GOA Trial Site Report

Improving knockdown control of annual ryegrass – the effects of droplet size, water rate and timing.

Trial code:	**GAWE07021-1**
Season/year:	Autumn 2021
Location:	'Wullara', Forbes
Collaborators:	Matt Duff and Matt Shepherd

Keywords

GAWE070, Annual ryegrass, resistance, glyphosate, spray quality, water rates, application timing, Forbes

Key findings

- The small target leaf area of seedling ARG means that XC spray qualities were ineffective on small 2-3 leaf ryegrass.
- Increasing water rates when using XC spray qualities did not improve control, however delaying application to allow the target to develop to a larger size did
- The smaller spray qualities of M and F achieved optimum control at the earliest timing and the lowest water rates - delaying application or increasing water rate gave no more benefit
- Optimising spray quality, water rates and timing of application resulted in 75% less surviving ARG plants
- Herbicide resistance is not always the sole cause for spray failure
- Spray failures should be critically assessed, as resistance is one of many factors that may contribute to poor levels of control.

Background

Recent research[1] by Grain Orana Alliance (GOA) investigating the control of glyphosate resistant annual ryegrass (ARG) challenged the assumption that poor ARG control by commercial applications was often due to glyphosate resistance. The suggestion is not that herbicide resistance is not real or can be the sole reason for herbicide failures in some circumstances. But trial work has also shown that assumed glyphosate resistance populations have been controlled very effectively with only moderate label rates of glyphosate.

These spray failures for weed control could also be caused by factors such as inappropriate water rates, poor water quality, incorrect droplet size for the target plant, poor spray timing or antagonism with other tank mixed herbicides, poor weather conditions and other factors can also affect control.

[1] 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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This trial looks to investigate the influence of application timing, spray quality and water rates on the control of ARG using glyphosate.

Aims

To better understand the potential influence of spray application parameters, such as application timing, water rate or spray quality to control ARG using glyphosate

Methods

Herbicide treatments were applied by a ute mounted sprayer with a 12 m boom fitted with 24 nozzles spaced at 50 cm. To achieve the targeted spray qualities as identified by the GRDC Nozzle Selection Guide, January 2021.

All treatments used Roundup Ultramax at the rate of 950 mL/ha and used rainwater as the spray carrier. No adjuvant was added.

Two water rates were tested: low and high at 50 and 100 l/ha respectively.

Two timings were tested,

- Early (7/04/21) where the 'average' of the ARG population was at the 2-3 leaf stage
- Delayed (16/04/21) where the average of the ARG population was at the 4 – 5 leaf stage

Three different nozzle type were used:

- Turbo Teejet: producing a fine (F) spray quality
- TeeJet AIXR: producing a medium (M) spray quality
- TeeJet TTI nozzle: producing a extremely coarse (XC) spray quality.

Note that the current label (2025) for ROUNDUP ULTRAMAX recommend water rates of 80 l/ha or less. And NOT to apply with spray droplets smaller than COARSE to VERY COARSE. In this trial these parameters were exceeded to examine the impact, and it is not an endorsement or recommendation in any way.

To apply the treatments in this trial all nozzles were a 015 (green) nozzle size.

Trial details		
Trial establishment date	7.4.2021	
Crop stage	Fallow	
Trial design	Type: small plot (~12m x 3m) Design: randomized complete block Replication: 4	Analysis ASREML – randomized complete block. Tested to a 95% confidence interval

Results

There was good rain over the summer period up until March that resulted in a solid germination of ARG. April was dry and the ARG was slow growing at the time of application.

The site had an initial ARG population of ~300 plants/m^2. Resistance testing conducted by Plant Science Consulting showed the population to be rate-responsive glyphosate resistance (Table 1).

Table 1. ARG resistance testing results to glyphosate

Herbicide	Herbicide group	Paddock sample	
		Survival %	Rating
Glyphosate @ 285 g.a.i./ha	Group 9	40	Resistant (R)
Glyphosate @ 541 g.a.i./ha	Group 9	15	R
Glyphosate @ 855 g.a.i./ha	Group 9	0	Susceptible (S)

