EVALUATION OF THIFENSULFURON FOR CONTROL OF SOME PASTURE WEEDS

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SUMMARY

Thifensulfuron at 11.3, 15 and 30 g/ha was evaluated on six pasture weeds in field trials and compared with herbicides recommended for control of each weed. Applications were made at two times, in early to mid October and early to mid November. Thifensulfuron provided good control of water pepper (*Polygonum hydropiper*) and willow weed (*Polygonum persicaria*) at both application times and generally performed better than 2,4-D or bentazone. Later applications of thifensulfuron controlled oxeye daisy (*Chrysanthemum glomeratum*) and giant buttercup (*Ranunculus acris*) equally as well as did 2,4-D and MCPA. Recovery of clovers (*Trifolium* spp.) was quicker in the 15 g/ha thifensulfuron treatment than the phenoxy herbicides treatments. The higher rates of thifensulfuron performed as well as the standard treatments against mouse-ear chickweed (*Cerastium glomeratum*) and stinking mayweed (*Anthemis cotula*).

Keywords: thifensulfuron, pasture weeds, phenoxy herbicides, *Polygonum* spp., *Ranunculus acris*

INTRODUCTION

Since their initial development in the late 1970's several herbicides of the sulfonylurea group have been evaluated and registered for a variety of uses. World-wide, very little effort has been devoted, however, to their development and use for weed control in pastures. The herbicide thifensulfuron (previous common name thiameturon-methyl) is a post-emergence chemical highly active against many broadleaf weeds and has good selectivity in cereal crops (Ambach *et al.* 1984; Sionis *et al.* 1985). Its broadcast use in pastures was first reported by Rahman and Martin (1989). Further studies have since been published on its activity against certain pasture weeds (James *et al.* 1992; Nicholson *et al.* 1993; Ostermeyer and Meier 1989) and on aspects of its pasture tolerance (Rahman *et al.* 1993).

Thifensulfuron has recently been registered for use in pastures in Germany for control of docks (*Rumex* spp.) and yarrow (*Achillea millefolium*), in Ireland for control of broadleaved dock (*Rumex obtusifolius*) and in Switzerland as a spot treatment for dock control. Experimental work has continued in New Zealand as this herbicide could 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. The present study evaluated rates and times of applications of thifensulfuron for selective control of a range of pasture weeds.

MATERIALS AND METHODS

Field trials were conducted on six pasture weed species, with sites located on farms around the Waikato district. Giant buttercup and oxeye daisy trials were on dairy pastures at Tirau (flat terrain) and Puahue (steep hillside) respectively, with a good distribution of the weeds growing in competition with the pasture. The water pepper and stinking mayweed were present as a mixture in the trial located in a ponding area with little pasture on a dry stock farm at Pirongia. The mouse-ear chickweed trial was in a new pasture being grazed by young dairy cattle at Te Awamutu and the willow weed trial was on winter cultivated arable land near Ohaupo.

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The treatments compared three rates of thifensulfuron (Harmony) (11.3, 15 and 30 g/ha), two herbicides (Tables 1-4) which may be regarded as the standards used for each weed, and an untreated control plot. Bentazone (Basagran) applications included Citowett at 0.02% v/v. Application of the treatments was made using a precision plot sprayer of 2 m boom width with four flat fan nozzles. When necessary, a spray boom shielding device was used to eliminate drift onto adjacent plots. Water rate was 300 litres/ha applied at a pressure of 210 kPa. The weeds were treated post-emergence in October (5 to 13 October 1993) when the weeds were young seedlings or rosettes, and in November (2-9 November 1993) when the plants were more mature and near flowering. The trials were laid out with time of application as main plots and the herbicides as split plots, except for the mouse-ear chickweed which was laid out as two adjacent trials, one for each time of application. All trials were of a randomised block design with four replications and plot sizes of 5 x 2 m to 10 x 4 m.

Assessments of the trials were made at approximately 2 weeks, 1, 2 and 3 months after treatment (2 WAT, 1 MAT, 2 MAT and 3 MAT) and for some sites, 4 months after treatment (4 MAT). Visual assessments of the phytotoxic damage to the weeds were recorded up to 2 MAT. Percentage ground cover estimates were made at 3 MAT and sometimes at 4 MAT and were often supplemented by weed plant counts. Where sufficient pasture was present, effects of the herbicides on pasture species were noted at the above times with particular reference to damage. Statistical analyses were performed using the Tukey multiple comparison test. Transformation of data was sometimes required (log, angular or square root) before analysis. Untransformed means are presented and significant differences are identified by the use of different appended letters. Data not included in the analyses are shown as means without appended letters.

RESULTS AND DISCUSSION

Water pepper and willow weed

There were no marked differences between the October and November sprayings for both weeds, hence only results from later applications are presented in Table 1.

The speed of activity of thifensulfuron on water pepper at both times of application was initially slower than for the two standards viz. 2,4-D (2,4-D Ester 80EC) and bentazone, but damage reached higher levels later on. At 1 MAT the level of damage was significantly higher at all three rates of thifensulfuron than for bentazone. By 3 MAT plant density was still significantly lower at the highest rate of thifensulfuron than in the bentazone treatment or the untreated control. Differences between thifensulfuron and 2,4-D at both times of application were not significant. Bentazone caused initial burning of the weed but regrowth quickly returned the weed to levels similar to the untreated control.

