# definingnz

FIELDAYS 2009

## Powering rural communities

High-tech protection for tomorrow's landscape

Turning waste into wealth

Rating the best beef

MASSEY UNIVERSITY

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Steve Maharey

# Massey ready for agri-food future

**As New Zealand's** leading agri-food university, Massey is delighted to be part of Fieldays 2009. Let me tell you a little of our story.

More than 80 years ago, Professors Geoffrey Peren and William Riddet strode across the pastures just outside the town of Palmerston North and agreed that an agricultural college should be built beneath their feet.

At the time, agriculture accounted for most of the New Zealand economy and the College was urgently needed to lift the capability of farmers through outstanding teaching and groundbreaking research. Massey Agricultural College was highly successful.

In 1964 the College became Massey University. Over the following decades the University expanded to include Humanities, Social Sciences, Business, Education, Fine arts and Design and new areas of science. Throughout, Massey has worked hard to assist New Zealand's land-based industries to meet new challenges.

Right now, as is widely accepted, our land-based industries need to go through a step change. New Zealand needs to produce more food at higher quality while adding value and ensuring sustainability.

To achieve this, Professor Robert Anderson has championed the shift from agriculture to agri-food. Professor Anderson saw that New Zealand's future lay with a move beyond the farm gate to where the food industry could add value to traditional commodities. This was a defining view of land-based industries and New Zealand might head.

> "Professor Anderson saw that New Zealand's future lay with a move beyond the farm gate to where the food industry could add value to traditional commodities. This was a defining view of not only where land-based industries but also where New Zealand might head."

Massey is ready to play its part in the drive for change. Today we can offer the expertise of more than 400 staff and postgraduates working on every aspect of the agri-food continuum. Our infrastructure is modern, we have 2000 hectares of farmland and a commitment to innovation. Other aspects of the University, such as business, design and social sciences also have a great deal to contribute.

We know that the challenges facing agriculture are huge. At Massey we are used to big challenges. We are an innovative, bold, "can-do" university that wants to work in partnership with industry. Make sure you talk with us about the future.

In this issue we have brought together the best of recent stories relevant to the industry, capturing the contribution of staff including Nicola Shadbolt, Steve Morris and Rebecca Hickson, and alumni including Craig Norgate.

You'll also find articles on the three projects we showcase at Fieldays, each making a unique contribution befitting the theme this year: My Land, Our Environment.

The work of Dr Dave Horne and James Hanly sees cutting-edge technology and advanced data analysis used to support on-farm decision-making minimising the impact of farm dairy effluent. The Life Cycle Analysis Centre being set up at Massey will focus on managing our environmental footprint – from greenhouse gas emissions to water use – and complements perfectly the existing Biochar Research Centre which harnesses the potential of waste products.

Finally, the Totara Valley project showcases how alternative energy collection can – and does – power a rural community.

We're proud of the contribution Massey makes to New Zealand, and we hope you enjoy Fieldays as much as we enjoy being here. Keep in touch with us by registering to receive our regular newsletters by email or reading more about the work we do, on our news website: http://news.massey.ac.nz ❖

4 COVER STORY

# Power to the people

A unique collaboration in Totara Valley could change the way New Zealand communities get their power.

definingnz



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COVER: Geoff Smith Photograph: David Wiltshire

# Power to the people

Dr Jim Hargreaves

A unique collaboration at the end of the electricity supply line in Tararua could change the way remote New Zealand communities around New Zealand get their power.

*Photographs: David Wiltshire*

Dr Jim Hargreaves and Geoff Smith

**Three** farming families living in the Totara Valley, about 20km from Woodville, are using energy technologies installed by Massey University and Industrial Research Limited (IRL) to produce electricity.

The idea was hatched when a Massey student struck up a conversation with a farmer's wife at Tararua church, according to renewable energy lecturer Dr Jim Hargreaves.

Since then, he says, the project has grown into a prototype for what may rural communities should consider.

"An increased emphasis has been placed on finding new ways for isolated communities to work with power companies to develop renewable energy sources," Hargreaves says. "This project proves these partnerships can work."

"This is the way of the future for isolated rural communities" – Geoff Smith

The distributed generation project capitalises on the resources available in the farming environment – wind, sun and water. The project features a number of distributed energy technologies including solar hot water and photovoltaics, along with a bio-diesel generator and a micro-hydro system.

A particularly novel development uses hydrogen as an energy carrier and for energy storage.

The production of hydrogen requires an energy supply and at Totara Valley this is provided by a wind turbine, located at a good wind site on a hill 2km above the farm houses.

The wind energy powers a water electrolyser that produces hydrogen fuel gas which is pumped down the hill to a fuel cell and water heater at the farm house in the valley below.

As well as transporting the energy, the system stores hydrogen in the pipeline so that a supply of energy can be maintained even when the wind is not blowing.

Hargeaves says the project has buy-in from the electricity supply company, Scanpower. "The energy produced in the valley that's not used by the residents is put back into the national grid, and Scanpower are now paying a good price for it," he says. "That will hopefully provide further incentive to those thinking about this sort of project."

Farmer Geoff Smith says it's been fascinating working with the project team. "We're benefiting from the wind turbine here while the neighbours have the hydro-system. I think this is the way of the future for isolated rural communities."

Alister Gardiner, manager of IRL's Hydrogen and Distributed Energy Platform, says collaboration is key to the success of the project.

"People in remote communities are used to helping each other to solve problems. This project relies on cooperation and collaboration as well as the integration of several different types of technology."

Similarly, he says the researchers have cooperated over a number of years to make the project a reality.

"This project has brought together scientists and engineers from Massey University and IRL with different areas of expertise. Over the years the relationship has built into an enduring one and I believe both organisations will reap the benefits for years to come."

He says the educational value of this relationship has been immense.

"Many energy technology students from all around the world have undertaken projects in association with this real-world research site, and gained the best possible training by working in association with both the University researchers and IRL staff who have designed and developed much of the technology." ❖

# DNA tests to trace the origin of the Māori potato

Photograph: Nick Roskruge

Dr Nick Roskruge during a field trip to Ollentaytambo in the Inca Valley of the Andes last year

**Fingerprint** DNA of taewa, the Māori potato, will be added to the gene bank at the International Potato Centre in Lima, Peru, to increase worldwide knowledge of the taewa's journey through the Pacific.

