THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

QAAFI
Queensland Alliance for Agriculture and Food Innovation

ARC funds bush foods research

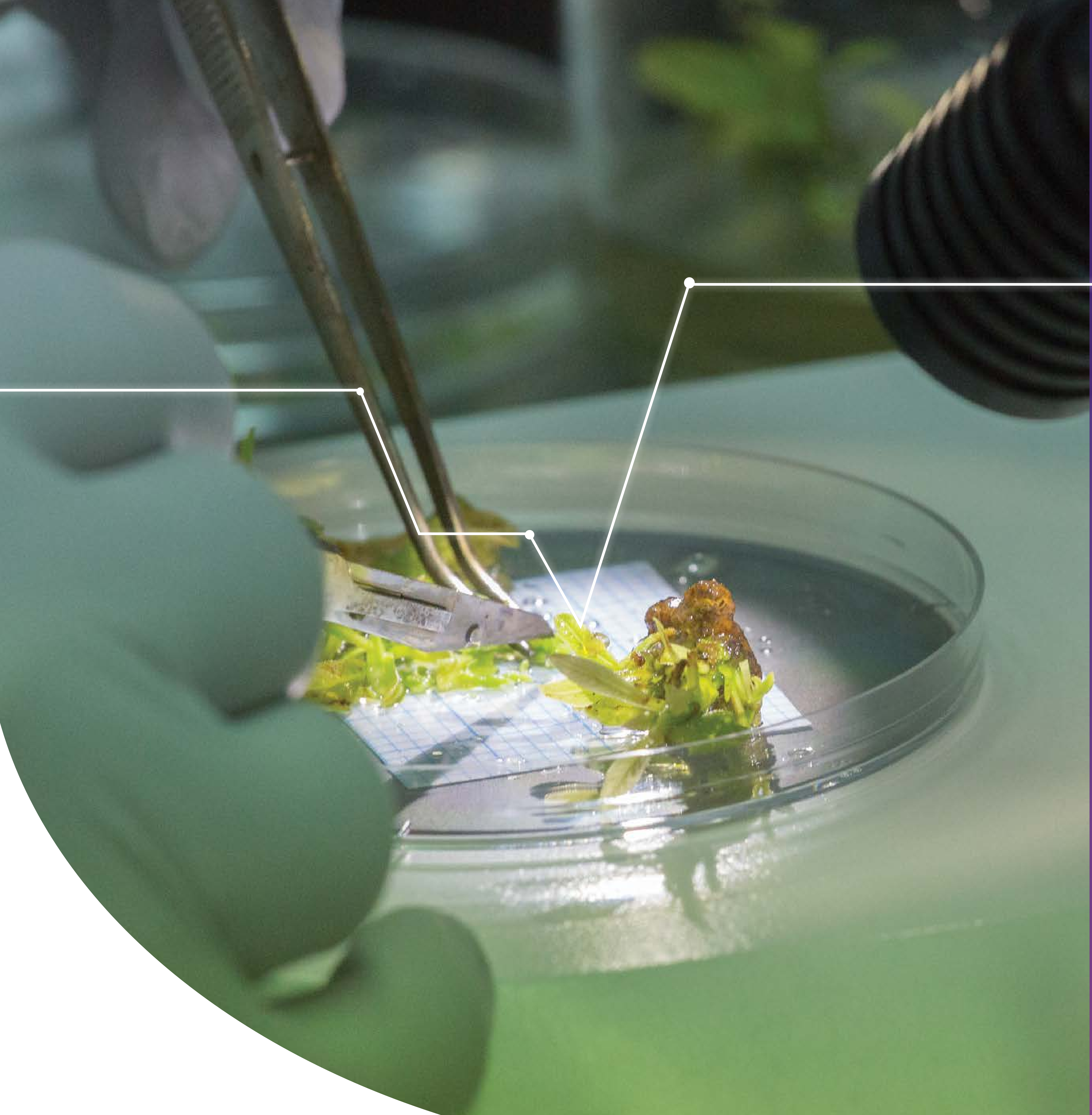
QAAFI's Associate Professor Yasmina Sultanbawa heads a new ARC Training Centre for Uniquely Australian Foods, supported by the Australian Research Council's Industrial Transformation Training Centre funding scheme, the Department of Agriculture and Fisheries, and The University of Queensland. Researchers plan to transform the native food and agribusiness sector through development of selected crops, foods and ingredients. An Indigenous governance group will oversee the process of converting traditional knowledge into branded products.

See also wattle seed bread rolls story on page 34.

Queensland Alliance for Agriculture and Food Innovation

Annual Report 2018

CONTENTS



ABOUT QAAFI

QAAFI is an agricultural and food sciences research institute of The University of Queensland – one of the world's leading research providers in tropical and subtropical agriculture and food production.

We deliver high-impact science for sustainable agriculture and food – across crops, horticulture, animals, and nutrition and food sciences, and are supported by industry and the Queensland Government.

Message from the Vice-Chancellor

Living in the bioeconomy

The digital revolution is transforming agriculture in the way it has transformed other key industries such as telecommunications, banking and mining.

Digital technologies constitute critical enabling infrastructure vital to the global transition from a fossil fuel-based economy to a bio-based one. This transition involves using renewable biological resources more sustainably to produce food, energy and industrial goods, and in developing completely new products and processes.

The University of Queensland (UQ) is well placed to deliver such innovative and sustainable solutions.

At UQ's Queensland Alliance for Agriculture and Food Innovation (QAAFI), agricultural and food science researchers have developed deep and extensive relationships with Australian and international farming communities, industry and government agencies.

QAAFI was established in 2010 as a joint alliance with the Queensland Government. By December 2018, it had generated more than $300 million in research funding to the benefit of the agriculture and food industries. In 2023, that figure is projected to be more than $500 million.

QAAFI's dedicated research capability – spanning crop, horticulture, animal and food and nutrition sciences – has helped to deliver research solutions to Queensland industries, and to tropical and sub-tropical agriculture and food systems globally.

One example of this is our investment in the sorghum pre-breeding program, made over 20 years, in collaboration with the Department of Agriculture and Fisheries (DAF) and the Grains Research and Development Corporation (GRDC). From a total investment of $78.4 million (in present value terms), total gross benefits of $696.5 million (in present value terms) have been generated, equating to a benefit-cost ratio of 8.9 to 1.

With the United Nations projecting the world's population will be approaching 10 billion by 2050, agriculture and food research remains more important than ever. And UQ-led innovations such as prediction-based crop improvement, speed breeding, beef genomics, tissue culture propagation, rapid detection of new pathogens which threaten industries like the banana and avocado industries, and sustainable development of Australian bush foods, provide a platform for step-changes in the way food is produced globally.

I thank Professor Robert Henry, who has led QAAFI since its inception, and QAAFI's dedicated team members, for their ongoing remarkable and important work.

Professor Peter Høj AC,
Vice-Chancellor and President of The University of Queensland

QAAFI: Delivering IMPACT

The University of Queensland is a global leader in agriculture and food.

Income

$45.5 million
Total research 2018

$370 million
Total contracted to date

$527 million
Total projected income to 2023

People

406 People 2018

19 Higher degrees awarded 2018

78 Higher degrees awarded since 2014

Engagement

210 Active contracts 2018

346 Industry presentations 2018

14 Facilities in Queensland and China

Rankings

#1 in Agriculture in Australia*

#4 in Agriculture in the world*

#5 Excellence in Research for Australia#

*NTU Performance Ranking of Scientific Papers for World Universities 2018 #Australian Research Council 2018

Honourable Mark Furner MP Queensland Minister for Agriculture Industry Development and Fisheries visited QAAFI on 2 July 2018 to meet with a number of women researchers at QAAFI, including (left to right) Dr Alice Hayward, Professor Neena Mitter, Dr Louisa Parkinson, Ms Anahita Mizani, Associate Professor Mary Fletcher and Associate Professor Yasmina Sultanbawa.

Message from the Minister

Growing Queensland agriculture

From its formation in 2010, the Queensland Alliance for Agriculture and Food Innovation, or QAAFI as we have come to know it, has grown to become a highly successful collaboration between government, academia and industry.

Agriculture is vital to Queensland. In 2017-18, the total value of Queensland's primary industry output was $20 billion, despite much of the state being drought-declared. This is a significant increase of 11% over the five-year average.

The Department of Agriculture and Fisheries seeks to create the conditions for successful agribusiness and supply chains that facilitate innovation and productivity – as well as meeting the challenges of climate and sustainable use of natural resources.

We support growth in market opportunities for Queensland food and produce, particularly in Asia, and safeguard Queensland's reputation for producing safe, clean and green, and nutritious food.

An important strategy for the Queensland Government in achieving these objectives is our investment in the R&D capability for agriculture and food in Queensland, and a key component in this investment is our strategic alliance with The University of Queensland in the QAAFI research institute.

The University of Queensland is ranked among the world's best agricultural research institutions – ranked #17 worldwide and #1 in Australia for agriculture, according to the latest QS World University Rankings by Subject 2019; and #4 worldwide and #1 in Australia for agriculture, according to the NTU Performance Ranking of Scientific Papers for World Universities.

This world-leading research capability in Queensland enables us to help our agriculture and food industries meet the challenges of climate variability and sustainable intensification of farming methods.

A good example of this is the recent Horticultural Tree Genomics project, where the Department's research staff are working with QAAFI, Queensland University of Technology, Hort Innovation and other collaborators to compile a detailed genomic blueprint of key horticultural crops such as avocados, mango, macadamia, and citrus fruit varieties.

This information will underpin the sustainable intensification of Queensland's horticultural industries and also deliver the world's first detailed map of the avocado genome. The Tree Genomics project also maps the genetics of these crops to performance of horticultural crops in the field, which will provide the industry with better data in selecting crops for key performance traits.

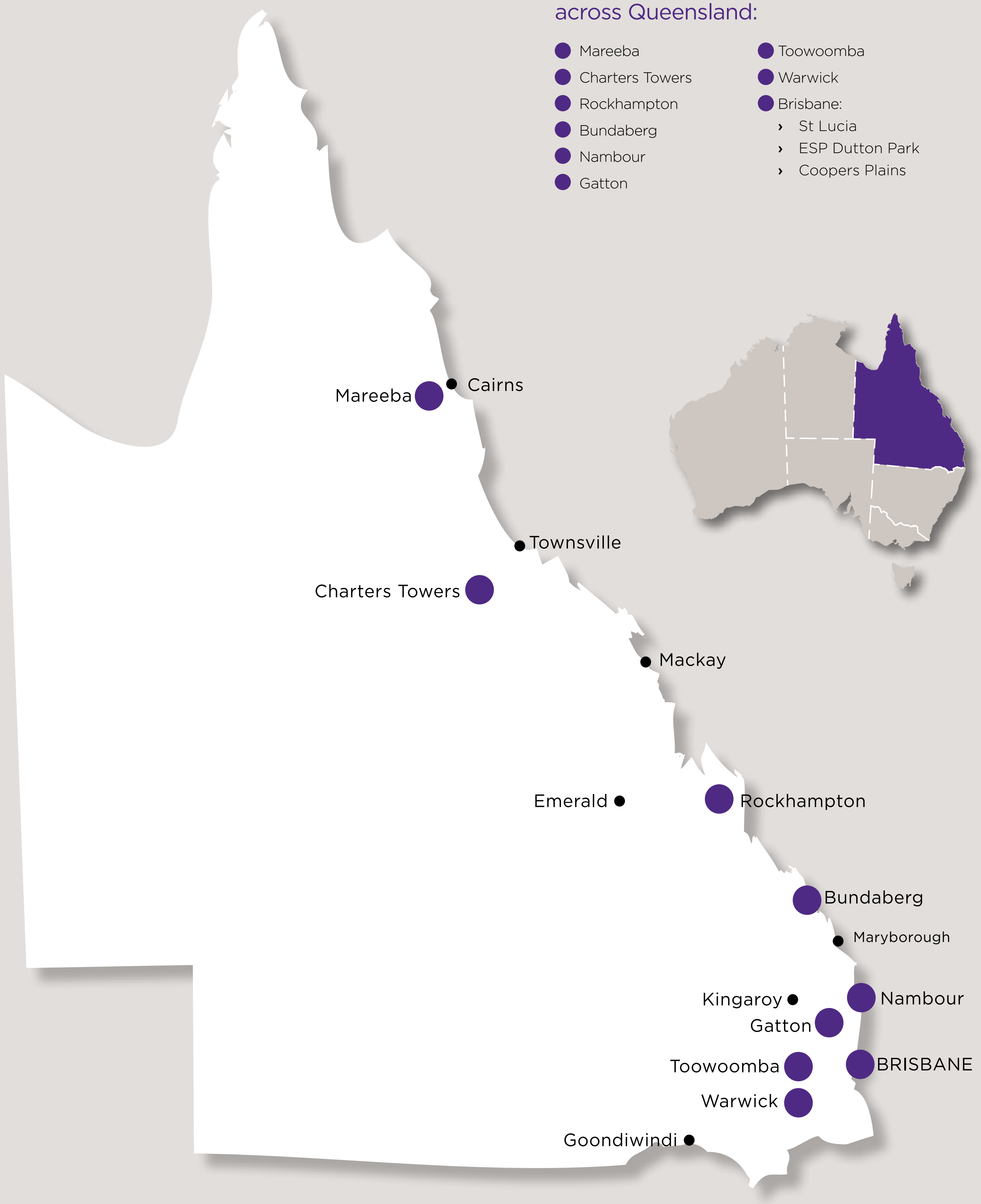
QAAFI enables Queensland's industries to benefit from the combined research excellence of both UQ and the Department's people, and draws on the department's regional networks and extension expertise. This partnership has already delivered significant outcomes for agriculture over the past decade, and is projected to have generated over half a billion in research funding by 2022.

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

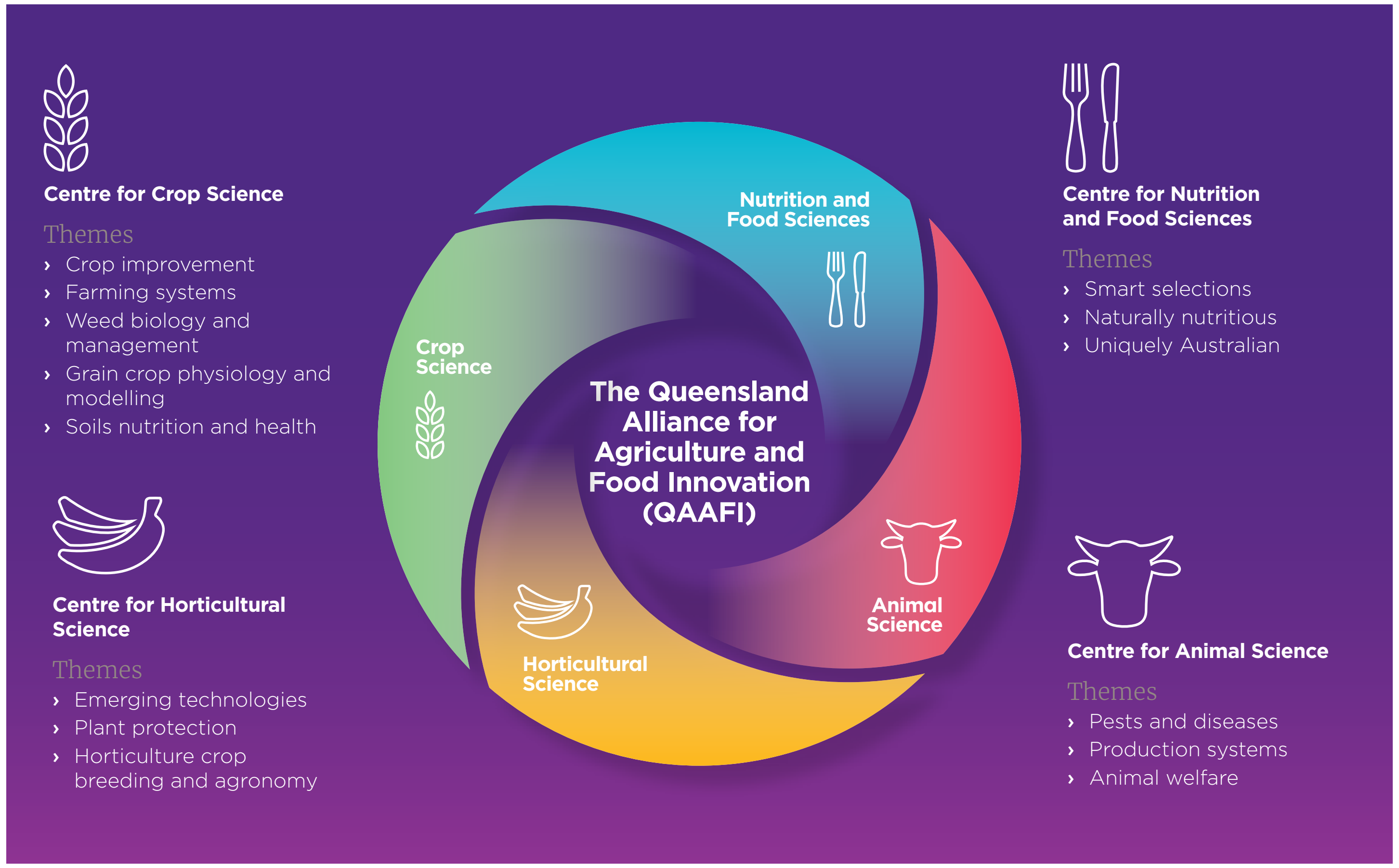
QAAFI in Queensland

Our researchers are located across Queensland:

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



Professor Robert Henry (right) and The University of Queensland's Vice-Chancellor Professor Peter Høj (second from left) hosted a visit to the Mitter lab by the Hon Kate Jones (seated) on 14 March 2019. Also pictured (L-R) are Professor Neena Mitter, Professor Bronwyn Harch and Jayeni Hiti Bandaralage.



Director's message

The changing face of agriculture

Faster-growing avocados, reinventing sugar cane, breeding better beef – advanced technologies are shaping modern agriculture and food production systems.

At QAAFI, our mission is to harness high-tech science for sustainable agriculture and food production.

To achieve this, we use game-changing technologies like artificial intelligence (AI), nanotechnology, genomics, gene editing and big data to produce safer, more nutritious food, using less resources.

Not only is UQ number one for agricultural science in Australia and one of the most highly ranked institutions in the world in this field, it is located in tropical and subtropical environments and, thus, well placed as a hub for digital agriculture and delivering step-change innovations for the growth and production of sustainable and nutritious food.

Through our alliance with the Queensland Government, QAAFI researchers utilise world-class research field station facilities throughout tropical and subtropical environments in Queensland. The sheer diversity of food production in this state also makes Queensland the home of agriculture, in comparison to temperate climates where a much narrower range of foods is produced locally.

But, more than our location and world-class scientific facilities, the key to our success has been our ability to attract global research leaders to join the QAAFI team.

In 2018, we welcomed global leader in prediction agriculture, Professor Mark Cooper, who has strengthened the world-class talent we have in crop breeding, joining Professor Graeme Hammer, who stepped down from his role as the Director of the Centre for Crop Science in QAAFI; Professor David Jordan; and Professor Ben Hayes, the co-inventor of genomic selection; to further development of new breeding systems that integrate crop performance with biological data, climate records and machine-based learning (AI).

We also welcomed Professor Ian Godwin, a passionate advocate for genetic innovation in crop breeding, to our team as the new Director of Crop Sciences.

As QAAFI approaches a decade of operations, our commitment remains to translate our world-class research into impact through engaging with industry, community and other partners locally and internationally.

Professor Robert Henry, Director, QAAFI

Meat science professor appointed

QAAFI has welcomed Louwrens Hoffman to the position of Professor of Meat Quality in the Centre for Nutrition and Food Sciences.

Professor Hoffman is a trained animal scientist and takes a "stable to table" approach to meat science.

Professor Hoffman says the reality facing the world is that it won't be able to produce enough meat protein from conventional livestock industries, so alternatives will be needed to replace or complement traditional sources.

Among these he includes, in Australia, non-domesticated animals such as kangaroos, which are able to use landscapes unsuitable for grazing. However, he says the biggest potential lies with insects and new plant sources.

"Numerous food sectors have started developing alternative foods to try and address these needs," Professor Hoffman said.

These alternatives, particularly as pertaining to the developed world, also need to address social issues such as global warming, ethical and fair trade production systems.

Within the meat sector, two new thrusts have come to the fore to address meat alternatives, with both focusing on replacing meat in 'meat'-like products: the use of plant proteins and insect proteins.

Professor Hoffman has had over 160 post-graduate students complete their studies under his guidance and has published more than 300 peer-reviewed papers in international journals.

Making her mark

QAAFI's Shannon Landmark, 27, and Luke Evans, 28, have been crowned joint winners of the prestigious Zanda McDonald Award.

The award seeks to recognise young professionals in the primary sector from Australia and New Zealand.

The pair were announced as winners at the annual Platinum Primary Producers (PPP) event and presented their prize by the widow of the late Zanda McDonald, Julie McDonald.

Ms Landmark is a trained vet, and the coordinator of QAAFI's Northern Genomics Project.

Her work focuses on improving genetic selection and reproductive technology and she works with beef producers, beef extension officers from state governments, consultants and vets, and university researchers and scientists.

Mr Evans is the station manager of Cleveland Agriculture, based at Rockhampton Downs Station, a 450,000-hectare beef property near Tennant Creek in the Northern Territory.

Chairman of the Zanda McDonald Award, Richard Rains, said the judges faced a tough decision in singling out one winner.

"Both Shannon and Luke are carving out their own distinct and different paths in their careers," Mr Rains said.

"We just couldn't separate the two on their leadership qualities, determination and spirit."

QAAFI's Professor Ben Hayes said he fully endorsed these sentiments and was delighted to have Ms Landmark on the team.

Louisa's stellar journey continues

She was the face of The University of Queensland's Create Change advertising campaign – and now avocado researcher Louisa Parkinson has proven her scientific mettle.

Dr Parkinson's PhD thesis was awarded the Dean's Award for Outstanding Higher Degree by Research Theses.

Dr Parkinson thanked her supervisors Dr Liz Dann and Dr Roger Shivaz for their support during her PhD.

"I'm so proud of this achievement and grateful for the fantastic supervisors I had during my PhD," she said.

QAAFI's Dr Liz Dann said Louisa's achievements resulted from hard work and the dedication she displayed towards her PhD research project.

Dr Parkinson's research led to the discovery of three new species of fungi and fungal pathogens that cause disease in avocados.

"I felt very proud to be able to name the first one, *Gliocladiopsis peggii*, after Ken Pegg, who is a prominent plant pathology researcher in Australia and a very important mentor to me," Dr Parkinson said.

She developed a molecular test to diagnose the presence of these pathogens, which will help avocado growers quickly put strategies in place to manage disease.

Dr Parkinson enjoys analysing DNA and the molecular side of her work.

"Diagnosing diseases is all about problem solving," she said.

UQ #1 in Food Science

UQ Food Science and Technology was the only Australian university in the top 100 in The ShanghaiRanking's Global Ranking of Academic Subjects 2018 – which ranks 4000 universities across 54 subjects, on indicators including research productivity and quality, the extent of international collaborations, and academic recognition.

QAAFI's Centre for Nutrition and Food Sciences' Director Professor Mike Gidley said the Centre conducts integrated fundamental and applied research to improve the taste, quality, appearance, nutritional value and safety of food.

"We aim to understand the fundamental characteristics of food that influence processing, food quality, consumer perception and nutritional value," Professor Gidley said.

"It's a 'fork to farm' consumer and nutritional focus to influence production choices across the agricultural industries."

