

Nutrient Action Programme –
Stakeholders meeting

**Review of phosphorus
content of concentrates,
and nitrogen, phosphorus
and manure excretion
from Dairy Cattle**

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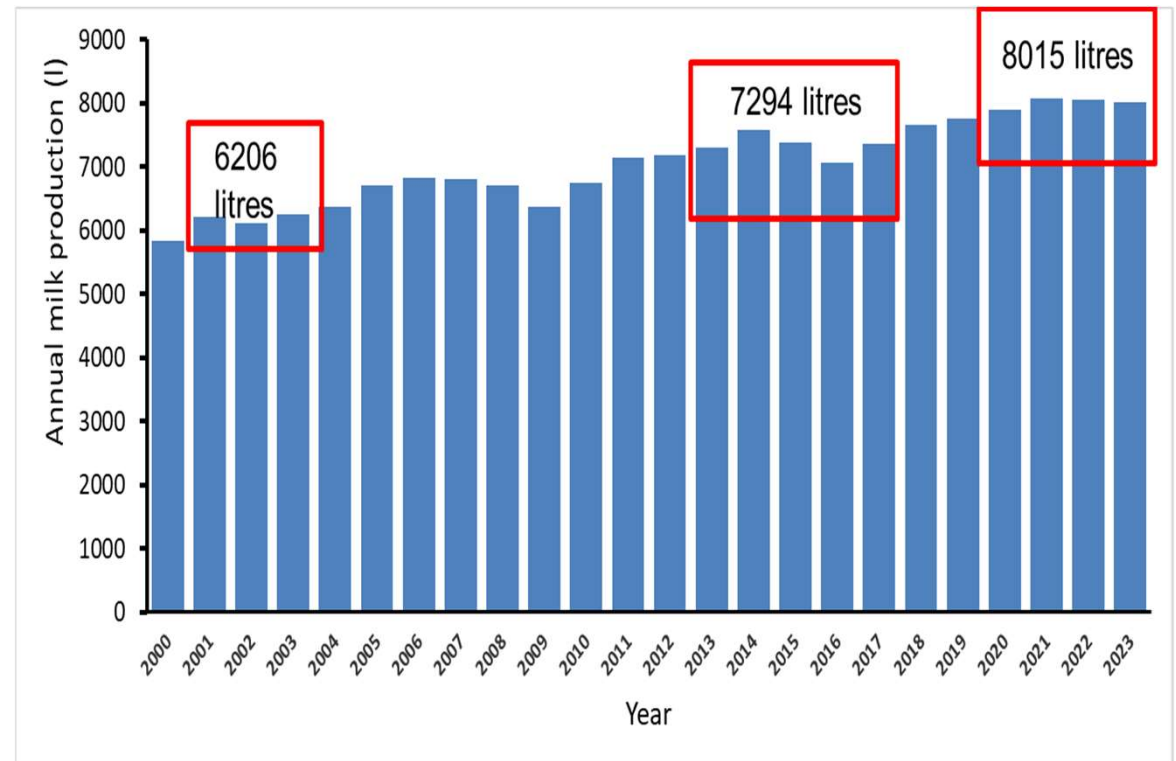
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Why review excretion levels?

➤ Nutrient excretion values for all classes of livestock are kept under review:

- Performance levels change
- Diets and systems change
- New science becomes available



Areas reviewed by AFBI

➤ P content of dairy cow concentrates

➤ Excretions

N excretion by dairy cattle (kg N/year)

P excretion by dairy cattle (kg N/year)

Manure excretion by dairy cattle (kg/week)



All use same model
which predicts
intakes across a
range of levels of
performance

➤ Revised approach – similar to that adopted within the UK Ammonia Inventory

P content of concentrate feeds in NI (determined by NIGTA)

Weighted P content of all concentrate ingredients

	Tonnes	% P	Tonnes of P
Wheat	554,839	0.30	1665
Barley	222,237	0.30	667
Whole and Flaked Maize	608,690	0.23	1400
Maize Gluten Feed	104,793	0.81	849
By-Products of Malting, Brewing and Distilling	184,480	0.83	1531
Other Grains & Cereal By-Products	101,271	0.35	354
Rape Seed Cake and Meal	114,209	1.01	1154
Soya Cake and Meal	406,451	0.66	2683
Whole Oilseeds & Other Oilseed Cakes and Meals	62,939	0.66	415
Milk Products/By-Products & Other Animal By-Products (excluding fats)	6,441	0.51	33
Citrus and Other Fruit Pulp	1,342	0.13	2
Molasses and Sugar	68,159	0.10	68
Oils and Fats	27,103	0.00	0
Dried forages & Dried Sugar Beet Pulp	51,761	0.08	41
Minerals, Vitamins etc	94,220	1.00	942
Soya Hulls	160,717	0.13	209
Palm Kernels	28,760	0.64	184
Other materials	41,140	0.30	123
Total	2,839,553		12,320
		0.43	

