

The genetic background of nitrogen use efficiency and methane emissions in Swiss dairy cows: Ongoing activities at Agroscope

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Agroscope, ¹Animal GenoPhenomics, ²Ruminant Nutrition and Emissions, ³Methods Development and Analytics, ⁴Research Contracts Animals, CH-1725 Posieux; www.agroscope.ch

Background

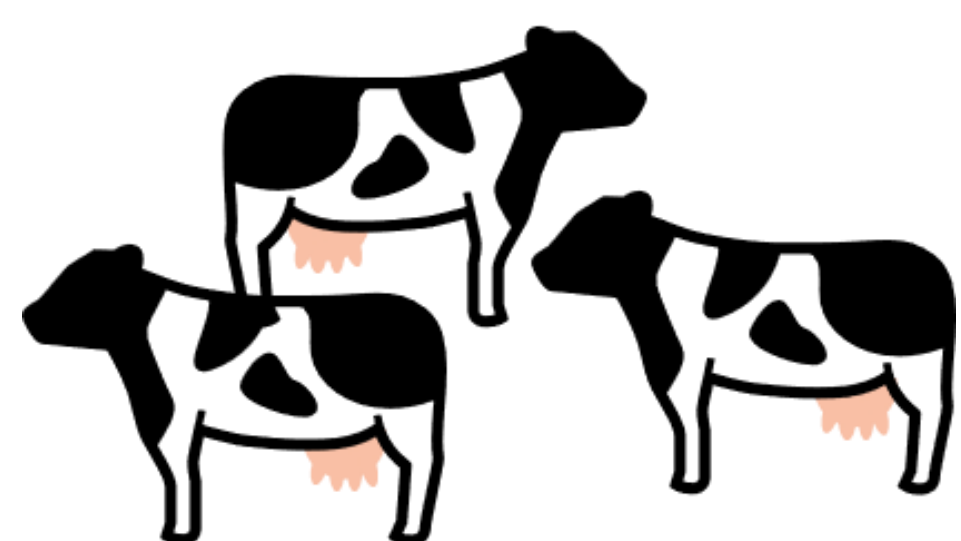
Breeding dairy cows with increased nitrogen use efficiency (NUE) can help **reduce nitrogen emissions from agriculture** in the long term. Individual differences in NUE between cows on the same ration suggest genetic differences. The aim of this study is to determine the **genomic variation in NUE of dairy cows** in relation to methane emissions (CH₄) and other traits.

Animals, Material and Methods

• Duration of experiment:



• Holstein cows



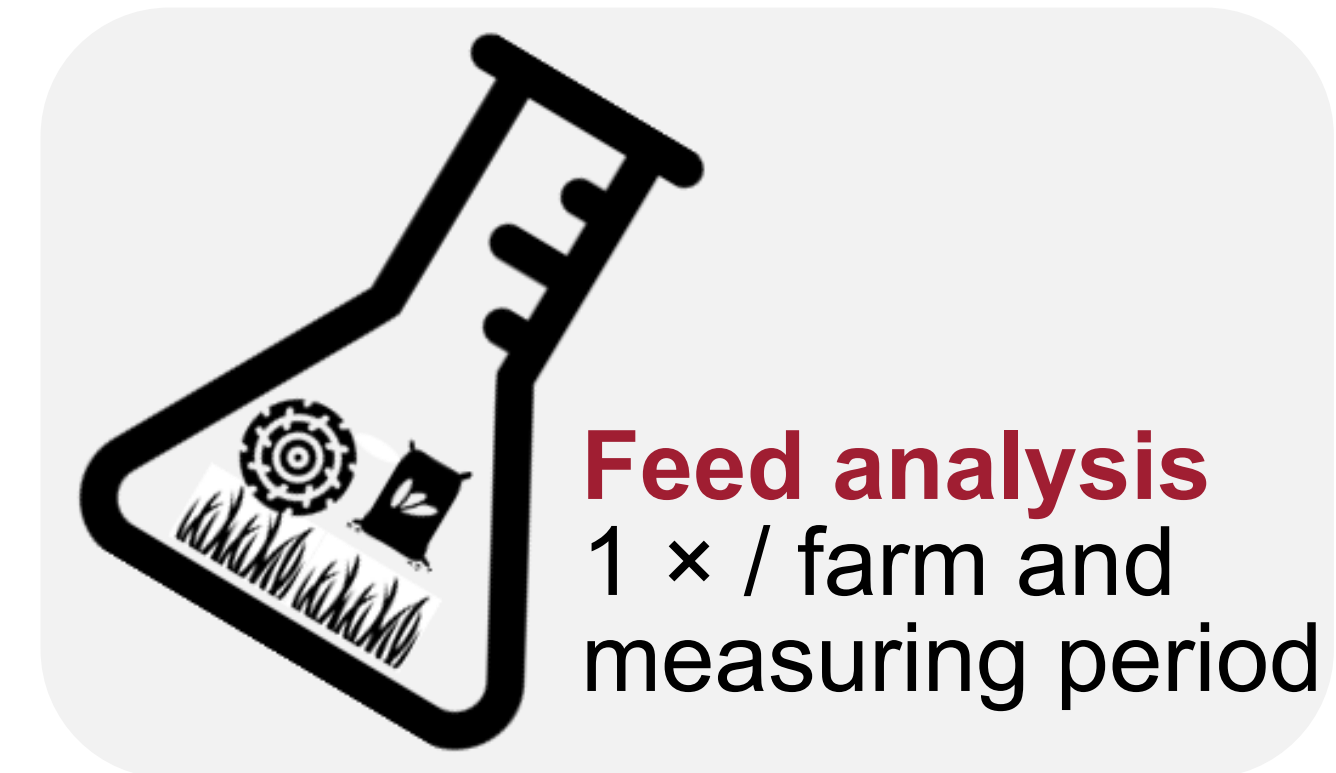
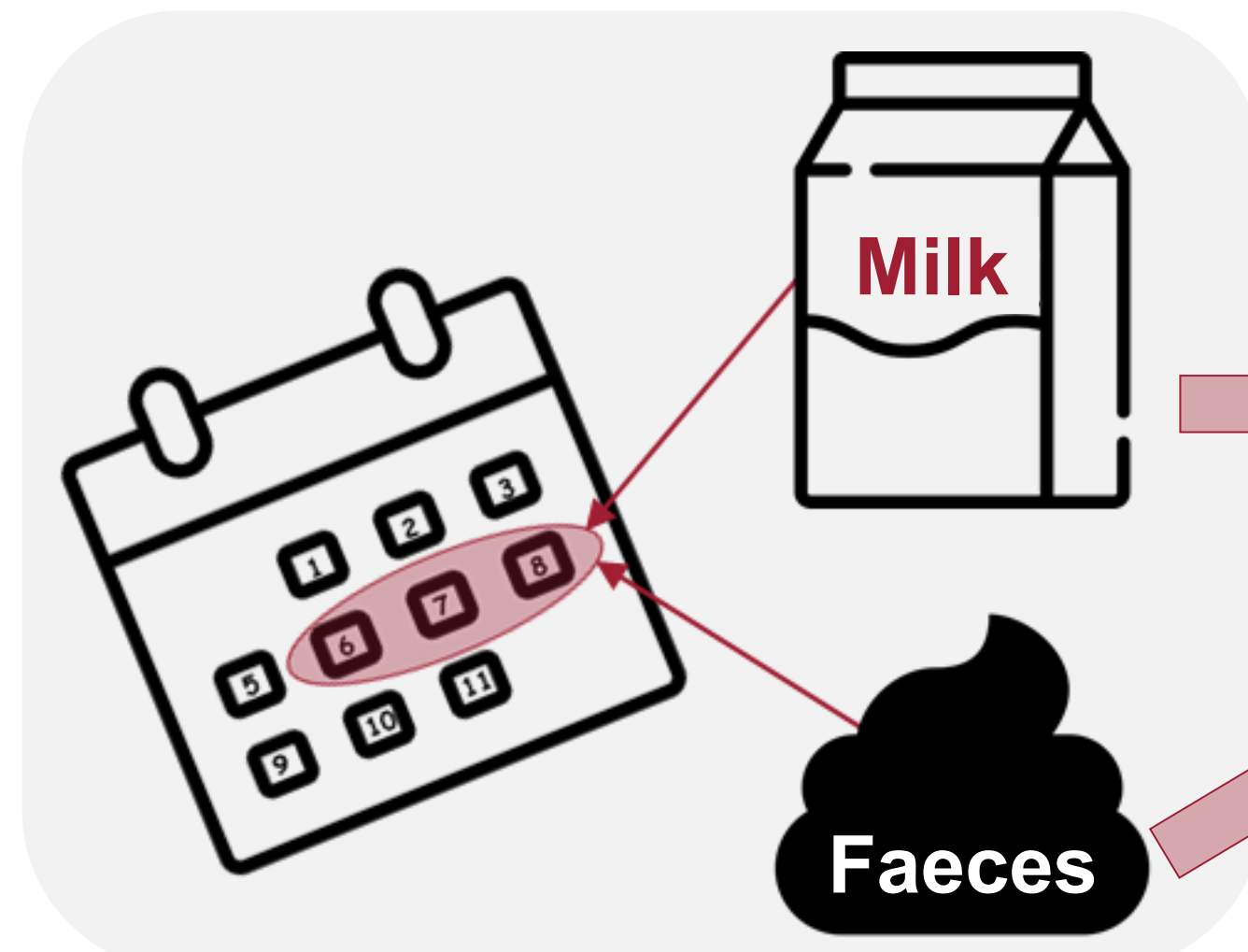
