Roundup Ready canola and glyphosate resistance

By Chris Preston, University of Adelaide

While the threat of glyphosate resistance is high in no-till cropping systems, recent research suggests crop competition and alternative weed management strategies are effective in managing glyphosate resistant populations.

There are currently 92 confirmed glyphosate resistant weed populations in Australia. Three weed species have evolved glyphosate resistance to date:

- Annual ryegrass
- Barnyard grass; and,
- Liverseed grass.

Glyphosate resistance occurs where glyphosate is used intensively, no other herbicides are used and no weed control is used after the glyphosate application.

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.

FIGURE 1: Left – effect of paraquat rate on efficacy of the double knockdown on glyphosate susceptible (S) and glyphosate-resistant (R) populations of annual ryegrass. Right – effect of time between glyphosate and paraquat applications of the double knockdown on efficacy against glyphosate-susceptible (S) and resistant (R1, R2) populations of annual ryegrass.

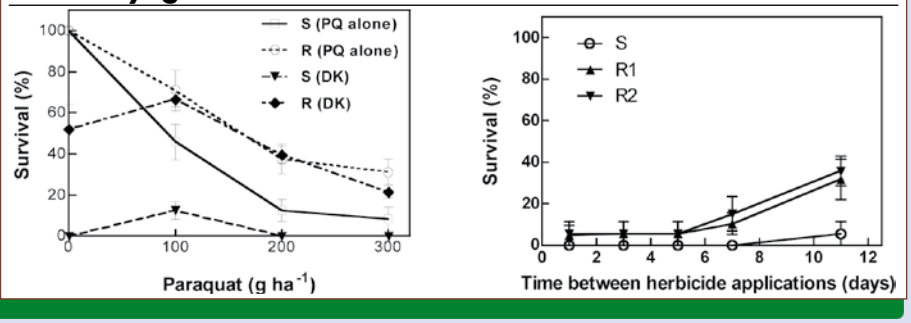
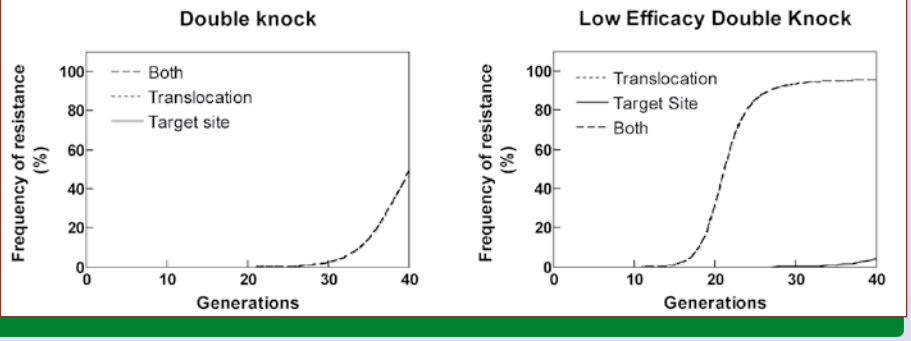


FIGURE 2: Predicted evolution of glyphosate resistance in fields containing the translocation mechanism, the target site mechanism or both mechanisms where the double knock is used as the knockdown treatment every year (left) or where a low efficacy double knock is used every year (right)



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.

Weeds and rotation crops

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.

But 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, rain-

fall, 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.

Double knocking weeds

A strategy for driving weed numbers down is to employ various forms of double knocking. Double knocking should be thought of as using a second weed control tactic to control the survivors of a previous tactic. Controlling seed set of surviving weeds is an effective way of reducing weed numbers and the impact of herbicide resistance.

There are many possible strategies for controlling weed survivors, including cutting hay or silage, crop topping, chaff carts or burning stubbles. But seed set control tactics need to be planned to obtain the greatest benefits.

The double knockdown – glyphosate followed by paraquat or paraquat/diquat – has been promoted as a way of reducing the risk of glyphosate resistance. But a poorly applied double knockdown risks increasing the risks of glyphosate resistance.

To get the most out the double knockdown, the paraquat/diquat application needs to occur at an effective rate of 1.3 L per hectare or more.

Secondly, the second herbicide application should ideally be made within five days of the glyphosate application.

More information: Dr Christopher Preston, University of Adelaide Ph: 08 8303 7237; E: christopher.preston@adelaide.edu.au
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RR canola delivers higher yields – again

Monsanto has released replicated demonstration trial results from a trial site based at Wallendbeen, NSW. The trial ran during the 2009 canola season and was focused on comparing the leading Roundup Ready, triazine tolerant and Clearfield canola systems.

In just one of many replicated trials carried out in 2009, the results again show Roundup Ready canola having a significant yield increase over triazine tolerant canola, as initially demonstrated in 2008 – its first year of commercial release.

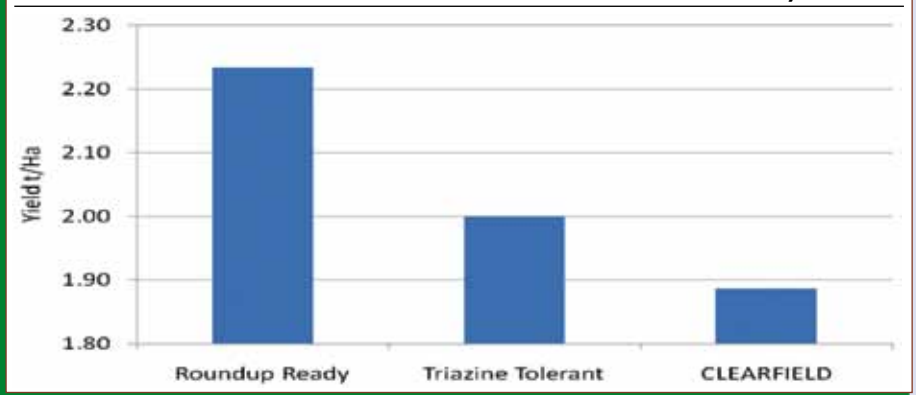
"Our trials with Roundup Ready canola have shown an 11 per cent yield increase above the triazine tolerant system which is consistent with our previous findings and with growers' experience. This proves you don't need to sacrifice yield for weed control," James Neilsen, Monsanto canola technical specialist, said.

The trial also demonstrated that yields from the Clearfield system were impacted by heavy weed pressure from Group B herbicide resistant weeds.

This trial highlights the importance to growers of the benefits of the Roundup Ready system, as it provides an alternative to other herbicide control systems.

"This is another tool in the grower's toolbox and offers real choice to growers. Roundup Ready is a more flexible and environmentally friendly herbicide control system and, as it is a non-residual herbicide, you could say it's a cleaner and greener canola," said James. ■

FIGURE 1: Yield comparison of Roundup Ready, triazine tolerant and Clearfield canola varieties at Wallendbeen, 2009



Managing resistance

The recently confirmed cases of glyphosate resistance in awnless barnyard grass and liverseed grass in the northern region were as a result of over reliance of glyphosate in the farming system combined with zero or minimum tillage farming practices.

The best way to avoid or to reduce the risk of herbicide resistance developing is to implement an Integrated Weed Management (IWM) plan. The basics are:

- Keep accurate paddock records;
- Scout fields before and after herbicide or weed control operations;
- Start with a clean field by practicing good fallow and whole farm management;
- Use the right herbicide product at the right time at the right rate;
- Use multiple herbicide modes of action in the weed control system;
- Control weeds when they are small;
- Control escapes: Prevention of weed seed set is vitally important to stop resistance developing;
- Ensure good farm hygiene: Clean equipment before moving fields; and,
- Use non-herbicide farming practices such as strategic cultivation and crop rotation.

Evaluate the suspected resistance

If glyphosate resistance is suspected, report it promptly to your Monsanto or Nufarm representative. But you should also first evaluate the situation:

- Was the application timing and rate appropriate for the weed species and growth stage, was spray coverage adequate, or did stubble cover prevent the herbicide from reaching the target?
- Were plants stressed?
- Glyphosate antagonism may occur due to tank mixes/additives, stubble cover, dust etc
- Did the suspect weed emerge before or after herbicide application?
- Has glyphosate been the main method of fallow weed control over the past 10 or more years?

If glyphosate resistance is still suspected, farmers should report it and consider an alternative method of weed control rather than risk the failure of a second application of glyphosate.

Collect suspected resistant weed samples for testing, and if possible, remove surviving weed plants from the field. ■