

USE OF GOATS FOR THE CONTROL OF ILLYRIAN THISTLE,  
*ONOPORDUM ILLYRICUM*

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*Summary.* Four paddocks of Illyrian thistle *Onopordum illyricum* L. were grazed with goats (13.9/ha), sheep (6.9/ha), and goats + sheep (6.9 + 3.5; 3.5 + 5.2/ha) from September 1987 to March 1989. Goats consumed 100% of flowering heads of thistles in summers 1987/88 and 1988/89 and 99.9% in summer 1989/90 before viable seeds were produced. Although this reduced the bank of seeds in the soil the density of seedlings in autumn 1990 was similar to that on other treatments. The sheep or goat + sheep did not prevent thistles from producing large quantities of viable seeds. Goats removed the physical barrier of thistles without damaging associated pasture. Future observations will examine whether the bank of viable thistle seeds in the soil can be exhausted.

### INTRODUCTION

Observations on a 40 ha paddock over 19 months in 1985-87 indicated that goats could assist in the control of Illyrian thistle *Onopordum illyricum* L. in annual pastures (1). A further trial, begun in 1987, was designed to examine the effects of sheep, goats and two combinations of sheep and goats on the control of Illyrian thistle.

### METHODS

Four 2.88 ha paddocks near Boorowa, heavily infested with Illyrian thistle, were set stocked from 10 September 1987 until early 1990 with first cross Border Leicester x Merino ewes and feral goat does (Table 1).

Table 1. Stocking rate in animals/ha.

Paddock	Goats	Sheep
A Sheep	0	6.9
B Sheep + goats	6.9	3.5
C Sheep + goats	3.5	5.2
D Goats	13.9	0

The mean percentage ground cover of pasture on the paddocks in September 1987 was: annual grasses 53%; Illyrian thistle 28%; annual legumes 11%; and broadleaved weeds 3%. Superphosphate was aerially applied at 125 kg/ha in each year of the trial.

The effect of treatments was ascertained by assessing botanical composition, recording number, size and seedhead production of thistles on four open and two closed 5x5 m quadrats per paddock and measuring change in number of thistle seeds in the soil.

On 14 August 1989 three 8x95 m strips of MCPA were applied at 0.5 and 0.75 kg a.i./ha in 110 L/ha of water in each paddock to examine the effect of spray-grazing on thistle control.

## RESULTS AND DISCUSSION

A comparison of plants in the open and closed quadrats showed that all animals grazed young thistle plants in autumn, winter and early spring (Table 2). Previous conclusions that animals virtually ignored young Illyrian thistle plants during these seasons (1) were incorrect and were the result of not having open and closed quadrats in that trial. Young thistle plants have fewer spines than older plants and are of high feed value (1).

Table 2. Mean diameter (cm) of thistles during autumn, winter and early spring 1988.

Paddock	Grazed; open quadrats	Ungrazed; closed quadrats
A Sheep	18	37
B Sheep + goats	17	44
C Sheep + goats	17	46
D Goats	19	60

The major difference in behaviour of sheep and goats occurred in late spring and summer when goats actively selected for the flowering stems of Illyrian thistle and sheep did not (Table 3).

Table 3. Effect of sheep and/or goats on consumption and height of flowering stems of Illyrian thistle meaned for three years.

Paddock	% eaten in:					Height (cm) in:				
	Early Nov.	Mid Nov.	Mid Dec.	Early Jan.	Early Feb.	Early Nov.	Mid Nov.	Mid Dec.	Early Jan.	Early Feb.
<u>Open quadrats</u>										
A	0	7	12	33	33	33	72	76	78	83
B	2	15	35	57	61	30	52	50	53	53
C	3	10	15	43	47	40	66	69	64	63
D	2	58	98	99 <sup>b</sup>	100	28	37	23	16	10
<u>Closed quadrats</u> <sup>a</sup>										
	0	0	0	0	0	50	97	101	109	107

<sup>a</sup>Meaned for the four paddocks

<sup>b</sup>99.97

In summer 1987/88 and 1988/89 goats ate all flowering stems and thus all seedheads (capitula) before January, i.e. before viable seeds were formed at the early brown seedhead stage (Table 4).

Table 4. Effect of maturity (based on colour) of seedhead (capitulum) viability of seeds of Illyrian thistle.

