



A cow triggers a small lever to be rewarded with food watched on by, from left, post-doctoral scientist Dr Adele Arnold, Ruakura Dairy Number 1 Farm Manager Phil Martin and Senior Scientist Dr Lindsay Matthews.

This issue of Intouch profiles the AgResearch farms that are located throughout New Zealand and act as a field laboratory resource for our scientific research.

Discovering what animals really, really want

In a world first, AgResearch animal welfare scientists have developed a technique that enables them to not only learn what an animal wants, but also what an animal feels.

The scientists have developed a sophisticated, custom-made apparatus for dairy cows at the Ruakura Dairy Number 1 Farm, near Hamilton, that lets them "ask" the cows to work for such things as food or shelter, thereby gaining an insight into the animals' subjective experiences. Using mathematical equations, scientists quantify the results to find out such things as how a cow's desire for food changes according to its body condition or where it is in its production cycle.

"No-one has attempted to use this sort of apparatus with a large scale operation of dairy cows before," says Senior Scientist Dr Lindsay Matthews who is working on the

research with post-doctoral scientist Dr Adele Arnold and Dexcel.

"It shows us whether they are willing to pay the price to obtain resources.

"It's an important question scientifically, so we can identify their requirements and ensure they have a good quality of life. It's also what a lot of consumers want to know before they buy an animal product, so this research is important for both farmers and their markets."

The apparatus includes a moving rod that guides the cows away from such things as food and shelter. They then have to walk back to where they were shunted from to access the food or shelter again.

"By exposing the animals to artificial wind and rain, we find out how important the shelter is under even more challenging conditions," says Lindsay.

"We couldn't do this easily on a regular commercial farm. We need our experimental apparatus to be in close proximity to a milking facility so we can investigate cows' needs under typical farming conditions."

Ruakura Dairy Number 1 Farm Manager Phil Martin says the farm essentially provides scientists with a field laboratory.

"Without interfering with the scientists' trials, we add on-farm knowledge and value to their work."

Different cultivars may affect animal performance

Rare grazing trials at AgResearch's Winchmore Farm are assessing the difference in animal performance when sheep graze different cultivars.

"Most pasture trials are based on pasture yields but we use a combination of pasture yield and animal performance to more closely reflect what happens on-farm," says AgResearch Lincoln Research Associate Cath Goulter.

"Farmers are particularly interested in such things as better liveweight gain or a higher number of grazing days, and this is what we measure."

The research is carried out for Agricom — a brand within PGG Wrightson that markets forages for increased farmer profitability. Agricom has a plant breeding relationship with AgResearch's Grasslanz® Technology and its international partners in the areas of ryegrass and tall fescue through the joint venture Grasslands Innovation.

About 300 ewe hoggets are allocated to 24 plots that contain a range of eight ryegrass cultivars, all of which contain novel endophytes. An endophyte is a naturally-occurring fungus that lives between plant cells in ryegrass and tall fescue. A novel endophyte has been identified for enhanced insect tolerance and increased animal productivity.



Winchmore Farm Manager John Carson and AgResearch's Cath Goulter check on the hoggets involved in the grazing trials.

"Being able to use a science farm for such research really helps because the manager, John Carson, is very accommodating and we have complete control over the trial."

Located near Ashburton, Winchmore Farm has a history of long-term fertiliser and border dyke irrigation trials.

Organic lamb production has major parasite challenge

Internal parasites are causing major losses in the production of organic lambs, according to a world-first study undertaken by scientists at AgResearch's Ballantrae hill country research farm.

Located near Palmerston North, the research farm was used by scientists from both AgResearch and Massey University's Institute of Veterinary Animal and Biomedical Sciences (IVABS) for the study. They concluded that the organic industry's expansion will continue to be constrained until the problem of internal parasites is addressed.

"The opportunity for part of the New Zealand pastoral industry to capture the opportunities available within the rapidly expanding global market for branded natural and organic products has to date not been realised," says AgResearch scientist Dr Alec Mackay.

"The inability of the current organic supply base to consistently supply product in the face of a range of production system challenges has been identified as the major impediment to growing this sector."

Alec says the nine-year study examined changes in livestock following a shift to organic production. Two farmlets at the research farm were managed using conventional farm practices, while two low chemical farmlets complied with the organic production standards of BIO-GRO New Zealand. Each farmlet, managed as a self-contained mini-farm, is approximately 18 hectares of moderate to steep hill country.

Due mainly to a lower prevalence of parasites, the conventional properties had higher lamb and sheep performance than the organic farmlets. Lamb liveweight at weaning was 1.77kg lower on the organic properties than on the conventional farmlets and after weaning the organic lambs had a reduced growth rate due to parasites. This can amount to a 25% difference in liveweight in the autumn. The organic farmlets had smaller ewes, leading to a lower ovulation rate and less lambs being born.