Taewa expert Dr Nick Roskruge will travel to Lima this month to compare taewa DNA with that of other potatoes deposited there. Roskruge visited the Potato Centre and indigenous grower communities while visiting Peru last year as a guest speaker at the International Congress of Ethnobiology.

Roskruge is a senior lecturer and researcher for the University's Institute of Natural Resources and is Kaiārahi Māori (Māori adviser) to the College of Sciences. He is also the chairman of Tahuri Whenua, the national Māori vegetable growers' collective, and is involved in a range of projects and reference groups involving indigenous horticulture, vegetable production, Māori land utility and soil systems.

Fingerprint DNA is the translation of plant material DNA into written form, he says.

"The fingerprint can then be compared or aligned to other fi ngerprints' that's how they can show their connections – or whakapapa.

During the six-week sabbatical, he will work in the potato centre's germplasm bank, where more than 3000 molecular samples of potatoes and kumara are kept, and will also visit indigenous grower communities and organisations in the Andes and in Chile.

"The origin of the potato is in the Andes and, while the link and journey between the kumara and South America is well known and proven, the story of the potato is not."

Roskruge says as well as the molecular approach using DNA samples, he will be looking at validating the connection between taewa and South America through comparisons of oral history.

"Validation using a molecular approach through DNA is fine, within the indigenous community another layer of validation comes from stories. Comparing the knowledge of indigenous communities in the Andes to Māori stories and knowledge helps increase the understanding of the relationship and journey of the potato over time."

Of Te Atiawa and Ngāti Tama descent, Roskruge has been involved in horticulture most of his life, beginning in the 1970s and 1980s in Taranaki picking gangs.

He says he was encouraged by his boss at the time to enrol at Massey in the diploma of horticulture. Since then he has attained a Bachelor of Horticulture and Technology (Hons), a Postgraduate Diploma of Māori Resource Development and last year graduated with a PhD in Soil Science.

"While I'm in the Andes a group of about 12 growers will come over and spend time with indigenous communities to talk about the link between South America and taewa. In time there is the potential to develop a reciprocal exchange to New Zealand."

His interest in taewa started about 10 years ago when he was working at a desk job at Massey's Manawatu campus. "I wanted to get out of the offi ce and had access to a seed bank, since then taewa and the collective have taken on their own life." ❖

# High-tech tools protect tomorrow's landscape

James Hanly

New Zealand farmers will be the first in the world to receive cutting-edge tools to manage farm dairy effluent. A blend of farm-specific data and technology providing decision support tools to help farmers schedule effluent irrigation and monitor irrigator performance.

Photographs: David Wiltshire

**New Zealand** farmers will be the first in the world to receive cutting-edge tools to manage farm dairy effluent.

Massey University scientist Dr Dave Horne and PhD researcher James Hanly have led the work in collaboration with research and development company Harmonic Ltd.

At the heart of the project is a blend of farm-specific data and technology providing decision support tools to help farmers schedule effluent irrigation and monitor irrigator performance.

Mr Hanly says the system has been designed for New Zealand, where many farmers rely on storage and small, travelling irrigators spraying onto paddocks.

"While land application of effluent is an improvement on pond-only treatment, it can still contribute to contamination of waterways, particularly for mole and pipe drained land, soils with a rising water table and sloping land," he says. "Farmers in these situations should probably be practising deferred irrigation which involves storing effluent and irrigating it when soil moisture conditions are suitable. As a first step, we developed a calculator to identify how much storage farmers need if they are to practise deferred irrigation of effluent – which can be more than many think."

The technology package begins at the pond where effluent level is monitored, along with weather data and soil moisture status, this information is fed into an analysis which provides daily advice on irrigation scheduling. The high-tech approach continues with monitoring of irrigator performance (speed and location) using GPS technology and an automatic pump shutoff system.

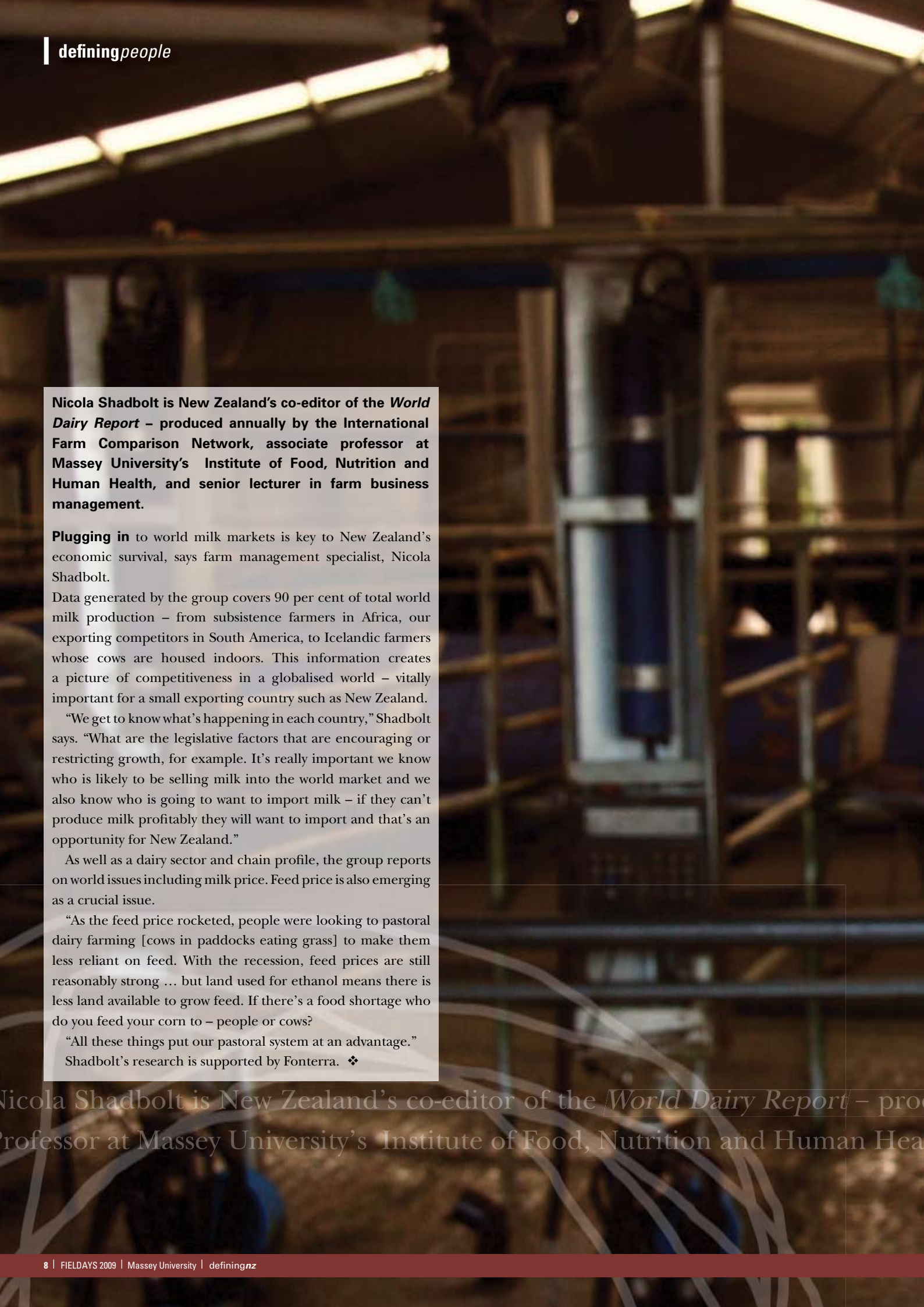
"The availability of farm-specific information is a key aspect of assisting improvements in farm dairy effluent system design and management," Mr Hanly says. "On the basis of real-time, comprehensive data, farmers will be able to make the most informed decisions for planning and implementing sustainable effluent practices."

