CONTROL OF BRACKEN AND SELECTIVITY OF RADIATA PINE TO PRIMISULFURON

R.D. WELSH, H.M. BEETZ and G.B. FOLLAS

Ciba-Geigy New Zealand Limited, Rangiora, Cambridge and Hastings

SUMMARY

Primisulfuron was evaluated in a series of trials over 5 years for the control of bracken (*Pteridium* spp) and selectivity to 1 to 2 year old radiata pine. Primisulfuron was slow acting and inferior to metsulfuron at 100 g/ha for the initial brownoff of existing fronds with no difference in effect between 50 and 100 g/ha. For the inhibition of rhizome regrowth 12 months after application, primisulfuron at 75 g/ha was significantly better than 50 g/ha, and comparable to metsulfuron at 100 g/ha. Primisulfuron was selective to radiata pine when applied post-planting at rates up to 100 g/ha.

Keywords: bracken, primisulfuron, radiata pine

INTRODUCTION

Bracken (*Pteridium esculentum*) is the most widespread weed affecting forestry in New Zealand (Preest 1975). A cover of bracken can develop within 2 years. The above ground parts consist of fronds rising sporadically from a much branched underground rhizome system. New fronds are produced annually. Where frosts prevail, fronds are killed off each year, but in less severe climates older fronds persist for several years.

Forest establishment does not require eradication of bracken, but instead the reduction of frond numbers and vigour, and this is usually adequate to allow the survival of the large majority of trees (Preest 1975).

The use of herbicides in forestry has become common practice with the emphasis on selective weed control within established radiata pine (*Pinus radiata*) plantations. Therefore a single post-planting treatment, when applied to mature bracken fronds is desirable for the release of radiata pine.

Primisulfuron is a new sulphonylurea which inhibits cell division in plants by limiting the production of amino acids necessary for the creation of new cells. The chemical and physical properties of the compound have been previously described by Maurer *et al* (1987). Primisulfuron is quickly translocated to actively growing tissue via the phloem and xylem. Treated growth stops immediately and over a period of several weeks plant chlorosis and necrosis occurs. The uptake via the foliage is enhanced by the addition of a non-ionic surfactant to the spray solution. An organosilicone adjuvant such as Silwett L77 was shown to be a superior adjuvant for addition to herbicides for the control of bracken when in full frond (Gaskin and Kirkwood 1987).

Initially three trials were carried out during 1985-86 in the North and South Islands. Results of this work suggested that primisulfuron has reasonable foliar activity on bracken and excellent inhibition of the new frond growth from the rhizomes. The results of further trials which evaluated the efficacy against bracken and selectivity to radiata pine of primisulfuron, are reported in this paper.

METHODS

Twelve trials were laid down over a period of 5 years at various sites in either forest plantations or railway sidings under a variety of environmental conditions. Trial sites were located in the South Waikato, Poverty Bay, Hawkes Bay and Nelson areas. The layouts consisted of a randomised block design with two to four replicates per treatment. Herbicides were applied using a modified Oxford precision sprayer fitted with a boom using either fan or hollow nozzles operating between 200-260 kPa and

Proc. 44th N.Z. Weed and Pest Control Conf. 1991: 28-30

and applying 200-300 litres/ha. Plot size varied from 10-25 m² with applications during the period of February to May.

Primisulfuron was evaluated at rates ranging from 50-100 g/ha in combination with either a surfactant (Triton X-45) or penetrant (Pulse) at 0.1% v/v concentration. Two formulations, 5WP and 75WG of primisulfuron (Beacon) were evaluated with metsulfuron (Escort 70DF) as a comparative treatment.

Assessments of effects were made at various intervals throughout the period of the trials. Bracken control efficacy was assessed on percentage brownoff and number of regrowth fronds/m². Tree tolerance was assessed by measurement of tree height and ground line diameter, and where appropriate, growth increments and volume index (d³h). Data were analysed after square root transformation, and significant differences between treatments were detected using an LSD test.

RESULTS AND DISCUSSION

Bracken frond brownoff

Frond brownoff was assessed on unsprayed as well as sprayed areas to define and eliminate effects due to the action of frosts. Generally all trials were located at sites of low frost severity. Throughout the 12 month period of evaluation, no rate responses from primisulfuron between 50-100 g/ha were apparent (Table 1). In comparison with metsulfuron, primisulfuron was slow acting and significantly inferior for the extent of brownoff. Both herbicides gave rise to considerable brownoff by 12 months.

