

## Alternate herbicide options for fallow control of (glyphosate resistant) common sow thistle (*Sonchus oleraceus*)

**Trial Code:** GOWE01618  
**Year/Season:** Summer 2017/18  
**Location:** 'Kurrajong Park', Coolah  
**Trial Cooperators:** Tim Whiting and Andrew McFadyen

### Keywords

GOWE016, common sow thistle, milk thistle, herbicide, resistance, glyphosate, paraquat, double knock, *Sonchus oleraceus*, Coolah

### Take home messages

- In this trial the following herbicides Velocity®, paraquat, Basta®, Sharpen® (26g/ha) and Pixxaro® EC provided effective control of common sow thistle
- Using paraquat as a double knock, following a range of 'initial' herbicide treatments was also effective even when the 'initial' treatments resulted in poor levels of control
- Using paraquat in a double knock strategy following normal herbicide use may offer a resistance management option to slow the development and the spread of glyphosate resistant common sow thistle but only where the control from the initial treatment was good.

### Background

Common sowthistle or milk thistle is a becoming a significant weed in our farming systems for a number of reasons but might primarily include its adaption to a wide variety of growing environments, prolific seeding rate and its ability to germinate almost any time of the year. In addition, sow thistle will not readily germinate and emerge from depth so the adoption of zero or minimal tillage systems that allow seedbanks to increase at or near the soil surface may have also allowed the weed to increase in its prevalence.

Currently glyphosate is the most common, primary herbicide used to control milk thistle in non-crop or fallow situations, but it also is commonly used in conjunction (tank mixes) with several other herbicides aiming at improved control.

However, there are concerns with the recent identification of glyphosate resistance that controlling this weed may become increasingly difficult as glyphosate becomes ineffective placing the burden for weed control onto tank mix partners. There are also concerns that our current system is over reliant on glyphosate as the primary herbicide to control sow thistle and that if we need to identify more effective tank mix options which may reduce or slow the rate of resistance development.

This trial has been designed to investigate what herbicide options might be effective at controlling sow thistle as stand-alone products, that is those with the ability to offer high levels of control. These products may still be used in conjunction with glyphosate as a tank mix but as a tank mix partner they will be effective at controlling any glyphosate resistant sow thistle plants present.

## 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 of any unregistered herbicide uses.

## Aim

This project has the following main aims:

- Investigate alternatives to glyphosate for the knockdown of common sow thistle.
- Determine the effectiveness of a double knock herbicide application.

## Methods

A small strip plot replicated trial was established in the summer of 2017/18 in an existing population of established sow thistle, which was at rosette stage approximately 10-20cm in diameter and growing under very hot and dry conditions (at the time of treatment).

The resistance status of the sow thistle at this site was unknown but it was not expected to be resistant to glyphosate. However, as the trial was interested in identifying potential herbicide options to be used when the common sow thistle is glyphosate resistant, most options did not contain glyphosate in the mix. As a result, any control from those options can be entirely attributed of the ability of those herbicides to control the common sow thistle.

A range of herbicide options as detailed below in **Table 1** were applied on the 17/4/2018. The double knock containing 2 L/ha of paraquat was applied on 23/4/2018 to one half of each plot.

All treatments were applied by an ATV mounted boom fitted with AIXR015 nozzles at 50 cm spacing operated at 3 bar applying a total spray volume of 100 L/ha as medium-coarse droplets.

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

# GOA Trial Site Report

**Table 1.** Herbicide treatments and rates applied

Product 1	Rate (mL or g)	Product 2	Rate (mL or g)	Adjuvant	rate %
Amicide® Advance 700	1600				
Amicide® Advance 700	1600	SHARPEN® WG	26	Hasten™	1.00%
Basta®	3750				
LVE Ester 680	800			Uptake®	0.50%
Grazon® Extra	500				
SHARPEN® WG	26			Hasten™	1.00%
Paraquat 250	2000				
Pixxaro® EC	400			Uptake®	0.50%
Precept®	1000			Uptake®	0.50%
Roundup® DST®	575			Activator®	1.25%
Roundup® DST®	1500			Activator®	1.25%
SHARPEN® WG	17			Hasten™	1.00%
SLEDGE®	160				
SLEDGE®	160	Roundup® DST®	575	Activator®	1.25%
Starane™ Advanced	600				
Stinger™	14	Starane™ Advanced	600	Wetter 1000	0.10%
Untreated control	0				
Velocity®	1000			Uptake®	0.50%

