agresearch
āta mātai, mātai whetū

G36

Annual Report

Rīpota ā-tau

2022

Cover image: Dawn breaks in a frosty Tai Tapu, Canterbury.

Contents
Rārangi take

About us

Ko wai mātou

AgResearch is one of seven Crown Research Institutes in New Zealand. We are responsible for delivering innovative science and research outcomes specifically for the agricultural sector.

Our approximately 880 staff, spread throughout New Zealand, drive economic and environmental sustainability for New Zealand's food production systems. We have three overarching goals on behalf of the New Zealand Government. These are to:

- Help foster and support prosperous land-based enterprises
- Produce research that protects and enhances natural resources in a sustainable fashion
- Contribute scientific understanding to added-value foods and bio-based products to meet evolving consumer demands.

We have two national centres (in Palmerston North and Lincoln) and two regional centres (in Hamilton and Mosgiel).

Chair and Chief Executive's review

Ngā arotakenga o te Heamana me te Tumuaki Whakahaere

AgResearch has reflected on another year with pride and optimism, having navigated the effects of a global pandemic and produced more award-winning science that supports the primary sector's resilience.

The group's loss after tax for the financial year is $1.2 million which includes our share ($0.9m) of the deficit from associates. Revenue for the financial year amounted to $156.5m which is 2% higher than last year's comparative revenue (comparative revenue for last year excludes the COVID-19 response and recovery fund). Operating expenditure for the year amounted to $156.1m and is marginally lower than last year.

The reporting period began, as is custom, with a Letter of Expectations from our shareholding Minister. In it, the Honourable Dr Megan Woods asked us to help accelerate Aotearoa New Zealand's economic performance and address the pressing environmental concerns our sector is facing on its journey toward a sustainable farming future.

The Board welcomed this advice and the opportunity to make formal submissions on the future shape of the research sector here in Aotearoa via *Te Ara Paerangi – Future Pathways*. The consultation process has been the catalyst for cooperation and knowledge sharing within the New Zealand research sector. AgResearch engaged by sharing some of our more innovative organisational initiatives about workforce and e-research. We also shared knowledge from our international research partners about other science system changes, and we look forward to contributing more to the co-design process.

We launched two significant strategies during the financial year.

Tā Mātou Rautaki is our plan to achieve our long-term aim of leading agri-based science innovation. It describes who we are, how we deliver our science, what our future-focused research will look like, and how we will know we are succeeding in our mission.

We identified four areas of focus to create a thriving culture and generate meaningful and enduring impact. They are interlinked, with success in one being tied to success in another. They are the product of an organisational co-design initiative to nurture and sustain strong science vitality at AgResearch.

It is augmented by *Te Ara Tika*, our plan to transform ourselves through te ao Māori. *Te Ara Tika* is future focused, and it identifies specific objectives that require immediate attention in order to deliver stronger outcomes to Māori within a te ao Māori context. AgResearch is highly conscious of our unique position to help build a far more diverse pipeline of researchers. Currently, there is a shortage of Māori choosing science as a career option.

We are making a meaningful contribution to researcher continuity by strategically co-locating our campuses on, or adjacent to, tertiary education institutions. Of critical importance is the need to address a shortage of Māori researchers working in the land-based science sector. This year we worked with rangatahi to launch Te Puawaitanga, our internship programme. This programme is aimed at those who have an interest in science; it enables them to become part of the science sector and, ultimately, influence how it functions in the future.

We are developing facilities to attract new talent. Our new Lincoln facility is a high priority for us. The Board,

management and project team are equally committed to ensuring this new facility on Lincoln University's campus is built on time, within budget and in a culturally welcoming way. We look forward to achieving a number of milestones and unveiling cultural themes and narratives embedded in the project upon its completion in late 2023.

We believe the facility and our new strategy-led focus will help us respond to new areas of growth and demand from our stakeholders.

AgResearch made structural changes to our Senior Leadership Team and the composition and make up of our research teams. The changes to our science structure came after a review and evaluation of the changes we made two years ago.

It found that further refinements were needed if we were to realise the full potential of our research teams identified in the initial review. Our science capability has been condensed into four Science Groups to further enhance the trans-disciplinary nature of our research and the ways our teams work together. The changes also reduced managerial overhead costs and clarified who is responsible for science delivery. We also increased science expertise in our senior leadership. The former Research Director position was divided into four new leadership positions, each with the title of Research Director pertaining to their field of expertise who, along with the new Chief Scientist, are full members of the Senior Leadership Team.

Our strategies ensure we are positioned to support the Government's science and innovation priority areas. They include transitioning New Zealand's primary industries into higher value products and exports; understanding and mitigating the effects of climate change; maintaining the health of land, water and living systems; moving to a low-carbon emissions society; reversing the decline in biodiversity; and maintaining biosecurity, including a focus on pests and weeds.

The New Zealand Government has set clear policy objectives to meet international climate change obligations. Lowering agricultural greenhouse gas (GHG) emissions through innovation and science is a key part of that. AgResearch scientists filled key roles in several He Waka Eke Noa workstreams and cross-sector initiatives that unite the nation's policy makers and sector experts.

It was also extremely noteworthy to finish 2021 on a high note when our research to breed low methane-emitting sheep as a tool to combat climate change won the supreme award at the Science New Zealand Awards. This award is given to the person or team who, in the judges' opinion, has best contributed to Aotearoa New Zealand's economic, environmental, social or cultural wellbeing.

With the support of the industry through the Pastoral Greenhouse Gas Research Consortium (PGgRc) and the government via the New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC), AgResearch scientists have spent over a decade identifying genetic differences which influence how much methane an individual sheep produces. By breeding for this low-methane genetic trait, we demonstrated that, after three generations, the lowest emitting sheep produce close to 13 percent less methane than the highest emitters, per kilogram of feed eaten. While the actual methane reduction at the farm scale will be less when sheep are also being bred for other desirable traits, it is still expected to be significant. The lower-emitting sheep have been found to be otherwise healthy and productive when it comes to their meat and wool. This knowledge is being shared with the sheep industry in New Zealand, with researchers globally, and is also assisting research into breeding lower-methane-emitting cattle.

This is the type of research AgResearch exists for and the type of innovation we will strive to create more frequently. The future looks bright for our organisation. We look forward to many more years of helping our farming sector thrive and grow.

Dr Paul Reynolds QSO
Chair

Dr Sue Bidrose
Chief Executive Officer

Tā Mātou Rautaki

Our strategy

AgResearch achieved a major milestone towards realising our ambition to become a strategy-led organisation when the Board signed off on a new organisation-wide strategy, *Tā Mātou Rautaki*, in late 2021.

The milestone was the manifestation of many months of planning, consultation and observating the success of other organisations. We created meaningful, achievable focus areas and a well-articulated strategy that is in alignment with our focus areas and core purpose.

Tā Mātou Rautaki is our plan to achieve our long-term aim of leading agri-based science innovation. It describes who we are, how we deliver our science, what our future-focused research will look like, and how we will know we are succeeding in our mission.

The strategy also allows for change. We accept that the research landscape and Government priorities will change and evolve. We must be cognisant of and embrace the need to explore new ideas and scan the horizon when we decide what to research.

To that end, we identified four areas of focus to create a thriving culture and generate meaningful and enduring impact. They are interlinked, with success in one being tied to success in another, and they are the product of an organisational co-design initiative to nurture and sustain strong science vitality at AgResearch.

They include:

- Science excellence: Strengthening connections with science vitality and science excellence
- Partnerships: Fostering strong collaboration, including partnerships
- Mātauranga Māori: Fully embedding te ao Māori within our ways of thinking and working
- Smart investments: Ensuring that we invest appropriately in a talented workforce, fit-for-purpose infrastructure, resources and processes.

Supporting New Zealand's agricultural endeavours to be the best they can has always been at the heart of what we do at AgResearch.

Defined by our government shareholder over a decade ago and still relevant today, our core purpose is to use science "to enhance the value, productivity and profitability of New Zealand's pastoral, agri-food and agri-technology sector value chains to contribute to economic growth and beneficial environmental and social outcomes for New Zealand".

Our strategy ensures we are positioned to support the Government's science and innovation priority areas. They include transitioning New Zealand's primary industries into higher-value products and exports; understanding and mitigating the effects of climate change; maintaining the health of land, water, and living systems; moving to a low-carbon emissions society; reversing the decline in biodiversity; and maintaining biosecurity, including a focus on pests and weeds.

Within *Tā Mātou Rautaki* we have an objective-focused framework to help prioritise and integrate all science undertaken by AgResearch. The framework was developed with the knowledge that future food production systems will be significantly different than they are today. It was also created with the knowledge that we must develop new and effective transdisciplinary teams with partners outside our traditional networks. It aims to be the cornerstone of our organisation's strategic and operational thinking and activities across the science and science-support space.

Tā Mātou Rautaki provides AgResearch with the remit to prepare for a future where policy, consumer, technology and market drivers (existing and yet to be imagined) will interact and offer opportunities for transformed agri-food systems. To support New Zealand's primary sector path to transformation, our science must be bold, agile and future focused, and we must have the flexibility to leverage and develop new ideas to achieve this overarching goal. We are compelled to scan the horizon and position our research accordingly and, where needed, shift its balance and invest more resources.

Te Ara Tika

AgResearch's plan to transform through te ao Māori gained further momentum in 2021/22 when we finalised and gained Board approval for our Te Ara Tika strategy.

It directly addresses the barriers Māori people and organisations experience working with a traditional science organisation.

And it signals and strengthens our commitment to our te Tiriti o Waitangi partners.

Ambitious and long-term, a key driver of Te Ara Tika is to bring a unique Māori approach to our science, and create meaningful impact for Māori by:

- Embracing mātauranga Māori as an equal knowledge system
- Being impact focused and delivering to Māori land, businesses and communities
- Honouring the Treaty relationship our partners have with the Crown
- Co-leading, co-designing and implementing to build the capabilities of our partners and ourselves
- Aligning our values to the values of our partners.

Te Ara Tika is future focused. Its mataora (life cycle) and whanaketanga (evolution) will be guided by an implementation plan. This plan has identified specific objectives that require immediate attention in order to deliver stronger outcomes to Māori within a te ao Māori context.

Of critical importance is the need to address a shortage of Māori researchers working in the land-based science sector. A breakdown of the ethnicities employed at AgResearch shows that just 3.3 percent of our workforce are Māori.

Working with rangatahi who have an interest in science will enable them to become part of the science sector. This will influence how the sector functions, and is, therefore, important to ultimately increase the number of Māori staff.

Over the next five years, we will build a pipeline of Māori researchers through partnerships formalised in memorandums of understanding agreements with Māori partners such as Waikato-Tainui, Poutama, Miraka, Te Pū Oranga Whenua and Wakatū Inc. We will strengthen our capacity by seconding staff to and from partner entities. We will also extend relationships within the tertiary sector and continue to support our PhD pipeline and post-doctoral researchers. We will also work with others, such as DairyNZ, Ministry for Primary Industries (MPI) and Māori education initiatives. This includes universities, CRIs, Pūhoro STEM, Kura Kaupapa Māori and the Māori Education Trust.

Instilled in Te Ara Tika is the key principle that our research and relationship with Māori within a te ao Māori context must be co-led and co-designed. This will be exhibited and reflected in our commitment to Māori as our Treaty partners through building partnerships and capability; aspirations and responsibilities that are embedded in our mātauranga Māori focus areas.

We will also embed mana whenua relationships in AgResearch's research centres. An example of this is the work we have started on a cultural narrative that will feature in our new build in Lincoln, a physical manifestation of our relationship with Ngāti Ruahikihiki o Ngāi Tahu. This demonstrates to our traditional and non-traditional partners how transformation through te ao Māori will lead to āta mātai, mātai whetū (innovative and quality science).

Digital blueprint

The New Zealand research sector, having identified the potential of new technologies and large data sets, has embraced new tools and ways of working to improve the impact of research.

However, the rapidity and scale of change has required organisations like ours to develop a strategy to ensure we are using this opportunity.

The AgResearch Board signed off on our Digital Blueprint in late 2021. Its official title is *Te Mahere Matahiko* and it outlines the digital transformation we plan to make over the next decade and beyond.

We consulted widely during the formation of the strategy, drawing on our own internal expertise and using external parties and stakeholders to broaden our knowledge and understanding of the digital landscape. They included the Commonwealth Scientific and Industrial Research Organisation, University of Auckland, Wageningen University, Farmlands Cooperative, Tasman District Council, House of Travel and KPMG New Zealand.

The Blueprint and supporting roadmap are intended to:

- Put our people and science at the heart of the design
- Support our refreshed strategic direction
- Take a modern approach to systems architecture
- Ensure that AgResearch continues to meet its obligations for cyber security and compliance.

We are proud that *Te Mahere Matahiko* aims to create a digital culture founded on manaakitanga (care to others in our domain) and kotahitanga (unity and collective benefit). It focuses on facilitating and supporting digital tools that are accessible and welcoming of all and celebrate our rangapū mahitahi (partnerships).

Te Mahere Matahiko will also challenge our science and scientists to consider new paradigms, methods and digital tools to improve the delivery of research. Where appropriate, we also actively pursue open science principles to share and grow our knowledge and be guided by scientific rigor. When developing the blueprint, we considered not only the challenges but also explored trends in technology, science and innovation ecosystems, and broader society.

Te Mahere Matahiko is supported by a systems roadmap and tactical plan *Te Ara Pūnaha Hangarau*. This outlines our priorities for the next two-to-four years. It has an initial focus on operational efficiency: we want to improve our processes and systems and build on our collaborations with other CRIs regarding cybersecurity and Māori data sovereignty.

We will strive to keep pace with science and technology that allows us to act quickly on new innovations and inventions.

Te Mahere Matahiko seeks to enable the aspirations outlined in *Tā Mātou Rautaki* (2021). Further, we seek to use our digital tools to facilitate transparent, respectful and supportive change as we transition to new structures, new ways of working and digital transformation.

Digital transformation entails a significant change to how we deliver our science, how we operate and how we engage. It is all too easy to focus technology delivery on back-office efficiencies where market offerings are plentiful; however, we aspire to strength in digital delivery for our core purpose and have already detailed an eResearch plan to:

- Grow capability in digital research methods and tools
- Establish a flexible eResearch infrastructure with fit-for-purpose components
- Deploy new digital services that support efficiency, quality and reproducibility of research and other AgResearch operations
- Position AgResearch as a sector leader among the CRIs in the eResearch area.

Case study

AgResearch increases computing power

AgResearch and New Zealand eScience Infrastructure (NeSI) formed a new partnership to design and deliver a future-focused eResearch Platform in 2021/22. The partnership was formed to help AgResearch meet our needs in advanced computing and data methods for our research.

It will also allow us to participate in the growth and development of national research infrastructure. AgResearch is the first to leverage the full power of NeSI's multi-tenant, cloud-native, high-performance computing platform. This all-in-one environment brings together expertise, computing and data, research networks, instruments at the institutional edge, and scientific pipelines and workflows to harness the power of the platform as a super-facility for research.

The infrastructure platform is also being co-designed with Research & Education Network New Zealand as a flexible, scalable environment that will support new communities and other current and future partners looking to leverage and contribute to lifting national capabilities.

AgResearch hopes to achieve capability development and develop tools to drive data capture and deeper data analysis. We will do this to inform the production of better quality agri-food products, increased yields and improved animal health. New opportunities will also emerge for developing computational capabilities across a range of research programmes, from refining data management processes to applications of data science approaches.

Our Science Plan

Our Science Plan is the operational plan that describes the strategic research priorities we will focus on. It will ensure we deliver the science-led innovation needed for the impacts and outcomes described in our *Statement of Corporate Intent*.

Our Science Plan reflects a whole-of-value chain, customer-centred approach that acknowledges the challenges and opportunities across global, national, regional and local scales.

It recognises the increasing complexity of the agricultural innovation system, the availability of new scientific tools, and the focus on contributing to impact.

Our Science Plan acts as a framework to guide the research we lead, where we collaborate, and how we invest the money we receive each year through the Strategic Science Investment Fund (SSIF). It also serves to reinforce the cross-discipline, collaborative behaviour we need to embrace to achieve the objectives and outcomes described in the plan.

The three overarching principles (inner) and seven highly interconnected science objectives (outer).

He haumi atamai

Smart investments

A key plank of our smart investments focus is forging deeper connections with our CRI partners.

AgResearch creates value for the primary sector through smart investments in our people, infrastructure, resources and processes. As a business that puts people first, wellbeing and safety is paramount. Our strategy-led approach of investing in our people was brought into sharper focus with the ongoing challenges New Zealand and the world faced with COVID-19.

Our people and our business successfully navigated the challenges of the Omicron variant in the reporting period by embracing many of the lessons we learned from the previous financial year. Those able and eligible again worked from home in February and March to help reduce the transmission of the virus. Our company-wide vaccine mandate came into effect in January and the small number of staff affected were able to make alternative work-from-home arrangements. The policy added an additional buffer of safety against the virus to go with our COVID-19 Protection Framework. The framework came into effect during the red-light setting phase of the pandemic during which all employees, visitors, contractors, stakeholders and tenants who had access to shared AgResearch campus facilities needed to be double-vaccinated.

AgResearch's approach was aligned to the procedures and protocols adopted by other CRIs, and the response and compliance from our people was extremely encouraging. While at time of writing, the impact of the pandemic is still being felt, AgResearch can be proud of the way we dealt with this challenge and the reservoir of resilience we have built during this time.

Taking a team approach

A key element of our 'smart investments' approach is forging deeper connections with our CRI partners. Following MBIE's *Te Pae Kahurangi* review of CRIs and signals in the subsequent *Te Ara Paerangi – Future Pathways* consultation process, the CRIs signalled a collective commitment to working more closely with these like-minded institutions. To that end, we are building stronger cross-CRI science and corporate services collaborations. We are joining forces in support functions such as technology and digital services, finance, human resources, and communications to share knowledge, resources, and ensure there is alignment in our future directions.

Discussions in the Food Pilot Plant at Te Ohu Rangahau Kai–our shared facility with Massey University and The Riddet Institute.

Building capability

New Zealand has a shortage of Māori researchers. In this financial year, only 3.3 percent of AgResearch staff identified as Māori and the number is consistent across most CRIs. A number of initiatives are in place to correct this imbalance. A new pan-CRI project was funded through the new MBIE Equity, Diversity and Inclusion Capability Fund. By working collectively, CRIs can better share and implement best practices, scale up the reach and responsiveness of each CRI, increase the attractiveness of science-based careers, and minimise barriers for Māori.

The pan-CRI initiative focuses on the implementation of four pathways:

- Understand the drivers and barriers faced by Māori graduates when choosing a career in science and with CRIs and the cultural change required to improve Māori participation in science
- Develop and implement a development and mentoring programme across all CRIs for Māori graduates
- Develop a broad pan-CRI graduate development programme of excellence based on shared knowledge, information, and best practice.
- Align CRI pathways and promote science careers through pan-CRI engagement with universities.

The first hui for Mā Te Ara Pūtaiao ka Tāeo (Enabling Science Pathways for Māori) leveraged our collective resources and networks to grow and develop the talent pool. The project will align pathways and promote science careers in CRIs as meaningful, quality employment options through pan-CRI engagement with universities. It will also provide Māori students and graduates with access to opportunities and visible career pathways across all CRIs.

Impact planning

AgResearch shared an outline with Manaaki Whenua, Scion, and ESR on the Impact Management Framework we are currently designing to address the expectation that researchers and institutions articulate line-of-sight to impact for their research. The pan-CRI Impact Planning and Evaluation Network (iPEN) discussed how we can demonstrate meaningful connections from our research and build on previous work undertaken by the Adoption and Practice Change SSIF programme. The impact framework currently includes five actions: engage, plan, monitor, evaluate, and promote. AgResearch will develop and refine the detail behind each element and socialise progress made with iPEN CRIs.

To supplement previous analysis, AgResearch took the lead on compiling a pan-CRI workforce composition report. The purpose was to create a view of key people-related information across all of the CRIs and Callaghan Innovation. Information was gathered on FTE/headcount, gender, ethnicity, age, tenure, recruitment, and remuneration. A key takeaway from the data is that the people-related risks identified in previous organisational analyses are largely consistent across CRIs. This reinforces the importance of the initiatives already underway to mitigate these risks but also highlights the opportunity for more pan-CRI initiatives.

The refreshed talent management and succession planning approach was carried out, and this resulted in a comprehensive report of key talent and succession risks within the organisation. Information from this process formed the basis of a capability workshop dedicated to addressing succession risks in science. From this, 46 key research areas have been prioritised for succession plans due to the high level of current people-related risk associated with them.

Sustainable progress

AgResearch wants to provide and act as an example to our people so they can feel pride in the place they work. New Zealand's seven CRIs and Callaghan Innovation have formed a formal pan-CRI Sustainability Group. Its initial aim is to collectively decarbonise our businesses and reach net carbon zero status. Much of this group uses Toitū Envirocare (formerly Enviro-Mark Solutions, a wholly owned subsidiary of Manaaki Whenua Landcare Research) for guidance, advice, carbon measurement, and reporting on the progress we make.

We established an AgResearch Sustainability Group and seconded a new Sustainability Lead (half time) from Plant and Food Research to develop an aspirational but robust Emissions Reduction Plan in

line with Government's Carbon Neutral Government Programme. Once the plan is in place, we will focus on developing and implementing a broader sustainability plan. The knowledge we acquire will also be shared with our stakeholders, many of whom are voluntarily embarking on the same journey toward becoming a more sustainable business.

Top: Te Ohu Rangahau Kai in Palmerston North; Bottom: from left, AgResearch Board Director Kim Wallace, Finance and Business Performance Director Tony Hickmott and Naylor Love Project Manager Gary Bowman viewing construction progress in the new Lincoln Facility.

Infrastructure

Our partnerships with the tertiary sector are also of profound importance. We have embarked on a strategy of physical co-location to maximise the potential of our common research interests. To articulate the strategy and augment our building plans, AgResearch and Lincoln University advanced our shared interests, ahead of our campus co-location, by signing a Letter of Intent in a key strategic initiative for both organisations.

The AgResearch Lincoln campus includes the development of a new 7,600 square metre fit-for-future scientific research facility and corporate headquarters for AgResearch on land adjacent to Lincoln University within the Lincoln precinct. The project is progressing well, with completion of groundwork and the concrete foundation earlier in the year. The facilities are due for completion in late 2023, which includes a minor delay due to COVID-19.

Following the facility's completion, AgResearch will provide MBIE with information and updates on the science and research undertaken at the facility in accordance with the Benefits Realisation Plan that was approved as part of the project's Implementation Business Case. It is expected that investment in the new facilities on land adjacent to the Lincoln University campus will increase the return on the investment in land-based research and education in New Zealand and will contribute to a sustainable and productive economy.

We have a five-year capital expenditure plan that provides guidance to our staff and enables us to engage with other potential partners about opportunities to collaborate or share significant future purchases. This will ensure we are able to attract, support, and retain high-quality staff and be an effective partner for national and international collaborations that sustain our culture of innovation excellence. We are also focusing on more fully capturing the collaborative value of Te Ohu Rangahau Kai, AgResearch and Massey University's shared food research facilities in Palmerston North.

Case study

New investment to benefit dairy farm research

Massey University and AgResearch have partnered to boost on-farm research capability and facilities in the lower North Island.

We have developed a new research facility on Massey University's Dairy 4 Farm. This will enable greater interaction between staff and students while also providing scope for a range of independent trials to operate at any one time.

The Dairy 4 Farm, adjacent to Massey's Manawatū campus, has approximately 600 spring calving cows and is the larger of the university's two farms.

The new facilities will boast two rotary milking platforms, which will allow detailed research projects to take place alongside the farm's daily operations. Other new facilities include a covered veterinary area for individual cow measurements and a multi-lane feed pad to enable differential feeding to various groups of cows. There will also be an effluent treating system, a data centre within the shed to store and manage research data, a teaching room, and a biosecurity station.

The partnership with AgResearch will help Massey build on its reputation of contributing world-leading pure and applied research, in partnership with industry, on matters that are of national and international interest. These matters include environmental impacts of climate change, biosecurity issues, animal welfare issues, and economic threats posed by innovations in food production.

The Dairy 4 Farm development at Massey University in Palmerston North. Shown is the covered veterinary area (left), multi-lane feeding pad (right), and rotary milking operations (rear).

Our people

Senior Research Scientist Scott Knowles (left) and summer intern Hanna Friedlander (right) inspect samples contributing to the Accelerated Evolution MBIE research programme at Te Ohu Rangahau Kai in Palmerston North.

Pay equity

While continuing to raise the bar on our organisational health and safety, we are now shifting focus on implementing our Toi Ora Framework to effectively manage psychosocial risks. We have a strong focus on fostering an inclusive and transparent culture in which equity, diversity, and inclusion remain key priorities for us.

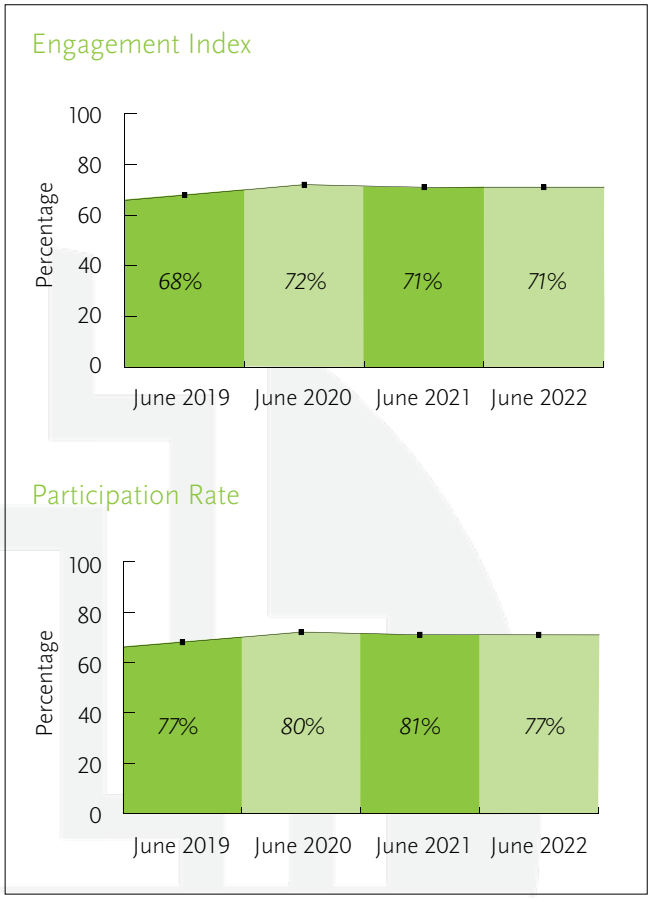
One of AgResearch's strategic initiatives is to provide an environment that is safe, inclusive, and equitable for all our people, where they feel valued. We made more meaningful steps to reduce the gender pay gap and support the delivery of this initiative in the financial year. Our overall gender pay gap was reduced a further 1.1 percent to 14.9 percent and closed several pay gaps in like-for-like roles. We have a specific goal to reduce our gender pay gap to 12.9 percent by 2025. We are also registered through www.mindthegap.nz to commit to pay gap reporting.

