VARIABILITY OF WHEAT AND BARLEY TOLERANCE TO DICLOFOP-METHYL WITHIN ONE SEASON

D. LEMERLE, R.B. HINKLEY AND C.R. KIDD

Department of Agriculture
Agricultural Research Institute
Wagga Wagga N.S.W. 2650

Summary. Two field trials illustrated alterations in the tolerance of wheat and barley to a high rate of diclofop-methyl within one season, by changes in sowing date, seeding rate and cultivar.

Both wheat and barley sown in mid May were less tolerant to diclofop-methyl than when sown in mid June. The magnitude of the yield loss was greater in barley than wheat. Barley showed a cultivar by seed rate interaction; barley cv. Schooner had a greater yield loss at seed rates of 20 and 50 kg ha^{-1} than Stirling, whereas at high seed rates both cultivars had the same degree of yield loss. Wheat cvv. Shortim and Avocet had the same yield reduction at seed rates from 15 to 120 kg ha^{-1}.

By delaying sowing by one month to mid June, wheat showed a cultivar by seed rate interaction, while barley did not. Wheat cv. Avocet had no significant yield loss at seed rates of 50 or 120 kg ha^{-1}, but had a yield reduction of 25% at a seed rate of 15 kg ha^{-1}. Shortim had a significant yield loss at all the seed rates.

These responses are probably related to cereal tillering pattern. In this environment wheat and barley tend to produce more tillers per plant when sown early or when sown at low seed rates.

It is essential that before herbicide is released, that there is adequate information on crop tolerance to it in all the situations likely to be encountered, due to the large effect of the environment on crop tolerance.

INTRODUCTION

Cereal tolerance to herbicides is intrinsically variable because herbicide activity is strongly influenced by the environment. Changes in wheat and barley tolerance to herbicides occur between and within seasons, due to differences in weather, sites, cultivars and agronomic practices (Butler and Allen 1981; Wilson 1979; Wilson 1981; Lemerle *et al.* 1981; Lemerle *et al.* 1984; Tottman *et al.* 1982). This makes damage from herbicides difficult to predict. High rates of herbicides exaggerate herbicide effects and expose differences in crop tolerance not always evident at the recommended rate (Lemerle *et al.* 1984; and Tottman *et al.* 1982).

It is the responsibility of the chemical companies to provide sufficient field data to show that a newly released herbicide, at the recommended application rate, effectively controls weeds with minimal crop damage in all the situations where the herbicide will be used.

In this paper two field trials illustrate how wheat and barley tolerance to a high rate of diclofop-methyl can be altered by changes in sowing date, seeding rate, cultivar, and interactions of these factors within one season.

MATERIALS AND METHODS

Two field experiments were conducted at Wagga Wagga, New South Wales on a red brown earth in 1983, one with wheat and the other with barley. Both experiments were a 2 x 2 factor factorial split-plot design, with the following treatments for wheat and barley respectively:

	Main plots (2 Cultivars x 2 herbicide)			Sub plots (3 Seed rates)	Replications
Wheat	Shortim x	unsprayed	x	15 kg ha^{-1}	x 4
	Avocet	2.25 kg ha^{-1}		50 kg ha^{-1}	
		diclofop-methyl		120 kg ha^{-1}	
Barley	Stirling x	unsprayed	x	20 kg ha^{-1}	x 3
	Schooner	1.69 kg ha^{-1}		50 kg ha^{-1}	
		diclofop-methyl		150 kg ha^{-1}	

Both trials were duplicated in time by two sowing dates; these were sown on 18th May and 14th June, 1983, with 150 and 250 kg ha^{-1} single superphosphate for wheat and barley respectively. Plot size was 8 rows by 7.7 m. Diclofop-methyl was applied at three times the recommended rate for wheat and barley, as shown above, with 0.04% Agral 60® in 100 L ha^{-1} water with a tractor-mounted compressed air sprayer at 150 kPa. The diclofop-methyl was applied at the 3 and 5 leaf stages of crop growth for wheat and barley respectively on the following dates for the two sowing dates:

	Mid May sowing	Mid June sowing
Wheat (3 leaf)	June 23	August 2
Barley (5 leaf)	July 4	August 12

The growing season was extremely wet with an annual rainfall of 694mm, compared to an annual average of 507 mm. The crops were grown in weedfree conditions (pre-season weed control and some handweeding). Grain yield was measured by harvesting the plots with a Seedmaster small-plot harvester in December, 1983.

