

A photograph of three cows grazing in a lush green field under a cloudy sky. The cows are positioned in the foreground, with several other cows visible in the background. The field is filled with tall grass, and there are trees and a fence line in the distance.

Managing Crude Protein to Improve Performance

Karina Pierce

IFA Smart Farming Conference

April 2019

Crude Protein?

- Protein in beef cattle/dairy diets is commonly expressed as **crude protein**
- Crude protein depends on the **nitrogen** content of the feed
- An animal must eat a balanced diet with enough energy, **protein**, fibre, water, minerals and vitamins to cover maintenance and growth as well as milk production and the needs of a growing foetus



Background

- Current feeding practices opt for high nitrogen (N) diets in an effort to maintain high milk yield and milk protein yields
- However...
 - Response of milk yield or milk protein yield to N is limited
 - Response of N excretion to dietary N is significant

Reasons why N nutrition is important:

Environmental Issues

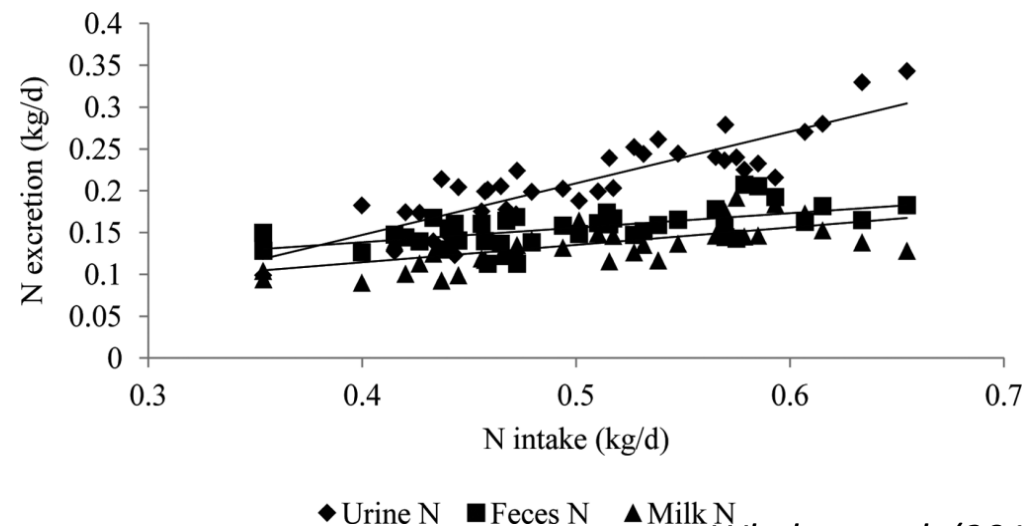
Inefficient use of a scarce resource

Cost



Nitrogen use efficiency in the lactating dairy COW

- High N diets are often fed to lactating dairy cows
- However...
 - Only 25-30% of the N fed is recovered in the milk
 - N retention in beef animals lower than dairy (10-20%)
- N can be lost from the production system as...
 - Ammonia
 - Nitrous Oxide
 - Nitrate Leachate



Whelan et al. (2012)

Challenge for Ireland

- Grass based system – over supply of protein to the cow
- Grass CP – 16-26%
- Limited ability to alter N excretion – low supplementation feeding levels



How Much Crude Protein?

Crude Protein (CP) % / kg fresh weight required in concentrate mixes for grass silage and ad lib meal diets for different classes of stock

Category of Animal	Grass Silage-Based Diets		
	10% CP in the Silage	14% CP in the Silage	Ad Lib meals
Weanlings (1.0 -1.5 kg feeding rate)	20%	12%	-
Weanlings (2.5 feeding rate)	16%	-	-
Suckler cows (dry)	-	-	-
Autumn Suckler cows (calves at foot)	18%	12%	-
Store cattle (500 kg+)	20%	12%	-
Growing bulls	18%	12%	12-13%
Finishing cattle (steers & heifers)	14%	11-12%	11-12%
Finishing bulls	11-12%	11-12%	11-12%

Depends on:

- type of animal
- age/growth stage of the animal

How Much Crude Protein?

