Wise Use of Nitrogen on Hill Country Pastures: Waikiekie

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Context

Monitor group: Waiotira & Maungaturoto

Farmers: David and Erin Gunson

Location: Waikiekie

Rainfall: Averages 1506 mm

Projects

2004 30 kg lamb project

- The rationale was that if lamb weights could be improved the positive spin-off would be huge – marketing early, higher prices, heavier ewes etc.
- Two paddocks of 6.3 ha and 8.3 ha were used as Control and Treatment.
- 90 kg N was applied to the Treatment area in August, September and October. 37 kg N was applied on the Control area in August.

2005 Whole farm project

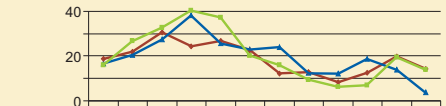
- N application rates were increased to 108 kg N per ha on average, across the whole farm, with dressings from June to November.
- Expected extra production and profit:
  - Grow more pasture - both quantity and quality
  - More opportunities to trade both cattle and sheep
  - Cranked up stock numbers: ~1000 more sheep, ~100 more cattle.

2006 Whole farm project

- N application rates were reduced from 108 kg N to 81 kg N per ha on average, across the whole farm, with dressings from June to November.
- Expected extra production and profit:
  - Grow more pasture - both quantity and quality
  - Hopefully more opportunities to trade both cattle and sheep.

Pasture production

Standardised to ME 10.8



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Plan 05/06	15.9	26.7	32.7	40.2	37.2	20.3	15.9	9.5	6.1	6.8	19.5	14.0
Actual 05/06	16.6	20.6	27.5	38.1	25.7	22.8	23.9	12.6	12.0	18.8	13.8	3.8
Actual 06/07	18.7	21.9	30.4	24.3	26.7	22.6	12.3	12.8	8.4	12.4	19.9	14.4

Annual pasture production:

Plan 05/06	**7483** kg DM/yr
Actual 05/06	**7193**
Actual 06/07	**6848**

The project team wishes to acknowledge the funders:

Results

Sheep

As at 1st July	2003/04	2004/05	2005/06	2006/07	2007/08
Trading ewes			593	672	200
Breeding ewes	1033	1100	1232	1149	1271
Ewe hoggets	334	325	505	655	750
Wether hoggets	76	300	380	210	0
Rams	15	15	30	22	22
Total sheep	**1458**	**1740**	**2740**	**2708**	**2243**

Cattle

As at 1st July	2003/04	2004/05	2005/06	2006/07	2007/08
Breeding cows	144	100	124	108	122
R 2 yr heifers				5	0
R 1 yr heifers	105	74	71	91	45
R 1 yr bulls	297	300	397	309	345
R 2 yr bulls	30	50	67	51	0
Breeding bulls	5	5	6	3	3
Total cattle	**604**	**529**	**665**	**567**	**515**

2006 Mating and lambing

	Mating wts	Scanning %	Dry %	Docking %
Trading ewes	59	163	3.6	121
¼ Finn x Romney MA ewes	62	181	1	148
¼ Finn x Romney 2-tooths	62	181	1	148
Ewe hoggets (312 mated)	41.5	138	12	88

Example lamb weights Spring 2006

Date 06	Weight	Birth rank	SR/ha	Gain/d	
17 Oct	22.0	Mixed	9.0	313	Black Face from Trading Ewes
18 Oct	20.5	Twins	8.0	311	
18 Oct	20.5	Twins	8.0	311	
19 Oct	27.0	Singles	10.0	417	
24 Oct	19.0	Twins	8.0	254	WF lambs
25 Oct	19.5	Twins	8.0	258	
26 Oct	19.5	Twins	8.0	254	
27 Oct	19.5	Twins	8.0	250	
27 Oct	18.0	Twins	8.0	226	
28 Oct	22.0	Twins	8.0	286	
29 Oct	22.0	Singles	10.0	273	

Projected lamb weights

Assume lamb weight 19.9 kg LW on 26th Oct 06

Wean date	Weight	Birth rank	Gain per day	$/kg LW
29 Nov 06	27.3	Mixed	220	$1.75
	28.3	Mixed	250	$1.75
	29.0	Mixed	270	$1.75
15 Dec 06	29.8	Mixed	200	$1.65
	31.3	Mixed	230	$1.65
	32.3	Mixed	250	$1.65

Nitrogen value

Purchase Urea	$500 / tonne
Apply Urea	$126 / tonne
Apply 100 kg N/ha (Urea 46% N) =	$127 / hectare

Response rates	**100 kg N applied**
10 kg DM/unit N	1000 kg DM/ha
15 kg DM/unit N	1500 kg DM/ha
20 kg DM/unit N	2000 kg DM/ha

Returns x Response Rates	**Cost/kg DM**
10 kg DM/unit N	$0.14
15 kg DM/unit N	$0.09
20 kg DM/unit N	$0.07

Profit analysis per ha

	2003/04	2004/05	2005/06	2006/07
Carcase weight	290	279	260	306*
Gross Income	$936	$883	$834	$795*
Expenditure	$408	$407	$451	$437*

*=estimate

Lessons we've learnt

- **You need a 15:1 response to make nitrogen pay at current prices:**
  - **Fodder alternative**
  - **Value of winter feed.**
- **Need to be proactive rather than reactive**
  - **Hit the 'sweet' times**
  - **September 2005**
  - **May 2006.**
- **Need to be VERY careful about when and how you use nitrogen**
  - **How to utilise the extra feed**
  - **What return will you get.**

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Wise Use of Nitrogen on Hill Country Pastures: Bay of Plenty

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Context

Farm: Mackintosh Farm.

Farmer: Tim Mackintosh leases the farm from his parents.

Location: Manawahe, 23 km SW of Whakatane and 38 km NE of Rotorua.

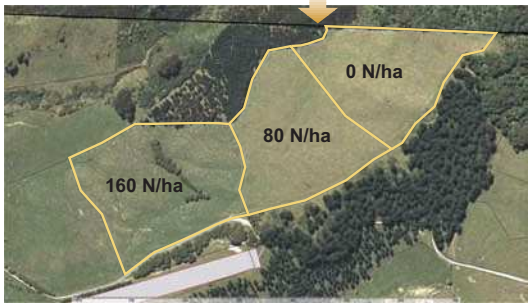
Size: 498 ha, of which 225 ha is effective.

Rainfall: Averages 2,100 mm and is generally well spread.

Stocking policy: Composite breeding ewes (58% of stock units), all mated to a blackface sire producing 150% lambs which are all finished at 16.0-16.5 kg cwt. Replacements are purchased in as two tooths. 50-60 beef breeding cows are run to assist with land development and utilise off farm grazing under trees. Traditionally up to 150 dairy grazers have been run but have now been replaced with trading cattle.

Method

- Three treatments of **0 N/ha** (control), **80 N/ha**, and **160 N/ha** were selected on a site with three hill paddocks of similar size and contour.
- Each paddock represented a treatment:



- The nitrogen was applied in the form of urea, split dressings in April and August.
- All treatments received a similar grazing management with rotating ewes other than the lambing period when they were set stocked. Dairy heifers were used in the autumn if necessary to tidy up pastures.
- Pasture growth for each treatment was determined by modeling the management utilising Stockpol computer software. Growth was also measured via cages (4 per treatment) during the lambing period in addition to pasture composition via dissection from the cuts.
- Animal liveweights were also monitored on and off the treatments during the lambing period only.

The project team wishes to acknowledge the funders:

Results

2005/6

- These results were not expected, especially the negative growth response for the nitrogen treatments with the pasture cuts. It was concluded the cages in the control area were on relatively easier country and in future need to be carefully placed on similar contour/aspect to the treatment paddocks.
- Nitrogen altered the pasture composition by increasing the ryegrass and reducing the clover.
- There was no significant difference in stock performance between treatments.