RESULTS AND DISCUSSION

The grain yields were analysed and the percentage data for the sprayed plots (as a % of the unsprayed plots for each seed rate) are presented in figure 1. Wheat and barley tolerance to diclofop-methyl was affected by sowing date, seed rate and cultivar, as well as interactions of these factors.

When sown in mid May both wheat and barley had significant grain yield loss when treated with three times the recommended rate of diclofop-methyl. The magnitude of this loss was greater in barley than wheat, even though the herbicide rate used on barley was less. This confirms that the safety margin of diclofop-methyl is narrower with barley than wheat (Friesen *et al.* 1976).

Wheat cvv. Shortim and Avocet sown in mid May had the same yield reduction from diclofop-methyl at the three seed rates, while barley showed a cultivar by seed rate interaction. Barley cv. Schooner had a greater yield loss at seed rates of 20 and 50 kg ha^{-1} than Stirling, whereas at the high seed rate both cultivars showed the same degree of yield loss.

By delaying the sowing of both wheat and barley by one month to mid June, crop tolerance to diclofop-methyl was improved. In contrast to the earlier sowing dates, wheat showed a cultivar by seed rate interaction whereas barley did not. Barley cv. Stirling had no significant yield loss at any seed rate, and Schooner had the same significant yield loss at all seed rates. Wheat cv. Avocet had no significant yield loss at seed rates of 50 or 120 kg ha^{-1}, but had a yield reduction of 25% at a seed rate of 15 kg ha^{-1}. Shortim had a significant yield loss at all seed rates.

In some situations wheat and barley tolerance to diclofop-methyl may be decreased at low crop seed rates, especially with early sown barley. This response is probably related to cereal tillering pattern (Lemerle *et al.* 1981). In this environment wheat and barley tend to produce more tillers per plant when sown early or when sown at low seed rates. These extra tillers initiate later than the main tillers. It is likely that other environmental factors e.g. soil fertility, moisture, could produce similar interactions.

It is essential that before herbicide is released, there is adequate information on crop tolerance to it in all the situations likely to be encountered, due to the large effect of the environment on crop tolerance. Agronomic practices can be manipulated to improve crop tolerance to diclofop-methyl.

ACKNOWLEDGEMENTS

This work is part of 2 projects, funded by the Wheat Industry Research Committee of N.S.W. and the Barley Industry Research Council of Australia.

LITERATURE CITED

Butler, J.N.B. and Allen, F.C. 1981. Proc. 34th N.Z. Weed and Pest Control Conf. 189-191.

Friesen, H.A., O'Sullivan, P.A. and Vanden Born, W.H. 1976. Can. J. Plant Sci. 56:567-578.

Lemerle, D., Fisher, J.A. and Hinkley, R.B. 1981. Proc. 6th Aus. Weeds Conf. 1:123-126.

Lemerle, D., Leys, A.R., Fisher, J.A. and Hinkley, R.B. 1984. Aust. J. Exper. Agric. Anim. Husb. In press.

Wilson, B.J. 1979. Aust. J. Exper. Agric. Anim. Husb. 19:108-117.

Wilson, B.J. 1981. Australian Weeds 1(2):3-5.

Tottman, D.R., Lupton, F.G.H., Oliver, R.H. and Preston, S.R. 1982. Ann. Appl. Biol. 100: 365-373.