Colour of seedhead	Stage of seed formation	% germination in 35 days
Green	Empty case	0
Early purple	Hollow case, thin outer walls	0
Late purple	Hollow case, thick outer walls	0
Early brown	Formed, soft, in placenta in capitulum	79
Late brown	Formed, hard, loose in capitulum	66

In 1989/90 goats ate 99.9% of flowering stems before January. The flowering stems not grazed were on a 10x10 m area on a goat camp. Although these flowering stems were consumed by early February some viable seeds fell to the ground between January and February. Seeds that did not fall and were eaten by goats in this period could have been rendered non-viable because (3) showed that less than 1% of saffron thistle, *Carthamus lanatus* L., seeds pass through goats and none germinate. It is recognised that stocking rate of goats has to be adjusted to the biomass of weeds available to effect complete consumption (4); thus, if stocking rate of goats had been increased in spring and summer 1989 all thistles could have been consumed before viable seeds were produced.

On the sheep and goat + sheep treatments between 35 and 97 million seeds/ha/yr were returned. The failure of the goat + sheep treatments to consume all thistles before viable seeds were produced was attributed to the stocking rate of goats being too low to consume the large biomass of thistles available.

Although goats reduced the number of thistle seeds in the soil over the period of the trial this has not yet resulted in a substantial decrease in seedling numbers (Table 5).

Table 5. Effect of grazing treatments on populations of thistle seeds (million/ha) and seedlings (/m<sup>2</sup>).

Paddock	<u>Seeds present in the soil in autumn:</u>		<u>Seedlings that established in:</u>	
	1988 <sup>a</sup>	1989 <sup>b</sup>	Spring 1989	Autumn 1990
			<u>Open quadrats</u>	
A	60	12	4.3	27
B	80	8	2.9	17
C	150	10	2.8	26
D	38	5	7.7	5
			<u>Closed quadrats</u>	
			6.1	12 <sup>c</sup>

<sup>a</sup>Total number of seeds

<sup>b</sup>Viable seeds

<sup>c</sup>Numbers restricted by ungrazed overburden

The application of MCPA in August 1989 had, by October 1989, greatly increased the consumption of non-flowering plants by sheep but only slightly increased consumption by goats, over that on unsprayed areas (Table 6). The MCPA may have been applied too early to encourage thistle consumption by goats because herbicide application at early flowering was more successful than at early stem elongation in encouraging goats to eat saffron thistle (3). MCPA reduced height and number of flowering stem (Table 6) as well as slowing the rate of maturity of thistles. As the biomass of Illyrian thistle in summer can vary between 30 and 80 t dm/ha, the spray-graze technique may be of value in reducing this biomass and thus the stocking rate of goats necessary to eat it before viable seeds are produced.

Table 6. Effect of MCPA applied in August 1989, on consumption of Illyrian thistles by goats and/or sheep.

Paddock	Plants (%) heavily	Height (cm) of flowering stems in Jan. 1990		Reduction (%) in seedheads (capitula) in Feb. 1990 grazed in	
		MCPA <sup>a</sup> +grazed	Grazed	MCPA <sup>a</sup> +grazed	Grazed
	Oct.1989 <sup>a</sup>				
A	52	77	127	71	1
B	38	40	40	79	66
C	60	52	87	88	6
D	16	17	17	100	100
Unsprayed	0				

<sup>a</sup>Meaned for both rates of MCPA.

No health problems occurred during the trial. Sheep averaged 72 kg with a minimum of 52 kg in winter 1989 and goats averaged 34 kg with a minimum of 29 kg in winter 1988. Goats (treatment A) were hand fed with field peas (150 g/hd/day) for 6 weeks in autumn 1988 after dry feed had been consumed and before annuals germinated.

The botanical composition in spring, meaned for all treatments, changed from annual grass dominance in 1987 (53% ground cover) to annual legume dominance in 1988 and 1989 (45% ground cover); there was little difference between treatments.

Although the thistle population has not been reduced by the goat treatment as yet, goats have removed the physical barrier to stock management in summer. It is our intention to continue the trial to ascertain whether the bank of viable thistle seeds in the soil can be exhausted.

#### REFERENCES

1. Campbell, M.H. and Holst, P.J. 1987. Proc. 8th Aust. Weeds Conf., Sydney. pp.24-6.
2. Holst, P.J. and Campbell, M.H. 1987. The role of goats in the control of weeds of pastures. In: Temperate Pastures. (Eds Wheeler, J.L., Pearson, C.J., Robards, G.E.) (AWC/CSIRO) pp.262-3.
3. Pierce, J.R. 1987. Proc. 8th Aust. Weeds Conf., Sydney, pp.31-4.
4. Harradine, A.R. and Jones, A.L. 1985. Aust. J. Exp. Agric. 25, 550-6