The dollars and sense of liming: The Stantons' story

Second and third generation Island farmers, the Stantons, run a mixed farming enterprise of cropping, sheep and cattle.

Most of the farm land is inherently acidic and soil testing over the last 10 years has shown a steady decline in pH. The Stantons place a high priority on maintaining soil fertility levels, especially in cropping paddocks. In the past, paddocks with low pH were limed prior to being cropped. This means that only some paddocks on each property have been limed, while test results show that nearly all paddocks will need to be limed at some stage.

"The current strategy is to set up a rotation of liming approximately one fifth of the total land base or about 300 ha per year to assist in budgeting. It's envisaged that possibly two full rotations will be needed to get all paddocks up to ideal levels of close to 5.5 pHCaCl. The only deviation to this plan is that paddocks being sown to lupins will not be limed the year the lupins are sown. A budget of $20,000 has been allocated per year to enable this to occur" explained Jenny Stanton.

Primary Industries and Regions SA (PIRSA) staff with assistance from the GRDC and Department of Environment, Water and Natural Resources (DEWNR), have developed three computerised decision support tools to assist landholders and advisers to make better decisions in treating soil acidity. They are:

- Acid$Cost — used to estimate the impact of acidification on production (i.e. the cost of not liming)
- LimeCheque (Lime Sources Cost Comparison) — a tool for calculating lime application rates for acidic soils and comparing the costs of lime from different suppliers
- Maintenance Liming Rate Calculator — a tool for calculating the replacement lime requirement to offset annual acidification and maintain the current pH of the soil.

All the tools can be found at
http://agex.org.au/project/soil-acidity/

Jenny took one cropping paddock "Middle of the Road" as an example to test the calculators.


The Stock Journal

FARM FACTS

Operators:
Richard and Kate Stanton with sons and daughters-in-law Will and Jenny and Michael and Sarah.

Location:
Stokes Bay and on the central plateau (SE of Parndana).

Size:
1,500 arable ha (spread over four farms).

Cropping rotation:
Legume (lupins on sandy soils and beans on ironstone soils), canola, cereal (wheat, barley or oats).

Livestock:
Merinos, 120 cattle, Poll Dorset stud.

Pastures:
Subclovers and annual grasses plus 250 ha kikuyu.

Soil Type:
Ironstone to deep sands. Main soil issues are acidity, non-wetting sandy soils and waterlogging.

Average rainfall:
582 mm.

The Cost of Not Treating Soil Acidity tool (Figure 1) shows that without liming there will be a $1,545 loss in production over the next four years of crop; run that over 10 years and the cost will be almost $3,900!

The Lime Sources Cost Comparison tool (Figure 2) was used to calculate the cost of moving the pH from 4.5 to 5.5 in one lime application. This requires a lime application rate of 4.3 t/ha at a total paddock cost of $2,260. In a nutshell a lime expenditure of approximately $2,300 will save $3,900 in lost production or a 70% return on their money. Due to the potential for inducing manganese deficiencies at this high lime application rate, the Stantons would probably apply two applications of about 2.5 t/ha spread over the 10 years.

Once paddocks have been limed the soil will still acidify. The Maintenance Liming Rate Calculator (Figure 3) calculates how much lime is needed to maintain soil pH levels. It also helps identify he key drivers of acidity. In this example, a key cause of low pH is the acidifying effects of nitrogen inputs, either via the legume component of the hay/cropping program or the application of nitrogenous fertilisers. On average almost 0.5 t of lime is required per year just to balance the acidification.

The Middle of the Road paddock was actually limed at 3t/ha in 2013 and the paddock was sown to beans. In hindsight, the paddock should have been limed the year before to enable the limesand to fully react with the soil.

"We put 100 kg/ha of Calciprill down the tube to give a quick pH lift and boost calcium levels as legumes, especially beans, love calcium just like grasses love nitrogen. The beans yielded well, averaging 2.5 t/ha, compared to an average of 1.8 t/ha pre-liming" Jenny said. "Since then I've noticed a distinct difference to the paddock: feed stays greener for longer once the soil profile starts to dry out, compared to adjacent paddocks that haven't been limed and the actual soil structure has changed, becoming more friable".

The paddock results that really convinced the Stantons of the benefits of liming was when they purchased a piece of L and N Deer's property — *Caledonia*.

