GOA Trial Site Report

Investigating alternative herbicide options for the control of resistant populations of annual ryegrass (*Lolium rigidum*)

Trial Code: GOWE04918-1

Season/Year: Autumn, 2018

Location: Narromine

Trial Partners: Richard Tink and Matt Shephard

Keywords

GOWE049, Annual ryegrass, resistance, knockdown, adjuvants, glyphosate, paraquat, wetters, Narromine

Take home messages

- Paraquat or products with a paraquat component can provide good levels of control of annual ryegrass – though important to ensure adequate coverage
- A range of other alternate herbicides tested were not useful in improving ARG control
- Knowing the resistance status of annual ryegrass populations allows for the use of the appropriate management option

Annual ryegrass (ARG) is expressing increasing levels of resistance to various herbicides across the Orana Region. Developing glyphosate resistance is arguably the highest concern, as it is key for ARG knockdown control in the fallow period. Effectiveness of glyphosate needs to be protected as much as possible to prolong its useful life.

This trial focuses on testing various knockdown options (including glyphosate tank mixes) for the control of glyphosate resistant ARG.

DISCLAIMER

Following is a report on a scientific experiment. It may contain some herbicide treatments that are not registered for the situation, manner or rate at which they are used in this trial. This document or anything else resulting from, construed or taken from this or by GOA or its representatives should not be taken as a suggestion, recommendation or endorsement for unregistered herbicide use.

Aim

Test the efficacy of a range of knockdown herbicide options for the control of ARG (with suspected resistance to glyphosate).

Methods

A small plot randomised complete block split design with three replicates was used for trial. It was established in a growers' paddock with visible ARG population.

Herbicide treatments (Table 2), were applied using an ATV mounted boom.

Results were analysed by ANOVA and results compared by using a LSD method with a 95% confidence interval. Any references to differences between treatments should be assumed to be statistically

different unless otherwise stated. The Analysis of Variance (ANOVA) and Least Significant Difference (LSD) tests are used to measure the difference between the averages.

Table 1. Trial site details

Trial Establishment Date	Winter, 2018
Soil Type	Sandy Red Loam
Previous Crop	Wheat
ARG resistance status	Detailed in appendix- suspected resistance to glyphosate

Table 2. Treatment list (products, chemical groups and active ingredients are listed in the annex).

Product 1	Rate (mL or g)	Product 2	Rate (mL or g)	Adjuvant	rate %
Alliance®	2800	-	-	-	-
Alliance®	1500	-	-	-	-
Boxer Gold®	2500	-	-	-	-
Clethodim	250	-	-	Uptake™	0.50%
	500	-	-	Uptake™	0.50%
Paraquat	1000	Balance®	100	-	-
	1000	Boxer Gold®	2500	-	-
	1000	diuron	280	-	-
	1000	-	-	-	-
	1500	-	-	-	-
	2000	-	-	-	-
Roundup CT®	500	Boxer Gold®	2500	Wetter TX	0.20%
	500	clethodim	250	Uptake™	0.50%
	500	Sledge®	150	Wetter TX	0.20%
	500	Sharpen®	34	Hasten™	1.00%
	500	Verdict™	150	Uptake™	0.50%
	500	-	-	Wetter TX	0.20%
Verdict™ 520	150	-	-	Uptake™	0.50%
	300	-	-	Uptake™	0.50%
Untreated control (UTC)	-	-	-	-	-

Table 3. Application records

First application	**Date Applied**	9/8/2017	**Temp (°C)**	**Wind (km/h)**	**Wind Dir.**	**Humidity (%)**
	Start time	16:40	17.1	0.4-1.0	S	41.4%
	Finish Time	15:00	**Δt**	7.1	**% Cloud**	5%
	Water rate (L/ha)	100	**Nozzle**	AIXR015	**Pressure**	3
	Equipment	ATV	**Speed**	7-8 km/hr		

Results

The ARG population in this trial was moderate with over 100 plants/m^2, as measured in the UTC.

While the site was selected because grower and agronomist suspected ARG resistant to glyphosate, commercial testing did not detect resistance. Commercial testing did not detect any ARG resistance to glyphosate, but it was resistant to Intervix.

