QAAFI
ANNUAL REPORT 2017

The University Of Queensland
AUSTRALIA

QAAFI
Queensland Alliance for Agriculture and Food Innovation

High impact science for sustainable agriculture and food

We are a research institute of The University of Queensland, one of the world's leading research providers in tropical and sub-tropical agriculture and food production. We work across crops, horticulture, animals, and nutrition and food sciences, and are supported by industry and the Queensland Government.

Cover image
Wheat grown under lights for 22 hours a day in a UQ laboratory.

Speed breeding is an accelerated breeding tool that is now being coupled with AI and genomic selection, to cut the length of time it takes to introduce new wheat varieties from 12 years to two or three. Speed breeding has been described as sowing the seeds for the next Green Revolution, and a game-changer reminiscent of Norman Borlaug's shuttle breeding technique.

Photo: Hannah Hardy, UQ.

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ABOUT QAAFI

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.

Research quality + **Industry impact** = **QAAFI mission**

Vice-Chancellor's message

With the global population rapidly approaching eight billion and particular pressure being experienced in the tropics and subtropics, the work of the Queensland Alliance for Agriculture and Food Innovation (QAAFI) is of the utmost priority.

QAAFI is a stand-out generator of innovation and impact in tropical and sub-tropical agriculture and food sciences. Its people strive not only to improve the competitiveness and sustainability of Queensland's tropical and sub-tropical agriculture and food sectors, but also to help meet the growing global demand for sustainable, nutritious and safe food.

Harnessing the collective strengths of the Department of Agriculture and Fisheries and The University of Queensland (UQ), QAAFI forges direct links to the agriculture and food industries and with local and global not-for-profits.

Since 2009 it has contracted $280 million to invest in research, and in 2017 attracted $40 million.

During 2017, QAAFI and UQ established a new Centre for Horticultural Science to meet the growth in demand for vegetables, fruit and nuts. The new centre will build on Queensland's strengths in the banana, avocado, citrus and macadamia food industries, and help create new industries.

Another significant achievement of the year was the international conference in tropical agriculture, TropAg2017, which attracted to Brisbane 720 delegates from 44 countries.

QAAFI's proven capacity to deliver globally-significant solutions by generating new knowledge and partnered innovation is among the many factors that make it a significant contributor to UQ's strategic objectives.

The quality of its endeavour is reflected in the University's high global rankings, which include first in Australia and fifth in the world in the field of agriculture.[1]

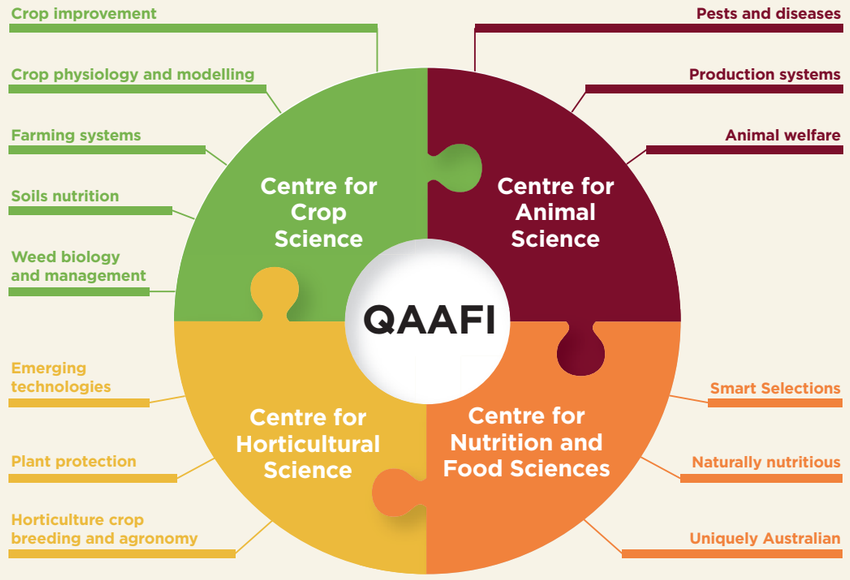
I congratulate and thank Professor Robert Henry and the diverse QAAFI team for their many successes in 2017. I also thank our colleagues in the Queensland Government, and our industry and philanthropic collaborators, for their on-going support for QAAFI's brilliant initiatives.

Professor Peter Høj
Vice-Chancellor and President

1 *Performance Ranking of Scientific Papers for World Universities 2017, rank by field*

Research themes

Agriculture and food sciences at UQ are helping to meet the growing global demand for sustainable, nutritious, safe food. QAAFI plays an important role building industry partnerships in Queensland and globally, and in developing research solutions and new technologies to improve decision making, increase productivity and better predict climatic change. We have world-leading research capabilities across crop, horticulture, animal and food sciences.



2017 in review

$40 million income in 2017

384 industry presentations

$280 million income contracted to date

14 research themes

478 people

187 active research contracts

40+ participating countries

1 research centre in China

238 students supervised to date

13 Facilities across Queensland

UQ is #1 in agriculture in Australia*

UQ is #5 in agriculture globally*

**Performance Ranking of Scientific Papers for World Universities 2017, rank by field - NTU*

Message from the Minister

Queensland's agricultural industries continue to go from strength to strength and there can now be no doubt that it is a key driver of our economy.

For 2017–18, the total value of Queensland's primary industry commodities (combined gross value of production and first-stage processing) is forecast to be $19.87 billion, 11 per cent greater than the average for the past five years.

Queensland is Australia's largest producer and exporter of beef, with more than three-quarters of the state's $5.2 billion beef exports going to Asian markets, and one of the largest producers of pork.

The state is one of the largest producers of fruit and vegetables, and over 95 per cent of Australia's bananas are grown in Queensland. Queensland is also the biggest producer of tropical fruits like mangoes, pineapples and avocados in Australia.

Agriculture is vital to Queensland, and my department, the Department of Agriculture and Fisheries (DAF), seeks to create the conditions for successful agribusiness and supply chains that facilitate innovation and productivity.

An important strategy in achieving this objective is our investment in the research and development capability in Queensland, which is amongst the best in the world.

Our ongoing collaboration with the University of Queensland (UQ) and industry in QAAFI, a dedicated agricultural and food research institute, has generated $280 million in total research income.

Formed in 2010 by the Queensland Government and UQ – a global leader in tropical agriculture and food research – QAAFI brings together expertise and equipment from UQ, partnered with the facilities and knowledge of DAF's 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 a direct positive impact to Queensland's agricultural industries.

One example of this is our co-investment, along with the Grains Research and Development Corporation, the Department of Primary Industry in New South Wales and QAAFI, is in the sorghum pre-breeding program run out of Hermitage Research Facility near Warwick.

Over a 20-year period this investment has delivered a gross gain of $696.5 million to Australian sorghum growers, which equates to a cost-benefit of $8.90 for every $1 invested by the research funders.

The Queensland Government, along with QAAFI, Meat & Livestock Australia via the MLA Donor Company, will invest $6.2 million by June 2021 to improve the genetic rate of gain of beef cattle in the northern beef industry.

Another focus for investment by the Queensland Government is the banana industry, by way of disease detection, diagnostics and capacity to respond to disease outbreaks.

The total investment of approximately $9.2 million (present value terms) in banana biosecurity has been estimated to produce total net benefits of approximately $70.8 million (present value terms) providing a benefit-cost ratio of approximately $7.7 to $1 of research investment funding.

Impacts such as these highlight the fruitful alliance between the Queensland Government and QAAFI.

I congratulate Professor Robert Henry and the team at QAAFI for their innovative research to boost industry, and ensure the sustainable management of natural resources in Queensland.

Hon Mark Furner
The Honourable Mark Furner MP
Queensland Minister for Agriculture
Industry Development and Fisheries

2017 Overview

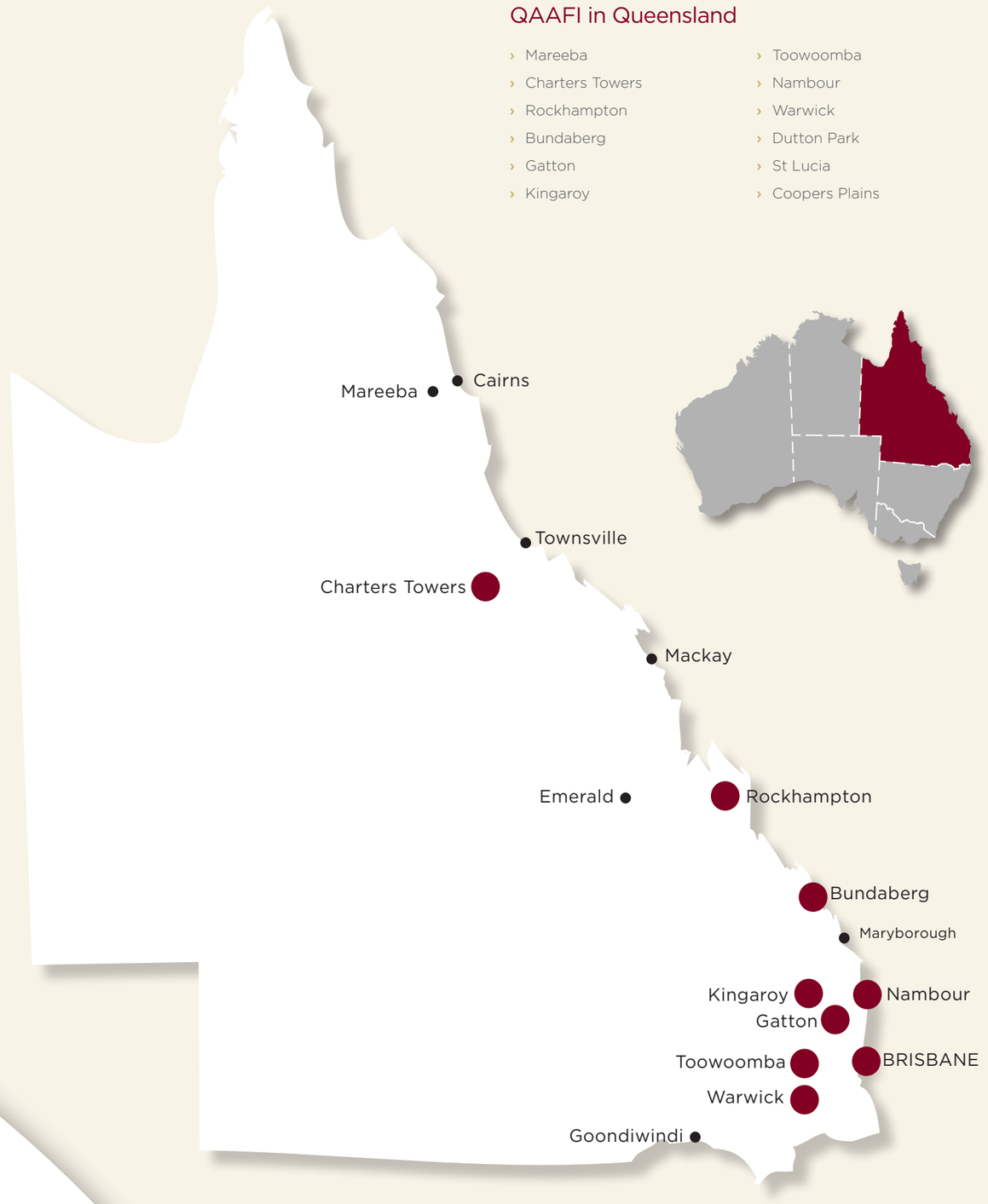
Some 73 research projects worth over $29 million to Queensland's agriculture and food industries form part of QAAFI's 2016-17 for the Department of Agriculture and Fisheries (DAF).

We worked with DAF to deliver:

- **10** new innovative tools, systems and information packages
- **74** briefings
- **10** industry and government reports
- **68** engagements with extension specialists
- **123** presentations
- **48** workshops
- **35** seminars
- **56** media activities

QAAFI in Queensland

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



Professor Robert Henry is co-author of a landmark global study published in Nature Genetics that maps divergences in the rice genome. The comprehensive study of the rice family tree confirms that wild Australian rice is the most directly related species to the ancient ancestor of all rices. Professor Henry says northern Australia's wild rices contain a wealth of untapped genetic diversity and at least two species are very closely related to domesticated rice, which means valuable traits such as drought tolerance and pest and disease resistance can be bred into commercial rice strains.

Director's Column

In 2017, QAAFI continued its growth and established two new UQ research centres – the Centre for Horticultural Science, and the Centre for Crop Science.

Formed from the former Centre for Plant Science, the new centres will build UQ and Queensland's R&D capacity in these industries.

The new Centre for Horticultural Science was fortunate to secure agricultural biotechnology innovator Professor Neena Mitter as the inaugural Director, while Professor Graeme Hammer continues at the helm of the Centre for Crop Science.

We also welcomed other key appointments in 2017, including a theme leader for Animal Welfare research, Professor Alan Tilbrook, one of the country's most eminent animal welfare researchers and Director of the National Animal Welfare Biomarkers Consortium.

Mr Stephen Williams joined us in 2017 as Deputy Director for Strategy and Engagement and has already made a significant contribution to QAAFI's operations.

In 2017, once again a QAAFI student won UQ's prestigious and highly competitive all-Institutes 3-Minute Thesis final and I extend my congratulations to Anahita Mizani – and to all the QAAFI RHD students who participated in an event that has become one of our Institute's annual highlights.

One of QAAFI and UQ's most significant achievements in 2017 was the highly successful UQ-led global conference on tropical and sub-tropical agriculture and food – TropAg2017. A key feature of this year's TropAg conference was support for the event from an alliance of northern Australia research providers – QUT, James Cook University, CQU and USQ.

Another important TropAg2017 initiative was collaboration with the Queensland Government to host their AgFutures agricultural technology conference as a theme within TropAg, enabling both organisations to leverage opportunities to engage high profile speakers and showcase Queensland's agricultural industries on the global stage.

The quality of QAAFI's research is reflected not only in UQ's global standing of agricultural science but also in QAAFI's record income in 2017 of $40 million, demonstrating the world-leading capabilities of QAAFI's scientists, and their capacity to work collaboratively with industry to meet challenges of importance to the agricultural and food sectors.

It only remains for me to thank all QAAFI staff and students for their outstanding efforts in 2017.

A fruitful appointment

The new Director of UQ's Centre for Horticultural Science, Professor Neena Mitter, aims to double the existing $37 million worth of contracted research work currently undertaken by QAAFI's horticultural scientists over the next five years.

Professor Mitter has an impressive record in her field, having pioneered world-first techniques in developing a stem cell multiplication method to supply up to 500 times more avocado plants to industry than was previously possible, with minimal additional resources.

She secured a highly competitive three-year, $1.2 million Advance Queensland Innovation Partnerships grant in 2017 to trial the new propagation technique in locations throughout Australia.

She also pioneered the non-genetically modified non-toxic BioClay crop pest and disease protection product, that reduces the need for pesticides.

A Deputy Council Member of UQ's Cultural Diversity and Innovation Forum, Professor Mitter was recognised by the Queensland Women in Technology (WiT) with a prestigious Life Sciences Outstanding Award in 2017, for her research in technological platforms impacting agricultural production, environmental sustainability and the socio-economic dynamics of farming communities.

Leading animal welfare

Professor Alan Tilbrook leads animal welfare research in Australia.

At QAAFI, Professor Tilbrook's research theme focuses on research to address priority areas in animal welfare in livestock industries – from nutrition, disease and genetics, to stress management in animal handling, environment and transport to continuous welfare improvement (pain management and mitigation).

Spanning beef, sheep and poultry industries, a key focus on Professor Tilbrook's work is the objective measurement of animal welfare. He is also the Director of the National Animal Welfare Biomarkers Consortium.

Since 2013, Professor Tilbrook has operated as Research Provider Champion and Chair of the Steering Committee for the National Animal Welfare Research, Development and Extension Strategy. He also chairs the annual National Animal Welfare Research, Development and Extension Forum.

Key appointment in strategy and engagement

Mr Stephen (Steve) Williams has been appointed QAAFI's new Deputy Director for Strategy and Engagement.

Mr Williams is a Graduate of the Australian Institute of Company Directors and for the past 25 years has worked in senior management roles with a focus on business development and management in companies both in Australia and the United States.

He has a background in telecommunication, software architecture and design, completing a Bachelor of Applied Science (computing) with Distinction, at the Queensland University of Technology.

RESEARCH HIGHLIGHTS

The science of more mangoes

QAAFI continues to have a strong showing in UQ's 3 Minute Thesis competition. Congratulations to Ms Anahita Mizani (Principal advisor Associate Professor Jim Hanan) for her success at the all-Institute's 3 Minute Thesis final and competitive performance in the UQ Final. In Ms Mizani's presentation, she shared her research on developing smaller mango trees for higher yields and profit.

ABC's Country Hour broadcast live at QAAFI

QAAFI hosted a delicious visit from ABC Radio's Queensland Country Hour, who broadcast their program live from our headquarters on 31 October 2017.

Host Charlie McKillop spoke to QAAFI's Director Professor Robert Henry; Professor Mike Gidley; Director of Centre for Nutrition and Food Sciences; Professor Stephen Moore, Director of Centre for Animal Science; Dr Heather Smyth, Centre for Nutrition and Food Sciences; Professor Ben Hayes, Centre for Animal Science; and Dr Glen Fox from the Centre for Nutrition and Food Sciences.

Topics discussed included:

- Niche markets for Australian produce and global food production
- Developing a premium Australian food brand
- Breeding for high quality beef
- What are the sensory properties that make Australian premium foods unique
- Uncovering sorghum's potential health benefits and why it's finding itself in mainstream diets.

A spread of gourmet Australian foods and wine were sampled as part of the program. The visit was organised by QAAFI's Communications and Marketing Manager Margaret Puls.

New centre will grow tomorrow's horticulture

A new Centre for Horticultural Science will be launched at The University of Queensland in 2018, to respond to the demand for plant-based foods, vegetables, fruit and nuts that improve human health.

UQ Vice-Chancellor and President Professor Peter Høj said the centre would build on the ability of UQ's world-class horticultural researchers to position Australia to compete in the rapidly evolving global fresh fruit and vegetable trade.