We worked in collaboration with the PSA to make improvements to our Remuneration Framework. The aim is to develop a new set of salary scales and a remuneration framework that supports gender pay equity, acts to eliminate gender bias, and reduces the gender pay gap. Alongside this, our science leadership team are working collaboratively and consulting with our science workforce to refresh and update their career pathways (Career Descriptors Review). The aim is to develop dynamic science career pathways in science excellence, entrepreneurship, industry, specialist, and research management. The work is being shared with our CRI partners.

Employee engagement

Our employee engagement survey (Our Voice) was open for participation in March. The survey consisted of 38 rateable items and two open-text questions that asked employees about their experience working for AgResearch.

Our Engagement Index (EI) result was 71 percent which is on par with the July 2021 result. The 'I have the flexibility I need in my work schedule to meet work/personal needs' question scored an 88 percent result. This is above the New Zealand Best in Class benchmark and is one of the initiatives the organisation has been driving as part of the Equity, Diversity, and Inclusion programme of work. Other themes that came through on what could make our employees' work experience positive were 'process, bureaucracy, and admin', 'tools and technology' and 'one team and collaboration'.

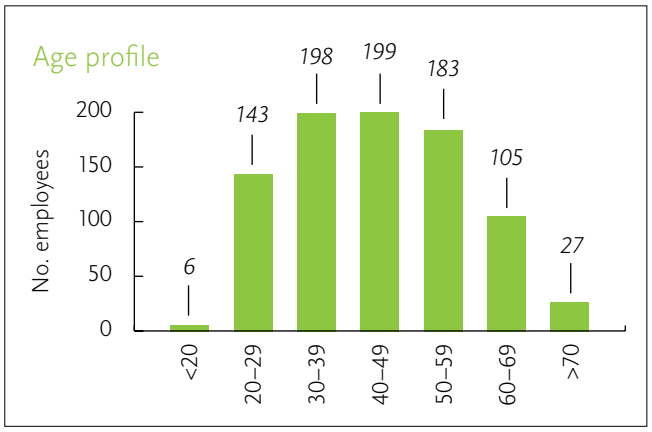


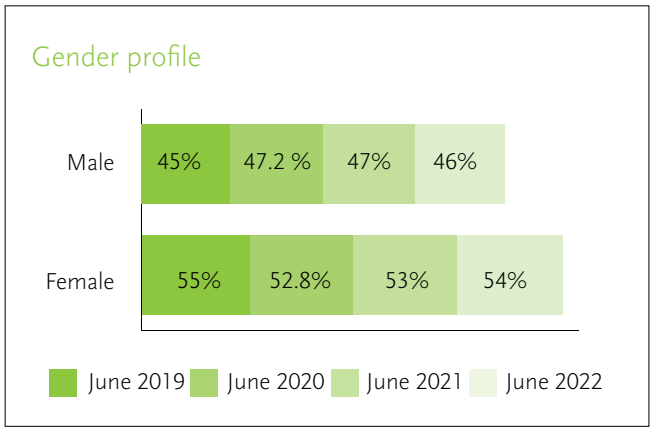
The following provides a snapshot of our people as at June 2022:

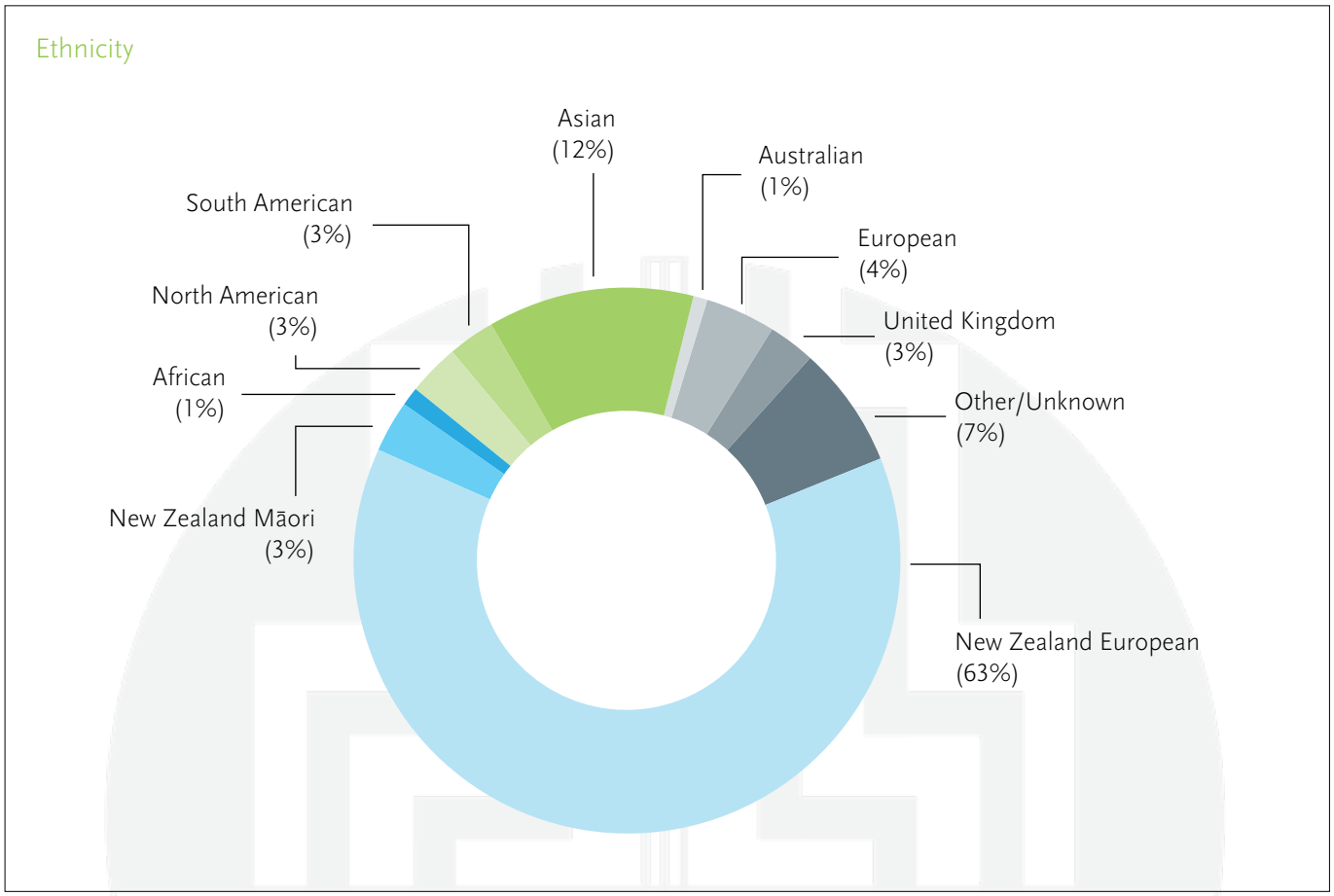
As at June 2022, AgResearch had 881 permanent, fixed-term and casual employees, studentships and contractors.

881

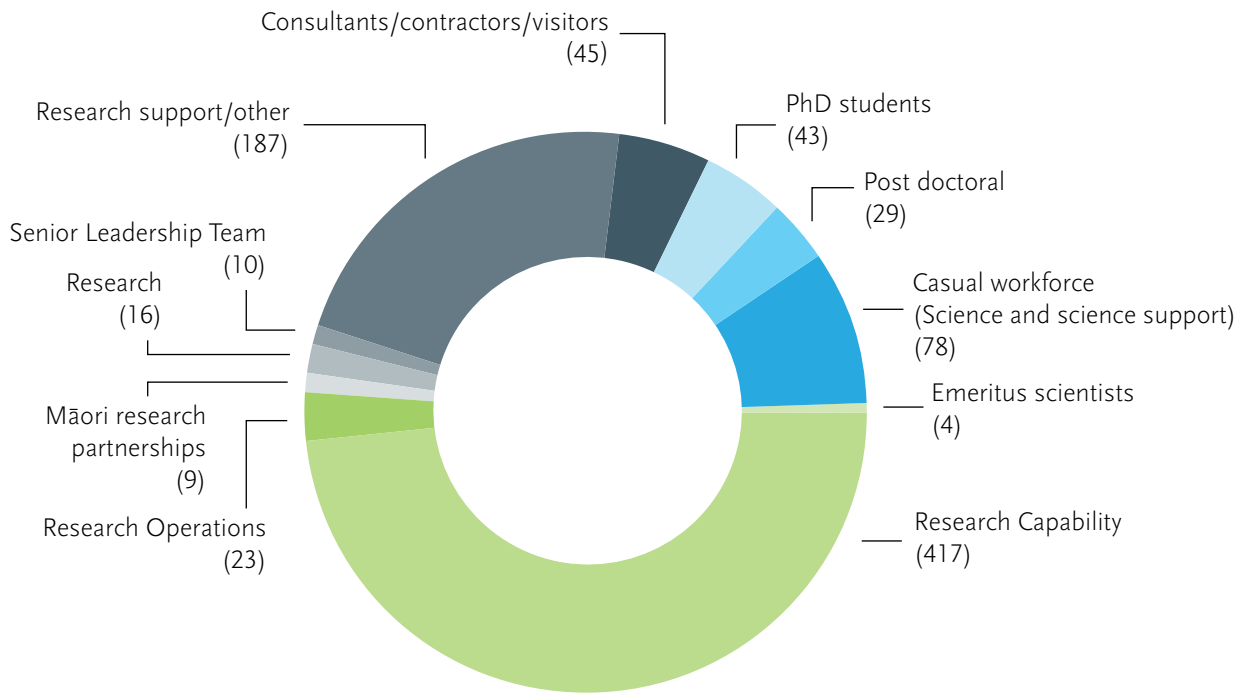
Our people are multi-cultural, originating from all corners of the globe. 53 percent are female, 47percent are male.



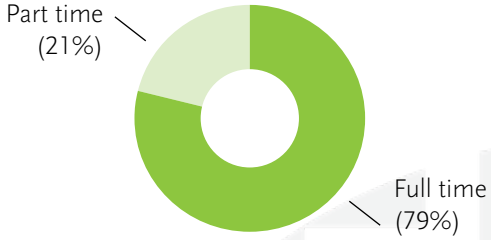




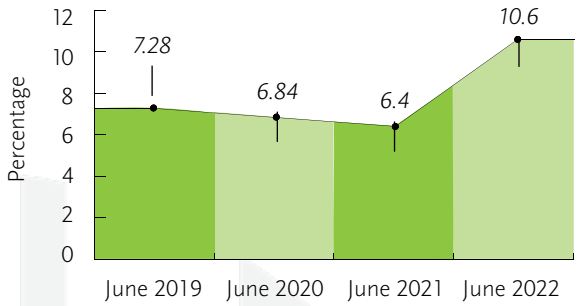
Divisions of workforce



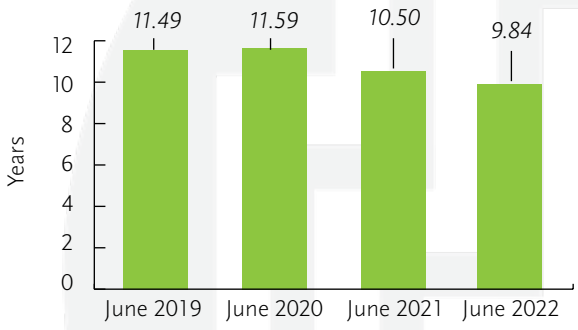
Employment type



Employment turnover



Average tenure



Ngā hononga

Partnerships

We are proud of the leadership role we play in the New Zealand research and development sector.

AgResearch reached a significant milestone in our history during 2022: we turned 30. For three decades we have been helping New Zealand's primary industries transition into higher-value products and exports by providing science solutions and innovations.

While 30 may not be very old in a scientific sense, the milestone was an opportunity for us to reflect on our contribution and that of the wider-CRI family over the past three decades. AgResearch was established under the Crown Research Institutes Act 1992 and was formed out of the pastoral agriculture research activities of the Ministry of Agriculture and Fisheries and the Department of Scientific and Industrial Research.

Thirty years ago, we had five research divisions: dairy and beef; forage; animal health; environmental agriculture; and sheep, deer, and equine.

Our remit now extends across the entire primary sector value chain. By international standards, we are a smallish organisation with a big job. And we are proud of the leadership role we play in the New Zealand research and development sector.

One of the keys to this success is the deep and lasting partnerships we have forged with many agri-business entities and organisations. The strength and value of these relationships came to the fore during the current financial year, which was a period in which our stakeholders endured unprecedented challenges and change.

Climate change is a cause for much uncertainty in the primary sector, as we collectively attempt to adapt and find new ways to mitigate the effects of our changing atmosphere and environment while balancing the changes we make in an increasingly fragile ecosystem.

Freshwater quality and availability, threats to our biodiversity, and resource scarcity have far-reaching, downstream effects on our food security. We know the size of the challenge ahead and we have an appreciation, thanks to scientific evidence, of the urgency required to deliver solutions.

AgResearch partners with government agencies and stakeholders to tackle these problems. We do so in an integrated way that provides the necessary scale and maximises the impact of our research.

Some of our key researchers provided critical science input into the workstreams of He Waka Eke Noa – a government, industry, Māori partnership – which published its key recommendations in June 2022. We also contributed alongside another government, industry, Māori and science initiative – MPI's Biogenic Emissions Reduction Science Accelerator (BERSA) – which did a broad assessment of mitigation research and development (R&D). This culminated in a long-term R&D strategy and will guide work within the new Centre for Climate Action.

Agricom hosted representatives from AgResearch and Plant and Food at their Marshdale farm in Oxford Canterbury to discuss pasture diversity. The farms 'perennial pasture' block (shown) is made up of 28 species including tall fescue, mustard, radish, crimson clover, herbs, legumes and 8 different grasses.

Māori partnerships

Te Ara Tika is our ambitious long-term plan to transform AgResearch into an organisation that brings a unique Māori approach to our science. Underlying Te Ara Tika is the key principle that our research and relationship with Māori within an ao Māori context must be co-led and co-designed. This will be exhibited and reflected in our commitment to Māori as our Tiriti partners through building partnerships, capability, aspirations, and responsibilities that are embedded in our mātauranga Māori focus area. The flow-on effects will be numerous.

Partnerships lead to better science outcomes. We also believe we can help create bridges and foster more meaningful relationships between other government entities and institutions and private entities, given the leadership role and forums we are lending our scientific expertise to. Many of these organisations are at the government and primary sector interface. They include our continued hosting of the New Zealand Greenhouse Gas Research Centre.

Crown Research Institute collective strength

A key organisational priority for AgResearch is to ensure we play a strong role in sharing knowledge and creating efficiencies across CRIs, which was a key recommendation from *Te Pae Kahurangi* review. In FY22, we contributed to several pan-CRI and cross-sector initiatives.

For example, we took a leading role in sharing our knowledge and creating scientific leadership regarding the latest innovations, implications, and potential of genetic research and genetic technologies. We hosted a 'National Conversation around Genetic Technologies' forum with the Prime Minister's Chief Science Advisor, Dame Juliet Gerrard. We also held a pan-CRI session with Food Standards Australia NZ to increase understanding and open dialogue.

Supporting the mānuka industry

Checking hives in Hurunui.

AgResearch is helping provide evidence on the geographic origin of mānuka honey. AgResearch has invested in Rapid Evaporative Ionization Mass Spectrometry (REIMS) technology. Our burgeoning food provenance capability came to the attention of Te Pītau Ltd (which evolved from the Mānuka Honey Appellation Society). The company commissioned us to run a honey pilot study to support the claim that New Zealand mānuka honey is distinct from Australian honey, which is derived from trees genetically similar to mānuka. The REIMS metabolite fingerprint clearly differentiates New Zealand and Australian honeys, based on 70 honeys provided by Te Pītau Ltd.

Methane vaccine programme review

AgResearch scientists participated in a Methane Vaccine Think Tank programme review run by the Pastoral Greenhouse Gas Research Consortium (PGgRc) and the New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC). The process is targeting the whole of PGgRc's programme, which supports researchers from AgResearch, University of Auckland, and DairyNZ, plus a patent attorney, a strategic advisor (Argenta) and an allied animal health company.

Importance of collaborations

Nationally, we remain committed to a range of collaborations, including Better Border Biosecurity, a long-standing collaboration that receives direct SSIF support; New Zealand Food Safety Science and Research Centre; FoodHQ and other projects with Massey University and Riddet Institute; Bioresource Processing Alliance; Bioprotection Aotearoa, the next iteration of Bioprotection Research Centre; and a joint postgraduate school in Food Transitions, with Lincoln University and the University of Canterbury.

National Science Challenges are another key collaborative vehicle that we remain committed to. We are the host of, as well as collaborators in, Our Land and Water National Science Challenge. We have research collaborations in the following Science Challenges: Biological Heritage; High-Value Nutrition; Science for Technological Innovation; and Building Better Homes, Towns and Cities.

Internationally, we continue to build global science collaboration and reputation, support - directly and indirectly - New Zealand stakeholders abroad, and work with international companies. The latter helps support world-class capability development by exposing our researchers to international trends and connections. We also support New Zealand's connectedness through science diplomacy. We do this through our work with government agencies, such as New Zealand Trade and Enterprise and the Ministry of Foreign Affairs and Trade, which encourages government trade and policy goals.

Partnering on animal welfare

Cheryl O'Connor presenting at the Primary Industries Summit.

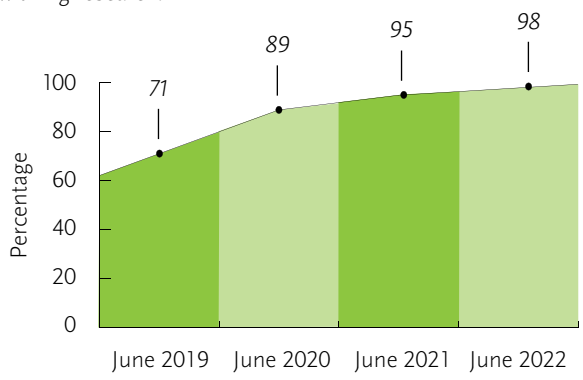
AgResearch had a strong presence at the Primary Industries Summit in Christchurch 2021. The annual event run by Federated Farmers provided us with the opportunity to champion new animal welfare research standards in front of a farmer- and sector-based audience. AgResearch's animal ethics team has played a leading role in drafting and signing a New Zealand Agreement on Openness in Animal Research and Teaching. The agreement is a set of industry guidelines for research organisations that use animals in research. Drs Cheryl O'Connor and Jim Webster, who both spoke at the summit, have been integral to the standards renewal process and both represented AgResearch in a session on 'Increasing transparency in animal welfare'.

Partnerships

Our annual Stakeholder Survey provides a snapshot of how our stakeholders view us:

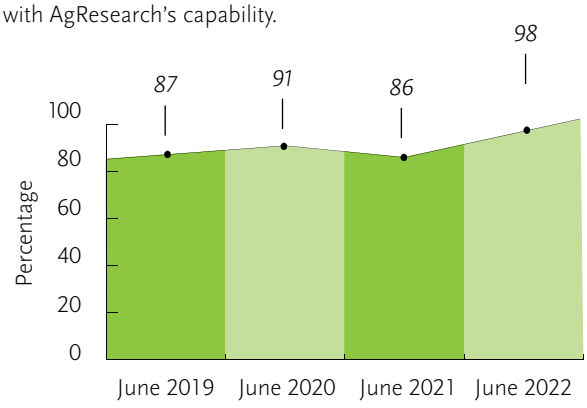
Stakeholder familiarity with brand

Percentage of stakeholders that are 'very' or 'quite familiar' with AgResearch.



Stakeholder familiarity with capability

Percentage of stakeholders that are 'very' or 'quite familiar' with AgResearch's capability.



92%

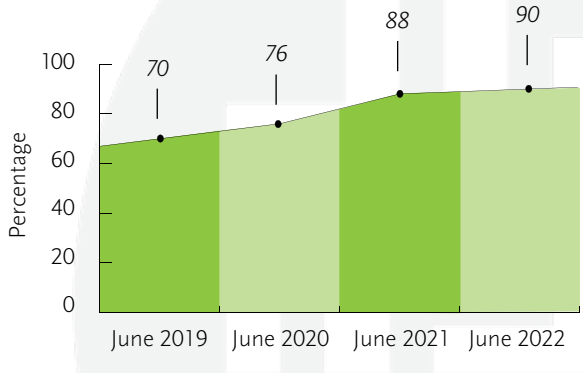
of stakeholders rated their current relationship with AgResearch as 'good or better'.

98%

of the stakeholders interviewed were able to freely identify one or more current strength of AgResearch.

Level of service

Percentage of stakeholders who rated the service received from AgResearch as 'good or better'.



Source: AgResearch stakeholder relationship survey: Peter Glen Research.

Case study

McDonald's beef up regenerative farming research

In a partnership that links scientific research with burger fans, McDonald's and AgResearch, as science provider, joined forces on a regenerative farming trial during the year to advance our shared interest in positively influencing the sustainability of pasture-based beef production.

The two-year project aims to improve soil health and environmental performance as well as alternative stock grazing management to boost the cycling of nutrients through soil. Compared with conventional grazing management practices, cattle will be offered longer pasture and grazed at higher stocking intensity for a shorter time, leaving greater 'residual' pasture after grazing.

The high-intensity stocking is intended to trample more pasture and, together with the greater residuals remaining after grazing, allow an increased proportion of nutrients to be returned directly to the soil in a more evenly distributed way.

"It is becoming increasingly important to identify factors influencing the sustainability of pasture-based beef production systems, given the changing climate, consumer expectations around food production systems and resource use, and environmental and regulatory requirements," says Dr Gerald Cosgrove, senior scientist and project advisor at AgResearch.

As well as exploring stock grazing and pasture cover management techniques, the study is also aimed at encouraging increased carbon storage in soils; this would contribute to a lower environmental footprint.

"This research is not only about achieving better environmental performance, but we're also aiming to show that we can do it without sacrificing beef production. As scientists, working with a top global brand like McDonald's is a great opportunity to share what is possible and to further position New Zealand as a leader in sustainable farming," says Cosgrove.

As one of the largest buyers of beef globally, McDonald's is actively progressing goals to drive position change in the global food system. During the financial year, the company announced a global goal to decarbonise all of its operations, including the supply chain, by 2050.

Mātauranga Māori

Māori knowledge

Over 20 AgResearch staff visited Pakihiroa Station on the East Cape to learn how the station employed Māori values across all aspects of running of the station.

AgResearch is seeking to enrich our science in a uniquely Aotearoa-based way by building our understanding of Māori knowledge systems. We believe Māori-centred and kaupapa Māori research will enhance our reputation for impactful science and deepen and broaden its adoption.

Our journey to embrace a uniquely New Zealand approach and deepen our relationship with tangata whenua mirrors that taken by many organisations when trying to broaden their outlook. They do so because they can see benefit in diversity of thought.

As a traditional research organisation, we have put programmes, strategies, and investments in place to embrace knowledge from different cultural perspectives because, ultimately, it will lead to more rounded and considered scientific outcomes.

In doing so, we want to become leaders in adopting principles of co-design and co-innovation, share responsibilities and risks, and build interdependence. To that end, we made some tangible steps toward this long-term goal in the reporting period. Foremost among these were a number of key appointments to boost our expertise and capacity.

Ariana Estoras was appointed as Director of our new Māori Research and Partnerships Group. Her appointment and the new structure of the Māori Research and Partnerships Group is central to AgResearch's vision to have the mātauranga Māori knowledge system on equal footing with western science. The group is led by te ao Māori values and tikanga-based principles. This enables more Māori-centred and kaupapa Māori research alongside our Māori partners in order to better respond to Māori needs and better deliver to Māori aspirations. Ariana provides additional leadership on AgResearch's Senior Leadership Team alongside Chris Koroheke, our Urungi.

Dr Dione Payne has joined AgResearch's international Science Advisory Panel (SAP). Dr Payne replaced Charlotte Bear from the US Department of Agriculture. Dr Payne brings important ao Māori and mātauranga Māori knowledge and skills to SAP. Dr Payne is Assistant Vice-Chancellor (Māori and Pasifika) at Lincoln University.

AgResearch and Manaaki Whenua strengthened our commitment to our mātauranga Māori programmes with the appointment of a joint Māori Capability Lead (Jo Petrie). The jointly funded and shared resource is ensuring our ao Māori learning and capability development offerings are fit-for-purpose to deliver on our strategy.

Collective expertise was also harnessed through the cross-CRI Crown Research Institute Māori Researchers Group to provide an ao Māori perspective on integrated farm planning for MPI. This group has also been approached for advice from Māori agri-business investment programmes within MPI and Te Puni Kokiri as well as Māori land collectives. The next step is for the group to formalise terms of reference.

We also drew on expertise in a pan-CRI team, which finalised the terms of reference for developing Māori data sovereignty principles in consultation with Te Ara Pūtaiao (Crown Research Institute Māori Leadership Group). The next step in this work is to start identifying data that will fall within the auspices of data sovereignty.

