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Farm Level Cost of a Carbon Tax on Nitrogen Fertiliser

Prepared for the Fertiliser Association of NZ

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1.0 EXECUTIVE SUMMARY

The purpose of this analysis is to calculate the amount of carbon tax payable on nitrogen fertiliser, at the farm level. Such a tax has been signalled by Government, with the proportion of free allocation, initially set at 95%, also signalled to decrease over time.

Inasmuch as nitrous oxide from nitrogen fertiliser is classified as an "agricultural" emission, pricing on this will start in 2025. In this respect the reduction in the free allocation relative to nitrogen fertiliser use used in this analysis is:

- By 1% per year from 2026 to 2030
- By 2% per year from 2031 to 2040, and
- By 3% per year from 2041 to 2050

The percentage payable (or liability) is therefore the inverse of the free allocation. The percentage payable over time, shown relative to year, is:

Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
% payable	5%	6%	7%	8%	9%	10%	12%	14%	16%	18%	20%	22%	24%
Year	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**
% payable	26%	28%	30%	33%	36%	39%	42%	45%	48%	51%	54%	57%	60%

The cost of the carbon tax on nitrogen fertiliser is dependent on:

- The amount of nitrogen within the fertiliser
- The relevant emission factor for the type of nitrogen fertiliser
- The carbon charge, i.e. $/tonne CO_2e
- The percent liability levied on the output

The analysis concentrated on the pastoral sector, given its dominance in the use of nitrogen fertiliser, namely dairying (67% of nitrogen fertiliser use) and sheep & beef (25% of nitrogen fertiliser use). This was done via analysis of the main farming regions/farm types:

Dairy	Sheep & Beef
Northland	1. S.I. High Country
Waikato/Bay of Plenty	2. S.I. Hill Country
Taranaki	3. N.I. Hard Hill Country
Canterbury	4. N.I. Hill Country
Southland	5. N.I. Intensive Finishing
New Zealand Average	6. S.I. Finishing Breeding
	7. S.I. Intensive Finishing
	8. S.I. Mixed Finishing
	9. All Class Average

Data on nitrogen use was derived from Dairybase and the Beef+Lamb NZ Economic Service survey, using an average figure across 5 years: 2013/14 – 2017/18. A quartile analysis was also carried out across each of the farm types.

The initial analysis was based on using a non-urease coated urea fertiliser, at a carbon cost of $25/tonne CO_2e.

If a mixture of nitrogen fertiliser equivalent to that indicated by the 2017 agricultural census was used, this increased the tax cost shown in the report by 0.5% for dairying, and 0.8% for sheep & beef

If all the nitrogen fertiliser used was a urease-coated urea fertiliser, the tax cost decreased: for dairying by 4.1%, sheep & beef by 4.3%

If all the fertiliser used was a non-urea type, then the tax cost increased: for dairying by 6.5%, sheep & beef by 6.1%.

Note that the difference in actual fertiliser cost was ignored.

Sensitivity analysis was carried out relative to varying the cost of carbon. This is illustrated below at the New Zealand average farm level. Cost shown is per farm, assuming a non-urease coated urea.

	NZ Dairy Average	NZ S&B All Class Average			NZ Dairy Average	NZ S&B All Class Average
@$25/T				**@$75/T**		
2025	$145	$55		**2025**	$436	$166
2030	$291	$111		**2030**	$873	$332
2040	$873	$332		**2040**	$2,618	$997
2050	$1,745	$664		**2050**	$5,236	$1,993
@$30/T				**@$100/T**		
2025	$175	$66		**2025**	$582	$221
2030	$349	$133		**2030**	$1,164	$443
2040	$1,047	$399		**2040**	$3,491	$1,329
2050	$2,094	$797		**2050**	$6,981	$2,658
@$50/T				**@$250/T**		
2025	$291	$111		**2025**	$1,454	$554
2030	$582	$221		**2030**	$2,909	$1,107
2040	$1,745	$664		**2040**	$8,727	$3,322
2050	$3,491	$1,329		**2050**	$17,453	$6,644

The quartile analysis showed (by definition) that the cost for Quartile 1 and 2 farms is relatively low, increasing for quartile 3 farms, and can be significant for quartile 4 farms. Some farm types are also more impacted; irrigated dairy farms (e.g. Canterbury) and farms which do a lot of cropping (e.g. Class 8 South Island Mixed Finishing farms), which use a lot of nitrogen as part of their system, will face much higher costs.

A key question is whether the tax would reduce the amount of nitrogen fertiliser used. This is unlikely for most farms; the elasticity of demand for nitrogen fertiliser is relatively inelastic (i.e. demand does not reduce much as a result of an increase in price), a significant part of this being that alternatives are usually 2-3 times more expensive.

A key aspect around behaviour change relating to the tax on nitrogen fertiliser would be the visibility of such a cost. This directly relates to the Point of Obligation (PoO) for the cost; if the PoO is at the processor/importer level, then the cost of the tax will be very largely hidden from the farmer, and hence significantly diminish any likely behaviour change. If the PoO is at the farm level, the cost is directly visible; while the overall cost may not be significant, its very visibility will at least (a) remind the farmer there is a cost, and (b) allow them to take this into consideration when assessing the overall cost of, and possible mitigations to, GHG emissions.

The advent of a carbon tax on nitrogen fertiliser would directly raise the probability of double counting; all the current carbon calculators include nitrogen fertiliser usage as an input, and hence include the direct N_2O emissions from the fertiliser[1] as part of the overall farm GHG emissions. Inasmuch as there would be a separate cost on the nitrogen fertiliser, this component of the total farm emissions would need to be identified and deducted from the farm emissions. The end result being an additional administrative cost to eliminate the possibly of double counting.

[1] As noted in Section 6, the Emission Factor for urea fertiliser also includes the CO_2 emitted from the fertiliser when applied to land and is therefore included in the nitrogen fertiliser tax.

2.0 BACKGROUND

Within the New Zealand Emissions Trading Scheme (ETS), the intent is to tax greenhouse gas emissions, which includes nitrous oxide emissions from the application of nitrogen fertilisers.

Nitrogen fertiliser is widely used within New Zealand agriculture, particularly by the pastoral sector to boost pasture growth. When nitrogen fertiliser is applied to the ground, microbes within the soil act on the fertiliser, releasing nitrous oxide into the atmosphere; about 1% of nitrogen in the soil, from any source, is lost as nitrous oxide.

The amount of CO_2-equivlent released from nitrogen fertiliser has been differentiated depending on the fertiliser type.

Table 1: Nitrogen fertiliser emission factors

	Emission Factor ($kgCO_2e/kg$ N)
Non-urea nitrogen fertiliser	5.40
Urea nitrogen fertiliser not coated with urease inhibitor	5.07
Urea nitrogen fertiliser coated with urease inhibitor	4.86
Weighted average (based on 2016 sales)	5.08

The cost of the carbon tax on nitrogen fertiliser therefore depends on:

- The amount of nitrogen within the fertiliser
- The relevant emission factor
- The carbon charge, i.e. $/tonne CO_2e
- The percent liability levied on the output (as the inverse of the free allocation provided by government).

Currently, as at 2020, the "free allocation" is set at 95%, but government has decided to reduce this this over the next 30 years[2]:

- By 1% per year from 2021 to 2030
- By 2% per year from 2031 to 2040, and
- By 3% per year from 2041 to 2050

This applies to industrial emissions; inasmuch as nitrous oxide from nitrogen fertiliser is classified as an "agricultural" emission, pricing on this will start in 2025. In this respect the reduction in the free allocation relative to nitrogen fertiliser use used in this analysis is:

- By 1% per year from 2026 to 2030
- By 2% per year from 2031 to 2040, and
- By 3% per year from 2041 to 2050

The impact on farm-level costing, if the industrial reduction in the free allocation is applied to nitrogen fertiliser, is shown in Section 5.

[2] Cabinet Paper ENV-19-MIN-0017. https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/env-19-min-0017-minute-industrial-allocation.pdf

2.1 Objective

The objective of this analysis is to:

(i) Calculate the carbon tax payable by the average farm based on average nitrogen useage over the last 5 years, covering a range of dairy and sheep and beef farms across New Zealand:

Table 2: Farm Types for Analysis

Dairy	Sheep & Beef
Northland	1. S.I. High Country
Waikato/Bay of Plenty	2. S.I. Hill Country
Taranaki	3. N.I. Hard Hill Country
Canterbury	4. N.I. Hill Country
Southland	5. N.I. Intensive Finishing
New Zealand Average	6. S.I. Finishing Breeding
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(ii) Calculate the additional costs to farmers over time, associated with potential changes in free allocation, based on Government phasing down industrial allocation as outlined above

(iii) Subject to data availability carry out an analysis outlined in (i) above, on a quartile basis, to give an indication of the impact of such costs across farms using different amounts of nitrogen fertiliser, within the same farm type.

2.2 Analysis Basis

The analysis is carried out based on average nitrogen fertiliser application by farm type[3]. Inasmuch as there are different emission factors by fertiliser type, the analysis investigated two scenarios:

(i) Based on (uncoated) urea only, given it makes up 57% of all nitrogen fertiliser sales based on a nitrogen content basis (2017 Ag Census) [Coated and uncoated urea makes up 84% of all nitrogen fertiliser sales], and

(ii) Based on a weighted average across all nitrogen fertiliser sales, categorised below.

[3] Journeaux et al, 2019. The Value of Nitrogen Fertiliser to the New Zealand Economy. http://www.fertiliser.org.nz/Site/research/projects/the-value-of-nitrogen-fertiliser-to-the-new-zealand-economy.aspx

Table 3: Proportion of nitrogen fertiliser sales, based on nitrogen content

	Urea nitrogen fertiliser not coated with urease inhibitor	Urea nitrogen fertiliser coated with urease inhibitor	Non-urea nitrogen fertiliser (DAP/SoA)	Total
Dairy				
Tonnes N	130,158	62,338	24,606	217,102
Proportion (%)	60%	29%	11%	100%
Sheep & Beef				
Tonnes N	36,227	19,252	21,753	77,231
Proportion (%)	47%	25%	28%	100%

Source: Ag Census 2017

3.0 DAIRY

3.1 Average Nitrogen Fertiliser Application

Table 4: Average dairy nitrogen fertiliser application by region

	Northland	Waikato/BoP	Taranaki	Canterbury	Southland	New Zealand
Effective ha*	140	127	105	231	205	153
Average kg N/ha**	112	128	148	234	171	150
Total kg N	15,680	16,256	15,540	54,054	35,055	22,950
Tonnes Urea Equivalent	34.1	35.3	33.8	117.5	76.2	49.9

*Dairy Statistics 2018

**Dairybase average 2013/14 – 2017/18

The "% liability" shown in the following tables is calculated as 1-free allocation percent, with the free allocation percent decreasing as outlined in Section 2.0

