

AgResearch Workshops 2019

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Two days, 2 workshops

In March, red meat scientists, technologists and processing companies considered the latest innovations and science to help drive transformation of the sector at two annual workshops in Hamilton – the MIA R&D Workshop and the AgResearch Meat Technology Workshop.

More than 100 participants, including representatives from all of the meat companies, packed – for the last time – into the McMeekan Centre on the AgResearch Ruakura campus on 13-14 March.

At the end of the event, after updating participants on the new Food Safety Science Research Centre that is being built on the Massey University campus in Palmerston North and due for opening early next year, AgResearch acting science group leader Dr Stefan Clerens summed up.

“One of the really strong points of this event is that it is a genuine workshop, where participants can really question the speakers and participate in discussion,” he said.

Representatives from all of the meat companies attended the event, the last to be held at the Ruakura campus as was highlighted by Cameron Craigie and AgResearch sector manager Dr Li Day at the popular workshop barbecue, staffed this year by AgResearch meat technologists Mustafa Farouk and Frank Zhang.

Craigie said he was “really happy” with the turnout, especially with the level of company support, and the way the workshop ran.

“We were really pleased with the quality of the speakers, it was well-attended and I felt the format was well spaced,” he said.

Next year the Meat Technology Workshop will probably be held at the AgResearch campus in Palmerston North. The intention is to alternate it with Lincoln in future years, said Craigie.



Dr Cameron Craigie, AgResearch science impact leader for meat and bio-based products, speaking at the CRI's meat technology workshop

(Below) AgResearch food technologists Mustafa Farouk and Frank Zhang get to work cooking the steaks, sponsored by Greenlea Premier Meats, and the lamb cutlets, from Alliance Group, at the AgResearch workshop barbecue. Participants raised a glass to mark the last Ruakura event





Left to right: Christina Moon and Carolina Realini (both AgResearch)



Rowan Ogg (left, AFFCO) and Gary Lindsay (ANZCO Foods Ltd), stop chatting for a photo opportunity



Gary Maclemman (Alliance), Margot Buick and John Brader (MIA Innovation)



PhD students Zack Zhang and Jennifer Kwan of AgResearch presented their work to delegates



Left to right, LASRA research scientists Sujay Prabakar and Rafea Naffa caught up with AgResearch scientist Sam Hitchman at lunch after the MIA R&D Workshop.

MIA - implementing innovation



Professor David Cameron-Smith of the Liggins Institute is leading a team putting together a proposal for the Meat Industry Association

Around 50 meat processing representatives attended the half-day Meat Industry Association (MIA) Research & Development (R&D) Workshop on 13 March focusing on current and future R&D.

MIA members met last November at a 'Big Ideas Day' workshop to see where the gaps are in research, what the scope is for collaborative R&D between companies and for guidance on where industry investment should be made, explained MIA science and innovation manager Richard McColl and partnership manager Kaylene Larking.

Another meat inspection workshop revealed that members expect less manual labour in this area in the future, replaced by more real-time inspection and non-invasive/destructive diagnosis and tools. Larking noted that trust will be essential to underpin changes throughout the chain – a key enabler for that will be robust track and trace systems. It was also acknowledged that it is necessary to look outside the sector for new technologies, such as artificial intelligence, quantum computing, 3D printing and sensing technologies, for example.

The workshop came up with five research concepts to follow:

New MIA Innovation factsheets

Results from MIA Innovation-funded research are starting to come through, said Larking, with new plain English fact-sheets being prepared. The latest research – 'Reducing STEC on-farm' – has just been uploaded to the MIA website, alongside two others, *A Review of Emerging Food Safety Technologies* and *Emerging Pathogens*. More will join them, including previous research papers. All are accessible for MIA members at www.mia.co.nz

traceability, sustainable meat industry, NZ Red Meat Inc meat attributes, artificial intelligence in the meat industry and labour supply.

"We've really got the opportunity to front-foot the value of red meat production, especially in the areas of sustainability and nutritional value," said McColl.



Left to right are: Kaylene Larking (MIA Innovation), Roger Cook (MPI) and Neil Smith (Silver Fern Farms)

“We are looking how to further build our R&D programme under those guidelines,” said Larking, adding two proposals for collaborative work are already in development.

Obtaining scientific verification to underpin claims for red meat exports is essential for the sector. Professor David Cameron-Smith, Chair of Nutrition at the Liggins Institute, University of Auckland, is heading a team put together by the MIA to undertake an industry-funded nutrition project.

