Project AC0115 - Workpackage 2: Development of Novel Methane Sensors

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Background

The overall objective of Project AC0115 is develop baseline methane emission factors for a new UK inventory of GHG emissions that can track and report on farm practices that modify or mitigate methane and nitrous oxide outputs. Part of the project's remit is to develop and test novel technologies that have potential on-farm application for tracking methane emissions from livestock. For breeding programmes to be able to select low emitting animals, there is a need to develop cheap, rapid, and precise methods of measuring methane emissions beyond the current best practice of using chambers.

Online monitoring of milking cows

Nottingham University developed and validated a technique for online monitoring of methane emissions by dairy cows during milking under Defra Project AC0219. Under Project AC0115, this technique has been deployed on 21 commercial farms to record individual emissions from approximately 2,000 cows. Differences have been found between and within farms in both mean emissions and level of variation; in general, farms feeding high-forage diets or grazing had higher means and were more variable. Repeatability studies have confirmed that the technique provides consistent ranking of individuals, which is essential for potential breeding programmes and mitigation monitoring.

Feeding station headspace hoods

Scotland's Rural College (SRUC) has developed a hood that fits over a commercial single point feed intake weighing system to estimate total methane emissions from beef animals while they are feeding. When an animal enters a feeder to eat, air is drawn through the hood and the flow and concentrations of gases are measured to compute methane output. Preliminary analysis of these systems mounted within chambers has shown significant associations with total methane output.

GreenFeed automated head chambers

This is a commercial system, developed by C-Lock Inc., USA, which measures methane emissions from free-ranging animals, encouraged to the device by a small supply of feed pellets. It is currently being assessed by the University of Reading, in comparison with conventional chamber and SF_6 methodologies. To date, overall estimates of methane emissions made by the GreenFeed system have been found to be comparable to values obtained by chambers, but 0.89 of the SF_6 technique. This may have been attributable in part to a lower number of visits to GreenFeed during grazing measurements, or the timing of the visits.

Laser Methane Detector

This is a commercially produced handheld methane analyser that measures methane concentrations at a distance. It has been evaluated by SRUC and Aberystwyth University to investigate its potential for calculating total methane emissions from cattle and sheep. Results to date are promising, with reasonable correlations between short (several minutes) samplings and whole-day chamber measurements. Further work is currently being carried out to identify the potential value to screen livestock with low emissions for breeding programmes.

Portable methane sampling unit ("Methcollar")

This device, developed by SRUC, is mounted on the animal and takes continuous samples of respired air through a series of sensors, and wirelessly transmits the data. The concept is still in early development, but a pilot study has shown promise in relating results to whole animal chamber measurements.