"In the year before we purchased the property, Lloyd had limed a paddock before sowing it to barley as barley is quite intolerant of low pH. As we cropped the whole property, we removed all the internal fences and the old barley paddock plus surrounding paddocks were sown to wheat. The old barley paddock stood out with an increase in yield of about 20-30% more than the surrounding paddocks. In 2007 the paddock was tested and the old barley paddock was pHCaC 5.8 and surrounding areas only 4.6. For many years, until the surrounding areas were limed, the yield difference was extremely noticeable. This very visible response to lime made us aware of the real economic benefits of maintaining our soil pH" Will said.

Once the Stantons had seen the results from the tools, they felt a lot more comfortable about their budgeted annual lime expenditure.

"Basically we will recoup that expenditure within a year or two of liming", Jenny said.

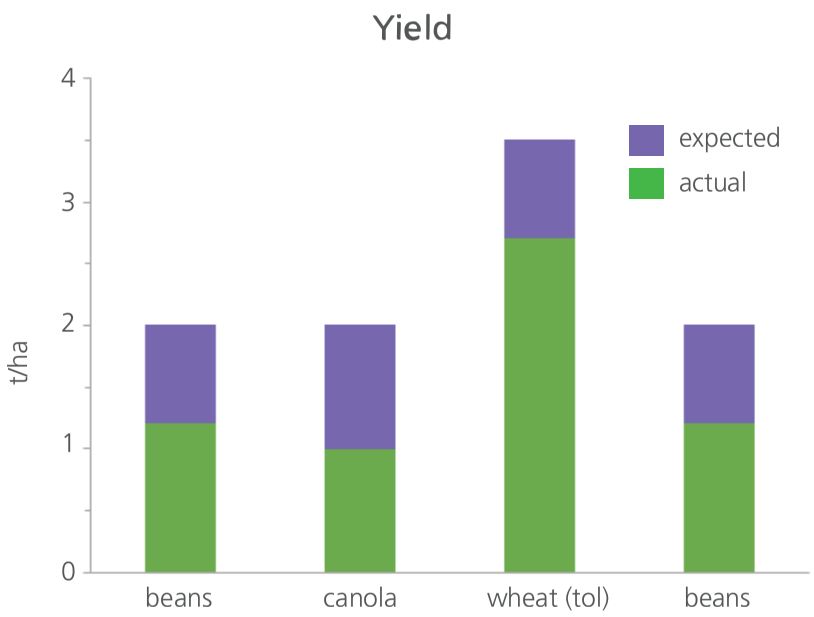
Take Home Messages

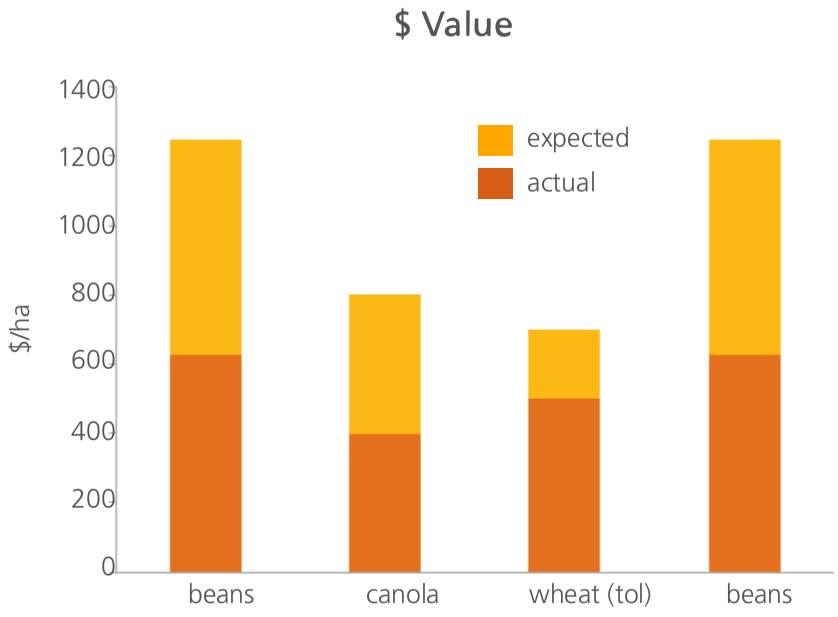
- Use the tools — they are easy to use and real eye opener on what acidity can be costing you.
- Significant yield improvements have been seen when cropped paddocks are limed.
- Make liming a part of your annual program.

