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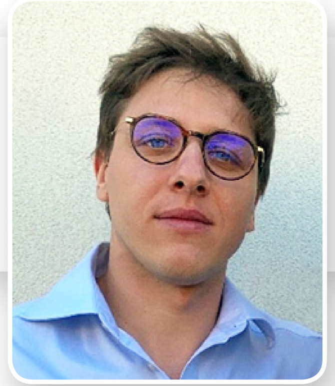
Rumen-protected methionine and lysine supplementation improved performance and the environmental impact of nitrogen when lowering dietary protein content in dairy farms

Abstract #2279T



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INTRODUCTION

- Methionine (Met) and lysine (Lys) have been identified as first limiting amino acids (EAA) for dairy cattle performance.[1]
- Ruminants use only part (5-45%) of their dietary nitrogen transformed into animal product while the remaining part is excreted into the environment through feces and urine.[2]
- One of the current challenges aim to reduce the negative impact of nitrogen losses on the environment (eutrophication and acidification…) by optimizing better nitrogen (N) use efficiency (NUE).

OBJECTIVE

Investigate better efficiency of metabolizable protein (MP) use by reducing N load through less soy bean meal (SBM) and balancing the profile of digestible amino acids (AA) in lactating dairy cows.

This project was funded by the European Agricultural Fund for Rural Development (EAFRD) and Regional Councils

SOS Protein Dy+

UNION EUROPÉENNE

Région PAYS de la LOIRE

CE PROJET EST COFINANCÉ PAR LE FONDS EUROPÉEN AGRICOLE POUR LE DÉVELOPPEMENT RURAL. L'EUROPE INVESTIT DANS LES ZONES RURALES

UNION EUROPÉENNE
UNANIEZH EUROPA

Région BRETAGNE

L'Europe s'engage en Bretagne / Avec le Fonds européen agricole pour le développement rural : l'Europe investit dans les zones rurales

MATERIALS AND METHODS

- The data refer to SOS Protein (EU Project Dy+Milk) trial.
- 444 lactating dairy cows from 5 commercial farms in the West region of France (188 DIM and 33 kg/d milk yield).
- The trials were conducted as ABA reversal design lasting 4 months (divided into 3 periods, **Table 1**).
- Dry matter intake (DMI) was measured per period and farm.
- Complete analysis and nutritive values were evaluated (INRA 2007) from samples collected per period.
- Milk yield (MY) and composition were analyzed five times.
- The relative impact of greenhouse gas (GHG) emissions including CO_2, CH_4 and N_2O were converted to CO_2 eq according to IPPC 2014.
- Emissions as CO_2 eq were evaluated using LCA methodology according to the product environmental footprint category rules (PEFCR) and the Joint Research Centre (JRC) approaches with fat and protein corrected milk (FPCM) as functional unit.
- Data were analyzed with ANOVA using Proc Mixed of R software.

Table 1. Experimental protocol

Period T	Period E	Period T'
Control diet T Partial mixed corn silage diet with different proportion (12 ± 2.8%) of grass silage	**Experimental diet E** -0.6 kg/cow/d soybean meal +0.6 kg energetic concentrate +0.2 kg amino acid mixture (35 g Lys as AjiPro®-L = 8.75 g LysDI +20 g Met as Smartamine® M = 12 g of MetDI)	**Control diet T'** Return to the control diet T
1 month	2 months	1 month
2 dairy milk controls n° 1 and 2	3 dairy milk controls n° 3, 4 and 5	2 dairy milk controls n° 6 and 7

RESULTS

- DMI was not impacted with treatment (23.7 ± 2.5 kg DM).

Table 2. PDIE, LysDI and MetDI intakes in control and experimental diet

	TT'	E
Total ingestion (kg DM/cow/d)	23.6	23.9
UFL 2007/kg DM	0.9	0.9
PDIE 2007 g/kg DM	99.2	96
LysDI (% PDIE 2007)	6.9	7.2
MetDI (% PDIE 2007)	1.8	2.4
LysDI (g/cow/d)	164	166
MetDI (g/cow/d)	44	54

- Milk yield: +0.6 kg/cow/d ($P < 0.01$).
- Milk protein: +0.5 g/kg and +39 g/d/cow ($P < 0.01$) (**Table 3**).
- Milk urea nitrogen: -48 mg/l ($P < 0.01$).

Table 3. Performance gains

Farm	Milk (kg/cow/d)	Milk protein (g/kg)	Milk protein (g/d)	Milk urea (mg/l)
1	+1.5	+0.4	+66	-49
2	+0.7	+0.4	+46	-85
5	+0.4	0	+12	-46
7	+0.6	+0.8	+47	na
8	+0.3	+0.5	+26	-33
Average	**+0.6**	**+0.5**	**+39**	**-48**

- Gross MP efficiency +4% and NUE +9% ($P < 0.05$).
- IOFC: +5%.
- CO_2 eq emissions decreased by 10% (**Figure 2**).

