

# Breeding values for feed efficiency across the lactation and parities

## Improving production efficiency through genetics

### Problem

Feed efficiency has been a recent hot topic in cattle breeding to improve the economic and environmental sustainability of the dairy industry. Feed efficiency is driven by both management and genetics. At the same production level, the difference between the most and the least efficient cow in a herd can be more than 1,000 Kg of dry matter per year. However, it is a big challenge to get sufficient records to make proper genetic evaluations and to take into account biological changes over time. Some genetic evaluation centers have recently started to estimate breeding values for feed efficiency, but the current methodology does not consider that feed efficiency can change during lactation and across parities.

### Solution

We applied a multi-trait random regression model to a large research farm data set with individual feed intake records on Holstein cows. This random regression model incorporates the knowledge on changes in variation over time into the modeling of the trait. Genetic parameters were estimated to assess how feed efficiency changes during lactation and across parities.

### Outcome

The approach showed that feed efficiency in early lactation is different from mid and late lactation in both first and second parity from a genetic point of view. The genetic correlations between mid and late lactation were strongly favourable in both parities. Across parities, the genetic correlations were around zero, which was unexpected. We will focus on improving the understanding of genetic correlations between parities and early versus mid and late lactation.

### Practical recommendations

- The model requires frequent measurement of individual cows' feed intake along with milk production and body weight across the lactation and parities.
- We recommend genetic evaluation centers to adapt the method for improving 'saved feed'/'feed efficiency' indices
- We recommend breed associations to adapt or include 'saved feed'/'feed efficiency' indices in their selection index to a higher degree.
- Model improvement is required better to understand the genetic correlation structure within and across parities.

### On-farm application

Frequent on-farm recording of individual cow feed intake along with milk production and body weight is currently limited to a few farms around the world. Current data available is typically from research or nucleus farms; however, new technologies can allow recording on commercial farms— this could be camera based solutions or further in the future drones. In the meanwhile, the model can work on research farm data, which requires collaboration across countries and/or institutions. With a sufficient amount of data, it would be possible to establish or improve a genomic evaluation for 'saved feed'/'feed efficiency', thus allowing in the future the selection of a more efficient and sustainable dairy cows' population, which will be beneficial for the farmer. The selection including the adaptation of this model will ensure that selection for improved efficiency will not lead to declined feed intake in early lactation and thereby hopefully lead to a less stressfull and more productive performance for the cow and improved economy for the farmer.

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### Publication

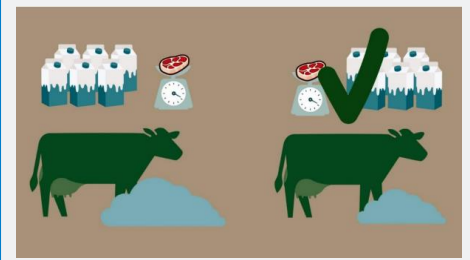
Novel genetic parameters to improve gRFI in dairy cattle using big data from multiple lactations and countries – submitted to WCGALP 2022

### Keywords

multi-trait random regression, genetic parameters, feed efficiency, across lactation and parities

### Illustrations

*Illustration of 'efficient cow': producing the same by eating less.*



"GENomic management Tools to Optimize Resilience and Efficiency - GenTORE" is an H2020 project which aims to develop innovative genome-enabled selection and management tools to empower farmers to optimize cattle resilience and efficiency in different and changing environments.  
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