

Wise Use of N-Fertiliser on Hill Country Pastures

WiseN Up!

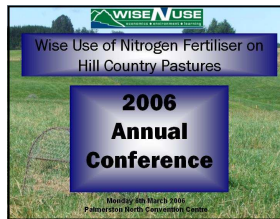
Special points of interest:

- The new project website was launched in early February. Visit www.wisenuse.co.nz for further information and resources on nitrogen use.
- FAQs 6 & 7 are now available. See the website for copies of these documents

Perspectives on N-Use from the Regional Councils

Speakers from Horizons and Environment Waikato provided much food for thought at this year's Wise Use of N-Fertiliser on Hill Country Conference.

The conference was held at the Palmerston North Convention Centre on the 6th March and attracted over 80 invited guests from the farming community, re-



gional councils and other industry groups.

Strong interest in the position of local Regional Councils on nitrogen use

encouraged the project team to invite this year's key speakers.

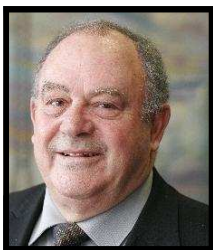
Garry Murfitt, (Chairman of Horizons Regional Council and local farmer) opened the conference with a presentation on 'Soil and Water Quality Issues and the Environmental Implications of N Use on Hill Country'.

Peter Singleton from Environment Waikato later presented 'A Regional Council Perspective: What's Happening to Our Clean Water?'

Copies of both papers are available on the project website.

See www.wisenuse.co.nz for further information.

Comments by Garry Murfitt Horizons Regional Council



"Fundamentally, Regional Councils are concerned about the off-site impacts of nitrogen....Essentially it's not about how much goes in, but what comes out at the end of the process."

"Studies already indicate that fertiliser use per se doesn't significantly contribute to off-site impacts. But, for pastoral farming at least, more fertiliser is used to increase pasture production, which in turn allows increased stocking rates. The increased concentration of nitrogen in the feed passes straight through the animal to the dung and urine which, where concentrated on the farm, does significantly contribute to off site impacts."

"On-site management practices will be crucial in minimising off-site impacts and "Best Management Practices" or "Codes of Practice" need to be developed and adopted by industry and the sectors. But these need to be robust and practical enough to give confidence that they will be taken up. Without these successful "Codes of Practice", regulation would have to be considered as an approach."

Comments by Peter Singleton Environment Waikato



"The general consensus amongst the water quality experts that we have consulted at Environment Waikato, NIWA and the University of Waikato is that Council's current approach to managing agriculture is not going to be sufficient to maintain water quality at present day levels in many parts of the Region."

"Algal blooms have made the Waikato River unsafe for swimming on several occasions. Testing of the Waikato region's rivers and streams shows that levels of bacteria were too high for safe swimming at nearly 70% of sites tested. An even greater proportion of streams (nearly 75%) were not suitable for stock to drink ."

"The conclusions are:

- *We are in this together.*
- *Water quality is getting worse.*
- *Not acting will ruin the environment and the agricultural economy.*
- *It is serious. The consequences are predictable and unpleasant.*
- *Regulation is inevitable as part of the solution."*

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Review of 'N-Fertiliser Responses on NZ Hill Country'

Dr Coby Hoogendoorn of AgResearch presented a review of trial information relating to N-Fertiliser Use on NZ Hill Country at this year's annual conference.

The presentation and its accompanying paper was well received by the conference participants and summarised the work to date as well as highlighting a range of things 'we still don't know'.

Coby's report focused on published work relating to nitrogen fertiliser use in hill country since 1982, and considered only grazing trial evaluations (as cutting trials fail to take account of the nutrient returned to the area through excrement).

Up until 1982 most of the work on nitrogen fertiliser responses in hill country had been done in moist environments, particularly those in the lower North Island. This was still the case in 1998 and remains largely unchanged today.

In the last 24 years there have been five grazing trials evaluating the use of fertiliser N in hill country. Two in the southern North Island, one in the Waikato, and two at Waipawa in the eastern North Island.

In the moist hill country trials at Whatawhata, dense ryegrass dominant, easy slopes in late winter/early spring gave the best N-responses, however at Ballantrae, responses on browntop dominant pastures were at least as great as where there was a higher ryegrass content. The high response efficiencies for hill country mean there may be economic responses above the commonly used rates of 20-50 kg N/ha, however, this depends on relative costs and returns, level of feed utilisation, and enterprise design.

