CHEMICAL CONTROL OF FIELD HORSETAIL

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SUMMARY

Field horsetail (*Equisetum arvense* L.) is a serious weed of temperate regions in the Northern Hemisphere. It infests horticultural crops and grassland, is toxic to stock and causes milk taints. The plant has an extensive rhizome system and produces tubers, making it difficult to control. Because the weed is found in only isolated pockets in New Zealand, it may be worth eradicating before it becomes more serious. Several herbicides were assessed for controlling field horsetail. Dichlobenil gave complete control of shoot growth but did not kill the tubers. Dichlobenil should be applied at 11 kg/ha. Repeat applications will be necessary to control germinating tubers.

INTRODUCTION

Field horsetail is a serious weed in the temperate regions of the world, particularly Europe, Canada, the Soviet Union and the USA, where it infests a wide range of horticultural crops, cereal crops and grassland (Holm *et al* 1977). The plant is toxic to grazing animals (Kingsbury 1964) and, in dairy pastures, causes taints making the milk unsaleable (Cooper 1988). It grows in light sandy, gravelly or loose soils. In New Zealand it is present in a few scattered sites through the North and South Islands, with the biggest area being about 200 ha in northern Westland (Connor 1977).

The plant grows to about 30 cm high and has an extensive rhizome system reaching depths exceeding 2 metres in suitable soils (Holm *et al* 1977). Under certain conditions tubers are produced on the rhizome system. These may support the plant through times of stress as well as acting as a source of propagules (Marshall 1984a; Williams 1979). Tuber numbers can reach 1000/m² and germinate readily when detached from the plant. The plants also produce spores.

Field horsetail is a difficult weed to control. Amitrole and glyphosate have shown variable effectiveness (Marshall 1984b; Ryan 1976; Hoyt and Carder 1962). It has also been reported as susceptible to asulam, chlorthiamid, dichlobenil, picloram, MCPA, MCPB, 2,4-D, 2,4-DB (Marshall 1984b; Patterson 1965; Ryan 1976).

Because field horsetail is currently found only in isolated pockets in New Zealand it may be in the national interest to eradicate this weed before it becomes a more serious problem. The objective of this study was to assess the effectiveness of several herbicides for this purpose.

METHODS

A uniform infestation of field horsetail on the Rangitikei river bank near Clydesdale in the Manawatu was chosen for the experiment. The treatments (Table 1) were applied in a randomised block design with four replicates. The plot size was 3 m × 10 m.

The herbicides amitrole, glyphosate and 2,4-D + picloram were applied by precision knapsack sprayer in 200 litres water/ha at 200 kPa in January or March 1987. The granular herbicides dichlobenil and picloram were applied by a pepper pot shaker.

The plots were visually scored for control of field horsetail shoots 3 weeks after the January applications. The site was flooded 3 weeks after the March treatment applications, depositing about 100 mm of silt which obscured the horsetail shoots on the trial site. Field horsetail is dormant over the winter. Final assessments were made in October on spring regrowth. Three quadrats (0.3 m × 0.45 m) were randomly placed within each plot. The number of field horsetail shoots was counted, the mean shoot height from five random measurements within each quadrat was recorded and the

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shoots within each quadrat were harvested to ground level, washed and dried for 24 hours at 100 °C.

The data collected for shoot number, shoot height and shoot yield were statistically analysed. These data did not conform to an analysis of variance model as the distribution was skewed and residuals were not randomly distributed. The Friedman multiple range rank test was used for data analysis (Noether 1971).

RESULTS AND DISCUSSION

The October visual assessment, shoot dry matter, shoot counts and shoot heights showed that dichlobenil gave excellent control of field horsetail shoot growth (Table 2). This confirmed the results of Marshall (1984b) and Ryan (1976). However, tubers dug from the dichlobenil treated plots were still viable. The higher application rate (11 kg/ha) is recommended for eradication of field horsetail as dichlobenil at 8 kg/ha exhibited poor control in one replicate.

The success of the dichlobenil treatment could depend on stand age, as older infestations may have a larger, deeper rhizome system and a greater number of tubers than young stands, making them more resistant to herbicide effects. There was no apparent movement of the herbicide into untreated areas. This was surprising, since dichlobenil preferentially accumulates in the areas of meristematic activity (Marshall 1984b) and some rhizomes within the treated plots would have been connected to those in untreated areas. All parts of an infestation must therefore be treated to obtain control.

