

# ARC can now determine an animal's 'burp tax'

By Susan Marais

**T**hanks to innovative American methane gas technology, the Agricultural Research Council's (ARC) livestock campus in Irene can now determine the methane gas emissions of individual dairy and beef cattle for research purposes.

The project is headed by Dr Georgette Pyoos, a junior researcher at the ARC. "We heard about the GreenFeeds feeding system in 2018 and saw it for the first time in 2022 at an American agricultural show. We purchased the technology last year and brought it to South Africa."

## Not an old-fashioned system

With its silver chimney, the GreenFeeds system almost looks like an old-fashioned coal stove on wheels. The difference is that the opening beneath the chimney is filled with livestock feed instead of fuel. When the animal starts feeding, it releases methane and carbon dioxide which are collected through various holes in the system and stored in a gas tank. All excess gas and dust are released through the chimney to the outside.

Dr Pyoos says these emissions can be measured on an hourly basis. Thanks to radio frequency identification (RFID) technology this data can be captured and synchronised immediately. The system can also be used to monitor the metabolic gases of other large animal species.

A single methane gas system can monitor approximately 20 animals daily. However, this number changes depending on the type of animal, the size of the pen or grazing paddock, the amount of feed distributed, and the reason for the research being conducted. The system can also be adapted to individual animals' diets.

Feed can be supplemented automatically with the help of a smartphone app, thanks to the automatic feeder at the top of the feeding trough. This app allows the ARC's research team to control the various aspects of the system over a distance. "The information flows to America where it is processed, and the ARC is then informed of the levels of methane and carbon dioxide," says Prof Michiel Scholtz, specialist researcher in animal breeding at the ARC.



Sandra Erasmus, manager of the ARC's dairy herd, is in charge of the dairy cattle division of the GreenFeeds research.

The information collected is available instantly so that immediate adjustments can be made if necessary.

## Import and export challenges

In a bid to keep costs as low as possible, the ARC imported only the most crucial parts of the equipment from the United States (US) while the rest were sourced locally based on clear instructions from the American manufacturer. Suitable components such as solar panels and batteries were purchased in South Africa, and the entire system was constructed here.

Despite clear instructions, constructing the equipment was no easy feat, Dr Pyoos explains. One of the problems was connecting the system to the Internet to allow data to be submitted to the ARC's databank. The researchers were about to give up when she realised that the SIM card was the problem. "The ARC's internet service provider is very sensitive to 'strange' activity and kept blocking the connection. We solved the problem by obtaining SIM cards from a different network provider."

## Similar systems

Prof Scholtz says there are other systems that measure methane emissions, but none are as effective as the GreenFeeds system. One such system is a methane



Dr Georgette Pyoos, a junior researcher at the ARC, is in charge of the GreenFeeds project's beef cattle study.

gas laser originally designed to detect methane gas leaks in pipes in an industrial environment. "You simply point the laser in the direction of the animal and it measures the methane emissions. Unfortunately, it isn't very accurate."

In another system, the animal stands in a sealed respiratory room from which the gases cannot escape. Since this is an unnatural system, it leads to heightened stress in animals, which can affect the test results. The third option is placing a mask on the animal so it can move around freely. "This isn't natural either and the drawbacks are similar to those of the respiratory room."

Hence, the ARC decided on the GreenFeeds system. An added bonus is that it can be used in conjunction with their GrowSafe feed intake system. "Animals can therefore be tested for both production performance and methane production."

The researchers are hoping to use the mobile system to test the methane production of veld animals. The data gathered will fill a big void regarding information on methane production in extensive systems.

### Research possibilities

A lot of uncertainty exists regarding gas emissions from cattle, says Prof Scholtz. This is simply because it hasn't been adequately researched. "For example, we don't know what the methane gas emissions by animals on natural



The mobile GreenFeeds system, which operates with sun panels and a battery, is used in the dairy department. (Photograph: supplied by the ARC).

veld entail. A Kenian study states that emissions estimates in this regard may be exaggerated by 70%."

That is why it is important for the ARC to research different animals in different situations for different reasons. Sandra Erasmus, manager of the ARC's dairy herd, is overseeing a study on the influence heat stress has on dairy cattle's (Holsteins) methane gas emissions. "The study is unique in the sense that South Africa's climate differs from other parts of the world where Holsteins are milked. In most parts of the developing world such as Europe, the US and New Zealand the temperatures are not nearly as high as in South Africa."

Researchers at the ARC suspect that heat stress can lead to an increase in methane gas production in our local dairy herds. Now this theory can be put to the test scientifically.

Dr Pyoos is in charge of methane gas research in beef cattle. "Despite the machinery having been delivered in May 2024, teething problems only allowed us to start collecting data in November. We are currently busy calibrating and collecting the data so that we can determine a baseline against which all tests will be measured."

The ARC decided to measure various indigenous and crossbreeds' methane emission levels. Dr Pooyos says three indigenous breeds – the Afrikaner, Bonsmara, and Nguni – and various crossbreeds such as Bonsmara x Simmentaler, Afrikaner x Simmentaler, Afrikaner x Angus, and Nguni x Angus are currently being studied. Furthermore, three indigenous maternal lines – Afrikaner, Bonsmara, and Nguni – are being crossed with five paternal lines – Afrikaner, Bonsmara, Nguni, Angus, and Simmentaler – to establish the emission levels in these crossbreeds.

"We are currently collecting information to establish a control group (baseline) after which we will be able to compare the different crosses with the group."

### Cattle's outlet valves differ

According to Prof Scholtz, the ARC believes practical research must flow from this development as it must eventually help producers to improve their production practices. "Performance testing such as daily growth and feed intake is important.



The GreenFeeds system collects methane gas when an animal feeds and then releases gas. (Photograph: supplied by the ARC)



The GreenFeeds system that has found a permanent home at the ARC's GrowSafe.

Other tests are also being conducted regarding the influence of feeding times, and the amount of feed an animal consumes at a given time, on the animal's methane gas emissions."

Researchers also want to investigate how the emissions from a cow that weans a heavier calf compares to that of a cow which raises a smaller calf.

It has been shown that feedlot animals release more methane gas through manure fermentation, whereas animals on natural grazing release more methane gas via their mouths. The question is which of these types of emissions will eventually have the biggest environmental impact and what can be learned from this information. <sup>SF</sup>

For more information, contact  
Dr Georgette Pyoos at  
PyoosG@arc.agric.za.