The study was funded by the Foundation for Research, Science & Technology (FRST).

Farm use reflects needs of science

Relocating a flock of experimental sheep to AgResearch's Aorangi Farm means the farm has switched from being a commercial operation to having a science research focus.

The flock, developed over 20 years for research, moved to Aorangi, near Palmerston North, to support the new Hopkirk Research Institute – a collaborative venture between Massey University and AgResearch.

AgResearch scientist Stewart Bisset, of the Animal Health Section, says the flock contains three experimental selection lines that have underpinned several major AgResearch projects that hope to address the increasing problem of drench resistance in New Zealand.

"The lines were originally developed to assess the feasibility of breeding sheep that are less reliant on the use of drenches. Those

selected for resistance or susceptibility to roundworm infection have since played a key role in research aimed at understanding the sheep immune system, identifying natural anti-parasite products and developing genetic markers for host resistance.

"Understanding immune responses to roundworm infection in sheep may be important in the future development of effective roundworm vaccines."

Another line has been selected for resilience – the ability to maintain good health and productivity when challenged by parasites.

"Reduced drench requirements in lambs should lower animal health costs, extend the useful life of available drenches and enable consumer demands to minimize drug usage in livestock to be met more easily."

Aorangi Farm Manager Steve Lees says flocks such as those at Aorangi could not be bred on a commercial farm.

"The major focus of staff is understanding that science comes first and that, whatever happens, the research must continue – often for very long periods of time."

Woodlands Farm research pivotal to improving sheep breeding

Improving New Zealand sheep through traditional genetics or DNA technology is the main focus of research at AgResearch's Woodlands Farm, near Invercargill.

Since 2002, Woodlands has been involved in Meat & Wool New Zealand's (MWNZ's) Central Progeny Test (CPT) – a project that underpins the performance of all sheep in New Zealand.

A progeny test is used to prove the genetics of a ram by comparing how his progeny perform under the same environmental conditions relative to progeny from other rams. Centralising the test at Woodlands allows extensive comparisons between rams and the use of novel or expensive measurement methods.

AgResearch Invermay's John McEwan and Nadia McLean are involved in the CPT. John says the test used to look at traits relating to meat production but now also evaluates such things as reproduction, parasite resistance and facial eczema. He says Woodlands is perfectly located for sheep research.

Managed by Kevin Knowler – a member of MWNZ's Southern South Island Sheep Council – Woodlands uses some of its land for more than one project, meaning up to 110% utilisation.

"To operate at this level the farm has an ideal infrastructure, with a multitude of small paddocks and well-maintained lanes," Kevin says.

- Latest results of the CPT trial are available at <http://www.meatandwoolnz.com/main.cfm?id=303> and SIL ACE analyses at <http://www.sil.co.nz/>



Woodlands Farm Manager Kevin Knowler and AgResearch Invermay technician Nadia McLean.

New tool to rank red deer

Scientists at AgResearch's Invermay Deer Farm have produced the world's first tool for ranking red deer according to genetic merit.

AgResearch Invermay scientist Dr Jason Archer set up a deer sire referencing project after recognising the need for a set of benchmarks against which stags could be ranked across farms according to genetic merit.

The project involved using deer industry sires to breed progeny whose pedigree and performance were measured to develop breeding values for production characteristics such as growth.

"We linked the results of sires from different herds, enabling us to compare their performance and rank them against each other," says Jason.

The programme led to the establishment of DEERSelect – a commercially-operated computer-based service for deer breeders that enables them to calculate the breeding values of their deer.

"This analysis enables the genetic performance of the sires used in these herds to be compared

on the same basis, after differences in environment have been removed," says Jason.

"There are significant commercial considerations in running a programme like this so we needed an independent operator and that's how AgResearch is seen. The Invermay Deer Farm was a logical place for the programme.

"This was an industry-leading project that has provided a platform, through DEERSelect, for us to continue carrying out more in-depth genetic research. It assists us in a whole range of other genetic programmes such as the programme we have for identifying markers for early breeding genes. It's a tool for the whole industry."

The sire referencing project was predominantly funded by the Foundation for Research, Science & Technology (FRST), with participating breeders also contributing. DEERSelect is operated by Meat & Wool New Zealand's Sheep Improvement Ltd, with input from Deer Industry New Zealand and AgResearch.



Dr Jason Archer at the Invermay Deer Farm.

Research for farm profit and environment

A project at AgResearch's Whatawhata Research Centre, near Hamilton, is beginning to show the multiple benefits of changing land management in hill country.

The 300 ha pastoral block used for the project has been transformed by forestry, native tree planting, livestock intensification and riparian management. The farm unit has boosted its annual farm economic surplus by 15% since changes were implemented in 2001. Pine forestry should further improve the long-term economic performance by increasing farm surplus five-fold when logging begins. Water on the farm is clearer since the changes were made and there have been declines in stream pollution from suspended sediment (by 70%), phosphorus (60%), nitrogen (30%) and faecal bacteria (40%).

"These early results indicate improved long-term economic and environmental

performance. It's showing farmers and policy-makers that win-win solutions can be found," says Dr Mike Dodd of AgResearch's Climate, Land & Environment Section.

A catchment farm management group, that included researchers from AgResearch, NIWA and Landcare Research, as well as district and regional council staff, farmers, the Department of Conservation and Māori, have guided the project. They developed an integrated farm plan to meet business viability and ecosystem health goals.

The plan included planting radiata pine trees to increase profit and control erosion on steep land, and replanting natives for biodiversity restoration and native tree timber production.

Stock management has changed from traditional sheep and cattle breeding enterprises to include a one-year bull-beef finishing system because bulls give better returns than breeding cows and young bulls generate less erosion damage than older, heavier animals. To improve water quality, all livestock have been excluded from streams and poplars were planted on pasture land for soil conservation in erosion-risk areas.

An ongoing monitoring programme feeds results back to the catchment group and other community stakeholders.

"We hope this will guide future planning in both research and farm practise," says Mike.

AgResearch farms capture New Zealand's farming diversity

AgResearch's 16 farms represent the range of properties that New Zealand farmers operate within and allow research across diverse farming environments.

"The diversity of land use is designed in part around the science capability of AgResearch's various campuses, although there is also some flexibility to adapt to the changing science demand," says AgResearch National Farm Manager Bruce Hunter.

The farms are run by 87 staff nationwide, with the farm types ranging from the open plains of Southland (Woodlands), Canterbury (Winchmore) and Manawatu (Aorangi) to the rolling downs of Otago (Invermay) and Waikato (Tokanui). Steep North Island hill country is captured by Whatawhata (Hamilton) and Ballantrae (Woodville). They represent a myriad of soil types ranging from the fragile sand pockets within the Manawatu and the summer-stressed stoney soils of the Canterbury plains to the deep, loamy soils of the Waikato and Southland.

"While AgResearch has traditionally researched sheep and beef, its dairy resource has expanded and it presently holds three dairy farms at Ruakura in Hamilton and Flock House near Palmerston North – milking a total of 1600 cows," says Bruce.

- If you want to carry out research at one of our farms, or to pay a visit, contact the appropriate farm manager: firstname.lastname@agresearch.co.nz (see map at right for relevant names).



All in a day's work



■ to contact intouch:

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Valuable seeds produced at Lincoln Farm

AgResearch's Lincoln Farm is the base for one of New Zealand's leading producers of high-quality nucleus seed that ultimately aims to increase the value of farming.

About one-third of the Canterbury-based farm is used to produce high-quality nucleus seed for Grasslanz® Technology Ltd, with the seed then sold to commercial seed companies. Grasslanz® has leased land at Lincoln Farm for about 16 years and during that time has produced more than 400 nucleus seed crops for commercial clients.

"We couldn't run our business on a regular, commercial farm," says Grasslanz® Seed Production Manager Shaun Monk.

"Producing top-quality nucleus seed requires a strict eight-year crop rotation system and our main requirement is to have clean soil to move onto."

Shaun and his team work closely with Lincoln Farm Manager Roger Orchard to ensure sowing takes place on soil that is not tainted with pasture seeds, weed seeds or residual chemicals.

"There are many restrictions that create a lot of extra work as we find ways of appropriately using the land within the rotation. One mistake, like feeding out a hay bale that contains pasture seeds, could reverse eight years of work," says Roger.

AgResearch plant breeders provide Grasslanz® with a cupful of seed for each new cultivar that is sown onto a .25ha block and intensively managed by specialised staff. The numerous ways to avoid cross-contamination

of the valuable nucleus seed include blowing down machinery between harvests with compressed air and close monitoring of the farm's 1500 sheep to ensure they don't carry seeds from one crop to another. Grasslanz® has an on-farm Ministry of Agriculture and Forestry (MAF)-approved seed cleaning facility and finished seed lines are stored on-site in a secure, low-humidity cool room, awaiting release for commercial crops and research trials.

Half of Lincoln Farm is used for science research, with the remainder being used by commercial clients including Grasslanz®, ReadyLawn and Watties.



Lincoln Farm Manager Roger Orchard, left, is pictured at the farm with Grasslanz® Seed Production Manager Shaun Monk.