GOA Site Report

Better pre-emergent herbicides to reduce annual ryegrass in Chickpeas

Trial Code: GOWE02414-1

Date: Winter 2014

Location: 'Allawah' (8 km NE Tullamore)

Collaborators: Jones Family

Background

Annual ryegrass (ARG) is currently developing herbicide resistance to many in-crop herbicides and in a lot of cases to multiple modes of action across the Orana Region[1]. In many paddocks, most of the Group A 'Fop' herbicides are no longer effective nor are the common Group B herbicides such as Logran®. As a result, on many farms the ARG population levels are increasing through the cereal phase of crop rotations. Due to this, the aim has become to reduce grass weed numbers in the broadleaf phases with products such as clethodim[2], which has traditionally exhibited less resistance.

However, in the recent herbicide resistance survey undertaken by GOA in the Central West of NSW it was revealed 22% of ARG samples submitted demonstrated resistance to clethodim (and a number of other herbicides) and for many of these populations this leaves few effective alternative herbicide options. Therefore, the remaining effectiveness of this product must be protected to prolong its useful life and using it to control large dense populations of ARG may be exposing the product to excessive resistance selection pressure.

One way to achieve this is to minimise the risk and rate at which resistance is developed, this is done through reducing the population numbers to which these herbicides are applied too. One option in achieving this is to improve the efficacy of any pre-emergent herbicide options used.

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

This trial concentrates upon a number of various pre-emergent herbicide options and assesses 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[3] (Evans, 2015).

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

[2] Common trade names include Select, Status, Platinum

[3] 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

- Compare a range of pre-emergent options and their effectiveness to reduce the populations of ARG in chickpeas
- If other weeds were present in the trial, then treatments were assessed for their effectiveness in control.

Methods

The trials used a replicated small plot randomised complete block design with 3 replicates. The trials were established in growers' paddocks where know ARG populations were expected.

Herbicide treatments were applied ahead of growers sowing equipment by ATV mounted boom and incorporated by the growers' equipment at sowing. PSPE applications were applied as soon as possible after sowing.

Crop establishment and ARG populations 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	22nd May 2014
Variety and seeding rate	PBA Hatrick @ 80 kg/ha
Seedling equipment	Flexicoil, knife point and press wheel, 375 mm tine spacing
Soil type	Red Clay loam
Paddock history	Wheat 2013, moderate stubble- fully retained

Table 2. Herbicide treatment, application timing and rates applied

Treatment		Rate/ha (g/mL)
1	Untreated Control (UTC)	nil
2	Trifluralin (IBS)	1700
3	Trifluralin + simazine (IBS)	1700 + 1100
4	Trifluralin + Terbyne® (IBS)	1700 + 1000
5	Simazine (IBS)	1100
6	Trifluralin + Diuron (IBS)	1250 + 1100
7	Trifluralin + Avadex Xtra®(IBS)	1700 + 1600
8	Trifluralin (IBS) + Experimental 1 (PSPE)[4]	1.700 + 1000
9	Simazine + diuron (IBS)	1100 + 1100
10	Terbyne® (IBS)	1000
11	Outlook® (IBS)	1000
12	Outlook® + simazine (IBS)	1000 + 1100
13	Simazine + trifluralin + Avadex Xtra® (IBS)	1100 + 1700 + 1600
14	Boxer Gold® (IBS)	2500
15	Boxer Gold® + trifluralin (IBS)	2500 + 800
16	Simazine + Balance® (PSPE)	1000 + 100
17	Trifluralin (IBS) + simazine (PSPE) + Experimental 1 (PSPE)	1700 + 1100 + 1000
18	Trifluralin (IBS) + simazine (PSPE) + Balance® (PSPE)	1700 + 1000 & 100

IBS- Incorporated by sowing, PSPE- post sowing pre-emergent

Table 3. Herbicide application details for IBS and PSPE treatments

IBS	**Date Applied**	22/05/2014	**Temp**	**Wind vel.**	**Wind Dir.**	**Humidity**
	Start time	1:15 pm	24.7°C	4.7 km/hr	NW	41%
	Finish Time	2:30 pm	**Δt**	8.5	**% Cloud**	30
	Water rate	100L/ha	**Nozzle**	TT015	**Pressure**	3 bar
	Equipment	ATV	**Speed km/hr**	7		
PSPE	**Date Applied**	22/05/2014	**Temp**	**Wind vel.**	**Wind Dir.**	**Humidity**
	Start time	3:10 pm	24.7 °C	4.7 km/hr	NW	41%
	Finish Time	3:25 pm	**Δt**	8.5	**% Cloud**	30
	Water rate	100 L/ha	**Nozzle**	TT015	**Pressure**	3 bar
	Equipment	ATV	**Speed km/hr**	7		