The Centre's expertise includes:

- Food quality and human nutrition
- Sensory and consumer science
- Molecular basis for food quality
- Food bio-materials and processing
- Molecular parasitology
- Host/pathogen interactions using genomics and biotechnology
- Biofortification of fruit, nuts and vegetables.

Crop Science Director appointed

Professor Ian Godwin, author of *Good Enough to Eat*, a new book about next generation genetic technologies such as CRISPR and GMOs in agriculture and food production, has been appointed the Director of Crop Science at QAAFI.

Professor Godwin, who has over 30 years' experience in agribiotechnology across crops ranging from sorghum, wheat and barley to beans and taro, believes the new genetic technologies represent a revolution in biology.

"This is an exciting and challenging time for agriculture and the bioeconomy," he says.

"If we are to produce more sustainable and nutritious food to meet the growing global demand – in the face of challenges from pests and diseases, eroded soils, lack of water and climate change – we need to be able to take the best from the latest genetic technologies and from organic and agro-ecological farming practices."

Professor Godwin says QAAFI's crop science research focus will continue to be on improving crop productivity, food quality and sustainability, using every safe, effective and innovative tool in the toolbox to do so.

Professor Godwin began his career undertaking sugar beet genetic engineering at Birmingham University in the UK in the 1980s. He joined UQ in 1990, holding an academic position in plant molecular genetics.

Genomics pioneer appointed

Professor Ben Hayes, co-inventor of Genomic Selection, has been appointed as the new Director of the Centre for Animal Science at QAAFI.

Professor Hayes is internationally known as an animal genetics innovator and regularly tops the list of the world's most highly cited scientists.

He said he was excited by the opportunity to work with industry and key stakeholders to support Australia's livestock industries build a sustainable and productive long-term future.

"The northern beef industry has had it tough but there will be an opportunity to rebuild the herd using genetic technologies to improve fertility, product quality and productivity."

Since joining QAAFI in 2016, Professor Hayes' focus has been on large-scale projects to implement genomic technologies in livestock industries – particularly through the Northern Beef Genomics Project.

"Big data and genomic selection promises to deliver sustainability and productivity gains that might otherwise have taken centuries to achieve with traditional selection," he said.

He believes improvements in animal fertility, meat quality and disease and parasite resistance in the northern beef herd, which accounts for around 70 per cent of all Australian beef, are enormous.

The Centre also researches pigs and poultry, the fastest growing livestock industries in Queensland.

Passion for sustainability rewarded

QAAFI's Cécile Godde had been awarded the 2018 Queensland Women in STEM Prize.

Ms Godde is studying sustainable grazing system intensification with Professor Daniel Rodriguez and CSIRO, and is passionate about creating a healthier planet.

"The Queensland Women in STEM Prize highlights the dedication of Queensland's women scientists, as well as their contribution to inspiring, and engaging with, the broader community about Queensland science," Minister for Environment and Science Leeanne Enoch said.

"Ms Godde incorporates many dimensions in her agricultural research, including biodiversity, climate change, greenhouse gas emissions, animals, food security and human livelihoods, and socio-economics," Ms Enoch said.

"She is passionate about creating a healthier planet, but she's also passionate about gender equity in science."

This passion has led Cécile to take part in the recent Homeward Bound scientific fact-finding expedition to Antarctica, involving women scientists from all over the world.

Acting Queensland Chief Scientist Dr Christine Williams said engagement and communication by scientists was important for building awareness of science in Queensland.

"The World Science Festival and the Queensland Women in STEM Prize provide valuable opportunities to celebrate the amazing achievements of women who are making a real difference in Queensland in the fields of science, technology, engineering and maths," Dr Williams said.

Horticulture Centre bears fruit

A new Centre for Horticultural Science at The University of Queensland opened its doors in 2018.

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.

Horticulture is 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."

Agricultural biotechnologist Professor Neena Mitter heads the Centre.

"There are many opportunities to grow horticulture through on-farm management systems and the high-tech approaches of big data, genomics and biotechnology," she said.

Gekko mobile phenotyping platform in operation at the Hermitage Research Station.

Why Queensland's agtech offering is turning heads globally

When it comes to industry-changing research in the agriculture sector, Queensland's scientists are doing some incredible, eye-catching work.

By Robert Henry
Director, QAAFI,
The University of Queensland

Republished from *The Brisbane Report*

There are a lot of new technologies coming out that we hope will advance agriculture both here in Queensland and throughout the world – and particularly the tropical world.

Recently, The University of Queensland ranked number one in Australia, and fourth on a global scale, for scientific publications in agriculture in the *Performance Ranking of Scientific Papers for World Universities*. So we really are seen as a key place for agtech developments.

Our opportunity to be world leaders is, I think, because we're an advanced country with a strong economy in a warmer environment, while many of the other leading agricultural universities are in more temperate parts of the world.

We have the right environment in which to conduct the research, and the sheer diversity of food production here enhances the possibilities. In other places, a much narrower range of foods is produced locally. We're in a prime position that's of growing importance in the world. The tropics and subtropics are where most of the food is going to be needed in the future – and where most of the people are going to live.

Of course, we also have the right people with high levels of expertise, great universities and world-class scientific facilities, with a lot of investment by local government into these science facilities.

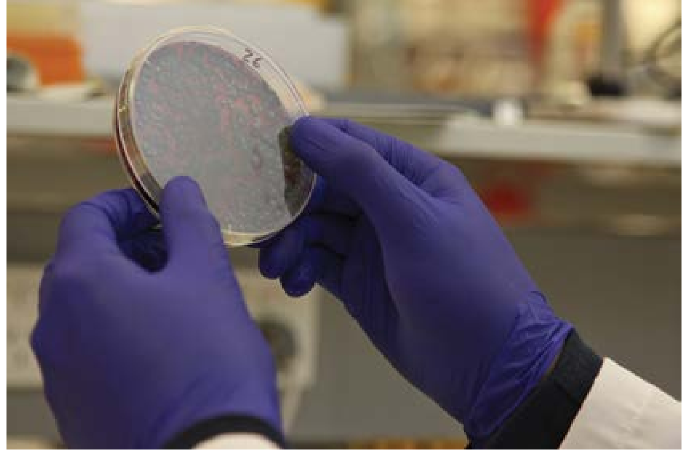
The agtech projects gaining attention

At QAAFI, we have hundreds of projects in progress at any one time, with large numbers of people working on them. We develop solutions for what you can do on the farm, but also what you can do right through the value chain to the consumer in terms of producing a higher value food product.

Professor Neena Mitter (right) with researchers Jayeni Hiti Bandaralage and Dr Alice Hayward (centre) have pioneered stem cell multiplication to propagate avocados.

Basically, anyone who eats – and that's everyone – is impacted by what we do because we work, as we put it, "from paddock to plate, both sides of the farm gate".

In food crops, we've made a difference with the laboratory propagation technologies we've developed to more efficiently propagate tree species, such as macadamia, mango and avocado, to allow rapid expansion of those industries. We've also improved the varieties of fruit trees.



QAAFI offers world-class scientists and facilities

Another unique technology we've developed for crop protection is one that we call BioClay, which offers an alternative to the use of insecticides, and one that leaves no residues. That product is now working its way towards the market and is a very important technology for producing the sort of products that consumers like, in that they're produced without the use of chemical insecticides or fungicides.

That's quite a radical new technology with great potential, and not just here, but worldwide. When we can develop a technology like that, we not only have advantages for the local industry, but we have a product or a range of products that have the potential go to a global market. That's what we're aiming for here – technologies that we can sell worldwide.

Using some of the more advanced sciences like genomics and DNA sequencing, we're also looking at re-inventing crops like sugar cane. It's not as attractive in the marketplace as it once was, so we'd like to think the future for sugar cane is to produce a much more diverse array of high-value products. So we're working out how to produce high-value chemical feed stocks and fuels from sugar cane.

With beef, we're working to improve the quality of the meat, which is very important of course to attract higher prices for the Queensland beef industry. And we work in animal health, animal nutrition and things like vaccines, such as tick vaccines for cattle.

Consumers are driving our agtech innovations

An important new area we're focusing on is animal welfare. That's an area where we feel we need to provide some leadership to help develop production methods that are more compatible with what consumers are looking for.

That's the key to successful agriculture these days: to produce higher quality products that meet the demands of discerning consumers and to meet the expectations of the market. In my mind, the business in agriculture is moving more of our products into the premium range, particularly in the export market so we can attract higher returns.

And of course, the growing affluence of people in Asia means that there's a great demand for safe, nutritious food products there and we're in a great position to satisfy that demand.

There's substantial potential for further growth. And that's where the innovation and the research and development that happens here is so important. People are uncertain about the future of many industries, but I think we can all agree that we're still going to be eating food in 50 years' time. Brisbane and Queensland can dominate in this sector. We are, after all, Australia's food bowl.

DISCOVERY

QAAFI works closely with industry and government partners in creating research solutions to challenging problems for profitable and sustainable agricultural and food production systems.

Prediction agriculture leaders: Professor Graeme Hammer, Professor Mark Cooper and Professor Ben Hayes.

New breeding technology draws on genomics, paddock realities and computer power

QAAFI researchers are world leaders in prediction-based crop improvement, a new breeding system that can predict the likely paddock performance of breeding material based on a marriage of biological data, climate records and machine-based artificial intelligence (AI).

Nuances in how this system works mean that Australia generally – and QAAFI in particular – are regarded as having a 'cutting-edge' advantage in exploiting this development and accelerating genetic gain that benefits grain production.

At the centre of the development work is The University of Queensland's Professor Graeme Hammer, who explains that the key to integrating diverse data sets – genetic, phenotypic, agronomic and climatic – is computer models that can simulate crop growth rates under realistic paddock conditions.

The model contains coefficients that drive crop growth and development over time.

These coefficients cover biological processes at the heart of crop growth without making the computations too complex, aspects such as photosynthesis, or nutrient and water absorption from roots.

Genomic data is then linked to those plant-growth coefficients via advanced analytical algorithms.

The AI is then able to detect better-performing genetic combinations for specific environments and climate conditions.

> *The crop growth model provides a way to harness the explosion in genomic and phenotyping data in ways that are biologically meaningful and useful to growers – Professor Graeme Hammer.*

Australia's advantage in this area arises from past Grains Research and Development Corporation (GRDC) investment in the critical component: a crop growth model within the Agricultural Production Systems sIMulator (APSIM).

The APSIM model has been adopted internationally and has continued to evolve in capability over the years.

A better way to breed

Seen as the linchpin of prediction-based crop improvement, APSIM has been used by QAAFI's Professor David Jordan to help breed high-yielding sorghum with improved adaptation to hot and water-limited environments.

The centrality of the crop growth model means that data about a plant's genotype (G) gets to interact with simulated environmental conditions (E) and management practices (M) to determine the genome's likely impact on plant growth, stress resilience and yield.

This three-way interaction is what occurs in the paddock, where it is known as the genotype-by-environment-by management interaction (GxExM).

It is this filtering, weighting and refocusing of genomic data through a GxExM prism that lifts the predictions to unprecedented and functionally useful levels.

In contrast, existing predictive technologies, such as statistical quantitative genetics and genomic prediction, attempt to make predictions about crop performance based directly on genetic data.

These kinds of genetic-based predictions were seen to falter when GxExM interactions are essential, which is the case for most of Australia's cropping systems, Professor Hammer says.

It is that limitation that the new way of making predictions is overcoming. For example, the crop growth model views variation in traits, such as tillering or flowering time, in terms of combined impacts on the size of a canopy and its use of water and light.

It can predict that a genotype that flowers early and doesn't tiller much is great in a drought, but has low yield potential in a good season. Other predictive tools can be blind to such interactions.

Genomic technologies can be used in clever and useful ways, but it was naive to think that they alone could form the basis for predictions about plant performance in a paddock, University of Queensland Professor Graeme Hammer said.

"The new approach makes it possible to select breeding material in terms of the right mix of interacting traits for specific environments," Professor Hammer says.

In the process, a new level of genetic gain in crop breeding becomes possible.

Firstly, a multitude of potential breeding material can be virtually tested in a fraction of the time required by field trials. This vastly accelerates selection of trait combinations best suited to different environments.

In addition, the same platform can be used to design the best breeding strategy to make the most useful genetic gain, including tolerances to environmental stresses.

"The new approach makes it possible to select breeding material in terms of the right mix of interacting traits for specific environments," Professor Graeme Hammer says.

Commercial implications

APSIM has also driven private sector developments, most notably through a past partnership between Professor Hammer's UQ team and Pioneer Hi-Bred International.

That partnership ultimately led to the development of popular and high-yielding maize hybrids (branded as AQUAmax) with improved tolerance to drought stress.

The AQUAmax varieties were developed by UQ alumni Professor Mark Cooper, who returned to the university in 2018 to occupy a chair partly supported by GRDC investment.

Part of Professor Cooper's role is to help increase public and private sector R&D collaboration.

> *The aim is to use crop-growth prediction to select the most suitable breeding lines and crosses, then follow this up with accelerated breeding techniques.*

"The main issue between private and public versions of this technology is scale," Professor Hammer says.

"Pioneer has a gigantic database of field trial and genomic data to help train an AI to detect the best-performing broad-scale genomic patterns.

"They interfaced this with crop modelling to target genomic predictions at paddock-relevant phenotypes. The approach is novel and it works."

Now, UQ is developing something similar for Australian pre-breeding programs, starting with sorghum and expanding to other crops, including work on wheat by UQ's Dr Lee Hickey.

The aim is to use crop-growth prediction to select the most suitable breeding lines and crosses, then follow this up with accelerated breeding techniques, such as 'speed breeding', also developed by Dr Hickey.

Field trials will still be needed to help validate the AI-based predictions.

Climate influence

Professor Hammer says climate data is a key driver of the crop growth model.

This allows the new breeding system to preview likely seasonal conditions and allow for the selection of traits that might be able to lessen the effects of climate change.

> *As the temperature increases, the atmosphere becomes drier and the associated increased vapour pressure deficit sucks more moisture from crops. That forces plants to use more water to achieve the same growth. University of Queensland Professor Graeme Hammer.*

"I originally started to work on APSIM because I thought it was the only way we could get a handle on the climate variability that Australian growers face," Professor Hammer says.

"The crop growth simulation studies started out by running historical seasonal conditions for the past 100 years to test possibilities to improve a farm's operation and financial resilience, with regards to rotations, crop and variety choices and management practices."

Since then, climate change forecast models have improved enough that the prediction-based crop improvement tool can now be used to test germplasm against future climate scenarios.

Professor Hammer considers climate forecasts are at their most robust when it comes to temperature predictions. Already the climate has heated by an average of 1˚C. The forecasts indicate a further 1˚C (plus or minus 0.5˚C) rise in the next 30 years.

As the temperature increases, the atmosphere becomes drier and the associated increased vapour pressure deficit sucks more moisture from crops. That forces plants to use more water to achieve the same growth.

There is an upside, however, in that higher atmospheric carbon dioxide levels enable plants such as sorghum to use water more efficiently.

The problem Professor Hammer has identified is that by 2050 the extra heat is predicted to take over from the enhanced water-use efficiency associated with the carbon dioxide increase.

This finding has motivated UQ researchers to target heat tolerance, as seen with the sorghum breeding work.

Ultimately, however, Professor Hammer says that temperature increases will inevitably negate the gain.

"It means we are fighting just to retain existing yield potentials, with our gains being swallowed up by warmer, drier conditions."

This is why he sees public and private sector research collaborations as being so important, because they increase the research resources and efficiency needed to try to make up for the world's slow response to climate change.

Original article published 8 April 2019 in Ground Cover by Gio Braidotti, 'New breeding technology draws on genomics, paddock realities and computer power'.

Big genomics data milked to feed the future

With support from the Bill & Melinda Gates Foundation, University of Queensland researchers are assisting smallholder milk producers in India with AI-based breeding technology.

With more than 1.3 billion people in India, the country's milk producers are focused on maintaining supply.

QAAFI's Professor Ben Hayes, who co-developed the big data genomic breeding technology, said India relied on cow and buffalo milk as an important source of nutrients – especially for children.

"Most of Indian's milk is produced by smallholder farmers with as few as two animals. Their income from milk is often the difference between 'getting by' and poverty," Professor Hayes said.

The smallholder producers deliver to a sophisticated and integrated supply chain, which includes a massive distribution arm that can reach nearly all Indian households.

The production arm of the system is facing the same crisis that afflicts agricultural systems globally – more milk is needed to keep pace with growing demand.

However, this extra milk needs to be supplied from the same amount of land, water, labour and animal feed.

Professor Hayes is familiar with the issue of increasing supply from the same resource base, having previously addressed similar constraints in the Australian dairy industry.

"The solution lies in taking advantage of existing genetic variation between animals in how efficient they are at turning feed into milk," Professor Hayes said.

"The trick is to establish a breeding program that identifies these animals, and to use them for breeding the herds of the future."

However, achieving this goal in a production system dominated by smallholder farmers introduces its own challenges.

Past breeding efforts in India have seen milk production rates stall at about four to five litres per animal per day.

In the Australian dairy industry, Professor Hayes was able to apply one of the most advanced breeding technologies currently available – a technology he co-developed called 'genomic selection' – to make rapid and efficient gains possible.

Genomic selection uses big data bioinformatics derived from genome-wide analysis of performance-recorded cows to detect gene effects associated with the desired trait.

The technology enables modelling to predict the genetic combinations, and therefore the stud bulls best suited to achieving genetic gain in the breeding target.

As a world-leading expert in genomic selection and its application to cattle-based industries, Professor Hayes was recently recruited by the Bill & Melinda Gates Foundation to revisit the stalled genetic gain, and the associated food security and poverty reduction implications, of India's milk industry.

Indian smallholder farmer measuring milk.
Photo supplied by Professor Ben Hayes UQ QAAFI.

"With this project we are aiming to double milk production to about 10 litres a day and achieve it with a modest increase in feed," Professor Hayes said.

The project is being undertaken in collaboration with Indian smallholder farmers who are already logging the milk production rates in order to generate data vital to Professor Hayes's computing algorithms.

Also taking part are two Indian organisations that are essential to the development of an integrated milk supply chain that seeks to pull smallholder farmers out of poverty.

The first is the BAIF Development Research Foundation, an organisation committed to promoting sustainable livelihoods among the rural poor through climate-resilient agriculture.

The second is the Amul cooperative, which was founded to stop the exploitation of milk producers by middlemen.

Amul-branded milk forms an important cornerstone of the milk supply chain and has a handling capacity of five million litres per day.

The project is also recording fertility traits associated with the genotyped cows and buffalos to ensure, in pushing more energy into milk production, the breeding program doesn't accidentally reduce fertility.

"From experience we know that if you select really hard for gains in milk production, fertility will decline," Professor Hayes said.

"We know that from 40 years of industries in other countries moving in the wrong direction.

"We are not going to make that mistake with the Indian cattle, so we are selecting for both milk production and fertility at the same time."

The University of Queensland today announced one of the world's most influential researchers in animal genetics has accepted a key leadership role to shape the future animal industries research.

Gympie identified as birthplace of global macadamia industry

Dr Hardner beside the world's oldest cultivated macadamia tree, planted in Brisbane's Botanic Gardens in 1858

The global macadamia industry may have originated from a single tree taken from Queensland to Hawaii in the 19th century, according to new research.

University of Queensland horticultural science researcher Dr Craig Hardner said a tree, or perhaps a couple of trees, were taken from Gympie.

"That sample was the foundation of the Hawaiian macadamia industry, which supplies around 70 per cent of the world's macadamia varieties," Dr Hardner said.

Dr Hardner, and Dr Catherine Nock from Southern Cross University, studied the structure of the chloroplast genome from the Hawaiian macadamia industry and mapped it back to trees in the wild.

"Most of the germplasm in Hawaii and particularly the germplasm used extensively throughout the world for commercial production came from a single population, and possibly even a single tree, at Mooloo, north-west of Gympie," Dr Hardner said.

The tree nut crop is native to Queensland and northern New South Wales, and modern macadamia production systems are only a few generations removed.

"Understanding the genetic diversity of trees in the wild is important because macadamia is a relatively new crop compared to crops such as peaches, where many centuries of domestication have helped improve important traits," Dr Hardner said.

"The potential to improve traits such as disease resistance and climate variability is substantial."

A key finding of the research, which was published in *Frontiers in Plant Science*, is that significant diversity of wild macadamia has been lost through land clearing since European development from the 19th century.

Although the macadamia nut was likely a component of the diet of Australia's Indigenous people, the first recorded European contact with macadamia was in 1848.

"The world's first cultivated macadamia tree was likely planted in 1858 by Walter Hill in the Brisbane Botanic Gardens, and it is still alive today," Dr Hardner said.

The genetics of this tree and two others that date back to this era, one planted at the University of California in Berkeley in 1879 and one growing in Dr Hardner's backyard in Yeronga, do not map back to any of the recent samples taken from the wild.

"This suggests that there was some diversity at the time of European settlement that has been lost to commercial macadamia production systems.

"We could well find that some old macadamia trees growing in people's backyards might also have this genetic diversity – like the tree in my backyard."

He and Dr Nock are working with the Macadamia Conservation Trust, macadamia industry and other stakeholders to sample old trees for genetics that have been lost to macadamia production systems.

The macadamia industry is worth approximately $3 billion and has undergone rapid global expansion in the last 50 years.

Australia, South Africa, Kenya, and the United States are the largest producers, and the crop is also cultivated in China, South East Asia, South America, Malawi, and New Zealand.

Future growth in global production is predicted following recent extensions in planting, particularly in China and South Africa.

This research was funded by The University of Queensland, Hort Innovation, Department of Agriculture and Fisheries, and Churchill Trust.

Just how much does enhancing photosynthesis improve crop yield?

Dr Alex Wu

In the next two decades, crop yields need to increase dramatically to feed the growing global population. Wouldn't it be incredibly useful if we had a crystal ball to show us the best strategies available to increase crop yields?

A team of scientists have just developed exactly that: a dynamic model that predicts the impact of diverse manipulations to the process of photosynthesis on the yield of wheat and sorghum crops.

"We have developed a reliable, biologically rigorous prediction tool that can quantify the yield gains associated with manipulating photosynthesis in realistic crop production environments," said Dr Alex Wu, from the ARC Centre of Excellence for Translational Photosynthesis (CoETP) and QAAFI at The University of Queensland.

Plants convert sunlight, carbon dioxide and water into food through photosynthesis, and several studies have shown that this vital process can be engineered to be more efficient. However, it has been difficult to assess the consequent impacts of these manipulations on crop yield, and considerable speculation remains.

Dr Wu, the lead author of the paper published in the journal *Nature Plants*, said that this modelling tool has the capacity to link across biological scales, from biochemistry in the leaf to the whole field crop over a growing season, by integrating photosynthesis and crop models.

"It is a powerful tool to assess and guide photosynthetic manipulations and unravel effects that confound the relationship between photosynthetic efficiency and crop performance, "he said.

Centre Deputy Director Professor Susanne von Caemmerer, one of the authors of the paper, said one of the most innovative aspects of this study is that it uses a cross-scale modelling approach to look at the interactions between stomata – the pores of the leaf that allow the exchange of CO_2 and water vapour – and photosynthesis.

"We know that it is not as simple as saying that improving photosynthesis will increase yield. The answer depends on the situation. For example, we found that in crops like sorghum, more photosynthesis can actually decrease yield in water-limited cropping situations. The modelling predicts that we can manage this "yield penalty" if we can also maintain a stable leaf stomatal conductance," she said.

Centre Chief Investigator Professor Graeme Hammer, another co-author of the paper, says that this study fosters the type of transdisciplinary research needed for future crop improvement and links research across the whole ARC CoE for Translational Photosynthesis, which has a main focus to increase the yield of major staple crops such as wheat, rice, sorghum and maize by enhancing photosynthesis.