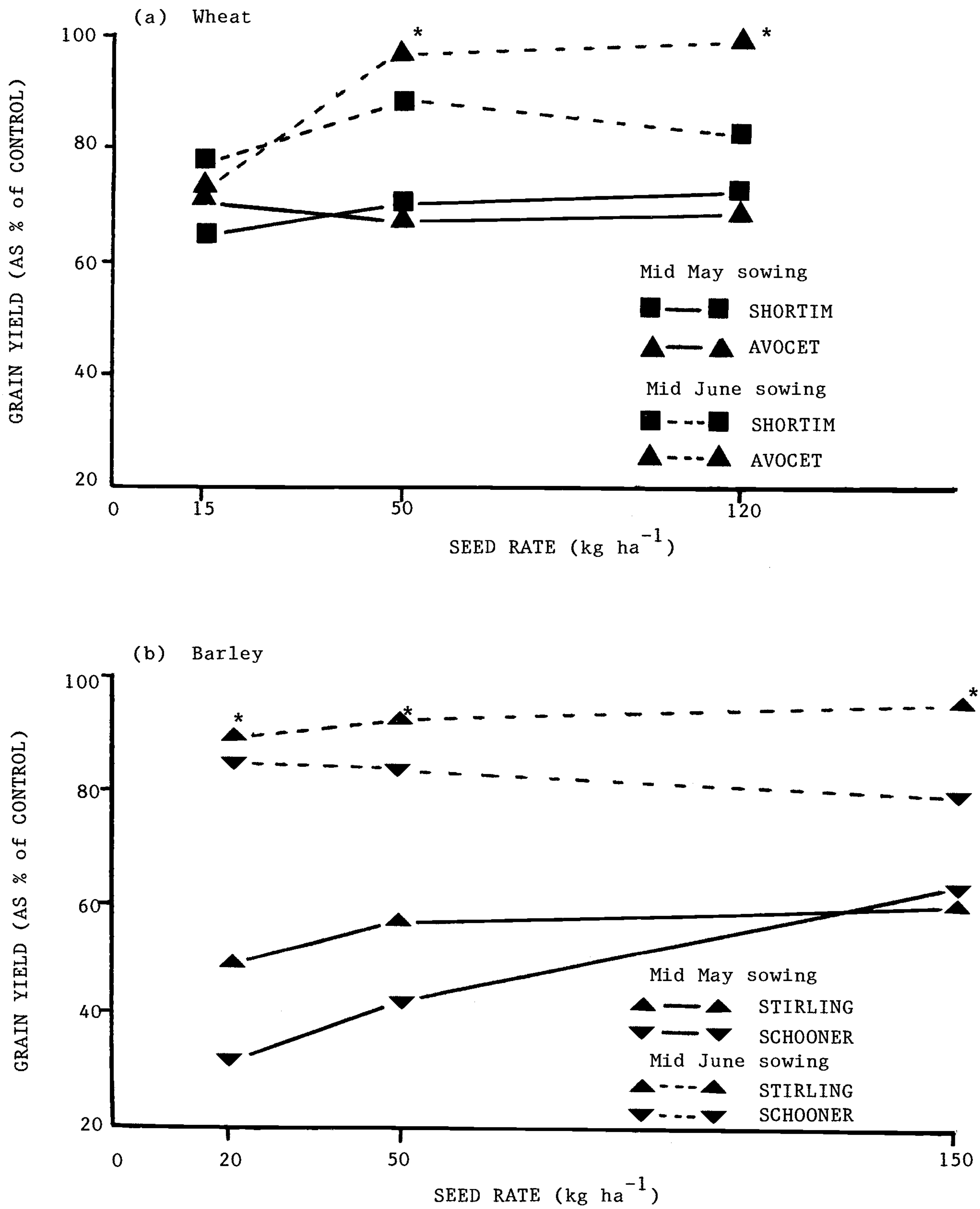

Fig. 1. Effect of sowing date, seed rate and cultivar on the tolerance of wheat and barley to diclofop-methyl (Asterisks indicate no significant yield loss compared to the unsprayed control within each seed rate).