Figure 1: The cost of not treating soil acidity

Current pH value ($CaCl_2$)	This year	Next year	Three years time	Four years time
Select pH value	Select crop type	Select crop type	Select crop type	Select crop type
4.5	beans	canola	wheat (tol)	beans
	Enter expected crop yield t/ha	Enter expected crop yield t/ha	Enter expected crop yield t/ha	Enter expected crop yield t/ha
	2	2	3.5	2
	Enter crop pasture value $/ha	Enter crop pasture value $/ha	Enter crop pasture value $/ha	Enter crop pasture value $/ha
	$625	$400	$200	$625
	Estimated loss of production	Estimated loss of production	Estimated loss of production	Estimated loss of production
	0.8 t	1 t	0.7 t	0.8 t
	Estimated value of lost production	Estimated value of lost production	Estimated value of lost production	Estimated value of lost production
	$500	$407	$138	$500

Cumulative loss/ha $1,545





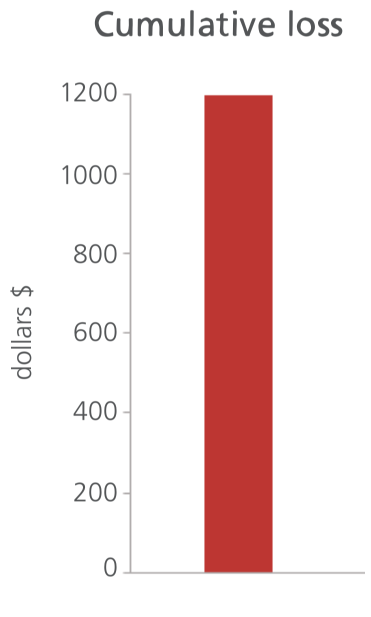


Figure 2: Lime sources cost comparison

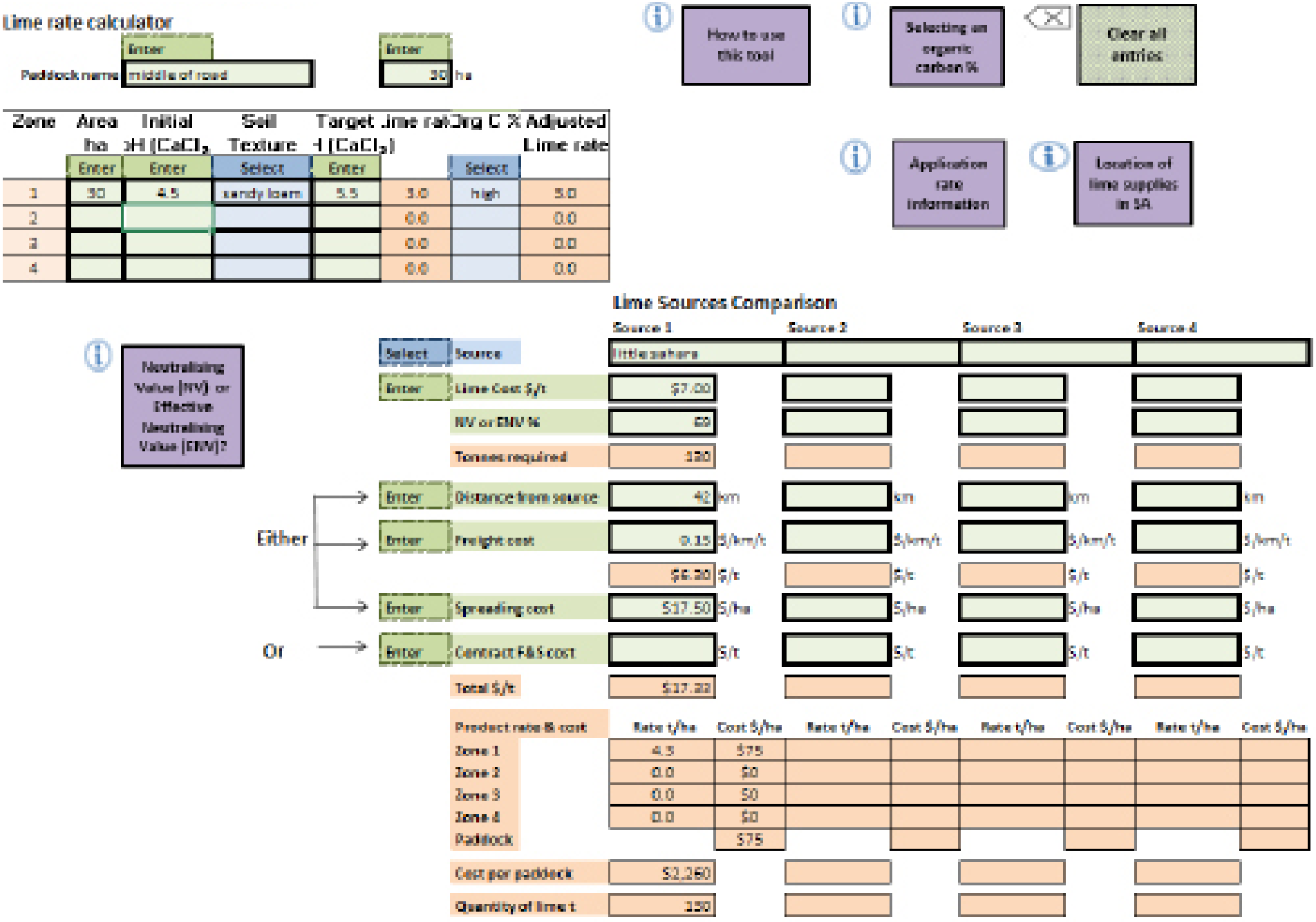


Figure 3: Maintenance liming rate calculator

Paddock name:	Enter	Middle of Road			Top Soil Texture:	Select	Loamy Sand						
	Year		1	2	3	4	5	6	7		
Year (20____)	Enter		2016	2015	2014	2013	2012	2011	2010		
Annual Rainfall	Enter		854	406	555	771	518	629	628		
Saturated Soil	Select		Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Leaching %			85%	85%	85%	85%	85%	85%	85%		
					Product Removal						
Crop Type	Select		Clover hay	Clover hay	Cereal grain	Grain legume	Oilseed	Cereal grain	Oilseed		
Yield (tonnes/ha)	Enter		3.6	6.45	3.3	2.3	1.9	4.5	2.1		
