
MOD

A growing problem

Increasing use of nitrogen fertilisers in NZ agriculture.

More nitrogen flowing to more rivers, causing algae to thrive.

74% of native freshwater species now endangered.

30% of rivers not swimmable.

The pain points

Nitrogen is washed away fast, limiting pasture growth, and must be reapplied seasonally.

Fertilisers account for 14% of dairy farm expenses.

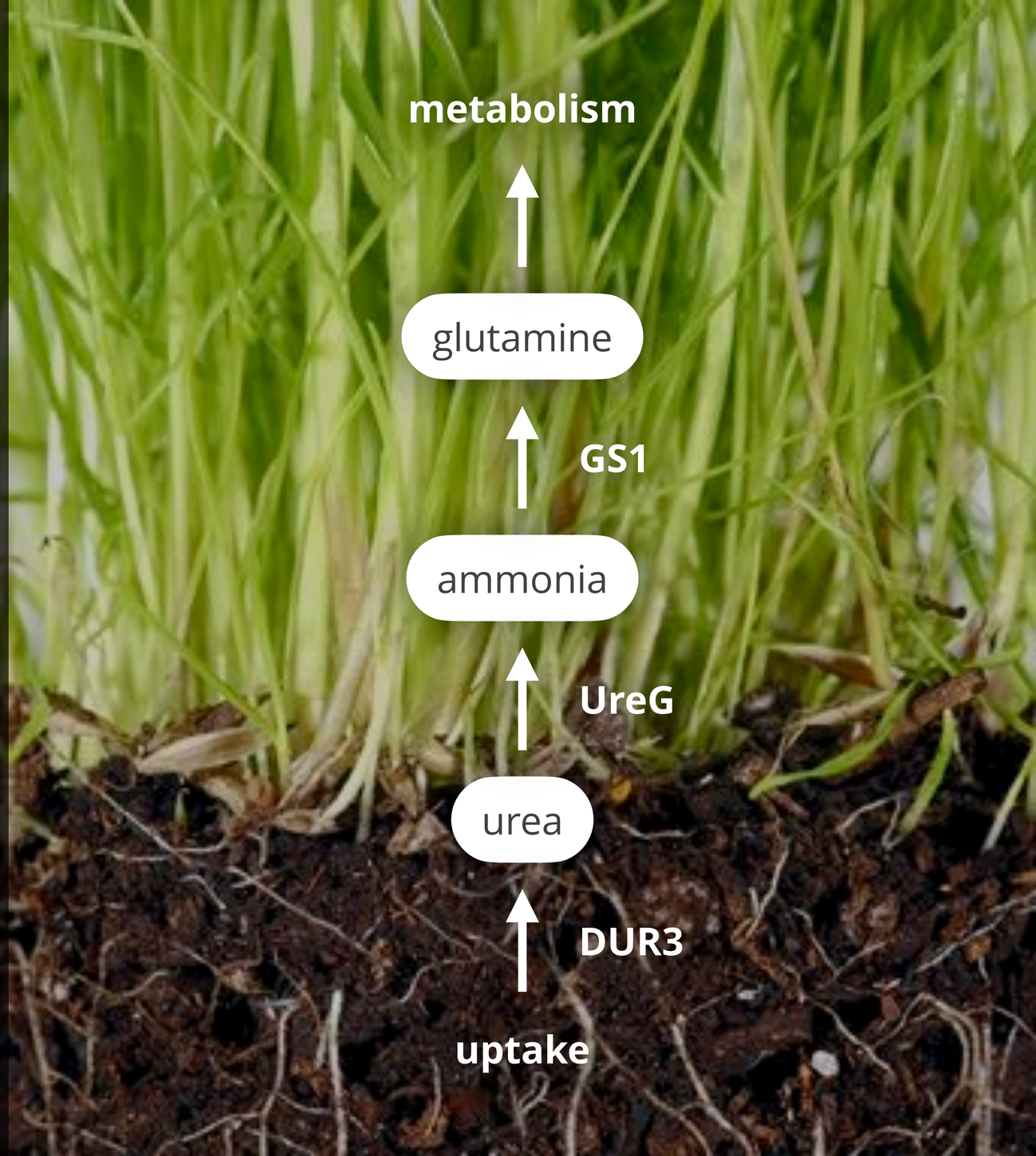
Damages cost NZ government over $10Million every year.

