OverseerFM – insights
Canterbury Regional trends
“moving to GMP”

(as of July 2021)

Prepared by Overseer Limited

OverseerFM Usage

OverseerFM was launched in June 2018

All farm accounts & analyses always in the latest model version

Currently operating v6.3.5

By July 2021 the software contains

13,000 farm accounts (c.12,000 actual farms)

8,000 users

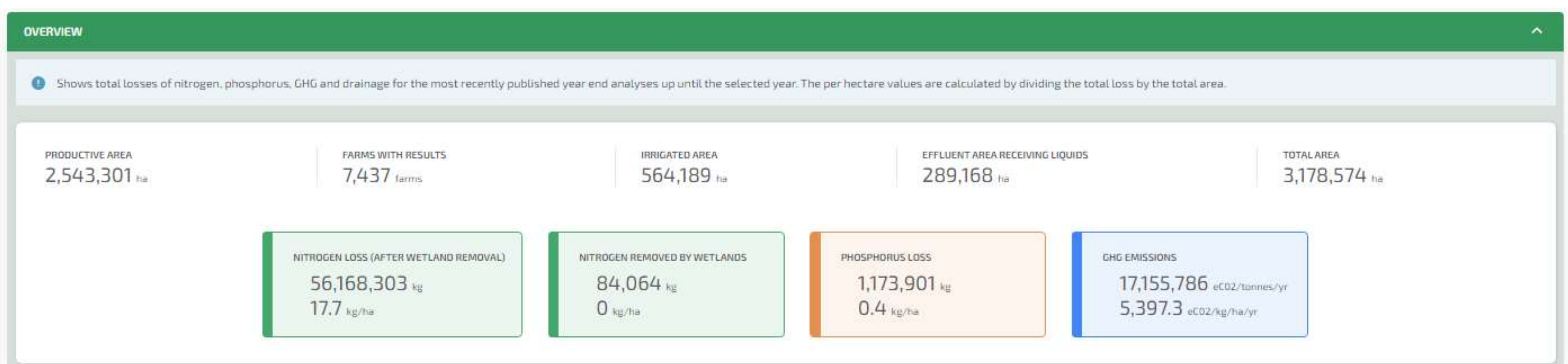
2,000 users per month

82,000 analyses created

Almost 3,000 farms in Canterbury with results

OverseerFM Usage

- Over 7,000 farms have generated results – providing the opportunity to start generating insights:
  - 4,500 dairy farms
  - 1,700 Mixed livestock & arable farms
  - 880 beef, sheep & deer farms
  - 140 crop & horticulture enterprises



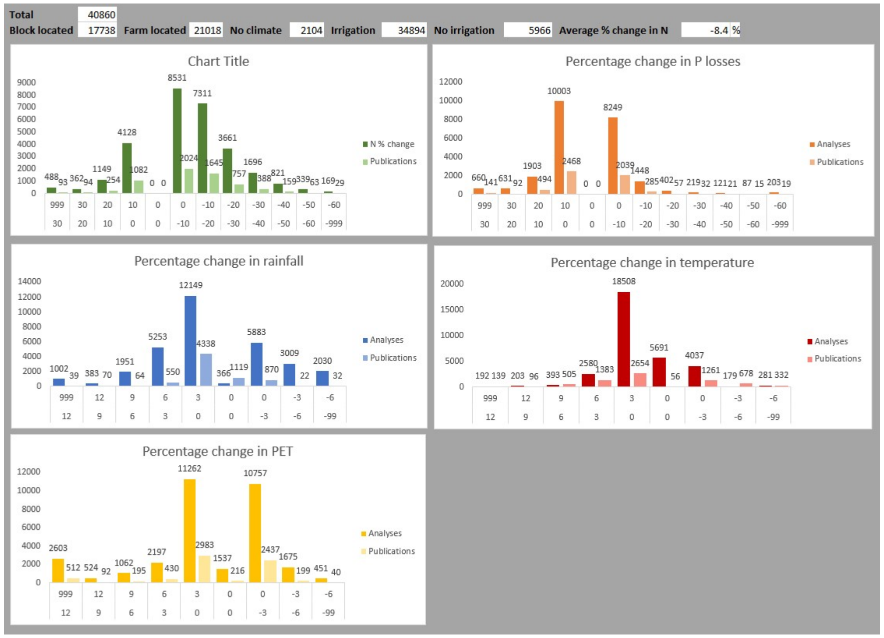
Climate data update – v6.4.0

- Overseer version 6.4.0 includes new climate data from NIWA, collected between 1991 and 2020. This data defines average monthly values for rainfall, temperature and PET (Potential Evapotranspiration) in 500 metre squared blocks across the country.

