Benefits of a lucerne pasture-crop rotation in the south-east of WA

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Abstract

This study compared the total soil N and subsequent grain yields and protein contents of wheat crops following either lucerne or annual pasture at two sites in south-east Western Australia. The soil N level following lucerne was generally greater than that following annual pasture. Yields and quality were also improved in crops following lucerne. Wheat crops yielded 0.5 to 2.0 t/ha more grain after lucerne, and grain protein was improved by up to 3%, compared with an annual pasture-wheat rotation. The results indicate that lucerne in a crop rotation may be a profitable and sustainable alternative to annual pastures.

Keywords

crop yields, grain protein, annual pasture

Introduction

A dryland lucerne (*Medicago sativa*) production system was evaluated in the south-eastern wheatbelt of Western Australia as an alternative to annual pasture leys. A previous report from this research (1) has shown that lucerne can contribute to the control of rising water tables by accessing stored soil water below 90 cm. Annual lucerne biomass was double that of annual pastures through effective use of out-of-season rainfall. In the Great Southern region of WA, the benefits to crops following a lucerne pasture included improved yields and grain quality (2,3). This study aimed to validate these results in the Esperance environment.

Methods

The experiments were conducted at Cascade and Wittenoom Hills near Esperance (34?S, 122?E), WA. The four rotation treatments were: 2 years lucerne, crop 2000; 2 years subclover, crop 2000; 3 years lucerne, crop 2001; and 3 years subclover, crop 2001.

At the completion of each pasture phase, the lucerne was removed with 1.5L/ha of Roundup[?] and 1L/ha of 2,4-D amine, while annual pastures were removed with 1L/ha of Roundup[?]. In 2000 the treatments going into crop were sown in May to *Triticum aestivum* cv. Camm with 10 kg P/ha and 20 kg K/ha; no N was applied during the growing season. The crop at Cascade was not harvested in 2000. In 2001, *Triticum aestivum* cv. Westonia was sown in June with 10 kg P/ha and 20kg K/ha; no N was applied. Further details are reported by Lyons and Latta (1).

Results

In January and February 2000, both sites received heavy rainfall (a 1-in-100 year rainfall event uncharacteristic of a generally winter-dominant rainfall zone) but experienced very dry conditions in the following winter and spring. In 2001, slightly above-average summer rainfall, followed by good winter and spring rains, were received (Table 1).

Table 1. Rainfall (mm) received at the two sites for the summer and growing seasons of 2000 and 2001.

	2000		2001	
	Wittenoom Hills	Cascade	Wittenoom Hills	Cascade
December - March	412	355	112	68
April - November	188	162	320	417
Annual average	350	300	350	300

Less soil water was stored below the lucerne than below the annual pasture in this study (1). In the cropping phase, the amounts of soil water available to the wheat crops following lucerne were similar to, or less than, those following annual pasture, at both sites, in both years.

During the pasture phase the legume content of the lucerne pasture was much higher (88%) at both Wittenoom Hills and Cascade, compared with the annual pasture (13% at Wittenoom Hills and 35% at Cascade). The remainder of both pastures was made up of grasses and broadleaf weeds.

In 2000 there was no treatment difference in total soil N following lucerne and annual pasture. In 2001, the total soil N after lucerne was significantly greater for both the first and second crops than after the annual pasture at Wittenoom Hills. This was not the case at Cascade.

Table 2. Total soil NO_3 and NO_4 contents (mg/kg) to 30 cm depth.

	2000		2001			
	Lucerne (1st crop)	Annual (1st crop)	Lucerne (2nd crop)	Annual (2nd crop)	Lucerne (1st crop)	Annual (1st crop)
Wittenoom Hills	8.5	9	15.3	13.4	15.7	11.3
LSD(P=0.05)	ns			2.4		
Cascade	not measured		15.3	11.7	15.3	11.7
LSD(P=0.05)				ns		

Wheat grain yields following lucerne were up to 2.0 t/ha, and grain proteins up to 3%, higher than those following an annual pasture (Table 3).

Table 3. Grain yields and proteins of wheat crops following lucerne and annual pasture.

	2000	2001

Wittenoom Hills	Lucerne (1st crop)	Annual (1st crop)	Lucerne (2nd crop)	Annual (2nd crop)	Lucerne (1st crop)	Annual (1st crop)
Grain yield (t/ha)	1.4	0.9	2.5	1.8	3.4	1.5
LSD(P=0.05)	ns			0.33		
Grain protein (%)	11.9	8.1	10.0	8.4	10.6	8.3
LSD(P=0.05)	2.59			0.70		
Cascade						
Grain yield (t/ha)	not harvested		3.6	3.0	3.7	2.9
LSD(P=0.05)				0.80		
Grain protein (%)	not harvested		10.00	8.80	9.80	8.30
LSD(P=0.05)				0.67		

Conclusion

This work shows that lucerne improved grain yields and protein contents of the following wheat crops, relative to those following an annual pasture. This was probably due to the higher levels of soil N following the lucerne pasture, which in turn reflected it's much higher legume content, compared with the annual pasture. The results indicate that lucerne in a crop rotation may be a profitable and sustainable alternative to annual pastures in the Esperance district.

References

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