He said horticulture was one of the largest and most diverse industries in Australian agriculture, accounting for about 18 per cent of its total value.

"Vegetables, fruit and nuts are key to our nutritional and physical wellbeing and we know there is great potential for science to boost the yields and nutritional content of horticultural foods even further," Professor Høj said.

"We've seen from the rising global demand for avocados that there is increasing consumer awareness of the importance of horticulture to health and that science can sustainably increase supply to meet that demand.

"In partnership with growers and industry collaborators, this new Centre for Horticultural Science will help grow the future of horticulture in Australia as a key domestic and premium export market."

The new centre will be led by agricultural biotechnologist Professor Neena Mitter.

Professor Mitter said there were many opportunities to grow horticulture through on-farm management systems and the high-tech approaches of big data, genomics and biotechnology.

"The majority of horticultural products grown in Australia are sold domestically, but Queensland is in a good position to access the Asian markets," she said.

"The centre will leverage the expertise of horticultural scientists in the Queensland Alliance for Agriculture and Food Innovation (QAAFI) who work collaboratively with our partners in the Queensland government and with industry in the areas of horticultural crop protection and crop improvement."

Professor Mitter has collaborated with government, industry and philanthropic organisations such as the Bill & Melinda Gates Foundation, which supported the early development of her BioClay product through a Gates Foundation Grand Challenges Explorations Award.

RESEARCH HIGHLIGHTS

Dr Lee Hickey wins Queensland Young Tall Poppy of the Year Award

Congratulations to Dr Lee Hickey on receiving the Tall Poppy of the Year Award.

The Tall Poppy Campaign was created in 1998 by the Australian Institute of Policy and Science to recognise and celebrate Australian intellectual and scientific excellence and to encourage younger Australians to follow in the footsteps of outstanding achievers.

The Campaign's Tall Poppies Reaching Students Program engages the winners of Young Tall Poppy Science Awards ('Tall Poppies') in activities to promote study and careers in science among school students and teachers as well as an understanding and appreciation of science in the broader community.

Dr Lee Hickey pictured with Hon Leeanne Enoch, Queensland's Minister for Environment and the Great Barrier Reef, Minister for Science and Minister for the Arts.

China collaboration on crop yield prediction

A UQ project to improve methodology for predicting crop yields from space received funding from a prestigious joint Queensland-China scheme in 2017.

The Queensland-Chinese Academy of Sciences (Q-CAS) Collaborative Science Fund provides individual grants up to $250,000 over two years for Queensland and Chinese researchers to undertake innovative research and development projects.

QAAFI's Dr Andries Potgieter will work with the Beijing-based Institute of Remote Sensing and Digital Earth (RADI) to develop crop yield prediction systems using satellite data and biophysical crop modelling systems.

Dr Potgieter and RADI's Dr Miao Zhang will lead the project, which Dr Potgieter said aimed to help producers and industry cope with weather extremes and climate change.

"Queensland is more exposed to climate variability and extremes than any other state in Australia," Dr Potgieter said.

"Farmers in both Queensland and China are facing the increased risk of volatile seasonal weather hanging over their heads."

"We will use earth observation data to predict crop yield at field scale. This will hopefully lead to improved prediction of farmer yields.

"We hope in this way to mitigate the impacts of climate risks and extreme weather events within a cropping season."

Dr Potgieter also produces the monthly sorghum and wheat crop outlooks circulated to industry and published on the QAAFI website.

Food scientist recognised as AIFST Fellow

AIFST Fellows announced

Professor Mike Gidley, Director of the Centre for Nutrition and Food Science, was named an Australian Institute of Food Science & Technology (AIFST) Fellow at the AIFST 50th Anniversary Convention in Sydney in July.

The AIFST elevated seven members to Fellows of the Institute, in recognition of their outstanding service to the AIFST and contributions to the food science and technology profession. The newly appointed Fellows were: Professor Mike Gidley, Dr Anne Astin, Tom Debney, Cheryl Hughes, Dr Tom Lewis, Dr Janet Paterson, and Cathy Moir.

Satellite imagery of Darling Downs and around Dalby captured on 31 May 2017 from the Sentinel II satellite.

RESEARCH HIGHLIGHTS

Tick conference a biting success

QAAFI's Professor Ala Tabor was the conference Chair for the 9th Tick and tick-borne pathogen (TTP9) conference held in conjunction with the 1st Asia-Pacific Rickettsia Conference in Cairns from 27 August to 1 September 2017.

The conference attracted 240 delegates from 37 different countries.

Delegates experienced nine diverse and engaging plenary speakers with a conference program of 130 posters and 120 short oral presentations.

"It was amazing seeing so many tick and rickettsia researchers together, presenting outstanding science." Professor Ulrike Munderloh from the University of Minnesota, said.

Professor Tabor said a cross section of researchers from medical, veterinary and wildlife under the 'One Health' overall theme presented the latest research associated ticks and vector borne infectious diseases.

Plum award for Australian native food industry collaboration

A powder extracted from the Kakadu plum to extend the shelf life of frozen ready-made foods has earned a UQ researcher and her team a national award for community engagement.

QAAFI's Associate Professor Yasmina Sultanbawa was recognised for her work with Aboriginal communities and industry in northern Australia to develop the powder.

Her team won the 2017 Outstanding Collaboration in Community Engagement award at the annual Business and Higher Education Round Table (BHERT).

"Australia's Indigenous population has long known the health benefits of native bush food, but the mainstream food industry has only been able to harness some of these benefits recently," Dr Sultanbawa said.

"The Kakadu plum is only the size of an olive but is packed with Vitamin C, antioxidant and antimicrobial properties."

Dr Sultanbawa has worked with government, researchers, industry and Aboriginal communities across the Top End of Australia since 2010, investigating the nutritional and functional value of the plum.

"We developed a puree and a powder that can be added to foods including frozen ready-made meals to extend shelf life up to 18 months, which is very significant advantage," Dr Sultanbawa said.

Indigenous communities, government, philanthropists and research partners worked collaboratively to develop an innovative business model to harvest, market and distribute the in-demand Kakadu plum fruit puree and powder.

Twenty tonnes of Kakadu plums are harvested across Northern Australia each year, with plans to increase this wild harvest to more than 100 tonnes to meet commercial demand.

L-R: Ms Rhonda Renwick – Founder and Director Kindred Spirits Foundation; Ms Michelle Cheah – Member Kindred Spirits Foundation; Prof Mohan Krishnamoorthy – Pro Vice Chancellor (Research Partnerships), University of Queensland; Mr Ian Harris – Director, Research Partnerships, University of Queensland; Ms Kathy Havers – Director, Kindred Spirits Foundation; Ms Lizzie Brown – Member, Kindred Spirits Foundation; Mr Mark Burton – Director, Kindred Spirits Foundation; A/Prof Yasmina Sultanbawa – QAAFI; Ms Susan Bannigan, President of BHERT; Dr Peter Binks, CEO of BHERT

The Kakadu plum consortium includes:

- Funding partners: Australian Government Department of Industry, Innovation and Science and The Australian Industry Group, AgriFutures Australia
- Industry partners: Kindred Spirits Foundation, Karen Sheldon Catering, Australian Native Foods and Botanicals
- Research partners: University of Queensland, Department of Agriculture and Fisheries, Charles Darwin University
- Aboriginal community partners: Palngun Wurnangat Aboriginal Corporation, Gundjeihmi Aboriginal Corporation, Mamabulanjin Aboriginal Corporation, Milingimbi Crocodile Rangers, Thamarrurr Rangers

DISCOVERY

In a world-first, University of Queensland researchers have invented a method of supplying 500 times more avocado plants to industry than is possible using current methods.

A new stem cell multiplication method is set to smash the avocado production bottleneck by reducing the time it takes for new avocado varieties to reach commercial orchards from 10 years to three years or less.

QAAFI researchers have successfully developed a stem cell tissue-culture system that can supply 500 times more plants. The technology is non-GM and environmentally-friendly, requiring less land, water, fertilisers and pesticides.

DISCOVER
Asking the right questions, finding information and finding theoretical solutions

ENGAGE

IMPACT

Smashing the avocado production bottleneck

In a world-first, University of Queensland researchers have invented a method of supplying 500 times more avocado plants to industry than is possible using current methods.

The new stem cell multiplication method could double avocado production in Queensland, as well as reducing the time it takes for new avocado varieties to reach commercial orchards from 10 years to three years or less.

"At present, to supply new trees, the avocado industry follows the same process they have for the last 40 years, which is to take cuttings from high quality trees and root them," said Professor Neena Mitter from the Queensland Alliance for Agriculture and Food Innovation, who leads the project.

"However, this is a cumbersome, labour and resource intensive process, as it takes about 18 months from the cutting stage to having a plant for sale which creates a huge bottleneck for nurseries across the globe in the number of trees that they can supply to growers."

Queensland produces 50 percent of Australia's high-value avocado crop, worth $460 million a year. However, the industry is hampered by a shortage of high-quality planting material and there is a backlog of plant orders until 2020.

With funding from the avocado industry and Department of Agriculture and Fisheries, Professor Mitter's team successfully developed a stem cell tissue-culture system that can supply 500 times more plants. The technology is non-GM and environmentally-friendly, requiring less land, water, fertilisers and pesticides.

"Ten-thousand plants can be generated in a 10 square-meter room on a soil-less media," said Professor Mitter.

"This is a potential game changer for the avocado industry across the globe."

The Queensland-owned technology involves a secret recipe of media, light, temperature and other factors to grow and root multiple avocado plants from the shoot tip of an existing plant.

Professor Mitter's team are now working with banana growers in Tully who are looking for heat-adapted avocado trees to grow alongside bananas, as a way of diversifying their income.

Avocado growers in Central Queensland, New South Wales and Western Australia are also collaborating on the project.

With new funding from the Queensland Government's Advance Queensland Innovation Partnerships and in collaboration with Anderson Horticulture the first 200 avocado plants developed by the new tissue culture multiplication method will be tested in regions across Australia, with growers capturing performance data on the growth, flowering and fruiting of the trees.

"From an initial investment of less than $2 million from government, universities and industry, we should see an annual return of $335 million, with benefits flowing across the production and supply chain in Queensland," Professor Mitter said.

The project also involves collaboration with the University of Southern Queensland and Central Queensland University.

Professor Mitter said the avocado multiplication technology would establish Queensland as a world leader in avocado clonal propagation.

"It would substantially boost exports, and create growth and jobs in the regions."

Professor Neena Mitter, Dr Alice Hayward and PhD student Jayeni Hiti Bandaralage inspect avocodo root stock that could contribute to easing the avocado shortage.

Northern focus on fertility

UQ beef researchers are taking on the ambitious task of DNA sampling 30,000 cows and heifers in their quest to boost the fertility of northern herds.

QAAFI scientists aim to develop a DNA test to predict the value of an animal's genetics for fertility.

The ambitious project is supported by the MLA Donor Company (with investment matched by the Australian Government) and the Queensland Department of Agriculture and Fisheries.

Project leader Professor Ben Hayes said fertility was a critical trait for northern producers. "Fertility is the main driver of productivity and profitability of northern beef producers, but weaning rates – an indication of fertility – can be as low as 40 per cent in some herds," he said.

"Lifting the reproductive performance of breeding herds is challenging for producers who manage extensive enterprises, (because) annual or biannual mustering limits the opportunity to record performance and track fertility traits across generations."

The answer, he said, was the genomic equivalent of an estimated breeding value (EBV). EBVs are already widely used in the beef industry to assess an animal's performance traits compared to the breed average. A DNA test, however, would provide a highly accurate prediction tool of true genetic merit. This would enable young bulls with excellent fertility genetics to be identified and used early in life.

DNA tests for fertility have been commercially used in the dairy industry for more than five years but the physiological differences between, for example, a Holstein and a Brahman, mean they are not transferable. There is a useful genomic-based breeding value for days to calving, but only for the Brahman breed.

Importantly, this project is commercially focused and aims to develop DNA tests that are not limited to a specific breed, so researchers are DNA-sampling different breed compositions – including crossbred cattle – across Queensland, the Northern Territory and Western Australia.

Many genes affect the trait of fertility, so Professor Hayes and his team have set out to record fertility traits for a large number of animals, drawing on female stock from collaborating herds across northern Australia.

To date, they have identified 15,000 cows and heifers and have DNA sampled and scanned 3000 to record the key fertility traits of:

Age of puberty: heifers that cycle early can produce more calves in their lifetime. (Previous work by the Beef Cooperative Research Centre found this to be a highly heritable trait.)

Professor Ben Hayes

Postpartum anoestrus: determines how easily a cow can fall pregnant again after her first calf.

The first round of scanning will assess whether heifers have cycled or not as an indication of age of puberty, and will take a tail hair sample for DNA testing. Later in the project, cattle will be assessed again for fertility after their second joining and their temperament will be measured and correlated with fertility.

"At the end of the project, in five years' time, our aim is to have a highly accurate genomic breeding value for fertility," Professor Hayes said. "Northern producers can use this as a tool when choosing bulls, to assess what animals will contribute genetically to their fertility goals."

Michael Lyons: Image credit: Michael Lyons

Herd fertility lifts profits

Producer case study

Wambiana: Michael and Michelle Lyons, with Michael's parents John and Ronda Lyons

Location: 70 kilometres south-west of Charters Towers

Area: 23,500 hectares

Enterprise: Breeding and fattening

Livestock: 3,000 to 3,500 head of cattle

Pasture: Mostly native pastures augmented with introduced pastures of Urochloa and Buffel plus introduced legumes of Stylos and Desmanthus

Soil: Loams on the Campaspe River frontage to grey cracking clays to light sand ridges

Average annual rainfall: 650 millimetres

Beef producers are playing a critical role in research to develop the accuracy of genomic predictions for profitable traits.

Wambiana Station at Charters Towers is one of the beef businesses collaborating with the QAAFI project.

Michael and Michelle Lyons, together with Michael's parents John and Ronda, operate a beef breeding and fattening operation on the 23,500-hectare property. They will provide up to 350 Brahman heifers for the Northern Genomics Project.

Mr Lyons believes fertility – a key profit driver listed in benchmarking by industry organisations such as MLA – is one of the most important traits northern producers can select for in their herd.

"In our business, I find the cows that wean a calf in April-May and calve again in November-December each year are very profitable," Mr Lyons said.

The Lyons beef enterprise has a two-pronged approach to selecting for fertility:

Breeders: Cows that are adapted to their environment and consistently calve each year with minimal inputs stay in the herd. Those that don't are culled.

Bulls: Michael selects bulls with above-average estimated breeding values (EBVs) for days to calving and scrotal size, and looks for bulls from dams which have produced a natural calf each year for at least four years.

"Some of the bulls we have produced from our IVF program are from dams that have had up to 14 calves in 14 years, which is an amazing feat in the north," Mr Lyons said.

Culling non-performing cows and selecting bulls with superior genetics was a critical strategy to improve the overall fertility of Wambiana's herd.

"We are a low-input business, so if we can genetically improve our fertility and get more calves on the ground without having to increase inputs to our breeders, it will lead to greater profitability."

Mr Lyons said a DNA test for fertility would provide more accuracy to the existing EBVs and greater predictability of reproductive performance.

Published in MLA Feedback magazine, Feb/March 2018

Naturally Nutritious

New findings were announced from from Hort Innovation's $10m research project to discover new 'superfoods' with health benefits. The Naturally Nutritious project is co-funded by the University of Queensland and the Queensland Government, and headed by QAAFI's Dr Tim O'Hare.

Purple maize

QAAFI scientists are developing purple sweetcorn varieties with the horticulture industry to help growers respond to increasingly health-conscious consumers.

With funding from the grower-owned research and development company, Hort Innovation, the new varieties are being developed through natural breeding programs.

Head researcher, QAAFI's Dr Tim O'Hare, said his team were focussed on developing sweetcorn with high levels of specific phytonutrients for human health.

"Not only is purple corn fun, the actual pigments in the varieties we are developing are phytonutrients and they have different health benefits to that of a traditional yellow corn," he said.

"The anthocyanins have been shown to be linked to cardio-vascular health and by that we mean lowering blood pressure or reducing atherosclerosis, reducing the chance of having a heart attack."

Consumer and professional 'taste testing' panels are assessing the flavour, smell and texture of the varieties, to help the scientists confirm that any alteration does not harm the flavour and quality of the products, and how these new types compare to traditional sweetcorn.

Hort Innovation chief executive John Lloyd said Australia is fortunate to have plenty of access to home-grown, healthy produce.

"Everyone loves Australian sweetcorn. It is extremely healthy and second to none with consistent quality making it sought-after both here and overseas," he said.

"What this project aims to do is build on that success, and offer growers more varieties to help diversify their product range and respond to the rising uber-health-conscious-consumer pocket of the market."

The new corn varieties are being investigated as part of the $10M Naturally Nutritious project, using Hort Innovation's Health, Nutrition and Food Safety Fund.

This project is supported by the Department of Agriculture and Fisheries and The University of Queensland and Hort Innovation.

The high-folate strawberry was bred in Queensland and its nutritional content assessed by Dr Michael Netzel from QAAFI and Professor Michael Rychlik's team at the Technical University of Munich.

Dr Netzel is the responsible Chief-Investigator for the high-folate strawberry in the Naturally Nutritious project.

New supercharged strawberry a sweet find

QAAFI scientists have discovered an 'alpha strawberry' that is very sweet in flavour and has folate levels that may be up to three times higher than standard strawberries.

Folate is an important B-group vitamin which is critical for a range of biological functions in adults and children, including the production of DNA and other genetic material. It is also essential for the healthy development of the foetus in early pregnancy and can help to prevent neural tube defects such as spina bifida.

The strawberry research is funded as part of a $10M Hort Innovation program aimed at developing naturally nutrient-dense food, and delivered and co-funded by QAAFI, and the Queensland Government.

Hort Innovation chief executive John Lloyd said while the strawberry is yet to undergo taste testing through consumer panels to see if it is as good as conventional breeds, the finding is exciting.

"This is essentially an 'alpha strawberry'. It contains way more folate than we would expect to see in a standard berry, based on folate levels of standard strawberries reported in the literature" he said.

Mr Lloyd said the variety was developed to help growers meet consumer demand.