The development of smart tools that provide real value to the farmer are at the heart of this research: information can be accessed with a mobile phone or a home computer.

Until now the trial has run at the University's Number 4 Dairy Farm, just outside Palmerston North, but with funding from DairyNZ's On-Farm Innovation Fund, Harmonic and Massey are taking the project to eight dairy farms across the country over the next year to assess the system under a range of different farm and regional conditions.

Harmonic Ltd is commercialising the system, and plan to make the package available on-farm in 2010. Current work is funded by Harmonic, Horizons Regional Council, the Foundation for Research, Science and Technology and the Dairy NZ On-Farm Innovation Fund. ❖

An effluent drainage monitoring station used on Massey's No 4 Dairy Farm near Palmerston North



**Nicola Shadbolt is New Zealand's co-editor of the *World Dairy Report* – produced annually by the International Farm Comparison Network, associate professor at Massey University's Institute of Food, Nutrition and Human Health, and senior lecturer in farm business management.**

**Plugging in** to world milk markets is key to New Zealand's economic survival, says farm management specialist, Nicola Shadbolt.

Data generated by the group covers 90 per cent of total world milk production – from subsistence farmers in Africa, our exporting competitors in South America, to Icelandic farmers whose cows are housed indoors. This information creates a picture of competitiveness in a globalised world – vitally important for a small exporting country such as New Zealand.

"We get to know what's happening in each country," Shadbolt says. "What are the legislative factors that are encouraging or restricting growth, for example. It's really important we know who is likely to be selling milk into the world market and we also know who is going to want to import milk – if they can't produce milk profitably they will want to import and that's an opportunity for New Zealand."

As well as a dairy sector and chain profile, the group reports on world issues including milk price. Feed price is also emerging as a crucial issue.

"As the feed price rocketed, people were looking to pastoral dairy farming [cows in paddocks eating grass] to make them less reliant on feed. With the recession, feed prices are still reasonably strong … but land used for ethanol means there is less land available to grow feed. If there's a food shortage who do you feed your corn to – people or cows?

"All these things put our pastoral system at an advantage."

Shadbolt's research is supported by Fonterra. ❖

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Photograph: David Wiltshire

Bridie Virbickas is among 61 students taking the soil properties and processes paper taught on the Manawatu campus.
*Photograph: David Wiltshire*

# Growing Smarter

## Innovation remains key to agri-food growth

**As global** food shortages worsen and governments grapple with the problem of how to feed growing populations with shrinking resources, the agri-food backbone of New Zealand's exports will continue to increase in importance.

Massey has always played a pivotal role in developing the people and the skills that place New Zealand at the cutting edge of what needs to happen to create a sustainable future.

Innovation is vital to cope with the dangers posed by climate change, pollution, water shortages and loss of arable land – and the mantra of "working smarter not harder" is implicit when the world no longer has the ability to simply grow more crops and breed more livestock to feed itself.

The University is already a world leader in the agri-foods area, unrivalled in research, skills development and knowledge transfer.

In April it joined five other food research and development organisations in establishing Food Innovation New Zealand to market the nation's food research expertise to the world.

A memorandum of understanding was signed with AgResearch, Fonterra, Plant and Food Research, the Riddet Institute, and the

BioCommerce Centre. The plan is to formally launch the brand in August.

University Vice-Chancellor Steve Maharey, who chairs the Food Innovation steering committee, says New Zealand and its leading food science organisations already have a global reputation for excellence.

"Collaboration between our organisations has helped grow the industry's reputation for providing New Zealand Government and worldwide private sector clients with world-class food research services and capability," Maharey says. This initiative is the first time the partners have formalised their collaborative efforts. The primary goal is to attract more global food giants to commission research in New Zealand and to establish research facilities here.

Recent farms systems projects include year-round lambing and identifying the most effi cient beef cattle for particular farms – both projects have the capacity to feed more people from less land.

Scientific breakthroughs in Omega-3 fish oil and calcium fortified Anlene milk have led to global commercialisation of products with significant health benefits. The common thread from fish oil to better farm systems is innovation, Maharey says.

The decision to renew the focus on agri-foods last year saw the degree programmes revised and updated. In addition to the worldclass Bachelor of Food Technology degree – recently selected by the Singapore Government to be taught there alongside other world-leading technology degrees – this year's crop of students had the choice of degrees in AgriScience, AgriCommerce or Environmental Management in place of the Bachelor of Applied Science programme.

The programmes were developed over two years after extensive consultation with recent graduates, current students, academics and industry. With student enrolments heading for records levels the change appears to have won approval where it counts.

**Massey Agriculture:**

- Total students in agriculture and life sciences: 2500 EFTS (700 postgraduates)
- Current research contracts in agriculture and life sciences: 115 valued at $15.6m
- Farms: 2200ha (three dairy, three sheep and beef, one deer, plus fruit, pasture and crops research units)

Massey University is a world leader in the agri-foods area, unrivalled in research, skills development and knowledge transfer. In April it joined five other food research and development organisations in establishing Food Innovation New Zealand to market the nation's food research expertise to the world.

