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Reduction of nitrogen excreted in dairy farms through the application of high N efficiency ration

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INTRODUCTION

- Agriculture is considered the main nitrogen source of pollution in water bodies (OECD, 2001);
- Environmental policy measures have been focused on water quality protection (EEC 91/676, MIPAF, 2006);
- At the moment the application of low impact animal breeding with low emissions of nutrients, N in particular, is considered the only way to improve N utilisation efficiency at farm scale. (Crovetto and Sandrucci, 2010)

AIM

- Aim of this study was to demonstrate that dairy cows N excretion can be reduced by adopting feeding techniques based on the reduction of diet CP content without negatively affect animal performances.

MATERIALS AND METHODS

- The study was performed in two demonstrative dairy farms located in Grana Padano (GP) and Parmigiano Reggiano (PR) production areas (Table 1);
- GP and PR cows were used to compare two diets with different CP content provided in two consecutive years. In the 2nd year CP was 5 % reduced (Table 2).
- Experimental design was a pretest - posttest with one group and two consecutive trials of one year each. Milk yield, fat and protein contents were determined once a month;
- Data were subjected to paired Student's t-test using IBM©SPSS© Statistics v.19;
- Nutrient balance was estimated according to ERM/AB-DLO (1999) and EMR (2001) methodology using N input / output flows to determine N excretion such difference between dairy cow N intake and milk N retention.

Table 1. Demonstrative farms profile

Item	GP farm		PR farm	
Location	Lombardy		Emilia-Romagna	
Breed	Friesian		Friesian	
Reference year	1°	2°	1°	2°
Cows, n.	121	120	218	228
Dairy cows, n.	109	108	185	191
Dry cows, n.	12	12	33	37
Milk yield, kg/cow/305 d	10.827	10.858	8.357	8.265
Dry period, d	57	58	77	82
Calving interval, d	433	431	486	486
Calving-conception, d	172	182	210	208
Milk yield, ton/year/farm	1.292	1.288	1.862	1.877

Monthly - test days were provided by Breeders Association (APA) of Cremona and Reggio Emilia province

RESULTS

- In GP farm no difference was found in milk yield as well as in milk quality composition between the two years monitored;
- In PR farm milk fat content resulted higher in PR1 than in PR2 while no difference was observed in milk yield and protein content (Table 3);
- N excretion was reduced by 8 and 7 % respectively in GP and PR farm as a consequence of CP reduction in dairy cow diet (Table 4).

Table 2. Feedstuffs and chemical composition of diets

	GP farm		PR farm	
Kg/cow/d	GP1	GP2	PR1	PR2
Corn silage	23.0	23.0	-	-
Alfalfa hay	6.0	6.0	8.0	6.75
Meadow hay	-	-	5.5	6.75
Corn – barley flaked mix	5.8	6.0	-	-
Corn meal	-	-	8.0	8.0
Protein – mineral mix	5.5	5.2	4.0	4.0
Vitamin-mineral mix	0.2	0.2	-	-
Yeasts	-	-	0.1	0.1
DMI, kg/cow/d	23.6	23.6	21.7	21.6
CP, DM %	16.00	15.20	14.75	14.00
NDF, DM %	34.30	34.20	37.49	36.38
Starch, DM %	26.50	27.00	23.10	23.20
EN_L, Mcal/kg DM	1.65	1.65	1.57	1.58

Table 3. Milk yield and quality traits

Item	GP farm			PR farm		
	GP1	GP2	SE of the difference	PR1	PR2	SE of the difference
Milk yield, kg/cow/d	35,5	35,6	0.89	27,4	27,1	0.43
Milk fat content, %	3,76	3,84	0.11	3,88	3,95	0.10
Milk protein content, %	3,51	3,53	0.02	3,70	3,65	0.04
Somatic cell count, *000/mL	499	416	41,65	330	406	50.36

Table 4. N balance estimation

Item	GP farm			PR farm		
	GP1	GP2	SE of the difference	PR1	PR2	SE of the difference
N intake, g/cow/d	605[a]	574[b]	4.98	513[c]	484[d]	2.47
Milk N, g/cow/d	193	194	4.48	150	146	2.25
N excretion, g/cow/d	412[a]	380[b]	1.90	363[c]	338[d]	1.42
		-8%			-7%	
NUE, *g/kg of milk*	11,6	10,7	-	13,2	12,4	-

[a,b] within row with different superscript are significantly different P< 0.05
[c,d] within row with different superscript are significantly different P< 0.05

CONCLUSIONS

- The reduction of CP diet had positive effects on environment improving nitrogen utilisation efficiency at farm scale without negatively affect dairy cows performances.

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