

Impact of application timing, spray quality and water rates on fallow weed control when using glyphosate

Grain Orana Alliance

Trial Code:	GAWE06522-2
Season/Year:	Summer 2022
Location:	The Wilgas, Wongarbron
Trial Partners:	Maurie and Kate Street
Trial Establishment Date:	22 March 2022

Keywords

GAWE065, annual ryegrass, sow thistle, milk thistle, fleabane, hard to kill weeds, resistance, glyphosate, spray quality, water rates, application timing, Wongarbron.

Key findings

- Increasing the water rate and delaying herbicide application by a week improved the level of weed control.
- The use of extremely coarse spray quality and low water rates had the lowest levels of control, regardless of application timing.

Background

Resent research undertaken by Grain Orana Alliance (GOA) investigating options to manage glyphosate resistant ryegrass (ARG). GOA speculated that the assumption of resistance was sometimes incorrect despite poor control by commercial applications on the targeted populations. Furthermore, it is speculated that other factors often play a significant part in the poor control often experienced.

Other contributing factors to weed control failure could include; inappropriate water rates, poor water quality, inappropriate droplet size for the target plant, poor spray timing or antagonism with other tank mixed herbicides, and poor weather conditions among others.

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This is not to suggest that herbicide resistance is not real or not the main reason for failure in some circumstances, however in the presence of resistance, shortcomings in our efforts to control weeds are being highlighted by poor control, which if rectified, could be much improved.

This has encouraged GOA, with support of the Grains Research and Development Corporation (GRDC), to undertake several lines of investigations to better understand the influence some of these factors may have on the efficacy of many of our spray applications.

Suggested reading- (<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>) ¹

Aims

Determine the impact of application timing, water rate or spray quality on the control of general fallow weeds, at this site this included sow thistle, using glyphosate.

Methodology

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

Treatments

All treatments: 450 gai/ha glyphosate (Panzer 450 @ 1L/ha), no additional pesticides or wetters were added.

Plots were sprayed using a ute mounted, 12m boom with 4 by 2.5 m sections. On each section different nozzles were used to apply 3 differing spray qualities and an untreated plot, detailed in Table 1 below.

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 in 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:

- Low = 50 L/ha (~16 km/hr)
- High = 100 L/ha (~8 km/hr).

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Two application timings:

- Early: targeting smaller weeds earlier in the application window (22/3/2022)
- Delayed: targeting larger target weeds in the applications window (1/04/2022, 10 days after the early application).

Spray quality and nozzles used are listed in Table 1.

Table 1: Nozzles used and spray quality/droplet size at the operating pressure of 4 bar²

Nozzle	Spray quality
AIXR110-02	Medium (M)
Hardi InJet 02	Very coarse (VC)
TTi110-02	Extremely coarse (XC)

Results

All weeds: the medium spray quality regardless of water rate or timing resulted in the lowest or equally lowest level of surviving weeds. When the application was delayed and applied as a low water rate and a XC droplet it resulted in the lowest level of control, however increasing water rate resulted in the lowest level of survival out of any treatment but this was no different than any other spray quality at that timing or water rate. The average weed population was 10 plants/m² (assessed in untreated plots, not reported).

² grdc.com.au/___data/assets/pdf_file/0029/438743/GRDC_Nozzle-Selection-Guide_2020_03.pdf

