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Abstract Submission Form

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Preferred presentation Oral

Preferred session Session 8: Global challenges in measuring methane in ruminants

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Title of your paper Towards breeding for lower enteric methane emissions of dairy cows in the Netherlands

Insert ABSTRACT text

Various strategies have been proposed to reduce enteric methane (CH4) emissions from ruminants, focusing on areas such as management, feeding strategies, feed additives, vaccination, and animal breeding. Among these, animal breeding currently shows the largest long-term potential, due to its low implementation costs, and permanent and cumulative effect. Nonetheless, implementing CH4 mitigation in breeding programs is still in its infancy. An important limitation to practical application has been the lack of phenotyping of CH4 emissions on individual cows, to estimate sufficiently reliable genetic

parameters, which are required for breeding decision. However, recent innovations have accelerated the collection of CH4 phenotypes. We describe the outcomes of a four year project in the Netherlands, that aimed to record CH4 emissions on 100 dairy farms, to be used in genetic parameter estimations. This dataset will be the basis for future national breeding value estimations for enteric CH4 of Holstein dairy cows, which will be implemented by the cooperative cattle improvement organization CRV. In the project, enteric CH4 emissions were measured by 'sniffers' that sample air from the feed bin of milking robots. The latest dataset included 110,188 weekly mean CH4 concentration (ppm) records on 7,749 cows from 72 farms, but data recording is ongoing. Several analyses have been performed already, with the following objectives: 1) define a CH4 trait from the raw concentration measurements, 2) estimate heritabilities and repeatabilities, 3) investigate different recording schemes, and 4) investigate the relationships between CH4 and other breeding goal traits. To date, the research output of the project showed that the phenotype for weekly mean CH4 concentration has a moderate heritability of 0.17 ± 0.04 and a repeatability of 0.56 ± 0.03. As the sniffers only measure concentrations, and not the total grams of CH4 emitted by breath, genetic correlations were estimated between the weekly mean CH4 concentration phenotype and a weekly mean CH4 production (g/day) phenotype. The latter was recorded by GreenFeed units on 797 cows from 16 farms (4 overlapping with sniffers). The genetic correlation was 0.76 ± 0.15, indicating that selection for lower concentrations will result in a reduction of total CH4 production output in g/day. Furthermore, with the novel dataset we confirmed that the genetic variance changed over a lactation. This has implications for recording schemes, and we showed that short recording of CH4 during the first or last weeks of recording can result in lower genetic gains than predicted from the reliability, when modelled without using random genetic and permanent environmental regressions over the lactation. In the last stage of the current project, genetic relationships among CH4 concentration, DMI, bodyweight, and milk yield traits were estimated, which are required to set up the selection index that includes CH4 mitigation. Preliminary results show moderate positive genetic correlations between CH4 and: dry matter intake (0.21 ± 0.12), body weight (0.06 ± 0.11), and milk yield (0.25 ± 0.12). The developed dataset and models, are currently used to set up national breeding value estimation for CH4 emissions of dairy cows in the Netherlands. Furthermore, the dataset will be used in additional research projects in the coming years, that aim to 1) investigate the relationship with the microbiome, 2), investigate the impact of selecting using the developed phenotype(s), 3) investigate incentives for farmers to use the CH4 breeding values, and 4) proof the impact of change in breeding values at farm and national level. This comprehensive approach not only improves our understanding of breeding for lower enteric CH4 emissions, but also integrates this knowledge into practical breeding strategies for sustainable dairy farming.

Enter keywords

methane emissions, sniffers, dairy cows, quantitative genetics, animal breeding