In the dry hill country trials, the maximum return from applied N was in late winter/early spring, before soil moisture levels fell below optimum for plant growth. This was provided that the extra pasture grown was actually eaten and that the most profitable stock class on the farm was used to harvest this growth.

Coby discussed the risk and uncertainty associated with N-fertiliser use and noted that production; price (or market); and financial uncertainty are the key issues. Of these, production risk was deemed to be the major source of uncertainty associated with fertiliser N use. Production risk arises from the variability inherent in the biological processes of pasture growth, and the conversion of this into animal products. Grazing management, soil condition and temperature, rainfall, and seasonal effects were amongst the factors quoted as contributing to production risk.

Coby went on to explain some simple steps that could be taken to minimise risk and uncertainty. This was to monitor soil condition (degree of saturation and pugging), weather conditions (likelihood of heavy rainfall event occurring 3-4 days post application) and pasture mass (prior to application and before stock are given access post application).

Coby made the point that measuring nutrient loss from hill country is exceedingly difficult, and up-scaling results from trial work to farm scale is fraught with difficulty.

The forms of nitrogen loss from the soil were explained, where leaching is the draining of water and therefore dissolved nitrogen

(nitrate, ammonium, and dissolved organic nitrogen) below the rooting depth of plants. Volatilisation is the escape to the atmosphere of ammonia gas from N-fertiliser shortly after application, and from fresh urine patches (urea → ammonium → ammonia). Nitrous oxide gas emissions are as a result of denitrification of nitrate in the soil.

In terms of leaching of dissolved N:

- There was no direct effects on leaching when N was applied at "reasonable levels" (i.e. best practice guidelines of no more than 20-40 kg N/ha and up to 50 kg N/ha and only in good growing conditions)
- Increased loss of ammonium, nitrate and dissolved organic nitrogen was expected due to indirect effects (i.e. increased number of urine and dung patches as stocking rates increased to consume the extra herbage grown)

In terms of volatilisation :

- If N-fertiliser was applied according to best practice guidelines (i.e. not in hot dry weather), very little ammonia was lost from this source
- There was an indirect increase in the amount of ammonia lost to the atmosphere due to the increased number of urine and dung patches

In terms of nitrous oxide emissions, there has been very little work done on hill country. From the lowland work, it is known that the following factors all increased nitrous oxide emissions:

- increased nitrates in the soil
- increased compaction of the soil

"Even if the major and trace element requirements of hill pastures are met, these pastures will always remain chronically nitrogen deficient. This means that there is potential to achieve increased pasture production from the use of nitrogen fertiliser in this environment."



- increased wetness of the soil
- increased concentration of dung and urine patches

Coby concluded by saying that if the economic, environmental and social sustainability of hill country farming is to be realised, then those parties responsible for investigating the impact of nitrogen fertiliser use on hill country must look carefully, remain open minded, and consider all of the implications put before them.

Coby's paper and presentation is available on the project website at www.wisenuse.co.nz.

"Do we (as stewards of the land, and as citizens of this country) want to have our deteriorating natural capital (soil, water, air) subsidise our agriculture?"
 Coby Hoogendoorn,
 Scientist, AgResearch

Focus Farm Feature

Waikiekie Community Group, Northland

Farm Profile

The Northland Focus Farm is owned by David and Erin Gunson and the project is supported by members of the Waiotira and Maungaturoto Farm Monitor Groups.

The farm is made up of 422ha, with 360ha in grass. The annual rainfall is around 1600mm. Olsen P levels average 20 over most of the farm and pH levels are 5.8 to 6.0. The contour is 20% easy, 60% moderate and 20% steep. David and Erin run breeding ewes and

breeding cows. Weaner bulls are purchased between Nov and May and most are sold store by Christmas.

Lambs are weaned in late Nov and the aim is to achieve 30kg lambs off the back of 160% lambs weaned. 75% are marketed by the end of Feb and ewe lambs are mated.

David and Erin also look for additional stock trading opportunities, like winter lamb finish-

ing, depending on the feed covers and Far-max analysis.

“Nitrogen works BUT at \$1.40/kgN on the ground you need to make sure you’re getting bang for your buck. The 3 top line items with nitrogen are response rate, pasture utilisation and stock margin”

What Happened in 2005 and What Was Learnt?

This was a whole farm approach comparing base performance with planned and actual performance.

Last winter the 109ha lambing platform received 42kgN/ha in early Aug, 30kgN/ha from mid-Oct to mid-Nov and was stocked at 10-18 ewes/ha plus ~1 cow per ha. The 63ha intensive beef platform used 43kgN/ha in early June and 42kgN/ha in early August and was stocked at ~875kg/ha. Monthly pasture covers were also taken.

The main purpose of the demo was to increase production and profit. Farmax showed that GM would increase to \$577/ha from \$533/ha. These differences were greater when modeled in 2004 but product price

decreases, especially for lamb, reduced the advantage.

What was Learnt?

When covers are run ‘close to the edge’ the window for decision making shrinks and you must take action sooner.

- Addressing feed supply challenges in the spring and being proactive with livestock marketing is critical. Adequate time must be allowed to address challenges and opportunities.
- When modelling through Farmax and N is required to be applied at a certain time, it is important not to delay applications, alterna-

tively take other appropriate action

- Trading can be profitable but there can be serious challenges with bought-in stock performance

“Make your mistakes on the computer – not on the farm”



Parameter	Production Results		
	Base	Planned	Actual
Lambing %	165	160	156
Lamb Weaning Weight	27	30	28
Intensive Beef Production	300	350	348
Net Pasture Production (kgDM/ha)	7311	7772	7848
Pasture Covers:			
August	1785	1785	1732
October		1867	1628
December		2277	1505
Net Production/ha (kg CW)	300	326	327
Gross Margin/ha (\$)	533	577	433

2006 Nitrogen Demonstration

- With the changes in product prices N will be more strategically applied (on time) to areas where return/kgN will show a more positive profit margin e.g. on twin bearing lambing areas and intensive beef areas.
- The crucial spring feed pinch will be better managed and the Oct-Jan marketing window will be a focus.
- Trading lambs will replace trading ewes (due to a predicted better 2006 autumn)
- Intensive beef SR will increase to 1200kg/ha.
- The twin-bearing ewe SR will decrease to 7-10 per hectare but the cattle SR will increase to equate feed supply with feed demand.

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Results from Greg Lambert's modelling of N-fertiliser use on a typical North Island hill country farm

- Farm stocking rate and production increased with increasing N application rate
- Financial return was highest at 20 and 40 kgN rates
- N leaching increased in a curvilinear fashion as N application rate increased
- N leached per kg product and per \$ gross margin also increased in a curvilinear fashion
- Economic responses to higher N rates may have occurred if the farm system had been tuned to better utilise the extra cool-season forage supply

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The results for this simulation suggest low rates of N application (20-60 kgN/ha p.a.) would be financially rewarding, but would give increased N leaching of 1-5 kg N/ha p.a.

See the project website for a copy of the full presentation

Did You Know?

- The total amount of N cycling through the soil-pasture-animal system is 400 to 1000 kg N/ha/yr
- Clovers fix 10 to 250 kg N/ha/yr
- Management practices that increase clover growth will increase N-fixation, including fertiliser P, S, K, Mo application, tight grazing in the spring, cropping/regrassing (if done well) and chemical topping
- Management practices that decrease clover growth include tight grazing in hot dry summers, treading damage in winter and fertiliser N application

AGRESEARCH SCIENTIST PROFILE: Robyn Dynes

AgResearch Scientist Robyn Dynes currently works with the N-project facilitators at the Latham property (Banks Peninsula) and the Northcote property (North Canterbury).

Robyn graduated with a PhD from Lincoln University on effects of gastrointestinal parasites in growing lambs and headed to Australia in 1991. She spent 13 years as an animal scientist with CSIRO Division of Livestock Industries in Western Australia, researching the nutritive and feeding value of pastures, understanding constraints to intake and the plant-animal interface. More recently Robyn was

national sub-program leader for Cooperative Research Centre for Plant Based Solutions to Salinity. This project attempted to objectively assess impacts of research on environmental, economic and social sustainability.

Robyn joined AgResearch in 2004 and is a farming systems scientist working on systems modelling, gastrointestinal parasites, and remote sensing applications in feed planning.

Robyn believes the Wise Use of Nitrogen in Hill Country Project is an asset for all farmers because it objectively tackles an area where economic and environmental sustainability are

essential. This is at a time of increasing public interest in impacts of farming practice on the environment.

“The strengths of this project are in the diversity of stakeholders involved and the combination of strategic research and on-farm demonstrations with a national focus. Its great to work with farmers and extension specialists who want to ‘do the right thing’ and balance the increasing tension between economic gains and environmental impacts”.

Robyn is based at AgResearch Lincoln.



The Project Team again wishes to acknowledge the funders:

