Minutes of the 5th Methane Phenotype Working Group (MPWG)

By Phone 1000 GMT 14th December 2012

Present: John Basarab (Agr & Rural Development, Canada), Yvette de Haas (Wageningen Uni, Netherlands), Roger Hegarty (UNE, Aus), Hutton Oddy (NSW DPI/UNE, Aus), Grant Shackell (AgResearch, NZ),

Apologies: Kristi Cammack (Uni of Wyoming, USA), Adrian Cookson (RMG Network, NZ), Ben Hayes (DPI VIC, Aus), Jan Lassen (Aarhus Uni, Denmark), John McEwan (AgResearch, NZ), Steve Miller (Uni of Guelph, Canada), Natalie Pickering AgResearch, NZ), Cesar Pinares (AgResearch, NZ), Marcos Vinicius da Silva (EMBRAPA, Brazil), Phil Vercoe (Uni of WA, Aus).

General Discussion:

1. Discussion continued around progress being made on the paper.

   • Briefly rounded off the current information around intake, which is now at a stage where there is plenty of data for the paper.

   In general it appears that the cattle intake measurements are not as repeatable as had been hoped, but that sheep information may be slightly better.

   What is obvious though is that intake measurements are dependent on the feeding system being used (e.g. Growsafe v......), feeding time and feeding pattern.

   Repeatability is around 0.4 near the time of feed delivery.

   Given this, the class of animal does not seem have an effect and similar repeatabilities are seen for cows, heifers bulls and steers.

   • Cesar was unable to attend the meeting, but did table the following:

     A preliminary test of the GreenFeed system with restricted-fed cattle indicates that the number of visits (each ~7 min) should be around 7. With animals in production, fed at will may be appropriate the number of visits in the case reported (Six). I like very much the idea of using the estimated CO2 output as an internal tracer, which in conjunction with CH4/CO2 may yield an estimated CH4 emission. This may work for fed-lot type systems as Jorgen propusses. What about free-ranging systems?. That is a challenge.

     Our data from sheep fed at 2 times maintenance indicates high relationship between CH4 and CO2 output and concentrations along the day, perhaps the same can be for animals fed ad lib. Is there any departure fro the relationship when animals are of the same size but different Milk yields?.

2. Discussion then moved to methane measurement

   This chapter will be coordinated by Yvette and Roger.

   • Yvette, Eileen Wall and Jan Lassen had recently held a Skype meeting to discuss a first draft. Jan had tabled a first draft around measuring methane during milking (See attached),
• A question was asked if New Zealand data were corrected for intake.

Two traits are analysed viz: methane output and methane yield (methane output/DMI). The NZ sheep high and low selection lines are based on the yield trait.

• John Basarab will write a cattle section around matching data with feeding systems in different countries (this needs to also be done with sheep), remembering that Growsafe is not the only intake measurement system.

John Basarab is also transferring data to Natalie.

John has also got covered within day repeatability of intake and CH4 as intake variation affects methane production.

• Pointed out that there is a need to remember:
  o the lag reaction of fermentation (needs input on rumen kinetics)
  o There seems to be a change in eructation patterns during milking and feeding (suggested by Garnsworthy paper), which may be a function of the headspace in the detection area.
  o The animals also ingest air
  o Suggested that there needs to be a stand-alone section in the paper, which deals with the short term relationships between intake/fermentation/methane output as well as the effects of genotype, breed (including taurus v indicus cattle – and buffalo??) and diet

• Roger will write around Australian sheep methane data (including that of John Goopy et al) and especially the trade off with length of feeding period.

• Discussion also moved to chambers v static (butter)boxes for sheep.

This is coming together; John McE and Cesar are coordinating.

3. A question was raised about who will be at PAG.

• None of the those on line are going, but it is expected that John McE, Natalie and Ben Hayes from the MPWG will attend. It is hoped that they will also meet informally with other ASGGGN members.

• Action from previous meeting outstanding
  John McE and Hutton to work on the introduction

4. Yvette informed the meeting that the COST application had progressed to the next round, with good marks, and that the ASGGN letter of support would be used at the next stage.

Action: Next meeting scheduled for 18th January 2013 same time.

Extraordinary item: Since the meeting set this date, I have noted that several members have indicated that they will be travelling after PAG, or to other Conferences at that time; and so a change of time may be required. GS will circulate
Questions arising from previous meetings: Comments still welcome.

**Question:** how can FI and CH₄ be used in real life?

- How should we describe CH₄? as CH₄DMI has DMI h² in it, confounding?
- In Breeding objective should be as 2 separate traits CH₄ and FI?
- This should come under the “best-bet information” and “parameter estimation and design for methane phenotyping programs” sections. Ben Hayes?

