The significance of cluster clover (trifolium glomeratum l.) In a subterranean clover-perennial ryegrass pasture under two constrasting management systems.

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Summary. Pasture survey data were collected from two nearby pasture paddocks carrying a mixed stand of subterranean clover, Trifolium subterraneum, and perennial ryegrass, Lolium perenne on a sandy loam soil under two contrasting management systems. Paddock I had been set-stocked during the past 15 years with about 20 crossbred ewes/ha plus lambs. Paddock II had been cut for hay over the past twelve years and stocked at c. 13.8 crossbred ewes/ha plus lambs. Subterranean clover cultivars were affected more severely by heavy set-stocking than by regular hay cutting: however. adequate seed was set in both paddocks. Cluster clover, Trifolium glomeratum, was far more abundant on the hard-grazed area than on the area cut for hay.

Introduction

In all Mediterranean-type environments of the world, sheep grazing pressure has a dramatic impact on yield and botanical composition of annual legume-grass pastures. Furthermore, under continuous, heavy grazing pressure small-seeded clovers such as cluster clover increase as a percentage of botanical composition and often in total quantity (1, 2, 3). Under conditions of severe grazing pressure there is a critical balance between seed production and seed consumption during summer and autumn which determines seed survival and subsequent additions to the seedbank or seedling density and consequent productivity of legume pastures.

Recent *in vivo* feeding experiments have shown the importance of hard-seededness and seed size in the survival of pasture legumes following ingestion by sheep (4). Furthermore, *in sacco* digestibility studies have shown clearly that legume seed is mainly destroyed by chewing by sheep rather than digestion: small seed escape chewing and hard seed escapes digestion (6, 7). This paper summarises some of the results of a farm survey to study the influence of two contrasting pasture management systems on botanical composition.

Methods

The pasture survey was conducted at Parawa on Fleurieu Peninsula, South Australia. Two paddocks (hereafter referred to as Paddock I and Paddock II) containing a subterranean clover, *Trifolium subterraneum,* and perennial ryegrass, *Lolium perenne,* pasture mixture established on a lateritic podzol soil with sandy loam surface with contrasting management histories were selected. Paddock I had been heavily set-stocked during the past fifteen years with about 20 crossbred ewes/ha plus their lambs. Paddock II had been cut for hay over the past twelve years (1978-1989) and stocked with about 13.8 crossbred ewes/ha plus lambs. During the period of the study (14 September 1990 - 16 May 1991) the paddocks were grazed continuously by sheep and stocked according to the rates indicated above.

To monitor the seed-seedling dynamics in the soil-pasture -animal complex, the seed reserves in the soil, pasture and faeces as well as some sward characteristics (plant density, herbage availability, botanical composition and percentage bare ground) were estimated, before the legume species commenced flowering (14 September 1990), before the subterranean clover cultivars and cluster clover had set seed (5 November 1990), when the seed of both clover species was mature (9 January 1991), before the opening of the normal rainfall season (18 March 1991) and after 48.5 mm of rainfall (16 May 1991) to examine the re-establishment of the pasture sward species. Furthermore, data were collected from grazed and ungrazed areas. However, data for the grazed areas only are presented in this paper.

Results and discussion

Data on plant density, herbage availability and legume hard seed reserves (Table I) show the impact of management practices on the decline of subterranean clover (hereafter referred to as sub clover) and the increase of cluster clover and winter grass, Poa annua, on the hard-grazed area as found previously (1,2,3). Barley grass, Hordeutn leporinum and capeweed, Arctotheca calendula, were also prominent on the hard-grazed area.

Table I. Plant density, herbage availabilty and legume hard seed reserves in a grazed subterranean clover-perennial ryegrass pasture at Parawa in September. 1990.

	Plant density (#/m^2)			Herbage availabilty (kgDM/ha)			Seed reserve (kg/ha)		
Paddocks	Paddocks			Paddocks					
	I		II	I		II	I		II
Sub clover	991		1089	340		439	214	***	497
Per. rye	76	***	169	158	***	333	-		-
Cluster clover	341	***	54	30	***	3	24	***	4
Winter grass	1563	***	681	288	***	192	-		-
Barley grass	60	***	6	37	***	1	-		-
Cape weed	293	***	10	608	***	9	-		-
Other spp.	147		697	25		194	-		-
Total	3471		2706	1486	***	1171	238		501

***– Signif. diff. (P< 0.001) between paddocks

The data on seed reserves (Tables 2, 3) clearly show that the heavy grazing reduces the percentage of sub clover seed that is buried : in part this is due to greater soil compaction. However, on both paddocks sub clover seed production is satisfactory which contrasts with many of the dairy pastures in the Adelaide Hills (5). It should be noted that cluster clover seed levels in Paddock I were significantly higher in January 1991 than in September 1990. Despite this, a large amount of seed disappeared from the grazing area. At least some of this loss of seed is ascribed to ants (6).