Targets for total diet composition for winter milk dairy cows

	Lactating Cow		
	Early-peak ¹	Mid-late	Dry cow
Dry matter intake (kg/day)	21.0	16.0	11.0
Energy UFL (per kg DM)	0.95-1.0	0.85-0.9	0.75
Fibre (min): NDF (%)	32	-	-
ADF (%)	21	-	-
Starch (max)	22	-	-
Oil (max)	5-6	-	-
Protein PDI (g/kg DM)	105-110	95	70
Crude protein (%)	17	15-16	13
Mineral profile (% of diet)			
Ca	0.8	0.7	0.4
P	0.4	0.35	0.3
Na	1.7	1.5	1.0
Mg	0.3	0.25	0.28

¹ peaking at 38-40kg milk

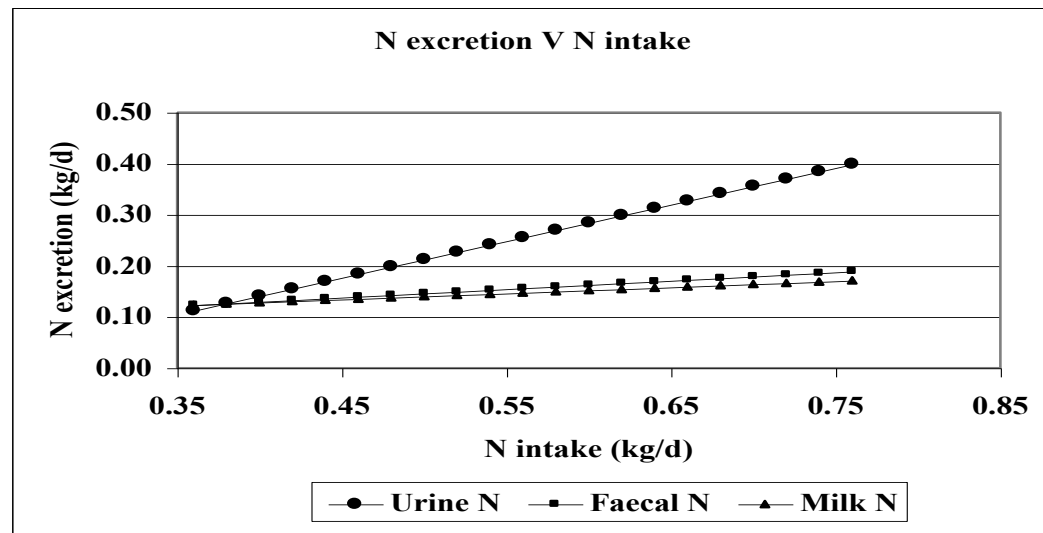
Not enough protein

- Poor growth rates and milk protein/production
- In early spring – the level of protein in spring grass is high, but the quality may not be adequate for the freshly calved cow
- In mid-summer – during a drought situation when grass becomes stemmy, protein levels in the grass can drop and may limit production
- Examples of low protein feeds are forage maize, whole crop cereal silage, fodder beet and low protein concentrates such as citrus pulp
- Balance these with high protein feeds to ensure adequate protein in the animal's diet

Too Much Protein?

- Excessive protein can result in excessive body weight loss as the cow metabolises the extra protein
- Avoid feeding high protein diets during the breeding season

Figure 1. Pattern of urinary, fecal, and milk N excretion plotted over the N intake range observed for cows in Experiment 1.



Feed Labels

Crude Protein

46230K2
PRIME LAMB FINISHER NUTS IN 25KG BAGS
A COMPLEMENTARY FEED FOR FEEDING TO LAMBS

ANALYTICAL CONSTITUENTS:

CRUDE OIL AND FATS	5.7 %	CRUDE PROTEIN	16.0 %
CRUDE FIBRE	9.0 %	CRUDE ASH	9.6 %
MOISTURE	15.0 %	VITAMIN E	55 mg/kg
SODIUM	0.7 %	SELENIUM	0.50 mg/kg

COMPOSITION:

Barley, Wheat Feed, Palm kernel expeller, wheat, Rape seed meal Feed stocks, Dried (sugar) beet pulp, Flower meal Feed stocks, (Sugar) cane molasses, Calcium Carbonate, Sodium Chloride, Vegetable oil & fat, Sodium Chloride.

ADDITIVES (PER KG):

Vitamins:

E672 Vitamin A 10000 iu, E671 Vitamin D3 2000 iu, 3a700 Vitamin E (all-alpha-tocopheryl acetate) 50 mg

Trace Elements:

Ferrous Sulphate Monohydrate (E1 Iron) 417 mg, Calcium Iodate Hexahydrate (E2 Iodine) 8 mg, Cobaltous Carbonate Monohydrate (E3 Cobalt) 1.3 mg, Manganous Oxide (E5 Manganese) 82 mg, Zinc Oxide (E6 Zinc) 83 mg, Sodium Molybdate (E7 Molybdenum) 5.1 mg, Sodium Selenate (E8 Selenium) 0.29 mg

Other Zootechnical Additives:

Sodium Chloride 0.5 %

INSTRUCTIONS FOR USE:

Feed with forage to growing lambs managed in semi-intensive systems to a maximum of 70% of the dry matter intake. Introduce gradually. Fresh water must be available.

Mole Valley Feed Solutions
Exmoor House, Line Way, S Molton, Devon.

NET WEIGHT: See bag or delivery note/label.
Store in a cool, dry place. Best before: 10-AUG-2014
In case of a complaint please return a sample with this label to the supplier.

Formula Code: F2 / 46230 Version: 14051 Serial: 28359634

WMS - Compound Feed - Certificate End Date 31/12/2016 (SI)
Establishment Approval No: CGB2017998