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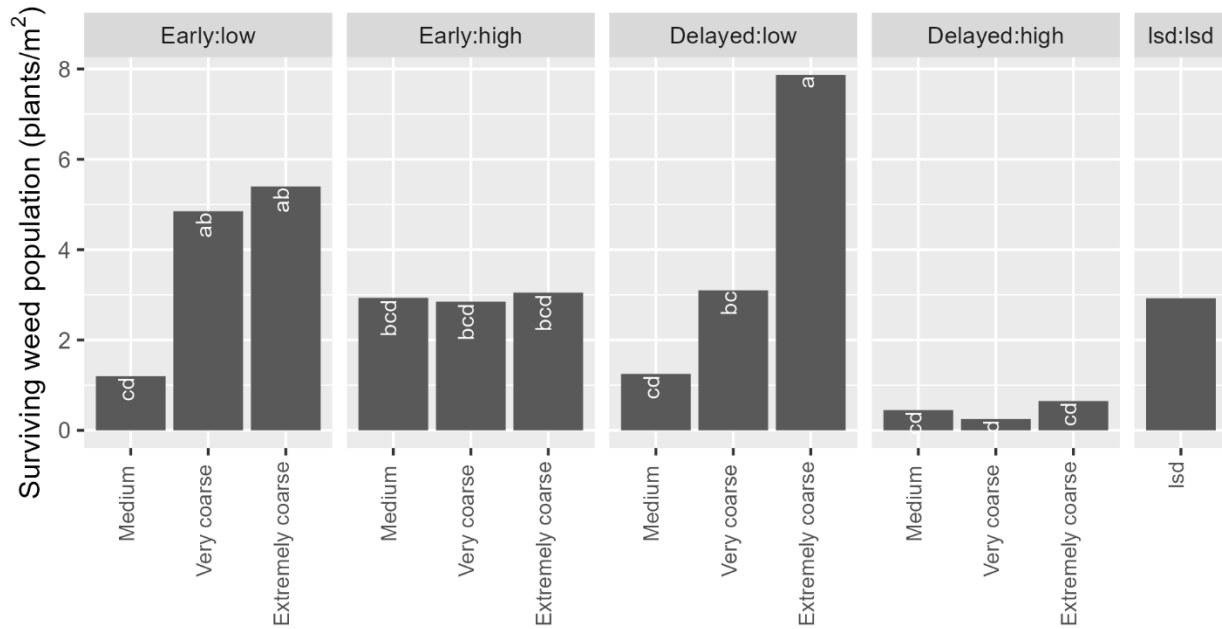
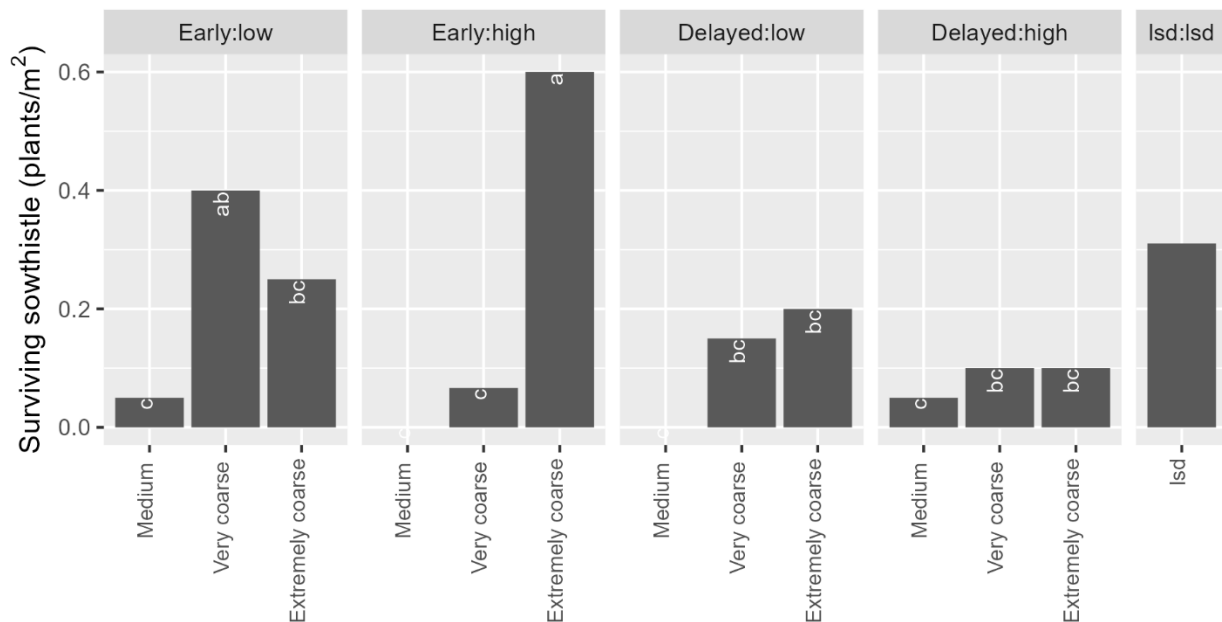


Figure 3: Surviving weed numbers assessed 45 days (early) and 35 days (recommended) after application. Treatments with the same letter are not significantly different.

Sowthistle: sowthistle population was 0.94 plants/m² (in untreated plots, not reported) and ranged from 2-8 leaf at the time of applications.



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Figure 1: Surviving sowthistle numbers assessed 45 days (early) and 35 days (recommended) after application in response to two application timings and two water rates and three spray qualities. Treatments with the same letter are not significantly different.

At both application timing and water rates the medium spray quality resulted in the lowest remaining weeds but it was not always different to other combinations. Where applications were delayed, regardless of water rates, all treatments resulted in the same level of control. At the early timing the XC spray quality at the high water rates resulted in the highest number of surviving sowthistles, significantly worse than the other spray qualities.

Remaining weeds:

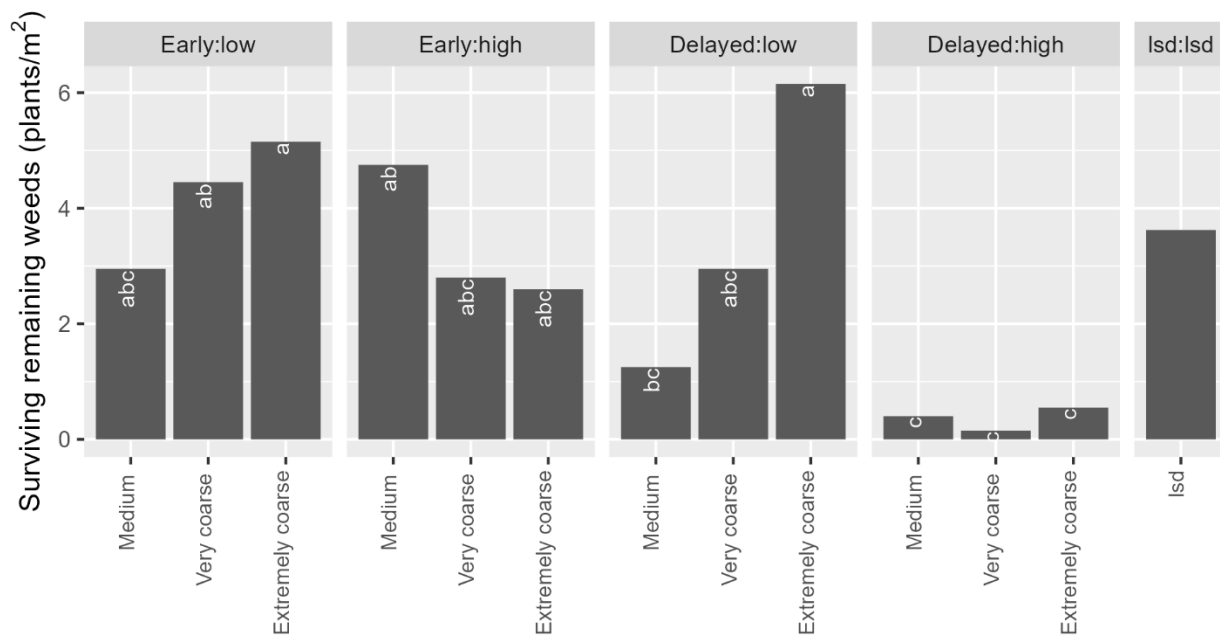


Figure 2: Number of surviving weeds (other than sowthistle) assessed 45 days (early) and 35 days (delayed) after application. Treatments with the same letter are not significantly different. See above comments

Discussion

The weed density and species at this site was mixed; sowthistle, cathead, fleabane and prickly lettuce being dominant. The average weed population (untreated) was ~10 plants/m². The average level of control across all treatments was low at about 70%.

- For the control of sowthistle (the most dominant weed in this trial), a 'medium' spray quality provided the highest reduction in the weed population regardless of timing or water rate. However, several other treatments achieved similar outcomes. The greatest number of survivors, depending on the weeds species, was where an XC droplet was applied in a low water rate at the

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delayed timing, but this was not dissimilar to the same spray quality and water rate applied at the early timing.

- Sowthistle control was worst where VC or XC spray qualities were used regardless of water rate.
- For other weeds using a high water rate at the delayed timing regardless of the spray quality employed resulted in the lowest survival.
- Overall, for both sowthistle and the other weeds the use of XC spray quality resulted in poor level of control, alternatively the use of a M quality generally resulted in the best outcome at any given water rate or timing.
- It may be that in a mixed weed population, different species will respond differently to timing, water rates and spray quality. In this trial, the delayed timing at a higher water rate provided the most consistent control regardless of spray quality, demonstrating that herbicides can possibly be applied too early.

Conclusions

- Medium spray qualities regardless of application timing or water rate offered consistently better control. The use of larger spray qualities, particularly the XC often resulted in higher levels of survival unless spray was delayed and water rates increased.
- If wanting to spray weeds in the early part of the application window, it may be advisable to avoid coarser spray qualities. Even where water rates were doubled to 100 L/Ha control was not always improved.
- If conditions dictate or drift excludes the use of M spray qualities, the use of coarser qualities such as a very coarse or XC and increasing water rates may improve efficacy, however delaying application may be more effective.

- **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 and Kate Street who hosted this trial.

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Appendix

Results

Timing	Rate	Quality	Other weeds	Sowthistle (plants/m2)	Total weeds
Timing1	Low	medium	2.9 abc	0.0 c	1.2 cd
	Low	very coarse	4.4 ab	0.4 ab	4.8 ab
	Low	Extremely coarse	5.2 a	0.2 bc	5.4 ab
	High	Medium	4.7 ab	0.0 c	2.9 bcd
	High	Very coarse	2.8 abc	0.1 c	2.8 bcd
	High	Extremely coarse	2.6 abc	0.6 a	3.0 bcd
Timing2	Low	Medium	1.3 bc	0.0 c	1.3 cd
	Low	Very coarse	3.0 abc	0.1 bc	3.1 bc
	Low	Extremely coarse	6.1 a	0.2 bc	7.9 a
	High	Medium	0.4 c	0.1 c	0.5 cd
	High	Very coarse	0.1 c	0.1 bc	0.3 d
	High	Extremely coarse	0.6 c	0.1 bc	0.6 cd
lsd	lsd	lsd	3.6	0.3	2.9

Spray application Details

Spray application	Timing 1	Timing 2
Date applied	22/03/2022	1/04/2022
Start time	7:30 AM	9:40 AM
Finish time	8:00 AM	10:00 AM
Water rate (l/ha)	50/100	50/100
Speed (km/hr)	8/16	8/16
Pressure (bar)	4	4
Equipment	Ute mounted boom	Ute mounted boom
Temp (oC)	16.4	18.4
Wind velocity (km/hr)	0-3	1-4
Wind direction	E	E
Humidity (%)	78.3	52.7
Δt	2.3	6.1
Nozzle	various	various
Cloud cover (%)	0	0