EFFECTS OF ANNUAL TREATMENTS OF MCPA AND MCPB ON GIANT BUTTERCUP (*RANUNCULUS ACRIS* L.) IN DAIRY PASTURES

G.W. BOURDOT and G.A. HURRELL

Ministry of Agriculture and Fisheries, P.O. Box 24, Lincoln

SUMMARY

Several dairy pastures containing giant buttercup (*Ranunculus acris* L.) in Takaka, were treated annually with phenoxy herbicides from 1984 to 1987. Averaged over sites and years, MCPA (applied in August) reduced the ground cover of giant buttercup to 56% of untreated while MCPB (November) reduced it to 49%. MCPA (August) followed by MCPB (November) reduced the cover to 34% of untreated while MCPB (August) followed by MCPB (November) reduced it to 29%. Near eradication was achieved at one site after 4 years of annual treatment regardless of herbicide, but at other sites the weed appeared to maintain a reduced but constant cover. Variation between populations in their resistance to MCPA explain these differences in control.

INTRODUCTION

Giant buttercup occurs throughout New Zealand (Garnock-Jones 1981) and is a serious weed in dairy pastures because it produces the acrid-tasting vesicant, γ -lactone protoanemonin (Connor 1977), which causes cows to avoid it and closely associated vegetation. Infested pastures are low-producing (Harper and Sagar 1953) and vulnerable to the spread of the weed when heavily grazed (Harper 1957).

Research in the North Island has shown that giant buttercup is susceptible to both MCPA and MCPB (Tuckett 1961; Popay *et al* 1984, 1989) and that best control is achieved from applications made in late winter or early spring (August or September) (Popay *et al* 1984, 1989). Tuckett (1961) concluded from trials in Taranaki that annual treatment with either MCPA or MCPB would progressively reduce this weed to such a low level within 3 or 4 years, that spot treatment only would be required from then on to keep a farm "buttercup-free". The consensus of opinion among dairy farmers in Golden Bay in the South Island, is that MCPB is much less effective than MCPA.

The purpose of the research reported here was to compare the effects of annual treatments of MCPA and MCPB on giant buttercup in dairy pastures in Golden Bay over several years.

MATERIALS AND METHODS

In 1984, 10 fields containing giant buttercup were selected on seven dairy farms in the lower Takaka valley. Four herbicide treatments (Table 1) were allocated at random to plots measuring 10 m by 30 to 70 m. The herbicides (IWD MCPA, potassium salt; IWD MCPB, sodium salt) were applied in 200 litres/ha water at 210 kPa through Teejet 11002 flat fan hydraulic nozzles 37.5 cm apart with a 10 m tractor-mounted boom.

The effects were assessed in May of each year (1985-88) by point analysis with 100 points at 0.5 m intervals along the length of each plot. The presence or absence of giant buttercup was determined on a 'first-hit' basis by viewing vertically down through the pasture using a 'gun-sight' device.

RESULTS

The effects of annual treatment with MCPA or MCPB on the ground cover of giant buttercup in May are illustrated in Fig. 1. This cover varied greatly between sites and years. The weed was almost eliminated by all treatments after 2 years at the Jones

Proc. 43rd N.Z. Weed and Pest Control Conf. 1990: 233-236

Fig. 1: Effect of annual treatments of MCPA and MCPB repeated for 4 years, on the percent ground cover of giant buttercup in May at 10 sites in Takaka. The percent covers averaged over sites (a) to (e) are given in (k).

TABLE 1: Herbicide treatments applied to pastures containing giant buttercup in 1984, 85, 86 and 87.

Herbicide	Rate(s) of application (kg ai/ha)	Month(s) of application	Frequency of application
MCPA	1.0	August	annually
MCPB	1.5	November	annually
MCPA/MCPB	1.0/1.5	August/November	annually
MCPB/MCPB	1.5/1.5	August/November	annually
untreated			

site (Fig. 1f) but the treatments were much less effective at the other sites, particularly at Silcock (1) (Fig. 1e).

A statistical analysis was performed on the cover data from the five sites for which 4 years of non-zero values were available; F. Fellowes, G. Stratford, C. Langford (b), C. Langford (t) and R. Silcock (1) (Fig. 1a,b,c,d,e). The average effects for these five sites are shown in Fig. 1k. The heights and slopes of the treatment lines were compared. The analysis of heights showed that all treatments reduced the cover compared to untreated ($P < .01$). No difference was found between MCPA and MCPB applied as single annual treatments. However, there was weak evidence ($P < .10$) that MCPB applied annually in August and again in November resulted in a lower cover than MCPA applied only in August (Fig. 1k). The average covers as a percentage of untreated for MCPA (August), MCPB (November), MCPA (August)/MCPB (November) and MCPB (August)/MCPB (November) were 56%, 49%, 34% and 29% respectively.

The analysis of the slopes of the treatment lines in Fig. 1k found no evidence of a time trend in the cover of untreated giant buttercup. Similarly there was no trend when MCPA was applied annually in August or when MCPB was applied annually in August and November. There was good evidence, however, ($P < .05$) that MCPB applied annually in November caused a continual decline in the cover of giant buttercup over time and weak evidence ($P < .10$) for this with MCPA applied in August followed by MCPB in November.