Group A herbicides: Application of clethodim at the higher rate (500 mL/ha) provided close to 96% control (when compared to the UTC plots). Statistically, this result was not different to the performance of clethodim at the lower rate (250 mL/ha) or to Roundup CT® treatment (550ml/ha). Verdict™ only controlled approximately 50% of ARG (**Figure 1**).

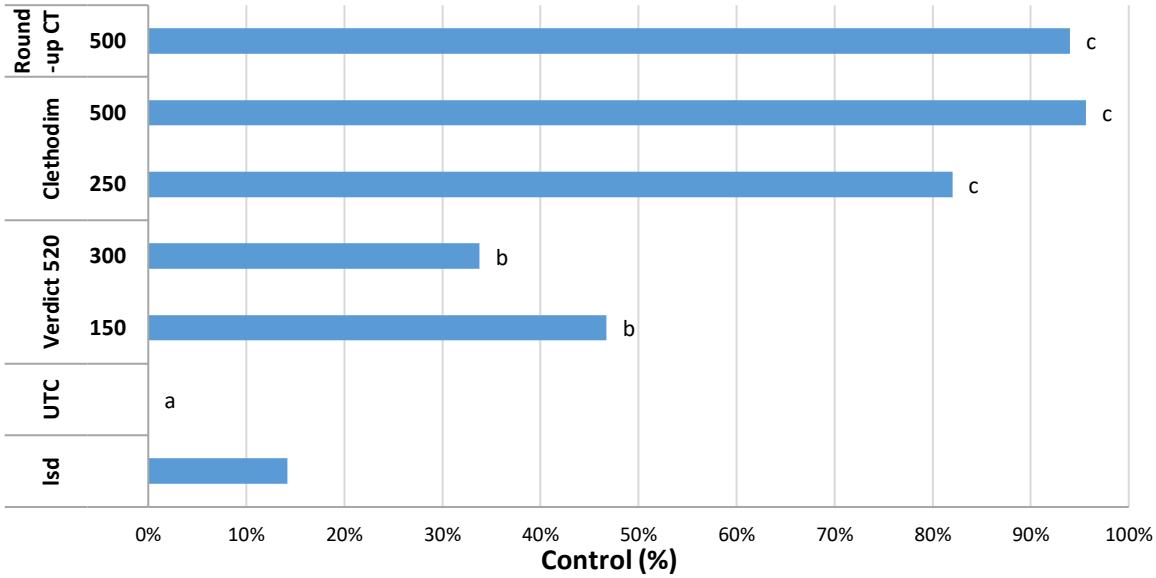

Figure 1. Percentage ARG control (compared to UTC) for a single application of selected Group A herbicides and Roundup CT®, 39 days after initial application.

Glyphosate tank mixes: Roundup CT® treatment (750 ml/ha) achieved close to 94% control, which was not (statistically) improved by the addition of any tank mixes. (**Figure 2**).

