

Common sowthistle – knockdown and double knock control in fallow

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Take home messages

- Currently no effective alternatives to glyphosate for consistent one-pass knockdown control of common sowthistle
- Control levels from all strategies improved on seedling to rosette weed stages compared to later growth stage application
- A range of options provide effective control of seedling to rosette staged common sowthistle when followed with a paraquat 2nd knock application
- The double knock program of glyphosate + 2,4-D followed by paraquat for flaxleaf fleabane also provides consistent management of common sowthistle
- Double knocks of Basta[®] followed by paraquat have provided the most consistent common sowthistle control, but may only be appropriate in sensitive areas or in optical spray situations due to cost
- Sharpen[®] as a 2nd knock option has provided similar levels of common sowthistle control to paraquat at 1.6-2.4 L/ha

Background

Management of common sowthistle (*Sonchus oleraceus*) has increased in difficulty over the last 10-15 years across most of the grain growing areas of northern NSW and southern Qld. The reasons for this are varied but include: the weed appears to have adapted to emergence at any time of the year, the seed is easily wind dispersed with reinfestation of 'clean paddocks' a constant challenge, and glyphosate tolerance and resistance levels have continued to increase.

It is clear that the industry can no longer rely on applications of glyphosate alone for common sowthistle control in fallow. The project activity undertaken during 2016 to 2018 has been to screen alternative herbicides for potential as standalone options on small weed stages but more likely as 1st knock applications in a double knock herbicide program. A double knock approach is where two different weed management strategies are employed in a sequential fashion to achieve a high level of weed control.

Approach

Two distinct series of knockdown trials have been conducted:

1. **Evaluation of alternatives to glyphosate for use as 1st knock.** The focus of this work was to identify whether existing fallow herbicide registrations may provide a viable alternative to glyphosate, either when applied alone or as part of a double knock strategy. In 2016 and 2017, paraquat was applied as the 2nd knock treatment. In 2018, a mixture of paraquat (Gramoxone[®] 250) + saflufenacil (Sharpen[®]) was applied.
2. **Evaluation of alternatives for use as 2nd knock.** The focus of this activity was to screen for alternatives to paraquat for use as a 2nd knock treatment in an attempt to improve the consistency of double knock control but also to reduce the high level of resistance selection pressure on paraquat.

Results to date

1. Evaluation of alternatives to glyphosate for use as 1st knock

Initial work evaluated a range of tank mixtures with glyphosate. However, unless marginal control was achieved from the glyphosate component (either a marginal rate under prevailing conditions or weeds exhibiting glyphosate resistance) the risk was that all treatments provided complete control as 1st knocks. Subsequent activity in 2016-2018 evaluated the majority of options in the absence of glyphosate. A total of 24 different 1st knock approaches have been evaluated. A range of chemistry has been evaluated with Group I chemistry such as Tordon™, Amicide® 625 and Starane™ Advanced providing useful activity. Table 1 shows the results from the most consistent 1st knock treatments. All listed treatments were evaluated together in six trials.

Table 1. Summary of efficacy from 1st knock applications alone on seedling to rosette staged common sowthistle 2016-2017, assessed ~five weeks after application (range 20-64 days)

1 st knock treatment	% Control (1 st knock alone)		Comparison to Glyphosate CT 1.0 L/ha (applied alone)	
	Mean 6 trials	Range	Significantly POORER control	Significantly IMPROVED control
Glyphosate CT 1 L/ha (450 g/L glyphosate)	86	73-99	NA	NA
Glyphosate CT 2 L/ha (450 g/L glyphosate)	96	92-100	-	2 trials
*Tordon™ 75-D 1 L/ha (300 g/L 2,4-D + 75 g/L picloram)	91	75-99	1 trial	2 trials
*FallowBoss™ Tordon™ 1 L/ha (300 g/L 2,4-D + 75 g/L picloram + 7.5g/L aminopyralid)	94	91-100	1 trial	2 trials
Starane™ Advanced 0.6 L/ha (333g/L fluroxypyr)	84	70-99	2 trials	-
Amicide® 625 1.8 L/ha (625 g/L 2,4-D amine) + Hasten 1%	94	82-100	1 trial	2 trials

*Note: Tordon™ 75-D and FallowBoss are both registered for use in fallow at a rate of 1L, but sowthistle is not separately listed as a weed controlled under this use pattern. Lower rates of both products are registered for use in wheat and sowthistle is listed as a weed controlled at these lower rates.

