



Soil Scientist Dr Tony van der Weerden (left), and engineers Steve Gebbie and Hong Zhang with the caravan-based system which automatically measures nitrous oxide emissions in fields.

Measuring greenhouse gases – the mobile way

This 1972 Gypsy Moth caravan has a renewed purpose – as the powerhouse for a hi-tech AgResearch-designed system that can remotely measure a paddock's greenhouse gas emissions.

Nitrous oxide (N_2O) is a greenhouse gas produced by New Zealand agricultural systems. It's vital that we are able to measure N_2O emissions – to establish levels, and underpin research to develop mitigation technologies and practices for farmers to reduce their greenhouse gas emissions.

Up until now, scientists had to measure manually, onsite – a time consuming and expensive process.

Cue the caravan and AgResearch investment, that enabled Team Leader of AgResearch's Nitrous Oxide Group Dr Cecile De Klein to develop a solar-powered gas analytical system.

Then with MAF funding, AgResearch Soil Scientist Dr Tony van der Weerden and engineers Steve Gebbie and Hong Zhang designed automated chambers and software to build a fully automated field-based system to measure N_2O

in New Zealand environments.

The data set obtained from the innovative system offers potential for modelling to support further greenhouse gas research.

See page 4 for more, and for further information contact tony.vanderweerden@agresearch.co.nz or Cecile.deklein@agresearch.co.nz

A NIFT-D idea to deliver premium, safe food products

An AgResearch group has become the first in the world to produce technology that accurately measures the average temperature of chilled boxed product, without breaking the seal of the carton.



AgResearch Smart Measurement Team Leader Shane Leath (left) and AgResearch Business Development Manager Ross Clarke with the NIFT-D™ machine.

It's called NIFT-D™, and it's now commercially available. Looking like an airport baggage scanning machine, it uses microwave technology to measure temperature based on the amount of moisture absorbed by the product. A box is simply fed through the machine to get an accurate reading of the average temperature of its contents.

NIFT-D™ can be used at key points in a supply chain to give a manufacturer confidence that every carton at every stage meets storage and shipping temperature requirements. It can also be used to test the efficiency and cooling rates of chillers in a processing plant.

It's a breakthrough that will perk up the ears of export meat companies, where assurance of temperature control is crucial in ensuring New Zealand product reaches overseas markets in tip-top condition.

NIFT-D™ stands head and shoulders above current methods of temperature measurement in these applications. Often, a probe is drilled into one box out of a large group, a laborious method that only gives a single-point temperature gauge of that box, and raises hygiene issues.

Communication was key to coming up with the ground-breaking NIFT-D™ design, says AgResearch Smart Measurement Team Leader Shane Leath.

"To figure out how to do it, we had to have an electrical engineer talking to a refrigeration engineer, a meat scientist, and a chemical engineer – if we'd had any of those missing, we wouldn't have come to the conclusion we did."

NIFT-D™ has made a valuable contribution to quality assurance at Taranaki-based Anzco Prepared Foods

Ltd, producers of frozen meat patties, and suppliers to McDonalds throughout New Zealand and the Pacific Islands. Technical Manager David Sadler brought in NIFT-D™ to ascertain the average temperature of meat at several points in the processing chain. Meat brought in for processing must have an even temperature when it is minced, or the product shape and weight becomes irregular.

"NIFT-D™ was a great investigative tool to make sure our systems and standards were working, and validate our process. It was easy and quick to use, and gave us a full, across the board check in much more detail than we could otherwise possibly do."

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A French connection to unravel plant growth secrets

An AgResearch scientist is lending his expertise in plant biology to one of Europe's most significant programmes for improving the way plants use nutrients.

Senior Scientist Dr Bruce Veit is working with two teams of French scientists to better understand molecular switches that promote growth in plants.

The initial alliance began in 2008 when Bruce received a six-month OECD Fellowship to work with Professor Christophe Robaglia at Université de la Méditerranée in Marseille to examine how a switch, known as TOR, contributes to plant growth. TOR is found in all multi-cellular organisms, where it appears to integrate information relating to nutrient levels, energy and stress. Based on the balance of these inputs, TOR either activates or represses growth.

Work with the Marseille scientists, and more recently collaborators at INRA (French National Institute for Agricultural Research) in Versailles led by Dr Christian Meyer, is focused on how particular inputs, such as sugar or nitrogen levels, are coupled to TOR-activated growth. Generally, favourable growth conditions, such as high energy and nutrients, with low stress, lead to more TOR activity, and enhanced growth.

However, in model plants such as *Arabidopsis*, it's possible to artificially increase TOR activity to obtain extra growth in less favourable conditions.

This type of approach has potential applications in agricultural settings. It could enhance yields in environments where plants suffer stress or limited nutrients.