Case study

Research strengthened by te ao Māori

Te Pū Oranga Whenua is a kaupapa Māori organisation seeking to redesign land use and development in a way that works for whānau. It is an inter-regional collective of diverse Māori agri-businesses led by wāhine. The organisation builds the capability of Māori agri-businesses so they can be more resilient and self-sustaining and achieve more than they could alone. Te Pū Oranga Whenua's usual activities are conducted for charitable purposes, whether relating to the relief of poverty, the advancement of education, or helping whānau thrive in their relationship with Papatūānuku.

AgResearch and Te Pū Oranga Whenua have built a relationship, described in a formal Heads of Agreement signed in May 2022, that formally explains our shared vision to use tikanga-led science and research co-design in our future endeavours.

AgResearch recognises that the world is rapidly changing, and we are seeking ways to respond to this change in partnership with Māori agribusiness land stewards and other partners. AgResearch's New Zealand Bioeconomy in the Digital Age programme seeks to gain a shared understanding of how Māori see a transformed agricultural sector, what is needed to achieve this, and the role that research can play to realise these needs.

We want to use te ao Māori frameworks to guide innovation and digital technology for Māori land utilisation. Te Pū Oranga Whenua is our guide on this journey and has introduced us to organisations that we can support. They include the Trustees of Ngāporo Waimarino Forest Trust (and Pipiriki Incorporation). In partnership with Te Pū Oranga Whenua we have started to assess the Trust's future land use options and build the capability of mana whenua. We are also helping the Trust extend the network of people who could contribute to achieving identified aspirations.

Te Pū Oranga Whenua has also helped us create a relationship with three farms that want to adopt biological farming practices and a 'farm gate to whānau plate' business model. The relationship is integrating the western theory of a circular bioeconomy with a traditional ao Māori-led approach that enables the creation of future-smart, sustainable, circular agri-food systems that eliminate waste and optimise resource use.

Enabling Te Ara Tika

AgResearch has invested $2.2 million through the Enabling Māori SSIF allocation. This is increasing to $3.9 million in FY23. This investment supports projects and relationships between AgResearch scientists and Māori partners and builds the current and future pipeline of Māori research capability.

AgResearch's mātauranga Māori learning and development programme is designed to build base-level capability across AgResearch to support Te Ara Tika, the plan to transform AgResearch with te ao Māori.

We currently offer six formal learning and development opportunities to build awareness, knowledge, skills, and confidence in te ao Māori. This approach is underpinned by our mātauranga Māori competency framework, which helps us target attendees for each of our offerings.

Demand for places continues to be high, and we have added to the programme to include an ao Māori eLearning module which provides an insight to how AgResearch works within the Māori world. It is available to the entire organisation and is part of our induction process to capture people new to the organisation. Additional cultural competency training has been organised to help prepare members of our key research programmes to interact and work with Māori stakeholders.

We are also part of a pan-CRI project team that is developing a framework (through MBIE Equity, Diversity, and Inclusion funding) to establish a Māori graduate development and mentoring programme. This will be rolled out across the CRIs, with the goal of increasing Maōri participation across the CRIs graduate and retention programmes.

Our learning and development programme ranges from formal classroom-style opportunities through to immersive workshops. Strategy and Communications Director Marie Bradley (standing) takes part in a discussion with colleagues during their immersive trip to the East Cape.

Māori engaged in science

One of the key pou (pillars) of Te Ara Tika is to build Māori capacity. This includes providing pathways for rangatahi into AgResearch and opportunities for fresh minds to explore, collaborate and contribute to solving the challenges of our future. Our Early Career Ambassador (Māori), Louise Hennessy is focused on outreach with rangatahi including our Te Puāwaitanga internship programme. The meaning behind the name Te Puāwaitanga is 'to flourish' or 'come to fruition'. We were pleased to support seven Te Puāwaitanga internships and five Pūhoro STEM Academy interns over the summer. The interns had the opportunity to co-design a research project or were placed in an existing project. They could build their skills and confidence undertaking research that incorporates te ao Māori and mātauranga Māori into agricultural science.

We signed an agreement of collaboration with Te Pū Oranga Whenua as part of our New Zealand Bioeconomy in the Digital Age science programme. Our researchers work with the Māori collective, including Ngāti Pāhauwera Development Trust, Paroa Trust, Grandad's Beef, Ora Innovation Group Ltd, and Ngāporo Waimarino Forest Trust. We worked as a single transdisciplinary team to trial new ways of working together to understand what matters for Māori businesses and communities when it comes to transformation of the agricultural sector by digital technology. Te Pū Oranga Whenua will lead research areas blending te ao Māori and digitisation design to meet Māori needs and desired outcomes for Māori land utilisation.

Over the next five years, we will also continue to invest in our relationship with Waikato-Tainui. This will build from last year's memorandum of understanding in areas of mutual interest to lift capability and enhance environmental outcomes, especially water quality. We will research non-chemical animal remedies through indigenous flora as a component to the holistic kaitiaki farm plan model with the Kohimarama Research collaboration (Ngā Uri o te Ngahere Trust, Pakihiroa Farms and Tauhara North 2 Trust).

We are partnering with Poutama, an independent charitable trust, established to provide business development services to Māori through our Kotahitanga agreement. This will maximise the skills, networks, and capabilities within the orbit of both organisations to help whenua-based and Māori food and beverage businesses flourish.

We have agreed a part-time secondment of AgResearch scientist Dulantha Ulluwishewa into Wakatū Incorporation. This serves as an extension of our agreement signed last year to advance our mutual areas of interest, both commercial and scientific. Our agreement also extends our geographical reach and relationship building with iwi in Te Tauihu (Nelson, Tasman, and Golden Bay regions).

Case study

Unlocking Mamaku's potential

AgResearch's relationship with Māori skincare company Ora Innovation Group Ltd was further cemented in the 2021/22 financial year with a focus on three key areas: developing knowledge to sustainably grow and harvest mamaku for commercial supply, developing intellectual property (IP) regarding processing of mamaku, and identifying future opportunities for research collaborations.

Mamaku (New Zealand Black Tree Fern) has traditionally been used by Māori as a rongoā for treating various skin conditions, and clinical trials conducted by AgResearch and Ora Ltd have shown that mamaku extract has excellent potential for the management of eczema and other inflammatory skin conditions.

This project started as a KiwiNet-funded programme to turn mamaku into an extract, then became an MBIE-funded Vision Mātauranga Capability Fund programme that provided scientific validation of the effectiveness and value of mamaku as a skincare ingredient, and now Ora is moving into AgResearch's pilot plant in Ruakura.

This past year, as part of an MPI funded project, AgResearch scientists visited a number of Māori landowner groups who are looking at mamaku as a potential land-use option and, if feasible, be a supplier of raw material to Ora Innovation. AgResearch also planted mamaku trees on our Ruakura campus in an ongoing signal of our long-term interest and support in the research. The knowledge we attain from the trail (we will begin to understand the plant better and the conditions needed to make this a viable land-use option) could be of direct benefit to landowners who would like to grow mamaku.

The next stage in the journey is building international research collaborations to understand the science of mamaku. This will involve understanding mamaku's composition and characterisation and its bioactivity. The research collaboration also aligns with Ora's aim to grow market penetration into China, including rebranding and product development in line with Chinese consumers.

Case study

Te Puāwaitanga success

AgResearch successfully relaunched and revitalised our longstanding Summer Student Internship Programme during the 2021/22 summer. We hosted seven Māori interns and five Pūhoro STEM Academy interns to feed into our Māori capability pipeline.

The internship programme, now known as Te Puāwaitanga (meaning 'to flourish'), is designed to create a thriving community of Māori students within AgResearch. We want these students to feel well supported and understand the value of diverse perspectives and knowledge, and use manaakitanga and whanaungatanga as guiding principles in their work.

The internship programme was held to coincide with the standard AgResearch Summer Student placements. However, the approach for Te Puāwaitanga is very different from previous and current internships. Instead of advertising for students to join specific research programmes, this programme seeks out talented students and then matches them to AgResearch programmes or initiatives based on their background, skills, and future aspirations. Interns co-design the contributions to their research projects with their supervisors, Māori mentors, and programme managers.

Over the 2021/22 summer, Te Puāwaitanga interns were brought in as a rōpū with regular meetings, presentation practices, and wrap-around support (including science support, personal and professional development opportunities, and holistic support). This model will continue to be used, as it ensures students are well supported, both personally and professionally.

Interns from AgResearch and DairyNZ attended a Wānanga in Maungatautari where they could connect and share experiences.

The students represented 10 iwi across the motu and stemmed from five universities and one kura kaupapa. The internship programme brought together four science teams, one of AgResearch's enabling platforms, and one MBIE programme. At the completion of the internship programme, AgResearch offered one intern a fixed term contract and two interns casual contracts. One intern was offered a new opportunity at Lincoln University as a result of his engagement in Te Puāwaitanga programme; the remaining students returned to complete their studies at university or kura. The support provided to students by this internship programme continues beyond the duration of the internship itself, with regular post-internship rōpū catchups.

He hiranga pūtaiao

Science excellence

AgResearch is taking a more holistic view on what science excellence is and looks like.

Science excellence is the foundation for Aotearoa New Zealand's CRIs.

Scientific excellence not only means excellence in scientific research, but also includes excellence in connecting science to stakeholders and society; teaching and mentoring scientists; and providing science management and science advice to policy makers.

AgResearch invests considerable time and expertise in defining, describing and measuring scientific excellence and its impact on society. Traditionally, it was defined by scholarly achievement relevant to the topic context; recognised world-class capability; transformative science in terms of risk; novelty, scientific and technical stretch; and generating internationally renowned new knowledge.

During the reporting period, AgResearch has reimagined and redefined what science excellence means to us, our future direction, and the end users of our science. The catalyst for the process to embed science vitality into our organisation was guided by the aim to create a learning environment that fosters creativity, inclusiveness, trust, and connectivity.

We consider science excellence as more than an output. And to signal our commitment to this approach, we became the first New Zealand research organisation to sign up to the San Francisco Declaration on Research Assessment (DORA), a worldwide, cross-disciplinary initiative. This initiative recognises the need to improve how scholarly research outputs are evaluated. It also encourage institutions, researchers, funders, publishers, and other key stakeholders to develop and promote best practice.

Since its inception in 2012, DORA has transformed itself from a website collecting signatures to a broader campaigning initiative. Organisations from across the world share real examples and practical guidance to inspire and enable the research community to reshape how we evaluate research. Fairer research assessment marks a move away from the continued incentivisation of traditionally narrow definitions of academic success. These narrow definitions have been credited with contributing to workplace stress (including bullying), high levels of competition, and job insecurity across research organisations worldwide.

As part of building a culture of creativity, collaboration, and inclusiveness, our Open Innovation Portal–a virtual ideas repository and factory where researchers can upload, view, share, and provide feedback on ideas, funding applications, science research design, and other innovations–is changing the way our scientists communicate, collaborate, and accelerate ideas into action. At the time of writing, the portal had over 100 ideas in various iterations and stages being actively shared, commented on; this draws on the wisdom, experience, and expertise of 300 plus active users.

Benchmarking our science

AgResearch's strategy, Tā Mātou Rautaki, has seven science objectives that act as a roadmap and reference point for our science leaders. To that end, we fine tuned the structure of our science leadership teams during the financial year to reflect our aim to be a strategy-led organisation. Our science groups now operate under the umbrella titles of Digital Agriculture, Ethical Agriculture, Resilient Agriculture, and Smart Food and Biobased Products. Working alongside Science Group Managers and Science Team Leaders, our Science Objective Champions and Insights Team provide direction, oversight, and monitoring as part of assessing delivery of impact against our science objectives. This will feed into our evidence-based strategic and operational decision-making to better prioritise where and on what we focus our research.

We are continuing to invest SSIF in an enabling platform regarding transdisciplinary and transformative research. It focuses on enhancing capacity and capability of our staff and partners to lead and participate in integrated research; provides an integrative 'hub' to connect existing and new related initiatives in our organisation and beyond; assists our researchers to share learnings, build capacity and capability to develop and strengthen relationships with Māori partners and te ao Māori; and monitors, evaluates, reflects, and learns from what is working and what isn't within an AgResearch context.

Our international Science Advisory Panel (SAP) remains an important voice in our evolution and a key influence on science and our future strategic direction set by our management and Board. The panel comprises of Emily Parker (Victoria University), Henning Steinfield (Food and Agriculture Organisation of the United Nations), Rickey Yada (University of British Columbia), Bronwyn Harch (Australia) and an expert in mātauranga Māori, Dr Dione Payne (Lincoln University).

Independent science and industry advisors will also provide valuable feedback through a variety of programme steering groups or advisory groups for significant SSIF, industry or MBIE funded programmes. Post COVID-19 and as part of taking a stronger, strategy-led approach, we will re-establish a programme of deep dives into key research areas to review progress and help with capability planning and direction.

World-leading research

AgResearch finished 2021 on a high note when our research to successfully breed low methane-emitting sheep as a tool to combat climate change won the supreme award at the Science New Zealand Awards. The supreme award is given to the person or team who, in the judges' opinion, has best contributed to Aotearoa New Zealand's economic, environmental, social or cultural wellbeing.

With the support of the industry through the Pastoral Greenhouse Gas Research Consortium (PGgRc) and the government via the New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC), AgResearch scientists have spent over a decade identifying genetic differences which influence how much methane an individual sheep produces. By breeding for this low methane genetic trait, the scientists have been able to demonstrate that after three generations the lowest emitting sheep produce close to 13 per cent less methane than the highest emitters, per kilogram of feed eaten. While the actual methane reduction at the farm scale will be less when sheep are also being bred for other desirable traits, it is still expected to be significant. The lower emitting sheep have been found to be otherwise healthy and productive where it comes to their meat and wool.

AgResearch senior scientist Dr Suzanne Rowe says this knowledge is being shared with the sheep industry in New Zealand and researchers globally. It is also assisting research into breeding lower methane emitting cattle.

Regeneration in action

AgResearch has started a new five-year multimillion dollar research programme with Synlait and Danone to provide farmers with tools to enhance soil health. The programme includes identifying where regenerative agriculture practices can make a difference.

Launched this financial year, the programme features a unique partnership between food producers Synlait and Danone, AgResearch, and MPI (through its Sustainable Food and Fibre Futures Fund).

The project will study soil health on ten farms over five years in Waikato, Canterbury and Otago. It will determine the impacts of changes in soil health on production, farm resilience, and the environment (including climate change). As well as on-farm production and performance, improved soil health is expected and will benefit the wider environment. We should see improved fresh water and nutrient outcomes, support for biodiversity, enhanced soil carbon storage and reduced greenhouse gas emissions.

The Government has committed $2.8 million to the research with Danone and Synlait contributing a further $1 million.

Beefing up farm resilience

Antimicrobial resistance (AMR) is a growing on-farm concern. AgResearch, along with a number of collaborators, published the first of many papers to enable a better understanding and share our research on the subject. The article highlighted the likely link between the use of antibiotics on dairy farms and the associated emergence of AMR in E. coli. It also described the importance of whole genome sequencing and understanding farm management strategies to identify farms at high risk for the emergence of AMR bacteria.

The paper was part of a joint postdoctoral position within the Food Integrity SSIF programme and highlights the continuing collaboration between that team, Cognosco (a Waikato-based veterinary research provider), and the Massey University Molecular Epidemiology Laboratory.

High-tech war on weeds

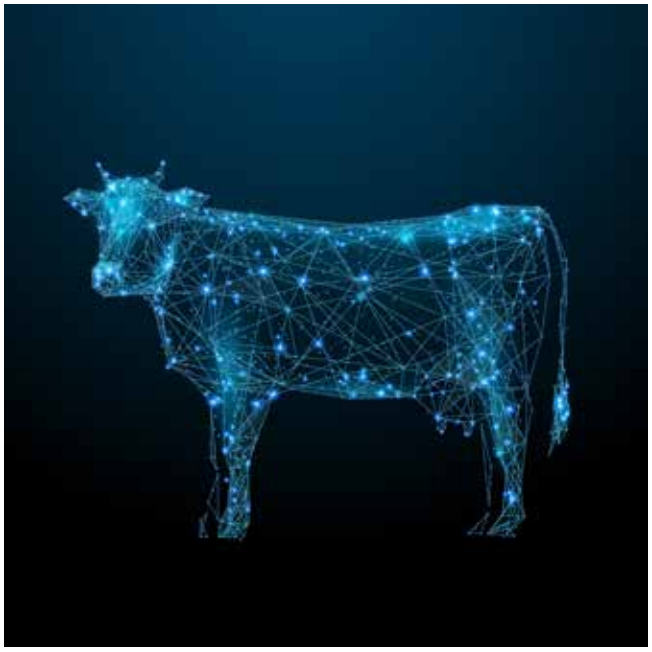
Nassella trichotoma

AgResearch has launched a new free web app designed to help farmers, landowners and regional councils manage Nassella tussock (*Nassella trichotoma*), a costly weed that has resisted eradication efforts in New Zealand for over a century.

The new app, developed with funding from the MBIE in collaboration with Environment Canterbury, provides a tool to visualise a range of weed grubbing strategies. The app deploys a population model that counts the number of Nassella tussock plants in summer and winter in each of seven different life stages of the tussock. It keeps track of their contribution to the total tussock population over successive years.

AgResearch Principal Scientist Graeme Bourdôt and colleagues have spent decades researching Nassella tussock. Dr Bourdôt says this app follows in the path of another similar tool for giant buttercup, which AgResearch developed to support dairy farmers in weed management decision making.

The dairy farm of the future



AgResearch is leading a team of researchers from DairyNZ and Fonterra who are exploring what a dairy farm will look like in the future, how technology can improve animal and herd wellbeing, and how that same technology can be used to explain to consumers what is happening down on the farm in a way that meets their expectations. The research team is using digital technologies and a range of sensors to provide farmers with more detailed insights into the health of their herds. The research is part of the New Zealand Bioeconomy in the Digital Age programme, which has the wider goal of helping New Zealand farmers transform their businesses by using technology. The research looked at how an animal is feeling in terms of its health and wellbeing.

Sensors applied to dairy cows provided a record of what an animal experienced through a day; that will ultimately provide insight into whether an animal, based on temperature or a reduction in activity, is unwell or unhappy. Another goal of the programme is to bring clarity and provide evidence of what sensors are useful for farmers. Lead researcher Jeremy Bryant says, "Consumers expect high levels of animal wellbeing and care. They're saying, 'I want to know if this animal has been treated well, and you are looking after it'. You can no longer just make a claim that this is the most well-cared-for animal in the world. Some will accept that it is. But others will say, 'show me some evidence'. And because wellbeing is a very multi-faceted thing – you have hunger, freedom to express normal behaviours, animal health–you need to capture a tremendous breadth of information. You need 'digital eyes' to do all the hard work. That's a big part of what this project is about." The research is being done in partnership with DairyNZ and Fonterra. National Institute of Water and Atmospheric Research (NIWA) also provided virtual climate station data.

Combating crop disease

Kale, a common brassica crop grown across New Zealand for winter feed.

AgResearch has discovered some novel endophytic associations with three Brassica species. The (fungi) biocontrol agents have a significant effect on inhibiting phoma stem canker, a damaging disease of Brassica crops worldwide. This study provides further demonstration of the potential of endophytic fungi isolated from natural germplasm sources as biocontrol agents, a key strength that has been developed at AgResearch. The finding has the potential to improve the resilience of important agricultural and horticultural crops and reduce the use of agrichemicals for disease control.

Case study

Artificially intelligent cooking

AgResearch scientists have taken their skills into the kitchen to identify the ideal cooking conditions for the 'perfect steak' while also harnessing the power of Artificial Intelligence (AI) to create new food combinations and recipes.

The scientists used a unique approach of analysing biochemical changes in beef steak during the cooking process. When being cooked, the steak releases compounds emitted as gases, called volatiles, which can be captured and analysed. These volatiles, among other factors such as texture and colour, help determine the eating quality of the steak.

Scientists Dr Santanu Deb-Choudhury and Dr Arvind Subbaraj studied the volatiles produced at a range of core temperatures from cooking steak using technology called Direct Analysis in Real Time Mass Spectrometry (DART-MS).

"The results look promising, and there is a clear difference in the volatile profile at different temperatures. This information can help pick the temperature 'sweet spot', thus providing a better eating experience," Dr Deb-Choudhury says.

While the United States Department of Agriculture recommends steaks be cooked at 63°C for a medium (degree of doneness), internal temperature during cooking could range from 45°C (rare) to 80°C (very well done), depending on preference.

"Of seven temperature regimes between 0°C and 72°C, cooking in the range of 58°C to 62°C released flavour compounds that differed in their intensity compared to the other temperature regimes," Dr Deb-Choudhury says.

"At this temperature range, the muscle fibres in the meat begin to become 'fork tender' and yet not releasing their juices completely. Also, the tough connective-tissue collagen begins to weaken, providing succulence to the cooked meat. We identified the balanced formation of flavour chemicals such as esters, providing fruity notes, and other reactive compounds that result in nutty and roasty odour notes. Flavour generation is complex and many factors are at play."

Beyond the quest to cook the perfect steak, AgResearch scientists have also spent time studying flavour compounds from various foods to identify unique flavours and combinations, including foods indigenous to New Zealand.

With a database of compounds identified and extracted from various foods, this is where the AI comes in, AgResearch senior data scientist Dr Munir Shah says.

"We've used the AI to compare the chemical makeup of various foods in our database to identify similarities with other foods, as well as where there are differences in the chemical makeup in foods already established as going well together," Dr Shah says.

"Using all of this information, we are now able to identify potential new food pairings and recipes with unique flavours. We'll be getting the input of chefs and diners to test how these new combinations stack up and the potential for further development."

Top: Dr Santanu Deb-Choudhury with chef Dale Bowie, of Sheppard restaurant in Wellington, analysing data captured by DART-MS; Bottom: Volatiles are monitored in real time during the cooking of a piece of steak.

Case study

Scientists aim to enhance infant formula

AgResearch scientists are working to identify a unique new way to make infant formula more like breast milk and better for babies by using ingredients that could enhance brain development and overall health.

Research into this next-generation infant formula could potentially create new opportunities for New Zealand's primary industries in a global market worth tens of billions of dollars annually.

The work started in 2021, thanks to funding from the government's 2021 Endeavour Fund. AgResearch scientists Dr Simon Loveday and Dr Caroline Thum, along with collaborators from Massey and Monash Universities, are researching ways to enhance the 'human-ness' of infant formula produced from New Zealand ingredients.

"We've recently discovered a new natural source of nutritional oil that is surprisingly similar to the fat in breast milk," Dr Thum says.

"We will be combining this new nutritional oil with dairy phospholipids (a special kind of fat) in response to recent evidence that this component of milk enhances babies' brain development. Fortunately, phospholipids are abundant in buttermilk, which is a by-product of butter production."

"We'll then test our next-generation formula ingredient in the laboratory using equipment that simulates the conditions inside a baby's digestive system. This will tell us how well the new combination is digested, compared to conventional infant formula. We aim to show improved fat and calcium absorption, in addition to the positive effect of the phospholipids for brain development," Dr Thum says.

With the global markets for infant formula and baby foods expected to continue their strong growth, new products that provide a health advantage are in high demand.

Dr Loveday says, "This new funding will allow us explore a new high-value opportunity for New Zealand's primary sector and contribute to New Zealand's global reputation as a source of naturally healthy foods."

Case study

A kiwifruit a day keeps the doctor away

AgResearch scientists teamed up with fellow experts from the University of Otago and Plant and Food Research to confirm that the "gut feel" of thousands of people who eat kiwifruit is indeed correct.

The new study yielded a plethora of data about the biochemical benefits of consuming the popular Sungold® kiwifruit variety.

The key findings validate the belief about the digestive benefits of eating the fruit and also strongly suggest that eating two Sungold® a day actually helps our mental wellbeing. This is due to the positive effect on several pathways in the gut-brain axis related to mood balance.

Dr Karl Fraser and his team at AgResearch are applying their 'systems level' understanding of the results from the experiment, which involved researchers from the University of Otago's medical school and Plant and Food Research.

AgResearch used mass spectrometry technology to measure over 1000 biochemical metabolites in stool and blood samples from 56 individuals who, as part of a clinical trial, were fed two Sungolds® or 7.5 grams of Psyllium (a dietary fibre) per day for 28 days.

Stool microbiome composition from both groups was also sent to an overseas laboratory for DNA testing to help understand both biochemical and microbial changes occurring due to the change in diet.

The test subjects kept a food diary along with an array of records about their gastric health (daily bowel habits) and mental wellness.

Important information about changes in the microbiome taxonomic composition and gene abundance, along with increases in activity in some biochemical pathways, provided strong evidence of the beneficial changes occurring in underlying mechanisms related to consuming kiwifruit.

The research was funded by the High-Value Nutrition National Science Challenge (HVN-NSC) and Zespri. Lead researcher Dr Fraser said, "AgResearch is involved in several HVN-NSC projects integrating metabolite, microbiome, dietary information, and clinical data so we can communicate the mechanisms of health benefits from consuming New Zealand foods such as kiwifruit.

"This work is important for the country's prosperity, to not just export our foods as a raw commodity but extract real value from our products. I'd love to see the day when New Zealand foods demand a significant financial premium overseas because of the science we have done."

The findings were presented to the New Zealand Gastroenterology Society and published in the *American Journal of Clinical Nutrition*.

Case study

Clever discovery in field leads to breakthrough

AGR96X infected grass grub larvae collected from a field trial six weeks post-application

A scientific discovery by AgResearch will offer farmers a much-needed alternative to combat New Zealand's most costly pasture pest.

The microorganism, known as AGR96X, kills grass grubs, which costs New Zealand dairy farmers $380 million and sheep and beef farmers $205 million in lost production each year.

The bacterium, first developed by AgResearch scientist Dr Mark Hurst targets manuka beetles, too.

Dr Hurst, a senior scientist in AgResearch's Microbial Solutions team, was collecting grass grubs and noticed several samples were suffering from the effects of an obvious, but then unknown, disease.

It was an exciting find for the AgResearch microbial solutions team, whose job it is to find naturally occurring beneficial microorganisms that can mitigate the effects of pests and develop methods to mimic their impact (but on a much grander scale).

Dr Hurst and associates successfully isolated, identified, and characterised the bacterium's mode of action and developed a novel formulation for delivery. Field tests have shown the product to be highly effective with comparable efficacy to chemical pesticides.