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

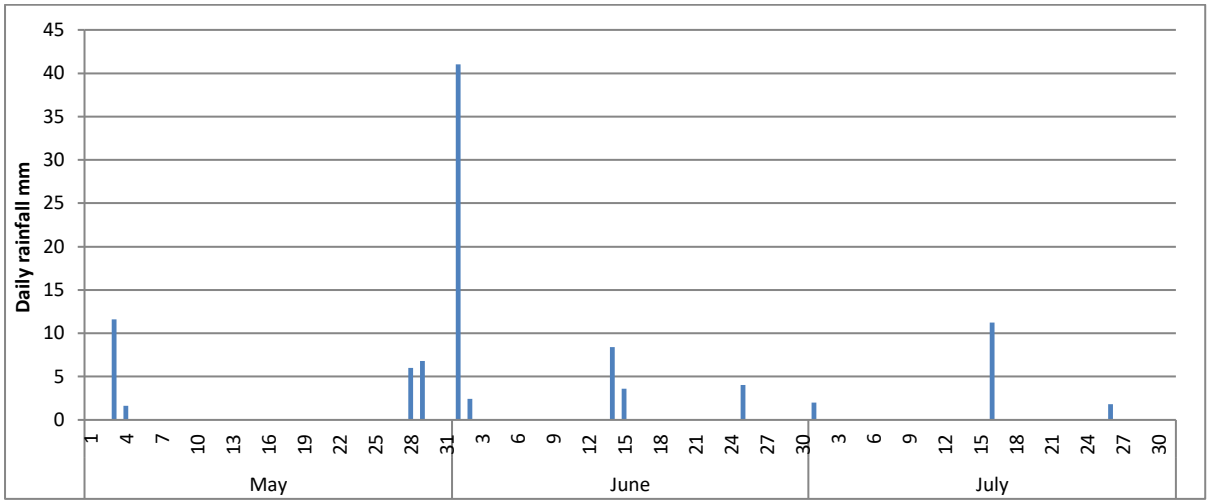

Figure 1. Daily rainfall from May till July 2014 at Tullamore BOM site

Results

There was no effect visually observed in any treatment on either the crop establishment or crop vigour rating 27 days after sowing (DAS) compared to the UTC treatment.

All treatments resulted in a reduction in ARG numbers assessed at 61 DAS compared to the UTC treatment as demonstrated in Figure **2** below.

