Meeting a Sustainable Future

Selwyn and Hinds | Inspiring High Performance, Low footprint farms

Farm Systems of the Future Field Day

Proprietors of Rakaia Incorporated (FO) Glenn Jones and Sarah Brett (SM)

1089 Ardlui Road, Te Pirita. SN 2030

20 October 2020

DairyNZ

Meeting a Sustainable Future – Selwyn and Hinds

Inspiring High Performance, Low footprint farms

Through this DairyNZ five-year project, Canterbury dairy farmers will lead the way in showcasing how nitrogen (N) losses can continue to be reduced in order to protect local waterways.

The project focuses on how farms in Hinds and Selwyn can meet N loss limits and maintain profitable businesses under the Canterbury Land & Water Regional Plan (LWRP). Reducing N is a key focus for the project as both catchments have N reduction targets; however, this project also focusses on other aspects of environmental footprint including, Phosphorus and Sediment losses and Green House Gas emissions.

This project builds on sustainable farming initiatives many farmers have already begun and on previous N loss research. It aims to give farmers confidence the limits are achievable. Many farmers have been making changes to reduce N loss for some time and this will continue to build on that.

A key aspect of this project is working alongside partner farms to identify the most appropriate solutions for them, considering their chosen production systems, goals, and aspirations. The information generated from these partner farms is being shared with other farmers and provide a good range of examples and options. In this approach we are also partnering with the rural professionals working with the farmers.

What does success look like?

- Farmers will have confidence in the options available to reduce environmental footprint and an understanding of the implications of these options on the overall performance of their production systems.
- The options will be demonstrated to other farmers as they are implemented.
- Farmers will have clarity on the most profitable options to reduce their environmental footprint in different conditions and farm systems.

How can you get involved?

If you are a farmer, you could become one of the supported farmers or engaged with the range of extension activities.

If you are a rural professional, you can work with the project team to provide research questions and find the most appropriate solutions for your client farmers.

For more information about the project please contact Virginia Serra (021932515/virginia.serra@dairynz.co.nz) Project Lead

Farm Overview

Hororata Farm is a 650 cow, seasonal supply dairy farm located in the Selwyn catchment. The farm is owned by The Proprietors of Rakaia Incorporation (Hororata) Ltd and supervised (for the incorporation) by John Donkers. Glenn Jones and Sarah Brett are the 50:50 sharemilkers on the property since it was purchased in the 2017/18 season. The total area of the farm is 184.3 hectare with 175 hectare effective.

Physical resources Hororata farm

<table>
<tr><th></th><th>Hororata Farm description</th></tr>
<tr><td>Land</td><td>Total area is 184.3ha. The effective area is 175ha and this is the area used to calculate the KPIs presented in this handout.
The area in Overseer declared as blocks is 180.4 ha</td></tr>
<tr><td>Soils</td><td>Average PAW *: 75 (very free draining and vulnerable to drainage and hence N leaching)
<table>
<tr><th>Soil Types:</th><th>% area</th><th>PAW*(mm)</th><th>Drainage** (mm/ha/yr)</th></tr>
<tr><td>Lism_2a.1</td><td>43%</td><td>PAW 75</td><td>268 mm (Pivot)
261 mm (Solid Set)
170 mm (Dryland)</td></tr>
</table>
*PAW_{0-60} Is the profile available water in the first 0-60cm. 63mm and 48mm PAW are very low water holding capacity soils
** Drainage as estimated by Overseer</td></tr>
<tr><td>Rainfall</td><td>723 mm/yr (as per Overseer)</td></tr>
<tr><td>Irrigation</td><td>163.9ha Pivot — There is 5.7ha of dryland
10.8ha Fixed grid — Central Plains Water</td></tr>
<tr><td>Effluent</td><td>Effluent applied on 44.2 ha (25% of the area)
Stone trap to large concrete saucer
Depth applied <12 mm by underslung on Pivot</td></tr>
</table>

Farm systems overview

Fodder beet and triticale for autumn feed rotate through all the irrigated pivot blocks. All MA cows are wintered off farm in June and July at a wintering block approximately 8 km from the farm and in the same catchment as the dairy farm. The young stock are grazed at Burnham.

The farm has a two-year crop program as part of the regrassing on the farm:

- Autumn grazed fodder beet is sown in November and grazed from March to May with a yield of 22 t DM/ha (conventional cultivation)
- In June, the FB paddock is direct drilled into eats/triticale and grazed in September and October (yield about 3 t DM/ha)
- In November this paddock is sown back to new grass.

Table 1: Physical description over time

	2019/20	2018/19	2017/18
Milking Platform (ha)	175	175	175
Peak Cows milked	650	650	650
Liveweight /ha	1,746	1,857	
BW	134/53	94/54	
PW	163/54	135/54	
Kg N applied /ha	232	210	
Kg MS/ha	1,582	1,531	1,442
Kg MS /cow	426	412	388
MS as % liveweight	91	82	
Days in milk	273	263	
Pasture and crop eaten (t DM/ha)	14.7	14.9	
Imported Supplements (t DM/ha)	1.7	1.5	
Dry cow Feed (t DM/ha)	2.7	2.7	
Total Feed Eaten (t DM/ ha)	19.1	19.1	

Glenn and Sarah, with the support of The Rakaia Incorporation, have introduced an aggressive regrassing programme with the aim of improving the quality of the pastures quickly. They have also done replanting of natives on the property which helps with biodiversity on the farm.

Hororata farm supplies Synlait and currently are receiving two milk sales premiums:

- "grass fed premium" = $0.25c/kg MS
- "Lead with Pride" = $0.20c/kg MS

Self- Assessment

Aspects of my farm business I am happy with?

- Staff.
- Low maintenance and animal health bills.
- Relationship with owners.
- Regrassing and planting programme.
- Lead with Pride Programme.

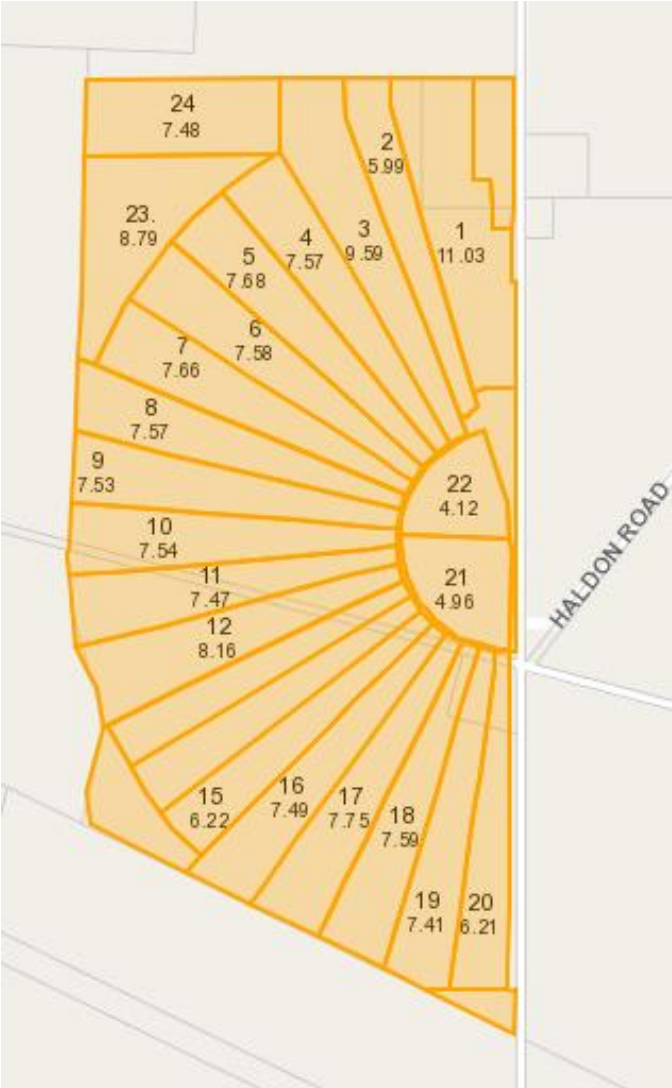
Aspects of my farm business I would like to change/need support with?

