CHILEAN NEEDLE GRASS (*STIPA NEESIANA*) 2. HERBICIDAL CONTROL IN LUCERNE

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SUMMARY

Pre-plant, early post-emergence and winter applied grass herbicides were compared in spring sown lucerne for ability to control Chilean needle grass seedlings. Pre-plant treatment with EPTC or trifluralin gave 99% and 97% reduction respectively in Chilean needle grass dry matter yield compared to untreated. Early post-emergence treatments of fluazifop-butyl, alloxym-sodium or carbetamide gave poor control. Winter treatments of atrazine, simazine or metribuzin in mixtures with paraquat resulted in >99% reduction of Chilean needle grass on the EPTC, trifluralin, fluazifop-butyl and alloxym-sodium plots. EPTC or fluazifop-butyl at establishment in spring, followed by metribuzin + paraquat in winter, is recommended for Chilean needle grass seedling control in lucerne.

INTRODUCTION

Chilean needle grass (*Stipa neesiana*), presently restricted in its distribution in New Zealand, is a potentially serious weed of drought-prone pastures in this country (Bourdôt and Ryde 1986). It appears to be well adapted to seasonally dry environments, and its sharp awned seeds penetrate and damage the wool, pelts, eyes and flesh of animals (Bourdôt and Ryde 1986). Bourdôt and Hurrell (1987) showed that effective herbicidal control of well established populations in pastures is not possible, but that glyphosate at rates as low as 0.72 kg ai/ha gives 100% kill of established clumps and tussocks. Glyphosate could thus facilitate the renovation of pasture infested with Chilean needle grass.

This study investigates one pasture renovation strategy in which Chilean needle grass plants were killed with glyphosate, lucerne (*Medicago sativa*) was sown and grass-killing herbicides used to control invading Chilean needle grass seedlings.

MATERIALS AND METHODS

The experiment was conducted on a Sedgemere Yellow-Grey Earth soil (4.4% carbon) on rolling hills at Blind River, Marlborough during the 1984/85 and 1985/86 seasons. Chilean needle grass, the dominant species on the site, was killed with a broadcast application of glyphosate at 1.08 kg ai/ha in the autumn of 1984. The site was fallowed during the winter months and rotary cultivated in early spring to prepare the seed bed. Lime at 2.0 t/ha was applied during these cultivations. Rhizobium-inoculated and pelleted seed of the lucerne cultivar WL318, was drilled 13 mm deep in 150 mm wide rows at 35 kg/ha (c. 10 kg bare seed/ha), with a Conner Shea drill on 11 October 1984.

The statistical design was a split-plot with spring treatments at establishment as main plots and winter treatments as sub-plots. Treatments were replicated four times and applied to plots measuring 5 m by 2 m.

Establishment treatments were EPTC at 5.8 kg ai/ha and trifluralin at 1.0 kg ai/ha applied and incorporated to 60-70 mm 5 h before drilling, and early post-emergence applications of fluazifop-butyl at 0.75 kg ai/ha, alloxym-sodium at 1.5 kg ai/ha and carbetamide at 4.2 kg ai/ha applied on 7 November 1984. At this time the lucerne had developed one to three trifoliate leaves while the Chilean needle grass also had one to three leaves and was beginning to tiller.

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The winter treatments of propyzamide at 0.5 kg ai/ha, 2,2-DPA at 5.9 kg ai/ha, atrazine at 1.0 kg ai/ha + paraquat at 0.6 kg ai/ha, simazine at 1.2 kg ai/ha + paraquat at 0.4 kg ai/ha and metribuzin at 0.35 kg ai/ha + paraquat at 0.4 kg ai/ha, were applied on 22 August 1985 before spring growth had started. At this time, the Chilean needle grass was multi-tillered and 50 to 150 mm tall. The lucerne was 60 to 70 mm tall.

Untreated control plots were included at both main-plot and subplot levels.

All herbicides were applied with a nitrogen gas powered precision sprayer delivering 200 litres/ha through 8002 Teejet fan nozzles at 210 kPa.

Fathen (*Chenopodium album*) germinated in large numbers along with the lucerne on all plots, except those treated with EPTC or trifluralin. It was killed with an over-all application of 2,4-DB at 1.2 kg ai/ha on 17 December 1984. Sitona weevil adults (*Sitona discoideus*) were controlled with chlorpyrifos (Lorsban 40 EC) at 0.6 kg ai/ha in late May 1985.

Effects of treatments at establishment were first assessed by a visual estimate of Chilean needle grass ground cover, on 17 January 1985, 3 months after drilling. The experiment was destructively sampled during the second season on 11 November 1985, 7 January 1986 and 25 March 1986, by which time the winter treatments had taken effect. On each occasion the lucerne was mown from a central strip 3500 mm by 750 mm in each sub-plot (sampled area = 2.63 m²). The fresh weights of the mown samples were recorded in the field and subsamples were retained for separation into Chilean needle grass and lucerne. These fractions were dried at 85 °C and the dry weight per plot was calculated for each species. The lucerne and Chilean needle grass yields were summed over the three harvests. Lucerne data were subjected to analysis of variance but Chilean needle grass data were not because of the large number of zeros.

Samples were not taken during the first growing season but the lucerne was grazed by sheep as necessary. Sheep were used to 'clean up' the stand after each sampling in the 1985/86 season.

