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Optimizing diets for metabolizable methionine may reduce dairy environmental impact.

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The cradle-to-farmgate environmental performance of dairy production was evaluated using Life Cycle Assessment (LCA) by comparing a standard commercial diet in French system (Control; CP: 16.5%, NE_L: 1.67 Mcal/kg DM, MP: 100 g/kg DM, Met: 1.8% MP and Lys: 6.9% MP) with a theoretical Met balanced diet formulated by substituting mainly soybean meal (SBM) with cereal (Treatment; CP: 15.8%, NE_L: 1.66 Mcal/kg DM, MP: 97 g/kg DM of, Met: 2.3% MP and Lys: 6.9% MP). The control diet was evaluated using INRA (2007) based on a mean BW of 650 kg, a DMI of 24.3 kg/d, a milk yield of 37.3 kg/d, a milk fat content of 3.99%, and a milk true protein concentration of 3.35% in mid-lactation Holstein cow. LCA calculations were done in the dairy module of the Animal Production Systems (APS) tool from Blonk Sustainability Tools following the methodological approach of Product Environmental Footprint Category Rules (PEFCR). Climate change impact, in kg CO₂ equivalent per kg fat and protein corrected milk (FPCM), was evaluated considering inputs, outputs, and direct farm emissions. Associated GHG emissions, including CH₄, N₂O and CO₂, were classified and characterized with the JRC Environmental Footprint impact assessment method (EF 3.0). The predicted DMI from the optimized Met balanced diet increased by 1.0 kg DM compared with the control. The predicted milk yield and composition increased by 0.5 kg of milk/d/cow, 3.6% of milk protein content and 0.5% of milk fat content with optimized Met balanced diet. Consequently, Life Cycle Inventory (LCI) parameters are affected. Optimized Met balanced diet decreased the impact on climate change, acidification, eutrophication and land use (Table 1). Met balanced diet improved cow performance and may reduce environmental impacts.

Table 1. Impact assessment results, /kg of FPCM)

Impact Category	Unit	Control	Treatment
Climate change	kg CO ₂ eq	2.06E+00	-14%
Climate change-land use and transform	kg CO ₂ eq	5.08E-01	-49%
Acidification terrestrial and freshwater	mol H ⁺ eq	3.55E-02	-3%
Eutrophication terrestrial	mol N eq	1.58E-01	-3%
Eutrophication marine	kg N eq	1.58E-02	-3%
Eutrophication freshwater	kg P eq	1.42E-04	-22%
Land use	Pt	2.27E+02	-11%

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