3.1.1 On-Farm Cost using Uncoated Urea

Table 5: Average dairy farm cost at $25/tonne CO_2e, Uncoated Urea only

	% Liability	Northland	Waikato/BoP	Taranaki	Canterbury	Southland	New Zealand
2025	5%	$99	$103	$98	$343	$222	$145
2026	6%	$119	$124	$118	$411	$267	$175
2027	7%	$139	$144	$138	$480	$311	$204
2028	8%	$159	$165	$158	$548	$355	$233
2029	9%	$179	$185	$177	$617	$400	$262
2030	10%	$199	$206	$197	$685	$444	$291
2031	12%	$238	$247	$236	$822	$533	$349
2032	14%	$278	$288	$276	$959	$622	$407
2033	16%	$318	$330	$315	$1,096	$711	$465
2034	18%	$358	$371	$355	$1,233	$800	$524
2035	20%	$397	$412	$394	$1,370	$889	$582
2036	22%	$437	$453	$433	$1,507	$978	$640
2037	24%	$477	$495	$473	$1,644	$1,066	$698
2038	26%	$517	$536	$512	$1,781	$1,155	$756
2039	28%	$556	$577	$552	$1,918	$1,244	$814
2040	30%	$596	$618	$591	$2,055	$1,333	$873
2041	33%	$656	$680	$650	$2,261	$1,466	$960
2042	36%	$715	$742	$709	$2,466	$1,600	$1,047
2043	39%	$775	$804	$768	$2,672	$1,733	$1,134
2044	42%	$835	$865	$827	$2,878	$1,866	$1,222
2045	45%	$894	$927	$886	$3,083	$1,999	$1,309
2046	48%	$954	$989	$945	$3,289	$2,133	$1,396
2047	51%	$1,014	$1,051	$1,005	$3,494	$2,266	$1,484
2048	54%	$1,073	$1,113	$1,064	$3,700	$2,399	$1,571
2049	57%	$1,133	$1,174	$1,123	$3,905	$2,533	$1,658
2050	60%	$1,192	$1,236	$1,182	$4,111	$2,666	$1,745
	100%	$1,987	$2,060	$1,970	$6,851	$4,443	$2,909

Table 6: Average dairy per hectare cost at $25/tonne CO_2e, Uncoated Urea only

	% Liability	Northland	Waikato/BoP	Taranaki	Canterbury	Southland	New Zealand
2025	5%	$0.71	$0.81	$0.94	$1.48	$1.08	$0.95
2026	6%	$0.85	$0.97	$1.13	$1.78	$1.30	$1.14
2027	7%	$0.99	$1.14	$1.31	$2.08	$1.52	$1.33
2028	8%	$1.14	$1.30	$1.50	$2.37	$1.73	$1.52
2029	9%	$1.28	$1.46	$1.69	$2.67	$1.95	$1.71
2030	10%	$1.42	$1.62	$1.88	$2.97	$2.17	$1.90
2031	12%	$1.70	$1.95	$2.25	$3.56	$2.60	$2.28
2032	14%	$1.99	$2.27	$2.63	$4.15	$3.03	$2.66
2033	16%	$2.27	$2.60	$3.00	$4.75	$3.47	$3.04
2034	18%	$2.56	$2.92	$3.38	$5.34	$3.90	$3.42
2035	20%	$2.84	$3.24	$3.75	$5.93	$4.33	$3.80
2036	22%	$3.12	$3.57	$4.13	$6.53	$4.77	$4.18
2037	24%	$3.41	$3.89	$4.50	$7.12	$5.20	$4.56
2038	26%	$3.69	$4.22	$4.88	$7.71	$5.64	$4.94
2039	28%	$3.97	$4.54	$5.25	$8.30	$6.07	$5.32
2040	30%	$4.26	$4.87	$5.63	$8.90	$6.50	$5.70
2041	33%	$4.68	$5.35	$6.19	$9.79	$7.15	$6.27
2042	36%	$5.11	$5.84	$6.75	$10.68	$7.80	$6.84
2043	39%	$5.54	$6.33	$7.32	$11.57	$8.45	$7.41
2044	42%	$5.96	$6.81	$7.88	$12.46	$9.10	$7.99
2045	45%	$6.39	$7.30	$8.44	$13.35	$9.75	$8.56
2046	48%	$6.81	$7.79	$9.00	$14.24	$10.40	$9.13
2047	51%	$7.24	$8.27	$9.57	$15.13	$11.05	$9.70
2048	54%	$7.67	$8.76	$10.13	$16.02	$11.70	$10.27
2049	57%	$8.09	$9.25	$10.69	$16.91	$12.35	$10.84
2050	60%	$8.52	$9.73	$11.26	$17.80	$13.00	$11.41
	100%	$14.20	$14.72	$14.07	$48.94	$31.74	$20.78

3.1.1.1 Dairy Sensitivity Analysis

Table 7: Average per dairy farm cost, with varying $/tonne CO_2e, uncoated urea only

	Northland	Waikato/BoP	Taranaki	Canterbury	Southland	New Zealand
@$25/T						
2025	$99	$103	$98	$343	$222	$145
2030	$199	$206	$197	$685	$444	$291
2040	$596	$618	$591	$2,055	$1,333	$873
2050	$1,192	$1,236	$1,182	$4,111	$2,666	$1,745
@$30/T						
2025	$119	$124	$118	$411	$267	$175
2030	$238	$247	$236	$822	$533	$349
2040	$715	$742	$709	$2,466	$1,600	$1,047
2050	$1,431	$1,484	$1,418	$4,933	$3,199	$2,094
@$50/T						
2025	$199	$206	$197	$685	$444	$291
2030	$397	$412	$394	$1,370	$889	$582
2040	$1,192	$1,236	$1,182	$4,111	$2,666	$1,745
2050	$2,385	$2,473	$2,364	$8,222	$5,332	$3,491
@$75/T						
2025	$298	$309	$295	$1,028	$666	$436
2030	$596	$618	$591	$2,055	$1,333	$873
2040	$1,789	$1,854	$1,773	$6,166	$3,999	$2,618
2050	$3,577	$3,709	$3,545	$12,332	$7,998	$5,236
@$100/T						
2025	$397	$412	$394	$1,370	$889	$582
2030	$795	$824	$788	$2,741	$1,777	$1,164
2040	$2,385	$2,473	$2,364	$8,222	$5,332	$3,491
2050	$4,770	$4,945	$4,727	$16,443	$10,664	$6,981
@$250/T						
2025	$994	$1,030	$985	$3,426	$2,222	$1,454
2030	$1,987	$2,060	$1,970	$6,851	$4,443	$2,909
2040	$5,962	$6,181	$5,909	$20,554	$13,330	$8,727
2050	$11,925	$12,363	$11,818	$41,108	$26,659	$17,453

3.1.2 Dairy On-Farm Cost Using Weighted Average Nitrogen Fertilisers

This analysis assumes the farms use a range of nitrogen fertilisers, as outlined in Table 3.

- 60% is uncoated urea
- 29% is urea coated with a urease inhibitor
- 11% is other nitrogen fertilisers

Table 8: Average dairy farm cost at $25/tonne CO_2e, using a range of nitrogen fertilisers

	% Liability	Northland	Waikato/BoP	Taranaki	Canterbury	Southland	New Zealand
2025	5%	$99	$103	$98	$341	$221	$145
2026	6%	$119	$123	$118	$409	$265	$174
2027	7%	$138	$144	$137	$477	$310	$203
2028	8%	$158	$164	$157	$545	$354	$232
2029	9%	$178	$185	$176	$614	$398	$261
2030	10%	$198	$205	$196	$682	$442	$289
2031	12%	$237	$246	$235	$818	$531	$347
2032	14%	$277	$287	$274	$955	$619	$405
2033	16%	$316	$328	$314	$1,091	$707	$463
2034	18%	$356	$369	$353	$1,227	$796	$521
2035	20%	$396	$410	$392	$1,364	$884	$579
2036	22%	$435	$451	$431	$1,500	$973	$637
2037	24%	$475	$492	$470	$1,636	$1,061	$695
2038	26%	$514	$533	$510	$1,773	$1,150	$753
2039	28%	$554	$574	$549	$1,909	$1,238	$811
2040	30%	$593	$615	$588	$2,045	$1,326	$868
2041	33%	$653	$677	$647	$2,250	$1,459	$955
2042	36%	$712	$738	$706	$2,455	$1,592	$1,042
2043	39%	$771	$800	$764	$2,659	$1,724	$1,129
2044	42%	$831	$861	$823	$2,864	$1,857	$1,216
2045	45%	$890	$923	$882	$3,068	$1,990	$1,303
2046	48%	$949	$984	$941	$3,273	$2,122	$1,390
2047	51%	$1,009	$1,046	$1,000	$3,477	$2,255	$1,476
2048	54%	$1,068	$1,107	$1,058	$3,682	$2,388	$1,563
2049	57%	$1,127	$1,169	$1,117	$3,886	$2,520	$1,650
2050	60%	$1,187	$1,230	$1,176	$4,091	$2,653	$1,737
	100%	$1,978	$2,050	$1,960	$6,818	$4,422	$2,895

As can be seen from Table 8, the difference in on-farm cost between using uncoated urea versus a range of nitrogen fertilisers, is -0.5%; there is a cost saving in using urease coated urea, which slightly offsets the additional carbon tax on other (non-urea) nitrogen fertilisers.

If all the nitrogen fertiliser used was urease-coated urea, then the cost as indicated in Tables 5/6/7 would decrease by 4.1%

If all the nitrogen fertiliser used was a non-urea nitrogen fertiliser, then the cost as indicated in Tables 5/6/7 would increase by 6.5%

3.2 Quartile Nitrogen Fertiliser Application

This analysis is based on quartile information from Dairybase, being the average over the period 2013/14 – 2017/18. The quartile data is based on kg N applied per hectare, and the analysis is based on using non-urease coated urea. The full annual analysis per region is shown in Appendix 1.