No Energy/UFL/UFV values

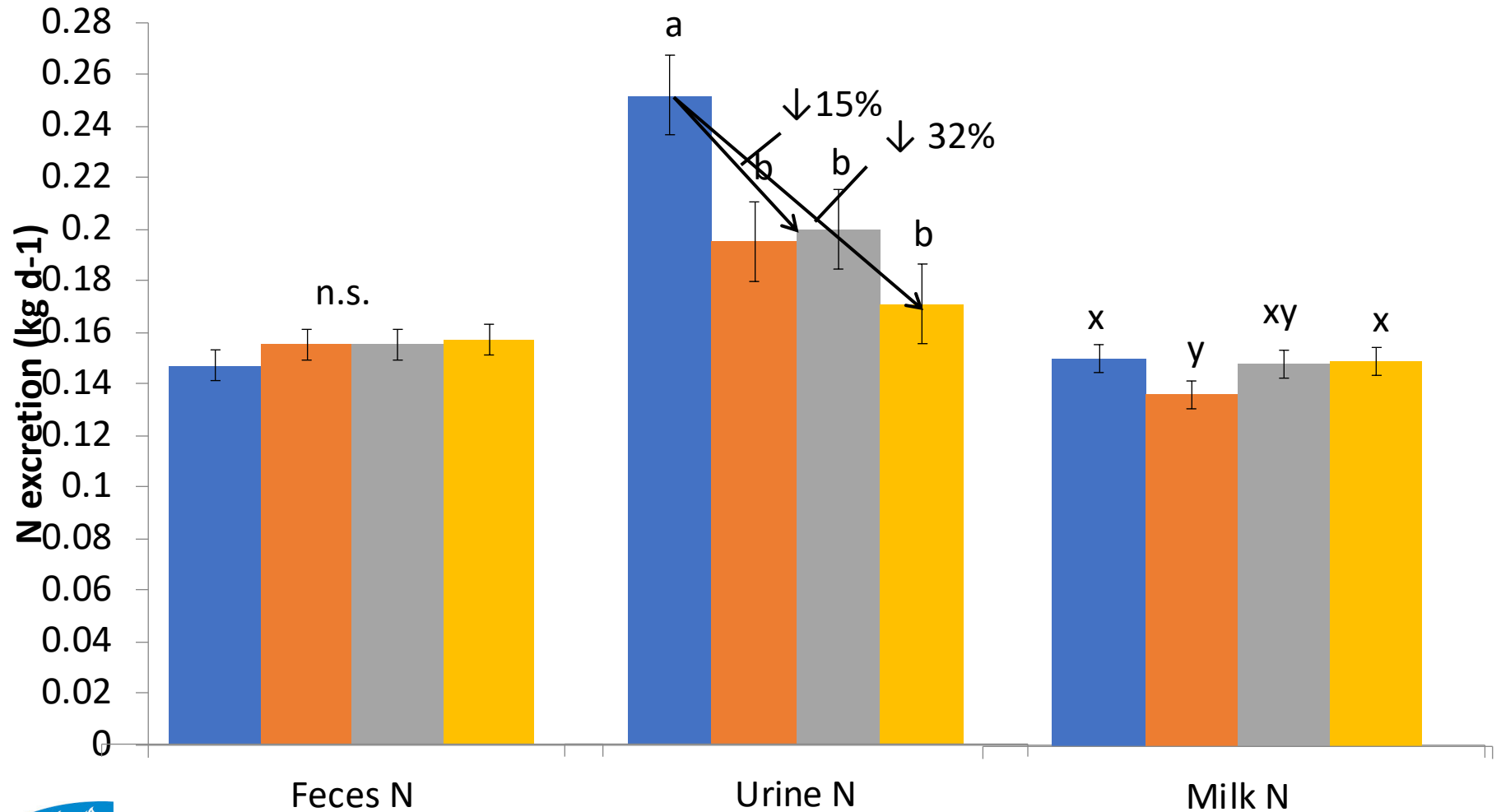
Ingredients in descending order

Evaluation of Concentrate Type on N Excretion Grazing cows

Table 4. Effect of supplementary concentrate type on nitrogen (N) balance

	Hi-Pro ¹	Lo-Pro ²	Lo-Pro + HMBi ³	Lo-Pro Corn ⁴	LSM± sem
<i>Intake (kg d⁻¹)</i>					
Feed N	0.663 ^a	0.609 ^b	0.612 ^b	0.583 ^b	0.017
PDI ⁴	2.260 ^a	2.103 ^b	2.098 ^b	2.153 ^{ab}	0.048
<i>N output (kg d⁻¹)</i>					
Feces	0.173	0.169	0.176	0.162	0.007
Urine	0.349 ^a	0.308 ^b	0.301 ^b	0.283 ^b	0.015
Milk	0.139 ^a	0.128 ^b	0.133 ^{ab}	0.137 ^{ab}	0.004
PDI milk ⁵	1.400	1.321	1.344	1.329	0.058
<i>N recovery⁶</i>					
Feces	0.259 ^b	0.283 ^a	0.287 ^a	0.280 ^a	0.009
Urine	0.523 ^a	0.504 ^{ab}	0.491 ^b	0.482 ^b	0.014
Milk	0.214 ^b	0.213 ^{ab}	0.220 ^{ab}	0.236 ^a	0.007
PDI Balance ⁵	0.486	0.494	0.408	0.465	0.057
Milk Urea N (mmol l ⁻¹)	1.828	1.771	1.900	1.755	0.119
RDP ⁵ balance	0.381 ^a	0.295 ^{ab}	0.304 ^{ab}	0.173 ^b	0.048