RESULTS AND DISCUSSION

By January 1985, 3 months after establishment treatment, EPTC had given excellent control of Chilean needle grass seedlings while trifluralin had also given good control (Table 1). Fluazifop-butyl and alloxydim-sodium were less effective and carbetamide was ineffective (Table 1). These treatment differences appeared to be due largely to differences in seedling densities. Confirmation of the efficacy of EPTC for seedling control has been obtained more recently in a newly-sown commercial stand of lucerne. EPTC applied at drilling gave more than 90% reduction (determined from counts on treated and untreated areas of the paddock) in Chilean needle grass seedling density.

TABLE 1: Visual estimates of ground covered by Chilean needle grass on 17 January 1985 (3 months after sowing the lucerne)

Treatment	% ground cover
EPTC (Eptam)	0.1
trifluralin (Treflan)	1
fluazifop-butyl (Fusilade)	4
alloxydim-sodium (Alloxol S)	2
carbetamide (Carbetamex 70)	32
untreated	34
LSD (.05)	19

In the second growing season estimates of Chilean needle grass dry weight supported the earlier conclusion that carbetamide is ineffective (Table 2).

Alloxydim-sodium and fluazifop-butyl, having given good initial suppression of the Chilean needle grass seedlings on their own (Table 1), resulted in poor control by the second season (Table 2). This was possibly due to limited residual activity of these herbicides. By contrast, EPTC, and to a lesser extent, trifluralin, maintained good control as single treatments.

TABLE 2: Chilean needle grass yield (kg/ha), accumulated over three cuts, as affected by herbicide treatment at time of establishment in spring, and in winter

Establishment treatments	Winter Treatments					
	untreated	propyz-amide	2,2-DPA	atrazine + paraquat	simazine + paraquat	metribuzin + paraquat
EPTC	32	13	1	1	0	1
trifluralin	109	122	15	1	2	0
fluazifop-butyl	318	698	43	0	4	0
alloxydim-sodium	1213	326	39	0	0	8
carbetamide	2895	2027	141	22	47	77
untreated	3233	2800	495	110	420	75

propyzamide—Kerb 50-W; atrazine—Actazine 5A; simazine—Simazol 80; metribuzin—Sencor; paraquat—Gramoxone

Best control in the second season resulted from sequences of establishment treatments in spring and winter treatments. The three triazines applied in late winter in mixture with paraquat, gave an extremely high level of control of Chilean needle grass on the plots previously treated with EPTC, trifluralin, fluazifop-butyl or alloxydim-sodium. By contrast, late winter applications of propyzamide and 2,2-DPA, except when used following EPTC, were ineffective, although 2,2-DPA was considerably more effective than propyzamide. There was thus a well defined group of 13 treatment sequences which resulted in equally good control of Chilean needle grass (Table 2).

Lucerne yield responded markedly to the herbicides, indicating strong competition between Chilean needle grass and lucerne (Table 3). With EPTC alone lucerne yielded 85% more than the untreated. However variation in lucerne yield was not attributable solely to variation in Chilean needle grass control. There were significant differences in lucerne yield within the group of 13 treatments giving equally low Chilean needle grass yields (between 0 and 8 kg/ha — Table 3 cf. Table 2). Lucerne yields with atrazine + paraquat following both trifluralin and fluazifop-butyl, were significantly lower than the highest yield in the group (ie. 8385 kg/ha with fluazifop-butyl/metribuzin + paraquat) (Table 3), despite there being no difference in Chilean needle grass control (Table 2). Metribuzin + paraquat gave higher lucerne yields overall, than atrazine + paraquat and simazine + paraquat. Since Chilean needle grass was the only significant weed present during the winter and following spring, these lucerne yield differences suggest that the lucerne had greater tolerance to metribuzin than to either atrazine or simazine.

TABLE 3: Lucerne yield (kg/ha) accumulated over three cuts, as affected by herbicide treatment at time of establishment in spring, and in winter.

Establishment treatments	Winter treatments					
	untreated	propyz-amide	2,2-DPA	atrazine + paraquat	simazine + paraquat	metribuzin + paraquat
EPTC	8646	8205	7561	7427	7897	8193
trifluralin	7523	7436	6652	6579	6899	7382
fluazifop-butyl	8201	7638	6460	6703	7009	8385
alloxydim-sodium	8236	8142	6681	7126	7157	7436
carbetamide	5610	6382	6779	6741	6794	7322
untreated	4662	5949	5498	5483	5648	7114

LSD (.05) = 1186 for comparing winter treatment means within establishment treatments.

LSD (.05) = 1535 for comparing any other means.

This study has shown that Chilean needle grass readily reinvades newly sown lucerne, from seed reserves in the soil and that these seedlings compete strongly with lucerne, reducing its yield. Daytime wilting of the lucerne was evident on ineffective treatments such as carbetamide, propyzamide and 2,2-DPA, suggesting competition for soil water. Very effective and safe herbicidal control of the seedlings of this grass was achieved with a pre-plant soil treatment of EPTC, followed by a winter treatment of metribuzin + paraquat. Lucerne is ideally adapted to the drought-prone environments in which Chilean needle grass occurs. Its sowing can therefore be recommended to facilitate the use of herbicides for control of this weed.

It is essential to kill existing Chilean needle grass plants before sowing lucerne since the herbicides shown here to be effective against seedlings and newly established plants, are less likely to control well established plants and those regenerating from large root and tiller systems. Glyphosate, used here at 1.08 kg ai/ha, has proven effective for this purpose (see also Bourdôt and Hurrell 1987).

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