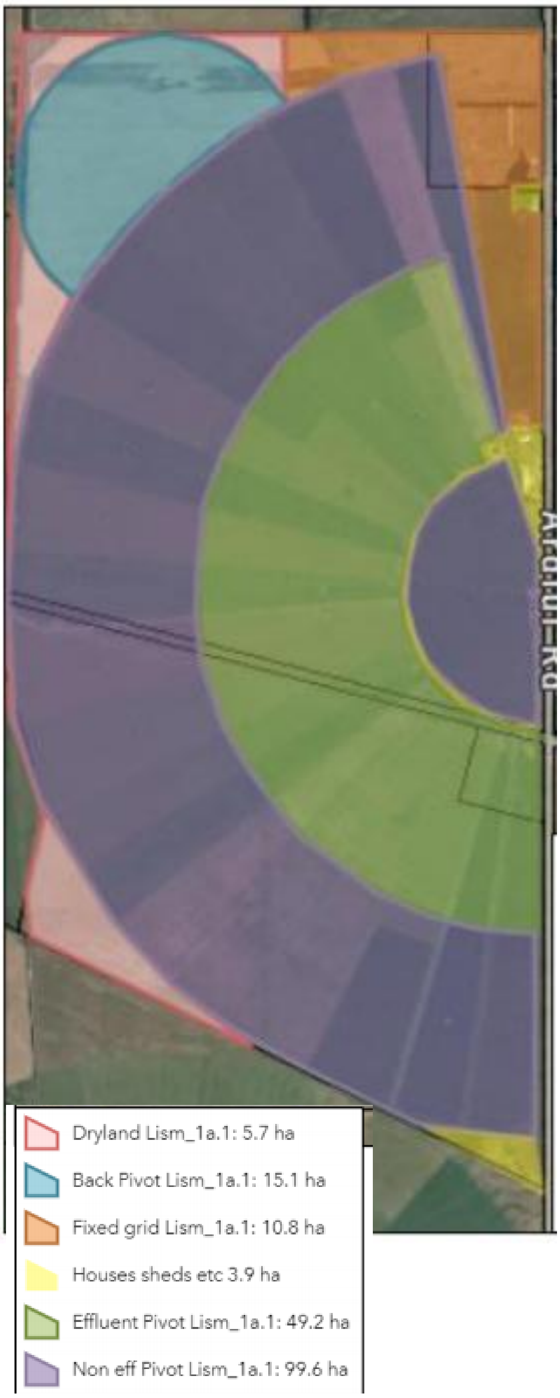
- Reduce winter grazing costs.
- Improve staff efficiency.
- Switching off from the farm and having family time.

Farm Map:

Figure 1: Farm Map

Figure 2: Blocks





Financial Performance

Table 2: Financial Performance for Sharemilking Business over time

	2019/20	2018/19	50:50 SM Canterbury Average 2018/19 season
Operating Profit ($/ha)	$1,744		$1,217
Farm Working Expenses ($/kg MS)	$2.53	$2.89	$2.63

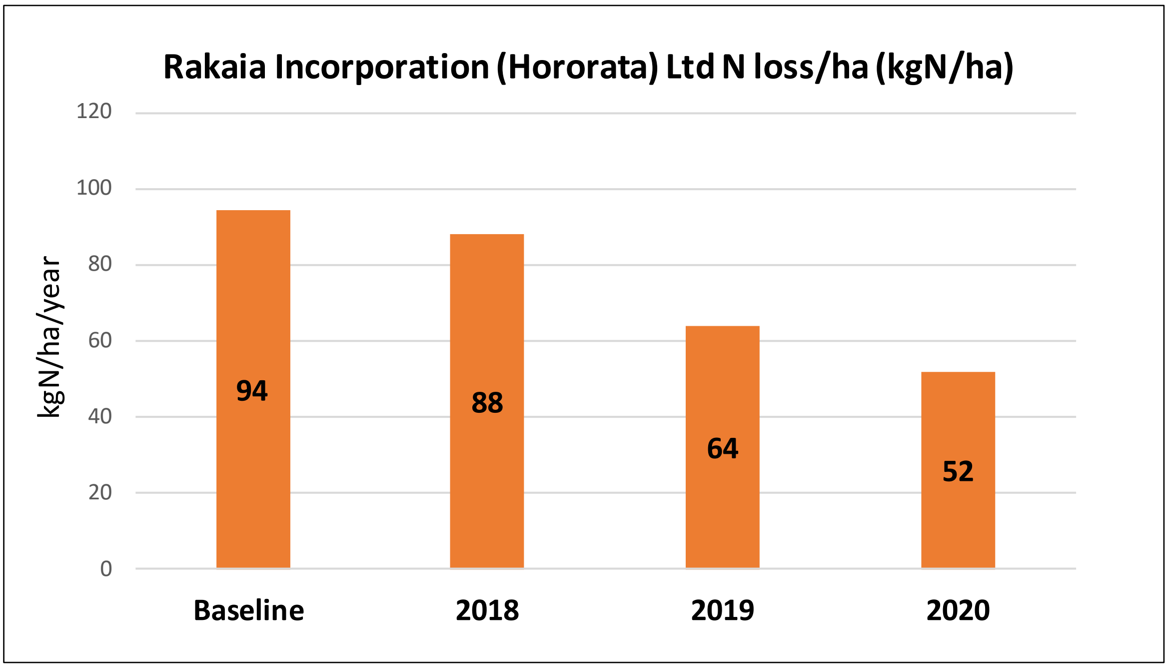
Environmental Performance

The property is under CPWL Environmental Management Strategy which have the same rules of the Selwyn Te Waihora sub-regional plan Change 1.

All the Overseer information presented in this handout has been modelled by Kirsty Thomas from Dairy Farm Management Services (and supported by David Ashby). The numbers presented in this handout have been taken directly from OverseerFM version V.6.3.4. These numbers will differ from any numbers reported using previous versions of OverseerFM.

The Baseline N loss (2009-13) on farm was 94 kg N/ha/yr. Since the Baseline season, the farm is more efficient with irrigation and N fertiliser (e.g. lower applications on the effluent blocks). This has lowered the N loss on farm. The N loss for the year end 2020 was 52 kg N/ha/yr (-45%). Therefore, the farm has already achieved the required reduction from baseline under the Selwyn Te Waihora sub regional rules. It is important to note that the farm was under different ownership during the baseline period.

Graph 1: N loss over time as estimated by OverseerFM (kg N/ha)



Drivers of N loss

Each farm has unique characteristics that will influence its nitrogen (N) leaching loss risk. These can be physical factors such as soil type and climate (especially rainfall); infrastructure such as effluent and/or irrigation systems; or farm management factors such as feed demand per ha, culling policy, fertiliser and supplement use, pasture types and off-paddock animal management.

Implementing “good management practices” in all aspects (soil management, irrigation, effluent, fertilisers etc.) is crucial to reduce N in waterways, independently of the N leaching number obtained from OverseerFM, as when modelling a farm in OverseerFM it is assumed that “good management practices” are applied.

Some of the critical aspects that contributes to N loss are:

- Drainage (water lost from the soil profile and out of the root zone taking nutrients with it)
- Annual N Surplus (N in outputs – N in Inputs)
- Timing of when mineral N is available in the soil and when drainage happens. For example, when N in urine parches is deposited at a time of the year when plants cannot uptake it and there is risk of drainage e.g. autumn and winter.

The following graphs explains the drivers of N loss and environmental footprint for Hororata farm.

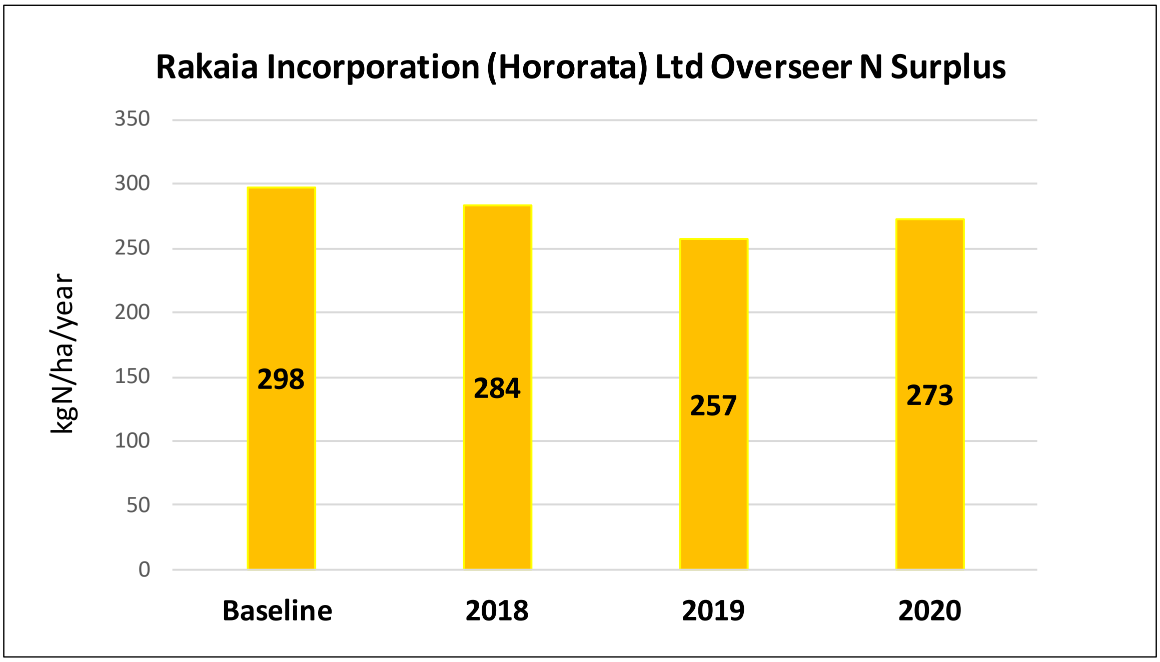
N Surplus

There is a high correlation between N Surplus and N leaching. N surplus is estimated by Overseer and it is the difference between N in Inputs and N in Outputs.

N Surplus = N Inputs (N Fertilizer + N Supplements + N Irrigation + N Clover) – N Output (N in meat and milk + N in exported feed)

The higher the N surplus the higher the risk of leaching but (as mentioned before there are other farm specific factors such as drainage (rain, irrigation and AET) and soil characteristics (PAW) that will affect this relationship.

Graph 2: N Surplus over time (KgN/ha/yr) as estimated by OverseerFM

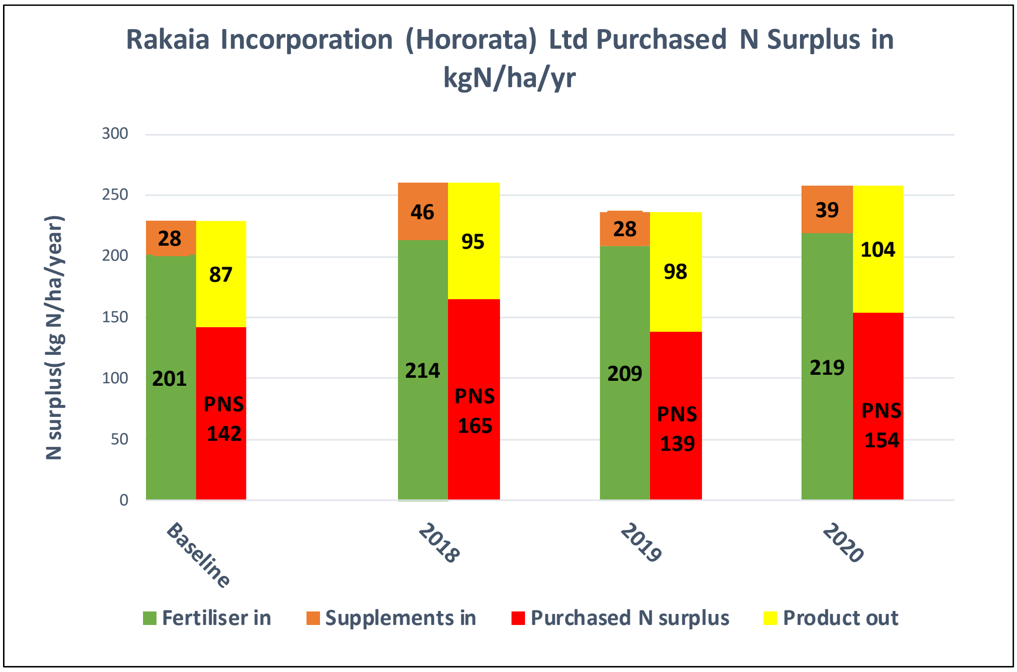


Purchased N Surplus

Purchased N Surplus is a KPI that is strongly correlated to N leaching. It is easily calculated (does not need Overseer) and is under management control.

Purchased N Surplus = N in fertiliser + N supplements - N in product (milk and meat) – N exported supplement

Graph 3: Purchased N surplus over time (KgN/ha/yr)

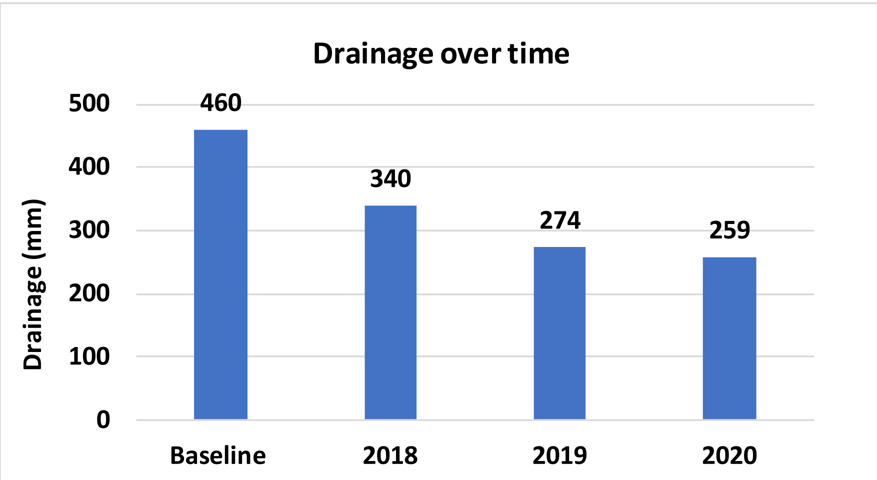


Drainage and N Leaching

There is a high correlation between N leaching and drainage. The higher the drainage the higher the risk of N leaching given all other conditions are the same. Drainage is mainly driven by rainfall and irrigation. On irrigated farms drainage can be reduced by improving irrigation efficiency. Soil type has a big influence (especially Profile Available Water = PAW). For farms with similar annual drainage but lighter soils (lower PAW), the leaching will be higher.

Drainage (0-60 cm root zone) = Rainfall + Irrigation – Run off – AET (actual Evapotranspiration)

Graph 4: Change in Drainage (mm/yr) as modelled by Overseer



Another way of thinking about the impact of drainage on N leaching is the concept of pore volume which is the relationship between drainage and the PAW of the soil. It represents how many times the soil is likely to flush during the year. The higher the number the higher the risk of leaching N from the soil profile.

Graph 5: Pore volume (Drainage/PAW) over time

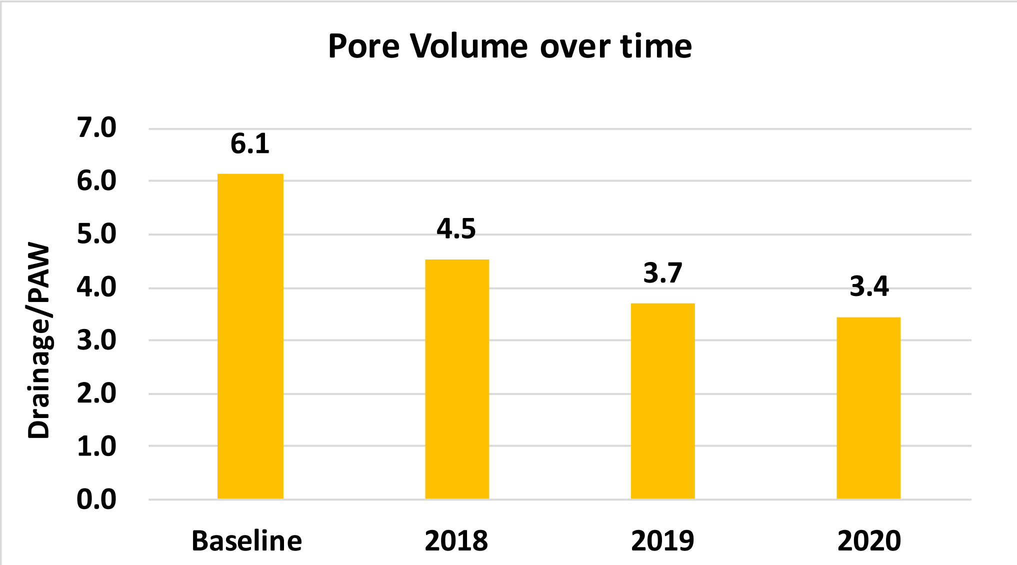


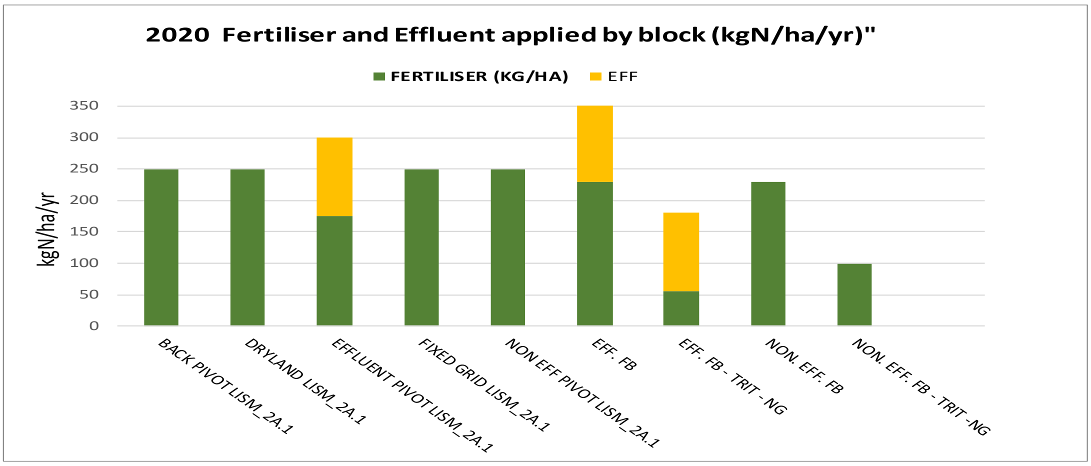
Table 3: Year end 2019 Impact of Drainage on N loss per Block

Year End 2019	Ha	Irrigation Supplied (mm)	Drainage (mm)	PAW (0-60cm)	Drainage/PAW	N loss/ha	% of N loss
1 BACK PIVOT LISM_2A.1	15.1	418	268	75	3.6	49	6%
2 DRYLAND LISM_2A.1	5.7	0	170	75	2.3	38	2%
3 EFFLUENT PIVOT LISM_2A.1	38	418	268	75	3.6	60	20%
4 FIXED GRID LISM_2A.1	10.8	407	261	75	3.5	41	4%
5 NON EFF PIVOT LISM_2A.1	79.9	418	268	75	3.6	49	33%
10 EFFLUENT PASTURE > FB	2.6	445	352	75	4.7	257	6%
11 NON EFF PASTURE > FB	4.9	445	352	75	4.7	217	9%
12 EFF KALE > PASTURE	3.1	465	330	75	4.4	104	3%
13 NON EFF KALE> PASTURE	5.1	465	330	75	4.4	108	5%
6 EFF. FB - TRIT - PASTURE	2.5	431	352	75	4.7	194	4%
7 NON EFF FB> TRIT> PASTURI	4.3	431	352	75	4.7	159	6%
8 EFF TRIT> PASTURE	3	418	269	75	3.6	42	1%
9 NON EFF. TRIT > PASTURE	5.4	418	269	75	3.6	39	2%
Total/Average	**180.4**	**408**	**274**	**75**	**4**	**65**	**100%**

Table 3 presents a good summary of N loss per block. As soil type is the same in all blocks the main reason for the difference in pore volume is the irrigation system and management that are affecting the drainage on the different blocks.