"Now that we have developed and tested this predictive model, our next step is to work closely with collaborators at the CoETP to design simulation scenarios that test the effects of other bioengineering and breeding trait targets," said Professor Hammer.

One of those collaborators is ANU Professor Graham Farquhar.

"In this study we are scaling up to the whole crop growth season and incorporating the feedback effects on photosynthesis of resources for the crop, such as water, which is critical in predicting consequences on crop productivity in future Australian crop environments", he said.

The team investigated three main photosynthesis manipulation targets: enhancing the activity of the main photosynthetic enzyme, Rubisco; improving the capacity of the leaves to transport electrons; and improving the flow of carbon dioxide (CO_2) through the internal layers of the leaf.

"This study permits us to quantify the consequences on crop yield for these three targets and their combinations for C_3 wheat and C_4 sorghum crops for irrigated or dryland cropping environments," said Dr Wu.

"We found crop yield changes from -1% to +12% depending on the combination of targets, crop, and the situation."

This research is published in *Nature Plants* and was funded by the Australian Research Council (ARC) Centre of Excellence for Translational Photosynthesis at the Australian National University and The University of Queensland.

Increasing the productivity and efficiency of chicken meat production

Dr Lida Omaleki's project, Clouds and *Pasteurella multocida*, funded by Agrifutures Australia, is investigating the re-emergence of the poultry disease fowl cholera and how genomic data can be used to investigate outbreaks.

Dr Lida Omaleki, researcher with QAAFI's Centre for Animal Science

In addressing the growing problem, Dr Omaleki has turned to international research to better understand the infection genomics field and the potential for genomic technology to provide quicker and more informative guidance veterinarians and farmers.

According to Dr Omaleki, the future of innovation in the chicken meat industry is bright, with big benefits on the horizon when it comes to preventing disease losses by means of sustainable, responsible prevention and control programs.

About the project

Fowl cholera is an economically significant disease of poultry caused by *Pasteurella multocida*.

"The disease has re-emerged as the chicken meat and layer industries have moved to free range and organic production systems," Dr Omaleki said.

Whole genome sequencing and bioinformatic analysis is now widely used to understand isolate relatedness in human nosocomial outbreaks as well as food-borne infectious diseases.

"There has been a lack of research in using genomic data to investigate fowl cholera outbreaks and this project has given us the opportunity to enable the lab to gain access to the very important tool of metagenomics in association with fowl cholera," Dr Omaleki said.

"We are now able to use metagenomic data for doing the in-silico typing of the outbreak isolates instead of conventional, more expensive PCR-based methods."

The main known reasons that *P. multocida* is escaping the protection provided by the autogenous killed vaccine, is the difference between the structure of lipopolysaccharide (LPS) of the challenge strain and the vaccine strain. LPS is the outer layer of the outer membrane of many Gram-negative bacteria including *P. multocida.*

The researchers are trying to use WGS to understand the changes in lipopolysaccharide outer core biosynthesis loci as it is the key immunogenic factor in case of killed autogenous vaccination

Working in the chicken meat industry

Dr Omaleki said her professional interest is derived from the fact that she has a degree in veterinary medicine and has always been interested in animal infectious diseases.

"My family has a farm, and to me any kind of livestock disease is important, both in terms of the family economy and animal welfare," she said.

"I look at chicken meat as a healthy affordable protein source for families, which can be more popular than other sources of proteins in many families and/or cultures."

Future innovations in the Australian chicken meat industry

Dr Omaleki sees great potential for the use of genomic technology to provide far quicker and far more informative guidance to veterinarians and farmers.

"I can see a future where there will be on-farm assays that provide information of which pathogens are present in a sample and whether currently used vaccines on that farm for those pathogens are relevant or need to be altered," she said.

"These assays will provide this information in near to real time."

"The assays will greatly improve the ability of the veterinarian to work with the poultry farmer to prevent disease losses by means of sustainable, responsible prevention and control programs. These assays will be very much driven by the rapid advancement in genomic technologies."

Based on an article published by AgriFutures

Professor Ian Godwin

Seeds of crop innovation

Fighting fake news

Scientists must speak out about the benefits of new genetic technologies, such as genetically modified organisms (GMOs) and gene editing, according to QAAFI's new Director of Crop Science, Professor Ian Godwin.

Professor Godwin is the author of *Good Enough to Eat?*, a new book about new genetic plant and animal breeding technologies. It charts the history of genetically modified foods from the laboratory to the global dinner plate.

He hopes the book will help end fear and misinformation generated by "fake news" about the safety of genetically modified foods.

"The future of billions of people literally depends on changing the narrative about how we view genetically modified food and genetic technologies," Professor Godwin said.

"If we are to produce more sustainable and nutritious food to meet the growing global demand – in the face of challenges from pests and diseases, eroded soils, lack of water and climate change – we need to be able to take the best from the latest genetic technologies and from organic and agro-ecological farming practices."

With 30 years' experience in agribiotechnology across crops ranging from sorghum, wheat and barley to beans and taro, Professor Godwin calls genetic technologies – such as CRISPR gene editing – a biological revolution.

"Genetically modified, or GM, crops use 37 per cent less pesticide, and increase crop yields by 22 per cent and farmer profits by 68 per cent – and the promise of new genome editing techniques is simply astonishing," Professor Godwin said.

"We have to stop pretending that 'natural is best' and challenge the notion that organic food companies are not actually big global companies with a conflict of interest when it comes to the GMO debate."

He said environmental groups that worked to restrict countries from growing or receiving GM foods proven to be safe and effective should be held morally accountable for their actions.

Sir Gordon Conway – author of *One Billion Hungry: Can We Feed the World?* – has described *Good Enough to Eat?* as "a lively dialogue" that tackles the "highly vociferous and unprincipled opposition from some sectors of the public who choose to ignore facts and realities" about GM food.

"Ian Godwin is a first-class scientist and his book gives us answers how food can be grown and engineered to meet one of the world's most important challenges," Professor Conway said.

In the book, Professor Godwin describes his experiences eating some of the world's first gene-edited cabbage, prepared by Sweden's Chef of the Year 2010 Gustav Tra¨gårdh; a horror story working with celery; and his time as part of a sorghum and cotton team in Biloela in Central Queensland, where locals rushed to get washing inside before crop dusters flew overhead and dumped huge amounts of endosulfan and other chemicals on crops.

"In those days in peak season, spraying was happening every day in any given region, and some growers were spraying their crops up to 17 times per growing season to ward off caterpillars – but now GM cotton has reduced the need to spray for insects to once or twice per season."

Professor Godwin said genetic technologies would continue to play a critical role in world-leading crop science undertaken at UQ – which is ranked fourth globally in the field of agricultural science and has been recognised internationally for its plant breeding expertise.

"Our focus will continue to be on improving crop productivity, food quality and sustainability in the crop sciences, and we will use every safe, effective and innovative tool in the toolbox to do so."

Comment:

Gene editing vital for future innovation

Professor Ian Godwin

Germany is one of the most technologically advanced nations in the world.

Germany has some very efficient agriculture, and some of the most environmentally conscious. Yet it could be way, way better.

Germany is the high citadel of the European fortress against GM crops, repelling constant incursions into Europe. Yet German agriculture, and European agriculture for that matter, could be so much more productive and sustainable if farmers were allowed to grow GM crops, yet only small amounts of insect-resistant Bt maize are grown, mostly in Spain.

Somewhat ironically, Europe imports over 70 per cent of its feed grain to supply the endless demand for wurst, schnitzel and pork knuckles – and nearly all of that feed grain is GM soy and maize.

GM crops continue to produce productivity gains and environmental benefits worldwide, although those benefits are mostly limited to cotton and canola in Australia. Ask most cotton farmers what they would grow if they did not have access to insect-resistant Bt and herbicide-tolerant varieties? For most of them the answer is "not cotton".

One of the most foolproof and cost-effective means to introduce technological change into agriculture is the seed. The seed, like a new smart phone, is brimming with new technology that improves lives and livelihoods. Most of that technology is genetics, and the new genetic kid on the block is gene editing.

You may have heard of CRISPR, the most popular form of gene editing. Have you seen headlines involving CRISPR bacon, CRISPR apples and potato CRISPRs? The first gene-edited crop, a soybean that produces higher quality oleic acid, has already hit the market in the US.

Science labs all over the world are tackling complex problems with gene editing.

Most of the applications involve the "knockout" of specific genes, in a way that makes the outcomes indistinguishable from any other natural mutation.

Labs in the US have produced polled cattle with none of the downsides associated with the trait in some breeds. Scientists in China have produced fragrant (jasmine) versions of all 10 rice varieties they have tried. Non-browning apples and potatoes have been made. Pigs with resistance to porcine reproductive and respiratory syndrome have been produced in Scotland. Chickens have been edited so that they are resistant to all known strains of bird flu, and also cannot pass the disease onto humans.

What is really exciting is that, as of October 8, 2019, gene-edited plants and animals with knockouts of genes will not be regulated by the Australian government. For our research teams, this means being able to plant field trials of our gene-edited sorghums with larger grain and more protein.

Most of North and South America, Japan and Russia are full steam ahead with gene editing in agriculture.

While in Europe, gene-edited organisms will be regulated as GM, even if they can't detect they have been gene edited.

This article 'Why our scientists are hanging out for October 8' first appeared on *Farm Online*.

Sugarcane at Meringa research station. Photo: SRA

Sugar set for 'energycane' reinvention

Gene editing sugarcane for use in renewable energy and bioplastics could help secure the industry's future.

QAAFI researchers are using genetic tools to reprogram sugarcane, constructing its fibres so they can be more easily broken down for use in the new world of renewables.

There's a transformation underway for sugarcane in Australia. It is the quintessential Queensland crop, steeped in the Australian psyche and economy through popular culture and more than 150 years of cultivation. But before too long, sugar may not be its primary output.

In a world looking increasingly to alternatives to fossil fuel, the use of sugarcane in the production of biofuel is growing. But beyond this, scientists are also unlocking the potential for sugarcane as a 100 per cent recyclable bioplastic – a substitute for petroleum in the production of countless items, from cosmetics to carpets to car parts.

"It's about reinventing sugarcane as a crop with a wider range of end uses," said QAAFI Director Professor Robert Henry.

"The sugarcane industry can produce sugar but it can also produce other things like electricity, biofuels for transportation, and oils to replace traditional plastics."

Professor Henry and his colleagues at QAAFI are working on sequencing the sugarcane genome as part of a US Joint Genome Institute project.

Much larger than the human genome, it is the last of the 20 major crops to be sequenced due to its complexity.

Nevertheless, with DNA science continuing to improve, Professor Henry expects to see "the mighty sugarcane" decoded by 2020.

Combined with extensive field trails, the research is pinpointing which genes are responsible for which traits and furthermore, how genetic variation influences a plant's composition and performance. These insights can then be used in breeding for specific outcomes, such as maximising sugar production, but also increased fibre or a fibre composition that is more easily broken down for conversion into biofuel or oils for plastics.

"It's about deconstructing the plant – looking at all the things in the genetics that contribute to the structure of the plant material that leads to it working better in those processes," he said.

Ultimately, Professor Henry would like to see a level of versatility where varieties can be quickly bred and grown to suit different market conditions. This would allow growers to maximise the value of their crop and cope with fluctuating sugar prices by targeting different markets – whether it be food, fuel or plastics – at different times.

A falling sugar price, driven by declining demand in world markets and increased competition from India and Brazil, is one of a confluence of events making alternative end-uses more attractive for Australian producers.

Consumers and industry are also looking increasingly to alternatives to fossil fuels for power, transport and in the production of plastics. This provides new commercial opportunities for renewables.

The science is quickly developing to a point that will allow growers to take advantage of these opportunities, through the development of new varieties tailored for a particular function, whether it be sugar, biofuel or bioplastics production.

"The technology advances and the needs are coming together and we really have the opportunity to do something in the relatively near future," Professor Henry said.

While sugar mills already burn bagasse (the fibrous residue that remains after juice is extracted from sugarcane stalks) to produce the energy for their milling operations, scientists are taking things further.

Supplying energy to the domestic electricity market is one possibility. Genetic improvements to more efficiently convert the bagasse into low-value sugars, and subsequently ethanol, will provide more options. "If we can turn those mountains of bagasse into a high-value product then we have got a very attractive proposition from an industry point of view," Professor Henry said.

To further this aim, QAAFI has teamed with US Joint BioEnergy Institute and Sugar Research Australia as part of an Australian Research Council Linkage Project, testing a range of sugarcane varieties with different chemical compositions to understand which types produce ethanol most effectively and efficiently.

"The sugarcane industry can produce sugar but it can also produce other things like electricity, biofuels for transportation and oils to replace traditional plastics."

Meanwhile, in Delhi, with the Indian Institute of Technology, researchers are investigating processes to most efficiently break down lignin (a complex part of the fibre in the sugarcane bagasse) into an aromatic chemical compound used in the production of plastics. Drink bottles made from a sugarcane bioplastic are just one product on the agenda from this QAAFI collaboration.

"Those sorts of products are quite possible; it's just all about the economics of doing it. Key to this is how suitable we can make the starting material for these processes, and that's how the genetics can make these products commercially realistic," he said.

Insights gained from the partnerships are being fed back into Professor Henry's breeding program to ensure varieties are developed with traits suitable for end markets.

Several target genes have been identified, and the first gene-editing experiments planned aim to tailor sugarcane to more effectively produce biofuels and bioplastics.

For biofuels, this includes producing a higher yield of fermentable material from the bagasse. For bioplastics, it requires altering the composition of lignin so it breaks down more easily.

These molecular-level changes will help make production of sugarcane biofuels and bioplastics more efficient and competitive in a market dominated by fossil fuels. "And that's what all the genomics work is largely about," Professor Henry said. "It's working out how we can get more efficient conversion, higher yields of products and higher value products."

Sugarcane, he said, is ideal for the production of renewables because it is fast-growing with abundant biomass and has sophisticated processing systems already built around it.

"We grow a very large amount of sugarcane per hectare and producing that much biomass and capturing that much carbon from the atmosphere and turning it into plant material is done very efficiently by the sugarcane plant. That is a key thing if we're trying to produce renewable materials from plants," he said.

Diversification of the crop to help meet the global need for fossil fuel alternatives in transport and plastics will help Australian sugarcane industry to remain viable.

"Really, sugarcane globally needs to make this transition from being just a sugar crop to being a crop with a wider range of uses if it's going to have a long-term future," he said.

Would you like maggots with that?

QAAFI researchers are investigating the use of maggots, locusts and other alternative proteins in a range of specialty foods.

Professor Louw Hoffman

Would you eat a sausage made from maggots? A commercially produced and healthy sausage, but made from maggots nonetheless? The same question can be asked for other insect larvae and even whole insects, such as locusts.

It is a serious question because an overpopulated world is going to struggle to find enough protein unless people are willing to open their minds (and stomachs) to a much broader notion of food.

Professor of Meat Science at the University of Queensland, Dr Louwrens Hoffman, says the reality facing the world is that it won't be able to produce enough meat protein from conventional livestock industries, so alternatives will be needed to replace or complement traditional sources.

Among these he includes, in Australia, non-domesticated animals such as kangaroos, which are able to use landscapes unsuitable for grazing. However, he says the biggest potential lies with insects and new plant sources.

One of the areas he is researching at QAAFI is the use of larvae (maggots) from the black soldier fly (*Hermetia illucens*) as a dietary protein source for chicken production. Poultry is a massive industry worldwide and is under pressure to find alternative proteins that are more sustainable, ethical and green than the grain crops currently being used.

This part of Professor Hoffman's extensive field of work originated with research he undertook in South Africa, collaborating with researchers in Italy. They set out to validate the commercial value of black soldier fly pre-pupae meal for chicken broiler production by determining the effects of different dietary levels (0%, 5%, 10% or 15%) on carcass, sensory and meat quality.

One of the areas Dr Hoffman is researching as part of the Queensland Alliance for Agriculture and Food Innovation (QAAFI) is the use of larvae (maggots) from the black soldier fly (Hermetia illucens) as a dietary protein source for chicken production.

He and his collaborators found that broiler diets can be up to 15 per cent larvae meal without affecting the chicken's production performance and nutrient-use efficiency, and with no impacts on the sensory characteristics (aroma, flavour, juiciness and tenderness) of the breast muscle, or the long-chain fatty acid composition of the cooked chicken meat.

> *"It's all pretty logical if you think about it," he says. "Chickens in the wild don't eat feed preparations, they eat insects and larvae. And while insects are largely foreign as a food in Western cultures, there are many millions of people around the world for whom they are a familiar part of the diet."*

That said, in Europe the larvae of the mealworm beetle (*Tenebrio molitor*) is gaining acceptance as a snack food, along with freeze-dried crickets.

In another project, Professor Hoffman has used black soldier fly larvae to make sausages. In experiments comparing the insect-based sausages with traditional pork sausages, the sausages made from fly larvae had fractionally less moisture and protein but had the same fat content and texture – in essence, the pork and larvae sausages couldn't be distinguished by taste or texture.

It is research like this that makes scientists like Professor Hoffman convinced that the time has come to look at the big picture and seriously tackle the future of food.

Professor Hoffman says changes in attitude, and responses to those changes, will be driven not just by the projected global population of 9.6 billion by 2050, but also by growing awareness among Western consumers of the environmental impacts of consuming meat from farmed livestock. He says any shift towards a more sustainable food source must include insects, which can be produced for this purpose on a commercial scale.

The black soldier fly is a particularly productive larvae producer because the adult flies don't eat any of the composting material. They die as soon as they have bred and laid eggs, leaving all of their food resource for larvae development. Also, when the larvae reach the end of this stage of the fly's life cycle they start moving away from where they have been feeding, allowing them to be directed to an automated collection point.

> *Insect larvae can also be produced as a product from 'upcycled waste' including sewage.*

An interesting sidebar to the research was to see if there are any health implications from larvae feeding on faeces that have a high pathogen load. Chickens that had been fed larvae raised on faeces were then exposed to salmonella. Half the chickens were administered antibiotics and half were untreated. The chickens that hadn't been given antibiotics came through the healthiest. Professor Hoffman says this particular experiment is still being

peer-reviewed but it raises potentially important new lines of research if the larvae have a natural ability to shield or suppress bacterial pathogens.

Looking ahead, Professor Hoffman says studies to date show that Western consumers will most likely need to see insect-based food masked, and this will probably have to be a part of introducing such protein sources into Western diets.

> *Studies by other researchers have shown that even Western consumers who are willing to try insects in a dish recoil from the idea of consuming or preparing insect-based meals themselves, unless the insects are processed and disguised. This points to insect protein needing to be incorporated into existing food products as an ingredient.*

However, there is already an early stumbling block in Europe where the European Union has moved to put a brake on insect consumption by ruling these protein sources can't be used as feed for animals destined for direct human consumption unless the insect larvae have been fed a diet considered safe for humans.

For Professor Hoffman, this is not supported by science and is a position that he believes raises a moral issue for humanity: "My counter argument is to ask if it is morally acceptable to feed food – human food like corn, maize and soya bean – to animals when there are so many people desperately in need of that protein source?"

He suggests there needs to be a better understanding of the difference between animal feed and human food. That understanding will need science – and a global reappraisal of what can constitute healthy, nutritional and safe food for all.

IMPACT

As one of the few research-intensive universities worldwide located in a subtropical 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 the tropical and subtropical agriculture and food supply chains.

Photo: Dr Barbara George-Jaeggli.
Photo © Ken Laws, DAF

Sorghum field © UQ

Breeding sorghum for growth

Researchers are using genetics to revolutionise the Australian sorghum industry, increasing both yields and profits for growers.

Recent analyses have shown that the rate of productivity gain for sorghum in Australia is greater than that reported by any other developed nation.

UQ has played a significant part in that outcome via a sorghum pre-breeding public research program, run by QAAFI.

The work has been led by Professor David Jordan at QAAFI, and Professor Graeme Hammer, the inaugural director of QAAFI's Centre for Crop Science.

> *Professor David Jordan says improved genetics are one of the principal contributing factors towards the upward surge in Australian sorghum.*

"Sorghum genetic improvement is the focus of a program led by UQ, in collaboration with the Department of Agriculture and Fisheries and the Grains Research and Development Corporation," he says.

"The program draws upon a range of scientific disciplines such as plant physiology, crop modelling, molecular biology, pathology and entomology."

UQ's development of elite germplasm (otherwise known as parent lines) for licensing to the global sorghum hybrid seed industry has generated both positive economic and environmental impacts.

Cumulative net benefits of more than $220 million have been felt in Australia since 1997, averaging out to around $20 million per year.

At the same time that sorghum yields have increased, growers have also benefited from decreased production costs due to higher insect resistance and reduced need for chemicals.

The traits commonly desired in sorghum are resistance to sorghum midge, high yield, and improved performance in water-limited environments.

Some producers have reported the percentage of midge-affected plants on their property has dropped from 40 per cent to less than five per cent thanks to more robust plant genetics.

"Other key achievements of the program have been increased efficiency and use of available water, and increased flexibility for growers to sow at different times of the year," Professor Jordan says.

"Genetic material from the pre-breeding program is now incorporated into every sorghum crop in Australia, which extends across 671,000 hectares in Queensland and northern New South Wales."

> *Aside from its uses as livestock feed, sorghum is also a staple for 500 million people worldwide. It has become popularised in the westernised human market as a gluten-free 'ancient grain' and has many of the same nutritional values as raw oats.*

Despite being a staple food in countries such as India and Ethiopia, sorghum is yet to reach its potential in the Australian food market, which leaves room for future growth. Some projections contend that by 2050 there will be 9.6 billion people on Earth, and food needs will have doubled.

"Sorghum's health benefits are not just because it is gluten-free, but also because of the high concentration of phytochemicals, especially antioxidants," Professor Jordan says.

"In some specific phytochemicals, concentrations were twice the concentration as some other products, such as psyllium husk, which is considered a high-fibre health product.

"Sorghum, in Australia, has primarily long been an important crop in the northern grain belt for local feedgrain and export uses.

"Our contribution has been to help maintain its value to growers and industry via continuous improvement."

New markets have also opened in China, where sorghum is used to make baijiu, a clear liquor. Baijiu is the most widely consumed alcoholic spirit in the world, with more than five billion litres sold per year, ranging in alcoholic content from 28 to 65 per cent.

Professor Hammer says there are still more opportunities to be explored.

"The program will continue to pursue benefits for growers and industry through high-impact science, targeting greater yields and advances in product quality," he says.

"New opportunities are arising around possibilities for simultaneous design of genetic traits and crop management systems.

"We refer to this as the GxExM paradigm – which stands for genetics x environment x management.

"This is an area where crop and climate modelling can connect with the adaptive elements of genetics and agronomy."

Professor Jordan comments that when compared to many other crops, sorghum is highly resistant to a range of environmental stresses, particularly drought and heat.

"These resistances, combined with its small, well-characterised genome, make the crop an excellent model to discover traits that can be used in other crops," he says.

> *Since 1989, the program has licensed nearly 3000 sorghum lines to the sorghum-producing industry – many more than any other public sorghum pre-breeding programs around the world combined.*

In terms of what he derives the greatest pride from, Professor Hammer says it is mostly the teamwork that has made the outstanding advances possible.

"It's a great trans-disciplinary team effort that focuses good science on industry impact," he says.

"The team has high regard, both nationally and internationally, where it contributes to food security issues, like those of smallholder farmers in Africa.

"The team leader, Professor David Jordan, maintains excellent working relationships across all the scientists and industry partners involved, and I think that's another element that cannot be overstated."

The story so far

1957: The Queensland Government commences a sorghum pre-breeding program based at Hermitage research station.

1962: The first commercial sorghum hybrids are introduced to Australia.

