THE TOLERANCE OF SIX WHEAT CULTIVARS TO CHLORSULFURON AND TRIASULFURON IN WESTERN AUSTRALIA

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Summary. The tolerance of six widely grown wheat cultivars in Western Australia to chlorsulfuron and triasulfuron was investigated using results obtained from field experiments in the period 1983 to 1988. At maximum recommended rates wheat tolerance to triasulfuron was superior to that of chlorsulfuron. The margin of safety was excellent for triasufuron but poor for chlorsulfuron. The cultivar Kulin was the most sensitive cultivar to both chlorsulfuron and triasulfuron. The difference in yield between triasulfuron and chlorsulfuron at maximum recommended rates ranged from 4 - 15% in favour of triasulfuron depending upon cultivar.

INTRODUCTION

The introduction of the sulfonylurea herbicides, chlorsulfuron and triasulfuron has caused significant changes in the use patterns of herbicides in Western Australia. Prior to the release of chlorsulfuron in 1983 the major herbicide for pre-emergent control of annual ryegrass in wheat was trifluralin which was used on 0.75 million hectares. By 1989 trifluralin use in wheat had fallen to less than 0.1 million hectares having being displaced by chlorsulfuron and triasulfuron (R. Madin, pers.comm., 1989). The current use of these two sulphonyl ureas is on 40% of the wheat area in Western Australia.

Given the widespread use of sulfonylurea herbicides, information on the relative yields of cultivars when treated with these two herbicides is desirable if farmers are to make sound decisions on herbicide use. Significant variation in the response of Australian wheat cultivars to chlorsulfuron has been reported for twice the maximum recommended rate (1,2,3). No reports on the response of Australian wheat cultivars in response to rates of triasulfuron are available. A report from Europe indicated that wheat shows excellent tolerance to triasulfuron and that no cultivar differences had been detected.(4).

This paper provides information on the relative tolerance to chlorsulfuron and triasulfuron of the six most widely grown wheat cultivars in Western Australia from 1983 to 1988, and discusses some of the implications of their use in wheat in Western Australia.

METHODS

The mean yield data from weed-free experiments comparing the relative tolerance of wheat cultivars to chlorsulfuron and triasulfuron were analysed. The yield data were from field experiments conducted from 1983 to 1988 in the wheat growing region of Western Australia in which rates of chlorsulfuron at 15 g a.i./ha, triasulfuron at 25 g a.i./ha and twice these rates respectively were applied prior to seeding.

Wheat was sown at 50 kg/ha with fertiliser application of 15-20 kg N/ha and 7-10 kg P/ha depending upon site fertility. Plot size ranged from 5 m^2 in the earlier years to 10 m^2 in later years. Wide variation in soil types was evident with deep sands, clay loam and duplex soils (sand or loam over clay) all being encountered. For each cultivar by herbicide an analysis of variance was performed on the treatment mean responses from each experiment using experiment as a blocking factor. The number of data sets for each cultivar ranged from four to fourteen with fewer sets for triasulfuron analyses compared to chlorsulfuron analyses (triasulfuron testing was not begun until 1986). Analysis was conducted only where four or more data sets were available for a cultivar by herbicide combination. The coefficients of variation for experiments from which the yield data was extracted ranged from 5 - 26%, with all but two experiments below 20%.

RESULTS AND DISCUSSION

The six cultivars for which analyses were undertaken were sown on 85% of the area in wheat in 1988. While Gamenya was the most important variety in 1983, it was the least important of the six by 1988. Halberd was sown or 20-25% of the wheat area between 1985 and 1988. The use of chlorsulfuron at 15 g/ha has resulted in significant yield reductions with four cultivars, while at 30 g/ha all cultivars were significantly reduced in yield (Table 1). Kulin was the cultivar most sensitive to chlorsulfuron, while Halberd was the most tolerant. Overall a low margin of safety exists for chlorsulfuron tolerance in wheat in Western Australia.

In contrast to the chlorsulfuron results, wheat cultivar tolerance to triasulfuron was excellent with only Kulin showing a significant reduction in yield at the recommended rate (Table 1). At the 50 g/ha rate triasulfuron reduced yields significantly in only three cultivars. The wheat tolerance to 25 or 50 g/ha of triasulfuron was equal to or better than the tolerance to 15 g/ha of chlorsulfuron, with a yield advanage of 4 to 15% in favour of triasulfuron at the maximum recommended rates.

The general poor tolerance of these wheat cultivars to chlorsulfuron has been perceived as one of the major reasons for farmers reducing use rates of chlorsulfuron in Western Australia. The results presented here would support the view that at maximum recommended rates chlorsulfuron has the ability to reduce the yield potential of the crop, and the reduced use rate by farmers may have been the correct response but only if it is not at the cost of reduced weed control. The continued sowing of Halberd in the Eastern wheatbelt, even though it is lower yielding than other recommended cultivars, could also be in part due to it's higher chlorsulfuron tolerance.

Table 1 The mean yield (t/ha) of six cultivars treated with chlorsulfuron and triasulfuron in weed-free tolerance experiments from 1983 to 1988.

	Chlorsulfuron (g/ha)			
Cultivar	0	15	30	l.s.d.[a]
Aroona	1.68	1.49 (89)[b]	1.34 (80)	0.17
Eradu	1.98	1.79 (90)	1.64 (83)	0.17
Gamenya	1.90	1.73 (91)	1.63 (86)	0.11
Gutha	1.89	1.76 (93)	1.65 (87)	0.14
Halberd	1.60	1.54 (96)	1.40 (88)	0.17
Kulin	1.90	1.52 (80)	1.40 (74)	0.18
	Triasulfuron (g/ha)			
Cultivar	0	25	50	l.s.d.
Aroona	1.64	1.63(99)	1.51 (92)	0.13
Eradu	1.92	1.83(95)	1.89 (99)	n.s.
Gamenya	1.53	1.50(98)	1.53(100)	n.s.
Gutha	1.74	1.68(97)	1.64 (94)	0.10
Halberd[c]				
Kulin	2.10	1.99(95)	1.96 (93)	0.12

a. l.s.d. at P=0.05
b. Values in parentheses are yield as percent of untreated.
c. No analysis as less than four data sets.

Wheat cultivar tolerance to triasulfuron was excellent even at twice the recommended rate. The potential for cultivar susceptibility to triasulfuron does exist, but at a very much lower level than for chlorsulfuron. The use of triasulfuron for weed control in chlorsulfuron sensitive cultivars is likely to produce significant yield benefits due a higher level of crop tolerance. The slight susceptibility of Kulin to triasulfuron is important as it leaves open the possibility that progeny derived from Kulin could show some level of reduced tolerance to sulfonylureas, especially under conditions where these herbicides can cause reduced crop yield such as waterlogging or high soil acidity.

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REFERENCES

1. Lemerle, D., Leys, A. R. , Hinkley, R. B. and Fisher J. A. 1985. Aust. J. Exp. Agric. 25, 922-926.
2. Bowran, D. G. 1989. Proc. 5th Ass. Wheat Breeding Soc. Aust. Perth. pp 207-210
3. Bowran, D. G. and Blacklow, W. M. 1987. Aust. J. Agric. Res. 38, 253-62.
4. Amerein, J. and Gerber, H. R. 1985. Proc. 1985 B. C. P. C. - Weeds pp 55-63.