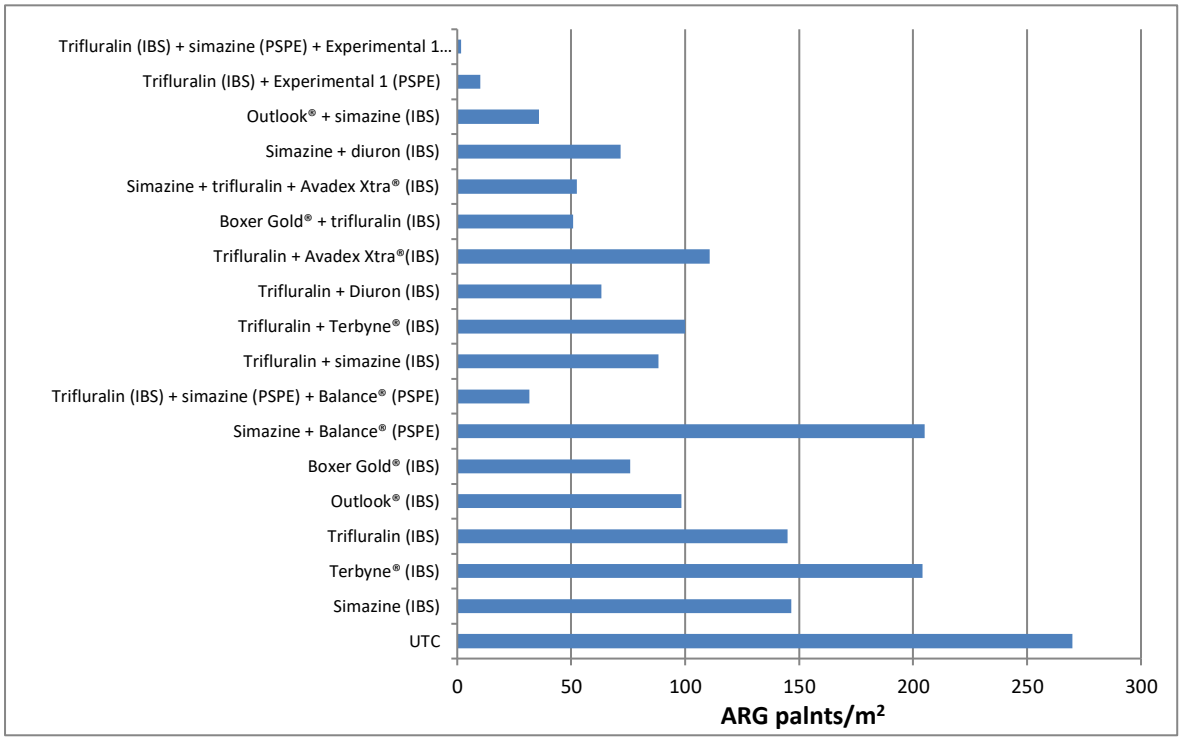

Figure 2. ARG populations 61 DAS in response to various pre-emergent herbicide treatments LSD = 48

Discussion

Simazine or simazine + Balance® is a common practice in the GOA region, resulted in very poor levels of ARG control, achieving only ~50% and ~25% control respectively.

The simazine treatment achieved a better level of control compared to the simazine + Balance® treatment despite using the same rate of simazine. It is suspected the mechanical incorporation by the sowing machinery may have advantaged the simazine only treatment (IBS) over the simazine + Balance® (PSPE) treatment which required rainfall to both incorporate and activate the herbicide. In this trial significant rain fell approximately 10 days post application. It is conceivable that an ARG germination occurred during this period before incorporation/activation of the PSPE treatments had occurred.

Terbyne® was less effective than simazine but offered similar control to the simazine + Balance® treatment. Trifluralin performed similarly to simazine. The single product treatments of Boxer Gold® and Outlook® performed significantly better than simazine, however, only achieved 72% and 63% control respectively. Boxer Gold® was the best performing single product treatment in this trial.

A number of the herbicide mixes tested appear to offer improved control over that of the standard practice of simazine or simazine + Balance® this can be seen in Figure **2** above. Of particular interest is the addition of trifluralin to simazine and Balance® where control improved from 25% to 88%.

The tank mixes of trifluralin + Experimental 1 or trifluralin + simazine + Experimental 1 were the best performing treatments in the trial. Both treatments reduced the ARG populations of around 270 plants/m^2 in the UTC down to less than 10 and 2 plants/m^2 or 96% and 99% control respectively.

Conclusion

This trial has demonstrated that the use of pre-emergent herbicides can reduce ARG populations which in turn will reduce the 'pressure' growers would be applying in the development of resistance to clethodim when used.

This trial has shown that the common options of simazine or simazine + Balance® mix only achieved control of 50% or less. This trial tested possible single product alternatives which achieved increased effectiveness in reducing ARG populations but overall control was still commercially unacceptable. Boxer Gold® was the most effective single product treatment but it still only achieved ~72% control which is still placing considerable resistance pressure on in-crop control.

This trial also established the potential for improved control which may be achieved through the combining a number of products. For example, the addition of trifluralin to a common industry approach of simazine and Balance® increased control to ~88%.

However, the addition of Experimental 1 in a number of mixes showed the highest levels of control achieved in this trial that certainly warrant further investigation.

In consideration of the use of alternatives, growers and advisors should base their choices on more than the results of just 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 considerations?
- Herbicide rotations and resistance management?
- The herbicide resistance status of the weeds you are targeting?

Acknowledgements

GOA would like to thank the Jones family of Tullamore for their hosting of this trial.