1993: The Grains Research and Development Corporation begins co-funding the sorghum pre-breeding program. Dr Robert (Bob) Henzell from the Department of Agriculture and Fisheries (DAF) leads the program and develops it into an industry-facing, multi-institutional research collaboration. DAF institutes a commercial licensing scheme to manage commercial use of germplasm produced by the program.

1997: A 20-year investment in five sorghum pre-breeding projects, made by DAF, the Grains Research and Development Corporation and UQ, commences.

2009: UQ's Professor Hammer is awarded an Australian Research Council (ARC) Discovery Project titled: Mechanistic characterisation of genotype x environment interactions in sorghum and arabidopsis.

2010: The Queensland Alliance for Agriculture and Food Innovation (QAAFI) is established at UQ as an industry-focused collaboration with the Queensland Government, and the sorghum pre-breeding program leadership transitions to Professor Jordan.

2010: Professor Jordan and Professor Ian Godwin receive an ARC Linkage Grant titled: NextGen Sorghum: Genomic approaches to novel renewable bioproducts.

2010: Professor Hammer leads the publication of an advanced computer model of sorghum growth and yield that is capable of simulating the consequences of manipulating complex adaptive traits.

2012: The Queensland Government announces a $4 million international collaboration involving UQ researchers to improve sorghum productivity under drought conditions, led by Professor Jordan and Professor Hammer and funded by a grant from the Bill and Melinda Gates Foundation.

2012: Professor Hammer is awarded both the Australian Medal for Agricultural Science and the Farrer Memorial Medal.

2013: Dr Emma Mace and Professors Ian Godwin and David Jordan lead a global consortium that publishes the world's first large-scale sorghum re-sequencing project in *Nature Communications*.

2013: Professor Jordan receives an ARC Linkage Project titled: Fertility crisis: harnessing the genomic tension behind pollen fertility in sorghum.

2015: Professors Godwin, Jordan and Jimmy Bottella are awarded an ARC Discovery Grant titled: Breaking the nexus: more biomass in cereal grain.

2018: Professor Hammer is included in the Clarivate Highly Cited Researchers 2018 list.

2019: Professor Hammer, Professor Jordan and Dr Emma Mace receive an ARC Linkage Project titled: Beat the heat: Adapting sorghum crops for global climate futures.

Native wattle seed used to create a gut-friendly bread roll

Associate Professor Yasmina Sultanbawa

Gut-friendly bush tucker bread takes off in Darwin

An award-winning University of Queensland team is working with a Top End Indigenous employment provider to create a new all-natural superfood bread using bush tucker ingredients.

QAAFI researcher Associate Professor Yasmina Sultanbawa has helped develop a healthy, long-life wholemeal bread that replaces artificial additives with wattle seed and Kakadu plum.

Dr Sultanbawa has worked with Northern Territory company Karen Sheldon Catering to create the delicious, gut-friendly bread from ingredients harvested by Aboriginal communities.

The team collaborated in the kitchen, the laboratory and in communities to make sure this new functional food ticked all the taste, health and cultural boxes.

QAAFI researchers provided the technical expertise to determine which species of wattle seed, and how much, would work in the bread, and to measure nutritional benefits and storage potential.

Dr Sultanbawa said ground wattle seed provided extra fibre, vitamins and minerals and acted as a natural emulsifier to extend shelf life, and powdered Kakadu plum was used as a bread improver.

"We had to understand how each cultivar of wattle seed would behave when cooked. For example, *Acacia victoriae* has a coffee aroma when roasted, so you can't put that into bread," said Dr Sultanbawa.

"The seeds were roasted and then we started looking at their properties. Some contained a fair amount of fat and we thought they might develop some rancid notes. So we started eliminating based on aroma and flavour," she said.

Seed from *Acacia coriacea*, an indigenous wattle seed, came out on top and the QAAFI team helped work out how much was needed to get the best results.

"We looked at all the nutritional breads in the supermarket and tried to match their qualities. Our wattle seed bread is very nutritious: you can get the recommended daily intake of iron, zinc, and dietary fibre in one bun," Dr Sultanbawa said.

One wattle-seed bun contains 2.5 times the iron, six times the potassium and nearly five times the zinc of an average white-bread equivalent.

The bread is already on the menu at Darwin's Qantas lounge, which takes 200 rolls a week, but Karen Sheldon Catering Director Sarah Hickey said she was hoping to find a big buyer to create the demand to produce the bread on a larger scale.

"It would be great to see an Aboriginal-owned and operated organisation that could make this bread as a par-baked product that could be frozen for up to 18 months and sent to remote communities," she said.

Dr Sultanbawa said it was rewarding to work on projects where the benefits went back into communities, making them stronger and helping to close the gap.

"Once the demand comes we can increase the supply, and then Indigenous communities can reap the social, cultural and economic benefits of developing social enterprises on their own land,' she said.

Dr Sultanbawa and her collaborators last year received a Business and Higher Education Round Table (BHERT) Community Engagement award for working with northern Australian Aboriginal communities and industry to develop a Kakadu plum natural preservative for ready-made meals.

Dr Glen Fox

Field crop trials based at Bundaberg

Climate change risk to beer production?

While the quality of your favourite tipple isn't under threat from climate change, heat stress may have an impact on beer production, says University of Queensland food and nutrition scientist Dr Glen Fox.

"While we've noticed heat and drought stress produces a change in the starch properties of the barley used in beer production, brewers will always ensure a constant quality of their golden beverage," Dr Fox said.

Beer is made from barley and other grains such as wheat or sorghum, along with hops for bitterness and aroma, and yeast is used for fermentation.

But heat and drought stress are impacting on the composition of these grains during the critical 'grain fill' period, the final stage of growth in cereals.

"Grain fill is where the grain is getting nice and plump just before maturity. There are also hundreds of compounds going through some metabolic change and a lot of those systems are all very sensitive to temperature," Professor Fox said.

He said European researchers were noticing the effect as well.

"From an Australian perspective, we are seeing quite severe heat shocks much earlier in spring and that is having an impact on grain fill efficiency," he said.

"We are still trying to understand the impact of this but what we are seeing is that the heat-stressed grain requires a higher temperature to make all of its grain components soluble in the initial stages of brewing. This can reduce efficiency."

Dr Fox said it was not so much a question of climate change impacting on the barley yield, or its even protein content, rather the grain composition.

"The risk for maltsters and brewers is that the barley might meet current specifications but does not perform the same in production, and this could cause problems in malting and brewing. But maltsters and brewers will always strive to ensure consistency of their products."

Dr Fox said his message to industry was to also consider grain composition and do some additional testing rather than risk finding problems further downstream in the brewing process.

"Barley growers do an amazing job but the challenge for them will be to potentially select varieties that might flower and mature a little bit earlier to reduce the risk of suffering some sort of stress event during grain fill. Yield is absolutely important but maltsters don't buy barley on yield, they buy on quality."

"Also our barley breeders invest enormous resources to develop high-yielding varieties with the required quality. Climate change unfortunately is presenting extra challenges for everyone."

Dr Fox said climate change impacts such as heat and drought stress could also impact on the nutritional profile of the grain.

"This also poses a risk for grain food industries, like the baking industry."

Dr Glen Fox takes up the position of Anheuser-Busch Endowed Professor of Malting and Brewing Science at University of California Davis from 1 July 2019.

L-R Elizabeth Worrall, Dr Karl Robertson and Professor Neena Mitter

More sustainable crops just a spray away

Scientists are investigating whether a clay-based 'vaccine' for plants could safeguard the nation's $5.5 billion-combined cotton and vegetable industries against pest infestation and crippling crop losses.

Funded by Hort Innovation and the Cotton Research Development Corporation, the project is being delivered by the University of Queensland (UQ) in partnership with Nufarm, and involves trials of the non-toxic, biodegradable product BioClay on farms in Queensland and other locations across the country.

Hort Innovation research and development general manager David Moore said the new work followed more than four years of research into developing the product, and the trials presented an exciting step toward the commercialisation of BioClay.

"The Australian vegetable industry is among Australia's largest horticultural industries with an estimated annual gross production value of $3.7 billion, and exports to Asia and the Middle East valued at over $270 million," he said.

"Globally, an estimated 40 per cent of food grown is lost to crop pests and pathogens.

"Pest and disease management is increasingly challenging for both the fruit and vegetable and cotton industries, who are facing climate change, pesticide resistance and chemical use limitations.

"The high-tech BioClay spray responds to these challenges by priming the plant's own defences, helping the plant to naturally attack specific crop pests and pathogens."

QAAFI is leading the trials, and while the project is not due for completion until 2021, agricultural biotechnologist and research leader, Professor Neena Mitter, said early signs were promising.

"Through large-scale trials we know that BioClay works, and the work we have done to date provides a great foundation for pest and disease management across vegetable and cotton crops," she said.

"BioClay offers sustainable crop protection and residue free food produce – which consumers demand.

"There is no genetic modification of the plants, and the process does not involve chemicals that might affect untargeted insects.

"BioClay is the first step towards revolutionising how we manage pest control organically for increased sustainability and resilience of crops and industry at large. This is an exciting project that has the potential to ultimately reshape industry approaches to pesticides."

This project has been funded by Hort Innovation using the research and development levy, the Cotton Research and Development Corporation (CRDC) and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for the Australian horticulture sector.

Integrating breeding technologies to supercharge future crops

The inspiration for the development of 'Speed Breeding' came from the first food product designed and purposefully bred for growing in space, a variety of wheat called USU-Apogee. Dr Lee Hickey discusses how speed breeding has evolved from this concept into a powerful new breeding technology.

The power of integrating speed breeding with genomic techniques

The speed breeding tool itself can be powerful because often one of the limitations in plant breeding is the time it takes to grow a generation. With this tool we can achieve breeding goals faster. But the real power of any breeding tool can be seen when you start to integrate it with other techniques into a breeding program.

Recently, we have started to work with industry partners to integrate speed breeding systems with genomic selection breeding strategies. This provided the combined effect of growing plant generations without having to test these plants in the field for traits that are expansive and laborious to measure.

Opportunities for producing better crop varieties

We need to respond to environmental challenges by producing better crop varieties. This means deployment of adaptive traits, such as improved water-use efficiency. For example, that might mean deeper roots so the crop can access stored soil moisture. But these kinds of traits take time – many breeding cycles – to pyramid and bring together.

The key to the delivery of more-robust and yield-stable crops is through accelerating the breeding process and increasing efficiency. At the University of Queensland, we're working to apply predictive-based breeding approaches and simultaneously bringing together many traits very quickly.

Increasing efficiency to overcome cost barriers

For many breeding programs, one of the main challenges is still the cost of genotyping. When integrating and approaching genomic selection with speed breeding, there is the possibility of doing two or three breeding cycles in just one year. If a lab is genotyping selection candidates two or three times a year and working with large population sizes, then cost is a challenge.

We can get around this by simulating the numbers and working out the most cost-effective breeding strategy and incorporating these technologies.

There's also a bit of a divide between the commercial and public sector breeding worlds because only certain crops are profitable to breed in some regions of the world. A lot of people in the public sector are only just learning what the commercial world is doing and how ahead they are with some of these technologies.

Global collaboration for low-cost options

I recently enjoyed a successful collaboration with the John Innes Centre, UK, in publishing speed breeding protocols and developing the technology. They have been a real powerhouse collaborator and helped document exactly how the technology was maintaining plant health and in developing the technology to cut costs.

I'm now working with ICRISAT in India. We're building speed breeding facilities there to help fast track their breeding efforts for many crops that are important in Asia and Africa. Speed breeding systems are also being built with CIMMYT in Mexico, who are developing important crops for the same regions. Also, one of my PhD students is based in Ethiopia. As part of his project, we're planning to set up a small speed breeding capacity there.

This technology is not overly difficult to implement with the right facilities. It comes down to controlling photo-period, temperature, and giving the plants the conditions that they need to grow fast. Traditionally, facilities like this have been expensive because of electricity costs. But we are looking at low-cost options for developing countries or resource-poor regions, thinking outside the box to make these technologies accessible and affordable.

Removing the bottlenecks of genome editing

I see tremendous potential to combine speed breeding with genome editing. This could remove the bottlenecks of genome editing, taking it out of the lab and doing it directly in the speed breeding process. This would mean editing thousands of plants simultaneously at a scale where it becomes transformed from a biotechnology into a breeding technology.

With predictive-based breeding, we could be breeding six generations per year for regions around the world. That would be a game-changer in terms of crop production.

First published by Joshua Broomfield on http://www.global-engage.com/agricultural-biotechnology/integrating-breeding-technologies-supercharge-future-crops/15th February 2019

The avocado detectives: Dr Liz Dann and Dr Andrew Geering

Smashing avocado disease threats

Researchers are working with the Australian avocado industry to safeguard one of the nation's favourite fruits from the threat of existing and emerging disease.

QAAFI researcher Dr Liz Dann is working on an industry avocado biosecurity project funded through Hort Innovation.

"The aim is to improve yields, fruit quality and build capacity to deal with biosecurity issues," Dr Dann said.

"I am constantly reviewing the disease management practices, and trialling new products or approaches for reducing the impact of the many diseases which affect avocados."

While Dr Dann's focus is managing existing diseases, her colleague Dr Andrew Geering is concentrating on developing diagnostic tests to protect the industry against new threats.

"Sometimes the biosecurity threats are well understood but others seem to pop out of the blue," Dr Geering said.

"A good example of a pest that was not previously on anyone's radar is the fungal disease Laurel wilt, which is spread by the tiny redbay ambrosia beetle.

"It's decimating the avocado industry in Florida.

"As soon as the beetle bores into the trunk of an avocado tree and introduces the fungus, the whole tree collapses within a month," Dr Geering said.

"There is no resistance.

"We don't have the beetle in Australia yet – but it is vital we have good diagnostic tests for a wide range of pests and pathogens."

Dr Dann said all diseases are manageable.

"We just need the tools and the capacity to maintain current biosecurity processes, and to meet emerging challenges."

Hort Innovation chief executive John Lloyd said the project is timely, with domestic consumption of avocados in Australia tripling over the past 20 years from 30,000 tonnes to 90,000 tonnes.

"There is no arguing avocados are everywhere, on café menus, on television, in pop culture; there is even an avocado emoji," he said.

"What this research aims to do is protect a fruit that Australians are highly affectionate about."

Australia produces around 66,000 tonnes of avocados annually, with a wholesale value of $534 million.

Time to open the Gondwana store

By Brad Collis

Robert Henry gazes ruefully northwards from the University of Queensland's St Lucia campus, caught between feeling excited and a niggling regret.

"There's a supermarket out there … but most Australians don't even know it," he said.

His excitement stems from this 'supermarket' being the enormous untapped food and cropping potential of countless indigenous plant species that a small, though growing, body of scientists are realising could be a genetic bounty holding a critical key to the planet's food security. Internationally, northern Australia in particular is already being talked about as the frontier for new plant genetics. Robert Henry's regret is that by-and-large it remains a blind spot for Australians. Most of the interest and research is being driven from overseas.

"Take wild rice which is abundant across northern Australia from Townsville to the Kimberley. I'm considered the local expert, but most of what I know is from Japanese scientists who have been studying our wild rice for 20 years," he said.

Robert Henry, Professor of Innovation in Agriculture and Director of QAAFI, said it is becoming increasingly clear that Australia is home to an enormous diversity of indigenous grain-bearing grasses, pulses and fruits of potentially huge value to plant breeders needing to bolster domesticated crops with increased climate resilience and pest and disease resistance.

"We have rice, ancestral grasses related to domesticated cereals, our own soybean, sorghum, mungbean, pigeon pea; even citrus and grapes, but they have mostly been overlooked because of a long-held false assumption that our only food crops are those introduced through European settlement."

Professor Henry believes this landscape ignorance may have arisen from a basic misunderstanding of the Aboriginal use of these plants. "It was often noted by explorers and settlers that indigenous people didn't undertake any traditional cultivation; the conclusion being that there were no crops to farm. Now, however, we are beginning to realise that indigenous plants bearing edible seeds and fruits were in such abundance naturally that a transition to farming, in the European sense, just wasn't required.

"For example, native rice is present in such abundance and in naturally weed- and disease-free stands that you don't need to plant it and manage it. You just harvest and store … activities that were observed and recorded, but not understood. We were blinded to the significance of this by our need to see crops being cultivated."

Professor Henry is now working on a project for the CRC for Developing Northern Australia to scope the potential for a rain-fed rice industry in the north based on local genetics: "We have learned that when we take Asian varieties into the north they only grow until pests and diseases find them. Native rice doesn't have this problem, which points to an opportunity to identify these resistance genes and back-cross into a high-yielding Asian rice.

He describes native species as "unknown, underutilised, underappreciated", a perspective he hopes to help change.

A measure of the opportunity (and historical ignorance) is DNA analysis is revealing that some of the plants like rice and soybeans (genus *Glycine)* that were assumed to be wild survivors of species introduced by early human migration, actually originated here.

Australian wild rice, for example, was assumed to have been brought to Australia from Asia and this may be why it has been ignored by breeders. However, research has now shown the Australian varieties are quite distinct and therefore likely to possess considerable genetic diversity that hasn't been captured in domesticated varieties.

Such potential locked up in native germplasm is now one of Professor Henry's primary interests in his agricultural innovation portfolio.

"It's the same with soybean. There is an increasing realisation that most of the genetic diversity for Glycine is right here. We've found at least eight species in Queensland alone that we have yet to even name," he notes. "And all the time we have been struggling to adapt introduced varieties to our variable climate … we've had our own."

Professor Henry is also studying wild sorghum in a joint project with Professor Ros Gleadow from Monash University in Melbourne: "The sorghum we grow commercially was domesticated in Africa, but the sorghum genus is Australian. All of the species exist here, mostly in Queensland, but apart from a Texan variety that has used genes from a wild Queensland sorghum, this resource also has largely been overlooked even though we have identified traits that could deliver bigger grains and help get sorghum into the human foods market."

Native citrus has gained some recognition through the finger lime, *Citrus australasica,* and the round lime, *Citrus australis.* Professor Henry said there are four Australian citrus species and all potentially have useful disease-resistance traits for domesticated species, as well as an early flowing trait that the American citrus industry has exploited to breed earlier fruiting trees.

Other fruits include wild grapes found to be of Gondwana origin – the super continent that split up about 180 million years ago to form the landmasses we know today as Australia, Africa, South America, Antarctica, the Indian subcontinent and the Arabian Peninsula. Professor Henry said the grapes' adaptation to a rainforest environment in Queensland has made them resistant to fungal pathogens: "This could provide the modern-day industry with some very exciting rootstock potential."

Another example of this extraordinary unfolding story that is destined to re-write Australia's agricultural history is pigeon pea. Australian farmers have been trying to build production to supply potentially high-value markets on the sub-continent, but the introduced varieties have struggled under pest and disease pressure. Now it has been found that most of the global biodiversity for this plant exists in an agroecological zone stretching between Townsville and Mount Isa. Again, the genetics that could protect the commercial crop are already here.

Wild parsnip growing in northern Australia
© Shutterstock

What all this amounts to, said Professor Henry, is the presence in Australia of indigenous genetic resources that have the potential to improve crop performance – in Australian production systems and elsewhere.

He believes that exploiting this resource would herald a second Green Revolution. The first Green Revolution, in the 1960s, used selective breeding to increase the ratio of grain to plant matter (the higher harvest index approach). Professor Henry believes there is as much to be gained again by capturing wild diversity that hasn't yet been incorporated into domesticated crop gene pools.

Serendipitously, with the growing awareness of this potential is the advent of new breeding technologies: "Until now we simply haven't had the tools, but modern pre-breeding allows us to accurately identify, and bring in, those genes and use genome sequencing and analysis to guide rapid back-crossing.

"It's an exciting new opportunity for agriculture because a lot of what we are growing today is based on something that was domesticated 10,000 years ago. Faced with climate change we have to broaden that genetic base. Exploiting the biodiversity existing in indigenous crops that are related to many introduced commercial varieties is one such technological opportunity, but right now there isn't any concerted effort to research this potential."

However, Professor Henry is confident this will change, especially if the national mindset can be moved from asking 'what do we have' to 'what don't we have'.

"That's exciting because the evidence is mounting that we probably have a bit of everything."

Industry Development Group members (L to R): Russell Ford (SunRice), Professor Robert Henry, Director (QAAFI), Jed Matz, CEO (CRCNA) and Paul Ryan (Olive Vale Pastoral).

Northern Australia set to go wild about rice

A new Cooperative Research Centre for Developing Northern Australia (CRCNA) project will lay the foundation for a northern Australian rice sector with the potential to produce more than one million tonnes of specialty rice annually.

CRCNA Chair Sheriden Morris announced the CRCNA's latest $505,000 research collaboration with project participants QAAFI at the University of Queensland (UQ), Charles Darwin University, Western Australia's Department of Primary Industries and Regional Development (WA DPIRD), Queensland's Department of Agriculture and Fisheries (DAF), Rice Research Australia (SunRice), Olive Vale Pastoral, and Savannah Ag Consulting at James Cook University's Cairns Institute.

Ms Morris said the project was the first of its kind undertaken in Australia.

"This project will take a broad look at the whole northern Australian rice supply chain and really zero in on what the opportunities for development are, given the current operational environment, and what can be done to improve this environment to facilitate growth across the industry.

"We expect this body of work will deliver an action plan for the industry and inform the CRCNA's strategic investment and research planning into the future," Ms Morris said.

QAAFI's Professor Robert Henry said northern Australia is well-placed to capitalise on emerging markets for speciality wild rice products and this research will help identify where further efforts and investment is needed.

"This region has significant potential to meet growing demand for high-quality rice products, but what we need is to bring all of the information and research together and identify the right combination of market, varieties, production methods, transportation and processing requirements to develop and deliver a cohesive long-term action plan for the industry."

The 18-month research project will evaluate three different northern rice industry scenarios including examining the production of wild rice, the production of a unique northern Australian rice variety and the potential for commercial use of genes from Australian wild rice to support the breeding of rice for global production.

Professor Henry said the wild rice industry could be an attractive opportunity for traditional owner-led enterprises, while developing a unique northern Australia rice variety could tap into consumer demand for high-value foods.

"We estimate by increasing wild rice production to around 100 tonnes a year, the industry would be worth around $10 million per year within five years, while a 'North Australian Rice' grade would be worth $50 million annually within seven years."

Charles Darwin University Senior Lecturer in Plant Science Dr Sean Bellairs said the region's native wild rice species are overlooked in the current agricultural system.

"The Canadian wild rice industry shows that we can develop our unique Australian native rices into a globally significant product in a way that supports many Indigenous and other enterprises."

The situational analysis project will include desktop and literature reviews drawing on current industry Strategic Plans with research staff based in Darwin, Kununurra, Brisbane and Cairns. An Industry Development Group will be established during the project and is expected to continue progressing the development of a northern rice agenda even after the project wraps up mid-2020.

Queensland Minister for Agricultural Industry Development and Fisheries Mark Furner said north Queensland was a major centre for horticulture, supplying a significant percentage of the nation's fruit and vegetables.

"A thriving local rice industry would be a welcome addition to our agricultural output," Minister Furner said.

The CRCNA's northern Australia rice industry situational analysis project is one of eight industry situational analyses funded by the CRCNA in 2017/18. Other industries the CRCNA will examine as part of its commitment to informing broader discussions on further policy, investment, R & D for Ministerial Forum consideration include the aquaculture, forestry, cropping, horticulture, bush foods, beef, health and infrastructure and communication sectors.

Cattle sires of the tropical north reveal their genetic secrets

Inhospitable environments, ticks, parasites and heat … it takes a careful mix of ancestry and breeding for a cattle industry to thrive in Australia's far north. Now, genome studies are creating opportunities to lift the industry's productivity.

To acquire their adaptation to tropical conditions, however, the progenitor of modern Brahman breeds incurred productivity penalties. This is reflected today in genetic traits that reduce fertility and meat quality compared with temperate breeds.