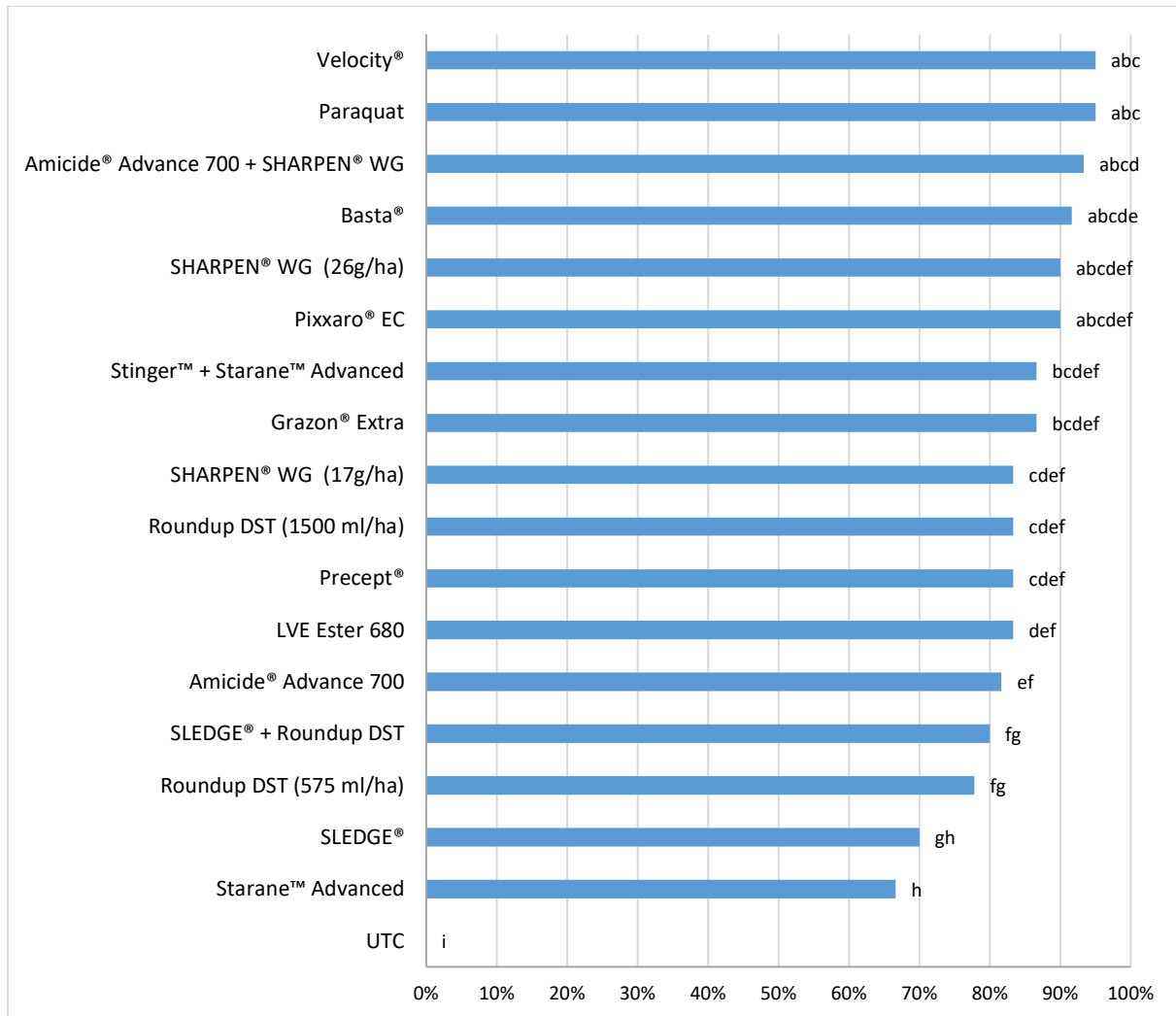
## Results

The results of the resistance testing and the full set of trial results are in the appendix.

**RESISTANCE STATUS:** at this site resistance to glyphosate was not detected by commercial testing, however, moderate levels of resistance were detected to Ally® with about 40% of the population expected to survive (see the Appendix)

