GOA Site Report

Pre-Emergent Herbicides options for Annual Ryegrass control in Chickpeas

Trail Code: GOWE02415-1

Year/Season: Winter 2015

Location: Narromine Station, 10 km North of Narromine

Collaborators: The Browning Family and Shannon Thomas

Keywords

Chickpeas, weeds, annual ryegrass, pre-emergent, herbicides, Narromine, GOWE02115-1, Narromine

Take home messages

This trial demonstrated that there are a number of pre-emergent herbicide options that have the potential to reduce the annual ryegrass (ARG) populations in your crops.

Commonly used herbicide choices have not performed well in terms of ryegrass control and changes in product choices can result in much higher level of ARG control in chickpeas

Tank mixing pre-emergent herbicides tends to provide better levels of control than single products with the additional benefit of controlling a broader weed spectrum and possible benefits for delaying the onset of resistance.

Background

Annual ryegrass (ARG) is expressing increasing levels of resistance to various herbicides across the Orana Region[1]. One product most concerning to many growers is the developing resistance to clethodim, as it represents the last remaining effective in-crop knockdown herbicide. Any remaining effectiveness of clethodim needs to be protected as much as possible to prolong its useful life. One way to achieve this is to minimise the risk and rate at which resistance is developed, this is done through reducing the weed populations to which these herbicides are applied too. One useful option in achieving this is to improve the efficacy of any pre-emergent herbicide options used.

GOA for a number of years has been investigating improved pre-emergent herbicide options focusing of ARG and this trial is a further continuation of that work.

This trial concentrates upon a number of various pre-emergent herbicide options and assess their potential to reduce ARG establishment. The options include a number of tank mixes, taking into account recent research, which has found that using tank mixes (at full rates) can "buy shots" and hence delay the onset of herbicide resistance. It has been found that farmers who used 2.5 herbicide modes of action (MOA's) on average per application were 83 times less likely to have glyphosate resistance than growers that had mixed 1.5 MOA's on average[2] (Evans, 2015).

[1] See GOA report: http://www.grainorana.com.au/documents?download=29

[2] Evans, J.A., Tranel, P.J., Hager, A.G, Schutte, B., Chenxi, W., Chatham, L.A., Davis, A.S. Managing the evolution of herbicide resistance, Pest Management Science, May, 2015. 10.1002/ps.4009

However, it should be remembered that information gained though this trial will only form part of the solution or management of this issue and weed populations must be targeted at every other chance. The lack of effective in-crop selective options for producers means that this must include pre-emergent options or other modes of control.

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 aims compare a range of pre-emergent options to reduce ARG establishment in chickpeas.

Methods

The trials used a small plot randomised complete block design with 3 replicates. The trials were established in growers' paddocks with known populations of ARG.

Herbicide treatments were applied using an ATV mounted boom. Incorporated by sowing (IBS) treatments were incorporated using a tyne plot planter when seeding the crop. PSPE applications were applied within 12 hours after seeding.

Crop establishment, ARG populations, estimated weed biomass and panicle counts were assessed in this trial before the site was sprayed out with herbicides to prevent seed set. Note: No crop safety data was collected for this trial.

Results were analysed using ANOVA for the analysis of variance and results compared by using a least significant difference (LSD) method with a 95% confidence interval. Any references to differences between treatments should be assumed to be statistically different unless otherwise stated.

Table 1. Trial site details

Seeding date	9th June 2015
Variety and seeding rate	Hatrick @ 55 kg/ha
Seedling equipment	DBS, knife point and press wheel, 275mm tine spacing
Row Orientation	North South
Nutrition	50 kg/ha MAP at seeding (approx. 4 cm below seed)
Soil type	Red Clay Loam
Paddock history	Canola Stubble, windrow burnt
Pre Application/ seeding treatment	2 L/ha of paraquat was applied to the site to remove any established ARG populations

