Emission mitigation measurements: experimental dairy housing and measurement concept

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Aim

- Developing and testing structural/process engineering, organisational and nutritional measures for ammonia and greenhouse gas emission mitigation

Location and orientation

- Free-standing housing away from other emission sources
- Orientation orthogonal to the prevailing wind direction
  → free wind flow and thus minimised transfer of gases between the two compartments

Construction and process engineering

- Two identical, spatially separated compartments each for 20 dairy cows with separate slurry systems
- Modular design of housing and floor elements
  → experimental variation of construction, engineering and organisation
- Outdoor-climate housing with curtains (flexible façades)

Measurement concept

- Dosing and sampling system for dual tracer-ratio method using SF_6 and SF_5CF_3 (Schrade et al. 2012, Mohn et al. 2018)
- Analytical instruments for NH_3, CH_4 and CO_2 (CRDS, Picarro), N_2O (QCLAS, Aerodyne) and tracer gases (GC-ECD, Agilent)
- Climate data sampling outside and inside the housing: wind speed and direction, air and slurry temperature etc.
- Documentation of exercise area soiling, slurry parameters, feed data (fodder and trough residue quantity, constituents), animal parameters (e.g. live weight, milk data, urine) etc.

Mitigation strategies tested

- Solid floor with slope (3%), urine collecting gutter and scraper for rapid urine drainage; different manure removing intervals; with/without outdoor exercise area (2015)
- Feeding stalls; different manure removing intervals; with/without outdoor exercise area (2016)
- Effect of linseed in diet on methane emissions (2016)
- Different N-levels in diet; slatted floors (2017)
- Feeding strategy (silage diet vs. hay diet); housing climate (2018)

Experimental dairy housing for emission measurements with weather stations

Measurement wagon with analytical instruments and calibration gases

Solid floor with slope (3%), urine collecting gutter and scraper for rapid urine drainage

Aisle with feeding stalls

Feeding table · Analytics · Office · Experimental compartment 1 · Collecting area · Experimental compartment 2 · Feeding table · Milking parlour · Outdoor exercise area · Outdoor exercise area

Prevailing wind direction

Agroscope · good food, healthy environment