The phytotoxicity of thifensulfuron became apparent as quickly as it did in the bentazone and 2,4-D treatments on the young willow weed but was a little slower on the older plants. Bentazone and all rates of thifensulfuron caused very high levels of damage to the willow weed at both application times and were more active than 2,4-D. Recovery by the willow weed was considerable and significant in the 2,4-D plots, with only some recovery occurring in the bentazone treatment (Table 1). The second time of application provided slightly better results by 2 MAT than the earlier application because of the large quantity of dead material standing in the plots and suppressing further weed germination. As this trial was on arable land, there was no pasture competition to minimise the subsequent germination of weeds

Oxeye daisy

At the first time of application the efficacy of thifensulfuron against oxeye daisy peaked at 1 MAT and then declined as many plants recovered. By 4 MAT ground cover scores and plant numbers at all rates had returned to levels which were not significantly different from those in the untreated control (Table 2). At the second time of application the two higher rates of thifensulfuron gave significant weed control, but were no better than the two standards at 3 MAT.

TABLE 1: Effects of herbicide treatments applied at pre-flowering[1] on water pepper and willow weed.

Treatment	Rate (g ai/ha)	Water pepper (applied 3.11.93) Damage (%) 1 MAT	Ground cover % 3 MAT	Plants (No./m^2) 3 MAT	Willow weed (applied 2.11.93) Damage (%) 1 MAT	Damage (%) 2 MAT	Ground cover (%) 3 MAT
thifensulfuron	11.3	79a[2]	5.5bc	7.7ab	66c	98	1.5
thifensulfuron	15.0	88a	2.8c	7.3ab	66c	99	1.3
thifensulfuron	30.0	95a	2.0c	3.8b	76bc	100	0.8
2,4-D	2070	79a	12.0abc	9.8ab	79b	90	56.3a
bentazone	1440	53b	30.8ab	19.4a	91a	97	11.3b
untreated		0	30.0a	19.2a	0	0	100

[1] Similar results were obtained from early spring applications (water pepper: 9.10.93; willow weed: 6.10.93).
[2] Means within a column followed by the same letter are not significantly different (P<0.05) according to the Tukey multiple comparison test. Means without letters were not included in analyses.

Thifensulfuron showed a strong rate response at 1 MAT, with the highest rate outperforming the lowest rate, often significantly. The marked improvement in control at the second time of application was most obvious at the middle rate of 15 g/ha with ground cover and plant numbers similar to the higher rate and standards in February (3 MAT). This treatment also exhibited less clover damage than the two standards at 3 MAT (Table 2).

TABLE 2: Damage, ground cover and plant numbers of oxeye daisy from two times of herbicide application and percent ground cover of clover after the second application time.

Treatment	Rate (g ai/ha)	First application (13.10.93) Damage (%) 1 MAT	Ground cover (%) 4 MAT	Plants (No./m^2) 4 MAT	Second application (9.11.93) Damage (%) 1 MAT	Ground cover (%) 3 MAT	Plants (No./m^2) 3 MAT	Clover Ground cover (%) 2 MAT
thifensulfuron	11.3	65b[1]	40ab	29a	69c	33ab	27ab	33bc
thifensulfuron	15.0	74ab	41a	32a	70bc	23b	12c	36ab
thifensulfuron	30.0	83a	21bc	17abc	85a	19bc	14bc	31bc
2.4-D	2070	78ab	7cd	10c	70bc	19bc	9c	29c
2,4-D +	2070							
clopyralid	30	85a	3d	11bc	84ab	8c	9c	7d
untreated		0	55a	25ab	0	50a	32a	40a

[1] Means within a column followed by the same letter are not significantly different (P<0.05) according to the Tukey multiple comparison test. Means without letters were not included in analyses.

Giant buttercup

Damage to giant buttercup by thifensulfuron was slower to appear than in the case of phenoxy herbicides, but by 1 MAT damage scores had reached levels similar to, or greater than, those of the phenoxy standards (Table 3). For the first time of application of thifensulfuron, some recovery of treated plants and establishment of seedlings resulted in higher ground cover compared to the standard treatments at 3 and 4 MAT. Most plants in the untreated plots and some at the low rate of thifensulfuron were large by the end of the trial and pasture in the vicinity was not being grazed by dairy cows. For the second time of application, however, thifensulfuron provided levels of control equal to the standards. There was no significant rate response for thifensulfuron. Overall, the middle rate of thifensulfuron (15 g/ha) provided good weed control, and clovers recovered more quickly from damage in this treatment than in the standard treatments (data not presented), in a trend similar to the clover results of the oxeye daisy trial (Table 2).

TABLE 3: Damage, ground cover and plant numbers of giant buttercup from two times of herbicide application.