**Question:** How long should the measurement be to capture the variation?

**Question:** How measurements with different technologies can be combined?

**Other business:**

Next ASGNN full meeting, to be held 27th June 2013 in Dublin, Ireland.

A 1-day workshop is planned as a satellite to the Greenhouse Gases in Animal Agriculture Conference being held immediately prior.

The agenda will cover a combination of science and business.

Tentatively, the workshop is titled 'Measurement of methane in individual animals for the purposes of establishing the parameters to permit genetic selection'. This will complement a short workshop on ‘new/alternative techniques’ (session 7) within the main Conference programme.

During the meeting there will also be a business/planning session. At this it is proposed that the management of the network will change.


The website is regularly updated.

**Action:** Grant has set up a page for each country and people should send in some information on programs, key people, links, photos etc for their countries page.

PAG conference 12-16th January, there is an opportunity to have an informal catch-up with those attending.
Measuring methane during milking

One way to get individual measurements from a large number of cows is to use the method described by Lassen et al. (2012). A machine that is developed to measure smoke from industry chimneys are installed in an automatic milking system where cows enter to get milked 1-6 times per day. The cows are fed high quality concentrate while they get milked. One of the advantages by measuring during milking is that the cow is not disturbed during her everyday routines so what is measured is reflecting the cows normal behavior. One disadvantage is that you only get a snapshot of the cows true biology and that is during milking. So if the breath concentration is particularly high or low during milking that will influence the results. Also it is hard to control the position of the cows head, so if the cows head is not directly in the feeding bin, concentrations will be low. The machine consists of essentially 4 parts. Part one is an inlet with a filter that is placed directly over the feeding bin where the cow gets the concentrate. The filter ensures that no large particles such as concentrate dust enter the system and ruins the analyzer unit. The second part is an air sampler that ensures flow of breath at a rate of 4 l/min. The tube from the inlet to the air sampler is approximately 5 meters long and is an 8 mm plastic tube. The last 3 meters of tubing before the air sampler is a heated tube that ensures that water from the breath does not condensate in the tube. This unit also heats the breath to 180 degrees Celsius to avoid water from the breath to enter the analyzer. The analyzer (GASMET DX-4000) is the third component. The analyzer is an FTIR analyzer that can measure up to 600 different gasses. The analyzer can be set to make a record at different time points varying from each second to every 5 minutes. In case measurements are made every 5 second an infrared measurement are made a registration in terms of a spectra on the fourth components which is a laptop. The analyzer needs to be calibrated once a day using pure Nitrogen. The calibration is done to avoid drifting of the results and to ensure an accurate background measurement. On the laptop a software is installed that can translate the spectra into gas concentrations. The spectra can be retranslated if one finds interest in other gasses than methane or carbon dioxide.

In a study breath from 93 cows getting milked in two separated AMS units were sampled and studied. Of the 93 cows 50 were Holsteins and 43 were Jerseys. Every 5 seconds a spectrum of air was registered. This data was merged with information on when which cow entered and left the AMS. So for a 5 minute milking one would have 60 methane and carbon dioxide registrations available for this cow. The machine was installed in each robot for 3 days. So for each of the 93 cows between 2 and 12 visits were recorded. Both direct methane and carbon dioxide concentrations as well as the ratio between methane and carbon dioxide were analyzed. Different phenotypes were defined per visit. That is a simple mean, a median, a 75% and a 90% quintile. Repeatability, defined as the animal variation divided with the total variation, between visits was estimated. Repeatability was highest when using the mean of the ratio between methane and carbon dioxide for each visit as phenotype.

Another similar approach was described by Garnsworthy et al. 2012a and Garnsworthy et al 2012b. In these studies only methane concentrations were registered and measurements were done every second on a total of 215 Holstein cows over a 5 month period. The method were compared to measuring in respiratory chambers and found an r2 of 0.78 between the two methods on 12 cows. The significant fixed sire effect in this study suggests a genetic component in the control of methane emission from individual cows.

The total methane production eg as liter of methane per day can be quantified from the ratio between methane and carbon dioxide (Madsen et al, 2010). The total carbon dioxide production from a cow can be estimated from traits like feed intake, weight, milk production and size of fetus if pregnant. Total methane production has been estimated using this approach on Finnish dairy cattle where methane and carbon dioxide was measured during eating of concentrate in dedicated concentrate feeders rather than during milking (Negussie et al., 2012).

References:


