TOLERANCE OF PERENNIAL RYEGRASS/WHITE CLOVER PASTURES TO FIVE SULFONYLUREA HERBICIDES

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Summary. The tolerance of perennial ryegrass, *Lolium perenne*/white clover, *Trifolium repens*, pastures to five sulfonylurea herbicides, the standard phenoxy herbicides (2,4-D and MCPA) and asulam was compared in four field trials during 1991 and 1993. With the exception of asulam, all the herbicides were more damaging to white clover than to perennial ryegrass. For the sulfonylurea herbicides, autumn applications were more damaging to white clover than were spring applications. Thifensulfuron (15-18.8 g/ha) applied in spring was the least damaging of the sulfonylurea herbicides producing only short term suppression of perennial ryegrass, while white clover damage was similar to that of 2,4-D. Tribenuron, primisulfuron, chlorimuron and metsulfuron severely suppressed perennial ryegrass for up to 3 months and removed much of the white clover within 2 months of application. Of the sulfonylurea herbicides evaluated in these trials, thifensulfuron appears to have the most potential as a broadcast treatment for selective control of some pasture weeds. Use of the other sulfonylurea herbicides should be limited to spot or directed applications due to their lack of selectivity to both perennial ryegrass and white clover.

INTRODUCTION

Sulfonylurea herbicides are highly active against a wide spectrum of broadleaf and grass weeds. While seed germination is not usually affected, subsequent root and shoot growth may be rapidly and severely inhibited (1). The need for such broad spectrum, low dosage compounds with greater crop selectivity is an important factor contributing to the rapid success of this group of chemicals. Since their initial development in the late 1970's several herbicides of the sulfonylurea group have been evaluated and registered for a wide variety of uses. These range from total vegetation control to selective weed control in crops such as rice, cereals, soya beans and maize, as well as for aquatic weed control (1,2,3). Worldwide very little effort has been devoted, however, to their development and use for weed control in pastures.

Early development work in New Zealand indicated that certain sulfonylurea herbicides had potential for control of pasture weeds such as ragwort, *Senecio jacobaea*, docks, *Rumex* spp, buttercups, *Ranunculus* spp., and thistles (4,5), and two chemicals were registered for spot treatment in the late 1980's. Experimental work has since concentrated on the tolerance of pasture species to broadcast applications of some sulfonylureas as they may offer an alternative to the phenoxy herbicides in certain situations, for example in the vicinity of horticultural crops or for treatment of pasture weeds that are resistant to phenoxy herbicides. This paper reports results of field trials on the tolerance of perennial ryegrass and white clover based pastures to five sulfonylurea herbicides applied in autumn or spring.

METHODS

Four field trials were conducted at the Ruakura Agricultural Centre near Hamilton between 1991 and 1993, with a trial being laid down in the autumn and spring of each year. All trials were on predominantly perennial ryegrass/white clover pastures and grazed by sheep, except Trial 4 which was grazed by dairy cows. The soil type in all cases was a Horotiu sandy loam with pH ranging between 5.4 and 5.8 and the organic C between 8.1 and 9.8%. In Trial 1 several sulfonylurea herbicides were tested for their effects on pasture production and compared with asulam, 2,4-D + clopyralid and the phenoxy herbicide standards, 2,4-D and MCPA (Table 1). The most promising treatments were further evaluated in the subsequent trials. All trials were of a randomised block design with plot-sizes of 2x10 m and 4 or 6 replications.

The herbicide treatments were applied approximately 10 days after grazing with a compressed gas powered precision sprayer delivering 300 L/ha at 210 kPa, using flat fan nozzles. A non-ionic wetting agent, Citowett, was added to the sulfonylurea herbicides at 0.2% v/v. Treatments in the two autumn trials were applied on 11 June 1991 (Trial 1) and 15 April 1992 (Trial 2) while the spring treatments were applied on 17 th October 1991 (Trial 3) and 17 th September (Trial 4). No rainfall was recorded within 6 hours after application in any trial.

The effects of treatments on the twp pasture species were determined at regular intervals by visual assessments (comprising an estimate of growth suppression and physical damage such as discolouration and distortion) by at least two observers. The pasture production was determined at critical times of damage by moving two 9x0.5 m strips from each plot. After recording the grenn weights, subsamples were taken for dry matter analyses. At most harvests further sunsamples were taken for pasture composition analyses by herbage dissection. the trials were grazed the day after the mowing and trimmed if required before spelling till next assessment.