		0 N/ha	80 N/ha	160 N/ha
Stockpol analysis	Pasture growth kg DM/ha	8,545	8,062	10,223
	Liveweight/ha	548	521	605
	Return/ha	$1,080	$854	$1,097
	Net return/ha	$1,080	$758	$905
	Relative net return/ha		-$322	$176
	N response kg DM/kg N		-6	+16
Pasture cuts	Pasture growth – 90 days	3,695	3,604	3,026
	Return/ha – 12c/kg DM	$355	$346	$290
	Net return/ha	$355	$231	$60
	Relative net return/ha		-$124	-$295
	N response kg DM/kg N		-2	-7
Dissection	Ryegrass %	54	73	72
	Clover %	15	6	8
	Weed %	7	7	3
	Other %	24	24	17

2006/7

- In the second year the results were more in line with expectation, with a positive pasture growth response shown to nitrogen especially with the pasture cuts over the lambing period.
- The 80 N/ha treatment produced a good net return per hectare unlike the 160 N/ha treatment which produced a slight loss.
- As for the first year, nitrogen increased the ryegrass and decreased the clover components of the pasture.

		0 N/ha	80 N/ha	160 N/ha
Stockpol analysis	Pasture growth kg DM/ha	7,316	7,373	7,819
	Liveweight/ha	365	372	504
	Return/ha	$634	$680	$815
	Net return/ha	$634	$584	$623
	Relative net return/ha		-$49	-$11
	N response kg DM/kg N		+4	0
Pasture cuts	Pasture growth – 90 days	1,267	3,330	3,577
	Return/ha – 12c/kg DM	$122	$320	$343
	Net return/ha	$122	$204	$113
	Relative net return/ha		$83	-$9
	N response kg DM/kg N		41	23
Dissection	Ryegrass %	13	52	55
	Clover %	8	4	3
	Weed %	6	9	6
	Other %	73	35	36

Key conclusions

Based on these findings, it is difficult to define a clear conclusion as to the response and financial return from the application of nitrogen over the two years of the trial.

The following conclusions are made concentrating mainly on the second year results which are deemed to be more credible than the first year:

- **Nitrogen effectively produces extra pasture with responses of 23-41 kg DM/kg N applied in the early spring.**
- **These responses translate into a good profit for the 80 N/ha treatment but a loss for the 160 N/ha treatment. This indicates the breakeven nitrogen response is in the vicinity of 25:1.**
- **Nitrogen alters the pasture composition by increasing the ryegrass and reducing the clover components.**

Wise Use of Nitrogen on Hill Country Pastures: Waitomo

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Context

Group: Waitomo

Farmers: Sue and Keith Smart

Farm: 15kms North of Pio Pio, Northern King Country

Effective size: 440ha

Average rainfall: 2300mm (even spread)

Topography: Rolling to steep country – 400m ASL

Stocking policy: *Sheep*
1850 MA ewes (140% sts), 800 hoggets (60% sts)
Beef
450 cattle (70:20:10 steers / bulls / grazing heifers)
Productivity
300 kg c /c / ha, Winter 740 kg LW / ha

Fertility: pH – 5.9, P – 15, K – 6, S –27, Mg – 11
N.B: Very high sulphur levels

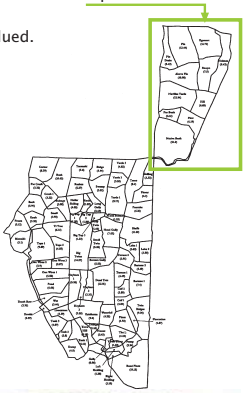
Previous N use: Average 37 kg N / ha / annum

Objective

To increase overall stocking rate on one area of the farm and establish the cost benefit of this compared to the base farming operation.

Method

- An 80 ha block of the farm was monitored as a separate farmlet.
- All stock movements tracked and valued.
- Block ran predominantly R2yr steers due to subdivision and logistics.
- Nitrogen was applied during spring and autumn months to the area to boost pasture growth and free up land for lambing ewes.
- Block was also used to provide "clean" pasture for ewe hoggets during the late summer / autumn.
- Total rates applied:



	kg N / ha	
	Autumn	Spring
2005/06	34	46
2006/07	-	36

Results

Environmental

- Pugging and soil damage became a concern.
- Water quality monitoring at two catchment outpoints in the first two years showed no signs of degradation. Long term monitoring required.
- Nitrogen leaching rates of 20 kg N / ha on base farm compared to 34 kg N / ha on project area (as estimated using OVERSEER model). Related to high cattle stocking rate.
- Ragwort control became an issue due to the predominantly cattle system.

System comparison

- Overall project results averaged:

	Base system	N project	% difference
Average kg LW carried	685	893	+30
Gross kg DM / ha (excl. N)*	8,359	9,419	+12
Total pasture loss**	13%	16%	+23
Gross margin ($ / ha)	406	519	+27
Gross margin (c / kg DM)	8.4	7.9	-6

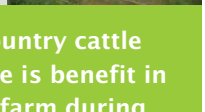
* Potential estimated using Farmax Pro.
** % of gross growth lost due to decay, and suboptimal grazing.

- The system overall grew significantly more grass than the base farming operation. This is credited to the higher pasture covers carried through most of the year (on average 300 – 500 kg DM / ha above the base farm).
- Overall return / ha higher but lower / kg DM consumed.

- With very high sulphur (S) levels on farm the overall benefit of S is limited. Therefore applying N as DAP as opposed to Urea significantly lowered the overall cost. This also shows a significant difference in the break even response rate:

	At 36 kg N/ha	
	DAP	Urea
Applied cost (c/kg N)	$0.68	$1.40
Breakeven response rate (kg DM / kg N)*	7.1	14.7

9.5c/kg DM (excluding Nitrogen cost).



Key conclusions

- **Stand alone applications of nitrogen to hill country cattle finishing systems were marginal: however, there is benefit in reducing stocking rate on the remainder of the farm during lambing.**
- **Window for an economic pasture response rate in spring at this altitude is narrow and the timing of nitrogen application in spring is crucial.**
- **Heavy cattle on light ash soils is not a sustainable farming practice.**
- **Need to factor in total nutrients required into costings to maximise the overall return i.e. DAP vs Urea.**
- **Sheep breeding systems hold the key to a positive economic outcome on steep country.**

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The project team wishes to acknowledge the funders:

Wise Use of Nitrogen on Hill Country Pastures: Manawatu

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Manawatu *Kimbolton*

Farmers: Ian & Annie Harvey

Farm details: 750 ha hill country total
27% flats, 30% medium hill, 43% steep hill

Climate: 1300 mm rain annually, prone to dry summers

Farm system: Breeding ewes & R 2 Yr bulls on hills
Cattle & lamb finishing on flat & easy land

Purpose: **To investigate the boundaries for stocking rates and stock performance using nitrogen-boosted pasture for extra feed late winter**

Method: Two paddocks used for each treatment initially
Measurements from pre-lamb to weaning

Application rates:

		Nitrogen applied (kg N/ha)				
	Ewes/ha	Jul	Aug	Sept	Oct	Total
2003	11		50	0	0	50
	13		50	50	0	100
	15		80	80	30	190
2004	13	60	50	0		110
	15	80	80	30		190
	17	110	100	50		260

Results

Pasture response range: ***2003*** 16:1 to 27:1 kg DM per kg N applied
2004 7:1 to 10:1 kg DM per kg N applied

Animal production:

Ewes/ha	Weight of lamb weaned (kg LW/ha)	
	2003	***2004***
11	504	
13	579	692
15	667	756
17		848

Economic comparison:

Advantage over base (GM $/ha) (based on un-replicated trial data)

Base: Ewes/ha	***2003*** 11 ewes/ha	***2004*** 13 ewes/ha
11	-	-
13	$107/ha	-
15	$75/ha	$0/ha
17	-	$67/ha