"Consumers are becoming more health conscious and are looking for the maximum amount of nutrients in their food," he said.

"Conversely, research has also shown that four out of five Australian adults are not getting the recommended daily intake of fruit and vegetables a day to get the nutrients they need.

"This new strawberry variety could help growers continue to tap into that health-conscious market through a novel offering."

QAAFI lead researcher, Dr Tim O'Hare said his team had identified a number of high folate strawberries so far in the Naturally Nutritious project, but this yet-to-be-named variety appears to be particularly high.

"High folate is generally found in dark green leafy vegetables, so having this folate dense strawberry variety is really novel," Dr O'Hare said.

"If people ate a 250g punnet of these high folate strawberries, it would give them their recommended daily intake of folate."

Dr O'Hare said the new strawberry was discovered by analysing the unknown biochemical properties of various strawberry lines.

"The next step will be to see how well the folate in this strawberry is absorbed by the body and also how well it grows in a production setting and, most importantly, to ensure that consumers like its taste."

Strawberries are grown in all states of Australia by an estimated 500 growers concentrated in the Sunshine Coast area of Queensland, the Yarra Valley and the Mornington Peninsula in Victoria, Wanneroo and Albany in WA, the Adelaide Hills in SA and Launceston in Tasmania.

Flour power: wheat discovery to increase flour yields

QAAFI researchers have discovered how to make more flour from the same amount of grain – a finding that could help avert food shortages around the world.

The world faces a looming food security crisis given increasing pressure from population growth and climate change. Of particular concern is an anticipated shortfall in the world's supply of wheat flour – the staple that supplies an estimated 20 percent of the total calories and proteins consumed worldwide.

The situation has triggered research efforts on an unprecedented scale to prevent shortages as the world heads towards peak population in about 2050. Researchers in Australia are at the forefront of some of this work, leading and participating in many local and international research programs.

Research led by QAAFI Director Professor Robert Henry has developed a new strategy to increase the world's supplies of flour that does not require growing more wheat or decades-long roll-out times for research and development.

Professor Henry's team discovered new information and is developing the tools needed to extract more flour during milling from the same amount of grain.

The discovery is based in wheat genomics. The researchers examined levels of gene expression in maturing grain, comparing 30 wheat varieties that are genetically programmed to produce grain with different milling properties.

Milling genes

Two genes were identified that determine how much flour can be extracted from grain – a trait called the 'flour yield'. These belong to a larger family of genes that encode fasciclin-like arabinogalactan proteins (FLAs). The two genes play a structural role that affects the rigidity of a compartment within the grain, which in turn affects how easily grain breaks up during milling.

Wheat grain has three main components – endosperm (the source of flour), bran (which needs to be separated from the endosperm to make flour) and germ (the embryo for a new wheat plant).

"The FLA genes affect the rigidity of the interface between endosperm and bran," Professor Henry says.

"We showed that when expressed at low levels, the resulting grain breaks up more easily during milling, resulting in more flour.

"That means we can select for higher flour yield by breeding wheat that is genetically programmed to express FLAs in the grain at low levels."

The finding has important food security implications. Currently, recovery of flour from dry milling usually ranges between 70 and 80 per cent of the wheat grain, which is below the theoretical maximum of 85 per cent. Existing testing techniques have made it extremely difficult for wheat breeders to target greater flour yield.

The new insight into the two FLA genes will allow DNA markers to be developed to easily, cheaply and quickly compare hundreds, even thousands, of breeding lines for their potential flour yield.

This kind of DNA marker-assisted screening technology, which could identify whether the relevant FLA genes are strongly or weakly expressed, can be used on minute amounts of plant material, sourced even from seedlings. This bypasses the need to produce large quantities of grain for a milling-based test to estimate flour yield.

The potential knock-on effect could considerably improve the general productivity of the wheat industry.

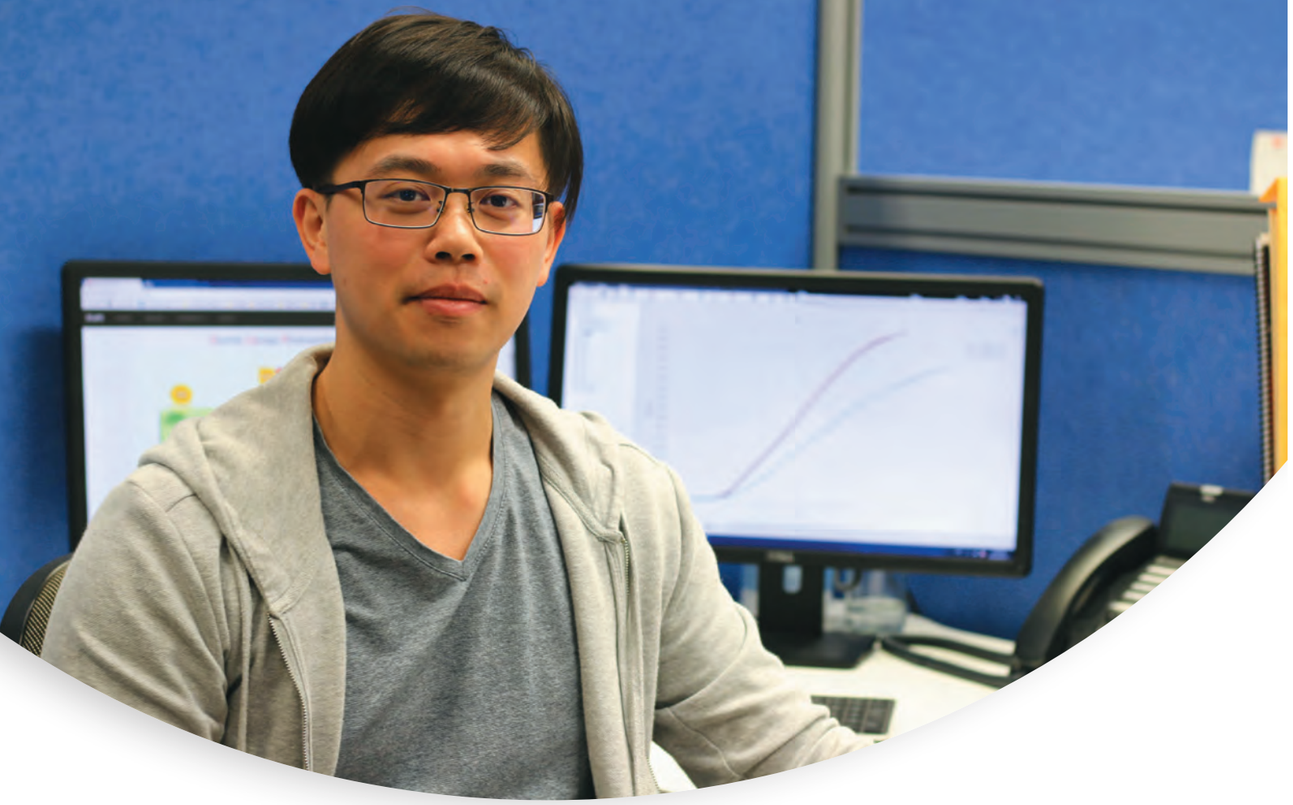
Yield and flour boost

Professor Henry believes it is already possible to breed wheat that produces extremely high quantities of grain, but the grain is usually unsuited to milling and is consequently used as feed for livestock.

"We now have the option to silence FLA gene expression in high-yielding but feed-grade wheat using gene editing techniques," he says. Adding milling quality to the genetics of what are currently feed wheats would increase the amount of premium-grade grain reaching mills and allow a jump to ultra-high flour yields.

Combining all the potential applications of this new selective breeding capability could quickly provide one of the yield 'quantum leaps' needed to meet future demand for wheat, he says.

Particularly attractive to Professor Henry is the potential to add more flour into the supply chain without the need to cultivate more land or use more water, soil nutrients or fertiliser.



Software shines a light on crop simulation

Crop scientists have developed an online application that predicts how crop growth is affected by photosynthetic changes at the molecular, cellular or leaf level of plants.

Food production depends on photosynthesis, the process by which plants capture sunlight and convert it into plant growth, biomass and grain. In the next decades, the world population is expected to reach 9.5 billion and food demand will increase significantly, so improving photosynthesis has become a global research priority.

"Enhancing photosynthesis has the potential to increase crop yields, but the link between photosynthesis and crop productivity is not straightforward because it crosses multiple scales of biological organisation," said Dr Alex Wu, a researcher with the ARC Centre of Excellence for Translational Photosynthesis (CoETP) at QAAFI.

"We created modelling tools that help us navigate through these complexities to identify targets that have the greatest impact on crop yield," he said.

This online "crystal ball" of crop growth, a small part of the cross-scale model, is designed to show researchers what would happen to a crop canopy with changes in photosynthesis under variable environmental and canopy conditions such as radiation, temperature, levels of CO_2, canopy size and amount of nitrogen in leaves.

"By developing simulation tools like these, we are working towards connecting lab-based research and discoveries, at the leaf or molecular level, with crop productivity under variable environmental conditions," Dr Wu said.

CoETP's Chief Investigator Professor Graeme Hammer, Director of QAAFI's Centre for Crop Science, said that researchers could now use the online application and see how their work is having an impact on crops in the field, which will radically accelerate the discovery process.

"They can also incorporate high temperature or high CO_2 conditions to test effects of climate change," Professor Hammer said.

The Diurnal Canopy Photosynthesis Simulator (DCaPS) online application, calculates diurnal (period from sunrise to sunset) canopy CO_2 assimilation and daily biomass increment for a crop under well-watered conditions. DCaPS is now publicly available at www.dcaps.net.au.

This study was published in the journal Functional Plant Biology in October 2017, and was funded by the Australian Research Council (ARC) Centre of Excellence for Translational Photosynthesis and the Queensland Alliance for Agriculture and Food Innovation (QAAFI) at the University of Queensland.

Cracking the genetic code for complex traits in cattle

A large global consortium of beef and dairy cattle researchers have analysed the genomes of more than 57,000 cattle to pinpoint the genes which influence the complex genetic trait of height, opening the door for other important complex traits to be mapped.

In a world first, the team demonstrated that the genes responsible for height in cattle also influence the trait same in humans and dogs.

Professor Ben Hayes from The University of Queensland who heads the 1000 Bull Consortium comprising 57 researchers from 30 institutes from around the world, said up to now it has been a major challenge for researchers to identify variants in the genome affecting complex traits such as height or fertility, due to the variation that occurs within multiple genes and through different behavioural and environmental factors.

To tackle this, the consortium pooled large genomic datasets and phenotypes collected for 57,000 individual cattle from around the world, in order to gain the clearest picture yet of cattle genetics.

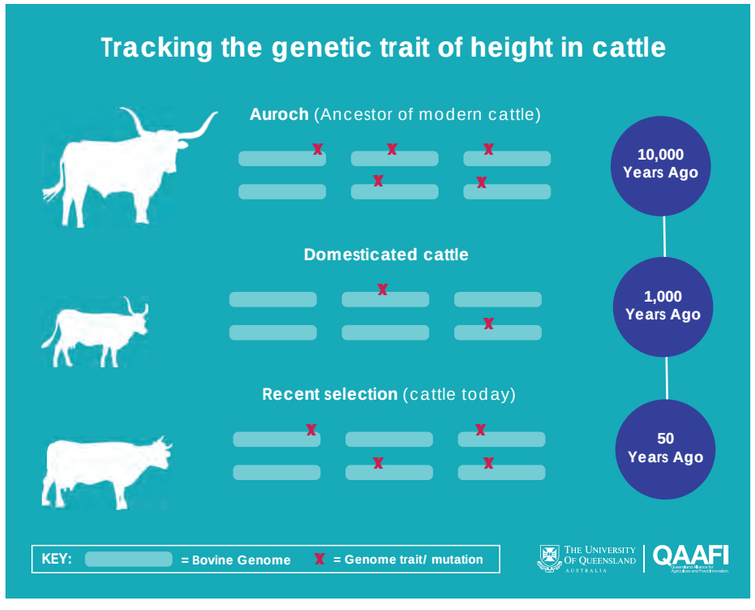
"We needed to access to vast resources of data in order to demonstrate, with a high degree of accuracy, that the genes affecting a complex trait like height, or stature, as it is referred to in the science, can be accurately identified from an animal's DNA," Professor Hayes said.

The Consortium's research showed that even for highly complex traits like height, the genes influencing the trait in cattle could be accurately identified.

Professor Hayes said by applying the same collaborative big data approach, it was now possible to identify genes associated with high value complex traits for the industry, such as beef and milk production, feed efficiency and reduced methane emissions.

When the team applied their findings to the genetic datasets collected for humans and dogs, they were surprised to find that there was a high degree of overlap.

"The same genes influencing height in cattle, also influence the trait in other mammalian species," Professor Hayes said.



"This is something that has never been demonstrated before.

"It opens up the possibility for researchers working in cattle and human genomics to share data on traits like body fatness and temperament."

The 1000 Bulls consortium also validated their findings on height by analysing the genetic material of miniature cattle, and the DNA sequenced from a bone of a 6,500 year old wild auroch.

"Aurochs are an extinct species of large wild ox, and the ancestor to all cattle breeds," Professor Hayes said.

"We were able to predict how tall this animal would have been from analysing its DNA, and then validating this with what we know from Auroch skeletons."

Aurochs were domesticated by ancient humans about 10,000 years ago and bred to be shorter, a trend which continued through to the middle-ages. In more recent times cattle have been selected to be taller, and the team demonstrated that variants affecting height have recently increased in frequency in many breeds.

Another key finding from the consortium's research is that the mutations which control traits like height are not located in the genes themselves, but in regulatory elements of DNA that control how the genes are turned on and off, and expressed.

"This helps explain why it is that cattle and fruit flies both have around 20,000 genes, yet cattle are so much more complex," Professor Hayes said.

"The regulatory elements of the human genome enable genes to be expressed in different ways which adds to the complexity."

Queensland's world-class genetic improvement program at the Hermitage Research Facility has delivered a cost benefit of $8.90 for every $1 invested in sorghum RD&E.

IMPACT

As one of the few research-intensive universities worldwide located in a sub-tropical environment, UQ is a global leader in agriculture and food science research for subtropical and tropical production systems.

QAAFI supports this leadership through extensive industry linkages, globally-recognised expertise and research infrastructure across a broad range of inter-connected disciplines, to deliver impact for across the tropical and sub-tropical agriculture and food supply chains.

DISCOVER — ENGAGE — **IMPACT**

The contribution that research makes to the world and lives of the people living in it

UQ and QAAFI deliver return on investment

Queensland possesses a world-class research and development capability. UQ is rated the number one agricultural research institution in Australia, and is among the world's top five agricultural research institutions in the 2017 NTU rankings. UQ and the Queensland government's investment in QAAFI builds upon the capabilities of both organisations, to deliver substantial returns on investment across Queensland's agricultural industries.

Investment in sorghum:

Grain sorghum is a major summer crop, produced at the moment largely as a feedgrain for the Australian domestic market – although new markets for Australian sorghum are opening up in China for use in fermentation of alcoholic spirit, and in the gluten-free human food market.

Genetics is one of the principal factors contributing to the current upward trend evident in Australian grain sorghum yields.

The Queensland Government, along with the Grains Research and Development Corporation, the Department of Primary Industry in New South Wales and UQ, have for the past 20 years supported improvement and innovation in a sorghum pre-breeding program run out of Hermitage Research Facility.

The cost-benefits of the research mainly stem from yield gains, estimated at 2.1 per cent a year. This estimate is based on Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) data that shows average sorghum yields increased from about 2 to 3.5 tonnes per hectare between 1996 and 2015.

The pre-breeding program has licensed nearly 3000 sorghum lines to the international sorghum industry since 1989, which is around 10 times the amount of plant breeding material than in all the other public sorghum breeding programs around the world – combined.

The economic analysis of this investment over this period which totalled $78.4 million shows this has delivered a gross gain of $696.5 million to Australian sorghum growers.

This equates to a cost-benefit of $8.90 for every $1 invested by the research funders.

Investment in beef:

The Queensland Government, QAAFI and Meat & Livestock Australia via the MLA Donor Company will invest $6.2 million over the period of years ending June 2017 to June 2021 to improve the genetic rate of gain of beef cattle in the northern beef industry.

The overall aim of the UQ project is to accelerate genetic gain for increasing productivity in northern Australia beef cattle herds to improve profitability of Australian northern beef enterprises.

Other benefits may include reduced methane emissions, increased regional employment and incomes, and continuous improvements in animal welfare – for example, to accelerate breeding for hornless or polled cattle.

Banana biosecurity:

The Australian banana industry is a major horticultural industry with an annual farm gate value of around $600 million. It is Australia's largest single horticultural industry by farm gate value.

Banana production in Australia is dominated by areas in the north of Queensland with other significant areas in south east Queensland and northern New South Wales.

However, the banana industry worldwide is subject to serious disease events, with Australia being no exception.

A focus for investment by the Queensland Government into the banana industry has been on banana disease detection, diagnostics and capacity to respond to disease outbreaks.

The impacts of investments made by The University of Queensland, the Queensland Department of Agriculture and Fisheries, Horticulture Innovation Australia Limited, and QAAFI over the period 2007 to 2017 has delivered improved diagnostics for several key banana diseases as well as ongoing surveillance, testing and technical capacity and advice that has maintained (and potentially improved) industry capacity to detect and respond to disease outbreaks in the Australian banana industry.

While it is difficult to quantify the range of impacts of this investment in protecting Queensland's banana industry, the total investment of approximately $9.2 million (present value terms) has been estimated to produce total net benefits of approximately $70.8 million (present value terms) providing a benefit-cost ratio of approximately $7.7 to $1 of research investment funding.

Resilience, reliability improves sorghum returns for growers

From the lab to the paddock, organic grower Paul Murphy says genetic improvements have recast sorghum as a more productive and profitable option for his farm business.

Research over the past 20 years has delivered a lift in long-term average yields and grain quality on Mr Murphy's 2000-hectare property in Queensland's Central Highlands region. He farms with his family in a marginal cropping area 40 kilometres south-east of Capella.

The combined yield and quality benefits stem from genetic traits developed through the sorghum program at The University of Queensland and the Queensland Department of Agriculture and Fisheries, now delivered through QAAFI at the Hermitage Research Facility in Warwick.

