EVALUATION OF THE SPOT GUN TECHNIQUE FOR CONTROL OF SWEET BRIAR

F.A. MEEKLAH and R.B. MITCHELL

Invermay Agricultural Research Centre
Private Bag
Mosgiel
NEW ZEALAND

Summary. Sweet briar *(Rosa rubiginosa)* was successfully controlled using low volumes of hexazinone concentrated in a spot on the soil surface near or within the stool of canes. A dose response/bush size relationship of 0.1 g hexazinone per 1 cm basal stool diameter (B.S.D.) was established for the range of bush sizes 20 to 40 cm B.S.D. Sub-surface placement using an injector lance did not improve sweet briar kill.

INTRODUCTION

Sweet briar is a range land weed covering an estimated 60 000 ha in the South Island of New Zealand (L.D. Bascand and G.H. Jowett, personal communication, 1981). The spread of this vigorous woody weed was considered to have increased following the reduction in rabbit numbers in the 1950's and a period of low grazing pressure before sheep numbers were increased in the 1960's. Molloy (1964) showed that sweet briar seedlings were vulnerable in the establishment phase to grass competition and close grazing. It is now considered that improvements in pasture cover through enlightened range management have almost eliminated briar establishment from seed on all but the most unstable sites (J. Higgens, personal communication, 1980; B.P.J. Molloy, personal communication, 1980).

The principal problem remaining is the control of established bushes. Control methods using granular herbicides such as picloram and dicamba and foliage absorbed picloram/2,4,5-T have been reported by Meeklah (1969) and Upritchard (1969) respectively. The economics of chemical control by blanket coverage are marginal, and the introduction of the spot gun method of treatment (Proude 1979) offered cheaper control.

The spot gun method entails the placement of herbicide concentrate on the soil surface close to the target weed, using a drench gun of the type commonly used for dosing farm animals. The advantages are the portability and light weight of the equipment, speed of treatment, and the small quantity of herbicide and diluent applied (as low as 10 mL per plant).

This paper reports the results of field experiments to determine
(a) the effectiveness of spot gun application of root absorbed herbicides,
(b) the optimum dose,
(c) the most effective place to apply the herbicide,
(d) the optimum time of application.

MATERIALS AND METHODS

The experimental sites used in this study lie within the semi-arid and sub-humid climate zones of Central Otago in the South Island of New Zealand.

Rainfall for the former averages 400 mm per annum with a soil moisture deficit of 290 mm; for the latter zone rainfall averages 520 mm per annum. Mean annual screen temperature is 10.8°C (range 3.0 to 17.7°C) with 178 days of ground frost.

Soils on the experimental sites were silt loam, except at Cromwell (loamy sand) with organic matter levels of 2 to 3.5%.

The drench gun used was modified with seals and washers to resist chemical attack (Porter 1979), and a soil injector lance also described by Porter (1979) was used for sub-surface application. Herbicides were applied at a concentration of 5% (1 g in 20 mL water). Except in placement studies the herbicide was placed in one spot 5 to 10 cm from the edge of the stool of canes, and on the upper side if on sloping ground. Height and basal diameter of the stool of canes was recorded. Where possible, bushes about 1.5 m high and 30 cm basal stool diameter (B.S.D.) ± 20% were utilised. Each treatment was replicated on five or six bushes selected at random.

Means of final assessments of percent dead wood per bush 15 to 30 months after treatment are reported in this paper. In some experiments the area and persistence of bare ground around the bush was recorded.

RESULTS

Herbicide comparisons. All the herbicides tested, except bromacil at 10 g/bush, produced acceptable control at Mt. Pisa (Table 1). At Cromwell where only large bushes were available, only hexazinone gave useful control.

Table 1. Effect of four herbicides on sweet briar at Mt. Pisa (mean bush size 1.7 m high by 32 cm B.S.D.) and Cromwell (mean bush size 2.5 m high by 50 cm B.S.D.)

Herbicide	Rate (g/bush)	Dead wood/bush (%)	
		Mt. Pisa	Cromwell
Hexazinone	1	-	45
	1.5	45	-
	2	-	67
	3	87	65
Karbutilate	1	-	3
	2	-	5
	3	-	7
Bromacil	6	49	2
	8	64	4
	10	29	3
Ethidimuron	2	-	4
	3	84	4
	4	91	9
LSD (5%)		54	23
CV%		73	92

Rate of application of hexazinone. The effect of rate of hexazinone on briar bushes of varying size applied during the winter to late spring period is shown in Table 2.

Table 2. Effect of rate of hexazinone on sweet briar at six sites.

Hexazinone rate (g/bush)	Dead wood/bush (%)					
	Site					
	Mt. Pisa		Northburn		Nenthorne	
	Mean bush size[1]					
	1.80 by 34	1.63 by 29	0.79 by 29	1.04 by 34	1.95 by 44	1.49 by 22
1.0	-	89	81	52	55	99
1.5	100	98	91	90	50	100
2.0	100	100	80	99	98	100
2.5	90	94	74	93	88	100
3.0	94	99	-	-	98	100
3.5	100	-	-	-	-	-
LSD (5%)	13	18	27	33	31	Not
CV%	10	15	28	30	30	analysed

[1]Height (m) by B.S.D. (cm)

From this data no useful dose/response relationship is apparent. However, a logit regression analysis of the wide range of data from all experiments reported in this paper was carried out. The regression equation was:-

$$\log (P/101-P) = 4.61 \text{ (s.e. } 0.314) + 0.47 \text{ (s.e. } 0.1116) \times D$$
$$-0.059 \text{ (s.e. } 0.0076) \times \text{B.S.D.}$$

where P = % dead wood in the bush
D = dose (g/bush)
B.S.D = basal stool diameter (cm)

This implies for example that a dose of 2 g hexazinone on bushes of 20 cm will typically achieve 98.7% dead wood, or 3 g on bushes of 30 cm B.S.D. = 98.6% dead wood, i.e., about 0.1 g hexazinone per centimetre of B.S.D. is needed. This analysis indicated a better dose/response relationship with B.S.D. than with bush height, and that little is to be gained by measuring bush height.

