FINAL REPORT

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

AGG00001

Quantifying herbicide resistance in modern farming systems Griffith region 2012

PROJECT DETAILS

PROJECT CODE:	AGG00001
PROJECT TITLE:	QUANTIFYING HERBICIDE RESISTANCE IN MODERN FARMING SYSTEMS GRIFFITH REGION 2012
START DATE:	01.07.2012
END DATE:	30.06.2014
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Summary

Herbicide resistance has been identified as the number one issue that growers and advisers are facing. This was identified in New South Wales (NSW) Department of Primary Industries (DPI) focus groups and GRDC Regional Cropping Solutions (RCS) groups.

A focused extension campaign of field days was run by district agronomists across NSW in 2012, raising the awareness of herbicide resistance and its implications on current and future farming systems. These field days aimed to capture information from growers and advisers on their current level of knowledge on this complex and major farming systems challenge, as well as discuss the implications herbicide resistance has on farming systems and farm profitability.

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Achievements/Benefits

Background

Herbicide resistance has been identified as the number one issue that growers and advisers are facing. This was identified in NSW DPI focus groups and GRDC RCS groups.

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Herbicide resistance in annual ryegrass (*Lolium rigidum*) and common sow thistle (*Sonchus oleraceus*) in the Western Riverina region of NSW has elevated significantly in recent years. The nature of the cropping and pasture rotations in the region has made managing herbicide resistance extremely difficult, and recent herbicide resistance surveys funded by GRDC have included only limited samples from this region.

Currently herbicide resistance is being managed based on these random surveys and indications from growers or advisers, which is potentially underestimating the levels of herbicide resistance in current farming systems. In addition, grain growers are spending large amounts of money on herbicides that are not working, resulting in large yield losses due to weeds. This has been compounded by flooding in March 2012 which washed weed seeds over large distances changing historical expectation of resistance status at the paddock level.

Objectives

The objectives of the project were to:

- Quantify current levels of herbicide resistance in annual ryegrass and common sow thistle across key herbicide groups in dryland and irrigated farming systems in the Griffith region of NSW.
- Collect site specific information to categorise levels of risk for developing herbicide resistance for various farming systems, based on rotational history and farming practices.
- Assess the ability of growers and advisers to predict the resistance status of each sample.

Methodology

Samples of annual ryegrass and common sow thistle seed and extensive paddock records were collected from the dryland and irrigation region surrounding Griffith in November/December 2012 by district agronomists, agribusiness agronomists, private advisers and growers.

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Sampling:

- The sampling protocols used for weed seed collection were similar to those previously developed by weed researchers. This involved collecting an A4 envelope of seed following weed maturity, with seed collected every five to 10 paces, to avoid bias towards single populations. Seed was collected from either a known resistant population or non-resistant population.
- Samples were appropriately identified, GPS referenced, and submitted with the appropriate questionnaire sheet, which requested information about the history of the paddock, the current farming system and the expected resistance status of the sample.

Testing:

- Herbicides were selected from those registered in Australia.
- Ryegrass samples were tested with four pre-emergent herbicides (triasulfuron#, trifluralin#, prosulocarb# + S-metolachlor # and pyroxasulfone#) and seven post-emergent herbicides (diclofop-methyl#, haloxyfop-R#, clethodim#, pinoxaden# + cloquintocet-mexyl#, imazamox# + imazapyr#, iodosulfuron-methyl-sodium# and glyphosate#).
- Sow thistle samples were screened with six post-emergent herbicides (metsulfuron- methyl#, iodosulfuron-methyl-sodium, MCPA# + imazapyr + imazapic#, clopyralid#, MCPA and glyphosate).
- Seed was tested at the Graham Centre resistance testing facility in Wagga Wagga, using the same protocols as commercial tests.

Communication and extension:

- The results from the testing and questionnaire formed the basis of an extension program across the region including presentations at GRDC Updates (Griffith 2012 - 70 people, Temora 2013 210 people), field days (Merriwagga - 110 growers and Rankins Springs 70 growers) and pre-season meetings (various in 2012 and 2013 totalling 250 growers and advisers).
- Results have also been compiled into an article for GRDC Ground Cover magazine.

Results

A total of 102 ryegrass samples and 31 sow thistle samples were collected from farms across the Western Riverina region of South Western NSW.

For ryegrass 69 samples were dryland, with the majority of samples collected from continuous cropping no-till rotations. A further 33 samples were from irrigated situations, with the majority from a continuous cropping with cultivation rotations. For sow thistle, 19 samples were dryland, with the majority of samples collected from a continuous cropping no-till rotation, and 12 samples were from irrigation, with the majority from a continuous cropping with cultivation rotation.

The key outcomes from this project were:

- 100% of the ryegrass samples and 22% of the sow thistle samples were resistant or developing resistance to at least one herbicide, with multiple resistance common in ryegrass.
- Growers and advisers were accurate 74% of the time when predicting ryegrass resistance. This reduced to 65% for post emergent herbicides.
- No-till continuous cropping rotations hosted higher resistance levels and often to more herbicides than less intensive rotations including pasture. However, in many cases, samples from paddocks that have had minimal herbicides often showed resistance to multiple herbicides.
- Cross resistance between Logran®# and Hussar®# in ryegrass was lower than expected.

Additional information

GRDC Update 2014 Temora paper: "Quantifying herbicide resistance in modern farming systems Griffith region 2012/2013, Barry Haskins Ag Grow Agronomy and Research Pty Ltd'

Discussion

Implications and recommendations

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- This project highlights the necessity of using not only pre-emergent herbicides, such as Treflan®#, Boxer Gold®# and Sakura®#, but also the necessity for non-herbicide weed control tactics, as the number of samples that were resistant to all key post-emergent herbicides that control ryegrass was alarming.
- This project also showed that resistance to glyphosate was much higher than what would have been suggested by industry trends, and this was expected by growers and advisers. This highlights the need to use other knockdown herbicides such as Gramoxone®# in conjunction with other non-herbicide knockdown tactics to extend the life of glyphosate#. The same applies for Axial®# and Verdict®#. Future research efforts into managing farms with glyphosate resistance may be worthwhile.
- This project showed that the ability of growers and advisers to predict if resistance was present or not was variable. Twenty six percent of the time the grower or adviser thought that a sample was susceptible, when in actual fact it was resistant. This may help explain the level of failed herbicide applications that commonly occur in the farming system.
- Cropping intensity has a large effect on resistance and the project reinforced this. The higher the cropping intensity, the greater the resistance to a wider number of herbicides.
- The lack of a relationship in resistance between group B sulfonyl urea herbicides Logran®# and Hussar®# was interesting and of practical use. The trend measured in this project was not expected, and may be a useful outcome for some growers and advisers.
- In many cases, there were ryegrass samples that tested resistant to various groups of herbicides that had never been used on that individual farm. In fact, some samples had never had any herbicides applied to them, and were geographically isolated from cropping land where herbicides were applied, but still tested positive to a range of herbicides. This has posed the question of how resistance occurs within a population, and the ways that resistance may enter a population or spread from one region to another.

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