CHILEAN NEEDLE GRASS (*STIPA NEESIANA*). 1. CONTROL WITH HERBICIDES IN PASTURE

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SUMMARY

Glyphosate applied in spring with a 'hockey stick' wick applicator to one or both sides of plants, killed 44% of Chilean needle grass (*Stipa neesiana*) tussocks. The remaining 56% of treated tussocks had several surviving tillers. Glyphosate applied in May and August with a spray boom to a Chilean needle grass-dominant pasture at 0.72, 1.08, 1.44 and 2.16 kg ai/ha, killed all plants, but gave no control when applied during drought conditions in December and February. 2,2-DPA at 2.0 and 5.0 kg ai/ha suppressed Chilean needle grass established in pasture when applied in May, December and February but not in August. Ethofumesate, propyzamide, TCA and maleic hydrazide were ineffective.

INTRODUCTION

Chilean needle grass (*Stipa neesiana*), a perennial tussock grass native to Southern Brazil, Uruguay and Argentina (Hayward and Druce 1919), is known to occur in New Zealand only at Waipawa in central Hawkes Bay, on rolling hills and flats near Lake Grassmere, Marlborough (Bourdôt 1983) and at Western Springs, Auckland. Recognised as an extremely undesirable plant on account of its sharp, penetrating seeds (Bourdôt and Ryde 1986), it was declared a Class B noxious plant by the Marlborough District Noxious Plants Authority in 1979, and public funds were made available for its control.

Chilean needle grass has not been reported as a weed elsewhere in the world except in Argentina. Here, known as flechilla (little dart), it is troublesome when in fruit, as the sharp hard calli of the spikelets, readily penetrate the skin of animals, causing painful wounds (Hayward and Druce 1919).

It has been recorded near wool factories in Scotland, France, Italy and Germany. It occurs at Tweedside and at a rubbish dump in Surrey, England (Hayward and Druce 1919). It would seem that the plant has spread from its native South America in the wool and hides of grazing animals.

MAF research programmes in both Hawkes Bay and Marlborough have focussed on the ecology and control of this grass in the drought-prone grassland environments to which it seems well adapted. The aim has been to assess its potential as a weed of pastoral agricultural systems in New Zealand and to formulate control strategies for the present infestations.

This paper presents the results of some tests at Blind River, Marlborough, on glyphosate, and other grass killers which are potentially selective in pasture containing Chilean needle grass. According to Matthews (1975), the grass is checked or killed by 2,2-DPA at 2 to 20 kg ai/ha, but no experimental evidence existed to support this. A literature search failed to find any other information on the response of Chilean needle grass to herbicides.

MATERIALS AND METHODS

Experiment 1: Wick application of glyphosate

On 14 October 1982, eleven pairs of discrete Chilean needle grass tussocks were selected on a steep face along Merrifields Road, Blind River. One of each pair was chosen at random, and wiped once from bottom to top with a 'hockey stick' wick

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TABLE 1: The effect of glyphosate applied to Chilean needle grass tussocks with a 'hockey stick' wick applicator on 14 October 1982.

	No of tussocks without green tissue on 9/12/82	No of tussocks without surviving tillers on 25/8/83	No of tussocks without seedlings in their bases on 25/8/83
wiped one side	8/11 (73%) ns	4/9 (44%) ns	1/9 (11%) ns
wiped two sides	10/11 (91%)	4/9 (44%)	1/9 (11%)

applicator using glyphosate (33% solution of Roundup and water). The other member of each pair was wiped similarly, but on both sides. Two months after treatment, on 9 December 1982, the tussocks were visually assessed as alive or dead. Ten months after treatment, on 25 August 1983, nine of the eleven pairs of tussocks were dug up, broken apart and searched for surviving tillers and new seedlings. The data were subjected to McNemar's test (Siegel 1956) to test the null hypothesis that one wipe = two wipes.