Placement of herbicide. In three experiments the effects of applying a given dose/bush at one, two, three or four spots around the bush, and of applying it into the basal stool, were examined (Table 3).

In 1977, on sloping ground at Nenthorne and Mt. Pisa no advantage was gained by applying the dose in other than a single spot, but at Mt. Pisa applying two thirds of the dose on the lower side of the bush (two spots below, one above) resulted in better control than two thirds on the upper side of the bush (two spots above, one below). In 1978 at Cromwell, on larger bushes, application into the centre of the basal stool was significantly better.

When soil injection, soil surface and centre of the bush applications were compared (Table 4), the latter appeared more efficient. This effect failed to reach significance on individual sites, but an analysis of mean data from all three sites showed that application in the centre of the bush was more efficient (s.e. 1.4066, $P < 0.05$). There was no significant difference between surface or injected applications (Table 4), nor between rates of application.

Table 3. Comparison of hexazinone spot placement patterns at three sites. (Mean of three dose rates per treatment)

		Dead wood/bush (%)		
		Site and application date		
Spots/bush (no.)	Placement on the slope	Nenthorne Oct 28 1977	Mt. Pisa Dec 9 1977	Cromwell Sept 1 1978
1		81	98	32
2		66	78	28
3	Two above, one below	86	58	21
3	Two below, one above	66	96	
4		85	91	39
Centre				68
LSD (5%)		39	27	40
CV%		39	29	73

Table 4. Comparison of soil injected and surface applied hexazinone. (Mean of three dose rates per treatment)

		Dead wood/bush (%)			
		Site and application date			
Spots/bush (no.)	Application method	Mt. Pisa (flat) Oct 3 1979	Mt. Pisa (hill) Oct 3 1979	Rocklands (flat) Sept 27 1979	Mean
1	Centre	100	100	100	100
1	Surface	97	95	100	97
1	Injected	92	92	100	95
4	Surface	96	91	100	96
4	Injected	99	98	99	99
LSD (5%)		14	12	Not	
CV %		11	9	analysed	

Time of application of hexazinone spot treatment. An experiment comparing hexazinone at five rates from 1 g to 3 g/bush was applied in October and December 1977 and in every month from April to November 1978. Only application in October 1977 gave poorer results than application in other months. Two other time of application experiments are not yet finalised.

DISCUSSION

In this project it has been demonstrated that the spot gun technique of applying a concentrated dose of herbicide at the soil surface near target bushes can be lethal. Of 900 bushes treated in the project, 660 were completely dead within the four year term of the project.

The optimum dose of hexazinone was not clearly defined. For the range of bush sizes on which we carried out experiments (1.5 m high by 30 cm B.S.D. ± 20%), there was no increased response to hexazinone dosages above 2.5 g/bush. Over the range of bush sizes used in this study (about 20 to 40 cm B.S.D.), a dose response/bush size relationship established by regression analysis implied the need for an extra 0.1 g hexazinone for every extra cm of B.S.D. to achieve the same percent dead wood.

Results from the 'spot' application of hexazinone and other materials were clouded by the erratic survival of briar bushes even when treated with what may be considered high doses of herbicide. This may have been due to sub-surface rocks or irregular sub-soil patterns disrupting the normal distribution of briar roots, or even just the non-uniformity of biological response.

Briar at the Rocklands site was much more sensitive to herbicide than at other sites; this may have been because of a severe but unrecorded advective frost which damaged and thus stressed the briar colony about two months after trials commenced.

The 'spot' of herbicide is probably more effective if jetted into the basal stool, although results were variable in experiments on rocky hill country. Sub-surface injection does not improve efficiency of kill. The principal reason for sub-surface injection is to reduce the area of dead herbage around each treated bush, but in this study no difference in dead area was found between surface and sub-surface application when observed 15 months after treatment.

The presence of soil moisture is expected to determine the distribution of hexazinone concentrate within the root zone. However, as this herbicide is relatively persistent and unaffected by U.V. light, it may persist in dry soil until sufficient moisture is available to facilitate distribution. A single experiment suggested that time of application may not be critical if a threshold dose of hexazinone (2 g) is reached for bushes not exceeding 1.5 m high by 30 cm B.S.D.; however, further more comprehensive experiments are in progress to confirm this.

LITERATURE CITED

Meeklah, F.A. 1969. Proc. 22nd N.Z. Weed & Pest Cont. Conf. p. 187-194.

Molloy, B.P.J. 1964. N.Z. Jl. Agric. 109-118.

Porter, J.F. 1979. Proc. 32nd N.Z. Weed & Pest Cont. Conf. p. 221-214.

Proude, C.K. 1979. Proc. 7th Asian-Pacific Weed Sci. Conf. p. 181-183.

Upritchard, A.J. 1969. Proc. 22nd N.Z. Weed & Pest Cont. Conf. p. 180-186.