In particular, Mr Murphy says resistance to midge pests now bred into modern sorghum cultivars has prevented midge-related yield losses of almost 40 per cent on his property.

"In past situations where we staggered our sorghum planting using cultivars susceptible to midge, we found there was no seed in the heads of late-sown plants," he said.

Since making the switch to midge-resistant varieties, however, he estimates yield losses caused by the insect have declined to just five per cent of the crop.

Such genetic resistance is an important consideration for the Murphys because the farm's certified organic status precludes them from using insecticide to control the mosquito-like pest.

The stay-green trait is another example of genetic improvement that has "made sorghum a more reliable crop". Mr Murphy says there are fewer crop failures, leading to higher average long-term yields.

Sorghum plants with the stay-green trait maintain green leaves and stems when water is limited during the grain-filling period. This results in higher grain yield, larger grain size and increased lodging resistance with no cost or yield loss in favourable environments.

The stay-green drought-resistance trait has made Mr Murphy's crop better able to withstand moisture stress and lodging – a key consideration for the mainstay summer crop, which accounts for one-third of the family's cropping program.

Stay-green has also helped boost overall grain quality in terms of seed size and appearance. "Without the benefit of stay-green, drought-stricken plants tend to produce grain that is pinched or smaller in size," Mr Murphy said.

"This is difficult to process because it is prone to cracking and has less nutritional value.

"From a visual perspective, large, plump grains are easier to market, especially in high-value export markets for baijiu (sorghum wine)."

Putting the profitability of the stay-green edge into perspective, Mr Murphy said standard grain quality could mean being paid $400 a tonne instead of $500 a tonne in premium organic markets. It has also allowed his family's enterprise to avoid a price penalty of up to $40/t incurred for organic grain containing more than eight per cent pinched grain.

"We haven't delivered sorghum containing more than four per cent pinched grain for the past five years, and I think that is certainly because of genetic gains in sorghum," Mr Murphy said.

Paul is also seeing the benefits of a new hybrid cultivar, Agitator, which he has been growing on his property for the past two years. It has been produced by the grower-owned seed company Radicle Seeds Australia, using genetic material licensed to it from QAAFI.

Mr Murphy is the chief executive officer of Radicle Seeds and says this low-tillering cultivar has two main advantages: high yield potential and climatic resilience.

"Reduced tillering means the plant doesn't grow extra vegetative biomass so it can channel more of its energy into grain production. The pre-breeding program has tested these tough, low-tillering lines as part of its trial program and provided data on parent lines, which we then use to commercially develop hybrid sorghum cultivars through Radicle Seeds Australia."

Looking to the program's future, Mr Murphy says sorghum germplasm to decrease lodging and deliver resistance to charcoal rot disease are high on his wish list.

"We haven't delivered sorghum containing more than four per cent pinched grain for the past five years, and I think that is certainly because of genetic gains in sorghum."

Paul Murphy, CEO, Radicle Seeds.

Radicle Seeds' CEO and sorghum innovator, Paul Murphy. © Paul Murphy.

Queensland's sorghum success story

Of all the world's cereal crops, productivity gains in Australian sorghum are unparalleled, and the industry's growth ranks among the highest globally.

This success is due to Queensland's world-class genetic improvement program at the Hermitage Research Facility in Warwick.

Funded by the Queensland Department of Agriculture and Fisheries (DAF), the Grains Research and Development Corporation (GRDC), and UQ, the sorghum genetic improvement program has delivered a cost-benefit of $8.90 for every $1 invested in sorghum RD&E.

Underpinning the program's success is the link between integrated research drawing on a range of scientific disciplines, such as plant physiology, molecular biology and entomology, and collaboration with the private sector.

Every grain of Australia's sorghum crop contains at least some elite germplasm bred by this group.

Average sorghum yields increased from about 2 to 3.5 tonnes per hectare between 1996 and 2015.

Sorghum is the main summer grain crop grown for most Queensland regions, and plays a key role in providing feed grains to the beef, dairy, pig and poultry industries.

New markets are opening for Australian sorghum in China to make Baijiu, the world's top selling liquor and with its gluten free status, demand is increasing for the product in the human health food markets.

The program has licenced nearly 3000 sorghum lines to the global sorghum industry since 1989 – around 10 times the amount of plant breeding material than all the other public sorghum breeding programs around the world combined.

The next steps in the research effort aim to develop a suite of adaptive traits for better root architecture, water use efficiency, heat tolerance and grain quality.

NASA provides inspiration for plant-breeding advance

Crop improvement rates are lagging behind expected growth in demand, but a UQ innovation is set to make it easier to close the gap.

Development of speed breeding protocols led by UQ are a game-changer for global plant breeders.

Not since Norman Borlaug's shuttle breeding technique – that made possible two generations of wheat a year – has there been such excitement worldwide about the recent publication of these protocols in 'Nature Plants' on January 1, 2018.

With speed breeding, however, the number of generations possible has been upped to six for bread wheat, durum wheat, barley and chickpea. That amounts to just six weeks to cycle from seed to seed in one generation. Canola is currently at four generations a year and more protocols are under development, including for lentils.

The accelerated generation times are achieved by "leaving the lights on" in the glasshouse for 22 hours a day. Once optimisations are made for light intensity, wavelength, temperature and nutrients, the photoperiod induces plants into the reproductive phase and flower faster than normal.

Speed breeding is an Australian innovation and one of the researchers who played a pivotal role in its development is QAAFI's Dr Lee Hickey, who developed speed breeding as his PhD topic at UQ, and with support from GRDC's scholarship program.

Dr Hickey said it took 10 years to refine the protocols. Over that time, the protocols benefitted from input from other researchers, including Professor Robert Park of the University of Sydney and the team led by Professor Brande Wulff at the John Innes Centre in the UK.

"The technique will likely work for many crop species that respond to longer daylight hours, such as sunflowers," Dr Hickey said.

"It will, however, require additional refinements for short-day species, such as maize, sorghum and rice."

Lighting the way

It was NASA that first tried using continuous light to grow wheat in outer space, inspiring Dr Hickey to contemplate a new way to grow plants on planet Earth.

"The cool thing about this story is that when we first proposed working with continuous light, people thought we were crazy and that it absolutely would not work," Dr Hickey said.

"The success we had shows the value of thinking outside the box, no matter how outlandish the idea may seem to conventional beliefs."

So far speed breeding has led to the faster development of mapping populations for trait discovery, it has fast tracked trait selection, and accelerated trait stacking into elite germplasm. It is even being used in the Netherlands to boost tomato production from glasshouses by 30 per cent.

Breeding companies in Australia were quick to trial and adopt the technique, with LongReach Plant Breeders and Dow AgroSciences working directly with Dr Hickey and his speed breeding facilities.

Tackling grain dormancy

Already, a milling wheat variety called DS Faraday has been developed that was speed bred at QAAFI to incorporate grain dormancy genes.

This new genetic material suppresses damage to grain quality from pre-harvest sprouting. The variety is described as especially suited to the northern growing region.

"I view speed breeding as just one tool in the shed that can be used in conjunction with many others to accelerate the delivery of improved cultivars that are capable of boosting crop productivity," said Dr Hickey.

"In my opinion, the really big gains for the industry will come from integrating speed breeding with trait-related technologies, including gene editing or by making it far easier to tap the genetic diversity in genebanks, similar to what we did to develop DS Faraday."

Currently, Dr Hickey is working with LongReach Plant Breeders to use speed breeding to rapidly stack (or combine) disease resistance traits in to their elite breeding lines.

But he warns that glasshouse growth will not always reflect performance in the field: "Speed breeding does not diminish the importance of testing new cultivars over several seasons in the field," he said.

Speeding up research

Speed breeding is now being used to accelerate the discovery rate of new and valuable traits by pre-breeding researchers, including root architecture traits that have the potential to better adapt wheat crops to drought, barley resistance to foliar diseases (namely powdery mildew, pot blotch, net form net blotch, spot form net blotch), and resistance to barley leaf rust.

Speed breeding accelerates the creation of mapping populations. These are developed by crossing plant lines that provide the maximum contrast possible for the desired trait, such as fully disease susceptible versus resistant. This contrast makes it possible to locate sites in the genome responsible for the trait.

Dr Hickey said the speed breeding protocols are scalable, flexible and can incorporate technological advances, for example in LED lights. He is especially keen on solar panel innovations that could power glasshouses while letting through wavelength of light that plants need to grow.

In addition, Dr Hickey has been working with the International Maize and Wheat Improvement Center (CIMMYT) in Mexico to help them trial the use of speed breeding. The CIMMYT wheat breeding program was responsible for the Green Revolution and it continues to provide wheat cultivars to the world that are known for their broad resilience under variable growing conditions.

"The current rate of improvement of important crops is inadequate to meet future demand and long generation times contribute to the problem," Dr Hickey said.

"With speed breeding, the hope is that we can shorten generation times to accelerate breeding and research programs globally."

Source: GRDC's GroundCover™ newspaper, Issue 133, March-April 2018

New project targets pimelea poisoning

A new QAAFI research project aimed at producing a preventative probiotic for cattle to mitigate poisoning from the potentially fatal pasture plant, pimelea, received funding from Meat & Livestock Australia (MLA) in 2017.

Improving beef production through management of plant toxins is led by QAAFI's Associate Professor Mary Fletcher.

MLA identified the impact of poisonous pasture plants on the health and productivity of grassfed cattle as a priority area, through the organisation's regional consultation process with producers.

Pimelea are small native herbs that are mainly found in inland areas of Australia, below the Tropic of Capricorn, with livestock poisoning primarily associated with native rice-flower (*Pimelea simplex*), and flaxweed (*Pimelea trichostachya*).

Pimelea poisoning affects cattle, sheep and infrequently horses, however it is potentially fatal for cattle. It can be caused by ongoing, accidental consumption of toxic plants or inhalation of dry plant dust and is most common in south-west Queensland, north-west New South Wales and northern South Australia.

It is also known as St George disease, Marree disease, and flaxweed poisoning.

MLA General Manager – Producer Consultation and Adoption, Michael Crowley, said the new project aimed to produce a rumen inoculum containing microbes able to detoxify plant toxins, but initial work will concentrate on the pimelea toxin, simplexin.

"The project will also investigate absorbent or slow-release systems for the rumen that would have broad use across a range of plant toxins," Mr Crowley said.

"The approach of this project is to devise strategies to enable toxin breakdown in the rumen before absorption into the bloodstream and impact on animal productivity.

"Currently, there is no effective vaccine or antidote for pimelea poisoning and management strategies to reduce contact between toxic plants and susceptible stock are the only options open to beef producers to avoid potentially devastating poisoning events.

"Production and reproductive inefficiencies are a major cause of economic loss in the northern Australian beef cattle industry. A better understanding of the impact of poisonous pasture plants like pimelea will enable the development of management strategies to address a currently under recognised factor contributing to these losses."

Associate Professor Mary Fletcher

Battling the pimelea scurge

TJ Moroney and Kylie Savidge. Photo courtesy Lucy Kinbacher.

Enterprise snapshot

John and Queenie Kilpatrick, Kylie Savidge and TJ Moroney

Location: 'Southampton', 110 kilometres north-west of St George

Area: 11,000 hectares

Livestock: Up to 700 breeders, Santa Gertrudis and Hereford-based crossed with Santa Gertrudis, Hereford, Droughtmaster and Angus sires

Rainfall: 425mm

Soil: Open red box country interspersed with sand ridges and rough mulga country

Pasture: Buffalo and native grasses, mulga

South-western Queensland producer Kylie Savidge knows all too well the devastating impact pimelea can have, with her family's grazing enterprise still recovering from an outbreak of the toxic native plant at the start of 2017.

She believes new research to develop an inoculum to pimelea will finally give beef producers a tool to reduce or prevent poisoning and alleviate the emotional and financial stress associated with stock fatalities and decreased production.

Kylie runs 'Southampton', an 11,000-hectare property 110 kilometres south-west of St George, with her parents John and Queenie Kilpatrick, her partner TJ Moroney and her children Jack (17), Ben (14) and Meghan (12).

Dry conditions in 2016 were exacerbated by the resurgence of pimelea growing across about 8000ha of the property.

The most favourable growing conditions for the species are when a wet winter follows a dry summer – dealing a harsh blow to producers who have managed cattle through tough seasons only to face poisoning concerns when conditions improve.

Kylie describes the pimelea as "looking like we had sown it", such was the prevalence of the plants in spring 2016, after a wet, warm winter followed several dry years. However, as the green plants are not palatable, the real impact was not felt until paddocks started to dry off in January/February 2017.

"As the grass hayed off, we started seeing the effects of pimelea poisoning – affected animals had swollen briskets and heads, rough coats, weight loss and terrible diarrhoea," she said.

Older cattle were not as badly affected, and the worst cases of poisoning occurred with first-calf heifers, weaners and introduced stock, including bulls.

Pimelea management strategies at 'Southampton' included removing stock from affected paddocks and on to mulga country where there was less risk, and weaning calves earlier (four to five months instead of seven to eight) to reduce pressure on breeders.

Severely affected stock were carefully moved to yards to reduce stress (cattle can die if they are exerted after exhibiting early signs of poisoning) where they were given three doses per day of Frusemide (a diuretic) and fed a high-protein diet with mineral supplements. (Dry urea-based loose lick is also available year-round to stock on 'Southampton'.)

At any given time there could be up to 60 head in the yards in various stages of treatment and recovery – a labour-intensive and stressful process. "Some of these cattle lived and some didn't, but we gave them all an equal chance. It was heartbreaking at the end of an intensive five days to then have to euthanise an animal we fought to save, knowing we could not do anything else except end their suffering," Kylie said.

"I estimate that we had around a 50:50 success rate in our attempts to treat the sick animals, with costs per animal ranging between $250 to more than $1000 per head."

The family have lost at least 70 head to pimelea, including 12 of 18 bulls, the majority of which were only purchased in 2016 to replace older sires.

The economic cost of pimelea has been significant, with medical and feeding costs compounded by lost productivity. There is also a chance the fertility of affected animals is compromised, so surviving bulls will be semen-tested.

"It has been exhausting – not only physically but emotionally, mentally and financially," Kylie said, with the issue taking its toll on the family, including her three children who have been involved in all aspects of managing the outbreak.

"My kids won't ever forget this experience – none of us will. It might be years between pimelea outbreaks but it is something that has a lasting impact on the producers who experience it.

"The knowledge that there could be an inoculum available in the next few years is encouraging. It would be a weight off our shoulders if we could go into the next pimelea outbreak knowing we had a tool that could protect our livestock."

Article published in MLA Feedback February/March 2018

Sorghum – the new gluten-free superfood?

Findings from a QAAFI study adds more value to Australian sorghum for human food markets.

Results from a QAAFI study show the bran fraction of Australia's only white coloured sorghum hybrid, Liberty, contains a broad range of 'healthy' phytochemicals – raising the grain's potential for human health food markets.

While the gluten-free status of sorghum was already known, there has been minor interest by the Australian food sector, despite sorghum being a food staple in many other countries, including India, and Ethiopia.

But QAAFI research, led by Dr Glen Fox, has revealed potential health benefits in the high concentration of phytochemicals in some sorghum varieties, especially antioxidants, in the bran layer.

The QAAFI study, which also included chickpea and soybean products from a Queensland gluten-free flour mill, were compared to shop-bought rice and rice bran, oat and oat bran, psyllium husks and quinoa.

Results showed higher concentrations of a number of compounds including phenolic acids and flavonoids in the sorghum bran fractions. In some specific phytochemicals, these concentrations were twice the concentration to other products, such as psyllium husks, which is considered a high fibre health product.

In the white sorghum tested in this project, there was no tannin present using a standard lab test. However, psyllium bran had the highest amount of tannin in the grains tested.

To better understand the potential value of the sorghum bran in human health, a laboratory in-vitro assay comparing the sorghum bran against whole sorghum meal and pearled sorghum showed a significant reduction in the rate of glucose release, suggesting a positive control on glucose in the diet.

Dr Michael Netzel, a Senior Research Fellow at QAAFI, said that the polyphenolic compounds in white sorghum bran exert an inhibitory effect on starch digestibility resulting in a significantly lower glucose release. This could present an important nutritional benefit of sorghum and sorghum bran if confirmed in human studies.

It should be noted that the results from this study only relate to the samples supplied by the industry partner for the project. It is known that bioactive compounds such as polyphenols and carotenoids in plant material (and subsequently derived processed products) can vary depending on the geographical location, environmental conditions and genetics.

To generate scientific evidence and to substantiate the observed in-vitro results of the present study, additional research through human trials, using selected sorghum products to measure the actual bioavailability and metabolism of the main bioactive compounds and subsequently bioactivity (potential health benefits) are required.

Industry partner, Ron Plant from Maralong Milling said the preliminary investigation provides a better understanding of the phytochemical composition and potential nutritional value of the mill's products

"We now have the scientific knowledge to put forward to potential customers, the nutritional and health benefits of this ancient grain compared to other similar grains in the market place," Mr Plant said.

This project was jointly funded by the Australian Department of Industry and Science, and Maralong Milling through the Innovation Connections program.

Edited story source: GRDC's GroundCover™ newspaper, Issue 133, March-April 2018

Baijiu sorghum

Opportunities for Australian sorghum

The national drink of China Baijiu is the biggest selling alcoholic spirit on the planet.

Baijiu is a distinctive white spirit (between 40-60% alcohol by volume) which is distilled mainly from sorghum that has been fermented in mud pits or earthenware jars.

Baijiu has a history dating back centuries and is a central part of Chinese culture and tradition.

The main grain used for baijiu is sorghum, although other grains may be used. China did not import sorghum in volume until 2013 and is now importing up to 10 million tonnes annually for animal feed and baijiu production. The majority of imported sorghum (8mt) is sourced from the United States, while about 1.6mt comes from Australia.

The Australian Export Grains Innovation Centre (AEGIC), together with QAAFI's Dr Glen Fox, and the Functional Grains Centre at Charles Sturt University, are examining opportunities for increasing the value of Australian sorghum in China.

With support from Austrade China researchers are working in China with key baijiu manufacturers to improve Australia's understanding of the quality attributes required for the manufacture of baijiu.