Basta® (200g/L glufosinate) at the rate of 3.75 L/ha was only included at two of the six trial sites in Table 2. It achieved complete control at one site and 99.9% at the second. Basta 3.75 L/ha significantly increased control to Glyphosate CT 1 L/ha at one of the two sites.

Mixtures of Group G herbicides (e.g. Sharpen – 700g/kg saflufenacil) with glyphosate were evaluated. They did not provide the consistency of control of treatments listed in Table 2, particularly when followed by paraquat.

A 2nd knock application of Gramoxone 250 (250g/L paraquat) was applied to all 1st knock treatments at a rate of 1.6 or 2.0 L/ha (depending on trial). Mean control from all treatments listed in Table 2



when double knocked was 99-100%. There was no significant difference in control between any of the treatments, in any trial.

Tables 2 and 3 show the results when targeting elongating staged common sowthistle. Table 2 shows the results from the 1st knock applications alone. Table 3 shows the same treatments when followed by a 2nd knock with Gramoxone at 1.6 or 2.4 L/ha (depending on trial).

Table 2. Summary of efficacy from 1st knock applications on elongating staged common sowthistle 2016-2017, assessed ~five weeks after 1st knock application (range 21-49 days)

1 st knock treatment	% Control (1 st knock alone)		Comparison to Glyphosate CT 1.0 L/ha (applied alone)	
	Mean 6 trials	Range	Significantly POORER control	Significantly IMPROVED control
Glyphosate CT 1 L/ha (450 g.a.i./L glyphosate)	60	40-84	NA	NA
Glyphosate CT 2 L/ha (450 g.a.i./L glyphosate)	70	35-97	-	4 trials
*Tordon 75-D 1 L/ha (300 g/L 2,4-D + 75 g/L picloram)	78	9-98	-	4 trials
*FallowBoss Tordon 1 L/ha (300 g/L 2,4-D + 75 g/L picloram + 7.5g/L aminopyralid)	77	18-100	-	5 trials
Starane Advanced 0.6 L/ha (333g/L fluroxypyr)	49	6-90	1 trial	2 trials
Amicide 625 1.8 L/ha (625 g/L 2,4-D amine) + Hasten 1%	80	35-100	-	4 trials
Basta 3.75 L/ha (200g/L glufosinate)	90	71-97	-	4 trials

*Note: Tordon™ 75-D and FallowBoss are both registered for use in fallow at a rate of 1L, but common sowthistle is not separately listed as a weed controlled under this use pattern. Lower rates of both products are registered for use in wheat and common sowthistle is listed as a weed controlled at these lower rates.



Table 3. Summary of efficacy from double knock applications on elongating staged common sowthistle 2016-2017, assessed ~five weeks after 1st knock application (range 21-49 days)

1 st knock treatment	% control double knock		Comparison to Glyphosate CT 1.0 L/ha	
	Mean 6 trials	Range	Significantly POORER control	Significantly IMPROVED control
Glyphosate CT 1 L/ha (450 g.a.i./L glyphosate)	80	50-100	NA	NA
Glyphosate CT 2 L/ha (450 g.a.i./L glyphosate)	89	62-100	-	2 trials
*Tordon 75-D 1 L/ha (300 g/L 2,4-D + 75 g/L picloram)	97	82-100	-	3 trials
*FallowBoss Tordon 1 L/ha (300 g/L 2,4-D + 75 g/L picloram + 7.5g/L aminopyralid)	96	77-100	-	3 trials
Starane Advanced 0.6 L/ha (333g/L fluroxypyr)	86	56-100	-	-
Amicide 625 1.8 L/ha (625 g/L 2,4-D amine) + Hasten 1%	93	77-100	-	3 trials
Basta 3.75 L/ha (200g/L glufosinate)	99	97-100	-	3 trials

2nd knock applications of paraquat were applied at 7 to 19 days after the 1st knock

*Note: Tordon™ 75-D and FallowBoss are both registered for use in fallow at a rate of 1L, but sowthistle is not separately listed as a weed controlled under this use pattern. Lower rates of both crops are registered for use in wheat and sowthistle is listed as a weed controlled at these lower rates.

