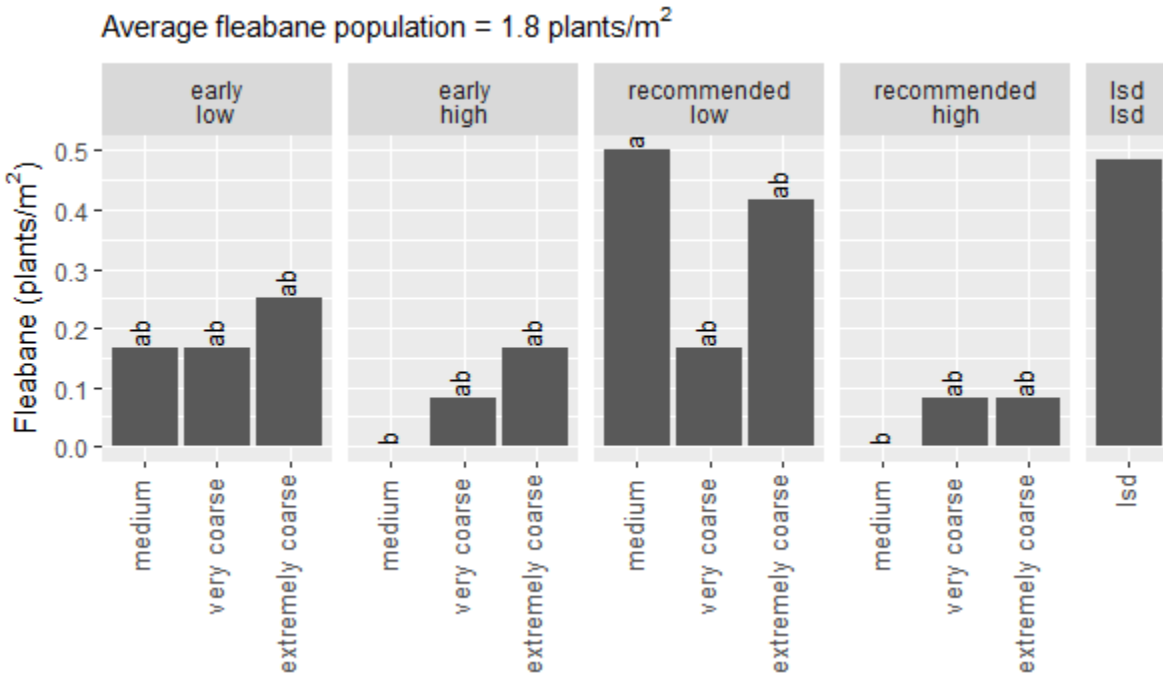


Figure 1: Number of surviving fleabane plants assessed 28 days (early) and 20 days (delayed) after herbicide application at 2 water rates. Results with the same letter are not significantly different.

## Sow thistle:

- Medium spray quality resulted in the lowest number of surviving sow thistle, regardless of timing or water rate.
- Extremely coarse spray quality at the low water rate had the highest numbers of surviving sow thistle regardless of timing
- There was no difference in surviving sow thistle at the high water rate (regardless of spray quality or timing).

