

## Herbicide resistance driving system change

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Herbicide resistance is driving farmers, and farming systems, 'back to basics' because, once resistant weed populations make pre-emergent chemicals ineffective, growers have few options other than good management and non-chemical control measures to fall back on.

These measures are being promoted as elements of integrated weed management (IWM) programs that combine physical, cultural and chemical weed control measures.

Resistance to glyphosate, a herbicide considered essential for the sustainability of no-till cropping systems, has become the key driver for adoption of IWM, which has the potential to slow or prevent the development of herbicide resistance, but integrated weed control is relevant to any farming system in which weeds are resistant to any herbicide.

Reducing weed seed set and adopting harvest weed seed control (HWSC) measures to prevent any seed that is set reaching the soil to renew the weed seed bank has emerged as a high priority for non-chemical control measures because the more weeds in a paddock the greater the likelihood that there will be individuals with herbicide resistance. Lowering weed populations reduces the risk of the population becoming herbicide resistant



AHRI TEAM MEMBER PETER NEWMAN DISCUSSING EARLY INDICATIONS FROM A WA HERBICIDE TRIAL.

and, perhaps more importantly, reduces the number of weeds present to compete with the crop, said University of Adelaide weeds scientist Chris Preston.

Management options include the use of agronomic measures like crop rotation, which can open the way for use of a herbicide with a different mode of action, and crop competition.

Peter Newman, a member of the WA-

based Australian Herbicide Resistance Initiative (AHRI) team headed by Professor Stephen Powles, said increasing crop competition can be an effective means of reducing weed seed set.

"Increasing wheat seeding rate by 40 kg/ha has been shown to halve weed seed set in some WA conditions.

"And in districts where average yield potential is more than 2 t/ha, reducing row spacing will increase yield and reduce weed seed set.

"Growers have been increasing row spacing to improve trash clearance at seeding, but new-generation seeders are designed for modern stubble-retention farming systems and row configurations such as paired rows or ribbon seeding can open the way for higher seeding rates without compromising trash clearance."

If there is no effective chemical available for weed control growers have no option but to turn to physical measures to attack the weed population at other stages or in other ways, Mr Newman said.

"Most of the herbicides used in cereal production are designed to target seedling weeds early in the season. Physical measures, including harvest-time seed removal or destruction, attack weed populations at another growth stage and do not rely on a chemical.



UNIVERSITY OF ADELAIDE WEEDS SCIENTIST DR CHRIS PRESTON CHECKS THE LEVEL OF IN-CROP WEED CONTROL. LOWERING WEED POPULATIONS REDUCES THE RISK OF THE POPULATION BECOMING HERBICIDE RESISTANT AND REDUCES THE NUMBER OF WEEDS PRESENT TO COMPETE WITH THE CROP.

“In recent years there has been a lot of work on reducing or preventing renewal of the weed seed bank by removing or destroying weed seeds at harvest so they aren't returned to the soil.

“Measures to achieve that include windrow burning to destroy seed post-harvest or using a chaff cart to remove seed in the chaff stream from the paddock for feeding to stock or burning at a centralised location.

“Many WA farmers, up to 80% in some districts, have indicated they plan to include chaff carts in their harvest systems to minimise seed-bank renewal and the risk of resistance, and chaff carts are currently sold out in WA.”

### Rotation of chemicals with different modes of action is an essential part of effective herbicide management.

The latest option for harvest-time seed management is the Harrington Seed Destructor, which is only now becoming commercially available. The Destructor, a self-powered mill towed behind or fitted to a header, uses a cage mill to crush seeds in the chaff stream.

‘Crop topping’ – applying a herbicide to crops ahead of harvest - aims to achieve a similar result by preventing weed seed set. Hay production can also reduce weed populations because cutting hay removes weeds before they can set seed or, if seeds are set before cutting, they are removed in the hay.

“The aim has to be to prevent seed set or, if weeds do set seed, to prevent them reaching the soil,” Mr Newman said. “This requires a no-tolerance mind set. If you see a weed, deal with it.



RYEGRASS ‘ESCAPES’ CAN FLAG A RESISTANCE ISSUE.

## ‘SUPPORT TOOLS’ FOR WEED CONTROL DECISIONS

Growers can obtain ‘decision support tools’ and the latest information about Integrated Weed Management (IWM) from a variety of web resources.

One of those is the Weedsmart site, [www.weedsmart.org.au](http://www.weedsmart.org.au), where there is a Weedsmart ‘app’ that will give them access to an online ‘tool’ to assess the risk of their weeds developing herbicide resistance.

Weed Seed Wizard, designed to coordinate management of measures aimed at reducing the weed seed bank, can be downloaded free from [www.grdc.com.au](http://www.grdc.com.au) or <http://grains.agric.wa.gov.au/weed-seed-wizard>

Weed Seed Wizard has been developed to help growers assess the impact of different combinations of weed management strategies on weed populations.

The Resistance and Integrated Weed Management (RIM) program, available free from [www.ahri.awu.edu.au/rim](http://www.ahri.awu.edu.au/rim), is designed to assess the effectiveness and financial implications of cropping and weed management scenarios over a 10-year period.