Table 2. Herbicide application details for IBS and PSPE treatments

IBS	**Date Applied**	9/06/2015	**Temperature**	**Wind Velocity**	**Wind Direction**	**Humidity**
	Start Time	11.40 am	17°C	7 km/h	WSW	43%
	Finish Time	1.00 pm	**Δt**	4.6	**% Cloud**	0
	Water Rate	100 L/ha	**Nozzle**	AIXR015	**Pressure**	3bar
	Equipment	ATV	**Speed**	7		
PSPE	**Date Applied**	10/06/2015	**Temperature**	**Wind Velocity**	**Wind Direction**	**Humidity**
	Start Time	8.45 am	9°C	3 km/h	W	80%
	Finish Time	9.00 am	**Δt**	1.3	**% Cloud**	0
	Water Rate	100 L/ha	**Nozzle**	AIXR015	**Pressure**	3bar
	Equipment	ATV	**Speed**	7		

Table 3. Treatment list

Treatment	Rate (mL /ha or g/ha)
Untreated Control (UTC)	0
Simazine (IBS)	1100
Simazine (PSPE)	1100
Simazine (PSPE) + Balance® (PSPE)	1100 + 100
Trifluralin (IBS) + simazine (PSPE) + Balance® (PSPE)	1700 + 1100 + 100
Trifluralin (IBS)	1700
Trifluralin (IBS) + Avadex Xtra® (IBS)	1700 + 1600
Trifluralin (IBS) + diuron (IBS)	1250 + 1100
Trifluralin (IBS) + Experimental 1 (IBS)	1700 + 1000
Trifluralin (IBS) + simazine (IBS) + Experimental 1 (IBS)	1700 + 1100 + 1000
Experimental 1 (IBS)[3]	1000
Trifluralin (IBS) + simazine (IBS) + Avadex Xtra® (IBS)	1700 + 1100 + 1600
Boxer Gold®(IBS)	2500
Boxer Gold® (IBS) + trifluralin (IBS)	2500 + 800
Outlook® (IBS)	1000
Outlook® (IBS) + simazine (IBS)	1000 + 1100
Sakura® (IBS)	118
Sakura® (IBS) + simazine (IBS)	118 + 1100

[3] Experimental 1 is a Group D herbicide which may in future become registered in Chickpeas

Table 4. Daily rainfall totals pre and post treatment, Narromine BOM station[4] (approximately 6 km from the trial site)

Date	Rainfall (mm)
8/04/2015	23.8
22/04/2015	56.1
22/05/2015	33.7
29/05/2015	3.5
31/05/2015	7
5/06/2015	2.7
18/06/2015	42.2
25/06/2015	5.5
13/07/2015	21.7

Date	Rainfall (mm)
17/07/2015	19.9
23/07/2015	10.1
24/08/2015	29.6

Rainfall:

- Significant rain prior to planting/pre-emergent application, site was very wet
- 42 mm within 10 days of herbicide application

Results

Crop establishment in this trial was reduced due to wet conditions at seeding with an average of 24 chickpea plants/m^2 established with no observable effect from any of the pre-emergent treatments.

Resultant weed populations and panicle/seed head counts are detailed in **Table 5** below. As can be seen, all treatments resulted in significantly lower ARG populations than UTC at both 49 and 84 days after treatment (DAT) assessments. All treatments except simazine (PSPE) resulted in lower ARG panicle counts at 112 DAT.

At the 84 DAT assessment, simazine both IBS and PSPE and simazine + Balance® all performed similarly reducing ARG populations only slightly to ~115 plants/m^2. Outlook®, Boxer Gold®, Sakura® and trifluralin all resulted in similarly lower ARG populations. Experimental 1 as a single product resulted in the lowest ARG population.

Most of the tank mix options tested performed similarly except trifluralin + Experimental 1, either with or without simazine which both resulted in the lowest mean ARG populations.

[4] Data from Narromine Airport (Station number 05115)

Table 5. ARG populations and panicle counts in response to various pre-emergent herbicide treatments- Narromine 2015.