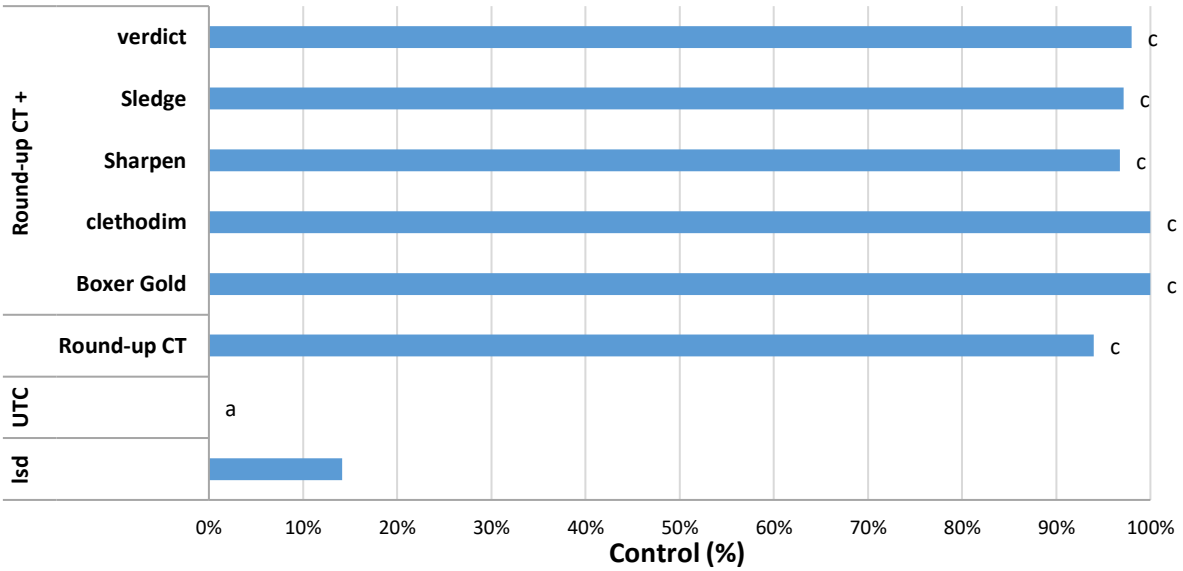

Figure 2. Percentage control of ARG (compared to UTC) for selected herbicides tank mixed with Roundup CT® (@500 ml/ha), 39 days after initial application.

Paraquat at 2000 mL/ha controlled approximately 96% of ARG. Paraquat at lower rates was not significantly lower in control but control did trend to be lower. Addition of a range of tank mix partners did not improve control over paraquat alone. Paraquat with selected tank mix partners did not significantly improve control. The level of control provided by Roundup CT® @ 500 mL/ha was not significantly different to any of the paraquat options (**Figure 3**). Control provided by Alliance® was not

statistically different to any of the paraquat treatments. Boxer Gold® alone only provided low levels of control (26%).

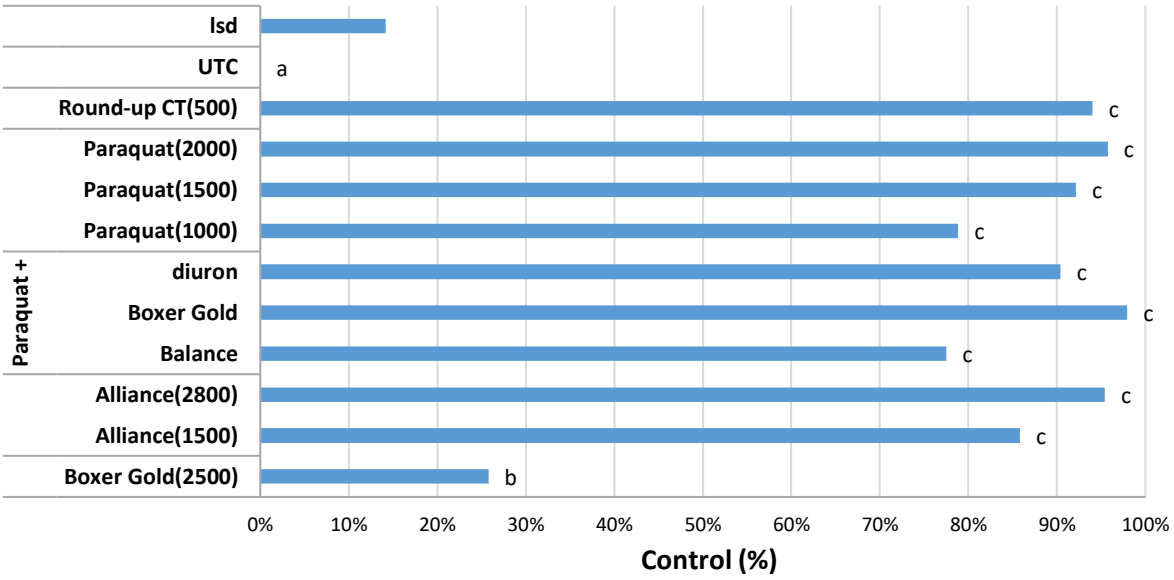

Figure 3. Percentage ARG control (compared to untreated) for paraquat, selected herbicides tank mixed with paraquat and Alliance®. Assessed 39 days after initial application.

Discussion

The trial site was selected as both grower and advisor suspected the ARG population had resistance to glyphosate because of past poor control. However, commercial testing did not detect any glyphosate resistance. Common commercial experiences with poor glyphosate control of ARG populations questions why is this the case? Could it be related to application set up, water quality for spraying or timing or other factors?

