HERBICIDES FOR GRASS SEED CROPS. 1. SEEDLING BROWNTOP, PHALARIS AND TALL FESCUE.

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SUMMARY

Browntop (*Agrostis capillaris* L.), phalaris (*Phalaris aquatica* L.) and tall fescue (*Festuca arundinacea* Schreb.) seed crops, with annual poa (*Poa annua* L.) and twincress (*Coronopus didymus* (L) Sm.) as the main weeds, were sprayed with herbicides to assess crop tolerance, weed susceptibility and the effect of weeds on seed yields. Browntop, phalaris and tall fescue were tolerant to ethofumesate (1.5 kg ai/ha) and terbutryn (0.3 kg ai/ha). Asulox (1.0 kg ai/ha) and diclofop-methyl (0.4 kg ai/ha) damaged browntop, and methabenzthiazuron (2.0 kg ai/ha) damaged phalaris. Chlorsulfuron inadequately controlled perennial ryegrass (*Lolium perenne* L.) in tall fescue. Diclofop-methyl (1.2 kg ai/ha) did control ryegrass. Chlorsulfuron and diclofop-methyl severely reduced tall fescue seed yields. Controlling weeds increased seed yields by 97 and 136% respectively in browntop and phalaris.

INTRODUCTION

There is little information on effects of weed competition, especially by grass weeds, or their herbicidal control in seedling stands of herbage grass seed crops. Henderson and Brock (1976) demonstrated that ethofumesate and methabenzthiazuron could be used on perennial ryegrass, tall fescue and browntop. Lee (1977) in glasshouse studies reported that tall fescue was less tolerant than ryegrass to ethofumesate at 1.1 kg ai/ha. Brown *et al* 1983 reported large seed yield increases for autumn sown cocksfoot (*Dactylis glomerata* L.) when annual poa was controlled with ethofumesate. Grass weeds, including annual poa, are common contaminants of ryegrass seed lots (Rolston *et al* 1985). Control of ryegrass in tall fescue seed crops is essential as a maximum of 1% contamination is allowed in First Generation certified seed and no contamination is permitted in Basic and Breeders seed. While diclofop-methyl is known to control ryegrass, the tolerance of tall fescue is not known.

The experiments reported here studied the effects of herbicides on weed control and seed yields of new cultivars of three species; browntop, phalaris and tall fescue.

METHODS

The experiments were conducted on autumn sown crops in the Manawatu, at Grasslands Division Aorangi research farm on a Kairanga silt loam soil.

Browntop: 'Grasslands Sefton' was sown on 3 April 1981 in 30 cm rows at 13 kg/ha. Herbicide treatments (Table 1), replicated four times, were applied on 24 April to plots of 6.5 m^2, when browntop seedlings had one leaf emerged and were 2-3 cm tall, except for ethofumesate which was applied on 10 June after tillering had begun. All plots except the untreated control were oversprayed for broadleaved weed control in late August. Nitrogen (50 kg N/ha) was applied on 2 October. Seed was harvested on 2 February 1982 from 1 m^2 quadrats. Seed yields were corrected to 14% seed moisture, 100% purity and 98% germination.

Phalaris: 'Grasslands Maru' was sown in 60 cm rows at 2.3 kg/ha on 3 April 1981. Herbicide treatments (Table 2), replicated four times were applied on 24 April when phalaris had one to two leaves and was 5 cm tall and weeds were at cotyledon to two leaf growth stage. Nitrogen was applied on 20 July (25 kg N/ha) and 2 October (50 kg N/ha). Seed was harvested from 3.6 m^2 quadrats on 20 January 1982. Seed yields were corrected to 14% moisture content, 100% purity and 90% germination.

TABLE 1: Effect of herbicides on weed control, crop injury and seed yield of 'Grasslands Sefton' browntop.

