



Effects of dietary protein concentration on the efficiency of nitrogen utilisation in lactating dairy cows

T. Yan, F. J. Young, D. C. Patterson and C. S. Mayne
Agriculture Branch, AFBI, Hillsborough, Co Down BT26 6DR

Introduction

- ◆ **The European Union Nitrates Directives set a limit on the amount (170 kg/ha) of manure N that may be applied to land each year. This limit has very significant implications for stocking rates on intensive livestock farms**
- ◆ **There is increasing interest in developing mitigation strategies to reduce N output in faeces and urine in animal production systems**
- ◆ **Objective: to evaluate effects of dietary CP concentration on the efficiency of N utilisation in lactating dairy cows**

Experimental Design

- ◆ A large continuous design study (47 first and 40 multi-lactation Holstein dairy cows) was undertaken with 3 dietary CP concentrations (180, 150 and 120 g/kg DM) from week 1 to 44 of lactation
- ◆ Three mixed diets each contained (DM basis) 55% concentrates and 45% forage (60% grass silage and 40% maize silage)
- ◆ During early (70 to 90 days), mid (150 to 170 days) and late (230 to 250 days) lactation, the same 4 cows and 4 heifers from each treatment were transferred to metabolism units for 8 days, with measurements of feed intake and faeces and urine outputs during the final 6 days.
- ◆ Data reported were obtained from the digestibility study and analysed as a one way ANOVA, with experimental period as block

Results (1)

Effects on dietary CP levels on DM intake and milk production

	Diet CP contents (g/kg DM)			s.e.	Sig.
	120	150	180		
Total DM intake (kg/d)	16.5	18.4	19.5	0.43	***
Milk yield (kg/d)	20.6	26.1	28.3	0.94	***
Milk fat (g/kg)	42	40	40	1.4	
Milk protein (g/kg)	34	35	36	0.9	
Milk lactose (g/kg)	47	46	46	0.8	
Live weight (kg)	554	536	536	13.4	

Results (2)

Effects on dietary CP levels on N intake and outputs

	Diet CP contents (g/kg DM)			s.e.	Sig.
	120	150	180		
N intake (g/d)	322	445	562	10.5	***
Faecal N output (g/d)	135	162	173	5.1	***
Urine N output (g/d)	92	138	207	5.4	***
Milk N output (g/d)	100	132	144	4.4	***
Retained N (g/d)	-5	13	38	1.8	***

Results (3)

Effects on dietary CP levels on N utilisation efficiency

	Diet CP contents (g/kg DM)			s.e.	Sig.
	120	150	180		
Faecal N/N intake (g/g)	0.42	0.36	0.31	0.010	***
Urine N/N intake (g/g)	0.28	0.31	0.37	0.008	***
Milk N/N intake (g/g)	0.31	0.30	0.26	0.007	***
Retained N/N intake (g/g)	-0.02	0.03	0.07	0.004	**

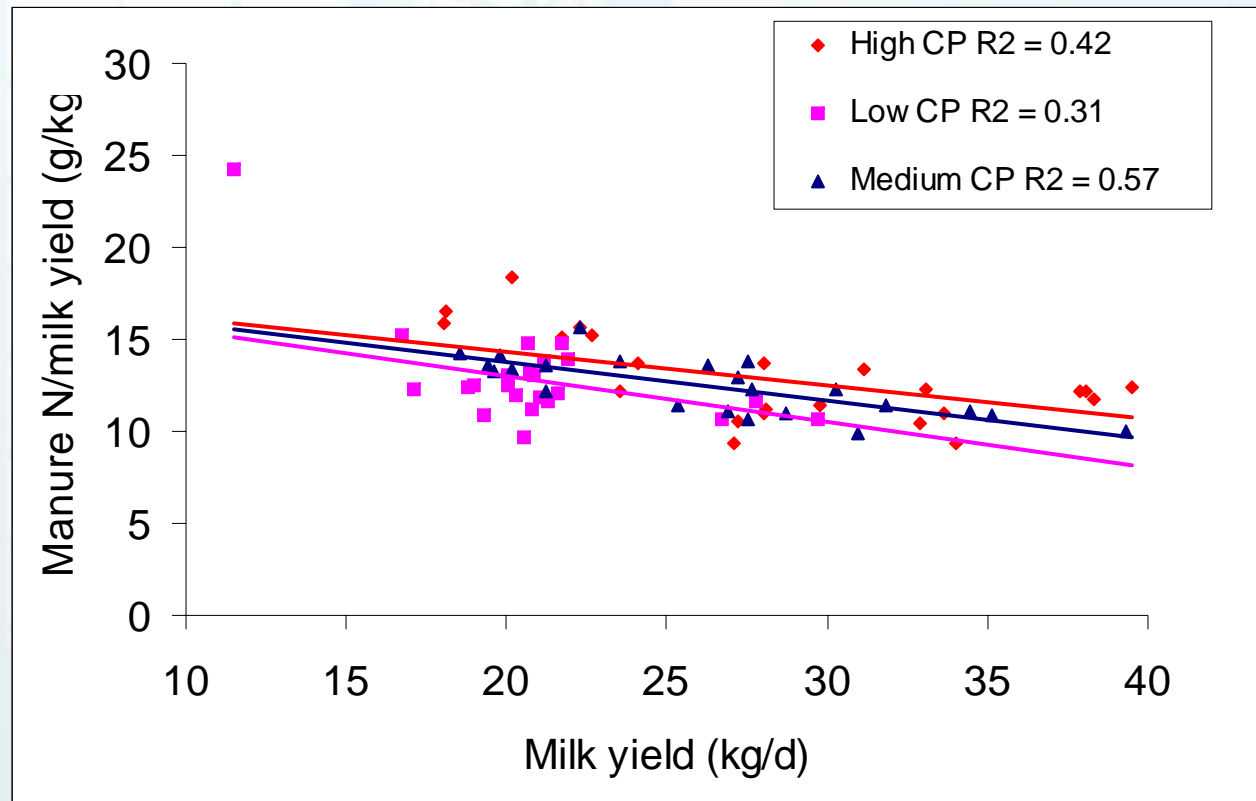
Results (4)

Effects on dietary CP levels on manure N excretion

	Diet CP (g/kg DM)			s.e.	Sig.
	120	150	180		
Manure N/DM intake (g/kg)	13.8	16.3	19.5	0.19	***
Manure N/N intake (g/g)	0.71	0.67	0.68	0.006	***
Manure N/milk yield (g/kg)	11.4	12.0	14.1	0.53	***

Results (5)

Milk yield vs. manure N output as a proportion of milk yield



Conclusions

- ◆ Manure N output associated with one kg milk production increased with increasing dietary CP concentration, but the increase was not significant with diets containing CP levels above 150 g/kg DM
- ◆ Overall dietary CP concentration of 150 g/kg DM may be appropriate in order to reduce manure N output, whilst reducing the decrease in milk yield normally observed with very low protein diets