Dichlobenil did not damage *Lotus* plants present at the trial site. These can provide a source of feed for stock as well as competition for any emerging horsetail shoots, as field horsetail is susceptible to shading (Holm *et al* 1977; Williams 1979).

Amitrole reduced shoot numbers but did not give good overall control (Table 2). This is contrary to the results of Hoyt and Carder (1962) and Marshall (1984b). Glyphosate was ineffective and the addition of a surfactant (Silwet L-77), to the March application failed to improve its effectiveness. Picloram caused tip burn to horsetail

TABLE 1: Herbicides used, rates and application dates

Herbicide	Treatment Code	Rate (kg ai/ha)	Application Date (1987)
Untreated	UT		
amitrole			
(Weedazol 4L)	AM	4.4	18 March
glyphosate			
(Roundup)	G1J	1.0	6 January
glyphosate	G2J	2.0	6 January
glyphosate	G1M	1.0	18 March
glyphosate	G2M	2.0	18 March
glyphosate			
+ Silwet L-77 (Pulse)	G1M + P	1.0 + 0.46	18 March
glyphosate + Silwet L-77	G2M + P	2.0 + 0.46	18 March
picloram (Tordon 2G)	P1J	0.25	6 January
picloram	P2J	0.5	6 January
picloram	P1M	0.25	18 March
picloram	P2M	0.5	18 March
2,4-D + picloram			
(Tordon 50-D)	DP1J	0.5 + 0.125	6 January
2,4-D + picloram	DP2J	1.0 + 0.25	6 January
2,4-D + picloram	DP1M	0.5 + 0.125	18 March
2,4-D + picloram	DP2M	1.0 + 0.25	18 March
dichlobenil (Prefix D)	DB1M	8.0	18 March
dichlobenil	DB2M	11.0	18 March

shoots after the January application and the high rate (0.5 kg/ha), reduced shoot numbers in October but did not provide effective overall control. 2,4-D + picloram gave excellent control of shoot growth at the January assessment but did not give any reduction in new shoot production in October. This is in contrast to the results of Patterson (1965) who reported field horsetail susceptible to picloram at 0.56 kg/ha, a rate slightly above that used in this experiment.

It is unlikely that flooding 3 weeks after the March application of herbicides had any effect on herbicide activity, since the herbicides used would have been absorbed into the plants by that time. The silt deposit left by the flood would not have provided any barrier to emerging horsetail shoots as they have been found to emerge through silt up to a metre thick in the United States (Holm *et al* 1977).

Eradication of field horsetail is likely to be a long and difficult process. It appears that treatment will be necessary to eradicate regrowth from tubers. Ryan (1976) reported shoots of field horsetail emerging 5.5 years after the site appeared free from the weed, which suggests that tubers can persist for a long time. Follow-up inspections and treatments would therefore be essential to ensure eradication. The weed is difficult to locate and treat on riverbank sites, and the spread of the weed by water-borne spores, tubers and rhizome fragments is likely to be significant.

TABLE 2: Mean shoot dry matter, numbers and height in October 1987.

Treatment Code	Shoot DM (kg/ha)	Shoot DM Ranks	Shoot Nos. (m ²)	Shoot No. Ranks	Shoot Ht (cm)	Shoot Ht Ranks
UT	722	42.0	622	54.5	10.0	47.5
AM	758	31.0	276	19.5	8.7	29.5
G1J	824	50.0	593	55.5	9.4	42.5
G2J	774	39.0	532	41.5	9.4	38.5
G1M	777	49.0	604	55.5	9.7	47.5
G2M	496	41.0	572	49.5	7.3	25.5
G1M + P	959	55.0	556	51.0	10.5	50.0
G2M + P	1009	57.0	580	51.5	9.5	40.5
P1J	712	47.0	448	34.0	9.1	41.5
P2J	567	27.5	332	23.0	9.9	46.0
P1M	514	25.5	521	46.0	8.1	30.0
P2M	343	23.0	409	27.0	8.5	31.5
DP1J	842	53.0	484	41.0	12.0	64.5
DP2J	644	45.0	446	39.5	8.9	39.5
DP1M	1035	53.0	559	48.5	10.9	51.0
DP2M	613	30.0	378	29.0	9.7	45.5
DB1	29	10.5	70	12.0	1.3	7.5
DB2	0	5.5	0	5.5	0	5.5
MD 5%*		29.6		29.6		29.6
SED	298		108		1.8	

* Minimum difference required between rank sums to be different at 5% significance level.

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