Nitrogen Output

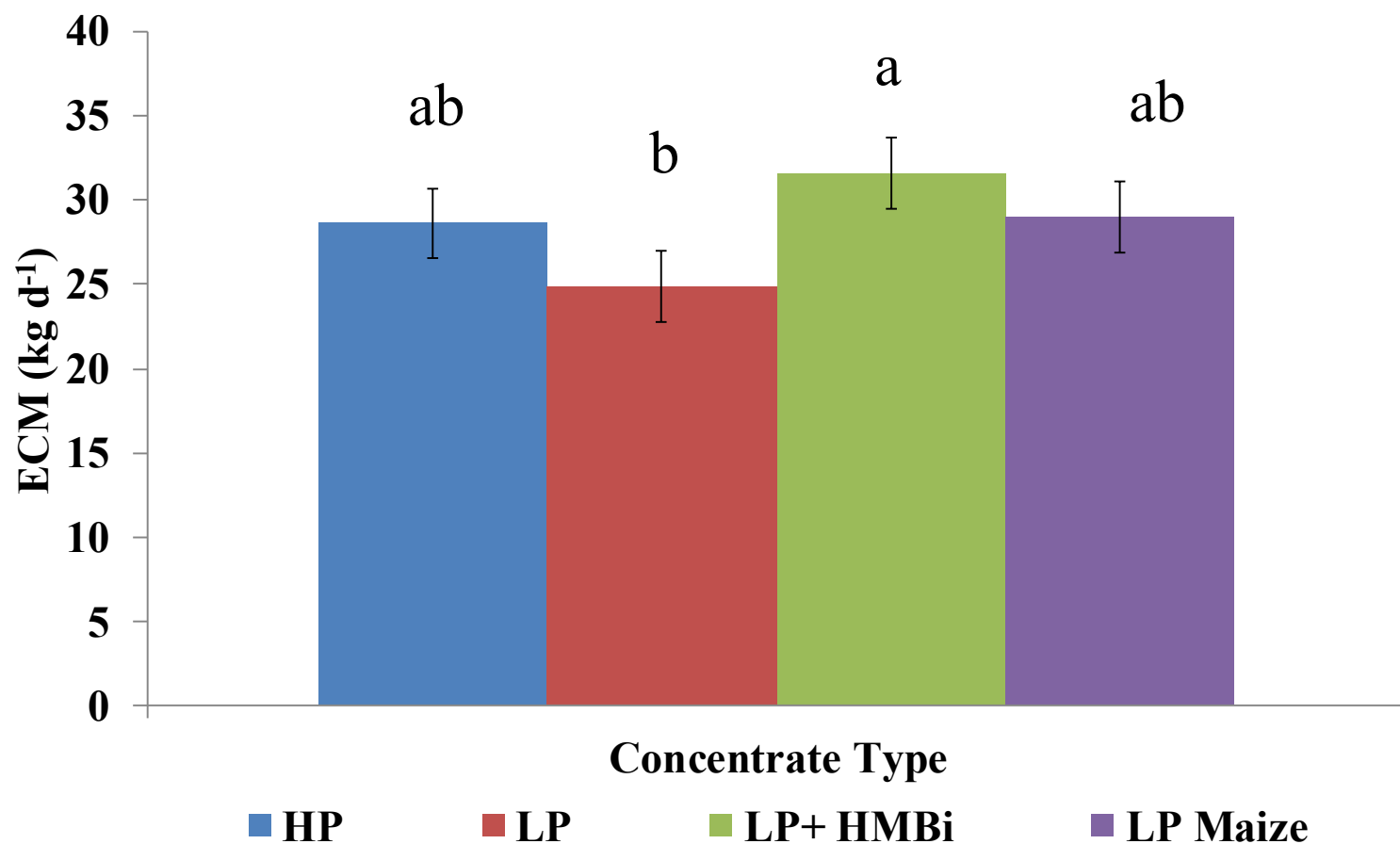


■ HP ■ LP ■ LP+ HMBi ■ LP Maize

a vs. b ($P < 0.05$)