Bridie Virbickas, 18, is among 61 students taking the soil properties and processes paper taught on the Manawatu campus. With 71 extramural enrolments – and another 100 internal enrolments anticipated for semester two – the numbers are well ahead of any of the past three years.

Virbickas says Massey's reputation is what drew her from the family dairy farm near Whakatane to do a Bachelor of AgriScience. Massey's well-known for how good it is at agriculture and the new degrees seem to have got more attention and are more focused," she says.

The soil paper, along with a paper called Plants in Agriculture, are regarded as "indicator papers", says the Director of Massey Agriculture, Professor Jacqueline Rowarth. "When those class sizes are up – and they are this year – we know we're looking at some good numbers graduating in two or three years' time.

"They're keen and motivated students and taking full advantage of all the extracurricular professional development opportunities that Massey Agriculture offers," Rowarth says.

Last year the Pro Vice-Chancellor of the College of Sciences, Professor Robert Anderson, announced the new bachelors degrees saying they underline the University's commitment to building a sustainable nation. Anderson calls them "future-proofing" Massey's agriculture graduates by drawing on the strengths the University has in multiple disciplines and developing partnerships across developing disciplines to provide the skills needed by industry.

AgriScience is for students planning careers at the interface of science, technology and management in agriculture, horticulture or equine studies, such as technicians, farm or horticultural managers, fertiliser or seed company representatives.

Virbickas says she is enjoying the soils side of her degree and could be interested in a career in the fertiliser industry that might in turn lead to a farm advisory role.

Anderson says AgriCommerce, developed in partnership with the College of Business, is for students wanting to work in business related to primary production, such as rural banking, exporting, rural valuation, logistics and supply chain management.

"The Bachelor of Environmental Management will provide the career foundation for managers in resources, environments, catchments and parks, as well as for regional planners and policy analysts," he says.

Robert Southward, co-ordinator of the Plants in Agriculture paper, says the semester one class of 87 internal students is the biggest in at least six years, with the students an even split between AgriScience, AgriCommerce and Bachelor of Science, with some Veterinary Science and diploma students as well.

Alastair Neville, 20, started doing a Bachelor of Applied Science last year but switched to AgriScience after deciding "it was the way to go". He came to Massey from his family's dairy farm at Reporoa because of its reputation and variety of programmes.

A key advantage is the ability to study in diverse areas due to the comprehensive nature of the University. "At the moment I'm doing economics as an option and my intention are to do some business papers as well," Neville says.

When he completes the degree he plans to work as a farm adviser, rural banking or as a technical sales represenative. "Nowadays having a degree opens more doors. "Dad started farming after fifth form but he says because of the amount of paperwork you do you need business skills. It's also about the science. Agriculture is so much more in-depth." ❖

# Recession in markets gives policy makers food for thought


Professor Allan Rae

**The rise** in the number of shoppers buying local produce is posing a puzzle for policy makers.

With around 80 per cent of produce from farms in New Zealand being exported, agri-food is a major area of business activity.

But one effect of the recession is that customers are choosing to spend their money locally, putting the lucrative export market in danger if consumers in other countries do the same.

Professor Allan Rae, an agricultural economist, leads a team of experts in agricultural trade policy and policy reform at Massey University.

They monitor national and international market and policy trends and the threats and opportunities they offer to New Zealand agrifood businesses.

"It is so important to get trade policies right," he says. "Nations trading products with one another will obtain greatest benefits if they are able to specialise in products in which they are internationally competitive.

"But sometimes trade policies distort markets and prices and farmers and processors may have the incentive to produce goods that would be better imported.

"Not only does this harm that country, but it is also likely to harm other countries whose export sales and returns have suffered."

Known for thinking "outside the barn", his team is taking a fresh look at the situation with the formation of a College Centre for Agribusiness Policy and Strategy at Massey.

Based within the College of Business, the new centre continues and builds on the work of the Centre for Agricultural Policy Studies that was established in 1981. It will enhance teaching and research at the University, help form new policy and engage further with the international community, creating connections that are valuable to agrifood exporters.

"The status change reflects the importance we place on the agri-food industry in New Zealand," says Professor Rae who will lead the centre.

"The move will strengthen the work we have been doing by placing a lot more emphasis on the impact of global food market and policy developments on New Zealand businesses and how trade policy can reflect that to the advantage of New Zealand farmers and agribusiness."

Massey has supported government agencies with analysis and policy advice for more than 20 years but the new centre will have a stronger agri-business flavour.

Professor Rae says this is a step in the right direction.

The team has a proven track record. It has been involved in both the Uruguay and Doha World Trade Organisation Agricultural Negotiations looking at how reductions in tariffs, export subsidies and changes to tariff-rate quotas would impact on New Zealand rural society – in terms of global and national prices, trade flows and economic benefits.

Other ongoing research projects involve policy development in the pastoral sector, using improved land-use modelling to gain a better understanding of how agri-business in different regions within the country might respond to policy reforms. This helps estimate changes in supply, demand and trade for products.

They are looking at how carbon taxes or emissions trading schemes will impose additional costs on some agri-food producers. If foreign suppliers do not face such costs then New Zealand exporters become less competitive.

Long-term there is an in-depth study of the Chinese agrifood market, including supply and demand for meat and dairy products and patterns of change as small producers exit the market.

Staff have also been involved in a Ministry of Agriculture and Forestry project to increase understanding of the major drivers of productivity growth in New Zealand agriculture – including farm extension, the impact of weather, and research and development efforts locally and overseas.

Professor Rae says they are constantly looking at the global picture with an eye on market drivers and trade policies in the European Union, United States and Asia.

"New Zealand has led the way in terms of agricultural policy – by removing taxpayer support for farmers," he says. "But this is a period of great uncertainty in the industry and we must look for new ways to trade and new products to deliver.

"Recent price escalation was the biggest short-term change in the global market since the 1970s, when there was the last sudden peak in prices.

"Those prices have now collapsed as suddenly as they peaked, and are now joined by recessionary forces. With around 80 per cent of agrifood produce in New Zealand being exported, it is key to get trade policy right.

"Massey has a strong reputation in this area and we have a solid platform for moving forward." ❖

# Landcorp partnership brings CT scanner to vet hospital

Professors Elwyn Firth and Hugh Blair prepare to scan a sheep.

