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FEBRUARY 2006 | PRIMEFACT 38 | MASTER — MANAGING ACID SOILS THROUGH EFFICIENT ROTATIONS

MASTER — Economic analysis

Dr John Brennan

Principal Research Scientist, Rural Innovation, Wagga Wagga

Dr Guangdi Li

Senior Research Scientist, Systems Research, Wagga Wagga

Summary

This Primefact reports the results of economic analysis based on 12 years' data from the MASTER experiment. Sensitivity analysis also has been done under various commodity prices.

Data and assumptions

- Crop yields, wool production and stocking rates were based on 12 years' data from the MASTER experiment (see Primefacts 32–35 for details).
- Variable costs for crops and sheep were adopted from appropriate gross margin budgets from NSW Department of Primary Industries.
- An initial application of 3.7 t/ha of lime costs approximately $250/ha, while the re-liming application of 1.8 t/ha after 6 years costs a further $121/ha.
- On-farm commodity prices used in the calculation: greasy wool 550 cents/kg; wheat $150; oats $125; triticale $140; peas $230; lupins $250 and canola $320.
- The livestock production system was based on Merino wethers.

Gross margins

- Total gross margin from limed annual and perennial pastures was over $1000/ha over 12 years undiscounted, and $790 with a real interest (discount) rate of approximately 4% (Table 1).
- Introducing crops into annual pasture grazing systems increased the gross margin significantly with lime application (Table 1). The cost of liming can be repaid in the first year with cropping (Table 2).

Table 1. Total gross margin ($/ha) over 12 years based on the assumptions listed above.

Treatment	Unlimed	Limed	Lime effect	Unlimed	Limed	Lime effect
	Undiscounted			Discounted at 4%		
Annual pastures	$934	$1,026	$92	$753	$789	$36
Perennial pastures	$966	$1,045	$79	$773	$798	$25
Annual pasture-crop rotations	$374	$1,485	$1,111	$299	$1,183	$884
Perennial pasture-crop rotations						
Option 1: PP-PP-PP-Oats-Peas-Wheat	$57	$785	$728	$38	$606	$568
Option 2: PP-PP-PP-Oats-Lupins-Wheat	$518	$1,035	$517	$434	$821	$387
Option 3: PP-PP-PP-Triticale-Lupins-Wheat	$515	$1,147	$632	$432	$922	$490
Option 4: PP-PP-PP-Canola-Lupins-Wheat	$371	$1,231	$860	$303	$997	$694

*PP refers to perennial pastures

Table 2. Cumulative returns ($/ha) with a discount rate of 4% (on-farm wheat price $150 t/ha; greasy wool price 550 cents/kg, and lime with spreading cost $60/t)

Year	AP-	AP+	APC-	APC+	PP-	PP+	PPC-	PPC+	PPC-	PPC+	PPC-	PPC+	PPC-	PPC+
							Option 1		Option 2		Option 3		Option 4	
1	42	-144	35	37	18	-172	79	-83	79	-83	78	-27	6	15
2	120	-32	30	46	101	-56	-61	-118	160	2	159	58	87	100
3	195	75	62	287	181	55	-20	141	201	261	200	317	128	359
4	267	179	92	330	257	162	-45	152	176	272	175	328	103	370
5	336	278	26	553	331	265	-12	221	210	341	209	397	137	439
6	403	373	53	593	402	364	21	287	243	407	241	463	169	505
7	467	380	81	714	470	374	84	314	305	434	303	534	174	609
8	529	468	107	751	535	466	-27	286	369	501	367	601	238	676
9	588	553	132	942	598	554	5	490	402	706	400	806	271	881
10	645	635	156	975	659	638	-15	499	382	714	380	815	251	890
11	700	713	180	1152	717	720	12	554	409	769	406	869	277	944
12	753	789	202	1183	773	798	38	606	434	821	432	922	303	997
Pay back period for lime (years)		11		1		11		3		3		3		1

* PP, perennial pasture; AP, annual pasture; PPC, perennial pasture-crop rotation; APC, annual pasture-crop rotation; + limed; - unlimed.

- Total gross margin from perennial pasture-crop rotations (all options) were lower than annual systems, but high enough to repay the investment in liming within 3 years (Table 2).
- Introducing canola into the system could pay for the cost of lime in the first year of liming. The application of lime increases the productivity of both annual and perennial pastures, by approximately $35–$40/ha/year from the first year. Given the cost of the liming application, it takes several years to pay for the liming.
- The period before a farmer is better off liming than not liming for both perennial and annual pastures is 11 years with a discount rate of 4% with Merino wethers (Table 2).
- More profitable livestock enterprises will have shorter payback periods for liming.
- Higher discount rates mean longer payback periods for the liming.