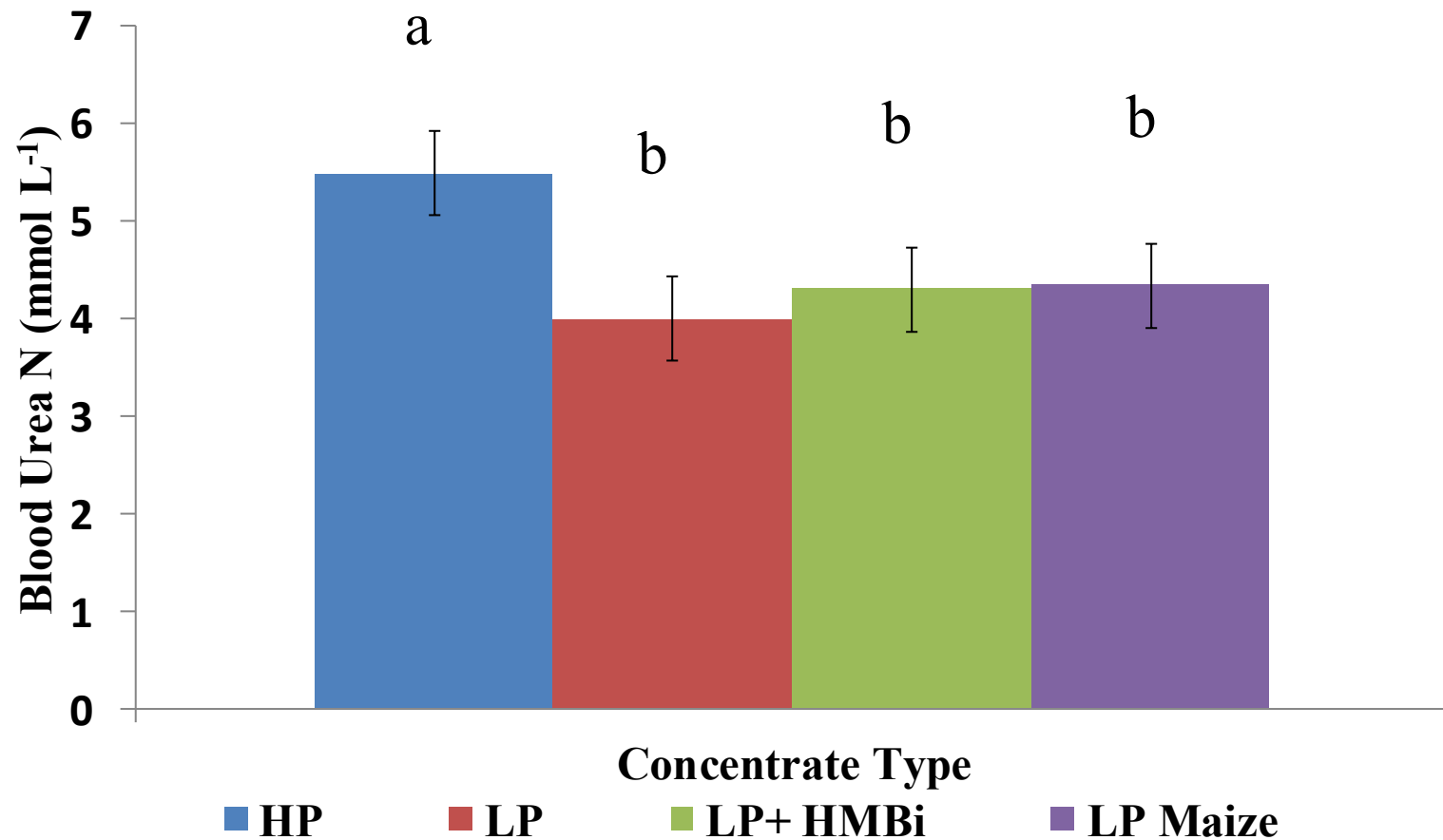
x vs. y ($P > 0.05$ but < 0.10)