- This release does not make any changes to the climate modelling in Overseer, it does change how farms define their climate and as such give's a much more accurate representation for each farm

- Benchmark results were generated in v.6.3.5 in May and then re-generated in July using v6.4.0

- With the move to v6.4.0 farm analyses which are not located (may have a non-Google maps address, no blocks drawn or are an uploaded xml file from Legacy) now produce no result. They cannot generate a result as they have no climate data until they are located. This accounts for the difference in farm numbers included in the comparisons between May and July.



National trends

		National - All Enterprises						National - Dairy only					
Dairy Season	Fonterra $	N loss	P Loss	N Surplus	NCE	GHG	Farms	N loss	P Loss	N Surplus	NCE	GHG	Farms
2010-11	$ 7.90	16	0.2	139	23	6,358	846						
2011-12	$ 6.40	16.1	0.2	139	24	6,582	915						
2012-13	$ 6.16	17.6	0.2	145	25	7,356	1,681	46.4	0.8	236	26	12,643	860
2013-14	$ 8.50	17.5	0.3	150	26	7,949	2,005	39.1	0.7	218	27	12,282	1,151
2014-15	$ 4.65	18.4	0.3	160	25	8,622	2,568	39.1	0.8	215	26	12,430	1,559
2015-16	$ 4.30	20.8	0.3	165	26	9,050	3,343	40.6	0.7	220	26	12,580	2,094
2016-17	$ 6.52	21	0.4	171	26	9,663	4,626	38.3	0.8	213	27	12,374	3,118
2017-18	$ 6.79	20.5	0.4	170	26	9,451	5,582	37.4	0.8	209	27	12,154	3,671
2018-19	$ 6.35	19.5	0.4	161	27	9,267	6,632	35.1	0.8	203	27	12,032	4,324
2019-20	$ 7.19	18	0.4	159	26	9,207	7,275	33.1	0.8	201	27	12,046	4,693

1981-2010 Climate Data
Source: OverseerFM,
v.6.3.5 May 2021

		National - All Enterprises						National - Dairy only					
Dairy Season	Fonterra $	N loss	P Loss	N Surplus	NCE	GHG	Farms	N loss	P Loss	N Surplus	NCE	GHG	Farms
2010-11	$ 7.90	15.5	0.2	139	24	6,518	773						
2011-12	$ 6.40	15.9	0.2	137	24	6,646	839						
2012-13	$ 6.16	17.5	0.2	138	24	6,868	1,374	55.4	0.9	263	26	13,978	570
2013-14	$ 8.50	16.6	0.3	142	25	7,278	1,547	46.8	0.9	251	26	13,483	706
2014-15	$ 4.65	17.5	0.3	153	25	8,151	1,951	45.2	0.9	233	26	13,092	986
2015-16	$ 4.30	20.4	0.3	158	25	8,614	2,566	47.3	0.9	235	26	13,181	1,362
2016-17	$ 6.52	20.2	0.4	166	26	9,520	3,675	40.5	0.8	222	27	12,787	2,218
2017-18	$ 6.79	19.4	0.4	165	26	9,228	4,617	38.2	0.8	216	27	12,449	2,776
2018-19	$ 6.35	18.5	0.4	157	26	9,046	5,615	35.8	0.8	206	27	12,235	3,380
2019-20	$ 7.19	17.0	0.4	155	26	8,979	6,350	34.0	0.8	203	27	12,236	3,784

1991-2020 Climate Data
Source: OverseerFM,
v.6.4.0 July 2021

- **Overall, the OverseerFM results indicate an improvement in farm environmental performance since 2017**
- Dairy farms have been monitoring N loss since 2013, the change to 2020 using the now more current NIWA climate data indicates :
  - National numbers for dairy show a **reduction in N leaching of 38.7%**
  - N surplus has **reduced by 23%**
  - Nitrogen Conversion Efficiency has **improved by 1%**
  - Greenhouse Gas emissions have **reduced by 12%**

