INFLUENCE OF SHEEP GRAZING ON THE SURVIVAL AND FATE OF NODDING THISTLE ROSETTES

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SUMMARY

Fate of individual nodding thistle rosettes was observed under different sheep grazing regimes for two seasons. No differences in the survival or flowering behaviour of rosettes under rotational or continuous grazing occurred. Early winter hard grazing resulted in greater mortality than similar late winter grazing. Continuous grazing, without any hard grazing, allowed greatest survival. Larger rosettes were more likely to survive and flower than smaller rosettes. Approximately 5% of all rosettes which survived to January did not flower. It is unlikely that control of established rosettes can be achieved solely by manipulating pasture cover and stocking rates.

INTRODUCTION

The importance of a dense pasture sward for pasture weed control is often stressed and particularly so in the case of nodding thistle (*Carduus nutans*) (Popay 1981). Several studies have demonstrated that maintaining a continuous cover reduces the emergence and survival of nodding thistle seedlings (Phung and Popay 1981; Popay and Kelly 1986; Martin and Rahman 1988). Conversely, overgrazing due to drought, or overstocking is frequently associated with severe nodding thistle infestations (Matthews 1971; Popay and Thompson 1980).

The system of controlled grazing by sheep, promoted by the MAF advisory services as a means of improving stock performance at high stocking rates has been claimed to control nodding thistle populations (Smith 1982). The grazing system broadly involves allocating feed to stock on a daily basis. Feeding requirements of stock vary through the season and have been calculated as the amount of feed (kg DM/ewe/day) required to meet target growth rates and body weights at certain times. A relationship exists between the feed intake of the stock and the residual feed remaining after grazing (RDM), so that the average per head requirement can be allocated on a daily basis by moving stock when the RDM is reduced to the desired level. Details of the grazing system and feeding requirements for all classes of stock were reported by Milligan (1981).

Relatively high residual pasture cover throughout summer coupled with intense stocking and hard grazing over a short period during winter are the features of the grazing system that are likely to enhance thistle control. In December 1985 sheep grazing trials were established at two sites in the Waikato region to test whether or not such a grazing scheme, alone, could control nodding thistle populations and to investigate what the critical factors of the grazing scheme might be. This paper reports on the effects of various grazing treatments on the behaviour of nodding thistle rosettes which had survived beyond the seedling stage.

METHOD

Grazing plots of approximately 1050 m² were fenced during the spring of 1985 at two sites in the Waikato region. One site was an established pasture near Hinuera on a Tirau sandy loam soil and the other site was a 1 year old pasture at Whakamaru on a Taupo silty sand soil. Both sites had been sprayed for nodding thistle control during the late winter of 1985 and had approximately 10% cover of thistles when trial work commenced.

The grazing treatments which are outlined in the "schedule of grazing treatments"

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were set out as a 2 x 4 x 1 factorial trial in a split plot design with one replicate of eight plots at each site. At each site four plots were randomly assigned to each of the two summer grazing options. (A and B). During winter the four plots in each of A and B were grazed under four different options. (i-iv) giving eight grazing treatment combinations over a year. All plots were continuously grazed during spring. Pasture mass was estimated using a calibrated pasture probe or pasture herbage cuts taken by an electric hand shear, and visual estimates.

SCHEDULE OF GRAZING TREATMENTS

Summer/Autumn (December—April)

Four plots in each treatment at each site.

A Pasture rotationally grazed at 3-5 week intervals.

Pre-grazing pasture cover approximately 2500-3500 kg DM/ha.

Stocking rate 160-1000 SU/ha

Grazing period 1 day-1 week

Residual pasture cover 1100-1500 kg DM/ha

B Pasture retired from grazing over December allowing rank regrowth.

Pasture dry matter yield approximately 4500-6000 kg DM/ha.

Early January-April pasture continuously grazed by sheep.

Stocking rate 10-60 SU/ha

Average pasture cover (APC) January-April 900-1200 kg DM/ha.

Winter (May-August)

One plot from each of A and B grazed in each of the following four options:

- (i) in early May plot mob stocked for 1-2 days at 1200-3000 SU/ha. Pre-grazing pasture cover 1200-2300 kg DM/ha. RDM 500-700 kg DM/ha.
- (ii) in early June plot mob stocked for 1-2 days at 2000-3000 SU/ha. Pre-grazing pasture cover 1700-4500 kg DM/ha. RDM 500-800 kg DM/ha.
- (iii) in early July plot mob stocked for 1-2 days at 3000-4000 SU/ha. Pre-grazing pasture cover 2300-3500 kg DM/ha. RDM 500-800 kg DM/ha.
- (iv) Continuous sheep grazing 10-60 SU/ha. Pasture cover maintained 1200-1600 kg DM/ha.

Spring (September-November)

Continuous grazing on all plots with ewes or ewes and lambs. Residual pasture cover approximately 1400-2000 kg DM/ha.