Overall weighted P content of concentrates offered in NI calculated as 0.43% by NIGTA



NIGTA cross-check of overall P levels in concentrates

Weighted P content by sector

	Tonnes	% P
Cattle	1286341	0.46
Calf	74058	0.48
Pig	206887	0.40
Poultry	843339	0.40
Sheep	60897	0.47
Other	7419	0.52
Straights	266597	0.50
Cereals fed on farm	106008	0.30
Non-Concentrates	51640	0.10
Total	2903186	0.43

Weighted P content for ruminant feeds

	Tonnes	% P
Dairy cow compounds	605467	0.48
Dairy - Coarse mixes or blends	242082	0.46
Beef cattle compounds	138431	0.45
All other cattle compounds	4719	0.51
Beef - Coarse mixes or blends	239543	0.41
Protein concentrates	2889	0.65
Imports	53209	0.46
Total	1286341	0.46

NIGTA values indicate mean P content of:

Dairy cow compounds = 0.48%

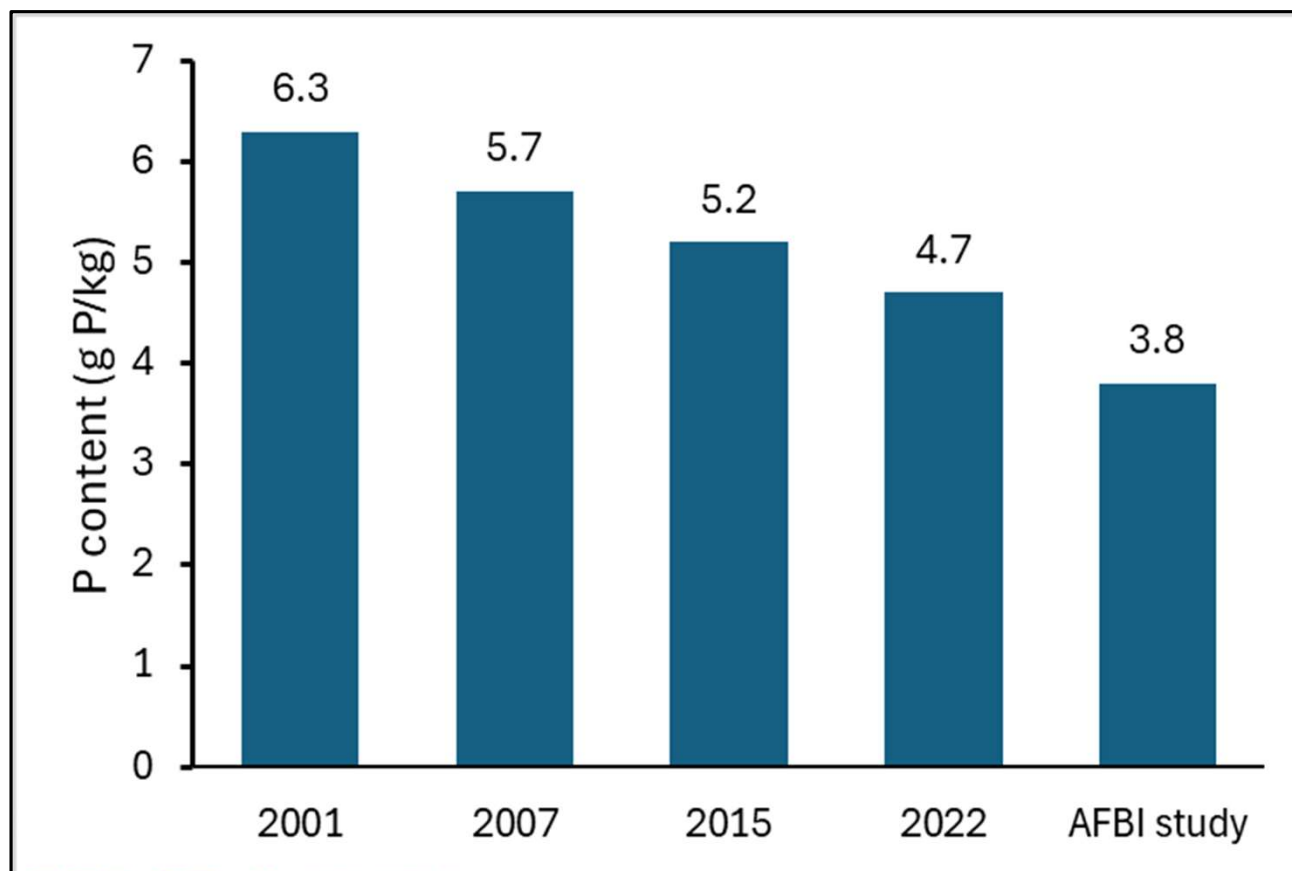
Dairy cow blends = 0.46%

Supports value of 0.43% for P content of concentrates offered in NI

AFBI validation of NIGTA data

- Check of P levels adopted for raw materials:
 - NIGTA facilitated access to two extensive raw material databases from two accredited NI labs (one feed compounder, one pre-mix supplier)
 - AFBI accessed raw material P levels from a number of external databases
 - Overall good level of agreement for raw material P values to those adopted by NIGTA:
 - **Value of 0.43% for all NI concentrates accepted as appropriate**
