Meeting A Sustainable Future – Selwyn and Hinds Farmer Profile

Phill and Jos Everest, Flemington Farm — Farm owners in Longbeach, Hinds

Farming Challenges and Mitigations

As part of the GHG project and the Meeting a Sustainable Future project, a number of modelling scenarios were run for the farm to reduce nitrogen (N) losses and greenhouse gas emissions while retaining profitability, of which the Everest's chose to look two in more depth - these are described in later sections. The Everest family have already fine-tuned their irrigation system using Variable Rate Irrigation (VRI), so they are operating at an optimal level in terms of reducing their impact through drainage. The farm needs to continue to reduce their N losses under regional rules - any further gains in reducing N loss will come from reducing their N surplus on farm. The modelling has looked at fertiliser reduction, lower replacement rates, and less cropping to lower N losses.

Why the Everests are involved in the project

"We care for the environment but need a balance between social, economic, environment – we can't go broke individually or as an industry/country. Being involved in DairyNZ's Selwyn/Hinds project has given us the opportunity to carefully review options. We are prepared to give things a go. For example by spreading plantain out of the fertiliser bulk spreader truck, using duals on pivots to reduce ruts, focusing on labour/time efficiency as our team only milk once a day with the automation in the dairy shed." ***– Phill Everest, Flemington Farm.***

Introduction – Flemington Farm

Flemington Farm is in the Hinds Catchment, located 10 km south of Ashburton, and is owned by Phill and Jos Everest and run by Paul Everest, their son. The dairy farm is 273 ha, is flat terrain, with a milking platform of 217 ha. 38 ha each season is used for feed crops and some young stock, with some of this rotated in and out of the milking platform to allow for crop rotations. The balance, 18 ha, is in trees, laneways and buildings.

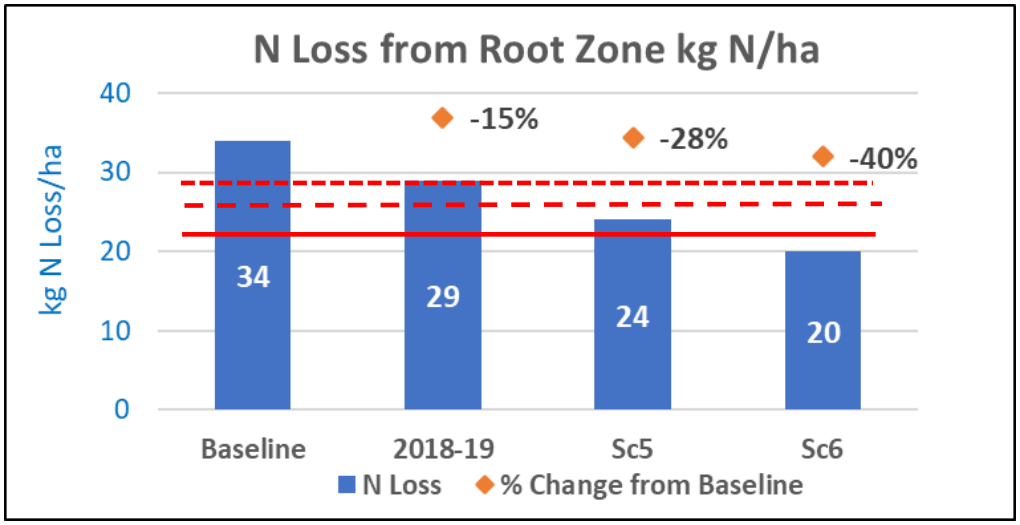
Relevant Farm Characteristics		
Soil • Longbeach Silt Loam - Heavy • 135mm Average PAW $_{0\text{-}60}$ • Tile Drained	**Rainfall , Irrigation and Drainage** • Average rainfall 624 mm annually • Independent supply. 2 wells, depth 50-60 m • 93% pivots (one with VRI), 7% hard hose gun • Most farm tile drained	**Effluent System** • Weeping wall • Effluent injected into 2 pivots, depth applied 1-2 mm

Farm System and Performance (2018/19)		
Effective Hectares • 217 ha milking platform • 38 ha support area. 23 ha of this is rotated in and out of the milking platform as supplement and youngstock grazing • 18 ha in trees and non effective land • 273 total ha	**Team** • 3.5 FTE (farm manager + 2 assistants + calf rearing/casual)190 cows/FTE, • 97,000 kgMS/FTE	**System** • 3.5 cows/ha • 84% pasture • 5% imported • 11% wintered off • 13.7tDM/ha pasture harvested (DairyBase)

Further info on Overseer versions, information sources etc can be found at the end of this document

Key Environmental Information

Nitrogen Loss and Nitrogen Surplus



TARGET REDUCTIONS
kg N/ha

2025	----------	**29**
2030	_ _ _ _ _	**26**
2035	_____	**22**

Overseer v6.3.3

Flemington had a Baseline N loss of 34 kgN/ha/yr, and has achieved under the 2025 target in the 2018/19 season. The two main drivers of N loss over time on the farm are N Surplus, and drainage (irrigation efficiency). At Flemington, the N surplus in 2018/19 (280 kgN/ha/yr) was higher than the Baseline (257 kgN/ha/yr) but due to significant improvements in irrigation efficiency, they have still been able to drop their N loss overall.

The 2019/20 season N loss is not shown in the graph above as the information can no longer be modelled in the Overseer version used in the graph (v6.3.3). However, the 2019/20 year would sit at the equivalent of around 27 kgN/ha/yr N loss, with this reduction mostly due to a drop in N surplus to 267 kgN/ha/yr.

See the modelling section below for what was changed to drop N loss further in scenario 5 and scenario 6 as shown in the graph above.

While their total N loss is low and they are already very close to the 2025 target, Phill says "We still want to do our share to continue to reduce losses where we can, as it's important that everyone in the catchment is doing their bit."

Greenhouse Gases

Flemington in the 2018/19 season produced a total of 14.8 t CO_2 equivalent/ha/yr, and 11 kg CO_2 eq/kgMS.

Catchment and Mahinga Kai

Flemington is in the Hinds Hekeao Plains catchment, and they are aware of their impact on Mahinga Kai. The local Mahinga Kai site is just above Flemington Farm and for last 20 years the Everest's have had all drains fenced off, and have now planted on the northside of the drains to provide shade to enhance biodiversity. They are also members of the Hinds Drains Working Group, and actively manage their drains by planting, maintaining, and excluding irrigation from them to improve the health of the drains.

Environmental Targets and Requirements

The farm is in the nutrient allocation sub-zone of Hinds (lower) between Hinds and Rangitata River, under Plan Change 2. Farms are required to produce a nutrient baseline at good management practice (little gmp) for ECan. From the 2017/18 season, unless part of an irrigation scheme, farms will be required to operate at or below their baseline N loss figure and be consistent with good management practices. As Flemington has an N loss of more than 20 kg N/ha/year, it will be required to progressively reduce N loss beyond good management practice levels by 15% by 2025, 25% by 2030 and 36% by 2035.

Challenges

The Everest's have chosen their low input system based on the challenges they have to work with at Flemington. Phill says that by choosing to have a lower stocking rate, they are working with rather than against the farm characteristics.

- Flemington is a farm that has heavy soils and a high water table, with drains throughout. At this stocking rate they are also able to have a low amount of feed brought onto the farm – and with the high water table and wet soils, they can stick to feeding this as grain the shed. By sticking to cow numbers in the 650-750 range, there is the added bonus that they are able to have their team milk only once per person, per day.
- Using fodder beet in autumn has taken the pressure off in that part of the season, as pasture damage in wet weather is a challenge. By using the beet, it also reduces the transition pressure at winter grazing as the cows are adjusted to 5kgDM beet before they leave the milking platform.

- Because the farm is already operating efficiently in terms of irrigation on heavier soils, and with a low stocking rate and low feed input, they don't have a lot of room to improve to further reduce both N loss and GHG significantly – further reductions will rely on additional fine tuning.

Mitigations Implemented to Date

N loss mitigations

Irrigation: The Everest's have invested in a centre pivot with variable rate irrigation (VRI), which means there is a high degree of irrigation efficiency. It also allows low application rate of effluent, which is injected into pivots over 50% of milking platform.

Farm System Choice: Flemington have adopted a low intensity system, with only 5% imported feed used on the milking platform, reducing their N surplus.

Drainage: Flemington's tile drains are very effective in reducing N loss on this farm, as the N is in the whole of the soil profile and is not lost when water drains, as it is through preferential flow. N loss is by matrix flow i.e. when water flows out of the 0-60 cm root zone from the soil pores. However, if high rates of effluent are applied, (greater than 5-10 mm depth) this can lead to high loss of effluent direct to water ways through preferential flow. Flemington farm have avoided this by applying effluent at a depth of 1-2 mm via pivots.

Fencing Waterways: Flemington Farm have had all their drains fenced off for at least 20 years, and have planted on the north side of the drains to provide shade to encourage biodiversity in the drains - in keeping with Mahinga Kai principles. Phill says they are currently looking into whether they can plant the south side of the drains in a way which allows them to be maintained as needed.