Environmental impact (using "Overseer" projections):

	NZ av.	Farm Nil N	Farm 30 kg N/ha	Farm 60 kg N/ha
Nitrogen inputs				
Clover N (kg N/ha)		96	86	76
Fertiliser N (kg N/ha)		0	30	60
Environmental losses				
Leaching (kg N/ha)	5-20	12	13	14
Direct winter loss (kg N/ha)		0	0	1
N_20 emissions (kg N/ha)		1.4	1.8	2.2
Indices				
Immobilisation (kg N/ha)		55	67	78
Farm N Surplus (kg N/ha)	30-80	78	98	118
N conversion efficiency (%)	15-20%	19%	16%	13%

Conclusions

- **The first two extra ewes/ha, using in the order of 100 kg N/ha appears to be the most profitable and most reliable gain for the 2003-04 and 2004-05 seasons.**
- **Using extra nitrogen to increase stocking to high rates brings more risk and more stress.**
- **Responses to nitrogen may be marginal or negative if the benefits are not captured or if the cost-price balance is less favourable than the figures used in these analyses.**
- **Using nitrogen on part of the farm (e.g. the "twinning" country) appears to be a good strategy. (However, this may not hold true in the future, and a financial analysis should be undertaken on a case by case basis.)**
- **Based on "Overseer" results, the rate of nitrogen leaching, the direct winter nitrogen loss and nitrate concentration in drainage water are all within acceptable levels for inputs of 30 and 60 kg N/ha.**

The project team wishes to acknowledge the funders:

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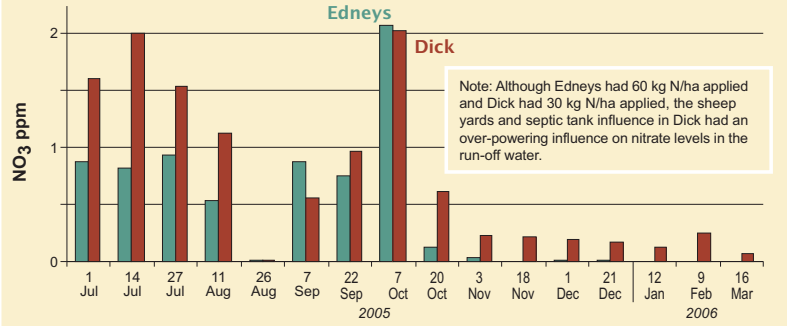
Water monitoring *2005-2006*

(information supplied by Malcolm Todd, Horizons Regional Council)

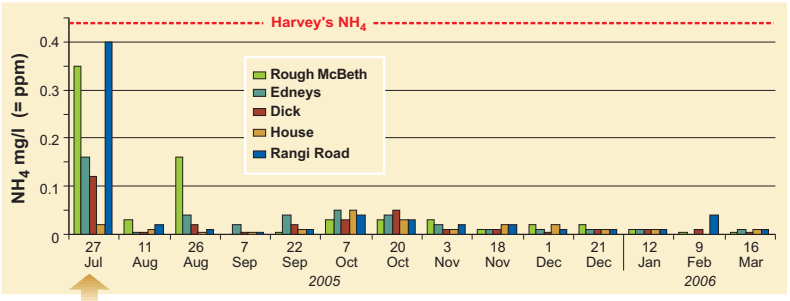
Paddock treatments for the water quality investigation

Paddock name	Rough McBeth	Edneys	Dick	House (Sub-catchment of Dick)	Rangi Road
Fertiliser treatment	30 kg N/ha as fine particle urea in suspension	60 kg N/ha as urea	30 kg N/ha as urea	Yards & house septic tank	30 kg N/ha as urea
Stocking rate	13	15	13	na	13
Area (ha)	56	37	37	5	38

Nitrate run-off measured



Ammonia concentrations in flowing water



- N applied 27 July.
- Ammonia concentration spikes after fertiliser application and heavy stocking intensities (during rotation).
- Note: The total nitrogen load from the stock and yards by itself was roughly equal to that of the other paddocks. Also, single events such as heavy rain or mob-stocking can greatly overshadow the impact of relatively small differences in fertiliser inputs. For accurate measurements, continuous water flow measurements, robust sampling protocol and a long time period are required.

Conclusions

- **Nutrient runoff from the farm catchments measured appears to be lower than the average sheep/beef farm.**

- Farm N output was around 2 to 6 kg N/ha (below the average of 10 kg N/ha for New Zealand sheep and beef cattle farms)**.**

- Farm P runoff was about 0.2 kg/ha, which is low by Overseer standards.

- **But, values are nudging the water quality guidelines for preventing algal blooms, especially for total phosphate and total nitrate.**

Community group discussion on N trial

Medium stocking rate area

High stocking rate area

Community group discussion on nutrient monitoring

Wise Use of Nitrogen on Hill Country Pastures: Taranaki Taumarunui

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	Taranaki *Mangamingi*	Taumarunui *Ohura*
Farmers:	Tim & Sue Hardwick-Smith	Scott & Robyn Gower
Farm details:	750 ha hill country total 27% flats, 30% med. hill, 43% steep hill	730 ha hill country total 24% flats, 51% med. hill, 25% steep hill
Climate:	1400 mm rain/year, variable summers	2200 mm rain/year, summer safe
Farm system:	Breeding ewes and cows with cattle and lamb finishing on flat & easy land	Breeding ewes and cows with cattle finishing on flat land

Purpose: **To fill a hole in the feed supply late winter to enable higher stocking rates to be wintered and hence utilise spring feed, without impacting stock performance**

Method: One paddock only for each treatment. Measurements from pre-lamb to weaning

Application rates:

Spring 2005 (single application)

24.7 ha	0.0 kg N/ha
29.5 ha	18.5
24.3 ha	37.0

Spring 2005 (single application)

14.5 ha	0 kg N/ha
19.5 ha	30
14.0 ha	60

Results

Pasture response range:

15:1 to 17:1 kg DM per kg N applied

13:1 to 18:1 kg DM per kg N applied

The nitrogen response was in the expected range.
There were no paddocks with a response that was unexpectedly high or low.

Animal production:

No weaning weight data

Rate of N/ha	Weight of lamb weaned (kg LW/ha)
0	322
30	345
60	455

Animal response was variable in some situations, depending on initial stocking rate relative to pasture covers and the base pasture growth rate.

Economic comparison:

2005	N application rate (kg N/ha)	Advantage over Nil N (GM $/ha)
	18.5	+$13/ha
	37.0	+$27/ha

2005	N application rate (kg N/ha)	Advantage over Nil N (GM $/ha)
	30	+$20/ha
	60	+$5/ha

The economic response was positive but not huge. Hence the need to investigate on a case by case basis.