Fixing the problem at the source

DUR3 protein used by common rice to increase urea uptake.

Increase UreG protein for converting urea into ammonia.

Increase GS1 for converting ammonia into glutamine.



Our to-do list

Between now and November:

1. Transform plant with DUR3/ UreG/GS1 construct.

2. Test results of transformation.

3. Compare urea uptake and plant growth rate with control.

Competition

Ecotain: Breeding diuretic pastures to dilute urea in livestock urine.

Overseer: Nutrient-flow software helps farmers reduce their fertiliser loss.

AgResearch: $44M into GMOs, plus another $25M for ryegrass.

Intellectual Property

NZ/Aus: Can patent our transgenic line, but not the naturally occurring genes.

US: Can also patent naturally occurring genes if synthesised.

DUR3, UreG and GS1 have not been used in patents in NZ, Australia, US or Canada.

ROI

Assuming +8% nitrogen use efficiency, and a 10% royalty:

$41,000 in royalties per year per 1% of NZ dairy farms.

Potential to expand with meat, fruit and vegetable farms.

Potential to scale globally.


BIOMATTERS
geneious
Return On Science
Powered by UniServices
THE UNIVERSITY OF AUCKLAND
FACULTY OF SCIENCE
School of Biological Sciences
Chiasma

Urea fertilisers imported into NZ [1, 2, 3, 4]	$281M /year
Land area used by dairy farms (20.9%) [5]	2.5M ha
Land area used by beef/sheep farms (70.9%)	8.5M ha
Land area used by horticultural farms (5.7%)	0.7M ha
Land area used by other livestock farms (2.5%)	0.3M ha
Fertiliser application rate by dairy farms	30 kg/ha/year
Fertiliser application rate by sheep/beef farms	8 kg/ha/year
Fertiliser application rate by horticulture [6]	50 kg/ha/year
Fertiliser application rate by other livestock farms [7]	8 kg/ha/year
Annual spending on urea fertilisers by dairy farms [8]	$118M /year
Expected increase in nitrogen-use-efficiency	8%

Annual savings on fertiliser	$9.4M /year
Average number of years per application of seed	2 years
Price markdown (set by seed manufacturer)	50%
IP royalty rate (paid by seed manufacturer)	20%
Added value available for capture by MOD	$472K /year
Average annual cost of urea fertiliser per farm [9]	$9,637 /year
Added value of seeds per farm per year	$384 /year
Current average annual cost of ryegrass per farm	$2,940 /year
Annual cost of MOD ryegrass per farm	$3,342 /year
Annual revenue cap	$8.2M /year
Annual revenue per 1% market share	$82K /year

