

Dairy cow nutrient excretion values

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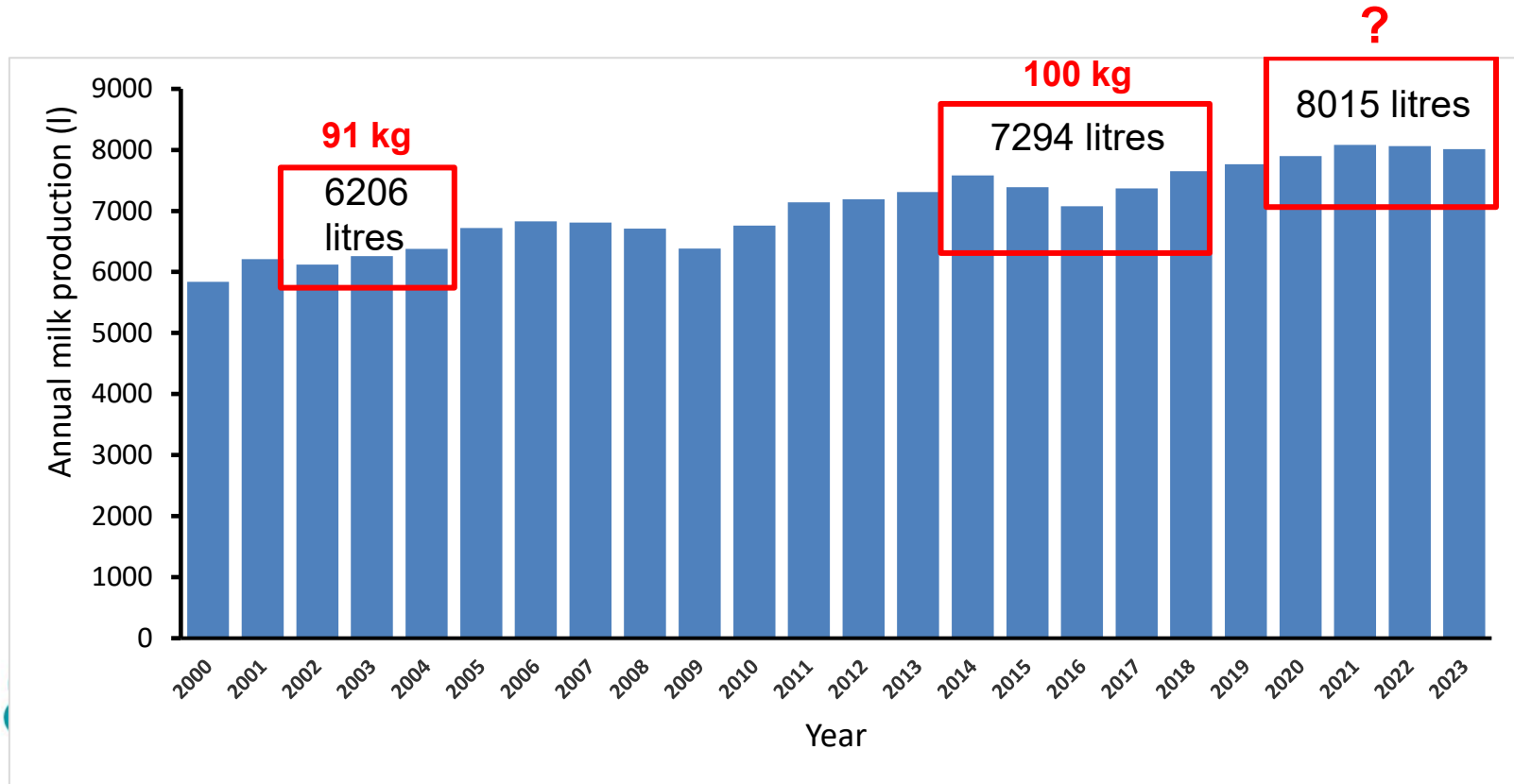


Background

- Nutrient excretion values for all classes of livestock are kept under review
 - Production systems change
 - Performance levels change
 - New science becomes available
- N excretion values are important as these determine the stocking rate on a farm
- Of particular importance on dairy farms

Changes in annual milk production per cow since 2000

(Stats. Rev. of NI Agric)



Moving away from a single value for all farms

- Previously a single value was adopted across all farms, irrespective of milk yield
- But milk yields vary widely between dairy herds
- A single value cannot accurately represent both lower and higher yielding systems
- Proposed to replace single excretion values for N and P, by values determined by milk yield on each farm.
 - ✓ Make values more accurate
 - ✓ Fairer system as values reflect actual milk yields
 - ✓ Opportunity to reflect improved management practices on individual farms
 - ✓ Avoids disproportionate impacts on farms close to regulatory thresholds