With a decade-long research record looking into basic aspects of growth control in plants, Bruce is one of the

world's foremost scientists in this area. Funded by the Foundation for Research, Science and Technology, he's identified and studied a group of proteins that may mediate some of TOR's effects on plant growth.

The joint New Zealand/French research will hopefully lead to insight on the large network of genetic interactions that control plant growth.

"The French are taking a leading role in addressing how nutrient levels and stress affect growth, and

describing the basic underlying control mechanisms," Bruce says, "Partnerships are so important in keeping up with an area of rapidly moving science like this – it's critical to collaborate."

"If we can understand how this pathway is regulated, we would have a good strategy for optimising growth responses to tailor plants to perform at their best in specific agricultural settings."

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AgResearch Scientist Dr Bruce Veit.

Remote measurement of greenhouse gases in fields



This AgResearch caravan-based measurement system for nitrous oxide green house gas from fields allows emissions to be measured without anyone needing to be on the site. Its telemetry system automatically sends results via a modem to a secure web address. Chambers with automated lids are placed in a field which open to take air samples. These air samples are pumped back to the analyser in the caravan, where repeat measurements allow a calculation of the N_2O emitted from the soil. Designed by Soil Scientist Dr Tony van der Weerden and engineers Steve Gebbie and Hong Zhang, it's powered by solar panels on the side of the caravan and a backup generator.



Boost lamb profits, for the cost of a gate

It's simple, cheap, and it's now been confirmed as a prime way to increase lamb weaning weights by up to 5kg a lamb.



A modified gate which only allows lambs to fit through to reach improved pasture to graze.

Creep grazing it's called – a farm management system where lambs pass back and forth freely through a modified metal gate to graze on pasture, and return to their mothers for milk. The gate is too small for an adult sheep to fit through, allowing only the lambs access to the pasture.

Supported by the Sustainable Farming Fund, Meat and Wool New Zealand, Landcorp and New Zealand Trade and Enterprise, AgResearch Scientist Ray Moss recently completed three years of extensive creep grazing field trials – with outstanding results.

"Of all the research I've been involved in over several decades, this would have to be one of the greatest returns for minimum effort and cost. For just \$200 to \$250 for a large gate that will last for years, farmers can significantly increase their lamb performance."

Results from the nine-site trial showed that where lambs were offered a normal feed allowance in a creep grazing system, farmers could expect around a 4kg liveweight advantage to those lambs at weaning.

On the one property where the system did not work well, stock had access to a very high feed allowance. This is logical, Ray says, because there's less incentive for the lambs to go walkabout.

The trial results prove creep grazing as a great management tool, he says.

"Getting lambs to a good weight quickly, and cost effectively, is one of the biggest challenges facing sheep farmers. Traditionally the best returns per kilogram have been earlier in the season, and getting lambs sold earlier also helps avoid the cost of flystrike and internal parasites that hit in summer and

autumn. So it's worth a lot of money to the sector – for the price of a gate." The system does have one small trade-off. When the lambs creep graze ahead of the ewes, where the lambs were up to 5kg heavier, the ewes were 1.5kg lighter.

"If you are talking a 10kg weight advantage for twin lambs, for the cost of 1.5kg of ewe condition that can be easily recovered, it's a no brainer as to which way to go," Ray says.

Until now, all research on creep grazing has been on rotational grazing systems. Ray will now look to test the system on set-stocking operations, where ewes stay in one paddock from lambing almost through to weaning. He'll also be trialling different pasture species for the lambs to creep on to establish which they prefer.

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Launchpad for new methane reduction discoveries

Potential new ways to reduce ruminant methane emissions have opened up, thanks to a genetic sequencing breakthrough.