Key points: Alternative 1st knocks

Seedling to rosette

- Variable control with glyphosate alone. Improved control with increased glyphosate rates
- Group I (phenoxy) options generally provided good suppression but not consistent control
- Group I product differences were clearly evident from 1st knock applications alone
- **Consistent and high levels of control (99-100%) achieved when either glyphosate or the Group I options listed in Table 2 were double knocked with paraquat**
- Basta is encouraging, either alone or double knocked, but cost prohibitive for broadacre application

Elongating

- No treatment provided acceptable control when applied alone
- Overall most consistent suppression was achieved with Basta, however poorer control when applied alone than other options in two of six trials
- **Basta double knocked with paraquat was the most consistent option and should be considered for optical spray uses**
- Group I options were encouraging, but only when double knocked
- Starane Advanced at 0.6 L/ha provided the least suppression of the listed group I herbicides when applied alone or when double knocked with paraquat

2. Evaluation of alternatives for use as 2nd knock

Paraquat has been the key active ingredient used as the 2nd knock option and can provide effective management of a wide range of grass and broadleaf weeds. However, it is clear we require other options to use in this management window to:

1. Avoid the more rapid selection of paraquat resistance and
2. Provide options that may improve weed control in situations where paraquat efficacy is not adequate.

Table 4. Summary of efficacy from 2nd knock applications on common sowthistle 2017-2018, assessed ~five weeks after 2nd knock application

2 nd knock treatment	% Control		Comparison to Gramoxone 1.6L/ha	
	Mean 8 trials	Range	Significantly POORER control	Significantly IMPROVED control
Untreated (1st knock only)	87	60-100	4 trials	-
*Gramoxone 250 0.8 L/ha (250g/L paraquat)	94	76-100	3 trials	1 trial
Gramoxone 250 1.6 L/ha (250g/L paraquat)	98	94-100	NA	NA
Gramoxone 250 2 L/ha (250g/L paraquat)	99	96-100	-	-
Gramoxone 250 2.4 L/ha (250g/L paraquat)	99	98-100	-	-
Sharpen 17 g/ha + (700g/kg Saflufenacil) Hasten 1%	100	98-100	-	1 trial
Sharpen 26 g/ha (700g/kg Saflufenacil) + Hasten 1%	99	97-100	-	1 trial

NB All treatments received the same 1st Knock application in each trial. The most common treatment was a mixture of glyphosate with 2,4-D amine, with the rates varying with the weed stage, environmental conditions and grower/adviser recommendations.

2nd knocks were targeted for application at ~7-14 days after the 1st knock. Mean interval was 11 days with a range of 7 to 19 days.

2 trials not included: 2016 trial excluded as Sharpen only evaluated at 34 g/ha. Final data not yet available from trial initiated 18/12/2018

*Label rates for Gramoxone are 1.2-2.4L/ha. 800 mL was included in trials as a 'failure rate'.

Key points: Alternative 2nd Knocks

- Evaluation in 2016 showed improved efficacy from Sharpen as a 2nd knock treatment compared to other group G options or Basta
- Sharpen performance has been more consistent when used in a 2nd knock application, with no regrowth evident in any of these trials
- Dose response to Gramoxone 250 was relatively flat from 1.6 – 2.4 L/ha but apparent in situations of marginal control
- Negligible dose response to Sharpen with similar performance to Gramoxone 250 at 1.6 – 2.4 L/ha

Conclusions

Inconsistent levels of control of common sowthistle with glyphosate alone are now commonplace. Results from these trials reinforce the need to use robust glyphosate rates, avoid spraying under stressed conditions and target small weed stages. There are no obvious direct replacements for glyphosate as a standalone knockdown option.

However, group I herbicides such as Tordon 75-D, FallowBoss Tordon and Amicide 625 have provided equivalent or improved control when followed by a paraquat double knock. For situations near sensitive crops or where cost isn't the major constraint (e.g. when applied via an optical sprayer), Basta has provided effective management when used as the 1st knock in a double knock strategy. Previous trial activity however showed inconsistent results on flaxleaf fleabane and a range of summer grass species when Basta was used as 1st knock in a double knock strategy.

Sharpen can be a very effective option on small common sowthistle but levels of regrowth are commercially concerning when used alone or in mixture with glyphosate. Results from this series of trials has also shown inconsistent double knock results when Sharpen + glyphosate is the 1st application.

In contrast, Sharpen has been very consistent when used as 2nd knock alternative to paraquat or in mixture with paraquat. Level of control from Sharpen at 17-26 g/ha has been at least equivalent to that achieved with paraquat at 1.6-2.4 L/ha. However, paraquat is a better option in mixed grass and broadleaf fallow situations.

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