

## Pre-emergent herbicides for managing resistant ryegrass populations

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### Abstract

In 2007, two field experiments were undertaken on sandy-loam soils in the southern Mallee at Culgoa and Jil Jil. Both sites have a similar long-term average rainfall. Present on the Jil Jil site is annual ryegrass with confirmed Group A (FOP) resistance whereas the Culgoa site has ryegrass with a high level of resistance to trifluralin and Group A (FOP) herbicides. Applied into moist soils, the conditions were ideal for the pre-emergent herbicides. In June, ryegrass numbers were significantly reduced through the use of trifluralin at 720 g active/ha (TriflurX<sup>?</sup> at 1.5 L/ha). Most of the remaining ryegrass, which was found within the crop row as well as on the edge of the plot, was later out-competed by the crop. Increasing the rate of TriflurX to 3.0 L/ha (active: trifluralin 1440 g/ha) further improved control by 10%. The addition of Avadex Xtra<sup>?</sup> (Group E) to the trifluralin mix failed to improve control whereas the addition of Dual Gold<sup>?</sup> (Group K) had a similar effect as increasing the trifluralin rate. Even though the addition of the other herbicides such as Dual Gold and Avadex Xtra did not improve ryegrass control, they could be important for delaying the onset of resistance. At Culgoa, trifluralin reduced ryegrass numbers by only 27%; increasing the rate of trifluralin to 3 L/ha only reduced ryegrass numbers by a further 7%. The addition of Dual Gold and Avadex Xtra to 1.5 L/ha trifluralin reduced ryegrass density by 44% and 56% respectively. BoxerGold<sup>?</sup> was significantly more effective than trifluralin and reduced ryegrass numbers by 74%. No yield data were recorded for wheat as the trial was terminated with the use of a non-selective herbicide in order to prevent further seed set of this resistant population.

### Background

With the increased use of in-crop selective herbicides for the control of annual ryegrass, there have been more cases of ryegrass resistance appearing. Currently, there is confirmed resistance to many of the in-crop selective herbicides in Groups A and B and also to pre-emergent selective herbicides such as trifluralin (Group D) and non-selective herbicides such as glyphosate (Group M).

The reduction in efficacy of Group A and B herbicides due to resistance has led to a greater reliance on trifluralin. A recent survey across Victoria, undertaken by Peter Boutsalis, found high levels of resistance to Glean<sup>?</sup> and Hoegrass<sup>?</sup>. In 2005, 125 random ryegrass samples were taken across the Wimmera and Mallee region. Over half of these ryegrass samples were resistant to Glean and over a third to Hoegrass. In the Mallee, 7 percent were resistant to trifluralin compared to 2 percent in the Wimmera. In South Australia, almost half of the samples were found to have resistance to trifluralin at 200 g/ha of active ingredient but only 14 percent were resistant to higher rates of trifluralin (400g/ha active). Results like these mean farmers have to take action now and develop strategies to manage herbicide resistance.

Currently, tank-mixing trifluralin with herbicides from other groups may improve efficacy and slow the development of resistance to trifluralin and provide an alternative for managing Group A resistant ryegrass populations. The aim of the trials reported here were to compare pre-emergent trifluralin mixes for the control of Group A resistant ryegrass, and to assess the performance of a new pre-emergent herbicide, BoxerGold<sup>?</sup>, which will be released by Syngenta in 2008. BoxerGold has new chemistry containing prosulfocarb (Group E) and S-metolachlor (Dual Gold<sup>?</sup>, Group K) and has activity on most resistant ryegrass populations. It also has excellent crop safety for both wheat and barley.

Nufarm also have several new pre-emergent herbicides being evaluated for the control of grass weed species. Work is taking place in the Wimmera and Mallee in a variety of broadacre crops. The process to gain registration is a time-consuming and expensive exercise.

### Method

The trial was conducted at the BCG Herbicide Resistance site, 25 km north of Birchip on the Warne Road, Jil Jil. The site has confirmed resistance to Group A (Fop) herbicides (e.g. Hoegrass).

A second trial investigated pre-emergent herbicide options for a paddock with confirmed trifluralin resistance at Culgoa. This site was not carried through to grain yield to prevent seed set of the resistant ryegrass.