Lime replacement/tonne grain yield (kg/ha)			40	40	9	20	2	9	2		
Lime required due to product removal (kg/ha)			144	258	29.7	46	3.8	40.5	4.2	Total (kg/ha)	526.2
					Legume Fixed Nitrogen						
kg N fixed per tonne legume production			30	30	0	60	0	0	0		
Legume fixed nitrogen (kg/ha)			108	193.5	0	138	0	0	0		
Leaching adjusted lime requirement (kg/ha)/kg N			3.1	3.1	0.0	3.1	0.0	0.0	0.0		
Lime required due to legume fixed N (kg/ha)			330.48	592.11	0	422.28	0	0	0	Total (kg/ha)	1344.9
					Fertilisers Inputs						
Fertiliser 1. (Seeding)											
Fertiliser Type	Select		Single Super	MAP	DAP	MAP	MAP	DAP	MAP		
Rate fertiliser (kg/ha)	Enter		90	40	50	80	84	50	86		
Product N (%)			0.0	10.0	18.0	10.0	10.0	18.0	10.0		
Rate of nitrogen			0	4	9	8	8.6	9	8.6		
Leaching adjusted lime requirement (kg/ha)/kg N			0.0	6.7	4.9	6.7	6.7	4.9	6.7		
Lime required due to seeding fertiliser applications (kg/ha)			0.0	26.6	43.7	53.3	57.3	43.7	57.3	Total (kg/ha)	282.0
Fertiliser 2.											
Fertiliser Type	Select			Urea	Urea		Urea	Urea	Urea		
Rate fertiliser (kg/ha)	Enter			75	200		150	200	150		
Product N (%)			0.0	46.0	46.0	0.0	46.0	46.0	46.0		
Rate of nitrogen			0	34.5	92	0	69	92	69		
Leaching adjusted lime requirement (kg/ha)/kg N			0.0	3.1	3.1	0.0	3.1	3.1	3.1		
Lime required due to in-crop fertiliser applications (kg/ha)			0.0	105.6	281.5	0.0	211.1	281.5	211.1	Total (kg/ha)	1090.9
Annual replacement lime required (kg/ha)			474.5	982.3	355.0	521.6	272.2	365.8	272.6		
Cumulative lime required over "n" years (kg/ha)			474.5	1456.8	1811.8	2333.3	2605.5	2971.3	3243.9		