Treatment	ARG plants/m² 49 DAT	ARG plants/m² 84 DAT	ARG panicles/m² 112 DAT
Untreated Control (UTC)	246 A	168 A	706 A
Simazine (IBS)	152 B	123 B	547 B
Simazine (PSPE)	154 B	112 B	632 AB
Simazine (PSPE) + Balance® (PSPE)	147 B	108 B	508 B
Trifluralin (IBS) + simazine (PSPE) + Balance® (PSPE)	39 CDEFG	29 CDE	201 CD
Trifluralin (IBS)	56 CDEF	39 CDE	184 CD
Trifluralin (IBS) + Avadex Xtra® (IBS)	44 CDEFG	30 CDE	151 CDE
Trifluralin (IBS) + diuron (IBS)	48 CDEFG	36 CDE	213 C
Trifluralin (IBS) + Experimental 1 (IBS)	14 FG	11 E	57 DE
Trifluralin (IBS) + simazine (IBS) + Experimental 1(IBS)	6 G	12 E	32 E
Experimental 1 (IBS)	17 EFG	21 DE	78 CDE
Trifluralin (IBS) + simazine (IBS) + Avadex Xtra® (IBS)	37 CDEFG	31 CDE	73 CDE
Boxer Gold®(IBS)	63 CDE	59 C	174 CDE
Boxer Gold® (IBS) + trifluralin (IBS)	34 DEFG	48 CD	203 CD
Outlook® (IBS)	83 C	56 C	144 CDE
Outlook® (IBS) + simazine (IBS)	71 CD	49 CD	88 CDE
Sakura® (IBS)	39 CDEFG	33 CDE	103 CDE
Sakura® (IBS) + simazine (IBS)	168 B	27 CDE	83 CDE
LSD	48.2	33.8	151

*Within each assessment letters represent groups, where treatments with the same letter (A, B, etc.) have means that are not significantly different from one another.

Discussion

Good rainfall in the lead up to the establishment of the trial had already seen a significant number of weed germinations and subsequent control of ARG. Despite this there was still a dense population of ARG present in the UTC of 168 plants/m^2 (at 84 DAT). Wet conditions prior to planting resulted in wetter than optimal planting conditions, this may have limited the effectiveness of the herbicide incorporation for the IBS treatments, as soil throw was sub-optimal. Heavy rainfall fell within 10 days following herbicide treatments, this should have ensured good incorporation and activation of the herbicides but may have had the potential to cause significant crop damage, although none was visually observed.

ARG from the trial area was previously tested to Verdict, Select, Achieve and Hussar and showed strong resistance to all products except Select with only 5% survival. The population's resistance to other products including many of the pre-emergent products in this trial is unknown. A sample population was left for testing but was inadvertently sprayed out before sampling.