Table 2. Total legume seed reserve in grazed subterranean clover-perennial ryegrass pasture at Parawa in January 1991.

	Legume seed reserve								
	Above or at ground level			Below ground level			Total		
Paddock I Species	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)
Subterranean clover	1244	68	5.52	7716	465	6.03	8960	533	5.96
var. *subterraneum*	213	10	4.85	754	42	5.62	967	53	5.45
var. *yanninicum*	1031	58	5.62	6962	423	6.07	7993	480	6.01
Cluster clover	-	-	-	17406	48	0.274	17406	48	0.274
Paddock II Species	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)
Subterranean clover	914	45	4.88	13198	804	6.09	14112	848	6.01
var. *subterraneum*	535	29	4.45	5969	280	4.68	6504	308	4.66
var. *yanninicum*	379	16	5.48	7229	524	7.25	7608	540	7.16
Cluster clover		-	-	1343	4	0.275	1343	4	0.275

Table 3. Total seed reserve under grazed conditions in a subterranean clover -perennial ryegrass pasture at Parawa (Paddocks 1 and II; March, 1991).

	Legume seed reserve								
	Above or at ground level			Below ground level			Total		
Paddock I Species	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)
Subterranean clover	82	4.7	5.69	8868	534	6.03	8950	539	6.02
var. *subterraneum*	51	2.9	5.61	992	52	5.20	1043	54	5.22
var. *yanninicum*	31	1.8	5.83	7876	483	6.13	7907	485	6.13
Cluster clover	-	-	-	11988	38	0.314	11988	38	0.314
Paddock II Species	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)	(#/m^2)	(kg/ha)	(mg/seed)
Subterranean clover	193	7.9	4.09	13683	801	5.86	13876	809	5.83
var. *subterraneum*	193	7.9	4.09	7029	323	4.59	7222	331	4.58
var. *yanninicum*	0	0	-	6654	479	7.19	6654	479	7.19
Cluster clover	-	-	-	983	3.3	0.337	983	3.3	0.337

Differences between paddocks for seed reserve are highly significant (P<0.001)

Table 4. Seedling density, herbage availability and legume hard seed reserves under grazed conditions in a subterranean clover-perennial ryegrass pasture at Parawa in May, 1991.

	Seedling density (#/m^2)			Herbage availabilty (kgDM/ha)			Seed reserve (kg/ha)		
	Paddocks			Paddocks			Paddocks		
	I		II	I		II	I		II
Sub clover	538		1031	37		53	259	***	552
Per. rye	68		85	98		124	-		-
Cluster clover	989	***	116	14	***	1	12	***	2
Winter grass	12295		14686	318		348	-		-
Barley grass	167	***	0	12	***	0	-		-
Cape weed	111	***	11	10	***	0	-		-
Other spp.	315		465	5		13	-		-
Total	14483		16394	494		539	271		554

***= Signif. diff. (P< 0.001) between paddocks

Table 5. Changes in the legume seed reserve in the soil-plant complex of a grazed subterranean clover- perennial ryegrass pasture at Parawa.

Seed and seedling reserve (#/m^2)	Paddock I		Paddock II	
	Subterranean clover	Cluster clover	Subterranean clover	Cluster clover
September 1990				
Hard seed density	3489	7901	8248	1251
January 1991				
Total seed density	8960	17406	14112	1343
March 1991				
Total seed density	8950	11988	13876	983
May 1991				
Seedling density	538	989	1031	116
Hard seed density	4193	4068	8848	598
Total reserve density	4731	5057	9879	714

Following the opening rains the data for May 1991 (Table 4) again highlight the adaptation of cluster clover to heavy grazing pressure and the relative reduction of productivity of sub clover. However, as shown in Table 5, the Parawa environment with 900mm annual rainfall has ideal soil and climate for growing excellent pastures of subterranean clover (a range of cultivars) and perennial ryegrass. In conclusion, this survey has shown that despite the potential for growth of subterranean clover in the Parawa environment, this species gives way to cluster clover under conditions of sustained heavy grazing *inter alia* because a high percentage of cluster clover seed (c. 76%) can survive ingestion by sheep (6) whereas only c. 2% of sub clover seed survives ingestion by sheep (4).

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