BROWNTOP SEED PRODUCTION: WEED COMPETITION EFFECTS AND HERBICIDE TOLERANCE

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ABSTRACT

In a browntop (*Agrostis capillaris* syn. *A. tenuis*) crop, weeds reduced seed yields by up to 78% (485 kg/ha). When the weed mass contributed 10 to 50% of the dry matter, every 1% increase in weeds decreased seed yield by 9.4 kg/ha. The main weed species causing yield loss were broadleaved species. The two best herbicide treatments were a mixture of metsulfuron 3 g/ha + mecoprop-bromoxynil-ioxynil 1035-225-225 g/ha; and a mixture of metsulfuron 3 g/ha + triclopyr 180 g/ha. In a first year browntop crop seed yields were tolerant to metsulfuron 3 g/ha, tribenuron 22 g/ha, thifensulfuron 30 g/ha, and diflufenican + bromoxynil 75 + 750 g/ha.

Keywords: bentgrass, competition, herbicide, metsulfuron, seed yield.

INTRODUCTION

Browntop (*Agrostis capillaris* syn. *A. tenuis*) for turf seed production in New Zealand, is grown on 500 ha with an annual production of 75 to 80 tonnes. New Zealand bred cultivars continue to be ranked in the top five in European turf trials. Weeds in browntop seed crops are competitive (Rolston and Hare 1986a and b), and lower seed quality with speedwell (*Veronica* spp.) being a common seed contaminant (W. Argyle, pers. comm.). A number of new herbicides have become available and farmers are using some of these, especially metsulfuron, on established crops. Browntop pastures have shown tolerance to metsulfuron at 18 to 100 g/ha (Popay *et al.* 1985; Turner *et al.* 1986). However the tolerance of seedling, first year seed production stands, to these herbicides is unknown. The trials reported in this paper evaluated both the effects of weed competition and herbicide tolerance on browntop seed crops.

MATERIAL AND METHODS

Weed competition and control trial

The trial was sown on 15 March 1996 with browntop cv. "Grasslands Sefton" at the Lincoln University Henley Research Farm, Springs Road, Lincoln. Plots were 4m x 4m, with three replications in a randomized block design. Herbicides were applied on 17 June 1996, in 300 litres/ha water with the browntop at the 3 leaf stage (Freekes Growth Score 1), and 2 cm tall. The herbicides used were mecoprop + bromoxynil + ioxynil mixture (Axall), dicamba, diflufenican + bromoxynil (Jaguar), diuron (Karmex), ethofumesate (Norton), fenoxyprop-P-ethyl (Puma S), metsulfuron (Escort), tribenuron (Granstar) and triclopyr (Grazon). Weeds present and stage of growth were; field pansy (*Viola arvensis*) 3-4 leaf, spurrey (*Spergula arvensis*) 4-5 leaf, wire weed (*Polygonum ariculare*) 4-6 leaf, speedwell (*Veronica* sp.) 4 leaf, chickweed (*Stellaria media*) 10 cm diameter, calandrinia (*Calandrinia* spp.) 7-8 leaf, annual poa (*Poa annua*) 2-3 tillers and wild oat (*Avena fatua*) 4 tillers. Seed was harvested by cutting 1.0 m² sample per plot, which was air dried in a hessian bag, before being threshed, cleaned and weighed to determine seed yield.

Herbicide tolerance

The browntop cv "Grasslands Egmont" was sown at 5 kg/ha in 15 cm rows sown on the 16 February 1996 at the AgResearch Farm, Lincoln on a Wakanui silt loam soil. The trial was sown with an 'Oyjord' cone seeder, in four blocks 1.35 m (9 rows) by 43 m long. Each block was interspersed with other grass species. Herbicides used,

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application date in 1996, and the Freekes growth stage (GS) at treatment were: diflufenican + bromoxynil (18 April, GS 3); fenoxyprop-P-methyl (29 September GS 4-5); mecoprop-bromoxynil-ioxynil mixture (July, GS 3); tribenuron (11 September, GS 4); thifensulfuron (11 September, GS 4). Crop injury was evaluated by visual evaluation on 9 July, 21 days after treatment (DAT) and 27 September, 102 DAT.

In both trials the browntop crops received 150 kg N/ha as urea and were sprayed with the fungicide tebuconazole at 190 g/ha after head emergence. Seed was harvested by cutting a 1.0 m wide x 1.35m long strip from each plot. The sample was air dried in a hessian bag, before being threshed, cleaned and weighed to determine seed yield.

RESULTS AND DISCUSSION

Weed competition and control

Weeds had a marked competitive effect on browntop seed yields (Figure 1), with yield declining 9.4 kg/ha for every 1% increase in weed mass as a percentage of total dry matter in December. This compares with a 4.7 kg/ha seed yield decline for every 1% in weed cover (visual observation) in August reported in a previous trial with browntop (Rolston and Hare 1986b). The main weeds were mostly broadleaf species (including shepherds purse (*Capsella bursa-pastoris*), field pansy, speedwell, wireweed and Calandrina) and a low level of *Poa annua*. This is in contrast to the trial reported by Rolston and Hare (1986b), which had a high proportion of *P. annua*.