As the data from the two autumn trials were compatible and the variances were similar, results from Trials 1 and 2 were converted to precent of untreated and are presented in one table. Least significant differences (l.s.d.'s) presented here are from anlayses variance performed on untransformed data as the data did not require transformation.

RESULTS AND DISCUSSIONS

Visual damage. All the sulfonylarea herbicides produced some damage symptoms on the pasture species. In perennial ryegrass a purplish discolouration developed within 2 weeks of spraying, staring at the tip of the leaf blades and, more often, on the midrib side of the blade. The discolouration turned to yellow in the more damaging treatments and eventually to brown as the foliage died. The oldest or largest leaf of a tiller appeared to be the most affected. In the case of white clover the leaflets and petioles showed a reddish purple discolouration initially, turning yellow with time. New clover leaves were very small and stolon growth was greatly reduced for several weeks after treatment. This effect persisted for several months with the more active herbicides. In the asulam treatments both perennial ryegrass and white clover showed yellowing within 3 weeks of treatment. For the phenoxy treatments perennial ryegrass showed no apparent effect but white clover plants were rapidly twisted and distorted with typical auxin type damage.

Most of the discoloured tissue was removed from the plots by the first grazing after treatment. Following this, all plots treated with either sulfonylurea or phenoxy herbicides contained noticeably less white clover. By the summer months the untreated plots as well as those treated with asulam were conspicuous by the large number of white clover flowers in them.

Autumn trials. The two autumn trials (Table 1) were conducted to test a range of candidate herbicides at the time of year that they would be applied for best control of certain target weeds, i.e. ragwort and nodding thistle, Carduus nutans, and therefore included some members of the group known to have activity on these weeds (5). The results showed that tribenuron, primisulfuron and metsulfuron were too damaging to both perennial ryegrass and to white clover and that chlorimuron was very damaging to white clover. The suppression of these species also allowed an increase in the 'other grasses' component which remained high until the spring. The level of damage to perennial ryegrass by thifensulfuron was similar to most of the other sulfonylurea herbicides but the amount of white clover damage was much less, particularly at the lower application rates. Asulam also suppressed perennial ryegrass and white clover production for a short time but was less damaging than the sulfonylurea herbicides, especially to white clover. None of the phenoxy herbicides significantly affected perennial ryegrass but they all severely reduced white clover. The low rate of MCPA caused less white clover damage than any other treatment except asulam, while 2,4-D produced damage similar to thifensulfuron. The high rate of MCPA and the 2,4-D plus clopyralid treatments were considerably more damaging, almost eliminating white clover from the pasture for more than 6 months (Table 1). It should be mentioned here that such high rates of the phenoxy herbicides and the 2,4-D/clopyralid mixture are currently being used to control nodding thistles that have become tolerant to phenoxy herbicides.

Overall, thifensulfuron was the least phytotoxic of the sulfonylurea herbicides tested, although it still proved highly damaging to white clover. At rates of 15-18.8 g/ha, required for control of common pasture weeds (4), it probably cannot be considered as a broadcast treatment for perennial ryegrass/white clover based pastures in the autumn.

Table 1. Effect of herbicide treatments applied to pasture in the autumn, Trials 1 and 2.

Treatments	Rate (g/ha)	Perennial ryegrass Dry matter (% of untreated)		White clover Dry matter (% of untreated)		White clover Damage (%)
		6 WAT*	12 WAT	6 WAT	12 WAT	30 WAT
thifensulfuron	15	61.9	117.2	11.1	27.6	32.5
thifensulfuron	18.8	50.7	97.0	11.4	25.9	25.0
thifensulfuron	30	51.4	90.1	9.0	11.0	37.5
primisulfuron	30	44.9	103.9	24.0	1.0	55.8
primisulfuron	60	35.6	88.2	27.5	0.6	40.8
tribenuron	20	56.8	109.4	33.4	0	65.0
tribenuron	30	48.8	86.9	27.7	0	77.5
metsulfuron	3	50.9	81.0	29.1	0	85.0
chlorimuron	30	92.0	123.0	30.7	0	35.0
asulam	1600	72.0	99.2	75.6	98.7	0
MCPA	1125	93.6	136.2	32.0	73.1	5.0
MCPA	2250	89.8	140.1	0	31.2	72.5
2,4-D + clopyralid	2160 + 30	83.3	142.2	11.0	3.1	80.4
2,4-D	2160	81.6	129.3	15.7	33.62	33.5
untreated		100	100	100	100	0
l.s.d. (P=0.05)		18.7	21.3	11.8	24.4	16.0

* WAT = weeks after treatment.

