THE EFFECT OF SOIL MOISTURE ON THE UPTAKE OF HERBICIDE BY GORSE

A. THOMPSON

*Soil and Field Research Organisation,
Ruakura Agricultural Research Centre, MAF, Hamilton*

Summary

Restricted gorse (*Ulex europaeus*) growth induced by low soil moisture prior to herbicide application resulted in highly significant reductions in 2,4,5-T effect. Variation in the amount of water available to the gorse plants after treatment had little effect on the performance of 2,4,5-T. Picloram effect on gorse was reduced where soil moisture was kept low both before and after treatment but other water regimes caused no significant differences in picloram effect.

INTRODUCTION

There is little doubt that the efficiency of herbicides, particularly 2,4,5-T, used for the control of gorse (*Ulex europaeus*) is considerably influenced by factors other than those directly related to rate and time of application. Apart from differences brought about by climatic factors at and immediately subsequent to treatment, it is not unusual to find marked variations in the level of control achieved by simultaneous treatment of infestations which apparently differ only in slope, aspect or soil type of the site.

Field observations suggest that these variations are most likely to be due to differences in the amount of moisture available to the gorse plants. Thompson (1973) has shown that gorse growing on a moist peat soil suffered consistently more severe effects from a range of herbicides than similar plants growing in a relatively dry mineral soil on a northern slope. Treatments containing picloram were less affected by site difference than was 2,4,5-T alone. Moffat (1973) found that in areas of higher summer rainfall 2,4,5-T was more effective than where rainfall was low. He also found that mixtures containing picloram were less susceptible than 2,4,5-T to variations in the amount of summer rainfall.

To obtain further information on the effect of soil moisture variations on the herbicide uptake the trial described in this report was conducted.

EXPERIMENTAL

Selected two year old gorse plants, 0.7 to 0.8 m tall, growing in 8 kg of Horotiu sandy loam in 25 cm diameter containers, were divided into two groups which were subjected for five weeks from 7.2.74 to 15.3.74 to pre-herbicide watering regimes of (a) low water (plants kept just above wilting point) and (b) high water (soil moisture maintained near pot water capacity). The plants were protected from natural rainfall. On 15.3.74 butoxyethanol ester 2,4,5-T 2.0 kg and potassium salt of picloram 0.5 kg in 2500 litres of water, were each applied to run off point, as separate treatments to half the treated plants in each watering

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group. Container soil was protected from herbicide contamination by a mulch of peat which was removed after treatment.

After herbicide application the pre-treatment watering groups were sub-divided and differential watering continued to give pre-post herbicide watering patterns of: low-low, low-high, high-low, high-high. Differential post herbicide watering treatments were maintained for eight weeks until 15.5.74. Gorse plants and pots were weighed and the required amounts of water added daily during the period of differential watering. From 15.5.74 until the termination of the trial all plants received *ad lib* water. Each treatment was replicated four times.

Treatment effects were scored for desiccation at approximately three month intervals and on 11.12.74 the ratio of branches completely desiccated to those showing some green foliage or bark was determined. At this time the number of regrowth shoots on each plant was also determined.

RESULTS

During the pre-herbicide watering period (7.2.74 to 15.3.74) gorse plants in the low water group received water at a mean rate of 0.163 litre/day while high water plants required 0.628 litre/day to maintain pre-determined weights. There were no significant differences in water usage within the two groups in the pre herbicide period. Post-herbicide water usage for the period 16.3.74 to 15.5.74 is given in table 1. Assessments of herbicide effects on treated plants under the various watering regimes are given in tables 2 and 3.

The inspection on 11.12.74 showed that, regardless of water regime, none of the plants treated with picloram had produced any regrowth shoots. With 2,4,5-T the low water regime before herbicide application gave a significantly greater amount of regrowth than where the pre-treatment water rate was high. The water regime post-2,4,5-T did not significantly affect shoot numbers.

DISCUSSION

Although gorse plants rapidly adapted to the low water regime by reducing growth activity and becoming extremely hard and spiny, water input figures for controls in Table 1 show that plants conditioned to such a regime were very slow to readjust their consumption when high rates of water became available. Table 1 also indicates that herbicide treatments caused a considerable decline in the amount of water taken up by the gorse, even before there was much visual evidence of herbicide effect on the treated plants. With 2,4,5-T this effect was evident only where the amount of post herbicide water was high, but following picloram treatment even the restricted consumption of low water plants was appreciably reduced, while those on high water used less than half the amount of untreated controls.

TABLE 1: POST HERBICIDE WATER USAGE
(litre/plant 16.3.74 — 15.5.74)

Water regime		2,4,5-T	picloram	control
Pre herbicide	Post herbicide			
Low	Low	6.1 eEF	5.3 fF	6.3
Low	High	11.9 bB	7.4 dD	16.2
High	Low	7.8 dD	6.3 eE	7.1
High	High	14.8 aA	10.5 cC	23.2
CV %		14		
Main effects		10.14 bB	7.35 cC	13.19 aA

Scrub Weeds

The efficiency of growth regulator herbicides, such as 2,4,5-T, on most plants is determined by the level of growth activity at the time of treatment. Tables 2 and 3 show that the restricted gorse growth induced by low water prior to herbicide application caused highly significant reductions in 2,4,5-T effect. Variation in the amount of water available to the gorse plants after treatment had little practical effect on the performance of 2,4,5-T, regardless of the pre-treatment water rate.

TABLE 2: HERBICIDE EFFECTS ON GORSE (assessed 6.8.74)

Water regime		2,4,5-T	picloram
Pre herbicide	Post herbicide		
Low	Low	4.5 cdCD	3.3 dD
Low	High	5.5 bcABCD	7.8 aA
High	Low	7.3 aAB	4.5 cdCD
High	High	6.8 abABC	5.0 cBCD
CV %		20	
Main effects		6.00 aA	5.13 bA

Desiccation scale: 1 = no effect, 10 = complete desiccation.

TABLE 3: HERBICIDE EFFECTS ON GORSE (assessed 11.12.74)

Water regime		2,4,5-T		picloram	
Pre herbicide	Post herbicide	Desiccation score	% dead branches	Desiccation score	% dead branches
Low	Low	6.8	56 cD	7.0	76 bBC
Low	High	6.8	60 cCD	9.8	98 aA
High	Low	9.0	94 aAB	9.0	92 aAB
High	High	8.8	92 aAB	9.0	92 aAB
CV %		10			
Main effects		75 bB		89 aA	

Desiccation scale: 1 = no effect, 10 = complete desiccation.

Picloram appeared to be considerably less dependent than 2,4,5-T on the level of pre-herbicide soil moisture. Although in Tables 2 and 3 the lowest desiccation scores for this herbicide were recorded where water was kept at a low level both before and after herbicide treatment, there were no significant differences in effect between other water regimes, and the highest effect scores were achieved where picloram was applied in conjunction with a low-high water regime.

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REFERENCES

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