Environmental impact (using "Overseer" projections):

	Farm Nil N	Farm 18 kg N/ha	Farm 36 kg N/ha
Nitrogen inputs			
Clover N (kg N/ha)	86	80	74
Fertiliser N (kg N/ha)	0	18	36
Environmental losses			
Leaching (kg N/ha)	14	15	16
Direct winter loss (kg N/ha)	0	0	1
N_2O emissions (kg N/ha)	16	1.9	2.1
Indices			
Immobilisation (kg N/ha)	45	52	60
Farm N Surplus (kg N/ha)	72	84	97
N conversion efficiency (%)	16%	14%	12%

	Farm Nil N	Hills 32 flats 129	Hills 64 flats 129
Nitrogen inputs			
Clover N (kg N/ha)	72	53	44
Fertiliser N (kg N/ha)	0	55	80
Environmental losses			
Leaching (kg N/ha)	17	20	21
Direct winter loss (kg N/ha)	0	1	1
N_2O emissions (kg N/ha)	1.6	2.4	2.7
Indices			
Immobilisation (kg N/ha)	34	58	68
Farm N Surplus (kg N/ha)	62	98	114
N conversion efficiency (%)	14%	9%	8%

Medium hills used for N trial on the Ohura farm

Taranaki farm, 18 kg/ha paddock

Ohura community group discussion

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The project team wishes to acknowledge the funders:

Key conclusions: Manawatu, Taranaki and Taumarunui

- Nitrogen is often used to cost-effectively fill a feed gap in the August-September period to help maintain stocking rates and stock performance. Using nitrogen on part of the farm (e.g. the "twinning" country) appears to be a good strategy. (However, a financial analysis should be undertaken on a case by case basis).
- Responses to nitrogen may be marginal or negative if the benefits are not captured or if the cost-price balance is less favourable than the figures used in these analyses.
- If extra nitrogen is used to increase stocking rates through winter and spring, there is more risk and more stress. In the 2003-04 and 2004-05 seasons there was a profitable gain using 100 kg N/ha to lift stocking rate by two extra ewes/ha.
- To achieve high stocking rates successfully, a high level of technical planning and monitoring is required. The nitrogen inputs were calculated for the predicted feed demands and pasture growth rates for each particular situation. While information is available on average pasture growth rates, nature will from time-to-time test the most experienced operators. The strategy outlined here is not for faint-hearted nor ill-prepared operators.
- For high stocking rates, farmers and staff should be skilled and experienced in feed budgeting, and have an active support network that includes other farmers, consultants and veterinarians.
- Before starting a high stocking rate system based on nitrogen use, contingency plans must be in place, outlining the actions to be taken in the case of too little or too much feed and the occurrence of animal health issues.
- This strategy is only appropriate where:
  1) the farm is well developed (at least 60-100 paddocks, Olsen P levels 15-20 on hill soils, adequate stock water, good access and soils that will cope with a higher stocking rate)
  and
  2) there is already good levels of stock performance (140%+ lambing, weaning weights average 26-28 kg (mid December), and sheep losses are less than 3% of stock numbers wintered)
  and
  3) there is a high level of stockmanship and feed budgeting skill in the management team.

Taranaki community group discussion

Wise Use of Nitrogen on Hill Country Pastures: Hawkes Bay

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Context

Location of farms: Waipukurau

Stocking policy: Set stocking mid winter (July) vs. rotational grazing / late set stocking (late Aug - immediately pre lamb) with and without 30 kg N/ha.

Objectives

- **To test if there is a different level of N response with different grazing regimes.**
- **Observe the impact of grazing management and nitrogen application on feed covers, feed quality and ultimately lamb & ewe liveweight gain to weaning.**
- **To observe if there is any variation in ewe lambing deaths between lambing blocks receiving nitrogen compared to non-nitrogen fertilised blocks.**

Treatments

- Three farms.
- Two blocks per treatment per farm (i.e. total of 6 blocks per treatment).

1. **Early July set stock, 8 ewes/ha, nil N.**
2. **Early July set stock, 9 ewes/ha, 30 kg N/ha.**
3. **Rotate to lambing, 8 ewes/ha nil N.**
4. **Rotate to lambing, 9 ewes/ha, 30 kg N/ha.**

- Set stock early July 1450 kg DM/ha or average of farm at that time. Target was to have1000-1100 kg DM/ha at lambing.
- Target cover at lambing for rotational grazed ewes 1250-1350 kg DM/ha.
- Apply urea at 65 kg/ha (30kg N/ha) just prior to lambing to both rotated and set stocked blocks with higher (9.0 ewes/ha) stocking rate. Nitrogen applied 16 August 2007.
- Additional feed if any to be utilized with cattle and recorded.
- Was anticipated that early set stocked would lower feed covers at start of lambing and put added pressure on the feed covers through lambing and thereby generate differences in responses:
  - Pasture response to nitrogen
  - Lamb survival
  - Lamb live weight gain through lactation
  - Ewe deaths
  - Ewe body weights at weaning.

Measured

- Ewe weights at set stocking early July.
- Ewe weights at set stocking/lambing for non rotated ewes.
- Number of lambs at docking.
- Number and weight of lambs at weaning.
- Ewe weights at weaning.
- Ewe deaths – number and cause.
- Record number of bearings and cast ewes.
- Pasture covers fortnightly over the trial period.

The project team wishes to acknowledge the funders:

Data summary

Nitrogen vs No Nitrogen

		Nitrogen	No Nitrogen
Pasture covers at lambing			
	Farm 1	1212	1200
	Farm 2	925	975
	Farm 3	1050	1050
		1062	**1075**
Ewe weight change SS - weaning			
	Farm 1	-2.7	-1.0
	Farm 2	2.6	4.5
	Farm 3	6.0	3.0
		1.9	**2.1**
Ewe deaths			
	Farm 1	1.4%	2.3%
	Farm 2	0.3%	1.3%
	Farm 3	1.3%	2.0%
		1.0%	**1.9%**
Weaning %			
	Farm 1	184%	172%
	Farm 2	185%	186%
	Farm 3	176%	170%
		182%	**176%**
Lamb lactation growth rate			
	Farm 1	272	283
	Farm 2	254	259
	Farm 3	302	292
		272	**281**
Weight lamb weaned/ha			
	Farm 1	501	448
	Farm 2	440	413
	Farm 3	500	420
		484	**434**

Set Stock vs Late Set Stock

		Early SS	Late SS
Pasture covers at lambing			
	Farm 1	1150	1275
	Farm 2	875	1025
	Farm 3	1050	1050
		1025	**1117**
Ewe weight change SS - weaning			
	Farm 1	-1.2	-2.6
	Farm 2	1.5	5.6
	Farm 3	5.5	4
		1.9	**2.2**
Ewe deaths			
	Farm 1	1.6%	2.1%
	Farm 2	0%	1.5%
	Farm 3	2.0%	1.6%
		1.2%	**1.6%**
Weaning %			
	Farm 1	179%	178%
	Farm 2	193%	178%
	Farm 3	179%	167%
		185%	**175%**
Lamb lactation growth rate			
	Farm 1	275	281
	Farm 2	244	270
	Farm 3	300	295
		276	**278**
Weight lamb weaned/ha			
	Farm 1	467	483
	Farm 2	416	437
	Farm 3	470	449
		455	**462**

Observations

- Season was very unfavorable in terms of pasture production compared to normal. Very wet late winter-early spring then very dry late spring. In all a very tough season when at no time was there considered to be a satisfactory level of feed for lambing ewes.
- Set stocking early reduced pasture covers at start of lambing to 1000-1100 kg DM/ha compared to 1100-1200 kg DM/ha for late set stocked.
- For individual paddocks observed that set stocking early on low covers (approx. 1100 kg DM/ha) resulted in covers falling to 800-900 kg DM/ha, and these blocks then failed to feed ewes well enough through lactation to maintain ewe weight gain similar to those set stocked either early or late on 1250+ kg DM/ha.
- Lamb LWG through lactation was similar on all blocks i.e. early set stocked and late set stocked with & without nitrogen. This suggests that the breeding ewe has the capability to maintain lamb liveweight gain at the expense of bodyweight even when at below optimum levels of nutrition because of poor season and low responses to fertiliser N.
- On one farm early set stocking had 26 g/day lower lamb LWG, on blocks where early set stocking occurred on low covers (1100 kg DM/ha) that fell to 800-900 kg DM/ha at lambing.
- Feed quality remained high throughout the lambing to weaning period on all blocks. This resulted in lamb liveweight gains of 277 g/day and final weaning weights some 3 kg heavier than last season; this was achieved on lower feed covers. This suggests that well controlled pasture covers (1300 -1600 kg DM/ha) will provide much better feed quality than higher covers. Higher clover content on lower pasture covers was also evident.
- Nitrogen applied at 30 kg N/ha produced only just enough additional pasture growth to feed the additional one lambing ewe/ha carried. This suggests a nitrogen response in the order of 10 kg DM/kg N applied.
- Ewe deaths were low, less than 2% over all farms. On N blocks, ewe deaths were 1% compared to 1.9% on No N blocks. Ewe deaths on Early Set Stock blocks were 1.2% compared to 1.6% on Late Set Stock blocks.
- Lambing % (number lambs weaned to ewes set stocked) showed a positive response to both early set stocking (+10%) and to nitrogen (+8%). This was consistent on all farms and treatments.
- Early set stocking had no effect on ewe weight at weaning compared to late set stocking.
- Stocking policy appeared to have no impact on the level of nitrogen response.
- There was no difference in weight of ewes at weaning when comparing the nitrogen block ewes to the non-nitrogen block ewes. Remember the stocking rate was 1 ewe/ha higher for the nitrogen blocks.
- The impact of stocking rate (plus 1 lambing ewe/ha) for nitrogen, similar weaning weight per ha and improved lambing % resulted in:
  - No difference in lamb weight weaned/ha for early vs. late set stocked.
  - Gain of 50 kg lamb weight weaned per hectare from nitrogen vs. no nitrogen.
  - At $1.50/kg store lamb value this equates to $75/ha for cost of $45/ha for the nitrogen applied.