Photograph: David Wiltshire

**Consumer** demand for leaner meat has led to the establishment of a new computed technology (CT) scanning unit for large animals.

Located at the University's vet teaching hospital on the Manawatu campus, the scanner will be used for any animals that require it, though the initiative came from Landcorp Farming.

A purpose-built facility costing $1.1million has been constructed around the $470,000 Philips scanner, the only one of its type in New Zealand that has an integrated table to allow for scanning of large animals such as horses, whales and cows.

Professor Hugh Blair says the catalyst for has been increasing demand over several decades from consumers who wanted less fat in their meat.

"One solution to this has been to select genetically leaner animals so that over time, the animals become progressively leaner. However, this has proven a challenge to animal breeders as it is diffi cult to estimate body fat in a live animal. CT scanning provides a non-invasive means of estimating body composition."

Landcorp has used CT scanning in its ram breeding programmes for more than a decade, Blair says, and Massey staff from Institute of Veterinary, Animal and Biomedical Sciences worked with them to establish the new scanning facility.

"Landcorp will use the facility to evaluate ram lambs from their North Island breeding programmes. Other ram breeding operations have also signalled their interest in using the scanner, and in addition to the commercial use, a number of production animal research trials are also lining up to use the facility.

"For example is it possible to measure the amount of brown fat in newborn lambs – brown fat is a primary energy source for newborn lambs and higher levels of brown fat are associated with increased survival rates."

Another example of the scanner's use is in companion animals. Elbow dysplasia is a common condition in many dogs, but is a complex disease with no cure. A dog recently referred to the veterinary teaching hospital had shown outward signs of the inheritable condition. A visit to the CT scanner pinpointed the subtle lesions that result in early osteoarthritis. The dog went straight to surgery with the surgeons armed with valuable, precise, anatomical information that allowed for a more comprehensive approach to therapy.

Radiography has been the diagnostic imaging standard of care in veterinary medicine for decades. It utilises x-rays, just like CT, to shine through a patient and yield a shadow of the internal anatomy on a piece of fi lm or computer monitor.

CT also uses x-rays but the x-ray tube spins around the patient and many, small detectors record the pattern of x-ray absorption in the patient. A powerful computer platform uses the data to generate volume sets of images displayed in thin slices of the patient on the screen, reducing the superimposition artefacts and providing exquisite spatial resolution of the patient's internal anatomy.

This exponential increase in information allows the radiologist to be more sensitive and specifi c in determining the underlying disease process. It also allows the medicine and surgical specialists to more precisely determine the degree of disease and response to therapy on re-check examinations.

Radiologist Dr Angela Hartman says the scanner is being used on Massey clients and on animals that are referred by vets around the country.

"CT scans are very affordable given the amount of information they provide the clinicians involved. They will allow for moresuccess in therapy given the more precise diagnosis."

Another project underway using the scanner is focusing on physiological stress in pregnant ewes.

"With the advanced image manipulation software on this machine, we can investigate some important animal health issues in a way that has never been possible before in New Zealand," Hartman says.

Students are also benefi ting from the new facility. "There are a number of veterinary students on imaging rotations who spend a lot of time here, obviously, but also surgical, medicine and anaesthesia students come in to supervise the individual cases they're working on," she says. "We had to oversize theworkstation room, as compared to human imaging facilities, to allow the number of students involved in the case to learn from the advanced imaging procedure." ❖

Honours student William Aitkenhead, Associate Professor Marta Camps and PhD student Kiran Hina
*Photograph: David Wiltshire*

# Turning waste into wealth

**While** all gardeners know manure helps the flowers grow, manure also gives off greenhouse gases contributing to global climate change.

At the newly established Biochar Research Centre at Massey University, researchers are trying to harness the good qualities of waste, while limiting the bad. Biochar is the result.

Associate Professor Marta Camps has been recruited to help lead the centre. She says biochar can help in many ways.

"Biochar has the potential of carbon sequestration as it is much more stable than the carbon from the material it is made, and it can remain in soils for hundreds to thousands of years," she says. "In New Zealand, there are high methane and nitrous oxide emissions as a result of the agriculture industry. The biochar technology may help New Zealand as a country in terms of meeting its international obligations regarding greenhouse gas emissions."

Biochar is a fine-grained charcoal that is produced by a process called pyrolysis, or thermal decomposition under oxygen-limited conditions. "In addition to sequester carbon, biochar has other potential environmental and agronomic benefits when applied to the soils," Camps says.

Camps and her team, who will soon be joined by another Professor and five PhD students, have been working on different biochars in the laboratory and have recently begun greenhouse trials.

"We'll using biochars made from a mixture of biosolids and green waste from Palmerston North City Council," she says. "We will apply the biochar to sandy soils and study the effects on soil properties and on the growth of rye grass. The idea is to use organic wastes that otherwise would release greenhouse gases and study the potential positive effects of the biochar obtained as soil conditioner."

To make the process more sustainable, it is important to source the waste material that will from close to where it will end up once converted, she says.

The government funds the Biochar Research Centre professorships, and the University's proposal to host the centre was led by Professor of Soil Science Mike Hedley, New Zealand Biochar Network co-ordinator Bill Dyck and acting director of the Centre for Energy Research Atillio Pigneri.

Hedley and Dyck also led the team instrumental in the University gaining another major government funded project. The Life Cycle Assessment Centre will be set up at Massey later in the year, thanks to a $1.3 million contract from the Ministry of Agriculture and Forestry. The centre will focus on managing New Zealand's environmental footprint – from greenhouse gas emissions to water use.

Partners in the centre include AgResearch, Landcare Research, Scion and Plant & Food.

As well as ensuring New Zealand retains its environment, the venture supports the economy by enabling producers to meet the needs of the "green" consumer, a market growing rapidly worldwide.

The University is supporting the new professorship and centre by funding three PhD scholarships and fees, to ensure a team can be appointed.

Key goals for the Life Cycle Assessment Centre include environmental footprinting of existing export products, providing information to export markets on the environmental and resource impact of food and fibre production, and design of low environmental footprint production systems.

The professor will also work with the Centre for Ecological Economics, a Massey-hosted collaboration with Landcare Research.

Key goals for the Life Cycle Assessment Centre include environmental footprinting of existing export products, providing information to export markets on the environmental and resource impact of food and fibre production, and design of low environmental footprint production systems.

