

'Necton' sulla — A preliminary agronomic evaluation

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Abstract

'Necton' sulla (*Hedysarum coronarium* L.) is a perennial forage legume with potential to provide high quality, non-bloating feed. This trial examined the effect of grazing intensity and frequency on sulla over one year. Annual dry matter yields ranged from 7.4 to 18.0 t/ha. There was no difference in the yield of hard- and lax-grazed plots but grazing in late autumn significantly decreased plant density and yield.

Keywords 'Necton', sulla, legume, grazing management

Introduction

Sulla (*Hedysarum coronarium* L.) is a herbaceous, short-lived perennial legume that grows 80-175 cm high and has a strong deep tap-root and numerous secondary roots. It is used in Mediterranean countries such as southern Italy, Spain, Tunisia, Turkey and in some parts of Australia for hay and silage making, and soil conservation. Sulla was introduced into New Zealand in the early 1950s largely for use in soil conservation, but its potential as a forage was more fully realised in 1982 (Watson 1982). There are two cultivars available in New Zealand, 'Necton' and 'Aokau'. Sulla produces high quality herbage which is readily eaten by stock. The condensed tannin content of sulla is approximately 4-5% DM (Tom Terrill pers. comm.), which eliminates the risk of bloat. Moreover, weight gains in lambs fed sulla were greater than those in lambs fed sulla with tannin effects removed (Barry 1989; Deadman 1989).

Recent cutting trials by MAF in Hawke's Bay and by NZ Agriseeds Limited in Canterbury produced annual DM yields from sulla of 12-18 t/ha (Rys *et al.* 1988; Graham Kerr pers. comm.). Similar yields were obtained in cutting trials in the Manawatu (Douglas 1984; Douglas & Foote 1985).

Although sulla has shown promise as a high quality forage, knowledge of its performance under grazing is scarce. There is a need to develop grazing management guidelines for sulla and to improve its establishment and persistence (Foote 1988; Rys *et al.* 1988). The objective of this trial was to examine the

effect of grazing intensity and frequency on the production of sulla over one year. The trial also provided experience with the establishment of sulla.

Materials and methods

The trial was started on 27 September 1988 on 0.22 ha of a Tokomaru silt loam at Massey University. The soil was ploughed in early spring 1988 and agricultural lime at 4 t/ha was incorporated to increase the pH from 5.5 to 6.0. 30% potassic super at 450 kg/ha was applied at sowing. Dehulled 'Necton' sulla seed, supplied by Agriseeds Limited, was inoculated with rhizobia strain NZPA 5410 and drilled at 7.0 kg/ha. Apparent nodulation failure resulted in pronounced yellowing of herbage and urea was broadcast at the rate of 100 kg N/ha on 17 October 1988 and after each grazing. Plant tissue analysis was used to monitor the remedial measures taken. Plots were hand weeded.

A randomised complete block design with split plots and 6 treatments with 3 replicates was used. Plot size was 120 m². The grazing treatments began when the plants were at the early reproductive (ER) growth stage 85 days after sowing (DAS). The main plots were (1) hard grazed (approximately 75% of leaf and stem material eaten leaving residual of 500-700 kg DM/ha), (2) lax grazed (approximately 60% of the leaf and stem material eaten leaving residual of 1000-1200 kg DM/ha), or (3) zero grazed (no herbage removed). At 105 DAS, and at subsequent grazings, the zero grazed main plots were split and the subplots grazed either hard or lax. The plants in this treatment were at the late reproductive (LR) growth stage when first grazed. The hard and lax grazed main plots were split and subplots grazed either hard or lax at 140 DAS and at subsequent grazings. The hard and lax grazed main plots were grazed whenever the plants were at the ER growth stage and the zero grazed main plot when the plants were at the LR growth stage; thus, the plots were grazed 4 and 3 times in a year respectively. The ER growth stage was defined as mid to late stem elongation and the LR growth stage as 10% of stems flowering.

All grazings were by mature ewes. Three 0.4 m² quadrats were used to measure available/residual DM and plant density in each plot.

Table 1 Cumulative DM yield (kg/ha) of 'Necton' sulla grazed at different growth stages and intensities over 365 days. (Number of grazings shown in brackets).

Growth stage	Grazing intensity			
	Hard	Hard/ Lax	Lax/ Hard	Lax
ER (4)	7627	8923	7371	9887
LR (3)	17943*	—	—	18003*
LSD 5%	5885			

* Pair of means within column significantly different ($P < 0.05$)

— Not applicable

Results

The annual **herbage** yield over 365 DAS of 'Necton' sulla grazed 3 times at LR growth stage was approximately twice that of sulla grazed 4 times at ER growth stage (Table 1). The intensity of grazing did not affect the annual yield of sulla, but the net utilisation of pregrazed yield was 72% over all hard grazed treatments, and 62% over all lax grazed treatments. There was no interaction effect between grazing intensity and grazing frequency on annual DM yield (Table 1). The initial grazing intensities of hard, lax, or zero resulted in no significant difference in the annual DM yield of the hard and lax grazed main plots.