TABLE 1: Mean percentage brownoff of bracken 3, 6 and 12 months after application of herbicides.

Treatment	Rate g ai/ha	Mean % brownoff		
		3 months 4 trials	6 months 7 trials	12 months 3 trials
untreated	0	6.2	13.6	18.6
primisulfuron	50	16.0	31.9	83.3
primisulfuron	75	16.9	32.0	83.8
primisulfuron	100	11.3	29.9	84.7
metsulfuron	100	—*	70.4	100
LSD (5%)		15.2	13.8	5.9

*metsulfuron not used at these locations

Bracken frond regrowth

Following the application of primisulfuron and metsulfuron to bracken fern in the summer-autumn period, there was a considerable reduction in rhizome regrowth in the following summer season (Table 2).

TABLE 2: Mean number of regrowth bracken fronds 6 to 12 months after application of herbicides.

Treatment	Rate g ai/ha	Number of regrowth fronds/m ²	
		6-8 months 7 trials	11-12 months 8 trials
untreated	0	6.3*	7.4*
primisulfuron	50	0.3	1.3
primisulfuron	75	0.3	0.7
primisulfuron	100	0.1	1.0
metsulfuron	100	0.4	0.6
LSD (5%)	0.4	0.4	0.6

*not included in the statistical analysis

As the difference between the unsprayed and treated areas was clearly evident, the LSD test applies only to the herbicide rate responses. At 6 months after application, both herbicides inhibited new frond growth. At 12 months there was a significant difference in the numbers of fronds between primisulfuron at 50 g/ha and 75 g/ha. The two higher rates of primisulfuron were comparable to metsulfuron at 100 g/ha. Fronds that emerged on treated plots were observed to be markedly suppressed in height and growth at 6 and 12 months after application.

Tolerance of radiata pine

The results of applying primisulfuron over 1-2 year old trees did not indicate any adverse growth effects (Table 3). There was no significant difference in tree growth measurements at time of application. The increments in tree height, ground-line diameter and volume-index were not significantly different between the three rates of primisulfuron. Three of the four trials in which tree measurements were made, generally had little bracken.

The volume index (d³h) figures, based on trial measurement data, show that tree growth following primisulfuron applications was not significantly affected at the 50 to 100 g/ha rates. Although slight needle scorch was noted at the 100 g/ha rate, this is believed to be of little practical consequence, though rates higher than 100 g/ha may be detrimental to tree growth (J.H. Balneaves pers. comm.).

TABLE 3: Growth response of radiata pine 1 year after application of primisulfuron.

Treatment	Rate g ai/ha	Tree height (cm)			Ground-line diameter (mm)			Volume- index d³h
		L/D	4 trials		L/D	2 trials		
			1 yr	Increment		1 yr	Increment	
untreated	0	61.1	128.2	67.1	6.8	17.3	10.5	920
primisulfuron	50	64.9	128.5	63.6	9.8	20.5	10.7	1040
primisulfuron	75	64.8	128.5	63.6	11.2	24.0	12.7	1080
primisulfuron	100	61.5	123.3	61.8	8.7	20.5	11.8	970
LSD (5%)		8.7	17.6	13.0	5.9	3.6	4.7	420

CONCLUSIONS

Twelve months after application in the summer/autumn period, primisulfuron at 75 g/ha gave effective brownoff of existing bracken and a high degree of inhibition of rhizome regrowth. Post-planting applications of rates up to 100 g/ha primisulfuron were selective to radiata pine planted at least 6-18 months previously.

ACKNOWLEDGEMENTS

The authors thank especially the foresters for their cooperation in the conduct of the trials, as well as D. Saville for helpful advice and statistical analyses.

REFERENCES

- Gaskin, R.E. and Kirkwood, R.C., 1987. Influence of adjuvants on the activity of asulam and glyphosate in bracken (*Pteridium* spp). *Proc. 40th N.Z. Weed and Pest Control Conf.*: 52-55.
- Maurer, W., Gerber, H.R. and Rufener, J., 1987. CGA 136872: A new post-emergence herbicide for selective control of *Sorghum* spp. and *Elymus repens* in maize. *Proc. 1987 British Crop Protection Conf. — Weeds*: 41-48.
- Preest, D.S., 1975. Review of observations on current methods of bracken control in forestry. *Proc. 28th N.Z. Weed and Pest Control Conf.*: 43-48.