AgResearch is currently working with Grasslanz Technology and Midlands Holdings to develop manufacturing capability and pursue ACVM registration.

Science Team Leader Dr David Wright succinctly sums up Mark's work as "a lot of science": science that came from technical know-how, developed over many years by AgResearch, to convert the bacterium into granules suitable to be used in equipment commonly found and used on-farm.

"It should help reduce the use of organophosphate chemicals like diazinon that are currently used to combat grass grub. Other beneficial microorganisms under development by the team have potential to increase plant utilisation of fertiliser leading to a reduction in applications of synthetic fertiliser," Wright says.

"It's really satisfying to see Mark's discovery and clever pathology work, and our knowledge and technology, go from our laboratories and get picked up by a commercial company and make it into manufacture. It's been a team effort and we now have patents in place over the method of formulation and its mode of action that we can use on our next discovery."

With the research and industry partner now compiling regulatory, shelf life, label claims, and refining production systems, the product should be available to farmers in 2024.

Case study

Creating the building blocks of food

Research taking place at the AgResearch food pilot plant is set to benefit New Zealand exporters and homegrown food lovers by adding more variety to what we eat.

And the good news is the research is expediting methods and ways of creating the building blocks of fermented foods.

Scientist Dr Ryan Chanyi has developed a new high-throughput technology platform which accelerates and improves the functions of microbes.

Dr Chanyi works in the MBIE Endeavour-funded 'Fermented Foods' programme.

Much of the work takes place at Te Ohu Rangahau Kai (which means a co-operative community of food researchers) located on Massey University's campus in Palmerston North. The facility was a Government-backed investment in smart food research. Scientists at the site isolate and purify proteins and peptides and work with amino acids, lipids, and bioactive compounds.

Dr Mike Weeks is an AgResearch Food Technology and Science Team Leader. He said, "To have food grade research facilities that meet the regulations and standards that a New Zealand dairy factory or meat processing plant have under the same roof is rather unique.

"But when you add in the fact that we share the facility with Riddet Institute and Massey University, which places leading researchers shoulder-to-shoulder, it has come as no surprise to us that Te Ohu Rangahau Kai has been a huge success."

The labs are modern and home to a plethora of research tools: homogenisers, grinders, blenders, sonicators that emit ultrasonic frequencies, membrane filtration systems, ultra-high temperature pasteuriser units, and aseptic bottle fillers, to name a few.

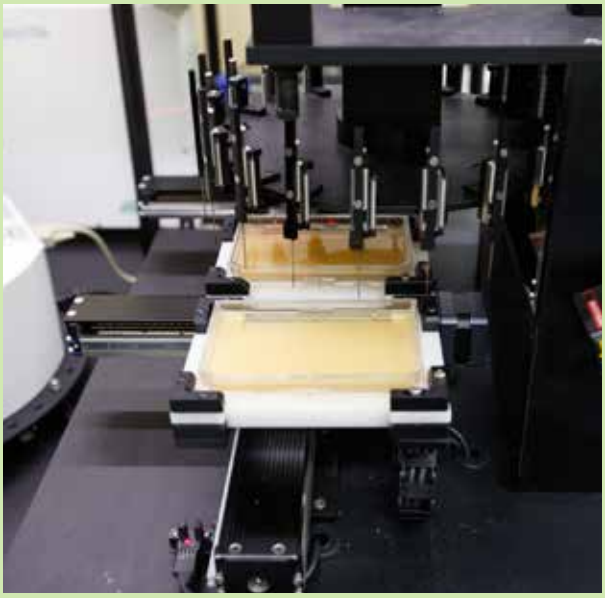
The fermented foods team researches the microstructure and physicochemical properties of lactic acid fermentation–the aforementioned food building blocks of cheese, yoghurt, and other fermented foods.

Lactic acid is created by microbes commonly called 'food starter strains'. In New Zealand, food manufacturers have access to only a limited number of approved strains to base their fermented foods.

It is the reason why, when you go to a delicatessen in New Zealand, there might be only a handful of cheeses available whereas in European delicatessens, there could be hundreds of cheeses available - all made by small, artisan producers.

The team, using the accelerated evolution technology pioneered by Dr Chanyi, can select bacterial starter strains from experimental or commercial fermentations, improve them, then match them to food tasting profiles for different markets.

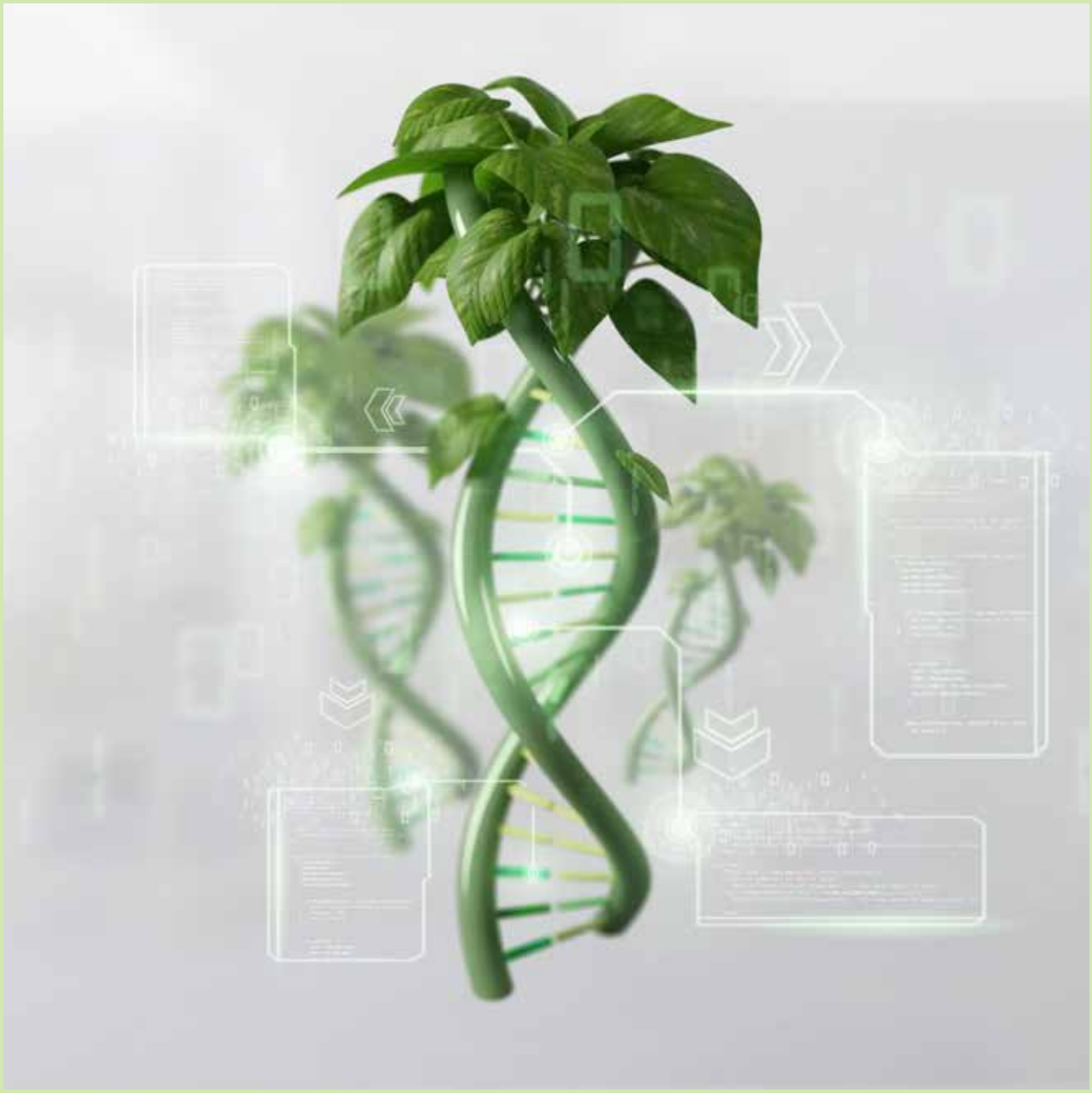
The team is also developing stable food production strains with reliable fermentation characteristics at a scale that would support it being released to a market. This includes new flavours and new strains that, for example, may make a yoghurt naturally thicker. AgResearch also has the research capability to match taste profiles with the cultural taste preferences of different markets to take our export products to new levels.



Left: Dr Ryan Chanyi reviews results from testing. Right: High throughput robotics and powerful biological assays are used to identify the evolved bacteria with improved properties from a sample pool of thousands.

Case study

Genomic research leads to huge lift in yields



AgResearch's Plant Genetics team is using genomic technology to dramatically improve the efficiency of forage breeding, and a leading agri-business consultancy believes the technology could provide the New Zealand dairy industry with a billion dollar-plus edge.

The team used genome-wide DNA markers to create genomic selection models. These models predict the breeding value of a plant for more than 20 forage traits, based on a DNA 'fingerprint' taken from the plant when just a six-week-old seedling.

The main focus is on enhancing the improvement of dry matter yield. At present, it takes three to four years of careful measurements to determine the value of a forage plant for yield (and 0.4 percent to 0.7 percent improvement is achieved each year). Because genomic selection identifies the best plants earlier, at a seedling stage, this leads to an increase from 0.7 percent to 2 percent in yield gains, nearly trebling genetic gain.

Plant Genetics Science Team Leader Dr Marty Faville said the value of using genomics in breeding programmes is probably best illustrated in a report by a leading agri-business consultancy. AbacusBio calculated that a lift in ryegrass dry matter yield from 0.7 percent to 2 percent would result in a $0.5 billion to $1.3 billion return to the dairy industry by 2040, if the technology is adopted by industry by 2026.

In a practical demonstration of AgResearch genomic selection models, yields from ryegrass progeny nearly doubled when genomics were used, compared to a non-genomic best-practice breeding approach. The research has been peer reviewed and published in academic journals and is, therefore, freely available to all seed companies to leverage.

The findings were presented at a DairyNZ Farmers forum in late-2021, and the feedback from farmers was extremely positive. AgResearch is also working with Grasslands Innovation, Barenbrug, Cropmark, and DairyNZ to develop a project using genomic tools to accelerate breeding for environmental and climate resilience trait benefits in both ryegrass and white clover.

Case study

Herbicide resistance greater than expected

Herbicide resistance is emerging as a serious and growing threat to New Zealand's food production; recent surveys by scientists have found more than half of arable farms and vineyards in some regions have weeds resistant to commonly used herbicides.

AgResearch scientists, who are carrying out the first systematic approach to surveying for herbicide-resistant weeds in arable crops with funding from the MBIE, say the results they are seeing are, often, many times the expected levels of resistance.

In addition, new resistant weed species are also being brought forward, or discovered, by the AgResearch scientists working alongside the Foundation for Arable Research and the Bragato Research Institute. This work is part of the Managing Herbicide Resistance programme which began in 2018. Herbicide-resistant weeds were first detected in New Zealand in 1979 but, until recently, reporting of herbicide resistance has largely been ad hoc and left to growers and rural professionals to recognise and alert researchers.

AgResearch senior scientist Dr Trevor James says the survey findings are a wake-up call, and we should be focusing efforts to manage the threat of herbicide resistance.

"The issue is that as this resistance grows, so too do the costs and impacts on farmers and crop production in New Zealand. We firstly need to understand the full scope of the problem across New Zealand, the mechanisms involved in the resistance, how the resistance is passed through the generations of these plants, and then we need to look at strategies to address it and slow the development of the resistance," Dr James says.

"At present, there are limited alternatives to many of these herbicides that the weeds are evolving resistance to, and that is an area that also deserves attention and research investment."

In 2019, a survey took seeds from 48 randomly selected arable farms in central Canterbury, and weeds resistant to Group A and B herbicides were identified from a quarter of those farms.

Further surveying across arable farms in Southland, Waikato, and Bay of Plenty and vineyards in Marlborough and Canterbury found at least 50 percent had weeds resistant to Group A and/or B herbicides. Glyphosate was found to be a problem in vineyards. The highest-risk weeds were pasture-related grasses.

Common resistant weed species identified by the researchers include ryegrass, wild oats, and chickweed, as well as first-time finds of resistant sow thistle (pūhā), summer grass, prairie grass and lesser canary grass.

Senior Scientist Dr Trevor James

Celebrating success

Science New Zealand Awards

Team and Supreme award
Low-methane emitting sheep team

The work of AgResearch scientists, engineers and farm staff to successfully measure and breed low-methane emitting sheep – as a tool to combat climate change– was recognised with the overall Science New Zealand Supreme Award and the AgResearch Team Award at the 2021 Science New Zealand Awards. The world-first research was funded and supported by industry through the Pastoral Greenhouse Gas Research Consortium and the government via the New Zealand Agricultural Greenhouse Gas Research Centre.

Team members: Suzanne Rowe, Arjan Jonkers, Sharon Hickey, Timothy Bilton, Melanie Hess, Natalie Pickering, Tricia Johnson, Ken Dodds, Rudiger Brauning, Sandra Kittlemann, César Pinares Patiño, Kathryn McRae, German Molano, Hannah Henry, Wendy Bain, Gordon Greer, Janine Wing, Sara Elmes, Erin Waller, Shannon Clarke, Gerrard Pile, Stefan Muetzel, Peter Reid, Mike Agnew, Steve Gebbie, Neville Aymes, Barry Veenvliet, Trevor Watson, Sheryl-Anne Newman, Edgar Sandoval, Kevin Knowler, Brooke Bryson, Melonie Hall, Grant Shackell, Graeme Attwood, Peter Janssen, Hayley Bird, Tracey van-Stijn, Emily Jones, and John McEwan.

Some members of the Science New Zealand Supreme Award winning Low-methane emitting sheep team


Ryan Chanyi


Ken Dodds

Early Career Scientist Award
Dr Ryan Chanyi

Food Technology Scientist Dr Ryan Chanyi received the Science New Zealand Early Career Scientist Award for his work on the new Accelerated Evolution technology within the five-year MBIE Endeavor 'Fermented Foods' programme. Ryan's work has created an entirely new research and innovation field for New Zealand, which has already attracted notable commercial uptake and made progress for New Zealand industry to produce added-value products that could be differentiated from other international players.

Lifetime Achievement Award
Dr Ken Dodds

Senior Statistician Dr Ken Dodds received the Science New Zealand Lifetime/Individual Achievement Award. During his career, Ken has been the author or co-author of some 318 publications, 10,884 citations, h index of 47 according to Google scholar. Furthermore, Ken has the highest Researchgate score in AgResearch at 48.31. Ken is also part of the 'Breeding low-methane emitting sheep' team.

AgResearch Awards


Richard Muirhead

Science Impact Prize
MitAgator team

The winner of the 2021 Science Impact Prize was the team behind MitAgator–Supporting cost-effective decision making towards farming within limits.

The science team contributing to MitAgator includes Richard Muirhead, Richard McDowell, Harry Yoswara, Stephen McDonald, Paul Smale, Chris Smith, Ross Monaghan, Gina Lucci, David Wheeler, Matt Brown, and Maxim Mikhisor.

Student Prize
Zac Beechey-Gradwell

The winner of the 2021 Student Prize was Zac Beechey-Gradwell (and co-authors) for his paper "Storing carbon in leaf lipid sinks enhanced perennial ryegrass carbon capture especially under high N and elevated CO2". Zac is a member of our Plant Biotechnology Team (Resilient Agriculture).


Zac Beechey-Gradwell

Personal achievements

Emeritus Ambassador
Dr Stephen Goldson

Dr Stephen Goldson was appointed an Emeritus Ambassador by the AgResearch Board in late 2021. Stephen retired at the end of September 2021 after 45 years in research, development and science leadership at AgResearch. Much of this work has been focused on the successful suppression of some of New Zealand's worst pasture pest species, as well as developing approaches to border biosecurity as Director of the Better Border Biosecurity Collaboration. The ambassadorship is recognition for a remarkable career and acknowledgment that Stephen still has significant skills to contribute to AgResearch and science in general.


Stephen Goldson


Alison Popay

Ray Brougham Trophy
Dr Alison Popay

Dr Alison Popay was the recipient of the 2021 Ray Brougham Trophy, awarded by the New Zealand Grassland Trust. Alison has spent a career developing her expertise, with particular emphasis on the essential symbiosis between ryegrass and its endophytes and the role of this interaction with the ecology of our ruminant-grazed pastures. Alison has been fully engaged in the development and delivery of messages for industry through her roles in the Plant Protection Society and the New Zealand Grassland Association. Alison's expertise was also recognised through commercial developments. She was part of the endophyte team that received the 2018 AGMARDT Technology Transfer Award and the 2018 Pickering Medal from the Royal Society of New Zealand for the development of AR37–an endophyte strain, released in 2007, valued at $3.6 billion to the New Zealand economy.

Hutton Medal
Dr Richard McDowell

Dr Richard McDowell was awarded the Hutton Medal by Royal Society Te Apārangi. The Hutton Medal is awarded for significantly advancing understanding in the animal, earth or plant sciences. Richard, Chief Scientist for the *Our Land and Water National Science Challenge* that AgResearch hosts, is a soil scientist who has made a major contribution to the scientific understanding of nutrient movement through soils and into water. He is best known for showing how contaminants move across land and into water and how to manage land to mitigate losses. He has used this knowledge to inform policy, and has made an immense contribution to the strategies available in New Zealand and overseas for mitigation of nutrient losses to water.


Richard McDowell


Barbara Barratt

Fellow of the Academy of the Royal Society Te Apārangi
Dr Barbara Barratt

Dr Barbara Barratt was elected as a Fellow to the Academy of the Royal Society Te Apārangi. Being made a Fellow is an honour that recognises distinction in research, scholarship or the advancement of knowledge at the highest international standards. Barbara pioneered internationally relevant research into the biosafety of introduced biocontrol agents for insect pests, which is now being widely applied domestically and internationally.

QING Innovation Track
Natalie Ahlborn

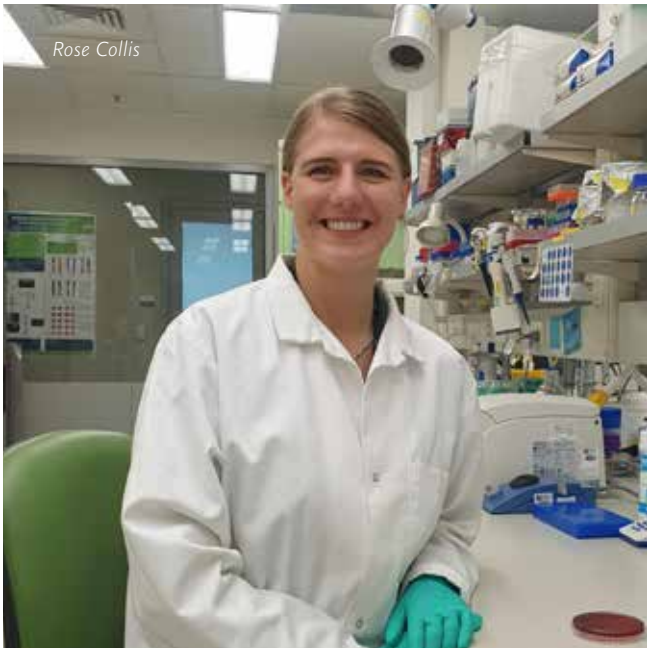
AgResearch/Riddet PhD student Natalie Ahlborn was part of the Riddet Institute team that won the QING Innovation Track competition hosted by Wageningen University & Research in the Netherlands. The competition asked young innovators to demonstrate an idea that shows climate adaptation in food systems. The team created a low-dairy mozzarella cheese made from a combination of dairy and alternative proteins that has a great nutritional profile, while also considering the environmental impacts of food.


Natalie Ahlborn

Massey University Dean's List for Exceptional Theses

Dr Rose Collis

Postdoctoral scientist Dr Rose Collis's PhD was included on the Massey University Dean's List for Exceptional Theses. To gain a place on the Dean's List, a doctoral thesis must meet very stringent criteria; it has to be submitted on time, and in each case all three examiners must agree that the thesis is of exceptional quality in every respect, including research and analytical content, originality, quality of expression, accuracy of presentation and contribution to knowledge in the field. Her thesis was entitled "Metagenomic analysis and culture-based methods to examine the prevalence and distribution of antimicrobial resistance on two New Zealand dairy farms."



Rose Collis

Vicki Burggraaf

Royal Arch Masons Centennial Award

Dr Vicki Burggraaf

Dr Vicki Burggraaf was awarded the Royal Arch Masons Centennial Award. The purpose of the award is the promotion of excellence in some aspect of professional, commercial, technical or other practical endeavour. Vicki will use the $25,000 award for travel to Europe to further develop her skills and networks in the circular bioeconomy.

AGMARDT Technology Transfer Award

Dr Brent Barrett

Dr Brent Barrett and the AgResearch Pastoral Genomics Research Team were the recipients of the AGMARDT Technology Transfer Award of the New Zealand Institute of Agricultural & Horticultural Science. This accolade was for embedding the latest tools of plant genomics and genetics in the leading New Zealand seed companies associated with commercial ryegrass and white clover breeding. This has included the development and implementation of new plant breeding decision support systems, genomic selection in ryegrass and clover, phenomics to estimate dry matter accumulation, and pre-breeding for phosphate efficiency and drought tolerance in clovers.

Members of the Pastoral Genomics Research Team with Brent Barrett holding their award.

New drive to harness mātauranga Māori for Aotearoa

Ariana Estoras
Director, Māori Research and Partnerships

"Mātauranga Māori should be seen as adding to the toolbox to tackle the big issues for agriculture and other sectors, rather than something that threatens the science status quo."

– Ariana Estoras

The new Māori Research and Partnerships Group led by Ariana Estoras is central to AgResearch's vision to have the knowledge system of mātauranga Māori in equal footing with Western science. This group also helps embed Te Ara Tika into AgResearch's everyday work. Te Ara Tika is a national plan to embrace ao Māori values and tikanga-based principles to better respond to Māori needs and better deliver to Māori aspirations.

"What we are striving for is an approach where we are adding knowledge and impact to the important science we have always done, so that we can respond with Māori to their needs and aspirations, but also help provide better solutions to farmers and all of society in Aotearoa," says Mrs Estoras, who herself comes from a background in science.

"Unfortunately, some have viewed mātauranga Māori as somehow diluting or being out of step with the science we've always done in Aotearoa. Some of this seems to be based on a lack of understanding and therefore an inability to see the value we can create. Our approach is centred around the strength of having more than one knowledge system contributing to solutions for some of the most complex challenges facing our communities. One way of looking at it is having the benefit of a 'wise old head' who has gathered knowledge not just from formal settings but also from life experience learning and interacting with farming and the natural world."

Ariana says it is encouraging to see the increasing recognition across the science and research sectors of the value Māori people, resources, and knowledge can bring. In agriculture, this means growing connections between scientists and Māori farmers and landowners, who bring huge collective wisdom and a hunger for positive change in line with kaitiakitanga (living in balance with the natural environment as guardians) of the land.

"The environmental challenges for farmers and Aotearoa as a whole are obviously front and centre right now, and I have no doubt that this is an area where mātauranga Māori can enhance what the science already has to offer where it comes to best use of productive land, water quality and reducing the climate change impact."

Ariana hails from Ngāti Uekaha and Ngāti Maniapoto, and as a child spent a lot of time learning from her grandfather on his Waitomo farm. After studying molecular genetics and gaining her master's degree in biochemistry, she worked with the Manuel whānau on the East Coast, who have a genetic disorder that resulted in members of the whānau losing their sight. Her work helped provide the whānau with some answers and was a launching pad for a career in science in Aotearoa and overseas. Her career has seen her move into the primary industries and, more recently, into leadership as AgResearch's Director of Māori Research and Partnerships.

The focus of the new Māori Research and Partnerships Group is "to continue to build Māori capacity and beneficial Māori-centred research led by and with Māori partners, while taking everyone with us."

"I have been able to work at the coalface with many Māori groups across my lifetime and was able to create bridges between science, policy, and funding and what they were looking to achieve, and I get a real buzz from that. I also feel privileged to be among the wāhine Māori in leadership roles in Aotearoa and helping to provide a path for our young people to follow."

Combining science and policy making for a better future

Dr Cecile De Klein
Principal scientist, Ethical Agriculture

Somewhat lost in the recent proposal by farmers on how they intend to address the existential problem of livestock greenhouse gas (GHG) emissions was the role played by science in the decision-making process.

A dedicated team of experts from AgResearch became a key source of knowledge for the primary sector partnership known as He Waka Eke Noa (HWEN), which comprises industry bodies, Māori, MPI, and the Ministry for the Environment. Its aim is to implement a framework by 2025 to reduce agricultural emissions.

AgResearch scientists Drs Cecile DeKlein, Robyn Dynes, Diana Selbie, and Tony Van Der Weerden participated in advisory groups as experts in measuring and managing emissions, methods of adaption, and sequestration in a farm system's context.

It was a substantial in-kind investment by AgResearch, with each scientist's time offered to signal our commitment to ensuring the future of the sector is framed using the best scientific knowledge and evidence available.

For Cecile, the experience was both rewarding and personal. The AgResearch Principal Scientist was raised in the Netherlands, a country that has successfully adapted to sea level changes and faces an ongoing battle to keep its head above water.

Any analogy with the New Zealand farming sector is quickly dismissed; the connection to the cause and effect of climate change and importance to the future of each country being the exception.

"If I look back to when I first came to New Zealand [30 years ago], GHG emissions were not high on the radar. Nutrient loses and water quality were just becoming part of the conversation. AgResearch was doing work on nitrate leaching that was starting to be recognised as an important environmental impact we needed to deal with. But even the nitrate leaching story was very early on, and it wasn't high on people's radar at all. Certainly not for land users or farmers."

Cecile says those early warnings 30 years ago about GHGs gained greater recognition when the New Zealand Greenhouse Gas Agriculture Research Centre was established and New Zealand became a signatory to the Kyoto Protocol.

And Cecile believes the work HWEN has completed and plans to do will eventually become just as pivotal in our journey towards zero emissions and a more sustainable farming future.