The centre will provide specific methodologies for New Zealand products, working with MAF and industry, to ensure environmental footprinting is fair and transparent in New Zealand. ❖

# Markets flock to new device for stock management

**Hours** spent immersed in crowded, dusty stockyards are paying off for industrial design Professor Tony Parker and electric fence manufacturer Gallagher.

Parker and the landmark Kiwi company have joined forces to develop a portable hand-held device that is changing the stockyard work routine.

The Smart Reader is designed to allow farm workers to automatically identify individual animals by a unique electronic number attached to them in the form of a tag or bolus.

In the year since its launch it has enjoyed strong market interest from many countries.

Gallagher's marketing manager Mark Harris, says the device forms an important part of the emerging trend towards improved individual animal performance monitoring and management on farms.

Radio Frequency Identification for livestock is an enabling technology that allows monitoring and recording of livestock performance (weight gain or milk production) at very low cost.

This provides the information for better decision-making around feeding, buying and selling livestock.

The technology also forms a part of livestock traceability schemes that many countries are now applying as part of food safety and authenticity requirements. It's a process otherwise known in the sector as "from pasture to plate" traceability. This serves the dual purpose of allowing farmers to follow the path of their stock, and food markets to know where their end product comes from, providing signifi cant marketing opportunities.

In addition, from a worst-biosecurity perspective it also allows the speedy identifi cation of specifi c livestock and animals they have been in potential contact with.

"If you do that quickly , the impact of a disease outbreak can be contained more effi ciently," Mr Harris says. These two factors are the driver behind the schemes that have been adopted in Australia and Canada. Harris likens the reader to a next generation supermarket bar code reader which overcomes issues of dirt and readability of tags in the farm environment.

By waving the wand containing an antenna over the tag or bolus the livestock number is recorded. Once the reader receives the number it either stores it in its memory or sends it to another storage device such as a smart scale or computer.

Parker says as well as providing for the transfer of individual animal information for livestock inventory management its benefi ts included its convenience with an ability to be portable in fi eld collection.

It is also fully integrated with other electronic devices such as weigh scales, automatic drafting units and compatible databases, as well as providing accurate record keeping for breeding and monitoring animal health risks.

Parker who was the industrial designer on the project, supported by Gallagher's product development team, says the smart reader's features include an ergonomic pistol grip and an integrated finger shield to reduce the likelihood of injury when working in confined spaces with unpredictable animals.

"Stock yards are often noisy and dark environments so you can't always hear the feedback it's equipped with a loud beeper and vibrating handle," he says. Overall form, part, lines and confi guration has been designed to enhance the unit's robustness, water resistance, ease of manufacture and promotion of a strong product brand.

How it looked was also intended to showcase a high value, robust professional electronic agricultural tool that would fit appropriately within the farm environment, Parker said.

One of his former Master of Design graduate students, Matt McKinley, now works for Gallagher's. ❖


Dr Sharleen Harper

# Droplet drift model to improve orchard safety

**Mathematics** graduate Dr Sharleen Harper had no idea when she enrolled as an undergraduate that the intricate equations she loved to devise could be used to solve environmental problems.

Her award-winning thesis featuring a mathematical model of chemical spray dispersal in orchards could help horticultural growers reduce the drift of harmful droplets.

Harper developed the model using an advection-dispersion equation to predict the transport of spray droplets – containing chemicals such as hydrogen cyanamide used by kiwifruit growers – that are carried by the wind and dispersed by turbulence downwind of orchard shelterbelts.

"The orcharding industry is placing a lot of effort into addressing spray drift concerns, and shelterbelts can be very effective tools," Harper says.

Her thesis won the Cherry Prize for the best graduate student paper at the annual Australia and New Zealand Industrial and Applied Mathematics Conference in 2007, making her the second New Zealander to win the prize in its 40-year history. It is also the first thesis to be listed on the Massey University Dean's List of Exceptional Doctoral Theses established this year.

The 28-year-old former Orewa College pupil hopes her research will become available to horticulturists to better manage spraying because "sprays containing chemicals may be hazardous to human or animal health in the surrounding environment," she says.

Harper has been working for the National Institute of Water and Atmospheric Research since May. Among other environmental research projects, she develops mathematical models to predict contaminant removal from city storm water. ❖

# Managing disease risk

**The death** of a meatworker from leptospirosis in 2007 led to a renewed interest in the disease, which affects farm stock but can be contracted by people who come into contact with them.

Leptospirosis is the nation's most common occupationally acquired disease and Massey University researchers are leading the way in research into its control.

Associate Professor Cord Heuer, from the University's Epicentre, is leads the research, part of the Institute of Veterinary, Animal and Biomedical Sciences.

It offers expertise in the understanding and control of disease in animal populations, the transmission of disease from animals to humans and hazards in urine-contaminated environments.

"Last year we did a study of meatworkers and found that 10 per cent of them tested positive," Heuer says. "That showed there was a real risk from sheep of shedding bugs that also go into people."

Meatworkers are in contact with the bacteria in kidneys of up to 25 carcasses on an average working day. Heuer says his team will now widen the scope of the research to include other at-risk groups.

"At the moment we are asking: if meat workers are at risk, who else is? Farmers and other workers in the animal industry such as truck drivers, but also veterinarians are likely to be at risk," he says. "Every year vets do thousands of pregnancy diagnoses so they are close to the source. This year we'll start screening a larger group of farmers and test farm workers and families. Next year we'll also go to veterinary conferences and ask for blood samples."

Heuer says leptospirosis often goes undiagnosed. "The disease can go from almost no symptoms at all to being hospitalised; people can lose kidneys, or even die," he says. "It is characterised by flu-like symptoms. But it doesn't have the respiratory symptoms and there is almost never a sample taken, so it is usually not diagnosed."

Even so, the number of notified cases has doubled in the past year, from 65 to 110. President of Rural Women New Zealand Margaret Chapman says anecdotally rates are much higher.

"Everybody knows someone who has had it in the farming community, if not had a family member affected," she says. "It's often not picked up by doctors and it is very debilitating."

Her organisation has raised more than $100,000 in the past year that has gone towards Massey's research.

Heuer says more work is needed to find the infection sources so recommendations can be made to target them. "Vaccination of animals is the only effective means of reducing the amount of disease in the environment," he says. "Someone needs to pay for it so it is dependent on the economics. In seriously infected deer herds, Massey's Professor Peter Wilson found vaccination can actually increase growth rates, so it has an economic return for farmers. We're now going to look at sheep and beef to see if the same is true."

