FURTHER HERBICIDE STUDIES ON GORSE SEEDLINGS

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Summary

Seedlings of gorse (*Ulex europaeus*) grown in the glasshouse were sprayed with various rates of 2,4,5-T, picloram and a 2,4,5-T/picloram mixture at the cotyledon, 2.5-4, 4-6 and 15-22 cm stages of growth. No evidence was found that the cotyledon stage seedlings were resistant to the herbicides tested but susceptibility tended to decrease with increasing age of seedling.

INTRODUCTION

In experiments on gorse seedling susceptibility to herbicides (Ivens 1977) studies were made of the effects of a range of chemicals on seedlings 2-3 cm high with 6-10 leaves. The question arises whether seedlings at different growth stages are likely to respond differently to herbicides. Matthews (1975), for example, states, presumably as a result of observations in the field, that gorse seedlings are quite resistant to 2,4,5-T in the cotyledon stage but become susceptible later. There is no record of this point having been tested experimentally and the present study was undertaken to obtain experimental evidence on seedlings of known age grown under glasshouse conditions.

METHOD

Seed was extracted from soil and acid scarified as detailed in Ivens (1977) before sowing into a peat/sand medium incorporating lime, superphosphate, Osmokote fertilizer granules and micronutrients in 10 cm 'Plantabags'. Seedlings were thinned to five per pot before spraying. Sprays were applied between 31 August and 18 October 1977 to seedlings in four growth stages from the cotyledon stage (4 weeks after sowing) to a height of 15-22 cm (16 weeks after sowing) when spiny side shoots were developing. The chemicals tested were 2,4,5-T butyl ester (applied at rates of 37.5, 75, 150 and 300 g/ha), picloram K salt (12.5, 25, 50 and 100 g/ha) and a proprietary 4/1 2,4,5-T/picloram mixture (25, 50, 100 and 200 g/ha). Each treatment was applied to four replicate pots and the response was assessed as the reduction in fresh weight of the shoots 8 weeks after spraying. The rates of chemical giving 50% reduction in fresh weight at harvest compared with unsprayed controls (GR 50) were calculated from regressions of percentage growth reduction against log application rate. Standard deviations of log GR 50s were calculated by a method suggested by Gordon (pers comm).

RESULTS

Table 1 shows the GR 50 estimates for the three products applied at four growth stages and it will be seen that there is a clear pattern of declining susceptibility (i.e. increased rates needed to produce the same degree of effect) with increased seedling age.

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TABLE 1: Application rates of three herbicides required to cause 50% growth reduction of gorse seedlings (GR 50 rate) at four stages of growth.

Growth stage	2,4,5-T ester		2,4,5-T/picloram 4:1		picloram K salt	
	log g/ha	g/ha	log g/ha	g/ha	log g/ha	g/ha
Cotyledons	1.41 ± 0.26	26	1.06 ± 0.44	12	0.87 ± 0.40	7
2.5-4 cm	1.50 ± 0.29	32	1.29 ± 0.40	19	1.46 ± 0.30	29
4-6 cm	1.39 ± 0.26	24	1.66 ± 0.26	45	1.64 ± 0.35	44
15-22 cm	1.72 ± 0.21	52	1.63 ± 0.32	42	1.57 ± 0.67	37

The percentage kill figures have also been analysed by analysis of variance (separately for each herbicide) and the means for all doses of each chemical are given in Table 2. The differences between growth stages were highly significant and the figures show that with all chemicals the reduction in growth was greater the younger the seedlings. With each chemical the percentage reduction with cotyledon stage seedlings was greater than with the most advanced stage of growth and in no case was there any evidence that cotyledon stage seedlings were affected less than the others. Comparisons should not be made between the columns in Table 2 as the three herbicides were tested at different ranges of application rate.

TABLE 2: Mean percentage growth reduction of gorse seedlings treated at four different stages of growth.

Growth stage	2,4,5-T ester	2,4,5-T/picloram 4:1	picloram K salt
	% growth reduction	% growth reduction	% growth reduction
Cotyledon	75.6 ab	83.1 a	76.6 a
2.5-4 cm	78.5 a	74.2 a	54.0 b
4-6 cm	70.2 b	57.2 b	48.5 b
15-22 cm	62.2 c	60.8 b	49.5 b

DISCUSSION

Gorse is a very variable species and at each time of treatment in the present trials the seedlings sprayed were variable in height. The variability was least at the earliest stage but seedlings remain in the cotyledon stage for a very short period and, by the time the cotyledons of the slower growing seedlings had opened out, the first true leaf had started to develop on the faster growing ones. With no seedlings had the first true leaves opened out, however, and most seedlings bore expanded cotyledons only. When the results of spraying were assessed there were no indications that the seedlings just emerging from the cotyledon stage were any more susceptible to herbicide action than those with a completely undeveloped shoot apex.

The results show that gorse seedlings were most susceptible to the chemicals tested at the youngest stage of growth and became less so as they grew older. In this connection it is of interest that Moss (1959) found

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gorse seed susceptible to the effects of 2,4,5-T before it germinated as long as it was scarified. The present findings do not agree with Matthews (1975) statement that gorse in the cotyledon stage is resistant to 2,4,5-T. In itself Matthews' statement is surprising as, with the great majority of plants, the effect of increasing size is to reduce susceptibility to herbicides. It is, however, possible that field observations on young gorse seedlings sprayed after clearing could give an impression of resistance because of rapid replacement of killed seedlings by freshly germinated ones.

Comparison of the GR 50 estimates in Table 1 with those from similar seedlings quoted earlier (Ivens 1977) shows that there was a tendency for lower rates to be needed to reduce growth in the present work. The difference was most marked with 2,4,5-T, the average values being 33 and 94 g/ha for the present and previous estimates respectively. This apparent increase in susceptibility was thought to be due to the use of a different growing medium in the present work, in which gorse seedlings grew more rapidly. It is probably also a result of the seedlings soft, fast growth that the oldest plants 15-22 cm high showed only a small difference in response from those at the 4-6 cm stage.

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