Treatment	Rate (g ai/ha)	First application (5.10.93) Damage (%) 1 MAT	First application Ground cover % 4 MAT	First application Plants (No./m²) 4 MAT	Second application (9.11.93) Damage (%) 1 MAT	Second application Ground cover (%) 3 MAT	Second application Plants (No./m²) 3 MAT
thifensulfuron	11.3	89ab[1]	22ab	4.9a	79a	4.8b	1.6b
thifensulfuron	15.0	90ab	12ab	3.5ab	84a	2.3b	1.6b
thifensulfuron	30.0	94a	12ab	4.4ab	90a	1.5b	1.4b
MCPA	2250	89ab	3c	2.8ab	86a	3.3b	1.4b
MCPA +	1125						
MCPB	1155	79b	3c	1.9b	79a	3.0b	1.7b
untreated		0	48a	4.4ab	0	31.3a	3.2a

[1]Means within a column followed by the same letter are not significantly different (P<0.05) according to the Tukey multiple comparison test. Means without letters were not included in analyses.

TABLE 4: Effect of herbicide treatments at two application times on mouse-ear chickweed and stinking mayweed.

Treatment	Rate (g ai/ha)	Mouse-ear chickweed First application (13.10.93) Damage (%) 1 MAT	Mouse-ear chickweed First application Plants (No./m²) 3 MAT	Mouse-ear chickweed Second application (2.11.93) Damage (%) 1 MAT	Mouse-ear chickweed Second application Plants (No./m²) 3 MAT	Stinking mayweed Second application (3.11.93) Damage (%) 1 MAT	Stinking mayweed Ground cover (%) 3 MAT	Stinking mayweed Plants (No./m²) 3 MAT
thifensulfuron	11.3	89b[1]	0.41ab	76b	0.46ab	66ab	24bc	4.2ab
thifensulfuron	15.0	90ab	0.74a	87ab	0.15bc	79bc	12bc	3.0ab
thifensulfuron	30.0	95ab	0.54ab	96a	0.06bc	90a	2cd	1.1b
bentazone	1440	86b	0.15b	91ab	0.11bc	63b	1d	1.0b
benazolin	315	99a	0.02c	96a	0.05c			
2,4-D	2070					55b	22ab	4.8ab
untreated		0	0.58ab	0	0.88a	0	46a	7.0a

[1]Means within a column followed by the same letter are not significantly different (P<0.05) ccording to the Tukey multiple comparison test. Means without letters were not included in analyses.

Mouse-ear chickweed and stinking mayweed

Damage to mouse-ear chickweed reached high levels by 1 MAT in all treatments. The lowest rate of thifensulfuron caused significantly less damage than the standard benazolin (Galtak) treatment for both times of application (Table 4). The level of control decreased with time and for the first application time thifensulfuron treatments had weed numbers similar to the untreated control by 3 MAT. Long term efficacy was much better for the second time of application, as the differences in plant numbers 3 MAT between the two high rates of thifensulfuron and the standards were not significant. Although bentazone had a quick burning effect on the mouse-ear chickweed, benazolin provided significantly better control of this weed for the first time of application.

For the first time of application the two higher rates of thifensulfuron showed significantly higher damage scores on stinking mayweed 1 MAT than 2,4-D or bentazone (data not presented). A similar trend was noted at the second time of application, although the differences were significant only for the highest rate of thifensulfuron (Table 4). By 3 MAT however, both bentazone and the highest rate of thifensulfuron had significantly lower weed ground cover and plant numbers than untreated. The 2,4-D treatment was less effective than bentazone and the high rate of thifensulfuron. Overall thifensulfuron showed similar efficacy on stinking mayweed at both times of application.

Observations on other weeds

Small numbers of some other pasture weeds were present in trial plots, particularly at the first time of application, and visual observations were recorded where possible. These showed thifensulfuron to be particularly effective against spurrey (*Spergula arvensis*) and broadleaf dock (*Rumex obtusifolius*) and to have reasonable activity against chickweed (*Stellaria media*) and shepherd's purse (*Capsella bursa-pastoris*). Thifensulfuron showed only limited activity against twincress (*Coronopus didymus*) and scrambling speedwell (*Veronica persica*).

The use of thifensulfuron as a broadcast application for control of weeds in pastures will largely be influenced by factors such as the efficacy of existing chemicals and other control measures, and the relative damage to pasture species caused by them. Control by thifensulfuron of at least four of the weeds investigated here was as good as that provided by the standard treatments. It provided very good control of the two *Polygonum* spp. at either time of application. When applied at close to flowering stage, its activity was similar to the standard herbicide treatments on giant buttercup and oxeye daisy. Control of mouse-ear chickweed and stinking mayweed was equal to the standard treatments only at the highest rate. The middle rate of 15 g/ha was the lowest needed to provide acceptable control of most weed species tested. Damage to clovers at this rate was comparable to or less than that caused by phenoxy herbicides. Limited data on pasture tolerance suggest that thifensulfuron has potential as a broadcast, spring applied herbicide in pastures (Rahman *et al.* 1993). We are continuing further work on aspects of pasture tolerance under a range of conditions. With its favourable environmental and toxicological profile (Beyer *et al.* 1988), thifensulfuron offers an alternative for many situations where a phenoxy herbicide cannot be applied.

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