ALTERNATIVE HERBICIDES FOR GRASS CONTROL IN LEGUME PASTURES

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Summary. Post-emergence herbicide treatments were tested for control of silver grass *(Vulpia myuros)*, annual ryegrass *(Lolium rigidum)* and volunteer barley *(Hordeum vulgare)* in subterranean clover *(Trifolium subterraneum)*, and for control of barley grass *(H. leporinum)* and red fescue *(Festuca rubra)* in medic *(Medicago* spp.) in South Australia in 1992. Carbetamide at 1750 g/ha gave the best control but is expensive. Clethodim + simazine at 60 + 400 g/ha gave moderate grass control with satisfactory legume tolerance, but the possibility of herbicide resistance is a concern. Simazine + paraquat at 400 + 40 or 400 + 60 g/ha also gave moderate grass control with satisfactory tolerance by both clover and medic. Paraquat at 150 g/ha temporarily suppressed clover growth and caused unacceptable damage to medic.

INTRODUCTION

The cost of the cereal root disease, take-all *(Gaumannomyces graminis* var. *tritici)*, has been estimated at $100-200 million p.a. across southern Australia (1,6). The major control strategy is through rotation with non-cereal crops although the practice of removing grasses (the disease hosts) in the pasture phase is of increasing importance. Both these techniques rely heavily on the use of selective grass herbicides and are therefore under threat from the development of herbicide-resistant grasses (11). Furthermore, these selective herbicides do not control *Vulpia* species (silver grasses) (8).

The use of herbicides to control grasses in pastures is expected to increase because it is a relatively simple and cost-effective technique, there is increasing evidence of the value of the pasture phase of rotations in sustainable farming systems, and it is one of the few effective options for cereal root disease control in low rainfall areas where grain legumes or oilseeds are not suitable.

Research in Western Australia suggests that the incidence of take-all increases by about 5% for each 100 kg/ha of grass dry matter in spring in the previous year's pasture (10). In South Australia, take-all was controlled when grass comprised 5% or less of the previous year's pasture (6).

The principal aims of 2 field experiments conducted in South Australia in 1992 were to investigate alternative herbicide strategies for the control of grasses in pastures that would:

(1) reduce the grass component to a level that would provide control of take-all,
(2) provide options to the currently available selective grass herbicides in order to reduce selection pressure for the development of herbicide-resistant grasses,
(3) provide adequate control of silver grass, and
(4) exhibit acceptable safety to pasture legumes.

METHODS

Post-emergence herbicide treatments were applied on 25 June in a medic pasture at Palmer (sandy loam, pH 8.2) and on 16 July in a subterranean clover pasture at Marrabel (clay loam, pH 6.1) in South Australia in 1992. Treatments were applied with a hand-held, 2 m-wide spray boom delivering 85 L/ha of spray mixture.

Grasses present at Marrabel were silver grass, annual ryegrass and volunteer barley. Barley grass was present at the Palmer site which was expected to also contain silver grass, but this was later provisionally identified as red fescue. Because of the early break to the season in South Australia in 1992, the grasses were well advanced (tillered) at the time of spraying.

Experimental design was a randomised complete block with 4 replicates and 12x3 m plots. Data were handled by analysis-of-variance techniques.

Effects of the herbicide treatments were assessed at both sites by visual inspections and by measuring the percentage ground cover of each species in grazed sections of the plots. Herbage was cut and oven-dried to determine pasture production (dry weight) and composition.

At Marrabel, cuts were taken from ungrazed pasture in 3 replicates on 21 September to determine total pasture dry weight, and from lightly grazed pasture in 2 replicates on 2 November. Equipment failure prevented any further sampling at the later date. The proportion of grass and clover in the samples from the later harvest was estimated visually, with reference to the ground cover measurements of 27 October.

At Palmer, herbage was cut from ungrazed pasture in all plots on 13 October and sorted into species to determine the proportion that each component contributed to total dry weight.

Results from some herbicide treatments are not reported in this paper but were included in the statistical analyses. Imazethapyr at 40 g/ha, mixed with paraquat or simazine, had little effect on grass control. Spraying oil added to several of the herbicide treatments also had little effect.

RESULTS AND DISCUSSION

Marrabel. All herbicide treatments significantly reduced total pasture dry weight on 21 September. Paraquat at 150 g/ha, followed by both simazine+paraquat mixtures, gave the largest decrease (44-66%). It is probable that many of the herbicide treatments suppressed clover production, since this was the main component of the pasture, but quantitative data were not obtained.

