Abstract

The objective of this study was to describe the collection protocol for growth, feed efficiency and greenhouse gas (GHG) emissions in young Italian Holstein bulls. The phenotypes will be used in genetic evaluations for the reduction of environmental impact in Italian Holstein.

The animals involved in this study were young Italian Holstein bulls undergoing own performance test at the Genetic Center (GC) of Italian National Breeders Association for the Holstein, Brown and Jersey dairy cattle breeds (ANAFIBJ). Phenotypic data was provided for on 218 Holstein bulls between the age of 171 and 541 days. All bulls were genotyped using various SNP chips resulting in 69,127 SNP after imputation.

The phenotypic data can be summarized in three groups: **A**) a group of traits describing growth and condition of the animal, **B**) a dataset derived from measures taken with the Roughage Intake Control system (RIC; Hokofarm Group, Marknesse, The Netherlands) and **C**) and dataset derived from measures taken using the GreenFeed (C-Lock Inc., Rapid City, SD, USA).

The group **A** included measures of body growth taken using electronic scales and stadiometers operated by qualified personnel. These included body weight (WEI), body condition score (BCS), heart girth (HG) and height (HEI). Group **B** included single-visit measures that were converted into daily measures and included: number of visits at the feeder per day (NVF), average intake at the feeder (AIF), average time at the feeder (ATF). Group **C** included single-visit measures then converted to daily records and included: number of visits (NVG), carbon-dioxide daily emission (CO_2), methane daily emission (CH_4), average airflow (AIR) and average time (ATG).

Variance components and genetic parameter estimation (heritability and genetic correlations) was carried out using a GBLUP mixed model that included a genomic relationship matrix built on the SNP markers.

The growth traits showed the largest estimates of heritability, close to 0.40. Heritability estimates for the RIC-derived traits were lower, ranging from 0.167 (AIF) to NVF (0.306). Estimates for emission traits ranged from 0.241 for ATG to 0.480 for CO_2.

Results suggest that selection indices could be built in order to reduce GHG emissions without compromising growth, condition, stature and feed intake. The upcoming research should be focused on the use of feed efficiency and relative GHG emission, as these components need to be adjusted by the growth and size of the animal. Subsequently a further data-set should include GC sire performance and their daughters', reared in dairy commercial farms.