Cameron-Smith – one of 10 speakers on the programme – outlined the thinking behind a proposed suite of four interconnected studies to run over the next three years. These will involve a range of research organisations, focusing on the nutritional value of grass-fed red meat in a modern diet. If successful, researchers will be looking at the short- and long-term clinical benefits of beef consumption in a modern “best evidence” flexitarian diet (University of Auckland/Liggins Institute/Otago), advanced analytics of cooked beef (AgResearch), in vitro protein digestion (Riddet Institute), and a clinical study to provide data comparing the health effects of the digestion of pasture-fed beef with plant-based alternatives (University of Auckland).

Another planned project, ‘Vision 2036’, is focused on the future of protein production and technology platforms to support the design of new processing plants, incorporating artificial intelligence, robotics, blockchain, internet of things and sensors, amongst others.

Workshop participants also heard detail on Meat Standards Australia’s new meat quality grading system for cuts from Professor David Pethick of Murdoch University in Perth.

Updates on other MIA Innovation and NZFSSRC work included in the programme were: lamb colour (PhD student, Jennifer Kwan); ultimate pH (Clyde Daly, Carne Technology); extending shelf-life (John Mills, AgResearch); trials of the new bovine ultrasonic knife (Shane Leath, AgResearch); STEC 100% kill (Tana Gupta, AgResearch) and interesting research on airborne STEC in processing (Delphine Rapp, AgResearch); and new collagen research from the Leather and Shoe Research Association (LASRA). Richard McColl also gave an update on two MIA projects: optimising operator ownership (Triple O) and delayed thoracic stick for halal slaughter.

AgResearch meat technology workshop



The meat quality assessment prototype robot fuses four sensor technologies, robotics and artificial intelligence. Future meat quality assessment could be done in real-time in the plant, guaranteeing consumers a high-quality experience. The robot does the work of five people, analysing the same piece of meat in real-time with minimal human error, all in less than 90 seconds, said Cameron Craigie, AgResearch science impact leader for meat and bio-based products

Transformative technologies

Opening the 2019 AgResearch Meat Technology Workshop, AgResearch partnerships and programme director Stuart Hall pointed to the five global mega trends – a hungrier world, a wealthier world, choosy customers, transformative technologies, along with a bumpier ride with globalisation and climate change – that are driving change for the food sector.

Noting the Crown Research Institute's work was "absolutely and utterly world class," he said: "Our consumer-centred, system-based science drives the world's smartest most sustainable land-use systems and the most sought-after food and bio-products."

Referring to the workshop's "Transformative Technologies" theme, he said the rise of alternative proteins means technology is already, "without doubt", influencing New Zealand's markets.

He urged the participants drawn from meat processing, science, government agencies and those servicing the red meat sector to: "Take the opportunity to talk about the challenges we might collectively tackle."

The workshop's three sessions, organised by a team led by AgResearch science impact leader meat and bio-based products Dr Cameron Craigie, heard from 15 speakers spread over the afternoon of the 13 and the morning of 14 March. The three sessions tackled food safety and provenance, processing and quality plus markets and value.

Prototype robot to measure quality in-line

The initial prototype of an in-line robot incorporating meat quality sensors and artificial intelligence to measure intramuscular fat (IMF) content, pH and tenderness of beef, lamb and venison was tested in a simulated commercial environment in November at AgResearch's Food Manufacturing Unit in Ruakura, reported Craigie.

The robot has been developed in the \$4.25 million five-year Ministry of Business Innovation and Employment (MBIE) 'Capturing the Value of Red Meat' project, now in Phase Two – three-fifths of the way through

the work towards development of the device.

The prototype, designed to work within the processing chain, incorporates four sensor technologies – near-infrared (NIR); hyperspectral imaging (HSI) and Raman spectroscopy. Nuclear magnetic resonance (NMR) as well as some additional hand-held NIR and Raman devices were tested alongside the robotic system on the same samples. Testing revealed challenges related to the speed of measurement and sampling area for contact sensors which the team are working to resolve.

"The next steps will be to finalise analysis, to explore how sensor fusion and artificial intelligence could improve the overall prediction accuracy and then to determine which of the technologies to take forward to Stage Three of the Project – to build a pre-commercial prototype and find out where best to site it in-plant," said Craigie.