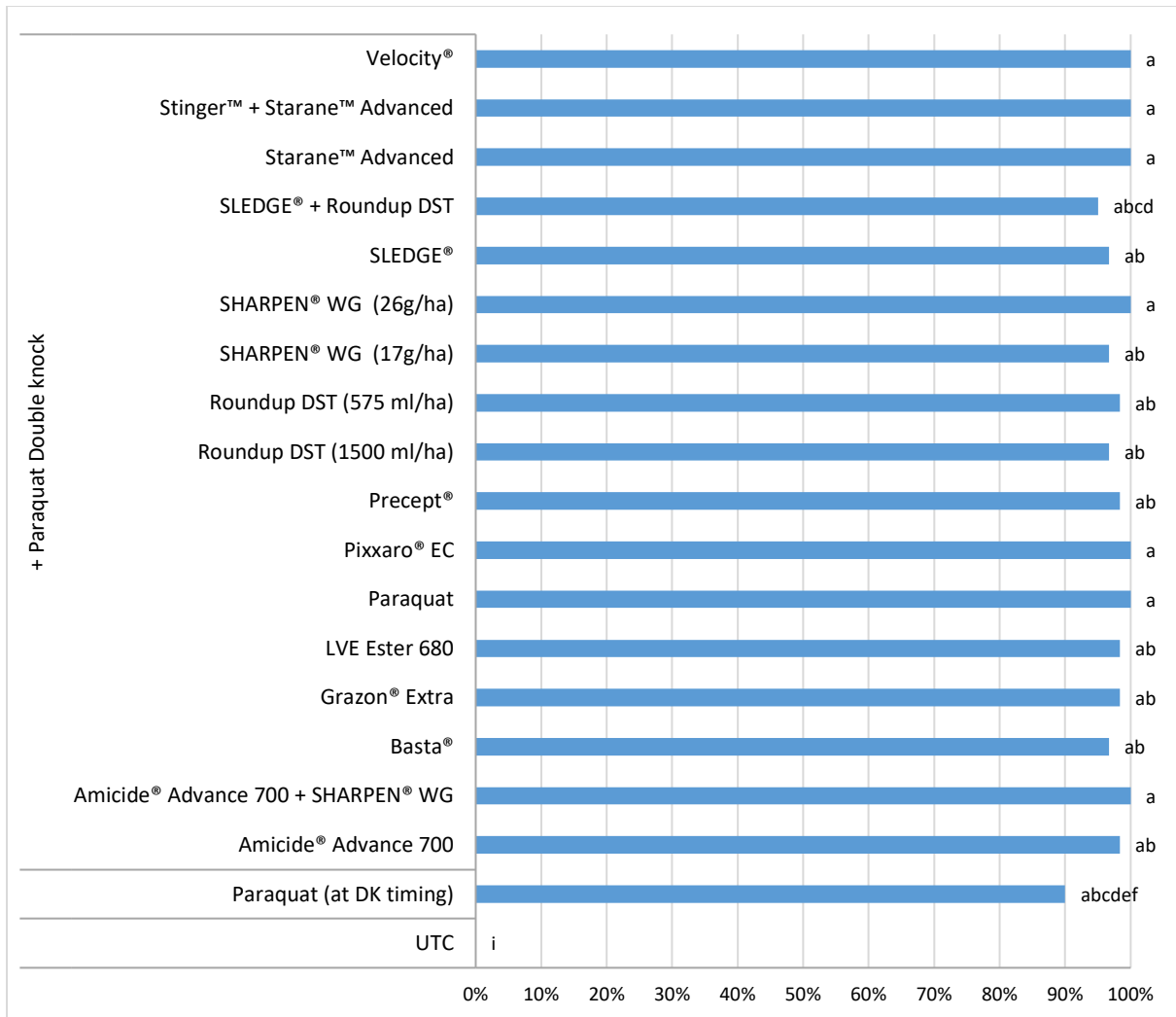
**SINGLE PASS:** The single pass treatments of Velocity®, paraquat, Basta®, Sharpen® (26g/ha) and Pixxaro® EC all resulted in greater than ~90% control when compared the untreated plots. Further, the level of control provided by the following products; Grazon® Extra, Sharpen® (17g/ha), Roundup® DST (1500mL/ha) and Precept® was as good as the best performing product (Velocity®, 95% control).

Tank mixes of Amicide® Advance 700 + SHARPEN® WG provided high levels of control however did not improve the level of control compared to Sharpen® (26g/ha) as a standalone. Stinger™ + Starane™ Advanced also provided high levels of control and did improve the performance of Starane™ Advanced (as a standalone). The other tank mix of SLEDGE® + Roundup® DST® provided approximately 80% control and was not an improvement of using either product as a stand-alone (**Figure 1**).



**Figure 1.** Sow thistle estimated percentage control achieved by various single pass herbicide treatments – assessed 41 days after treatment.

Half of every plot (strip plot) was treated with 2 L/ha paraquat applied 7 days after the first pass. This resulted in a commercial level of control across all treatments when compared to the untreated control (UTC) (Figure 2). The level of control provided by the first pass did not influence the level of control provide by the double knock. One half of the untreated control plots were treated with paraquat at 2 l/ha at the double knock timing, the levels of control were 90% and not significantly different to any of the double knocked (DK) plots.



**Figure 2.** Sow thistle estimated percentage control achieved by a double knock of paraquat at 2 l/ha – assessed 41 days after treatment

## Discussion

Testing at this site did not reveal any sow thistle resistance to glyphosate, and the performance of Roundup® DST® in this trial would tend to support these results.