Sensitivity analysis

- Total gross margin from pasture-crop rotations increased as the wheat price increased (Fig. 1).
- Total gross margins on the limed treatments were higher than the unlimed treatments (Fig. 1).
- With lime, annual pasture-crop rotations had better financial return than perennial pasture-crop rotations, due to the higher cost of perennial pastures in the system.
- The gross margin from perennial and annual pastures was very sensitive to increases of the wool price (Fig. 2).
- Lime can be profitable when the wool price is over 550 cents/kg.
- There is very little difference between annual and perennial pastures in terms of financial return over 12 years with lime, due to the high establishment cost of the perennial pastures.
- However, perennial pastures would have more beneficial effects on the environment than annual pastures, as perennial pastures could improve the sustainability of grazing systems through better use of water and nitrogen in the high rainfall zone (500–800 mm) in south-eastern Australia.

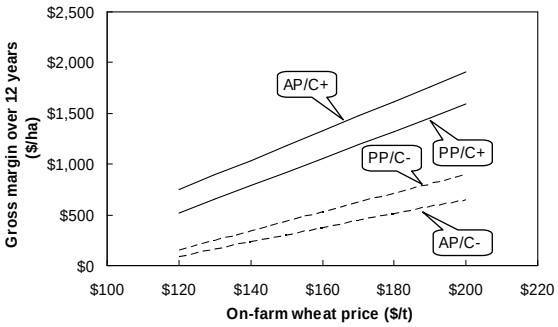

Fig. 1. Total gross margin over 12 years under different wheat prices. AP/C, annual pasture-crop rotations; PP/C, perennial pasture-crop rotations; + limed and – unlimed.

- As the on-farm wheat price increases from $120/t to $180/t, the break-even period for annual pasture-crop rotations changes from 3 years to 1 year, but for perennial pasture-crop rotations remained unchanged (Table 3).
- In perennial pasture-crop rotations, lime can be paid off more quickly with canola in the rotation than other crop options (Table 3).
- When wool price increases from 350 cents/kg to 750 cents/kg, the break-even period changes from more than 12 years to 5 years.
- Higher lime prices mean longer payback periods for the liming as shown in Table 3.

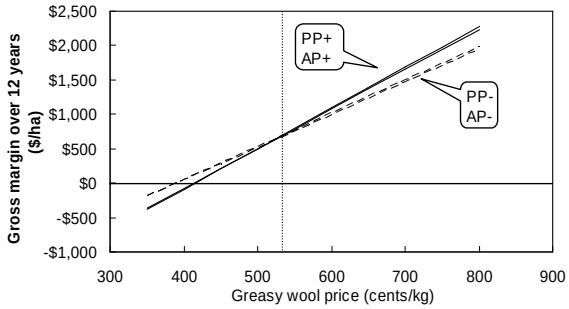

Fig. 2. Total gross margin over 12 years under different wool prices. AP, annual pastures; PP, perennial pastures; + limed and – unlimed.

Table 3. Payback period (years) under different commodity prices for the limed treatments in comparison with the unlimed treatments with a discount rate of 4%

Treatment	AP-	AP+	APC-	APC+	PP-	PP+	PPC-	PPC+	PPC-	PPC+	PPC-	PPC+	PPC-	PPC+
On-farm wheat price ($/t)							Option 1		Option 2		Option 3		Option 4	
$120		11		3		11		3		3		3		3
$150		11		1		11		3		3		3		1
$180		11		1		11		3		3		3		1
Greasy wool price (cents/kg)														
350		>12		1		>12		3		3		3		1
550		11		1		11		3		3		3		1
750		5		1		5		3		3		3		1
Lime and spread ($/t)														
$40		5		1		5		2		3		3		1
$60		11		1		11		3		3		3		1
$80		>12		3		>12		3		4		3		3

* PP, perennial pasture; AP, annual pasture; PPC, perennial pasture-crop rotation; APC, annual pasture-crop rotation; + limed; - unlimed. Options 1–4 for PPC treatments are defined in Table 1.

Acknowledgments

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Further information

- Primefact 31, *MASTER — Experimental design*
- Primefact 32, *MASTER — Soil acidity and lime responses*
- Primefact 33, *MASTER — Crop responses to lime*
- Primefact 34, *MASTER — Pasture responses to lime*
- Primefact 35, *MASTER — Sheep responses to limed pastures*
- Primefact 36, *MASTER — Nitrate leaching and deep drainage on acid soils*
- Primefact 37, *MASTER — Earthworm numbers and microbial carbon concentration*

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