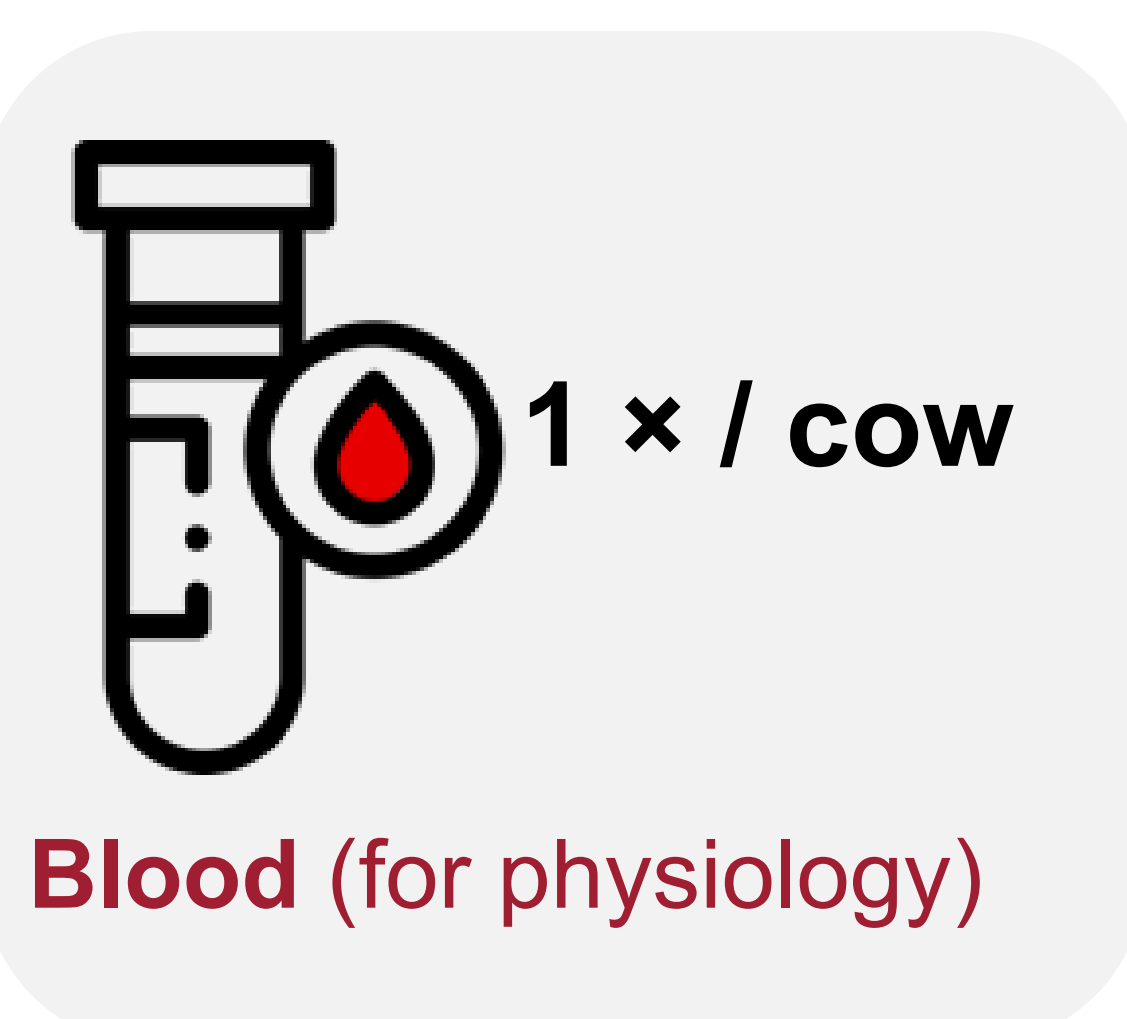
× 1'500 – 2'000
Lactation day 90 - 250