- Check of P levels in dairy concentrates
 - NIGTA facilitated access to a database from the accredited lab of a major NI feed compounder (162 samples from 34 individual dairy cow feeds)
 - High level of agreement with values determined in earlier analysis by NIGTA: Values accepted as:
 - **Dairy cow compounds = 0.48% P**
 - **Dairy cow blends = 0.46% P**

Changes in the P content of dairy cow concentrates over the last two decades (g/kg fresh)



Reduction in P levels due to

- 1) Conscious effort by feed industry to reduce diet P levels
- 2) Trend towards rations with higher quality ingredients
- 3) Shift in relative costs of some feed ingredients

Areas reviewed by AFBI

➤ ~~P content of dairy cow concentrates~~

➤ Excretions

N excretion by dairy cattle (kg N/year)

P excretion by dairy cattle (kg N/year)

Manure excretion by dairy cattle (kg/week)



All use same model
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Calculation of dairy cow intakes

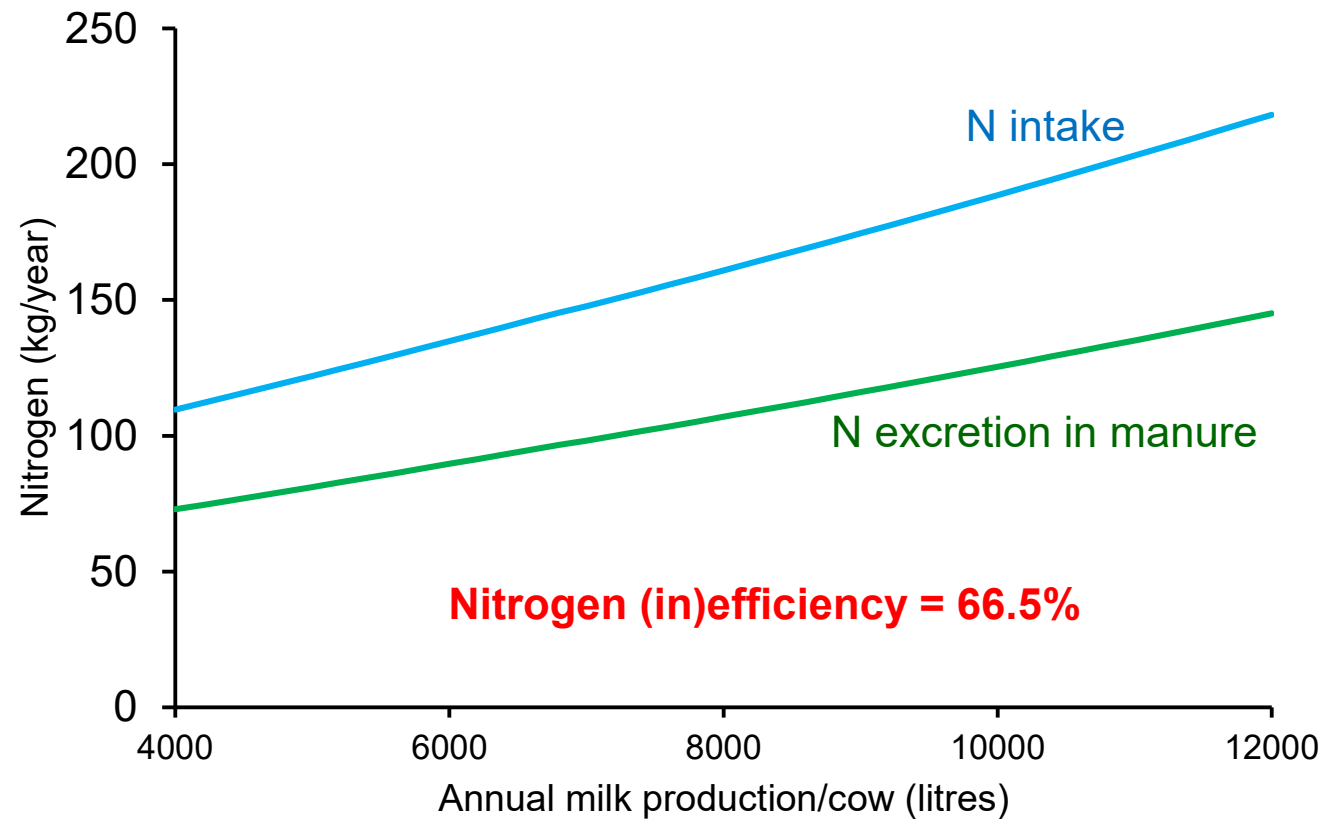
1. Model developed for cows producing between 4000 and 12,000 litres
2. Calculate total energy requirement of a dairy cow over a 12-month period based on equations in Feed-into-milk
 - Milk plus
 - Maintenance plus
 - Movement plus
 - Pregnancy plus
 - Growth
3. Convert energy intake to DM intake
4. Partition to different diet components

