A comparison of wheat and barley response to herbicides between southern New South Wales and southern Queensland

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Summary Herbicide tolerance of wheat and barley cultivars has been tested at Wagga Wagga in southern New South Wales since the 1980s and on the Darling Downs in southern Queensland since 1999. Although each project tests the cultivars and herbicides specific for their region, a number of herbicides and cultivars were common to each project.

Overall, response between the two projects was similar for approximately 50% of the common cultivar × herbicide combinations. Crop damage was greater from testing in southern New South Wales than in southern Queensland for over a third of the common cultivar × herbicide combinations. This reinforces the need for regional testing for variations in cultivar tolerances to herbicides.

Keywords Wheat, barley, cultivar, tolerance, herbicide.

INTRODUCTION

Several Grains Research and Development Corporation funded projects have quantified the yield losses associated with herbicide damage in different regions within Australia. One project based in Wagga Wagga, New South Wales (NSW), provides crop tolerance data for the southern grain region, while another based on the Darling Downs, Queensland, provides information for the northern grain region. Herbicide tolerance screening is conducted under weed-free conditions and yield losses of 10–15% are quite common in both projects. This information is available to the industry in the form of risk ratings for different cultivars and herbicide combinations. For the southern region, this information is available in the annual NSW Agriculture publication 'Weed Control in Winter Crops' and for southern Queensland from the Department of Primary Industries and Fisheries website. This paper reports on the similarities and differences in cultivar response to selected herbicides between the two projects.

MATERIALS AND METHODS

Nineteen wheat and 10 barley cultivars were common to both regions, and 13 herbicides were common for wheat and 11 for barley, resulting in 113 cultivar × herbicide combinations in wheat and 64 in barley (Tables 1 and 2). Results were obtained from unpublished annual reports from the NSW project from 1996 to 2002 by Lockley, Lemerle, and Littlewood, and from the Queensland project from 1999 to 2003 by Walker and Churchett. In both regions, the herbicides were applied at both the recommended (1X) and double label rates (2X) and at the growth stage recommended on the label. While most cultivar combinations have been tested for three or more seasons, some have only one year of data.

Yields losses were compared using the following ratings: VL (very low risk) = no significant yield losses for 1X and 2X in any season, L (low risk) = some significant yield losses at 2X only for one or more seasons, M (medium risk) = some significant yield losses at 1X and 2X in one season, H (high risk) = significant yield loses at 1X and 2X for two or more seasons.

RESULTS

Yield losses from herbicide damage were similar for around 50% of the cultivar × herbicide combinations examined in barley and wheat. However, the yield penalty was greater for 38% of barley and 35% of wheat combinations in southern NSW compared with southern Queensland, whereas the reverse was true for only 9–13% of the cultivar × herbicide combinations (Tables 1 and 2).

Response was generally similar for clodinafop, fluroxypyr, fenoxaprop, tralkoxydim and bromoxynil in wheat cultivars and for fluroxypyr and MCPA (LVE and amine) in barley cultivars. However, there was limited testing of tralkoxydim in Queensland and fenoxaprop in NSW. Damage tended to be greater in southern NSW for chlorsulfuron, MCPA LVE, picloram + MCPA and 2,4-D in wheat cultivars, and for metsulfuron, 2,4-D and picloram + MCPA in barley cultivars. However, crop damage tended not to be greater for any one particular herbicide in southern Queensland compared with southern NSW across all cultivars.

Fifty percent of wheat and 52% of barley combinations received a very low or low risk rating for both regions, while only three cultivar × herbicide

Table 1. Comparison of herbicidal tolerance of wheat cultivars screened in Queensland (Q) and New South Wales (NSW). Yield data were compared using the following ratings: VL (very low risk) = no significant yield losses for 1X and 2X in any season; L (low risk) = some significant yield losses at 2X only for one or more seasons; M (medium risk) = some significant yield losses at 1X and 2X in one season; and H (high risk) = significant yield loses at 1X and 2X for two or more seasons. 1X is recommended rate and 2X is double rate. An asterisk indicates one year of testing only.

	Fluroxypyr		MCPA LVE		Dicamba		Bromoxynil		Metsulfuron		Tralkoxydim		Chlorsulfuron	
Cultivar	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW
Braewood									VL	VL			VL	VL
Cunningham			VL	M			VL	VL	H	L			VL	M
Ellison									VL	VL*			VL	VL*
Giles							VL	VL	H	L	VL*	L		
Hartog			VL	VL					L	L				
Hybrid Mercury									M*	L	VL*	VL		
Janz	VL	VL*	VL	L	L	VL	VL	L	VL	M	VL*	VL	VL	M
Kamilaroi									L	M				
Sunbri			VL	L			VL	VL	L	VL	VL*	VL		
Sunbrook	VL	VL			VL	VL	VL	VL*	VL	VL	VL*	VL		
Sunco			VL	L					M	L				
Sunstate			VL	VL			VL	M	VL	M	VL*	L		
Sunvale							VL	VL						
Wollaroi	VL	VL	VL	VL	VL	L	VL	VL	L	M	VL*	VL	VL	M
Yallaroi	VL	VL	VL	VL			L	VL	M	M	VL*	VL	VL	M
SUN376G									VL	L*			VL	VL*

Table 1. (continued).