The light grazing that occurred prior to 2 November may have partially masked differences between treatments, and the harvesting of only 2 replicates decreased the sensitivity of the statistical analysis. Given these limitations, no treatment significantly reduced clover or total dry weight on 2 November. Several treatments significantly reduced grass dry weight, with 1750 g/ha carbetamide and clethodim+simazine giving complete grass control (Table 1).

These results are supported by the ground cover measurements on 27 October, where carbetamide and clethodim+simazine were the only treatments to significantly decrease grass ground cover and significantly increase clover cover.

Table 1. Pasture dry weight (kg/ha) at Marrabel, 2 November 1992

Treatment and rate (g/ha)	Clover	Grasses	Total
Untreated	2556	639	3195
Paraquat (150)	3074	1019	4093
Carbetamide+paraquat			
(350+40)	3269	577	3846
(700+40)	2895	102	2997
Simazine+paraquat			
(400+40)	3086	250	3335
(400+60)	2833	58	2891
Clethodim+paraquat (60+40)	3098	356	3453
Carbetamide (1750)	3479	0	3479
Carbetamide+simazine			
(350+400)	3119	15	3134
(700+400)	3207	36	3242
Clethodim+simazine (60+400)	2985	0	2985
l.s.d. (5%)	n.s.	478	n.s.

Some herbicide treatments containing paraquat initially reduced clover vigour which allowed grasses, especially silver grass, to increase in proportion. This effect was most obvious with 150 g/ha paraquat. The clover recovered as the season progressed but the proportion of grass remained higher than in untreated pasture (Table 1) and, according to percentage ground cover measurements, was significantly higher for silver grass.

Palmer. Most herbicide treatments significantly reduced barley grass dry weight, but fewer significantly reduced total dry weight (Table 2). Paraquat at 150 g/ha caused severe medic damage, but 40-60 g/ha in mixtures with other herbicides was acceptable. The ground cover measurements in grazed areas showed that there was a higher percentage of bare ground where barley grass was controlled.

The herbicide treatments that significantly decreased barley grass dry weight also decreased the proportion of barley grass in the pasture. Carbetamide, both carbetamide+simazine treatments, and simazine+paraquat at 400+40 g/ha significantly increased the proportion of medic in the pasture.

Conclusions. Carbetamide at 1750 g/ha gave the best grass control but is an expensive treatment (approximately $65/ha). Lower rates (350 and 700 g/ha) were tested in mixtures with paraquat or simazine, in order to reduce the cost of treatment, but grass control suffered as a result. It appears that at least 700 g/ha carbetamide is needed for acceptable grass control and that carbetamide+simazine is more promising than carbetamide+paraquat.

Other research has shown that a mixture of a selective grass herbicide with simazine can give good control of a range of grass weeds including silver grass (6,9). Such mixtures do not overcome the threat of herbicide resistance. If they are used in the pasture phase, selective grass herbicides should not be applied in the crop phase (5).

Clethodim was the selective grass herbicide used in these experiments because it has some activity on silver grass at high rates (2,3,4,7,12). Unfortunately, it has poor activity on barley grass (7) which was the dominant weed at Palmer. An alternative grass herbicide, such as fluazifop, would have been more appropriate in this situation.

Mixtures of simazine with paraquat controlled silver grass and other annual grass weeds in southern New South Wales (9). Similar treatments in South Australia have sometimes given unsatisfactory control of grasses other than silver grass (13). At rates that exhibit acceptable safety to pasture legumes, mixtures of simazine with paraquat may not control all grasses well enough to effectively reduce take-all. Nevertheless, these treatments merit further investigation as they are relatively cheap and offer an alternative to the selective grass herbicides. Based on the results from this experiment and on other research experience, application to young plants and/or an increase in the paraquat rate above 60 g/ha may be necessary to achieve a satisfactory level of grass control. This is likely to increase the risk of pasture legume damage (especially in medics) and reduce feed availability during winter, but may be the price that has to be paid if take-all is to be controlled.

Table 2. Pasture dry weight (kg/ha) at Palmer, 13 October 1992

Treatment and rate (g/ha)	Medic	Barley grass	Fescue	Broadleaf	Total
Untreated	1156	1104	0	80	2340
Paraquat (150)	471	104	84	310	869
Carbetamide+paraquat					
(350+40)	856	956	0	46	1858
(700+40)	1158	243	147	91	1639
Simazine+paraquat					
(400+40)	1344	74	26	226	1670
(400+60)	996	290	58	179	1522
Clethodim+paraquat (60+40)	1456	530	0	550	2536
Carbetamide (1750)	1370	0	167	164	1701
Carbetamide+simazine					
(350+400)	1466	369	43	38	1916
(700+400)	1065	96	5	4	1170
Clethodim+simazine (60+400)	1058	980	0	22	2060
l.s.d. (5%)	486	477	n.s.	n.s.	655

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