FIGURE 1: Relationship between weed mass and seed yield in browntop.

Increasing weed mass had a negative linear effect on browntop mass in December at flowering with a correlation of $R^2 = 0.72$; while an increasing browntop mass was associated with a positive linear increase in seed yield (Figure 2). Thus the main effect of weed competition was to affect the browntop mass, and therefore the number of tillers to form seed heads.

The most effective treatments were combinations of metsulfuron (3 g/ha) with either a mecoprop-bromoxynil-ioxynil mixture or with triclopyr; the best treatment increased seed yields by 360%, equal to 485 kg seed/ha (Table 1). With a grower's price of \$6-50/kg, this represents a \$3150/ha increase in gross revenue. The mean seed yield increase for 10 treatments was 292 kg/ha, worth \$1890/ha, or an average of \$12 return for every \$1 spent on weed control in seedling first year browntop seed crops. Any treatment that reduced the weed mass to under 18% of total herbage mass increased seed yields by at least 66% and in most cases more than doubled seed yield (Figure 1). Seedling browntop is tolerant to metsulfuron applied at 3 g/ha, a rate commonly used in established browntop. The level of weed control achieved with metsulfuron was enhanced by mixing with other herbicides, increasing seed yields by 26 to 46% compared with metsulfuron alone (Table 1).

FIGURE 2: Relationship between browntop mass in December and seed yield.

TABLE 1: Browntop seed yields, crop injury and weed control from herbicide treatments.

Herbicide	Rate (g ai/ha)	Seed yield (kg/ha)	Seed purity (%)	Crop injury % 21 DAT ²	102 DAT	Weed mass (%)	Total dry matter (kg/ha)
control		134	58.4	0	0	50	2860
M+B+I ¹	1035 + 225 + 225	441	97.8	0	0	7	5110
dicamba	400	337	98.0	0	0	25	3320
metsulfuron	3	422	97.5	0	0	16	5600
metsulfuron + M+B+I	3+ 1035+ 225+225	619	98.5	3	0	15	5090
metsulfuron + triclopyr	3 + 180	535	99.2	0	0	16	4540
tribenuron	11	256	96.6	3	0	28	4490
diflufenican + bromoxynil	38 + 375	334	98.9	0	0	14	4240
ethofumesate	750	121	90.0	13	12	47	2600
ethofumesate + diuron	750 + 1600	426	98.1	13	33	17	4580
ethofumesate + M+B+I	750 + 1035 + 225+225	473	97.5	43	8	12	4770
fenoxypop + M+B+I	112 + 1035 + 225+225	420	97.6	20	0	12	4370
LSD (P<0.05)		286	25.7	14.7	12.5	23	1872

¹ M+B+I = mecoprop + bromoxynil + ioxynil mixture

² DAT = days after treatment

Herbicide tolerance

The seed yield of the untreated controls (Table 2) ranged from 340 to 480 kg/ha. The results are expressed as relative seed yields to allow easy comparison between herbicide blocks. Browntop showed good tolerance to all herbicides with no reduction in seed yield from any of the 12 herbicides evaluated (Table 1 and 2). Ethofumesate alone or in mixture and fenoxypop mixed with mecoprop caused visual crop injury

in the weed control trial (Table 1), but no crop injury was observed in the herbicide tolerance trial. Browntop had good tolerance to the commonly used broadleaf hormone mixture mecoprop + bromoxynil + ioxynil and diflufenican + bromoxynil (recently registered in ryegrass seed crops). Tribenuron, thifensulfuron and metsulfuron are low cost sulfonyl urea herbicides that show promise for use in browntop seed crops. Tribenuron has recently been registered for grass seed crops in Norway including bentgrass (*Agrostis* spp.) and in the USA in grass seed crops including ryegrass, tall fescue and cocksfoot (Rolston *et al.* 1997). Metsulfuron is being used by some growers in established (second year) browntop seed crops and the results of this trial suggests that it can be used in first year crops, but more work on rates and combinations is required.

TABLE 2: Relative seed yields of browntop in herbicide tolerance trial.

Herbicide	Rate (g ai/ha)	Relative seed yield	Signif LSD 5%
untreated	nil	100	
M+B+I	2070+ 450 +450	98	NS
metsulfuron	3	94	NS
tribenuron	11	117	NS
tribenuron	22	130	NS
thifensulfuron	15	103	NS
thifensulfuron	30	106	NS
diflufenican + bromoxynil	75 + 750	100	NS
fenoxypop	56	117	NS

CONCLUSION

First year browntop seed crops are very sensitive to competition, with large losses in potential yield if weeds are not controlled. Seed yields were increased by up to 360% when weeds were controlled with an early winter herbicide application. Metsulfuron has potential for use in browntop, and further work on rates, timing and mixtures are required.

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