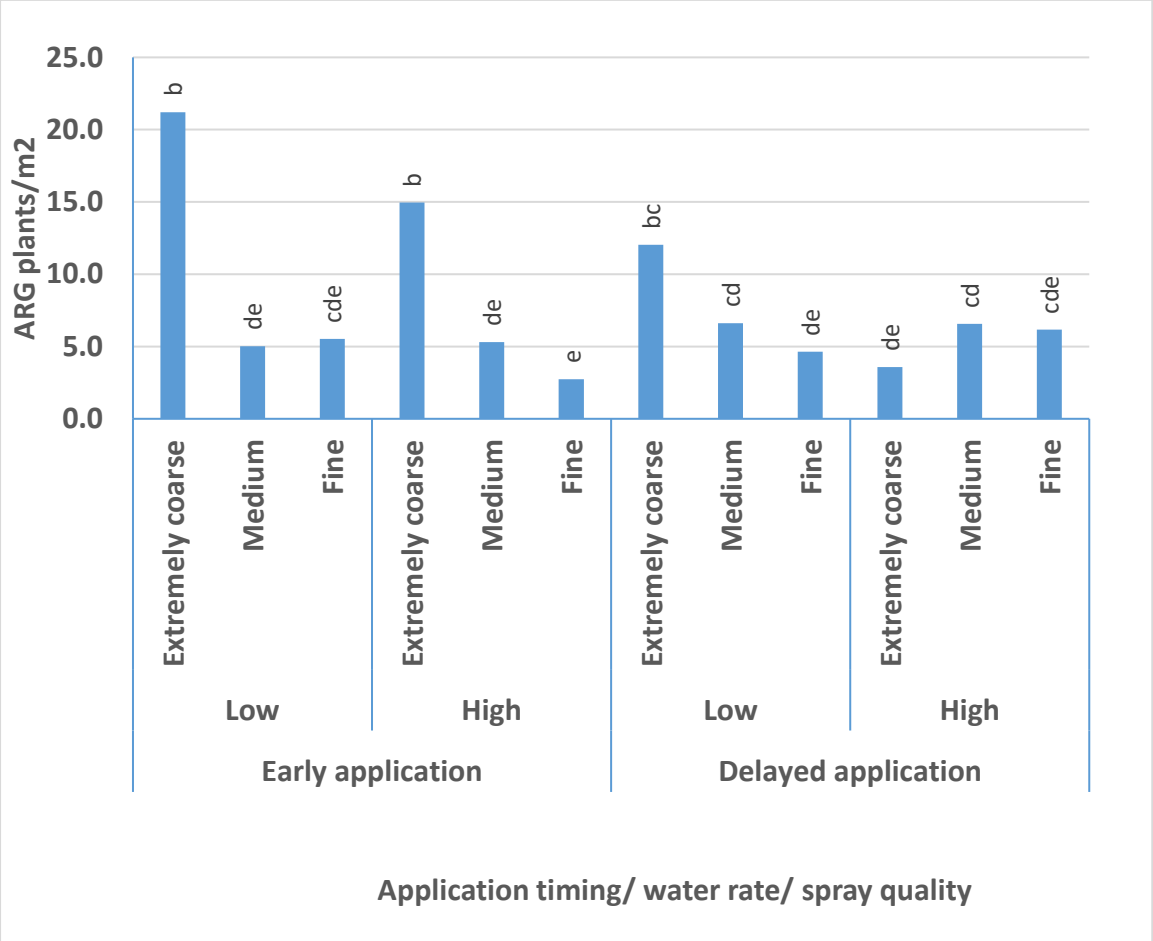

Figure 1. Surviving ARG numbers 43 days after application (DAA) in response to time of application, water rate (low or 100L) and spray quality. Treatments with the same letter are not significantly different.

As illustrated in Figure 1 at the early application the XC spray quality resulted in the highest population of survivors at both water rates. Moving to M or F spray quality improved the outcome. Delaying the application, resulted in no difference in the surviving populations or water rates except the XC and F at the low water rate.

The lowest level of survivors still resulted in ~5 plant/m^2, which would be commercially unacceptable but still represents on 25% of the population resulting from the use of XC spray qualities, at the earliest application timing.

Discussion

Using an XC spray quality at the earlier spray timing and low water rate resulted in the highest surviving population of ARG or the worst control (Figure 1). Often with the larger spray qualities it is suggested to increase water rates to compensate but in this circumstance a doubling of the water rate did not improve control. Only delaying application resulted in improved control, matching that what was achieved but the smaller spray qualities. It is postulated that this is as a result oof a larger target developing. At the earlier timing the larger spray droplets may simply not been capable of retaining the spray droplet rather than being missed by them. If the later was true, the increase in water rate would have compensated more than it did. Once the target had developed in size- increasing water rates did not improve performance from the XC spray.

In contrast applying a F or M spray quality on smaller plants at the earlier timing resulted in significantly fewer ARG (than the XC). There was no advantage to delays in application or increasing water rates using these spray qualities. This is most likely to the better coverage of the finer droplet spectrum.

The current (2025) label for Roundup ULTRAMAX stipulates that COARSE to VERY COARSE spray quality be used it is very important to match this with the plant size and water rate to ensure adequate coverage.

Conclusion

When using GLYPHOSATE products, it is important to check the label requirements regarding spray quality. Caution should be exercised if spraying small weeds with XC spray qualities. Based on this work increasing water rate did not improve outcomes. If spraying small targets, consider using the finest spray quality that the label and spray conditions would allow. If this is achieved, increasing water rates may not achieve any further improvements to control.

Acknowledgements

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manufacturer referred to. Other products may perform as well or better than those specifically referred to.

Appendix

TIMING	WATER RATE	SPRAY QUALITY	WATER RATE	TIMING	ARG/m2	LSD
Early application	Low	Extremely coarse	Low	Early	21.2	b
		Medium	Low	Early	5.0	de
		Fine	Low	Early	5.5	cde
	High	Extremely coarse	High	Early	15.0	b
		Medium	High	Early	5.3	de
		Fine	High	Early	2.7	e
Delayed application	Low	Extremely coarse	Low	Delayed	12.0	bc
		Medium	Low	Delayed	6.6	cd
		Fine	Low	Delayed	4.6	de
	High	Extremely coarse	High	Delayed	3.6	de
		Medium	High	Delayed	6.6	cd
		Fine	High	Delayed	6.2	cde