Wise Use of Nitrogen on Hill Country Pastures: Dannevirke

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Context

Farmers: Stuart and Jude Ellingham.

Property description and location: "Bywell" is a 612 ha property (564 effective) of which 95 ha is rolling, and the remainder is medium/steep. It is best described as an intensive breeding and finishing unit. Bywell is located in the Whetukura district approximately 35 km north east of Dannevirke. In addition, a further 50 ha property located at Waipukarau is utilised to finish lambs and grow out ewe hoggets for mating and lambing.

Management: Policy decisions are made by Stuart and Jude.

Staff: Two full time labour units.

Climate: Bywell receives an average rainfall of 1400 mm/yr, and is at an altitude of 360 m to 652 m a.s.l. Pasture growth is strongest in November-January and lowest in July and August (soil temp. 5˚C).

Soil fertility: 14 - 20 Olsen P
3 - 7 Sulphate sulphur
6 - 7 Potassium
pH 5.9
Historically 75% DAP and 25% Urea applied (40 N, 20P and 20 S/ha)

Development: Subdivided into 85 paddocks. 95ha of improved pasture (last 1 - 5 years), rest native pastures.

Sheep policy

- A high performance ewe flock (Highlander's) is maintained on the property. The majority of ewe hoggets are wintered on the Waipukurau property.
- Lambing performance has fluctuated between 135 - 150% over the past 4 years in the MA Ewes and 60 - 80% in the ewe hoggets.
- Surplus lambs are sold either prime or store.

Beef policy

- The beef system is designed to be profitable, simple, flexible, to fit around maximising returns from the sheep system.
- Purchase yearling bulls in October/November at 200 kg - 250 kg liveweight and kill by the end of December the following year at 330 kg carcass weight.
- Bull cells also used to finish lambs post weaning from early January through till April.

Project objectives

To demonstrate the wise use of fertiliser nitrogen under commercial conditions in a range of hill country farming systems, in order to encourage practices that enhance long term farm profitability whilst minimising potential detrimental environmental effects.

Community group aims

- To learn more about the economics of using N in the Ellingham's farming system.
- To become more knowledgeable of the effect N has on pasture, soil, water systems, feed and stock management, and profit.
- To better understand N response rates.
- Why use P when we have N?

The project team wishes to acknowledge the funders:

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Methods

- Project commenced early 2005.
- Take a whole farm approach to nitrogen use.
- Monitor effects of 80 kg/ha over whole farm for full year, applied in May and August and compare to plan and production levels attained in the preceding 2 years.
- Monitor pasture growth rates, livestock weight and condition score, pasture composition, loss of nutrients from the soil.
- Increase ewe numbers and graze hoggets off. Finish the majority of male lambs.
- Change from original beef cow and weaner bull finishing policy, to yearling to 2½ yr bull policy only.
- Replace beef cows with ewes.

Results to date

- Focus placed on developing and intensifying 100 ha for cattle finishing. Stocking rate lifted from 2.0 to 2.8 bulls/ha.
- Ewe numbers increased by 1300.
- Replacement in lamb ewe hoggets grazed off Bywell.
- Phased out of old bull policy into new.
- 40 kg N/ha applied May and 30 kg N/ha applied August in 2005. Only 40 kg N/ha applied to 45 ha in 2006.
- 8.6% of total annual feed supply is from nitrogen in 2005.
- Spring nitrogen response:
  - 1 August application @33 kg N/ha
  - N response 27 kg DM/kg N.
- Autumn nitrogen response:
  - 16 April application of N @ 36 kg N/ha
  - N response rate 23 kg DM/kg N
  - Duration of response for both approx. 60 days.

			N leached (kg N/ha)	Concentration of N in drainage water (ppm)	P requirements to maintain Olsen P status at current level
Old low N	Easy	Middle block	10	2	22
	Steep	Rest of farm	7	2	21
Old high N	Easy	Middle block	12	3	22
	Steep	Rest of farm	9	2	21
New high N	Easy	Middle block	11	3	23
	Steep	Rest of farm	8	2	21

- N leached is within the range of an average NZ S&B farm (av. = 5-20 kg N/ha/yr). Old farm system with 40 kg N/ha, predicted N leachate was 8.5 kg N/ha. Old farm system with 80 kg N/ha, N leached predicted at 10.5 kg N/ha. New farm system (more ewes + fewer, older cattle) with 80 kg N/ha N leacheate predicted to be 9.5 kg N/ha.
- The steep parts of the farm leaches 3 kg N/ha less than easy country due to both lower water infiltration and thus lower drainage and to higher sheep compared to cattle numbers on steep compared to easy country. Cattle urine patches contribute more to leaching than do sheep urine patches.
- The concentration in drainage water is below the recommended level maximum for safe drinking water of 11.3 ppm.

Nitrogen decision making - conclusions

- Nitrogen can be built into the farm system:
  - to increase the number of stock carried on the farm
  - to offset deficits in feed supply and improve per head performance of existing stock.
- In the 1st year of the project (2005) on the Ellingham property 80 kg N/ha split equally over April and August was applied to the whole farm and stocking rate was increased to use the projected pasture response to N.
- In 2006 the cost of N was higher and the projected lamb price was lower, so the economics of using N to increase stocking rate had to be re-evaluated.
- On the Ellingham property the sheep numbers rise and fall according to the economics of N while bull numbers remain fixed by the constraints of how many bulls are needed to stock the bull finishing unit.
- The conclusion of the analysis conducted in autumn of 2006 was that given the price of N of $1.40/kg N applied and the projected new season average lamb price of $3.70 (lower than last season), using autumn N to boost stocking rate could not be justified economically. The spring N still appeared economic but would only be applied if covers were low. In August the covers were 150 kg DM/ha above target and so a decision was made not to put on N. Spring N was only applied at 40 kg N/ha to 45 ha, on bull cells, where economics of N use were more favourable.

Environmental issues

N losses in leaching/runoff

Rate of N (kg/ha/yr)		kg/ha/yr N fixation	N leaching loss	N gaseous loss	N immobilised
Old low N	20	99	15	17	72
New high N	75	82	16	28	95

- These N losses are at the higher end of the average range of 5-20 kg N/ha/yr for New Zealand sheep and beef farms.

P losses in runoff

- P losses in runoff were very low (0.5 to 0.6 kg P/ha/yr) for the easy and steep blocks.
- The P losses were low because Olsen P levels (11 to 21) are appropriate for the level of pasture production. The higher the soil Olsen P the greater the risk of soil clay particles, enriched with fertiliser P, running off into surface water bodies.
- DAP/elemental S was between May and September, where there is a greater risk of intense rainfall events that can wash off a greater amount of recently applied soluble fertiliser P. A small improvement in P loss could be made by applying this fertiliser outside of these months – however, this probably compromises the N strategy.

