PASTURE PRODUCTION LOST TO UNSPRAYED THISTLES AT TWO SITES

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SUMMARY

Permanent quadrats were established at two sites, and the size of all thistles growing unchecked in the quadrats was recorded at monthly intervals. The Manawatu site had nodding thistle (*Carduus nutans*), winged thistle (*C. tenuiflorus*) and a few Scotch thistles (*Cirsium vulgare*) present. The Hawkes Bay site had nodding, Scotch and slender winged thistle (*Carduus pycnocephalus*). Total area covered by thistles in 1984/85 peaked at 9.4% in the Manawatu and 15.1% in Hawkes Bay, and averaged about 6% over the year. However in Hawkes Bay in September 1982, nodding thistles alone covered 59% of the ground, and averaged 30% ground cover over 1982/83 causing losses estimated at $110/ha.

INTRODUCTION

Thistles are a very visible element of the weed flora, especially when flowering. Control operations incur various costs, including lost production due to suppression of clovers by herbicides.

To calculate a cost-benefit analysis for different control programmes, we need to know the cost (in lost production) of doing nothing and allowing unchecked thistle growth. In this paper we present estimates of the amount of pasture production lost to thistles at two sites when no control operations were conducted.

METHODS

The location and sizes of individual thistle plants were recorded monthly in permanent quadrats from March 1981 to February 1983 at Argyll Road (13 km north of Waipukurau in Hawkes Bay), and at both Argyll Road and Midland Road (18 km north-east of Palmerston North in the Manawatu) in 1984/85. The paddock at Argyll has been used for other work on thistles (e.g. Popay *et al* 1984; Edmonds and Popay 1983). Both sites were dry slopes facing north-east.

From 1981 to 1983 at Argyll four quadrats each 0.5 m^2 were examined monthly by A.I.P. and the diameter of all nodding thistle rosettes was recorded. Since no measurements of plant size were made on flowering individuals, data from the 1984/85 work were used to estimate the leaf lengths of flowering plants over the subsequent censuses until death.

In July and August 1984 five transects each 10 m by 0.5 m were set up at each site by D.K. and all thistles in the transects were mapped to the nearest millimetre. For each thistle, including flowering plants, the length of its longest leaf was recorded.

In order to relate rosette size to the total area of the plant, rosettes of different sizes were cut off at ground level and brought to the laboratory. The longest leaf was measured before the plant was passed intact through a leaf-area machine to measure the shadow cast by the plant. A regression equation relating longest leaf to plant area was used to estimate the area of each plant at each census. For the 1981-83 data the rosette radius was treated as the length of the longest leaf. The estimated areas were then summed for all plants present in the transects.

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RESULTS

There was a close relationship between the length of the longest leaf on thistle rosettes and the total area of the plant (r = 0.989, Fig. 1), for Scotch, slender winged and nodding thistle rosettes, so the same equation was used for all species.

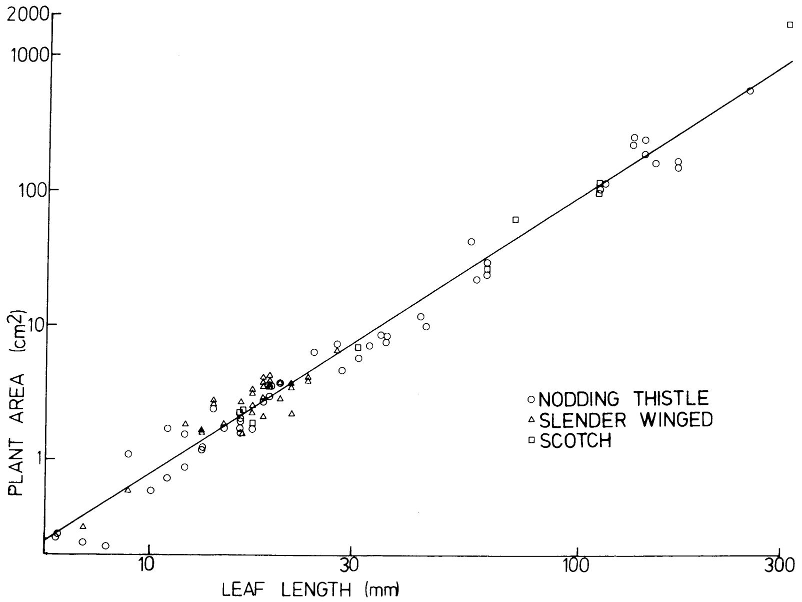

Fig. 1: **The area of the shadow cast by 94 thistle rosettes as a function of the length of the longest leaf (r = 0.989, $y = (0.0899x)^{2.07}$).**