• Participation of cantonal and private farms

• Ration depending on farm and season



• 1 measuring period/cow

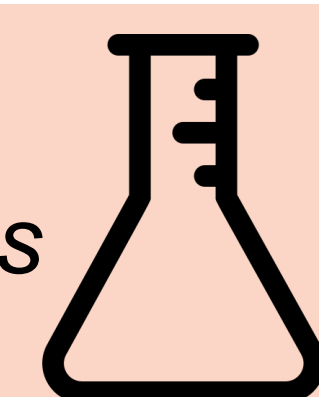


Phenotypes

Infrared spectroscopy is a **cost-effective alternative to chemical analysis** for the detection of NUE and CH₄ with higher throughput. **Algorithms** that «translate» infrared (IR) spectra of milk or faeces into NUE or CH₄ are developed based on reference data and IR spectra. Existing algorithms will be **further developed** in international collaboration. Once the algorithms have reached a high level of accuracy, **IR spectra will be sufficient for the determination of NUE or CH₄.**

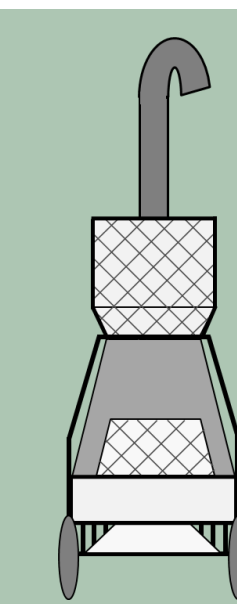
★ Reference methods

Nitrogen use efficiency
Weighing feed intake, chem. analysis of milk and feed



NUE
measured

Methane emissions
via GreenFeed®

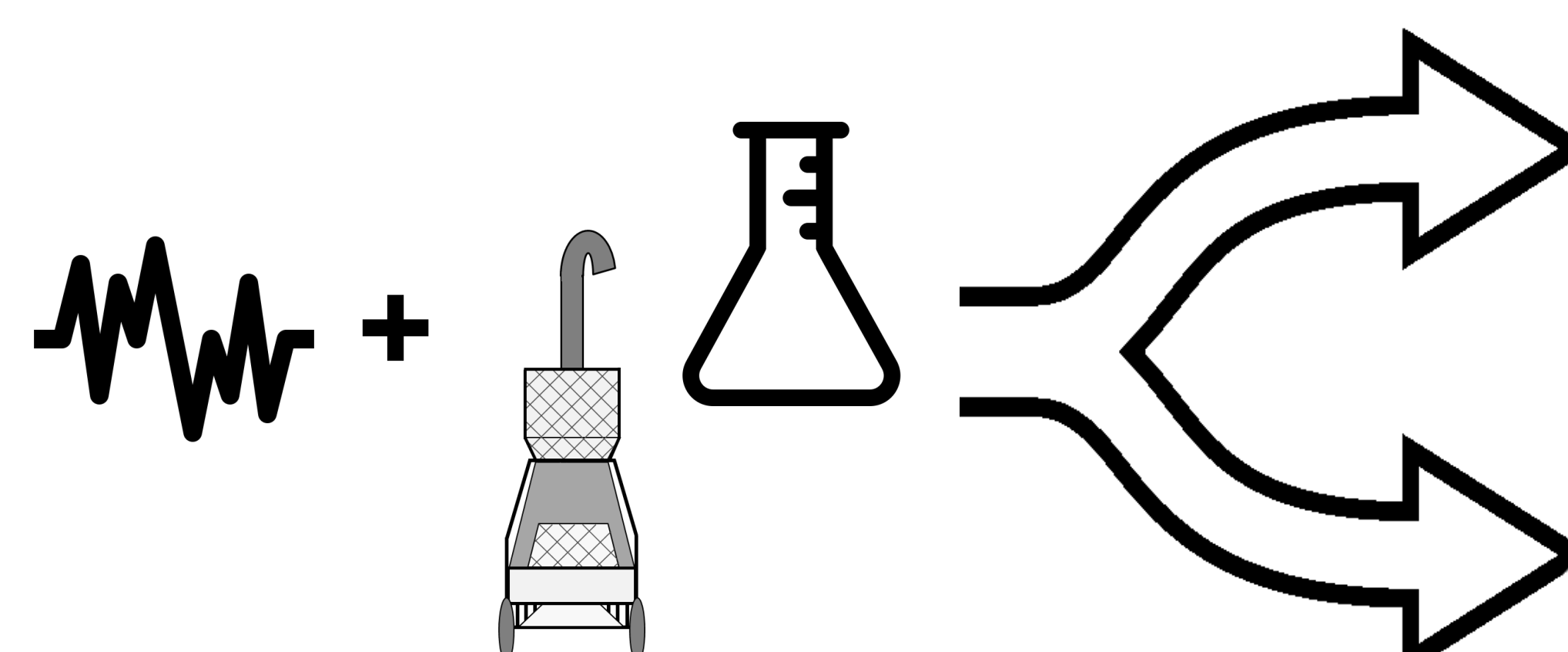


CH₄
measured

★ Infrared spectroscopy



★ Algorithms (artificial intelligence)



Status/situation as of October 31, 2023

- > 4,200 samples collected (of milk, faeces, hair, blood each)
- 1,010 different individuals
- Gold standard measurements of 83 individuals for feed intake and 282 individuals for methane emissions
- 21 farms (Experimental Farm Agroscope Posieux, farm of the Penitentiary Facility of canton Fribourg in Bellechasse, Grangeneuve School Farm, Sorens Organic School Farm and 17 private farms within a radius of about 30 km)