Plant density, shoot yield per plant, and daily growth rate per ha were similar for the ER and LR growth stage treatments up to the grazings in autumn (Table 2). The final autumn grazing of the ER growth stage treatment occurred on 18 March, whereas that for the LR growth stage treatment was on 29 May. At the following spring harvest (28 September) the plant density of the ER growth stage treatment was 28% of that of the LR growth stage treatment (Table 2). Similarly, the daily growth rate over winter of the ER growth stage treatment was 22% of that of the LR growth stage treatment, suggesting that either lateness of autumn grazing or growth stage at grazing affected plant density and thereby daily growth rate (Table 2). Plant density,

shoot yield per plant, and daily growth rate were unaffected by grazing intensity with the exception of an interactive effect of grazing intensity and growth stage on shoot yield per plant at 28 September harvest (Table 3).

The shoot yield per plant was lower for plants grazed hard rather than lax in autumn at the ER growth stage, but not for plants grazed at the LR growth stage (Table 3). Over the 365 day, shoot yield per plant increased and plant density decreased in all treatments (Tables 2 and 3).

Discussion

The annual DM yield of 'Necton' sulla ranged across the treatments from 7.4 to 18.0 t/ha, which was similar to the 12-18 t/ha reported under cutting and grazing trials (Table 1, Douglas 1984; Rys *et al.* 1988). Sulla grew throughout the year with high growth rates in summer and low growth rates in winter (see Table 2).

DM yield was unaffected by the intensity of grazing, but was affected by either the growth stage at grazing, or more probably, nearness to winter of autumn grazing (Tables 1 and 2). The experimental design did not allow for the possible effect of late autumn grazing on subsequent yield but this will need to be examined. Nevertheless, the large decrease in plant density and the consequent decrease in growth rate and yield in the ER growth stage treatment grazed in late May suggests that grazing sulla in late autumn needs to be avoided (see Table 2).

Table 3 Shoot DM yield per plant (g) of 'Necton' sulla at different growth stages and grazing intensities on 28 September 1989, 365 DAS.

Growth stage	Grazing intensity			
	Hard	Hard/ Lax	Lax/ Hard	Lax
ER (4)	11.7	30.1	12.6	28.6
LR (3)	20.3	—	—	30.1
LSD 5% = 12.0				

Table 2 Effect of growth stage at grazing on plant density (plants/m²), shoot DM yield per plant (g) and net daily growth rate (kg DM/ha) of 'Necton' sulla over 365 days. Values **meant** over all grazing intensities.

Growth stage	Date of grazing					
	22/12/88 85	11/1 105	16/2 140	18/3 172	29/5 240	28/9/89 365 DAS*
ER (4)	85 ± 7.0		64 ± 6.7		45 ± 2.8	14 ± 1.4
LR (3)	—	92 ± 8.9	—	60 ± 7.2	—	50 ± 2.5
ER (4)	3.2 ± 0.9		5.4 ± 1.0		9.8 ± 3.4	20.7 ± 1.8
LR (3)	—	3.9 ± 1.0	—	6.3 ± 2.6	—	25.1 ± 2.6
ER (4)	28 ± 2.5		42 ± 7.8		22 ± 2.1	13 ± 2.1
LR (3)	—	34 ± 6.0	—	46 ± 1.3	—	59 ± 6.8

*Days after sowing

Sulla behaved similarly to other perennial forage legumes such as lucerne and red clover in that plant density declined over time and plant size (shoot yield per plant) increased (Table 2 and 3; Leach 1967; Hay & Ryan 1989). The factor that had the greatest effect on plant density was late autumn grazing, whereas the interaction between hard grazing and late autumn grazing had the greatest effect on plant size (Tables 2 and 3). Lax grazing in late autumn did not affect plant size (Table 3). The low plant density in the ER growth stage treatment on 28 September was not compensated for by an increase in plant size relative to plants in the other treatments, suggesting that the maximum plant size for the conditions had been attained. Therefore, grazing in late autumn, and particularly hard grazing, decreased total yield by decreasing plant density below the point that could be compensated for by an increase in plant size. Presumably, plants die during winter from treading damage to growing points, lack of stored carbohydrate, insufficient active leaf area, or disease. These factors will be examined in future trials.

Although sulla was grown with the use of urea due to nodulation failure in this trial, the growth and production of effectively nodulated sulla in current trials appears similar to that of sulla grown with urea. An effective rhizobia strain ICMP 10149 was selected as part of the current sulla programme and is now commercially available.

Conclusions

Sulla has the potential to provide high yields of non-bloating forage over spring, summer and autumn provided it is grazed when between the early stem elongation and 10% flowering-growth-stages. Hard grazing the plants so that all leaflets were removed did not affect regrowth but grazing in late autumn or winter killed plants and decreased yield. The death of sulla plants grazed in winter has been identified as a management problem that requires further research, particularly as sulla is winter active.

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