

Methane Module

TECHNICAL NOTE

Relates to: Recording and reporting associated with the Methane Module

Date: Updated April 2021 (move to a single measurement)

Background

Breeding sheep with lower methane emissions is now possible as the outcomes from the 10-year multi-million-dollar collaboration between Pastoral Greenhouse Gas Research Consortium (PGGRC), New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) and AgResearch have been implemented by B+LNZ Genetics with breeding values delivered through the standard NZ Genetic Evaluation (NZGE).

Methane gas is a potent greenhouse gas and individual sheep vary in the methane that they emit. Breeding can be used to lower methane emissions on farm as these differences are passed on to the next generation with a moderate level of heritability. Though progress is slow (around 1% per year with single trait selection), it is cumulative and to date no detrimental associations with production or health traits have been found

Methane measurement

The portable accumulation chambers (PAC) were developed to enable rapid and cost-effective measurement of methane (CH₄) and carbon dioxide (CO₂) emissions for individual sheep. The method involves placing the sheep in a sealed box of known dimensions for 50 minutes and measuring their gas emissions. This estimate does not give absolute estimates of their emissions but is used to rank animals or groups of animals relative to each other.

The AgResearch PAC trailer can measure 12 animals at a time and up to 7 groups can be run daily, so a total of 84 animals can be measured in a day. This service is now available to breeders to measure sheep on their own farm.

Animals selected for testing should be;

- under 1 year of age but animal up to 18 months may be tested with AgResearch approval
- all animals tested on a day should be of the same sex.
- animals need to be balanced across sires, with at least 10 to 15 animals per sire depending on the level of accuracy required. There should be a range of good (top 10-12) and not so good (bottom 3-5) animals from each sire.

Note: Pregnant sheep cannot be tested after their first trimester (until research has been completed to ascertain impact of measurements any later than this).

There is just 1 visit to your farm with the PAC trailer and the minimum number of animals to methane test is 120 animals which takes about 1.5 days.

Records

There are a considerable number of records collected during PAC measurement which are used to calculate the key traits, methane (CH₄) and Carbon Dioxide (CO₂), which are noted in Table 1. The protocol changed from two measurements to one measurement in 2021, so only the R1 traits methane (PACCH4GDR1) and carbon dioxide values (PACCO2GDR1) are entered now.

Table 1: PAC traits used in the analysis.

Abbreviation	Type	Official Name	Units
PACCH4GDR1	Numeric (Measurement)	PAC CH ₄ grams per day Rnd1	g/day
PACCO2GDR1	Numeric (Measurement)	PAC CO ₂ grams per day Rnd1	g/day

Reporting

Once data is loaded, methane and carbon dioxide BV's are calculated (Table 2). These BVs are generated as part of the routine single step NZGE analysis that occur weekly, with the BVs updated as new data is loaded. The key goal is to reduce methane emissions per kilogram of feed eaten, you may like to only report the Methane BV -PACCH4 BV. On sire summaries you may like to report the number of progeny with the trait measurement or the accuracy value.

Table 2. Methane and carbon dioxide breeding values and abbreviations

Abbreviation	Full Name	Type	Units
PACCH4eBV	PAC methane emission eBV	Estimated BV (eBV)	g/d
PACCO2eBV	PAC carbon dioxide emission eBV	Estimated BV (eBV)	g/d
PACCH4gBV	PAC methane emission gBV	Genomic BV (gBV)	g/d
PACCO2gBV	PAC carbon dioxide emission gBV	Genomic BV (gBV)	g/d

What is best?

Lower values (more negative) for methane (PACCH4) breeding values are better, indicating lower emissions per kilogram of feed eaten.

PAC methane measurements (g/day) equate to approximately 1/3 of the actual total daily methane emission of an average animal around 6 months of age. Adjustment between the PAC and actual methane measurements – along with emission changes during growth, and as an adult – will be included in index values that have yet to be finalised.

Genotyping

If the sires and close relatives are genotyped with low density chip (15K SNP) or above, the merit for methane and carbon dioxide emissions can be spread to close relatives for maternal breeds through single step to track gene flow between individuals.

Further Information

<http://www.sil.co.nz/files/FAQ%20Methane%20Measurements-FINAL.pdf>