Canterbury trends

		ECAN - All Enterprises						ECAN - Dairy Only							
Dairy Season	Fonterra $	N loss	P Loss	N Surplus	NCE	GHG	Farms	N loss	P Loss	N Surplus	NCE	GHG	Farms	% irrigation	% effluent
2010-11	$ 7.90	27.7	0.3	144	24	6,632	790	66.4	0.8	285	24	14,097	328	87.7	29.3
2011-12	$ 6.40	27.8	0.3	144	24	6,690	841	62.4	0.8	289	25	14,419	357	87.0	30.1
2012-13	$ 6.16	27.7	0.3	143	24	6,520	1,323	58.5	0.7	286	25	14,586	547	84.0	31.5
2013-14	$ 8.50	25.3	0.3	146	24	6,621	1,407	51	0.7	283	25	14,632	611	82.8	32.2
2014-15	$ 4.65	25.2	0.3	157	24	7,026	1,539	49.9	0.7	281	25	14,693	713	82.9	34.1
2015-16	$ 4.30	27.6	0.3	173	25	8,121	1,969	49.8	0.6	282	26	14,976	1,029	85.6	36.4
2016-17	$ 6.52	26.9	0.3	180	26	8,978	2,258	47	0.6	276	26	14,870	1,227	86.0	37.2
2017-18	$ 6.79	27.9	0.3	179	25	8,681	2,478	49.2	0.7	275	26	14,737	1,230	86.7	37.7
2018-19	$ 6.35	25.9	0.3	172	26	8,595	2,689	47.5	0.6	271	27	14,833	1,312	87.6	37.7
2019-20	$ 7.19	23.6	0.3	168	26	8,366	2,797	42.7	0.6	266	27	14,960	1,340	86.8	36.7

1981-2010 Climate Data
Source: OverseerFM,
v.6.3.5 May 2021

		ECAN - All Enterprises						ECAN - Dairy Only							
Dairy Season	Fonterra $	N loss	P Loss	N Surplus	NCE	GHG	Farms	N loss	P Loss	N Surplus	NCE	GHG	Farms	% irrigation	% effluent
2010-11	$ 7.90	27.5	0.3	143	24	6,653	726	65.1	0.9	284	24	14,145	282	87.0	30
2011-12	$ 6.40	27.8	0.3	139	24	6,700	777	65.4	0.9	290	25	14,436	302	87.0	30
2012-13	$ 6.16	26.9	0.3	139	24	6,602	1,215	60.2	0.9	287	25	14,705	449	87.0	32.0
2013-14	$ 8.50	23.9	0.3	142	24	6,691	1,283	54.6	0.8	285	25	14,820	489	86.0	33.0
2014-15	$ 4.65	23.6	0.3	147	24	7,022	1,365	53.2	0.8	280	25	14,784	548	87.0	36.0
2015-16	$ 4.30	27.0	0.4	164	25	8,103	1,708	55.3	0.8	279	26	15,094	776	88.0	37.0
2016-17	$ 6.52	25.4	0.4	170	26	8,835	1,976	49.4	0.7	276	27	14,932	948	89.0	39.0
2017-18	$ 6.79	25.6	0.3	168	26	8,468	2,262	46.5	0.7	275	26	14,795	1,033	88.0	39.0
2018-19	$ 6.35	23.8	0.3	167	26	8,372	2,477	44.5	0.7	268	27	14,864	1,120	88.0	38.0
2019-20	$ 7.19	21.7	0.3	163	27	8,120	2,610	40.6	0.7	265	27	15,016	1,157	88.0	37.0

1991-2020 Climate Data
Source: OverseerFM,
v.6.4.0 July 2021

- Across All Enterprises N loss is down 21.1%.
- N Surplus and GHG emissions have increased overall, but have showed reductions since 2017.

