Spring grazing management of medic pastures to optimise productivity of herbage and seed

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Summary. The impact of grazing pressure on the production of herbage and seed from an established pasture of barrel medic, Medicago truncatula, cv. Paraggio was studied during spring at Korunye, South Australia. Three stocking intensities (20, 40 and 60 sheep/ha were used during four grazing periods (0, 2, 4 and 6 weeks). Both stocking density and grazing period significantly affected pasture availability and seed production: furthermore, there was a significant interaction between stocking density and grazing period ($P<0.001$) for important parameters.

Introduction

In recent years Australia has had some 40 million ha of crop and sown pasture lands that rely on legumes to maintain or improve levels of soil nitrogen and to help guarantee the quality and quantity of livestock feed (1). In the cereal-livestock zone (250-500 mm rainfall) barrel medic has been of special interest. Despite the importance of legume-based pastures many pastures have low legume content. The reasons for the demise of legumes in these pastures are many (2, 3, 4, 5): however, poor stands of medics result from inadequate seed reserves in the soil which reflect management practices. The research described in this paper was undertaken to assess the separate and joint effects of stocking density and grazing period on herbage and seed production and sheep body weight gains in spring.

Methods

An established stand of barrel medic, *Medicago truncatula,* cv. Paraggio at Korunye approximately 60km north of Adelaide, was used for this experiment. On 2 August , 1991, the trial site was sprayed with Targa? at 250 mL/ha to control grass weeds. The experiment was fenced and sheep introduced on 30 September 1991. Three stocking densities (20, 40 and 60 sheep/ha) were used during four grazing periods (0, 2, 4 and 6 weeks) on the medic-based pasture. Stocking density treatments were arranged in a completely randomized block design with four replications. Stocking densities were allocated to main plots and grazing periods (by using grazing exclosures) were the sub plots. Plot size was reduced to the scale where three sheep were assigned to each main plot: paddocks were of equal length but varied 3-fold in width. To obtain representative samples of each treatment all 12 paddocks were divided into four notional strata.

Pasture availability samples from a 50 x 50 cm quadrat were cut to ground level on the first day of the experiment and continued at two-week intervals after completion of each grazing period Pasture samples were hand-separated into medic and other species before drying in a forced -draught dehydrator at c. 85 C? for determination of dry matter (DM) yield. After sampling to determine the level of pasture availability a grazing exclosure cage was randomly allocated to each stratum within each paddock to prevent sheep from further grazing. Thus, the areas of pasture subjected to the various grazing periods became sub-plots in a split-plot system. After the 6-week grazing period herbage samples of 50 x 50 cm were taken when the medic was at the full-flowering stage and a few pods were in the early stage of development. Later, dry pasture residues (including mature pods) were collected from within the cages from 50x50cm quadrats. Sheep body weights were measured on the first day of the experiment (I October) and at the end of the experiment on 12 November 1991.

Results and discussion

Pasture availability .

Stocking density and grazing period both greatly affected pasture availability (Table I) and there was a significant interaction between stocking density and grazing period for the 'medic' , 'other spp' and 'total' pasture components. The very low rainfall in October undoubtedly retarded pasture regrowth (and later restricted seed production of the medic).

Table 1. Impact of stocking density and grazing period on pasture availability over a six-week period at Korunye. South Australia, 1991.

Stocking density	Pasture components	Grazing period (weeks) 0	2	4	6
		Pasture availability (kg DM/ha) 30.9.91	14.10.91	28.10.91	11.11.91
Low (20 sheep/ha)	Medic	3808	3296	2978	1584
	Other spp.	1073	1881	2338	851
	Total	4881	5177	5316	2435
Medium (40 sheep/ha)	Medic	4160	2614	2823	846
	Other spp.	886	1532	873	361
	Total	5046	4146	3696	1207
High (60 sheep/ha)	Medic	4104	1837	1884	185
	Other spp.	986	2271	1018	213
	Total	5090	4108	2902	398
Significance of Interaction[a]		Least Significant Difference			
Medic	P<0.01	887			
Other spp.	P<0.01	548			
Total	P<0.01	1082			

[a](Stocking density x Grazing period)

Grazing period had a significant effect (P<0.01) on medic herbage production (Table 1). At low stocking density the available medic forage after 6 weeks of grazing dropped to 40% of the non-grazed control while for medium stocking density and high stocking density it was 20% and 4% respectively hence the interaction.

Most of the 'other spp.' component in the experiment was self-sown wheat, from the previous cropping year. The self-sown wheat population was not dramatically reduced, although it was retarded by spraying with Targa. Grazing period had a highly-significant effect on availability of 'other spp.' although the percentage reduction with time was not as dramatic as with the medic component. However, the interaction between stocking rate and grazing period was significant.

The 'other spp.' component of available forage increased during the first two weeks of grazing and then tended to decrease as grazing period continued. At low stocking density, available forage continued to increase up to 4 weeks (double the control) and then dropped after 6 weeks (42% of available forage in control plots). The same pattern was observed at medium and high stocking densitites after 2 weeks of grazing. During October and early November 'other species' were still in the vegetative growth stage. The growth rate of 'other spp. exceeded the consumption rate of grazing animals at all stocking rates for the first two weeks. In the same period, medic plants were still leafy and in the early reproductive growth stage, hence grazing pressure was mostly directed to the medic rather than 'other spp.. As the medic plants reached early maturity due to the dry season and the fibre proportion increased in the plant materials, the sheep concentrated on the 'other spp. of pasture.