3.2.1 Northland

Table 9: Northland dairy quartile information

	Q1	Q2	Q3	Q4
Av Effective ha	155	158	163	181
Av kg N/ha	35	98	138	208
Total N (kg)	5,411	15,528	22,499	37,570
Tonnes Urea Equivalent	11.8	33.8	48.9	81.7

Table 10: Northland dairy sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$34	$98	$143	$238
2030	$69	$197	$285	$476
2040	$206	$590	$856	$1,429
2050	$412	$1,181	$1,711	$2,857
@$30/T				
2025	$41	$118	$171	$286
2030	$82	$236	$342	$571
2040	$247	$709	$1,027	$1,714
2050	$494	$1,417	$2,053	$3,429
@$50/T				
2025	$69	$197	$285	$476
2030	$137	$394	$570	$952
2040	$412	$1,181	$1,711	$2,857
2050	$823	$2,362	$3,422	$5,714
@$75/T				
2025	$103	$295	$428	$714
2030	$206	$590	$856	$1,429
2040	$617	$1,771	$2,567	$4,286
2050	$1,235	$3,543	$5,133	$8,572
@$100/T				
2025	$137	$394	$570	$952
2030	$274	$787	$1,141	$1,905
2040	$823	$2,362	$3,422	$5,714
2050	$1,646	$4,723	$6,844	$11,429
@$250/T				
2025	$343	$984	$1,426	$2,381
2030	$686	$1,968	$2,852	$4,762
2040	$2,058	$5,904	$8,555	$14,286
2050	$4,115	$11,809	$17,110	$28,572

3.2.2 *Waikato/Bay of Plenty*

Table 11: Waikato/BoP dairy quartile information

	Q1	Q2	Q3	Q4
Av Effective ha	138	138	158	186
Av kg N/ha	56	110	148	213
Total N (kg)	7,678	15,208	23,286	39,641
Tonnes Urea Equivalent	16.7	33.1	50.6	86.2

Table 12: Waikato/BoP dairy sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$49	$96	$148	$251
2030	$97	$193	$295	$502
2040	$292	$578	$885	$1,507
2050	$584	$1,157	$1,771	$3,015
@$30/T				
2025	$58	$116	$177	$301
2030	$117	$231	$354	$603
2040	$350	$694	$1,063	$1,809
2050	$701	$1,388	$2,125	$3,618
@$50/T				
2025	$97	$193	$295	$502
2030	$195	$386	$590	$1,005
2040	$584	$1,157	$1,771	$3,015
2050	$1,168	$2,313	$3,542	$6,029
@$75/T				
2025	$146	$289	$443	$754
2030	$292	$578	$885	$1,507
2040	$876	$1,735	$2,656	$4,522
2050	$1,752	$3,470	$5,313	$9,044
@$100/T				
2025	$195	$386	$590	$1,005
2030	$389	$771	$1,181	$2,010
2040	$1,168	$2,313	$3,542	$6,029
2050	$2,336	$4,626	$7,084	$12,059
@$250/T				
2025	$487	$964	$1,476	$2,512
2030	$973	$1,928	$2,952	$5,025
2040	$2,920	$5,783	$8,855	$15,074
2050	$5,839	$11,566	$17,709	$30,147

3.2.3 Taranaki

Table 13: Taranaki dairy quartile information

	Q1	Q2	Q3	Q4
Av Effective ha	125	112	103	122
Av kg N/ha	75	130	173	240
Total N (kg)	9,380	14,512	17,709	29,281
Tonnes Urea Equivalent	20.4	31.5	38.5	63.7

Table 14: Taranaki dairy sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$59	$92	$112	$186
2030	$119	$184	$224	$371
2040	$357	$552	$673	$1,113
2050	$713	$1,104	$1,347	$2,227
@$30/T				
2025	$71	$110	$135	$223
2030	$143	$221	$269	$445
2040	$428	$662	$808	$1,336
2050	$856	$1,324	$1,616	$2,672
@$50/T				
2025	$119	$184	$224	$371
2030	$238	$368	$449	$742
2040	$713	$1,104	$1,347	$2,227
2050	$1,427	$2,207	$2,694	$4,454
@$75/T				
2025	$178	$276	$337	$557
2030	$357	$552	$673	$1,113
2040	$1,070	$1,655	$2,020	$3,340
2050	$2,140	$3,311	$4,040	$6,680
@$100/T				
2025	$238	$368	$449	$742
2030	$476	$736	$898	$1,485
2040	$1,427	$2,207	$2,694	$4,454
2050	$2,853	$4,414	$5,387	$8,907
@$250/T				
2025	$594	$920	$1,122	$1,856
2030	$1,189	$1,839	$2,245	$3,711
2040	$3,567	$5,518	$6,734	$11,134
2050	$7,133	$11,036	$13,468	$22,268

3.2.4 Canterbury

Table 15: Canterbury dairy quartile information

	Q1	Q2	Q3	Q4
Av Effective ha	207	243	262	254
Av kg N/ha	132	230	267	320
Total N (kg)	27,294	55,890	70,005	81,253
Tonnes Urea Equivalent	59.3	121.5	152.2	176.6

Table 16: Canterbury dairy sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$173	$354	$444	$515
2030	$346	$708	$887	$1,030
2040	$1,038	$2,125	$2,662	$3,090
2050	$2,076	$4,250	$5,324	$6,179
@$30/T				
2025	$208	$425	$532	$618
2030	$415	$850	$1,065	$1,236
2040	$1,245	$2,550	$3,194	$3,708
2050	$2,491	$5,101	$6,389	$7,415
@$50/T				
2025	$346	$708	$887	$1,030
2030	$692	$1,417	$1,775	$2,060
2040	$2,076	$4,250	$5,324	$6,179
2050	$4,151	$8,501	$10,648	$12,359
@$75/T				
2025	$519	$1,063	$1,331	$1,545
2030	$1,038	$2,125	$2,662	$3,090
2040	$3,114	$6,376	$7,986	$9,269
2050	$6,227	$12,751	$15,972	$18,538
@$100/T				
2025	$692	$1,417	$1,775	$2,060
2030	$1,384	$2,834	$3,549	$4,120
2040	$4,151	$8,501	$10,648	$12,359
2050	$8,303	$17,002	$21,296	$24,717
@$250/T				
2025	$1,730	$3,542	$4,437	$5,149
2030	$3,459	$7,084	$8,873	$10,299
2040	$10,378	$21,252	$26,620	$30,897
2050	$20,757	$42,504	$53,239	$61,793

3.2.5 Southland

Table 17: Southland dairy quartile information

	Q1	Q2	Q3	Q4
Av Effective ha	212	239.2	208.2	236.2
Av kg N/ha	110.4	171.2	196.4	230
Total N (kg)	23,405	40,951	40,890	54,326
Tonnes Urea Equivalent	50.9	89.0	88.9	118.1

Table 18: Southland dairy sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$148	$260	$259	$344
2030	$297	$519	$518	$689
2040	$890	$1,557	$1,555	$2,066
2050	$1,780	$3,114	$3,110	$4,131
@$30/T				
2025	$178	$311	$311	$413
2030	$356	$623	$622	$826
2040	$1,068	$1,869	$1,866	$2,479
2050	$2,136	$3,737	$3,732	$4,958
@$50/T				
2025	$297	$519	$518	$689
2030	$593	$1,038	$1,037	$1,377
2040	$1,780	$3,114	$3,110	$4,131
2050	$3,560	$6,229	$6,219	$8,263
@$75/T				
2025	$445	$779	$777	$1,033
2030	$890	$1,557	$1,555	$2,066
2040	$2,670	$4,671	$4,665	$6,197
2050	$5,340	$9,343	$9,329	$12,394
@$100/T				
2025	$593	$1,038	$1,037	$1,377
2030	$1,187	$2,076	$2,073	$2,754
2040	$3,560	$6,229	$6,219	$8,263
2050	$7,120	$12,457	$12,439	$16,526
@$250/T				
2025	$1,483	$2,595	$2,591	$3,443
2030	$2,967	$5,191	$5,183	$6,886
2040	$8,900	$15,572	$15,549	$20,657
2050	$17,799	$31,143	$31,097	$41,315

On a proportional basis, there appears to be a decreasing range on N use, and the cost of this, going from North to South. I.e. there is a greater range of nitrogen fertiliser use within the first quartile group, and this decreases as you move up the quartiles.

Table 19: Proportional cost of each quartile relative to Q4

	Q1 vs Q4	Q2 vs Q4	Q3 vs Q4
Northland	14%	41%	60%
Waikato/BoP	19%	38%	59%
Taranaki	32%	50%	60%
Canterbury	34%	69%	86%
Southland	43%	75%	75%

3.3 Dairy Discussion

Obviously, the impost of a carbon charge and a decrease in the free allocation will increase costs at a farm level. Of the two, the carbon charge has the bigger impact, which is then compounded by the decrease in the free allocation.

As this analysis shows it is (unsurprisingly) the upper two quartile of farms which will face the greater costs, especially those irrigated farms (e.g. Canterbury), who are reliant on higher levels of nitrogen fertiliser as part of their overall farm system.

The main question is whether such increase in cost will alter farmer behaviour. This is more difficult to predict, given there are a range of factors involved. As previous analysis[4] has shown, the price elasticity for nitrogen fertiliser is relatively inelastic, with a large part of this relating to the cost of alternative supplementary feeds. A key factor, therefore, is whether the cost of alternatives, currently 2-3 times greater than nitrogen fertiliser, will reduce in comparative cost such that they become more attractive.

A key aspect around behaviour change relating to the tax on nitrogen fertiliser would be the visibility of such a cost. This directly relates to the Point of Obligation (PoO)for the cost; if the PoO is at the processor/importer level, then the cost of the tax will be very largely hidden from the farmer, and hence significantly diminish any likely behaviour change. If the PoO is at the farm level, the cost is directly visible; while the overall cost may not be significant, its very visibility will at least (a) remind the farmer there is a cost, and (b) allow them to take this into consideration when assessing the overall cost of, and possible mitigations to, GHG emissions.

It is also important to note that:

(i) Many of the supplementary feeds require nitrogen fertiliser to grow, and

(ii) A reduction in nitrogen fertiliser on pastoral farms to boost pasture growth, coupled with a compensatory increase in supplementary feed, will not necessarily reduce nitrous oxide emissions.

As the carbon tax on nitrogen fertilisers increase, it could be expected that more farmers will use a urease-coated urea compared with a non-urease-coated urea, as the advantage in

[4] Journeaux, 2019. Issues with accounting for nitrogen fertiliser greenhouse gas emissions.

carbon-tax terms to the urease-coated urea is 4.1%. Currently though the purchase price of urease-coated urea's is around 10% dearer, so there is some leeway to be made up.

4.0 SHEEP & BEEF

4.1 Average Nitrogen Fertiliser Application

Table 20: Average sheep & beef nitrogen fertiliser application by farm class

Farm Type	South Island High country	South Island Hill country	North Island Hard Hill country	North Island Hill country	North Island Intensive finishing	South Island Finishing breeding	South Island Intensive finishing	South Island Mixed finishing	All Class Average
Effective ha	7,821	1,506	784	422	285	445	228	417	643
Pastoral area N applied to (ha)	706	473	479	298	179	229	171	74	n/a
Average kg N/ha (pasture)	8.3	9.8	10.0	13.9	19.2	20.0	15.6	88.5	n/a
Crop area N applied to (ha)	70	60	54	56	106	76	73	195	n/a
Average kg N/ha (Crop)	78.2	40.2	9.2	9.2	18.2	38.2	15.6	221.0	n/a
Total kg N	11,362	7,034	5,302	4,667	5,350	7,492	3,814	49,672	8,736*
Tonnes Urea Equivalent	24.7	15.3	11.5	10.1	11.6	16.3	8.3	108.0	19.0

*Based on the weighted average of 13.6kgN/ha over the whole effective area.
Source: Beef + Lamb NZ Economic Service. Averages based on the 2013/14 – 2017/18 years