Associate Professor Cord Heuer

At present, ACC only recognises meatworkers as being at risk of contracting leptospirosis at work.

"If we are able to make a case and say if a farmer gets infected there's a high probability it's from his animals, then that may have an impact there. It would help because more testing and more targeted treatment would be done, followed by more awareness about vaccinating livestock, so that's the only way you can have an impact in the public health sector." ❖

# From feudal to future-focused

**Medieval history** is not a subject you would equate with rural business supremo Craig Norgate, but the feudal era preoccupied most of his study in his first year at Massey University.

In a way the study of olde world history and its emphasis on the land use methods of the day is somewhat apt for a man who has made his name transforming the face of the modern-day dairy, meat and wool sectors.

For if Norgate retains a fascination for the past, his business mind remains firmly focused on the future, as it has been since graduating with a business studies degree more than 20 years ago.

The 44-year-old chairman of rural services company PGG Wrightson says his special interest studies and his major both helped him gain a foothold on the career ladder.

"I did find that the core grounding in accounting and finance stood me in good stead for having a real intuition for that aspect of business, which has allowed me to concentrate on the people side of it."

Outside the lecture theatre, his rugby prospects sidelined by a back injury possibly aggravated by a student job delivering furniture, ensured that Massey was also a very social time for him where his main sporting activity "was on the pool table at the Fitz".

But for every beer he enjoyed, the young Norgate also kept a watchful eye on his business activity. He wryly recounts that his focus equally lay on "my fledgling share portfolio".

His everyman grassroots appeal, equally at home in the bar as the boardroom, has helped ensure his survival in a sector he knows faces more tough times.

The rugby-loving son of the Taranaki heartland was a driving force behind the consolidation of the dairy industry, which led to the creation of New Zealand's largest company Fonterra. At 36 he was the country's highest paid chief executive. At 38 when his contract was not renewed he sought new pastures, eventually leading him to PGG Wrightson, another company forged from Norgate's penchant as a dealmaker extraordinaire.

He wants to do for the wool industry, what he helped do for the dairy sector – now coming down from a decade of heady highs.

"It will [experience heady highs] again unless the sheep industry can reposition both meat and strong wool at the top end of the ethical food and fibre markets respectively.

"Dairy will continue to benefit from growth in developing markets with productivity improvements the key to New Zealand farmers benefiting."

PGG Wrightson has even diversified its interests as far as South America, setting up NZ Farming Systems Uruguay to develop dairy farm operations in that country.

Norgate adds to the mounting sense of expectation and pressure on him by declaring that "the [agricultural] sector is in good heart and will be the key to the recovery of the New Zealand economy".

"It always has been when we've been through a recession," he says.

"Partly because we see a drop in the value of the New Zealand dollar and a drop in interest rates, which underpin the profitability of farming, provided it's based on productivity rather than letting costs get out of hand."

And the tertiary sector has a real role to play around science and around talent too.

"Take the dairy industry for example," he says.

"It's very much underpinned by the science investment made in the 1970s and 1980s, and that gave us productivity that led the world for quite a time. Under-investment in the late 1990s and early part of the decade is still starting to come home to haunt us a little bit and we really need to step up that investment in science."

Craig Norgate – agriculture will be the key to economic recovery

It is at this point he sounds a warning to the new government about keeping election pledges like finding a substitute for the now-scrapped $700 million Fast Forward fund investment into rural sector innovation.

"We're certainly expecting the National Government to keep its promise and replace that with something else.

"It's crucial to the New Zealand economy that we get that R&D [research and development] spending above the OECD average. Agriculture is one of the core areas which can get benefit out of R&D so it's one of the first places for the country we can get a good return for that investment."

Norgate notes that while it could be argued National, with its coalition agreement with the Māori Party, has done more for Māori than was achieved under their previous alignment with Labour, the former government had been more active in the agricultural field than its traditional blue ribbon rural standard-bearers.

"So we've got to be very careful that National does not take that rural constituency for granted. Absolutely they have to deliver rather than saying 'they're our natural voters anyway we don't need to do anything for them'."

Norgate prescribes a three-pronged strategy to boost productivity.

Short-term is about making sure New Zealand uses the science that already exists – adopting existing technology.

Medium-term there is a need to fill the gap that was left by "a decades" of under investment.

Long-term there is a need to keep feeding the infrastructure.

As part of that it was essential to make use of the "one heck of a lot of degree-qualified people in agriculture in New Zealand". ❖

Mark Jeffries

**Mark Jeffries** has been appointed as Massey University's Agri-Food Strategy Manager, responsible for developing strategy to enhance the University's contribution to the agri-food value chain.

Jeffries will work directly with an executive group including Vice-Chancellor Steve Maharey, Professors Robert Anderson and Lawrence Rose (Pro-Vice Chancellors of the Colleges of Sciences and Business) and Distinguished Professor Paul Moughan (Co-director of the Riddet Institute).

Maharey says a key role for Mr Jeffries is to chair an Agri-Food Leaders Group composed of leaders from across the university.

"We know many groups and people at Massey have strong and productive relationships within the agri-food sector," Maharey says. "But in this tough economic time and when increasing pressure is being placed on our physical resources, we want to do everything possible to ensure we have the most effective communication and the most productive collaboration university-wide.

"Mark's background in the sector – at Meat & Wool New Zealand and Livestock Improvement Corporation, and at the Dairy Farmers Federation in Australia – means that he has both the scctor knowledge and an appreciation of the challenges we are all facing.

"Mark is a key part of our agri-food strategy, enabling better, stronger management of relationships with key partners in the sector."

In an additional capacity, Jeffries is working with both Lincoln and Massey universities to accelerate outcomes from the Agricultural Partnership for Excellence. Two projects of strong interest to the industry are a priority.

The first is a centre for farm systems business management. An early focus of the centre will be to develop an on-going continuing professional development programme for farm consultants. The second is a review of the professional development needs at the governance and management levels of the country's leading agribusinesses. Jeffries has an Honours Degree in Agricultural Science from La Trobe University (Melbourne). ❖

# The cornerstone of our national economy

**The agri-food** sector is, and will remain, the cornerstone of the New Zealand economy well into the future. Massey University has powered agriculture in New Zealand for more than 80 years, and is home to specialist agri-food skills and knowledge transfer ability like no other.

