GOA Site Report

Pre-emergent herbicides options for annual ryegrass control in wheat.

Trail code: GOWE02615-1

Season/year: Winter 2015

Location: Narromine Station, 10 km North of Narromine

Collaborators: Jodi Browning and Shannon Thomas

Keywords

Wheat, weeds, annual ryegrass, *Lolium rigidum*, pre-emergent, herbicides, Narromine, GOWE02615-1, tank mixing, resistance

Take home messages

- There are several pre-emergent herbicide options that have the potential to reduce annual ryegrass populations in wheat including: Trifluaralin, Avadex®, Sakura® and Boxer Gold®.
- 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 resistance onset.
- Tank mixing products also provided less variation in weed control results.

Background

Annual ryegrass (ARG), *Lolium rigidum,* is expressing increasing levels of resistance to various herbicides across the Orana Region[1]. A concern to growers is developing clethodim resistance, as it represents one of the last remaining effective, in-crop knockdown herbicides. Considering this, the remaining clethodim effectiveness needs to be protected to prolong its useful life. One way to achieve this is minimising the risk and rate at which resistance develops by reducing the weed populations prior to clethodim application. Improving the use and efficacy of any pre-emergent herbicide options available is one tool that can be used.

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

This trial concentrates on various pre-emergent herbicide options to assess their potential to reduce ARG establishment. The options include several tank mixes based on 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). This can be extended to include all frequently used herbicides that are under increasing risk of resistance developing, e.g. clethodim.

[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

The 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 opportunity. The lack of effective in-crop selective options means growers must include pre-emergent options or other modes and control methods.

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

- To compare a range of pre-emergent options to reduce ARG establishment in wheat.

Methods

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

Herbicide treatments were applied using an ATV mounted boom. Incorporated by sowing (IBS) treatments were incorporated using a tyne plot planter when sowing the crop. Post sow pre-emergent (PSPE) applications were applied within 12 hours after sowing. Post emergent (PE) treatments were applied approximately one-month post-sowing.

Crop establishment, ARG populations, estimated weed biomass and panicle counts were assessed before the site was sprayed out with herbicides to prevent seed set.

No crop safety data was collected during 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

Sowing date	9 June 2015
Variety and sowing rate	Sunmate @ 45 kg/ha
Seedling equipment	DBS, knife point and press wheel, 275 mm tyne spacing
Nutrition	50 kg/ha MAP at sowing (~4 cm below seed)
Soil type	Red clay loam
Paddock history	Canola stubble which had been windrow burnt

Table 1. Treatments list.

Treatment	Rate (mL/ha or g/ha)
Untreated control (UTC)	0
Trifluralin (IBS)	1500
Trifluralin (IBS)	2250
Trifluralin (IBS)	3000
Trifluralin (IBS) + Boxer Gold® (IBS)	1500 + 2500
Trifluralin (IBS) + Logran® (IBS)	800 + 20
Trifluralin (IBS) + Avadex Xtra® (IBS)	2000 + 2000
Trifluralin (IBS) + Sakura® (IBS)	2000 + 118
Trifluralin (IBS) + metribuzin (IBS)	1000 + 200
Trifluralin (IBS) + Dual Gold® (PSPE)	3000 + 500
Sakura® (IBS)	118
Sakura® (IBS) + Avadex Xtra® (IBS)	118 + 2000
Avadex Xtra® (IBS)	3000
Boxer Gold® (IBS)	2500
Boxer Gold® (IBS) + Boxer Gold® (PSPE)	1750 + 750
Boxer Gold® (PE)	2500
Metribuzin (IBS)	200
Terbyne® (IBS)	1400

Table 2. Herbicide application details for IBS, PSPE and PE treatments.

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IBS	**Date applied**	9/06/2015	**Temp (°C)**	**Wind (km/hr)**	**Wind Dir.**	**Humidity (%)**
	Start time	11.40 am	17	7	WSW	43
	Finish time	1.00 pm	**Δt**	4.6	**% Cloud**	0
	Water rate	100 L/ha	**Nozzle**	AIXR015	**Pressure**	3 bar
	Equipment	ATV	**Speed (km/hr)**	8	-	-
PSPE	**Date applied**	10/06/2015	**Temp (°C)**	**Wind (km/hr)**	**Wind dir.**	**Humidity (%)**
	Start time	8.45am	9	3	W	80
	Finish time	9.00am	**Δt**	1.3	**% Cloud**	0
	Water rate	100 L/ha	**Nozzle**	AIXR015	**Pressure**	3 bar
	Equipment	ATV	**Speed (km/hr)**	8	-	-
PE	**Date applied**	7/7/2015	**Temp (°C)**	**Wind (km/hr)**	**Wind dir.**	**Humidity (%)**
	Start time	3:40pm	14	0-2	SW	63
	Finish time	3:45pm	**Δt**	3.7	**% Cloud**	0
	Water rate	100 L/ha	**Nozzle**	AIXR015	**Pressure**	3 bar
	Equipment	Hand Boom	**Speed (km/hr)**	8	-	-

Table 3. Rainfall days pre and post treatment.

Date	Rainfall (mm)[3]
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
17/07/2015	19.9
23/07/2015	10.1
24/08/2015	29.6

Rainfall

- Significant rain prior to sowing/pre-emergent application was received, with the site was very wet.
- 42 mm, 10 days after herbicide application.