Stamped into the Brahman genome, therefore, is a unique balance of adaptation and productivity-penalty traits. It took evolution, domestication and concerted breeding to achieve that balance. But it amounts to a benefit-cost equation that limits the value of the northern beef industry, even as it made that industry possible.

QAAFI Professor Stephen Moore, who retires from the position of Director of the Centre for Animal Science in July 2019, thinks it is possible to rejig the genetic scales.

A mosaic of ancestry and breeding

En route to decoupling productivity penalties and adaptation traits, Professor Moore first had to sequence, assemble and then decipher the functional structure of the Brahman genome.

Sequencing a genome alone produces little in the way of useful information. It amounts to a description written in the 'nucleic acid' language of the genetic code.

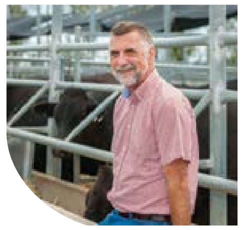
To acquire meaning, DNA sequence is used as a reference point to compare and contrast the genetics of animals on a spectrum of functional characteristics, reflecting the genetic diversity of a population.

Only then does the genome reveal subtle sequence differences that make it possible to improve the performance of important animal traits.

For the Brahman cattle project, it took one rigorously compiled 'reference sequence' and comparisons with 50 additional genomes to achieve a breakthrough. A further 100 genomes have already been sequenced and another 100 are in the pipeline, with QAAFI's Professor Ben Hayes adding to the power of the QAAFI study with input from his 1000-bull genome project.

Included in the analysis was DNA from the Australian bulls that most influenced the genetics of Australia's Brahman herds. Thanks to the foresight of the late Dr Brian Burns, semen samples of top bulls dating back to the 1950s were preserved, allowing Professor Moore to analyse the cattle's historical pedigree.

Revealed is a genome that is a mosaic of DNA from different ancestral sources. Clearly visible is the bones of the *Bos indicus* genome – the subspecies that was domesticated in the Indus Valley of Pakistan some 6000 years ago and gave rise to tropically adapted cattle.



However, there is also a small mosaic of DNA from *Bos taurus* – the subspecies domesticated in Iraq that is responsible for highly productive European cattle breeds.

Of particular interest were 'fixed genetic differences', meaning mosaics of DNA that are inherited together in a population and are exclusive to a breed. This indicates DNA that is essential to that breed's core characteristics.

As the resolution improves, the genetic basis of both the adaptation and the productivity-penalty traits is coming into focus.

Professor Moore's goal is to use the genome information directly to predict which parents are needed to create bulls that can sire a more productive Brahman herd while retaining their hardy adaptations.

However, to make the desired genetic gain requires a starting gene pool that contains lots of genetic diversity.

Fortunately for the northern cattle industry, the ancestry of Brahman herds has provided the researchers with all the diversity they need.

Ancestry matters

Normally, domestication and breeding programs narrow an animal's gene pool, with the narrowing making additional genetic gain difficult. Fortunately, that is not the case for Brahman cattle due to their unusual ancestry.

They originate in four breeds of *B. indicus* bulls and cows that were imported to Texas in the US starting in 1854. Extensive crossing then mixed together these gene pools to produce American Brahman cattle.

From the 1930s onward – but accelerating from the 1950s – American Brahmans were imported to Australia where they were found to cope well in the tropical north where they created a new cattle industry.

With them came the widened genetic diversity that is the grist for successful breeding programs.

"What we are learning from this genome work is that lots of improvement is possible for tropically adapted cattle," Professor Moore said. "Using genomic prediction techniques, we can make that gain with unprecedented efficiency, translating it into a more profitable, yet resilient, northern livestock industry."

ENGAGEMENT

At QAAFI, our agricultural and food science researchers have developed extensive relationships with Australian and international farming communities, industry and government agencies.

Strong collaboration is at the heart of QAAFI's research effort. We partner with organisations across the globe to facilitate mutually beneficial collaborations, which can be leveraged to secure further research funding and to attract the best minds to work on key challenges in the agriculture and food industries.

Professor Ben Hayes takes a hair sample for DNA analysis © QAAFI

Jefferis family among northern cattle producers excited by fertility predicter

The dream of running a heifer up a crush somewhere in the Gulf country, pulling out some tail hair and within minutes, getting an accurate prediction on her fertility, is one that could soon be realised.

Developing a DNA test to predict the value of an animal's genetics for fertility is the subject of research being undertaken by QAAFI, funded by MLA Donor Company, with investment matched by the federal government, and the University of Queensland.

McKinlay Brahman breeders, Rodger and Lorena Jefferis, based at Elrose, are among the producers supplying cattle for the Northern Genomics Project and say they're excited by its prospects.

"Being able to get a prediction on which heifers we should keep and which ones we shouldn't – I think that's something," Rodger said. "That guarantees our future, because there's suddenly a sort on the cattle, you're not running blindly and running extras."

Rodger, a former president of the Australian Brahman Breeders Association, has been a long-time advocate of using modern techniques to advance the breed, citing the research into gene markers undertaken by the Beef CRC.

"We learnt a lot of world-beating stuff for cattle in general – it was in the days when MSA grading came in, and there was work on feed efficiency – the light was starting to come on as far as the advances that could be made in science," he said.

UQ leading research

The current project is led by Professor Ben Hayes, Director of QAAFI's Centre for Animal Science at The University of Queensland.

He said 52 herds had so far contributed data, the majority of them in Queensland, ranging from the NSW border, through to Central Queensland, up to the Gulf and the Cape, and over to the Northern Territory border.

> *"There are a couple of herds in the NT and one in Western Australia," he said. "We'd like to broaden that but the challenge is that participants need to be control mating."*

He was confident of reaching the target of 30,000 heifers scanned "no trouble at all", saying more than 12,000 had been ovary scanned in the year the project has been running to date.

The process involves having a vet do ovary scans to record whether heifers have cycled and gone through puberty.

"The ones who go through earlier are more likely to get a calf on the ground and be more profitable over their lifetime," Professor Hayes said.

"Each of those heifers had 10 tail hairs taken – we extract the DNA from that and run it across a machine that takes a snapshot across the DNA.

"We use that and the ovary scan information to find the genes associated with early puberty."

As to its reliability, Dr Hayes said that depended on the data set collected, adding that the project was the biggest study ever done in beef cattle for fertility.

It incorporates all breeds used in northern Australia, both pure *Bos taurus* and *Bos indicus* and composites.

Dr Hayes said making sure they captured all breeds represented in the north had been one of the selection criteria.

The project has a five-year life, three years of collecting data and another two crunching it.

"It's fantastic how enthusiastic people are," Dr Hayes said. "They're going out of their way to muster their cattle in – I guess they feel the tools to address fertility issues are finally nearly there."

Fertile ground for producers

The traditional practice for getting non-productive females out of cattle herds has been to identify them when they missed out on calving, which could take many months to realise.

Rodger Jefferis said it was chopping the tail off.

> *"I liken it a bit to – you're having a marathon from Blackall to Barcy and you wait to the last 50 and say, you're all too slow, instead of going to the first 10 and saying, we're going to breed from you."*

What he says the Northern Genomics Project is doing is finding the lead rather than waiting years to find the tail.

"You can get the non-productive cows out way early, when they've got milk teeth so they're good feeder prospects and they're not eating your grass for another couple of years," he said.

He was part of a group of 25 or so producers, corporations and small private breeders alike, representing a variety of breeds, that took part in an update at the Jefferis' McKinlay property, Elrose, in early October.

The project, which wants to test 30,000 females, is still looking for northern beef herds to participate in the research.

Herds can represent a range of breed compositions, including crossbred cattle, but producers need to: have a history of herd-recording using National Livestock Identification System tags; practise controlled mating; and be able to provide lines of about 100 heifers/cows that are consistently managed.

Collaborating producers will receive information about when heifers cycle, the fertility performance of their herd compared to other herds in their region and a head start into genomics-assisted breeding.

Mr Jefferis said it was extremely pleasing to see where the industry was going, after the kick in the guts that everyone got from the live export trade suspension.

Rodger and Lorena Jefferis. © by Sally Cripps, QCL.

"Anything that makes people more efficient and more productive and help us all stay ahead in the industry has got to be good," he said.

"Fertility is critical in this part of the world where we all struggle.

"People up north are crying out for more calves – that's their livelihood."

He expected the amount of relativity data generated by the genomics project would eventually provide other benefits in growth and carcase attributes.

"I said to the room full of people, all giving their time to do this extra recording, ovary scanning and rating for temperament, the industry is very indebted to people like yourselves because we're all going to benefit.

"It's not that long ago that people were sitting back and saying to hell with all that stuff.

"Now they're starting to say, 'What about us, we want to be in it'. The light's really starting to come on."

Original article published in Queensland Country Life on 23 October 2018

Photo: © UQ

Partnering on disease-resistance crops

QAAFI's Dr Craig Hardner is a co-principal investigator on AUD 13.5 million (USD 10 million) United States Department of Agriculture (USDA)-funded project led by Washington State University, RosBREED: applying science to improve the financial and ecological sustainability of new rosaceous cultivars like apples, almonds and apricots.

The research consortium consists of 11 USA universities (Washington State University, Clemson University, University of Florida, University of Minnesota, Michigan State University, Texas A&M, University of Arkansas, University of California – Davis, California Polytechnic, University of New Hampshire, and Cornell University) in collaboration with USDA-Agricultural Research Service.

Professor André Drenth on survey for blood disease in Java 2017 © UQ

Banana blood disease targeted by Australian and Indonesian researchers

A deadly banana disease that first caused problems in South Sulawesi over a century ago has now spread across the Indonesian Archipelago and to peninsular Malaysia – posing a threat to Australia's $600 million banana-growing industry in northern Australia.

Banana blood disease was named after the red-brown discoloration when visibly healthy-looking green banana fruit are cut.

The pathogen that causes banana blood disease impacts on most banana varieties, and no effective resistance has been identified so far. For infected territories, banana blood disease is now considered one of the most important banana diseases.

QAAFI, through its partnership with the Department of Agriculture and Fisheries, plays a key role in helping protect the banana industry in a Hort Innovation-funded research project led by Professor André Drenth.

The objective of this project is to improve the detection, identification and incursion management of exotic banana diseases.

Bananas originated in Southeast Asia, with Indonesia and Papua New Guinea playing a key role in the evolution of the world's most popular fruit. However, many micro-organisms that cause disease in bananas have co-evolved with the fruit in these countries that neighbour Australia to the north.

One disease of particular concern is banana blood disease caused by the bacterium *Ralstonia syzygii subsp. celebesenis* which belongs to a group of pathogens that cause bacterial wilts in banana, and is related to Moko disease.

This pathogen first caused problems in South Sulawesi in the early part of the 20st century. The Dutch colonial administration quarantined this area and for over 60 years the pathogen remained contained to Sulawesi. However, in 1987 it turned up in Java and since that time it has spread rapidly over the Indonesian Archipelago and also invaded peninsular Malaysia.

Blood disease symptoms

Symptoms of banana blood disease include characteristic red brown vascular staining toward the centre of the pseudostem, wilted and necrotic leaves, with fruit bunches that appear outwardly healthy but are internally stained red/brown, rotten and inedible. Blood disease results in reduced numbers of marketable bunches and causes significant wilting, generally reducing the vigour of the tree and killing whole plants in severe cases.

Banana blood disease is one of the key target pathogens in Professor Drenth's Hort Innovation project. His research is focused on the occurrence, spread, vectors, mode of infection, and improvements in management of such diseases that will help both countries.

Surveys

The banana blood disease research got a boost from a Bilateral Plant Biosecurity Initiative between Australia and Indonesia led by the Cooperative Research Centre for Plant Biosecurity that sought to fund small projects with potentially a large impact.

Working with Dr Wayan Mudita from Nusa Cendana University in West Timor, Professor Drenth undertook a small project to conduct several surveys to determine the extent and impact of banana blood disease in Indonesia. From a series of surveys undertaken on several of the large islands of Indonesia, it became clear that the banana blood disease problem was more widespread than initially thought.

During the term of this grant, the Ministry of Research, Technology and Higher Education of the Republic of Indonesia awarded Professor Drenth a World Class Professorship at the University Gadjah Mada in Yogyakarta in 2017. This initiative provided funding for further surveys and training, as well as infrastructure support for the Indonesian researchers. This support enabled Professor Drenth to spend some time at Gadjah Mada University, working with Professor Siti Subandiyah, the Head of Research Center for Biotechnology, in 2017.

Collaboration

Strong collaboration between the Australian and Indonesian researchers has resulted in Australian and Indonesian students being co-supervised by members of both teams.

Significant gaps were identified in the understanding of banana blood disease, and a series of field trials were undertaken in Indonesia to gain an understanding of the infection and spread of this pathogen. This experimental work, undertaken by Professor Drenth and Professor Subandiyah, is funded by a grant from the Australian Plant Biosecurity Science Foundation.

Ms Jane Ray, working as a PhD student on this project, was awarded a 2019 Endeavour Cheung Kong Research Leadership Award, enabling her to spend up to six months in Indonesia working on the infection biology and epidemiology of the banana blood disease.

In March 2019 the Crawford Fund awarded Professor Drenth an International Engagement Award, which will further strengthen the established links with Gadjah Mada University and Nusa Cendana University through funding Professor Drenth to conduct training and mentoring to young Indonesian scientists in the area of plant pathology.

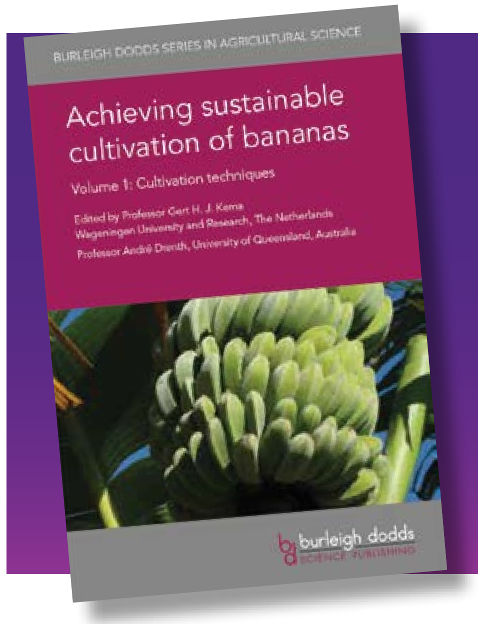
Win-win

QAAFI encourages the development of strong connections and links with relevant and leading research organisations in the world in our quest to improve agricultural productivity and profitability for the benefit of all.

The banana blood disease research demonstrates QAAFI's capability to initiate and develop successful national and international research programs that attract funding from a range of different sources.

A better understanding of the disease will aid Indonesia's banana growers to reduce the impact of the disease. This will in turn reduce the risk to Australia and will allow for testing and validation of identification techniques developed in Australia – a win-win situation for all parties involved in the collaborations.

Banana blood disease © Andre Drenth



Sustainable cultivation of bananas

In addition to collaborating with developing countries, Professor Drenth and his team also have strong collaboration with Professor Gert Kema from Wageningen University, in the Netherlands. Professor Drenth and Professor Kema are co-editors of a series of books on the sustainable cultivation of bananas, with Volume 1 published in 2018.

Global pig science conference a success

The digestive physiology of pigs was under the microscope at the International Symposium on Digestive Physiology of Pigs (DPP) held at the Brisbane Exhibition and Convention Centre in 2018.

Delegates at the Digestive Physiology of Pigs conference © Dr Eugeni Roura

Symposium Co-Chair Associate Professor Eugeni Roura, from QAAFI's Centre for Nutrition and Food Sciences at UQ, explained that the digestive tract of pigs is the closest non-primate model to a human digestive system.

"So researching how we control appetite in pigs could help us find some solutions to the human obesity crisis," Dr Roura said.

The scientific framework of the DPP conference program focused on the digestive system and latest advances in pig digestive physiology.

Held in the Asia Pacific region for the first time, the Brisbane conference set a new benchmark for the event, with a 20 per cent increase in delegate numbers.

Dr Roura said 500 delegates from 38 countries attended the event.

"If you are involved in the science of pig physiology, this conference is considered a 'must attend'," Dr Roura said.

He said the attractiveness of Brisbane as a destination, including ease of international access, and the strong promotion of the event in Asia, particularly China, resulted in 80 per cent of the delegates coming from overseas – 10 per cent of whom were from China.

Australians come together to improve animal welfare

If there is one thing most Australians agree on, it's that we all want better animal welfare.

A recently launched University of Queensland initiative, The Animal Welfare Collaborative, brings together all interested Australians to work towards a shared goal—to make Australia a global leader in animal welfare.

UQ Professor of Animal Welfare Alan Tilbrook said that the Collaborative is currently working with 60 agricultural industry, government, academic, animal welfare and community groups. "We have embraced all, no matter their disposition on the use of animals, and have brought them all to the table to talk."

"The strength of the Collaborative is that it is led by Australian universities and thus provides non-partisan independence, credibility, and scientific rigour, allowing us to lead initiatives with a clear focus on the animals," he said.

The Animal Welfare Collaborative is funded by The University of Queensland and is powered by the tireless efforts of researchers at The University of Queensland, The University of Newcastle, The University of Western Australia and The University of Adelaide. The Collaborative is committed to working closely with all federal, state and territory governments.

The Animal Welfare Collaborative has four key goals:

- Encouraging all of society to contribute their ideas on how to improve animal welfare
- Facilitating an inclusive, constructive, evidence-based discussion about animal welfare
- Promoting best practices in animal welfare
- Translating and enhancing a science-based approach to animal welfare.

"The Collaborative has a broad remit of animal species to cover, but the group's initial focus is Australia's animal production and horse racing industries, which have been the focus of public concern in recent years," Professor Tilbrook said.

At a recent summit held in Sydney, the Collaborative brought together 60 organisations with a broad range of opinions to 'custom build' the Collaborative so that it becomes an efficient and novel instrument to achieve its goals.

Animal Health Australia CEO Kathleen Plowman said it was encouraging to see so many groups with a diverse range of views represented at the summit.

"The summit provided a respectful forum for discussion and debate, with everyone in agreement that providing animals with the highest level of welfare outcomes was the main priority," said Ms Plowman.

Nearly two-thirds of the organisations present at the summit voiced their enthusiasm for continuing to work together to make The Animal Welfare Collaborative a success.

Dr Jill Fernandes and Professor Alan Tilbrook. Photo by Cam Neville.

Key organisations who attended the Animal Welfare Summit meeting in Sydney in April 2019 include:

- Animals Australia
- Animal Health Australia
- Animal Welfare Science Centre
- Australian Chicken Meat Federation
- Australian Eggs
- Australian Livestock & Property Agents Association
- Australian Livestock Exporters' Council
- Australian Meat Processor Corporation
- Australian Pork Limited
- Australian Superfine Woolgrowers' Association
- Australian Veterinary Association
- Australian Wool Innovation
- Cattle Council of Australia
- Country Women's Association of NSW
- Dairy Australia
- LiveCorp
- Meat & Livestock Australia
- Murdoch University
- National Farmers' Federation
- Poultry Hub
- Tasmanian Institute of Agriculture
- The University of Queensland
- The University of Melbourne
- The University of Newcastle
- The University of Western Australia
- The University of Adelaide
- The University of New England
- Western Sydney University.

Other organisations interested in participating or learning more about The Animal Welfare Collaborative are encouraged to contact coordinators via the website theanimalwelfarecollaborative.org

Multi-million dollar collaborative project to design the tree of the future

Australian researchers have turned to plant genetics to help solve DNA mysteries and create the horticultural tree crops of the future under a new $11.3 million joint research project.

Delivered through Hort Innovation, this five-year project will develop a breeders genomic toolkit for tree breeders and researchers to better understand how genes control traits that are valuable to Australian growers, including tree size, yield, disease resistance, and tree maturity.

Two of the research programs within the project will be conducted by QAAFI at The University of Queensland (UQ), and the third through the Institute for Future Environments (IFE) within the Queensland University of Technology (QUT).

The project aims to build a complete DNA map that will visualise the genetic make-up and variability of the nation's five leading tree crops that represent 80 per cent of the total value of horticultural tree crop production in Australia.

This includes avocados, mango, macadamia, almond and citrus fruit varieties. The project will produce the world's first detailed map of the avocado genome.

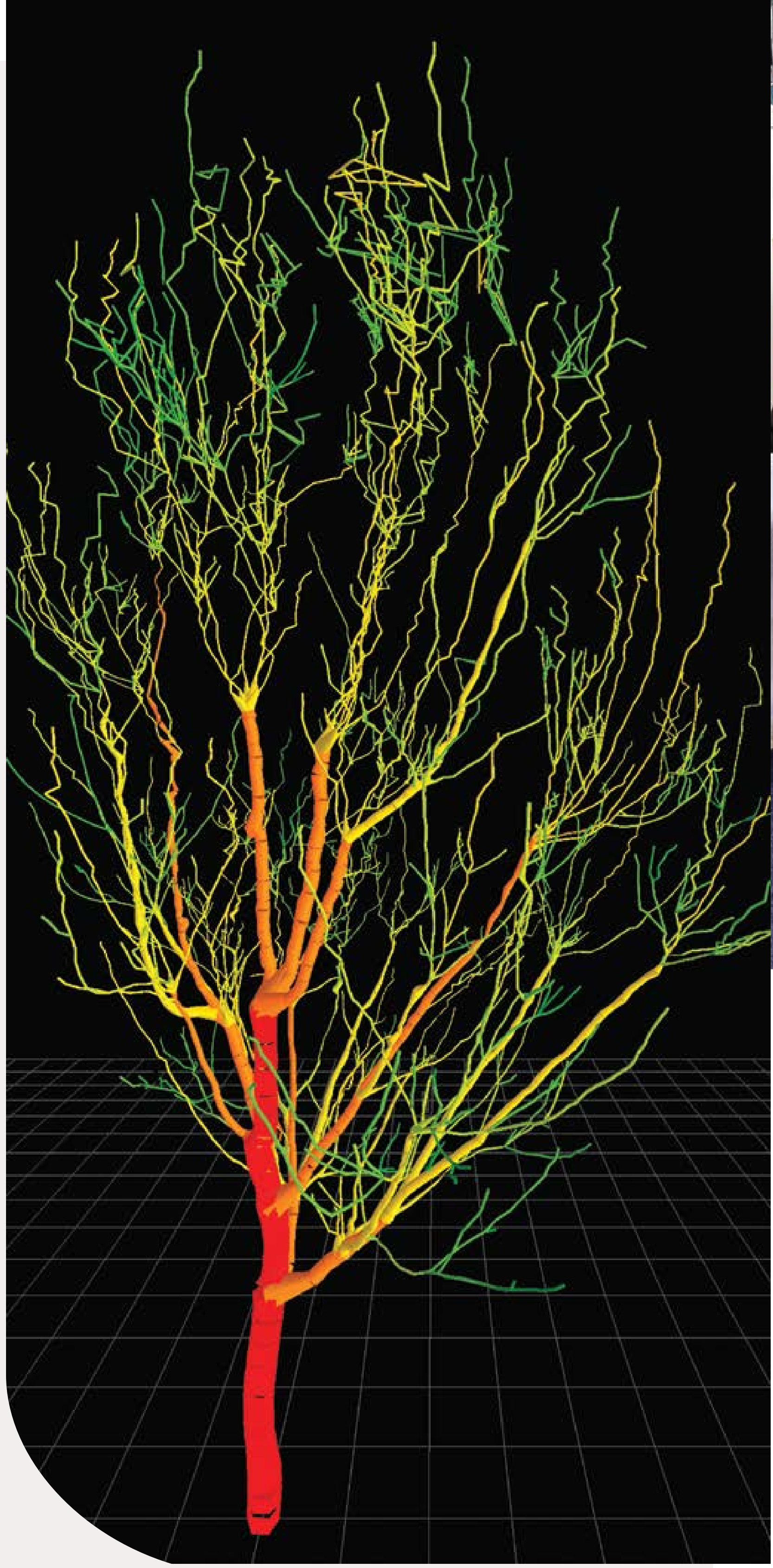
Hort Innovation Chief Executive Officer Matt Brand said Australia's ability to be at the forefront of horticultural biotechnology was essential to ensure the industry remained profitable, productive and protected.