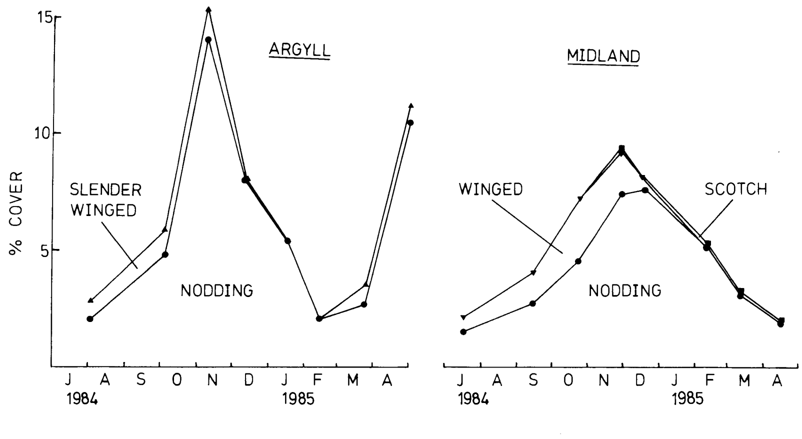

Fig. 2: **The estimated percentage of pasture space covered by thistles at Argyll Road (Hawkes Bay) and Midland Road (Manawatu) in 1984/85 in quadrats totalling 25 m².**

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The total area covered by thistles at Argyll Road in 1984/85 peaked in November at 15.1% (Fig. 2). Most of this coverage was due to nodding thistle (92%) with nearly all the rest being slender winged thistle. Scotch thistle accounted for less than 0.5% of the total area of thistles in November 1984. Dry weather in December and January was associated with a sharp decline in total thistle area. In March and April 1985 heavy autumn rains produced extensive germination.

At the Manawatu site in 1984/85 thistle areas also peaked in November but occupied only 9.4% of the pasture (Fig. 2). Of this area, 79% was due to nodding thistle and 20% to winged thistle. There was a slower decline in thistle area over summer than at Argyll, and nodding thistle cover did not peak until December. This was probably related to higher summer rainfall in the Manawatu than in Hawkes Bay. Due to continuing dry weather, there had been little germination of the new crop of thistles by mid April 1985.

To assess the effect of thistles on overall pasture production, the proportion of pasture covered at each census was calculated. Thistles covered the largest areas in spring when pasture growth rates are high, so it is at these times of year that the greatest losses in dry matter production/ha occur. However the lower percentage of thistle cover in winter may still be significant as there is often a shortage of feed at this time. To estimate pasture losses over the whole year in a way which emphasizes the equal importance of different seasons, the percentage of pasture covered at each census was averaged over all censuses in the year (Barlow 1985). At both Midland and Argyll in the 1984/85 season about 6% of production was lost (Table 1), and at both sites more than ¾ of this was due to nodding thistle.

The effect of year to year variation is shown in the data from Argyll for nodding thistle from 1981 to 1983. The 1981/82 season was marked by low levels of nodding thistle cover through the year with no seasonal peak (Fig. 3), but in 1982/83 nodding thistle was abundant, covering 59% of the quadrats on 20 September 1982. Observations on the rest of the paddock showed that the quadrats were not atypical in this regard. The estimated effect on pasture production is given in Table 1.