On two permanently marked transect lines in each plot approximately 50 nodding thistle plants were identified and their fate over the season followed. Diameter and growth stage of these plants were initially recorded in April of 1986 and 1987, then reassessed the following July or August, October and January.

Data presented in Tables 1 and 2 are the averages between the two sites over both seasons and have been divided into four size categories based on the rosette diameter in April: (i) 3-10 cm diameter; (ii) 11-15 cm diameter; (iii) 16-20 cm diameter; and (v) over 20 cm diameter.

RESULTS

The main effect of the two summer grazing regimes on the behaviour of the rosettes recorded in April is presented in Table 1. There was, consistently, a slightly greater survival of rosettes in continuously grazed pasture compared with those in rotationally grazed pasture although differences were not significant. Larger plants were more likely to survive the winter and were more likely to flower in the summer. A small proportion of plants remained as rosettes in January. This proportion was slightly higher amongst smaller rosettes but was not related to the summer grazing treatments.

TABLE 1: Effect of summer grazing by sheep on the behaviour of established nodding thistle rosettes.

Rosette diameter in April (cm)	Rotational grazing (Treatment A*)	Continuous grazing (Treatment B)
Percent of April rosettes surviving to August		
3-10	53	61
11-15	69	76
16-20	76	80
over 20	87	88
Percent of April rosettes flowering by January		
3-10	19	27
11-15	40	47
16-20	51	57
over 20	60	64
Percent of April rosettes remaining as rosettes in January		
3-10	11	7
11-15	7	5
16-20	2	3
over 20	3	3

*Differences between Treatments A and B were not statistically significant.

TABLE 2: Effect of time of winter grazing by sheep on the behaviour of established nodding thistle rosettes.

Rosette diameter in April (cm)	Time of Winter Grazing				mean
	May (Trt i)	June (Trt ii)	July (Trt iii)	Continuous (Trt iv)	
Percent of April rosettes surviving to August					
3-10	43*	58	58	71*	58
11-15	57*	69	81*	82*	72
16-20	61	83	82	87	78
over 20	83	86	95	86	88
mean	61	74	79	82	
Percent of April rosettes flowering by January					
3-10	19	16	28	27	23
11-15	31	35	59	48	43
16-20	23*	55	59	79*	54
over 20	45	73	56	75	62
mean	30	45	51	57	
Percent of April rosettes remaining as rosettes in January					
3-10	4	12	5	14	8
11-15	5	8	3	8	6
16-20	5	0	5	0	3
over 20	4	1	<1	7	3
mean	5	5	3	7	

* Differences within a plant size range between Trt (i) and Trts (iii) and/or (iv) were significant at the 5% level.

Table 2 presents the main effects that time of winter grazing had on the behaviour of nodding thistle rosettes. Small, but mostly non-significant differences, occurred between the winter grazing treatments. Earlier hard grazing tended to cause highest mortality of rosettes and survival was highest in the continuously grazed pasture. The proportion of rosettes which flowered was mostly a factor of rosette size in April and not well related to winter grazing treatment. The percentage of rosettes remaining vegetative by January was also more determined by plant size than by winter grazing treatment and was generally low for all sizes.

DISCUSSION AND CONCLUSIONS

During summer rotationally grazed plots (Treatment A) were subjected to periods of high pasture cover between grazings. This level of competition was expected to cause rosettes to become etiolated and weakened and so render them more susceptible to removal or damage by grazing and trampling. In contrast those rosettes in the short continuously grazed pastures (Treatment B) were expected to develop as low growing rosettes with little or no stem, and be less susceptible to damage by stock grazing. However the data presented here indicate that varying the pattern of grazing in a pasture has little effect on the survival or behaviour of established nodding thistle rosettes.

Plots that were hard grazed during winter received only 1 or 2 days of grazing between May and August. During the long period without grazing large pasture dry matter yields accumulated providing a very competitive sward. However survival of rosettes over this period was similar on those plots that were grazed only once and those where pastures were continuously grazed to moderate levels throughout winter. Early winter hard grazing appeared to increase rosette mortality more than late winter hard grazing, especially of the smaller rosettes, suggesting that mortality was caused more by stock eating and trampling plants than by pasture competition.

After spring, when all plots were continuously grazed to moderate levels, rotational grazing of Treatment A plots commenced in December while Treatment B plots were closed from grazing until early January allowing very large pasture dry matter yields (approximately 4500-6000 kg DM/ha) to build up. The lack of significant differences in the percentage of rosettes flowering in January between Treatment A and Treatment B indicates that pasture competition, even at very high levels for 4-6 weeks, has little effect on thistle behaviour at that stage in their life cycle.

It is concluded from this study that once nodding thistle rosettes are established and past the seedling stage, varying pasture competition by different grazing management programmes will have only a minor influence on the behaviour of the thistles and will not lead to their control. Any major influence by grazing management on the control of nodding thistle must therefore operate at the seedling emergence and establishment phases of the life cycle. Once nodding thistles have become established in sheep grazed pastures control by means other than grazing management will be needed.

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