RAGWORT POPULATION AND CONTROL STUDIES

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Summary

When a ragwort population was allowed to flower and seed without interference, more than 90% of the ragwort plants died. Ester 2,4-D applied in May gave less effective ragwort control than applications in October. Data on herbicide effects on ragwort seed and seedling populations were collected.

INTRODUCTION

Despite the efficiency of modern herbicides, ragwort (*Senecio jacobaea*) remains, under certain site and management conditions, a persistent and troublesome pasture weed. The hypothesis has been advanced that such problem infestations might be most effectively controlled by allowing mature plants a period of undisturbed growth to complete their natural cycle of flowering, seeding and dying. Herbicide treatments would then be restricted to low rates in late autumn aimed at the control of the small, immature plants and seedlings which remain or come in after the larger plants have died out.

This concept, often referred to as the "Matthews technique" (Matthews and Thompson 1977), was examined as part of a project to study the biology and control of ragwort, in a trial near Athenree on a site with a long history of ragwort infestation. The farmer's annual, late autumn treatment of 1.0 kg/ha 2,4-D ester from the air had reduced ragwort flowering, but failed to give control of the long-standing infestation. The site had last been treated about 12 months before the trial commenced.

METHOD

The trial site was divided into two blocks. On one the herbicide treatments 1 and 2 shown in Table 1 were applied to the existing ragwort infestation in May or October 1976, and repeated in May or October 1977. The ragwort on the larger second block was left untreated in 1976 and allowed to flower and seed in the summer of 1976-77 before treatments 3 - 6 were applied in May or October 1977. Each herbicide treatment of 2,4-D butoxy ethanol ester was replicated four times with two untreated controls in each block. Plot size was 25 x 8 m.

Prior to the initial herbicide treatment the location and size of readily visible ragwort plants was recorded along a transect line on each plot. The fate of these plants, plus new plants which appeared subsequently, was monitored in October, February and April thereafter. The amount of viable ragwort seed in the top 20 mm of soil was determined at the start of the trial and on each plot in July, January and April thereafter. The ragwort seedling population on each plot was determined in May of each year and monitored in September, December, February through to the juvenile rosette stage in April.

RESULTS

Table 1 indicates ragwort plant numbers and sizes at each time of treatment and summarises the effect of treatments on these populations.

In both years 30% - 40% of ragwort plants survived treatment 1 with a fairly high proportion flowering; a result probably similar to that achieved by the farmer's late autumn aerial spraying in previous years. These survivors, supplemented by an influx of new plants, mainly seedlings, were sufficient to maintain the infestation at a fairly constant level from year to year.

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TABLE 1: Treatment effects on ragwort plant populations (as % of mean plant numbers at May 1976 = 180 plants/100m²)

Treatment (kg/ha)	Applied	Plants at treatment		Fate of treated plants			New plants after treatment			Total Rosettes carried forward
		No.	Diameter (cm)	Assessed	Died before flowering	Flowered died	Surviving rosettes	Flowered died	Surviving rosettes	
1) 2,4-D 0.75	May 1976	98	14	April 1977	46	12	42	2	34	77
2,4-D 0.75	May 1977	79	12	April 1978	41	9	29	1	42	70
2) 2,4-D 1.5	October 1976	133	19	April 1977	115	5	13	1	12	25
2,4-D 1.5	October 1977	32	14	April 1978	27	2	3	0	7	11
3 2,4-D 0.75	May 1977	57	9	April 1978	44	4	9	1	58	66
4 2,4-D 1.5	May 1977	55	9	April 1978	49	1	5	0	43	47
5 2,4-D 0.75	October 1977	84	13	April 1978	72	4	8	0	14	22
6 2,4-D 1.5	October 1977	81	13	April 1978	76	1	4	0	10	14
7 untreated	May 1976	102	14	April 1977	16	79	8	9	46	54
	May 1977	55	9	April 1978	20	12	23	5	97	120

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Despite the considerable increase in ragwort plant size before the treatment 2 application in October 1976, almost 90% of plants receiving this treatment died in both years. The number of new plants which appeared following spring treatment was also greatly reduced, so that in April 1978 the number of plants carried forward to the next season was only 11% of the number present in May 1976. In both years, the number and proportion of flowering plants was much lower than on treatment 1.

When the original ragwort population was allowed to grow, flower and seed without treatment in the first year, over 90% of plants either died before flowering, or flowered and died in the following summer. Consequently, plant numbers and mean rosette sizes were appreciably less than in 1976. Treatment 3 was, therefore, more effective on treated plants than treatment 1 had been, while the single herbicide application of treatment 6 achieved about the same result as two applications in treatment 2. Treatments 4 and 5 indicated that doubling the rate of herbicide in May or halving it in October only marginally affected the results on these smaller plants.

The cyclic pattern, particularly of flowering, in an undisturbed ragwort infestation is shown in the population changes on untreated controls. After the heavy flowering in the summer of 1976-77, only 8% of the original rosettes survived. Even when the numbers of new plants were added to these, the total rosettes carried forward from April 1977 were little more than half the numbers at May 1976, while flowering on controls in the 1977-78 summer was only 19% of that in the previous summer. When seedlings which survived as new plants in April 1978 were combined with older surviving rosettes, they constituted a plant population 20% higher than that originally recorded in May 1976, providing the base for a further heavy flowering in the 1978-79 summer.

TABLE 2: Viable ragwort seed in the soil (seeds/m²)

Treatment (kg/ha)			Applied	Seed numbers assessed				
				May 1976	January 1977	April 1977	January 1978	April 1978
1	2,4-D	0.75	May 1976 +	750	300	1800	400	950
2	2,4-D	1.5	May 1977 Oct 1976 +	750	300	650	250	250
3	2,4-D	0.75	Oct 1977	750	-	13000	850	1100
4	2,4-D	1.5	May 1977	750	-	14800	1000	900
5	2,4-D	0.75	Oct 1977	750	-	12200	1150	700
6	2,4-D	1.5	Oct 1977	750	-	13900	900	750
7	untreated			750	400	14300	1000	2200

Table 2 shows changes in the populations of viable ragwort seed in or on the soil over the term of the trial. In particular, it indicates the levels to which soil populations of seed decline in January prior to the input of fresh seed, and the effect of treatments on the amount of viable seed present in April after flowering. By comparing plant population data from Table 1 with that for seed recovery from Table 2 it can be seen that the 10% - 14% of flowering plants on treatment 1 produced enough seed to maintain plant numbers without depleting the seed in the soil, whereas the lower numbers flowering on treatment 2 appeared unable to sustain plant numbers or the soil seed population. The results of treatments 3 - 7 demonstrate that the large amounts of seed resulting from a single heavy flowering rapidly declined to a level only marginally above that found prior to flowering and little was added to the store of viable seed in the soil.

Table 3 follows the population changes in two generations of ragwort seedlings from germination in April/May through to those surviving as juvenile plants in the

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TABLE 3: Ragwort seedlings in pasture (seedlings/m²)

			Applied	Seedling numbers assessed					
				May 1976	December 1976	April 1977	May 1977	December 1977	April 1978
1	2,4-D	0.75	May 1976 + May 1977	123	3.6	1.3	120	2.8	1.0
2	2,4-D	1.5	Oct 1976 + Oct 1977	135	0.8	0.3	78	0.4	0.2
3	2,4-D	0.75	May 1977				380	4.4	1.8
4	2,4-D	1.5	May 1977				345	2.8	1.3
5	2,4-D	0.75	Oct 1977				408	0.8	0.3
6	2,4-D	1.5	Oct 1977				360	0.8	0.3
7	untreated			115	5.6	1.6	376	6.0	2.8

following April. Except where herbicide treatments were applied in October, the number of seedlings reaching the juvenile rosette stage in the April following germination were adequate to maintain the population of mature plants. Treatment with 2,4-D in May, when seedlings were very small, had a much less serious effect on their numbers than application in October when the seedlings were larger. Whether this is due to resistance to herbicide by cotyledon stage seedlings or simply to sheltering by the taller pasture is not clear, but observations indicate elements of both.

CONCLUSIONS

The data collected indicate that the "Matthews technique" for the control of problem ragwort infestations was at least a partial success. Over 90% of the ragwort population died when allowed to flower and seed without interference, and the surviving plants were much more effectively controlled by the late autumn herbicide treatments than was the original infestation. However, to the extent that late autumn herbicide treatment is an essential part of the technique, its effectiveness was much reduced by the failure of May applications to control the large numbers of seedlings which resulted from the earlier mass flowering, and to prevent the ingress of the many new plants which appeared during the winter and spring.

Spring treatments provided much better control, not only of the original infestation, but also of seedlings and the new plants which came in during the winter and early spring. Consequently, herbicide treatment at this time, after the original ragwort population had been allowed to flower and die out, gave a much more effective demonstration that the technique advocated by Matthews does work.

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REFERENCE

Matthews, L.J. and Thompson, A., 1977. Ragwort control through seeding then spraying. *Proc. 29th Ruakura Farmers' Conf.*: 6-7.