THE TOLERANCE OF SOME BARLEY CULTIVARS TO HERBICIDES USED FOR WILD OAT CONTROL

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SUMMARY

Over two seasons field trials of advanced breeding lines of barley cultivars were sprayed with three herbicides recommended for wild oat (*Avena fatua*) control at the recommended rate and double rate. Difenzoquat at either rate had little effect on maturity, plant height or yield. Diclofop-methyl at the double rate and flamprop-methyl at either rate delayed maturity, reduced plant heights and grain yields. There were significant differences between cultivars and their reaction to some chemicals.

INTRODUCTION

Herbicides for control of wild oats (*Avena* sp) have been reported to have differential effects on bread wheat cultivars in New Zealand (Mitchel 1981), and durum wheat and triticale (Mitchel 1982). Butler and Allen (1981) have shown that barley cultivars exhibit differential responses to difenzoquat and diclofop-methyl.

Plant breeders should be aware of the specific responses of new cultivars to commercially available herbicides. This paper reports trials which were carried out in the seasons 1982-3 and 1983-4 to evaluate the response of six advanced barley breeding lines to three chemicals available for wild oat control.

MATERIALS AND METHODS

Replicated small plot yield trials of six barley cultivars and breeding lines were sprayed with difenzoquat (Avenge) plus surfactant, diclofop-methyl (Hoegrass), and flamprop-methyl (Sniper) at the recommended rate and double the recommended rate. Flamprop-methyl, although not registered for use on barley, was used to maintain uniformity with previous trials. Cultivars used in the 1982-83 trial (Trial 1) were Triumph and Mata as standards; two feed barleys, HW2.02 and HR59.01; and two malting barleys, HJ198.01, HW29.01. In the 1983-84 trial (Trial 2) Triumph, HJ198.01, HW29.01 and HR59.01 were again tested, with two new malting barley lines, 111.01 and HJ194.01. Trials were of a four-replicate, split-plot design with chemicals as main plots and cultivars as sub-plots. Plots were sown with a cone seeder and were of three rows at 15 cm coulter spacing, 5.5 m long. Trial 1 was sown on 20.10.82, difenzoquat and diclofop-methyl were applied on 11.11.82 at the 2-4 leaf stage, and flamprop-methyl on 9.12.82 at the 2-3 node stage. Trial 2 was sown on 28.10.83, difenzoquat and diclofop-methyl were applied at the 2-3 leaf stage on 16.11.83, and flamprop-methyl applied on 5.12.83 at the 4-6 leaf stage. Chemicals were applied using a propane operated sprayer using 730154 Tee jets giving an application rate of 240 litres/ha. A broad leaf weed control herbicide consisting of 1.8 kg ai/ha dichlorprop, 0.5 kg ai/ha MCPA and 0.56 kg ai/ha dicamba was applied to each trial at the 5-6 leaf stage.

Plant damage after spraying was recorded, as well as relative maturity of the lines (days from sowing to 50% ear emergence), plant heights at harvest and grain yields.

RESULTS AND DISCUSSION

In both trials there was slight leaf scorch after spraying with difenzoquat at the low rate and with diclofop-methyl at either rate. There was moderate scorching with difenzoquat at the high rate, while flamprop-methyl at either rate caused severe leaf scorch.

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TABLE 1: Trial 1. Main effects of chemicals on cultivars in 1982-83.

Treatment (kg ai/ha)	Ear emergence (days)	Height (cm)	Yield relative to untreated or Mata
Mean of all cultivars untreated	62	66	100(5.9 t/ha)
difenzoquat 1.0	64	67	93
difenzoquat 2.0	64	68	92
diclofop-methyl 1.0	64	69	89
diclofop-methyl 2.0	67	68	86
flamprop-methyl 0.75	66	60	90
flamprop-methyl 1.5	67	57	92
LSD 5%	1.0	4.0	9.0
Cultivars:			
Mean of all chemicals			
Mata	66	67	100(5.2 t/ha)
Triumph	66	65	93
HW2.02	65	64	112
HJ198.01	65	64	106
HR59.01	65	66	117
HW29.01	63	64	100
LSD 5%	1.0	2.0	6.0

TABLE 2: Trial 1. Interaction between chemicals and cultivars in 1982-83. (Yields relative to untreated = 100)

Treatment (kg ai/ha)	Mata	Triumph	HW2.02	HJ198.01	HR59.01	HW29.01
untreated	100	100	100	100	100	100
difenzoquat 1.0	102	94	92	85	94	88
difenzoquat 2.0	100	85	92	94	94	87
diclofop-methyl 1.0	97	82	79	105	89	80
diclofop-methyl 2.0	95	104	68	80	88	86
flamprop-methyl 0.75	89	82	91	89	80	108
flamprop-methyl 1.5	92	86	99	89	86	98
LSD 5%	15	15	12	12	12	14

Trial 1: The main effects of chemicals on cultivars are shown in Table 1.