Throughout those 80 years, initiatives we have taken to support innovation and productivity in the sector range from building modern infrastructure including a $25 million food development complex, a $17 million animal health and food safety research facility and developed 2000 hectares of farms providing physical resources unmatched in Australasia.

However, infrastructure alone is not the answer. We have continuously provided graduates across a range of agricultural and related displines – from soil scientists to production, vets and agri-business. Our alumni are playing a crucial role in expanding the sector across the value chain.

At present Massey has more than 400 staff and postgraduates working in support of the agri-food business – some of them featured in this publication are internationally acknowledged experts on pastoral livestock, trade policy, veterinary science and dairy production. As well as the core agri-food staff, Massey has solid foundations in our fundamental sciences enabling the applied research. We are proud to partner organisations such as Fonterra, Plant & Food Research, AgResearch and the Massey-hosted Riddet Institute to develop a world-beating food cluster at the heart of our agri-food cluster in Manawatu.

We are prouder still to provide the research and knowledge transfer that underpins much of the commercial work undertaken by these and other companies.

Massey is a world leader in the agri-food sector and we intend to build further on our achievement, taking a leadership role and providing the support required for New Zealand to become a global innovator. We look forward to working with you. ❖

Professor Robert Anderson ONZM, Pro Vice-Chancellor of the College of Sciences and a long-standing advocate for the agri-food industry

Emeritus Professor Colin Holmes (right) and Doris Adeyinka at the ag-hort scholarships evening in May

# Ag-hort scholarships growing

**Close to** $400,000 in funds from 140 scholarships are awarded to Massey's agriculture and horticulture students eachyear, including a new $25,000 award to honour the contribution of dairy science Emeritus Professor Colin Holmes.

The Colin Holmes Dairy Scholarship was this year split to provide two recipients $12,500.

Doris Adeyinka received her earlier education from the Ahmadu Bello University in Nigeria before starting a PhD at Massey University in 2007.

Adeyinka's research addresses a major animal health problem in dairy cattle, the retention of foetal membranes by cows during the calving process. The research involves an in-depth study of bovine placental development and the processes that contribute to retained foetal membranes, so strategies can be developed to minimise the incidence and consequences of retained foetal membranes for the dairy industry.

The other recipient of the new award is Pullanagari Rajashker Reddy, who undertook his earlier studies at the University of Agricultural Sciences in Bangalore, India, before starting his PhD last year. Reddy's project uses precision agriculture technologies to help reduce problems in the dairy industry with loss of nitrates in drainage waters and losses of greenhouse gas nitrous oxide.

The Holmes Scholarships were developed by the Board of Trustees for the Westpac Taranaki Agricultural Research Station, in order to encourage postgraduate research to benefit the dairy industry.

The TrustPower Tararua Wind Farm Research Bursary is also newly established, providing two students $4000. TrustPower's flagship wind farm sited along a ridge of the Tararua Ranges is currently the largest in New Zealand and the best performing wind farm in the world. The stage three expansion in 2007 resulted in three new turbines (the largest installed in the southern Hemisphere) and a portion of the transmission circuit taking a prominent position on the Massey University Tuapaka Research Farm. To recognise and celebrate this long term collaboration, the bursary plan was developed.

This year's recipients of the TrustPower awards are William Aitkenhead, and Christie Creed. Mr Aitkenhead, originally from Masterton but now resident in Cambridge, is a Massey BSc graduate who majored in agricultural science, and has returned to undertake an honours year, specialising in soil science. Creed trained as a teacher at the Pacific University in United States but is now a permanent resident of New Zealand and is undertaking a Masterate in natural resource management.

As well as postgraduate funding, many awards are available to undergraduates including significant scholarships funded by the Stewart family, Horizons Regional Council and the Sydney Campbell Trust. ❖

definingnz

A special agri-food issue of Massey's monthly publication profiling research, success and innovation from New Zealand's defining university.

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Professor Steve Morris with Rebecca Hickson
*Photograph: David Wiltshire*

# Rating the best beef

**Improving** returns from New Zealand beef has seen PhD researcher and lecturer Rebecca Hickson travel the length of Massey's 474ha Tuapaka farm more times than she cares to recall. From daytime visits to observe the cows in the paddock atop the Tararua Range, to eight-hour shifts providing a 24-hour monitoring and assessment of each of the cows as they laboured, her job was to identify the most effective calvers.

Intensively monitoring the Angus herd was a labour of love, Hickson says.

"We watched every one give birth," she says. "Recordings included how long it took, time at each stage, birth time and weight. We watched about 65 give birth the fi rst year and 80 the following."

Calves were followed and intensively tracked, the measure of efficiency used the weight of the calf at weaning divided by the liveweight of the cow.

The Massey team, funded by Meat and Wool NZ and led by Professor Steve Morris, also questioned when heifers were best calved.

"It was more profitable to calve heifers at two instead of three years of age," Hickson says. "Rate of assistance at calving increased with birthweight of the calf and decreasing live weight of heifers but wasn't affected by body dimensions."

Industry surveys had revealed that a difficult birth was implicated in half of the calf deaths between birth and marking, so Hickson's research can be used to minimise those losses by selecting cow and sire size to contribute to ease of calving.

Some progeny will be used for another beef cattle experiment now under way, as Massey assists Meat and Wool NZ to find the most efficient beef cow.

Though farm numbers are stable at around 25,000, beef cattle numbers are dropping, Morris says, with about 4.5 million beef cattle and 1.1 million breeding cows.

"Farmers are increasingly looking to beef breed cross dairy heifers as replacements for breeding cows," Morris says. "So this experiment compares cows of different types to fi nd the most effi cient. Dairy and dairy cross-breed are expected to have increased milk yield and therefore wean heavier cows than the base Angus breed."

With tightening economic conditions, the emphasis is on maximising return to farmers.

"Cow maintenance costs are a large proportion of the costs of keeping a beef cow," Morris says. "For farmers with a 200-cow herd, a 10 per cent improvement in feed efficiency would generate an extra $3350 in net farm income."

The new trial will include some Angus heifers from Hickson's original experiments evaluated over three breedings and two calvings, with Angus-Friesian, Angus-Jersey and Angus-Friesian-Jersey, pure Friesian and pure Jersey cows also evaluated.

"The bottom line is what is the more efficient cow on hill country," Ms Hickson says. "Is a great big cow and a bigger calf best – or a small cow and a smaller calf?" ❖