"While currently profitable, the horticultural tree industry faces numerous and significant challenges that stem from plant diseases, slow production and climatic changes," he said.

"Plant production is, by definition, a slow and timely process. This project will break down the genetic code of our five leading tree crop varieties to assess ways to develop more resilient trees that can withstand the changes expected in the coming years."

QAAFI's Professor Robert Henry said the long generation time of tree crop production made it difficult for plant breeders and physiologists to proactively or "rapidly" develop new plant varieties in response to pest and disease outbreaks, changing climate and evolving consumer preference.

Prof Roger Hellens from IFE added, "Advances in genomic sciences have benefitted many agricultural industries, but they haven't fully extended into horticulture in the same way they have impacted on field crops."



A digitised macadamia tree. Image from DAF-UQ Small Trees High Productivity Project © A/Prof Jim Hanan

"Earlier genomic studies in apples demonstrated that elite seedlings could be bred and planted as commercial varieties after just 24 months using genomic prediction approaches – this is seven years earlier than through conventional breeding methods."

Genomic approaches offer opportunities to progress the efficiency of genetic variation on individual plant performance.

Outputs delivered through this project will have a major impact on Australian horticulture through improved management systems and more efficiently developed varieties.

Queensland biotech leaders celebrate 20 years at the BIO international conference

Queensland showcases biotech innovation at BIO 2018

Around 150 Queensland biotechnology leaders attended a delegation led by Queensland Premier The Honourable Annastacia Palaszczuk to the 2018 BIO International Convention in Boston.

The event marked Queensland's 20th mission to the BIO International Convention.

UQ Vice-Chancellor Professor Peter Høj AC led a UQ delegation to the event, which was also attended by QAAFI Director Professor Robert Henry, QAAFI Deputy Director Mr Steve Williams and Professor Neena Mitter, Director of the Centre for Horticultal Science.

Premier Palaszczuk said Queensland researchers are world leaders in agriculture, viral, bacterial and parasitic infection, vaccine research and drug discovery.

Boston, the host of the 2018 BIO International Convention, is one of the world's largest biotech hubs and home to some of the world's largest biotech companies.

Hon Annastacia Palaszczuk, Premier of Queensland (left) with Professor Neena Mitter

UQ Vice-Chancellor Professor Peter Høj AC with Hon Kate Jones, Innovation Minister

Ministerial visits

QAAFI has welcomed visits by The Hon Mark Furner, Minister for Agriculture Industry Development and Fisheries to UQ's St Lucia campus on 2 July 2018, to meet staff working in agriculture at QAAFI, and to the Health and Food Sciences Precinct at Coopers Plains on 4 October 2018.

Minister Furner samples native Australian foods

L-R Professor Robert Henry, Dr Beth Woods and Hon Mark Furner with PhD student Maral Seidi Damyeh

L-R Professor Neena Mitter, Professor Joe Shapter, Hon Mark Furner, Professor Robert Henry, Mr Steve Williams

In July 2018, The Hon Kate Jones, Minister for Innovation and Tourism Industry Development, met with QAAFI's 2018 Qld Women in STEM nominees Dr Louisa Parkinson and Jayeni Hiti Bandaralage.

L-R Dr Beth Woods, Mr Garry Fullelove, Professor Robert Henry, Minister Furner, Professor Mary Fletcher.

QAAFI staff congregate at the 2018 Annual Research Meeting on 20 November

Measuring impact panel discussion L-R Professor Mark Blows, Ms Vicki Lane, Mr Johann Schröder

2018 QAAFI Research Meeting

The biennial QAAFI Annual Research Meeting (QRM) was held on 20 November 2018. The QRMs are an opportunity for staff and students to come together with their colleagues in the Queensland Government, and other invited guests from industry, to share updates on the research undertaken in QAAFI.

Along with the presentations by staff and students, a highlight of the meeting was a panel discussing measuring research impact, chaired by UQ Deputy Vice-Chancellor of Research Professor Bronwyn Harch, which featured Professor Mark Blows, Mr Johann Schröder from MLA, and Ms Vicki Lane.

Beef Australia 2018

QAAFI hosted a seminar on sustainability at Beef Australia in Rockhampton on 10 May. The event was hosted by Australian beef industry luminary and QAAFI Advisory Board member David Crombie AM, and featured talks by QAAFI's Professor Ben Hayes, Dr Luis Prada e Silva, and Professor Alan Tilbrook on beef genetics, nutrition and welfare. The talks were followed by an industry panel, which included beef producer Lucinda Corrigan and Super Butcher Managing Director Susan McDonald.

QAAFI at AusBiotech

QAAFI hosted an 'Emerging technologies in agriculture' stream at the AusBiotech conference, held in Brisbane on 31 October 2018. Sessions included agtech and big data, food and health, and gene technologies. The event was hosted by TropAg 2019, the world's leading tropical agriculture and food conference.

Presenting at AusBiotech were L-R Professor Bronwyn Harch, DVCR UQ; Professor Ben Hayes, QAAFI; Dr Nicole Jensen, GRDC General Manager for Genetics and Enabling Technologies, Prof Guojie Zhang, Associate Director, China National GeneBank, BGI; Professor Robert Henry, Director, QAAFI.

Future farming and food workshop at GFIA

Senator Susan McDonald, Managing Director of Super Butcher, opened the QAAFI Future Farming and Food seminar at GFIA in Brisbane on 12 November, giving a talk on Investing in the future of farming and food.

Senator Susan McDonald

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.

Louisa Parkinson poses in front of the billboard bearing her image

Career success

Model student graduates into a research star

She was the face of The University of Queensland's 2015 Create Change advertising campaign – and now avocado researcher Louisa Parkinson has proven her scientific mettle.

Ms Parkinson, who graduated in December 2017 with a PhD, has discovered three new species of fungi and fungal pathogens that cause disease in avocados.

"I felt very proud to be able to name the first one, *Gliocladiopsis peggii*, after Ken Pegg, who is a prominent plant pathology researcher in Australia and a very important mentor to me," Dr Parkinson said.

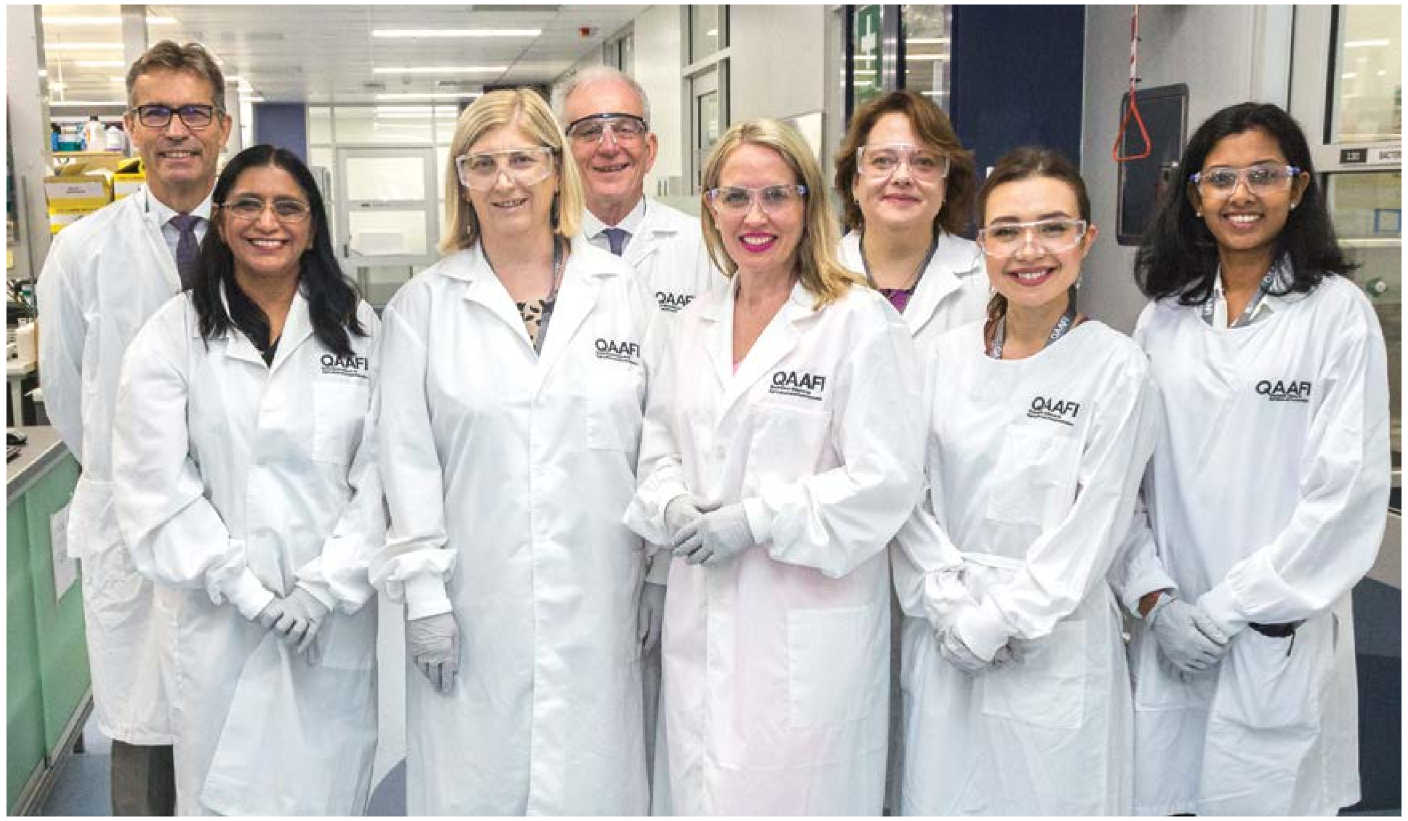
"He was over the moon. To have a new species named after you is quite special, I think."

Discovery of the new species in the Nectriaceae family will help researchers better understand the fungal pathogens that cause black root rot in avocado, a major disease affecting the avocado industry that can wipe out entire new orchard plantings.

"I also developed a molecular test to diagnose the presence of these pathogens, which will help avocado growers quickly put strategies in place to manage disease," she said.

Dr Parkinson enjoys analysing DNA, and the molecular side of her work.

"Diagnosing diseases is all about problem solving," she said.



Dr Parkinson (second from right) with L-R UQ Vice-Chancellor Professor Peter Høj AM, Professor Neena Mitter, UQ DVCR Professor Bronwyn Harch, Professor Robert Henry, Hon Kate Jones MP, Ms Lynne Turner, DAF, and Jayeni Hiti Bandaralage.

She also enjoys the interaction with the avocado industry and communicating her research with growers.

"I feel like my work will help make a difference to the avocado industry," she said.

Creating change at UQ is nothing new to Dr Parkinson. In 2015 when UQ launched their advertising campaign with the 'Create Change' tagline, she answered a call for auditions on UQ's Facebook page and was selected to audition, winning the part from other students and professional actors.

"It was a full-on Hollywood experience," Dr Parkinson said of the advertisements that featured her on television and on billboards.

"They filmed part of my scene with remote-controlled flying camera drones. The film crew were 100 metres away and the director was shouting "action," "cut" and directional cues through a speaker, just like in the movies. They also filmed me up close and with special lighting equipment and the whole film crew standing in front me, watching. It was very exciting and nerve-wracking."

"My face appeared on UQ's inter-campus buses for quite a while and it always made me smile when I saw that."

Her family were also very proud. "My family have taken photos at my billboards," she said.

"The number of selfies Mum and I have taken with my picture is quite funny!"

Dr Parkinson has also been recognised by members of the public and other staff and students.

"On several occasions I was at the movies when the Create Change advert came on before the film and it felt so awesome and totally surreal seeing me on the big screen in the theatre," she said.

"I will treasure those moments, and never forget it. This whole experience has been truly memorable and I am so grateful."

Although a Brisbane local, Dr Parkinson identifies as Filipino-Australian.

Dr Parkinson at an avocado orchard © QAAFI

"I was born in Queensland, but I do have a Filipino background and I like to promote my heritage as well as participate in my mother's culture," she said.

Her favourite avocado recipe is a Filipino dessert made of mashed avocado mixed with sugar or honey and a splash of evaporated milk.

"This may not sound appetising as avocados are famously made in savoury recipes. But it is actually very delicious," Dr Parkinson said.

"Mum used to make this dessert for me as a child and I still love to eat it."

Dr Parkinson now works in avocado biosecurity for QAAFI at the EcoSciences Precinct in Dutton Park as a Research Officer for the avocado industry.

Global focus

Tacos and tan spot disease for Tamaya

In 2018, QAAFI's Tamaya Peressini travelled to the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, as part of her honours thesis research focused on a disease called tan spot in wheat.

Tamaya performing disease evaluations 10 days post-infection at CIMMYT's glasshouse facilities © Tamaya Peressini

Tan spot is caused by the pathogen *Pyrenophora tritici-repentis* (*Ptr*), and her project aimed to evaluate the resistance of tan spot in wheat to global races to this pathogen.

"The germplasm I'm studying for my thesis carries what is known as adult plant resistance (or APR) to tan spot, which has demonstrated to be a durable source of resistance in other wheat pathosystems such as powdery mildew," said Tamaya.

Tan spot is prevalent worldwide, and in Australia causes the most yield loss out of the foliar wheat diseases. In Australia, there is only one identified pathogen race that is prevalent – *Ptr* Race 1.

For *Ptr* Race 1, the susceptibility gene *Tsn1* in wheat is the main factor that results in successful infection in *Ptr* strains that carry Toxin A.

However, globally it is a more difficult problem, as there are seven other pathogen races that consist of different combinations of necrotrophic toxins.

Hence, developing cultivars that are multi-race resistant to *Ptr* presents a significant challenge to breeders as multiple resistant genes would be required for resistance to other pathogens.

"The benefit of studying this at CIMMYT was that I had access to different strains of the pathogen which carry different virulence factors of disease, I was exposed to international agricultural research, and importantly, I was able to create research collaborations that would allow the APR detected in this population to have the potential to reach developing countries to assist in developing durably resistant wheat cultivars for worldwide deployment," explained Tamaya.

Recent work in Dr Lee Hickey's laboratory at QAAFI has identified several landraces from the Vavilov wheat collection that exhibited a novel resistance to tan spot known as adult plant resistance (APR). APR has proven to be a durable and broad-spectrum source of resistance in wheat crops; namely with the *Lr34* gene which confers resistance to powdery mildew and leaf stem rust of wheat.

"My research is focused on evaluating this type of resistance and identifying whether it is resistant to multiple pathogen species and other races of *Ptr.*

"This is important to the Queensland region, as the northern wheat belt is significantly affected by tan spot disease. Introducing durable resistance genes to varieties in this region would be an effective pre-breeding strategy because it would help develop crop varieties that would have enhanced resistance to tan spot should more strains reach Australia. Furthermore, it may provide durable resistance to other necrotrophic pathogens of wheat," said Tamaya.

The plant material Tamaya studied in her honours thesis was a recombinant inbred line (RIL) population, with the parental lines being the APR landrace (carries *Tsn1)* and the susceptible Australian cultivar Banks (also carries *Tsn1).*

To evaluate the durability of resistance in this population to other strains of *Ptr*, this material along with the parental lines of the population and additional land races from the Vavilov wheat collection were sent to CIMMYT for Tamaya to perform a disease assay.

"At CIMMYT I evaluated the durability of APR identified in plant material in Australia by inoculating with a local strain of *Ptr* and also with a pathogen that shares ToxA: *Staganospora nodorum,"* Tamaya said.

"After infection, my plant material was kept in 100 per cent humidity for 24 hours (12 hours light and 12 hours dark) and then transferred back to regular glasshouse conditions. At 10 days post-infection I evaluated the resistance in the plant material."

From the evaluation, the APR RIL demonstrated significant resistance compared to the rest of the Australian plant material against both pathogens.

The results are highly promising, as they demonstrate the durability of the APR for both pre-breeding and multi-pathogen resistance breeding. Furthermore, this plant material is now available for experimental purposes at CIMMYT where further trials can validate how durable the resistance is to other necrotrophic pathogens and also be deployed worldwide and be tested against even more strains of *Ptr*.

A selfie at Mexico's Sun and Moon temples of Teotihuacan © Tamaya Peressini

"During my visit at CIMMYT I was able to immerse myself in the Spanish language and take part in professional seminars, tours, lab work and field work around the site. A highlight for me was learning to prepare and perform toxin infiltrations for an experiment comparing the virulence of different strains of spot blotch."

"I also formed valuable friendships and research partnerships from every corner of the globe and had valuable exposure to the important research underway at CIMMYT and insight to the issues that are affecting maize and wheat growers globally.

"Of course, there was also the chance to travel on weekends; where I was able to experience the lively Mexican culture and historical sites – another fantastic highlight to the trip!"

"I would like to thank CIMMYT and Dr Pawan Singh for hosting me and giving the opportunity to learn, grow and experience the fantastic research that is performed at CIMMYT and opportunities to experience parts of Mexico.

"The researchers and lab technicians were all so friendly and accommodating. I would also like to thank my supervisor Dr Lee Hickey for introducing this project collaboration with CIMMYT.

"Lastly, I would like to thank the Crawford Fund Queensland Committee for funding this visit; not only was I able to immerse myself in world class plant pathology research, I have been given valuable exposure to international agricultural research that will give my research career a boost in the right direction," concluded Tamaya.

SOURCE: The Crawford Fund

Supporting information

QAAFI Research Staff

Prof. Robert Henry **Professor of Innovation in Agriculture**

Centre for Animal Science

Professor Stephen Moore	Centre Director
Associate Professor Patrick Blackall	Principal Research Fellow
Dr Diogo Costa	Research Officer
Dr Robert Dixon	Senior Research Fellow
Dr Jill Fernandes	Research Officer
Associate Professor Mary Fletcher	Principal Research Fellow
Dr Geoffry Fordyce	Senior Research Fellow
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 Mona Moradi Vajargah	Postdoctoral Research Fellow
Dr Gabriele Netzel	Postdoctoral Research Fellow
Dr Loan Nguyen	Postdoctoral Research Fellow
Dr Lida Omaleki	Research Officer
Dr Gomathy Palaniappan	Senior Research Fellow
Dr Hassendrini Peiris	Research Officer
Dr Luis Prada E Silva	Senior Research Fellow
Dr Ali Raza	Research Officer
Dr Elizabeth Ross	Research Fellow
Professor Alicja Tabor	Professorial Research Fellow
Professor Alan Tilbrook	Professorial Research Fellow
Dr Cornelia Turni	Senior Research Fellow
Dr Kai Voss-Fels	Research Fellow

Centre for Crop Science

Professor Graeme Hammer	Centre Director
Dr Behnam Ababaei	Research Officer
Dr Robert Armstrong	Research Officer
Associate Professor Andrew Borrell	Principal Research Fellow
Associate Professor Bhagirath Chauhan	Principal Research Fellow
Dr Karine Chenu	Senior Research Fellow
Dr John Christopher	Senior Research Fellow
Dr Simon Clarke	Research Officer
Professor Mark Cooper	Chair Crop Improvement
Miss Elizabeth Czislowski	Research Officer
Dr Joseph Eyre	Research Fellow
Dr Barbara George-Jaeggli	Research Fellow
Professor Ian Godwin	Centre Director - Crop Science
Dr Adrian Hathorn	Postdoctoral Research Fellow
Dr Lee Hickey	Senior Research Fellow
Professor David Jordan	Professorial Research Fellow
Dr Alison Kelly	Senior Research Fellow in Statistic
Dr Emma Mace	Senior Research Fellow
Dr Gulshan Mahajan	Research Officer
Dr Sudheesh Manalil Velayudhan	Research Officer
Dr Louisamarie Parkinson	Research Officer
Dr Andries Potgieter	Senior Research Fellow
Associate Professor Nageswararao Rachaputi	Principal Research Fellow
Professor Daniel Rodriguez	Professorial Research Fellow
Dr Yongfu Tao	Postdoctoral Research Fellow
Mr Michael Thompson	Research Officer
Dr Najeeb Ullah	Advance Qld Research Officer
Dr Erik Van Oosterom	Senior Research Fellow
Dr James Watson	Research Fellow
Miss Kylie Wenham	Postdoctoral Research Fellow
Dr Erin Wilkus	Research Officer
Dr Chung-Chi Wu	Research Officer
Dr Yan Zhao	Postdoctoral Research Fellow

Centre for Horticultural Science

Professor Neena Mitter	Centre Director
Dr Olufemi Akinsanmi	Senior Research Fellow
Dr Mohammad Alam	Research Officer
Dr Mulusew Ali	Research Officer
Dr Inigo Auzmendi	Research Fellow
Dr Witharanage Basnayake	Research Fellow
Ms Kaylene Bransgrove	Research Officer
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	Postdoctoral Research Fellow
Dr Andrew Geering	Senior Research Fellow
Dr Liqi Han	Research Fellow
Associate Professor James Hanan	Principal Research Fellow
Dr Craig Hardner	Senior Research Fellow
Dr Alice Hayward	Research Fellow
Ms Emily Lancaster	Postdoctoral Research Officer
Dr Alistair McTaggart	UQ Development Fellow
Ms Anahita Mizani	Research Officer
Dr Karishma Mody	Postdoctoral Research Fellow
Ms Katie O'Connor	Research Officer
Mr Jonathan Peters	Postdoctoral Research Fellow
Dr Karl Robinson	Research Fellow
Dr Lindsay Shaw	Research Fellow
Associate Professor John Thomas	Principal Research Fellow
Mr Benjamin Toft	Research Officer
Associate Professor Bruce Topp	Principal Research Fellow
Dr Nga Tran	Postdoctoral Research Fellow
Associate Professor Steven Underhill	Principal Research Fellow
Dr Megan Vance	Research Officer
Ms Melanie Wilkinson	Research Officer
Dr Yuchan Zhou	Research Fellow

Centre for Nutrition and Food Sciences

Professor Michael Gidley	Centre Director
Dr Nadia De Jager	Research Officer
Dr Sushil Dhital	Research Fellow In Starch/Plant Cel
Ms Guangli Feng	Research Officer
Dr Bernadine Flanagan	Research Fellow
Dr Glen Fox	Senior Research Fellow
Dr Agnelo Furtado	Senior Research Fellow
Professor Robert Gilbert	Professorial Research Fellow
Dr Purnima Gunness	Postdoctoral Research Fellow
Professor Louwrens Hoffman	Professor of Meat Science
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
Dr Anh Phan	Postdoctoral Research Fellow
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
Dr Barbara Williams	Senior Research Fellow
Dr Peng Wu	Research Officer

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
Dr James Carter	Honorary Associate Professor
Dr Yashvir Chauhan	Honorary Associate Professor
Dr Ian Chivers	Honorary Senior Fellow
Dr Sandra Dunckel	Honorary Fellow
Professor Geoffrey Fincher	Honorary Professor
Professor Elliot Gilbert	Honorary Professor
Dr Yingbin He	Honorary Senior Fellow
Professor Mario Herrero	Honorary Professor
Dr Arief Indrasumunar	Honorary Fellow
Professor Wayne Jorgensen	Honorary Professor
Professor Kemal Kazan	Honorary Professor
Dr Ardashir Kharabian-Masouleh	Honorary Senior Fellow
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 Miranda Mortlock	Honorary Senior Fellow
Dr Parimalan Rangan	Honorary Senior Research Fellow
Professor Maurizio Rossetto	Honorary Professor
Professor Michael Rychlik	Honorary Professor
Dr Roger Shivas	Honorary Professor
Professor Blake Simmons	Honorary Professor
Dr Dharmendra Singh	Honorary Fellow
Associate Professor Dharini Sivakumar	Honorary Associate Professor
Emeritus Professor Roger Swift	Emeritus Professor
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
Dr Norhasnida Zawawi	Honorary Senior Fellow