- **OverseerFM results for dairy farms show a reduction in N leaching of 37.7%**
- P loss has reduced by 23%
- N surplus has reduced by 7%
- Nitrogen Conversion Efficiency has improved by 3%
- Greenhouse Gas emissions have increased by 6%
- The area irrigated with effluent has increased by 23%

Understanding Canterbury dairy trends

Factor	2014	2020	
Animals	28.2 RSU per ha	27.99 RSU per ha	No change
Effluent	33% of effective farm area	37% of effective farm area	Improvement
Fertiliser	242 kg/N/ha	227 kg/N/ha	Improvement
Feed	2% crops, 16% supplements	3% crops, 14% supplements	Improvement
Drainage	320mm	252mm	Improvement

Source: OverseerFM, July 2021

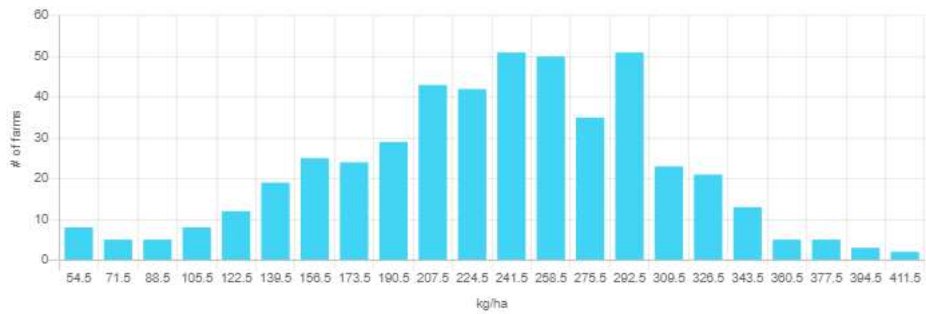
- Increased area receiving dairy effluent, representing improved management and nutrient utilisation
- Reduction in fertiliser rates supports the reduction in N Surplus and improvement in Nitrogen Conversion Efficiency
- Reduction in supplements & return to pasture as a percentage of the diet also reducing N surplus
- Drainage reduced by improved irrigation management practices

- *This analysis looks at Canterbury dairy farms in OverseerFM, comparing 2014 data with 2020.*
- *The 2020 data has 1,157 farms compared with 489 in 2014, this means we are not comparing the exact same farms; however, it does provide a reasonable view of overall change in the region.*

Reductions in N fertiliser - Dairy

2014

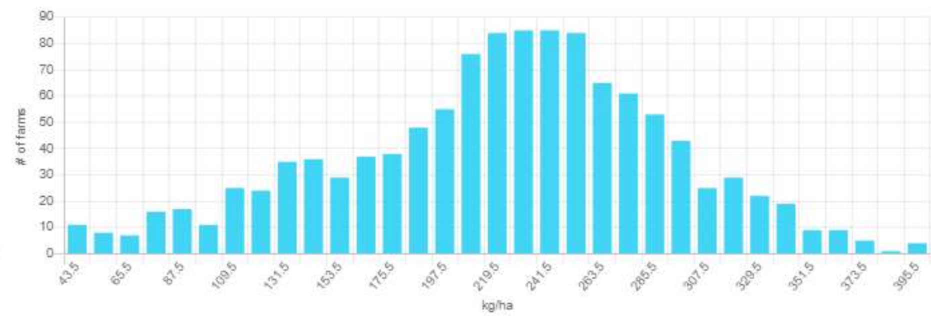
N in synthetic fert on pasture (kg/ha)



MIN	MAX	MEAN	MEDIAN	STD DEV	LOWER QUARTILE	UPPER QUARTILE
46.1	413	234.5	242	69.7	190.7	285

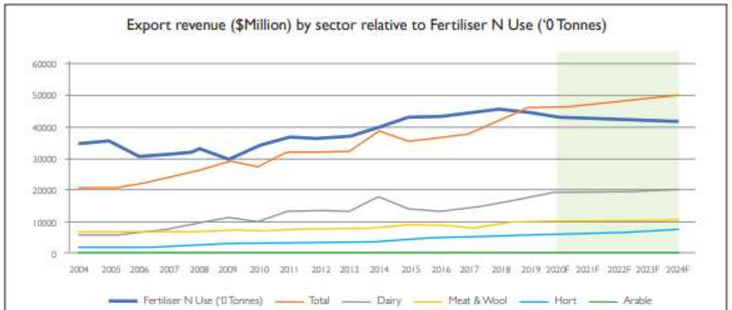
2020

N in synthetic fert on pasture (kg/ha)



MIN	MAX	MEAN	MEDIAN	STD DEV	LOWER QUARTILE	UPPER QUARTILE
38.1	398	220.4	227.2	68.3	179.4	265

Source: OverseerFM, July 2021



Changes in nitrogen fertiliser use and changes in primary industry export revenue over time (in total and by individual sector groups).

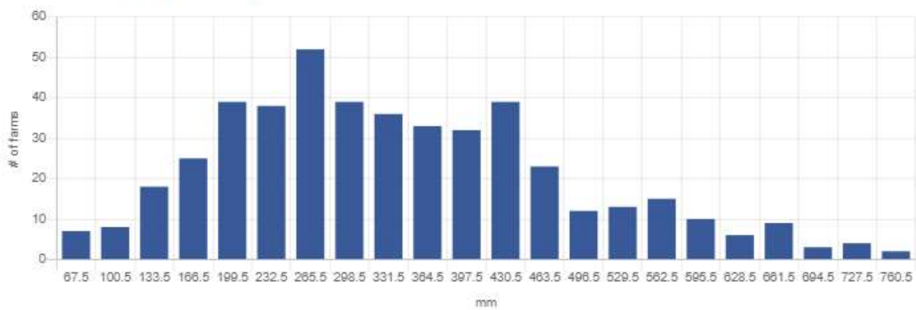
Data source: MPI's Situation and Outlook for Primary Industries, March 2020, MfE's New Zealand's Fourth Biennial Report under the United Nations Framework Convention on Climate Change and the Fertiliser Association of New Zealand

- This reflects Fertiliser Association data which indicates N fertiliser use is now declining
- Additional Fertiliser Association data shows that nationally >42% of N fertiliser sales are coated with urease inhibitors, reducing GHG emissions and allowing a reduction in application rates of up to 10%

Changes in drainage / irrigation - Dairy

2014

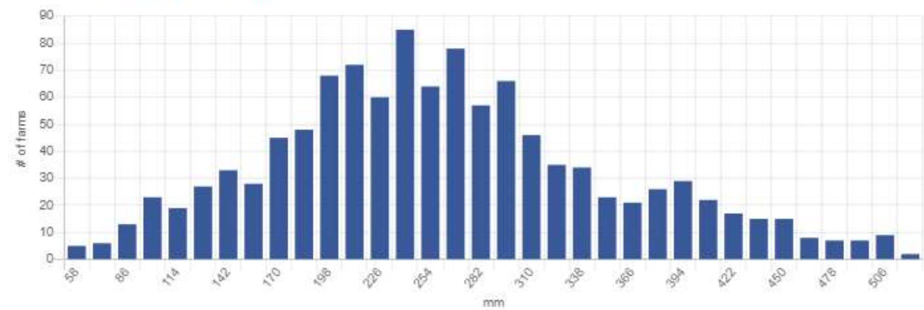
Average annual drainage (mm)



MIN	MAX	MEAN	MEDIAN	STD DEV	LOWER QUARTILE	UPPER QUARTILE
51.5	756	339.9	320	145.1	236.6	429.1

2020

Average annual drainage (mm)



MIN	MAX	MEAN	MEDIAN	STD DEV	LOWER QUARTILE	UPPER QUARTILE
51.5	514.4	260.9	252	93.6	198.2	315

Source: OverseerFM, July 2021

	Travelling	Spraylines	Solid set	Micro	Ctre pivot	Border dyke
2014	29%	9%	0.3%	0%	54%	8%
2021	14%	12%	1%	0%	71%	2%

	Fixed	Variable trigger	Variable depth	Variable both
2014	54%	20%	5%	21%
2021	19%	33%	13%	35%

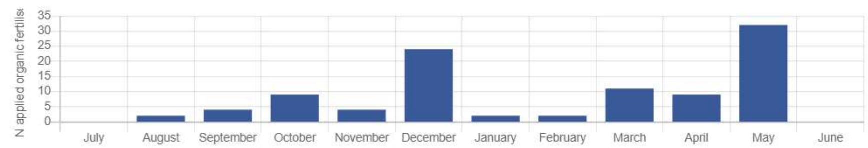
- Significant move to centre pivots from border dyke and travelling irrigators.
- Big drop in fixed irrigation to irrigating based on soil moisture readings.
- This is likely to be the reason for the big drop of in drainage and hence N losses.

Timing of activities

2014

N APPLIED SYNTHETIC FERTILISER

N APPLIED ORGANIC FERTILISER



ANIMALS (RSU)

IRRIGATION APPLIED

Source: OverseerFM, July 2021

2020

N APPLIED SYNTHETIC FERTILISER

N APPLIED ORGANIC FERTILISER

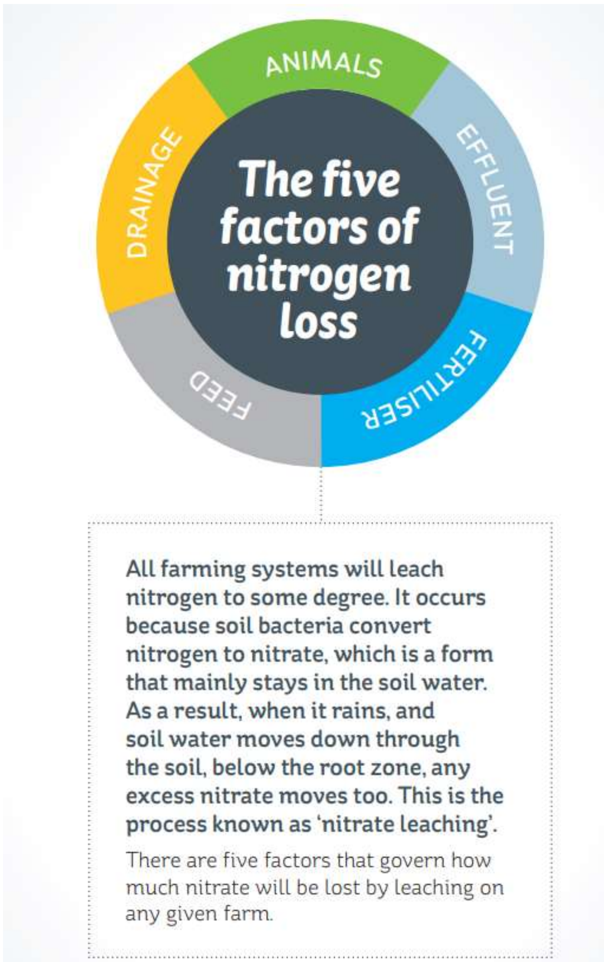
ANIMALS (RSU)