Energy Corrected Milk

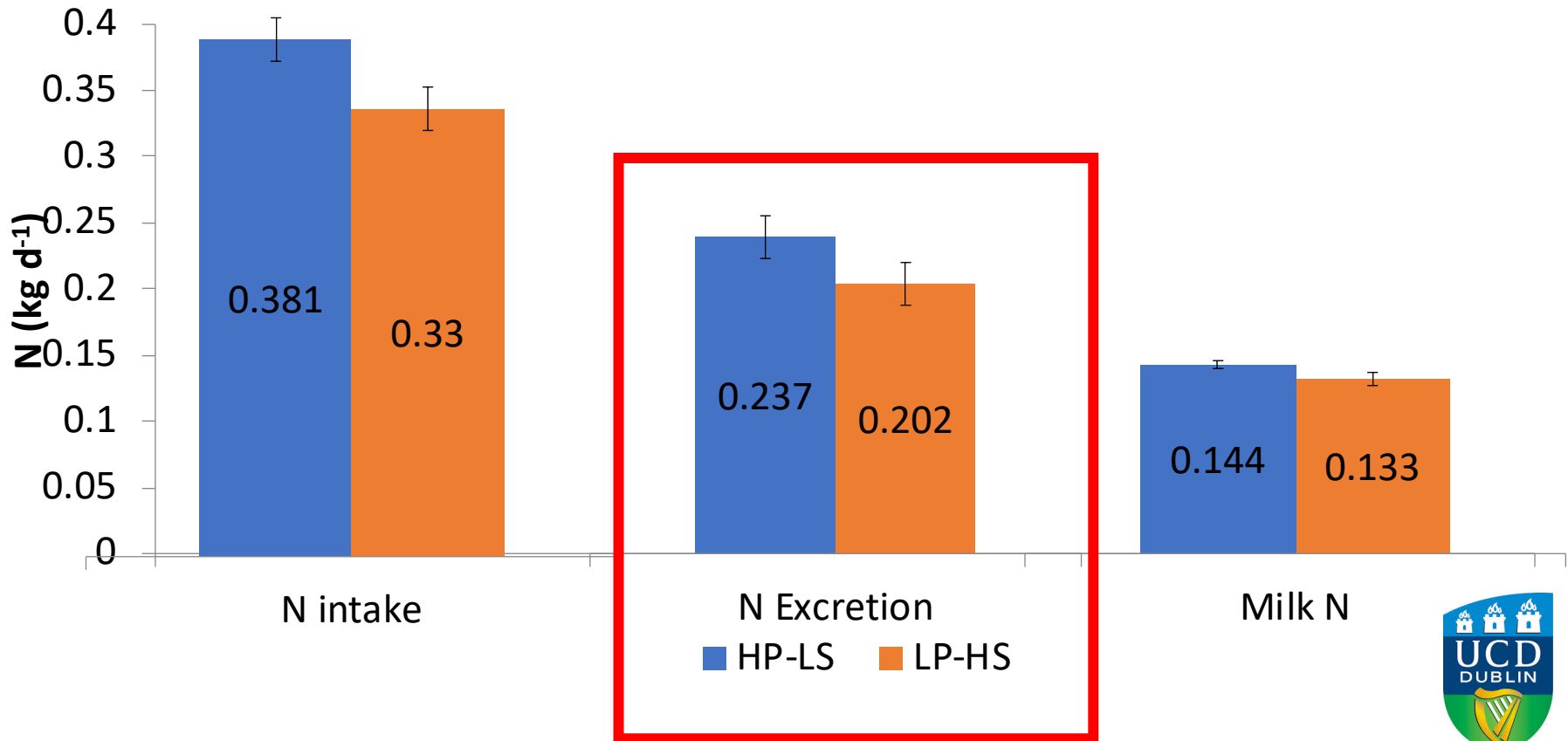


a vs. b, $P < 0.05$

Blood Urea Nitrogen



Nitrogen Balance



Profit Monitor per hectare analysis (1,568 farms)

	Top 25% ¹			Average		
Physical						
Herd Size (No. cows)	139			117		
Dairy Hectares	53			52		
Stocking rate (LU/ha)	2.64			2.27		
Grass used (t DM/ha)	11.6			9.3		
	/ha	/cow		/ha	/cow	

Feed costs are the biggest cost on livestock farms

Feed	628	238	4.01	563	248	4.46
Fertiliser	323	112	2.06	287	126	2.27
Vet	163	62	1.04	143	63	1.13
AI	77	29	0.49	68	30	0.54
Contractor	238	90	1.52	222	98	1.76
Other Var. Costs	265	100	1.69	228	101	1.81
Total variable costs	1,693	641	10.8	1,531	674	12.1
Gross margin	4,489	1,700	28.7	3,304	1,456	26.2