4.1.1 On-Farm Cost using Uncoated Urea

Table 21: Average sheep & beef farm cost at $25/tonne CO_2e, Uncoated Urea only

	% Liability	South Island High country	South Island Hill country	North Island Hard Hill country	North Island Hill country	North Island Intensive finishing	South Island Finishing breeding	South Island Intensive finishing	South Island Mixed finishing	All Class Average
2025	5%	$72	$45	$34	$30	$34	$47	$24	$315	$55
2026	6%	$86	$53	$40	$35	$41	$57	$29	$378	$66
2027	7%	$101	$62	$47	$41	$47	$66	$34	$441	$78
2028	8%	$115	$71	$54	$47	$54	$76	$39	$504	$89
2029	9%	$130	$80	$60	$53	$61	$85	$44	$567	$100
2030	10%	$144	$89	$67	$59	$68	$95	$48	$630	$111
2031	12%	$173	$107	$81	$71	$81	$114	$58	$756	$133
2032	14%	$202	$125	$94	$83	$95	$133	$68	$881	$155
2033	16%	$230	$143	$108	$95	$108	$152	$77	$1,007	$177
2034	18%	$259	$160	$121	$106	$122	$171	$87	$1,133	$199
2035	20%	$288	$178	$134	$118	$136	$190	$97	$1,259	$221
2036	22%	$317	$196	$148	$130	$149	$209	$106	$1,385	$244
2037	24%	$346	$214	$161	$142	$163	$228	$116	$1,511	$266
2038	26%	$374	$232	$175	$154	$176	$247	$126	$1,637	$288
2039	28%	$403	$250	$188	$166	$190	$266	$135	$1,763	$310
2040	30%	$432	$267	$202	$177	$203	$285	$145	$1,889	$332
2041	33%	$475	$294	$222	$195	$224	$313	$160	$2,078	$365
2042	36%	$518	$321	$242	$213	$244	$342	$174	$2,267	$399
2043	39%	$562	$348	$262	$231	$264	$370	$189	$2,455	$432
2044	42%	$605	$374	$282	$248	$285	$399	$203	$2,644	$465
2045	45%	$648	$401	$302	$266	$305	$427	$218	$2,833	$498
2046	48%	$691	$428	$323	$284	$325	$456	$232	$3,022	$532
2047	51%	$734	$455	$343	$302	$346	$484	$247	$3,211	$565
2048	54%	$778	$481	$363	$319	$366	$513	$261	$3,400	$598
2049	57%	$821	$508	$383	$337	$387	$541	$276	$3,589	$631
2050	60%	$864	$535	$403	$355	$407	$570	$290	$3,778	$664
	100%	$1,440	$892	$672	$592	$678	$950	$483	$6,296	$1,107

Table 22: Average sheep & beef per hectare cost at $25/tonne CO_2e, Uncoated Urea only

	% Liability	South Island High country	South Island Hill country	North Island Hard Hill country	North Island Hill country	North Island Intensive finishing	South Island Finishing breeding	South Island Intensive finishing	South Island Mixed finishing	All Class Average
2025	5%	$0.01	$0.03	$0.04	$0.07	$0.12	$0.11	$0.11	$0.75	$0.09
2026	6%	$0.01	$0.04	$0.05	$0.08	$0.14	$0.13	$0.13	$0.91	$0.10
2027	7%	$0.01	$0.04	$0.06	$0.10	$0.17	$0.15	$0.15	$1.06	$0.12
2028	8%	$0.01	$0.05	$0.07	$0.11	$0.19	$0.17	$0.17	$1.21	$0.14
2029	9%	$0.02	$0.05	$0.08	$0.13	$0.21	$0.19	$0.19	$1.36	$0.15
2030	10%	$0.02	$0.06	$0.09	$0.14	$0.24	$0.21	$0.21	$1.51	$0.17
2031	12%	$0.02	$0.07	$0.10	$0.17	$0.29	$0.26	$0.25	$1.81	$0.21
2032	14%	$0.03	$0.08	$0.12	$0.20	$0.33	$0.30	$0.30	$2.11	$0.24
2033	16%	$0.03	$0.09	$0.14	$0.22	$0.38	$0.34	$0.34	$2.42	$0.28
2034	18%	$0.03	$0.11	$0.15	$0.25	$0.43	$0.38	$0.38	$2.72	$0.31
2035	20%	$0.04	$0.12	$0.17	$0.28	$0.48	$0.43	$0.42	$3.02	$0.34
2036	22%	$0.04	$0.13	$0.19	$0.31	$0.52	$0.47	$0.47	$3.32	$0.38
2037	24%	$0.04	$0.14	$0.21	$0.34	$0.57	$0.51	$0.51	$3.62	$0.41
2038	26%	$0.05	$0.15	$0.22	$0.36	$0.62	$0.55	$0.55	$3.93	$0.45
2039	28%	$0.05	$0.17	$0.24	$0.39	$0.67	$0.60	$0.59	$4.23	$0.48
2040	30%	$0.06	$0.18	$0.26	$0.42	$0.71	$0.64	$0.64	$4.53	$0.52
2041	33%	$0.06	$0.20	$0.28	$0.46	$0.79	$0.70	$0.70	$4.98	$0.57
2042	36%	$0.07	$0.21	$0.31	$0.50	$0.86	$0.77	$0.76	$5.44	$0.62
2043	39%	$0.07	$0.23	$0.33	$0.55	$0.93	$0.83	$0.83	$5.89	$0.67
2044	42%	$0.08	$0.25	$0.36	$0.59	$1.00	$0.90	$0.89	$6.34	$0.72
2045	45%	$0.08	$0.27	$0.39	$0.63	$1.07	$0.96	$0.95	$6.79	$0.77
2046	48%	$0.09	$0.28	$0.41	$0.67	$1.14	$1.02	$1.02	$7.25	$0.83
2047	51%	$0.09	$0.30	$0.44	$0.71	$1.21	$1.09	$1.08	$7.70	$0.88
2048	54%	$0.10	$0.32	$0.46	$0.76	$1.28	$1.15	$1.15	$8.15	$0.93
2049	57%	$0.10	$0.34	$0.49	$0.80	$1.36	$1.22	$1.21	$8.61	$0.98
2050	60%	$0.11	$0.36	$0.51	$0.84	$1.43	$1.28	$1.27	$9.06	$1.03
	100%	$0.18	$0.59	$0.86	$1.40	$2.38	$2.13	$2.12	$15.10	$1.72

4.1.1.1 Sheep & Beef Sensitivity Analysis

Table 23: Average per sheep & beef farm cost, with varying $/tonne CO_2e, uncoated urea only

	South Island High country	South Island Hill country	North Island Hard Hill country	North Island Hill country	North Island Intensive finishing	South Island Finishing breeding	South Island Intensive finishing	South Island Mixed finishing	All Class Average
@$25/T									
2025	$72	$45	$34	$30	$34	$47	$24	$315	$55
2030	$144	$89	$67	$59	$68	$95	$48	$630	$111
2040	$432	$267	$202	$177	$203	$285	$145	$1,889	$332
2050	$864	$535	$403	$355	$407	$570	$290	$3,778	$664
@$30/T									
2025	$86	$53	$40	$35	$41	$57	$29	$378	$66
2030	$173	$107	$81	$71	$81	$114	$58	$756	$133
2040	$518	$321	$242	$213	$244	$342	$174	$2,267	$399
2050	$1,037	$642	$484	$426	$488	$684	$348	$4,533	$797
@$50/T									
2025	$144	$89	$67	$59	$68	$95	$48	$630	$111
2030	$288	$178	$134	$118	$136	$190	$97	$1,259	$221
2040	$864	$535	$403	$355	$407	$570	$290	$3,778	$664
2050	$1,728	$1,070	$806	$710	$814	$1,139	$580	$7,555	$1,329
@$75/T									
2025	$216	$134	$101	$89	$102	$142	$73	$944	$166
2030	$432	$267	$202	$177	$203	$285	$145	$1,889	$332
2040	$1,296	$802	$605	$532	$610	$855	$435	$5,666	$997
2050	$2,592	$1,605	$1,210	$1,065	$1,221	$1,709	$870	$11,333	$1,993
@$100/T									
2025	$288	$178	$134	$118	$136	$190	$97	$1,259	$221
2030	$576	$357	$269	$237	$271	$380	$193	$2,518	$443
2040	$1,728	$1,070	$806	$710	$814	$1,139	$580	$7,555	$1,329
2050	$3,456	$2,140	$1,613	$1,420	$1,627	$2,279	$1,160	$15,110	$2,658
@$250/T									
2025	$720	$446	$336	$296	$339	$475	$242	$3,148	$554
2030	$1,440	$892	$672	$592	$678	$950	$483	$6,296	$1,107
2040	$4,320	$2,675	$2,016	$1,775	$2,034	$2,849	$1,450	$18,888	$3,322
2050	$8,641	$5,349	$4,032	$3,549	$4,069	$5,697	$2,901	$37,776	$6,644

4.1.2 Sheep & Beef On-Farm Cost Using Weighted Average Nitrogen Fertilisers

This analysis assumes the farms use a range of nitrogen fertilisers, as outlined in Table 3.

- 47% is uncoated urea
- 25% is urea coated with a urease inhibitor
- 28% is other nitrogen fertilisers

Table 24: Average sheep & beef farm cost at $25/tonne CO_2e, using a range of nitrogen fertilisers

	% Liability	South Island High country	South Island Hill country	North Island Hard Hill country	North Island Hill country	North Island Intensive finishing	South Island Finishing breeding	South Island Intensive finishing	South Island Mixed finishing	All Class Average
2025	5%	$73	$45	$34	$30	$34	$48	$24	$317	$56
2026	6%	$87	$54	$41	$36	$41	$57	$29	$381	$67
2027	7%	$102	$63	$47	$42	$48	$67	$34	$444	$78
2028	8%	$116	$72	$54	$48	$55	$77	$39	$508	$89
2029	9%	$131	$81	$61	$54	$62	$86	$44	$571	$100
2030	10%	$145	$90	$68	$60	$68	$96	$49	$635	$112
2031	12%	$174	$108	$81	$72	$82	$115	$58	$761	$134
2032	14%	$203	$126	$95	$83	$96	$134	$68	$888	$156
2033	16%	$232	$144	$108	$95	$109	$153	$78	$1,015	$179
2034	18%	$261	$162	$122	$107	$123	$172	$88	$1,142	$201
2035	20%	$290	$180	$135	$119	$137	$191	$97	$1,269	$223
2036	22%	$319	$198	$149	$131	$150	$211	$107	$1,396	$246
2037	24%	$348	$216	$163	$143	$164	$230	$117	$1,523	$268
2038	26%	$377	$234	$176	$155	$178	$249	$127	$1,650	$290
2039	28%	$406	$252	$190	$167	$191	$268	$136	$1,777	$312
2040	30%	$435	$270	$203	$179	$205	$287	$146	$1,904	$335
2041	33%	$479	$297	$224	$197	$226	$316	$161	$2,094	$368
2042	36%	$523	$323	$244	$215	$246	$345	$175	$2,284	$402
2043	39%	$566	$350	$264	$233	$267	$373	$190	$2,475	$435
2044	42%	$610	$377	$284	$250	$287	$402	$205	$2,665	$469
2045	45%	$653	$404	$305	$268	$308	$431	$219	$2,855	$502
2046	48%	$697	$431	$325	$286	$328	$459	$234	$3,046	$536
2047	51%	$740	$458	$345	$304	$349	$488	$248	$3,236	$569
2048	54%	$784	$485	$366	$322	$369	$517	$263	$3,427	$603
2049	57%	$827	$512	$386	$340	$390	$546	$278	$3,617	$636
2050	60%	$871	$539	$406	$358	$410	$574	$292	$3,807	$670
	100%	$1,451	$899	$677	$596	$683	$957	$487	$6,345	$1,116

As can be seen from Table 24, the difference in on-farm cost between using uncoated urea versus a range of nitrogen fertilisers, is +0.8%; the increased usage of non-urea nitrogen fertilisers means there is an increased carbon tax cost, which is not quite offset by the use of urease-coated urea.