"[Kyoto], which requires us to report on our emissions, was when researchers and policy makers started to grapple and try and find some solutions to farm emissions and also gain some understanding of the size of the problem. Having [AgResearch] at the HWEN table has been vital

because we know science and farm systems knowledge is so important to enable solutions that will work for all parties."

There is still much work to the done on that front.

Working on the solutions will remain Cecile's main focus. But having influence over the policy and direction the sector is taking was in her words, "a very rewarding experience that can only improve the research we do at AgResearch."

"I'm a bit of an integrator. I really enjoy getting people together to see what we can achieve and consider other ways of doing things. It will influence how we help New Zealand to get where it needs to go. Previously my network was largely research focused. But now having contacts and knowledge of the regulatory pathways and the huge hurdles there, which was completely unknown to me, has really been important for me and helped me get a much better understanding of the challenges we must overcome."

As well as having a strong presence on HWEN working groups, AgResearch's chief executive, Dr Sue Bidrose, was a member of MPI's Biogenic Emissions Reduction Science Accelerator (BERSA) leadership group.

Cecile says, "HWEN and BERSA will help the sector better prioritise what needs to be done next and what needs to improve for us to reach our targets. We need to be as transparent and open as possible about identifying which options we might need for acceleration and what that would mean in terms of cost. Certainly towards the end of the [HWEN] process there was more and more discussion about the role science can and will need to play."

More announcements are due about that soon. For now, though, Cecile remains optimistic that Aotearoa New Zealand can meet its emissions targets.

"I think the generation coming through now can have hope. We are going to go through some big changes but I feel confident that we can adapt and use fundamental science and come up with innovations, tools, and use elements of commercialisation, which is what farming is good at, which will make the future of the industry more sustainable. As long as there is a good seamless connection between science and policy, I can see how it could work."

Strategically tackling farming in New Zealand

Dr Dave Houlbrooke
Research Director, Capability

Dr Dave Houlbrooke provides an insider's view on how AgResearch has mobilised its science capability to tackle two areas of huge strategic importance to the New Zealand farming sector.

Few people, not least farmers, will be surprised to hear that two of the most in-demand and ascendant areas of research at AgResearch fall within the realms of Digital and Resilient Agriculture.

Digital technology has the unlimited potential and power to transform agriculture. Resilient Agriculture's tentacles reach every blade of pasture cover, soil type, and animal within a farm's fences. Think climate change and beyond, and how together they affect every farm facet and an entire supporting value chain.

It's a big job. Fortunately, our scientists like a challenge!

Which begs the question, how is AgResearch responding to meet these challenges?

The answer can be found in two of our four science groups. As you would expect, there's much more to their name plates than meet the eye. However, they are effectively clusters of scientists who combine their different areas of expertise, backgrounds, experiences, and skills into a single team under the umbrellas of Digital Agriculture and Resilient Agriculture.

Corporate structures are not riveting reading material. Dave Houlbrooke would add science team structures to that list. His job entails making sure we are getting the most out of our science teams and how they are structured. AgResearch has come up with a way of doing that that is unique to New Zealand.

Research teams have traditionally been organised into teams of specialists. AgResearch deconstructed old research silos and adopted a new group structure, partly out of necessity given the enormity of the challenges our sector faces.

Dave explains, "The groups create research scale without greatly increasing the size of teams. It's something you learn when you collaborate with another organisation. You draw from their experiences and talent pool, and we've found the same happens when we, as an organisation, research in a transdisciplinary way."

A recent success that demonstrates what Dave is talking about is AgResearch's low methane-emitting sheep breeding programme. The award-winning genetic research was a true team effort. The Resilient Agriculture group brought its rumen microbiology and methane mitigation technologies to the table, while the Digital Agriculture group provided genomic and farm systems capability with vital bioinformatics analysis. This fact was recognised as the key to the programme's success when it won the supreme award at last year's Science New Zealand awards.

"We create and increase science impact by taking a holistic view to solving problems for farmers," Dave says.

"We have expert farm systems level understanding of their businesses and we combine that with our key research capabilities.

"It's like a big jigsaw with many different pieces all coming together to provide answers to problems, and a plan on what needs to be done, to fix it. The low methane sheep breeding programme is a good example of that. We have brought animal genetics together with rumen microbiology and bioinformatics and we're now literally rolling that science through farm gates on the back of sheep testing trailers.

"Not all science has to have a result like that. But it does show that a research culture and science structure that supports transdisciplinary programmes can make a difference."

Leaders changing the science landscape

Dr Linda Johnson and Dr Sofia Orre-Gordon
Science group leaders

Leaders of successful organisations often put the interests of their teams first.

It is not surprising then to hear Linda Johnson and Sofia Orre-Gordon, leaders of two of our science groups, sum up their jobs as follows.

"In a nutshell, we make sure every team member has got everything and all the support they need to thrive."

Linda has her hands on the tiller of our Resilient Agriculture science group; Sofia leads our Digital Agriculture research group.

Both groups are thriving for a variety of reasons.

First, they both operate in areas of research crucial to the future of the primary sector, and that creates huge expectations.

Their common leadership philosophy – the second reason both groups are thriving – was developed and refined during stints at the research coalface.

That helps to explain why both leaders are not daunted by their role.

"I'm more excited than daunted," explains Sofia.

"The need for digital science solutions is growing rapidly. Technology is changing how we farm and it is changing how we can do research.

"We have access to increasing amounts of data and more recently computing power, and our job is to make sense and order of that.

"I think with anything like technology, which is fast moving, no day is the same. It's an extremely dynamic time for research and our researchers.

"That was one of the things, for me personally, that I was attracted to as a group leader."

Linda's job in the Resilient Agriculture space is also not without its challenges. AgResearch has found answers to contemporary challenges using traditional strengths.

For example, the Resilient Agriculture Group views forages, animals, and their associated microorganisms through a climate change lens.

"A number of scientists who come under the resilient umbrella bring very traditional science skills, expertise, and backgrounds to contribute to a larger goal than what they might traditionally have worked on.

"The most obvious example in my group is climate change.

"We have a number of different skillsets all working on the same problem, whether that be a microbiologist working on what's going on in an animal's rumen, or an expert in genomics who

is looking at the genetic make-up of forages and other feeds.

"It's what makes AgResearch unique. We can provide the complete picture and the broadest possible understanding of the parts of a problem and, of course, solutions to address them."

The Resilient Agriculture Animal Nutrition and Rumen Microbiology teams are developing new methane mitigation technologies.

"We're looking at a broad spectrum of ideas in conjunction with researchers from other groups from methane and nitrous oxide inhibitors, vaccines, feeding systems, new forages, novel endophytes, and the interactions of all of the above."

The digitally focused group is also heavily involved in researching greenhouse gas emissions.

"The digital group works with data and digital technologies that we think can transform farming. But we don't do it in isolation. All of our researchers and field technicians are keen to work smarter. Our software experts, Artificial Intelligence experts, and statisticians work across the entire gambit of our research."

Both group leaders work closely with their colleagues in the food and ethical agriculture spaces.

Linda explains, "We want to deliver value and one of the concerns of our customers is that new technologies are socially acceptable or ethical. There's no point coming up with a with new tools if they're not socially acceptable so we have experts at AgResearch who can help us out with that, too."

Linda Johnson

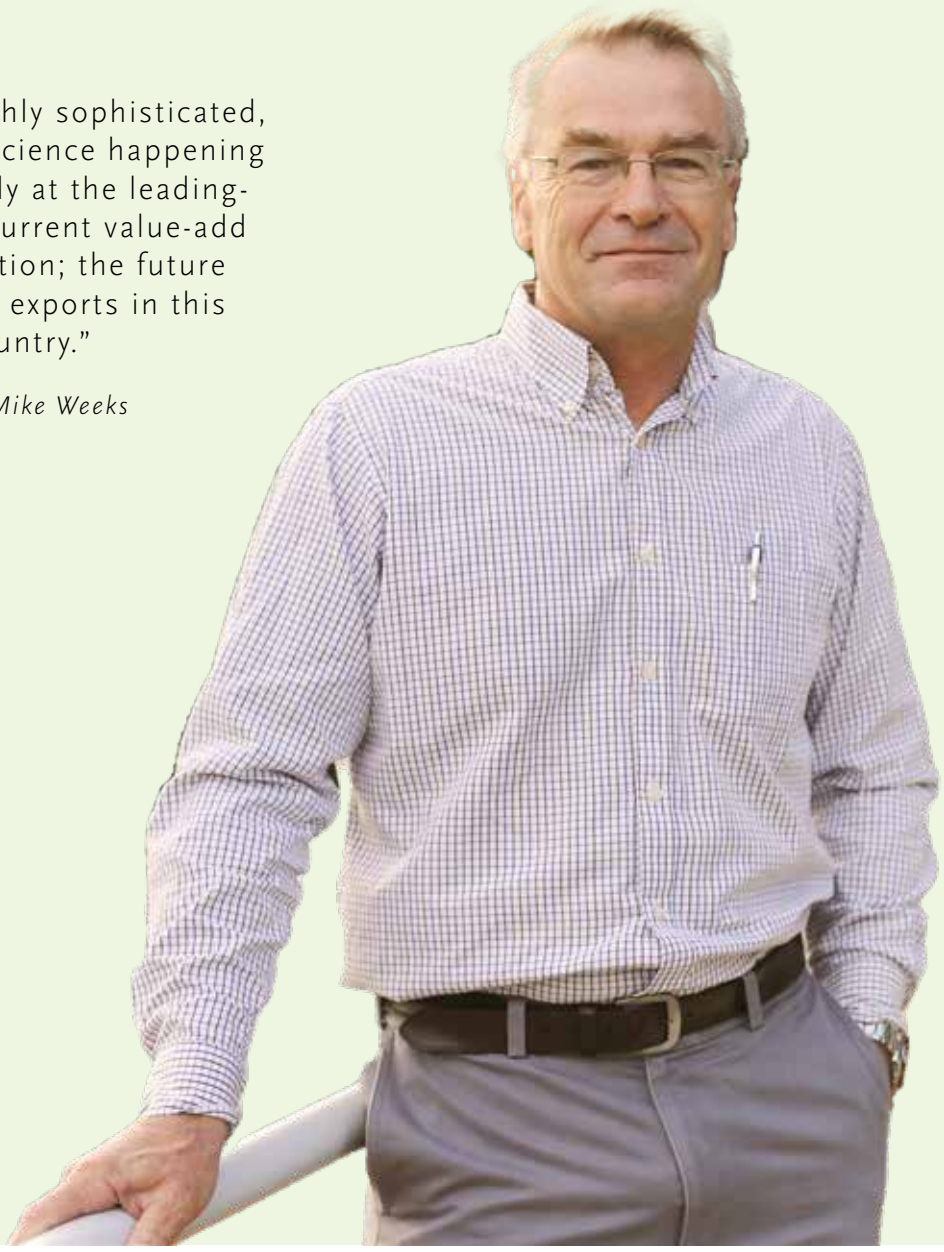
Sofia Orre-Gordon

Mike's high-tech second home

Dr Mike Weeks
Science Team Leader, Food Technology and Processing

"[We] have highly sophisticated, cutting-edge science happening that is directly at the leading-edge of the current value-add food revolution; the future of food and exports in this country."

– Dr Mike Weeks



When Mike Weeks strolls through his multilevel second home – AgResearch's new food pilot plant in Palmerston North – proteins, amino acids, lipids, and bioactive compounds are omnipresent as scientists, and often students under their tutelage (among others), isolate and purify proteins and peptides.

To Mike's trained eye, it is nothing unusual. All in a day's work.

"But every so often you stop to appreciate how unique the food pilot plant is and what's happening here," he said.

"We have scientists working on AgResearch's traditional strengths, meat and dairy research, all under the same roof, which is in itself rather unique and special. But alongside that you also have highly sophisticated, cutting-edge science happening that is directly at the leading edge of the current value-add food revolution; the future of food and exports in this country."

The food pilot plant, located in the building named Te Ohu Rangahau Kai, which means a co-operative community of food researchers, officially opened last year. Located on Massey University's campus in Palmerston North, it overlooks AgResearch's Grasslands campus, a short stroll away. The facility was a Government-backed investment in smart food research, and after a year of bedding in, the place is a hive of activity.

Mike is an AgResearch Food Technology and Science Team Leader. In his role he gets an overview of progress being made at Te Ohu Rangahau Kai's coalface. Mike sees and interacts with scientists researching new cultures for fermented dairy and meat products, others developing new methods of fermentation, and yet more choosing new strains of bacteria to be used in drinking yoghurts.

"To have food-grade research facilities that meet the regulations and standards that a New Zealand dairy factory or meat processing plant have under the same roof is rather unique.

"But when you add in the fact we share the facility with Riddet Institute and Massey University, which places leading researchers shoulder-to-shoulder, it has come as no surprise to us that Te Ohu Rangahau Kai has been a huge success."

The labs are modern and home to a plethora of research tools: homogenisers, grinders, blenders, sonicators that emit ultrasonic frequencies, membrane filtration systems, ultra-high temperature pasteuriser units, and aseptic bottle fillers, to name a few.

The upshot, Mike explains, is that "we can work with commercial customers to research and even complete first runs of products on a scale that provides our customers the evidence and surety they need to get a market sense of how it will perform, taste and even how long it will last on the shelf, when it makes it there."

The pilot plant is attracting international interest.

Mike's research, among other things, includes working with Ultra High Temperature milk and lactoferrin. One such example illustrates Te Ohu Rangahau Kai's strengths. A Singaporean research institute had investigated the bioactivity of lactoferrin and measured whether it can remain intact during human digestion. However, they needed researchers with the capability and tools to see if their initial results could be replicated at a scale that would validate their market expansion plans.

"And we can do that at the food pilot plant. Some of the valuable functional components in milk provide challenges in terms of maintaining their function in final products but we have the tools and knowledge that the international science community is looking to leverage off. This is fantastic as it exposes AgResearch to new research and researchers. Our pilot plant has a very bright future ahead."

Te kāwanatanga ā-rangatōpū

Corporate governance

Our Board

The Board promotes the highest standards of corporate governance practice and ethical conduct by all Directors and employees of AgResearch Limited and its subsidiaries.

The Board endorses the overall principles embodied in the New Zealand Institute of Directors' 'Code of Practice for Directors'. It has only independent Directors on the Board whose skills and experience bring balance and diversity to decision making.

Dr Paul Reynolds QSO

Chair

Dr Paul Reynolds served as Chief Executive of the Ministry for the Environment from 2008 until 2015. Prior to that he worked at the Ministry of Research, Science and Technology (1998–2002) as Chief Policy Adviser and then, from 2002–2008, was Deputy Director General (Policy) at the Ministry of Agriculture and Forestry.

Paul has a background in scientific research, holding a PhD in Biochemistry from the University of Otago. He is also Deputy Chair of Manaaki Whenua–Landcare Research.

Paul was made Companion of the Queen's Service Order in the Queen's Birthday Honours, 2018.

Kim Wallace

Deputy Chair
Chair–Audit and Risk Committee

Kim Wallace is an experienced independent director. She currently serves on the Boards of Quotable Value and Port Nelson. Before pursuing a full-time career in governance in 2017, Kim enjoyed a 24-year career in the global dairy industry, which included working in senior executive roles based in New Zealand, the USA, Germany and Australia.

Jackie Lloyd

Director
Chair–People and Culture Committee

Jackie Lloyd is an independent director. She is currently a director of Kiwi Group Holdings and Naylor Love Enterprises, a Board member of New Zealand Cricket and Museum of New Zealand Te Papa Tongarewa, a trustee of The Lion Foundation and a member of the National Council of the Institute of Directors in New Zealand (Inc).

Dr Louise Cullen

Director

Louise Cullen combines her environmental science and dairy farming backgrounds to bring a pragmatic, evidence-based focus to the businesses and organisations she works with. Louise is currently a director for the Tatua Co-operative Dairy Company and a member of a number of agricultural industry groups.

Lain Jager

Director

Lain Jager is best known for his time with Zespri, where he was CEO from 2008 to 2017. Today, Lain is involved in a range of investment projects in tourism and agri-business, serves as a director on several Boards, and acts as a strategic advisor to a small number of companies. Lain was appointed to the Board in July 2020.

Rukumoana Schaafhausen

Director

Rukumoana Schaafhausen is an experienced independent director. She was recently the Chair of Waikato-Tainui and is currently serving across a number of iwi, community, private, and public organisations in governance roles. These include Contact Energy, Te Waharoa Investments, Water Governance Board, Miro Berries, The Tindall Foundation, and The Prince's Trust. She has received the Sir Peter Blake Award and the US Embassy Wahine Toa Award for Leadership. Rukumoana practised as a commercial and property lawyer and holds a Bachelors in Law.

Mary-Anne Macleod

Director

Mary-Anne joined the Board in February 2022. She is a professional director and provides strategic advice, principally to local and central government agencies. She is currently on the boards of NIWA, the Environmental Protection Authority, DairyNZ, and Fire and Emergency New Zealand and has previously served on the boards of Bay Venues Limited and Quayside Holdings Ltd. She was the Chief Executive of the Bay of Plenty Regional Council for seven years. She has a Master of Science (Hons) in Earth Sciences and Geography.

Charles Taitua

Board observer

Charles was appointed as Board observer in February 2022. He has held many different roles within the farming industry from milking cows to working for Wrightson in the King Country. Charles's passion is to inspire others "who don't come from a traditional farming background or follow the traditional pathways into the industry" and "to uplift Māori participation in the sector, at all levels".

Role of the Board

The Board is responsible to shareholders for charting the direction of the company by setting objectives, strategy and key policies and monitoring management's running of the business to ensure it is aligned with the direction set.

The Board delegates the conduct of the day-to-day affairs of the company to the Chief Executive. The Board is responsible for the appointment, from time to time, of the Chief Executive and annually reviews their performance.

The workings of the Board and its code of conduct are governed by the Companies Act 1993, AgResearch's constitution, the Crown Research Institutes Act 1992, the Crown Entities Act 2004, the annual *Statement of Corporate Intent* and the Board's manual. This manual sets out all the functions and operating procedures of the Board. The policies approved by the Board clearly set out those matters on which only the Board can make decisions. These include dividend payments, solvency certificates, raising new capital, major borrowings, approval of the annual financial statements, appointment of Directors to subsidiaries and associates, major capital expenditure and acquisitions.

Each year, the company produces a *Statement of Corporate Intent* and an operating budget, which are reviewed and approved by the Board. Monthly management accounts are prepared and these are reviewed by the Board throughout the year to monitor management's performance against the budget and the *Statement of Corporate Intent*.

Independent professional advice

With the prior approval of the Chair, each Director has the right to seek independent legal and other professional advice at the company's expense concerning any aspect of its operations or undertakings to help them fulfill their duties and responsibilities as a Director.

Director education

The Board had a budget of $15,000 to assist Directors with the financial costs of attending courses and conferences on governance matters. Directors who attend report back at Board meetings on matters learnt that would improve the governance of the company. The Chair authorises expenditure from this budget.

Board membership

The constitution currently sets the size of the Board at a minimum of two Directors and a maximum of nine Directors.

In the financial year the Board consisted of the Chair and six other Directors.

Directors are generally appointed for a three-year term and may be reappointed for further terms.

Mary-Anne Macleod was appointed to the Board in February 2022. She joins Lain Jager, Dr Louise Cullen, Jackie Lloyd, Rukumoana Schaafhausen, Kim Wallace and Board Chair Dr Paul Reynolds.

Board and standing committee meetings

The following table sets out the Board and committee meetings that Directors attended during the financial year. The Board has established two standing committees to guide and assist the Board with overseeing certain aspects of corporate governance– the Audit and Risk Committee and the People and Culture Committee.

The Board and each committee are empowered to seek any information they require from employees in pursuing their duties and to obtain independent legal or other professional advice.

Board of Directors	Board meetings attended	Audit and Risk Committee
Dr Paul Reynolds (Chair)	11	4
Kim Wallace (Deputy Chair, Chair–Audit and Risk Committee)	11	4
Jackie Lloyd (Chair–People and Culture Committee)	11	-
Dr Louise Cullen	11	-
Rukumoana Schaafhausen	11	-
Lain Jager	11	4
Mary-Anne Macleod	4	3
Number of meetings held	**11**	**4**

Statutory reporting–Board

To our shareholders and stakeholders

The Directors are pleased to report that AgResearch Limited met its obligations in all material aspects under the Crown Research Institutes Act 1992 for the year ended 30 June 2022.

Dividends

No dividends were declared during the year to 30 June 2022.

Director salaries

Board of Directors	2021	2022
Dr Paul Reynolds (Chair)	$ 73,315	$ 73,315
Kim Wallace	$ 50,286	$ 50,286
Jackie Lloyd	$ 40,943	$ 40,944
Dr Louise Cullen	$ 35,943	$ 35,943
Rukumoana Schaafhausen	$ 35,943	$ 35,943
Lain Jager	$ 35,943	$ 35,943
Colin Armer	$ 35,943	-
Mary-Anne Macleod	-	$ 14,976
	$ 308,316	$ 287,352
Grasslanz Technology Limited		
Robert John Hay (Chair)	$ 20,000	$ 20,000
Ian Boddy	-	$ 5,000
	$20,000	$25,000
Farmax Limited		
Andrew MacPherson (Chair)	$24,996	-
	$24,996	-
Total	$ 353,312	$ 312,353

Directors' interests

The Board received no notices during the year from Directors requesting the use of company information that would not otherwise have been available to them. There were no share dealings by Directors with the company.

Directors' interests disclosed during the year to 30 June 2022 are set out in the table below. The 'Director' and 'Trustee' columns also identify Chair and Deputy Chair roles where relevant. Interests do not include trusteeships, directorships or shareholdings in private trusts and small companies with whom no transactions have occurred during the year. These interests have been appropriately recorded within the interest register, which is updated regularly.

AgResearch interest list financial year 22

Board of Directors	Director of	Trustee of	Shareholder of
REYNOLDS, Paul (Chair)	Landcare Research New Zealand Limited (Deputy Chair) Enviro-Mark Solutions Limited (Chair)	Student Volunteer Army Foundation (Chair)	
CULLEN, Louise	Acorn Goats Limited Balachraggan Farms Limited Capra Farming Limited Cookson Trust Farms Limited Tatua Co-operative Dairy Company Limited Waikato Valley Cricket Association	Acorn Trust Limited	Ballance Agri-Nutrients Limited Dairy Goat Co-operative (NZ) Limited Fonterra Co-operative Group Livestock Improvement Corporation Limited Ravensdown Limited Tatua Co-operative Dairy Company Limited
JAGER, Lain	Ārepa Holdings Limited Carrfields Limited DMS Limited Miro Limited Nibblish GP Limited Origin Capital Partners Management Limited Rotorua Outdoor Activities New Zealand Spring Sheep Dairy NZ Management Limited	The Jager Family Trust	Eastern Gold Orchard Flossie Limited Nibblish GP Limited Olive Hill Limited Origin Capital Partners Management Limited SLC Limited Partnership TreeQuest Limited Willows Rd Orchard

Board of Directors	Director of	Trustee of	Shareholder of
LLOYD, Jackie	Kiwi Group Holdings Limited Museum of New Zealand Te Papa Tongarewa Naylor Love Limited New Zealand Cricket (Board Member)	Lion Foundation Limited	
MACLEOD, Mary-Anne	DairyNZ Inc Fire and Emergency NZ Limited Environmental Protection Authority Limited MacMacleod Limited National Institute of Water and Atmospheric Research Limited	Araneacattus Family Trust	
SCHAAFHAUSEN, Rukumoana	Alvarium Investments (NZ) Limited Contact Energy Limited Hautupua GP Limited Te Wharaoa Investments GP Limited Three Waters National Transition Unit	The Prince's Trust The Tindall Foundation	Schaafhausen Inc Limited
TAITUA, Charles (Board Observer)	CTT Holdings Limited t/a Te Tuara Agri	CTT Family Trust Gladys May Cribb Whanau Trust Hapimana Trust Te Kukuwai o Kahuwera	CTT Family Trust
WALLACE, Kim	Kim Wallace Consulting Limited Origin Capital Partners Management Limited (Audit Chair) Overseer Limited Port Nelson Limited (Finance and Risk Committee Chair) Seahorse Beach Investments Limited		Kim Wallace Limited Seahorse Beach Investments Limited

Our Senior Leadership Team

Dr Sue Bidrose

Chief Executive

Dr Sue Bidrose joined AgResearch as CEO in July 2020. She started her working life with the Ministry of Agriculture and Fisheries as a laboratory technician specialising in metabolic diseases of dairy cattle.

She then worked in the community sector and, after completing her Doctorate in Psychology, worked in central government in research, policy and operational leadership roles.

Sue then moved across to local government, most recently as Chief Executive of Dunedin City Council, before returning to the agricultural science sector here at AgResearch.

Stuart Hall

Deputy Chief Executive: Commercial Partnerships

Stuart Hall's key areas of experience include sales and marketing, leadership and strategy development. He has extensive experience in a number of executive sales and commercial roles.

Fleur Evans

People and Culture Director

Fleur Evans is an experienced organisational development professional with a proven track record in leading organisational culture change programmes, developing strategies to build critical skills and leadership capability, and strategic workforce planning.

Tony Hickmott

Finance and Business Performance Director

Prior to joining AgResearch as Finance and Business Performance Director in October 2017, Tony Hickmott was the Chief Financial Officer at Capital and Coast District Health Board in Wellington where he provided leadership for the DHB. He has a wealth of experience in finance, audit and risk, government funding models, and finance team leadership.

Greg Rossiter

Information Technology Director

Greg Rossiter is an experienced IT professional with an extensive background leading cross-functional teams to deliver major change projects.

Chris Koroheke

Urungi, Māori Strategy Director

Chris Koroheke's role on the Executive Leadership Team is to strengthen the relationships across the burgeoning Māori agri-business sector. His background is in developing relationships across organisations and iwi.

Ariana Estoras

Māori Research and Partnerships Director

Ariana hails from Ngāti Uekaha and Ngāti Maniapoto. She has a master's degree in biochemistry. Her vision is to have the knowledge system of mātauranga Māori on an equal footing with western science and "build Māori capacity and beneficial Māori-centred research".