*New approach to calculation of
manure N excretion for dairy cattle for
different milk yield bands*

Approach taken

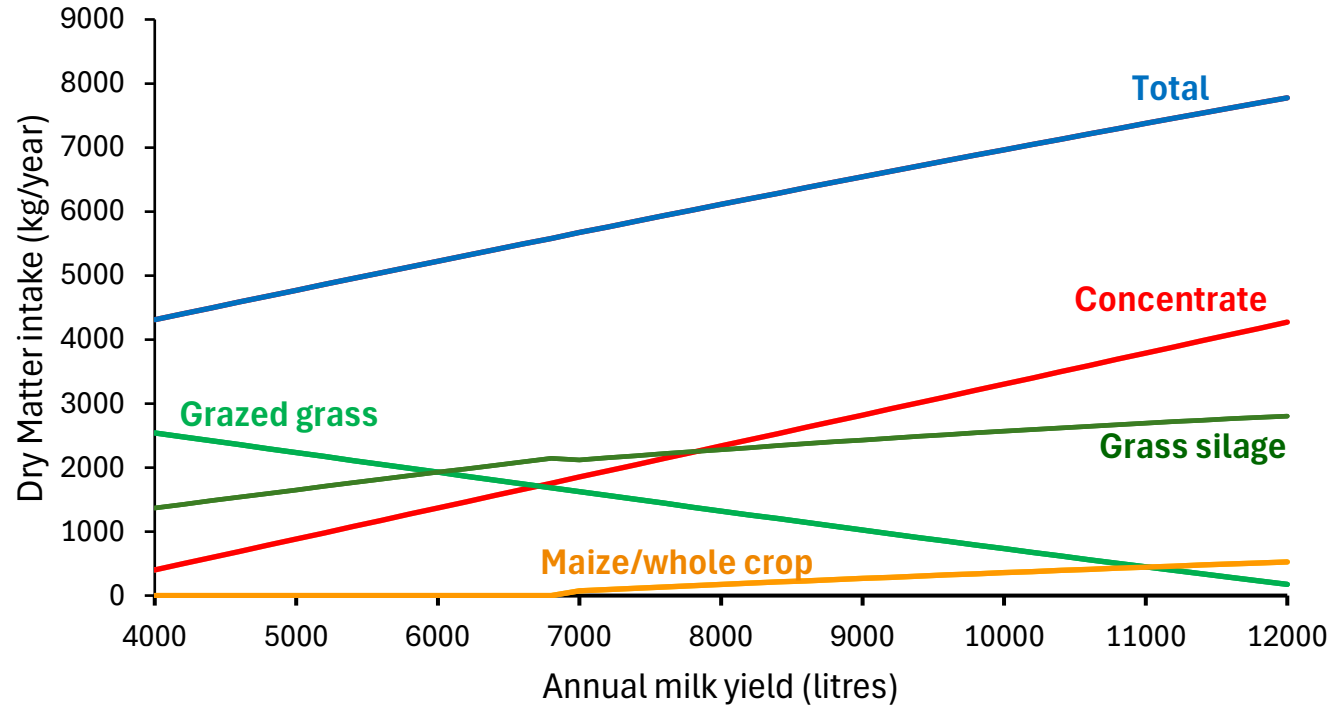
- Approach adopted is similar to that adopted within the UK Ammonia Inventory
 1. Calculate total energy requirement of a dairy cow over a 12-month period
 2. Separate intake into different diet components
 3. Apply N concentration of each diet component to determine total N intake
 4. Apply a N utilisation value to determine N excreted
- As far as possible assumptions align with those in the ammonia inventory
- Calculations undertake for cows producing between 4000 and 12,500 litres (500 litre intervals)

Calculating total energy requirement

- Total energy requirements of cows over 12 months determined as total of:
 - energy for milk production, plus
 - energy for maintenance, plus
 - energy for movement and walking, plus
 - energy for pregnancy, plus
 - energy for growth, plus
 - = Total energy requirement per cow per year

Calculations based on equations within Feed-Into-Milk

Intakes of each diet component then calculated or estimated



Intakes of each diet component of the diet at each milk yield band (DMI, kg/year)