N Fertiliser Use

Graph 6: N fertiliser use – effluent and non-effluent block

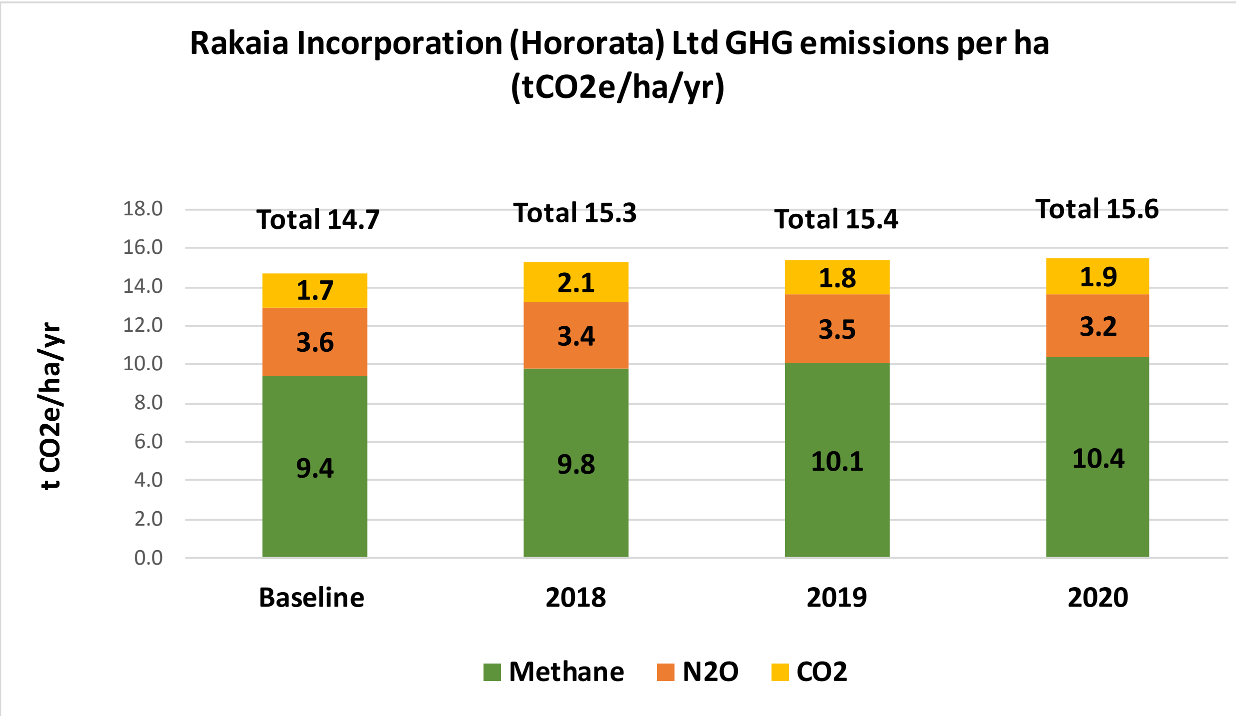


Greenhouse Gases

The main contributor in a dairy farm of GHG is methane which in turn is driven by dry matter intake (DMI). This is directly related to milks solids production.

The other GHG that farmers can influence in nitrous oxide (N2O). The main driver of N2O is N surplus and N intake, hence N fertiliser and N in supplement.

Graph 7: GHG over time



Overseer Modelling

Both the farm owners and Sharemilkers are interested in ways to reduce N losses further and increase/maintain profitability. This includes the possibility of wintering the MA cows on the farm which allows Glenn and Sarah to manage the winter grazing more efficiently by being able to keep an eye on things better and give them more time at home during winter. Currently the MA cows are winter grazed at Te Pirita which is around 8 km drive away.

Kirsty Thomas from the Dairy Farm Management Services conducted a modelling exercise for Hororata farm using a combination of OverseerFM (to assess the impact on environmental footprint) and Farmax (to assess the impact on financial performance) of the scenarios considered.

The information presented in this handout has been extracted from the report written by Kirsty on the modelling exercise. Table 4 describes the modelling scenarios and table 5 presents a summary of the results. Please note that the results presented here have been modelled with a previous version of OverseerFM.

Table 4: Modelling Scenario Description

Scenarios	**Description/ Results**
Scenario 1: Effluent area extended	• To extend effluent over the whole area of the main pivot and also under the back pivot. • N fertiliser was reduced from 242 kg N/ha/yr to 206 kg N/ha/yr on all area under the pivot to offset the N application from effluent. • A decrease in N fertiliser caused lower pasture production. Therefore, more grass supplement was required increasing the cost of bought feed by $32,802. • The overall reduction in N fertiliser use reduce N fertiliser costs by $11,142. • The reduction in N fertiliser costs did not outweighed the increase in bought feed. • The overall result was a $111/ha decrease in profit compared to the current system. N leaching losses are reduced from 55 to 54 kg N/ha/yr and nitrogen surplus from 276 to 272. However, it did not change GHG emissions. • It is important to note a significant investment must be made to allow the spread of effluent onto all the pivots.
Scenario 2: Reducing Cow numbers	• Cow numbers were reduced from 652 (peak cows milked) to 564 (peak cows milked). • The area of autumn grazed fodder beet and spring sown triticale was lowered from 7.5 ha to 5.7 ha. • As a result, net milk sales were $228,124 lower than the current season, and livestock sales were lower by $15,445 reducing the total revenue for the farm by $243,568. • Less cows and young stock resulted in a large reduction in dairy grazing costs ($45,227). • Less cows and making silage on farm meant not as much silage supplement was bought in. reducing feed cost by $131,386 • Other farm working expenses decreased including; animal health costs ($5,337), Breeding ($4,586), farm dairy costs ($1,138) and calf feed costs ($502). • A lower area in fodder beet meant crop costs reduced by $5,774. • The decrease in farm working expenses was not enough to outweigh the loss in milk sales and livestock sales. • The overall result was a $277/ha decrease in profit compared to the current system. The decrease in cow numbers decreased the N leaching losses from 55 to 53 kg N/ha/yr and nitrogen surplus from 276 to 255. GHG emissions were also lowered by 21 % due to lower cow numbers and no crop on farm.

Scenario 3: Wintering on, same cow numbers	• Wintering cows on farm was achievable by sowing winter fodder beet: • As the stock numbers remained the same, there was no difference in total revenue on the property. • Wintering the MA cows on the farm resulted in a massive reduction in dairy grazing costs ($160,938). • Also, as a larger area of milking platform was in winter fodder beet, N fertiliser applications were lower. This reduced fertiliser costs by $7,374. • However, as all cows remained on the farm over winter, more silage supplement was bought in to feed the stock. Therefore, bought feed costs increased by $226,228. • An increase in fodder beet caused an increase in feed crop and regrassing costs by $39,266. • Overall, a decrease in farm working expenses was not enough to outweigh the loss in milk sales and livestock sales. The overall result was a $598/ha decrease in profit compared to the current system. N leaching losses was reduced from 55 to 57 kg N/ha/yr due to increased crop on the property, a higher stocking rate and stock on the property over winter. GHG emissions were increased by 9 %
Scenario 4 Wintering on, reduced cow numbers	• To cope with wintering on farm, 90 less cows were carried on the property: • As a result, net milk sales were $233,124 lower than the current season and livestock sales were lower by $14,988. Reducing the total revenue by $247,514. • Wintering cows on farm was achievable by sowing winter fodder beet and In summer 10 ha of baleage was made on the farm which was fed out later in the season. • Again, wintering the MA cows on the farm and less cows resulted in a reduction in dairy grazing costs ($179,608). • Also, as a larger area of milking platform was in winter fodder beet, N fertiliser applications were lower. This reduced fertiliser costs by $6,205. • Other farm working expenses decreased including; animal health costs ($5,337), Breeding ($4,586), farm dairy costs ($1,139) and calf feed costs ($502). • However, an increase in fodder beet caused an increase in feed crop and regrassing costs by $31,386. • In addition, as all cows remained on the farm over winter, more silage supplement was bought in to feed the stock. Therefore, bought feed costs increased by $29,463. • Overall, a decrease in farm working expenses was not enough to outweigh the loss in milk sales and livestock sales. The overall result was a $667/ha decrease in profit compared to the current system. N leaching losses were reduced from 55 to 56 kg N/ha/yr and GHG emissions were reduced by 5 % due to lower cow numbers on farm.