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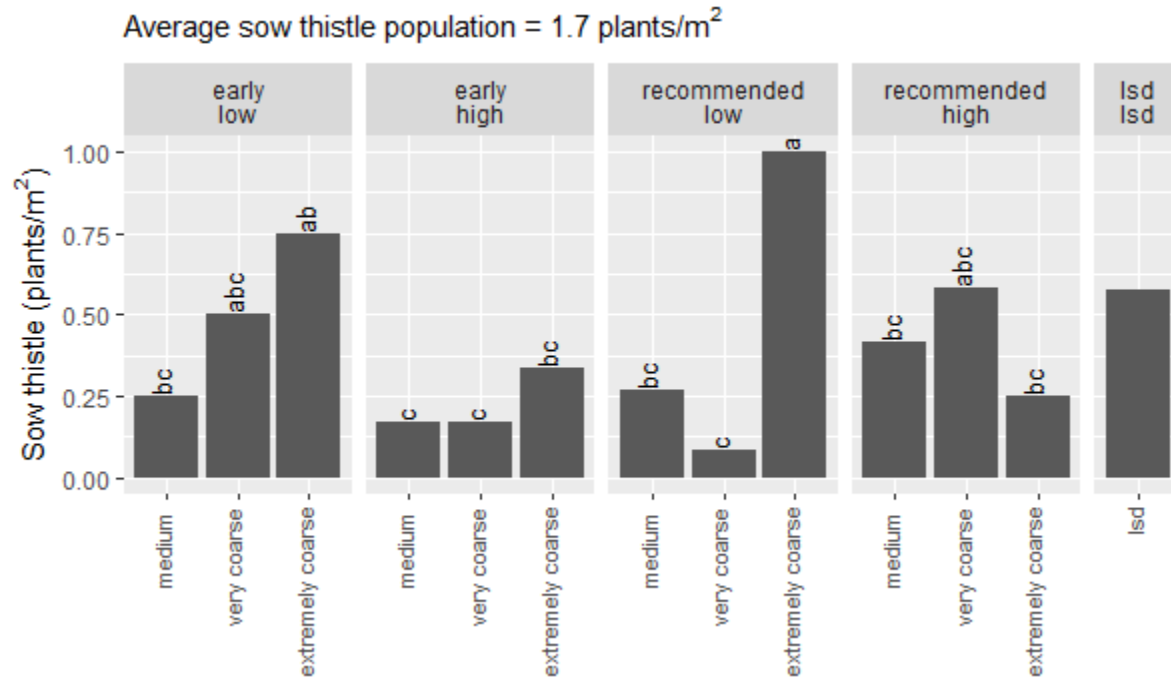


Figure 2: Number of surviving sow thistle assessed 28 days (early) and 20 days (delayed) after herbicide application at 2 water rates. Results with the same letter are not significantly different.

## All weeds:

- A medium spray quality resulted in the least number of surviving weeds regardless of timing or water rate.
- An extremely coarse spray quality at the low water rate had the highest numbers of surviving weeds regardless of timing.
- There was no difference in surviving weeds at the high water rate (regardless of spray quality or timing).

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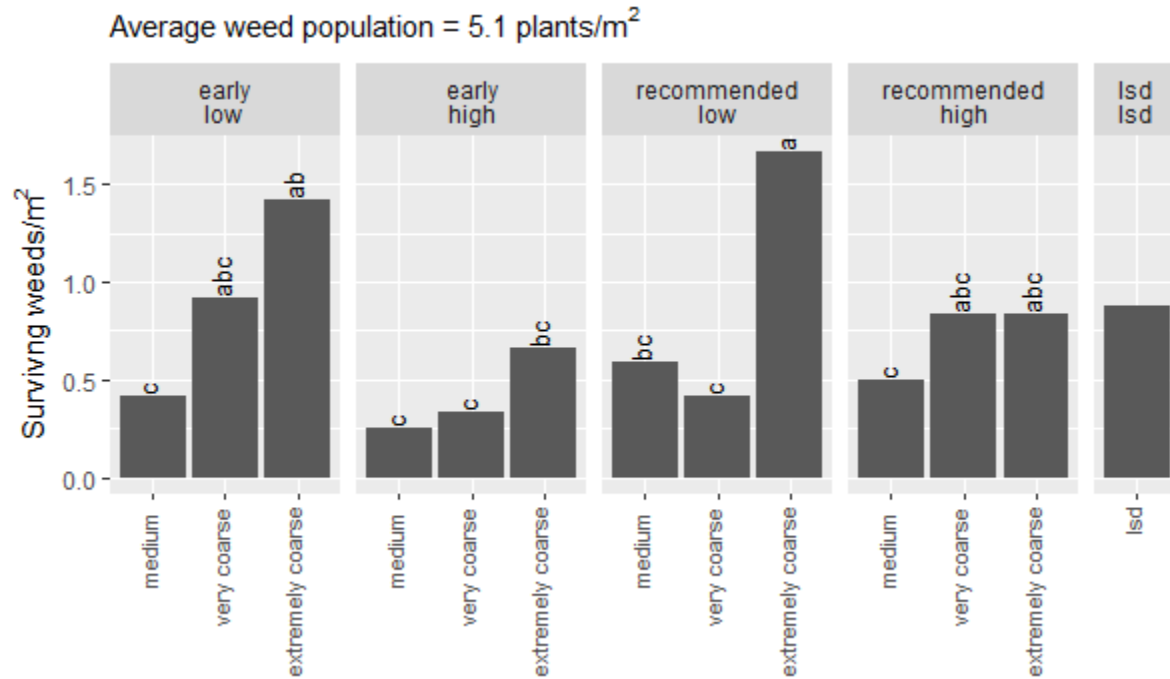


Figure 3: Number of surviving weeds assessed 28 days (early) and 20 days (delayed) after herbicide application at 2 water rates. Results with the same letter are not significantly different.

## Discussion

The weed density at this site was quite low and sporadic. The average weed population (untreated) was ~ 5 plants/m<sup>2</sup>. The better treatments reduced the total population by >90% from untreated populations (not shown).

For fleabane control:

- Medium spray quality resulted in the lowest number of surviving weeds.

For sow thistle:

- The greatest control was achieved with a medium spray quality, regardless of timing or water rate
- Extremely coarse spray qualities, applied with low water rates, regardless of timing resulted in the poorest weed control
- Increasing water rates did improve the outcome when using coarser spray qualities to levels similar to other spray qualities tested at lower water rates.

When considering overall weed control, medium spray qualities in all cases achieved the highest levels of control but were not always different to other spray qualities and water rates or timing. The worst level of control was resultant from extremely coarse when combined with low water rates. Increasing water rates or delaying application improved control to a level similar to other spray qualities at the same timing.

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## Conclusions

Control was optimized when medium spray qualities were used, regardless of timing or water rate. Moving to coarser spray qualities with low water rates often resulted in the lowest level of control. Increasing water rates or delaying applications improved the resultant control.

If growers are targeting smaller weeds or spraying earlier in the window to maximize fallow efficiencies, using medium spray qualities is worth considering label permitting. If labels specify the use of coarser spray qualities to minimize drift potential, they should consider both increasing water rates and also delaying application to ensure a larger target.

## Acknowledgements

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## Additional reading:

“Is our ryegrass really getting harder to kill through our over reliance on glyphosate?”

<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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## Appendix 1

### Results

Timing	Rate	Quality	Fleabane		Sow thistle		Total weeds	
(plants/m <sup>2</sup> )								
Early	Low	Medium	0.2	ab	0.3	bc	0.4	c
	Low	Very coarse	0.2	ab	0.5	abc	0.9	abc
	Low	Extremely coarse	0.3	ab	0.8	ab	1.4	ab
	High	Medium	0.0	b	0.2	c	0.2	c
	High	Very coarse	0.1	ab	0.2	c	0.3	c
	High	Extremely coarse	0.2	ab	0.3	bc	0.7	bc
Recommended	Low	Medium	0.5	a	0.3	bc	0.6	bc
	Low	Very coarse	0.2	ab	0.1	c	0.4	c
	Low	Extremely coarse	0.4	ab	1.0	a	1.7	a
	High	Medium	0.0	b	0.4	bc	0.5	c
	High	Very coarse	0.1	ab	0.6	abc	0.8	abc
	High	Extremely coarse	0.1	ab	0.3	bc	0.8	abc
Isd	Isd	Isd	0.5		0.6		0.9	

### Spray application details

Spray application	Timing 1	Timing 2
Date applied	8/02/2022	16/02/2022
Start time	2:00 PM	10:00 AM
Finish Time	2:25 PM	10:35 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 (°C)	29	28.7
Wind velocity (km/hr)	5-9	2-6
Wind direction	SW	NE
Humidity (%)	38	52.4
Δt	9.8	7
Nozzle	Various	Various
Cloud cover (%)	60	0