If all the nitrogen fertiliser used was urease-coated urea, then the cost as indicated in Tables 21/22/23 would decrease by 4.3%

If all the nitrogen fertiliser used was a non-urea nitrogen fertiliser, then the cost as indicated in Tables 21/22/23 would increase by 6.1%

4.2 Quartile Nitrogen Fertiliser Application

This analysis is based on quartile information from Beef + Lamb NZ Economic Service, being the average over the period 2013/14 – 2017/18. The quartile data is based on kg N applied per hectare, and the analysis is based on using non-urease coated urea. The full annual analysis per farm type is shown in Appendix 2. The cost shown is at a farm level.

4.2.1 Class 1 South Island High Country

Table 25: SI High Country quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	9,108	11,248	5,354	5,448
Average kg N/ha	0.02	0.3	1.6	7.5
Total N (kg)	182	3,149	8,673	40,751
Tonnes Urea Equivalent	0.4	6.8	18.9	88.6

Table 26: SI High Country sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$1	$20	$55	$258
2030	$2	$40	$110	$517
2040	$7	$120	$330	$1,550
2050	$14	$240	$660	$3,099
@$30/T				
2025	$1	$24	$66	$310
2030	$3	$48	$132	$620
2040	$8	$144	$396	$1,859
2050	$17	$287	$792	$3,719
@$50/T				
2025	$2	$40	$110	$517
2030	$5	$80	$220	$1,033
2040	$14	$240	$660	$3,099
2050	$28	$479	$1,319	$6,198
@$75/T				
2025	$3	$60	$165	$775
2030	$7	$120	$330	$1,550
2040	$21	$359	$989	$4,649
2050	$42	$719	$1,979	$9,297
@$100/T				
2025	$5	$80	$220	$1,033
2030	$9	$160	$440	$2,066
2040	$28	$479	$1,319	$6,198
2050	$55	$958	$2,638	$12,396
@$250/T				
2025	$12	$200	$550	$2,583
2030	$23	$399	$1,099	$5,165
2040	$69	$1,198	$3,298	$15,496
2050	$139	$2,395	$6,596	$30,991

4.2.2 *Class 2 South Island Hill Country*

Table 27: SI High Country quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	1,575	1,259	1,437	1,770
Average kg N/ha	0.3	2.2	5.4	11.5
Total N (kg)	504	2,720	7,817	20,315
Tonnes Urea Equivalent	1.1	5.9	17.0	44.2

Table 28: SI Hill Country sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$3	$17	$50	$129
2030	$6	$34	$99	$257
2040	$19	$103	$297	$772
2050	$38	$207	$595	$1,545
@$30/T				
2025	$4	$21	$59	$154
2030	$8	$41	$119	$309
2040	$23	$124	$357	$927
2050	$46	$248	$713	$1,854
@$50/T				
2025	$10	$52	$149	$386
2030	$19	$103	$297	$772
2040	$58	$310	$892	$2,317
2050	$115	$621	$1,784	$4,635
@$75/T				
2025	$103	$295	$428	$714
2030	$206	$590	$856	$1,429
2040	$617	$1,771	$2,567	$4,286
2050	$1,235	$3,543	$5,133	$8,572
@$100/T				
2025	$13	$69	$198	$515
2030	$26	$138	$396	$1,030
2040	$77	$414	$1,189	$3,090
2050	$153	$827	$2,378	$6,180
@$250/T				
2025	$32	$172	$495	$1,287
2030	$64	$345	$991	$2,575
2040	$192	$1,034	$2,973	$7,725
2050	$383	$2,068	$5,945	$15,450

4.2.3 Class 3 North Island Hard Hill Country

Table 29: NI Hard Hill Country quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	534	801	880	923
Average kg N/ha	0.0	0.5	3.5	20.0
Total N (kg)	0.0	400	3,045	18,456
Tonnes Urea Equivalent	0.0	0.9	6.6	40.1

Table 30: NI Hard Hill Country sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$0	$3	$19	$117
2030	$0	$5	$39	$234
2040	$0	$15	$116	$702
2050	$0	$30	$232	$1,404
@$30/T				
2025	$0	$3	$23	$140
2030	$0	$6	$46	$281
2040	$0	$18	$139	$842
2050	$0	$37	$278	$1,684
@$50/T				
2025	$0	$5	$39	$234
2030	$0	$10	$77	$468
2040	$0	$30	$232	$1,404
2050	$0	$61	$463	$2,807
@$75/T				
2025	$0	$8	$58	$351
2030	$0	$15	$116	$702
2040	$0	$46	$347	$2,105
2050	$0	$91	$695	$4,211
@$100/T				
2025	$0	$10	$77	$468
2030	$0	$20	$154	$936
2040	$0	$61	$463	$2,807
2050	$0	$122	$926	$5,614
@$250/T				
2025	$0	$25	$193	$1,170
2030	$0	$51	$386	$2,339
2040	$0	$152	$1,158	$7,018
2050	$0	$305	$2,316	$14,036

4.2.4 *Class 4 North Island Hill Country*

Table 31: NI Hill Country quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	340	441	437	471
Average kg N/ha	0.0	2.2	8.6	30.8
Total N (kg)	0.0	952	3,774	14,526
Tonnes Urea Equivalent	0.0	2.1	8.2	31.6

Table 32: NI Hill Country sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$0	$6	$24	$92
2030	$0	$12	$48	$184
2040	$0	$36	$144	$552
2050	$0	$72	$287	$1,105
@$30/T				
2025	$0	$7	$29	$110
2030	$0	$14	$57	$221
2040	$0	$43	$172	$663
2050	$0	$87	$344	$1,326
@$50/T				
2025	$0	$12	$48	$184
2030	$0	$24	$96	$368
2040	$0	$72	$287	$1,105
2050	$0	$145	$574	$2,209
@$75/T				
2025	$0	$18	$72	$276
2030	$0	$36	$144	$552
2040	$0	$109	$431	$1,657
2050	$0	$217	$861	$3,314
@$100/T				
2025	$0	$24	$96	$368
2030	$0	$48	$191	$736
2040	$0	$145	$574	$2,209
2050	$0	$290	$1,148	$4,419
@$250/T				
2025	$0	$60	$239	$921
2030	$0	$121	$478	$1,841
2040	$0	$362	$1,435	$5,523
2050	$0	$724	$2,870	$11,047

4.2.5 *Class 5 North Island Intensive Finishing*

Table 33: NI Intensive Finishing quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	286	302	280	271
Average kg N/ha	0.3	5.0	18.9	60.3
Total N (kg)	86	1,523	5,296	16,335
Tonnes Urea Equivalent	0.2	3.3	11.5	35.5

Table 34: NI Intensive Finishing sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$1	$10	$34	$104
2030	$1	$19	$67	$207
2040	$3	$58	$201	$621
2050	$7	$116	$403	$1,242
@$30/T				
2025	$1	$12	$40	$124
2030	$1	$23	$81	$248
2040	$4	$69	$242	$745
2050	$8	$139	$483	$1,491
@$50/T				
2025	$1	$19	$67	$207
2030	$2	$39	$134	$414
2040	$7	$116	$403	$1,242
2050	$13	$232	$805	$2,485
@$75/T				
2025	$2	$29	$101	$311
2030	$3	$58	$201	$621
2040	$10	$174	$604	$1,863
2050	$20	$347	$1,208	$3,727
@$100/T				
2025	$2	$39	$134	$414
2030	$4	$77	$268	$828
2040	$13	$232	$805	$2,485
2050	$26	$463	$1,611	$4,969
@$250/T				
2025	$5	$97	$336	$1,035
2030	$11	$193	$671	$2,070
2040	$33	$579	$2,014	$6,211
2050	$65	$1,158	$4,027	$12,423

4.2.6 *Class 6 South Island Finishing Breeding*

Table 35: SI Finishing Breeding quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	381	489	517	395
Average kg N/ha	1.2	6.6	16.4	53.4
Total N (kg)	465	3,215	8,499	21,119
Tonnes Urea Equivalent	1.0	7.0	18.5	45.9

Table 36: SI Finishing Breeding sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$3	$20	$54	$134
2030	$6	$41	$108	$268
2040	$18	$122	$323	$803
2050	$35	$244	$646	$1,606
@$30/T				
2025	$4	$24	$65	$161
2030	$7	$49	$129	$321
2040	$21	$147	$388	$964
2050	$42	$293	$776	$1,927
@$50/T				
2025	$6	$41	$108	$268
2030	$12	$81	$215	$535
2040	$35	$244	$646	$1,606
2050	$71	$489	$1,293	$3,212
@$75/T				
2025	$9	$61	$162	$402
2030	$18	$122	$323	$803
2040	$53	$367	$970	$2,409
2050	$106	$733	$1,939	$4,818
@$100/T				
2025	$12	$81	$215	$535
2030	$24	$163	$431	$1,071
2040	$71	$489	$1,293	$3,212
2050	$141	$978	$2,586	$6,425
@$250/T				
2025	$29	$204	$539	$1,338
2030	$59	$407	$1,077	$2,677
2040	$177	$1,222	$3,232	$8,031
2050	$353	$2,445	$6,464	$16,061

4.2.7 Class 7 South Island Intensive Finishing

Table 37: SI Intensive Finishing quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	192	240	242	239
Average kg N/ha	1.7	9.2	19.0	39.1
Total N (kg)	334.1	2,210	4,599	9,362
Tonnes Urea Equivalent	0.7	4.8	10.0	20.4

Table 38: SI Intensive Finishing sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$2	$14	$29	$59
2030	$4	$28	$58	$119
2040	$13	$84	$175	$356
2050	$25	$168	$350	$712
@$30/T				
2025	$3	$17	$35	$71
2030	$5	$34	$70	$142
2040	$15	$101	$210	$427
2050	$30	$202	$420	$854
@$50/T				
2025	$4	$28	$58	$119
2030	$8	$56	$117	$237
2040	$25	$168	$350	$712
2050	$51	$336	$700	$1,424
@$75/T				
2025	$6	$42	$87	$178
2030	$13	$84	$175	$356
2040	$38	$252	$525	$1,068
2050	$76	$504	$1,049	$2,136
@$100/T				
2025	$8	$56	$117	$237
2030	$17	$112	$233	$475
2040	$51	$336	$700	$1,424
2050	$102	$672	$1,399	$2,848
@$250/T				
2025	$21	$140	$291	$593
2030	$42	$280	$583	$1,187
2040	$127	$840	$1,749	$3,560
2050	$254	$1,681	$3,498	$7,120