Table 5: Overseer and Farmax modelling Results

Scenario	Description	N loss Kg N/ha/yr	Kg N Surplus	GHG (t CO_2 eq.) /ha	EFS before tax ($/ha)
Current Farm System	Current Season 2019/20 Base File	55	276	10,320	$3,203
Scenario 1	Increase effluent area	54(-1)	272	10,360 (0%)	$3,092 (-$111)
Scenario 2	Reduce Cow Numbers	53(-2)	255	8,984 (-21%)	$2,926 (-$277)
Scenario 3	Wintering on: keeping same cow numbers	57(+2)	278	11,213 (+9%)	$2,605 (-$598)
Scenario 4	Wintering on reducing cow numbers	56(+1)	253	9,784 (-5%)	$2,579 (-$667)

KEY MESSAGES

1. Know the numbers for your farm
2. Understand your regulation requirements
    a. Consents
    b. Audit
    c. Nutrient limits e.g. Selwyn 30% reduction in N loss for dairy farmland by 2030
3. Understand the key drivers for your farm for N and P loss
4. Explore your options and understand the reduction in N leached of each mitigation (not a bundle of mitigations where possible)
5. Develop a plan when you have identified the changes selected for your farm to be compliant by deadline as:
    a. Investments take time to plan, finance and implement
    b. Changes in farm system (e.g. stocking rate and N fertiliser use) need time to be imbedded
6. Stay focused on profit as profit is essential to having a sustainable business to:
    a. Be able to make changes to reduce environment footprint and
    b. Meet your goals
7. Effluent need system that meets consent and makes it easy to reduce fertiliser N applied (i.e. not part paddocks)
8. Use effluent N as a fertiliser to reduce N leached (recycling of Nitrogen)
9. With GHG on the horizon know your:
    a. GHG CO_2 eq. /ha
    b. GHG CO_2 eq./kg MS
10. Know the numbers for the key drivers of GHG for your farm
    a. Dry matter intake (as calculated by overseer) and
    b. N Surplus/Purchased N Surplus

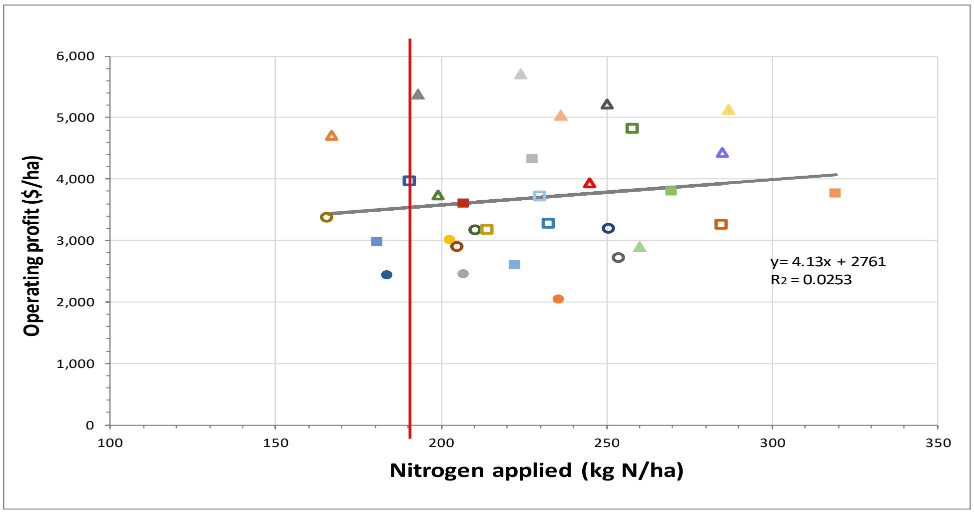
Farming under a N Fertiliser Cap

Central Government's new freshwater regulations came into law on September 3, 2020, including a cap on synthetic nitrogen fertiliser use. Regional councils are charged with implementing and monitoring the rules. The details on how they plan to do that will become clearer as they work their way through the changes. For more detailed information on all aspects of the regulation visit *www.dairynz.co.nz.*

Nitrogen use, pasture harvested and profit

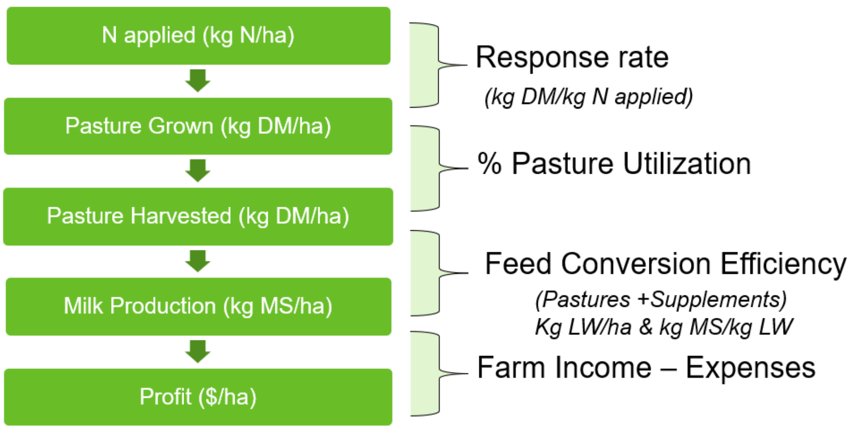
The correlation between nitrogen applied and profit is shown in Graph 8.

Graph 8: 2018-19 Operating Profit vs N applied (Canterbury Owner Operators -DairyBase)



Lower N fertiliser use is likely to reduce pasture growth, however how pasture is managed and utilised can minimise the impact on milk production and profit.

Figure 1: N fertiliser use and profit



For the same amount of N fertiliser used there are several factors that will influence how much pasture is grown and harvested. Some of these factors are:

- Nitrogen use efficiency affected by timing of N fertiliser, rate of applications and environmental conditions influencing pasture growth (soil temperature, soil moisture, other nutrients etc.)
- Time available for N response (timing between N application and grazing)

- Clover content on the pasture and its management
- Effluent block management
- Factors affecting the release of N in the soil (e.g. cultivation)
- Pasture management and monitoring that can affect pasture utilization

