The Swiss way of breeding dairy cattle for reduced methane: CH_4COW

B. Bapst[1], T.F.-O. Neuenschwander[2] and A. Butty[1]

[1]Qualitas AG, Chamerstrasse 56, CH-6300 Zug, Switzerland
[2]Holstein Switzerland, Route de Grangeneuve 37, CH-1725 Posieux, Switzerland
Corresponding Author: beat.bapst@qualitasag.ch

Abstract

In Switzerland, agriculture contributes 14.3% of greenhouse gas emissions, primarily methane from livestock, especially dairy cows. To meet emission reduction targets, a nationwide effort is underway to measure methane emissions and reduce the impact of dairy cows with genetic selection. The project named CH_4COW is funded by various entities and aims to install methane detection systems on 60 farms across Switzerland, focusing on different feeding systems and breeds. The project represents a significant step towards reducing methane emissions through breeding strategies tailored to Swiss dairy farming conditions. Long-term benefits include potential collaborations in areas like ruminant nutrition and life cycle assessment.

Keywords: methane mitigation, dairy cattle, phenotyping, sniffer, breeding.
Presented at the ICAR Anual Conference 2024 in Bled at the Session 11: Methane Emission-Free Communications: Genetics, Environmental, and Life Cycle Assessment Studies

Introduction

In Switzerland, 14.3% of greenhouse gas emissions come from agriculture. Although this is not much compared to transport, for example, agriculture is under societal and political pressure to reduce its emissions. Agriculture is responsible for 83.3% of methane emissions in our country (FOEN, 2024). Livestock, especially dairy cows, are a major contributor. Therefore, in order to meet the target of a 50% reduction in greenhouse gas emissions by 2030 compared to 1990 and CO_2 neutrality by 2050 (FOEN, 2023), action is needed at all levels. Besides farm and management level, the dairy industry has powerful tools at the cow level. Feeding measures can be very effective and have an immediate impact (Hristov et a., 2015). Breeding actions have a medium to long-term aspect (e.g. Pryce *et al*., 2014), but if implemented in the right selection strategy they are sustainable. For this reason, the umbrella organization of all Swiss cattle breeding organizations decided to launch a phenotyping offensive with the aim of implementing a routine genetic evaluation for reduced methane emission based at least in part on Swiss phenotypes.

The reasons for having our own phenotypes are the following:

1. Our feeding systems are often different from the rest of the world; we have distinctly different summer and winter diets and in general our diets are very emphasized on roughage (Zeitz, Soliva and Kreuzer, 2012).
2. Some farmers are not allowed to feed silage due to specific regulations for certain cheese manufacturing processes (FOAG, 2015).

3. Animal welfare regulations and programs require regular outdoor access or even grazing in some cases (TSchV, 2024).

4. Swiss milk production is not only based on Holstein (HOL) breeds: An important part comes from Brown Swiss (BSW) or certain local breeds such as Simmental or Original Braunvieh (Identitas, 2024).

The new genetic methane mitigation project

Description

The CH_4COW project started this year in January and will last for 4 years. The installation of 60 sniffers on farms across the country will take place this year. Thirty sniffers will be installed in HOL herds, and the other in BSW herds. The project is funded by the Swiss Federal Office of Agriculture (FOAG), some regional governments and the Association of Swiss Cattle Breeders (https://asr-ch.ch/en/). Although most sniffers will be placed in automatic milking systems (AMS), ten of the HOL farms are not allowed to have AMS due to regulations for certain cheese manufacturing processes, mainly Gruyère AOP (FOAG, 2015). There, the sniffers will be installed in automated feeding stations in parallel with the installation of an animal identification system.

Aims

The start of this project is a first step towards the reduction of methane emissions from dairy cattle in Switzerland through breeding. Several options for the next step will be available and need to be validated. In the short term, we will be able to contribute our methane phenotypes to an extension of existing methane phenotype predictions using mid-infrared spectroscopy milk data, or to develop our own prediction. After that, we should be able to perform genomic evaluation for routine purposes. In the medium or long term, based on the experience gained, we could extend the sniffer phenotyping process to perform a genomic evaluation with real measured phenotypes.

Outlook

The future pool of data and knowledge could form the basis for further collaborations. Not only in breeding, but also in related disciplines such as ruminant nutrition or life cycle assessment.

List of references

FOAG, Federal Office of Agriculture, 2015. Specifications of GRUYERE AOP. https://www.gruyere.com/fileadmin/documents/gruyere/pdf/Cahier_des_charges/cahier-des-charges-definitif-du-6-juillet-2001-anglais-aop-2014-v2016.pdf (accessed 13 May 2024).

FOEN, Federal Office for the Environment, 2024. Switzerland's Greenhouse Gas Inventory (1990-2022). https://www.bafu.admin.ch/bafu/en/home/topics/climate/state/data/climate-reporting/ghg-inventories/latest.html (accessed 13 May 2024).

FOEN, Federal Office for the Environment, 2023. Switzerland's targets for reducing greenhouse gas emissions. https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/emission-reduction/reduction-targets.html (accessed 13 May 2024).

Hristov, A. N., Oh, J., Giallongo, F., Frederick, T. W., Harper, M.T., Weeks, H. L., ... and Duval, S., 2015. An inhibitor persistently decreased enteric methane emission from dairy cows with no negative effect on milk production. Proceedings of the national academy of sciences, 112(34), 10663-10668.

Identitas, 2024. Cattle - Evolution by breed. https://tierstatistik.identitas.ch/data/cattle-breeds.csv (accessed 13 May 2024).

Pryce, J. E., Gonzalez-Recio, O., Thornhill, J. B., Marett, L. C., Wales, W.J., Coffey, M. P., ... and Hayes, B. J., 2014. Validation of genomic breeding value predictions for feed intake and feed efficiency traits. Journal of Dairy Science, 97(1), 537-542.

TSchV, 2024. Tierschutzverordnung gestützt auf das Tierschutzgesetz vom 16. Dezember 2005 (TSchG) https://www.fedlex.admin.ch/eli/cc/2008/416/de (accessed 13 May 2024).

Zeitz, J. O., Soliva, C. R., and Kreuzer, M., 2012. Swiss diet types for cattle: how accurately are they reflected by the Intergovernmental Panel on Climate Change default values? Journal of Integrative Environmental Sciences, 9(sup1), 199-216.