DISCUSSION

The results do not support the assertion that MCPA is more effective than MCPB for controlling giant buttercup. However, this interpretation needs qualification since the MCPA was applied in August, 3 months earlier than the MCPB in November. Because the assessment of both treatments was done in May, more "recovery" could have occurred on the MCPA treatment, masking any intrinsic superiority over MCPB. Nevertheless in the context of a whole growing season, the results suggest that MCPB at 1.5 kg/ha in November, gives control of giant buttercup as good as MCPA at 1.0 kg/ha in August. By contrast, Popay *et al* (1989) found that MCPA was slightly superior to MCPB for giant buttercup control when both treatments were allowed equal recovery time. To resolve the question of the relative efficacy of MCPA and MCPB, it would be necessary to simultaneously monitor population decline and recovery after treatment with these two herbicides, over a full growing season.

The use of an additional treatment of MCPA or MCPB in late spring, following an earlier treatment in late winter, was advocated by Matthews (1975). A November treatment following August treatment appeared to result in lower cover than August treatment alone in the case of Stratford (Fig. 1b) and Langford (b) (Fig. 1c), but overall there was only weak evidence for this.

The proposition of Tuckett (1961) that the giant buttercup populations can be reduced to a level manageable by spot-treatment after 3 or 4 years of annual treatment with MCPA or MCPB is not generally supported by these results, although there was some evidence that annual treatment with MCPB caused a continual decline in cover (Fig. 1k). The only exception was the case of Jones for which all treatments reduced the

cover within 2 years to a level undetectable by the sampling procedure (Fig. 1f). At all other sites the cover remaining after 4 years of annual treatment was in excess of that which would allow spot-treatment over more than a small area of pasture, supporting the findings of Popay *et al* (1989). The evolution of MCPA-resistance in giant buttercup explains why Tuckett's proposition no longer has wide validity. The Jones population consists of a high proportion of MCPA-susceptible phenotypes and had never been treated with herbicide before the trial (Bourdote and Hurrell 1988). The other populations compared here are comparatively resistant due to the historical use of MCPA (Bourdote *et al* 1989). Resistance in North Island populations of giant buttercup (Bourdote *et al* 1990) also explains why Tuckett's proposition was not realised in trials by Popay *et al* (1989).

The ground cover in May, of untreated giant buttercup, varied between years but there was no pattern to suggest a climatic influence (Fig. 1). Site-specific differences in the grazing "pressure" during the grazing immediately before assessment in May, and variation in the proximity of this grazing to the assessment date, probably account for the haphazard fluctuations in cover. Although giant buttercup is not eaten by cows, it is trampled and reduced in leaf area according to stock density and length of grazing period. In the light of these yearly fluctuations in cover of untreated giant buttercup and the lack of any trend in the cover averaged over sites (Fig. 1k), it may be concluded that the giant buttercup populations at the trial sites were at equilibrium. There was certainly no evidence that populations were increasing in the absence of control measures.

ACKNOWLEDGEMENTS

We thank Mr D.J. Saville, MAF Lincoln, for statistical advice and analyses and the farmers named in Fig. 1, for allowing the trials on their dairy farms in Takaka. We also thank Dr M. Trought, MAF Blenheim, and Mr C. Dyson, MAF Lincoln, for helpful discussion during the planning of this work.

REFERENCES

- Bourdote, G.W. and Hurrell, G.A., 1988. Differential tolerance of MCPA among giant buttercup (*Ranunculus acris*) biotypes in Takaka, Golden Bay. *Proc. 41st N.Z. Weed and Pest Control Conf.*: 231-234.
- Bourdote, G.W., Harrington, K.C. and Popay, A.I., 1989. The appearance of phenoxy-herbicide resistance in New Zealand pasture weeds. *Brighton Crop Protection Conf. — Weeds*: 309-316.
- Bourdote, G.W., Hurrell, G.A. and Saville, D.J., 1990. MCPA-resistance in *Ranunculus acris* in North Island dairy pastures. *Proc. 43rd N.Z. Weed and Pest Control Conf.*: This volume.
- Connor, H.E., 1977. *The Poisonous Plants in New Zealand*. Government Printer, Wellington.
- Garnock-Jones, P.J., 1981. Check list of dicotyledons naturalised in New Zealand. 9. Ceratophyllaceae, Nymphaeaceae, Ranunculaceae, and Violaceae. *N.Z. J. Bot.* 19: 157-160.
- Harper, J.L., 1957. Biological flora of the British Isles — *Ranunculus acris* L. (*R. acer* auct. plur.). *J. Ecol.* 45: 289-342.
- Harper, J.L. and Sagar, G.R., 1953. Buttercups — some aspects of the ecology of buttercups in permanent grassland. *Proc. 1st Brit. Weed Control Conf.*: 256-265.
- Matthews, L.J., 1975. *Weed Control by Chemical Methods*. New Zealand Ministry of Agriculture and Fisheries Bulletin No. 329. Government Printer, Wellington.
- Popay, A.I., Edmonds, D.K., Lyttle, L.A. and Phung, H.T., 1984. Timing of MCPA applications for control of giant buttercup. *Proc. 37th N.Z. Weed and Pest Control Conf.*: 17-19.
- Popay, A.I., Edmonds, D.K., Lyttle, L.A. and Phung, H.T., 1989. Chemical control of giant buttercup (*Ranunculus acris* L.). *N.Z. J. Agric. Res.* 32: 299-303.
- Tuckett, A.J., 1961. Giant buttercup. *Proc. 14th N.Z. Weed and Pest Control Conf.*: 124-126.