
Methane Module

TECHNICAL NOTE

Relates to: Recording and reporting associated with the Methane Module

Date: Updated Sept 2024

Background

Breeding values for sheep methane emissions are available to breeders through the New Zealand Genetic Evaluation (NZGE), thanks to collaborative research between the Pastoral Greenhouse Gas Research Consortium (PGGRC), New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) and AgResearch. Breeder can use these as a tool to lower their animal's methane emissions as part of their breeding programme.

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 can be incorporated into breeding programmes with minimal impact on production or health traits.

Methane measurement

The AgResearch 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 an absolute measure of their emissions but is used to rank animals or groups of animals relative to each other.

This service is available to breeders to measure sheep on their own farm and involves one visit to the farm with the PAC trailer in a year. Trailers are located in both the North and South Islands.

The preference is that 168 animals will be tested during one visit. The PAC trailer can measure 12 animals at a time and up to 7 groups can be run daily. To maintain accuracy, 12-15 offspring per sire need to be evaluated, with most breeders evaluating about 14 sires.

Options do exist to measure fewer eligible animals during one visit. This is to be discussed with AgResearch.

Animals selected for testing should be:

- Under 1 year of age, but animals up to 18 months may be tested with AgResearch approval
 - All animals tested on a day to be of the same sex
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- Animals need to be balanced across sires, with at least 10 to 15 animals per sire. There should be a representative sample of all progeny from each sire in terms of Index, BVs and phenotype. AgResearch can assist with this selection.

Records

There are a considerable number of records collected during PAC measurement which are used to calculate the key traits CH₄ and CO₂, which are noted in Table 1.

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 one third 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.

Interim Methane sub-index

An interim index for methane has been set up in SIL and nProve as a custom index until a methane yield breeding value and associated index weighting are available. The long-term value of carbon is difficult to determine, so a “desired gains” approach has been taken for the interim index weight. In this case, outcomes of various index weightings are assessed and a weighting selected that gives an appropriate balance between methane reduction while still making near maximum gains in other productive and health traits. This approach was suggested by AgResearch, and work conducted by AbacusBio and B+LNZ Genetics' science team has reviewed the outcome and are satisfied that it represents an appropriate interim weighting.

Detailed information can be found in the [SIL Methane BV units and Interim Methane Index Technical Note](#) October 2023.

Genotyping

Including animal genotypes from low density chip (15K SNP) or above ensures the full value of methane and carbon dioxide breeding values from the analyses for phenotyped animals is obtained.

Further Information including a link to FAQs on: www.methanebv.co.nz