4.2.8 Class 8 South Island Mixed Finishing

Table 39: SI Mixed Finishing quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	378	423	431	424
Average kg N/ha	59.2	118.1	159.1	266.6
Total N (kg)	22,370	49,973	68,653	113,100
Tonnes Urea Equivalent	48.6	108.6	149.2	245.9

Table 40: SI Mixed Finishing sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$142	$317	$435	$717
2030	$284	$633	$870	$1,434
2040	$851	$1,900	$2,611	$4,301
2050	$1,701	$3,800	$5,221	$8,601
@$30/T				
2025	$170	$380	$522	$860
2030	$340	$760	$1,044	$1,720
2040	$1,021	$2,280	$3,133	$5,161
2050	$2,041	$4,561	$6,265	$10,322
@$50/T				
2025	$284	$633	$870	$1,434
2030	$567	$1,267	$1,740	$2,867
2040	$1,701	$3,800	$5,221	$8,601
2050	$3,402	$7,601	$10,442	$17,203
@$75/T				
2025	$425	$950	$1,305	$2,150
2030	$851	$1,900	$2,611	$4,301
2040	$2,552	$5,701	$7,832	$12,902
2050	$5,104	$11,401	$15,663	$25,804
@$100/T				
2025	$567	$1,267	$1,740	$2,867
2030	$1,134	$2,534	$3,481	$5,734
2040	$3,402	$7,601	$10,442	$17,203
2050	$6,805	$15,202	$20,884	$34,405
@$250/T				
2025	$1,418	$3,167	$4,351	$7,168
2030	$2,835	$6,334	$8,702	$14,335
2040	$8,506	$19,002	$26,105	$43,006
2050	$17,012	$38,005	$52,211	$86,013

4.2.9 All Class Average Farm

Table 41: All Class Average quartile information

	Q1	Q2	Q3	Q4
Average Effective ha	603	714	622	633
Average kg N/ha	2.1	5.7	13.3	34.0
Total N (kg)	1,273	4,038	8,248	21,513
Tonnes Urea Equivalent	2.8	8.8	17.9	46.8

Table 42: All Class Average sensitivity analysis: per farm cost

	Q1	Q2	Q3	Q4
@$25/T				
2025	$8	$26	$52	$136
2030	$16	$51	$105	$273
2040	$48	$154	$314	$818
2050	$97	$307	$627	$1,636
@$30/T				
2025	$10	$31	$63	$164
2030	$19	$61	$125	$327
2040	$58	$184	$376	$982
2050	$116	$369	$753	$1,963
@$50/T				
2025	$16	$51	$105	$273
2030	$32	$102	$209	$545
2040	$97	$307	$627	$1,636
2050	$194	$614	$1,255	$3,272
@$75/T				
2025	$24	$77	$157	$409
2030	$48	$154	$314	$818
2040	$145	$461	$941	$2,454
2050	$290	$921	$1,882	$4,908
@$100/T				
2025	$32	$102	$209	$545
2030	$65	$205	$418	$1,091
2040	$194	$614	$1,255	$3,272
2050	$387	$1,228	$2,509	$6,544
@$250/T				
2025	$81	$256	$523	$1,363
2030	$161	$512	$1,045	$2,727
2040	$484	$1,536	$3,136	$8,180
2050	$968	$3,071	$6,273	$16,361

4.3 Sheep & Beef Discussion

The same comments as made in the dairy section apply equally here; obviously, the impost of a carbon charge and a decrease in the free allocation will increase costs at a farm level. And again, of the two, the carbon charge has the bigger impact, which is then compounded by the decrease in the free allocation.

This analysis has shown a number of key factors:

(i) Overall, the use of nitrogen fertiliser by the majority of sheep & beef farmers is relatively low.

(ii) By definition, it is the fourth quartile farmers who use the greater amount of nitrogen fertiliser, and it is they who will face the greatest cost. In contrast, the cost to the first and second quartile farmers is minimal.

(iii) Of particular interest is that, on average, a significant proportion of the nitrogen fertiliser used on sheep & beef farms is for cropping, either for supplementary feed, or cash cropping. This is illustrated as follows:

Table 43: Crop N as a proportion of total N

	South Island High country	South Island Hill country	North Island Hard Hill country	North Island Hill country	North Island Intensive Finishing	South Island Finishing Breeding	South Island Intensive Finishing	South Island Mixed Finishing	All Class Average
Crop N as a proportion of total N applied	48%	34%	9%	11%	36%	39%	30%	87%	54%

This creates issues, as the opportunity to substitute nitrogen fertiliser in cropping regimes is limited. As the Tables show, farms with a high proportion of cropping such as the South Island Mixed Finishing class, could face significant costs depending on the price of carbon and the proportion of liability.

Again, the key question is whether such increases in cost will alter farmer behaviour, as discussed in Section 3.3. This is possibly more problematic on sheep & beef farms, as in many instances, especially on hill country properties, the opportunity to feed supplements direct to livestock, as an alternative to using nitrogen fertiliser, is much more difficult. In the absence of nitrogen fertiliser, and any compensatory improvement in product prices (of which there is no evidence), farmers are more likely to reduce stocking rates, and/or per animal production.

Plus, again, there is the issue of the visibility of the cost of the tax, which relates back to the discussion on the Point of Obligation as raised in the dairy section. The same issue arises for sheep & beef farmers; if the PoO is at the processor/importer level, then the cost is very largely hidden. If the PoO is at the farm level, the cost of the tax is visible, which allows the farmer to take it into consideration when assessing GHG mitigations.

5.0 FARM LEVEL COST IF NITROGEN FERTILISER RATED AS AN INDUSTRIAL PRODUCT

As discussed in Section 2, nitrogen is rated as an "agricultural" product, hence the reduction in the free allocation starts from 2025. The impact, if nitrogen was rated as an "industrial" product, and the free allocation was reduced from 2020, is illustrated in the next two tables.

Table 44: Average per dairy farm cost, with varying $/tonne CO_2e, uncoated urea only, assuming free allocation reduction starts in 2020

	Northland	Waikato/BoP	Taranaki	Canterbury	Southland	New Zealand
@$25/T						
2020	$99	$103	$98	$343	$222	$145
2030	$298	$309	$295	$1,028	$666	$436
2040	$696	$721	$689	$2,398	$1,555	$1,018
2050	$1,292	$1,339	$1,280	$4,453	$2,888	$1,891
@$30/T						
2020	$119	$124	$118	$411	$267	$175
2030	$358	$371	$355	$1,233	$800	$524
2040	$835	$865	$827	$2,878	$1,866	$1,222
2050	$1,550	$1,607	$1,536	$5,344	$3,466	$2,269
@$50/T						
2020	$199	$206	$197	$685	$444	$291
2030	$596	$618	$591	$2,055	$1,333	$873
2040	$1,391	$1,442	$1,379	$4,796	$3,110	$2,036
2050	$2,584	$2,679	$2,561	$8,907	$5,776	$3,782
@$75/T						
2020	$298	$309	$295	$1,028	$666	$436
2030	$894	$927	$886	$3,083	$1,999	$1,309
2040	$2,087	$2,163	$2,068	$7,194	$4,665	$3,054
2050	$3,876	$4,018	$3,841	$13,360	$8,664	$5,672
@$100/T						
2020	$397	$412	$394	$1,370	$889	$582
2030	$1,192	$1,236	$1,182	$4,111	$2,666	$1,745
2040	$2,782	$2,885	$2,758	$9,592	$6,221	$4,072
2050	$5,167	$5,357	$5,121	$17,813	$11,552	$7,563
@$250/T						
2020	$994	$1,030	$985	$3,426	$2,222	$1,454
2030	$2,981	$3,091	$2,955	$10,277	$6,665	$4,363
2040	$6,956	$7,212	$6,894	$23,980	$15,551	$10,181
2050	$12,918	$13,393	$12,803	$44,534	$28,881	$18,908

Table 45: Average per sheep & beef farm cost, with varying $/tonne CO_2e, uncoated urea only, assuming free allocation reduction starts in 2020

	South Island High country	South Island Hill country	North Island Hard hill country	North Island Hill country	North Island Intensive finishing	South Island Finishing breeding	South Island Intensive finishing	South Island Mixed finishing	All Class Average
@$25/T									
2020	$72	$45	$34	$30	$34	$47	$24	$315	$55
2030	$216	$134	$101	$89	$102	$142	$73	$944	$166
2040	$504	$312	$235	$207	$237	$332	$169	$2,204	$388
2050	$936	$579	$437	$385	$441	$617	$314	$4,092	$720
@$30/T									
2020	$86	$53	$40	$35	$41	$57	$29	$378	$66
2030	$259	$160	$121	$106	$122	$171	$87	$1,133	$199
2040	$605	$374	$282	$248	$285	$399	$203	$2,644	$465
2050	$1,123	$695	$524	$461	$529	$741	$377	$4,911	$864
@$50/T									
2020	$144	$89	$67	$59	$68	$95	$48	$630	$111
2030	$432	$267	$202	$177	$203	$285	$145	$1,889	$332
2040	$1,008	$624	$470	$414	$475	$665	$338	$4,407	$775
2050	$1,872	$1,159	$874	$769	$882	$1,234	$628	$8,185	$1,439
@$75/T									
2020	$216	$134	$101	$89	$102	$142	$73	$944	$166
2030	$648	$401	$302	$266	$305	$427	$218	$2,833	$498
2040	$1,512	$936	$706	$621	$712	$997	$508	$6,611	$1,163
2050	$2,808	$1,738	$1,310	$1,154	$1,322	$1,852	$943	$12,277	$2,159
@$100/T									
2020	$288	$178	$134	$118	$136	$190	$97	$1,259	$221
2030	$864	$535	$403	$355	$407	$570	$290	$3,778	$664
2040	$2,016	$1,248	$941	$828	$949	$1,329	$677	$8,814	$1,550
2050	$3,744	$2,318	$1,747	$1,538	$1,763	$2,469	$1,257	$16,369	$2,879
@$250/T									
2020	$720	$446	$336	$296	$339	$475	$242	$3,148	$554
2030	$2,160	$1,337	$1,008	$887	$1,017	$1,424	$725	$9,444	$1,661
2040	$5,040	$3,120	$2,352	$2,071	$2,373	$3,323	$1,692	$22,036	$3,876
2050	$9,361	$5,795	$4,368	$3,845	$4,408	$6,172	$3,142	$40,924	$7,197

In essence the 2025 start date means that the free allocation is 5% higher throughout the period compared with a 2020 start date.

6.0 THE ISSUE OF DOUBLE COUNTING

The advent of a separate tax on nitrogen fertilisers also raises the issue of a potential double count (and cost). When calculating farm-level GHG emissions, the current calculators all take into account the amount of nitrogen fertiliser applied on the farm and calculate the direct N_2O emission from this nitrogen fertiliser[5] and include this as part of the overall farm GHG emissions.

But if the farmer has already paid the carbon tax on the nitrogen fertiliser, this component needs to be removed from the farm-level calculation, otherwise there will be a double-count.

Of the current carbon calculators, only Overseer (a) can differentiate the different types of nitrogen fertiliser and hence apply the different emission factors, and (b) differentiate the N_2O emissions from the various sources.