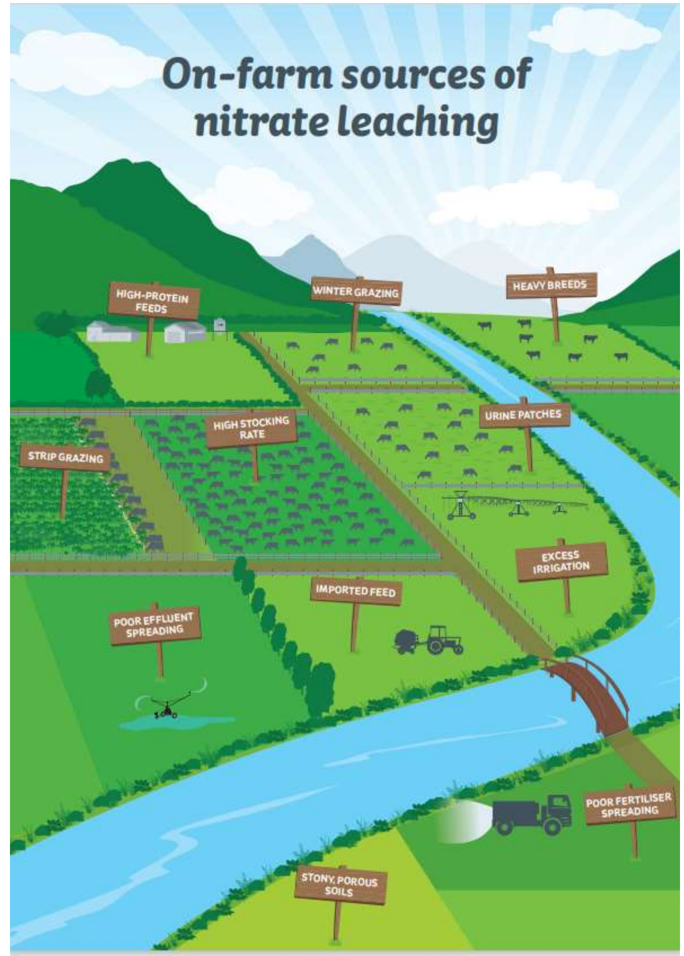
IRRIGATION APPLIED

Source: OverseerFM, July 2021

- Animal distribution unchanged.
- Irrigation reasonably unchanged, although shoulder season irrigation reduced.
- Synthetic fertilizer applications in April & May have reduced.
- Organic fertilizer applications in March, April, May have reduced considerably.

Are the changes real? Factors affecting N loss





* Graphics reproduced from the Ballance Agri-Nutrients "More than just a number" booklet, produced to support farmer workshops aimed at improving N efficiency on farm.

Understanding & mitigating nitrogen losses

Nitrogen leaching risk

33 kg / ha / yr

This number is the estimated amount of nitrogen with the potential to be lost by leaching into groundwater or waterways.

Smaller numbers are better.

Nitrogen conversion efficiency

35 %

This number indicates the percentage of the nitrogen brought into the farming system that is converted to product (e.g., meat, milk).

Larger numbers are better.

Nitrogen surplus

114 kg / ha / yr

This number indicates the quantity of nitrogen brought into the farming system that does not leave the farm in product.

Smaller numbers are better.

Reducing your number

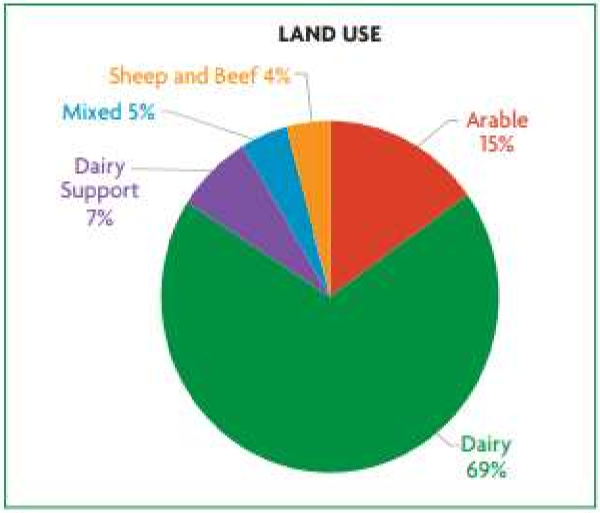
WHAT FACTORS CONTRIBUTE TO NITRATE LEACHING ON MY FARM?

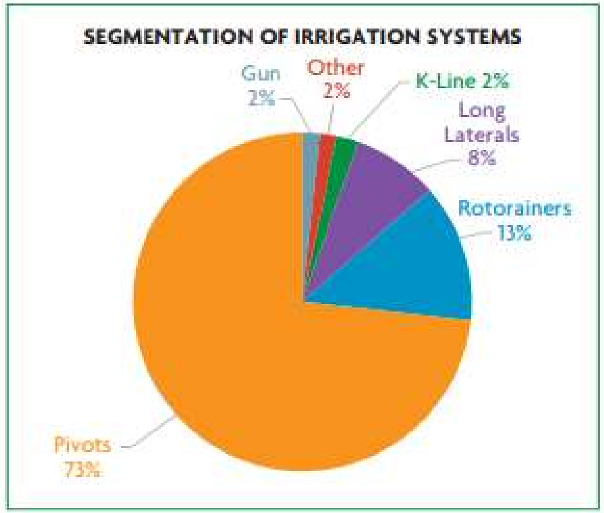
Use the table on page 12 to assess whether or not you can influence any of these factors