Experiment 2: Boom application of glyphosate

Glyphosate was applied at 0.72, 1.08, 1.44 and 2.16 kg ai/ha to a Chilean needle grass-dominant pasture at Blind River on each of four occasions — 3 May 1982, 10 August 1982, 10 December 1982 and 15 February 1983. The statistical design was a split-plot with main-plots as treatment occasion and sub-plots as rate of glyphosate. There were four replicates and sub-plots measured 5 m by 2 m. Application was with a nitrogen gas-powered precision sprayer delivering 200 litres/ha through 8002 Teejet nozzles at 210 kPa. The treated swards were visually assessed on several occasions to determine the effect of the herbicide on the Chilean needle grass.

The pasture was very short (<50 mm) at all times of treatment. This was due to 'hard' grazing before the May and August treatments, and to severe drought at the December and February treatments.

Experiment 3: Selective herbicides on pasture

On 3 May 1982, 10 August 1982, 10 December 1982 and 15 February 1983, five herbicides, each at two rates (Table 2), were applied to another area of the pasture used for Experiment 2. There were three replicates, with time of application as main-plots and herbicides as sub-plots. The treatments were applied to 2 m by 5 m plots using the equipment described for Experiment 2.

The treatments were assessed in November 1983. The May treatments were also assessed on 17 November 1982. Ground covers of Chilean needle grass, perennial ryegrass (*Lolium perenne*), legumes (*Trifolium spp* and *Medicago spp*), other species, bare ground and litter were estimated using point analysis with 50 points per plot.

RESULTS

Experiment 1: Wick application of glyphosate

By 10 months after treatment, 44% of the tussocks had no surviving tillers and appeared to have been entirely killed by the glyphosate (Table 1). The number of surviving tillers per surviving tussock ranged from 1 to 60. Earlier observation, 2 months after treatment, suggested that 82% of the tussocks had been killed.

Seedlings were growing out of the bases of 89% of the tussocks 10 months after treatment (Table 1). These appeared to have originated both from seeds in the bases of dead tillers, and from free-fallen seed of terminal panicle origin. 'Dead' tussocks contained up to 10 seedlings.

There were no significant differences between one and two wipes.

Experiment 2: Boom application of glyphosate

Visual assessments on several occasions and finally on 23 August 1983, showed that all rates of glyphosate had given complete kill of treated plants when applied in May and August. However Chilean needle grass seedlings recolonised these plots in large numbers. The December and February treatments by contrast, had no effect on Chilean needle grass.

TABLE 2: The effect of herbicides applied on four occasions to a sheep/cattle pasture at Blind River, on the cover of Chilean needle grass and legumes as assessed in November 1983. Values are averages over both application rates for each herbicide. The 'untreated' was excluded from the statistical analysis and the analysis adjusted to account for missing plots.

a) Chilean needle grass ground cover (%)						
Herbicide	Rates (kg ai/ha)	Spraying time				mean
		3 May 1982	10 Aug 1982	10 Dec 1982	15 Feb 1983	
2,2-DPA	2.0, 5.0	26	49	16	20	28
ethofumesate	1.0, 2.0	42	39	42	52	44
propyzamide	0.5, 1.5	47	37	51	42	44
TCA	10.0, 15.0	39	57	32	15	36
maleic hydrazide	1.0, 2.0	28	43	35	44	38
untreated			(34)			
mean		36	45	35	35	
LSD (.05) = 19, for comparisons between herbicides within spraying times						
LSD (.05) = 23, for other comparison except spraying time means (column means) and herbicide means (row means)						
b) legumes ground cover (%)						
2,2-DPA	2.0, 5.0	28	20	45	20	28
ethofumesate	1.0, 2.0	23	15	14	10	15
propyzamide	0.5, 1.5	32	34	45	36	37
TCA	10.0, 15.0	30	20	28	17	24
maleic hydrazide	1.0, 2.0	25	20	29	23	24
untreated			(26)			
mean		28	22	32	21	
LSD (.05) = 12, for comparisons between herbicides within spraying times						
LSD (.05) = 12, for other comparisons except spraying time means (column means) and herbicide means (row means)						
2,2-DPA (Dowpon 740-SP)		ethofumesate (Nortron)				
propyzamide (Kerb 50-W)		TCA (Winstones TCA 90)				
maleic hydrazide (BASF MH 30)						