<u>Spring trials</u>. Previous work on the efficacy of thifensulfuron on various pasture weeds indicated that it might be better tolerated by the pasture species when applied in the spring (4). Results from the two spring trials (Tables 2 and 3) show that although thifensulfuron caused some suppression of perennial ryegrass also in the spring it was for a shorter period, probably due to the faster growth of perennial ryegrass at this time of the year. However, this

suppression was sufficient to reduce the total pasture yield, recorded 2 or 3 weeks after treatment, compared to the phenoxy herbicides.

In the case of white clover also, production was severely suppressed for a shorter time than in the autumn trials, especially in Trial 4 (Table 3) and was not significantly different from the untreated by about 20 weeks after treatment for all but the highest rate. Thifensulfuron resulted in clover damage similar to that of the standard phenoxy herbicides although the results varied considerably between the two trials. This was most likely due to better growing conditions around the time of treatment as Trial 3 was sprayed 1 month later than Trial 4, when the pasture was growing at a faster rate. Recovery of the white clover in all treatments was faster in the spring trials compared to the autumn trials.

Table 2. Effect of herbicide treatments applied to pasture in spring 1991, Trial 3.

Treatment	Rate g/ha	Perennial ryegrass DM (kg/ha)		White clover DM (kg/ha)			
		2 WAT*	8 WAT	2 WAT	8 WAT	21 WAT	32 WAT
thifensulfuron	15	984	446	54.0	70.5	54.6	40.4
thifensulfuron	18.8	820	414	54.0	80.1	51.8	46.1
thifensulfuron	30	851	396	42.2	58.0	34.2	39.5
2,4-D	2160	1196	474	21.3	35.9	41.8	69.0
MCPA	2250	1279	495	19.8	27.2	27.5	40.1
asulam	1600	1191	443	99.2	117.0	71.2	79.1
untreated		1409	450	156.8	128.5	67.0	53.7
l.s.d. (P=0.05)		375	127	23.7	26.2	18.6	19.9

* WAT = weeks after treatment.

Table 3. Effect of herbicide treatments applied to pasture in spring 1992, Trial 4.

Treatment	Rate g/ha	Perennial ryegrass DM (kg/ha)			White clover DM (kg/ha)			
		3 WAT*	6 WAT	9 WAT	3 WAT	6 WAT	18 WAT	27 WAT
thifensulfuron	11.3	914	611	1040	79.8	29.1	627	198
thifensulfuron	15	780	482	977	48.8	6.5	542	155
thifensulfuron	18.8	862	546	1053	109.0	4.8	598	160
thifensulfuron	30	732	489	1080	47.7	3.2	372	185
2,4-D	2160	1022	699	1059	66.3	28.1	459	162
MCPA	2250	1270	549	1071	6.6	22.2	277	130
asulam	1600	969	512	893	76.6	39.6	611	151
untreated		1204	623	1016	120.0	102.6	554	174
l.s.d. (P=0.05)		164	161	221	53.1	11.9	150	47

* WAT = weeks after treatment.

From these results it was concluded that of the sulfonylurea herbicides tested, only thifensulfuron has potential as a broadcast, spring applied herbicide in pastures. The other chemicals, viz. metsulfuron, tribenuron, chlorimuron and primisulfuron, would probably have to be limited to spot or directed applications. They could also offer possibilities for providing effective control of some troublesome weeds in the year before resowing of pastures as discussed by Mitchell *et al* (6) or when a different crop is to be planted before pasture renovation (7). Thifensulfuron has recently been registered for broadcast use in pastures in Germany and Ireland and as a spot treatment in Switzerland. Work is continuing in New Zealand on refining the rates and times of application before it is recommended as a broadcast treatment for control of pasture weeds in the spring.

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