Maturity was delayed by all chemicals, especially diclofop-methyl at the double rate and flamprop-methyl at either rate. There were significant chemical-by-cultivar interactions. Diclofop-methyl delayed the maturity of Triumph, HJ198.01, HR59.01 and HW2.02 at the double rate of application, and also of HW2.02 at the recommended rate. Flamprop-methyl delayed the maturity of Mata, HW2.02 and HR59.01 at either rate while Triumph and HW29.01 were affected by the double rate only.

Chemical-by-cultivar interactions on yields are shown in Table 2. The yield of Triumph was reduced by both rates of flamprop-methyl and by the recommended rate of diclofop-methyl, but not by the higher rate of the latter. Diclofop-methyl at either rate reduced the yields of HW2.02 and HW29.01 and at the double rate reduced the yield of HJ198.01. Flamprop-methyl reduced the yield of HR59.01 at either rate. Flamprop-methyl reduced the heights of HR59.01 and HJ198.01 at both rates.

TABLE 3: Trial 2. Main effects of chemicals on cultivars in 1983-84.

Treatment (kg ai/ha)	Ear emergence (days)	Height (cm)	Yield relative to untreated or standard
Mean of all cultivars			
untreated	56	83	100(5.7 t/ha)
difenzoquat 1.0	57	83	103
difenzoquat 2.0	57	83	102
diclofop-methyl 1.0	58	80	100
diclofop-methyl 2.0	60	81	92
flamprop-methyl 0.75	62	74	84
flamprop-methyl 1.5	66	74	81
LSD 5%	2.0	4.0	7.0
Cultivars:			
Mean of all chemicals			
Triumph	61	80	100(4.9 t/ha)
111.01	62	81	122
HR59.01	60	77	121
HW29.01	55	80	106
HJ194.01	61	81	106
HJ198.01	57	79	112
LSD 5%	1.0	2.0	6.0

TABLE 4: Trial 2. Interaction between chemicals and cultivars in 1983-84. (Yields relative to untreated = 100)

Treatment (kg ai/ha)	Triumph	111.01	HR59.01	HW29.01	HJ194.01	HJ198.01
untreated	100	100	100	100	100	100
difenzoquat 1.0	118	109	102	97	97	99
difenzoquat 2.0	115	102	98	104	100	99
diclofop-methyl 1.0	118	93	101	100	103	92
diclofop-methyl 2.0	128	85	97	93	76	81
flamprop-methyl 0.75	104	78	76	95	75	86
flamprop-methyl 1.5	108	72	82	88	54	90
LSD 5%	13	9	11	11	10	10

Trial 2: The main effects of chemicals and cultivars are shown in Table 3. Application of the double rate of diclofop-methyl and either rate of flamprop-methyl delayed maturity. Chemical-by-cultivar interactions occurred. Diclofop-methyl at either rate delayed the maturity of 111.01 and HW29.01 while at the double rate HJ194.01 and HJ198.01 were affected. Flamprop-methyl at either rate delayed the maturity of 111.01, HW29.01 and HJ198.01, but the maturity of Triumph was delayed at the double rate only.

In general plant height was reduced by diclofop-methyl applied at the double rate and by flamprop-methyl at either rate. Diclofop-methyl reduced the height of Triumph at the recommended rate and of HW29.01 at the double rate. Flamprop-methyl reduced the height of 111.01 at the double rate only, while at either rate it reduced the height of Triumph, HR59.01, HW29.01 and HJ198.01.

Yield depressions were caused by diclofop-methyl at the double rate and by flamprop-methyl at either rate.

The cultivar-by-chemical interactions (Table 4) show that diclofop-methyl at the double rate reduced the yields of HJ194.01 and HJ198.01. Flamprop-methyl at the double rate reduced the yield of HW29.01, while at either rate it reduced the yields of 111.01, HR59.01, HJ194.01 and HJ198.01. An anomalous response was the apparent yield stimulation in Triumph by several chemical treatments.

CONCLUSION

Differences in the response of barley cultivars to herbicides used for wild oat control occurred but these differences were not consistent. Difenzoquat had little effect on yield, maturity or plant height and showed no interaction with any of the cultivars in trials. Diclofop-methyl was more severe in its effects, though some cultivars showed a high degree of tolerance. Flamprop-methyl showed severe phytotoxic effects on barley cultivars and there were marked interactions with cultivars. In yield response Mata appeared tolerant to all chemicals used. Triumph seemed relatively tolerant to all chemicals though it was affected by flamprop-methyl in one year. The cultivar 111.01 showed low tolerance to double rates of diclofop-methyl and to flamprop-methyl at either rate of application; HW59.01 was affected by diclofop-methyl in one year and by flamprop-methyl in both years; HR29.01 showed mixed reactions, with yield being reduced by diclofop-methyl in one year and by flamprop-methyl the following year; HJ198.01 was not tolerant to diclofop-methyl in both years and to flamprop-methyl in one year; HJ194.01 showed tolerance only to difenzoquat; while HW2.02 (now dropped from testing) was only affected by diclofop-methyl.

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