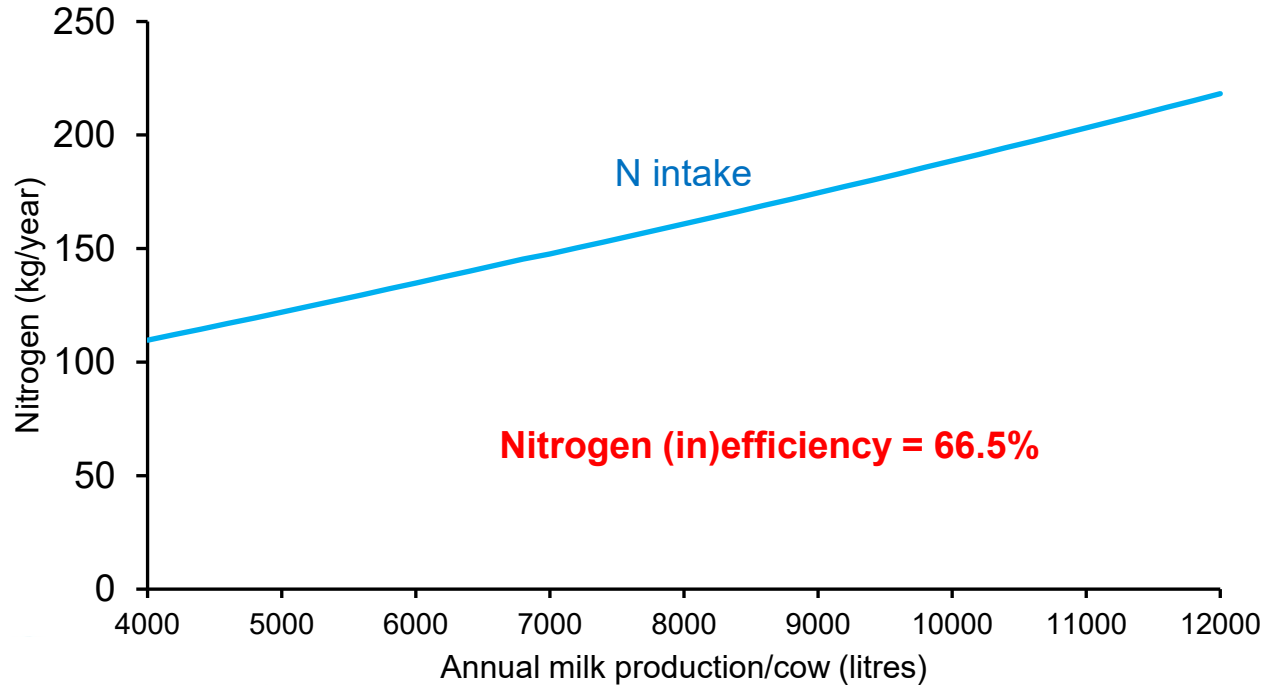
Milk yield	Concentrate	Grazed grass	Grass silage	Maize/whole crop silage	Total DMI
<6000	1250	2002	1858	0	5110
6000 - 6500	1493	1849	1991	2	5334
6501 - 7000	1735	1697	2075	52	5559
7001 - 7500	1978	1545	2157	101	5781
7501 - 8000	2221	1394	2237	149	6001
8001 - 8500	2464	1244	2314	197	6219
8501 - 9000	2707	1095	2388	244	6434
9001 - 9500	2950	947	2459	290	6647
9501 – 10,000	3193	802	2528	335	6858
>10,000	3436	658	2593	379	7066

Assumed composition of feedstuffs -based on local NI values in the Ammonia Inventory

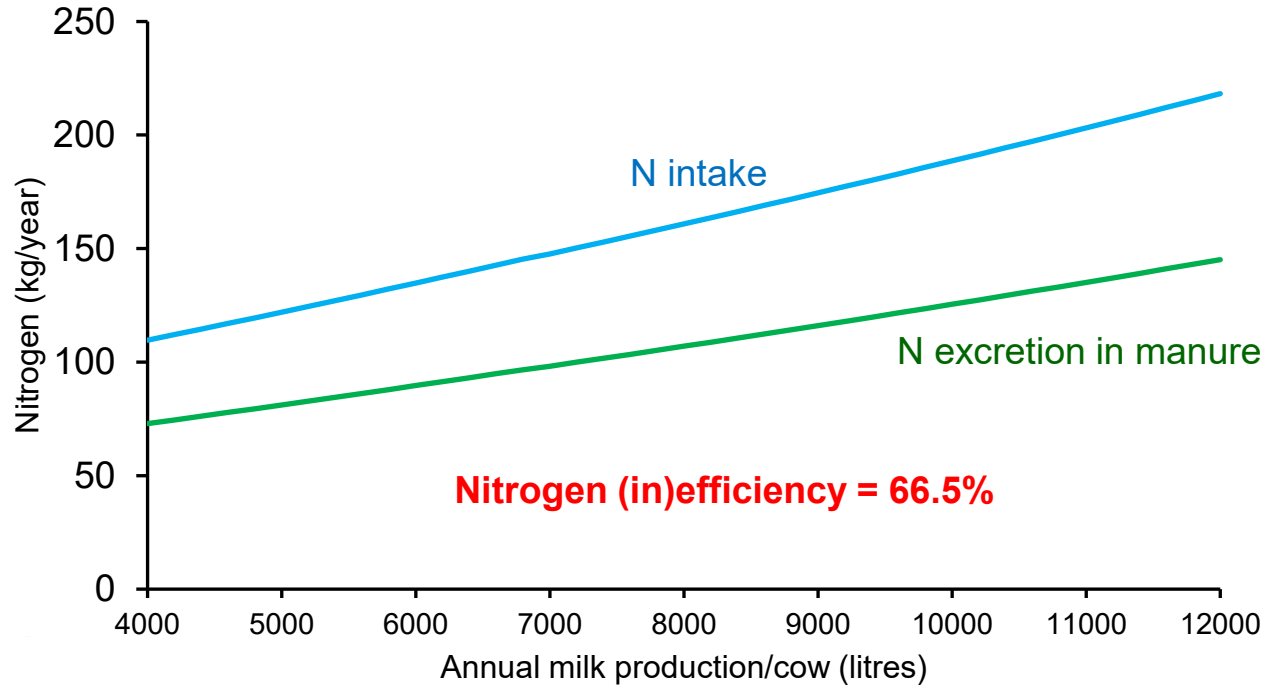
	Crude protein content (MJ/kg DM)
Concentrates	19 – 22%
Grazed grass	17.3
Grass silage	12.4
Maize/Whole-crop	8.8

Based on outcomes of a series of meetings between CAFRE, NIGTA and AFBI (2021) to review existing data, source new data and fill gaps with ‘considered opinion’

Total N intake calculated across a range of milk yields



Total N excretion calculated across a range of milk yields



How do values from new methodology compare with values from previous methodology

	Milk yield (l/day)	Value using original methodology (kg/year)	Value using new methodology (kg/year)
2004	6200	91	91.4
2019	7294	100.5 (100)	101.1
2025	8015	-	107.2

Excellent agreement between previous and new methodologies

Proposed Banding for N excretion

Milk yield band (litres)	N excretion per cow (kg/year)
< 5000 litres	77
5000 - 7000	90
7001 – 8000	103
8001 – 9000	112
9001 – 10,000	121
10,001 – 12,000	135
>12,000 litres	149

Calculating phosphorus excretion in manure

- Uses same model as for N excretion,
- Applies P values to inputs (feeds) and outputs to determine total P intake
- Then uses a 'balance approach' to determine P excreted in manure
- $\text{P excreted in manure} = \text{P intake, minus P retained by the cow, minus P output in calf, minus P output in milk}$

	Assumed P content of feeds (% DM)
Concentrates	0.53 (0.47 fresh)
Grazed grass	0.34
Grass silage	0.31
Maize/Whole-crop	0.22

Proposed revised Banding for N and P

Milk yield band (litres)	N excretion per cow (kg/year)	P excretion per cow (kg/year)
< 5000 litres	77	11
5000 - 7000	90	13
7001 – 8000	103	15
8001 – 9000	112	17
9001 – 10,000	121	18
10,001 – 12,000	135	20
>12,000 litres	149	22

Options for farmers in relation to N excretion value

1. Use the value for their herd milk yield band
2. Use a value specific to their own farms milk yield (of benefit to farmers in lower half of the band)
3. On higher milk output farms, calculate a value based on their own farm inputs and outputs
4. Adopt the maximum value of 149 kg N/year

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Background to development of the farm specific model

- Higher output herds particularly impacted by banding
- Prediction of N inputs 'less good' at these higher milk yields as lacks data.
- Some of these farmers are feeding protected amino acids and may be reducing protein levels which the model does not reflect

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Overview of model

- 'Simple' and yet 'scientifically robust'
- Model adopts most of same assumptions/equations as in banding approach.
- 4 components
 - Animal 'model'
 - Concentrate 'model'
 - Grazing 'model'
 - Conserved forage 'model'

An example high output farm

- 11, 700 litres per cow (4.17% fat and 3.29% protein)
- 4.1 t concentrate/cow/year
- No grazing
- Actual composition of all forages adopted

	Diet composition	
Concentrate CP content (% fresh)	18%	
Total diet CP content (% DM)	16%	
	N excretion values (kg/cow/year)	
Based on N banding (10000 – 12000 litres)	135	
Based on actual farm input data	130	

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Thank you