Adjunct Appointments

Dr Barry Blaney	Adjunct Senior Fellow
Professor Graham Bonnett	Adjunct Professor
Dr Bruce D'Arcy	Adjunct Senior Fellow
Dr John Dixon	Adjunct Professor
Dr Rosalind Gilbert	Adjunct Fellow
Dr Lisa-Maree Gulino	Adjunct Fellow
Mr Wayne Hall	Adjunct Professor
Dr Jagger Harvey	Adjunct Senior Research Fellow
Associate Professor Mark Hickman	Adjunct Associate Professor
Dr David Innes	Adjunct Associate Professor
Mr Robert Karfs	Adjunct Associate Professor
Professor Vicki Lane	Adjunct Professor
Associate Professor Zivile Luksiene	Adjunct Associate Professor
Mr William Macleod	Adjunct Associate Professor
Professor Cathrine McIntyre	Adjunct Professor
Ms Sarah Meibusch	Adjunct Associate Professor
Dr Kodanda Mereddy	Adjunct Senior Research Fellow
Dr Selina Ossedryver	Adjunct Fellow
Ms Diane Ouwerkerk	Adjunct Fellow
Dr Sambasivam Periyannan	Adjunct Senior Fellow
Mr Gregory Platz	Adjunct Professor
Dr Richard Silcock	Adjunct Senior Fellow
Professor John Skerritt	Adjunct Professor
Associate Professor Youhong Song	Adjunct Associate Professor
Associate Professor Paul Stothard	Adjunct Associate Professor
Dr Michael Sweedman	Adjunct Fellow
Dr Santosh Taware	Adjunct Senior Fellow
Ms Lynne Turner	Adjunct Professor
Associate Professor Neil White	Adjunct Associate Professor
Dr John Wilkie	Adjunct Senior Fellow
Dr Rex Williams	Adjunct Associate Professor
Professor Graeme Wright	Adjunct Professor

QAAFI Affiliates

Professor Stephen Adkins	Affiliated Professor
Professor Elizabeth Aitken	Affiliate Associate Professor
Professor Stephen Barker	Affiliated Professor
Professor Ross Barnard	Affiliated Professor
Professor Michael Bell	Affiliated Academic
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 Res Fellow
Dr Bruce D'Arcy	Affiliated Senior Fellow
Dr Mark Dieters	Affiliated Academic Level D
Dr Marina Fortes	Affiliated Research Fellow
Professor Shu Fukai	Affiliated Professor
Associate Professor Michael Furlong	Affiliated Associate Professor
Professor Victor Galea	Affiliated Associate Professor
Associate Professor John Gaughan	Affiliated Associate Professor
Professor Elizabeth Gillam	Affiliated Professor
Professor Neal Menzies	Affiliated Professor
Professor Murray Mitchell	Affiliated Academic Level E
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	Affiliate Research Fellow
Professor Zhiping Xu	Affiliate Principal Research Fellow
Professor Chengzhong Yu	Affiliate Professorial Res Fellow

QAAFI Operational and Technical Staff

Miss Rosalee Armitage	Postgraduate Admin Assistant
Ms Carol Ballard	Research Hub Manager
Dr Guta Bedane	Research Assistant
Mrs Stephanie Brew	Admin Assistant/Receptionist
Ms Maria Caldeira	HSF Officer
Mrs Suzanne Campbell	Centre Administration Officer
Ms Mridusmita Chaliha	Administrative Officer
Mr Errol Corsan	Principal Plant Improvement Consult
Mrs Anne Cox	Executive Administration Officer
Mr Kurt Deifel	Technical Officer
Mr Peter Devoil	Principal Farming Systems Modeller
Mr Scott Diefenbach	Wheat Research Field Assistant
Mr Cameron Doig	Research Development Officer
Ms Elizabeth Eden	Administration Officer (Marketing)
Mr Mark Eldridge	Research Technician
Ms Madeleine Gleeson	Research Assistant
Ms Tyne Hamilton	Marketing and Communications Officer
Miss Hannah Hardy	Marketing and Communications Officer
Mrs Jayeni Hiti Bandaralage	Research Assistant
Mr Aaron Hughes	Facility Infrastructure Coordinator
Mrs Elizabeth Humphries	HSF Manager
Mr Ritesh Jain	Research Assistant
Ms Shirley Jones	Senior Research Technician
Dr Reginald Lance	Senior Plant Improvement Consultant
Miss Shannon Landmark	Research Assistant
Mr Robert Landon	Research Partnerships Manager
Mrs Emma Linnell	Executive Administration Officer
Ms Janelle Low	Centre Administration Officer
Ms Thi Lu	Centre Administration Officer
Dr Narelle Manzie	Project Officer
Ms Carolyn Martin	Marketing and Communications Manager
Ms Cassie Martinez	Administrative Officer
Mr James McLean	Field Technician
Mr Stuart Meldrum	Senior Research Technician
Mrs Sandra Micallef	Data Manager
Mrs Narges Mojtahedi	Research Assistant
Mrs Annie Morley	Executive Assistant to Director
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
Ms Katie Payne	Senior Postgrad Administrator
Mr Jonathan Peters	Research Assistant
Ms Akila Prabhakaran	Research Assistant
Ms Margaret Puls	Marketing and Communications Manager
Mr Sean Reynolds Massey-Reed	Research Technician
Dr Vivian Rincon-Florez	Senior Research Technician
Mr David Rodgers	Senior IT Support Officer
Miss Melissa Rowan	Centre Administration Officer
Mrs Reema Singh	Research Assistant
Mrs Angela Strelow	Centre Administration Officer
Ms Julianna Thomson	Centre Administration Officer
Mrs Hanna Toegel	Assistant Research Technician
Ms Bronwyn Venus	Manager, Engagement and Development
Ms Kooliha Vincent-Lucas	Indigenous Trainee
Mr Stephen Williams	Deputy Director
Miss Elizabeth Worrall	Research Assistant
Miss Wen Yee	Research Assistant
Dr Dagong Zhang	Senior Research Assistant
Ms Xin Zhao	Centre Administration Officer

QAAFI Research Higher Degree students in 2018

Centre for Animal Science

Name	Program	Supervisor	Project Title
Mr Andrew Jacob Ferguson	PhD	AsPr Timothy John Mahony	Immunogenetic Differences Underlying Susceptibility of Cattle to Respiratory Disease
Mr Matthew David Silverstein	PhD	Dr Cornelia Turni	A new species interfering with vaccine efficacy.
Mr Thomas Peter Karbanowicz	PhD	Prof Alicja Elzbieta Tabor	Biotechnological approaches to identify vaccine antigens in economically important ticks: Yeast Display and Proteomics
Ms Ai Hwee Kho	PhD	Dr Peter James	Rapid detection of nematodes in sheep and goats using near-infrared spectroscopy (NIRS)
Ms Chian Teng Ong	PhD	Prof Alicja Elzbieta Tabor	Pathogenomics of infectious causes of bovine infertility in northern Australia
Mr Tristan Jacob Russell Wimpenny	PhD	AsPr Timothy John Mahony	Identification of the role of microRNAs in Bovine Herpesvirus 1 replication and virulence.
Miss Emily Francisca Mantilla Valdivieso	PhD	Prof Alicja Elzbieta Tabor	Cattle tick and buffalo fly host biomarkers for resistance
Mr Mukund Madhav	PhD	Dr Peter James	Transinfection of buffalo flies with Wolbachia and characterisation of its biological effects
Mr Aaron Schulze	MPhil	AsPr Mary Therese Fletcher	Bio-actives:Value-adding to Industrial Hemp Production
Mrs Christie Louise Warburton	PhD	Prof Benjamin Hayes	Genomics approaches to improve productivity in cattle
Mr Zhi Hung Loh	PhD	AsPr Mary Therese Fletcher	Mitigating the Effects of the Toxin Simplexin in Pimelea Poisoning of Cattle by Developing a Microbial Probiotic
Mr Muhammad Noman Naseem	PhD	Dr Peter James	Pathogenesis of buffalo fly lesions and factors determining variation in susceptibility amongst cattle
Mr Muhammad Kamran	PhD	Dr Peter James	Variation amongst cattle in susceptibility to the effects of ticks and biting flies and the determination of phenotypic and immunological markers for resistance
Mr Russell James Gordon	PhD	AsPr Mary Therese Fletcher	Mitigating the effects of the plant toxin Simplexin on Australian livestock
Mrs Sadia Afreen Chowdhury	PhD	AsPr Mary Therese Fletcher	Authentication of uniquely Australian food products with claimed health benefits

Centre for Crop Science

Name	Program	Supervisor	Project Title
Mr John Edward Smith	PhD	Prof Michael John North Bell	The impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton in southern QLD
Mr Andrew Lincoln Fletcher	PhD	Dr Karine Chenu	Understanding transpiration efficiency in wheat to enhance future breeding
Ms Colleen Hunt	PhD	Prof David Jordan	Statistical analysis of sorghum breeding trials with complex genetic components
Ms Mengge Zhang	MPhil	Dr Lee Thomas Hickey	A tool box for developing wheat cultivars with improved root systems
Mr Alemu Tirfessa Woldentensaye	PhD	Dr Erik Jan Van Oosterom	Identifying sorghum [Sorghum bicolor (L.) Moench] plant types adapted to moisture stress areas of Ethiopia
Mr Xuemin Wang	PhD	Prof David Jordan	Enhancing genomic selection through the use of crop modelling
Ms Dipika Roy	PhD	Dr Lee Thomas Hickey	Understanding the genetics of spot blotch resistance in barley
Ms Mengwei Li	MPhil	Dr Joseph Xavier Eyre	Sorghum and maize establishment in cold and drying soils
Ms Amy Elizabeth Watson	PhD	Dr Lee Thomas Hickey	Integrating genomic selection and speed breeding to increase genetic gain in spring wheat (Triticum aestivum) breeding
Mr Sana Ullah Khan	PhD	Dr Lee Thomas Hickey	Accelerated genome editing to speed up genetic gain in crops
Miss . Geetika	PhD	Dr Nageswararao Chenchu Rachaputi	Physiological constraints to yield of mungbean iin dryland and irrigated conditions
Ms Dilani Tharanga Senevirathna Jambuthenne Gamaralalage	PhD	Dr Lee Thomas Hickey	Mining novel genes for adult plant resistance to stripe rust in wheat landraces
Mr Samir Alahmad	PhD	Dr Lee Thomas Hickey	Accelerating the development of durum wheat adapted to drought and crown rot conditions
Ms Jia-Yee Samantha Yap	PhD	Prof Maurizio Rossetto	Is the Sunda-Sahul floristic exchange ongoing? A study of distributions, functional traits, climate and landscape genomics to investigate the invasion in Australian rainforests
Mr James Lawrence McLean	MPhil	Prof Daniel Rodriguez	Proximal and remote sensing as tools to assist data collection in extensive maize and sorghum agronomic trials
Ms Kanwal Shazadi	PhD	Dr Karine Chenu	Can genetic variations in root architectural development during the crop cycle affect wheat productivity in water-limited environments?
Ms Cecile Marie Godde	PhD	Prof Mario Herrero	Assessing the potential for pasture intensification in the tropics
Mrs Prameela Rani Vanambathina	PhD	Dr Nageswararao Chenchu Rachaputi	Development and application of molecular tools to identify pest and drought resistance traits in the Australian wild pigeonpea
Mr Asad Muhammad Khan	PhD	AsPr Bhagirath Singh Chauhan	Biology of Amaranthus retroflexus and Amaranthus viridis
Miss Xiaoyu Zhi	PhD	Dr Barbara George-Jaeggli	Predicting Photosynthetic Capacity from Hyperspectral Data in Sorghum
Mr Mahendraraj Sabampillai	PhD	Dr Nageswararao Chenchu Rachaputi	Genotypic variation for effect of heat stress during reproductive phase in pigeonpea.
Mr Asad Amin	PhD	Dr Lee Thomas Hickey	Integrating crop modelling and genomics to improve plant breeding
Mr Albert Chern Sun Wong	PhD	Prof Andrew Kenneth Borrell	Manipulation of genes to manage drought resistance in field crops
Mr Jed Calvert	PhD	Dr Roger Graham Shivas	Fungal Endophytes in the Iron Range
Mr Zerihun Tadesse Tarekegn	PhD	Dr Lee Thomas Hickey	Integrating speed breeding and association mapping strategies to identify and introgress genes for key pathology and agronomic traits in bread wheat in Ethiopia
Mr Uwe Grewer	PhD	Prof Daniel Rodriguez	Bio economic modelling of farming systems under climate change for ex ante assessments of agricultural development policies
Ms Loretta Maree Serafin	PhD	Prof Daniel Rodriguez	Improving the reliability and profitability of sorghum in north west NSW
Mrs Charlotte Rambla	PhD	Dr Lee Thomas Hickey	Optimising root systems in wheat
Ms Adhini Pazhany	PhD	Prof Robert Henry	Expression genomics to widen the gene pool of sugarcane for improved biomass partitioning
Ms Virginie Perlo	PhD	Prof Robert Henry	Discovery of molecular control of variation in carbon partitioning in sugarcane
Ms Kalpani Ananda	PhD	Prof Robert Henry	Sorghum Genomics: Diversity and evolution of the Sorghum genus and the role of cyanogenesis
Ms Katrina Hodgson-Kratky	PhD	Prof Robert Henry	Genomics of sugarcane bioenergy traits
Ms Sharmin Hasan	PhD	Prof Robert Henry	Diversity of domestication loci in wild rice populations.
Mr Ali Imad Mohammad Moner	PhD	Prof Robert Henry	Exploring gene diversity in the genome of wild rice populations
Mr Patrick Mason	PhD	Prof Robert Henry	Diversifying cane sugar production systems: identifying carbon petitioning in a number sugar cane varieties in order to optimize production for a number of processes
Ms Annelie Marquardt	PhD	Prof Robert Henry	The role of sucrose transporters and feedback regulation in the sugarcane leaf

Centre for Horticultural Science

Name	Program	Supervisor	Project Title
Mr Christopher Michael O'Brien	PhD	Prof Neena Mitter	Cryopreservation of Avocado shoot tips for the conservation of Persea Germplasm
Ms Emily Kathryn Lancaster	PhD	Prof Andre Drenth	Epidemiology, impact and management of myrtle rust in Lemon Myrtle plantations
Mr William Barry Nak	PhD	Prof Neena Mitter	Topical application of RNA interference to modulate plant gene expression
Ms Thi Phuong Thuy Mai	PhD	AsPr Bruce Leonard Topp	Application of genomics in Macadamia breeding
Mrs Thu Ha Ngo	PhD	AsPr Andrew David William Geering	Post-translational processing of the caulimovirid capsid protein and utilisation of antipeptide antibodies for diagnosis
Ms Jasmine Nunn	MPhil	AsPr Bruce Leonard Topp	Genetic variation in Macadamia for resistance to Husk Spot, Pseudocercospora macadamiae
Mr Zhi Xian Lim	PhD	Prof Neena Mitter	Topical application of bioclay to protect crop plants from insect pests
Ms Shulang Fei	PhD	Prof Neena Mitter	RNAi-based Management for Fusarium Wilt of Banana
Ms Samira Samarfard	PhD	AsPr Ralf G Dietzgen	Potential exotic virus threats to Lucerne seed production in Australia
Mr Benjamin David Toft	PhD	AsPr James Scott Hanan	Exploring phenotypic and genotypic diversity in canopy architecture and crop load for improved production in macadamia
Ms Jayeni Hiti Bandaralage	PhD	Prof Neena Mitter	Micropropagation as an Alternative for Avocado Clonal Propagation
Mr Ritesh Gyanchandaji Jain	PhD	Prof Neena Mitter	Topical application of RNA interfrence to manage insect pests of horticultural crops
Mrs Olumide Sekinat Jeff-Ego	PhD	AsPr Olufemi Akinyemi Akinsanmi	Occurence and virulence of phytophthora species in macadamia in Australia
Mrs Katie Merryn O'Connor	PhD	AsPr Bruce Leonard Topp	Selection strategies to improve yield in macadamia using component traits and genomics
Mr Alexander Tomas Nilon	PhD	Prof Neena Mitter	Bioclay for Control of Tomato Spotted Wilt Virus

Mrs Sari Nurulita	PhD	AsPr John Edwin Thomas	Virus-Infected Garlic in Australia and Indonesia, and Factors Affecting Disease Epidemiology
Miss Jane Denise Ray	PhD	Prof Andre Drenth	Biology and Epidemiology of the Banana Blood Disease
Mr Mohamed Zakeel Mohamed Cassim	PhD	AsPr Olufemi Akinyemi Akinsanmi	Unravelling the biotic cause and interaction of abnormal vertical growth in macadamia
Miss Fernanda Yuri Borges Naito	PhD	AsPr Ralf G Dietzgen	Differential plant gene expression in response to tospovirus and rhabdovirus infection and viral counter-defense
Mr Michael Bird	PhD	Dr Craig Hardner	Maximizing gains from selection in Eucalyptus
Mr Kandeeparoopan Prasannath	PhD	AsPr Olufemi Akinyemi Akinsanmi	Etiology of flower blight complex in macadamia
Mr Onkar Nath	PhD	Prof Neena Mitter	Improving avocado through genomic analysis
Mr Bader Alsubaie	PhD	Prof Robert Henry	Jojoba Genomics for Sex Determination
Mr Othman Aldossary	PhD	Prof Robert Henry	Jojoba Genomics for Stress Tolerance

Centre for Nutrition and Food Sciences

Full Name	Program	Supervisor	Project Title
Mr Adam O'Donoghue	PhD	Dr Timothy James O'Hare	Assessing the bioactivity of tomato extracts from varieties with unique carotenoid profiles on human in vitro prostate cancer cell lines
Ms Mingxia Han	PhD	Prof Michael Gidley	Carotenoid bioavailability related to molecular organisation
Ms Emmy Hainida Khairul Ikram	PhD	Dr Michael Erich Netzel	Exploring the Nutritional Potential of Carica papaya Linn Cultivars
Mr Alexander Trung Chanh Bui	PhD	Prof Michael Gidley	Design rules for nutritionally-functional grains
Ms Thi Le Thoa Nguyen	PhD	Dr Glen Patrick Fox	Structure and Functionality of Oat Carbohydrates
Mr Ji Wang	MPhil	AsPr Eugeni Roura	Manipulating feed intake in pigs by bitter compounds
Mr Kim Seng Galex Neoh	PhD	Dr Glen Patrick Fox	Assessing Australian wheat quality for Japanese ramen noodles
Mr Shiyao Yu	PhD	Prof Robert Gilbert	Genetically modified corn using site directed mutagenesis
Mr Amjad Iqbal	PhD	AsPr Eugeni Roura	Dietary manipulation of nutrient-specific appetites and feed particle size for improved growth uniformity in broilers
Mr Haiteng Li	PhD	Prof Michael Gidley	Gut microbial response to diverse forms of resistant starch
Mr Fahad F A A Alderees	PhD	AsPr Yasmina Sultanbawa	Elucidating the mechanism of action of nanoencapsulated plant bioactives against weak-acid resistant yeasts in a beverage system
Mr Wen Wen Yu	PhD	Dr Glen Patrick Fox	Interactions of barley endosperm proteins with starch and their effects on functional properties
Mr Sungbo Cho	PhD	AsPr Eugeni Roura	Nutrient specific appetites and feather pecking behaviour in laying hens
Mr Shahram Niknafs	PhD	AsPr Eugeni Roura	Nutrient-specific appetite in poultry
Mr Vishal Ratanpaul	PhD	Prof Michael Gidley	Interplay between grain digestion and fibre in relation to gastro-small-intestinal passage rate and feed intake in a pig model: Physiological manipulation of satiety
Mr Wei Hu	PhD	Dr Timothy James O'Hare	Endogenous fatty acid desaturation of palmitic to palmitoleic acid in macadamia kernel tissue.
Mrs Selina Anne Fyfe	PhD	AsPr Yasmina Sultanbawa	Using native Australian food ingredients to value add to and preserve foods and beverages, and to assess the changes to safety, quality and sensory properties
Dr Mekonnen Melaku Gebremariam	PhD	Dr Heather Eunice Smyth	Enabling rational food design by connecting dynamic sensory perception, oral physiology and food oral processing
Mr Yeming Bai	PhD	Prof Michael Gidley	Mechanistic exploration of effects of ginseng (a traditional Chinese food additive and medicine) on the digestion rate of starch containing foods
Ms Saleha Akter	PhD	AsPr Yasmina Sultanbawa	Elucidating mechanisms of antimicrobial activity of Australian native plant extracts
Mrs Sarah Karen Osama	PhD	Dr Glen Patrick Fox	Identifying genes for resistance to pre-harvest sprouting and black point in barley (Hordeum vulgare)
Ms Shammy Sarwar	PhD	AsPr Yasmina Sultanbawa	Innovative non thermal technologies for treatment of fungal contamination in strawberries
Mr Sharif Sami Nada	PhD	Prof Robert Gilbert	Modelling Glycogen Structure and Metabolism
Miss Caili Li	PhD	Prof Michael Gidley	Understanding how resistant starches get broken down by bacteria in a large intestine model
Mr Zeping Shao	PhD	AsPr Eugeni Roura	Phenotype and genotype association between food allergy and taste
Miss Shiyi Lu	PhD	Prof Michael Gidley	Bacterial fermentation of cellulose-?based composites as plant dietary fibre
Mr Eshetu Mulisa Bobasa	PhD	AsPr Yasmina Sultanbawa	Evaluation of urolithins obtained from ellagitannins in Kakadu plum (Terminalia ferdinandiana)
Mrs - Widaningrum	PhD	Prof Michael Gidley	Microbial fermentation of insoluble plant dietary fibres.
Mr Maximiliano Jose Muller Bravo	PhD	AsPr Eugeni Roura	Nutritional interventions in piglets to improve post-weaning health outcomes
Mrs Batlah R B Almutairi	PhD	AsPr Yasmina Sultanbawa	Extraction of oligosaccharides from Australian native food plants and its applications in probiotic food systems
Mr Oladapo Oluwaseye Olukomaiya	PhD	AsPr Yasmina Sultanbawa	Evaluation of natural antioxidant sources as functional ingredients in animal feed
Mr Dongdong Ni	PhD	Prof Michael Gidley	Plant cell wall architecture and molecular organisation
Mr Shaoyang Wang	PhD	Dr Heather Eunice Smyth	A systematic approach to understanding wine texture and mouthfeel.
Mr Madan Kumar Chapagai	PhD	Prof Michael Gidley	Rice grain structural factors that are involved in controlling the rate of digestion of cooked rice
Mr Miaomiao Zhou	PhD	AsPr Eugeni Roura	Starch and lipids in food: structural effects on brain function
Mr Keyu Tao	PhD	Prof Robert Gilbert	Understanding the molecular mechanisms controlling sensory properties in starch containing foods
Mrs Sharon Gai Nielsen	PhD	Dr Glen Patrick Fox	Multiphase Design and Linear Mixed Model analysis of NIR scanning data
Miss Maral Seidi Damyeh	PhD	AsPr Yasmina Sultanbawa	Use of novel, clean, green technologies for the extraction of plant bioactive compounds of commercial value for shelf life extension of capsicum
Miss Xiaoyan Tan	PhD	Prof Robert Gilbert	Structural features controlling germination and other functional properties of barley
Miss Yingting Zhao	PhD	Prof Robert Gilbert	The influence of amylose in high-starch foods on biosynthesis-structure-property relations
Ms Maria Stephanie	MPhil	Dr Glen Patrick Fox	Formulation Of Gluten-Free Composite Flour Made With Sorghum Grains, Other Grains, And Legumes
Mr Hong Yao	PhD	Prof Michael Gidley	Microbiome responses to food carbohydrates
Mr Shaobo Zhang	PhD	Prof Robert Gilbert	Molecular Dynamics Simulation Study of Starch
Mr Oladipupo Qudus Adiamo	PhD	AsPr Yasmina Sultanbawa	Extraction and Characterization of Bioactive Peptides with Antioxidative and Angiotensin-Converting Enzyme Activities Derived from Proteins of Australian Acacia sp.
Mr Apurba Lal Ray	PhD	Dr Timothy James O'Hare	Genetic factors affecting anthocyanin development in purple-pericarp sweetcorn
Miss Kodagoda Hitige Gethmini Kavindya Kodagoda	PhD	Dr Michael Erich Netzel	Assessment of the nutritional quality of Australian grown Plumcot
Ms Hayba Qayssar Younan Badro	PhD	Prof Robert Henry	Applications of sequencing as a tool in rice improvement
Mr Tom Kukhang	PhD	Prof Robert Henry	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
Ms Bing Cheng	PhD	Prof Robert Henry	Genetic and environmental factors influencing coffee quality
Ms Thi Minh Hue Tran	PhD	Prof Robert Henry	Genetics of biochemical compounds determining arabica coffee (C. arabia L.) quality

Publications

Book

Achieving sustainable cultivation of bananas. Volume 1, cultivation techniques. Edited by Gert H. J. Kema and Andre Drenth Cambridge, United Kingdom: Burleigh Dodds Science Publishing, 2018. doi:10.19103/as.2017.0020

The Wild Oryza Genomes. Edited by T. K. Mondal and R. J. Henry Berlin, Germany: Springer, 2018. doi:10.1007/978-3-319-71997-9

Book Chapter

Campbell, S.D., Vogler, W.V. and Tana, T. (2018). Management: physical, cultural, chemical. In Steve Adkins, Assad Shabbir and Kunjithapatham Dhileepan (Ed.), Parthenium weed: biology, ecology and management (pp. 157-176) Wallingford, United Kingdom: CAB International.

