POPULATION STUDIES ON RAGWORT (*SENECIO JACOBAEA*)

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SUMMARY

Ragwort populations at three sites were monitored between 1975 and 1978. Soil type, climate and site contour had relatively minor effects on the behaviour and growth of undisturbed ragwort populations in dairy pastures. Consistently lower amounts of viable ragwort seed were found in the peat soil than in the Maeroa ash or pumice soils. The levels of ragwort flowering and of regrowth from flowering plants was higher on the pumice soil than on Maeroa ash or peat soil. Management practices such as mowing to control flowering had a large influence on ragwort population behaviour. In the undisturbed populations of this study ragwort seedlings appeared to be the principal source of replacement plants.

INTRODUCTION

Although ragwort is one of the most important weeds of New Zealand pastures, the ecology of the plant as it occurs under dairy cattle grazing conditions is not particularly well understood. Poole and Cairns (1940) investigated botanical aspects of ragwort behaviour and made control recommendations appropriate to the time. Thompson (1980) demonstrated the cyclic pattern of population changes which lead to large fluctuations in the density of ragwort infestations.

Overseas workers have attempted to describe ragwort population dynamics. In Scotland, Forbes (1977) used data from a 1 year study of a ragwort infestation to construct a model of population flux and mortality over a 7 year period in a hypothetical population. Schmidl (1972) described the behaviour of an artificially introduced and protected ragwort population in Victoria, Australia.

In 1975 a 3 year study was commenced in the Waikato to determine whether ragwort populations growing under different environmental conditions exhibited any significant variations in growth patterns. Results of the study are reported in this paper.

METHODS

The study was commenced in 1975 at three sites, each with a long history of ragwort infestation. Site 1 was on a Te Kuiti silt loam near Te Kuiti, site 2 on a droughty Ngaroma silt pumice soil near Whakamaru and site 3 on a consolidated Rukuhia peat soil near Hamilton. The contour at site 1 was rolling, at site 2 was slightly rolling and at site 3 was flat; all sites were free draining. Fertility levels at all sites were moderate to poor by dairying standards. Pastures comprised mainly ryegrass (*Lolium* sp)/white clover (*Trifolium repens*) and were generally rather weak and open. The mean total rainfall for the years 1975 to 1978 recorded near sites 1, 2 and 3 was 1820, 1289 and 1275 mm respectively. The respective annual mean daily temperatures for the three sites were approximately 12, 12 and 13.4°C.

None of the sites had been treated with herbicides for at least 12 months before the project commenced. Ragwort on site 1 was mowed during the summer of 1974-75 and that on site 3 mowed for several summers before the start of the project. Site 2 received no form of ragwort control for at least 12 months prior to the study commencement. All sites were grazed by dairy cows throughout the life of the project.

At the commencement of the study and at subsequent inspections the location and diameter of all ragwort plants at each site was recorded along four 25 m permanent transect lines. The fate of these original plants plus that of all new plants which

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subsequently appeared on the transect lines was monitored in October, February and April of each year. Plants were later classified in four categories.

Seedlings — these were counted on ten 50 x 50 cm quadrats in September and December and the results used to calculate the numbers for the whole transect and as a check on the numbers of juvenile plants entering the single rosette category at assessments in February and April.

Single rosettes — small plants considered to be of seedling origin but probably containing a proportion of root regrowths.

Multiple rosettes — large plants which developed several rosettes on a single crown.

Flowering plants — these developed from both single and multiple rosettes.

The amount of viable ragwort seed in the top 20 mm of soil on each transect line was determined by germinating seed in soil samples collected at the start of the project, and in January and April of each year thereafter to ascertain the pre- and post-seedfall levels.

RESULTS AND DISCUSSION

Figures 1-3 show the patterns of change in ragwort plant populations and in the amount of viable seed in the soil at the three sites during the study period. The raw data collected in these studies permitted the life history of every plant recorded to be followed. Thus the proportions of plants dying before flowering, or behaving as annuals, biennials or perennials were calculated and these values are referred to in the following text. However for clarity the raw data have been condensed to produce very much simplified diagrams that represent a summary of the numbers of plants in each plant category from year to year.