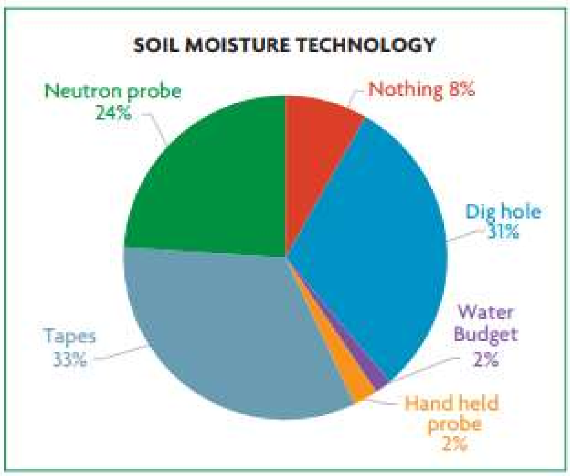
FACTOR	IS THIS A FACTOR ON YOUR FARM? (yes/no)	CAN YOU INFLUENCE IT? (yes/no)
Porous soils (sands, stony soils, pumice soils)		
High rainfall (>1200 mm/year)		
Irrigation not closely monitored		
Cow breed		
High stocking rate		
Mainly high-protein feed		
Grazing-only system (no supplement)		
Cows grazed on pasture in winter		
Pastures get pugged in winter		
No feed pad available		
No stand-off pad available		
No animal housing available		
Small effluent area		
Limited effluent storage		
Effluent application not closely monitored		
Effluent application rate too high		
Effluent applied in late autumn/winter		
Nitrogen fertiliser applied at high rates		
Nitrogen fertiliser applied when plants not growing		
Nitrogen fertiliser applied when soil is waterlogged		
Pastures frequently grazed too hard		
Pastures frequently grazed too light		

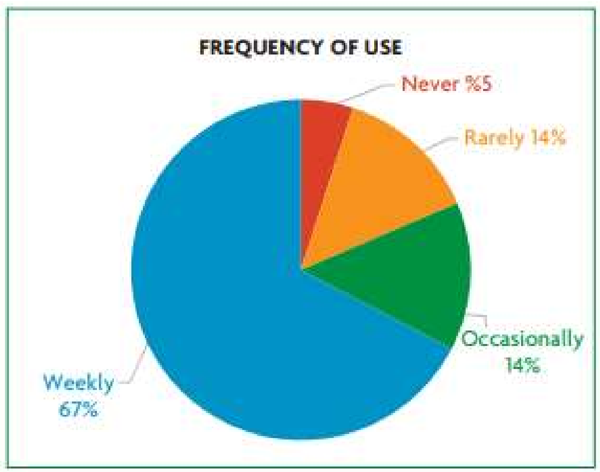
* Graphics reproduced from the Ballance Agri-Nutrients "More than just a number" booklet, produced to support farmer workshops aimed at improving N efficiency on farm.

Understanding if irrigation changes are real?









Results of 2017 ECAN / IrrigationNZ irrigation efficiency pilot study

- 73% pivots

- 69% dairy farms
- 51% scheme water

- 57% using probes or tapes
- 33% of those using occasionally or less often

- **72% of infrastructure less than 10 years old**

- Suggests the conversion to pivot irrigation and improved management practices modelled in OverseerFM are real.

Source: ECAN / Irrigation NZ Summer Student Irrigation Efficiency Pilot Program 2016–17

Benchmarking opportunity

- OverseerFM provides a single database
- OverseerFM can provide insights into farm management practices and environmental effects of farming
  - By industry
  - By Region
  - Across time
- Due to the regulations – Canterbury has the most robust dataset
- Results in v.6.4.0 use the most recent NIWA climate dataset, covering the period 1991-2020, and use actual farm location, providing additional confidence in the results

- Only OverseerFM provides farmers with the ability to understand their N, P and GHG losses in one place AND to model mitigations, enabling farms to avoid pollution swapping

Conclusions

- It may be significant that since 2017, OverseerFM is indicating improvements in farm environmental performance

- OverseerFM data indicates that the Canterbury Land & Water Plan is producing actions on farm which are reducing N (& P) loss
- The use of the updated climate data information from NIWA has not significantly affected the results
- Those reductions are especially seen on dairy farms
- The reductions are being achieved by:
  - Reductions in N fertiliser usage
  - Reduction in supplement usage
  - Increased area of farms receiving effluent applications
  - Increased area irrigated by pivot irrigation
  - Increased usage of irrigation management tools
- These management practise changes suggest farms are moving towards GMP with their current systems
- Further improvements will likely require farm system change