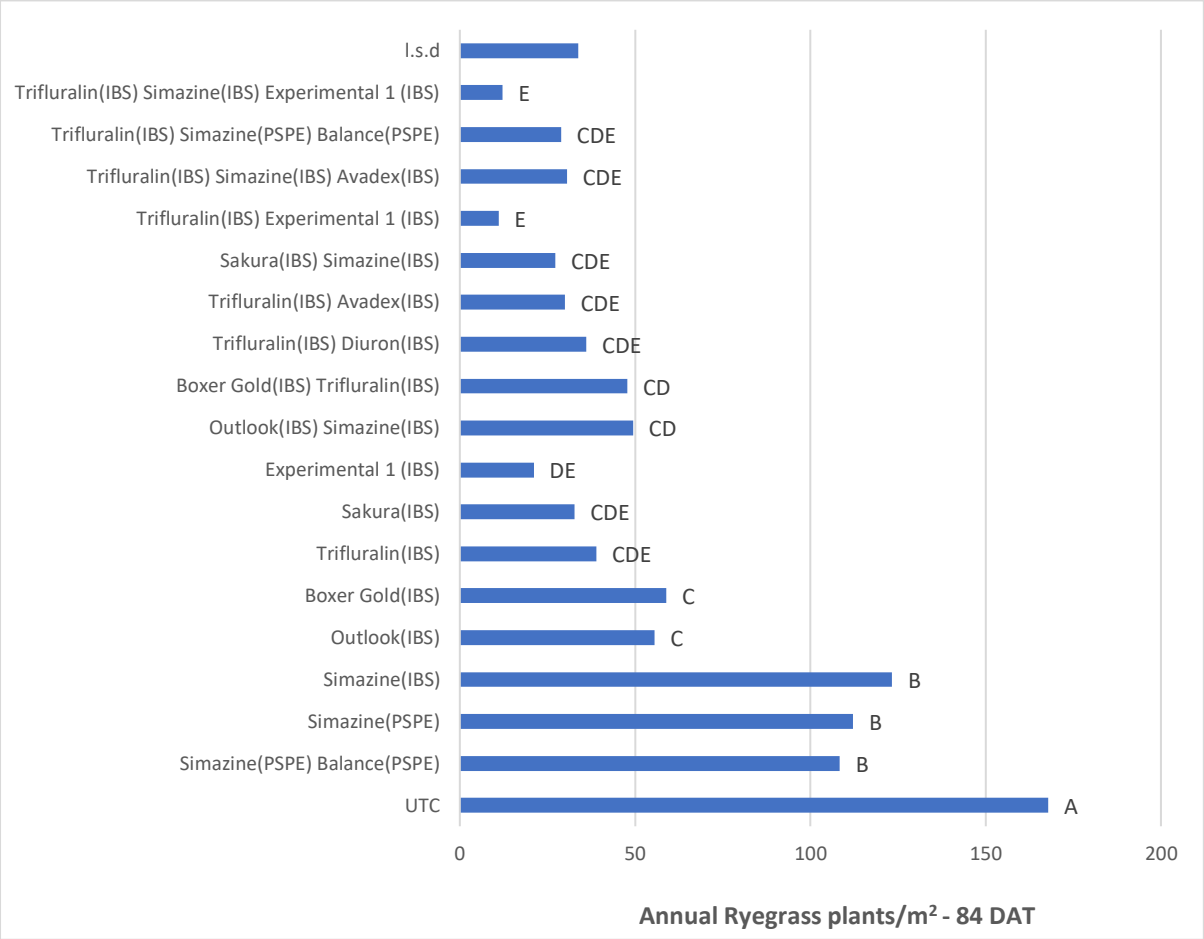

Figure 1. ARG 84 days after treatment in response to various pre-emergent herbicide options

In this trial all products resulted in a reduction in the ARG population when compared to the untreated control. However, the common pre-emergent strategy employed in chickpeas in the GOA region of simazine +/- Balance® performed poorly achieving less than 40% control 84 DAT with ~115 plants/m^2 that would require control with post emergent herbicides.

The other single product treatments such as Outlook®, Boxer Gold®, trifluralin, Sakura® and Experimental 1 all resulted in improved control over Simazine alone. There was no significant difference between the last three mentioned but Experimental 1 was the only single product treatment that achieved better than the commercially acceptable level of 90% control of ARG. It was also a component of the two top performing tank mix treatments in the trial.

In this trial many of the tank mixes tested did not necessarily result in lower ARG levels than what could be achieved by one of the single product options tested but they could offer a broader spectrum of weed control.

Conclusion

This trial has demonstrated that the use of pre-emergent herbicides can reduce ARG populations compared with no treatment.

The trial has also demonstrated a number of options that are more effective than the commonly used pre-emergent herbicide, simazine +/- Balance®. If growers were to employ some of the more effective

alternates, the improved levels of control of ARG will reduce the weed control burdens placed on our key post emergent knockdown herbicides. This in turn will hopefully reduce the rate of development of resistance in those products but it may also improve crop performance in the interim through less weed competition and fewer escapes.

A number of alternate single products available to use resulted in better reductions in ARG than simazine but a number of tank mix options also tested could provide similar reduction in ARG but with potentially a broader spectrum of control.

Experimental 1 also performed well alone or as part of a tank mix and is worthy of future investigations.

In consideration of the use of alternatives growers and advisors should base their choices on more than the results of just this one trial. Growers should also take into account a number of other influences such as-

What other weeds are present and the effectiveness of the alternatives are on these?

What is the cost of these alternatives in comparison to each other?

Any varietal differences in crop tolerances of the particular alternatives?

Plant back or residue restrictions?

Herbicide rotations and resistance management?

The herbicide resistance status of the weeds you are targeting?

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 goes out to the Browning family from Narromine who hosted this trial.