Dr Sara Edwards

Research Operations Director

Sara focuses on project delivery and how our portfolio of projects is strategically aligned to delivering AgResearch's Science Plan. Sara's background is in genetics and she has held leadership roles within AgResearch as Science Team Leader for Reproduction and as acting Science Group Leader for Animal Science.

Dr Marie Bradley

Strategy and Communications Director

Marie has a background in molecular biology and is an experienced government policy and strategy sector manager. Marie once worked for Plant and Food Research, MBIE, and held various operational and strategy roles at the Foundation for Research, Science and Technology.

Dr Dave Houlbrooke

Research Capability Director

Dave oversees and leads AgResearch's science capability in our four Science Groups – both personnel and science-based infrastructure and equipment. Dave's background is in Environmental Sciences including farm management practices for mitigating contaminant losses and treatment of dairy effluent and soil physical management.

Statutory reporting–company

For the year ended 30 June 2022

Remuneration greater than $100,000

During the year ended 30 June 2022, 229 staff received remuneration of or exceeding $100,000 per annum, as shown in the table below.

Remuneration included performance awards, superannuation benefits, vehicle benefits, and severance and exit payments.

Termination payments

During the year, the Group made the following payments to former employees in respect of termination of their employment with the Group.

Total amount paid	**$ 407,677**
Number of employees	11

Remuneration band	Number of employees	Remuneration band	Number of employees
$ 100,000 to $ 109,999	53	$ 200,000 to $ 209,999	3
$ 110,000 to $ 119,999	30	$ 210,000 to $ 219,999	2
$ 120,000 to $ 129,999	42	$ 220,000 to $ 229,999	2
$ 130,000 to $ 139,999	32	$ 240,000 to $ 249,999	2
$ 140,000 to $ 149,999	22	$ 280,000 to $ 289,999	1
$ 150,000 to $ 159,999	13	$ 300,000 to $ 309,999	1
$ 160,000 to $ 169,999	11	$ 310,000 to $ 319,999	1
$ 170,000 to $ 179,999	4	$ 350,000 to $ 359,999	1
$ 180,000 to $ 189,999	5	$ 550,000 to $ 559,999	1
$ 190,000 to $ 199,999	3		
		Total	229

Executive remuneration reporting

AgResearch's remuneration policy is to reward employees at all levels of the organisation fairly and consistently under the following principles:

Market relativity
Market practice Market position Labour market conditions
Internal relativity
Recognising different levels of complexity and accountability between roles
Ability to pay
Balancing company responsibilities with commitment to competitive market positioning
Performance
Reward for delivery and high performance

Donations

Donations paid during the year ended 30 June 2022 were $1,500.

Directors and employees indemnity and insurance

During the year, the company indemnified Directors and certain employees to the fullest extent permissible by law. The company also has Directors and officers insurance.

Auditor

Anthony Smith of Deloitte Limited is the appointed auditor of the company under contract from the Office of the Auditor-General and under section 21 of the Crown Research Institutes Act 1992.

Performance indicators

AgResearch's 2022/2023–2026/2027 *Statement of Corporate Intent* (SCI) identified the following non-financial operating indicators against which progress to achieve the SCI operating outcomes is measured. Target figures are from AgResearch's 2022/2023–2026/202 SCI.

Science excellence

	Indicator and description	*FY22 Target*	FY22 Result	FY21 Result	FY20 Result	FY19 Result	FY18 Result
*	**Research collaboration**						
	Percentage of publications with collaborations with:						
	a) Only AgResearch authors	*< 15%*	9%	10%	9%	14%	14%
	b) Other New Zealand authors	*> 30%*	36%	37%	32%	34%	29%
	c) International authors	*> 25%*	29%	29%	26%	32%	33%
	d) A combination of New Zealand and international authors.	*> 20%*	24%	24%	33%	20%	25%
	(Data for this indicator is reported for calendar years.)						
*	**Science quality**						
	Impact of scientific publications (mean citation score).	*2.70*	5.07	4.01	3.36	3.15	2.78
	Recognised world class capability						
	Field-Weighted Citation Impact scoring for top 10 publications in each of our defined key capability areas.	*> 1*	Achieved	-	-	-	-
	Strong science vitality						
	Science Vitality Index	*> 60%*	62%	-	-	-	-

KPIs for FY18-21 have been updated to reflect the reporting parameters outlined by MBIE.

* By signing DORA, AgResearch made a public commitment to valuing the scientific content of a paper over and above any publication metrics or journal indices. The Metrics Toolkit (https://www.metrics-toolkit.org/metrics/citations_articles/) advises, "Citation counts should never be interpreted as a direct measure of research quality." We request that MBIE reconsiders its requirement to report this metric in light of this information.

Partnerships

	Indicator and description	*FY22 Target*	FY22 Result	FY21 Result	FY20 Result	FY19 Result	FY18 Result
+	**Genuine partnerships with strategic alignment**						
	End-user collaboration: Revenue per FTE from commercial sources.	*$75.0 K*	$95.0 K	$ 95.3 K	$ 75.6 K	$ 85.4 K	$ 83.1 K
	Contribution to stakeholder strategy 'Good' or 'Better'.	*> 80%*	86%	-	70%	83%	-
	Strengthening and building national and global science collaboration						
	Actively lead and participate in pan-CRI initiatives to progress the science agenda and to realise greater operational efficiencies	*Achieved*	Achieved	-	-	-	-
+	**Uptake of our research to contribute to impact**						
	Technology and knowledge transfer: Commercial reports per scientist FTE	*1.00*	1.11	1.16	1.16	1.29	1.26

Mātauranga Māori

	Indicator and description	*FY22 Target*	FY22 Result	FY21 Result	FY20 Result	FY19 Result	FY18 Result
	Mātauranga Māori knowledge systems are embraced and valued within our organisation						
	Best practice framework(s) co-developed with our Māori partners to enable the weaving of AgResearch science and mātauranga Māori together	*1*	Achieved	-	-	-	-
	Kaupapa Māori-led research programme(s)	*1*	Achieved	-	-	-	-
	Our research and enabling services contribute to Māori-centred and kaupapa Māori solutions						
	Preference to work rating by our Māori partners	*> 60%*	62%	-	-	-	-
+	**Pipeline of Māori capability and capacity to undertake kaupapa Māori research**						
	Māori graduate programme(s) with other CRIs	*Achieved*	Achieved	-	-	-	-
	Network of established mātauranga Māori practitioners and internal champions to help implement and embed Te Ara Tika	*Achieved*	Achieved	-	-	-	-

+ Our annual report features a selection of impact case studies. These describe how a selection of our research projects contribute to impact for our stakeholders.

Smart investments

	Indicator and description	*FY22 Target*	FY22 Result	FY21 Result	FY20 Result	FY19 Result	FY18 Result
*	**Financial sustainability**						
	Financial indicator: Revenue per FTE, based on average FTEs over the year	*$ 225.0 K*	$ 242.3K	$ 256.0 K	$ 240.0 K	$ 239.5 K	$ 229.6 K
	Smart investment in best practice infrastructure and a healthy and safe working environment						
	Science Capex Plan refreshed annually and used to drive smart capital investment	*Achieved*	Achieved	-	-	-	-
	New Lincoln science facility contractor appointed and construction underway	*Achieved*	Achieved	-	-	-	-
	No notifiable injuries and < 2 notifiable events	*0, < 2*	0, 0	0, 0	0, 0	0, 0	-
	Recruit and retain highly motivated staff						
	Engagement Index (maintain a high level of staff motivation)	*> 70 %*	71%	71%	72%	68%	65%
	SSIF is invested to support our strategy						
	SSIF investment clearly aligned to strategic priorities	*Achieved*	Achieved	-	-	-	-

* By signing DORA, AgResearch made a public commitment to valuing the scientific content of a paper over and above any publication metrics or journal indices. The Metrics Toolkit (https://www.metrics-toolkit.org/metrics/citations_articles/) advises, "Citation counts should never be interpreted as a direct measure of research quality." We request that MBIE reconsiders its requirement to report this metric in light of this information.

Pūrongo pūtea

Financials

Financial performance indicators

For the year ended 30 June 2022

Cash flow	Actual 2022	Budget 2022	Actual 2021
Net cash flow from operating activities $k	**16,107**	19,959	42,958
Net cash flow from investing activities $k	**(27,948)**	(47,412)	85
Net cash flow from financing activities	**13,167**	13,049	(2,198)
Total net cash flow $k	**1,326**	(14,404)	40,845
Effect of exchange rate changes $k	**-**	-	(10)
Cash at the beginning of the year $k	**95,842**	93,175	55,007
Cash at the end of the year $k	**97,168**	78,771	95,842

Operating margin %	**7.4%**	9.7%	24.4%
Operating margin per FTE $k	**17.7**	24.7	62.1
Revenue growth %	**(5.9%)**	6.3%	6.6%
Quick ratio	**5.0**	3.1	5.1
Interest coverage	**14.5**	19.0	46.2
Operating margin volatility %	**76.3%**	50.3%	84.4%
Forecasting risk %	**3.3%**	0.0%	3.5%
Adjusted return on equity %	**(0.8%)**	(0.4%)	14.6%
Capital renewal	**2.0**	-	-
Equity ratio %	**70.2%**	69.0%	70.5%

Indicator definitions:

Adjusted return on equity: Surplus after tax (excluding fair value movements net of associated tax impact) ÷ average shareholder's funds excluding asset revaluation reserve, expressed as a percentage.

All other indicators are based on the Treasury prescribed calculations, which may differ from normal accounting calculations for that indicator.

Consolidated statement of comprehensive income

For the year ended 30 June 2022

in thousands of New Zealand dollars	Note	Actual 2022	Budget 2022	Actual 2021
Revenue				
Ministry of Business, Innovation and Employment				
Strategic science funding	1	**44,963**	44,963	44,963
Our Land and Water National Challenge	1	**12,830**	18,647	8,768
COVID-19 Response and Recovery Fund	1	**-**	-	13,570
Other	1	**14,614**	12,177	16,780
Commercial	1	**61,360**	72,305	61,817
Farm produce	1	**5,175**	4,015	4,855
Other revenue	1	**17,593**	17,918	15,662
Total operating revenue		**156,535**	170,025	166,415
Operating expenditure	2	**(156,141)**	(169,143)	(153,788)
Other gains/(losses)	3	**(101)**	(275)	18,145
Finance costs	4	**(802)**	(866)	(874)
Share of deficit of associates	5	**(897)**	(800)	(1,591)
Surplus/(deficit) before tax		**(1,406)**	(1,058)	28,307
Tax expense/(benefit)	6	**(165)**	(296)	3,824
Net surplus/(deficit) after tax for the year		**(1,241)**	(762)	24,483
Other comprehensive income				
Items that will not be reclassified subsequently to surplus or deficit:				
Revaluation of properties	8	**20,909**	-	6,807
Income tax relating to components of other comprehensive income	6	**(3,519)**	-	(1,141)
Other comprehensive income for the year net of tax		**17,390**	-	5,666
Total comprehensive income for the year net of tax		**16,149**	(762)	30,149
Net surplus/(deficit) is attributable to:				
Equity holders of the parent		**(1,241)**	(762)	24,483
Total comprehensive income is attributable to:				
Equity holders of the parent		**16,149**	(762)	30,149

The statement of accounting policies and the accompanying notes form an integral part of these financial statements.

Consolidated statement of financial position

For the year ended 30 June 2022

in thousands of New Zealand dollars	Note	Actual 2022	Budget 2022	Actual 2021
Current assets				
Cash and cash equivalents		**97,168**	78,771	95,842
Trade and other receivables	10	**29,799**	24,131	43,767
Prepayments		**3,575**	4,706	5,017
Loan receivable	13	**2,038**	-	-
Biological assets - livestock	12	**4,058**	4,780	3,832
Inventory		**1,021**	1,099	1,074
Property held for sale		**75**	-	75
Current tax	6	**139**	1,523	-
Total current assets		**137,873**	115,010	149,607
Non-current assets				
Investments in associates and joint ventures	5	**5,347**	5,599	5,707
Other investments	16	**2,205**	2,638	2,638
Property, plant and equipment	8	**254,743**	243,632	216,546
Biological assets - forestry	15	**1,275**	1,327	1,327
Goodwill	18	**-**	907	907
Intangible assets	9	**2,179**	3,272	1,612
Right-of-use assets	14	**22,196**	22,429	23,845
Total non-current assets		**287,945**	279,804	252,582
Total assets		**425,818**	394,814	402,189
Less:				
Current liabilities				
Trade and other payables	11	**72,890**	73,102	79,245
Employee entitlements	19	**6,380**	7,929	6,899
Current tax	6	**-**	-	2,556
Lease liabilities	17	**2,164**	2,834	1,711
Other current liabilities		**137**	-	-
Total current liabilities		**81,571**	83,865	90,411

The statement of accounting policies and the accompanying notes form an integral part of these financial statements.

in thousands of New Zealand dollars	Note	Actual 2022	Budget 2022	Actual 2021
Non-current liabilities				
Deferred tax	6	**16,368**	8,965	13,283
Lease liabilities	17	**21,085**	21,941	22,792
Other non-current liabilities	20	**387**	387	447
Total non-current liabilities		**37,840**	31,293	36,522
Total liabilities		**119,411**	115,158	126,933
Net assets		**306,406**	279,655	275,256
Equity				
Share capital	7	**62,268**	62,268	47,268
Revaluation reserves	7	**113,948**	90,895	96,558
Retained earnings		**130,189**	126,492	131,430
Total equity		**306,406**	279,655	275,256

Dr Paul Reynolds
Chair
19 September 2022

Kim Wallace
Deputy Chair
19 September 2022

The statement of accounting policies and the accompanying notes form an integral part of these financial statements.

Consolidated statement of cash flows

For the year ended 30 June 2022

in thousands of New Zealand dollars	Note	Actual 2022	Budget 2022	Actual 2021
Cash received from operating activities				
Receipts from customers		**162,589**	199,986	184,923
Interest received		**1,212**	840	1,032
Dividends received		**114**	-	35
Total cash received from operating activities		**163,915**	200,826	185,990
Cash disbursed on operating activities				
Payments to employees		**69,561**	68,564	69,450
Payments to suppliers		**74,372**	109,207	68,729
Restructuring		**124**	-	636
Income tax paid		**2,963**	2,230	3,343
Interest paid		**788**	866	874
Total cash disbursed on operating activities		**147,808**	180,867	143,032
Net cash flow from operating activities	22	**16,107**	19,959	42,958
Cash received from investing activities				
Disposal of property, plant and equipment		**25**	-	14,200
Disposal of investments and intangible assets		**2**	-	56
Total cash received from investing activities		**27**	-	14,256
Cash disbursed on investing activities				
Investment in property, plant and equipment		**26,346**	45,282	12,392
Purchase of other investments and intangible assets		**1,629**	2,130	979
Partner contribution to research consortiums		**-**	-	800
Total cash disbursed on investing activities		**27,975**	47,412	14,171
Net cash flow from investing activities		**(27,948)**	(47,412)	85
Cash received from financing activities				
Capital drawdown	7	**15,000**	15,000	-
Total cash received from financing activities		**15,000**	15,000	-
Cash disbursed on financing activities				
Repayment of the lease liabilities		**1,833**	1,951	2,198
Total cash disbursed on financing activities		**1,833**	1,951	2,198
Net cash flow from financing activities		**13,167**	**13,049**	**(2,198)**
Total net cash flow		**1,326**	(14,404)	40,845
Cash at beginning of year		**95,842**	93,175	55,007
Effect of exchange rate changes on the balance of cash held in foreign currencies		**-**	-	(10)
Cash at end of year		**97,168**	78,771	95,842

The statement of accounting policies and the accompanying notes form an integral part of these financial statements.

Consolidated statement of changes in equity

For the year ended 30 June 2022

in thousands of New Zealand dollars	Note	Share capital	Revaluation Property, plant and equipment	Retained earnings	Total equity
Balance at 1 July 2020		47,268	90,950	106,889	245,107
Profit after tax for the year		-	-	24,483	24,483
Revaluation of properties	8	-	6,807	-	6,807
Transfer of revaluation reserve on sold assets		-	(58)	58	-
Income tax relating to components of other comprehensive income	6	-	(1,141)	-	(1,141)
Total comprehensive income		-	5,608	24,541	30,149
Balance at 30 June 2021		47,268	96,558	131,430	275,256
Balance at 1 July 2021		47,268	96,558	131,430	**275,256**
Issue of new shares	**7**	**15,000**	**-**	**-**	**15,000**
Profit/(loss) after tax for the year		**-**	**-**	**(1,241)**	**(1,241)**
Revaluation of properties	**8**	**-**	**20,909**	**-**	**20,909**
Income tax relating to components of other comprehensive income	**6**	**-**	**(3,519)**	**-**	**(3,519)**
Total comprehensive income		**15,000**	**17,390**	**(1,241)**	**31,149**
Balance at 30 June 2022		**62,268**	**113,948**	**130,189**	**306,406**

Statement of accounting practices

For the year ended 30 June 2022

Reporting entity

AgResearch Limited is a Crown Research Institute. Its principal activity is research and development in the pastoral sector of New Zealand. The consolidated financial statements of AgResearch Limited and its subsidiaries, associates and joint arrangement interests (together referred to as "the Group") have been prepared in accordance with the requirements of the Companies Act 1993, the Financial Reporting Act 2013, the Crown Research Institutes Act 1992, the Crown Entities Act 2004 and the Public Finance Act 1989.

Basis of preparation

The financial statements have been prepared in accordance with New Zealand Generally Accepted Accounting Principles (GAAP). They comply with the New Zealand Equivalents to International Financial Reporting Standards (NZ IFRS) and other applicable financial reporting standards as appropriate for tier 1 profit-orientated entities.

The financial statements are presented in New Zealand dollars rounded to the nearest thousand. The financial statements were authorised for issue by the directors on ## September 2022.

Estimates and judgements which are considered material to understand the performance of AgResearch are found in the following notes:

- Revenue: Note 1
- Property, plant and equipment: Note 8

Basis of consolidation

The financial statements of members of the Group are prepared for the same reporting period as AgResearch Limited, using consistent accounting policies.

In preparing The Group's financial statements, intra-group balances, and any unrealised income and expenses arising from intra-group transactions, are eliminated. Unrealised gains arising from transactions with equity accounted investees are eliminated against the investment to the extent of AgResearch's interest in the investee. Unrealised losses are eliminated in the same way as unrealised gains, but only to the extent that there is no evidence of impairment.

Goods and services tax (GST)

The consolidated financial statements are prepared on a GST exclusive basis with the exception of receivables and payables which include GST.

Inventories

Inventories are valued at the lower of cost, determined on a first-in first-out basis and net realisable value. The cost of harvested agricultural produce is measured at fair value less estimated point-of-sale costs at the point of harvest.

Statement of cashflows

Cash and cash equivalents

Cash and cash equivalents include cash on hand, cash in banks, demand deposits and other highly liquid investments readily convertible into cash.

Operating activities

Operating activities include all transactions and other events that are not investing or financing activities.

Investing activities

Investing activities are those activities relating to the acquisition and disposal of current and non-current investments and any other non-current assets.

Financing activities

Financing activities are those activities relating to changes in the equity and debt structure of the Group.

The Group as lessor

The Group enters into lease arrangements as a lessor. Leases for which the Group is a lessor are classified as finance or operating leases. Whenever the terms of the lease substantially transfer all the risks and rewards of ownership to the lessee, the contract is classified as a finance lease. All other leases are classified as operating leases.

Budget figures

The unaudited budget figures are those approved by the Board and presented in the Statement of Corporate Intent, noting that the Board approval is of the Statement of Comprehensive Income, Statement of Financial Position and Capital Expenditure budget. The budget has been prepared using the same accounting policies as for these Consolidated Financial Statements.

Changes in accounting policies and disclosures

Accounting policies are changed only if the change is required by a standard or interpretation or otherwise provides more reliable and more relevant information. There were no changes to accounting policies in the 2022 year.

Standards and interpretations effective in the current period

In the current year the Group has adopted all mandatory new and amended standards and interpretations applicable to the Group.

There are no standards or interpretations issued, but not yet effective, that are expected to have a material impact on the Group.

1 Revenue

Revenue from contracts with customers

The Group applied the following judgements that significantly affect the determination of the amount and timing of revenue from contracts with customers:

Identifying performance obligations in a contract

The Group provides research services that are either for an entire project or part of a project that is managed by the Group for customers. The research services are a promise to report findings and related intellectual property in the future and are part of the negotiated work performed between the Group and the customer.

The Group determined that the milestones within each contract are generally not capable of being distinct. The fact that the Group would not be able to sell the individual milestones on a stand-alone basis indicates that a customer could not benefit from an individual milestone. In addition, the individual milestones are highly correlated, because the Group would not be able to transfer the work performed to date if the customer terminated the contract prior to completion.

The Group determined that the input method is the best method in measuring progress of the research services because there is a direct relationship between the effort (i.e., cost of hours incurred) and the transfer of service to the customer. The Group recognises revenue on the basis of the cost incurred relative to the total expected cost to complete the contract.

Principal versus agent consideration

The Group occasionally enters into contracts with its customers that require a third party to perform the work, on the customer's behalf, with the third party receiving full consideration and autonomy. Under these contracts, the Group provides hosting services (i.e., coordinating the selection of third parties and managing the delivery of the contract). The Group determined that it does not control the service, and it does not obtain benefits from the services performed, therefore it is an agent in these contracts.

Government grants

Revenue received from New Zealand's Strategic Science Investment Fund (SSIF) is considered to be a grant for research purposes and is accounted for under NZ IAS 20, Accounting for Government Grants and Disclosure of Government Assistance. The Fund is recognised as revenue in the year it is received. The primary condition is that the Group should undertake research activities as defined under the contractual agreement that awards the funding.

Our Land and Water National Science Challenge

Revenue received in respect of *Our Land and Water National Science Challenge* funding is accounted for as research revenue and brought to account as services are provided, based upon the proportion of completion of the contract at the end of the reporting period. The stage of completion is the proportion of contract costs incurred for work performed to date compared to the estimated total contract costs.

Commercial revenue

The Group derives revenue from the provision of research services to a range of agriculture-based customers in New Zealand. The Group determined that the milestones within each research contract are generally not capable of being distinct. These contracts are typically determined to have one single performance obligation that is integrated and fulfilled over time.

The transaction price is normally fixed at the start of the project. The nature of commercial contracts can sometimes lead to variations in the job scope, which is known as contract modification. It is also normal practice for contracts to include bonus and penalty elements based on timely construction or other performance criteria known as variable consideration. An estimate of variable consideration is included in the transaction price to the extent that it is highly probable that a significant reversal of revenue will not occur when any uncertainty is subsequently resolved.

Under the terms of the written contracts, the Group is contractually restricted from redirecting research outcomes to another customer and has an enforceable right to payment for work done. Therefore NZ IFRS 15.35(c) is satisfied and the Group recognises revenue in relation to contracting services over time.

Commercial contract assets are initially recognised at fair value. They are subsequently adjusted for credit impairment loss.

The Group becomes entitled to invoice customers for research services based on achieving a series of performance-related milestones. The Group will previously have recognised a contract asset for any work performed. Any amount previously recognised as a contract asset is reclassified to trade receivables at the point at which it is invoiced to the customer. If the milestone payment exceeds the revenue recognised to date under the cost-to-complete method then the Group recognises a liability for the difference. There is not considered to be a significant financing component in contracts with customers as the period between the recognition of revenue under the cost-to-cost method and the milestone payment is always less than one year.

Farm produce

Revenue from the sale of goods is recognised when the Group has transferred the control of the goods to the buyers.

Other revenue

Royalty revenue is recognised on an accrual basis in accordance with the substance of the relevant agreement and usage volumes provided by licensees. Dividend revenue from investments is recognised in the financial period in which the right to receive payment is established. Interest revenue is recognised on a time-proportionate basis that takes into account the effective yield on the financial asset.

COVID-19 impact on revenue

The effect of the COVID-19 continues to have an impact on the Group. Although there is no impact on SSIF, commercial revenue from some science research projects were permanently lost and some others will have delays to FY23 and beyond.

This is due to:

- Commercial customers facing significant uncertainty in the short-to-medium term, which impacts research and development spending commitment
- Global supply chain disruption and consumer COVID-19 responses generating significant market volatility
- International revenue significantly impacted by the border closure.

During the 2021 financial year, $13.57m of the CRRF from MBIE was received to replace the revenue lost due to COVID-19 and support the Group to maintain its national science capability and continue capital investment programmes, which will support the health and primary sectors and New Zealand's COVID-19 recovery path. There were no conditions or obligations associated with the grant, therefore it was recognised in profit and loss in the 2021 financial year. No equivalent revenue was received in the 2022 financial year.

in thousands of New Zealand dollars	2022	2021
Other revenue		
Interest	**1,184**	1,029
Dividends	**114**	35
Royalties	**12,399**	11,177
Operating lease income	**3,896**	3,421
	17,593	15,662

2 Operating expenditure

in thousands of New Zealand dollars	Note	2022	2021
Employee related			
Salary and wages		**67,128**	68,371
Superannuation contribution		**1,870**	1,861
Operational			
Amortisation and impairment of intangible assets	9	**498**	561
Depreciation	8	**11,498**	11,322
Depreciation of right-of-use assets	14	**2,226**	2,460
Short-term and low-value lease expenses		**220**	148
Other operating expenses		**22,299**	23,738
Science third party sub-contracts		**26,414**	20,083
Site and property expenses		**6,943**	6,434
Supplies		**14,162**	15,593
Financial and administration			
Auditor's remuneration - for services as auditor *		**356**	279
Bad debts		**34**	1
Change in provision for expected credit loss		**6**	(2)
Directors' fees		**314**	353
Donations		**2**	2
Financial and legal expenses		**2,171**	2,584
		156,141	153,788

* The audit fee includes Office of the Auditor-General Audit Standards and Quality Support Charge contribution of $27,300 (2021: $22,200) and audit remuneration related to other subsidiaries of $4,912 (2021: $4,568) and prior period Deloitte fees of $7,983k.

3 Other gains/(losses)

in thousands of New Zealand dollars	Note	2022	2021
Net gain/(loss) from foreign currency exchange		**8**	(114)
Net gain/(loss) on sale of property, plant and equipment		**8**	213
Net gain/(loss) on distribution of other investments		**-**	8
Net gain (loss) on sale of non-current assets held for sale		**(30)**	-
Net gain (loss) on sale of subsidiaries		**169**	-
Change in fair value of other investments		**(355)**	103
Change in fair value of derivative financial instruments		**-**	11
Change in fair value of forestry	15	**33**	82
Change in fair value of livestock	12	**548**	19
(Impairment) / write ups of property, plant and equipment and software	8, 9	**(416)**	(778)
Land compensation		**12**	14,027
Insurance proceeds		**-**	4,650
Impairment of investments	16	**(78)**	(76)
		(101)	18,145

4 Finance cost

in thousands of New Zealand dollars	Note	2022	2021
Interest expense on lease liabilities		**796**	860
Other interest expense		**6**	14
		802	874

5 Investments in associates and joint ventures

Associates are those entities in which the Group has significant influence, but not control, over the financial and operating policies. Joint ventures are those arrangements in which the Group has contractually agreed joint control and has rights to the net assets of the venture rather than having rights to assets and obligations for its liabilities. Associates and joint ventures are accounted for using the equity method (equity accounted investees).

Under the equity method, an investment in an associate is initially recognised in the consolidated statement of financial position at cost and adjusted thereafter to recognise the Group's share of the profit or loss and other comprehensive income of the associate. When the Group's share of losses of an associate exceeds the Group's interest in that associate, the Group discontinues recognising its share of further losses. Additional losses are recognised only to the extent that the Group has incurred legal or constructive obligations or made payments on behalf of the associate.

On acquisition of the investment in an associate, any excess of the cost of the investment over the Group's share of the net fair value of the identifiable assets and liabilities of the investee is recognised as goodwill, which is included within the carrying amount of the investment. The goodwill is assessed annually for impairment as part of the investment.

Associate company	Balance Date	% of ownership interest and voting power held by the group 2022	2021	Principal activity
Velvet Antler Research New Zealand Limited	30 September	-	50	Managing investments in velvet antler research and commercialising the intellectual property
DEEResearch Limited	30 June	-	50	Research and development relevant to deer farming and processing for deer products (except deer velvet)
Biopolymer Network Limited	30 June	43	43	Research and development of high performance bio- based products
Pastoral Greenhouse Gas Research Consortium held via (AgResearch [PPGR Consortia] Limited)	30 June	22	22	To undertake research into greenhouse gases produced by ruminants and exploit any resulting intellectual property
Encoate Holdings Limited	30 June	50	50	To research and develop bacteria and probiotics stabilisation technologies
Overseer Limited	30 June	50	50	Operating entity set up to sub-license the Overseer model to end users
Southern Dairy Hub Limited Partnership	31 May	37.5	37.5	Promotion and development of dairy industry good activities
SDH GP Limited	31 May	37.5	37.5	General partner

All associates are incorporated in New Zealand. There are no restrictions on the ability of any associate to pay dividends, repay loans or otherwise transfer funds to the investor company.

All associates are private entities and there is no quoted market price available for the investments. DEEResearch Limited and Velvet Antler Research New Zealand were deregistered this financial year with a carrying amount of nil (2021: nil).

Summarised financial information for associates and joint ventures

in thousands of New Zealand dollars	2022	2021
Share of profit/(loss) from continuing operations and total comprehensive income	**(897)**	(1,591)
Share of total comprehensive income	**(897)**	(1,591)
Aggregate carrying amount of the Group and company's interest in the associate investments	**5,330**	5,284
Aggregate carrying amount of the Group and company's interest in the joint ventures	**17**	423
	5,347	5,707

6 Taxation

Current tax

Current tax is calculated by reference to the amount of income taxes payable or recoverable in respect of the taxable profit or tax loss for the period. It is calculated using tax rates and tax laws that have been enacted or substantively enacted by reporting date. Current tax for current and prior periods is recognised as a liability (or asset) to the extent that it is unpaid (or refundable).

Deferred tax

Deferred tax is accounted for using the comprehensive balance sheet liability method in respect of temporary differences arising from differences between the carrying amount of assets and liabilities in the financial statements and the corresponding tax base of those items.

In principle, deferred tax liabilities are recognised for all taxable temporary differences. Deferred tax assets are recognised to the extent that it is probable that sufficient taxable amounts will be available, against which deductible temporary differences or unused tax offsets (e.g., losses) can be utilised. However, deferred tax assets and liabilities are not recognised if the temporary differences giving rise to them arise from the initial recognition of assets and liabilities (other than as a result of a business combination), which affects neither taxable income nor accounting profit. Furthermore, a deferred tax liability is not recognised in relation to taxable temporary differences arising from goodwill.

Deferred tax liabilities are recognised for taxable temporary differences arising on investments in subsidiaries, associates and joint ventures except where the Group is able to control the reversal of the temporary differences and it is probable that the temporary differences will not reverse in the foreseeable future. Deferred tax assets arising from deductible temporary differences associated with these interests are only recognised to the extent that it is probable that there will be sufficient taxable profits against which to utilise the benefits of the temporary differences and they are expected to reverse in the foreseeable future.

Deferred tax assets and liabilities are measured at the tax rates that are expected to apply to the period(s) when the assets and liabilities giving rise to them are realised or settled, based on tax rates (and tax laws) that have been enacted or substantively enacted by reporting date. The measurement of deferred tax liabilities and assets reflects the tax consequences that would follow from the manner in which the Group expects, at the reporting date, to recover or settle the carrying amount of its assets and liabilities.

Deferred tax assets and liabilities are offset when they relate to the income taxes levied by the same taxation authority and the Group intends to settle its current tax assets and liabilities on a net tax basis.

Current and deferred tax for the period

Current and deferred tax is recognised as an expense or income in the profit and loss, except when it:

- Relates to items recognised in equity, in which case the deferred tax or current tax is also recognised directly in equity; or
- Arises from the initial accounting for a business combination, in which case it is taken into account in the determination of goodwill or excess.

Tax expense comprises:

in thousands of New Zealand dollars	2022	2021
Current tax expense	**485**	3,670
Adjustments recognised in relation to the current tax of prior years	**(296)**	(412)
Deferred tax expense relating to the origination and reversal of temporary differences	**(664)**	418
Adjustments recognised in relation to deferred tax of prior years	**309**	148
Total tax expense/(benefit)	**(165)**	3,824

The total charge for the year can be reconciled to the accounting profit as follows:

in thousands of New Zealand dollars	2022	2021
Gain (loss) from continuing operations	**(1,406)**	28,307
Income tax expense calculated at 28% (2021: 28%)	**(394)**	7,926
Effect of revenue that is exempt from tax	**-**	(9,234)
Origination and reversal of temporary differences	**235**	1,269
Effect of expenses that are not deductible	**162**	4,230
Effect of impairment (reversals)/losses that are not (assessable)/deductible	**-**	5
Associates' results reported net of tax	**(182)**	(107)
	(179)	4,089
Adjustments recognised in the current year in relation to the current and deferred tax of prior years	**14**	(265)
Income tax expense/(benefit) recognised in profit or loss	**(165)**	3,824

Current tax assets and liabilities

in thousands of New Zealand dollars	2022	2021
Current tax assets		
Tax refund receivable	**139**	-
	139	-
Current tax liabilities		
Income tax payable	**-**	(2,556)
Net current tax liability/(asset)	**139**	(2,556)

Deferred tax assets/(liabilities) arise from the following:

in thousands of New Zealand dollars	Opening balance	Charged to surplus	Charged to other comprehensive income	Acquisitions disposals	Closing balance
2022					
Temporary differences					
Biological assets	(667)	(136)	-	-	(803)
Property, plant and equipment	(14,899)	552	(3,519)	-	(17,866)
Intangible assets	683	89	-	-	772
Provisions	1,296	119	-	-	1,415
	(13,587)	624	(3,519)	-	(16,482)
Unused tax losses and credits					
Tax losses	304	(190)	-	-	114
	(13,283)	434	(3,519)	-	(16,368)
2021					
Temporary differences					
Biological assets	(741)	74	-	-	(667)
Property, plant and equipment	(12,820)	(938)	(1,141)	-	(14,899)
Intangible assets	585	98	-	-	683
Financial assets	(29)	29	-	-	-
Provisions	1,389	(93)	-	-	1,296
	(11,616)	(830)	(1,141)	-	(13,587)
Unused tax losses and credits					
Tax losses	37	267	-	-	304
	(11,579)	(563)	(1,141)	-	(13,283)

Income tax recognised directly in other comprehensive income:

in thousands of New Zealand dollars	2022	2021
Revaluation of properties	(3,519)	(1,141)
Total income tax recognised directly in other comprehensive income	(3,519)	(1,141)

7 Equity

Share capital

Capital consists of 62,268,000 fully paid ordinary shares of $1.00 each (2021: 47,268,000 fully paid ordinary shares). The increase in share capital this year relates to the first of two capital injections from the Crown amounting to $15m comprising 15,000,000 ordinary shares of $1.00 each. The second capital injection of $30m, comprising 30,000,000 ordinary shares of $1.00 each, is receivable next financial year. The purpose of the $45m capital injection is to provide funding to progress the build of the new scientific research facility and corporate headquarters for AgResearch in Lincoln.

Reserves

The asset revaluation reserve arises on the revaluation of land, land improvements and buildings. Where revalued assets are sold, the portion of the asset revaluation reserve relating to that asset and which is therefore effectively realised, is transferred directly to retained earnings.

8 Property, plant and equipment

The Group has the following classes of property, plant and equipment:

- Land and land improvements - campus/farms
- Buildings - campus/farms
- Leasehold improvements
- Plant and equipment
- Vehicles
- Capital work in progress.

Fair value measurement

Land, land improvements and buildings are measured at fair value. Fair value is determined on the basis of an independent valuation prepared by external valuation experts (using either market value or optimised depreciated replacement cost), less any subsequent accumulated depreciation and subsequent accumulated impairment losses. Land, land improvements and buildings are revalued at least every three years or whenever there has been an indicator of a significant movement in the fair value. The fair values are recognised in the consolidated financial statements of the Group and are reviewed at the end of each reporting period to ensure that the carrying value of land, land improvements and buildings is not materially different from their fair values.

Any revaluation increase arising on the revaluation of land, land improvements and buildings is accumulated in the asset revaluation reserve, except to the extent that it reverses a revaluation decrease for the same asset previously recognised as an expense in profit and loss, in which case the increase is credited to profit and loss to the extent of the decrease previously charged. A decrease in carrying amount on the revaluation of land, land improvements and buildings is charged as an expense in profit and loss to the extent that it exceeds the balance, if any, held in the asset revaluation reserve relating to a previous revaluation of that asset.

All other assets are recorded at cost less accumulated depreciation and accumulated impairment. Capital work in progress is recorded at cost.

Assets measured at fair value are classified as level 3 assets in the fair value hierarchy.

Depreciation is provided for on a straight-line basis on all tangible property, plant and equipment, other than freehold land and capital work in progress, at depreciation rates calculated to allocate the assets' cost or other revalued amount over their estimated useful lives. Leasehold improvements are depreciated over the period of the

lease or estimated useful life, whichever is the shorter, using the straight-line method. The estimated useful lives, residual values and depreciation method are reviewed at the end of each annual reporting period.

Depreciation on revalued buildings is charged to the profit and loss. On the subsequent sale or retirement of a revalued property, the attributable revaluation surplus remaining in the asset revaluation reserve, net of any related deferred taxes, is transferred directly to retained earnings.

The following estimated useful lives are used in the calculation of depreciation:

- Land improvements 5-50 years
- Buildings (including farms) 5-80 years
- Leasehold Improvements 3-40 years
- Vehicles 3-10 years
- Plant and equipment
    - Dairy plant and equipment 5-25 years
    - Computer hardware 3-5 years
    - Other plant and equipment 3-15 years.

Fair value measurement of the Group's land, land improvements and buildings

The Group's land and buildings are stated at their "Fair Value" as defined in NZ IFRS 13, being the price that would be received on sale of the asset, less any subsequent depreciation and impairments.

The valuation was performed by independent valuers, Colliers Limited, under the requirements of NZ IAS 16 Property, Plant and Equipment. These valuations were performed using either market value or optimised depreciated replacement cost. For non-specialised assets where there is a comparable market for the same or a similar asset, value is determined by one or more of the following:

- Direct comparison
- Income
- Cost approach.

Assets that have a specialised use for the Group have been valued at optimised depreciated replacement cost. These assets include site improvements such as roads, fences and buildings. Optimised depreciated replacement cost is a method of valuation based on an estimate of the current gross replacement cost of an asset less allowances for physical deterioration and optimisation for obsolescence and surplus capacity. The Group's campus assets have been classified by Colliers International as non-specialised assets and have, therefore, been assigned a market-based value.

The Group acquired land from Lincoln University for $1 last year. Due to restrictions in place over this land, management has determined this to be its fair value.

in thousands of New Zealand dollars	Land and Land Improvements[1]	Buildings[1]	Leasehold Improvements[2]	Plant & Equipment[2]	Vehicles[2]	Capital Work-in Progress[2]	Total
2022							
Balance at beginning of year	69,101	116,343	166	21,691	207	9,038	216,546
Additions	273	797	13	3,275	80	24,652	29,090
Disposals	-	(34)	-	(58)	-	-	(92)
Revaluation	8,342	12,567	-	-	-	-	20,909
Impairments	(342)	130	-	-	-	-	(212)
Depreciation	(772)	(5,043)	(13)	(5,624)	(46)	-	(11,498)
Balance at end of year	76,602	124,760	166	19,284	241	33,690	254,743
Cost or valuation	76,620	125,006	708	117,929	751	33,690	354,704
Accumulated depreciation	(18)	(246)	(542)	(98,645)	(510)	-	(99,961)
Balance at end of year	76,602	124,760	166	19,284	241	33,690	254,743
2021							
Balance at beginning of year	64,486	120,324	190	20,829	242	4,721	210,792
Additions	498	234	-	6,143	8	4,342	11,225
Disposals (including transfer to leased assets)	(62)	(6)	-	(110)	-	-	(178)
Transfers	-	(156)	-	181	-	(25)	-
Reinstated through current year profit and loss	75	-	-	-	-	-	75
Revaluations	4,928	1,885	(6)	-	-	-	6,807
Impairments	(108)	(667)	(3)	-	-	-	(778)
Reclassified as 'Assets held for sale'	(75)	-	-	-	-	-	(75)
Depreciation	(641)	(5,271)	(15)	(5,352)	(43)	-	(11,322)
Balance at end of year	69,101	116,343	166	21,691	207	9,038	216,546
Cost or valuation	69,275	116,869	695	114,882	700	9,038	311,459
Accumulated depreciation	(174)	(526)	(529)	(93,191)	(493)	-	(94,913)
Balance at end of year	69,101	116,343	166	21,691	207	9,038	216,546

[1] Assets are stated at their Fair Value

[2] Assets are stated at their cost

The Group's assets were revalued during the year resulting in a net increase of assets of $20,697k (2021: $6,029k)

in thousands of New Zealand dollars	2022	2021
Through the asset revaluation reserve, being a reversal of prior year revaluations.	**20,909**	6,807
Through the profit and loss	**(212)**	(778)
	20,697	**6,029**

Had the Group's land and buildings (other than land and buildings classified as held for sale or included in a disposal group) been measured on a historical cost basis, their carrying amount would have been as follows:

in thousands of New Zealand dollars	2022	2021
Land and land improvements	**22,299**	21,851
Buildings	**86,747**	88,336

Fair value measurement of the Group's land, land improvements and buildings

The Group's land and buildings are stated at their "Fair Value" as defined in NZ IFRS 13, being the price that would be received on sale of the asset, less any subsequent depreciation and impairments.

The valuation was performed by independent valuers, Colliers Limited, under the requirements of NZ IAS 16 Property, Plant and Equipment. These valuations were performed using either market value or optimised depreciated replacement cost. For non-specialised assets where there is a comparable market for the same or a similar asset, value is determined by one or more of the following:

- Direct comparison
- Income
- Cost approach.

Assets that have a specialised use for the Group have been valued at optimised depreciated replacement cost. These assets include site improvements such as roads, fences and buildings. Optimised depreciated replacement cost is a method of valuation based on an estimate of the current gross replacement cost of an asset less allowances for physical deterioration and optimisation for obsolescence and surplus capacity. The Group's campus assets have been classified by Colliers International as non-specialised assets and have, therefore, been assigned a market-based value.

The Group acquired land from Lincoln University for $1 last year. Due to restrictions in place over this land, management has determined this to be its fair value.

9 Intangible assets

Purchased intangible assets

Purchased intangible assets such as intellectual property, patents, trademarks and licences are recorded at cost less accumulated amortisation and accumulated impairment losses. Amortisation is charged over their estimated useful lives, which varies between five and 20 years. The estimated useful life and amortisation method is reviewed at the end of each annual reporting period.

Acquired computer software licences are capitalised on the basis of the costs incurred to acquire and bring to use the specific software. These costs are amortised over their estimated useful lives (between three and five years on a straight-line basis). Costs associated with maintaining computer software programmes are recognised as an expense as incurred.

Access rights relate to an agreement between the Group and Massey University whereby the Group has access to the Dairy Research Farm and associated research facilities in the Manawatū for a period of 20 years from 1 July 2020. This is aligned with both parties desire to encourage synergies and closer collaborative working between their respective agricultural and dairy research activities with a view to enhancing the value each organisation can add to New Zealand through research, science and technology.

Internally generated intangible assets - research and development expenditure

Research expenditure is expensed in the period incurred.

The cost of an internally generated intangible asset represents expenditure incurred in the development phase of the asset only.

Development expenditure is expensed in the period incurred unless all of the following conditions have been demonstrated:

- The intention to complete the intangible asset and use or sell it
- How the asset created will generate future economic benefits
- The ability to measure reliably the expenditure attributable to the intangible asset during its development
- The availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset.

Internally generated intangible assets that satisfy the asset recognition criteria above are amortised on a straight-line basis over future periods from which benefits are expected to accrue. These future periods are between five and seven years.

Computer software development costs that are directly associated with the production of identifiable and unique software products controlled by the Group, and that will probably generate economic benefits exceeding costs beyond one year, are recognised as intangible assets. Direct costs include the software development employee costs and an appropriate portion of relevant overheads.

Computer software development costs recognised as assets are amortised over their estimated useful lives (not exceeding five years).

Disposal of intangible assets

Realised gains and losses arising from disposal of intangible assets are recognised in the profit and loss in the period in which the transaction occurs.

in thousands of New Zealand Dollars	Software	Intellectual property and patents	Access Rights	Total
2022				
Balance at beginning of year	1,565	47	-	1,612
Additions	101	-	2,000	2,101
Disposal arising from sale of subsidiary	(832)	-	-	(832)
Impairment	(204)	-	-	(204)
Amortisation	(292)	(6)	(200)	(498)
Balance at end of year	338	41	1,800	2,179
Cost	8,883	1,631	2,000	12,514
Accumulated depreciation	(8,545)	(1,590)	(200)	(10,335)
Balance at end of year	338	41	1,800	2,179
2021				
Balance at beginning of year	2,396	54	-	2,450
Additions	535	-	-	535
Transfers from work in progress to profit and loss	(812)	-	-	(812)
Amortisation	(554)	(7)	-	(561)
Balance at end of year	1,565	47	-	1,612
Cost	12,168	1,632	-	13,800
Accumulated depreciation	(10,603)	(1,585)	-	(12,188)
Balance at end of year	1,565	47	-	1,612

10 Trade and other receivables

in thousands of New Zealand dollars	2022	2021
Trade receivables not past due	14,138	1,692
Past due 1 - 30 days	4,360	8,181
Past due more than 30 days	1,737	2,072
Less provision for impairment in receivables	(12)	(9)
Net trade receivables	20,223	11,936
Accrued income and other receivables	9,518	26,589
Insurance proceeds receivable	-	4,650
Receivables from associates	58	511
Receivables from other related parties	-	81
Total trade and other receivables	29,799	43,767

The fair value of trade and other receivables is approximately equal to their carrying value. Terms of trade vary according to individual customer contracts. As at 30 June 2022, trade receivables of $1,737k (2021: $2,072k) were past due. These relate to a number of independent customers for whom there is no recent history of defaults.

A provision for the impairment of receivables is established using simplified expected credit losses model which sees a lifetime expected loss allowance for all trade receivables .

11 Trade and other payables

Trade payables and other payable are recognised when the Group becomes obliged to make future payments resulting from the purchase of goods and services. Trade and other payables are subsequently measured at amortised cost using the effective interest method. This represents their fair value given the short-term nature of the liability.

A provision is recognised when the Group has a legal or constructive obligation as a result of a past event, it is probable that an outflow of economic benefits will be required to settle the obligation, and the provision can be reliably measured.

The fair value of trade payables is approximately equal to their carrying value as all amounts are expected to be settled within 90 days. No interest is charged on trade payables.

in thousands of New Zealand dollars	2022	2021
Trade payables	**16,681**	16,338
Income in advance	**55,135**	62,302
Provisions	**1,074**	605
Total payables	**72,890**	79,245

Financial risk management strategies

The Group has financial risk management policies in place to ensure that all payables are paid within the credit time frame.

12 Biological assets - livestock

Livestock are valued at their fair value less estimated point-of-sale costs by reference to the most relevant active market. An allowance is made for a reduction in the value of certain livestock held for research trials. Changes in the valuation of livestock are recognised through profit and loss.

in thousands of New Zealand dollars	Sheep	Beef cattle	Dairy cattle	Deer	Total
2022					
Reconciliation of changes in the carrying value					
Balance at beginning of year	1,121	916	1,445	350	3,832
Increases due to acquisitions	189	273	9	-	471
Decreases due to sales	(898)	(851)	(285)	(103)	(2,137)
Net increase due to births, growth and deaths	687	266	265	127	1,345
Changes in fair value less estimated point-of-sale costs	30	153	215	150	548
Balance at end of year	1,129	757	1,649	524	4,058
Quantity of livestock at end of year	7,190	863	1,009	1,069	
2021					
Reconciliation of changes in the carrying value					
Balance at beginning of year	1,070	957	1,531	375	3,933
Increases due to acquisitions	70	511	26	-	607
Decreases due to sales	(922)	(1,060)	(280)	(127)	(2,389)
Net increase due to births, growth and deaths	776	514	250	122	1,662
Changes in fair value less estimated point-of-sale costs	127	(6)	(82)	(20)	19
Balance at end of year	1,121	916	1,445	350	3,832
Quantity of livestock at end of year	7,264	1,132	1,019	977	

Livestock valuation method

Livestock was valued by PGG Wrightson Limited by reference to market evidence of recent transactions for similar livestock, taking into account the age, breed, type, condition and location of the animals.

Financial risk management strategies

The Group is exposed to financial risks relating to the damage to livestock from climatic changes, diseases and other natural forces. The Group has processes in place aimed at monitoring and mitigating those risks, including pest and disease monitoring and management strategies.

13 Loan receivable

The loan receivable represents the consideration payable by Farm IQ Systems Ltd for the purchase of Farmax (a previously held subsidiary of AgResearch Ltd) on 1 September 2021 plus 6% interest for the 10 month period to 30 June 2022. At any time on or after 31 December 2022, AgResearch Ltd may elect, by written notice to Farm IQ Systems Ltd, to convert all of the loan amount, together with all unpaid interest accrued, into conversion shares by applying that amount to subscribe for conversion shares at the conversion price.

14 Right-of-use assets

The Group leases several assets including land and buildings, IT and science equipment and vehicles. Extension options are included in a number of property leases. In determining the lease term, management has considered all facts and circumstances that create an economic incentive to exercise an extension option. Extension options are only included in the lease term if the lease is reasonably certain to be extended.

Right of use assets are initially measured at cost. This comprises the initial amount of the lease liability adjusted for any lease payments made at or before the commencement date, plus any initial direct costs incurred, less any lease incentives received. The right of use asset is depreciated on a straight-line basis over the lease term.

The Group applies NZ IAS 36 to determine whether a right-of-use asset is impaired.

in thousands of New Zealand dollars	Property	Plant and equipment	Vehicles	Total
2022				
Cost				
Balance at beginning of year	**27,449**	**24**	**635**	**28,108**
Additions	**633**	**-**	**112**	**745**
Disposals	**(285)**	**(24)**	**(93)**	**(402)**
Balance at end of year	**27,797**	**-**	**654**	**28,451**
Accumulated depreciation				
Balance at beginning of year	**(3,946)**	**(13)**	**(304)**	**(4,263)**
Depreciation	**(2,062)**	**(4)**	**(160)**	**(2,226)**
Disposals	**124**	**17**	**93**	**234**
Balance at end of year	**(5,884)**	**-**	**(371)**	**(6,255)**
Carrying amount				
Balance at end of year	**21,913**	**-**	**283**	**22,196**
Average lease term (years)	**11**	**1**	**2**	
2021				
Cost				
Balance at beginning of year	28,975	275	538	29,788
Additions	609	24	188	821
Disposals	(2,135)	(275)	(91)	(2,501)
Balance at end of year	27,449	24	635	28,108
Accumulated depreciation				
Balance at beginning of year	(2,236)	(183)	(215)	(2,634)
Depreciation	(2,176)	(106)	(178)	(2,460)
Disposals	466	276	89	831
Balance at end of year	(3,946)	(13)	(304)	(4,263)
Carrying amount				
At 30 June 2020	23,503	11	331	23,845
Average lease term (years)	9	1	2	

15 Biological assets–forestry

Forests are recorded at their fair value less point-of-sale costs on an annual basis using anticipated harvesting timing and yield and an applicable discount rate. Changes in the valuation of forests are accounted for through profit or loss. During the year, 4.2 ha of forestry was logged and sold generating income less costs to sell of $55k.

Emissions trading scheme

Forestry land is subject to the provisions of the New Zealand Emissions Trading Scheme (ETS). Should the land be deforested (the land is changed from forestry to some other purpose), a deforestation liability will arise.

Compensation units are recognised based on their cost.

The Group has radiata pine tree crops at Ballantrae, Invermay and Woolford.

in thousands of New Zealand dollars	2022	2021
Reconciliation of changes in the carrying value		
Balance at beginning of year	**1,327**	1,245
Decreases due to harvesting and sale of forestry	**(85)**	-
Changes in fair value less estimated point-of-sale costs	**33**	82
Balance at end of year	**1,275**	1,327
Area (ha) of forest at end of year	**115**	119

Forestry valuations

Forestry was valued by Alan Bell & Associates as at 30 June 2022. The value of forestry at 30 June 2022 was $1,275k (2021: $1,327k).

The methodology used is "stand-based" in line with forestry management practices and harvesting. Where transactions have occurred for similar tree crops, value is based on those transactions.

Where there have been no such transactions, value is based on:

- Estimates of future costs and returns for mature crops
- Standard investment costs for young crops
- A mixture of the above for intermediate crops.

Additional inputs to the value arrived at are:

- Anticipated harvest timing and yield
- A 8.5% real discount rate on pre-tax cash flows (2021: 8.5%)
- An assumed 3% compounding rate on standard costs (2021: 3%)
- Current market prices and long-term trends in log prices. Log prices used are based on current market prices and 12-quarter rolling average prices published by the Ministry of Primary Industries.

Emissions units

The Group held 18,975 ETS units as at 30 June 2022. There is no change to the ETS units during the 2022 financial year (2021: no change). All ETS units are carried at their original cost.

Financial risk management strategies

The Group is exposed to financial risks arising from changes in timber prices. The Group is a long-term forestry investor and does not expect timber prices to decline significantly in the foreseeable future. It has, therefore, not taken any measures to manage the risks of a decline in timber prices.

Land value and contingency

In the event that the forest areas are harvested, a deforestation liability equivalent to the decrease in carbon will be incurred. This liability is not recognised on the balance sheet as there is no current intention of changing the land use subject to the ETS.

16 Other investments

in thousands of New Zealand dollars	2022	2021
Fonterra Co-operative Group Limited	**1,367**	1,772
Other investments	**838**	866
Total	**2,205**	2,638

Valuation of other investments

- Fonterra shares are valued using the quoted market price on the NZX market
- All other investments are valued using the quoted market price on the NZX listed market, NZX unlisted market or the share prices set by the individual entities as appropriate.

Impairment on other investments

During the year, the gains/(losses) of other investments was recognised as follows:

in thousands of New Zealand dollars	2022	2021
BioPacific Ventures Fund	**-**	11
Other	**78**	65
Total	**78**	76

17 Lease liabilities

The lease liability is initially measured at the present value of the lease payments that are not paid at the lease commencement date, discounted by using the rate implicit in the lease. If this rate cannot be readily determined, the Group uses its incremental borrowing rate.

The lease liability is subsequently measured by increasing the carrying amount to reflect interest on the lease liability (using effective interest rate method) and by reducing the carrying amount to reflect the lease payments made. It is remeasured when there is a change in future lease payments, or if the Group changes its assessment of whether it will exercise an extension or termination option.

The total cash outflow for leases amounts to NZ $2,438k (2021: $2,877k).

in thousands of New Zealand dollars	2022	2021
Current	**2,164**	1,711
Non-current	**21,085**	22,792
Total	**23,249**	24,503

Amounts payable under leases	2022	2021
Within one year	**2,164**	1,711
Later than one year but not later than five years	**5,654**	5,955
Later than five years	**15,431**	16,837
Total	**23,249**	24,503

18 Goodwill

The movement of goodwill is shown below:

in thousands of New Zealand dollars	2022	2021
Opening balance	**907**	907
Derecognised on disposal of a subsidiary	**(907)**	-
Closing balance	-	907

The opening balance of goodwill relates to the purchase of Farmax Limited, incorporated as a 100% subsidiary in June 2018. This subsidiary was sold to Farm IQ Systems Ltd on 1 September 2021 and goodwill is therefore derecognised.

19 Employee entitlements

in thousands of New Zealand dollars	2022	2021
Annual leave	**4,577**	5,297
Payroll accruals	**1,803**	1,602
Balance at end of year	**6,380**	6,899

Provision is made for entitlements owing to employees in respect of wages and salaries, annual leave, and alternative days leave. Provisions are recognised when it is probable they will be settled and can be measured reliably.

In the current year, the employee entitlements provision includes $157k to remediate former staff for historic payroll matters in relation to compliance with the Holidays Act 2003 (2021: $494k).

20 Other non-current liabilities

Key money

In 2015, AgResearch Limited sold a building and entered into a sub-lease of the land on which the building is located. The lessee has paid an upfront lump sum as key money in relation to the lease. The key money is being recognised as income over the term of the lease (including renewal periods).

in thousands of New Zealand dollars	2022	2021
Key money received in advance	**447**	506
Key money referable to lease in current period	**(60)**	(59)
Total Other non-current liabilities	**387**	447

21 Investments in subsidiaries

Subsidiaries are entities controlled by the Group.

The results of any subsidiaries that become, or cease to be, part of the Group during the year are consolidated from the date that control commenced or until the date that control ceased. On 1 September 2021, AgResearch sold Farmax to Farm IQ Systems Ltd. The results of Farmax are consolidated up to and including 31 August 2021 (profit of $56k).

The interests of any non-controlling shareholders are stated in proportion of the fair values of the identifiable assets and liabilities recognised on acquisition plus their share of post-acquisition surpluses.

Subsidiary companies	Balance date	% of ownership interest and voting power held by the Group 2022	2021	Principal activity
Celentis Limited	30 June	100	100	Holding company
Grasslanz Technology Limited	30 June	100	100	Cultivar development and management
AgResearch (USA) Limited	30 June	100	100	Cultivar development and management in the USA
Grasslanz Technology Australia Pty Limited	30 June	100	-	Cultivar development and management in the Australia
AgResearch (Pastoral Genomics Consortia) Limited	30 June	100	100	Holding company
AgResearch (PPGR Consortia) Limited	30 June	100	100	Holding company
Covita Limited	30 June	100	100	Holding company
Phytagro New Zealand Limited	30 June	100	100	Holding company
Farmax Limited	30 June	-	100	Development and distribution of farm management software

Grasslanz Technology Limited is a direct subsidiary of Celentis Limited. AgResearch (USA) Limited and Grasslanz Technology Australia Pty Limited is a direct subsidiary of Grasslanz Technology Limited. All other subsidiary companies are direct subsidiaries of AgResearch Limited.

All subsidiary companies are incorporated in New Zealand.

22 Reconciliation of surplus after tax with net cashflow from operating activities

in thousands of New Zealand dollars	2022	2021
Surplus after tax	(1,241)	24,483
Non-cash Items		
Depreciation	11,498	11,322
Intangible assets amortisation	498	561
Depreciation of right-of-use	2,226	2,460
Net (gain)/loss on sale of property, plant and equipment	(8)	(213)
Net (gain)/loss on sale of subsidiary	(169)	-
Share of deficit of associates	897	1,591
Investment write down/revaluation	78	76
Change in fair value of forestry	(33)	(82)
Change in fair value of livestock	(548)	(19)
Change in fair value of other investments	355	(111)
Property, plant and equipment and software impairment/(write up)	416	778
Net (gain)/loss from foreign currency exchange	(8)	114
Change in fair value of derivative financial instruments	-	(11)
Bad and doubtful debt provision	40	-
Other non-cash items	30	(119)
Movements in working capital		
Change in current taxation	(2,695)	(82)
Change in deferred tax	(433)	563
(Increase)/decrease in inventory	54	68
(Increase)/decrease in livestock	322	120
(Increase)/decrease in receivables	13,681	(17,061)
(Increase)/decrease in prepayments	441	(2,766)
(Increase)/decrease in other current assets	(2)	200
Increase/(decrease) in provisions	(252)	(301)
Increase/(decrease) in payables	(6,193)	37,928
Increase in insurance proceeds receivable	-	(4,650)
Items classified as investing activities		
Increase/(decrease) in property, plant & equipment, intangible assets and investment accruals	(2,902)	2,136
Other land compensation	55	(14,027)
Net cash flow from operating activities	16,107	42,958

23 Heritage assets

Heritage assets are those assets that are held for the duration of their physical lives because of their unique cultural, historical, geographical, scientific and or environmental attributes. The Group has identified a germplasm collection as a heritage asset with no acquisition cost. The nature of this heritage asset, and its significance to the science the Group undertakes, makes it necessary to disclose it. The Directors believe there is no practical basis upon which to reliably measure the fair value of this collection. Details of the collection are outlined below:

Asset	Description
Margot Forde Germplasm Centre	New Zealand's national genebank of grassland plants and Australia's genebank for perennial grasses and legumes

24 Operating lease arrangements

The Group as a lessor

in thousands of New Zealand dollars	2022	2021
Non-cancellable operating lease receivables		
Receivable no later than 1 year	**2,260**	2,325
Receivable later than 1 year and not longer than 5 years	**4,452**	2,602
Receivable later than 5 years	**318**	944
Total non-cancellable operating leases	**7,030**	5,871

Operating lease receivables relate to land and buildings leased on the four campuses owned by AgResearch Limited. The lease terms are between one month and 17 years, with one lease having an option to extend for a further five terms, each of five years. Lease income is recognised in profit or loss on the straight-line basis over the lease terms. Management constantly manage the risks associated with any rights retained in the leased assets. The following approaches have been taken to reduce the risks associated:

- All leases have the provisions for periodic rent reviews to market rates
- The lessees are liable for any damage or loss to the leased properties caused by careless or abnormal use
- No lessees have an option to purchase the property at the expiry of the lease period.

25 Joint operation investments

Joint operations are joint arrangements between the Group and another party in which there is a contractual agreement to undertake a specific business project and in which the joint parties are severally liable in respect of costs and liabilities of the project and share in any resulting output. The Group's share of the assets, liabilities, revenues and expenses of joint operations are incorporated into the Group financial statements on a line-by-line basis using the proportionate method. Where the Group transacts with its jointly controlled entities, unrealised profits and losses are eliminated to the extent of the Group's interest in the joint operation.

Details of the Group's material joint operations at the end of the year are as follows:

Subsidiary companies	Balance date	% of ownership interest and voting power held by the Group 2022	2021	Principal activity
Grasslands Innovation Limited	30 June	30	30	To identify, develop and exploit product opportunities in proprietary forage cultivars and other forage technologies

The 30% interest in Grasslands Innovation Limited is held via Grasslanz Technology Limited, a wholly-owned subsidiary of AgResearch Limited. Grasslands Innovation Limited is incorporated in New Zealand. Grasslands Innovation Limited is considered a joint operation by virtue of the contractual arrangements that specify the parties' rights to the economic inputs and outputs of the joint arrangement and retention of ownership rights to pre-existing IP contributed by the parties.

26 Transactions with related parties

The ultimate shareholder of the Group is the Crown. The Group undertakes many transactions with other Crown entities, state-owned enterprises and government departments, which are carried out on a commercial and arms-length basis. A summary of other related party transactions is detailed below.

Trading transactions with related parties

	Sale of services		Due from	
in thousands of New Zealand dollars	2022	2021	2022	2021
Research, development and other services				
Transactions between AgResearch and related parties:				
Subsidiaries	**4,298**	3,725	**13**	120
Associates and joint ventures	**1,474**	6,313	**58**	511
Joint operations	**497**	396	**-**	-
Transactions between the Group and related parties:				
Entities of which key management personnel are associated *	**8,947**	8,539	**2,411**	535

Revenue from MBIE are disclosed in the Consolidated Statement of Comprehensive Income.

	Purchase of services		Due to	
in thousands of New Zealand dollars	2022	2021	2022	2021
Research, development and other services				
Transactions between AgResearch and related parties:				
Subsidiaries	**150**	64	**-**	3
Associates and joint ventures	**250**	-	**-**	-
Transactions between the Group and related parties:				
Entities of which key management personnel are associated *	**5,065**	2,948	**3**	170

The amounts outstanding are unsecured, on normal trade terms and will be settled in cash. No guarantees have been given or received. No expense has been recognised in the period for bad or doubtful debts in respect of the amounts owed by related parties.

* Trading transactions with entities of which key management personnel are associated include:

	Sale of services		Purchase of services		Due to	
in thousands of New Zealand dollars	2022	2021	2022	2021	2022	2021
Contact Energy Limited	**-**	-	**2**	1,298	**-**	-
DairyNZ Limited*	**2,390**	-	**1,339**	-	**1,946**	-
Enviro-Mark Solutions Limited T/A Toitu Envirocare	**-**	-	**-**	21	**-**	-
Grasslands Innovation Limited	**1,275**	1,092	**-**	122	**-**	-
House of Science NZ Charitable Trust*	**-**	-	**28**	-	**-**	-
Kim Wallace Limited	**-**	-	**49**	48	**-**	-
Landcare Research New Zealand Ltd	**624**	1,175	**2,788**	1,254	**(2)**	(69)
Museum of New Zealand	**-**	-	**-**	6	**-**	-
NIWA Vessel Management Limited*	**328**	-	**289**	-	**247**	-
NZ Post	**-**	-	**69**	62	**(2)**	(2)
Overseer Limited**	**37**	334	**250**	-	**-**	-
PGGRC	**1,315**	5,902	**-**	-	**-**	454
Riddet Institute	**-**	36	**-**	-	**-**	-
Science New Zealand (Acri)	**-**	-	**100**	137	**-**	(18)
Spring Sheep Dairy NZ Limited Partnership*	**211**	-	**-**	-	**193**	-
Te Waharoa Investments Ltd*	**26**	-	**-**	-	**12**	-
Total	**6,206**	8,539	**4,914**	2,948	**2,394**	365

* Entity was not related to the Group during FY21
** Key Management personnel are no longer associated with these entities

Equity interest in related parties

Details of the percentage of interests held in related parties are disclosed in Notes 5 and 21 to the Consolidated Financial Statements.

Key management remuneration reporting

The compensation of the Directors and executives, being the key management personnel of the Group, comprised:

in thousands of New Zealand dollars	2022	2021
Chief Executive Officer *	550	494
Directors' fees	313	353
Salaries and other short-term employee benefits	2,820	2,586
Termination payments	277	27
Total	3,960	3,460

* The Chief Executive Officer, who joined AgResearch on 27 June 2020, received $550k remuneration during the financial year which includes superannuation (2021: $494k). The company has no incentive schemes.

27 Financial instruments

Financial instruments carried in the Consolidated Statement of Financial Position include cash and cash equivalents, investments, derivative financial instruments, receivables and trade creditors. The particular recognition methods adopted are disclosed in the accounting policies where relevant.

Financial risk management

The Group has exposure to the following risks from its use of financial instruments:

- Credit risk
- Market risk
- Liquidity risk.

The Group has a Treasury policy, which it applies to actively manage these risks (refer below).

Credit risk

The financial instruments that potentially subject the Group to credit risk are cash, short-term deposits, forward-rate agreements and accounts receivable.

Credit risk is managed through the Treasury policy which:

- Places restrictions on the level of investment with any one counter-party
- Restricts the counter-parties that may be used to A Grade registered banks and the New Zealand government
- Sets parameters within which short-term investments must be made.

The Group has no significant concentrations of credit risk. The maximum exposure to credit risk is represented by the carrying value of each financial asset in the statement of financial position.

Trade receivables consist of a large number of customers spread across diverse sectors and geographical areas. On-going credit evaluation is performed on the financial condition of the trade receivables. Credit assessments are undertaken to determine the credit quality of the customer, taking into account their financial position, past experience and other relevant factors. Individual risk limits are granted in accordance with the internal credit policy and authorised via appropriate personnel as defined by the Group's delegation of authority manual.

The carrying amount of financial assets recorded in the financial statements, net of any allowances for losses, represents the maximum exposure to AgResearch of any credit risk.

AgResearch does not have any significant credit risk exposure to any single counter party. The credit risk on liquid funds and derivative financial instruments is limited because the counter parties are banks with high credit ratings assigned by international credit rating agencies.

AgResearch has not changed its overall strategy regarding the management of risk during the financial year.

Market risk

Currency risk

Revenues and expenses in foreign currency are translated to New Zealand dollars at the exchange rates in effect at the time of the transaction or at rates approximating them. Assets and liabilities are converted to New Zealand dollars at the rates of exchange ruling at balance date.

Currency risk in respect of the Group's transactions is managed in accordance with the Group's Treasury policy and includes the use of forward foreign exchange contracts. It is estimated that a 10% decrease in the New Zealand dollar would increase profit and equity by $53k (2021: $37k). It is estimated that a 10% increase in the New Zealand dollar would reduce profit and equity by $43k (2021: $30k).

Cash flow risk

For those currency exposures less certain in their timing and extent, such as future sales and purchases, it is the Group's policy to manage the risk on a group wide basis. Under the Treasury policy the purchased cover is up to 100% depending on how far out the anticipated exposure is (to a maximum of 12 months).

The Group uses foreign currency forward exchange contracts, within the above Treasury policy limits, to manage these exposures.

There has been no change during the year to the Group's exposure to currency risks or the manner in which it measures the risks.

Interest rate risk

The Group has no borrowings and is, therefore, not exposed to interest rate risk other than in relation to its investments, which are not material.

Liquidity risk

Liquidity risk represents the Group's ability to meet its financial obligations on time. The Group generates sufficient cash flows from its operating activities to make timely payments.

Liquidity risk is managed through:

- Monitoring cash flow forecasts (both operational and anticipated non-recurring items) and aligning investment decisions with these
- Compliance with the Treasury policy, which sets a liquidity buffer for unforeseen cash flows
- Monthly review by senior management
- Regular oversight by the Audit and Risk Committee.

There has been no change during the year to the Group's exposure to liquidity risks or the manner in which it manages and measures the risks.

Maturity analysis–financial liabilities

in thousands of New Zealand dollars	On demand	Less than 1 year	Between 1 year and 5 years	Total
2022				
Trade and other payables	-	**16,681**	-	**16,681**
	-	**16,681**	-	**16,681**
2021				
Trade and other payables	-	16,338	-	16,338
	-	16,338	-	16,338

Fair value

Cash and cash equivalents, trade receivables, other receivables and payables

The carrying amounts of financial assets and financial liabilities recorded at cost in the financial statements approximate their fair value.

Investments

Investments, except for 'other investments', which are valued at fair value, are carried at cost. It is not practical to estimate the fair values of unlisted associates.

Derivative financial instruments

Foreign currency contracts are shown at fair value.

Fair value of financial assets and financial liabilities

in thousands of New Zealand dollars	Note	Loans and receivables	Fair value through profit and loss	Financial liabilities at amortised cost	Carrying amount	Fair value
2022						
Financial assets						
Cash and cash equivalents *		**97,168**	**-**	**-**	**97,168**	**97,168**
Trade and other receivables	10	**29,799**	**-**	**-**	**29,799**	**29,799**
Loan receivable	13	**2,038**	**-**	**-**	**2,038**	**2,038**
Non-listed equity investments **		**-**	**587**	**-**	**587**	**587**
Listed equity investments **		**-**	**1,618**	**-**	**1,618**	**1,618**
		129,005	**2,205**	**-**	**131,210**	**131,210**
Financial liabilities						
Trade and other payables	11	**-**	**-**	**16,681**	**16,681**	**16,681**
		-	**-**	**16,681**	**16,681**	**16,681**
2021						
Financial assets						
Cash and cash equivalents		95,842	-	-	95,842	95,842
Trade and other receivables	10	43,767	-	-	43,767	43,767
Non-listed equity investments *		-	823	-	823	823
Listed equity investments *		-	1,815	-	1,815	1,815
		139,609	2,638	-	142,247	142,247
Financial liabilities						
Trade and other payables	11	-	-	16,419	16,419	16,419
		-	-	16,419	16,349	16,349

* Cash and cash equivalents includes $1,199k (2021: $214k), which belongs to NZ Agricultural Greenhouse Gas Trust. This fully offsets with the balance owing to NZ Agricultural Greenhouse Gas Trust in trade and other payables. Cash also includes short-term deposits with maturity dates no greater than 12 months of $80m (2021: $82m).

** Equity investments consist of Fonterra shares $1,367k (2021: $1,772k) and other investments of $838k (2021: $866k) as per Note 16. The level classification determined is based on the fair value within these investments.

28 Contingencies and commitments

in thousands of New Zealand dollars	2022	2021
Capital commitments		
Lincoln Campus building capital commitments	**49,387**	3,173
Other asset purchases committed to and contracted for at balance date	**6,849**	161
Funding commitments to associates	**-**	288
Total capital commitments	**56,236**	3,622

Litigation and other contingent liabilities

There are no known significant contingent liabilities or pending litigation.

Contingent assets

There are no known significant contingent assets in the current year.

29 Capital management

The Group's capital is its equity, which is made up of:

- Share capital.
- Asset revaluation reserve.
- Retained earnings.

The Crown Research Institutes Act 1992 requires AgResearch Limited to maintain its financial viability in order to undertake research for the benefit of New Zealand.

The Group manages its capital to ensure that entities in the Group will operate in a financially responsible manner, be financially viable and continue as a going concern. The Group is not subject to any externally imposed capital requirements.

The Group's policies in respect of capital management and allocation are reviewed regularly by the Board of Directors.

There have been no material changes in the Group's management of capital during the year.

30 Significant events after balance date

There were no significant events and transactions that occurred subsequent to 30 June 2022.

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INDEPENDENT AUDITOR'S REPORT

TO THE READERS OF AGRESEARCH LIMITED'S GROUP
FINANCIAL STATEMENTS FOR THE YEAR ENDED 30 JUNE 2022

The Auditor-General is the auditor of AgResearch Limited Group (the Group). The Auditor-General has appointed me, Anthony Smith, using the staff and resources of Deloitte Limited, to carry out the audit of the financial statements of the Group on his behalf.

Opinion

We have audited the financial statements of the Group on pages 89 to 126 that comprise the consolidated statement of financial position as at 30 June 2022, the consolidated statement of comprehensive income, consolidated statement of changes in equity and consolidated statement of cash flows for the year ended on that and the notes to the financial statements that include accounting policies and other explanatory information.

In our opinion, the financial statements of the Group:

- present fairly, in all material respects:
    - its financial position as at 30 June 2022; and
    - its financial performance and cash flows for the year then ended; and
- comply with generally accepted accounting practice in New Zealand in accordance with New Zealand equivalents to International Financial Reporting Standards.

Our audit was completed on 19 September 2022. This is the date at which our opinion is expressed.

The basis for our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities relating to the financial statements, we comment on other information, and we explain our independence.

Basis for our opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the Professional and Ethical Standards and the International Standards on Auditing (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board. Our responsibilities under those standards are further described in the Responsibilities of the auditor section of our report.

We have fulfilled our responsibilities in accordance with the Auditor-General's Auditing Standards.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of the Board of Directors for the financial statements

The Board of Directors is responsible on behalf of the Group for preparing financial statements that are fairly presented and that comply with generally accepted accounting practice in New Zealand.

The Board of Directors is responsible for such internal control as it determines is necessary to enable it to prepare financial statements that are free from material misstatement, whether due to fraud or error.

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In preparing the financial statements, the Board of Directors is responsible on behalf of the Group for assessing the Group's ability to continue as a going concern. The Board of Directors is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the Board of Directors has to cease operations, or has no realistic alternative but to do so.

The Board of Directors' responsibilities arise from the Crown Research Institutes Act 1992.

Responsibilities of the auditor for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements, as a whole, are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance, but it is not a guarantee that an audit carried out in accordance with the Auditor-General's Auditing Standards will always detect a material misstatement when it exists. Misstatements are differences or omissions of amounts or disclosures and can arise from fraud or error. Misstatements are considered material if, individually or in the aggregate, they could reasonably be expected to influence the decisions of readers taken on the basis of these financial statements.

For the budget information reported in the financial statements, our procedures were limited to checking that the information agreed to the Group's statement of corporate intent.

We did not evaluate the security and controls over the electronic publication of the financial statements.

As part of an audit in accordance with the Auditor-General's Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. Also:

- We identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- We obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances but not for the purpose of expressing an opinion on the effectiveness of the Group's internal control.

- We evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors.

- We conclude on the appropriateness of the use of the going concern basis of accounting by the Board of Directors and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to continue as a going concern.

- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

- We obtain sufficient appropriate audit evidence regarding the financial statements of the entities or business activities within the Group to express an opinion on the consolidated financial statements. We are responsible for the direction, supervision and performance of the Group audit. We remain solely responsible for our audit opinion.

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We communicate with the Board of Directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Our responsibilities arise from the Public Audit Act 2001.

Other Information

The Board of Directors is responsible for the other information. The other information comprises the information included on pages 2 to 88, but does not include the financial statements, and our auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of audit opinion or assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on our work, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Independence

We are independent of the Group in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1: *International Code of Ethics for Assurance Practitioners* issued by the New Zealand Auditing and Assurance Standards Board.

Other than the audit, we have no relationship with, or interests in, the Group.

Anthony Smith
Partner
for Deloitte Limited
On behalf of the Auditor-General
Christchurch, New Zealand

19 September 2022

Directory

Senior Leadership Team

Dr Sue Bidrose
Chief Executive Officer

Stuart Hall
Deputy Chief Executive, Commercial Partnerships

Tony Hickmott
Director Finance and Business Performance

Fleur Evans
Director People and Culture

Greg Rossiter
Director Information Technology

Chris Koroheke
Urungi, Director Māori Strategy

Ariana Estoras
Director Māori Research and Partnerships

Dr Sara Edwards
Director Research Operations

Dr Marie Bradley
Director Strategy and Communications

Dr Dave Houlbrooke
Director Research Capability

Board of Directors

Dr Paul Reynolds QSO
Chair

Kim Wallace
Deputy Chair
Chair – Audit and Risk Committee

Jackie Lloyd
Chair – People and Culture Committee

Rukumoana Schaafhausen
Director

Dr Louise Cullen
Director

Lain Jager
Director

Mary-Anne Macleod
Director

Charles Taitua
Board Observer

Information

Auditors
Deloitte Limited on behalf of the Auditor-General

Bankers
ANZ Bank New Zealand Limited

Science working for New Zealand

The Crown Research Institutes (CRIs) proudly work, individually and collectively, to create a more prosperous, sustainable and innovative New Zealand

agresearch
āta mātai, mātai whetū

ESR
Science for Communities
He Pūtaiao, He Tāngata

GNS SCIENCE
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Manaaki Whenua
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NIWA
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