

## *New herbicide management solutions*

Christopher Preston, Peter Boutsalis, Jenna Malone, Sam Kleeman and Gurjeet Gill

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### **Take home messages**

- Trifluralin<sup>®</sup> resistance in annual ryegrass is increasing in southern Australia
- New pre-emergent herbicides provide control of trifluralin-resistant annual ryegrass
- Paraquat and glyphosate resistance have been identified in annual ryegrass
- Solutions are being developed to control glyphosate-resistant annual ryegrass on fence lines

### **Herbicide resistance in Southern Australia**

Recent surveys of southern Australia have identified high levels of herbicide resistance in annual ryegrass. In most areas resistance to Group A fop and Group B sulfonylurea herbicides is very high. More concerning is the increase in resistance to clethodim and trifluralin herbicides (Table 1). There are variations between regions, for example trifluralin resistance is much higher in South Australia than elsewhere. These regional differences largely reflect differences in cropping practices and hence herbicide use patterns.

**Table 1.** Percentage of paddocks with herbicide-resistant annual ryegrass in cropping regions of southern Australia

<b>Region</b>	<b>Year</b>	<b>Trifluralin<sup>®</sup></b>	<b>Hoegrass<sup>®</sup></b>	<b>Glean<sup>®</sup></b>	<b>Achieve<sup>®</sup></b>	<b>Axial<sup>®</sup></b>	<b>Select<sup>®</sup></b>
Populations resistant (%)							
SA- Mid North	2008	40	76	73	64	59	40
SA- Mallee	2007	19	6	67	2	2	2
SA- South East	2007	39	60	69	50	53	41
SA- Eyre Peninsula	2009	5	30	78	29	30	11
Vic- Western	2005	5	35	57	28	30	12
Vic- Northern	2006	2	40	43	nt	34	11
Vic - Southern	2009	0	79	81	84	68	23
NSW - SE	2008	6	81	70	nt	nt	21
Tas	2009	0	11	23	nt	nt	0

## **New pre-emergent herbicides**

The increasing extent of trifluralin-resistant annual ryegrass makes alternative herbicides vital for the continued use of no-till seeding systems. Over the past 6 years we have conducted many trials with several pre-emergent herbicides in an attempt to identify possible replacements for Trifluralin. Below are our comments about how these products have behaved in our trials on trifluralin-resistant annual ryegrass and where we see the products fitting into the cropping rotation.

**Trifluralin (Group D).** Trifluralin is a well known herbicide that has an excellent fit with knife-point and press wheel cropping systems in most cereals and many break crops. Trifluralin is tightly bound to stubble and organic matter and performance will be reduced in high-stubble conditions. Trifluralin is damaging to wheat if it gets into the crop row, so good separation is necessary between the herbicide and the crop seed. Incorporation by seeding is essential for good annual ryegrass control. Unfortunately, resistance to Trifluralin has evolved and is increasing in many cropping regions. Increasing the rate or the addition of triallate may provide some additional control of resistant annual ryegrass, but are not effective management strategies.

**Boxer Gold<sup>®</sup> (prosulcarb + S-metolachlor Group J + K).** Boxer Gold controls trifluralin-resistant annual ryegrass. Boxer Gold is registered in wheat and barley. Barley is more tolerant of Boxer Gold than wheat. Boxer Gold is water soluble and some incorporation can occur with rainfall, but the herbicide is most reliable when incorporated by sowing. Boxer Gold can be damaging to wheat if it gets down to the crop seed. We have also seen damage to wheat when herbicide treated stubble gets incorporated into the seed row. Because Boxer Gold is more soluble, some damage can occur on light soils and with shallow seeding depths. Separation of seed and herbicide is important. Boxer Gold does not bind to stubble as much as Trifluralin, but performance decreases with high stubble loads. Boxer Gold has less soil persistence than Trifluralin, so in long growing seasons annual ryegrass will emerge after the herbicide has dissipated.

**Triallate (Group J).** Triallate has traditionally been used for wild oat control, in some cereals, some pulses and canola. Some annual ryegrass suppression occurs with the higher label rates, but insufficient for triallate to be a stand-alone annual ryegrass herbicide. Our trials have always found addition of triallate to any of the other pre-emergent herbicides provides extra control of annual ryegrass. Triallate needs incorporation by sowing to achieve the best results as a mixing partner.

**Pyroxasulfone (Group K).** Pyroxasulfone is due to be released as Sakura\*\* in 2012 and controls trifluralin-resistant annual ryegrass. It will initially be registered in wheat and barley. Wheat is more tolerant than barley. Pyroxasulfone is quite water soluble and some will be incorporated by rainfall; however, incorporation by seeding is more reliable. Separation of herbicide and crop seed, particularly for barley, is important to avoid crop damage. Pyroxasulfone has longer soil persistence than Trifluralin. This means annual ryegrass emergence will be controlled until later in the season, but also that rotation options of sensitive crops will be reduced.

Dimethenamid-P (Group K). Dimethenamid-P is due to be released as Outlook\*\* in 2012 and controls trifluralin-resistant annual ryegrass. It will be initially registered in pulse crops. Dimethenamid-P is very damaging to wheat and barley, so will not be registered for these crops. The best weed control results with dimethenamid-P occur with incorporation by sowing.

### How to get the best out of new pre-emergent herbicides

Over-reliance on a single pre-emergent herbicide will inevitably lead to resistance to that mode of action. Within the pre-emergent herbicides discussed there are only 3 different modes of action. None of these herbicides will be registered in all crops in the rotation. For example, neither Boxer Gold, nor pyroxasulfone will be available for canola. Therefore, if Trifluralin resistance is not yet present, it will be important to use these new herbicides for some crops in the rotation so that Trifluralin can be saved for use in crops like canola.

