QAAFI

ANNUAL REPORT 2016

Vice-Chancellor's message

The Queensland Alliance for Agriculture and Food Innovation (QAAFI) is a partnership between The University of Queensland (UQ) and the Queensland Government to improve the competitiveness and sustainability of Queensland's tropical and subtropical agriculture and food sectors through high impact science.

Developed as a strategic joint-initiative, QAAFI harnesses the collective strengths of the Department of Agriculture and Fisheries and UQ, to forge direct links to the agriculture and food industries that the University could not achieve on its own.

In 2016 QAAFI succeeded in developing long-term strategic research collaborations with industry, including the Meat & Livestock Australia's Northern Beef Collaborative Partnership, worth up to $8 million a year and Horticulture Innovation Australia's $10 million Naturally Nutritious project which, with the support of our government and industry collaborators, aims to investigate potential new 'superfoods'.

Agriculture-related research at UQ is consistently ranked among the best in the world: UQ is ranked 7 globally in the 2016 NTU Ranking, 17 in the QS World Universities Ranking by Subject, and in the top 20 of the Academic Ranking of World Universities life science ranking.

QAAFI plays an important role not only in building industry partnerships in Queensland and globally, but also in consolidating UQ's research capability in agriculture and helping to establish UQ as an international leader in tropical agriculture and food science.

Agriculture and food sciences at UQ are helping to meet the growing global demand for sustainable, nutritious, safe food and creating positive change in the many countries where our experts work collaboratively on important and innovative projects.

I congratulate Professor Robert Henry and his team for their many successes in 2016, in delivering high-impact science for collaborators and industry.

I also thank our colleagues in the Queensland Government and our industry and private collaborators for their ongoing support of the QAAFI initiative.

Professor Peter Høj
Vice-Chancellor and President

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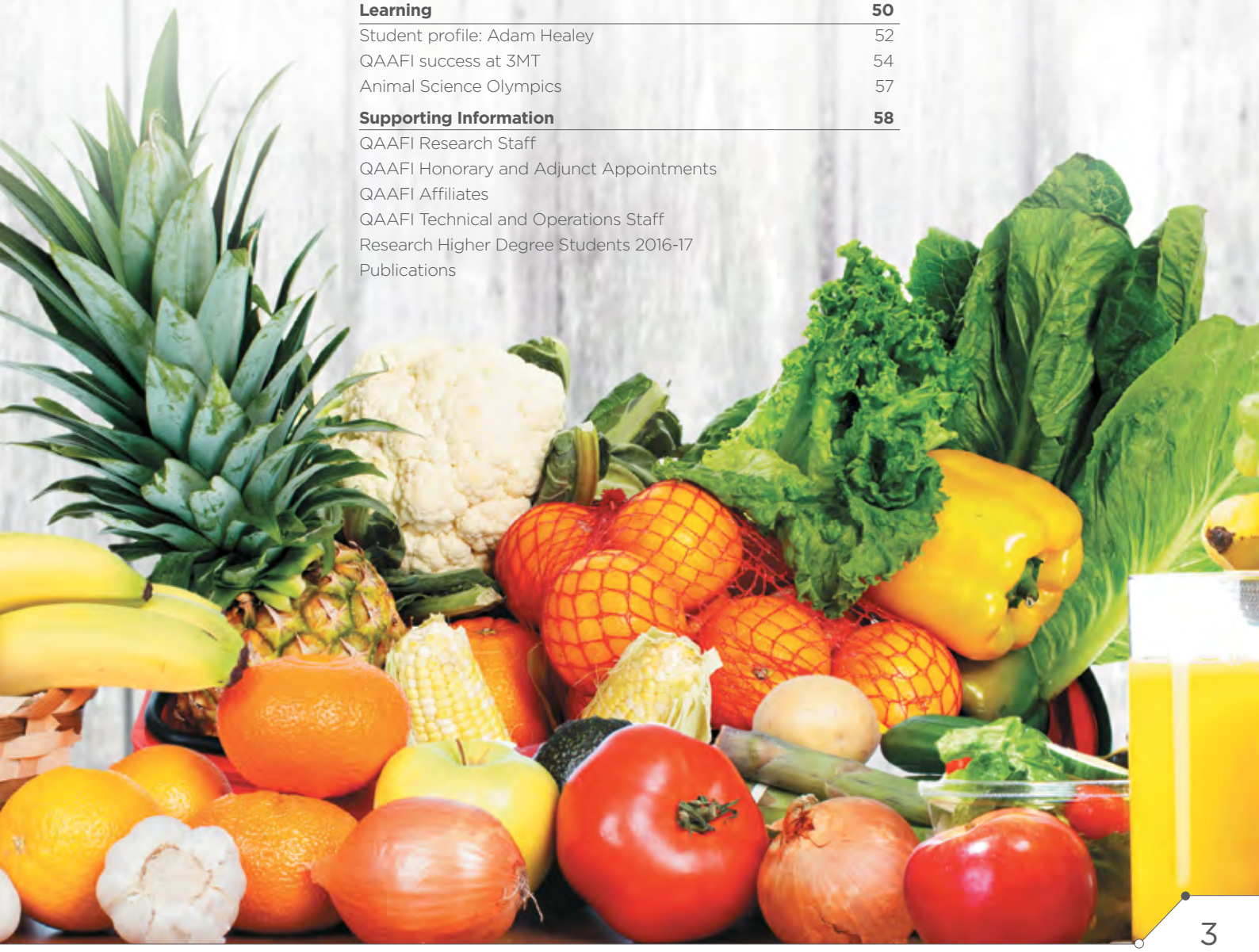
Cover image
Bioclay, a new environmentally alternative for crop protection, could eliminate the need for spraying toxic chemicals and pesticides on crops.

See story on page 20.

Photo: Getty Images.



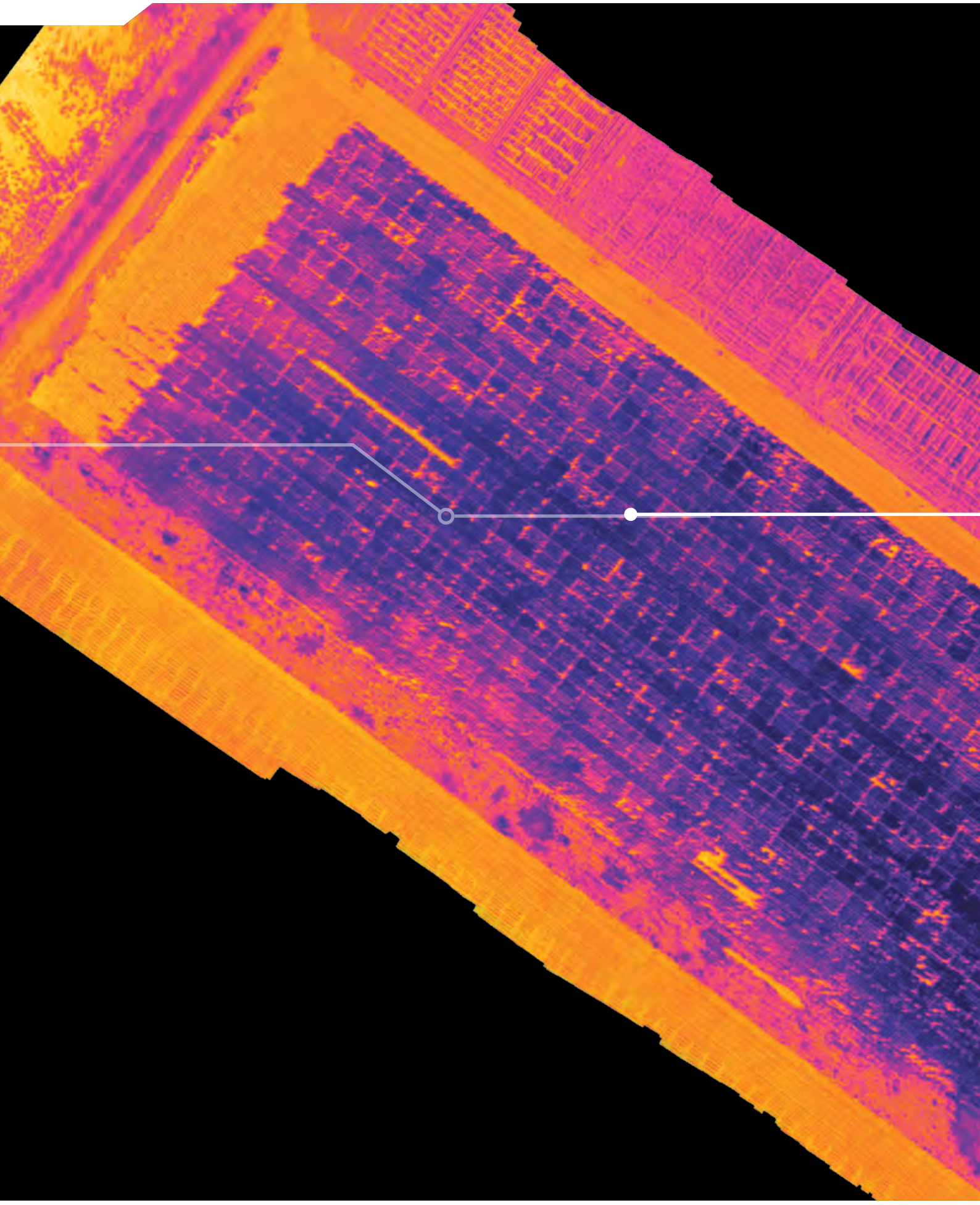
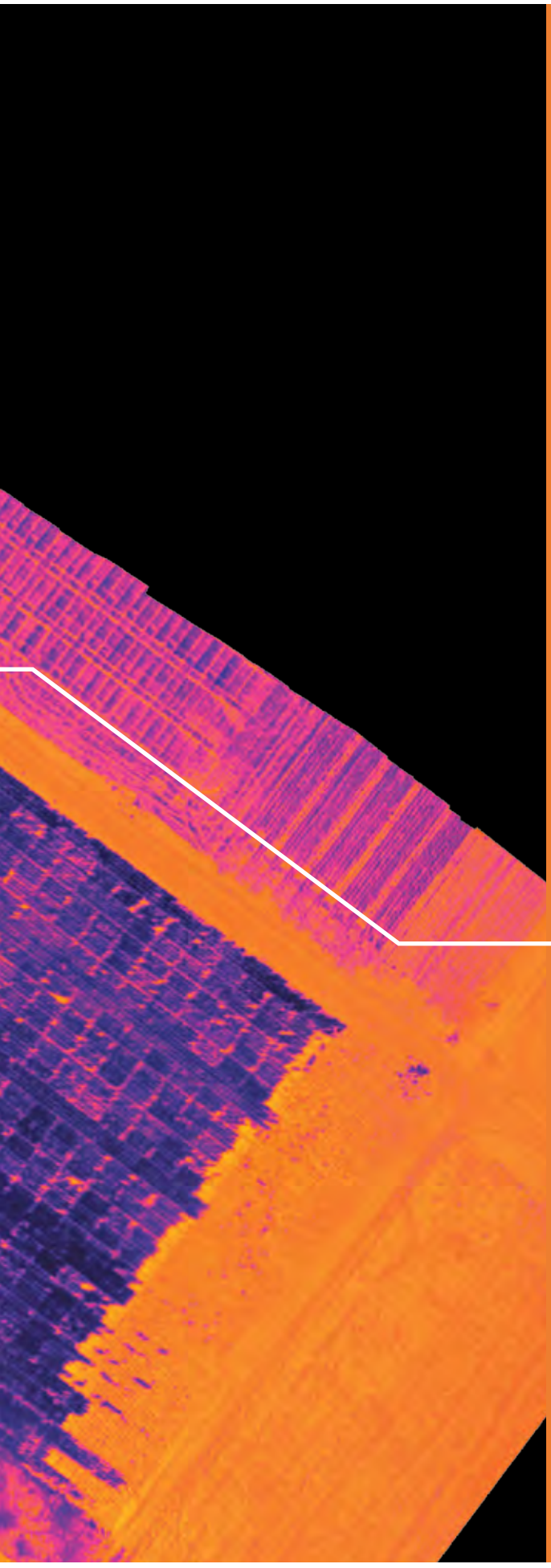


Photo: QAAFI researchers are screening sorghum lines for traits related to photosynthetic efficiency. The researchers are gathering information on plot cover, canopy temperature, reflectance, phenology and dynamic plant growth using proximal sensing and imaging from sensors and cameras attached to a mobile phenotyping platform and a UAV. This image is a composite of thousands of drone images stitched together to show canopy and soil temperature to help identify water loss. Image by Ken Laws, Department of Agriculture and Fisheries.



ABOUT QAAFI

Research quality + Industry impact = QAAFI mission

QAAFI's mission and vision:

Our mission is to significantly improve the competitiveness and sustainability of the tropical and sub-tropical agriculture and food sectors through high-impact science.

Our vision is sustainable agriculture and food achieved through science and innovation.

We aim to be a world leading research institute in plant science, animal science, and nutrition and food sciences, delivering outcomes in discovery, learning, and engagement.

Message from the Minister

Geographically, Queensland is Australia's second largest state, covering more than 173 million hectares. Almost 144 million hectares (or 83 per cent) of the land area is used for agriculture. Queensland has the largest area of agricultural land of any Australian state and the highest proportion of land area in Australia dedicated to agriculture.

For 2016–17, the total value of Queensland's primary industry commodities (combined gross value of production and first-stage processing) is forecast to be $18.55 billion, which is six per cent greater than 2015–16, and 15 per cent greater than the average for the past five years.

Investment in agricultural research and development to support innovation and commercial outcomes has been critical to this growth, and to maintaining the future sustained growth of Queensland's agricultural industries.

Queensland's agricultural R&D capability ranks among the best in the world. A key strategy in developing this capability, and harnessing the benefits of global agricultural innovation for Queensland, has been the Queensland Alliance for Agriculture and Food Innovation (QAAFI).

Formed in 2010 by the Queensland Government and The University of Queensland (UQ) – a global leader in tropical agriculture and food research – QAAFI brings together expertise and equipment from UQ to partner with the facilities and excellence of Department of Agriculture and Fisheries (DAF) research teams, to work collaboratively on key challenges facing the agricultural industries.

QAAFI represents one of our largest and most important university partnerships. We have invested in around 90 agricultural and food innovation projects with QAAFI that are delivering impact to Queensland's agricultural industries.

Research and development is critical to the future sustainability and profitability of agriculture and our researchers are developing many innovative technologies, including remote sensing, robotics, unmanned aerial vehicles and industrial biotechnology, to further boost productivity of the sector.

Recently my Department renewed its research contract with UQ to enable QAAFI to continue its valuable work in supporting agricultural and food innovation throughout Queensland.

Congratulations to Professor Robert Henry and the team at QAAFI for a very successful year in 2016.

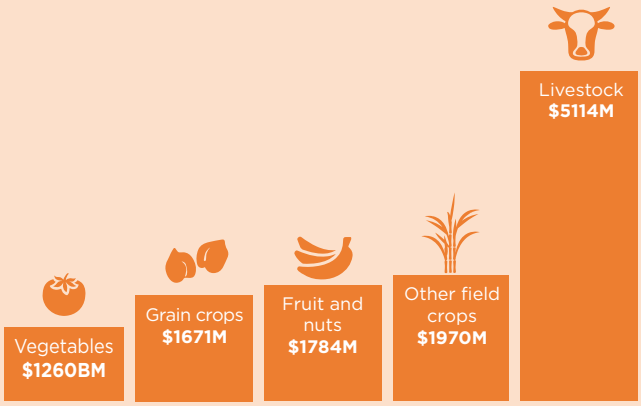
The Honourable Bill Byrne MP
Queensland Minister for Agriculture and Fisheries and Minister for Rural Economic Development

Queensland Agriculture

Gross value of production ('farm gate')

For 2016–17, the gross value of production (GVP) of Queensland's primary industry commodities at the 'farm gate' is forecast to be almost $14.55 billion, 14 per cent greater than the average for the past 5 years.

Total $14.55 Billion



Livestock
$5114M

Beef	$4060M
Poultry	$ 619M
Pigs	$ 333M

Grain crops
$1671M

Chickpeas	$ 793M
Wheat	$360M
Sorghum	$ 257M
Barley	$ 70M
Maize	$64M

Other field crops
$1970M

Sugar cane	$1420M
Cotton	$ 870M

Fruit and nuts
$1784M

Bananas	$ 584M
Avocados	$ 225M
Macadamias	$ 140M
Mangoes	$ 92M

Source: 2016-17 forecast figures (Queensland AgTrends, October 2016) Department of Agriculture and Fisheries

QAAFI Research Meeting 2016

The QAAFI Research Meeting was held at The University of Queensland, St Lucia on 14-15 November.

Over 200 staff, students and invited guests attended the research meeting. The program included an address by Assistant Director General of the Department of Science, Information Technology and Innovation, Dr Christine Williams; UQ Deputy Vice-Chancellor of Research Professor Robyn Ward, and industry guests.

Director's Column

In 2016 QAAFI consolidated its position as a world leading agricultural research institute for agriculture and food research in the tropics and subtropics.

QAAFI continues to attract significant industry income, reaching $225M of external funding in 2016 since commencing operations in 2010. This figure represents a recognition by industry of the value and impact of QAAFI research and is an important validation of the QAAFI model, which is a unique Australian partnership, and among only a handful of similar scientific research partnerships anywhere in the world.

In six years, QAAFI has grown to over 450 scientists, including 238 higher degree students supervised to date, and has collaborations with more than 200 Department of Agriculture and Fisheries employees. Last year the Queensland Government entered into a new contract with the University of Queensland to continue support for QAAFI on an ongoing basis.

The University of Queensland has also significantly invested in QAAFI's success, with QAAFI moving into its first purpose-built headquarters located in the Queensland Bioscience Precinct (QBP) building on the St Lucia campus in 2016. In November 2016, a new ag-nano and animal health laboratory was opened on level three of the QBP building.

The global research capability that QAAFI represents has allowed us to attract world-leading scientists to Queensland and in 2016 three of our researchers were listed on the Thomson Reuters' Highly Cited Researchers list: Professor Christine Beveridge; Professor Ben Hayes; and Professor Kemal Kazan.

In 2016 QAAFI established a new Advisory Board, to provide strategic advice to grow QAAFI's research capability, and to help the organisation meet the growing global demand for safe food and improved nutrition.

I would like to take this opportunity to thank QAAFI's research and operational staff and our Research Higher Degree students for their ongoing contribution to QAAFI's growth and success.

QAAFI Advisory Board 2016

Chair: **Mr John Chapman**, former Executive Director of Agri-Science, Department of Agriculture and Fisheries

Mr David Crombie, Agribusiness industry leader

Professor Robyn Ward, Deputy Vice-Chancellor (Research), University of Queensland

Dr Mirjana Prica, Managing Director, Food Innovation Australia Ltd

Mr Malcolm Letts, Deputy Director General, Department of Agriculture and Fisheries

Dr Brian Keating, former Executive Director, CSIRO Agriculture, Food and Health

Prof. Robyn Ward

Malcolm Letts

Dr Mirjana Prica

Dr Brian Keating

John Chapman

David Crombie

QAAFI opened new multi-million dollar nanotechnology and animal health laboratory facilities in the Queensland Bioscience Precinct at UQ's St Lucia campus.

QAAFI's head office staff moved into new premises in the Queensland Bioscience Precinct at UQ's St Lucia campus.

RESEARCH SNAPSHOT

2016 IN REVIEW

$34M total income

250+ industry presentations

$225M external research funding to date

14 research themes

450 people

165 active research contracts

30+ participating countries

1 new research centre in China

238 students supervised to date

13 Facilities across Queensland

UQ #1 Agricultural research institution 2016*

UQ #7 Global agricultural research institution 2016*

**NTU Rankings*

RESEARCH HIGHLIGHTS

New research partnership to boost northern cattle industry

A multi-million dollar research and development program launched in 2016 will provide a massive boost to Australia's vital northern beef cattle industry.

The Northern Beef Collaborative Partnership, between Meat & Livestock Australia and The University of Queensland, is the most significant injection of research funds into northern beef cattle for 20 years and is designed to deliver significant productivity gains for producers.

MLA Managing Director Richard Norton said the collaboration between the MLA Donor Company (MDC) and UQ was worth up to $8 million a year for a minimum of three years and targeted productivity improvement research projects in three main areas:

- Animal nutrition, supplementation and feedbase
- Cattle health and welfare
- Reproduction efficiency and management

"Investments of this calibre are vital to the ongoing prosperity of northern beef producers," Mr Norton said.

UQ Vice-Chancellor and President Professor Peter Høj said the partnership would create change across a vitally important sector of the Queensland and Australian economy.

"Collaboration between researchers and industry is essential if we are to translate world-class research into achievable, practical solutions that benefit industry, society and the environment," he said.

$10m research project seeks 'superfoods' to keep us healthy

Fruit, vegetables and nuts with particular health-giving benefits are the focus of a $10 million research project at QAAFI.

Horticulture Innovation Australia (HIA) will co-fund scientists at QAAFI to work with their AgriScience colleagues at the Department of Agriculture and Fisheries (DAF) to investigate potential 'superfoods'.

QAAFI's Dr Tim O'Hare, who developed SuperGold sweet corn, a variety that protects against macular eye degeneration, will lead the new Naturally Nutritious research project.

Like the Queen Garnet 'superplum' with its blood-pressure lowering properties, SuperGold sweet corn was developed within DAF and the new Naturally Nutritious research builds upon the DAF's long-term co-investment partnership with HIA and research collaboration with QAAFI.

Agriculture Minister Mr Bill Byrne said the Department's 'superplum' and SuperGold corn had attracted worldwide interest.

"Our Queensland scientists will identify target foods across a range of fruits, nuts and vegetables where the food's phytonutrient content can be boosted for additional health benefits," Mr Byrne said.

"They will also test in human clinical trials the health benefits of the Queen Garnet plum and new DAF strawberry lines that are rich in folate."

Dr O'Hare said a key aspect of the Naturally Nutritious program was identifying potential for new naturally healthy food products that might deliver a measurable health outcome.

This project is jointly funded by the Department of Agriculture and Fisheries and UQ and Horticulture Innovation Australia.

Prestigious Discovery Early Career Researcher Award for Dr Lee Hickey

QAAFI researcher Dr Lee Hickey was awarded an Australian Research Council DECRA award for his research to develop and validate novel crop improvement protocols.

The highly competitive DECRA scheme provides focused support for researchers and aims to support excellent basic and applied research and expand Australia's knowledge base and research capability.

Dr Hickey's DECRA research program involves fusing together four leading-edge technologies – genomic selection, speed breeding, high-throughput phenotyping and crop modelling – to assist in the development of improved crop cultivars targeting yield under drought.

"More efficient breeding techniques could accelerate genetic gain in wheat – beyond what is expected to occur in ongoing breeding programs, and will empower breeders to develop robust cereal cultivars in the face of climate change," Dr Hickey said.

QAAFI success at Business/ Higher Education Round Table Awards

QAAFI's Dr Yasmina Sultanbawa received an Honourable Mention for "Best Community Engagement 2016" at the annual Business/Higher Education Round Table Awards.

Organisations involved in developing this project include UQ, Australian Native Food Industry Ltd., Queensland Department of Agriculture and Fisheries, Australian Prawn Framers Association, Karen Sheldon Catering, Kindred Spirits Foundation, Charles Darwin University, Gundjeihmi Aboriginal Corporation and Mamabulanjin Aboriginal Corporation.

The project began in 2010 with funding from the Rural Industries Research and Development Corporation (RIRDC) to evaluate the bioactive properties of various Australian plants and their potential uses in agriculture.

Dr Sultanbawa's team identified the Kakadu plum showed the greatest promise for protection against spoilage microrganisms. She later led a project to develop a natural Kakadu plum glaze used to extend the shelf-life of cooked and chilled prawns which is now used by 15 per cent of the Queensland aquaculture industry.

L-R Ken Boal, President, B/HERT Board; A/Prof Yasmina Sultanbawa, QAAFI; Rhonda Renwick, Kindred Sprits; Amanda Garner, Chair, Australian Native Food Industry Ltd; and Sarah Meibusch, Deputy Director QAAFI

RESEARCH HIGHLIGHTS

QAAFI's Mike Bell receives top grains industry honour

Professor Mike Bell, from the UQ School of Agriculture and Food Sciences, who also holds a joint appointment at QAAFI, was presented with the Grains Research and Development Corporation (GRDC) Recognising and Rewarding Excellence Award at the GRDC Grains Research Update in 2016.

"It's a tremendous honour to have received this award, and a privilege to have worked with the many dedicated growers, advisors and researchers who have made the Australian grains industry what it is today," Professor Bell said.

"Improving the productivity of grains systems is a critical factor in our ability to meet the food demands of a rapidly expanding global population.

"However with finite reserves of productive crop land, it is essential that we balance crop removal with appropriate nutrient inputs to ensure land use is sustainable.

"Balancing the competing demands of profitability and long-term sustainability is a challenge that lies at the core of much of our current research.

"I am extremely grateful to my research team and collaborators, as well as the funders of my research, for their support through the years."

The prestigious award comprises a travel bursary aimed at extending the professional networks and collaborative research opportunities of key Australian research scientists for the benefit of the wider grains industry.

GRDC northern panel chair Mr James Clark said Professor Bell was an outstanding industry leader with a proven track record in delivering useful and practical information to growers, managing research and development projects, and mentoring young researchers.

"Professor Bell has an exceptional ability to deliver practical information to growers that can help improve their crop and farming system management year-in-year-out," Mr Clark said.

"He is also widely respected as an innovative and forward-thinking leader when it comes to managing research projects.

"At the same time, his contribution to the future capacity of our industry can't be underestimated – a number of researchers began their career under Professor Bell's mentorship."

In a career that has spanned more than 30 years, Professor Bell's research work has helped the industry to better understand the presence and behaviour of nutrient concentrations within the soil profile, which in turn has enabled growers to more accurately estimate crop yield potential and implement more targeted fertiliser programs.

Professor Mike Bell

Promoted in 2016

Congratulations to the following QAAFI researchers who were promoted to the rank of Professor in 2016.

Professor Neena Mitter:
Promoted to Professorial Research Fellow

Professor Ala Tabor:
Promoted to Professorial Research Fellow

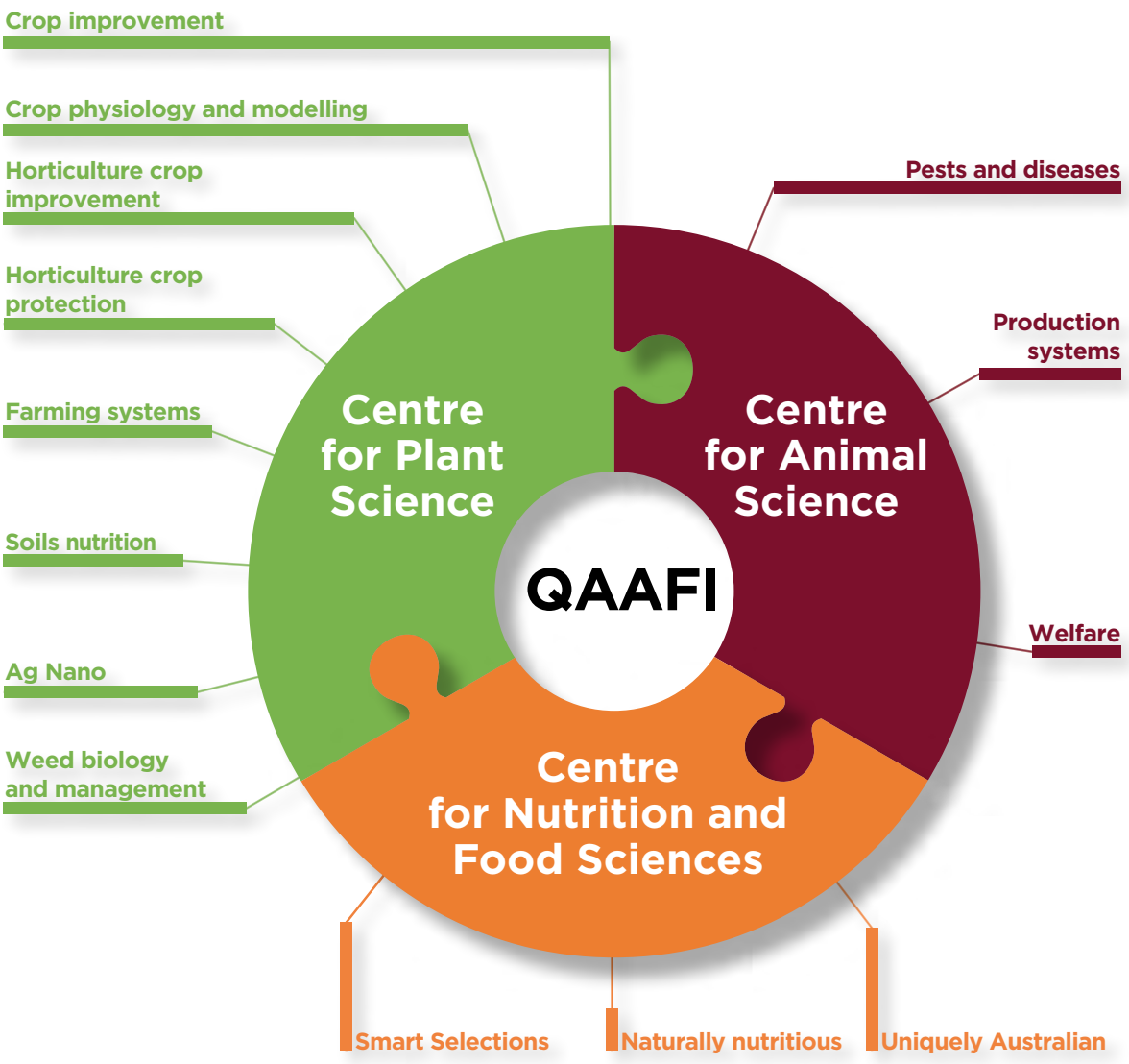
The following QAAFI staff were also promoted in 2016:

- Dr Bhagirath Chauhan: Promoted to Principal Research Fellow
- Dr Mary Fletcher: Promoted to Principal Research Fellow
- Dr Rao Rachaputi (RCN): Promoted to Principal Research Fellow
- Dr Yasmina Sultanbawa: Promoted to Principal Research Fellow
- Dr Lee Hickey: Promoted to Senior Research Fellow
- Dr Bernadine Flanagan: Promoted to Research Fellow

QAAFI in Queensland

- Mareeba
- Charters Towers
- Rockhampton
- Bundaberg
- Gatton
- Kingaroy
- Toowoomba
- Nambour
- Warwick
- Dutton Park
- St Lucia
- Coopers Plains

QAAFI RESEARCH THEMES

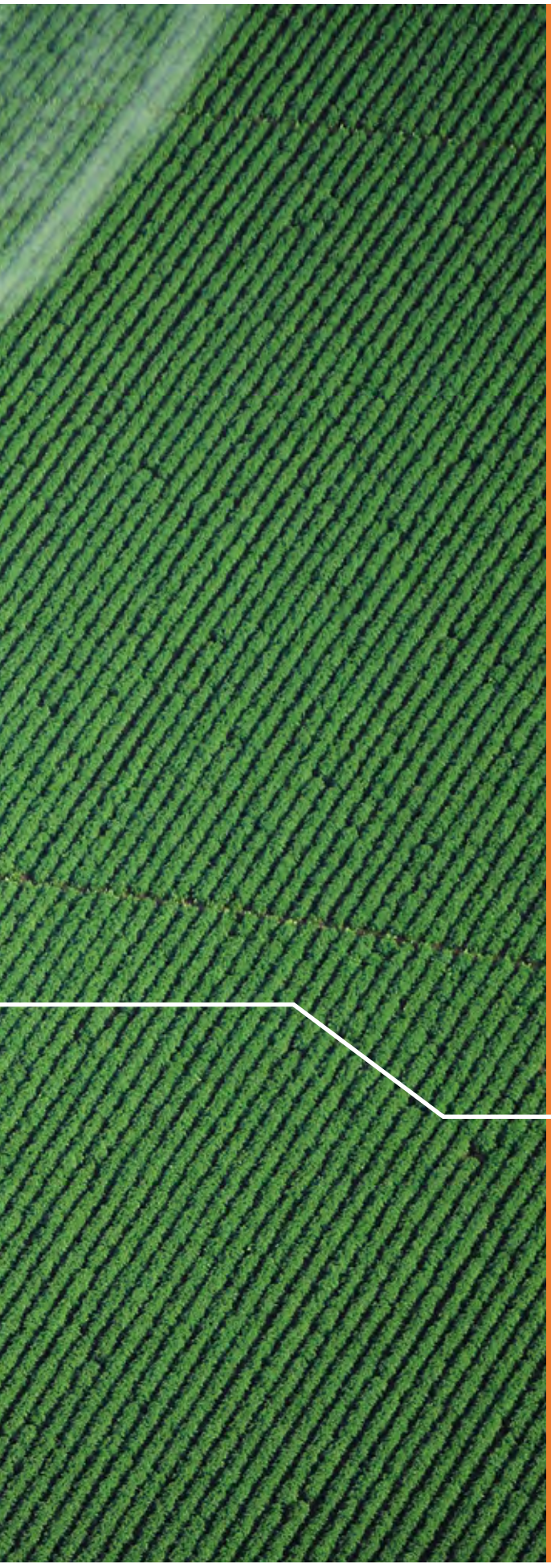


Research Overview 2016

Some key achievements included:

- The sorghum breeding program licensed 197 lines to commercial companies over the past 12 months and recent field data suggests the resulting hybrids have significant benefits over commercial varieties.
- A new interactive plant breeding tool has been developed and launched that links photosynthesis biochemistry to crop growth and yield in field environments.
- An economic selection tool was developed for the macadamia industry which combines benchmarked costs from the Department of Agriculture and Fisheries financial planner, income from RVT (Regional Variety Trial) derived yield curves, and adjustments for eight non-yield traits.
- Significant progress was made in the development of new and improved molecular diagnostics for the detection of Fusarium wilt 'Tropical Race 4' for the banana industry.
- The Bioclay project received significant world-wide interest in the last six months due to a land mark publication in 'Nature Plants' and main stream media interest. It is anticipated that this will result in additional commercial opportunities.
- In Central Queensland, mungbean yields of greater than 2.5tons/ha were obtained for the first time under specific field trial combinations of time of sowing, row spacing and irrigation, setting a new benchmark for this crop.
- Initial results from nitrogen-use-efficiency trials on the Darling Downs suggested many growers may be over-applying fertilizer nitrogen, with optimum application rates as little as half industry recommended optimums.
- A native rice population has been identified from wild populations in North Queensland with quality and yield traits suitable for starting a native rice breeding program.
- Zeaxanthin biofortified popcorn/corn chip maize variety program has identified selections that are four to five times higher in zeaxanthin than standard maize.
- A novel, live vaccine strain has been developed for Actinobacillus pleuropneumoniae (major pork respiratory disease) that will overcome the limitations of the current vaccines. A safety trial has been completed.
- Dr Luis Filipe Prada e Silva has been appointed to the Centre for Animal Science as the new ruminant nutritionist, filling the position previously held by Stu McLennan prior to his retirement.

Image: iStock



DISCOVERY

UQ researchers have made a discovery that could help conquer the greatest threat to global food security – pests and diseases in plants. BioClay – an environmentally sustainable alternative to chemicals and pesticides – could be a game-changer for crop protection.

Crops primed for protection without chemicals

A breakthrough in agricultural nanotechnology could help reduce food production losses to pests and pathogens, without the toxicity impacts of current chemical sprays.

Professor Neena Mitter, QAAFI

Mike Pointon, NuFarm

Professor Gordon Xu, AIBN

Viruses are part of the pest and pathogen burden that reduces food production globally by a massive 20 to 40 per cent, even as an estimated 795 million people – one in nine – do not have enough food to lead a healthy, active life.

That statistic has inspired agricultural scientist Professor Neena Mitter and her UQ colleague Professor Zhi Ping (Gordon) Xu to develop novel crop protection technology, and links with agribusiness partner, Nufarm, will help deliver the new technology to farmers.

Working in QAAFI's Centre for Plant Science, Professor Mitter explains that currently there is no way to directly protect crops from viruses. Instead, pesticides are used to kill the insects that transmit viral diseases.

"Not only are viruses causing food losses, the chemicals we use to control their insect vectors have toxicity issues to human health, to our waterways from run-off, and to the environment," she says.

"That was why I started looking at alternative crop protection methods."

Her new approach involves boosting the plant's own defences, priming them in the manner of a vaccine to naturally attack specific viruses.

The tools Professor Mitter uses are wisps of genetic material that are sprayed onto the plant. This biological material, however, is extremely fragile. To help stabilise it, she teamed up with nanotechnology experts led by the University of Queensland's Professor Gordon Xu, based at the Australian Institute for Bioengineering and Nanotechnology (AIBN).

A high tech combination

"The solution involves a combination of nanotechnology and biotechnology ," Professor Xu says.

"It means we can target any virus – or combination of viruses – that cause crop losses without killing insects and with no toxic effects to humans or the environment." Professor Neena adds.

No gene modification or DNA is required in their protocol.

The method takes advantage of a quirk in the genetic language of living organisms: namely that all genes – including viral genes – have to be 'expressed' to have an effect.

Expressing a gene involves making many molecular copies of the gene's DNA. These copies take the form of RNA molecules, a chemical cousin of DNA. The RNA copies then serve as the scaffold to make the compounds required for life, such as hormones, enzymes and structural proteins.

Normally, just one strand of the DNA 'double helix' is copied, meaning that the plant's own RNA molecules are single-stranded. In contrast, when viruses reproduce inside a plant, they go through a stage when they produce double-stranded RNA (or dsRNA). Plants have learnt to detect and attack this dsRNA, a natural defence response called 'gene silencing'.

Nano-clay delivery system

Professor Mitter triggers the plant's own, gene-silencing defences by exposing the plant to dsRNA made synthetically in the laboratory. Professor Xu's contribution was to develop a nanoscale 'clay' matrix that is ideally suited to protect this dsRNA once it is sprayed onto a crop.

The specially designed matrix forms minuscule, stacked layers that Professor Mitter compares to puff pastry. These degrade naturally, but in the process they dramatically extend the dsRNA's protective effect.

The BioClay formulation involves suspending the dsRNA and clay matrix mixture in water and spraying the clear solution onto plants.

In proof-of-concept studies with tobacco plants in the glasshouse, one application of BioClay provided 20 days' protection against tobacco mosaic virus, which amounts to a commercially viable period of time. Based on the clay degradation profile on the leaf surface, Professor Xu and Mitter believe that, with tweaking, the protective effect can be extended even more, up to 50 days. Field trials are underway to validate the findings.

Bioclay's commercial application

Global lead for transformational innovation at Nufarm, a worldwide manufacturer of crop protection products, is Mike Pointon, who has closely followed BioClay's development. Nufarm is undertaking supportive research of its own on the Bioclay product.

Mr Pointon says issues with chemical-based crop protection are increasing worldwide.

"We are seeing the chemical targets evolve resistance, there is regulatory pressure on active ingredients due to toxicity concerns, and the cost of discovery for new chemicals is enormous," he says.

"That means Nufarm is very interested in new crop protection technology and this research absolutely has the potential to find commercial application."

BioClay circumvents key problems caused by chemical sprays. There are no toxic compounds or breakdown products associated with BioClay.

It does not leave problematic residues on food. It is applicable across plant crops, from cereals through to horticulture. It is highly specific, affecting only the dsRNA-targeted pathogen. And should resistance emerge, the dsRNA can be tweaked to get around it.

Best of all, Mr Pointon believes that the same approach can be applied to other classes of disease-causing pathogens, such as fungi.

"The main hurdle is the current cost of making the dsRNA," he says.

"However, there are companies now starting up to exploit economies of scale to get the cost down. The work undertaken by Professor Mitter and Xu is definitely changing how we look at controlling pests."

New discovery at heart of healthy cereals

Researchers in QAAFI's Centre for Nutrition and Food Sciences have identified a new mechanism for how healthy cereals such as oats reduce the amount of cholesterol in the blood stream, thereby lowering the risk of heart disease.

The discovery could lead to ways of boosting the cholesterol-fighting properties of other cereals, including wheat.

QAAFI's Professor Mike Gidley said the study, funded through the Australian Research Council Centre of Excellence in Plant Cell Walls, revealed new information on the function of beta glucans – a healthy soluble fibre naturally occurring in the cell walls of some plants, particularly cereals.

"We've known for some time that beta glucans in oats reduce blood cholesterol, but now we've discovered one of the ways in which they do it," Professor Gidley said.

Lead researcher Dr Purnima Gunness said the findings challenged the theory that beta glucans 'mop up' bile, which is secreted during digestion, and prevent its absorption in the small intestine.

"It was thought that the body's use of cholesterol to make new bile was one of the mechanisms for how beta glucans reduced the amount of cholesterol in the blood stream," Dr Gunness said.

The research, using pigs as a model for humans, revealed that the beta glucan in oats actually reduced, rather than maintained, the total amount of circulating bile.

"We aren't quite sure yet why, but in the presence of beta glucan there is much less circulating bile. "This means that fats, which bile helps break down, are not digested as rapidly or as completely."

A lower or slower absorption of fat is an important factor in reducing blood cholesterol.

Dr Purnima Gunness

Professor Steve Moore

World genomics expert Professor Ben Hayes joined QAAFI in 2016

Unlocking the genetic secrets of legendary bulls

QAAFI and Department of Agriculture and Fisheries researchers have sequenced 50 top Brahman bulls in an effort to understand how genes from temperate cattle bred into Brahmans might influence important production traits in modern Brahman cattle.

The Sequencing the Legends project is led by Professor Steve Moore, Director of the Centre for Animal Science at QAAFI, in collaboration with Professor Ben Hayes, a genomics expert who co-invented genomic selection.

Queensland is home to nearly half of Australia's beef cattle, which mostly have a large Brahman influence. But the Brahman genome has been found to contain around 7-10 percent of *Bos taurus* genes, a legacy of the breed formation.

"Understanding the genetics underlying production traits in Australian tropically adapted cattle is essential for further breed development and cross breeding strategies," Professor Moore said.

"Brahmans are adapted to tropical climates and there has been over 300,000 years of separation between *Bos indicus* cattle like the Brahman and the *Bos taurus* cattle breeds that are important to temperate production systems."

Professor Moore said it was not fully understood how *Bos taurus* genes in the Brahman genome might impact the animal's performance. "Are the taurine genes just a random mix or have specific taurine genes been retained in Brahmans because they were associated with desirable production traits?"

Professor Moore and his colleagues, Professor Ben Hayes and Dr Brian Burns from the Department of Agriculture and Fisheries, lead the research team sequencing the DNA from Brahman sires, some dating as far back as the mid-1950s. The Australian Brahman Breeders Association were instrumental in selecting and locating the most influential sires for the project.

Professor Moore said the aim was to develop world-class tropical beef breeding programs to boost production in northern Australia.

This project is jointly funded by the Department of Agriculture and Fisheries and UQ and Meat & Livestock Australia.

Researchers discover a special power in wheat

A new photosynthesis discovery at QAAFI may help breed faster-growing wheat crops that are better adapted to hotter, drier climates.

A research team led by QAAFI Director Professor Robert Henry discovered that photosynthesis occurs in wheat seeds as well as in plant leaves.

"This discovery turns half a century of plant biology on its head," Professor Henry said.

"Wheat covers more of the earth than any other crop, so the ramifications of this discovery could be huge. It may lead to better, faster-growing, better-yielding wheat crops in geographical areas where wheat currently cannot be grown."

Professor Henry said the research built on a biological discovery in the 1960s at the old Colonial Sugar Refining Company in Brisbane.

"Many said that discovery should have won a Nobel Prize," he said. "The Brisbane researchers at that time demonstrated that sugarcane and some other tropically adapted plants had evolved a different photosynthesis pathway than that seen in around 85 per cent of plants."

The classic photosynthesis pathway was known as C3, and plants with the alternative photosynthesising chemistry came to be known as C4 plants, Professor Henry said.

"C4 plants capture carbon faster and have higher growth rates, particularly in subtropical and tropical environments," he said.

"Our research characterised a previously unknown photosynthetic C4 pathway in the seeds of wheat – which is not a C4 plant. Like most plants, wheat photosynthesises through its leaves, but we've discovered there is also a unique type of photosynthesis in the seed. This has never been known before, yet the wheat seed is quite green when you peel it off and it is the last part of the plant to die."

Professor Henry said photosynthesis – the process by which plants converted sunlight into energy for growth and produce oxygen – was arguably the most important biological process on earth.

"Wheat has the classic C3 photosynthetic pathway in its leaves, however C3 plants, which include rice, are less efficient in hotter, drier climates," Professor Henry said.

"The holy grail of plant science has long been to bioengineer the photosynthetic pathways in C3 and C4 plants to grow larger, more productive crops that are better adapted to climate change and boost food security. The population of the world's tropical regions will soon exceed that of the rest of the world, and this discovery may be important in growing food to meet future demand."

Wheat has been cultivated for 10,000 years and it always been a C3 plant, Professor Henry said.

"Wheat's photosynthetic pathway evolved 100 million years ago when atmospheric carbon dioxide levels were up to 10 times higher than they are today," he said.

"One theory is that as carbon dioxide began to decline, the plant's seeds evolved a C4 pathway to capture more sunlight to convert to energy."

Discovery could boost Queensland's mandarin industry

QAAFI's high impact science has solved a 100-year mystery regarding the sexual cycle of the fungus that causes black spot on the fruit of Queensland mandarins.

Researchers can now induce the production of sexual spores of this fungus in the laboratory, allowing for inoculation studies and screening for resistance against the black spot disease. They also can now study the role the sexual spores, called ascospores, play in the disease cycle and in the infection of fruit in the field.

Their findings have been published in Phytopathology, the leading international journal in this field.

The black spot fungus restricts market access of Australian fruit and limits access to high value markets such as the United States and Europe, with industry estimating Queensland could export $64 million of mandarins to these markets if barriers such as black spot can be overcome.

This project has been jointly funded by the Department of Agriculture and Fisheries, the University of Queensland, Citrus Research and Development Foundation of the USA and Horticulture Innovation Australia.

AI helps make the world more food secure

In the race to improve food security, a new QAAFI-developed intelligent crop modelling tool is helping researchers identify how improved plant growth efficiency will translate into better yields.

Planet Earth's population is expected to reach nine billion in 2050, but the production of important food staples – such as bread, wheat and rice – are currently projected to fall short of growing demand.

A major R&D push is underway globally to lift the yield potential of staple cereal crops.

The target of these research efforts is photosynthesis. Yield gains are being sought by improving plants' efficiency at capturing sunlight and converting it into plant growth, biomass and grain, with a target to increase grain yields by 50 per cent in the next 20 years.

These research efforts take many forms, one of which is the $100 million International Wheat Yield Partnership, which draws heavily on Australia's world-leading photosynthesis research capability.

Within Australia, leading laboratories are working collaboratively through the Australian Research Council (ARC) Centre of Excellence for Translational Photosynthesis (CoETP).

At QAAFI, Professor Graeme Hammer leads the University of Queensland's node of the ARC CoETP Centre.

Crop simulation software

Professor Hammer's team has developed crop simulation software that can radically accelerate the discovery process. The software system can be fed early-stage photosynthesis discoveries – discoveries that are being made at the molecular (or subcellular) scale – and extrapolate how this altered photosynthesis biochemistry might impact on crop performance in the form of virtual plants grown under realistic farming conditions affected by real-world weather, soil and rainfall data.

"There is this idea that if photosynthesis pathways in plant leaves can be made more efficient you will see an equivalent lift in yields, but that is simply not the case," Professor Hammer says. "As you move up from the molecular scale to the crop level, you are going to lose effects."

Without the crop simulation technology, it can take years of field trials to understand the relationship between enhanced photosynthesis efficiency and crop performance. Professor Hammer's simulations can achieve something similar in just hours.

Within the simulation, sunlight strikes the crop's canopy at different angles and with varying intensity as the virtual sun moves across a virtual sky whose cloud cover is drawn from real-world weather data. The effects of all these dynamic variations are captured and used to better understand the impact on crop productivity of changes to photosynthesis biochemistry.

Dr Alex Wu (right) with Viridiana Silva-Perez from CSIRO and the CoETP

Professor Graeme Hammer

Agricultural Production Systems sIMulator

The bedrock to this new, more advanced crop simulation technology is APSIM – the Agricultural Production Systems sIMulator – that was developed in Australia (with input from Professor Hammer, among others) to support researchers and plant breeders while also assisting farmers with crop management decisions.

APSIM was developed to simulate biophysical processes in farming systems, in particular where there is interest in the economic and ecological outcomes of management practice in the face of climatic and market risks.

It is modular in structure. Different components deal with factors relating to farm management decisions, climate and the plant's genetic makeup.

Essentially, APSIM can configure a virtual paddock where plant genetics can interact realistically with soil, climate and farm practices to explore the effect of changing these variables.

Professor Hammer's team has now extended APSIM's core capabilities to take into account variation in the plant's photosynthetic efficiencies.

"The previous modelling platform included a simple mathematical relationship when dealing with photosynthesis," Professor Hammer says. "For sorghum crops, for example, on average the plant creates 1.25 grams of dry mass per megajoule of light absorbed, given enough water and nitrogen.

"What we have now added in are sub-routines that determine this light conversion efficiency based on more detailed models of photosynthesis biochemistry. That means we can now take into account variation in how efficiently plants capture carbon dioxide or how well the carbon dioxide is converted into sugar."

The ability to integrate photosynthesis' constitutive parts into a crop model draws heavily on the work of project collaborators Professor Graham Farquhar and Professor Susanne von Caemmerer form the ARC CoETP at the Australian National University, who have pioneered the development of photosynthesis biochemistry models.

The value of this modelling capability was highlighted recently when an initial study showed that a 25 per cent increase in efficiency of photosynthetic enzymes generated just a five per cent increase in crop growth.

"The modelling highlights that there are many interacting factors affecting growth at crop scale and the impact on yield can vary in different environments," Professor Hammer says. "Serious play with these models helps us retain a sense of the broader reality in which the plant functions so that we can better focus on the best-bet options for different growing environments."

This project is jointly supported by the Department of Agriculture and Fisheries, the University of Queensland and the ARC Centre of Excellence for Translational Photosynthesis (CoETP).

Pictured: Grower Darryl Bartelen inspects chickpea crop. Photo: Nicole Baxter

IMPACT

The impact of QAAFI's tropical agriculture and food research is making a real contribution to the world, and the lives of people. We welcome industry participation and understand industry needs – enabling industry partners to leverage our globally-recognised expertise and research infrastructure across a broad range of disciplines, to deliver real benefits for industry and community.

CASE STUDY

Going deep to combat nutrient deficiency

For the past 10 years, chickpeas have been the most profitable crop for growers Darryl and Sara Bartelen on their Tulloona property in northern New South Wales. Research led by QAAFI on chickpea nutrition has inspired them to trial the work on their property.

Promising results from deep-placement nutrient trials have inspired grower Darryl Bartelen to try the practice at scale on his own farm.

Chickpeas are a pillar crop for Darryl Bartelen, who farms at Tulloona, in northern NSW. They're certainly his most profitable. "I lean towards them all the time," he says.

So when an on-farm trial presented results showing a 50 per cent increase in chickpea yields, he paid attention.

At a Grains Research and Development Corporation (GRDC) update in 2016, Mr Bartelen saw data from a project trialling deep phosphorus and potassium placement.

The trials, led by QAAFI's Professor Mike Bell, who holds a joint Professorial appointment with QAAFI and UQ's School of Agriculture and Food Sciences, assessed the subsoil fertility and economic impacts of placing phosphorus and potassium at depths of 20 to 30 centimetres.

Australia's soils are naturally poor in these nutrients and shortages are becoming even more pronounced in the northern grain growing region.

Some of the nutrients which crops draw up from the subsoil are removed in grain. The remainder are deposited as stubble residue on the soil surface. However root activity is low close to the soil surface.

Crops in the northern region often rely on deep soil moisture, with roots reaching depths of 90cm. Phosphorus and potassium are relatively immobile and don't infiltrate from the surface to deeper soil with moisture like nitrogen and sulphur do.

Phosphorus and potassium trials

Trials to address this with 'deep-banded' phosphorus and potassium were run by QAAFI at sites ranging from the Goondiwindi region into NSW, as far south as Gilgandra and west to Nyngan.

The work started in 2012 and was funded by the GRDC as part of the More Profit from Crop Nutrition I and II projects. The trials found that phosphorus and potassium application at 20cm improved yields, but with some variability across crops and soil types.

However, significant yield increases in chickpeas during the trials caught Mr Bartelen's interest and in 2016 he tried deep phosphorus and potassium on his own farm. He deep-ripped to 20cm with a 12-metre chisel plough, which had previously been converted to a no-till planter, with four four-hectare trial strips.

He applied 200 kilograms of phosphorus per hectare and 200kg/ha of potassium in the first block, 100kg/ha of potassium in the second block, 100kg/ha of phosphorus in the third block, and nothing in the fourth block, as a control. He then planted chickpeas and wheat on each block.

"Where I planted chickpeas on deep phosphorus, there was an incredibly high return on investment," he says. "But where I planted wheat, the response was very slight."

The deep potassium application, meanwhile, did not appear to have a significant impact on yields.

The 2016 results from deep phosphorus were sufficiently promising that in 2017 Mr Bartelen applied deep phosphorus to 900ha. "But I've left six runs unsown with deep phosphorus in a couple of paddocks, so I'll be able to measure using the satellite imagery and yield data to ascertain if I've made my money back."

He's also trialling deep nitrogen application on some blocks.

Most of the 900ha is being planted to wheat, while some is being planted to barley and chickpeas. Mr Bartelen's goal is to determine the best stage in his crop rotation to apply deep phosphorus.

He says deep cultivation is not good for the soil, so it is important to identify the best timing to mitigate the potential loss of soil moisture.

Results from the QAAFI trials currently suggest a large application of deep phosphorus and potassium only once every five years.

"They won't move – they don't dissolve very well – they just sit there," says Mr Bartelen. "So every five years you might have to go out there and reapply it, but you have to apply a high rate."

"The cost of doing that is pretty extreme; 20 to 25cm is a long way down when you're pulling machinery – it requires a lot of horsepower and diesel."

If grower trials and the ongoing work by QAAFI can iron out the variable results from deep phosphorus and potassium application, Mr Bartelen thinks it could be rapidly adopted by northern growers. "I think in a few years everybody will be looking at deep phosphorus, if a few growers can show it is returning increased yields of 20 per cent increase or better," he says.

This project is jointly supported by the Department of Agriculture and Fisheries, University of Queensland and Grains Research Development Corporation.

Chickpeas in Queensland

- Chickpeas are now Queensland's top grain crop.
- Originally cultivated in the Mediterranean and Middle East, chickpeas were first grown in Australia as a commercial crop in Goondiwindi during the 1970s. Chickpeas are becoming increasingly popular in Central Queensland, with the area where chickpea is planted continuing to increase.
- Legumes can play a valuable role in crop rotations and provide benefits such as disease breaks, weed control, and nitrogen fixation.
- All chickpeas grown in Queensland are the Desi variety. In 2015 Queensland produced 554,000 tonnes of chickpeas.
- Approximately 99% of Queensland's chickpeas are bulk exported to the main export markets of Bangladesh, India, the United Arab Emirates and Pakistan. Upon arrival, the chickpeas are processed – either split or ground for flour.
- Around 1% of Queensland's chickpeas are not bulk exported. Some of these are split and exported to high-value export markets such as the United States and the rest sold domestically.

PULSES
2016
#LOVEPULSES

Professor Andre Drenth

Science to protect Queensland's banana industry

In March 2015, a banana farm in Tully in Far North Queensland went into lockdown. Harvesting of fruit was stopped and movement of plant material, soil, equipment, vehicles and people on and off the farm were restricted. More than 16,000 banana plants were destroyed.

This sudden rush of activity was in response to the positive identification of a fungus called fusarium wilt tropical race 4 (TR4) by QAAFI scientists working in the Banana Plant Protection Program, which triggered state and national emergency plant pest response arrangements.

Fusarium wilt may be caused by several different strains of the fungal organism, and is commonly known as Panama disease. The most serious of which is tropical race 4 (TR4) which has had a devastating impact on commercial Cavendish plantations internationally.

Diagnostic support and scientific information and advice that underpins Biosecurity Queensland's emergency plan, which was developed by Department of Agriculture and Fisheries (DAF) in consultation with the Australian Banana Growers' Council, has come from the Banana Plant Protection Program.

Developed and run by QAAFI and DAF, with funding from Horticulture Innovation Australia (HIA) the Banana Plant Protection Program has provided the tools which assist the Australian banana industry to detect, eradicate or contain two banana disease incursions into Australia.

Panama disease resistance has been a key target of the protection program. Last century, the Panama disease race 1 strain wiped out large-scale global production of the then ubiquitous Gros Michel bananas, which were replaced with the Cavendish variety. But while Cavendish is resistant to race 1, it's highly susceptible to the TR4 strain.

Queensland's banana growers have been bracing themselves for TR4's arrival since 1997, when it was detected in the Northern Territory. Most of the territory's small banana industry was wiped out as a result of that outbreak.

The detection of TR4 in far north Queensland, where most of Australia's bananas are grown, had the potential for a similar devastating outcome in Queensland.

The Banana Plant Protection Program is one of a number of current projects QAAFI is working on to mitigate the impacts of the disease as part of the multi-agency response to the detection of TR4 in Queensland.

Getting ahead of the problem

Australia's proactive approach to disease management is rare in the international banana industry, but logical given the local industry's historic attunement to biosecurity issues.

That history dates back a century, when the banana bunchy top virus was detected in northern New South Wales and south-east Queensland, where it has been carefully contained ever since. More recently, in 2001, there was an outbreak of the black sigatoka fungal disease in Tully, which was eradicated from the major production area in a world-first success.

In 2013, an outbreak of the banana freckle fungus in the Northern Territory was also met with an eradication program, the plan for which was developed by the Northern Territory Government with input from other state biosecurity agencies, and scientists who were working as part of the Banana Plant Protection Program.

"Nine years ago we started looking at banana freckle," says Professor Andre Drenth, who leads the program. "Morphological and molecular studies indicated that there were three different pathogen species, one endemic and two exotic, for which we developed molecular diagnostic assays. Once we finished that work we had a way to identify all three of the freckle pathogens."

When a tissue sample was sent in from a Northern Territory farm with an unknown disease in 2013, the test developed in that work identified it as one of the new exotic strains of the banana freckle pathogen.

"If we had not done that basic research, we wouldn't have even started the eradication campaign, because we wouldn't have been sure if it was endemic or exotic," says Professor Drenth.

The Panama response

The re-emergence of TR4 in Australia's main banana producing region is the next challenge for the Banana Plant Protection Program and the science behind the disease-containment plans used in Tully will now segue into work on Fusarium wilt resistance screening.

"The Banana Plant Protection Program has been instrumental in importing and screening varieties for resistance to both Race 1 and TR4 in a systematic manner through replicated trials set up in northern New South Wales, north Queensland and the Northern Territory to screen for resistance to R1 and TR4," Professor Drenth said.

The Banana Plant Protection Program has established agreements with banana-breeding programs around the world in addition to those already established by DAF.

"Australia is one of the few places in the world where you can see material from all the breeding and selection programs around the world tested side by side in a rigorous manner," says Professor Drenth. "Collaborators like to work with us because we provide scientifically rigorous screening and evaluation."

Ongoing research

Ongoing screening of current and new material will continue in 2017, and efforts will focus on research to further develop diagnostic assays for existing and emerging banana pathogens.

The overall objective is to develop and maintain a capacity for accurate detection and identification of emerging endemic and exotic plant pathogens to support management of emerging endemic diseases and reduce the risk from incursions of exotic banana pathogens.

Researchers also plan to develop and test scientifically-based eradication strategies by better understanding infection biology, epidemiology and spread of pathogens, in order to improve the incursion response to exotic and emerging pathogens.

This project has been funded by Horticulture Innovation Australia using banana industry levies with co-investment from the Department of Agriculture and Fisheries, the University of Queensland and funds from the Australian Government.

CASE STUDY

Improving heifer productivity

Producers Doug and Zoe O'Neill of 'Mt Oweenee' near Charters Towers were concerned about the performance of their maiden heifers.

With a group of like-minded producers, they approached Dave Smith, from the Department of Agriculture and Fisheries (DAF), and QAAFI's Dr Geoffry Fordyce, to run a Meat & Livestock Australia (MLA) Producer Demonstration Site (PDS) project north of Charters Towers to investigate how to lift heifer reproduction.

What tends to happen in many northern enterprises is that bulls are put in with maiden heifers at the beginning of the wet season and pregnancy tested the following year in the middle of the dry season.

Even if reasonable conceptions rates are achieved, there is a fair chance that they did not actually get into calf until late in the wet season, which means they have a reduced chance of getting back in calf as a first calf breeder.

Even in continuously mated herds, it is important to get the replacement breeders off to the best possible start.

The 'Mt Oweenee' herd comprises a mixture of Brahman, Charbray and Droughtmaster cross animals. The O'Neills usually mate heifers for about four months starting in January.

"The pregnancy rates in our maiden heifers was quite variable and ranged from 30% in some years to around 70% in others and we needed to improve this," Mr O'Neill said.

As part of the PDS, the O'Neills monitored the weights, disease status and cycling activity of their maiden heifers for a three year period starting in 2014.

"It was run over three dry and challenging seasons and our heifers had to be sent on agistment for some of that time but we persevered so we could collect the data. The effort was well worth it however and we have learnt some valuable lessons," he said.

The lessons included:

- Less bulls. Dr Fordyce recommended implementing fertility testing for bulls, which led to a reduction of bulls from 12 to four bulls per 350 heifers. For the O'Neills, this subsequently proved to be the right decision. "It did not impact the conception rates and we ended up some $24,000 better off immediately as we reduced our bull cost/pregnancy from $21/pregnancy down to $7/head," Mr O'Neill said.
- Focus on health. Fertility diseases were also a major concern so the O'Neills vaccinated their bulls for vibriosis and monitored the herd for Pestivirus. Diseases of fertility were not a factor over the three years of the PDS and the heifers remained free of Pestivirus. "While disease can causes crashes in some years if not managed properly, in most cases it is nutrition and the body weight of the heifers at joining that is usually the cause of poor performance," Dr Fordyce said.

"It was too hard to differentiate between breeds in this PDS simply on phenotype but the key message is that we need to aim to have a target weight of 400kg in this herd at the time of pregnancy test," Mr Smith said.

"The economics and cost benefits of achieving this will vary from year to year but stocking rates and determining the phosphorus (P) status of your heifer paddock are paramount.

"If heifers are being run on P deficient paddocks, then a simple blood test at the end of the growing season will help determine if an extra 30-60 kgs can be obtained by simply supplementing with P over the wet season."

Finally, the pre-puberty heifer traits are highly heritable and rapid progress can be achieved by selecting bulls with low age at puberty and good scrotal circumference measurements.

Dr Fordyce suggested that producers should target bulls from cows that produced a weaner and got back in calf as first calf cow.

"The trial was an excellent learning experience. We now know that our target liveweight at joining is around 350 kgs and by identifying the non-pregnant heifers early, it has allowed us to make sound decisions going forward," Mr O'Neill said.

Take home messages

- Target mob average of 400kg at pregnancy diagnosis or 350kg at start of joining to get high pregnancy rates
- Foetal aging is a valuable tool in managing joining periods and preferably retain those heifers pregnant early in the joining period.
- Use fewer, but better bulls (maximum 2.5% bulls)
- Though disease can be an issue, body weight at joining is the main problem

Source: MLA, 22 July 2016

Buzz about natural fly insecticide

Photo: Phil Savory

QAAFI researchers have developed a clean and safe insecticide to combat nuisance flies in cattle feedlots, using spores of a naturally occurring fungi.

QAAFI Senior Research Fellow Dr Peter James said flies were a nuisance for workers and could carry disease.

"The spores of a Queensland strain of the *Metarhizium anisoplaie* fungus have been developed as an ultra-low volume spray that attaches to the external surface of the fly or is ingested by the flies and kills them," he said. "The spray is very safe, has no effects on humans or animals, and is part of an integrated control approach to suppress fly populations."

"It sticks to the surface of flies and also to vegetation around feedlots, and is not sprayed on cattle."

Dr James said flies were beginning to develop resistance to chemicals now used in feedlots and the fungal spray provided a clean, residue-free, safe and sustainable alternative.

The insecticide has been tested at feedlots in the Dalby area in Western Queensland.

"A lot of work has gone into isolating different strains of the fungus that are effective against flies, then testing different ways of mixing it and applying it in an ultra-low volume formulation."

He said the spray did not kill flies immediately.

"This is very much about suppression of the population rather than a 'hit them and die immediately' approach, as we do not want to knock out the natural predators and parasites of the flies, which would ultimately lead to a resurgence in pest numbers."

The project, funded by Meat & Livestock Australia, and led by Dr James and Dr Diana Leemon from Department of Agriculture and Fisheries, aims to develop a commercial product for use in cattle feedlots.

The project builds on work carried out by Department of Agriculture and Fisheries scientists in previous MLA funded projects.

Trials promise macadamia yield boost

Macadamias are the first – and so far only – Australian native food crop to see significant commercial development, and the home-grown nut's flavour and nutrition attributes have generated a surge in popularity in recent decades.

While Australia is no longer the only country growing macadamias, it's certainly one of the largest producers, with an annual harvest of nearly 50,000 tonnes. That volume is expected to grow to cater for rising international demand, and already 70 per cent of Australia's macadamias are exported.

For many years the Australian industry has been based on varieties little improved from the wild macadamias that dot southern Queensland and northern New South Wales. However, four new cultivars have been released by the Department of Agriculture and Fisheries (DAF) and Horticulture Innovation Australia (HIA) that could significantly improve the industry's productivity. The new varieties are part of a long-running breeding effort which is now run by QAAFI, an institute of the University of Queensland, jointly supported by the Queensland Government.

The Macadamia Breeding and Conservation project is led by Associate Professor Bruce Topp, a principal research fellow at QAAFI's Centre for Plant Science, and is funded by HIA with the macadamia levy and the Australian Government.

The project has its origins in a 1996 CSIRO initiative, which began planting 4500 macadamia seedlings. After 22 years of selection trials, a handful of those cultivars have been released as new commercial varieties in 2017.

The potential for improvement is significant. Most current commercial varieties are only two to four generations removed from wild macadamias, compared to crops like peaches, which are the beneficiaries of 16 or more generations of breeding. New varieties offer an opportunity to make Australian macadamia growers more competitive internationally.

New varieties set for release

Growers were consulted to determine what traits they were looking for in new macadamia varieties. Top of the list was improved yield, and this has been reflected in the cultivar selections.

The top 20 'elite' cultivars selected in the progeny breeding trials had an average yield per tree up to 30 per cent higher than standard varieties. That's a big jump in yield, but Professor Topp emphasises it's the product of a 22-year process. Those 20 elite selections were evaluated in regional variety trials managed by DAF through a separately funded project.

Beyond higher-yielding varieties, the breeding program is also exploring smaller trees that make harvesting and high-density planting easier, better rootstocks, and nuts with less saturated fat.

Speeding up the process

The macadamia is a large tree. It doesn't reach full production until it is 12 to 15 years old, and seedlings need to be grown for seven or eight years to get an accurate picture of their mature yield.

That makes field trials to test how varieties perform in a commercial orchard set-up a time-consuming process. Speeding up that process is one of Professor Topp's main goals.

"In the next phase of the program, we're concentrating on producing a much larger number of seedlings, and we've developed a new method to screen them much more rapidly," he says.

"We've done experiments to look at the visual evaluation of yield, and compare that to the actual yield we've obtained," says Professor Topp. "We use trained assessors to go out and visually estimate the yield from what's on the tree." The visual assessments have proven accurate enough to use instead of manually weighing each tree's nut production – a big time saver with 10,000 trees to examine.

Strong balance in the gene bank

As the home of the macadamia nut, Australia has a unique resource in its backyard. Four species of macadamias are distributed across northern New South Wales and Queensland, providing a bank of genetic material that puts Australian breeding programs in a strong position compared to those from competing suppliers such as Brazil, South Africa or China.

Only two of those species, *Macadamia integrifolia* and *Macadamia tetraphylla*, produce edible raw nuts, but the other two varieties offer promising traits as rootstocks. "The native germplasm is one of the real strengths we've got," Professor Topp says.

The initial breeding work by the CSIRO established two germplasm trials at Tiaro in Queensland and Alstonville in New South Wales, which planted a collection of 220 accessions of the four species, as parent material for breeding.

In 2017, a PhD project is expected to genotype and phenotype the entire collection, to identify novel traits that may improve commercial macadamia varieties, allowing QAAFI to use genomic selection to speed up identification of promising new varieties.

This project is funded jointly funded by the Department of Agriculture and Fisheries and University of Queensland, and Horticulture Innovation Australia.

Beyond MR Buster: Trials show upside to sorghum yields

New data from on-farm trials conducted across NSW and Queensland has the potential to help growers lift the yields of sorghum by providing guidelines on how to match hybrids and management that better suit local, and expected seasonal outlooks.

Beginning in July 2014 and concluding in June 2017, the trials have gathered data from more than 2000 plots which looked at 12 commercial and experimental hybrids over 19 sites.

Funded by the GRDC, the Queensland Alliance for Agriculture and Food Innovation (QAAFI) – a combined University of Queensland and Queensland government research institute – and the NSW Department of Primary Industries, the research has provided valuable guidelines for growers looking to evaluate hybrids that are new, or new to them.

QAAFI Associate Professor Daniel Rodriguez leads the Queensland arm of the project and worked closely with farmers, seed companies and agronomists to select hybrids that offer a range of traits.

"Advancements in plant genetics, agronomy, the cropping system and their interactions mean that some combinations of new hybrids and management may offer much higher yield potentials," Dr Rodriguez said.

"The main message from the project is that picking the right hybrids and management strategies for the location and expected seasonal conditions can significantly increase yields."

For many growers, the baseline sorghum hybrid is Pacific Seeds' MR Buster, released in the 1990s and accounting for an estimated 40 to 50 per cent of the Queensland crop. In these trials MR Buster was sown at all sites as a standard. "Growers can choose from a large range of high yielding sorghum hybrids having contrasting maturity types, tillering type, yield potential, and yield stability," Dr Rodriguez said.

"Choosing the right hybrid for the right target yield and environment can make the differences between good yields and exceptional yields. It's a matter of horses for courses."

Commercially available hybrids can be characterised by their yield response when grown across sites of different yield potential, e.g. low yielding (drier sites or seasons) - to high yielding (wetter sites or seasons). Hybrids can be characterised by their yield potential (high or low) and their type of yield stability (dynamic or static). For example in static stability the yield of the hybrid remains relatively constant across a range of low to high yielding sites. While in dynamic stability, the yield response of the hybrid to better yielding environments is much steeper, although the later hybrids tend to perform poorly in bad seasons. The project evaluated the yield potential and stability of most available hybrids in the Northern Grains Region, using the most popular (older) hybrid in the region MR Buster as a standard. Results showed that:

- Most hybrids yielded more than MR Buster in both low, and high yielding sites.
- Some hybrids were higher yielding than MR Buster and also showed dynamic stability.
- Some hybrids were higher yielding than MR Buster and also more stable, showing static stability.

"High yielding hybrids showing dynamic stability are better suited for irrigation or high yielding sites and wetter seasons, though lodging might be an issue in those sites," Dr Rodriguez said. "On the other hand more stable hybrids might trade some yield in the better sites and seasons for more consistent yield in the poorer sites and seasons."

"Sorghum growers in the Northern region have options to chase higher yields or yield stability, and they need to be aware of the trade-offs," Dr Rodriguez said.

"Once the yield target is decided, hybrid and management can be chosen based on simple crop design rules that we derived from the collected data set."

For example, in sites and seasons where yields were between 5.5 and 10t/ha the highest yields were obtained with medium-long and long maturity, high yielding dynamic hybrids sown in solid configurations at more than 70,000 pl/ha. While in sites and seasons where yields were between 2.5 and 5.5t/ha the highest yields were obtained with low tillering and early maturity hybrids also sown in solid configurations.

The research shows that in sorghum what really matters is not just agronomy, but to understand how to match hybrids and agronomy to site and seasonal conditions. "As the skill of seasonal climate forecasts improves, there will be potential for their use to inform these decisions but at the moment soil conditions at planting and field history are our best allies to inform target yields," Dr Rodriguez said.

This project is jointly supported by the Department of Agriculture and Fisheries, the University of Queensland, GRDC and the NSW Department of Primary Industries.

Ethiopian technicians at the Melkassa Research Station making breeding crosses between sorghum lines. Photo: Professor David Jordan

ENGAGEMENT

Formed as an alliance with the Queensland Government, QAAFI forges strategic industry partnerships to tackle local and global challenges in tropical and sub-tropical agriculture and food production. Our high impact science research and engagement activities are focused on supporting the whole of the supply chain in agriculture and food. We work with industry, government, not-for-profit sector and collaborate with a range of research agencies across Australia and globally.

UQ School of Agriculture and Food Science's Dr Chris Lambrides co-leads the project

UQ plant breeding expertise recognised globally

The University of Queensland's expertise in plant breeding has been recognised by a $3.8M grant from the Bill & Melinda Gates Foundation to evaluate and improve breeding programs in developing countries.

UQ was selected to implement the Breeding Program Analysis Tool because of the university's international reputation for excellence in plant breeding, particularly in tropical crops, and its experience in improving sorghum breeding in Ethiopia.

UQ School of Agriculture and Food Sciences project leader Dr Chris Lambrides said the project would identify ways of improving breeding programs, leading to greater genetic gains and on-farm profitability.

"This is a very exciting project because it will contribute to making a real difference to millions of resource-poor farmers worldwide," Dr Lambrides said.

"We will be using the Breeding Program Analysis Tool developed by the Gates Foundation across key public sector plant breeding programs in Africa and Asia for sorghum, rice, maize, wheat, cowpea, chickpea, common bean, groundnut, yam, sweet potato, cassava, and banana."

Project co-leader and UQ Queensland Alliance for Agriculture and Food Innovation researcher Professor David Jordan said very few organisations possessed the range of technical and applied breeding expertise of UQ and its partner, the Queensland Department of Agriculture and Fisheries.

Professor Jordan leads Australia's sorghum pre-breeding program funded by the Grains Research Development Corporation.

"Sorghum is a great example of the gains that can be achieved by effective plant breeding even in difficult dryland cropping environments," Professor Jordan said.

"Productivity gains from sorghum in Australia are the highest in the world."

The Gates Foundation's project involves developing a website to act as an information hub and encourage organisations to conduct self-assessments using the tools available online.

The project will review breeding programs in 11 key African and Asian geographic regions – Mali, Burkina Faso, Nigeria, Ghana, Ethiopia, Uganda, Tanzania, Bangladesh and the Indian states Bihar, Orissa, Uttar Pradesh.

"We are investigating the possibility that in the future the tool will be made available to other donors and or interested parties at a reasonable cost," Dr Lambrides said.

"Effective plant breeding is fundamental to improving farmer profitability and reducing risk."

Director-General of Agriculture and Fisheries in Queensland Dr Beth Woods with Professor Robert Henry.

High Tech food, will the world swallow it?

In association with UQ Alumni and to commemorate World Food Day, QAAFI ran a Global Leadership Series seminar on the subject of 'High Tech Food' on 13 October 2016 on advanced science approaches to improving the nutrition, diversity and sustainability of global food production.

Speakers included Professor Robert Henry speaking on the latest scientific advances and technology drivers in agriculture; Professor Mike Gidley on the gut microbiome and consumer attitudes to technology and food; Professor Ben Hayes on the genomics revolution; and Professor Neena Mitter on harnessing the power of nanotechnology for more sustainable agriculture and food.

The panel highlighted how, that in order to grow agricultural sustainably to meet global food demand, advanced scientific techniques, such as gene editing, genomics and nanotechnology would be required.

Professor Mike Gidley entertainingly demonstrated, with the aid of a loaf of white bread and a seven-metre garden hose, that high tech foods have been with us for around 100 years, in the form of sliced white bread and Coca-Cola, and how these highly processed foods are absorbed in the upper gut, providing little nutrition to the colonies of microbes in the large intestine, which play an important role in regulating health.

Attended by 180 people, the Global Leadership seminar was introduced by Dr Beth Woods, the Director General of Agriculture and Fisheries in Queensland Government, and facilitated by Mr Pete Lewis.

Drones to support on farm agronomic research

(L-R) Dr Clive Murray (Regional Project Manager South and South East Asia at Syngenta Foundation for Sustainable Agriculture) to my left

Dr Barbara George-Jaeggli presented on high-yielding sorghum

Dr Joe Eyre presents at the 2016 Summer Grains Field Walk day

Summer Grains industry event

A summer grains field walk was held at Gatton on 12 February 2016.

Hosted by QAAFI's Associate Professor Daniel Rodriguez, the Field Walk provided experimental results on the 2014-15 growing season for a GRDC, Australian Centre for International Agricultural Research (ACIAR) and Department of Agriculture and Fisheries funded projects.

Keynote presentations included 'Tactical agronomy for sorghum in the Northern Grains Region' by Dr Daniel Rodriguez; and 'Maize hybrids and management for rainfed cropping in Queensland' by QAAFI's Dr Joseph Eyre.

Other presentations included:

- Twin row vs solid maize configurations for high yields (James McLean)
- High yielding sorghum (Barbara George-Jaeggli)
- Multi-cobbing maize for high yields in rainfed cropping (Joseph Eyre)
- Drought tolerant maize demo (James McLean)
- Stress wheels for sorghum and maize demos (Claire Farnsworth)
- Can on site rapid soil testing kits replace soil lab testing? (Stuart Brown)
- Using drones to support on farm agronomic research (James McLean)

The Summer Grains Field Walk and experimental results research is available in a booklet downloadable on the QAAFI website.

The perfect papaya

Christopher Columbus called it the "fruit of the angels" and now QAAFI scientists have, for the first time, identified the sensory properties of the 'perfect' papaya.

"According to our consumer taste tests, the perfect papaya is red, small or hand-sized, fewer seeds, a velvety texture, and sweet caramelised rockmelon and banana flavours," said QAAFI's Dr Heather Smyth.

Despite being rich in anti-cancer components and often described as a 'superfood', papayas are off the menu for many consumers, due to perceptions of the fruit's pungent taste or aroma.

"Papayas are super healthy – full of carotenoids and anti-cancer compounds such as isothiocyanates, in the flesh and seeds – but there are perceptions of them being expensive and having a bad flavour," Dr Smyth said.

"If people have a bad fruit experience, they won't go back."

She said previous consumer work undertaken by Horticulture Innovation Australia had identified three distinct groups of consumers: those who loved papayas, those who consumed them occasionally and those who never ate them (the majority).

Dr Smyth's study, funded by Pacific Agribusiness Research for Development Initiative and the Department of Agriculture and Fisheries, aimed to evaluate which varieties of papaya were most preferred by consumers, and to identify the characteristics of the preferred varieties.

"There was a strong preference for red papayas, as opposed to the yellow papaya, which are also known in Australia as papaws," she said.

The Australian-grown Skybury and Fijian Red varieties were preferred by most consumers.

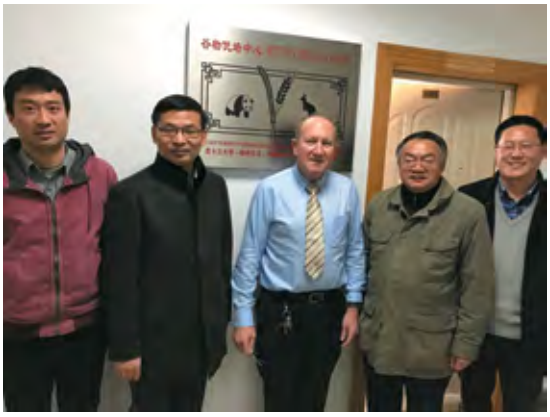
She believes there may be an untapped new market of those who enjoyed the red papaya but are not currently consuming it – "if breeders can develop the preferred characteristics and processors are able to serve the fruit in snack food form"

Australia produces around $20 million papaya annually, with most of it grown in Queensland around the Innisfail and Mareeba areas.

This project is jointly supported by the Department of Agriculture and Fisheries, UQ, and the Pacific Agribusiness Research for Development Initiative.

Australia-China cereals research centre established

A new cereals research centre, a joint initiative between Australia and China, was established in December 2016.



(L-R) Dr Enpeng Li (UQ PhD graduate, lecturer at Yangzhou University); Prof Qiaoquan Liu, Dean of Agriculture at YZU, Honorary Professor at UQ; Professor Gilbert; Dr Wensha Guo, Party Secretary, Agriculture Faculty, YZU; and Dr Zhou, head of HR, YZU.

Formed by QAAFI, YangZhou University College of Agriculture and the Chinese Academy of Agricultural Sciences, the Better Cereals Centre will undertake fundamental research aimed at improving grain quality, including nutrition.

QAAFI's Professor Bob Gilbert, who championed the initiative, said the collaboration would lead to a better understanding of the drivers for Australia's largest trading partner with regard to agriculture research, development, marketing and customs.

The Centre builds upon QAAFI's largest collaboration in China, which is focused on the starch chemistry of grains, and is led by Professor Gilbert. Professor Gilbert was among the first foreign appointees of the highly prestigious 1000-Talents Program established by the People's Republic of China, who provided generous incentives to establish state-of-the-art research facilities in China.

Prof Gilbert works in YangZhou, China, under the Program. He has world-leading equipment there for finding the relations between the genetics, structure and properties of starch and starch-containing foods, and glycogen, which is important for the maintenance of the level of blood sugar.

QAAFI's Professor Robert Henry, Professor Mike Gidley, Professor Steve Moore, Associate Professor Andrew Borrell, Dr Glen Fox and Ms Tiparat Tikapunya attended the 2016 Sino-Australian Conference on Agriculture and Agri-Product Safety on December 12-13, 2016 at Yangzhou University, Jiangsu Province, China. Topics of focus included crop germplasm resources; high-efficiency and safe production of crops; preventing and controlling animal diseases and zoonoses; and technology for agro-ecological environmental protection and safe production of agri-products.

QAAFI's beef in Brazil

QAAFI researchers and their colleagues from UQ's Schools of Agriculture and Food Science, Chemistry and Molecular Biosciences, and Veterinary Science, received funding to explore agricultural science in Brazil.

Collaborating with researchers from Universidade Estadual Paulista (São Paulo State University - UNESP), the initiative will cover agricultural genomics, animal nutrition, agronomy, animal health, and biosecurity.

Proposed outcomes for both institutions include student mobility, joint research proposals, and access to large data sets. The economies of Brazil and Queensland are heavily reliant on agriculture, and the research is expected to have broad benefits for both regions including improved meat quality and livestock fertility, and advances in soil carbon sequestration.

QAAFI's Professors Tim Mahony (fifth from left), Steve Moore (fourth from right) and Ben Hayes (second from right) helped organise the Brazil workshop on food production

Innovative technology for faster avocados

QAAFI's Dr Alice Hayward won a prestigious mid-career Advance Queensland Research Fellowship in 2016, to develop the world-first MICROpropagator – a non-GM, non-toxic, root-inducing formula to speed up the root production of woody crops such as avocados.

This work is supported by DAF and UQ. Dr Hayward's industry partners are DAF, Delroy Orchards, Jasper Farms and Anderson Horticulture Pty Ltd. Dr Hayward will spend a portion of her fellowship working with DAF scientist Dr Lindy Coates.

Meeting the challenge of climate change and food security

Over 200 delegates met in November in Hyderabad at the International Conference on Climate Change, Water, Agriculture and Food Security (ICCCWAFS), convened by the International Water Management Institute and the Norwegian Institute of Bioeconomy Research.

QAAFI's Associate Professor Andrew Borrell was a keynote speaker, as well as delivering the Closing Summary at the conference.

He presented case studies highlighting genetic and management solutions to this challenge, including genetic solutions for drought adaptation in sorghum in Australia, India and Africa, and management solutions for rice-based cropping systems in Asia.

"The conference explored the nexus between climate change, water, agriculture and food security," said Dr Borrell.

"Discussions were not limited to science, but also included the biophysical, technological, institutional, social, economic and political drivers of climate change. It's all about maintaining food security in the face of heightened climate variability."

Dr Borrell said both the impact of climate change on food production, and the cost of extreme climate events on the global economy, were significant.

Simulations from eight global climate models presented at the conference showed there will be a significant reduction in yield of both rice and wheat in West Bengal, with yield reductions in some areas expected to be up to 52 per cent and 59 per cent for rice and wheat, respectively.

"Data was also presented at the conference showing that the cost of natural disasters exacerbated by climate change is already substantial (USD 165 billion a year), and predicted to increase threefold to USD 450 billion by 2030, primarily from floods," said Dr Borrell.

According to Dr Borrell, there were some very innovative ways to deal with the considerable challenges ahead.

"Remote-sensing technologies to understand the supply and demand for water at the catchment scale were suggested as one solution for managing extreme events. Solar irrigation pumps, slow-release fertilisers, novel water-saving technologies, and enhanced canal engineering were all discussed."

An approach to train agriculture extension agents and farmers in India and Africa to produce short videos featuring local farmers demonstrating improved agricultural practices with low-cost pocket video cameras, microphones and tripods was also presented.

"Sound policies, good economics and political will are critical," said Dr Borrell. "But it needs to be kept in mind that farmers won't adopt climate-smart technologies if they are not profitable".

Water and food security will also require gender-just policies.

Delegates at the ICCCWAFS conference

Keynote speakers at ICCCWAFS (left to right): Dr Andrew Borrell (UQ), Mr Jeremy Bird (DG, International Water Management Institute), and Dr Nils Vagstad (DG, Norwegian Institute of Bioeconomy Research).

PhD student Louisa Parkinson is an avocado researcher at QAAFI and the face of UQ's student recruitment campaign. Photo: Phil Savory.

LEARNING

Create change at QAAFI.
Agriculture in the 21st century faces multiple challenges and QAAFI welcomes RHD students to help produce safe, nutritious food in challenging tropical and sub-tropical environments. The world's population is expected to grow by over a third by 2050, and most of this growth will be in the tropics. QAAFI and UQ attract the best people to undertake research using advanced sciences and precision agriculture to produce sufficient, safe and nutritious food that meets their dietary needs and food preferences an active and healthy population.

Shady Queensland eucalypt shines as renewable global biofuel

When Canadian PhD student Adam Healey arrived at UQ to study the biofuel properties of a fast-growing eucalypt, he did not have to look far for a sample of his target tree – as it grows in the university's Great Court.

"The Corymbia group of Eucalypts are a good amenity tree, planted in South and Central Queensland for its shade properties," said Mr Healey, a PhD student with QAAFI.

"The Corymbia group is a rainforest tree that originates from Northern Queensland, but when it was relocated, it formed spontaneous hybrids with the native 'spotted gum' eucalypt."

The resulting hybrids grow twice as fast as either parent species and combine their desirable traits (frost and disease resistance, excellent wood quality and form) into a single genetic background.

It is these Corymbia hybrids that offer exciting possibilities as a potential source for biofuel production.

"These hybrids grow well in low nutrient and poor quality soils, so planting them doesn't compete with agriculture. There are issues involved with using edible feedstocks, such as corn or sugarcane, to produce fuel. The biomass of these trees is mainly composed of polysaccharides, which you can break down into individual sugars and ferment into liquid fuel."

Once planted, the Corymbia trees can be harvested for decades, as they can re-grow from their own stump after being cut down. A key difference between a biofuel and fossil fuels, is how long it takes to replenish the source of each.

Mr Healey's PHD project investigates the genetics of trees to find which are well-suited for fuel production, with the goal of creating a new non-edible feedstock for producing biofuels.

"The problem is that trees take a long time to grow, which makes breeding for these biofuel traits more difficult," Mr Healey said.

"By identifying genes responsible for these traits, you can select for trees that will be easier to produce fuel from at a very young age."

The formation of wood is a complex process that involves the co-ordination of hundreds of genes.

However, Mr Healey's research, using next-generation genome sequencing, uncovered mutations in the gene pathways of Corymbia hybrids that were previously unknown, which influence cell wall biosynthesis.

Mr Healey said the eucalypt biofuel research in Australia could help benefit the world – along with eucalypts native to Australia.

"The hybrids I have worked on have been deployed overseas because they grow in a wide variety of rainfall conditions, have excellent wood quality and growth characteristics, and resistance to a wide variety to pests and insects," he said.

Prior to commencing his PhD with QAAFI, Mr Healey worked on biofuel research in Canada for a biofuel company funded by Shell Gasoline. However, when the company pulled out its funding, he began looking for new opportunities.

"The work I was doing in Ottawa was on fungal genetics – fungus produce the enzymes that break down plant biomass and my job was trying to figure out how to make them more efficient."

However, after the project funding was pulled, Mr Healey went to work in a pharmaceuticals company working in microbiology. "But it wasn't research that I was passionate about and I decided to pursue a graduate degree," he said.

It was at this point that sunny Queensland and the Corymbia hybrid trees became part of Mr Healey's plans.

"Professor Henry and Associate Professor Lee had identified these particular eucalypt hybrids as a potential source for biofuels," Mr Healey said.

"The collaboration with industry and contacts internationally that I was able to access as a student with QAAFI made everything possible."

For his project, Mr Healey sampled around 700 hybrid trees at a plantation near Gympie Queensland.

Thanks to a collaboration between QAAFI and the Joint BioEnergy Institute (JBEI) in Emeryville, California, Mr Healey was able to ship wood samples to JBEI and travel there investigate the biomass composition of these hybrids.

"You take wood shavings from individual trees then analyse what each is composed of," Mr Healey said, explaining the process. "Then, you sequence the genome of trees of interest and try to find what makes them special."

This gave him new gene targets to look at – of mutations that occur in less obvious gene pathways that control growth and biomass composition.

Professor Henry said QAAFI was a research organisation that developed sustainable technologies, mainly in food-based agriculture.

"But we also look at agriculture in supplying non-food products including fuel, and nutritional benefits," Professor Henry said.

He said it was important to promote consumer awareness of the issues.

"Biofuels may play a replacing or fossil fuels for airline fuels, for example, and could also replace oil for non-fuel products like plastics and various materials."

QAAFI's continued success at 3MT

RHD student Ghanendra Gartaula from the Centre for Nutrition and Food Sciences continued QAAFI's impact in UQ's Three Minute Thesis (3MT) competition, following his success at the UQ All-Institute 3MT final, and progression into the UQ final.

After winning the QAAFI heat, Ghanendra gave an exceptional presentation entitled 'Is Wheat Porridge Possible?' at the All-Institute final in competition with seven other finalists from across UQ's research disciplines to secure a spot in the UQ finals.

"It was really a very thrilling and exciting journey all the way from QAAFI through to the UQ 3MT Final," Ghanendra said.

"3MT is really a wonderful platform to share your research findings to people who do not understand the technical writings in the research paper or thesis. More than that, it gives you a chance to reach to a wider range of people."

Ghanendra urged RHD students not to miss the chance to develop your self-confidence in communication skills which is a must in the career pathways.

"Please be a part of this event. Who knows, you could be the person-of-the-event next year!"

Congratulations to the UQ Final winners: Anna-Liisa Sutt (overall Winner and People's Choice winner) for her presentation "Dying to talk", from the School of Medicine; and Thisun Piyasena (Runner-Up) for her presentation "Taming the chimera", from the School of Chemistry and Molecular Biosciences.

Ghanendra's success follows the strong performance of QAAFI's talented RHD cohort at the UQ 3MT All-Institute's finals since 2013, when QAAFI first began enrolling RHD students. Since that time, a QAAFI student has been selected to represent the UQ institutes at the UQ 3MT finals each year:

- 2016
  Ghanendra Gartaula, CNAFS: Is wheat porridge possible?
- 2015
  Cecile Richard, CPS: Root out hunger with drought-proof wheat (winner).
  Madeleine Gleeson, CPS: Dear avocado, why won't you root? (People's choice winner)
- 2014
  Honglei (Holly) Zhai, CNAFS: More cereals in your diet-Less fat in your body (UQ Wildcard winner won People's choice in UQ competition).
  Greta Busch, CAS. A paralysing problem (runner up).
- 2013
  Karishma Mody, CPS. 'Single n Hot' - The new nanovaccine.

3MT® THREE MINUTE THESIS
FOUNDED BY THE UNIVERSITY OF QUEENSLAND

QAAFI 3MT winners 2016
Gold Winner: Ghanendra Gartaula (CNAFS) Is wheat porridge possible?
Silver Winner: Nga Tran (CPS) Citrus black spot: The search for Mr. Perfect
Bronze Winner: Shulang Fei (CPS) Making stronger bananas

QAAFI student receives the 2016 Lynsey Welsh Award

QAAFI PhD student, Titilayo Falade (CNAFS), who is sponsored by the Australian Government's Australia Awards scholarship program, was awarded the 2016 Lynsey Welsh Award for innovation in near infrared science.

The Lynsey Welsh award is presented in memory of the late Lynsey Welsh who made significant contribution to cereal science, near infrared science and the Australian Near Infrared Spectroscopy Group (ANISG).

Ms Falade was presented the award for her oral presentation on her PhD research using near infrared spectroscopy for modelling aflatoxin contamination in single kernels of maize.

Her advisory team is led by Dr Glen Fox and include Dr Mary Fletcher, and Dr Yasmina Sultanbawa.

"I chose a career in food safety to focus on mycology challenges because food safety is critical to sustainability in agriculture," Ms Falade said.

"This award has encouraged me to uphold a legacy in these important fields of research."

"Near infrared science is an excellent way to use environmentally and user-friendly technology to investigate food safety concerns and unlock hidden patterns that may not be readily observed."

Ms Falade said she was grateful for the support and opportunities she has received from the Australia Awards and UQ, which provided her the opportunity to attend global conferences and workshops related to her field.

The Agricultural Research Connections workshop jointly organised by the Bill and Melinda Gates Foundation, the first African Symposium on Mycotoxicology and the Australasian Grain Science Association conference are just a number of events Ms Falade has been able to attend. She also received a QAAFI travel grant to attend the World Mycotoxin conference in Canada.

"Being able to meet and interact with world renowned scientists and seasoned researchers from around the world has enriched my life and experience as a young researcher," Ms Falade said.

In the future, she hopes to make contributions towards addressing food safety and security challenges faced in the developing world.

"Of utmost importance to me is to work with farmers in developing countries, particularly within Africa, to investigate and offer solutions to food safety and agricultural challenges," Ms Falade said.

"I also hope to inspire young researchers and women around the world in agriculture and research."

2016 Animal science Olympics – judges L-R: Prof Ross Barnard (UQ-SCMB); Prof Dennis Poppi (UQ-SAFS); Dr Wayne Hall (DAF-Agri-Science Qld); Dr Kim Agnew (Merial); Dr Peter Johnson (DAF- Animal Science); Dr Jacqui King (DAF- Biosecurity); A/Prof Jo Meers (UQ-SVS); Dr Sigrid Lehnert (CSIRO); Sarah Meibusch, QAAFI; Dr Rob Dempster (Virbac). (Not pictured: Dr Gene Wijffels, CSIRO; Professor Ben Hall, QAAFI).

Animal Science Olympics

In November 2016, QAAFI has held its 4th Animal Science Olympics, an animal science poster competition. Established in 2012 by Professor Ala Lew-Tabor, the competition is run by QAAFI Centre for Animal Science.

This year the competition has attracted 26 participants, both RHD students and early career researchers from various UQ Schools and Institutes, CSIRO and the Department of Agriculture and Fisheries. The competitors presented their research across many broad areas of animal science including koala healing, rumen microbiology and bovine genetics.

A. Nahuel A. Pachas (UQ SAFS) - Animal Science Innovation Award for RHDs only - $3000 (sponsored by QAAFI Centre for Animal Science)
Poster entitled: The effect of tree density on biomass production of Leucaena leucocephala and Chloris gayana using a Nelder fan design

Ben Schofield (UQ SAFS) - Animal Science Genetics/Genomics Award for RHDs and ECRs - $3000 (sponsored by QAAFI Centre for Animal Science)
Poster entitled: Rumen Microbial Community Structure of Sheep Fed the Probiotic, Bacillus amyloliquefaciens H57

Supporting information

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Prof. Andre Drenth	Professorial Research Fellow
Dr Joe Eyre	Research Fellow
Dr Andrew Geering	Senior Research Fellow
Dr Barbara George-Jaeggli	Research Fellow
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A/Prof. Jim Hanan	Principal Research Fellow
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Dr Adrian Hathorn	Postdoctoral Research Fellow
Dr Alice Hayward	Advance Qld Postdoc Research Fellow
Dr Juliane Henderson	Research Fellow
Dr Lee Hickey	Senior Research Fellow
Prof. David Jordan	Professorial Research Fellow
Dr Duy Le	Research Officer
Dr Guoquan Liu	Research Officer
Dr Emma Mace	Senior Research Fellow
Dr Gulshan Mahajan	Research Officer
Dr Sudheesh Manalil Velayudhan	Research Officer
Dr Andrew Miles	Senior Research Fellow
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Dr Stephen Mudge	Research Officer
Dr Andries Potgieter	Senior Research Fellow
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Dr Karl Robinson	Research Officer
A/Prof. Daniel Rodriguez	Principal Research Fellow
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Dr Vijaya Singh	Research Officer
Dr Dharmendra Singh	UQ Postdoctoral Research Fellow
Dr Lila Singh-Peterson	Research Fellow
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A/Prof. John Thomas	Principal Research Fellow
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Dr Alex Wu	Research Officer
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A/Prof. Mary Fletcher	Principal Research Fellow
Dr Geoffry Fordyce	Senior Research Fellow
Prof. Ben Hayes	Professorial Research Fellow
Dr Peter James	Senior Research Fellow
Mr Ross Koufariotis	Research Officer
Dr Maggy Lord	Research Fellow
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Dr Luis Prada E Silva	Senior Research Fellow
Prof. Ala Tabor	Professorial Research Fellow
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Dr Jill Ulrich	Research Officer

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Dr Agnelo Furtado	Senior Research Fellow
Prof. Bob Gilbert	Professorial Research Fellow
Dr Nima Gunness	Postdoctoral Research Fellow
Dr Deirdre Mikkelsen	Research Fellow
Dr Michael Netzel	Senior Research Fellow
Dr Nilesh Nirmal	Postdoctoral Research Fellow
Dr Tim O'Hare	Senior Research Fellow
Dr Sandra Olarte Mantilla	Research Officer
A/Prof. Eugeni Roura	Principal Research Fellow
Dr Kinnari Shelat	Research Fellow
Dr Heather Smyth	Senior Research Fellow
A/Prof. Yasmina Sultanbawa	Principal Research Fellow
Dr Barbara Williams	Senior Research Fellow
Dr Peng Wu	Research Officer

QAAFI Honorary and Adjunct Appointments

Honorary appointments

QAAFI Centre for Plant Science

Professor Birger Lindberg Moller	Honorary Professor
Professor Blake Simmons	Honorary Professor
Professor Colin Wrigley	Honorary Professor
Professor Frederik Botha	Honorary Professor
Mr Greg McLean	Honorary Senior Research Fellow
Dr Ian Chivers	Honorary Senior Fellow
Professor Kemal Kazan	Honorary Professor
Professor Mario Herrero	Honorary Professor
Professor Maurizio Rossetto	Honorary Professor
Associate Professor Michael Mackay	Honorary Associate Professor
Dr Parimalan Rangan	Honorary Senior Research Fellow
Associate Professor Phillip Banks	Honorary Associate Professor
Professor Rod Wing	Honorary Professor
Dr Roger Shivas	Honorary Professor
Associate Professor Slade Lee	Honorary Associate Professor
Professor Vincent Vadez	Honorary Professor
Dr Yingbin He	Honorary Senior Fellow

QAAFI Centre for Animal Science

Dr Brian Burns	Honorary Senior Research Fellow
Dr Jess Morgan	Honorary Fellow
Dr Ken Yong	Honorary Fellow
Dr Manuel Rodriguez-Valle	Honorary Professor
Dr Marcelo Benvenutti	Honorary Fellow
Associate Professor Rafat Al Jassim	Honorary Associate Professor
Dr Stephen Were	Honorary Senior Research Fellow
Associate Professor Stuart McLennan	Honorary Principal Research Fellow

QAAFI Centre for Nutrition and Food Sciences

Dr Ardy Kharabian-Masouleh	Honorary Senior Fellow
Associate Professor Dharini Sivakumar	Honorary Associate Professor
Dr Francesca Sonni	Honorary Fellow
Dr Francisco Vilaplana	Honorary Fellow
Professor Geoffrey Fincher	Honorary Professor
Professor Michael Rychlik	Honorary Professor
Professor Qiao-quan Liu	Honorary Professor
Professor Steven Chen	Honorary Professor

QAAFI Adjunct Appointments

QAAFI Centre for Plant Science

Associate Professor Ian Bally	Adjunct Associate Professor
Professor Graham Bonnett	Adjunct Professor
Associate Professor David Butler	Adjunct Associate Professor
Associate Professor Emma Mace	Adjunct Associate Professor
Professor Lynne McIntyre	Adjunct Professor
Dr Sam Periyannan	Adjunct Fellow
Professor John Skerritt	Adjunct Professor
Associate Professor Youhong Song	Adjunct Associate Professor
Associate Professor Neil White	Adjunct Associate Professor
Dr John Wilkie	Adjunct Senior Fellow
Professor Graeme Wright	Adjunct Professor

QAAFI Centre for Animal Science

Dr Barry Blaney	Adjunct Senior Fellow
Dr Rosalind Gilbert	Adjunct Fellow
Dr Lisa Gulino	Adjunct Fellow
Dr Jagger Harvey	Adjunct Senior Research Fellow C
Professor Wayne Jorgensen	Adjunct Professor
Dr Selina Ossedryver	Adjunct Fellow
Ms Diane Ouwerkerk	Adjunct Fellow
Dr Richard Silcock	Adjunct Senior Fellow

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Associate Professor Azivile Luksiene	Adjunct Associate Professor
Dr Ram Mereddy	Adjunct Senior Research Fellow

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QAAFI Centre for Plant Science

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Professor Ross Barnard	Affiliated Professor
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Professor Christine Beveridge	Affiliated Professor
Professor Jimmy Botella	Affiliated Professor
Professor Bernard Carroll	Affiliated Professor
Dr Marisa Collins	Affiliate Senior Research Fellow
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Dr Michael Furlong	Affiliated Associate Professor
Associate Professor Victor Galea	Affiliated Associate Professor
Professor Elizabeth Gillam	Affiliated Professor
Professor Ian Godwin	Affiliated Professor
Dr Christopher Lambrides	Affiliated Research Fellow
Professor Neal Menzies	Affiliated Professor
Dr Miranda Mortlock	Affiliate Research Fellow
Professor Peer Schenk	Affiliated Professor
Professor Susanne Schmidt	Affiliated Professor
Professor Brad Sherman	Affiliated Professor
Associate Professor Kathryn Steadman	Affiliated Associate Professor
Associate Professor Gordon Xu	Affiliate Principal Research Fellow
Professor Michael Yu	Affiliate Professorial Res Fellow

QAAFI Centre for Animal Science

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Dr Marina Fortes	Affiliated Research Fellow
Associate Professor John Gaughan	Affiliated Associate Professor
Dr Maggie Hardy	Affiliated Research Fellow
Professor Murray Mitchell	Affiliated Academic Level E
Professor dennis Poppi	Affiliated Professor
Dr Simon Quigley	Affiliated Senior Research Fellow

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Ms Maria Caldeira	HSF Officer
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Mr Cameron Doig	Finance Officer - QAAFI
Ms Ann Dunn	Finance Manager
Ms Liz Eden	Centre Administration Officer
Miss Hannah Hardy	Marketing and Communications Officer
Mrs Luba Hickey	Marketing and Communications Officer
Mrs Libby Humphries	HSF Manager
Mr Bob Landon	Research Partnerships Manager
Mrs Emma Linnell	Executive Administration Officer
Ms Janelle Low	Centre Administration Officer
Ms Sarah Meibusch	Deputy Director, Engagement and Business
Mrs Annie Morley	Executive Assistant to Director
Ms Kat Payne	Senior Postgrad Administrator
Mrs Jackie Perren	Human Resources Consultant
Mr Eric Pham	Senior Finance Officer
Ms Margaret Puls	Marketing & Communications Manager
Miss Melissa Rowan	Centre Administration Officer
Ms Bronwyn Venus	Research Grant Administrator
Mrs Jasmine Vowell	Human Resources Officer
Ms Fiona Zhao	Finance Assistant

QAAFI Research Higher Degree students in 2016

Principally enrolled in the Queensland Alliance for Agriculture and Food Innovation

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Aaron	Schulze	MPhil	Bio-actives: Value-adding to Industrial Hemp Production	Principal	A/Prof. Mary Fletcher
Abhijeet	Survase	PhD	Genomics for consumer traits in chapatti quality	Principal	Prof. Robert Henry
Adam	O'Donoghue	PhD	Assessing the bioactivity of tomato extracts from varieties with unique carotenoid profiles on human in vitro prostate cancer cell lines	Principal	Dr Tim O'Hare
Adnan	Riaz	PhD	Harnessing novel sources of adult plant resistance to leaf rust in wheat	Principal	Dr Lee Hickey
Alemu	Tirfessa Woldentensaye	PhD	Identification of sorghum plant types adapted to moisture stress areas in Ethiopia	Principal	Dr Erik Van Oosterom
Alexander	Bui	PhD	Design rules for nutritionally functional grains	Principal	Prof. Michael Gidley
Alexander	Nilon	PhD	Bioclay for control of tomato spotted wilt virus	Principal	Prof. Neena Mitter
Ali	Mohammad Moner	PhD	Exploring gene diversity in the genome of wild rice populations	Principal	Prof. Robert Henry
Amjad	Iqbal	PhD	Dietary manipulation of nutrient specific appetites and feed particle size in broilers for improved growth uniformity	Principal	A/Prof. Eugeni Roura
Amy Elizabeth	Watson	PhD	Understanding the genetics of grain quality and development of new breeding methodologies in wheat (Triticum aestivum L.)	Principal	Dr Lee Hickey
Anahita	Mizani	PhD	Towards high density production systems for mango: architectural analysis of vigour management techniques	Principal	A/Prof. Jim Hanan
Andrew	Ferguson	PhD	Immunogenetic differences underlying susceptibility of cattle to respiratory disease	Principal	A/Prof. Tim Mahony
Andrew Lincoln	Fletcher	PhD	Understanding transpiration efficiency in wheat to enhance future breeding	Principal	Dr Karine Chenu
Annelie	Marquardt	PhD	The molecular analysis of yellow canopy syndrome-induced yellowing in the sugarcane leaf	Principal	Dr Frederik Botha
Arslan	Peerzada	PhD	Ecology and management of weeds in sorghum	Principal	A/Prof. Bhagirath Chauhan
Asad	Khan	PhD	Biology of cow vine (Ipomoea lonchophylla) and bell vine (Ipomoea plebeia): two emerging weeds of summer crops	Principal	A/Prof. Bhagirath Chauhan
Benigni Alfred	Temba	PhD	Occurrence of mycotoxins in harvested maize in Kenya and Tanzania and postharvest control by photosensitization	Principal	A/Prof. Mary Fletcher
Benjamin David	Toft	PhD	Understanding macadamia architectural development and responses to manipulation to improve productivity and profitability	Principal	A/Prof. Jim Hanan
Bing	Cheng	PhD	Genetic and environmental factors influencing coffee quality	Principal	Prof. Robert Henry
Carla	Castro Tabilo	MPhil	Influence of training procedures on amino acid and sweetener preferences in pigs	Principal	A/Prof. Eugeni Roura
Caspar	Roxburgh	PhD	Drivers for high yield in rainfed cropping: A comparative analysis between Manica, Mozambique and Queensland Australia	Principal	A/Prof. Daniel Rodriguez
Cecile	Richard	PhD	Delivery of wheat root traits that contribute to water limited yield stability	Principal	Dr Jack Christopher
Cecile	Richard	PhD	Delivery of wheat root traits that contribute to water limited yield stability	Joint Principal	Dr Lee Hickey
Cecile Marie	Godde	PhD	Assessing the potential for pasture intensification in the tropics	Principal	A/Prof. Daniel Rodriguez
Colleen	Hunt	PhD	Statistical analysis of sorghum breeding trials with complex genetic components	Principal	Prof. David Jordan
David	Poppi	PhD	Elucidation of the roles and requirements of sulphur amino acids in the diet of barramundi	Principal	Prof. Stephen Moore
Dilani Tharanga Senevirathna	Jambuthenne Gamaralalage	PhD	Mining novel genes for adult plant resistance to stripe rust in wheat landraces	Principal	Dr Lee Hickey
Dipika	Roy	PhD	Understanding the genetics of spot blotch resistance in barley	Principal	Dr Lee Hickey
Dongjie	Liu	PhD	Effect of plant tissue drying on nutrient release	Principal	Prof. Michael Gidley
Elizabeth	Worrall	PhD	Crop protection through topical application of clay based nanoparticles to deliver RNAi	Principal	Prof. Neena Mitter
Emily Kathryn	Lancaster	PhD	Epidemiology, impact and management of myrtle rust in Lemon Myrtle plantations	Principal	Prof. Andre Drenth

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Eric	Dinglasan	PhD	Understanding the genetic control of quantitative resistance to yellow spot (Pyrenophora tritici-repentis) in wheat (Triticum aestivum L.)	Principal	Dr Lee Hickey
Fahad	Al-Asmari	PhD	Assessment of natural antimicrobials and photosensitization on the microbial contaimination of dates (Phoenix doctylifera L.)	Principal	A/Prof. Yasmina Sultanbawa
Fahad	Alderees	PhD	Elucidating mechanisms of antimicrobial activity of Australian native plant extracts	Principal	A/Prof. Yasmina Sultanbawa
Geetika	Geetika	MPhil	Role of photosynthesis and leaf conductance in determining the genotypic variation in transpiration efficiency (TE) in sorghum	Principal	Dr Erik Van Oosterom
Ghanendra	Gartaula	PhD	Relationship between cereal dietary fibre solubility and phenolic compounds: Methods of increasing the amount of soluble dietary fiber in cereal flours to improve bioactive function	Principal	Prof. Michael Gidley
Guangli	Feng	PhD	Bacteria mediated metabolism of polysaccharides and associated micronutrients in plant cell walls under in vitro and in vivo large intestine conditions	Principal	Prof. Michael Gidley
Haiteng	Li	PhD	Gut microbial response to diverse forms of resistant starch	Principal	Prof. Michael Gidley
Hannah	Robinson	PhD	Investigating root traits to improve drought adaptation in barley	Principal	Dr Lee Hickey
Hayba	Badro	PhD	Applications of genotyping by sequencing in rice	Principal	Prof. Robert Henry
Hongyan	Li	PhD	Rice proteins: value adding through new science	Principal	Prof. Robert Gilbert
James Lawrence	McLean	MPhil	Proximal and remote sensing as tools to assist data collection in extensive maize and sorghum agronomic trials	Principal	A/Prof. Daniel Rodriguez
Jarud	Muller	MPhil	Hydration as a factor in survival of neonatal calves in tropical Australia	Principal	Dr Geoffry Fordyce
Jayeni Chathurika Amarathunga	Hiti Bandaralage	PhD	Tissue culture as an efficient, cost effective and disease free alternative for clonal avocado rootstock production	Principal	Prof. Neena Mitter
Ji	Wang	MPhil	Bitter taste sensitivity and feed intake in pigs	Principal	A/Prof. Eugeni Roura
Jia-Yee Samantha	Yap	PhD	The evolution of Australia's modern rainforest assemblages: Competitive advantage vs rapid invasions	Principal	Dr Maurizio Rossetto
Jing	Ai	PhD	Techniques for delivery of high-moisture lower energy density shelf-stable rice snacks	Principal	Prof. Michael Gidley
John	Gorham	PhD	Changes to gut bacteria composition and diversity by the addition of soluble dietary fibres to porcine diets: human health implications	Principal	Dr Deirdre Mikkelsen
John	Smith	PhD	The impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton in southern QLD	Principal	Prof. Mike Bell
Katie	O'Connor	PhD	Application of genomics in genetic improvement of macadamia	Principal	A/Prof. Bruce Topp
Laura	Ziems	PhD	Dissecting the genetic interactions associated with Rph20 resistance to leaf rust (Puccinia hordei) in barley	Principal	Dr Lee Hickey
Lijun	Sun	PhD	Studying the effect of phytochemicals on starch digestion in vitro and in vivo	Principal	Prof. Michael Gidley
Louisamarie	Parkinson	PhD	Investigating avocado tree mortality during early field establishment	Principal	Dr Elizabeth Dann
Lucas	Grant	PhD	Fruit components and their effects on the gastrointestinal bacterial community	Principal	Dr Barbara Williams
Madeleine	Gleeson	PhD	Regulation of adventitious rooting in avocado for improved clonal propagation technologies	Principal	Prof. Neena Mitter
Maximiliano	Muller Bravo	PhD	Nutritional interventions in piglets to improve post-weaning health outcomes	Principal	A/Prof. Eugeni Roura
Mekonnen Melaku	Gebremariam	PhD	Enabling rational food design by connecting dynamic sensory perception, oral physiology and food oral processing	Principal	Dr Heather Smyth
Melissa	Wooderson	MPhil	Analgesia and haemostasis to achieve high standards of calf welfare and healing during castration, dehorning, branding and ear marking	Principal	Dr Geoffry Fordyce
Mesfin Dejene	Ejigu	PhD	Utilization of crop residues as ruminant feeds and/or for conservation forming in crop - livestock farming systems	Principal	Dr Rob Dixon
Ming	Wang	PhD	Pattern-oriented modelling of biological systems in Australian orchards	Principal	A/Prof. Jim Hanan
Minghai	Fu	PhD	Manipulation of the preference of piglets for herbal compounds through maternal flavour conditioning to decrease the use of feed anibiotics	Principal	A/Prof. Eugeni Roura
Mingxia	Han	PhD	Carotenoid bioavailability related to molecular organisation	Principal	Prof. Michael Gidley
Mridusmita	Chaliha	PhD	A metabolomic approach to assess the efficacy of Australian native plant extracts in intervening spoilage in a model feed system	Principal	A/Prof. Yasmina Sultanbawa
Mukund	Madhav	PhD	Transinfection of buffalo flies with Wolbachia and characterisation of its biological effects	Principal	Dr Peter James
Nam Van	Hoang	PhD	Analysis of genes controlling biomass traits in the genome of sugarcane (Saccharum spp. hybrids)	Principal	Prof. Robert Henry

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Naveenkumar	Athiyannan	PhD	Molecular genetic characterisation of a broad stem rust resistance gene derived from the D genome progenitor Aegilops tauschii of bread wheat	Principal	Dr Sam Periyannan
Nga	Tran	PhD	Identity, population biology and development of molecular diagnostic tools for early detection and control of the citrus scab fungus Elsinoe spp	Principal	Prof. Andre Drenth
Nia	Patriyawaty	MPhil	Genotypic variation for tolerance to high temperature stress during reproductive phase in mungbean (Vigna radiata (L.) Wilczek)	Principal	A/Prof. RCN Rachaputi
Oliver	Meldrum	PhD	Defining the disassembly of plant cell walls and component polysaccharides within the digestive tract, their influence on the resident microflora and the host immune system	Principal	Prof. Michael Gidley
Olumide	Jeff-Ego	MPhil	Host-pathogen interaction of Phytophthora cinnamomi and macadamia	Principal	Dr Femi Akinsanmi
Patricia Tracy	Eats	PhD	Understanding the molecular basis of differing the virulence potential of bovine herpesviruses	Principal	A/Prof. Tim Mahony
Patrick John	Mason	PhD	Diversifying cane sugar production systems: identifying carbon petitioning in a number sugar cane varieties in order to optimize production for a number of processes	Principal	Prof. Robert Henry
Paula Georgina	Calvo Brenes	PhD	Factors affecting colour in zeaxanthin-biofortified sweet corn	Principal	Dr Tim O'Hare
Peterson Weru	Wambugu	PhD	Genomic characterization of African cultivated and wild Oryza species	Principal	Prof. Robert Henry
Prameela	Vanambathina	PhD	Development and application of molecular tools to identify pest and drought resistance traits in the Australian wild pigeonpea	Principal	A/Prof. RCN Rachaputi
Pridhuvi	Thavaraj	PhD	Investigating the effect of casein micelle size on the physico-chemical and funcitonal properties of milk gels.	Principal	A/Prof. Eugeni Roura
Prudence	Powell	PhD	A plant model for diabetes	Principal	Prof. Robert Gilbert
Raghvendra	Sharma	PhD	Molecular genetic characterisation of rust disease resistance genes from Valilov's wheat collection	Principal	Dr Sam Periyannan
Ravi Chandrabhan	Nirmal	PhD	Analysis of gene expression in the developing seed with the quality of wheat	Principal	Prof. Robert Henry
Rewati	Bhattarai	PhD	Effect of food structure on enzymatic digestion of starches	Principal	Prof. Michael Gidley
Rousset Leslie	Palou Egoaguirre	PhD	Use of plant derived compounds to condition piglet intake at weaning and reduce post-weaning use of therapeutics	Principal	A/Prof. Eugeni Roura
Ryan	Fowler	PhD	Pathogenicity of Net Form of Net Blotch (Pyrenophora teres f. teres)	Principal	Dr Lee Hickey
Saira	Sultan	PhD	Breakdown of indospicine residues in meat products through processing and effects on its in vitro bioaccessibility and absorption	Principal	A/Prof. Mary Fletcher
Saleha	Akter	PhD	Elucidating mechanisms of antimicrobial activity of Australian native plant extracts	Principal	A/Prof. Yasmina Sultanbawa
Samir	Alahmad	PhD	Rapid trait pyramiding in durum wheat (triticum turgidum)	Principal	Dr Lee Hickey
Samira	Samarfard	PhD	Potential exotic virus threats to Lucerne seed production in Australia	Principal	A/Prof. Ralf Dietzgen
Sarah Karen	Osama	PhD	Identifying genes for resistance to pre-harvest sprouting and black point in barley (Hordeum vulgare)	Principal	Dr Glen Fox
Shahram	Niknafs	PhD	Nutrient-specific appetite in poultry	Principal	A/Prof. Eugeni Roura
Shirani	Widana Gamage	PhD	Thrips-tospovirus-plant molecular Interactions: Studies on capsicum chlorosis virus	Principal	A/Prof. Ralf Dietzgen
Shiyao	Yu	PhD	Genetically modified corn using site directed mutagenesis	Principal	Prof. Robert Gilbert
Shiyi	Lu	PhD	Bacterial fermentation of cellulose based composites as plant dietary fibre	Principal	Prof. Michael Gidley
Shulang	Fei	PhD	Identification of candidate genes for blackleg resistance in canola (Brassica napus)	Principal	Prof. Neena Mitter
Si-Qian	Chen	PhD	Comparison of the structure and mechanical properties of bacterial cellulose produced by different Gluconacetobacter xylinus strains	Principal	Prof. Michael Gidley
Solomon	Hassen	PhD	Rules and incentives: managing risks and opportunities in maize-legume dominant farming systems of central and southern Ethiopia	Principal	A/Prof. Daniel Rodriguez
Solomon Admassu	Seyoum	PhD	Optimising Genotype x Environment x Management Interactions to enhance maize productivity in variable agro-climates of Eastern and Southern Africa	Principal	A/Prof. RCN Rachaputi
Sungbo	Cho	PhD	Nutrient specific appetite in feather pecking hens	Principal	A/Prof. Eugeni Roura
Thi Le Thoa	Nguyen	PhD	Structure and functionality of oat carbohydrates	Principal	Dr Glen Fox
Thi Minh Hue	Tran	PhD	Genetics of biochemical compounds determining arabica coffee (C. arabia L.) quality	Principal	Prof. Robert Henry
Thomas	Karbanowicz	PhD	Biotechnological approach to isolate and identify Ixodes holocyclus (Australian paralysis tick) proteins implicated in tick - host interactions for the development of anti tick treatments	Principal	Prof. Ala Tabor
Thu Ha	Ngo	PhD	New serological diagnostic assays for banana streak virus and characterization of the virus-encoded aspartic pretease	Principal	Dr Andrew Geering

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Tiparat	Tikapunya	PhD	Grain quality of Australian wild rice compared to domesticated rice	Principal	Prof. Robert Henry
Tom Danga	Kukhang	PhD	Genetic analyses of an 8 x 8 set of full diallele crosses and mass propoagation via somatic embryogenesis of elite (Coffea Arabica L.) hybrids from the CIC Coffee Breeding Program	Principal	Prof. Robert Henry
Tristan	Wimpenny	PhD	Identification of the role of microRNAs in Bovine Herpesvirus 1 replication and virulence	Principal	A/Prof. Tim Mahony
Vishal	Ratanpaul	PhD	Cereal food innovation through understanding mechanisms underlying nutritional value	Principal	Prof. Michael Gidley
Wanporn	Khemmuk	PhD	Plant pathogenic Magnaporthales in Australia, with particular reference to Pyricularia oryzae on wild and cultivated rice	Principal	Dr Andrew Geering
Wei	Zou	PhD	Mechanism of reduction in starch digestion rate of durum wheat by protein	Principal	Prof. Robert Gilbert
Wen Wen	Yu	PhD	Towards new means of prevention and health maintenance for diabetes: New characterization techniques for starch and glycogen	Principal	Prof. Robert Gilbert
Widaningrum	Widaningrum	PhD	Microbial fermentation of insoluble plant dietary fibres	Principal	Prof. Michael Gidley
William	Nak	PhD	Tropical application of RNA interference to modulate plant gene expression	Principal	Prof. Neena Mitter
William Patrick	Davidson	MPhil	Alternative uses of group H and L herbicides on glyphosate-resistant weed species	Principal	A/Prof. Bhagirath Chauhan
Xuemin	Wang	PhD	Enhancing genomic selection through the use of crop modelling	Principal	Prof. David Jordan
Yeming	Bai	PhD	Mechanistic exploration of effects of ginseng (a traditional Chinese food additive and medicine) on the digestion rate of starch containing foods	Principal	Prof. Robert Gilbert
Zhi Xian	Lim	PhD	Topical application of bioclay to protect crop plants from insect pests	Principal	Prof. Neena Mitter

Principally enrolled in Australian Institute of Bioengineering & Nanotechnology

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Jianye	Fu	PhD	Synthesis, characterization and catalytic performance of micro meoporous materials in the hydrodesulfurization reaction of FCC diesel	Associate	Dr Peter James
Liang	Zhao	PhD	Bioengineering of protein-modified nanoparticles on immune reactions.	Associate	Prof. Neena Mitter
Manasi	Jambhrunkar	PhD	Protein delivery using designer peptide hydrogels	Associate	Prof. Neena Mitter
Weiyu	Chen	PhD	Development of a novel vaccine nano-adjuvant system to enhance immunity against Tumours.	Associate	A/Prof. Timothy Mahony

Principally enrolled in School of Agriculture and Food Sciences

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Ali Ahsan	Bajwa	PhD	Invasion biology, interference and management of parthenium weed (Parthenium hysterophorus L.) in agro-ecosystem	Associate	A/Prof. Bhagirath Chauhan
Anh	San	PhD	Lenticel discolouration, under-skin browning and resin canal disorder in Australian mango fruit cultivars	Associate	Dr Heather Smyth
Benjamin	Schofield	PhD	Microbial community structure and functionality in ruminants fed the probiotic Bacillus amyloliquefaciens H57	Principal	A/Prof. Athol Klieve
Donald	McMurrich	MPhil	Canopy manipulation of sorghum to create a more efficient, stress tolerant plant with increased yield	Associate	Dr Glen Fox
Elizabeth	Czislowski	PhD	Characterisation of putative pathogenicity SIX genes in Fusarium oxysporum f.sp. cubense.	Associate	Prof. Neena Mitter
Elvis Teng	Chua	PhD	Investigating the effect of culture conditions on microalgae and its metabolites: A metabolomics study	Associate	Dr Gabriele Netzel
Elvis Teng	Chua	PhD	Investigating the effect of culture conditions on microalgae and its metabolites: A metabolomics study	Associate	Dr Michael Netzel
Faisal Saeed M	Alsenani	PhD	Screening and isolation of natural health products and new antibiotics from microalgae	Associate	Dr Michael Netzel
Lara-Simone	Pretorius	PhD	Identifying the phytotoxic metabolites of Fusarium oxysporum to develop new approaches for disease resistance in plants.	Associate	Dr Andrew Geering
Lourdes	Urban Alandete	PhD	Developing methods to maximize the shelf life of manufactured food products containing whole grains	Associate	Prof. Michael Gidley
Lu	Yu	PhD	Extending the shelf life of rice foods using high pressure processing	Associate	Prof. Robert Gilbert
Maria	Botero-Uribe	PhD	Developing a potato value chain from the raw material to the processed chip	Associate	Prof. Robert Gilbert
Monia	Anzooman	PhD	Understanding physiological basis for wheat genotypes adaption on sodic, magnesic or dispersive soils	Associate	Dr Jack Christopher
Nadeem	Iqbal	PhD	Ecology and management of weeds in glyphosate resistant cotton (Gossypium hirsutum L.)	Associate	A/Prof. Bhagirath Chauhan

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Nghia Khang	Tran	PhD	Bioactive compounds from rice bran	Associate	Prof. Michael Gidley
Sara	Ghorbani Gorji	PhD	Identifying natural products for improving the quality and shelf life of mayonnaises and salad dressings	Associate	Dr Heather Smyth
Tiago	Alves Correa Carvalho da Silva	PhD	Feeding strategies for the early-weaned calf	Associate	A/Prof. Stu McLennan
Yadav	Sharma Bajagai	PhD	Effects of probiotics on productivity and health of poultry	Principal	A/Prof. Athol Klieve
Yaqoub	Al-Hosni	PhD	Impact of heat load on microbial community and rumen function	Associate	A/Prof. Rafat Al Jassim
Zhong Xiang	Cheah	PhD	Role of trace element nutrition in food quality and disease resistance in sweet corn	Associate	Dr Tim O'Hare
Zhong Xiang	Cheah	PhD	Role of trace element nutrition in food quality and disease resistance in sweet corn	Principal	Prof. Mike Bell

Principally enrolled in School of Biological Sciences

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Indeewari	Dissanayake	PhD	Regulatory mechanisms underlying wheat root developmental plasticity in response to nitrate and phosphate deficiency	Associate	Dr Lee Hickey
Tahsha	Say	PhD	Elucidating the molecular mechanisms underlying sponge-microbial signalling during settlement of Amphimedon queenslandica larvae	Associate	A/Prof. Eugeni Roura
Tinashe	Chabikwa	PhD	An investigation into the role of sugars and hormones in plant architectural development from a molecular perspective	Associate	A/Prof. Jim Hanan

Principally enrolled in School of Chemical Engineering

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Piyali	Chakraborty	PhD	Tribology and sensory science of meal replacement beverages	Associate	Dr Heather Smyth

Principally enrolled in School of Chemistry and Molecular Biosciences

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Chin Hong	Lee	PhD	Nonsense-mediated decay (NMD) is involved in epigenetic regulation of gene expression in Arabidopsis thaliana	Associate	Prof. Neena Mitter
Liang	Fang	PhD	Campylobacter typing/identification	Associate	A/Prof. Pat Blackall
To Loan	Nguyen	PhD	Whole genome differential gene expression and marker discovery associated with pubertal development in beef cattle	Associate	Prof. Stephen Moore

Principally enrolled in School of Medicine

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Vincent	Lal	PhD	Health risk assessment of mixed contaminants: Interaction of metals on the uptake of polyaromatic hydrocarbons (PAHs) in human liver cells	Associate	A/Prof. Mary Fletcher

Principally enrolled in School of Veterinary Science

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
David	Wakeham	PhD	Multidrug resistant pathogenic Escherichia coli isolated from livestock - significance to animal and public health	Associate	Prof. David Jordan
Kylie	Francis	MPhil	Investigation of the relationship between environmental adaptation and reproductive function in tropically adapted bulls in Northern Australia	Associate	Dr Brian Burns
Leena	Awawdeh	PhD	Studies on avian pathogenic escherichia coli in commercial broiler chickens in Southeast Queensland	Associate	Dr Corni Turni
Lesley	Duffy	PhD	Campylobacter in poultry processing, selection and survival	Associate	A/Prof. Pat Blackall
Ngoc Bang	Nguyen	PhD	Effects of polymorphism of the genes related to thermotolerance and dietary addition of pro-/prebiotics on heat stress and productivity of hihg productive temperate cattle	Associate	Prof. Ben Hayes

Principally enrolled in the School of Human Movement and Nutrition Sciences

First Name	Last Name	Program	Project Title	Advisor Role	Advisor Full Name
Yasmine	Aridi	PhD	Reducing the progression of cognitive decline in older adults by optimizing nutritional status	Associate	A/Prof. Eugeni Roura

Publications

Journal articles

Afonso, C., Amarasinghe, G., Banyai, K., Bao, Y., Basler, C., Bavari, S. et al. (2016) Taxonomy of the order Mononegavirales: update 2016. Archives of Virology, 161(8): 2351-2360.

Akinsanmi, O., Neal, J., Drenth, A. & Topp, B. (2017) Characterization of accessions and species of Macadamia to stem infection by Phytophthora cinnamomi. Plant Pathology, 66(2): 186-193.

Al-Asmari, F., Nirmal, N., Chaliha, M., Williams, D., Mereddy, R., Shelat, K. et al. (2017) Physico-chemical characteristics and fungal profile of four Saudi fresh date (Phoenix dactylifera L.) cultivars. Food Chemistry, 221: 644-649.

Bajwa, A., Sadia, S., Ali, H., Jabran, K., Peerzada, A. & Chauhan, B.* (2016) Biology and management of two important Conyza weeds: a global review. Environmental Science and Pollution Research, 23(24): 1-17.

Barton, D. & Morgan, J. (2016) A morphological and genetic description of pentastomid infective nymphs belonging to the family Sebekidae Sambon, 1922 in fish in Australian waters. Folia Parasitologica, 63.

Bejerman, N., Giolitti, F., Trucco, V., de Breuil, S., Dietzgen, R. & Lenardon, S. (2016) Complete genome sequence of a new enamovirus from Argentina infecting alfalfa plants showing dwarfism symptoms. Archives of Virology, 161(7): 2029-2032.

Bejerman, N., Mann, K. & Dietzgen, R. (2016) Alfalfa dwarf cytorhabdovirus P protein is a local and systemic RNA silencing supressor which inhibits programmed RISC activity and prevents transitive amplification of RNA silencing. Virus Research, 224: 19-28.

Brenya, E., Trusov, Y., Dietzgen, R. & Botella, J. (2016) Heterotrimeric G-proteins facilitate resistance to plant pathogenic viruses in Arabidopsis thaliana (L.) Heynh. Plant Signaling and Behavior, 11(8).

Bunyatang, O., Chirapongsatonkul, N., Bangrak, P., Henry, R. & Churngchow, N. (2016) Molecular cloning and characterization of a novel bi-functional α-amylase/subtilisin inhibitor from Hevea brasiliensis. Plant Physiology and Biochemistry, 101: 76-87.

Camelo-Garcia, V., da Silva Andrade, S., Geering, A., Kitajima, E. & Rezende, J. (2016) Genome organization and host range of a Brazilian isolate of johnsongrass mosaic virus. Archives of Virology, 161(5): 1335-1341.

Casadebaig, P., Zheng, B., Chapman, S., Huth, N., Faivre, R. & Chenu, K. (2016) Assessment of the potential impacts of wheat plant traits across environments by combining crop modeling and global sensitivity analysis. Plos One, 11(1).

Chamara, B., Marambe, B. & Chauhan, B. (2016) Management of Cleome rutidosperma DC. using high crop density in dry-seeded rice. Crop Protection, 95: 120-128.

Chand, K., Lee, K., Lavidis, N., Rodriguez-Valle, M*, Ijaz, H., Koehbach, J. et al. (2016) Tick holocyclotoxins trigger host paralysis by presynaptic inhibition. Scientific Reports, 6.

Chen, C., Lawes, R., Fletcher, A., Oliver, Y., Robertson, M., Bell, M. et al. (2016) How well can APSIM simulate nitrogen uptake and nitrogen fixation of legume crops?. Field Crops Research, 187: 35-48.

Cheng, B., Furtado, A., Smyth, H. & Henry, R. (2016) Influence of genotype and environment on coffee quality. Trends in Food Science and Technology, 57(A): 20-30.

Chen, W., Zhang, B., Mahony, T., Gu, W., Rolfe, B. & Xu, Z. (2016) Efficient and durable vaccine against Intimin β of Diarrheagenic E. Coli induced by clay nanoparticles. Small, 12(12): 1627-1639.

Constantin, L., Constantin, M. & Wainwright, B. (2016) MicroRNA biogenesis and hedgehog-patched signaling cooperate to regulate an important developmental transition in granule cell development. Genetics, 202(3): 1105-18.

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Deng, B., Sullivan, M., Chen, C., Li, J., Powell, P., Hu, Z. et al. (2016) Molecular structure of human-liver glycogen. Plos One, 11(3).

Devi, A., Gunjilac, A., Wilkinson, J., Vanniasinkam, T. & Mahony, T. (2016) Prevalence of Campylobacter spp. in diarrhoea samples from patients in New South Wales, Australia. International Microbiology, 19(1): 33-37.

Dietzgen, R., Mann, K. & Johnson, K. (2016) Plant virus-insect vector interactions: current and potential future research directions. Viruses, 8(11).

Dinglasan, E., Godwin, I., Mortlock, M. & Hickey, L. (2016) Resistance to yellow spot in wheat grown under accelerated growth conditions. Euphytica, 209(3): 693-707.

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