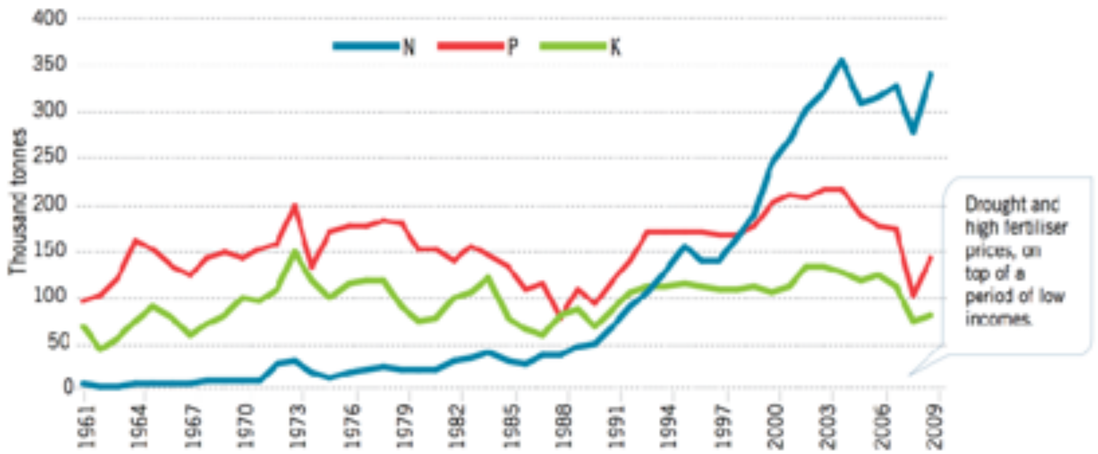
Pasture fertiliser input trends

FERTILISER

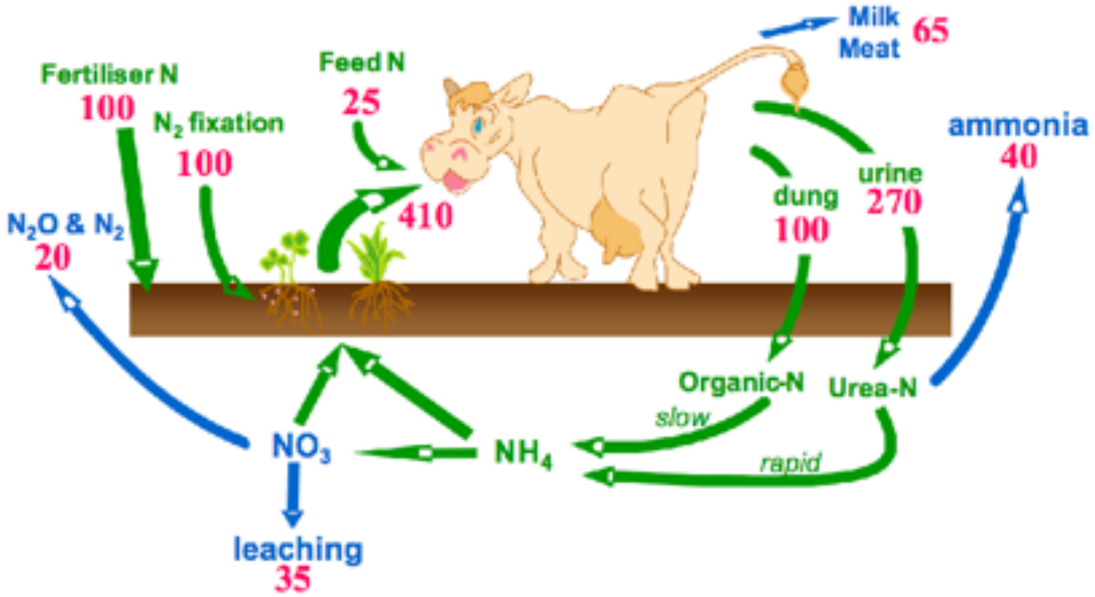
Fertiliser is a critical input for the production of feed. In New Zealand, this has traditionally consisted of ryegrass and clover pastures, but farmers are increasing the diversity of their pasture species and the use of alternative feed sources such as forage crops, maize silage and palm kernel expeller meal (PKE).

Over the past 50 years, use of fertiliser has increased, particularly the application of nitrogen between 1990 and 2004 (Figure 19).