Wise Use of Nitrogen on Hill Country Pastures: Wairarapa

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Context

Farm location: **Castlepoint Station** located at Castlepoint on Wairarapa coast, 64 km from Masterton.

Size: 2952 ha, of which 2794 ha effective.

Climate: Wind flow predominately from NW.
Average rainfall 970 mm – traditionally summer dry.

Aspect: 40% northerly, 40% southerly, 10% flat, 10% east/west.
Trial concentrated on 68.3 ha of north facing hill country.

Pasture growth: Historic pasture growth measurements of this N facing country have found that it significantly under-performs throughout the year compared to the southerly facing and flat country.

Traditionally a feed deficit occurs from end of August through to October on Castlepoint Station.

With high wind run through Oct/Nov limiting pasture growth, high value is put on providing adequate feed through early spring to maintain ewe lactation and build ewe condition before it dries out.

Methods

- Year 1 treatments replicated in Year 2:

Control	60 kg N/ha	120 kg N/ha
6 sheep/ha	6.6 sheep/ha	8.3 sheep/ha

- Initial cattle stocking rates in Year 1 ranged from 0.5/ha to 2.2/ha. In Year 2 cattle were not added until 1st week Oct at 0.3/ha to 1.9/ha.
- Trial ran from 8th Aug 05 (set stocking) through to 2nd Dec 05 (weaning) in Year 1 & 14th Aug 06 to 1st Dec 06 this year.
- Urea applied in single application 2 weeks prior to set stocking due to:
  - Cost in applying differential applications of urea over small areas with helicopter.
  - Feed pinch occurs from end Aug through to Oct (30-60 days). After this soil moisture likely to become limiting factor to growth.
  - Any urea application after this may impact on pasture quality in the late spring.
- Trial consists of three set stocking rates of twinning ewes set stocked across the three rates of nitrogen. The stocking rates are topped up with cattle. These stocking rates are replicated.
- Wet dry ewes are replaced with ewes with lambs at foot at docking.
- R1 yr steers/heifers added or removed throughout trial to try to maintain pasture covers in the 1300-1400 kg DM/ha range.

Data collected

- MA ewe liveweight at set stocking, docking, drenching & weaning.
- Ewe LWG from set stocking to weaning.
- Lamb LWG from birth to weaning – 5kg birth wt (assumed), weighed at docking, drenching & weaning.
- Docking & weaning %.
- Steer LWG, numbers set stocked & time on trial block (cattle grazing days).
- Pasture Plan measurements on monthly basis.
- Pasture cover measurements taken weekly during trial period and monthly the rest of the year.
- Met Station data collection: soil moisture, rainfall, soil & air temperature, wind run & direction & solar radiation (pyronometer).
- Mini lysimeter leachate collection & testing.
- Stream water sampling & testing.

The project team wishes to acknowledge the funders:

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Objectives

- Improve lamb survival and weaning weight by improving feed supply to ewes over early lactation through strategic use of N.
- Improve feed quality in late spring through improved pasture utilisation and control.
- Test wider application of strategic input of N – management implications, risk profile of increasing stocking rate on northerly country.
- Formulate most feasible stocking rate/nitrogen scenario on a whole farm basis for Castlepoint Station.
- Gather objective water quality data to help inform the debate around the environmental effects of the use of N.
- Investigate the accuracy/reliability of water quality testing and modeling for nitrogen leaching on trial blocks.

Results

Production

	2005			2006			Av. 2005 & 2006		
	0 N	60 N	120 N	0 N	60 N	120 N	0 N	60 N	120 N
Sheep									
Ewe stocking rate (ewe/ha)	5.2	5.3	7.6	5.9	6.6	8.1	5.55	5.96	7.83
Lamb LWG (g/d)	260	270	261	273	283	267	266	277	264
Lamb weaning weight (kg)	26.6	27.4	26.6	29.3	30.2	28.8	27.9	28.8	27.7
Lamb LWG/ha	206	235	304	250	300	346	228	267	325
Ewe weaning weight (kg)	66.2	68.7	69.6	66.6	69.4	66.9	66.4	69.0	68.2
Cattle									
Cattle grazing days/ha	97	156	146	37	61	82	66.8	108.5	114.1
Cattle LWG (kg/d)	1.2	0.9	1.6	1.4	1.5	1.4	1.3	1.2	1.5
LWG/ha	113	135	224	54	93	121	83	114	173
N response rate (kg DM/kg N)		10	18		13	10		11	14

Cost benefits

	2005			2006			Av. 2005 & 2006 in 2005 $			Av. 2005 & 2006 in 2006 $		
	0 N	60 N	120 N	0 N	60 N	120 N	0 N	60 N	120 N	0 N	60 N	120 N
Lamb price ($/kg LW)	*1.5*	*1.5*	*1.5*	*1.4*	*1.4*	*1.4*	*1.5*	*1.5*	*1.5*	*1.4*	*1.4*	*1.4*
Lamb value ($/ha)	382	431	562	422	503	587	417	485	595	389	453	556
Ewe LWT value ($/ha)	0	7	14	0	9	1.0	0	8	7	0	8	7
Cattle price ($/kg LW)	*1.65*	*1.65*	*1.65*	*1.77*	*1.77*	*1.77*	*1.65*	*1.65*	*1.65*	*1.77*	*1.77*	*1.77*
Cattle value ($/ha)	186	223	370	95	165	215	137	189	285	144	197	298
Total revenue ($/ha)	568	661	946	517	677	803	554	682	888	533	657	861
Marginal costs	0	110	227	0	116	241	0	116	241	0	113	234
Gross margin ($/ha)	567	552	718	517	560	562	554	569	654	533	544	627
Marginal benefit ($/ha)		-$16	$151		43	45		15	100		11	94

What was learnt

Year 1

- Lamb growth rates did not appear to be compromised with the grazing pressure created in the higher stocked paddocks.
- The advantages of getting additional weight onto ewes early in a summer dry environment vastly outweigh any cost of running heavier ewes.
- First years trial work was undertaken in an atypical season – need 3 years data for accuracy.
- Pasture quality and growth changes are already being seen in the applied nitrogen paddocks as a result of the subdivision, nitrogen use and higher stocking rate.
- It would be very difficult and impractical to extrapolate this trial (use of 120 kg N/ha) onto a whole farm basis on Castlepoint Station.

Year 2

- Cattle and ewes are responsive to higher covers, lambs are not.
- Within each year there was very little weight difference between treatments, indicating that lamb growth rates were not responsive to N treatment. The lamb LWG/ha was better in the 60 and 120 kg N treatments as a result of the higher stocking rates – more lambs on the ground.
- Good liveweight gains recorded in both ewes and cattle on the low covers.
- It would be difficult to manage a whole farm in the same way the trial plots were managed.
- Using N to alleviate a feed pinch may be profitable. Using N to lift stocking rate on 12 month basis probably not.

Wise Use of Nitrogen on Hill Country Pastures: Wairarapa

Whole farm modelling

Whole Farm Modelling Analysis (2006) - Base Model vs 120 N Bulls

- Undertaken to investigate the economics and practicability on a large scale on Castlepoint Station.
- 600 ha of northerly slopes receiving a 120 kg N/ha hit of nitrogen in the early spring (response rate 13 kg DM/kg N). The overall use of N changed from 14 to 40 kg N/ha on a whole farm basis.
- On the 600 ha of northerly slopes, ewe stocking rate would increase from 5.5 ewes/ha to 7.8 ewes/ha (no change in overall ewe numbers). Stocking rates would decrease on the rest of the slopes so that all ewes were 1.6 kg heavier at weaning and had a 2.0% higher lambing percentage. No effect on lamb LWG.
- On high N northerly slopes an extra 0.85 bulls/ha would be set-stocked onto northerly lambing country on 8th September.
- Bulls purchased at beginning of May at 160 kg and sold late November @ 342 kg.
- Cost of N $1.43, bull margin $251, store ram lamb price in December $1.52/kg LW.

	Gross margin		Net revenue $/kg DM		Consumed feed
Model	Per ha	Per kg DM	Sheep	Cattle	kg DM/ha
Base	569	9.27	13.2	11.0	6135
120 N bulls	576	9.08	13.1	12.1	6467

Results

- **On Castlepoint shifting from 14 to 40 kg N when N priced at $1.43/kg N gives a small improvement in Gross margin per ha of $7/ha.**
- **On a practical side this whole farm approach would be very labour intensive and climatically risk adverse. A total of 510 bulls would need to be sourced to stock the 600 ha at 0.85 bulls/ha. Additional feed costs of running extra animal would decrease the returns per kg eaten further.**
- **There is an environmental cost in terms of increased N leaching due to the increased number of cattle wintered on high N treatments. Given the very small improvement in economics, do the returns justify the increased environmental risks?**

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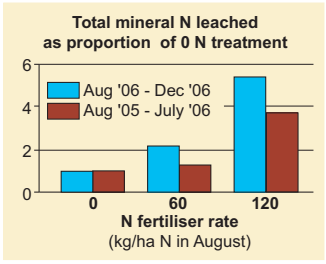
Leachate results

- The 60 N paddocks leached 1.3x as much N as the 0 N fertiliser paddocks in Year 1 and 2x the amount in first quarter of Year 2.
- The 120 N paddocks leached 3.5x as much N as the 0 N fertiliser paddocks in Year 1 and 5.5x the amount in first quarter of Year 2.
- There is much less ammonium-N (NH_4-N) leaching so far this year than at the same time last year.
- Amounts of nitrate-N (NO_3-N) leaching so far this year are similar to that leached over the same period last year.
- Overall amounts of mineral N leaching (ammonium and nitrate) are less than at the same time last year.



Summary

The first year and quarter of the three year trial

- **Applying fertiliser N in early August increases mineral N leaching compared to not applying any fertiliser N.**
- **The increase in mineral N leaching as the fertiliser N application rate is increased has an exponential relationship.**
- **These results are consistent with other trials in New Zealand and overseas.**

Water sampling results

Both years data combined

Ammonia

- Concentrations prior to fertiliser application were typical of most Wairarapa rivers.
- Concentrations rose significantly immediately following application and decreased at each collection after that.
- Large spike following application (0.4 g/m^3). Returned to levels prior to treatment after 2-3 months.
- Increased stock units brought into trial paddocks could contribute to increased ammonia concentrations.
- All values were below guideline levels for fish toxicity.

Nitrate

- Increased downstream from forest, through trial and pasture flats.
- Increased before application as conditions wetted up. No significant change after application. Decreased as conditions dried and stream flow decreased.
- Results are considered to reflect overall landuse rather than urea application.
- Concentrations higher than guideline value to avoid nuisance algal growth (0.04-0.1 g/m^3).
- Similar/lower concentrations to many Wairarapa rivers and tributaries.
- **Estimates of N loss post-application in 2006, based on the actual data collected, have indicated that 6 kg of ammonia was lost between the top and bottom of the trial, which equates to 120 kg of urea (worst case scenario). 4000 kg of urea was applied to trial paddocks, and some to paddocks on other side of stream.**
- **This would indicate that only 3% of the urea was lost into the waterway.**

Wise Use of Nitrogen on Hill Country Pastures: Nelson

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Context

Farm: Glengyle Downs

Owners: Ashley and Cathy Peter

Location: Dovedale, 20 km southwest of Nelson

Land areas:

Total area	410 ha
Leasehold	50 ha
Freehold	360 ha
Effective hectare	**371 ha**

Dryland-effective area (83%)
70 ha flat, 270 ha rolling hill, 40 ha hard hill.

Rainfall: Av. 1100 mm (43 inches).

Grazing policy: General policy was to set stock the areas with twin ewes prior to lambing, and bulls or heifers rotated through the areas according to pasture covers.

Method

	2004	2005	2006
Control	6.3 ha	6.3 ha	6.3 ha
Wise N	5 ha	16.5 ha	16.5 ha
	100 kg urea *10th Aug 2004*	120 kg Ammo 31 *10th June 2005*	100 kg urea *5th May 2006*
	100 kg urea *19th Sep 2004*	120 kg Ammo 36 *22nd Aug 2005*	100 kg urea *28th July 2006*
		120 kg Ammo 31 *26th Sep 2005*	100 kg urea *24th Sep 2006*

The initial change from urea to Ammo fertiliser was due to a response the farm had to sulphur; however, this was changed back in 2006 to concentrate on the nitrogen aspect of the trial.

Main farm, looking west from the trial block

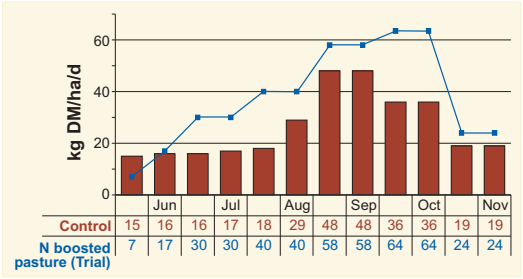
Results

Ewe price into and out of the system was the same and cattle were grazed in the system on a liveweight gain basis.

		Gross income / ha	Expenditure / ha	Gross margin / ha	Product / ha	3 yr av. GM / ha
2004	Control (6.3 ha)	$656	$52	$605	144	$614
	Trial (5 ha)	$912	$154	$758	260	$720
2005	Control (6.3 ha)	$660	$79	$581	121	3 yr av. product / ha
	Trial (16.5 ha)	$1025	$316	$709	332	
2006	Control (6.3 ha)	$728	$72	$655	198	$154
	Trial (16.5 ha)	$1018	$299	$719	276	$298

		Av. lamb price	Av. lamb weight	kg DM eaten / kg product	Return / kg DM grown	Pasture growth kg DM/ha
2004	Control (6.3 ha)	$48.63	24.2	15.70	$0.25	2348
	Trial (5 ha)	$51.18	25.7	17.13	$0.19	4068
2005	Control (6.3 ha)	$38.48	24.0	23.42	$0.18	3313
	Trial (16.5 ha)	$42.49	26.4	18.64	$0.11	6501
2006	Control (6.3 ha)	$50.42	29.9	15.13	$0.18	3646
	Trial (16.5 ha)	$51.55	29.7	18.84	$0.12	5800

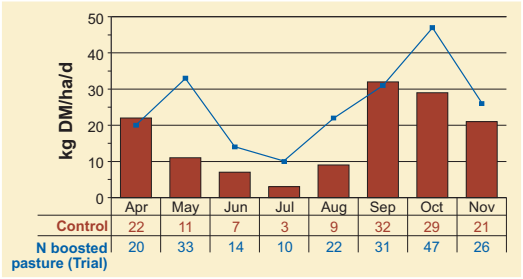
Pasture growth 2005 (cage cuts)



2005

Response:	kg DM/ha/d per kg N	Over no. of days
June to Aug	22.7	73
Aug to Sep	11.9	35
Sep to Dec	29.0	66

Pasture growth 2006 (cage cuts)



2006

Response:	kg DM/ha/d per kg N	Over no. of days
May to Aug	24.1	94
Aug to Sep	9.0	52
Sep to Dec	13.5	68

The project team wishes to acknowledge the funders:

What was learnt

- **The buying and selling margin of stock between July and November is harder to manage than utilising stock on the farm more efficiently.**
- **Nitrogen use to increase stock numbers is relatively easy.**
- **Moisture is a key part in achieving a good nitrogen response.**
- **Farmlet scale nitrogen application is profitable by utilising the stock held on the farm. Any whole farm nitrogen application needs to be well planned and purchase decisions made before June to fully utilize the extra pasture grown.**
- **Choice of stock policy on nitrogen boosted grass has a big influence on profitability.**
- **The farm can grow up to 45% more pasture by applying nitrogen, over the period May to November.**
- **Financial result supports nitrogen on this block with this stock policy.**