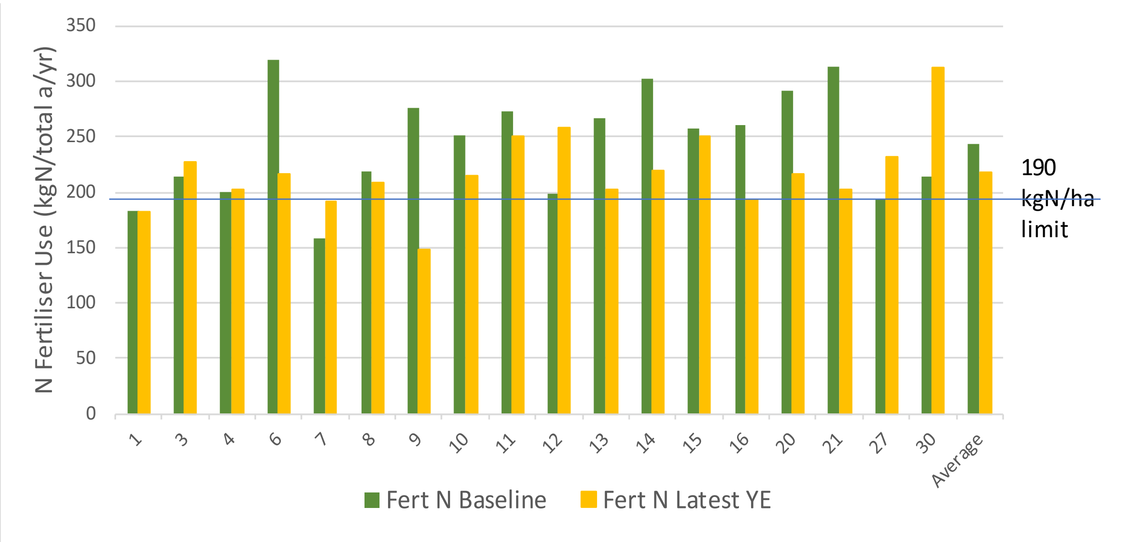
Similarly, how pasture harvested will translate into profit will depend on several factors including:

- How efficient pasture and supplement used are converted to milk production.
- Proportion of feed going into maintenance and milk production
- Cost of nitrogen, feed and overall operating expenses
- Milk price

Strategies to Reduce N fertiliser use successfully

Graph 9 compares N use in the baseline period (2009-2013) with the latest years available for nineteen of the partner farms involved in the Hinds and Selwyn project. The average N use for the latest year ends available was 218 kg N/ha compared to 244 kg N/ha during the baseline period (11% reduction). Four of these farms had increased N use compared to the baseline period. The year ends (yellow bars) represent the latest year end available for each farm.

Graph 9: Hinds and Selwyn Partner farms- Kg N applied /ha: Baseline Period & Year end.



Please note that the data from the partner farms presented in this document comes from Overseer which calculates N fertiliser used divided by the total area of the farm and not effective area as it is calculated in DairyBase.

Transition to lower N use

330 – 280 kg N

Most farms could take this step without major impact

280 – 230 kg N

Good planning and management is required

230 – 190kg N

Last 40 kg N could be challenging

- Significant reductions (+ 60 kg N/ha) will require time to adapt to new system
- Successful transition better to do in stages rather than in one blow
- Clover needs time to re-establish and be actively fixing N

Strategies to Reduce N use (Farmers' experiences)

The following recommendations are based on experiences from Canterbury farmers who have reduced N fertiliser rate successfully and without compromising pasture harvested or profit. The farmers have been involved with the Forages for Reduced Nitrate Leaching research programme and the Hinds and Selwyn Project. Many of these strategies are supported directly by science and some are based mainly on farmer experience.

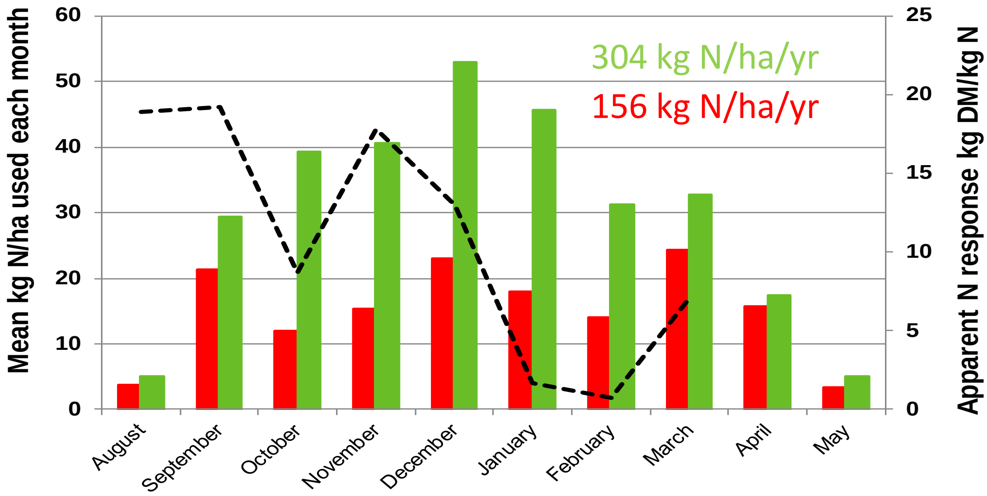
1. Application rates

Moving to lower application rates of no more than 40 kg N/ha in early spring and then to 0.8 kg N/ha per day of round length. N applications of 40kg N/ha are most beneficial when filling a genuine feed deficit (e.g. early spring). Mixing with other nutrients can reduce the N rate applied if other nutrients are needed. e.g. mix with Potash, DAP, Sulphate of Ammonia. Costs do increase, however there are advantages to applying nutrients like potassium and sulphate Sulphur in small amounts where there is a risk of these nutrients being lost from the root zone from rain causing drainage.

2. Timing of Applications

Not applying N in January/February when soil mineralisation rates are high, and clover is fixing N. Mineral N is available and N is not likely to be the limiting factor for growth. To gain confidence and to check what is limiting pasture growth take herbage samples. One farmer reports pastures looking N deficient, however herbage analysis showed K was deficient, not N. Graph 10 shows that the apparent N response rate to N applied is quite low over the January/February period.

Graph 10: (Pastoral21 Lincoln Farmlet trial N Use)



Red bars: monthly application rates low N system (156 kg N/ha/yr)
Green bars: monthly application rates high N system (304 kg N/ha/yr)
Dotted line: apparent N response (extra kg DM grown / extra kg N applied)

3. N fertiliser and pasture management

Increasing the round length to ensure grazing at 2½ to 3 leaf stage to grow more grass compared to grazing at 2 leaf or shorter where yield is significantly compromised. In Canterbury this is between 22- 24 days during the spring/summer period (generally from October-February). Where the farm traditionally has been following the cows with N, increasing round length will reduce the total number of grazings per year and 'automatically' will reduce the number of N applications. A longer round length will also reduce the N content in pasture and therefore reduce urinary N excretion.

Optimizing conditions for clover growth, ensuring good soil fertility (pH, P, K and Mo) and grazing management to avoid continuous shading of clover. Plan also for good clover establishment when renewing pastures. Clover will fix N and compensate to some extent the lower N from fertiliser.
Addressing other factors that may be limiting pasture growth such as, soil fertility, pH, weeds, irrigation, pasture species, drainage etc. Paddock scale soil tests (P, K, S and pH) have been successfully used by several farmers for a more targeted approach to soil nutrients and requirements.
Pasture walks and "feeding the wedge" i.e. only applying N if a genuine feed deficit is forecasted. Especially hold back in late autumn when pasture response can be slow and N loss risk is high due to drainage from autumn/winter rain. Any application of N needs to ensure that the extra pasture grown is not lost through increasing residuals or topping.