Herbicide	Rate (kg ai/ha)	Weed cover % May	Weed cover % Aug	Weed control % Pa	Weed control % Cd	Weed control % Fo	Crop injury %	Seed yield kg/ha
asulam	0.5	26	73	25	22	20	57	530
(Asulox)	1.0	13	63	36	10	25	80	60
	1.5	8	30	72	15	25	79	80
ethofumesate	0.5	50	63	33	64	38	7	580
(Nortron)	1.0	55	48	63	63	65	0	620
	1.5	60	24	80	69	70	0	750
terbutryn	0.3	19	75	8	100	100	5	600
(Igran 500W)	0.6	14	76	2	100	100	20	490
	0.9	10	77	8	100	100	50	450
diclofop-methyl (Hoegrass 36E)	0.4	52	86	2	0	0	95	0
untreated control		60	98	0	0	0	0	380
hand weeded control		58	29	80	96	81	0	720
LSD (0.05)		14	22	25	20	35	15	157

Pa = *Poa annua,* Cd = *Coronopus didymus,* Fo = *Fumaria officinalis*

TABLE 2: Effect of herbicides on weed control, crop injury and seed yield of 'Grasslands Maru' phalaris.

Herbicide	Rate (kg ai/ha)	Weed cover (%)	Weed control (%) Pa	Weed control (%) Cd	Crop injury (%)	Seed yield kg/ha
asulam	0.75	19	82	72	0	800
	1.50	7	97	90	21	800
	2.25	3	96	94	30	780
ethofumesate	0.75	3	89	95	10	900
	1.50	1	98	99	19	870
	2.25	1	99	99	45	800
methabenzthiazuron	1.0	16	30	98	0	730
(Tribunil)	2.0	5	82	100	13	480
	3.0	2	94	100	20	430
terbutryn	0.3	19	0	95	0	650
	0.6	15	20	100	3	520
	0.9	9	48	100	13	490
untreated control	0	78	0	0	0	380
LSD (0.05)		5	19	6	14	216

Pa = *Poa annua,* Cd = *Coronopus didymus*

Tall fescue: 'Grasslands Roa' was sown in 60 cm rows at 5.5 kg/ha on 3 April 1981. Herbicide treatements (Table 3) replicated three times were applied on 6 May 1981 when the tall fescue had two or three leaves and was 5 cm tall, and weeds had two to three leaves. The chlorsulforon and diclofop-methyl plots were sown as duplicated plots with one of each pair being oversown with perennial ryegrass, 'Grasslands Ruanui'. Nitrogen

was applied on 2 October at 50 kg N/ha. Seed was harvested from 1.8 m^2 quadrats in December 1982, 20 months after sowing. Plots were sprayed with atrazine in June 1982. Seed yields were corrected to 14% seed moisture and 100% purity and germination.

In each experiment plots were visually assessed in late May or early June, and August for weed cover, for the control of annual poa and twincress, and for crop injury.

TABLE 3: Effect of herbicides on weed cover, crop injury and seed yield of 'Grasslands Roa' tall fescue.

Herbicide	Rate (kg ai/ha)	Weed cover (%)	Seedlings /m^2 June	Crop injury (%)	Seed yield kg/ha
asulam	0.75	6	103	3	580
	1.50	1	82	10	700
	2.25	1	83	25	500
ethofumesate	0.5	4	78	2	440
	1.0	2	100	0	530
	1.5	1	88	0	560
methabenzthiazuron	1.0	8	103	2	690
	2.0	12	76	0	530
	3.0	3	76	3	540
terbutryn	0.3	19	85	2	550
	0.6	12	75	3	740
	0.9	8	80	0	760
diclofop-methyl	0.4	19	50	78	80
	0.8	16	50	87	15
	1.2	20	42	88	10
chlorsulfuron	0.015	7	68	74	180
(DPX-4189, 20% ai)	0.030	2	73	76	160
	0.045	2	74	79	40
untreated control		25	75	0	530
LSD (0.05)		8	20	12	150