	Clodinafop		Picloram + MCPA		Fenoxaprop		2,4-D		Flamprop		Triasulfuron	
Cultivar	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW
Braewood			VL	VL*			VL	VL				
Cunningham	VL	VL	VL	VL			VL	L	M	M	L	VL
Ellison							VL	VL*				
Giles			VL	VL*			VL*	VL	L	VL	L	VL
Hartog	VL	VL	VL	H			M	VL	L	VL		
Hybrid Mercury	VL*	VL	VL*	L*	VL*	VL*	VL*	VL	VL*	L		
Janz	VL	VL	VL	VL	VL	VL*	VL	L	VL	L	L	M
Kamilaroi			VL	L			VL	VL	L	L		
Kennedy											L	VL
Lang											VL	VL
Strzelecki											VL	VL
Sunbri	VL	VL					VL	L	L	L		
Sunbrook	VL	VL	VL	M*	VL	VL*	VL	VL*	M	L		
Sunco	VL	VL	VL	L					L	VL		
Sunstate							L	L	L	L		
Sunvale									L	L		
Wollaroi	VL	VL	VL	M*	VL	VL*	VL	L	L	M	VL	M
Yallaroi	L	VL	VL	L			VL	M	VL	M	L	M
SUN376G							VL	L*				

combinations had medium risk ratings in both regions. These were Yallaroi × metsulfuron, Cunningham × flamprop and Grimmett × picloram + MCPA. No cultivar × herbicide combination has a high risk rating in both regions.

Seventeen wheat and 14 barley combinations produced very different results between regions, with 80% of the higher risk ratings in NSW. The wheat herbicides were metsulfuron (six cultivars), picloram + MCPA (three cultivars), chlorsulfuron and 2,4-D (each two cultivars), and MCPA LVE, bromoxynil, flamprop, and triasulfuron each for one cultivar. The barley herbicides were 2,4-D and picloram + MCPA (each three cultivars), dicamba, metsulfuron, and tralkoxydim (each two cultivars), and diclofop + fenoxaprop (one cultivar).

DISCUSSION

In both Queensland and New South Wales, registered herbicides have caused a range of phytotoxic symptoms in crops, particularly wheat and barley. These symptoms have varied in appearance, degree of severity and persistence between cultivars, and have the potential to cause significant yield losses. This problem has been researched at two sites in the northern (Darling Downs) and southern grain growing regions (Wagga Wagga) of eastern Australia. These sites experience different rainfall patterns, temperatures, frost occurrences and

Table 2. Comparison of herbicidal tolerance of barley cultivars screened in Queensland (Q) and New South Wales (NSW). Yield data were compared using the following ratings: VL (very low risk) = no significant yield losses for 1X and 2X in any season; L (low risk) = some significant yield losses at 2X only for one or more seasons; M (medium risk) = some significant yield losses at 1X and 2X in one season; and H (high risk) = significant yield loses at 1X and 2X for two or more seasons. 1X is recommended rate and 2X is double rate. An asterisk indicates one year of testing only.

	MCPA 500		Fluroxypyr		MCPA LVE		Dicamba		Bromoxynil		Metsulfuron	
Cultivar	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW
Binalong									M	VL	VL	VL
Gairdner	VL	VL*	VL	L	VL	L	VL	M	L	M	VL	L
Grimmett					L	L	H	L	M	L	L	M
Kaputar					VL	VL*	VL	VL*	L	L*	VL	L*
Lindwall							L	M*	VL	VL*	L	VL*
Mackay									L	VL*	VL	VL*
Schooner					VL*	VL					VL*	H
Skiff					VL	VL			VL	VL	VL	M
Tantangara	VL*	VL*	VL	VL	L	M	L	L	VL	L	VL	L
WB236									VL*	VL	VL*	VL

Table 2. (continued).

	Tralkoxydim		2,4-D		Diclofop + fenoxaprop		Picloram + MCPA		Metsulfuron + MCPA	
Cultivar	Q	NSW	Q	NSW	Q	NSW	Q	NSW	Q	NSW
Binalong			VL	VL	M	VL	VL	VL		
Gairdner			VL	M	VL	L	VL	VL	VL*	VL
Grimmett			VL	VL			M	M		
Kaputar	VL*	VL*	VL	VL*						
Lindwall	VL*	VL*	VL	VL*			VL	VL*		
Mackay			VL	VL*	VL	VL*	VL	VL*		
Schooner	VL*	M	VL*	M			VL*	M		
Skiff			VL	VL			VL	VL		
Tantangara	VL*	M	VL	L	VL	L	VL	M	VL*	VL
WB236			VL*	M	VL*	VL	VL*	M		

have very different soil types. These differences may affect the degree and severity of damage and consequent yield loss inflicted on a cultivar.

Overall, yield response was similar for approximately half of the different herbicide × cultivar combinations. Most had no significant yield losses at the recommended rate, and yields of Yallaroi, Cunningham and Grimmett were significantly reduced by metsulfuron, picloram + MCPA, and flamprop, respectively in both regions. However, there were yield losses for many herbicide × cultivar combinations for both wheat and barley in the individual regions, particularly for metsulfuron, picloram + MCPA, chlorsulfuron, and 2,4-D.

The durum wheat cultivars, Kamilaroi, Wollaroi and Yallaroi, were generally more affected by the sulfonylurea herbicides in NSW than in Queensland. Overall, some cultivars, including Cunningham, Wollaroi and Yallaroi, appeared more prone to herbicide damage compared with other cultivars, such as Sunbri, Sunbrook and Janz.

When the crop response differed between the two regions, generally yield losses were greater in NSW than in Queensland. A possible reason is that this comparison was based on more than seven years of testing in NSW and five years testing in Queensland. Reasons for these differences need to be investigated further, and may include research into rates, timing, adjuvants, and environmental effects.

The differences in barley and wheat cultivar responses to a range of herbicides indicate that the testing of crop tolerance needs to continue at the two sites. The information generated provides a valuable resource for the growers of both regions, enabling them to choose safer herbicides for their sown cultivars, or selecting more tolerant cultivars for their important herbicides.

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