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Wise Use of Nitrogen on Hill Country Pastures: Marlborough

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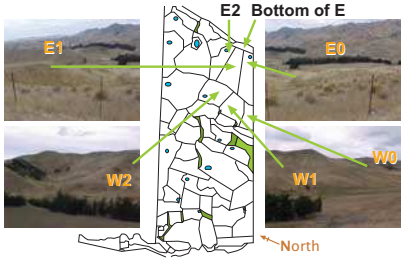
Context

Farm: Breech Oak

Property owner: Warrick Lissaman

Location: Seddon, approx. 35 km south of Blenheim

- Land areas: Hills 167 ha, Easy 151 ha, Lucerne 25 ha, **Effective 343 ha**
- Rainfall average: 650 mm with a range from 450-1000 mm.
- N-demonstration area (east and west facing blocks):
  East0 (control) 12ha, E1 7.8ha, E2 10.8ha
  West0 (control) 6.2ha, W1 9.1ha, W2 12.6ha



- **Grazing policy:** Cows, heifer cattle and ewes were rotated through blocks prior to lambing then ewes were set stocked, twin ewes in the E blocks and single ewes on the W blocks (due to the high chance of having to destock the west blocks early due to lack of rainfall). Cattle were also set stocked at this time. Cattle are moved out of the blocks if feed becomes tight, followed by the ewes (dependant on pasture covers).

Method

2005

Control - W0 6.2 ha
W1 - 9.1 ha
W2 - 12.6 ha

Control - E0 12 ha
E2 - 10.8 ha
E1 - 7.8 ha

27th May 2005:
W1 & E1 - 75 kg urea/ha
W2 & E2 -115 kg urea/ha

2nd Aug 2005:
W1 & E1 - 75 kg urea/ha
W2 & E2 - 120 kg urea/ha

2006

Control - W0 6.2 ha
W1 - 9.1 ha
W2 - 12.6 ha

Control - E0 12 ha
E2 - 10.8 ha
E1 - 7.8 ha

13th May 2006:
W1 & E1 - 75 kg urea/ha
W2 & E2 -120 kg urea/ha

27th July 2006:
W1 & E1 - 75 kg urea/ha
W2 & E2 - 120 kg urea/ha

April 06 - Bottom of E

May 06 - top of E2 looking to bottom of E

The project team wishes to acknowledge the funders:

Results

Ewe price into and out of the system was the same and cattle were grazed in the system on a liveweight gain basis.

		Gross income / ha	Expenditure / ha	Gross margin / ha	Product / ha	2 yr av. GM / ha	2 yr av. kg DM / ha
2005	Control W0	$421	$11	$411	58	$300	$53
	W1	$376	$201	$175	116	$279	$156
	W2	$509	$257	$252	165	$263	$177
2006	Control W0	$218	$28	$190	47		
	W1	$606	$224	$382	196		
	W2	$569	$294	$275	189		

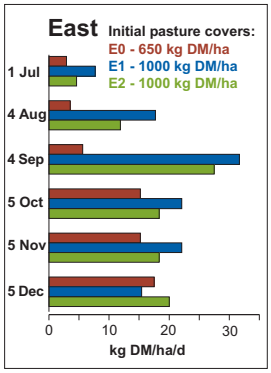
		Av. lamb price	Av. lamb weight	kg DM eaten / kg product	Return / kg DM grown	Pasture growth kg DM/ha	2 yr av. kg DM / ha
2005	Control W0	$30	18.1	57.32	$0.14	2927	2754
	W1	$31	18.9	21.48	$0.04	4367	4147
	W2	$31	19.0	21.75	$0.05	4727	5316
2006	Control W0	$54	30.3	22.10	$0.07	2581	
	W1	$41	24.8	16.89	$0.10	3926	
	W2	$50	28.9	19.69	$0.05	5905	

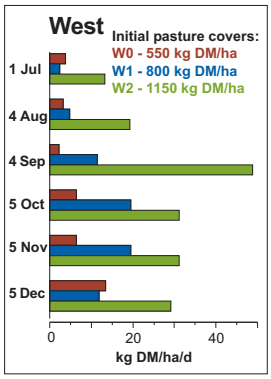
		Gross income / ha	Expenditure / ha	Gross margin / ha	Product / ha	2 yr av. GM / ha	2 yr av. kg DM / ha
2005	Control E0	$168	$4	$164	118	$162	$117
	E1	$681	$209	$472	112	$442	$142
	E2	$694	$335	$359	191	$379	$183
2006	Control E0	$165	$4	$161	117		
	E1	$604	$192	$412	173		
	E2	$685	$286	$399	174		

		Av. lamb price	Av. lamb weight	kg DM eaten / kg product	Return / kg DM grown	Pasture growth kg DM/ha	2 yr av. kg DM / ha
2005	Control E0	$30	18.1	7.96	$0.04	3742	3525
	E1	$22	13.1	33.44	$0.10	4755	4605
	E2	$50	21.1	19.24	$0.07	4999	4442
2006	Control E0	$45	26.8	9.12	$0.05	3308	
	E1	$48	28.2	14.75	$0.09	4454	
	E2	$48	28.0	16.15	$0.10	3886	

2006 pasture cut data

2005 data was derived from pasture covers and is not shown





	13 May 06 to 4 Aug 06 Pasture grown	N used	Response kg DM/kg N	5 Aug 06 to 5 Dec 06 Pasture grown	N used	Response kg DM/kg N	Total: 13 May 06 to 5 Dec 06 Pasture grown	N used	Response kg DM/kg N
Control W0	292			1255			1548		
W1	287	34.5	-0.1	3109	34.5	53.7	3396	69.0	26.8
W2	1302	55.2	18.3	6212	55.2	89.8	7514	110.4	54.0
Control E0	268			2572			2840		
E1	979	34.5	20.6	4164	34.5	46.1	5144	69.0	33.4
E2	629	55.2	6.5	3722	55.2	20.8	4351	110.4	13.7

2005 C/N ratio:
West = 12
East = 11

Note: E2, cage rubbed & shifted in Sept cut. Cages not set up until 28th May, therefore July cut is under reading actual pasture grown.

What was learnt

- One of the goals was to increase financial returns by 20% through nitrogen use; as a rule this was exceeded on the respective blocks.
- On average the east blocks grew a similar amount of pasture to the west blocks but with less variation between years and treatments.
- The eastern blocks had lower nitrogen responses but more reliable profit with nitrogen use.
- The most consistent returns seem to be that of 75 kg urea/ha.
- Pasture cut responses in 2006 far exceeded those anticipated; disappointingly we did not cut pastures in 2005 consistently to compare the pasture cut nitrogen responses between years.
- Pasture cover estimation on the nitrogen blocks was difficult due to the pasture density.
- As a short term response the warmer western faces responded very well to N, therefore in feed shortage situations N applications to the western facing country would seem the best bang for buck.
- 2005 results are skewed because of the "standing hay" that was in the E blocks as the trial was set up, positively influencing the W0 2005 result.
- There is a big increase in product produced between the Control blocks and the 75 kg urea blocks. This increase diminished on the 120 kg urea blocks.
- Fertiliser application in May achieved good responses on the east facing blocks, perhaps this acted as a type of antifreeze, whereas the west blocks remained warmer (note: only one years data).
- Nitrogen recipe:
  - Up to 75 kg urea applied at the end of July achieved good nitrogen responses on east and west facing country.
  - N application on the eastern blocks in 2005 and 2006 resulted in a significant increase in profit.
  - There may be an opportunity to use N on the east block in May and west blocks in July for best return.

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