Like many other spirits, baijiu is distilled from fermented grains (primarily sorghum, however other grains including wheat, rice and corn may be used in varying amounts).

There are several baijiu production methods across China depending on the style. Baijiu production usually employs a unique style of fermentation which distinguishes it from other types of spirits.

Western-style spirits such as whisky go through several distinct steps before distillation. Grain is usually malted to extract sugars and then fermented in a separate tank using yeast, before being distilled and aged.

With traditional baijiu, a starter culture unique to the region is added to a mixture of steamed grains and water in an earthenware jar or an underground mud pit. Unlike whisky, the sugar conversion and fermentation occurs at the same time in the same container. The resulting mixture is then distilled and aged.

Baijiu sorghum vats. Photo courtesy AEGIC.

ENGAGEMENT

"TropAg2017 balanced the messages of major challenges ahead, strong reasons to be optimistic, and with opportunities for the young people coming through."

Peter Horne, General Manager - ACIAR

Strong collaboration with industry is at the heart of QAAFI's research effort. We seek to grow our engagement with producers, agribusiness, governments, NGOs, non-profits, students, and other research institutions to create change in the tropical and sub-tropical agriculture and food industries.

Partnering with institutions and organisations across the globe facilitates mutually-beneficial collaborations, which can be leveraged to secure further research funding and to attract the best minds to work with us in targeting key challenges in the agriculture and food industries.

DISCOVER — **ENGAGE** Exchanging knowledge, understanding and resources in a reciprocal context — IMPACT

TropAg: Science to nourish the world

The heat is on agriculture and food production in the tropics. With the global population expected to reach nine billion by 2040, the greatest pressure will likely be experienced in the world's tropical zone which is home to half the world's population, including more than half of its young people, and many of its fastest growing economies.

In the developed world there is an increasingly obese but undernourished population battling various chronic illnesses associated with environmental factors, including too much of the wrong food.

This contrasts with a large proportion of the world's population still struggling to attain enough calories a day to survive.

The role of science in providing solutions to meet these challenges was the focus of TropAg2017. The conference had as its theme nutrition security – ensuring people, both in developing and developed countries, have access to the critical nutrients in food that support and boost core bodily functions, and provide the fuel to live a healthy and active life.

Leadership in sustainable agriculture and food

The second international TropAg2017 conference, was held in Brisbane on November 20-22, 2017, and confirmed Queensland as a global leader in sustainable agriculture and food production.

Hosted by UQ and QAAFI, in partnership with the Queensland Government, a key feature of TropAg2017 was an alliance of northern Australia research providers – QUT, James Cook University, CQU and USQ – who sponsored the event, and helped develop the scientific symposia.

TropAg2017 conference showcased a coalition of Queensland University research institutions to an audience of 720 delegates.

AgFutures

Dr Beth Woods, Director-General of the Department of Agriculture and Fisheries, whose Department were a major sponsor of the conference through the AgFutures stream, gave the opening address, highlighting the successful partnership between the Queensland government and TropAg2017.

The AgFutures stream of the TropAg conference included four symposia focussing on agri-technolgy to an international audience. Other sessions in the wider conference were also promoting Queensland agri-technology.

Networking events

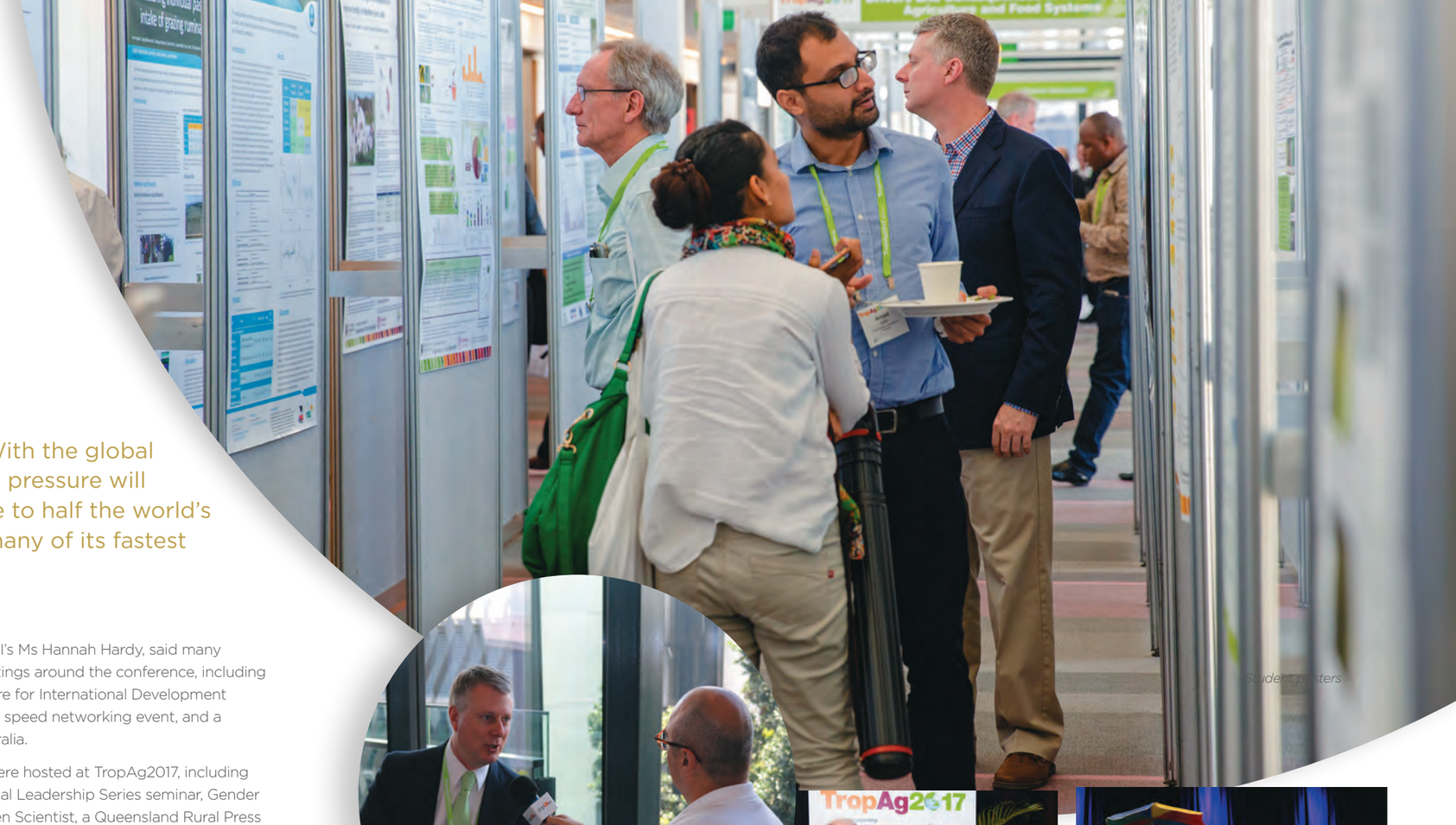
Conference organiser, QAAFI's Ms Hannah Hardy, said many organisations arranged meetings around the conference, including the Researchers in Agriculture for International Development (RAID) Early and Mid-Career speed networking event, and a Regional Development Australia.

A series of satellite events were hosted at TropAg2017, including PacBio Research Day, a Global Leadership Series seminar, Gender and Food Breakfast, Next Gen Scientist, a Queensland Rural Press Club breakfast and a free screening of the Food Evolution movie.

Global reach

Over 160 international delegates were in attendance and engaging in presentations by Queensland researchers.

- Bangladesh
- Brazil
- Cameroon
- Canada
- China
- Ethiopia
- Ghana
- Hong Kong
- India
- Indonesia
- Iran
- Italy
- Japan
- Kenya
- Malawi
- Malaysia
- Mali
- Mexico
- Mozambique
- Myanmar
- Nepal
- Netherlands
- New Zealand
- Nigeria
- Pakistan
- Papua New Guinea
- Peru
- Philippines
- Rwanda
- Samoa
- Singapore
- South Africa
- Spain
- Switzerland
- Tanzania
- Thailand
- Timor-Leste
- Tunisia
- Uganda
- United Kingdom
- United States
- Vanuatu
- Vietnam
- Zimbabwe



Student posters

Kevin Diehl, Director, Regulatory Product Strategy, Scientific Affairs and Industry Relations, DuPont Pioneer, United States, talks to media at TropAg

Professor Robert Henry and Dr Beth Woods

Tango band entertained conference dinner guests

TropAg2017 Incorporating AgFutures

720 Attendees

24 Trade stands

35 Symposias

46 countries represented

248 Posters

252 Speakers

Working with the Bill & Melinda Gates Foundation

QAAFI forges strategic industry partnerships to tackle local and global challenges in tropical and sub-tropical agriculture and food production. We work with the Bill & Melinda Gates Foundation on key projects to boost food and nutrition security in tropics and sub-tropics.

Gates Foundation visit to discuss crop improvement research

Dr Jeff Ehlers, Senior Program Officer at the Bill & Melinda Gates Foundation *visited UQ on October 5, 2017 to review ongoing projects between the Gates Foundation and UQ.*

(L-R) Professor Graeme Hammer, Director, Centre for Crop Science at QAAFI; Professor Robyn Ward, Deputy ViceChancellor (Research) at UQ; Gates Foundation's Dr Jeff Ehlers.

Plant breeding boost in Africa and Asia

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

The University of Queensland is implementing the Bill & Melinda Gates Foundation' Breeding Program Analysis Tool (BPAT).

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.

"We will be using the BPAT 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," Dr Lambrides said.

Project co-leader, QAAFI's Professor David Jordan, said sorghum was a great example of the gains that can be achieved by effective plant breeding even in difficult dryland cropping environments.

The BPAT 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 is reviewing 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.

Growing more sorghum with less water

"It's crucially important to food security in Africa as sorghum is grown in the drier and resource-poor areas, where its capacity to better tolerate drought, high temperatures and low fertility make it a preferred crop to maize."
– Professor David Jordan

Professors David Jordan and Graeme Hammer of QAAFI's Centre for Crop Science first received support from The Bill & Melinda Gates Foundation in 2012, to build capacity and productivity for sorghum breeding programs in sub-Saharan Africa and other water-limited environments.

This was followed by a four-year $4.6-million project investigating problems common to sorghum growers in low-rainfall regions across the globe, involving one of the largest drought tolerant sorghum research projects ever undertaken.

Sorghum is the world's fifth most important cereal and a staple food crop for half a billion people in the semi-arid tropics, including Asia and Africa. The project involved the use of sophisticated computer modelling to exploit new marker technologies, which allow rapid development of new varieties.

"We're looking at things like root architecture and designing root systems for sorghum plants that access water deeper down in the profile," Professor Hammer said.

"We're also looking at transpiration efficiency – that's the efficiency with which a plant uses water to make grain – and there's quite a variation with sorghum for both those traits." The project investment supported development of advanced phenotyping platforms to evaluate large numbers of plant varieties in order to generate a step-change in information to enhance research into crop growth, water use efficiency and drought adaptation.

The future of BioClay

"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 Mitter

UQ researchers from QAAFI and the Australian Institute of Biotechnology and Nanotechnology (AIBN) have made a discovery that could help conquer one of major threats to global food security – pests and diseases in plants.

With initial support from The Bill & Melinda Gates Foundation, BioClay – an environmentally sustainable alternative to chemicals and pesticides – has potential to be a gamechanger for crop protection.

Viruses are part of the pest and pathogen burden that reduces food production globally by 20% to 40%, affecting an estimated 795 million people – one in nine – without enough food to lead a healthy, active life.

"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," Professor Mitter says.

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

A spray of nano-sized degradable clay is used to release double-stranded RNA that protects plants from specific disease-causing pathogens. The technology reduces the use of pesticides without altering the genome of the plants.

Eradicating bunchy top from Australia to Africa

"The project will look to Southeast Asia, where many bananas and their diseases originate, to identify wild species of seeded bananas that may have natural resistance to bunchy top."
– Associate Professor John Thomas

Queensland scientists are tackling one of the world's worst threats to banana crops – bunchy top disease – with help from the Bill & Melinda Gates Foundation in the form of a $US5.7 million investment.

Led by QAAFI's Associate Professor John Thomas, the research aims to tackle bunchy top disease by strengthening the ability to control and eradicate the disease globally. The project involves controlling bunchy top in Nigeria and Benin, and looking for sources of resistance in Southeast Asia – the ground zero of banana disease.

First identified in Fiji in 1889, bunchy top has since spread around the world. Although not native to Africa, bananas have become an important food source for over 100 million people in sub-Saharan Africa and a source of income for over 50 million small-holder farmers.

In Africa the project aims to rehabilitate lost production areas at a community level in Nigeria and Benin and to search for wild species of seeded bananas that may have natural resistance to bunchy top.

"The virus is controllable and with considerable effort you can get rid of it in a defined area, but history shows us that once the disease is established in one place it usually stays there, so this work may provide the breakthrough we need to get on top of this disease once and for all," said Associate Professor Thomas.

L-R Dr Lee Hickey, Dr Craig Cormick, Dr Alison Van Eenennaam, Professor Robert Henry

Food Evolution movie screening

The TropAg2017 conference kicked off with a free screening of the Food Evolution movie, a documentary looking at public attitudes to GMO foods.

One of the stars of the film, US-based beef biotechnology specialist Dr Alison Van Eenennaam was a guest on a panel discussion immediately following the film's screening. Other panellists included QAAFI's Professor Robert Henry, technology communications specialist Dr Craig Cormick, and was hosted by GM advocate, QAAFI's Dr Lee Hickey.

Super tasting at UQ!

QAAFI's Dr Eugeni Roura recruited a crowd of volunteers to participate in his research on super tasters at the UQ Market Day in February.

Super tasters experience at least one of the five basic tastes with greater intensity. In particular, supertasters show increased sensitivity to bitter and they may dislike strong, bitter foods.

Regulation and market access of gene-edited and GMO food and products

As part of TropAg2017 and National Agriculture Day, QAAFI partnered with the Rural Press Club to host a breakfast seminar on GMOs and gene-edited food and products.

Panellists discussed the work being done with gene editing in Australian agriculture, the market status and global regulatory environment for gene-edited livestock and crops, how gene editing differs from GMOs, and what consumers think.

Facilitator: Neil Lyon, Editor, Grain Central hosted the discussion. Panel speakers were:

- Kevin Diehl, Director Regulatory Strategy and Industry Affairs, DuPont Pioneer, USA
- Professor Robert Henry, Director, Queensland Alliance for Agriculture & Food Innovation
- Stuart Armitage, President, Queensland Farmers' Federation & Darling Downs cotton grower

L-R DAF's Bernadette Ditchfield and Lynne Turner with LSQ's Mario Pennisi at the Rural Press Club breakfast at TropAg.

RURAL PRESS CLUB
WHERE THE BUSH TALKS BUSINESS

NanoBio Innovation in Agriculture

Creating innovative solutions for productive sustainable agriculture.

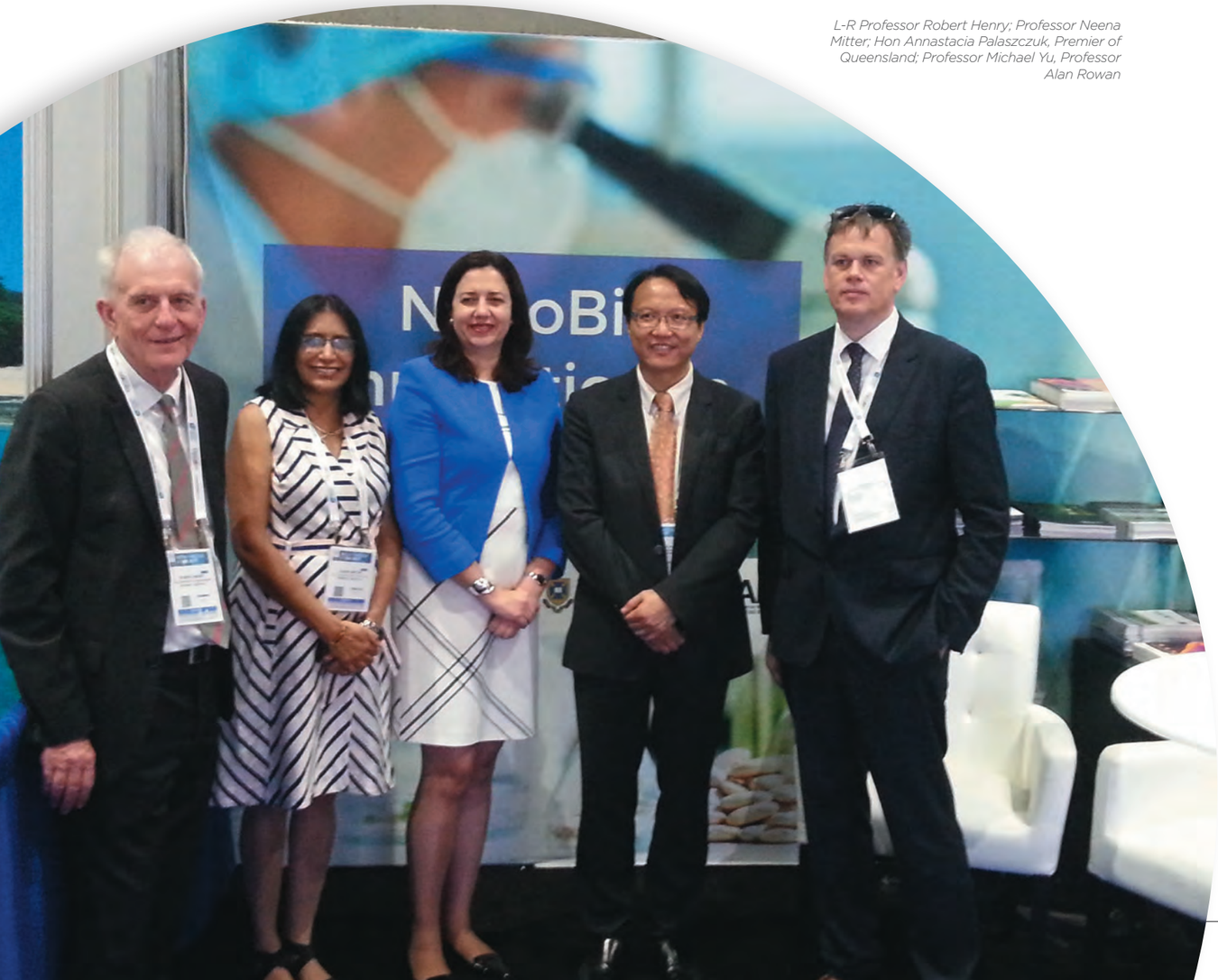
Premier Annastacia Palaszczuk launched a new UQ agricultural nanotechnology initiative, the Nano Bio Innovation in Agriculture hub, at the International BIO2017 conference in San Diego, USA, in June 2017.

