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

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The objective of the EU Project Dy+Milk was to investigate better efficiency of metabolizable protein (MP) use by reducing dietary MP content through less soybean meal (SBM) and balancing the profile of digestible amino acid (AA) in lactating dairy cows. A total of 444 lactating dairy cows from 5 farms in the west region of France were used for 4 mo (39 ± 10% primiparous, 188 ± 101 d in milk (DIM), 9,500 ± 477 kg milk/cow/lactation period of 365d). The trials were conducted as ABA reversal design with 3 successive periods. In the first and third periods of one month each in each farm (Control), semi-complete corn silage diets with different proportions (12 ± 2.8%) of grass silage were offered ad libitum (net energy of lactation (NE_L): 1.62 ± 0.03 MCal kg/DM, MP: 99 ± 4 g kg/DM of PDIE in INRA2007, Met: 1.8 ± 0.0% MP and Lys: 6.9 ± 0.1% MP). In the second period of 2 mo (treatment), experimental diets were offered ad libitum by substituting 0.6 kg/d/cow of SBM (i.e., 15%, PDIE: 96 ± 4 g kg/DM) with corn or barley to maintain NE_L supply and by balancing Met (Smartamine M, 2.4% MP) and Lys (AjiPro-L, 7.2% MP). Dray matter intake (DMI) was measured per period and farm. Gross analysis and nutritive values were evaluated from representative samples collected per period. Milk yield and composition were analyzed 5 times. Efficiencies of MP and NUE were evaluated. The relative impact of greenhouse gases (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 PEFCR and the JRC approaches with fat and protein corrected milk (FPCM) as functional unit. Data were analyzed with ANOVA using Proc Mixed of R. DMI was not impacted with treatment (23.7 ± 2.5 kg DM). Milk yield increased ($P < 0.01$) by 0.6 kg/d/cow while milk protein increased ($P < 0.01$) by 0.5 g/kg and 39 g/d/cow with the treatment. Milk urea nitrogen decreased ($P < 0.01$) by 48 mg/l with the treatment. Gross MP efficiency increased ($P < 0.05$) by 4% and NUE by 9% with the treatment. Consequently, CO_2 eq emission decreased by 10%. These results confirmed that better balancing Met and Lys, thanks to rumen-protected AA in reduced MP content diets with less SBM, increased performances and improved environmental impact of nitrogen in high productive dairy herds.

Keywords: nitrogen efficiency, amino acids.