LUCERNE IN CROP ROTATIONS

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Abstract

This paper describes effect of lucerne versus annual medic based pasture on soil parameters and wheat production after one year of pasture. Data are presented from two sites in Northern Victoria. Prior to cropping pasture treatments were phosphate versus no phosphate and continuous grass control versus nil grass control before cropping.

Keywords: lucerne, wheat, annual pasture

A lucerne phase in crop rotations potentially benefits grain yield and protein and the profitability of grazing enterprises. Sites were established at Glenloth and Walpeup to appraise the effects of lucerne on soil conditions and subsequent crop growth and yield in Northern Victoria. Cropping following lucerne will conclude in 2000.

Method

Pasture treatments were established at Glenloth $(36.10^{\circ}\text{S}, 143.40^{\circ}\text{ E})$ and at Walpeup $(35.10^{\circ}\text{S}, 142.00^{\circ}\text{E})$ in 1995. Treatments at both sites were a 2 x 2 x 2 factorial combination of ; 1) Pasture type - Lucerne v Annual; 2) Pasture nutrition - Nil P v P (10 kg phosphorus/ha/year as superphosphate in winter); and, 3) Grass control - Nil v Fusilade (500 ml/ha/year in winter). Treatments were laid out in a randomised block design of 3 replications, and were subjected to first and second wheat crops (C1P1 and C2P0) in 1997 following the first crop, C1P0, in 1996.

Crops (CcPp) are referenced by year of cropping (c) following years of pasture (p).

Wheat crops, C2P0 and C1P1, were completed in 1997. Plant measures included tissue %N and biomass (BM) at development stages Z30, anthesis and maturity, spike number at anthesis and maturity, and kernel size, kernel number, grain protein and grain yield at maturity. Soil measures included P, PO₄, Total N, NH₄-N, Organic Carbon and NO₃-N in the surface (0 - 0.1 m) at sowing, and NH₄-N and NO₃-N to 1.3 m at Z30, anthesis and maturity. Available N (Av. N) was calculated as the sum, NO₃-N + NH₄-N.

Results and discussion

Glenloth

Table 1. Effect of pasture type on wheat growth and yield at Glenloth ?

?	?		Crop C2	P0		Crop C1P1					
Parameter ?											
?	?	?	Annual	Lucerne	LSD	Annual	Lucerne	LSD			
?	?	?	?	?	?	?	?	?			

%N	?	Z30	1.67	1.82	ns	1.62	1.96	0.29 *
BM	(g/m ²)	Z30	52	63	ns	68	104	25.0 *
Plant N	(g/m ²)	Z30	0.87	1.15	ns	1.09	2.09	0.66 **
?	?	?	?	?	?	?	?	?
%N	?	anth.	1.04	0.90	ns	1.02	1.25	0.22 *
BM	(g/m ²)	anth.	155	170	ns	178	256	41 **
Ν	(g/m ²)	anth.	1.65	1.53	ns	1.84	3.31	0.88 **
spikes	(/m²)	anth.	185	192	ns	167	185	ns
?	?	?	?	?	?	?	?	?
Yield	(t/ha)	Mat.	0.80	0.81	ns	0.75	0.70	ns

Soil measurements in C1P1, made at sowing following one year of pasture, showed a significant accumulation of available N confined to the surface soil (0 - 0.1 m) following lucerne (P<0.01): there were no significant effects on organic carbon or total N in the soil. The increase in available N attributable to lucerne (16.2 ppm) equated to approx. 25 kg N/ha, and was associated with significant increases in 1) tissue N concentration, 2) wheat biomass, and 3) crop N accumulation at both Z30 and anthesis. However, there were no commensurate effects on spike production and yield, presumably because of overriding seasonal conditions.

Table 2. Effect of pasture type on available N (ppm), total N (%) and organic carbon (%) at Glenloth ?

?		?	Crop C2P0				Crop C1P1			
Parameter Depth (m) ?										
?	?	?	Annual	Lucerne	LSD	Annual	Lucerne	LSD		
?	?	?	?	?	?	?	?	?		
Av. N?	(0 - 0.1)	sow	7.4	7.1	ns	10.4	26.6	10.7 **		

?	(0.1- 0.3)	SOW	4.0	3.4	ns	4.3	4.6	ns
?	(0.3- 0.7)	SOW	2.4	2.3	ns	2.7	2.8	ns
?	(0.7- 1.0)	SOW	1.5	1.5	ns	2.6	2.7	ns
?	(1.0- 1.3)	SOW	1.6	1.3	ns	2.1	2.1	ns
?	?	?	?	?	?	?	?	?
total N?	(0 - 0.1)	SOW	0.078	0.082	ns	0.087	0.094	ns
Org. C?	(0 - 0.1)	SOW	0.97	0.96	ns	0.91	0.94	ns

Walpeup

N concentration of the vegetative plant material at Z30 was much greater at Walpeup than seen at Glenloth, suggesting that N supply at Walpeup was more attuned to constricted growth demands mediated by availability of water. The greater tissue N concentration at Walpeup was achieved at the expense of growth. The slight depression in yield caused by Lucerne in Crop C1P1 at Walpeup (P<0.05) remains unexplained at this stage.

Table 3. Effect of pasture type on wheat growth and yield at Walpeup ?

???	Crop C2P0				Crop C1P1					
Parameter Units										
?										
?	?	?	Annual	Lucerne	LSD	Annual	Lucerne	LSD		
Plant measures	?	?	?	?	?	?	?	?		
?	?	?	?	?	?	?	?	?		
Ν	(%)	Z30	4.05	3.80	ns	4.72	4.45	ns		
BM	(g/m ²)	Z30	17.4	21.0	ns	22.3	25.0	ns		
Plant N?	(g/m ²)	Z30	0.69	0.79	ns	0.90	0.94	ns		

?	?	?	?	?	?	?	?	?
Yield	(t/ha)	Mat.	0.77	0.72	ns	0.64	0.49	0.11*

Table 4. Effect of pasture type on available N (ppm), total N (%) and organic carbon (%) at Walpeup ?

?	?	?	Crop	C2P0	?	Crop	C1P1	?
Parameter	Depth (m)	?	?	?	?	?	?	?
?	?	?	Annual	Lucerne	LSD	Annual	Lucerne	LSD
Av. N ((0 - 0.1)	SOW	7.2	9.1	ns	12.7	12.5	ns
?	(0.1- 0.3)	SOW	4.0	4.2	ns	3.0	4.5	ns
?	(0.3- 0.7)	SOW	1.5	1.5	ns	1.8	1.2	ns
?	(0.7- 1.0)	SOW	3.4	5.2	ns	3.8	3.3	ns
?	(1.0- 1.3)	SOW	6.1	5.7	ns	4.6	5.4	ns
?	?	?	?	?	?	?	?	?
total N?	(0 - 0.1)	SOW	0.048	0.043	ns	0.046	0.043	ns
Org. C	(0 - 0.1)	sow	0.48	0.46	ns	0.57	0.54	ns

Conclusions

Wheat growth benefited following one year of lucerne pasture through increased N but this was not seen in improved yields. Future crops will determine the extent to which lucerne can effect grain growth and yield.