Substantial challenges face the future of agricultural production and the global agricultural sector needs to grow more food with less resources while facing new threats from climate change and bio security.

Radical new approaches and disruptive technology can mitigate these challenges.

The Hub for NanoBio Innovation in Agriculture (HNIA) is a unique bridge between scientific discovery and agricultural application. UQ expertise in this field means HNIA has the delivery systems, expertise, and facilities to validate and bring to market new technologies that transform agricultural products and practices.

With commercial partners, outcomes-focused research, and accelerated translation, HNIA is creating advanced materials-based solutions that will seed a sustainable future for communities worldwide.



L-R Professor Robert Henry; Professor Neena Mitter; Hon Annastacia Palaszczuk, Premier of Queensland; Professor Michael Yu, Professor Alan Rowan

QAAFI's Professor Bob Gilbert meets with the Governor of JiangSu Province

Starch structure supplies new clues for human health

A recent discovery about the role of debranching enzymes in starches will have major implications for nutrition and human health, according to Professor Bob Gilbert, Research Professor at The University of Queensland.

Professor Gilbert is one of Australia's most cited polymer chemists and was one of the first non-Chinese recruited under the Chinese Government's prestigious 1000-Talent scheme. He divides his time between Brisbane and China's College of Agriculture, Yangzhou University.

Professor Gilbert heads a research program on the relationship between starch and glycogen structure, and nutrition, diabetes and obesity.

Professor Gilbert said the debranching enzymes discovery was the culmination of more than 10 years of work.

His group have used a range of new experimental and theoretical techniques to investigate what it is about the structure of starches that influence their digestibility.

Starch and glycogen are both highly branched glucose polymers, with very similar chemical structures. Starch is synthesized by plants for energy storage, and also provides about 50 per cent of our food energy. Humans and other animals synthesize glycogen as a glucose (blood-sugar) reservoir.

Foods with a low glycaemic response and resistant starch have major health benefits, so there is considerable interest in developing novel techniques to slow down starch digestion. Rapidly digested foods are implicated in the development of a range of 'modern' diseases including type 2 diabetes, obesity and colorectal cancer.

"For more than a decade we have been asking ourselves questions about the structural characteristics of starches," Professor Gilbert said.

"We know that starches with somewhat longer branches are digested more slowly. However while you can develop a rice variety that is very slow to digest, the problem is that it tastes horrible. People won't eat it willingly unless they are diabetic and they absolutely have to."

Professor Gilbert and his team have been using their data and very advanced theory to develop a novel transgenic way of making plants that are very close to natural or wild type, but which are slower to digest. The first of these plants is now growing under controlled conditions in China.

"These new methods will open doors to a greater understanding of starch and glycogen properties, which in turn will aid researchers in the development of foods with a more favourable digestibility profile," he said.

The team has made recent further breakthroughs in understanding the reason for the variability in amylose chain length in mutant plants compared to wild type plants. The researchers previously thought that debranching enzymes in mutant plant varieties were redundant. However they now believe that this variability provides a certain robustness for germination.

"High environmental variability is not something that is good for plants in their ecological niche," Professor Gilbert says.

"What we have uncovered has allowed us to understand some of the biological driving forces, as well as a new method for fitting amylose data. We have learned something about biological function and we are about to learn a great deal more."

LEARNING

The world awaits you at QAAFI.

If you are a high-achieving student with a keen interest in meeting the challenge of producing enough nutritious food to sustain future generations, then a research higher degree with QAAFI will open doors for you globally.

Join our world-leading researchers and facilities, and gain access to our extensive global industry network.

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

– 2016 PhD graduate and biofuel researcher Adam Healey

Read why QAAFI PhD researcher Cécile Godde is heading to Antarctica on pages 54-55.

Cecile worked with MARS Inc. in Brazil

Why I am going to Antarctica

Cécile Godde is a PhD student with CSIRO and QAAFI at The University of Queensland. She studies sustainable grazing system intensification and is passionate about creating a healthier planet. This passion has taken Cécile from the tropics and sub-tropics to Antarctica, where she took part in the Homeward Bound initiative, which seeks to heighten the influence and impact of women with a science background on the decision-making that shapes our planet.

I want to make a change for a healthier planet

I graduated in 2014 in France, my home country, with a Master's Degree in Agricultural and Environmental Sciences. I am currently a second year PhD candidate at CSIRO and QAAFI at The University of Queensland.

Prior to starting my PhD, I worked for CSIRO, Greening Australia, the International Livestock Research Institute in Costa-Rica, MARS Inc. in Brazil, and the French governmental agency for organic agriculture, Agence BIO, in France.

Although my PhD has a strong focus on agriculture, it incorporates many disciplines and areas of research: biodiversity, climate change, greenhouse gas emissions, animals, food security and human livelihoods, socio-economics, and policies.

Research, contrary to what many people think, is not all about doing some mystical calculations behind a closed door. In my research, I meet and collaborate with a lot of people, learn new things every day, write, design communication tools, give talks, interact with media, and travel.

Photo: ©Jeremy Goldberg

It is a very exciting time to be a woman in science

Opportunities do arise but far too slowly, and prejudices are pervasive. This is a considerable issue as we cannot address our environmental issues without solving gender inequalities.

Research and agriculture is a male-dominated sector, and this sad reality gave me a strong desire to make things change.

I was fortunate to secure an incredible opportunity, together with 79 other women from all around the world, to take part in a worldwide and world-class leadership, strategic and science initiative and outreach for women: the Homeward Bound initiative.

The program aims to heighten the influence and impact of 1000 women with a science background in order to influence policy and decision-making as it shapes our planet over the next 10 years.

Homeward Bound includes a year of leadership, strategic and communication training, culminating on a three-week voyage to Antarctica!

Why Antarctica?

Antarctica is the frame or backdrop for the initiative. Women were widely discouraged from exploring the continent until the mid-20th century, and the United States prohibited American women to work in the region until 1969.

Antarctica is the last true wilderness on the planet, a precious and unique beauty. It is also an extremely fragile natural world, a critical barometer of our planet's health and of our society's behaviour and decisions. The ice is melting at very fast rates, so well past the time to act together for a more equitable and sustainable future.

The science of growing food in Africa

For most of the world's poorest people, 'how to grow food' is a question of life and death. UQ research is helping to change lives.

Queensland agricultural scientists are world leaders in their field, and have particular expertise in tropical climates.

It is this scientific expertise that is being put to work in SIMLESA: an international Research for Development (R4D) project funded by the Australian Centre for International Agricultural Research (ACIAR).

SIMLESA is a partnership between The University of Queensland, the International Maize and Wheat Improvement Centre (CIMMYT) and the governments of Ethiopia, Kenya, Tanzania, Malawi and Mozambique.

The SIMLESA approach

In Africa, the story of food is totally different. Traditional farming systems need to be updated for today's climate and market challenges.

Some people can't find good quality seeds while others are unsure when to plant them or how to space them properly. It's also a huge problem managing weeds when all you have are your hands and a hoe, and most people grow the same crop in the same field every year.

People in Africa have worked tirelessly to address these problems. Governments, Non Government Organisations (NGOs) and private enterprise are working together to lift people out of poverty.

How can small changes solve these problems, and in the process improve people's lives? These are the questions QAAFI research officer Dr Caspar Roxburgh has explored.

"You can't grow enough food for your family if you plant late. You miss the season so you're already playing catch up. But even if you get it right, it won't work if the plants are too crowded," Dr Roxburgh said.

It sounds like basic stuff, but Dr Roxburgh explains that a lot of this research just hasn't been done yet in Africa.

"We work with the farmers in Africa. We find out who's doing the best, learn from them, and then we do the science to back it all up."

Each small change adds up to a bigger impact for families and communities. The research is holistic, looking at each problem as part of a connected system.

"This is a complete overhaul of the system. In some of these communities, people were just figuring it out by themselves," he said.

"They have little education, no computers with internet, no credit access and have a hard time reaching markets. Could you imagine running a business in those conditions?

"But we know how to grow food in these environments, the answers are there, we just need to adapt them and share that knowledge with the people."

– Dr Caspar Roxburgh

ACIAR's general manager Melissa Wood with QAAFI's SIMLESA project manager Daniel Rodriguez examining maize harvested from a SIMLESA trial site in Tanzania.

Example of smart packaging (above)

Oliver Meldrum's vision for a waste-less world earnt him a place in the International Food Technology Challenge Mentor Program, involving a trip to Las Vegas, in 2017, where he met with some of the world's top research groups and NGOs, who are actively involved in tackling the global food challenge.

Waste not, want not

Up to half the world's food is never eaten. QAAFI PhD student Oliver Meldrum believes packaging could be the solution.

Global food security is an emerging challenge with the world population projected to reach 9.7 billion by 2050.There is an urgent need to identify reliable sources of nutritious food to meet the growing demand.

One way we can meet this global challenge is by improving food availability. Reducing food loss and waste across the supply chain from farm-to-fork is a task equally critical for advanced and developing countries.

In developing countries, food waste is compounded by inadequate infrastructure including refrigeration, transport and storage, with edible food more likely to remain unharvested due to a shortage of transport and processing facilities.

In developing and affluent countries alike, consumers enjoy the easy access and convenience of ready-to-eat foods.

Unfortunately, these products tend to be nutritionally poor, containing large amounts of sugar, salt, and saturated fats that are often used to prolong the shelf-life.

The answer?

Active packaging can offer a solution to extend shelf-life and monitor the freshness of highly nutritious, but perishable fresh foods.

The removal of reactive oxygen from a closed package by applying nitrogen gas has been trialled for a number of years to extend freshness.

Recent advances in food labelling has led to temperature sensitive (so called thermochromatic) inks that respond to elevated temperatures and can monitor frozen or chilled foods during transport.

The development of new smart packaging materials is essential to retain freshness, preserve nutritional value and reduce food waste.

It is also key for designing carbon-neutral packaging materials made entirely of renewable sources, such as cellulose.

New scientific developments in the area of cellulose-based nano-materials are capable of replacing millions of tonnes of non-renewable plastic packaging with more sustainable solutions.

This is likely to provide economic benefits, increase food security, and reduce environmental impacts by avoiding the squandering of energy and resources used in packaging production.

In a bigger picture, recovering a portion of this food waste can help to close the gap in food security.

In a world that will need to double food production to avoid large-scale malnutrition, these innovations produce a paradigm shift toward sustainability. This could represent one of the best solutions to ensuring that benefits are felt across the world.

- Oliver Meldrum

Supporting information

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Centre for Animal Science

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Dr Robert Dixon	Senior Research Fellow
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Professor Benjamin Hayes	Professorial Research Fellow
Dr Natasha Hungerford	Research Fellow
Dr Peter James	Senior Research Fellow
Dr Lambros Koufariotis	Research Officer
Dr Maggy Lord	Research Fellow
Associate Professor Timothy Mahony	Principal Research Fellow
Dr Gabriele Netzel	Research Fellow
Dr Lida Omaleki	Research Officer
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Dr Luis Prada E Silva	Senior Research Fellow
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Professor Alan Tilbrook	Professorial Research Fellow
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Centre for Crop Science

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Miss Elizabeth Czislowski	Research Officer
Mr Peter Devoil	Principal Farming Systems Modeller
Dr Joseph Eyre	Research Fellow
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Dr Lee Hickey	Senior Research Fellow
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Dr Reginald Lance	Senior Plant Improvement Consultant
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Dr Stephen Mudge	Research Officer
Dr Louisamarie Parkinson	Research Officer
Dr Andries Potgieter	Senior Research Fellow
Associate Professor Nageswararao Rachaputi	Principal Research Fellow
Mr David Rodgers	Senior IT Support Officer
Associate Professor Daniel Rodriguez	Principal Research Fellow
Dr Caspar Roxburgh	Research Officer
Dr Lila Singh-Peterson	Research Fellow
Dr Yongfu Tao	Research Fellow
Dr Najeeb Ullah	Research Officer
Dr Erik Van Oosterom	Senior Research Fellow
Dr James Watson	Research Fellow
Dr Erin Wilkus	Research Officer
Mr Alemu Woldetensaye	Research Scholar
Dr Chung-Chi Wu	Research Officer

Centre for Horticultural Science

Professor Neena Mitter	**Centre Director, Horticultural Science**
Dr Olufemi Akinsanmi	Senior Research Fellow
Dr Mohammad Alam	Research Officer
Dr Inigo Auzmendi	Research Fellow
Dr Witharanage Basnayake	Research Fellow
Dr Lilia Costa Carvalhais	Research Fellow
Dr Elizabeth Dann	Senior Research Fellow
Associate Professor Ralf Dietzgen	Principal Research Fellow
Professor Andre Drenth	Professorial Research Fellow
Mr Stephen Fletcher	Research Officer
Dr Andrew Geering	Senior Research Fellow
Dr Barbara George-Jaeggli	Research Fellow
Dr Liqi Han	Research Fellow
Associate Professor James Hanan	Principal Research Fellow
Dr Craig Hardner	Senior Research Fellow
Dr Alice Hayward	Advance Qld Postdoc Research Fellow
Dr Karl Robinson	Advance Queensland Research Fellow
Associate Professor John Thomas	Principal Research Fellow
Associate Professor Bruce Topp	Principal Research Fellow
Associate Professor Steven Underhill	Principal Research Fellow
Dr Megan Vance	Research Officer
Dr Yuchan Zhou	Research Fellow

Centre for Nutrition and Food Sciences

Professor Michael Gidley	**Centre Director, CNAFS**
Dr Nadia De Jager	Research Officer
Dr Sushil Dhital	Research Fellow
Dr Bernadine Flanagan	Research Fellow
Dr Chrishanthi Fernando	Research Fellow
Dr Glen Fox	Senior Research Fellow
Dr Agnelo Furtado	Senior Research Fellow
Professor Robert Gilbert	Professorial Research Fellow
Dr Purnima Gunness	Research Fellow
Dr Hung Hong Trieu	Research Officer
Dr Deirdre Mikkelsen	Research Fellow
Dr Michael Netzel	Senior Research Fellow
Dr Timothy O'Hare	Senior Research Fellow
Dr Sandra Olarte Mantilla	Research Officer
Ms Basak Percin	Visiting Research Student
Associate Professor Eugeni Roura	Principal Research Fellow
Dr Kinnari Shelat	Research Fellow
Dr Heather Smyth	Senior Research Fellow
Associate Professor Yasmina Sultanbawa	Principal Research Fellow
Professor Roger Swift	Emeritus Professor
Dr Barbara Williams	Senior Research Fellow
Dr Peng Wu	Research Officer
Dr Dagong Zhang	Senior Research Assistant

QAAFI Honorary and Adjunct Appointments

Honorary Appointments

Associate Professor Rafat Al Jassim	Honorary Associate Professor
Professor Nadaf Altafhusain Balechand	Honorary Senior Fellow
Associate Professor Phillip Banks	Honorary Associate Professor
Dr Marcelo Benvenutti	Honorary Fellow
Professor Frederik Botha	Honorary Professor
Dr Brian Burns	Honorary Senior Research Fellow
Associate Professor David Butler	Honorary Associate Professor QAAFI
Professor Scott Chapman	Honorary Professor
Dr Yashvir Chauhan	Honorary Associate Professor
Professor Stephen Chen	Honorary Professor
Dr Ian Chivers	Honorary Senior Fellow
Professor Geoffrey Fincher	Honorary Professor
Professor Elliot Gilbert	Honorary Professor
Dr Yingbin He	Honorary Senior Fellow
Professor Mario Herrero	Honorary Professor
Professor Wayne Jorgensen	Honorary Professor
Professor Kemal Kazan	Honorary Professor
Associate Professor Stan Kubow	Honorary Associate Professor
Associate Professor Slade Lee	Honorary Associate Professor
Professor Birger Lindberg Moller	Honorary Professor
Professor Qiao-quan Liu	Honorary Professor
Associate Professor Michael Mackay	Honorary Associate Professor
Mr Greg McLean	Honorary Senior Research Fellow
Associate Professor Stuart McLennan	Honorary Principal Research Fellow
Dr Jessica Morgan	Honorary Fellow
Dr Parimalan Rangan	Honorary Senior Research Fellow
Dr Manuel Rodriguez Valle	Honorary Professor
Professor Maurizio Rossetto	Honorary Professor
Professor Michael Rychlik	Honorary Professor
Dr Roger Shivas	Honorary Professor
Professor Blake Simmons	Honorary Professor
Associate Professor Dharini Sivakumar	Honorary Associate Professor
Dr Francesca Sonni	Honorary Fellow
Professor Vincent Vadez	Honorary Professor
Dr Francisco Vilaplana	Honorary Fellow
Dr Stephen Were	Honorary Senior Research Fellow
Professor Rod Wing	Honorary Professor
Professor Colin Wrigley	Honorary Professor
Dr Wai Yong	Honorary Fellow

Adjunct Appointments

Dr Barry Blaney	Adjunct Senior Fellow
Professor Graham Bonnett	Adjunct Professor
Dr Rosalind Gilbert	Adjunct Fellow
Dr Lisa-Maree Gulino	Adjunct Fellow
Dr Jagger Harvey	Adjunct Senior Research Fellow C
Dr Alison Kelly	Adjunct Associate Professor
Dr Izabela Konczak	Adjunct Senior Fellow
Professor Cathrine McIntyre	Adjunct Professor
Ms Sarah Meibusch	Adjunct Associate Professor
Dr Selina Ossedryver	Adjunct Fellow
Ms Diane Ouwerkerk	Adjunct Fellow
Dr Sambasivam Periyannan	Adjunct Senior Fellow
Dr Richard Silcock	Adjunct Senior Fellow
Professor John Skerritt	Adjunct Professor
Associate Professor Youhong Song	Adjunct Associate Professor
Dr Santosh Taware	Adjunct Senior Fellow
Associate Professor Neil White	Adjunct Associate Professor
Professor Graeme Wright	Adjunct Professor