The level of control provided by Roundup® DST® at the lower label rate (575 mL/ha) was not commercially acceptable. In this trial sow thistle ranged from 5-30 cm in diameter and some plants were starting to elongate at the time of application, somewhat larger than the label recommendation up 'up to 3 cm diameter'.

Several products provided over 90% control as a single pass providing confidence that alternatives to glyphosate are available. These include Velocity®, paraquat, Basta®, Sharpen® (26g/ha) and Pixxaro® EC. The tank mixes tested were either not better than the performance of one or the other of the partners (i.e. Amicide® Advance 700 + SHARPEN® and WG and SLEDGE® + Roundup® DST®) and/or the level of control was less than commercially acceptable (i.e. Stinger™ + Starane™ Advanced and SLEDGE® + Roundup® DST®). Suggesting the tank mixes in this trial didn't offer much improvement for the additional costs.

In this trial paraquat as a single pass achieved around 95% control at the first application timing and 90% when applied at the same time as the double knock, within commercially acceptable levels of control (>90%) as a single pass option.

The performance of paraquat on sow thistle confirms that it can be successful as a single pass option, and that its application can be delayed. The results from this trial would suggest that farmers should avoid using standalone products such as SLEDGE®, Starane™ Advanced and Amicide® Advance 700 to control sow thistle. If these products are to be used as a first pass to target 'other weeds', the use of paraquat 'double knock' should be seen more as part of the weed management strategy for the 'other weeds' and a first pass control on sow thistle.

In this trial, regardless of the level of effectiveness of the initial treatments, a double knock treatment with paraquat resulted in very high levels of control.

## Conclusion

In this trial several herbicides provided a high and acceptable level of control of small to medium common sow thistle plants including Velocity®, paraquat, Basta®, Sharpen® (26g/ha) and Pixxaro® EC.

This trial has demonstrated that paraquat can be employed either as part of a single pass approach or used as a double knock, following up any conventional herbicide choices to achieve high levels of control and avoid over the reliance on glyphosate. Paraquat, based on this and other trials, is likely one of the useful alternatives to glyphosate for the control of common sow thistle.

## 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 the Paspaley Pastoral and the staff at Kurrajong Park who hosted this trial.

## Appendix

Figure 3- Excerpt from herbicide resistance tests performed on the sow thistle 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 Kurrajong Park	
		Survival	Rating
Ally 7g/ha+ 0.2% BS1000	Group B - Sulfonylureas	40	RR
Glyphosate 540@ 1.0L/ha	Group M	0	S
Glyphosate 540@ 2L/ha	Group M	0	S
Glyphosate 540@ 4L/ha	Group M	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
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Herbicide treatment	With or without double knock*	Estimated control	LSD
Amicide® Advance 700	with	98%	ab
Amicide® Advance 700 + SHARPEN® WG	with	100%	a
Basta®	with	97%	ab
Grazon® Extra	with	98%	ab
LVE Ester 680	with	98%	ab
Paraquat (at single knock timing)	with	100%	a
Pixxaro® EC	with	100%	a
Precept®	with	98%	ab
Roundup® DST® (1500 mL/ha)	with	97%	ab
Roundup® DST® (575 mL/ha)	with	98%	ab
SHARPEN® WG (17g/ha)	with	97%	ab
SHARPEN® WG (26g/ha)	with	100%	a
SLEDGE®	with	97%	ab
SLEDGE® + Roundup® DST®	with	95%	abcd
Starane™ Advanced	with	100%	a
Stinger™ + Starane™ Advanced	with	100%	a
Paraquat (at double knock timing)	with	90%	abcdef
Velocity®	with	100%	a
UTC	without	0%	i
Starane™ Advanced	without	67%	h
SLEDGE®	without	70%	gh
Roundup® DST® (575 mL/ha)	without	78%	fg
SLEDGE® + Roundup® DST®	without	80%	fg
Amicide® Advance 700	without	82%	ef
LVE Ester 680	without	83%	def
Precept®	without	83%	cdef
Roundup® DST® (1500 mL/ha)	without	83%	cdef
SHARPEN® WG (17g/ha)	without	83%	cdef
Grazon® Extra	without	87%	bcdef
Stinger™ + Starane™ Advanced	without	87%	bcdef
Pixxaro® EC	without	90%	abcdef
SHARPEN® WG (26g/ha)	without	90%	abcdef
Basta®	without	92%	abcde
Amicide® Advance 700 + SHARPEN® WG	without	93%	abcd
Paraquat	without	95%	abc
Velocity®	without	95%	abc

\* double knock of 2 l/ha paraquat, applied 7 days after the initial application