Figure 1. AA impact in dairy farms

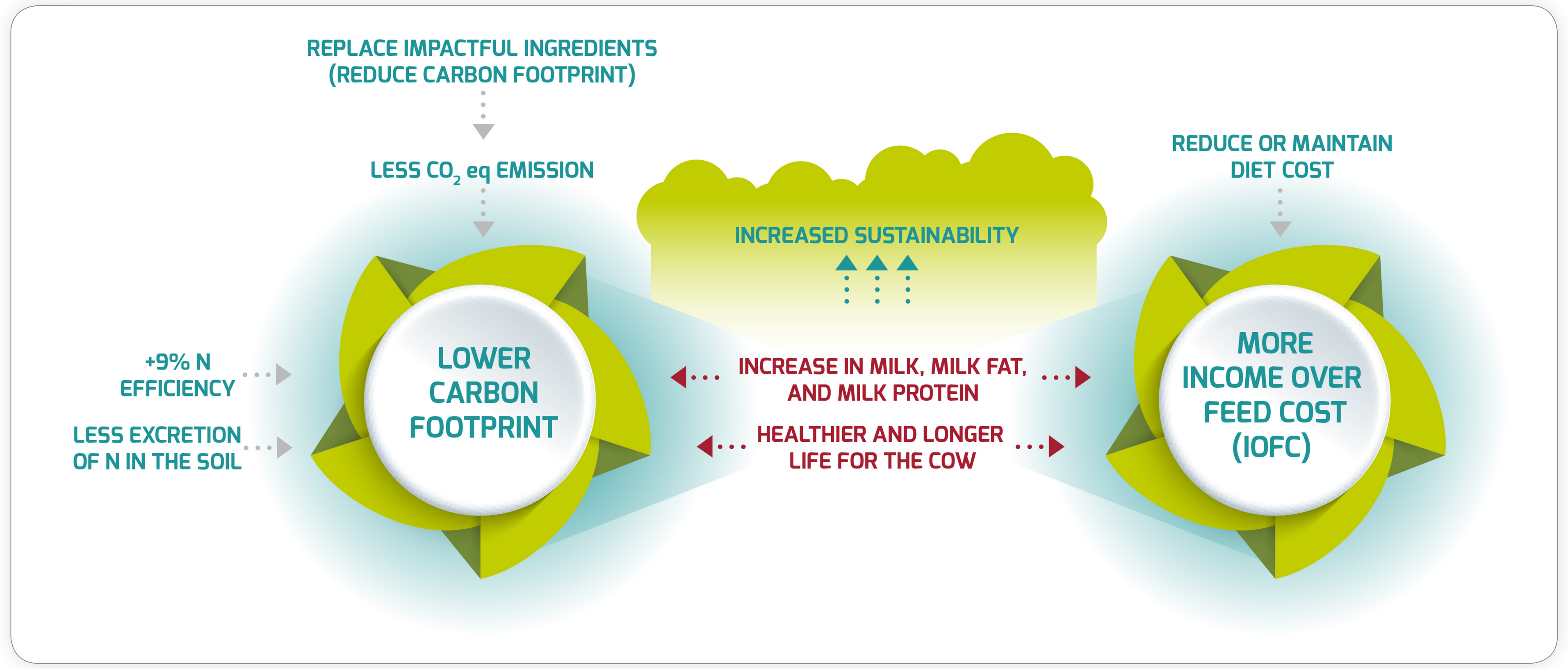
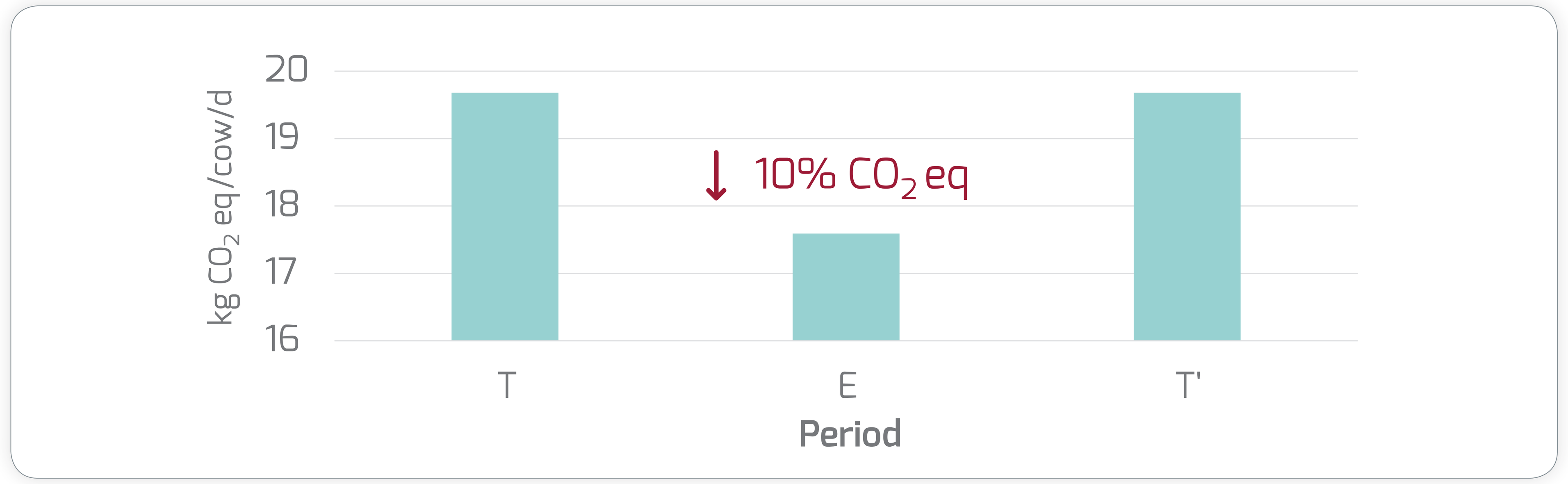


Figure 2. Diet CO_2 eq emissions



CONCLUSIONS

These results confirmed that better balancing Met and Lys, thanks to rumen-protected AA in reduced MP content diets with less SBM, increased performance and improved the environmental impact of nitrogen in high productive dairy cows.

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