## AIM FOR WEED CONTROL DIVERSITY – POWLES

Herbicide resistance poses a major threat to global food production, according to AHRI head and University of WA professor Steve Powles, who will be one of the keynote speakers at next year’s SANTFA annual conference.

“We need to preserve the herbicides we have and the only way to do that is to diversify the way we control weeds,” he said.

“To keep herbicides like glyphosate working on Australian farms we need to use them as infrequently as possible and apply non-herbicide control measures wherever we can.

“You only need to look at what is happening in the US, where there has been a massive over-use of glyphosate, to see what will happen if we do not learn from that and diversify our weed control methods.

“To win the battle against herbicide resistance we need good science coupled with good agronomy, good agricultural engineering, well-trained scientists and technicians, and dedicated farmers implementing a range of weed control practices.”

“Any weed that survives a herbicide spray is cause for concern because, even if it isn’t resistant, it increases the risk of more weeds to deal with in the future and the likelihood of resistance developing.”

The ‘double knock’ technique, in which two pre-emergence herbicides are applied a few days apart, with the second chemical intended to kill any weeds that survived the first spray, was developed as a counter to the emergence of herbicide resistance.

Many of today’s ‘alternative’ physical and cultural weed control methods were an integral part of farming before herbicides became available, Mr Newman said.

“There is really nothing new or exciting here. The old methods work and the old messages are valid. The key is to put

together a combination of measures that will be effective in your farming system and environment and pay attention to the detail so they work as well as they possibly can.

“It’s about the attention to detail and focusing on reducing weed numbers.

“We are starting to see farmers who have been using chaff carts for a decade or so with crops that are clean as a whistle, with weeds difficult to find.

“Initially most growers who decide to include a chaff cart or other harvest-time seed control measure in their system maintain their seeding-time herbicide program, but over the longer term, as weed populations are reduced by the control pressure pre-seeding and at harvest, there

is potential for significant savings in chemical costs by reducing the number of sprays or shifting back to lower-cost earlier-generation chemistry.

“However, reducing chemical costs is secondary. The major benefit is not having weeds competing with the crops.”

Break crops, typically a legume or canola, in a cereal cropping program, have a role in IWM because they can open the way for use of a different chemical with a different mode of action on ryegrass and other grass weeds, often at a growth stage other than the seedling stages targeted by pre-emergence herbicides.

“The role of weed survival in the development of resistance means it is critical to stack weed management practices,” Dr Preston said.

“The aim must be to kill any weed that survives a herbicide so there is no resistant survivor to lay the foundation for a resistant population.”

It is also important to change herbicides periodically.

“Rotation of chemicals with different modes of action is an essential part of effective herbicide management,” said Professor Powles.

“Herbicides are still valuable weed control tools, and to ensure they remain effective into the future it is important that they are not over-used on the same weed populations.”

“It is important to rotate chemicals to minimise the risk of selecting weeds with resistance to a particular herbicide or mode of action.”

Dr Preston agrees that rotating chemical groups is important, with no quick chemical fix or ‘glyphosate alternative’ in the chemical pipeline.



## GLYPHOSATE RESISTANCE GAINING GROUND

Glyphosate resistance is widespread in the South East of SA.

The annual University of Adelaide resistance survey found that glyphosate-resistant annual ryegrass in 16% of the 122 South-East paddocks sampled in last year’s survey.

No glyphosate-resistant ryegrass was found in the SA Mallee.

According to the Glyphosate Sustainability Working Group, glyphosate resistance has been documented in 511 Australian weed populations: 363 populations of annual ryegrass, 76 of awnless barnyard grass, 57 of fleabane, 10 of windmill grass, three of liverseed grass and most recently, two populations of great brome in SA.

SA leads the way on glyphosate resistance in annual ryegrass, with 149 resistant populations, ahead of NSW (116 populations), Victoria (55) and WA (43).

The world’s first case of glyphosate resistance was documented in 1996, in annual ryegrass in Victoria. By 2004 the number of confirmed glyphosate-resistant ryegrass populations was more than 40, and just nine years later the figure is more than 360, with more resistant populations identified each year.

And the number of resistant weed populations seems certain to continue increasing, given growers’ reliance on chemical weed control and that repeated use of the same chemicals selects for resistance.

With resistance to Group A, B, C, D, and Q chemicals also present in annual ryegrass, growers are increasingly turning to physical controls such as hay production, green or brown manuring and harvest-time seed destruction to keep control of ryegrass and other herbicide-resistant weeds.

Andrew Storrie, Executive Officer of the Glyphosate Sustainability Working Group, said growers who suspect they have weeds with glyphosate resistance on their property should:

- contact their local agronomist
- consider whether the apparent herbicide failure was due to:
- poor spraying conditions or incorrect rate
- surviving plants emerging after the glyphosate application or the spray not reaching them
- a spray ‘miss’ or application problem

If resistance is still suspected after this exercise they should contact a member of the Working Group – Dr Chris Preston in SA – for advice on sampling and testing of the suspect plants for resistance, he said.