

Preventing and Managing Glyphosate Resistance in Weeds

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Take home messages

- Glyphosate resistance has now occurred in three grass weeds and will probably occur in others
- Glyphosate resistance occurs where there is intensive use of glyphosate and few or no other weed control tactics
- Fencelines and other uncropped areas around the farm are at risk of glyphosate resistance
- Competition helps manage glyphosate resistant weeds
- Roundup Ready canola will increase the risk of glyphosate resistance, so needs to be managed carefully within an integrated weed management system.

Glyphosate Resistant weeds in Australia

Since its first discovery in 1996, there are now 87 confirmed sites with glyphosate resistance in Australia. These come from four states and a variety of situations (Table 1). A number of populations are from winter fallow systems in northern NSW; however, an increasing number are from fencelines and other uncropped parts of the farm. Glyphosate resistant annual ryegrass occurs when populations are treated intensively with glyphosate, where no other herbicides applied and where there is little or no tillage. Relying solely on glyphosate for weed control is the greatest risk factor for glyphosate resistant weeds.

Table 1. Occurrence of glyphosate resistant annual ryegrass in Australia.

Situation		Number of sites	States
Broadacre cropping	Chemical fallow	25	NSW
	No-till winter grains	13	NSW, Vic, SA, WA
Horticulture	Tree crops	4	NSW
	Vine crops	14	SA, WA
Other	Driveway	1	NSW
	Fenceline	20	NSW, SA, Vic, WA
	Firebreak	2	NSW, SA
	Irrigation channel	6	NSW
	Airstrip	1	SA
	Railway	1	WA

From Preston, C. (2008) Australian Glyphosate Resistance Register. National Glyphosate Sustainability Working Group. Online. Available from www.weeds.crc.org.au/glyphosate

In addition, three populations of awnless barnyard grass and two populations of liverseed grass have been confirmed resistant to glyphosate in a summer cropping/ fallow situation in northern NSW. Resistance in these summer grass weeds has major implications for the management of summer fallows and weed control in summer crops. It also demonstrates that weeds other than annual ryegrass can evolve resistance to glyphosate.

To date, glyphosate resistance has not occurred widely in no-till cropping systems, despite the large amount of glyphosate used in this system. Studies have indicated that glyphosate resistant annual ryegrass populations do not perform well under crop competition. However, resistance can appear in areas with little competition like

fencelines and be dragged into the cropped area with harvest and seeding equipment creating a problem in the paddock. In addition, small numbers of glyphosate resistant ryegrass are likely present in paddocks that could become apparent with lack of competition.

Continued Use of Glyphosate on Glyphosate Resistant Populations may Result in Populations with Higher Resistance.

So far at least two mechanisms of resistance to glyphosate have been discovered. These are a target site mutation and reduced herbicide translocation. Both mechanisms provided modest levels of resistance meaning some control can be gained of resistant populations with glyphosate or glyphosate mixtures. However, populations can accumulate both mechanisms of resistance and are much more resistant to glyphosate (Figure 1).

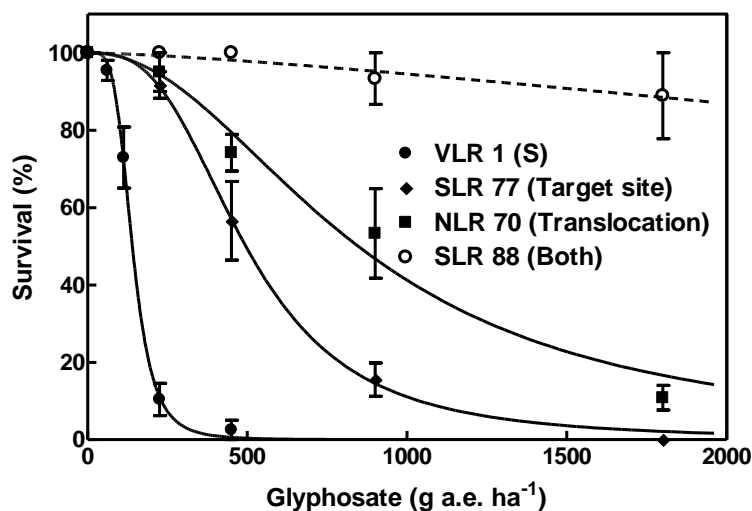


Figure 1. Dose response to glyphosate of populations of annual ryegrass with different mechanisms of resistance.

Roundup Ready Canola and Glyphosate Resistance

Growing Roundup Ready canola will increase the risk of glyphosate resistance in weeds. This is because glyphosate will be applied later, and therefore applies more selection pressure, than a pre-sowing application of glyphosate. It is important that Roundup Ready canola is used in a way that will not significantly increase the risk of glyphosate resistance occurring.

Getting the best out of Roundup Ready canola will mean using the crop as part of a multiple year weed management program. Roundup Ready canola allows a broad-spectrum herbicide to be used in crop to control most weed species. It would be sensible to take advantage of this feature when planning a rotation. Experience from 2008 indicates two applications of glyphosate provided better weed control than one application. Two applications should certainly be used in situations with higher weed burden.

Reducing the risk of glyphosate resistance requires action in the rest of the rotation. It is possible to take advantage of the rarity of glyphosate resistance and the lack of fitness of glyphosate resistant weeds. Sowing a competitive crop in the year after growing Roundup Ready canola will maximise the impact of crop competition on glyphosate resistant annual ryegrass. This will also help maximise the benefits of weed control from the Roundup Ready canola. Not using glyphosate in the year after growing Roundup Ready canola will do most to reduce the selection pressure for glyphosate resistance. However, benefits will occur from a crop year without glyphosate application elsewhere in the rotation.

Including other weed management strategies throughout the rotation will also help manage the risk of glyphosate resistant weeds. Recent survey work has identified competition and seed set control as important in reducing the amount of glyphosate resistant weeds in paddocks.

Herbicide Resistance in Other Herbicide Tolerant Canolas

There are two other types of herbicide tolerant canola available to growers; TT canola and Clearfield canola. Weeds can become resistant to both imidazolinones and to triazines and do so more rapidly than they do to glyphosate. Continuing to rely on triazines or imidazolinones for weed control will also lead to weed resistance. Annual ryegrass has already evolved resistance to both these herbicide groups.

In planning the use of herbicide tolerant canola, it will be important to choose the type most appropriate for the situation. This will be influenced by soil type, rainfall, weed spectrum and herbicide resistance risk. It is also important to maintain an integrated weed management system including opportunities for effective control of difficult to manage weeds.

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