Dryland lucerne seeding rates had no effect on pasture production.

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Abstract

Lucerne was sown at 1 and 3 kg/ha with subterranean clover at a site near Boort in north central Victoria to test the hypothesis that the dry matter production of lucerne is unaffected by seeding rate. Over 6 years, lucerne yields averaged 612 and 653 kg DM/ha per year for the 1 and 3 kg/ha seeding rates respectively, while the annual species component yielded on average 3112 and 3179 kg DM/ha per year, respectively. The 3 kg/ha lucerne produced significantly more dry matter in only the first 2 winter - spring periods. The data indicate little if any advantage from sowing lucerne at 3 kg/ha in this dryland environment.

Introduction

Lucerne is highly recommended for crop and livestock enterprises. In north central Victoria, the lucerne seeding rates used by farmers vary from 0.5 to 6 kg/ha, with an average of 2 kg/ha. Farmers using low (<2 kg/ha) seeding rates claim their lucerne yields are similar to, or better than those obtained with higher rates. This suggests that for lucerne at low plant densities, higher yields per plant compensate for the low densities. To test this hypothesis, lucerne was sown at two rates and growth per unit area measured regularly.

Method

A seeding rate experiment with lucerne was established at Fernihurst (143?50'E, 36?14'S), 15 km south of Boort in north central Victoria. The average annual rainfall forof the site is 396 mm, with an April-October average of 264 mm. The topsoil (0-10 cm) is a clay loam with a pH_{water} of 6.2 and an Olsen P of 4 mg/kg. The 40 ha paddock was subdivided into 3 equal sized sub-paddocks. In June 1985 the lucerne was sown with subterranean clover under a barley crop. One half of each sub-paddock was sown with 1 kg/ha, and the other half with 3 kg/ha of lucerne (*Medicago sativa* cv. CUF 101), both with subterranean clover (*Trifolium subterraneum* cv. Seaton Park and cv. Nungarin, each at 2 kg/ha). From August 1986 to August 1993, dry sheep rotationally grazed the 3 sub-paddocks at an average stocking rate of 4.5/ha. Pasture growth was measured at 6 weekly intervals using 6 pairs of sheep exclusion cages, with the cages from each pair positioned approximately 10 metres apart on the 1 kg/ha and 3 kg/ha lucerne blocks. There were 2 pairs of cages in each sub-paddock. They were shifted approximately 3 metres at the beginning of each measurement period to avoid sheep exclusion effects on production. Lucerne yields were estimated by cutting lucerne to 1 cm height using 1.0 m^2 quadrats at the beginning and end of each period. Lucerne density was measured in each quadrat. Yields of annual pasture were estimated in 0.25m^2 quadrats in the same manner as the lucerne yields. Pasture production was aggregated for each calendar season. All data were analysed by analysis of variance using Genstat 4.2 (1).

Results and discussion

Six years after the lucerne was sown, lucerne plant densities had declined to about 10% of their first year densities for both seeding rates (Table 1).

Table 1. Average densities (plants/m^2) of lucerne sown at 1 and 3 kg/ha in 1985 (= P<0.01, *** = P<0.001).**

Seeding Rate (kg/ha)	1987	1988	1989	1990	1991	1992	1993

1	16.7	11.9	7.3	5.6	3.9	2.6	1.7
3	39.8	27.9	15.4	11.7	8.2	5.5	3.9
LSD(P=0.05)	5.3	3.7	2.3	4.1	2.0	1.7	1.1
	***	***	***	**	***	**	**

Over this period, the 3 kg/ha lucerne yielded more (P<0.05) dry matter than the 1 kg/ha lucerne in only the winter - spring of the first two years (Table 2). When seasonal production was averaged over the 6 years, the 1 kg/ha lucerne produced 23% less dry matter than the 3 kg/ha lucerne in winter, with no differences at other times of the year (Table 2). However the average winter lucerne yields were so low (71 versus 92 kg/ha) that the additional 21 kg/ha of dry matter was unlikely to feed many extra stock. There were no significant differences between the two seeding rates in average spring production of lucerne, nor in the yields of the annual pasture component on any occasion.

Table 2. Effects of lucerne seeding rate on the yields (kg DM/ha) of the lucerne and annual pasture components at Fernihurst from 1986 to 1993. (ns = not significant, * = P<0.05, ** = P<0.01), and rainfall (mm), for 1987-1993.

	Lucerne				Annual pasture				Rainfall
	Lucerne seeding rate (kg/ha)				Lucerne seeding rate (kg/ha)				(mm)
Period	1	3	LSD(P=0.05)		1	3	LSD(P=0.05)		
Summer-autumn 1986-87	407	476	128	ns	57	57			126
Winter-spring 1987	297	358	48	*	1196	1151	275	ns	161
Summer-autumn 1987-88	634	521	143	*	393	422	199	ns	235
Winter-spring 1988	210	292	71	*	2864	3241	1181	ns	262
Summer-autumn 1988-89	741	709	178	ns	1775	2003	545	ns	278
Winter-spring 1989	164	99	164	ns	3678	3836	1685	ns	218
Summer-autumn 1989-90	372	365	293	ns	41	83	42	ns	140
Winter-spring 1990	220	294	130	ns	2466	2310	657	ns	162

Summer-autumn 1990-91	285	305	94	ns	72	79	33	ns	103
Winter-spring 1991	162	187	83	ns	3519	3299	1415	ns	243
Summer-autumn 1991-92	160	146	61	ns	337	364	68	ns	145
Winter-spring 1992	107	147	47	ns	2570	2537	825	ns	337
Summer-autumn 1992-93	331	445	225	ns	104	139	64	ns	211
Autumn pooled	190	185	33	ns	397	450	145	ns	
Winter pooled	71	92	16	*	1355	1374	194	ns	
Spring pooled	122	137	31	ns	1360	1355	269	ns	
Summer pooled	229	239	40	ns	0	0			

The average water-use efficiency of the pasture (lucerne plus annual species) for the April-November growing season was 16 kg DM/mm, after allowing 70 mm for evaporation (2). This is considerably less than the 24 kg/mm monitored by the author on 60 paddocks in north central Victoria from 1993 to 1997. In the experiment reported in this paper, it is likely that annual pasture growth was severely constrained by the low soil phosphorus (3). Also, lucerne growth at the site may have been constrained by a saline (22,000 mg/kg total soluble salts) watertable that fluctuated between 0.6 m depth in winter and 2 m depth in summer. Lucerne roots were observed no deeper than 1.1 m depth in a soil pit dug and left open for 4 years. These data indicate no advantage from seeding lucerne at 3 kg/ha in this dryland environment. This result is similar to one from Condobolin in central west NSW where the cumulative production of lucerne over 20 months was 11.9, 9.1 and 9.6 t/ha for seeding rates of 1, 2 and 4 kg/ha, respectively (L. Roesner personal communication). These results suggest that the roots of lucerne sown at 1 kg/ha can just as effectively explore the soil volume and utilise all of the available soil water as the roots of lucerne sown at higher rates.

References

(1) Genstat 4.2. 2000. Lawes Agricultural Trust, Rothamsted Experimental Station.

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