Figure 19: N-P-K consumption in New Zealand. SOURCE: FERT RESEARCH

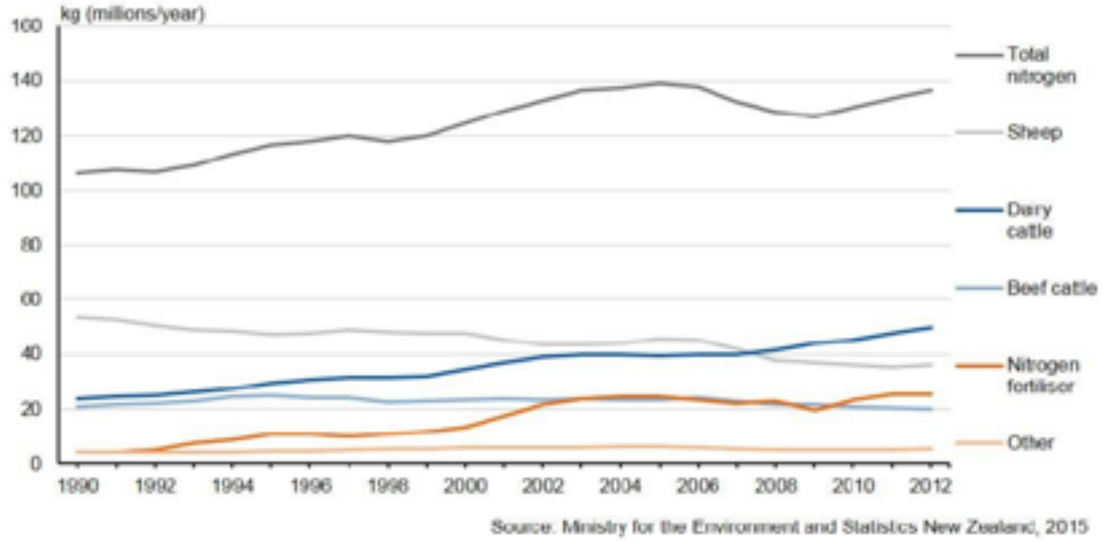


Nitrogen cycle for dairy farms



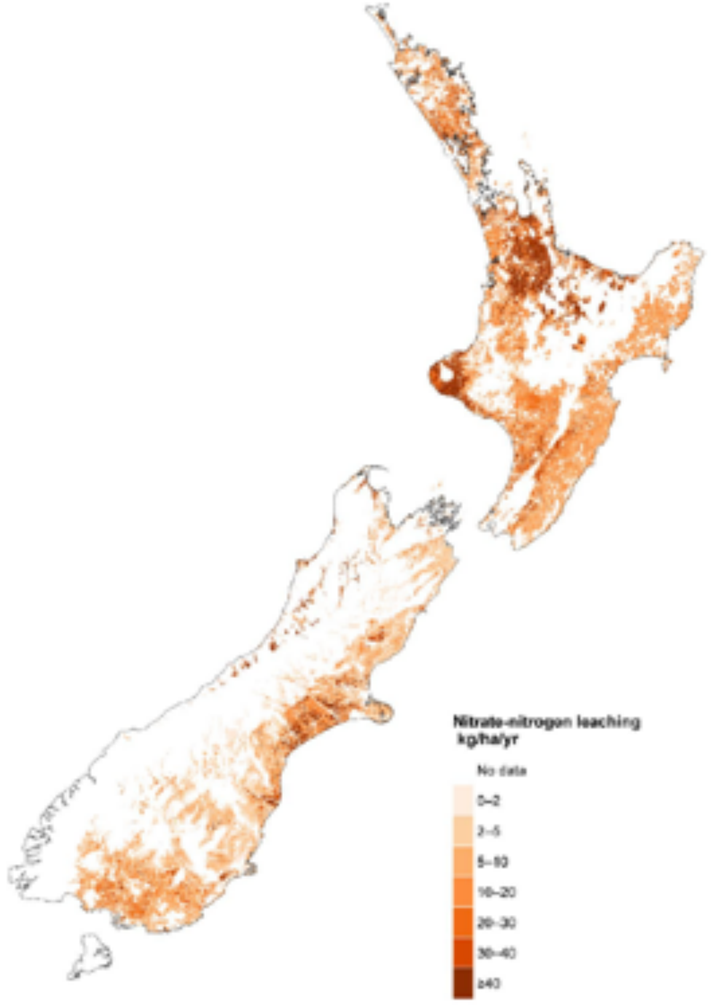
The nitrogen cycle in a clover- based pasture producing about 900 kg MS/ha