Ragwort is usually regarded as a biennial plant, but field observations indicate that it frequently deviates from strictly biennial behaviour either by taking more, or sometimes less, than 2 years to reach the flowering stage, or by regrowing from the crown after flowering to become a short lived perennial. After combining together plants which took the two routes to perennialism, Schmidl (1972) and Forbes (1977) considered respectively that 2% and 8% of their study plants were annuals, 45% and 39% biennials and 39% and 53% perennials.

Fig. 1: Site 1: Life paths of ragwort plants — 1975-1978.

Figures in boxes = actual plant numbers/100m².

Figures in arrowed lines = plant numbers as percent of numbers in box from which lines originate.

Fig. 2: Site 2: Life paths of ragwort plants — 1975-1978. *See Fig. 1.

Fig. 3: Site 3: Life paths of ragwort plants — 1975-1978. *See Fig. 1.

Ragwort seed has no inherent dormancy (van der Meijden and van der Waals-Kooi 1979) and will germinate at any time of the year (Poole and Cairns 1940; Schmidl 1972). In the field conditions of the present study practically all germination occurred soon after seedfall, i.e. in April and May, and amounts of viable seed in or on the soil rapidly declined to pre-flowering levels in January (Figs 1, 2, 3). The amounts of seed found at post-flowering sampling in April of sites 1 and 2 closely reflected the levels of flowering from which it was derived. This was not so in the peat soil at site 3 where quantities of

viable seed recovered in 1976 and 1978 were much below what similar or lower levels of flowering had produced at the mineral soil sites. No explanation for this can be offered but it is of interest as a similar effect was noted at another peat trial site near Whakatane (Thompson unpublished).

Once the study populations were freed of the effects of pre-study mowing and had established a normal pattern of undisturbed growth, seedlings, augmented by an unknown, but probably small, proportion of root regrowths, were the principal source of replacement plants. This is evident in figures 1, 2 and 3 where the only input of plants into the population is from the seedling category. Over all sites and years about 80% of the seedling plants recorded as entering the ragwort populations in September of each year died before flowering and none flowered as annuals. An average of 11% of seedling plants which entered the populations in 1975 and 1976 at sites 1 and 2 and in 1976 at site 3 flowered in their second year, behaving as biennials, the range being from 5% at site 1 to 26% at site 3. Twenty percent and 4% of the seedlings recorded in 1975 at sites 1 and 2 respectively flowered for the first time in their third summer. At these sites a further 5% and 1% of 1975 seedlings survived as non-flowered rosettes at the termination of the study in autumn 1978. Seedling numbers at site 3 in 1975 were extremely low and none survived beyond the juvenile rosette stage.

Many rosettes die before flowering. Forbes (1977) calculated that 35% of his model population died as rosettes. In our study an average 24% of plants which reached the rosette stage died before flowering, with little difference in this percentage between sites.

The mowing to control ragwort flowering at sites 1 and 3 before the project commenced distorted normal ragwort behaviour by inducing a high proportion of multicrown, perennial plants, resulting in heavy flowering in 1976, particularly at site 3. Because of this disturbance the proportion of rosette plants which flowered in the first year of the study was extremely variable, ranging from 21% at site 2 to 89% at site 3. However, when the populations settled into a pattern of undisturbed growth the rate of flowering became quite stable; from 30% to 40% at sites 1 and 3 (excluding site 3 in 1977 because very few flowering plants were present) and 50% to 60% at site 2.

Crown regrowth after flowering is a well known characteristic of ragwort plants reported by Poole and Cairns (1940), Schmidl (1972) and Forbes (1977). They found respectively that 33%, 28% and 44% of their flowered plants regenerated. In our study the amount of regrowth after flowering was generally lower than these figures. It ranged from 5% to 10% at site 1, 16% to 25% at site 2 and 1% to 4% at site 3 (excluding flowering in 1977). Over all sites only four plants flowered three times; one at site 1 and three at site 2.

CONCLUSIONS

The differences in soil type, climate and site contour appeared to have relatively minor effects on the behaviour and growth of undisturbed ragwort populations in dairy pastures.

The only apparent site related differences were the generally higher percentages of ragwort flowering and of post-flowering regrowth on the pumice soil, and the consistently lower amounts of viable seed found in the peat soil. Management practices such as the mowing of flowering plants has a great influence on ragwort population behaviour. In the undisturbed populations of this study ragwort seedlings were the principal source of replacement plants.

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