Observations

Significant rainfall prior to planting resulted in wetter than optimal sowing conditions, this may have limited the effectiveness of the IBS treatment incorporation. The trial had a significant germination of ARG prior to sowing and heavy stubble in places from the previous year's canola crop.

Assessments of the wheat establishment showed variation of between 46-64 plants/m^2, however, none of the treatments were statistically different to the untreated control (UTC), with the average being 55 plants/m^2 in treatment plots and UTC had 52 plants/m^2.

Results

The resulting ARG population was assessed on several occasions. Panicle and seed head counts are detailed in Table 4.

All treatments, except for metribuzin and Terbyne®, resulted in statistically significantly lower ARG populations than the UTC at the 52 days after treatment (DAT) assessment and lower ARG panicle counts at 112 DAT.

[3] Data from Narromine Airport, approx. 6km from trial site (Station number 05115)

Table 4. ARG populations and panicle count results.

Herbicide treatment	ARG plants/m² 49 DAT		ARG panicles/m² 113 DAT	
UTC	296	a	535	ab
Treflan (IBS) @ 1500 mL/ha	66	efgh	96	def
Treflan (IBS) @ 2250 mL/ha	63	efgh	304	c
Treflan (IBS) @ 3000 mL/ha	39	fgh	339	bc
Treflan (IBS) @ 800 mL/ha + Logran (IBS) @ 20 mL/ha	87	de	302	c
Treflan (IBS) @ 3000 mL/ha + Dual Gold (PSPE) @ 500 mL/ha	35	gh	121	def
Treflan (IBS) @ 2000 mL/ha + Sakura (IBS) @ 118 mL/ha	43	efgh	55	ef
Treflan (IBS) @ 2000 mL/ha + Avadex (IBS) @ 2000 mL/ha	34	h	104	def
Treflan (IBS) @ 1500 mL/ha + Boxer Gold (IBS) @ 2500 mL/ha	53	efgh	199	cd
Treflan (IBS) @ 1000 mL/ha + Metrabuzin (IBS) @ 200 mL/ha	73	efgh	98	def
Terbyne (IBS) @ 1700 mL/ha	181	bc	618	a
Sakura (IBS) @ 118 mL/ha	37	fgh	105	def
Sakura (IBS) @ 118 mL/ha + Avadex (IBS) @ 2000 mL/ha	35	gh	76	def
Metribuzin (IBS) @ 200mL/ha	261	ab	100	def
Boxer Gold (PE) @ 2500mL/ha	148	cd	34	f
Boxer Gold (IBS) @ 2500 mL/ha	78	efg	138	de
Boxer Gold (IBS) @ 1750 mL/ha + Boxer Gold (PSPE) @ 750mL/ha	80	ef	124	def
Avadex (IBS) @ 3000 mL/ha	96	de	95	def

Discussion

Good rainfall prior to trial establishment resulted in numerous ARG germinations which were controlled prior to sowing. Despite this, there was still a dense population of ARG present in the UTC of 296 plants/m^2 at 49 DAT.

ARG from the trial area was previously tested for resistance to Verdict™, Select™, Achieve® and Hussar®. The ARG 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's in this trial, is unknown.

Heavy rain fell within 10 days of treatment, which should have ensured good incorporation and activation of the herbicides, but could have potentially caused significant crop damage. Wheat plant populations suggested there was no effect on the resultant crop establishment, however, sub lethal dose effects may have occurred.

When considering the outcomes of this trial, it should also be noted that very wet and puggy soils from pre-sowing rainfall may have limited the incorporation and subsequent effectiveness of several IBS treatments.

All products resulted in a significant reduction in the ARG population compared with the UTC. The common pre-emergent chemical trifluralin used in wheat in the Orana region achieved good levels of control (between 88 -93%, rate dependant) as a standalone product. In this trial Sakura® also provided >90% control. Boxer Gold®, applied IBS or split IBS and PSPE, provided better than 70% control, however, when applied as a PE treatment control levels dropped to ~50%.

Figure 1. Percent reduction of ARG plants compared at 52 and 83 DAT (treatments are separated by the number of products in the tank mix).

Trifluralin was tested at various rates and with several different tank partners (Figure 1). Generally, decreasing ARG emergence, although doubling the rate did not result in double the suppression. Metribuzin as a stand-alone product had virtually no impact on ARG emergence, but when mixed with a low-rate of 1000 mL/ha trifluralin, as per the metribuzin label, suppression increased to >75%, which was not statistically significantly different to trifluralin applied alone at higher rates.

Mixing products with trifluralin provided only incremental improvement in ARG control for all products, except for metribuzin, as discussed above. The degree of variability in the results tended to decrease when products were tank mixed. For example, trifluralin + Sakura® had a variation of about 20% between the best and worst performing plots, but when mixed the variation reduced to 4%.

Conclusion

The trial demonstrated that using pre-emergent herbicides can reduce ARG populations which, in turn will reduce the selection pressure growers would be applying for resistance development to clethodim to control ARG.

This trial has demonstrated that the common practice of the use of trifluralin in the Orana region does provide reasonable levels of control, however, it also demonstrated some single product alternatives that would be useful in a best practice herbicide rotation. More importantly it demonstrated some of the benefits of tank mixes in providing improved and more reliable suppression of ARG.

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