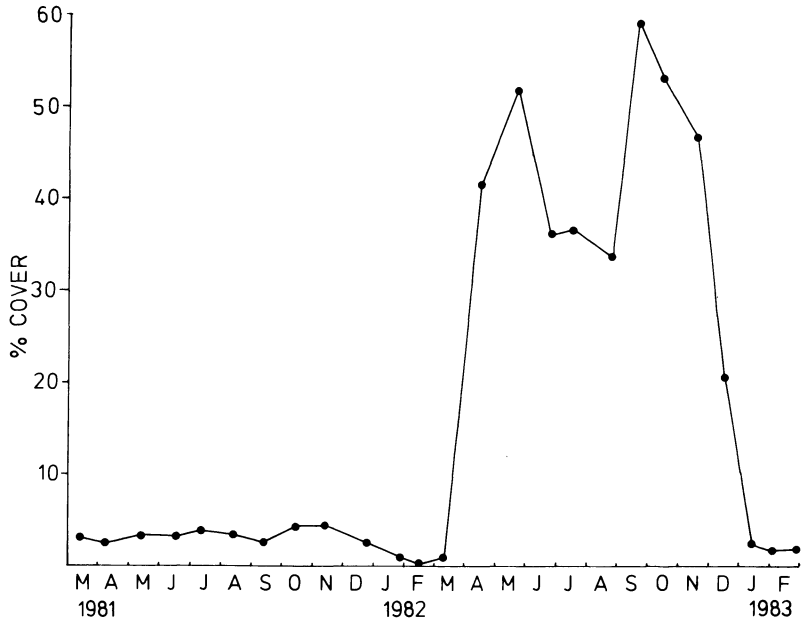

Fig. 3: The estimated percentage of pasture space covered by nodding thistles at Argyll Road in 1981-83 in quadrats totalling 2 m².

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TABLE 1: Estimated pasture losses to thistles over the whole season, autumn to autumn (average % ground cover).

					Species		
Site	Location	Season	Nodding	Winged	Slender-w.	Scotch	All
Midland	Manawatu	1984/85	4.28	0.87	0	0.09	5.24
Argyll	Hawkes Bay	1894/85	6.17	0	0.59	0.02	6.78
		1981/82	2.78	—	—	—	—
		1982/83	29.7	—	—	—	—

DISCUSSION

In this paper we have taken the total area of the shadow cast by thistle rosettes as a measure of their effect on pasture, assuming zero production from beneath the shadow and normal production from elsewhere. However, factors other than shading (root competition, discouragement of grazing) may be involved in reducing pasture production. Ideally the effect of thistle rosettes would be measured directly in units of pasture growth or stock production, but these data provide a first step. Interestingly, thistle rosettes only shade one-third of the area within a circle circumscribed by the longest leaf.

A related difficulty involves the measurement of thistles during their flowering stage. Leaves produced on the flowering stalks get progressively shorter further up the stem. The rosette leaves and lower stem leaves degenerate as flowering progresses, so that the contact patch at ground level shrinks. The contact patch is what has been measured in this study. It is possible that the flowering plant has effects on pasture production beyond the contact patch, either negative (reduced light flux, root competition) or positive (improved soil moisture relations due to shading in summer). Again, our results are presented in the absence of any data on actual pasture production around flowering thistle plants.

The data for the 1984/85 season show that nodding thistle was by far the most important species at both sites, but the sites were selected to study that species. Only a wide-ranging survey could provide an estimate of the relative importance of the different thistle species.

The results for Argyll over three seasons emphasize the fluctuation of the weed/pasture system. This variation makes the evaluation of control programmes difficult. If the annual gross margin per stock unit is taken as $25, the stocking rate as 15/ha, and if this stocking rate is reduced in direct proportion to lost pasture production, then the losses due to nodding thistle were about $22/ha in both 1981/82 and 1984/85 and $110/ha in 1982/83. Treatment with herbicide costs $7-13/ha for materials and $8-16/ha for application, giving a total cost of $15-30/ha. Therefore, herbicide treatment would have been cost-effective in 1982/83, even allowing for secondary effects on pasture suppression and clover damage (Maclean 1957), but would probably not have been worthwhile in 1981/82 and 1984/85.

ACKNOWLEDGEMENTS

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