The mean level of total available forage across all stocking rates declined as grazing period increased. A similar pattern was observed for medium and high stocking density: however, at low stocking density due to light grazing pressure and since the growth rate of the 'other spp. component of the pasture exceeded animal consumption, *the* total available forage tended to increase up to 4 weeks of grazing at which stage the grass species reached physiological maturity and vegetative growth ceased. After 6 weeks of grazing at low stocking density the total available forage was 50% of the control treatment but at high stocking density it was only 8% of the control.

Seed production .

Medic pod production and/or survival and consequent seed production (Table 2) was very sensitive to stocking density and grazing period.

Table 2. The impact of stocking density and grazing period on medic pod data and medic seed data at Korunye, 1991.

		Grazing period (weeks)			
Stocking density	Pasture components	0	2	4	6
Low (20 sheep/ha)					
	Pod yield (kg/ha)	917	573	499	487
	Pods (#/m^{2})	1664	1147	941	893
	Mean pod weight (mg)	55	49	53	55
	Seed yield (kg/ha)	351	210	190	148
	Mean seed weight (mg)	3.14	2.83	3.03	2.72
	Seeds (#/pod)	6.6	6.1	6.7	6.0
Seed/pod ratio (%)		38	38	39	31
Medium (40 sheep/ha)					
	Pod yield (kg/ha)	977	592	325	208
	Pods (#/m^{2})	1792	1249	694	420
	Mean pod weight (mg)	53	48	46	50
	Seed yield (kg/ha)	354	220	113	65
	Mean seed weight (mg)	3.08	2.72	2.56	2.79
	Seeds (#/pod)	6.4	6.3	6.5	5.5
	Seed/pod ratio (%)	38	37	38	32
High (60 sheep/ha)					
	Pod yield (kg/ha)	754	331	259	142
	Pods (#/m^{2})	1450	647	586	301
	Mean pod weight (mg)	51	57	45	46
	Seed yield (kg/ha)	277	123	105	38
	Mean seed weight (mg)	2.99	2.96	2.70	2.22
	Seeds (#/pod)	6.2	6.3	6.8	6.0
	Seed/pod ratio (%)	37	37	41	29

		Significance	Least Sig. Diff.
Stocking density	Seed yield (kg/ha)	P< 0.05	73
Grazing period	Pod yield (kg/ha)	P< 0.01	159
	Pods (#/m^{2})	P< 0.01	269
	Seed yield (kg/ha)	P< 0.01	65
	Mean seed weight (mg)	P< 0.01	0.37
	Seeds (#/pod)	P< 0.01	0.4
	Seed/pod ratio (%)	P< 0.01	6.3

Pod production significantly decreased as grazing period increased (P<0.001). The impact of stocking density on pod production increased with period of grazing. After 4 weeks and 6 weeks of grazing there was a significant difference in pod production between low stocking density and medium and high stocking density treatments. Lower grazing pressure led to greater medic herbage in spring which in turn led to greater production of pods. Defoliation increases the rate of flower production and promotes burr production in subterranean clover (4). In this experiment because of the late application of treatments (1 October) and due to the very dry growing season the grazed paddocks did not have opportunity for regrowth and under higher grazing pressures more developing pods were consumed which led to lower pod production.

Medic seed yield followed a similar pattern to pod production. The mean seed production in non-grazed treatments (controls) across the three stocking densities was 327 kg/ha while the lowest was c. 87 kg/ha, obtained from plots at high stocking density. For the 4 and 6 week grazing periods under all stocking densities, seed production was less than 200 kg/ha which is not enough for a successful re-establishment in the following year (2). No significant difference in seed production was observed between the low and medium stocking density treatments after 2 weeks of grazing.

Sheep body weight gains.

Sheep mean body weight was 58.1kg at time of introduction to the plots and it increased to 60.3kg after 6 weeks of grazing (Table 3). However, there was a significant interaction between stocking rate and grazing period (P<0.01).

Table 3. Sheep body weights (kg) at the start and finish of the grazing experiment at Korunye.

	Grazing period		
Stocking density	30.9.91 (start)	11.1 1.91 (finish)	Weight changes
Low (20 sheep/ha)	59.2	63.2	+4.0
Medium (40 sheep/ha)	57.0	60.0	+3.0
High (60 sheep/ha)	58.3	57.8	-0.5
Significance of Interaction [a]		Least Significant Difference	
Sheep body weight	P<0.0 I	5.2	

[a](Stocking density x Grazing period)

The results of this experiment suggest that grazing pressure could significantly affect pasture availability as well as pod and seed yield. The experiment suggests that a grazing pressure of 40 sheep/ha for 4 weeks is optimal to make the most efficient use of medic pastures for livestock production. However, in terms of high residual seed reserves, the grazing pressure of 40 sheep/ha for two weeks is superior under conditions of this experiment. These results are specific to site and growing season (in this case a dry spring). However, the experiment supports the principle that applying severe grazing pressures at flowering and pod developing stage could be detrimental to pod and seed production of medic pasture.

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