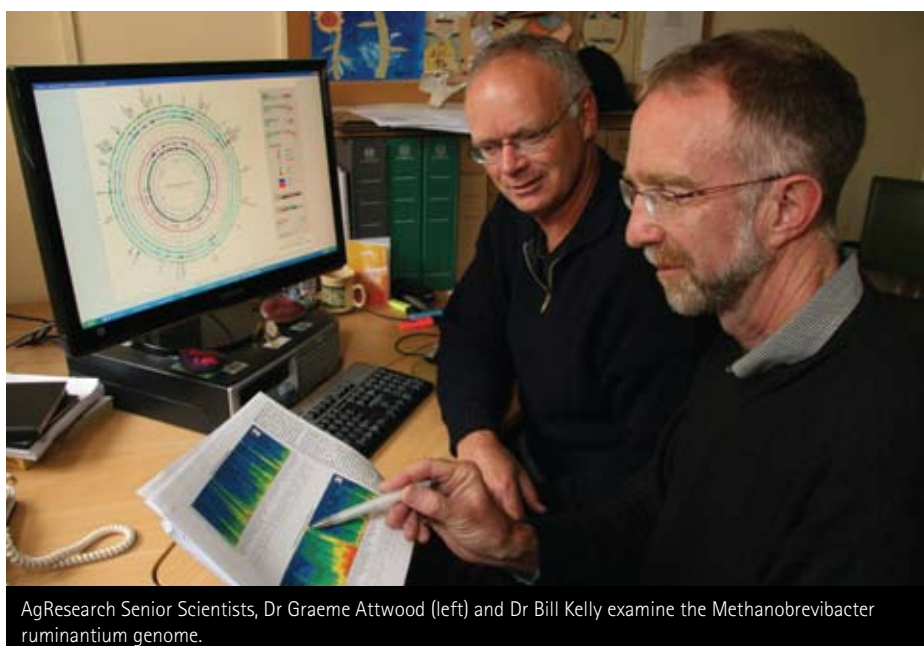
Last year, a team of scientists from AgResearch's Food, Metabolism & Microbiology section who work with the Pastoral Greenhouse Gas Research Consortium (PGgRc), achieved a world-first in mapping the genetic sequence of a rumen methanogen. Methanogens are the group of micro-organisms in the fore-stomach of grazing ruminants that produce methane.

With methane emissions from sheep, cattle and deer making up a high proportion of the country's greenhouse gas emissions, the agricultural sector needs mitigation solutions tailored to New Zealand farming conditions.

AgResearch Senior Scientist Dr Graeme Attwood, says having the organism's entire genetic blueprint underpins a host of PGgRc research to mitigate greenhouse gas emissions from the agricultural sector.

"From that sequence, we have already made some crucial discoveries about how this organism lives, behaves and interacts with other rumen microbes. These insights move us closer to finding ways to inhibit methanogen action in the rumen."

One discovery is large proteins on the surface of the methanogen that may be good candidates for reducing methane production in the rumen. Graeme's team believe many of these surface proteins are the 'glue' that allows the methanogen to interact with other rumen organisms to obtain hydrogen – its energy source. If they could somehow interfere with this association, and the methanogen's ability to get hydrogen, this would hinder its ability to grow in the rumen,



and lead to lower methane production.

Through sequencing the genome, the team has also been able to define the enzymes involved in the methane formation pathway. They're now aiming to target different steps in this pathway by designing molecules that can bind to these enzymes and prevent their function, thus hampering methane production.

Enzymes involved in cell wall breakdown have also been earmarked as good contenders to knock out methane. A lytic enzyme involved in breaking open methanogen cells during a process called phage replication is a promising area being pursued by AgResearch Senior Scientist Dr Ron Ronimus and his colleagues.

Graeme says while they are still some years away from delivering on-farm

solutions to knock out methane emissions in agriculture, the research already made possible by the sequencing success is very encouraging.

"We can now embark on research paths to crack this challenge that is important to the sustainability of New Zealand farming systems, and our economy."

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Climate change makes for hot debate at Grasslands Conference

Is climate change a manmade phenomenon? This topic packed out the room and led to heated discussion at the recent 71st Annual New Zealand Grasslands Association Conference.

More than 300 farmers, agribusiness consultants and scientists attended the conference, in Waitangi in November. AgResearch was the lead sponsor of the Association, presenting eight spoken papers and 12 poster papers, and Chairman Sam Robinson speaking at the conference dinner.

A plenary session on global warming looking at the question 'that global warming is a reality and that anthropogenic emissions are threatening our future' by far stirred the most interest over the two-day event.

Key speakers in the session were David Wratt, from NIWA, who spoke in support of the question and Willem de Lange from Waikato University, who spoke against the proposition.

Grasslanz CEO Dr John Caradus said discussion on the issue was so intense it was a struggle to get people back to their seats after a coffee break.

"There are still two sides to this issue, and people were clearly keen to hear two experts in the field present both viewpoints.

"The whole question however was ably covered by James Palmer from MAF. He made the telling point that irrespective



About 200 farmers, researchers and agribusiness representatives attended the field day on the Jacks' farm.

of what one believes, offshore markets, and their consumers, will demand some action on behalf of our agricultural community to reduce the impact of greenhouse gases on the environment.

"His message was very strong that we need to listen to what these critical markets are saying, and change our thinking and behaviours in order to retain them."

The conference programme also included local Maori farming corporation representative Rawson Wright, speaking on Maori farming in Northland as a corporatised model that, by and large,

worked well, and has a future.

Field trips included nearby Te Ngaio Farms, to see how changes in pasture management have significantly lifted milk solids production, and a unique effluent management system as a method for nutrient management. And on the Jacks Family Farm, a look at how intensive beef systems have increased farm profit, and balancing animal production and profit, while future-proofing the business.

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