N-leaching over time

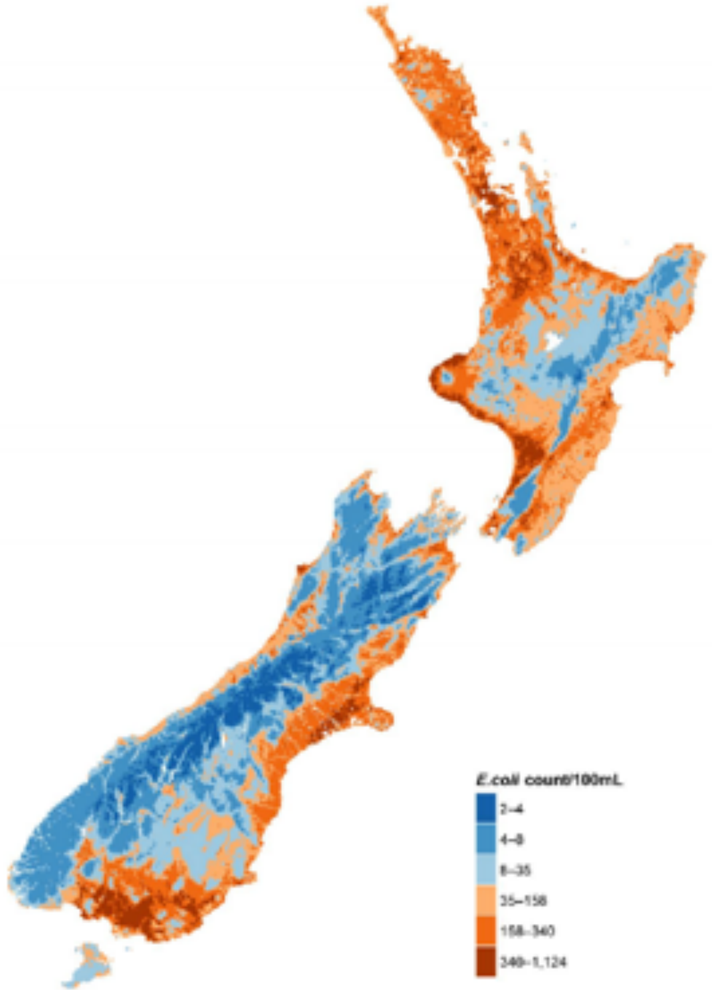


Source: Ministry for the Environment and Statistics New Zealand, 2015

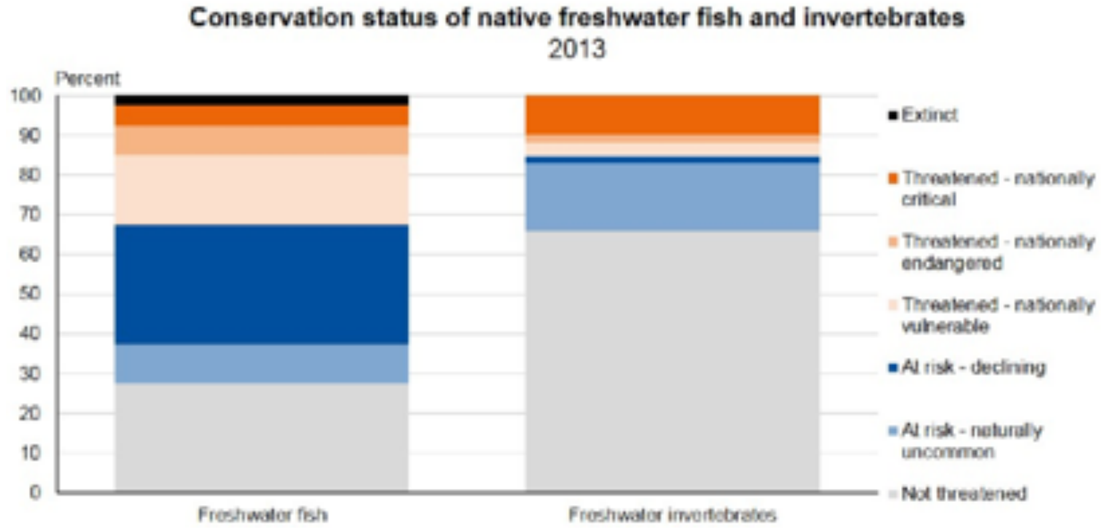
Geography of N-leaching



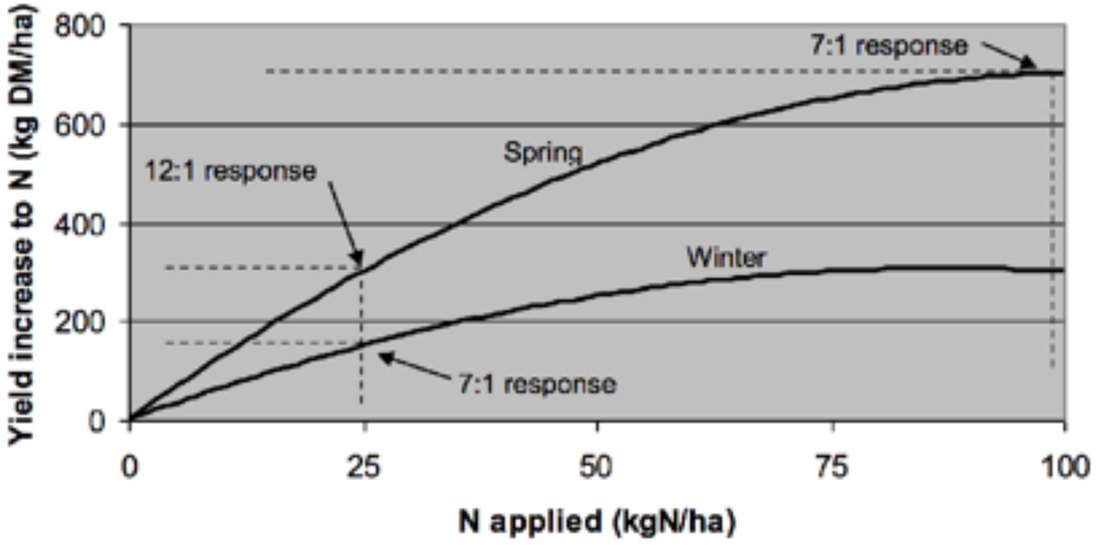
E. coli concentrations 2013

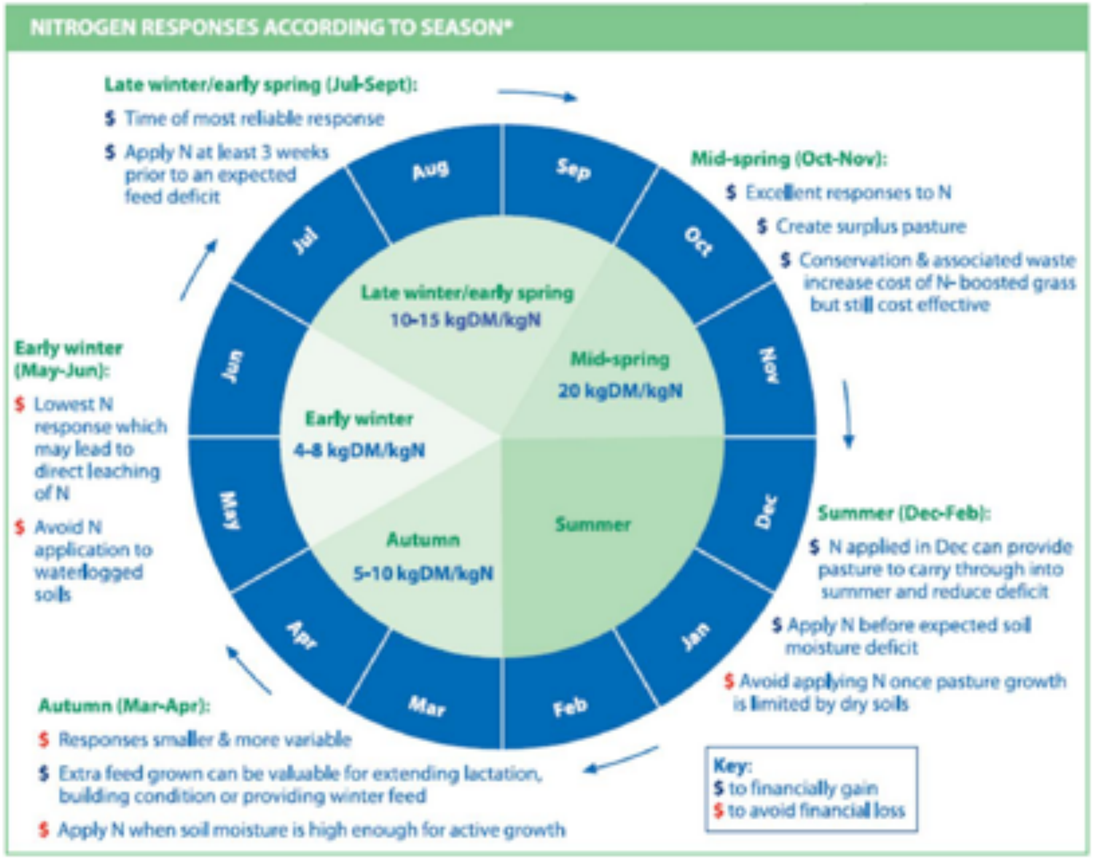


Fish endangerment 2013



Seasonal effect on N-fertiliser





Snapshot of NZ dairy 2017

HERDS AND COWS

Total number of herds	11,748
Average herd size	414
Number of cows (milking)	4.8 million

FARMERS AND DAIRY LAND

Number of farm owner/ operators	8,508
Number of sharemilkers	3,240
Average farm size	147ha
Average cows per ha	2.8

THE NORTH ISLAND HAS 73%
of New Zealand's dairy herds,
60% of dairy cows and produces 57% of New Zealand's milksolids.

THE SOUTH ISLAND HAS 27%
of New Zealand's dairy herds,
40% of dairy cows and produces 43% of New Zealand's milksolids.

Total effective hectares of dairy land in New Zealand

1.7 million hectares

Milk processed by dairy companies (2016-17)

21.0 billion litres

containing 1.8 billion kilograms of milksolids

DAIRY FARMING CONTRIBUTED 28% (in 2016-17) of the total value that New Zealand earned from its merchandise exports.* That is 35% of New Zealand's total primary industry export value.

The value of dairying in New Zealand

Jobs in the dairy industry (excl. farm business owners)

47,310 employees

Amount of export revenue NZ earnt from dairy farming (2016-17)

$NZ13.4 billion

New Zealand produces

3%

OF ALL THE MILK IN THE WORLD.

New Zealand is the world's largest exporter of dairy products, but is only the **8th** largest milk producer worldwide.

Numbers employed in the dairy industry in New Zealand

	Number employed
On-farm	33,760
Processing and wholesaling	13,550
Total dairy employment	47,310

Costs per N-fertiliser type

Types of fertiliser N

All the common fertilisers (urea, ammonium sulphate and DAP) produce the same amount of DM per kg N applied i.e. a kg N is a kg N regardless of the product. Therefore choose the cheapest form based on the cost per unit N, after taking into account the value of the other nutrients (see below).

Type	Cost ($/tonne) [1]	Value of companion nutrient ($/tonne)	Cost of N ($)	Amount of N (kg)	Cost of N ($/kg N)
Urea	795	Nil	795	460	1.73
Coated urea	758	Nil	750	380	1.97
Ammonium sulphate	645	$102 (230 Kg of S at 0.45 cents/Kg)	560	205	2.73
DAP	1082	$680 (200 kg of P at $3.40/kg)	402	180	2.23

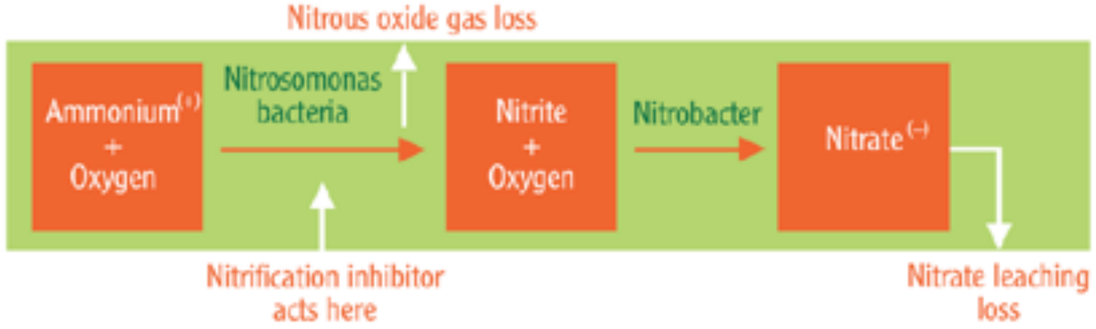
Note [1] all costs are ex works April 2012

NZ fresh water trends 2017

Nitrification and leaching

How it works

Under aerobic conditions, nitrogen compounds in the soil are converted, by bacteria, to nitrates. This includes the conversion of ammonium to nitrate, with the release of nitrous oxide.



Only ammonium and nitrate are readily taken up by plant roots. Ammonium (with its +ve charge) is held on soil particles more efficiently, and nitrate (with its –ve charge) is more easily leached under higher rainfall or irrigation, particularly if it is present in much greater quantities than plants can use.

Reviewing NZ GMO regulation

https://www.youtube.com/watch?v=gMquI9PyBPk