QAAFI Affiliates

Dr David Adamson	Affiliated Senior Research Fellow
Professor Stephen Adkins	Affiliated Professor
Professor Elizabeth Aitken	Affiliated Associate Professor
Professor Stephen Barker	Affiliated Professor
Professor Ross Barnard	Affiliated Professor
Professor Kaye Basford	Affiliated Professor
Professor Michael Bell	Affiliated Professorial Research Fellow
Professor Christine Beveridge	Affiliated Professor
Professor Jose Botella	Affiliated Professor
Professor Wayne Bryden	Affiliated Professor
Professor Bernard Carroll	Affiliated Professor
Dr Alison Cawdell-Smith	Affiliated Senior Fellow
Professor Scott Chapman	Affiliated Professorial Research Fellow
Dr Marisa Collins	Affiliated Senior Research Fellow
Dr Bruce D'Arcy	Affiliated Senior Fellow
Dr Mark Dieters	Affiliated Senior Fellow
Dr Marina Fortes	Affiliated Research Fellow
Professor Shu Fukai	Affiliated Professor
Dr Michael Furlong	Affiliated Associate Professor
Associate Professor Victor Galea	Affiliated Associate Professor
Associate Professor John Gaughan	Affiliated Associate Professor
Professor Elizabeth Gillam	Affiliated Professor
Professor Ian Godwin	Affiliated Professor
Dr Margaret Hardy	Affiliated Research Fellow
Professor Neal Menzies	Affiliated Professor
Professor Murray Mitchell	Affiliated Academic
Dr Miranda Mortlock	Affiliated Research Fellow
Professor Dennis Poppi	Affiliated Professor
Dr Simon Quigley	Affiliated Senior Research Fellow
Professor Peer Schenk	Affiliated Professor
Professor Susanne Schmidt	Affiliated Professor
Professor Bradley Sherman	Affiliated Professor
Associate Professor Kathryn Steadman	Affiliated Associate Professor
Dr Mark Turner	Affiliated Associate Professor
Dr Olivia Wright	Affiliated Research Fellow
Professor Zhiping Xu	Affiliated Principal Research Fellow
Professor Chengzhong Yu	Affiliated Professorial Research Fellow

QAAFI Operational and Technical Staff

QAAFI Technical Staff

Ms Leena Awawdeh	Senior Research Technician
Dr Guta Bedane	Research Assistant
Miss Leanne Bridges	Field Trial Assistant
Dr Miguel Villamil Castro	Research Assistant
Mr Antonino Cavallaro	Senior Research Technician
Mr Kurt Deifel	Technical Officer
Mr Scott Diefenbach	Wheat Research Field Assistant
Mr Mark Eldridge	Research Technician
Miss Laura Haaima	Research Assistant
Mr Edward Howell	Field Trial Assistant
Mr Ritesh Jain	Research Assistant
Ms Shirley Jones	Senior Research Technician
Miss Shannon Landmark	Research Assistant - Beef Breeding
Ms Sylvia Malory	Research Assistant
Mr James McLean	Field Technician
Mr Stuart Meldrum	Senior Research Technician
Ms Codie Murphy	Field Trial Assistant
Dr Marta Navarro-Gomez	Research Assistant
Miss Jasmine Nunn	Field Trial Assistant
Mr Christopher O'Brien	Research Assistant
Ms Cecilia O'Dwyer	Senior Research Technician
Ms Angela O'Keeffe	Senior Research Technician
Mr Jonathan Peters	Research Assistant
Dr Anh Phan	Senior Research Technician
Ms Akila Prabhakaran	Research Assistant
Miss Jane Ray	Research Assistant
Dr Vivian Rincon-Florez	Senior Research Technician
Mrs Reema Singh	Research Assistant
Mrs Hanna Toegel	Assistant Research Technician
Miss Wen Yee	Research Assistant

QAAFI Operations Staff

Miss Rosalee Armitage	Postgraduate Admin Assistant
Mrs Elizabeth Barnes	Centre Administration Officer
Mrs Stephanie Brew	Admin Assistant/Receptionist
Ms Maria Caldeira	Health, Safety and Facilities Officer
Mrs Suzanne Campbell	Centre Administration Officer
Mr Cameron Doig	Research Development Officer
Ms Elizabeth Eden	Centre Administration Co-ordinator
Ms Tyne Hamilton	Digital Marketing Officer
Miss Hannah Hardy	Marketing and Communications Officer - Engagement
Mrs Luba Hickey	Marketing and Communications Officer
Mr Aaron Hughes	Facility Infrastructure Coordinator
Mrs Elizabeth Humphries	Health, Safety and Facilities Manager
Mr Robert Landon	Research Partnerships Manager
Mrs Emma Linnell	Executive Administration Officer
Ms Janelle Low	Centre Administration Officer
Ms Thi Lu	Centre Administrative Officer
Ms Cassie Martinez	Administrative Officer
Ms Sarah Meibusch	Deputy Director, Engagement and Business
Mrs Annie Morley	Executive Assistant to Director
Ms Katie Payne	Senior Postgrad Administrator
Ms Margaret Puls	Marketing and Communications Manager
Miss Melissa Rowan	Centre Administration Officer
Mrs Angela Strelow	Centre Administration Officer
Ms Bronwyn Venus	Senior Res Development Coordinator
Ms Kooliha Vincent-Lucas	Indigenous Trainee
Mr Stephen Williams	Deputy Director

QAAFI Research Higher Degree students in 2017

Australian Inst of Bioengineering & Nanotechnology

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Weiyu	Chen	PhD	Application of clay nanoparticles as efficient adjuvant in vaccine against pathogenic diarrheagenic E. Coli	AsPr Timothy John Mahony	Associate
Jianye	Fu	PhD	Synthesis, characterization and catalytic performance of micro meoporous materials in the hydrodesulfurization reaction of FCC diesel	Dr Peter James	Associate
Manasi	Jambhrunkar	PhD	Protein delivery using designer peptide hydrogels	Prof Neena Mitter	Associate
Liang	Zhao	PhD	Bioengineering of protein-modified nanoparticles on immune reactions.	Prof Neena Mitter	Associate

Faculty of Medicine

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Adnan	Choudhury	PhD	The impact of land use policy on public health, the economy and environment: A Multi-criterion Analysis	Prof Mario Herrero	Associate
Vincent	Lal	PhD	Health risk assessment of mixed contaminants: Interaction of metals on the uptake of polycyclic aromatic hydrocarbons in human liver cells	AsPr Mary Therese Fletcher	Associate
Nida	Murtaza	PhD	Dietary based impacts on host microbe interactions in the gut, to improve health outcomes for IBD and IBS patients	Prof Michael Gidley	Associate

Queensland Alliance for Agriculture & Food Innovation

Muhammad Umair	Ahsan	PhD	Exploring the molecular control of the juvenile to adult phase change in subtropical / tropical trees	Prof Neena Mitter	Principal
Jing	Ai	PhD	Techniques for delivery of high-moisture lower energy density shelf-stable rice snacks	Prof Michael Gidley	Principal
Saleha	Akter	PhD	Elucidating mechanisms of antimicrobial activity of Australian native plant extracts	AsPr Yasmina Sultanbawa	Principal
Samir	Alahmad	PhD	Rapid trait pyramiding in durum wheat (triticum turgidum)	Dr Lee Thomas Hickey	Principal
Fahad	Alderees	PhD	Elucidating mechanisms of antimicrobial activity of Australian native plant extracts	AsPr Yasmina Sultanbawa	Principal
Batlah	Almutairi	PhD	Extraction of oligosaccharides from Australian native food plants and its applications in probiotic food systems	AsPr Yasmina Sultanbawa	Principal
Naveenkumar	Athiyannan	PhD	Molecular genetic characterisation of a broad stem rust resistance gene derived from the D genome progenitor Aegilops tauschii of bread wheat	Dr Sambasivam Periyannan	Principal
Hayba	Badro	PhD	Applications of Genotyping by Sequencing in rice	Prof Robert James Henry	Principal
Yeming	Bai	PhD	Mechanistic exploration of effects of ginseng (a traditional Chinese food additive and medicine) on the digestion rate of starch containing foods	Prof Michael Gidley	Principal
Rewati	Bhattarai	PhD	Effect of food structure on enzymatic digestion of starches	Prof Michael Gidley	Principal
Michael	Bird	PhD	Maximizing gains from selection in Eucalyptus	Dr Craig Hardner	Principal
Alexander	Bui	PhD	Design rules for nutritionally---functional grains	Prof Michael Gidley	Principal
Paula Georgina	Calvo Brenes	PhD	Factors affecting colour in zeaxanthin-biofortified sweet-corn	Dr Timothy James O'Hare	Principal
Carla	Castro Tabilo	MPhil	Salivary and skin biomarkers relevant to perinatal conditioning in pigs	AsPr Eugeni Roura	Principal
Mridusmita	Chaliha	PhD	Exploring the bioactive potential of Terminalia ferdinandiana (Kakadu Plum) ? a native plant of Australia	AsPr Yasmina Sultanbawa	Principal
Bing	Cheng	PhD	Genetic and environmental factors influencing coffee quality	Prof Robert James Henry	Principal
Si-Qian	Chen	PhD	Characterisation of cellulose produced by different Komagataeibacter strains: Towards an improved plant cell wall model	Prof Michael Gidley	Principal
Sungbo	Cho	PhD	Nutrient specific appetite in feather pecking hens	AsPr Eugeni Roura	Principal
William Patrick	Davidson	MPhil	Alternative uses of group H and L herbicides on glyphosate-resistant weed species	AsPr Bhagirath Singh Chauhan	Principal
Eric	Dinglasan	PhD	Understanding the genetic control of quantitative resistance to yellow spot (Pyrenophora tritici-repentis) in wheat (Triticum aestivum L.)	Dr Lee Thomas Hickey	Principal
Trung Kien	Do	PhD	Mango anthracnose in Australia associated with varietal resistance, phenolic compounds and novel antifungal products	Prof Elizabeth Anne Black Aitken	Principal
Shulang	Fei	PhD	Identification of candidate genes for blackleg resistance in canola (Brassica napus)	Prof Neena Mitter	Principal
Guangli	Feng	PhD	Bacteria mediated metabolism of polysaccharides and associated micronutrients in plant cell walls under in vitro and in vivo large intestine conditions	Prof Michael Gidley	Principal
Andrew	Ferguson	PhD	Immunogenetic Differences Underlying Susceptibility of Cattle to Respiratory Disease	AsPr Timothy John Mahony	Principal
Andrew Lincoln	Fletcher	PhD	Understanding transpiration efficiency in wheat to enhance future breeding	Dr Karine Chenu	Principal
Ryan	Fowler	PhD	Pathogenicity of Net Form of Net Blotch (Pyrenophora teres f. teres)	Dr Lee Thomas Hickey	Principal
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	Prof Michael Gidley	Principal
Mekonnen Melaku	Gebremariam	PhD	Enabling rational food design by connecting dynamic sensory perception, oral physiology and food oral processing	Dr Heather Eunice Smyth	Principal
Madeleine	Gleeson	PhD	Regulation of adventitious rooting in avocado for improved clonal propagation technologies	Prof Neena Mitter	Principal
Cecile Marie	Godde	PhD	Assessing the potential for pasture intensification in the tropics	AsPr Daniel Rodriguez	Principal
Mingxia	Han	PhD	Carotenoid bioavailability related to molecular organisation	Prof Michael Gidley	Principal
Solomon	Hassen	PhD	Rules and opportunities: Designing more productive and resilient cropping system strategies for central and southern Rift Valley of Ethiopia	AsPr Daniel Rodriguez	Principal
Jayeni Chathurika Amarathunga	Hiti Bandaralage	PhD	Tissue culture as an efficient, cost effective and disease free alternative for clonal avocado rootstock production	Prof Neena Mitter	Principal
Katrina	Hodgson-Kratky	PhD	Genomics of sugarcane bioenergy traits	Prof Robert James Henry	Principal
Colleen	Hunt	PhD	Statistical analysis of sorghum breeding trials with complex genetic components	Prof David Jordan	Principal
Amjad	Iqbal	PhD	Dietary manipulation of nutrient specific appetites and feed particle size in broilers for improved growth uniformity	AsPr Eugeni Roura	Principal
Dilani Tharanga Senevirathna	Jambuthenne Gamaralalage	PhD	Mining novel genes for adult plant resistance to stripe rust in wheat landraces	Dr Lee Thomas Hickey	Principal
Olumide	Jeff-Ego	PhD	Occurence and virulence of phytophthora species in macadamia in Australia	Dr Olufemi Akinyemi Akinsanmi	Principal
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	Prof Alicja Elzbieta Tabor	Principal
Asad	Khan	PhD	Biology of Amarathus hybridus, A. mitchelli, and A. powelii: emerging weeds of cotton systems	AsPr Bhagirath Singh Chauhan	Principal
Ai Hwee	Kho	PhD	Rapid detection of nematodes in sheep and goats using near-infrared spectroscopy (NIRS)	Dr Peter James	Principal
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	Prof Robert James Henry	Principal
Emily Kathryn	Lancaster	PhD	Epidemiology, impact and management of myrtle rust in Lemon Myrtle plantations	Prof Andre Drenth	Principal
Haiteng	Li	PhD	Gut microbial response to diverse forms of resistant starch	Prof Michael Gidley	Principal
Zhi Xian	Lim	PhD	Topical application of bioclay to protect crop plants from insect pests	Prof Neena Mitter	Principal
Shiyi	Lu	PhD	Bacterial fermentation of cellulose--?based composites as plant dietary fibre	Prof Michael Gidley	Principal
Mukund	Madhav	PhD	Transinfection of buffalo flies with Wolbachia and characterisation of its biological effects	Dr Peter James	Principal
Thi Phuong Thuy	Mai	PhD	Application of genomics in Macadamia breeding	AsPr Bruce Leonard Topp	Principal
Annelie	Marquardt	PhD	The molecular analysis of yellow canopy syndrome-induced yellowing in the sugarcane leaf	Prof Frederik Botha	Principal
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	Prof Robert James Henry	Principal
James Lawrence	McLean	MPhil	Proximal and remote sensing as tools to assist data collection in extensive maize and sorghum agronomic trials	AsPr Daniel Rodriguez	Principal
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	Prof Michael Gidley	Principal
Anahita	Mizani	PhD	Towards high density production systems for mango: architectural analysis of vigour management techniques	AsPr James Scott Hanan	Principal
Ali	Mohammad Moner	PhD	Exploring gene diversity in the genome of wild rice populations	Prof Robert James Henry	Principal
Maximiliano	Muller Bravo	PhD	Nutritional interventions in piglets to improve post--weaning health outcomes	AsPr Eugeni Roura	Principal
William	Nak	PhD	Tropical application of RNA interference to modulate plant gene expression	Prof Neena Mitter	Principal
Kim Seng Galex	Neoh	PhD	Assessing Australian wheat quality for Japanese ramen noodles	Dr Glen Patrick Fox	Principal
Thu Ha	Ngo	PhD	Post-translational processing of the caulimovirid capsid protein and utilisation of antipeptide antibodies for diagnosis	Dr Andrew David William Geering	Principal

