breed4green: Recording of new phenotypes for methane emission and feed efficiency in Austrian dairy cattle

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Abstract

Climate change and the rising and fluctuating costs for energy and concentrated feed are major challenges for the livestock sector. The breed4green project focuses on researching strategies to reduce methane emissions and enhance feed efficiency within the Austrian cattle industry. Measurements of methane and CO_2 emissions are currently being conducted on both experimental and commercial farms using the GreenFeed system. The aim of the project is to collect methane and CO_2 measurements of approximately 1,000 Fleckvieh and 200 Brown Swiss cows. In addition, various phenotypes such as health, body weight, BCS, metabolism, energy intake and milk mid infrared (MIR) spectra are recorded. Data on feed intake from experimental farms are also available for validation. The genetic potential of direct traits like methane, CO_2 and feed efficiency, along with their correlations to health and other traits, will be analyzed. The project also includes the development and validation of MIR equations for emitted methane and energy balance. The focus will be on investigating the use of these indirect traits to reduce methane emissions and improve feed efficiency in breeding programs to pave the way for genomic selection. The results will also be used to optimize herd management. Furthermore, the environmental impact of relevant dairy and beef production systems in Austria will be investigated.

Keywords: GreenFeed, methane emission, feed efficiency, mid infrared, dairy cattle. Presented at the ICAR Annual Conference 2024 in Bled at the Session 11: Methane Emission-Free Communications: Genetics, Environmental, and Life Cycle Assessment Studies

The cattle sector is challenged by climate change and its implications on animal wellbeing and feed production but is also made responsible for methane emissions. breed4green aims to improve sustainability in Austrian cattle farming, focusing on individual animals. Genetic improvements in feed and energy efficiency, as well as reducing greenhouse gas emissions, are key leverage points to reduce environmental impacts and are focus of breed4green.

The goal of the project, which started in May 2023 and will run until December 2027, is to investigate breeding strategies focusing on feed efficiency and reduction of greenhouse gas emissions for the Austrian cattle industry. To achieve this, phenotypes to assess the genetic background of these traits will be generated. As they are expensive to

breed4green: direct and indirect traits for feed efficiency and greenhouse gas emissions for cattle breeding and herd management

record, proxies will be developed and validated. Data from research stations and commercial farms will be used to derive these novel traits for breeding in the areas of feed efficiency and greenhouse gas emission reduction.

Methane and CO_2 measurements on individual animals in experimental and commercial farms using the GreenFeed system, combined with extensive data collection on health and feed efficiency (health, weight, body condition score, metabolism, energy intake, mid-infrared (MIR) spectra) form the basis for research in this area. This will be complemented by existing data on feed intake at the station and additional data from station records as well as from commercial farms like performance data, data from the cattle data network, data from AMS systems and sensors. The goal is to conduct measurements on approximately 1,000 Fleckvieh and 200 Brown Swiss cows in commercial farms. At the moment, the data recording on the first farms is in progress.

The focus of the project is on the genetic improvement of feed efficiency and methane emissions. The genetic potential of the direct trait methane and CO_2 emission, and the genetic correlations to health and other traits in the total merit index, as well as the factors influencing the methane output of the animals, are analyzed. The new data are also used for the development and validation of MIR equations. The potential of the indirect trait MIR-methane is analyzed and indirect traits for feed efficiency are developed. The developed MIR estimators for energy balance and energy deficit are validated using station data, and their potential for improving feed efficiency is investigated in conjunction with other relevant traits. The genetic relationships between the traits feed efficiency and methane or CO_2 emissions are analyzed, and the potential of using indirect traits for feed efficiency and methane emissions for broad application in breeding is explored. The project aims to lay the foundation for genomic selection for feed efficiency and reduction of greenhouse gas emissions. Furthermore, the environmental impact of relevant milk and beef production systems in Austria is being researched.

Partners

In breed4green; the Cattle Breeders Austria; Higher Federal Teaching and Research Institute for Agriculture Raumberg Gumpenstein; LKV Austria; BOKU University; ZuchtData EDV Dienstleistungen GmbH; Fleckvieh Austria and Brown Swiss Austria work together in 10 work packages to achieve these goals; breed4green is supported by the Austrian Federal Ministry for Agriculture, Forestry, Regions and Water Management and dafne.at. The project has further cooperation and supporting partners.

Figure 1. Partners in breed4green.