ARG population at this site was found to be strongly resistant to Intervix®, however, no resistance was detected to Group A herbicides clethodim and Verdict™. Excellent control was achieved with clethodim, even at the lower rate. However, Verdict™ ARG control was relatively poor.

Both Roundup CT® @ 500 mL/ha and paraquat @ 2000 mL/ha provided high levels of control. Adding a tank mix or adjuvant to either of these products did not improve control.

Alliance® and paraquat provided high levels of control and the addition of various tank mixes to paraquat did not significantly improve the level of control.

In this trial paraquat, clethodim and Alliance® were found to provide good levels of ARG control (on glyphosate susceptible populations) and could be considered as alternatives to glyphosate.

Conclusion

Knowing the glyphosate resistance status of ARG populations is important to determine rate and product requirements for better control.

Paraquat (and Alliance®) may be suitable alternatives to glyphosate for ARG control. Where Group A, specifically clethodim resistance is not present then Clethodim may also be an option. Addition of various products to either glyphosate or paraquat did not improve control.

Acknowledgements

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DISCLAIMER — TECHNICAL

Appendix –

Figure 4- Excerpt from herbicide resistance tests performed on ARG population

Table 1: Results as determined by resistance testing 3 weeks after treatment. Data recorded as % survival (% of plants surviving) as compared to untreated plants. 100% refers to all plants surviving and 0% refers to death. Data is the mean of 2 replicate pots per herbicide rate. Included in the test was a susceptible (S) biotype and resistant biotypes. Data for the S and R biotypes is not shown.

Herbicide	**Herbicide Group**	**Paddock Sample** Alisons	
		Survival	Rating
Select 250ml/ha + 1% Hasten	Group A - Dims	0	S
Select 500ml/ha + 1% Hasten	Group A - Dims	0	S
Verdict 520 @ 100ml/ha + 1% Hasten	Group A - Fops	0	S
Roundup CT @ 750ml/ha + 0.2% Wetter TX	Group M	0	S
Intervix 500ml/ha + 1% Hasten	Group B - Imidazolinones	85	RRR
Paraquat 2L/ha + 0.2% BS1000	Group L	0	S

Resistance-rating:	RRR- indicates plants tested have strong resistance	RR - indicates medium-level resistance	R-indicates low-level but detectable resistance	S- indicates no detection of resistance

Ryegrass control 30 days after the application of various glyphosate treatments.

Product 1	**Rate 1**	**Product 2**	**Rate 2**	**Adjuvant**	**Rate**	**ARG/m^2**		**Control (%)**	
Alliance®	1500					28	c	86%	bcde
	2800					9	c	95%	abc
Boxer Gold®	2500					156	b	26%	g
Clethodim	250			Uptake™	0.50%	34	c	82%	cde
	500			Uptake™	0.50%	8	c	96%	abc
Paraquat	1000	Balance®	100			43	c	78%	e
	1000	Boxer Gold®	2500			4	c	98%	ab
	1000	diuron	280			22	c	90%	abcde
Paraquat	1000					38	c	79%	de
	1500					14	c	92%	abcd
	2000					7	c	96%	abc
Roundup CT®®	500	Boxer Gold®	2500	Wetter TX	0.20%	0	c	100%	a
		clethodim	250	Uptake™	0.50%	0	c	100%	a
		Sharpen®	34	Hasten™	1.00%	6	c	97%	ab
		Sledge®	150	Wetter TX	0.20%	5	c	97%	ab
		Verdict™	150	Uptake™	0.50%	4	c	98%	ab
				Wetter TX	0.20%	9	c	94%	abc
Verdict™ 520	150			Uptake™	0.50%	113	b	47%	f
	300			Uptake™	0.50%	147	b	34%	fg
UTC						218	a	0%	h
lsd						46		14%	

List of products and active ingredients

Registered Name	Group	Active
Alliance	L Q	250 g/l amitrole, 125 g/l paraquat
Boxer Gold®	J K	800 g/l Prosulfocarb, 120 g/l S-Metolachlor
Roundup CT	M	455 g/l glyphosate
Sharpen® WG	G	700 g/kg saflufenacil
Sledge®	G	25 g/L Pyraflufen-ethyl
Platinum	A	240 g/L Clethodim
Diurex	C	900g/kg diuron
Verdict 520	A	520 g/l Haloxyfop