

Life Cycle Assessment approach to demonstrate environmental benefits from optimizing diets for AAs

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Moderator: Sloan Brian (Business Director Protected AA)

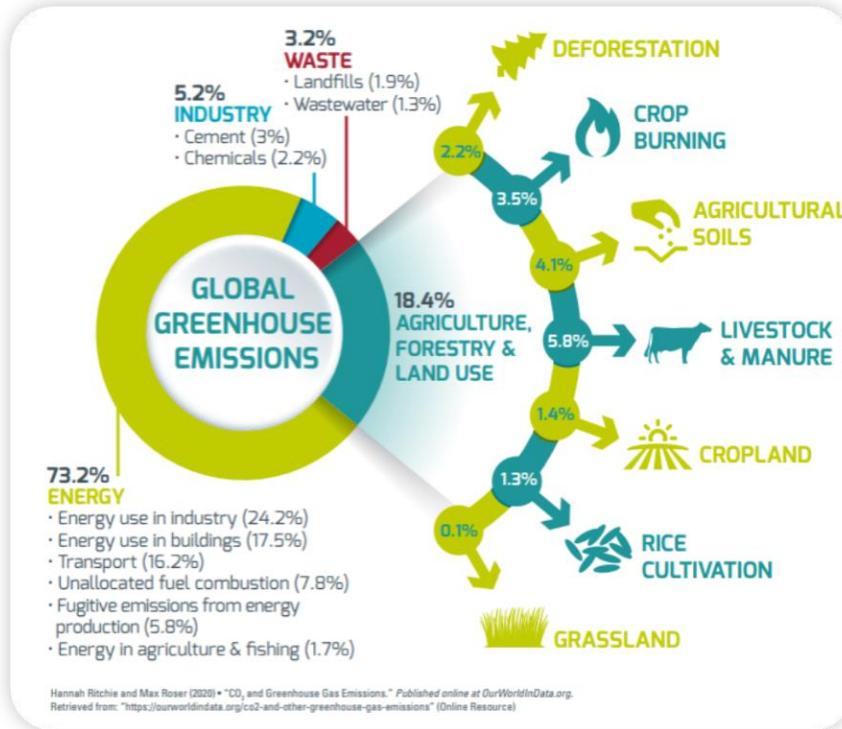
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Introduction

Figure 1. Agriculture's influence on global GHG emissions



- Life Cycle Assessment (LCA) was used to study the environmental impact of optimizing balanced amino acid diets.

- An average of 5.8% of global greenhouse gas (GHG) emissions come from livestock and manure.
- Feed production contributes to the total agriculture, forestry and land use emissions.
- Optimizing balanced amino acid diets may reduce environmental impact through better efficiency of feed utilization.

Objective

Evaluate the cradle-to-farm-gate environmental performance of dairy production using LCA by comparing a standard commercial diet with a theoretical methionine (Met) balanced diet formulated by substituting mainly soybean meal (SBM) with cereal, according to INRA 2007 feeding system.

Table 1. Comparison between control (CON) and optimized (NET) diets

Composition	CON	MET
CP (% DM)	16.5	15.8
NE _L (Mcal/kg DM)	1.67	1.66
MP (g/kg DM)	100	97
Met (% MP)	1.8	2.3

Ingredients	CON (% DMI)	MET (% DMI)
Whole plant corn, 30% DM, silage	52.0	51.0
Permanent grassland silage	12.6	12.4
Soybean meal	11.5	4.5
Barley	4.7	0.0
Rapeseed meal	4.5	12.4
Potatoes	2.8	1.0
Fodder beet	2.6	1.0
Permanent grassland haylage	2.2	2.1
Corn	1.9	0.0
Wheat gluten feed	1.8	5.8
Alfalfa 17-18% CP	1.7	5.1
Permanent grassland hay	1.5	1.5
Urea	0.1	0.0
Wheat straw	0.1	2.7
Limestone	0.0	0.4
99% DL-Methionine	0.0	0.1
Total	100.0	100.0

Functional unit

$$FPCM (kg) = \text{milk (kg)} * (0.1226 * \text{True Fat\%} + 0.0776 * \text{True Protein\%} + 0.2534)$$

Results

Table 2. Intervention LCI parameters and qualitative zootechnical effects

Qualitative zootechnical	Effect	Quantitative LCI flows
1. Milk quality	Increased protein	+3.6% protein
	Increased fat	+0.5% fat
2. Milk production	Increased milk	+1.3% milk
3. Longer life	+0.2 years at culling	-6.12% liveweight output
4. Fertility	-8 days	-7.47% youngstock for replacement
5. Reduced illness	-21% mastitis (proxy)	+0.277% milk (total 2&5 = +1.575%)

Table 3. Impact assessment results/kg of FPCM

Impact Category	Unit	CON	MET	Change
Climate change	kg CO ₂ eq	2.06E+00	1.77E+00	-14%
Climate change-land use and transform.	kg CO ₂ eq	5.08E-01	2.57E-01	-49%
Acidification terrestrial and freshwater	mol H ⁺ eq	3.55E-02	3.44E-02	-3%
Eutrophication terrestrial	mol N eq	1.58E-01	1.53E-01	-3%
Eutrophication marine	kg N eq	1.58E-02	1.54E-02	-3%
Eutrophication freshwater	kg P eq	1.42E-04	1.12E-04	-22%
Land use	Pt	2.27E+02	2.02E+02	-11%