Hand-held NIR for quality testing along the cold chain

Dr Marlon Reis and Dr Yash Dixit (both AgResearch) also reported on other work within the above MBIE project testing mini hand-held NIR devices, such as NIRScan Nano to measure meat quality at any point along the cold chain between farm and retail. The results were positive, said Reis.

"We think we can use the mini-NIR to capture the background of an animal and sensory attributes of the meat and there is also potential to accurately measure IMF and a wide range of pH," he reported.

Classification of beef eating quality

Keynote speaker, Dr Jean François Hocquette of the French National Institute for Agricultural Research (INRA), reported on the findings of an intra-EU research group, led by himself, looking at ways to reduce the variability in the eating quality (EQ) of Europe's beef.

His team had assessed the grading systems of seven countries and found that Meat Standard Australia (MSA)'s consumer-focused EQ



Keynote speaker for the AgResearch Meat Technology Workshop, Dr Jean-François Hocquette, talked about his team's investigation of the suitability of the MSA system for European meat quality classification

classification was the only one that was classifying cuts, based on EQ, rather than carcass conformation, said Hocquette.

"The consumer doesn't eat carcasses," he commented.

The MSA system also incorporates pre-slaughter factors such as hormone growth promoter implants and allows for the brahman beef breed common in Australia, and also post-chiller factors, such as ageing time and cooking method, the group found.

"Our conclusion was that MSA is highly applicable in Europe, with some adjustments for the European beef herd and production conditions," concluded Hocquette, adding the European herd has a high proportion of dairy beef, similar to New Zealand.

"It might also be possible to combine indices related to sensory and nutritional quality, social and environmental considerations and economic efficiency in order to provide objective assessment of the overall sustainability of beef."

Discussions are now underway in Europe, particularly in France which has the biggest beef herd (19.2 million) and great respect for high quality beef. The MSA classification system has already been introduced at one French premium beef company, Beauvallet, supplied by Limousin producers, where it has been encouraging farmers to supply higher quantities of premium beef.

Hocquette also advised of the establishment of a new International Meat Research 3G Foundation, launched in Europe last July, which is supported by the Specialised Section of the United Nations Economic Commission for (Europe) on Standardisation of Meat (UNECE). The Foundation's Scientific Council directs its R&D activity, while a commercial unit will support meat companies in Europe.



"Sir" Dave Pethick of Murdoch University in Perth explained Meat Standard Australia's meat quality grading. He has been involved in its design

REIMS has potential for predicting consumer preference and meat origin

Dr Alastair Ross (AgResearch) was "very excited" about the potential he had ascertained for the application of Rapid Evaporation Ionisation Mass Spectrometry (REIMS) in the red meat industry, he told the workshop.

More commonly used in the medical field for cancer diagnosis, Ross' research had shown REIMS can help in the rapid measurement of complex chemical/molecular signatures in food to predict consumer preference and origin of the meat.

It is fast and simple to use, he reported, taking only five to 10 seconds between measurements. "It gives a detailed fingerprint, which can be stored, and might be useful for future big data mining and it can also validate the identity of a sample," he said.

Shockwave technology reduces ageing time

CSIRO meat scientist Dr Aarti Tobin has been investigating shockwave technology to see what value it can add to meat. The technology involves acoustic pressure pulses through water, which "smash" cells in food products, like fruit or meat to tenderise them. For fruit, it has been proven to improve juice yield by five to 10 percent, she explained.

"It looks like it could have the ability to reduce ageing time for meat, which will lead to a cost saving with accelerated ageing," she said.

The next steps will be to look at how shockwave affects different muscles, do some protein analysis and how it affects meat structure, said Tobin. A small student project will also look at digestibility.



Delegates at the AgResearch Meat Technology Workshop

Working on extending shelf-life

AgResearch work continues in the important area of meat spoilage and shelf-life extension, which means meat processors can avoid waste of a valuable perishable product and also add value.

AgResearch senior scientist and microbiologist John Mills has been looking at emerging technologies that may be of help in detecting more accurately bacterial communities and quantities. He found that while Next Generation Sequencing (NGS) and Whole Genome Sequencing (WGS) were of some use in adding sensitivity and specificity to microbiological analysis, partly because of the time involved in getting results back, they cannot yet completely replace culture methods.

Other work, finding out how to delay lamb spoilage by interrupting communication within communities of bacteria, was reported by PhD student Zack Zhang. His quorum sensing work has found cinnamaldehyde and garlic effective in degrading the type one auto-inducer (AHL) signals between the bacteria and extending storage life for lamb by two to five days.