4. **Placing of N fertiliser**

Applying less N fertiliser on effluent areas, targeting times when effluent N is sufficient. If effluent areas are consistently getting effluent, they may only need N fertiliser in early spring and possibly autumn. The N content of effluent can be variable, therefore testing may be required. Applying different amounts of N fertiliser on the effluent area may not be practical where only parts of the paddock get effluent or effluent is not spread on the paddock often.
Avoiding areas of higher fertility within paddocks (e.g. first 20-30 meters into a paddock, area around the trough, stock camps) and areas of the farm likely to have low response to N, e.g. dry areas, poorer species. Identify "no go areas" on the spreading map.
Skipping a few paddocks from routine applications when pasture growth rates are high and silage making is not wanted/needed. A weekly farm walk and constructing a feed wedge will help with these decisions.

5. **Special products/technology:**

Coated urea (N-Protect, SustaiN) reduces volatilisation (the conversion of N in urea to ammonia gas, lost to the air). When using coated urea and conditions for volatilization are present (hot, dry and windy or moist soils in cooler situations) N applied can be reduced by 10% to grow the same amount of pasture than when applying uncoated urea.
Gibberellic acid (GA) is a growth hormone found in plants that promotes stem elongation and tiller size but is not a substitute for N fertiliser. When applied with N fertiliser good responses can be expected in early spring and autumn. Many farmers are using GA with N fertiliser specially in the autumn as a way of achieving a higher response to the N fertiliser applied.
Fertigation (injection of fertiliser into an irrigation system) and urea applied as a liquid can be used to reduce rates and get even distribution of the N. Fertigation trials have not shown a higher response rate to applying N in a liquid form compared to N in a solid form (i.e. the form of N does not affect the pasture response). However, if it allows lower application rates and more precise management at an acceptable return on capital, it is a tool that can be used well on farms that are suited to the set up.

Farmers' lessons of what to avoid:

- Inadequate and/or inaccurate monitoring and recording of N fertiliser applications leading to higher N used than expected at the end of the season.
- Routinely following each grazing with N fertiliser and not responding to a genuine feed deficit. This can be particularly wasteful if on fast grazing rounds.
- Needing N fertiliser to meet a feed deficit generated by following fast grazing rounds. When grazing on fast rounds (< 21 days) pasture is grazed before the 2½ leaf stage (compared to a longer grazing round and grazing at between 2½ and 3 leaf stage) missing out on the period of highest accumulation of growth. This will result in a lower response rate to N fertiliser.
- Using high N fertiliser rates each time that cannot be fully used by plants increasing the risk of the surplus N being lost from the root zone.
- Inadequate pasture monitoring and recording to inform decision making

- The extra N boosted grass grown is poorly utilised, e.g. increase in residuals or excessive pre-graze mowing or topping.
- Harvesting more silage than required due to too high N applications in the previous six weeks.

For more information https://www.dairynz.co.nz/about-us/regional-projects/selwyn-and-hinds-meeting-a-sustainable-future

What are the rules on synthetic nitrogen fertiliser use?

Central Government's new freshwater regulations came into force on September 3, 2020, including a cap on synthetic nitrogen fertiliser use. Regional councils are charged with implementing and monitoring the rules. The details on how they plan to do that will become clearer as they work their way through the changes. For more detailed information on all aspects of the regulation visit the Dairynz website.

- What are the rules on synthetic nitrogen fertiliser use?
  The amount of synthetic nitrogen fertiliser applied to land **in pastoral land use** will be capped at 190kgN/ha/year from 1 July 2021.
    - There are two limits (both of 190 kg N/ha/year):
    - a. An absolute limit per hectare on pastoral land (i.e. grazed land) not used to grow annual forage crops (i.e. pasture/grass)
    - b. An averaged limit across pastoral land on the farm
    - It is possible to put more than 190kg N/ha/year on forage crops but only if offset by applying lower amounts on pasture.

Pastoral land use means the use of land for the grazing of livestock. It doesn't include the grazing on the stubble of a crop that has been harvested after arable land use.

The nitrogen cap applies to a **'contiguous land holding'**. This is 'one or more parcels of land within a farm'. So, if there is a support block contiguous (joined) with the milking platform, it is all subject to the same N-cap. If the run-off is separate, both blocks must separately meet the N-cap.

Recording and reporting: All dairy farmers will need to record the tonnages of all synthetic nitrogen fertiliser applied on farm and the area it was applied to. Farmers will then have to report to their regional council on the amount used each year.

Farmers that exceed the N cap could apply for a resource consent. Two options are available:

1) Consent for a non-complying activity requiring a **synthetic N reduction plan** that demonstrates how the farm will reduce their use of synthetic N by **1 July 2023**
2) Consent for a non-complying activity requiring the farm to ensure that the rate at which N may enter water as a result of their application of synthetic N fertiliser does not exceed the rate that would enter water if 190kg N/ha/year was applied. This will be granted for a **maximum term of 5 years.**

Regional councils are still working on the details on how this will be implemented at a regional level.

What do I need to do now?

1. **Understand the new regulations** and how they would apply to your farm. Discuss what it means for you with your trusted advisor.
2. **Know how much synthetic N fertiliser was applied last year** over each hectare of the farm. It is important to accurately identify the size of the reduction required.
3. **Have good systems in place for recording** the tonnages and the area it was applied to of all synthetic N fertiliser applied on farm. Ensure all sources of synthetic N are accounted for.
4. **Review your current N use strategy** to identify potential areas to improve N use efficiency.
    a. How much N fertiliser was applied and when? Was the N fertiliser applied to the paddocks/areas of the farm targeted? Some farmers have reported significant discrepancies between planned and actual N use.
    b. How much N fertiliser was applied on the effluent and non-effluent areas?
    c. How many applications, how often and at what rate (kg N/ha/application)?
    d. What type of N fertiliser was used?
    e. Has the N boosted grass been used to fill a genuine feed deficit?
5. **Create a plan to meet the 190 kg N/ha cap**. If you are currently using more than 190 kg N/ha of synthetic fertiliser over any area of the farm you need to take some actions now to comply with the new requirements. If a significant reduction is required (>50 kg N/ha), targeting half of the required reduction now (2020/21 season) and the other half next season can help ease into the new system with less N fertiliser used.

Appendix I

N Loss Targets and Mitigation

Rules of the CPWL Environmental Management Strategy

The property is located in CPWL Environmental Management Strategy which have the same rules of the Selwyn Te Waihora sub-regional Plan. The rules of the Selwyn Te Waihora sub-regional plan (plan Change 1) are outlined below:

Assist with achieving the water quality limits in Section 11.7.3, being a 14% reduction in nitrogen losses across the catchment beyond those that could be reasonably anticipated by adopting good management practices, by 1 January 2022 by requiring farming activities (including farming activities within irrigation schemes) to:

Implement a Farm Environment Plan prepared in accordance with Schedule 7 Part A, where a property is greater than 10 hectares; and

Where a property's nitrogen loss calculation is greater than 15 kg of nitrogen per hectare per annum, further reduce losses of nitrogen from farming activities by implementing management practices that are in the order of half-way between good management practice and maximum feasible mitigation, which means the required reduction in the losses of nitrogen from the property or farming enterprise are:

(i) 30% for dairy; or
(ii) 22% for dairy support; or

Note, the property is not in a Cultural Landscape Values Management Area or in the Phosphorus Sediment Risk Area.

Regular auditing must also take place. After the first audit (1 year after the land use consent is granted), the frequency of audits is dependent on the previous audit grade. The time frame until the next farm audit is required is shown in Table 1. This is scheduled with CPWL.

Table 1: Timeframe until the next audit is required

Audit Grade	Timeframe when next audit is required
A	**3 years**
B	**2 years**
C	**12 months**
D	**6 months**

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