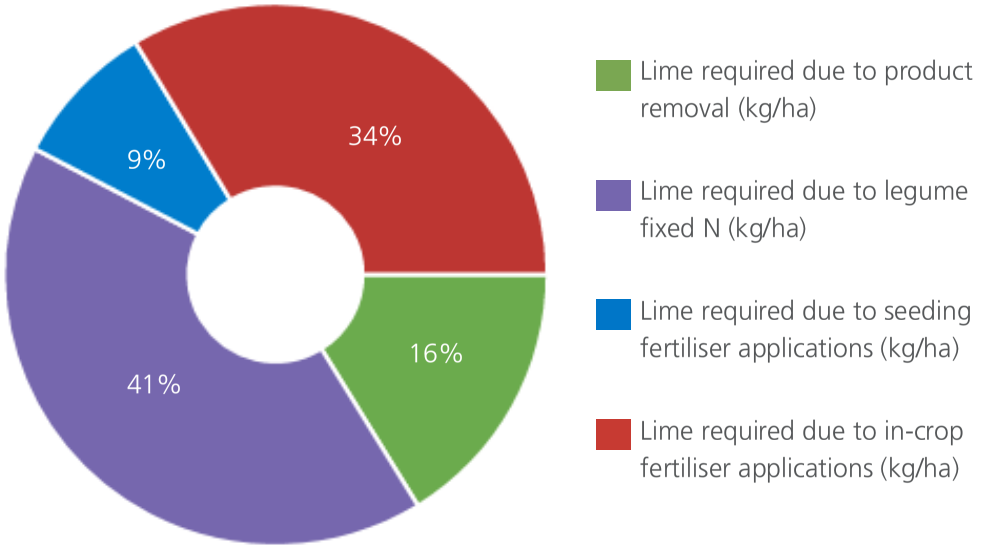
Summary of lime requirement to address annual acidification

Number of years of management data (n)	7

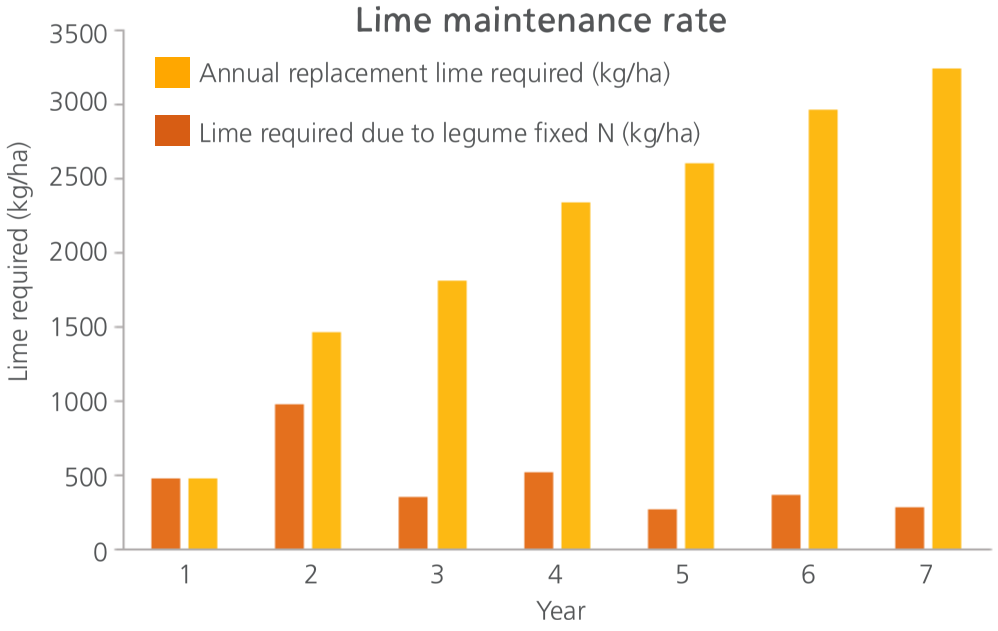
Cumulative replacement required by management practise (kg/ha)

Lime required due to product removal (kg/ha)	526.2
Lime required due to legume fixed N (kg/ha)	1344.9
Lime required due to seeding fertiliser applications (kg/ha)	282
Lime required due to in-crop fertiliser applications (kg/ha)	1090.9
Total cumulative lime required over "n" years (kg/ha)	3243.9
Average annual replacement lime required (kg/ha)	463.4
Recommended lime application rate for 10 year period (t/ha)	4.6

Influence of management practise on total lime required



Lime maintenance rate



FOR MORE INFORMATION

Natural Resources Kangaroo Island
37 Dauncey Street Kingscote SA 5223
P 08 8553 4444 E kinrc@sa.gov.au
www.naturalresources.sa.gov.au/kangarooisland

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