PHI refresh

ESR's Dr Beverly Horn covered what to expect in the latest refresh of the Process Hygiene Index (PHI). This involves an update of the index score, an investigation of the potential for a lag in bacterial growth following dressing and the development of a user-friendly online PHI interface.

"We are trying to make it as useful as possible for you," she said. ESR will be calling for volunteers from the meat companies to join the programme soon.



AgResearch senior scientist and microbiologist John Mills – working on better detection of bacterial communities and numbers

Flavour strongest player for lamb

Results from recent studies in the AgResearch Strategic Science Investment Fund (SSIF)'s Flavour Mapping Project were reported in two presentations from senior scientist Dr Carolina Realini and University of Otago's Dr Pat Silcock.

The study aimed to replicate the commercial supply of livestock in New Zealand and involved 10 mobs of sheep of different breeds, sex, feed and farm location. Trained taste panels tested eight lamb loins from each of the mobs, with the sensory properties of the lamb being found to be relatively similar, on a group basis, reported Silcock.

Based on those results, samples from six of the mobs were selected for a further consumer study, involving 160 New Zealanders in Dunedin (run by the University of Otago), who were given the lamb cooked to medium. Then a further 160 New Zealand-based Chinese consumers who had arrived here within the last year, were tested in Auckland (University of Auckland) with lamb cooked to well-done, the Chinese preferred level of doneness.

"Flavour was the strongest player when rating for overall liking for lamb," reported Realini, adding that willingness to pay increases with quality for both with a larger dollar variation for premium lamb. The Chinese consumers said they were willing to pay a \$1 more per kg than their New Zealand counterparts for premium lamb.

Taste Pure Nature launch in California

Beef + Lamb NZ's general manager international market development, Nick Beeby covered the latest news from the development of the sector's "origin brand" "Taste Pure Nature". At the time of writing, a pilot campaign for the brand was poised for imminent launch in California.

The 'Taste Pure Nature' campaign is initially targeting 'conscious foodies' in the state, whose shopping and eating habits have been intricately researched by the B+LNZ researchers who followed a sample around for two and a half months, explained Beeby.

"We're not trying to take on the world, so we're pouring our money into a region, where we know it will work," he said, adding the campaign will have a strong digital component, along with events and advertising.

Underlying the 'Taste Pure Nature' campaign is a nationwide NZ Farm Assurance Programme, which already has 3,500 of New Zealand's 10,500 red meat farms signed up for independent verification of their production systems, plus the sector's Environment Strategy.

The origin brand is designed to work underneath the New Zealand meat exporters' own brands and the those of retailers and foodservice companies.

Other speakers in the workshop provided more information on the use of blockchain in agricultural systems (IBM blockchain leader, Shahid Saiyad), a customisable platform for artificial intelligence (IBM head of artificial intelligence, Isuru Fernando) and an MBIE-funded study looking at Chinese consumers' preferences for fermented meat products, like ham and salami (Anne-Marie Manzano).



Nick Beeby, B+LNZ's general manager international market development updated delegates on the Taste Pure Nature origin brand activity, which was due to launch its first pilot campaign targeting 'conscious foodies' in California the week after the workshops

The culmination of 50 years of research

This is the culmination of 50 years of research," commented Dr Carrick Devine, a former MIRINZ scientist (the forerunner of the meat group at AgResearch) and one of the team who developed tenderisation using electrical stimulation, amongst many other world leading meat technologies.

Congratulating the speakers on covering areas such as flavour, meat quality and emerging technologies, he said: "No-one in those days believed we could reach a stage where tenderness was not an issue in 2019. That does not mean that our meat is always tender, but rather that we now can do it by controlling things.

"As Cameron said, now we are developing the technology to measure meat quality online. While we really can do this, it needs the co-operation of the industry to achieve procedures that would be recognised and be incorporated into the wider industry and not be a curiosity."

More information and copies of presentations are available on request from Dr Cameron Craigie Cameron.craigie@agresearch.co.nz.

Red Meat Sector Conference v9

Delegates from throughout the red meat sector will be drawn to Christchurch this year on Sunday 28 and Monday 29 July for the ninth Red Meat Sector Conference. The programme is currently being drawn up and sponsors sought. More information next issue and at www.redmeatsector.co.nz.