Profit Monitor per hectare analysis (1,568 farms)

	Top 25% ¹			Average		
Physical						
Herd Size (No. cows)	139			117		
Dairy Hectares	53			52		
Stocking rate (LU/ha)	2.64			2.27		
Grass used (t DM/ha)	11.6			9.3		
	/ha	/cow		/ha	/cow	
Milk yield (litres)	15,658	5,931		12,623	5,561	
Milk solids (kg)	1,270	481		1,008	444	
Fat/Protein		4.28/ 3.61			4.21/ 3.55	
Financial (€/ha)	/ha	/cow	c/litre	/ha	/cow	c/litre
Gross Output	6,182	2,342	39.48	4,831	2,128	38.27
Co-op price			38.42			37.60
Variable Costs						
Feed	628	238	4.01	563	248	4.46
Fertiliser	323	112	2.06	287	126	2.27
Vet	163	62	1.04	143	63	1.13
AI	77	29	0.49	68	30	0.54
Contractor	238	90	1.52	222	98	1.76
Other Var. Costs	265	100	1.69	228	101	1.81
Total variable costs	1,693	641	10.8	1,531	674	12.1
Gross margin	4,489	1,700	28.7	3,304	1,456	26.2

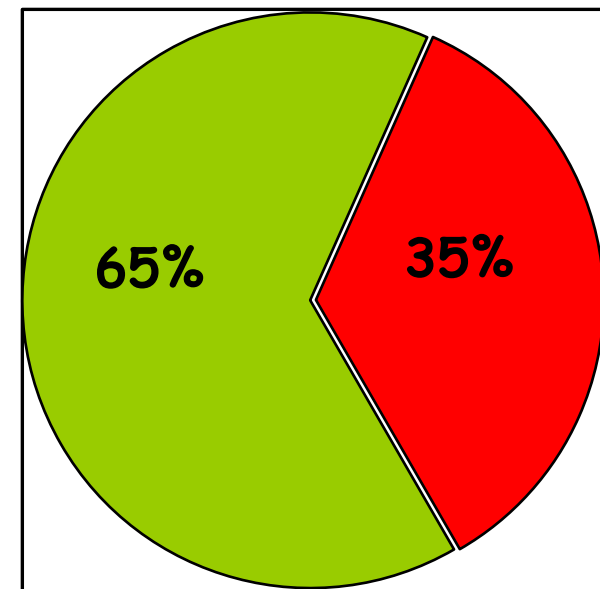


Feed costs - Beef

- “*Conversion of feed to product*”
- Providing feed - particularly during the indoor winter period - is the **LARGEST** variable cost in BEEF production:

 **70%+**

Variable costs
Grange suckler
calf-to-beef system



 **feed**  **other**



The cheapest ration does not always mean the best value!

Rations should be bought on the basis of:

- 1) Energy Content
 - 2) Protein Content
 - 3) Mineral Content
 - 4) Fibre Content
-
- **ENERGY IS GENERALLY THE MOST LIMITING NUTRIENT IN GRASS BASED LIVESTOCK DIETS**
-
- High protein does not mean high energy
 - High crude protein does not tell us anything about the quality of protein
 - Diets often too high in protein – protein is expensive!

Potential Cost Savings

Varies year to year

Example:

Protein %

20%	Starting with 20% protein as base
18%	- €8/ton
16%	-€7/ton
14%	-€4/ton
12.5	-€2/ton

Summary: a saving of €21/ton to go from 20% to a 12.5% protein using same energy and raw material range on offer.

Ingredients offered:

Barley, Maize, Gluten, Distillers, PK, Hulls, Beet Pulp & Wheatfeed

Take Home Messages

- Lower protein diets can be fed without negatively impacting on animal performance
- Lower protein diets:
 - Reduce N excretion, especially urinary N
 - Reduce feed costs
 - Reduce reliance on imported feedstuffs
- Reducing crude protein in animal diets contributes to sustainability of Irish agriculture



Thank You