Greenhouse Gas mitigations

Phill says while there is no one silver bullet available to dramatically reduce our GHG losses, there are a number of small practices that we can adopt now that will make a difference. Flemington have implemented a number of these, including:

- Low application rates of effluent (1-2mm), utilising the variable rate irrigation (VRI) technology on the pivots and storage capacity of over 50 days to ensure effluent is applied at a time when it can be fully used for pasture growth and not lost to water or the atmosphere
- Not applying N fertiliser in the shoulder season to reduce N surplus and therefor N_2O emissions
- Sowing alternate pasture species such as Italian ryegrass and plantain for over five years
- Using fodder beet as a low N feed instead of kale to reduce N content in cow urine
- Increasing MS production per cow to lower the feed needed for maintenance of cows as opposed to milk production
- Planting shelter and riparian strips – a total of 22km has been done on farm to date.

For information on how these mitigation options reduce Greenhouse gases, see the Greenhouse Gas mitigation page.

Future Mitigations

Case study on options for future Greenhouse Gas reduction

Six scenarios were initially modelled for Greenhouse Gas (GHG) reduction in Overseer and Farmax, of which Phil, Jos and Paul chose to focus on Scenario 5 and 6, as described below.

- *Scenario 5:* N fertiliser use reduced from 349 kgN/ effective ha (313 kgN/total ha) to 203 kgN/ effective ha (187 kgN/total ha). Effluent blocks are treated separately to account for the N content in the effluent. Crop area (wheat, barley and fodder beet) is reduced from 23.3 to 18.9 ha, and stock replacement rate is reduced to 20%. It is assumed that there is enough potential to increase feed efficiency so that milk production can be maintained.
- *Scenario 6:* As above in scenario 5, plus further reduction of N fertiliser to 134 kgN/ total ha. Milk production is maintained, and to fill the modelled drop in pasture production from the reduced N fertiliser, additional barley grain will be bought in.

Modelling Outcomes

The main opportunity for the Everest's to drop N loss further is to reduce their N surplus, as they have already optimised their irrigation efficiency. Scenarios 5 and 6 show that there is potential to drop from their Baseline by 28% and 40% respectively, mostly by reducing their N surplus. Scenario 5 improves the profitability of the farm by 11%, while scenario 6 reduces profitability due to the expense of bringing in the barley to replace the pasture not grown. GHG outputs are improved in both cases, with a drop of 8% and 11% - this gain comes predominantly from the reduction in N^2O and CO_2 from lowered N fertiliser use.

Overseer Version 6.3.3		**Baseline 2011-12, 2012-13**	**2018-19**	**Scenario 5**	**Scenario 6**
Changes	**Year Compared to**				
N loss % change	Baseline 2012 & 2013		-15%	-28%	-40%
GHG losses % change	2018-19		-	-8%	-11%
Profitability % change	2018-19		-	+11%	-11%
Farm parameters					
Production (KgMS)		358,511	367,400	367,400	367,400
Peak cows		763	750	750	750
Pasture & crop eaten (t DM/ha)[1/]		14.7	16.8	16.5	16.5
N fertiliser use (kg N/total ha)		221	313	187	134
Crop Area (ha)		32.1	23.3	18.9	18.9
Nitrogen					
N Loss/ha		34	29	24	20
N Surplus/ha (Overseer)		257	280	226	201
Purchased N Surplus/ha		222	238	112	67
Greenhouse gases					
Total GHG (tCO2e/ha/yr)		14.8	14.8	13.7	13.2
Profitability					
Operating Profit ($/ha)			$2,980	$3,320	$2,640

**A more in depth version of this table is available in the Flemington Case Study*

Other Information

OverseerFM Updates

As new scientific evidence or more accurate information is found, Overseer FM updates the models used and includes this new information. Since this case study was done, there has been an update to OverseerFM, and soil information from SMaps has been updated. This gives different numbers for the farm, but the trends remain the same as in the previous versions. Knowing what version over Overseer is being used for any information you are comparing is important.

Further Information

For further information on this farm and the changes they are making, as well as the project:

- Virginia Serra, DairyNZ. Project Lead, 021 932 515 virginia.serra@dairynz.co.nz
- Phillipa Hedley, DairyNZ. Case Study Lead, 027 615 4476 pip.hedley@dairynz.co.nz
- Meeting a Sustainable Future Partner Farms page
- Meeting a Sustainable Future project page
- Flemington Farm Case Study, Flemington partner farm page

Information Sources:

Figure	Season/s	Source
Soil Data	-	**OverseerFM / ECan GIS**
Baseline N loss	2012-2013	OverseerFM 6.3.3
Current N loss	2018/19	OverseerFM 6.3.3
Physical Farm System	2018/19	DairyBase

For information on DairyBase, click here

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