**Table 1. The trial details.**

Details	Trial 1	Trial 2
Location	Jil Jil (25 km north of Birchip)	Culgoa (30 km north of Birchip)
Number of Replicates	4	
Number of Treatments	8	
Plot Size	3m x 24m	
Crop Type	Barley	Wheat
Variety	Vic Sloop	Yitpi
Target Plant Density	150 plants/m <sup>2</sup>	175 plants/m <sup>2</sup>
Sowing Date	14 <sup>th</sup> May 2007	25 <sup>th</sup> April 2007
Seeder	Jenke Bar (no-till, narrow points and press wheels on 30cm row spacing)	
Sowing Speed	7.5km/hr	
Soil Type	Mallee sandy loam	
Soil Conditions	Moist, light rain during with heavy rain following.	Topsoil dry, moisture at depth, good rain following.
Herbicides	7/5/07 Credit <sup>?</sup> and Bonus <sup>?</sup> at 1.5 L/ha	Not required

**Table 2. Treatment descriptions and costings at Jil Jil.**

Treatment number	Product	Rate/ha	Method	Cost (\$/ha)
1	Control			
2	TriflurX	1.5 L	IBS*	8.55
3	TriflurX	3.0 L	IBS	17.10
4	TriflurX + Dual Gold	1.5 L + 0.5 L	IBS	22.70
5	TriflurX + Avadex Xtra + Dual Gold	1.5 L + 1.6 L + 0.5 L	IBS	47.10
6	TriflurX + Avadex Xtra	1.5 L + 1.6 L	IBS	33.00
7	BoxerGold	2.5 L	IBS	34.00
8	Triathelete	1.8 L	IBS	N/A

**NOTE:** Prices shown are approximate and will vary. \*IBS = Incorporated by sowing

**Table 3. Treatment descriptions and costings at Culgoa.**

Treatment number	Product	Rate/ha	Method	Cost (\$/ha)
1	Control			
2	TriflurX	1.5 L	IBS	8.55
3	TriflurX	3.0 L	IBS	17.10
4	TriflurX + Dual Gold*	1.5 L + 0.5 L	IBS	22.70
5	TriflurX + Avadex Xtra + Dual Gold*	1.5 L + 1.6 L + 0.5 L	IBS	47.10
6	TriflurX + Avadex Xtra	1.5 L + 1.6 L	IBS	33.00

7	TriflurX + Lexone	1.5 L + 180 g	IBS	16.10
8	BoxerGold	2.5 L	IBS	34.00

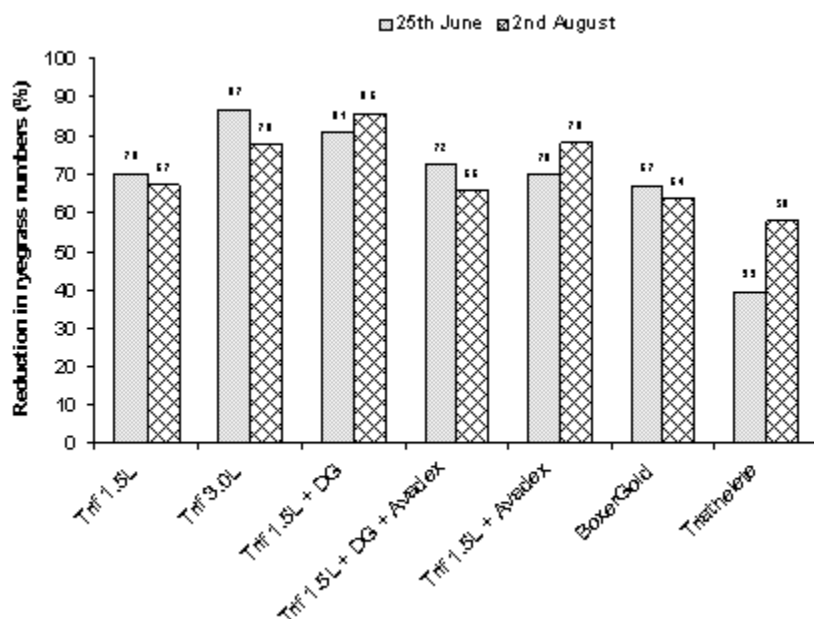
\*The use of Dual Gold above 0.25 L/ha is not registered in wheat and was used in this research only to demonstrate the effect of this mix on ryegrass control. When using any of these herbicides always follow the instructions on the registration label.

The density of ryegrass plants was assessed by counting the number of plants per square metre when the crop was at the 4-5 leaf stage, and ryegrass at 2-leaf.

A knockdown herbicide (glyphosate) was applied to control early-germinating weeds at Jil Jil. The Culgoa site did not require a knockdown prior to sowing.

## Results

Figure 1 illustrates that trifluralin significantly reduced ryegrass numbers by 70 percent when measured on 25 June. Where trifluralin had been applied, most of the ryegrass was found in the crop row or just on the edge, where there was no chemical present. Increasing the rate of TriflurX from 1.5 L/ha to 3.0 L/ha further improved ryegrass control.



**Figure 1. The reduction in ryegrass numbers, expressed as a percentage of the control, for two assessment times (25 June and 2 August) at the Jil Jil site. DG = Dual Gold**

There was no significant effect on barley grain yield from the competition of ryegrass (Table 4). In terms of grain quality, no differences were recorded in retention or screenings between the treatments at harvest.

