Using Spot-Sample Breath Measurements of Methane Emissions from Dairy Cattle for Genetic Evaluations

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Many strategies exist to reduce enteric methane emissions from dairy cattle, of which the most widely recognized methods include feeding strategies. A developing method is animal breeding, which results in a cumulative, permanent, and cost-effective solution for farmers. Our aim was to estimate genetic parameters from spot-sample measurements by two non-invasive breath recording devices: sniffers (ppm) and the GreenFeed (g/cow/day). The devices were installed on 25 farms, where four farms recorded with both systems simultaneously although at a different location in the barn. The data were corrected for hour of the day, whereafter averages per week were taken. In total, 31,861 weekly averages from 1,770 cows were recorded for sniffers, and 4,444 weekly averages from 737 cows for GreenFeed. The heritability and a genetic correlation between measuring methods were estimated from mixed models using a restricted maximum likelihood approach. The models included fixed effects for: herd*year*week, parity, and 3rd order Legendre polynomials for days in milk, and random effects for the genetic cow effect and the repeated measurements for each cow. The estimated heritabilities were similar to the heritability of milk yield and show that differences between cows are partly due to genetic factors, and therefore selecting for lower emitting cows is possible (h^2= 0.29 for sniffer, and 0.39 for GreenFeed). The genetic correlation between enteric methane emissions recorded by sniffers and GreenFeed was 0.62 ± 0.13, which suggests that the two devices ranked cows similarly from low to high emitting and could be combined in genetic evaluations. In conclusion, breath recorded methane emission shows potential to be included in breeding programs. Before enteric methane can be included in a breeding goal, genetic correlations with other breeding goal traits have to be estimated, so a reduction in methane emissions will not negatively influence production, feed efficiency, conformation, fertility, or health.