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Thi Le Thoa	Nguyen	PhD	Structure and Functionality of Oat Carbohydrates	Dr Glen Patrick Fox	Principal
Dongdong	Ni	PhD	Plant cell wall architecture and molecular organisation	Prof Michael Gidley	Principal
Sharon	Nielsen	PhD	Multiphase Design and Linear Mixed Model analysis of NIR scanning data	Dr Glen Patrick Fox	Principal
Shahram	Niknafs	PhD	Nutrient-specific appetite in poultry	AsPr Eugeni Roura	Principal
Alexander	Nilon	PhD	Bioclay for Control of Tomato Spotted Wilt Virus	Prof Neena Mitter	Principal
Ravi Chandrabhan	Nirmal	PhD	Analysis of gene expression in the developing seed with the quality of wheat	Prof Robert James Henry	Principal
Christopher	O'Brien	PhD	Cryopreservation of Avocado shoot tips for the conservation of Persea Germplasm	Prof Neena Mitter	Principal
Katie	O'Connor	PhD	Application of genomics in genetic improvement of Macadamia	AsPr Bruce Leonard Topp	Principal
Adam	O'Donoghue	PhD	Assessing the bioactivity of tomato extracts from varieties with unique carotenoid profiles on human in vitro prostate cancer cell lines	Dr Timothy James O'Hare	Principal
Oladapo	Olukomaiya	PhD	Evaluation of natural antioxidant sources as functional ingredients in animal feed	AsPr Yasmina Sultanbawa	Principal
Sarah Karen	Osama	PhD	Identifying genes for resistance to pre-harvest sprouting and black point in barley (Hordeum vulgare)	Dr Glen Patrick Fox	Principal
Rousset Leslie	Palou Egoaguirre	PhD	Use of plant derived compounds to condition piglet intake at weaning and reduce post-weaning use of therapeutics	AsPr Eugeni Roura	Principal
Virginie	Perlo	PhD	Discovery of molecular control of variation in carbon partitioning in sugarcane	Prof Robert James Henry	Principal
Prudence	Powell	PhD	A Plant Model for Diabetes	Prof Robert Gilbert	Principal
Vishal	Ratanpaul	PhD	Cereal food innovation through understanding mechanisms underlying nutritional value	Prof Michael Gidley	Principal
Jane	Ray	PhD	Diversity and diagnostics of Ralstonia species that cause bacterial wilts of bananas	Prof Andre Drenth	Principal
Hannah	Robinson	PhD	Investigating root traits to improve drought adaptation in barley	Dr Lee Thomas Hickey	Principal
Mahendraraj	Sabampillai	PhD	Genotypic variation for effect of heat stress during reproductive phase in pigeonpea.	Dr Nageswararao Chenchu Rachaputi	Principal
Samira	Samarfard	PhD	Potential exotic virus threats to Lucerne seed production in Australia	AsPr Ralf G Dietzgen	Principal
Aaron	Schulze	MPhil	Bio-actives:Value-adding to Industrial Hemp Production	AsPr Mary Therese Fletcher	Principal
Zeping	Shao	PhD	Satiation driven by functional bitter compounds from horticultural vegetables	AsPr Eugeni Roura	Principal
Raghvendra	Sharma	PhD	Molecular genetic characterisation of rust disease resistance genes from Vavilov's wheat collection	Dr Sambasivam Periyannan	Principal
John	Smith	PhD	The impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton in southern QLD	Prof Michael John North Bell	Principal
Keyu	Tao	MPhil	Understanding the molecular mechanisms controlling sensory properties in starchcontaining foods	Prof Robert Gilbert	Principal
Pridhuvi	Thavaraj	PhD	The Effect of Dietary Fibre on the Perception of Taste and Energy Intake in Humans	AsPr Eugeni Roura	Principal
Alemu	Tirfessa Woldentensaye	PhD	Identification of sorghum plant types adapted to moisture stress areas in Ethiopia	Dr Erik Jan Van Oosterom	Principal
Benjamin David	Toft	PhD	Phenotypic and genotypic diversity in canopy architecture and crop load for improved macadamia production	AsPr James Scott Hanan	Principal
Nga	Tran	PhD	Identity, population biology and development of molecular diagnostic tools for early detection and control of the citrus scab fungus Elsinoe spp	Prof Andre Drenth	Principal
Thi Minh Hue	Tran	PhD	Genomic studies of biochemical compounds determining arabica coffee (Coffea arabica L.) quality	Prof Robert James Henry	Principal
Prameela	Vanambathina	PhD	Development and application of molecular tools to identify pest and drought resistance traits in the Australian wild pigeonpea	Dr Nageswararao Chenchu Rachaputi	Principal
Ji	Wang	MPhil	Bitter taste sensitivity and feed intake in pigs	AsPr Eugeni Roura	Principal
Ming	Wang	PhD	Pattern-Oriented Modelling of Biological Systems in Australian Orchards	AsPr James Scott Hanan	Principal
Shaoyang	Wang	PhD	Native Australian Plant Floods - the solution for removing chemical preservatives from wine	Dr Heather Eunice Smyth	Principal
Xuemin	Wang	PhD	Enhancing genomic selection through the use of crop modelling	Prof David Jordan	Principal
Amy Elizabeth	Watson	PhD	Understanding the genetics of grain quality and development of new breeding methodologies in wheat (Triticum aestivum L.)	Dr Lee Thomas Hickey	Principal
-	Widaningrum	PhD	Microbial fermentation of insoluble plant dietary fibres.	Prof Michael Gidley	Principal
Tristan	Wimpenny	PhD	Identification of the role of microRNAs in Bovine Herpesvirus 1 replication and virulence.	AsPr Timothy John Mahony	Principal
Melissa	Wooderson	MPhil	Analgesia and haemostasis to achieve high standards of calf welfare and healing during castration, dehorning, branding and ear marking	Dr Geoffry Fordyce	Principal
Elizabeth	Worrall	PhD	Crop protection through topical application of clay based nanoparticles to deliver RNAi	Prof Neena Mitter	Principal
Jia-Yee Samantha	Yap	PhD	The evolution of Australia's modern rainforest assemblages: competitive advantage vs rapid invasions	Prof Maurizio Rossetto	Principal
Shiyao	Yu	PhD	Genetically modified corn using site directed mutagenesis	Prof Robert Gilbert	Principal

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Wen Wen	Yu	PhD	Towards new means of prevention and health maintenance for diabetes: new characterization techniques for starch and glycogen	Dr Glen Patrick Fox	Principal

School of Agriculture and Food Sciences

Yaqoub	Al-Hosni	PhD	Evaluation of Chronic and Acute Heat Stress on Physiology, Rumen Fermentation and Microbiota of Feedlot Cattle	AsPr Rafat Al Jassim	Associate
Faisal Saeed M	Alsenani	PhD	Screening and isolation of natural health products and new antibiotics from microalgae	Dr Michael Erich Netzel	Associate
Monia	Anzooman	PhD	Understanding physiological basis for wheat genotypes adaption on sodic, magnesic or dispersive soils	Dr John Christopher	Associate
Ali Ahsan	Bajwa	PhD	Invasion biology, interference and management of parthenium weed (Parthenium hysterophorus L) in agro-ecosystem	AsPr Bhagirath Singh Chauhan	Associate
Zhong Xiang	Cheah	PhD	Genetic and Agronomic Zinc Biofortification in Sweet-corn	Prof Michael John North Bell	Principal
Elvis Teng	Chua	PhD	Development of a pipeline for EPA and other high-value compounds from Nannochloropsis	Dr Gabriele Annette Netzel	Associate
Elizabeth	Czislowski	PhD	Characterisation of putative pathogenicity SIX genes in Fusarium oxysporum f.sp. cubense.	Prof Neena Mitter	Associate
Sara	Ghorbani Gorji	PhD	Identifying natural products for improving the quality and shelf life of mayonnaises and salad dressings	Dr Heather Eunice Smyth	Associate
Nadeem	Iqbal	PhD	Ecology and management of weeds in glyphosate resistant cotton (Gossypium hirsutum L.)	AsPr Bhagirath Singh Chauhan	Associate
Karen	Massel	PhD	Optimisation & utilisation of CRISPR/cas9 to further the understanding of nitrogen use efficiency in sorghum bicolor	Dr Emma Sian Mace	Associate
Donald	McMurrich	MPhil	Canopy Manipulation of Sorghum to create a more efficient, stress tolerant plant with increased yield.	Dr Glen Patrick Fox	Associate
Windu	Negara	PhD	Improving the efficiency of rumen function - when to intervene	AsPr Athol Klieve	Principal
Lara-Simone	Pretorius	PhD	Identifying the phytotoxic metabolites of Fusarium oxysporum to develop new approaches for disease resistance in plants.	Dr Andrew David William Geering	Associate
Yadav	Sharma Bajagai	PhD	Effects of probiotics in productivity and health of poultry.	AsPr Athol Klieve	Principal
Maria	Sulman	PhD	Developing a potato value chain from the raw material to the processed chip	Prof Robert Gilbert	Associate
Yan Yan	Tang	PhD	Development and characterisation of functional food from microalgae	Dr Michael Erich Netzel	Associate
Susan	Thompson	PhD	Diaporthe species responsible for stem cankers on sunflower in Australia	Dr Roger Graham Shivas	Associate
Nghia Khang	Tran	PhD	Bioactive compounds from rice bran	Prof Michael Gidley	Associate
Lourdes	Urban Alandete	PhD	Developing methods to maximize the shelf life of manufactured food products containing whole grains	Prof Michael Gidley	Associate
Jason Brett	Weare	MPhil	The nutritional management of grazing dairy cows on a PMR system subjected to environmental heat stress.	AsPr Rafat Al Jassim	Associate
Kylie	Wenham	PhD	Investigation into the emerging soil borne disease of peanut ? Neocosmospora root rot	Prof Graeme Charles Wright	Associate
Belinda	Worland	PhD	Identification of nitrate transporters and corresponding regulatory and metabolic genes under variable conditions of nitrate supply in diverse Sorghum bicolor genotypes for improved nitrogen use	Dr Emma Sian Mace	Associate
Lu	Yu	PhD	Enhancing the quality of ready-to-eat rice using high pressure processing	Prof Robert Gilbert	Associate

School of Biological Sciences

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Tinashe	Chabikwa	PhD	An investigation into the role of sugars and hormones in plant architectural development from a molecular perspective	AsPr James Scott Hanan	Associate

Indeewari	Dissanayake	PhD	Regulatory mechanisms underlying wheat root developmental plasticity in response to nitrate and phosphate deficiency	Dr Lee Thomas Hickey	Associate
Tahsha	Say	PhD	Elucidating the molecular mechanisms underlying sponge-microbial signalling during settlement of Amphimedon queenslandica larvae	AsPr Eugeni Roura	Associate

School of Chemical Engineering

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

School of Chemistry and Molecular Biosciences

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Chin Hong	Lee	PhD	Biological and biochemical function of DEFECTIVE EMBRYO and MERISTEM (DEM) in plants	Prof Neena Mitter	Associate
Loan To	Nguyen	PhD	Whole genome differential gene expression and marker discovery associated with pubertal development in beef cattle	Prof Stephen Moore	Associate
Xinle	Tan	PhD	Mechanisms of glycogen assembly	Prof Robert Gilbert	Associate

School of Human Movement and Nutrition Sciences

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

School of Veterinary Science

First Name	Last Name	Program	Project Title	Advisor Full Name	Advisor Role
Leena	Awawdeh	PhD	Studies on avian pathogenic Escherichia coli in commercial broiler Chicken in South East Queensland	Dr Cornelia Turni	Associate
Agnes	Dela Cruz	MPhil	Studies on porcine circovirus-2 (PCV-2) infection of pigs in the Philippines and Australia	Dr Cornelia Turni	Associate
Lesley	Duffy	PhD	Campylobacter in poultry processing, selection and survival	AsPr Patrick Joseph Blackall	Associate
Patricia Tracy	Eats	PhD	Compassion fatigue in dairy farming in the new millenium: characterisation of the impacts to humans and animals via routine occupational trauma to Queensland dairy farm workers.	Prof Alan John Tilbrook	Associate
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	Prof Benjamin Hayes	Associate
David	Wakeham	PhD	Multidrug resistant pathogenic Escherichia coli isolated from livestock - significance to animal and public health	Prof David Jordan	Associate

QAAFI graduates in 2017

First Name	Last Name	Program	Project Title	Degree Award Date	Advisor Full Name	Advisor Role
Fahad	Al-Asmari	PhD	Antimicrobial activity of plant extracts and photosensitization against pathogenic and food spoilage fungi occurring on fresh date (Phoenix dactylifera L.) fruits	22/09/2017	AsPr Yasmina Sultanbawa	Principal
Titilayo Diana Omozejele	Falade	PhD	Factors related to differential occurrence rates of aflatoxins in maize grains: investigations with near infrared spectrometry and metabolite analysis	30/01/2017	Dr Glen Patrick Fox	Principal
Minghai	Fu	PhD	Dietary Manipulation of Feed Intake in Pigs by Bitter Compounds	06/10/2017	AsPr Eugeni Roura	Principal
.	Geetika	MPhil	Role of Leaf Photosynthesis and Stomatal Conductance in determining the Genotypic Variation in Whole-Plant Transpiration Efficiency (TE) in Sorghum	22/05/2017	Dr Erik Jan Van Oosterom	Principal
John	Gorham	PhD	Changes to gut bacteria composition and diversity by the addition of soluble dietary fibres to porcine diets: human health implications.	16/06/2017	Dr Deirdre Mikkelsen	Principal
Lucas	Grant	PhD	Fruit components and their effects on the gastrointestinal bacterial community	29/08/2017	Dr Barbara Anne Williams	Principal
Adam	Healey	PhD	Genomic and phenotypic characterization of commercial Corymbia hybrids for lignocellulosic biofuel production	10/02/2017	Prof Robert James Henry	Principal
Nam Van	Hoang	PhD	Analysis of genes controlling biomass traits in the genome of sugarcane (Saccharum spp. hybrids)	22/05/2017	Prof Robert James Henry	Principal
Wanporn	Khemmuk	PhD	Plant pathogenic Magnaporthales in Australia, with particular reference to Pyricularia oryzae on wild and cultivated rice	10/04/2017	Dr Andrew David William Geering	Principal
Hongyan	Li	PhD	Understanding the texture of cooked rice from the molecular, instrumental and sensory levels	14/07/2017	Prof Robert Gilbert	Principal
Jarud	Muller	MPhil	Dehydration as a risk factor for calf mortality in northern Australia	17/11/2017	Dr Geoffry Fordyce	Principal
Nascimento Salomao	Nhantumbo	PhD	Residue Management Strategies for the Rainfed N-Deprived Maize-legume Cropping Systems of Central Mozambique	30/01/2017	AsPr Daniel Rodriguez	Principal
Louisamarie	Parkinson	PhD	Investigating soilborne nectriaceous fungi impacting avocado tree establishment in Australia	22/09/2017	Dr Elizabeth Kathryn Dann	Principal
Nia	Patriyawaty	MPhil	Genotypic variation for tolerance to high temperature stress during reproductive phase in mungbean [Vigna radiata (L.) Wilczek]	22/09/2017	Dr Nageswararao Chenchu Rachaputi	Principal
David	Poppi	PhD	Elucidation of the roles and requirements of sulphur amino acids in the diet of barramundi (Lates calcarifer).	03/11/2017	Prof Stephen Moore	Principal
Cecile	Richard	PhD	Breeding wheat for drought adaptation: Development of selection tools for root architectural traits	03/11/2017	Dr John Christopher	Principal
Caspar	Roxburgh	PhD	Drivers for high yield in rainfed cropping: A comparative analysis between Manica, Mozambique and Queensland Australia	10/04/2017	AsPr Daniel Rodriguez	Principal
Solomon Admassu	Seyoum	PhD	Optimising Genotype x Environment x Management Interactions to Enhance Maize Productivity in Variable Agro-Climates of Eastern and Southern Africa	02/06/2017	Dr Nageswararao Chenchu Rachaputi	Principal
Abhijeet	Survase	PhD	Genomics of consumer traits in chapatti quality	20/12/2017	Prof Robert James Henry	Principal
Benigni Alfred	Temba	PhD	Occurrence of Mycotoxins in Harvested Maize in Kenya and Tanzania and Postharvest Control by Photosensitization	10/04/2017	AsPr Mary Therese Fletcher	Principal
Tiparat	Tikapunya	PhD	Grain quality of Australian wild rice (compared to domesticated rice)	06/10/2017	Prof Robert James Henry	Principal
Peterson Weru	Wambugu	PhD	Genomic characterization of African cultivated and wild Oryza species	08/05/2017	Prof Robert James Henry	Principal
Shirani	Widana Gamage	PhD	Thrips-Tospovirus-Plant Molecular Interactions: Studies on capsicum chlorosis virus	14/07/2017	AsPr Ralf G Dietzgen	Principal
Laura	Ziems	PhD	Dissecting the genetic interactions associated with Rph20-based leaf rust resistance in barley: 'minor genes' with major implications	16/06/2017	Dr Lee Thomas Hickey	Principal
Wei	Zou	PhD	Mechanism of Reduction in Starch Digestion Rate of Durum Wheat by Protein	28/02/2017	Prof Robert Gilbert	Principal

Publications

Book Chapter

Aime, M., McTaggart, A., Mondo, S. & du Plessis, S. (2017) Phylogenetics and phylogenomics of rust fungi. In (Eds.), Fungal phylogenetics and phylogenomics (pp. 267-307). Cambridge, MA., United States: Academic Press (Elsevier Press).

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Batey, I., Wrigley, C.* & Miskelly, D. (2017) Industrial processing of grains into co-products of protein, starch, oils and fibre. In Colin Wrigley, Ian Batey, Diane Miskelly (Eds.), Cereal grains: assessing and managing quality 2nd ed. (pp. 635-652). Kidlington, United Kingdom: Woodhead Publishing (Elsevier).

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Fox, G. & O'Hare, T. (2017) Analysing maize grain quality. In (Eds.), Achieving sustainable cultivation of maize: volume 1 (pp. 1-24). Cambridge, England: Burleigh Dodds Science Publishing.

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Geethalakshmi, V., Mehreteab, T., Lakshmanan, A., Borrell, A.*, Nagothu, U., Arasu, M. et al. (2016) System of rice intensification: climate-smart rice cultivation system to mitigate climate change impacts in India. In Udaya Sekhar Nagothu (Eds.), Climate change and agricultural development: improving resilience through climate smart agriculture, agroecology and conservation (pp. 232-258). Abingdon, Oxon, United Kingdom: Routledge.

Hayes, M., Mylotte, R. & Swift, R.* (2017) Humin: its composition and importance in soil organic matter. In Donald L. Sparks (Eds.), Advances in agronomy (pp. 47-138). Cambridge, MA United States: Academic Press.

Indrasumunar, A.*, Gresshoff, P.* & Scott, P.* (2017) Prospect of the legume tree Pongamia pinnata as a clean and sustainable biodiesel feedstock. In (Eds.), Clean energy for sustainable development (pp. 399-417). Amsterdam, The Netherlands: Elsevier.

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Lees, A., Lees, J., Sejian, V. & Gaughan, J. (2017) Management strategies to reduce heat stress in sheep. In (Eds.), Sheep Production Adapting to Climate Change (pp. 349-370). : Springer Singapore.

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Journal Article

Ababaei, B.* & Etedali, H. (2017) Water footprint assessment of main cereals in Iran. Agricultural Water Management, 179: 401-411.

Abbaraju, P.*, Meka, A.*, Song, H.*, Yang, Y.*, Jambhrunkar, M., Zhang, J.* et al. (2017) Asymmetric silica nanoparticles with tunable head-tail structures enhance hemocompatibility and maturation of immune cells. Journal of the American Chemical Society, 139(18): 6321-6328.

Abbaraju, P.*, Yang, Y.*, Yu, M.*, Fu, J.*, Xu, C.* & Yu, C.* (2017) Core-shell-structured dendritic mesoporous silica nanoparticles for combined photodynamic therapy and antibody delivery. Chemistry - An Asian Journal, 12(13): 1465-1469.

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Aithal, S., Kei, J.*, Aithal, V.*, Manuel, A.*, Myers, J.*, Driscoll, C.* et al. (2017) Normative study of wideband acoustic immittance measures in newborn infants. Journal of Speech Language and Hearing Research, 60(5): 1417-1426.

Akinsanmi, O.* & Drenth, A.* (2017) Characterisation of husk rot in macadamia. Annals of Applied Biology, 170(1): 104-115.

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Alam, M.*, van Oosterom, E.*, Cruickshank, A., Jordan, D.* & Hammer, G.* (2017) Predicting tillering of diverse sorghum germplasm across environments. Crop Science, 57(1): 1-10.

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