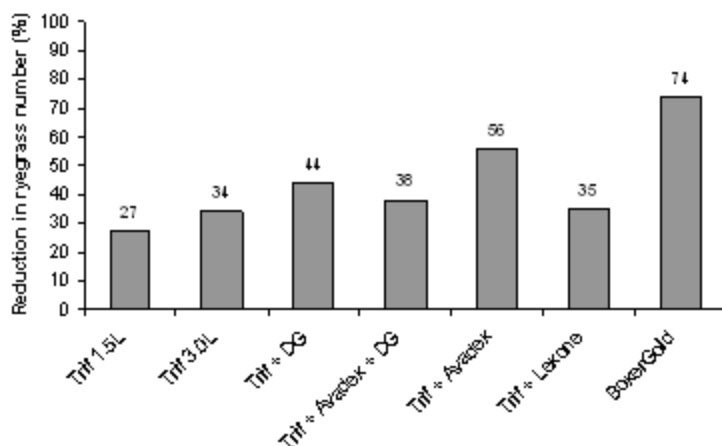
**Table 4. Barley and ryegrass results at harvest, Jil Jil.**

Treatment	Barley plant density (per m <sup>2</sup> )	Barley yield (t/ha)	Ryegrass seed heads at harvest (heads/m <sup>2</sup> )
Control	116	2.6	28.9
TriflurX (1.5 L/ha)	115	2.7	7.5
TriflurX (3.0 L/ha)	115	2.5	3.1
TriflurX + Dual Gold (0.5 L/ha)	122	2.5	0.8
TriflurX + Dual Gold + Avadex Xtra	98	2.5	5.6
TriflurX + Avadex Xtra (1.6 L/ha)	110	2.6	1.4
BoxerGold (2.5 L/ha)	99	2.5	2.2
NUL1479 (1.8 L/ha)	105	2.6	1.7
Significant difference	NS	NS	S
LSD (P=0.05)		0.3	10.9
C.V (%)		10.8%	56.7%

S – Significant Difference, NS – Not significant

Even though there was no effect on yield, ryegrass population is expected to build up rapidly in treatments that allowed significant production of ryegrass seed heads.

At Culgoa, trifluralin was not as effective and only reduced ryegrass numbers by 32 percent (Figure 2). However, further reductions were found when chemicals with different modes of action (MODs) were added to the mix. BoxerGold had excellent control, reducing ryegrass numbers by greater than 74 percent with the majority of ryegrass found in the crop row. Surprisingly, BoxerGold was less effective than trifluralin at Jil Jil where it would have been expected to be as effective or better at least. It could be that the conditions were perfect for trifluralin (e.g. moist with follow-up rain) and the mechanism of trifluralin entry into the plant was more effective.



**Figure 2. The effect of pre-emergent herbicides on ryegrass control at Culgoa as of 30<sup>th</sup> May 2007**

### Interpretation

Competition from ryegrass had no significant effect on barley grain yield (Table 4). There was also no effect of herbicide treatments on the screening content of barley grain. Optimum conditions at the time of sowing resulted in excellent uniform germination of ryegrass across the trial. Pre-emergent herbicides such as trifluralin work extremely well when incorporated into moist soils. As in the case of this trial, conditions were ideal and a significant reduction in ryegrass numbers was achieved where pre-emergent herbicides were used. The surviving ryegrass numbers were found in the crop-row and were later out-competed by the crop.

The addition of Avadex Xtra failed to improve ryegrass control whereas the addition of Dual Gold seemed to work well and further reduce ryegrass number by 10 percent. New chemistry such as BoxerGold proved to be as effective as trifluralin with excellent ryegrass control and crop safety. At Culgoa, BoxerGold was twice as effective as trifluralin which could be due to confirmed resistance to trifluralin in this ryegrass population.

### Conclusion

Long-term management strategies should consider the use of non-selective herbicides and non-chemical options such as cultivation and hay production. Problem paddocks need to be identified and monitored at the start and end of every growing season. This monitoring will help farmers understand how their management of the ryegrass population is progressing. Pre-emergent herbicide use is a vital part of most cropping systems and needs to be well planned and executed. It is important to understand how products work and how other factors such as soil and climate will affect the likely outcome. Resistance to trifluralin is difficult to diagnose in the paddock because of interactions with stubble and the volatile characteristics of the chemical. If it is suspected, a laboratory test needs to be carried out to confirm the status of resistance. Mixing trifluralin with products such as Avadex Xtra and Dual Gold has shown to have varying levels of additional control on ryegrass over the past four years. As it is an expensive option, it is critical that the risk of low efficacy be understood before using these types of mixes where efficacy is strongly dependent on soil moisture.