This is illustrated below:

Figure 1: Overseer Printout for Canterbury Dairy Farm

[5] Note that the Emission Factor for urea fertiliser also includes the CO_2 emissions from the fertiliser when applied to land, and so is included in the nitrogen fertiliser tax calculated.

Figure 2: Overseer Printout for Waikato Dairy Farm

Emissions by source

METHANE	ECO2/KG/HA/YR 9726
Enteric	9457
Dung	99
Effluent	170

N2O	ECO2/KG/HA/YR 2485
Excreta paddock	1838
Excreta effluent	14
N fertiliser	175
Crops	1
Indirect	458

For the Canterbury dairy farm, N_2O emissions from the nitrogen fertiliser are: 15% of total N_2O emissions, and 4% of total biological GHG emissions. For the Waikato dairy farm, the figures are 7% and 1 % respectively.

To remove the possibility of double counting, then:

(i) For current calculators that just estimate GHG emissions, the nitrogen fertiliser input would need to be ignored (i.e. not entered into the calculator)

(ii) For Overseer, inputting nitrogen fertiliser is an important factor in determining nitrate leaching losses, and therefore need to be included. In this situation the farmer (or their advisor) would need to (a) check the amount of N_2O attributable to nitrogen fertiliser within the GHG component of Overseer, and (b) then remove this component from the overall total farm GHG emission.

In any event, there will be an additional administrative cost in ensuring no double counting is occurring.

7.0 APPENDIX 1: DAIRY QUARTILE ANALYSIS

This is based on: non-urease coated urea, at $25/tonne CO_2e

7.1 Northland

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$343	$984	$1,426	$2,381
2026	6%	$412	$1,181	$1,711	$2,857
2027	7%	$480	$1,378	$1,996	$3,333
2028	8%	$549	$1,574	$2,281	$3,810
2029	9%	$617	$1,771	$2,567	$4,286
2030	10%	$686	$1,968	$2,852	$4,762
2031	12%	$823	$2,362	$3,422	$5,714
2032	14%	$960	$2,755	$3,992	$6,667
2033	16%	$1,097	$3,149	$4,563	$7,619
2034	18%	$1,235	$3,543	$5,133	$8,572
2035	20%	$1,372	$3,936	$5,703	$9,524
2036	22%	$1,509	$4,330	$6,274	$10,476
2037	24%	$1,646	$4,723	$6,844	$11,429
2038	26%	$1,783	$5,117	$7,415	$12,381
2039	28%	$1,920	$5,511	$7,985	$13,334
2040	30%	$2,058	$5,904	$8,555	$14,286
2041	33%	$2,263	$6,495	$9,411	$15,715
2042	36%	$2,469	$7,085	$10,266	$17,143
2043	39%	$2,675	$7,676	$11,122	$18,572
2044	42%	$2,881	$8,266	$11,977	$20,001
2045	45%	$3,086	$8,857	$12,833	$21,429
2046	48%	$3,292	$9,447	$13,688	$22,858
2047	51%	$3,498	$10,037	$14,544	$24,286
2048	54%	$3,704	$10,628	$15,399	$25,715
2049	57%	$3,909	$11,218	$16,255	$27,144
2050	60%	$4,115	$11,809	$17,110	$28,572
	100%	$6,858	$19,681	$28,517	$47,620

7.2 Waikato/Bay of Plenty

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$487	$964	$1,476	$2,512
2026	6%	$584	$1,157	$1,771	$3,015
2027	7%	$681	$1,349	$2,066	$3,517
2028	8%	$779	$1,542	$2,361	$4,020
2029	9%	$876	$1,735	$2,656	$4,522
2030	10%	$973	$1,928	$2,952	$5,025
2031	12%	$1,168	$2,313	$3,542	$6,029
2032	14%	$1,362	$2,699	$4,132	$7,034
2033	16%	$1,557	$3,084	$4,722	$8,039
2034	18%	$1,752	$3,470	$5,313	$9,044
2035	20%	$1,946	$3,855	$5,903	$10,049
2036	22%	$2,141	$4,241	$6,493	$11,054
2037	24%	$2,336	$4,626	$7,084	$12,059
2038	26%	$2,530	$5,012	$7,674	$13,064
2039	28%	$2,725	$5,397	$8,264	$14,069
2040	30%	$2,920	$5,783	$8,855	$15,074
2041	33%	$3,212	$6,361	$9,740	$16,581
2042	36%	$3,504	$6,940	$10,626	$18,088
2043	39%	$3,795	$7,518	$11,511	$19,596
2044	42%	$4,087	$8,096	$12,396	$21,103
2045	45%	$4,379	$8,674	$13,282	$22,610
2046	48%	$4,671	$9,253	$14,167	$24,118
2047	51%	$4,963	$9,831	$15,053	$25,625
2048	54%	$5,255	$10,409	$15,938	$27,133
2049	57%	$5,547	$10,988	$16,824	$28,640
2050	60%	$5,839	$11,566	$17,709	$30,147
	100%	$9,732	$19,277	$29,515	$50,245

7.3 Taranaki

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$594	$920	$1,122	$1,856
2026	6%	$713	$1,104	$1,347	$2,227
2027	7%	$832	$1,288	$1,571	$2,598
2028	8%	$951	$1,471	$1,796	$2,969
2029	9%	$1,070	$1,655	$2,020	$3,340
2030	10%	$1,189	$1,839	$2,245	$3,711
2031	12%	$1,427	$2,207	$2,694	$4,454
2032	14%	$1,664	$2,575	$3,142	$5,196
2033	16%	$1,902	$2,943	$3,591	$5,938
2034	18%	$2,140	$3,311	$4,040	$6,680
2035	20%	$2,378	$3,679	$4,489	$7,423
2036	22%	$2,616	$4,047	$4,938	$8,165
2037	24%	$2,853	$4,414	$5,387	$8,907
2038	26%	$3,091	$4,782	$5,836	$9,649
2039	28%	$3,329	$5,150	$6,285	$10,392
2040	30%	$3,567	$5,518	$6,734	$11,134
2041	33%	$3,923	$6,070	$7,407	$12,247
2042	36%	$4,280	$6,622	$8,081	$13,361
2043	39%	$4,637	$7,173	$8,754	$14,474
2044	42%	$4,993	$7,725	$9,427	$15,588
2045	45%	$5,350	$8,277	$10,101	$16,701
2046	48%	$5,707	$8,829	$10,774	$17,814
2047	51%	$6,063	$9,381	$11,447	$18,928
2048	54%	$6,420	$9,932	$12,121	$20,041
2049	57%	$6,777	$10,484	$12,794	$21,155
2050	60%	$7,133	$11,036	$13,468	$22,268
	100%	$11,889	$18,394	$22,446	$37,113

7.4 Canterbury

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$1,730	$3,542	$4,437	$5,149
2026	6%	$2,076	$4,250	$5,324	$6,179
2027	7%	$2,422	$4,959	$6,211	$7,209
2028	8%	$2,768	$5,667	$7,099	$8,239
2029	9%	$3,114	$6,376	$7,986	$9,269
2030	10%	$3,459	$7,084	$8,873	$10,299
2031	12%	$4,151	$8,501	$10,648	$12,359
2032	14%	$4,843	$9,918	$12,422	$14,418
2033	16%	$5,535	$11,334	$14,197	$16,478
2034	18%	$6,227	$12,751	$15,972	$18,538
2035	20%	$6,919	$14,168	$17,746	$20,598
2036	22%	$7,611	$15,585	$19,521	$22,658
2037	24%	$8,303	$17,002	$21,296	$24,717
2038	26%	$8,995	$18,419	$23,070	$26,777
2039	28%	$9,687	$19,835	$24,845	$28,837
2040	30%	$10,378	$21,252	$26,620	$30,897
2041	33%	$11,416	$23,377	$29,281	$33,986
2042	36%	$12,454	$25,503	$31,943	$37,076
2043	39%	$13,492	$27,628	$34,605	$40,166
2044	42%	$14,530	$29,753	$37,267	$43,255
2045	45%	$15,568	$31,878	$39,929	$46,345
2046	48%	$16,606	$34,003	$42,591	$49,435
2047	51%	$17,643	$36,129	$45,253	$52,524
2048	54%	$18,681	$38,254	$47,915	$55,614
2049	57%	$19,719	$40,379	$50,577	$58,704
2050	60%	$20,757	$42,504	$53,239	$61,793
	100%	$34,595	$70,841	$88,732	$102,989

7.5 Southland

	% Liability	Q1	Q2	Q3	Q4
2025	**5%**	$1,483	$2,595	$2,591	$3,443
2026	**6%**	$1,780	$3,114	$3,110	$4,131
2027	**7%**	$2,077	$3,633	$3,628	$4,820
2028	**8%**	$2,373	$4,152	$4,146	$5,509
2029	**9%**	$2,670	$4,671	$4,665	$6,197
2030	**10%**	$2,967	$5,191	$5,183	$6,886
2031	**12%**	$3,560	$6,229	$6,219	$8,263
2032	**14%**	$4,153	$7,267	$7,256	$9,640
2033	**16%**	$4,746	$8,305	$8,293	$11,017
2034	**18%**	$5,340	$9,343	$9,329	$12,394
2035	**20%**	$5,933	$10,381	$10,366	$13,772
2036	**22%**	$6,526	$11,419	$11,402	$15,149
2037	**24%**	$7,120	$12,457	$12,439	$16,526
2038	**26%**	$7,713	$13,495	$13,475	$17,903
2039	**28%**	$8,306	$14,534	$14,512	$19,280
2040	**30%**	$8,900	$15,572	$15,549	$20,657
2041	**33%**	$9,790	$17,129	$17,103	$22,723
2042	**36%**	$10,680	$18,686	$18,658	$24,789
2043	**39%**	$11,570	$20,243	$20,213	$26,855
2044	**42%**	$12,460	$21,800	$21,768	$28,920
2045	**45%**	$13,350	$23,357	$23,323	$30,986
2046	**48%**	$14,239	$24,915	$24,878	$33,052
2047	**51%**	$15,129	$26,472	$26,433	$35,118
2048	**54%**	$16,019	$28,029	$27,987	$37,183
2049	**57%**	$16,909	$29,586	$29,542	$39,249
2050	**60%**	$17,799	$31,143	$31,097	$41,315
	100%	$29,666	$51,905	$51,829	$68,858

8.0 APPENDIX 2: SHEEP & BEEF QUARTILE ANALYSIS

This is based on: non-urease coated urea, at $25/tonne CO_2e

8.1 Class 1 South Island High Country

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$1	$20	$55	$258
2026	6%	$1	$24	$66	$310
2027	7%	$2	$28	$77	$362
2028	8%	$2	$32	$88	$413
2029	9%	$2	$36	$99	$465
2030	10%	$2	$40	$110	$517
2031	12%	$3	$48	$132	$620
2032	14%	$3	$56	$154	$723
2033	16%	$4	$64	$176	$826
2034	18%	$4	$72	$198	$930
2035	20%	$5	$80	$220	$1,033
2036	22%	$5	$88	$242	$1,136
2037	24%	$6	$96	$264	$1,240
2038	26%	$6	$104	$286	$1,343
2039	28%	$6	$112	$308	$1,446
2040	30%	$7	$120	$330	$1,550
2041	33%	$8	$132	$363	$1,705
2042	36%	$8	$144	$396	$1,859
2043	39%	$9	$156	$429	$2,014
2044	42%	$10	$168	$462	$2,169
2045	45%	$10	$180	$495	$2,324
2046	48%	$11	$192	$528	$2,479
2047	51%	$12	$204	$561	$2,634
2048	54%	$12	$216	$594	$2,789
2049	57%	$13	$228	$627	$2,944
2050	60%	$14	$240	$660	$3,099
	100%	$23	$399	$1,099	$5,165