### Glyphosate and paraquat resistance in annual ryegrass

Glyphosate resistance has occurred where there has been intensive use of glyphosate over a long period of time and where few or no other weed management has been employed. To date in Australia five weed species have evolved resistance to glyphosate: annual ryegrass, barnyard grass, liverseed grass, windmill grass and fleabane. Glyphosate resistance in the last four species has evolved from summer fallow uses of glyphosate.

Glyphosate resistance in annual ryegrass has been documented from 134 sites across NSW, Vic, SA and WA (Table 2). Of particular concern is the number of un-cropped sites around the farm, such as fence lines, where glyphosate resistance is occurring. This is a concern because glyphosate-resistant weeds can move off fence lines and into the cropped area.

**Table 2:** Situations where glyphosate-resistant annual ryegrass has occurred.

Situation		Number of sites	States
Broadacre cropping	Chemical fallow	29	NSW
	Winter grains	32	Vic, SA, WA
	Irrigated crops	1	SA
Horticulture	Tree crops	4	NSW
	Vine crops	17	SA, WA
Other	Driveway	2	NSW, Vic
	Fence line	36	NSW, SA, Vic, WA
	/Firebreak		
	Irrigation channel	10	NSW, SA
	Airstrip	1	SA
	Railway	1	WA
Roadside	1	SA	

Recently, we detected paraquat resistance in several populations of annual ryegrass from South Australia. These populations had been treated with paraquat for a long period of time. One population was resistant to both glyphosate and paraquat. We don't yet know the extent of paraquat resistance, but this finding demonstrates that over reliance on any herbicide can result in resistance.

Glyphosate-resistant weeds are occurring along fence lines due to intensive use of glyphosate, no competition and no other effective weed control. It should be possible to reduce the risk of glyphosate-resistant weeds by changing some of these practices. For example, where fences are no longer useful, removing the fence and cropping the area will provide both competition and a change in weed management practices. Other practices that could be employed would be mowing or slashing the weeds along the fence line, with herbicide employed only for the area immediately under the wire. Cropping as close to the fence as possible and cutting a fire break late in the season will reduce the area treated solely with glyphosate.

Many growers will continue to want a herbicide option to keep fence lines clean of weeds, so we have been exploring herbicide options for controlling glyphosate-resistant annual ryegrass on fence lines. An experiment was conducted to examine a range of herbicide options to control a large population of glyphosate-resistant annual ryegrass along a fence line. Glyphosate even at high rates provided little control (Figure 1). Mixtures of Amitrole T<sup>®</sup> and Diuron<sup>®</sup> at high rates to glyphosate provided about 60% control. SpraySeed<sup>®</sup> mixed with Diuron and SpraySeed double knock were the best treatments. This population was very large and high rates of residual herbicides were essential to get control. In smaller populations, lower rates of residual herbicides may be effective. Generally we have found the addition of residual herbicides to fence-line sprays improves control of glyphosate-resistant annual ryegrass. However, care needs to be taken with residual herbicides to ensure they are not used in situations where damage to desirable plants, such as trees, might occur. Further research continues to develop new options for fence line weed management.

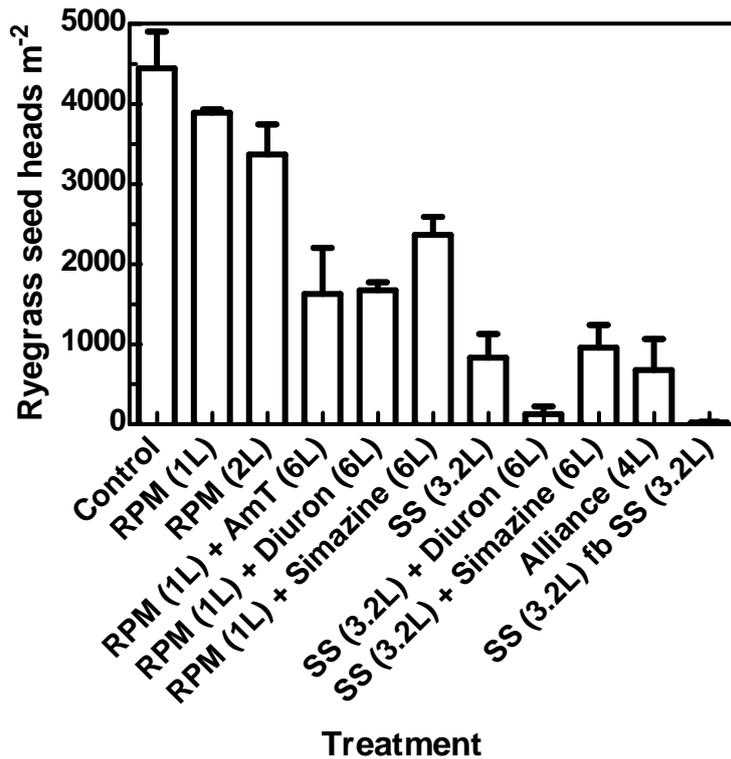


Figure 1: The efficacy of different mixes and rates of herbicides on glyphosate-resistant ryegrass. RPM = Roundup PowerMax, SS = Spray.Seed, AmT = Amitrole T, fb = followed by after 14 days.

Dr. Christopher Preston School of Agriculture, Food & Wine, University of Adelaide  
 christopher.preston@adelaide.edu.au

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