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

Calculation of Manure N excretion

1. Apply appropriate N values to each diet component to determine total N intake
1. Apply a N use efficiency value (66.5%) to determine N excretion in manure



N excretion at each milk yield band

Milk yield band (litres)	N excretion per cow (kg/year)
< 6000 litres	88
6001 - 6500	92
6501 – 7000	96
7001 – 7500	100
7501 – 8000	105
8001 – 8500	109
8501 – 9000	114
9001 – 9500	118
9501 – 10,000	123
>10, 000 litres	128

- Single value 'penalises' lower input herds
- More precise calculation for individual farms
- Multiple bands reduces the impact of a small change in yield on any farm
- Added complexity?/ Practicalities of determining which yield band a herd is in?

Calculating phosphorus excretion in manure

- Approach used previous involved assuming the N : P ratio in manure was 5.4 : 1
- Given the decline in the P content of dairy cow diets over last decade, the N : P ratio in slurry is likely to have changed – however, we do not have current data on N : P ratios in slurry.
- Given this, a ‘balance approach’ has been adopted
- $P \text{ excreted in manure} = P \text{ intake} \text{ minus } P \text{ retained by the cow} \text{ minus } P \text{ output in calf} \text{ minus } P \text{ output in milk}$

Phosphorus excretions associated with each N band

Milk yield band (litres)	N excretion per cow (kg/year)	P excretion per cow (kg/year)
< 6000 litres	88	13
6001 - 6500	92	14
6501 – 7000	96	15
7001 – 7500	100	15
7501 – 8000	105	16
8001 – 8500	109	17
8501 – 9000	114	17
9001 – 9500	118	18
9501 – 10,000	123	18
>10, 000 litres	128	19

Previous value was
19 kg/cow/year for
all herds

Volume of slurry produced/cow/week

- A DEFRA value was adopted previously in NI:
 - 7500 litre cow produces 0.37 m³ manure per week
- AFBI conducted an extensive modelling exercise of local NI data describing manure output from dairy cows
- Dataset comprised 1100 individual cow values from 1990 – 2024
- Relationship developed between DMI intake and manure production ($r^2 = 0.84$)
 - 8000 litre cow produced 0.37 m³ slurry per week
- **Value to remain unchanged at 0.37 m³ slurry/cow/week**

In conclusion

- Mean P content of dairy cow concentrates identified as 0.47% (fresh)
- Dairy cow N excretion values updated and 'banded'
- Dairy cow P excretion values updated (reduced) and 'banded'
- Dairy cow manure excretion value remains unchanged
- Methodology adopted across all 3 excretions now aligned (similar to that adopted within the UK Ammonia Inventory)

Thank you



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