8.2 Class 2 South Island Hill Country

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$3	$17	$50	$129
2026	6%	$4	$21	$59	$154
2027	7%	$4	$24	$69	$180
2028	8%	$5	$28	$79	$206
2029	9%	$6	$31	$89	$232
2030	10%	$6	$34	$99	$257
2031	12%	$8	$41	$119	$309
2032	14%	$9	$48	$139	$360
2033	16%	$10	$55	$159	$412
2034	18%	$12	$62	$178	$463
2035	20%	$13	$69	$198	$515
2036	22%	$14	$76	$218	$566
2037	24%	$15	$83	$238	$618
2038	26%	$17	$90	$258	$669
2039	28%	$18	$97	$277	$721
2040	30%	$19	$103	$297	$772
2041	33%	$21	$114	$327	$850
2042	36%	$23	$124	$357	$927
2043	39%	$25	$134	$386	$1,004
2044	42%	$27	$145	$416	$1,081
2045	45%	$29	$155	$446	$1,159
2046	48%	$31	$165	$476	$1,236
2047	51%	$33	$176	$505	$1,313
2048	54%	$35	$186	$535	$1,390
2049	57%	$36	$197	$565	$1,468
2050	60%	$38	$207	$595	$1,545
	100%	$64	$345	$991	$2,575

8.3 Class 3 North Island Hard Hill Country

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$0	$3	$19	$117
2026	6%	$0	$3	$23	$140
2027	7%	$0	$4	$27	$164
2028	8%	$0	$4	$31	$187
2029	9%	$0	$5	$35	$211
2030	10%	$0	$5	$39	$234
2031	12%	$0	$6	$46	$281
2032	14%	$0	$7	$54	$328
2033	16%	$0	$8	$62	$374
2034	18%	$0	$9	$69	$421
2035	20%	$0	$10	$77	$468
2036	22%	$0	$11	$85	$515
2037	24%	$0	$12	$93	$561
2038	26%	$0	$13	$100	$608
2039	28%	$0	$14	$108	$655
2040	30%	$0	$15	$116	$702
2041	33%	$0	$17	$127	$772
2042	36%	$0	$18	$139	$842
2043	39%	$0	$20	$151	$912
2044	42%	$0	$21	$162	$983
2045	45%	$0	$23	$174	$1,053
2046	48%	$0	$24	$185	$1,123
2047	51%	$0	$26	$197	$1,193
2048	54%	$0	$27	$208	$1,263
2049	57%	$0	$29	$220	$1,333
2050	60%	$0	$30	$232	$1,404
	100%	$0	$51	$386	$2,339

8.4 Class 4 North Island Hill Country

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$0	$6	$24	$92
2026	6%	$0	$7	$29	$110
2027	7%	$0	$8	$33	$129
2028	8%	$0	$10	$38	$147
2029	9%	$0	$11	$43	$166
2030	10%	$0	$12	$48	$184
2031	12%	$0	$14	$57	$221
2032	14%	$0	$17	$67	$258
2033	16%	$0	$19	$77	$295
2034	18%	$0	$22	$86	$331
2035	20%	$0	$24	$96	$368
2036	22%	$0	$27	$105	$405
2037	24%	$0	$29	$115	$442
2038	26%	$0	$31	$124	$479
2039	28%	$0	$34	$134	$516
2040	30%	$0	$36	$144	$552
2041	33%	$0	$40	$158	$608
2042	36%	$0	$43	$172	$663
2043	39%	$0	$47	$187	$718
2044	42%	$0	$51	$201	$773
2045	45%	$0	$54	$215	$829
2046	48%	$0	$58	$230	$884
2047	51%	$0	$62	$244	$939
2048	54%	$0	$65	$258	$994
2049	57%	$0	$69	$273	$1,049
2050	60%	$0	$72	$287	$1,105
	100%	$0	$121	$478	$1,841

8.5 Class 5 North Island Intensive Finishing

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$1	$10	$34	$104
2026	6%	$1	$12	$40	$124
2027	7%	$1	$14	$47	$145
2028	8%	$1	$15	$54	$166
2029	9%	$1	$17	$60	$186
2030	10%	$1	$19	$67	$207
2031	12%	$1	$23	$81	$248
2032	14%	$2	$27	$94	$290
2033	16%	$2	$31	$107	$331
2034	18%	$2	$35	$121	$373
2035	20%	$2	$39	$134	$414
2036	22%	$2	$42	$148	$455
2037	24%	$3	$46	$161	$497
2038	26%	$3	$50	$175	$538
2039	28%	$3	$54	$188	$580
2040	30%	$3	$58	$201	$621
2041	33%	$4	$64	$222	$683
2042	36%	$4	$69	$242	$745
2043	39%	$4	$75	$262	$807
2044	42%	$5	$81	$282	$870
2045	45%	$5	$87	$302	$932
2046	48%	$5	$93	$322	$994
2047	51%	$6	$98	$342	$1,056
2048	54%	$6	$104	$362	$1,118
2049	57%	$6	$110	$383	$1,180
2050	60%	$7	$116	$403	$1,242
	100%	$11	$193	$671	$2,070

8.6 Class 6 South Island Finishing Breeding

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$3	$20	$54	$134
2026	6%	$4	$24	$65	$161
2027	7%	$4	$29	$75	$187
2028	8%	$5	$33	$86	$214
2029	9%	$5	$37	$97	$241
2030	10%	$6	$41	$108	$268
2031	12%	$7	$49	$129	$321
2032	14%	$8	$57	$151	$375
2033	16%	$9	$65	$172	$428
2034	18%	$11	$73	$194	$482
2035	20%	$12	$81	$215	$535
2036	22%	$13	$90	$237	$589
2037	24%	$14	$98	$259	$642
2038	26%	$15	$106	$280	$696
2039	28%	$16	$114	$302	$750
2040	30%	$18	$122	$323	$803
2041	33%	$19	$134	$356	$883
2042	36%	$21	$147	$388	$964
2043	39%	$23	$159	$420	$1,044
2044	42%	$25	$171	$452	$1,124
2045	45%	$26	$183	$485	$1,205
2046	48%	$28	$196	$517	$1,285
2047	51%	$30	$208	$549	$1,365
2048	54%	$32	$220	$582	$1,446
2049	57%	$34	$232	$614	$1,526
2050	60%	$35	$244	$646	$1,606
	100%	$59	$407	$1,077	$2,677

8.7 Class 7 South Island Intensive Finishing

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$2	$14	$29	$59
2026	6%	$3	$17	$35	$71
2027	7%	$3	$20	$41	$83
2028	8%	$3	$22	$47	$95
2029	9%	$4	$25	$52	$107
2030	10%	$4	$28	$58	$119
2031	12%	$5	$34	$70	$142
2032	14%	$6	$39	$82	$166
2033	16%	$7	$45	$93	$190
2034	18%	$8	$50	$105	$214
2035	20%	$8	$56	$117	$237
2036	22%	$9	$62	$128	$261
2037	24%	$10	$67	$140	$285
2038	26%	$11	$73	$152	$309
2039	28%	$12	$78	$163	$332
2040	30%	$13	$84	$175	$356
2041	33%	$14	$92	$192	$392
2042	36%	$15	$101	$210	$427
2043	39%	$17	$109	$227	$463
2044	42%	$18	$118	$245	$498
2045	45%	$19	$126	$262	$534
2046	48%	$20	$134	$280	$570
2047	51%	$22	$143	$297	$605
2048	54%	$23	$151	$315	$641
2049	57%	$24	$160	$332	$676
2050	60%	$25	$168	$350	$712
	100%	$42	$280	$583	$1,187

8.8 Class 8 South Island Mixed Finishing

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$142	$317	$435	$717
2026	6%	$170	$380	$522	$860
2027	7%	$198	$443	$609	$1,003
2028	8%	$227	$507	$696	$1,147
2029	9%	$255	$570	$783	$1,290
2030	10%	$284	$633	$870	$1,434
2031	12%	$340	$760	$1,044	$1,720
2032	14%	$397	$887	$1,218	$2,007
2033	16%	$454	$1,013	$1,392	$2,294
2034	18%	$510	$1,140	$1,566	$2,580
2035	20%	$567	$1,267	$1,740	$2,867
2036	22%	$624	$1,394	$1,914	$3,154
2037	24%	$680	$1,520	$2,088	$3,441
2038	26%	$737	$1,647	$2,262	$3,727
2039	28%	$794	$1,774	$2,436	$4,014
2040	30%	$851	$1,900	$2,611	$4,301
2041	33%	$936	$2,090	$2,872	$4,731
2042	36%	$1,021	$2,280	$3,133	$5,161
2043	39%	$1,106	$2,470	$3,394	$5,591
2044	42%	$1,191	$2,660	$3,655	$6,021
2045	45%	$1,276	$2,850	$3,916	$6,451
2046	48%	$1,361	$3,040	$4,177	$6,881
2047	51%	$1,446	$3,230	$4,438	$7,311
2048	54%	$1,531	$3,420	$4,699	$7,741
2049	57%	$1,616	$3,610	$4,960	$8,171
2050	60%	$1,701	$3,800	$5,221	$8,601
	100%	$2,835	$6,334	$8,702	$14,335

8.9 All Class Average Farm

	% Liability	Q1	Q2	Q3	Q4
2025	5%	$8	$26	$52	$136
2026	6%	$10	$31	$63	$164
2027	7%	$11	$36	$73	$191
2028	8%	$13	$41	$84	$218
2029	9%	$15	$46	$94	$245
2030	10%	$16	$51	$105	$273
2031	12%	$19	$61	$125	$327
2032	14%	$23	$72	$146	$382
2033	16%	$26	$82	$167	$436
2034	18%	$29	$92	$188	$491
2035	20%	$32	$102	$209	$545
2036	22%	$35	$113	$230	$600
2037	24%	$39	$123	$251	$654
2038	26%	$42	$133	$272	$709
2039	28%	$45	$143	$293	$764
2040	30%	$48	$154	$314	$818
2041	33%	$53	$169	$345	$900
2042	36%	$58	$184	$376	$982
2043	39%	$63	$200	$408	$1,063
2044	42%	$68	$215	$439	$1,145
2045	45%	$73	$230	$470	$1,227
2046	48%	$77	$246	$502	$1,309
2047	51%	$82	$261	$533	$1,391
2048	54%	$87	$276	$565	$1,472
2049	57%	$92	$292	$596	$1,554
2050	60%	$97	$307	$627	$1,636
	100%	$161	$512	$1,045	$2,727

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