Experiment 3: Selective herbicides on pasture

The experimental pasture was dominated by the two grasses, Chilean needle grass and hairgrass (*Vulpia bromoides*). There were only scattered plants of ryegrass, danthonia (*Rytidosperma caespitosum*), barley grass (*Hordeum leporinum*) and goosegrass (*Bromus hordeaceus* (= *B. mollis*)). Legumes present were striated clover (*Trifolium striatum*), white clover (*T. repens*), woolly clover (*T. tomentosum*), suckling clover (*T. dubium*) and Bur medick (*Medicago polymorpha*). Dovesfoot (*Geranium molle*), mouse-ear chickweed (*Cerastium glomeratum*), storksbill (*Erodium cicutarium*), dandelion (*Taraxacum officinale*) and buckshorn plantain (*Plantago coronopus*) were also present. Statistical analysis was not possible for species other than the two dominant grasses and the combined legumes because of the low and variable ground covers.

The covers recorded in November 1983, 9 months after final treatment in February 1983, were subjected to analysis of variance. In this analysis, treatment means were 'deflated' by 88/120 while the variance estimates were 'inflated' by 120/88 to account for the bias introduced by 32 missing-plot estimates (spraying error).

Overall, rate of herbicide had no effect on the cover of Chilean needle grass but there was a highly significant herbicide by rate interaction such that ethofumesate and propyzamide both gave greater needle grass cover at the higher rates (Table 2). This appeared to be due to particularly good control of barley grass with these herbicides at

the high rates, which facilitated an increase in the needle grass, itself unaffected by these herbicides.

2,2-DPA resulted in lower cover than the other herbicides and gave best control when applied in summer (Table 2a). Other herbicides tended to increase needle grass cover.

2,2-DPA caused no significant reduction in legume cover (Table 2b). By contrast TCA applied in February, and ethofumesate at all times, reduced the legume content of the swards.

DISCUSSION

Pure stands of Chilean needle grass from several square metres to several hectares in area are common in grassland near Lake Grassmere. Populations of scattered individuals also occur in pastures while isolated tussocks may be found, often along roadsides, fencelines, in waste areas and in pastures. Since isolated tussocks are likely to be the fore-runners of new infestations, the Marlborough Noxious Plants Authority has placed some emphasis on their eradication. Spot-spraying of glyphosate has been tried but the bare ground created around the plants is rapidly colonised by Chilean needle grass seedlings. Manual wick application of glyphosate could be an effective alternative for killing isolated tussocks with the advantage of minimising bare ground and recolonisation. Tussocks need be wiped only once, on one side, but retreatment will probably be necessary to control tussock regrowth and seedlings which may establish within the tiller bases of the dead tussock.

Selective removal of Chilean needle grass from some pastures may also be possible with a tractor-mounted wick using glyphosate. The Chilean needle grass would need to be higher than the surrounding pasture. This could be achieved by grazing management since Chilean needle grass is less palatable than the 'better' pasture plants.

Although selective removal of well established Chilean needle grass from pasture with broadcast spray application of herbicide does not seem possible, the partial control of such plants achieved with 2,2-DPA at 2.0 and 5.0 kg ai/ha and TCA at 10.0 and 15 kg ai/ha in summer suggests that these herbicides may selectively remove more susceptible seedlings. Seedlings of the closely related nassella tussock (*Stipa trichotoma*), are safely removed from new pasture in summer with 2,2-DPA at 1.0 kg ai/ha (Leonard 1962). 2,2-DPA is likely to be less damaging to the legume component of the sward than is TCA.

Glyphosate is highly effective at killing established Chilean needle grass plants at rates as low as 0.72 kg ai/ha providing the plants are not water-stressed. Research is now underway in Marlborough to see if Chilean needle grass can be removed from pasture by treating with glyphosate and oversowing fertiliser and seeds of ryegrass *cv* Ruanui, cocksfoot (*Dactylis glomerata*) *cv* Wana and phalaris (*Phalaris aquatica*) *cv* Maru. 2,2-DPA at 1.0 kg ai/ha is being applied annually to the new swards in autumn or late summer to establish its efficacy on Chilean needle grass seedlings which germinate in large numbers along with the oversown species.

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