RESULTS AND DISCUSSION

Weeds: Untreated control plots in the browntop and phalaris site had 60 and 75% respectively of ground area covered with weeds in May (Tables 1 and 2). In contrast the ground area covered with weeds in the tall fescue crop in June was much lower (25%) (Table 3). The main weed species were annual poa and twincress, with fumitory (*Fumaria officinalis* L.) occurring in the browntop trial. In the three experiments annual poa was effectively controlled by ethofumesate (1.5 kg ai/ha), asulox (1.5 kg ai/ha) and methabenzthiazuron (3.0 kg ai/ha). In the browntop, ethofumesate application was delayed to allow further growth of browntop, by which time annual poa was also at a more advanced growth stage and control was less effective. Twincress was effectively controlled by terbutryn (0.3 kg ai/ha) and methabenzthiazuron (1.0 kg ai/ha) and partially controlled by asulox and ethofumesate (Tables 1 and 2). Fumitory was controlled only by terbutryn (0.3 kg ai/ha).

In tall fescue, chlorsulfuron effectively controlled annual poa and twincress (Table 3), but only partially controlled ryegrass (Table 4). Diclofop-methyl at 1.2 kg ai/ha was the only treatment to reduce ryegrass contamination to less than the 1% allowed in First Generation certified seed (Table 4), but seed yields of tall fescue were significantly reduced.

Crop Tolerance: Browntop winter growth was reduced by asulox (0.5 kg ai/ha), terbutryn (0.6 kg ai/ha) and especially by diclofop-methyl (0.4 kg ai/ha) and seed yields were subsequently lower (Table 1). Mid winter growth of phalaris was suppressed by

TABLE 4: Effect of herbicides on ryegrass contamination in tall fescue plots and machine dressed seed.

Herbicide	Rate (kg ai/ha)	Ryegrass seedheads/m²	Ryegrass in seed (% by mass)
chlorsulfuron	0.015	27.6	9.3
	0.030	5.2	12.3
	0.045	0.5	3.9
diclofop-methyl	0.4	7.5	2.3
	0.8	0.3	1.2
	1.2	0	0

increasing rates of each herbicide and seed yields were significantly reduced by methabenzthiazuron (2.0 kg ai/ha) and terbutryn (0.9 kg ai/ha) (Table 2). Winter growth and seed yield of tall fescue was seriously reduced by low rates of diclofop-methyl and chlorsulfuron. Asulox at the highest rate reduced tall fescue growth, but with little effect on seed yield (Table 3). All three crops showed acceptable tolerance to ethofumesate (up to 1.5 kg ai/ha) although winter growth of phalaris was suppressed. Tall fescue also tolerated terbutryn (0.9 kg ai/ha), asulox (1.5 kg ai/ha) and methabenzthiazuron (3.0 kg ai/ha).

Seed Yields: In the browntop and phalaris trials weed control by herbicides increased seed yield by up to 97 and 136% respectively. The benefits from weed control in these two trials were associated with an initial high percentage of ground area covered with weeds. Importantly, partially effective weed control significantly increased seed yields. Most of the yield response in these trials can be attributed to annual poa control since this was the most common species.

The yield response to weed control in tall fescue is difficult to interpret because autumn sown tall fescue does not produce a seed crop in the first summer. Further the tall fescue trial had a lower percentage of ground covered by weeds than the other sites.

CONCLUSION

Where weeds, especially annual poa, are a serious problem in seedling crops, reductions in seed yield can be large. The herbicide ethofumesate (1.5 kg ai/ha) can be used on cultivars of the crop species tested to control annual poa. Ryegrass cannot be effectively controlled in seedling stands of tall fescue with chlorsulfuron. Diclofop-methyl will control ryegrass but will severely reduce tall fescue seed yields. Future research should investigate the use of ethofumesate in mixtures with methabenzthiazuron, and terbutryn in an attempt to broaden the spectrum of weed control, improve crop tolerance and reduce costs.

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