Hardner, C. and Topp, B. (2018). Macadamia integrifolia and M. tetraphylla. In Lee Thomson, John Doran and Bronwyn Clarke (Ed.), Trees for life in Oceania: conservation and utilisation of genetic diversity (pp. 147-151) Canberra, ACT Australia: Australian Centre for International Agricultural Research.

Henry RJ (2018) Oryza australiensis. In The Wild Oryza Genomes. Compendium of Plant Genomes Mondal TK and Henry RJ, eds., Springer-Verlag: Heidelberg pp 61-66. doi.org/10.1007/978-3-319-71997-9

Khalil, Usman, Ali, Shafaqat, Rizwan, Muhammad, Rahman, Khalil Ur, Ata-Ul-Karim, Syed Tahir, Najeeb, Ullah, Ahmad, Mirza Nadeem, Adrees, Muhammad, Sarwar, M. and Hussain, Syed Makhdoom (2018). Role of Mineral Nutrients in Plant Growth Under Extreme Temperatures. In Plant Nutrients and Abiotic Stress Tolerance (pp. 499-524) Singapore: Springer Singapore. doi:10.1007/978-981-10-9044-8_21

Moner A and Henry RJ (2018) Oryza meridionalis. In The Wild Oryza Genomes. Compendium of Plant Genomes. Mondal TK and Henry RJ, eds., Springer-Verlag: Heidelberg pp 177-182. doi.org/10.1007/978-3-319-71997-9

Moner, A. and Henry R.J. (2018) Oryza meridionalis. In The Wild Oryza Genomes. Compendium of Plant Genomes Mondal TK and Henry RJ, eds., Springer-Verlag: Heidelberg pp 177-182. doi.org/10.1007/978-3-319-71997-9

Pérez de León, Adalberto A. , Mahan, Suman, Messenger, Matthew, Ellis, Dee, Varner, Kevin, Schwartz, Andy, Baca, Dan, Andreotti, Renato, Rodríguez Valle, Manuel , Rosario Cruz, Rodrigo , Domínguez García, Delia Inés , Comas Pagan, Myrna , Canabal, Carmen Oliver, Urdaz, Jose, Collazo Mattei, Francisco , Soltero, Fred, Guerrero, Felix and Miller, Robert J. Show less (2018). Public-private partnership enabled use of anti-tick vaccine for integrated cattle fever tick eradication in the USA. Pests and vector-borne diseases in the livestock industry (pp. 275-298). Edited by Claire Garros, Jérémy Bouyer, Willem Takken and Renate C. Smallegange. The Netherlands: Wageningen Academic Publishers.

Prusinkiewicz, Przemyslaw, Cieslak, Mikolaj, Ferraro, Pascal and Hanan, Jim (2018). Modeling plant development with L-systems. In Richard J. Morris (Ed.), Mathematical modelling in plant biology (pp. 139-169) Switzerland: Springer International Publishing.

Pue, Aisak G., Fletcher, Mary T., Blaney, Barry, Greenhill, Andrew R., Warner, Jeffrey. M., Latifa, Atagazli and Ng, Jack C. (2018). Addressing food insecurity in Papua New Guinea through food safety and sago cropping. In Hiroshi Ehara, Yukio Toyoda and Dennis V. Johnson (Ed.), Sago palm, multiple contributions to food security and sustainable livelihoods (pp. 123-137) Singapore: Springer Nature. doi:10.1007/978-981-10-5269-9

Rana, Anuj , Karunakaran, Aneesh , Fitzgerald, Timothy L., Sabburg, Rosalie, Aitken, Elizabeth A. B., Henry, Robert J. , Powell, Jonathan J. and Kazan, Kemal (2018). A highly efficient and reproducible Fusarium spp. inoculation method for Brachypodium distachyon. In Gaurav Sablok, Hikmet Budak and Peter J. Ralph (Ed.), Brachypodium genomics: methods and protocols (pp. 43-55) New York, NY, United States: Humana Press. doi:10.1007/978-1-4939-7278-4

Reilly, Morgann C., Campen, Saori Amaike, Simmons, Blake A., Baker, Scott E., Gladden, John M. and Magnuson, Jon K. (2018). Cloning and expression of heterologous cellulases and enzymes in aspergillus niger. In Mette LÃ¼beck (Ed.), Cellulases (pp. 123-133) New York, NY, United States: Humana Press Inc.. doi:10.1007/978-1-4939-7877-9_10

Wambugu P and Henry RJ (2018) Oryza bathii. The Wild Oryza Genomes, Compendium of Plant Genomes. Mondal TK and Henry RJ, eds., Springer-Verlag: Heidelberg pp 67-74. doi.org/10.1007/978-3-319-71997-9

Journal Article

Abo-Ismail, M., Lansink, N., Akanno, E., Karisa, B., Crowley, J., Moore, S.* et al. (2018) Development and validation of a small SNP panel for feed efficiency in beef cattle. Journal of Animal Science, 92(2): 375-397.

Adam, D.*, Beard, L.*, Johnston, S.*, Nicolson, V., Lisle, A.*, McKinnon, A. et al. (2018) Recording body temperature in koalas (Phascolarctos cinereus): a comparison of techniques. Australian Veterinary Journal, 96(8): 308-311.

Ai, J.*, Witt, T.*, Cowin, G.*, Dhital, S.*, Turner, M.*, Stokes, J.* et al. (2018) Anti-staling of high-moisture starchy food: effect of hydrocolloids, emulsifiers and enzymes on mechanics of steamed-rice cakes. Food Hydrocolloids, 83: 454-464.

Ai, J.*, Witt, T.*, Gidley, M.*, Turner, M.*, Stokes, J.* & Bonilla, M. (2018) Modelling of Thermal Sterilisation of High-Moisture Snack Foods: Feasibility Analysis and Optimization. Food and Bioprocess Technology, 11(5): 979-990.

Akter, S.*, Netzel, M.*, Fletcher, M.*, Tinggi, U. & Sultanbawa, Y.* (2018) Chemical and nutritional composition of Terminalia ferdinandiana (kakadu plum) kernels: a novel nutrition source. Foods, 7(4)

Akyazi, R., Soysal, M., Altunç, E., Lisle, A.*, Hassan, E.* & Akyol, D. (2018) Acaricidal and sublethal effects of tobacco leaf and garlic bulb extract and soft soap on Tetranychus urticae Koch. (Acari: Trombidiformes: Tetranychidae). Systematic and Applied Acarology, 23(10): 2054-2069.

Alahmad, S.*, Dinglasan, E.*, Leung, K., Riaz, A.*, Derbal, N., Voss-Fels, K.* et al. (2018) Speed breeding for multiple quantitative traits in durum wheat. Plant Methods, 14(1)

Alahmad, S.*, Simpfendorfer, S., Bentley, A. & Hickey, L.* (2018) Crown rot of wheat in Australia: Fusarium pseudograminearum taxonomy, population biology and disease management. Australasian Plant Pathology, 47(3): 285-299.

Alam, M.*, Neal, J., Howell, E.*, Russell, D. & Topp, B.* (2018) 'MPM1': a macadamia hybrid showing breakdown of biological rhythm in morphogenesis. Acta Horticulturae, 1205(1205): 631-636.

Alam, M.*, Neal, J., O'Connor, K.*, Kilian, A. & Topp, B.* (2018) Ultra-high-throughput DArTseq-based silicoDArT and SNP markers for genomic studies in macadamia. PLoS One, 13(8)

Al-Asmari, F.*, Mereddy, R. & Sultanbawa, Y.* (2018) The effect of photosensitization mediated by curcumin on storage life of fresh date (Phoenix dactylifera L.) fruit. Food Control, 93: 305-309.

Alawneh, J.*, Parke, C.*, Lapuz, E., David, J., Basinang, V., Baluyut, A. et al. (2018) Prevalence and risk factors associated with gross pulmonary lesions in slaughtered pigs in smallholder and commercial farms in two provinces in the Philippines. Frontiers in Veterinary Science , 5(FEB)

Alderees, F.*, Mereddy, R., Webber, D., Nirmal, N.* & Yasmina Sultanbawa* (2018) Mechanism of action against food spoilage yeasts and bioactivity of Tasmannia lanceolata, Backhousia citriodora and Syzygium anisatum plant solvent extracts. Foods, 7(11): 1-15.

Ali, D., Marincowitz, S., Wingfield, M., Roux, J., Crous, P. & McTaggart, A. (2018) Novel Cryphonectriaceae from La Réunion and South Africa, and their pathogenicity on Eucalyptus. Mycological Progress, 17(8): 953-966.

Ali, S., Gill, R., Ulhassan, Z., Najeeb, U.*, Kanwar, M., Abid, M. et al. (2018) Insights on the responses of Brassica napus cultivars against the cobalt-stress as revealed by carbon assimilation, anatomical changes and secondary metabolites. Environmental and Experimental Botany, 156: 183-196.

Allen, B., Fawcett, A., Anker, A., Engeman, R., Lisle, A.* & Leung, L.* (2018) Environmental effects are stronger than human effects on mammalian predator-prey relationships in arid Australian ecosystems. Science of The Total Environment, 610-611: 451-461.

Amarasinghe, G., Aréchiga Ceballos, N., Banyard, A., Basler, C., Bavari, S., Bennett, A. et al. (2018) Taxonomy of the order Mononegavirales: update 2018. Archives of virology, 163(8): 1-12.

Ambrose, R., Gravel, J., Commins, M., Fowler, E. & Mahony, T.* (2018) In Vivo Characterisation of Five Strains of Bovine Viral Diarrhoea Virus 1 (Subgenotype 1c). Pathogens (Basel, Switzerland), 7(1): 1-18.

Amin, A.*, Nasim, W., Fahad, S., Ali, S., Ahmad, S., Rasool, A. et al. (2018) Evaluation and analysis of temperature for historical (1996-2015) and projected (2030-2060) climates in Pakistan using SimCLIM climate model: ensemble application. Atmospheric Research, 213: 422-436.

Amin, A., Nasim, W., Mubeen, M., Ahmad, A., Nadeem, M., Urich, P. et al. (2018) Simulated CSM-CROPGRO-cotton yield under projected future climate by SimCLIM for southern Punjab, Pakistan. Agricultural Systems, 167: 213-222.

Amin, A., Nasim, W., Mubeen, M., Sarwar, S., Urich, P., Ahmad, A. et al. (2018) Regional climate assessment of precipitation and temperature in Southern Punjab (Pakistan) using SimCLIM climate model for different temporal scales. Theoretical and Applied Climatology, 131(1-2): 121-131.

Amos, B.*, Hayes, R., Leemon, D. & Furlong, M.* (2018) Small hive beetle (Coleoptera: Nitidulidae) and the yeast, Kodamaea ohmeri: a facultative relationship under laboratory conditions. Journal of Economic Entomology, 112(2): 515-524.

Amos, B.*, Leemon, D., Hayes, R., Cribb, B.* & Furlong, M.* (2018) Associations between the small hive beetle and the yeast Kodamaea ohmeri throughout the host life cycle. Journal of Economic Entomology, 111(4): 1501-1508.

An-Vo, D., Mushtaq, S., Zheng, B., Christopher, J.*, Chapman, S. & Chenu, K.* (2018) Direct and indirect costs of frost in the Australian wheatbelt. Ecological Economics, 150: 122-136.

Anzooman, M.*, Christopher, J.*, Mumford, M., Dang, Y.*, Menzies, N.* & Kopittke, P. (2018) Selection for rapid germination and emergence may improve wheat seedling establishment in the presence of soil surface crusts. Plant and Soil, 426(1-2): 227-239.

Anzooman, M.*, Dang, Y.*, Christopher, J.*, Mumford, M., Menzies, N.* & Kopittke, P.* (2018) Dataset on seed details of wheat genotypes, solution treatments to measure seedling emergence force and the relation between seedling force and strain. Data in Brief, 21: 1598-1602.

Anzooman, M.*, Dang, Y.*, Christopher, J.*, Mumford, M., Menzies, N.* & Kopittke, P.* (2018) Greater emergence force and hypocotyl cross sectional area may improve wheat seedling emergence in sodic conditions. Plant Science, 277: 188-195.

Ashraf, S., Chaudhry, U., Raza, A., Ghosh, D. & Zhao, X. (2018) In vitro activity of ivermectin against Staphylococcus aureus clinical isolates. Antimicrobial Resistance and Infection Control, 7(1)

Aslam, A.*, Thomas-Hall, S.*, Manzoor, M., Jabeen, F., Iqbal, M., Uz Zaman, Q. et al. (2018) Mixed microalgae consortia growth under higher concentration of CO2 from unfiltered coal fired flue gas: Fatty acid profiling and biodiesel production. Journal of Photochemistry and Photobiology. B, Biology, 179: 126-133.

Atack, J., Weinert, L., Tucker, A., Husna, A., Wileman, T., Hadjirin, N. et al. (2018) Streptococcus suis contains multiple phase-variable methyltransferases that show a discrete lineage distribution. Nucleic Acids Research, 46(21): 11466-11476.

Auzmendi, I. & Hanan, J.* (2018) Using functional-structural modeling of carbon acquisition and utilization to understand fruit size distribution in tree canopies. Acta Horticulturae, 1228: 59-65.

Awan, T., Lim, C., Ahmed, S., Safdar, M. & Chauhan, B.* (2018) Weed-competitive ability of a hybrid and an inbred rice cultivar in managing Ischaemum rugosum in dry-seeded rice. Pakistan Journal of Agricultural Sciences, 55(4): 739-748.

Baguley, B.*, Skinner, T.* & Wright, O.* (2018) Nutrition therapy for the management of cancer-related fatigue and quality of life: a systematic review and meta-analysis. British Journal of Nutrition: 1-15.

Bajwa, A.*, Chauhan, B.* & Adkins, S.* (2018) Germination ecology of two Australian biotypes of ragweed parthenium (Parthenium hysterophorus) relates to their invasiveness. Weed Science, 66(1): 62-70.

Bajwa, A.*, Ullah, A., Farooq, M., Chauhan, B.* & Adkins, S.* (2018) Effect of different densities of parthenium weed (Parthenium hysterophorus L.) on the performance of direct-seeded rice under aerobic conditions. Archives of Agronomy and Soil Science, 65(6): 796-808.

Baker, D.*, Rice, S., Leemon, D. & James, P.* (2018) Horizontal transmission of Metarhizium anisopliae (Hypocreales: Clavicipitacea) and the effects of infection on oviposition rate in laboratory populations of Musca domestica (Diptera: Muscidae). Pest Management Science, 74(4): 987-991.

Baldini, F., Rougé, J., Kreppel, K., Mkandawile, G., Mapua, S., Sikulu-Lord, M.* et al. (2018) First report of natural Wolbachia infection in the malaria mosquito Anopheles arabiensis in Tanzania. Parasites and Vectors, 11(1)

Bandumula, N., Mahajan, G.* & Kumar, R. (2018) Farm level and aggregate economic impact of direct seeded rice in Punjab. Journal of Experimental Biology and Agricultural Sciences, 6(1): 253-257.

Barker, S.* & Barker, D.* (2018) Ticks in Australia: endemics; exotics; which ticks bite humans?. Microbiology Australia, 39(4): 194-199.

Barker, S.* & Burger, T.* (2018) Two new genera of hard ticks, Robertsicus n. gen. and Archaeocroton n. gen., and the solution to the mystery of Hoogstraal's and Kaufman's "primitive" tick from the Carpathian Mountains. Zootaxa, 4500(4): 543-552.

Barton, D., Smales, L. & Morgan, J.* (2018) A redescription of Serrasentis sagittifer (Rhadinorhynchidae: Serrasentinae) from Rachycentron canadum (Rachycentridae) with comments on its biology and its relationship to other species of Serrasentis. Journal of Parasitology, 104(2): 117-132.

Baziar, G., Jafari, M., Noori, M. & Samarfard, S.* (2018) Evaluation of genetic diversity among Persian fig cultivars by morphological traits and RAPD markers. HortScience, 53(5): 613-619.

Bessa, L., Pieterse, E., Sigge, G. & Hoffman, L. (2018) Insects as human food; from farm to fork : Insects as human food. Journal of the Science of Food and Agriculture.

Bhatia, D., Wing, R., Yu, Y., Chougule, K., Kudrna, D., Lee, S. et al. (2018) Genotyping by sequencing of rice interspecific backcross inbred lines identifies QTLs for grain weight and grain length. Euphytica, 214(2).

Bhattarai, R.*, Dhital, S.*, Mense, A., Gidley, M.* & Shi, Y. (2018) Intact cellular structure in cereal endosperm limits starch digestion in vitro. Food Hydrocolloids, 81: 139-148.

Blamey, F.*, Paterson, D., Walsh, A., Afshar, N., McKenna, B.*, Cheng, M. et al. (2018) Time-resolved x-Ray fluorescence analysis of element distribution and concentration in living plants: an example using manganese toxicity in cowpea leaves. Environmental and Experimental Botany, 156: 151-160.

Boe-Hansen, G.*, Fortes, M.* & Satake, N.* (2018) Morphological defects, sperm DNA integrity, and protamination of bovine spermatozoa. Andrology, 6(4): 627-633.

Bouwman, A., Daetwyler, H., Chamberlain, A., Ponce, C., Sargolzaei, M., Schenkel, F. et al. (2018) Meta-analysis of genome-wide association studies for cattle stature identifies common genes that regulate body size in mammals. Nature Genetics, 50(3): 362-367.

Bouxin, F., Strub, H., Dutta, T., Aguilhon, J., Morgan, T., Mingardon, F. et al. (2018) Elucidating transfer hydrogenation mechanisms in non-catalytic lignin depolymerization. Green Chemistry, 20(15): 3566-3580.

Brand, T., Engelbrecht, J., Van der Merwe, J. & Hoffman, L. (2018) Effects of varying sweet lupin dietary inclusion levels on feather classes, leather traits and meat composition of feedlot ostriches. South African Journal of Animal Science, 48(1)

Brand, T., Engelbrecht, J., Van der Merwe, J. & Hoffman, L. (2018) Feed preference of grower ostriches consuming diets differing in Lupinus angustifolius inclusion levels. South African Journal of Animal Science, 48(1)

Brand, T., Kritzinger, W., van der Merwe, D., Muller, A., Hoffman, L. & Niemann, G. (2018) Feather and skin development of ostriches Struthio camelus. Journal of the South African Veterinary Association, 89.

Brand, T., Van Der Merwe, D., Hoffman, L. & Geldenhuys, G. (2018) The effect of dietary energy content on quality characteristics of Boer goat meat. Meat Science, 139: 74-81.

Brand, T., van der Westhuizen, E., van Der Merwe, D. & Hoffman, L. (2018) Analysis of carcass characteristics and fat deposition of Merino, South African Mutton Merino and Dorper lambs housed in a feedlot. South African Journal of Animal Sciences, 48(3): 477-488.

Brand, T., Viviers, S., Van der Merwe, J. & Hoffman, L. (2018) The influence of different dietary energy concentrations on the production parameters of feedlot ostriches. South African Journal of Animal Science, 48(1): 162-169.

Bunna, S., Sereyvuth, H., Somaly, Y., Ngoy, N., Mengsry, L., Chea, S. et al. (2018) Head rice yield of crops harvested by combine and hand at different ripening times in Cambodia. Experimental Agriculture, 55(01): 1-11.

Bunna, S., Sinath, P., Sereyvuth, I., Somaly, Y., Chea, S., Ouk, M. et al. (2018) Fissured grain and head rice yield of crops harvested manually or by combine at different ripening stages in Cambodia. Plant Production Science, 22(1): 1-10.

Burgess, T., Tan, Y., Garnas, J., Edwards, J., Scarlett, K., Shuttleworth, L. et al. (2018) Current status of the Botryosphaeriaceae in Australia. Australasian Plant Pathology, 48(1): 35-44.

Burns, B.*, Hiendleder, S., Laing, A., Fordyce, G.* & Herring, A. (2018) Ultrasonographic measurements in first trimester concepti identify predictors of birth weight and postnatal development in cattle. Journal of Animal Science, 96(10): 4186-4194.

Butler, J., Freeman, J., Potts, B., Vaillancourt, R., Grattapaglia, D., Silva-Junior, O. et al. (2018) Annotation of the Corymbia terpene synthase gene family shows broad conservation but dynamic evolution of physical clusters relative to Eucalyptus. Heredity, 121(1): 1-18.

Calus, M., Goddard, M., Wientjes, Y., Bowman, P. & Hayes, B.* (2018) Multibreed genomic prediction using multitrait genomic residual maximum likelihood and multitask Bayesian variable selection. Journal of Dairy Science, 101(5): 4279-4294.

Canfell, O.*, Littlewood, R.*, Wright, O.* & Walker, J.* (2018) Clinical relevance and validity of tools to predict infant, childhood and adulthood obesity: a systematic review. Public Health Nutrition, 21(17): 1-13.

Canfell, O.*, Littlewood, R., Wright, O.* & Walker, J.* (2018) Response to 'Clinical relevance and validity of obesity risk prediction tools' by Redsell et al. Public Health Nutrition, 21(17): 1-2.

Cawthorn, D., Fitzhenry, L., Muchenje, V., Bureš, D., Kotrba, R. & Hoffman, L. (2018) Physical quality attributes of male and female wild fallow deer (Dama dama) muscles. Meat Science, 137: 168-175.

Chabikwa, T.*, Brewer, P.* & Beveridge, C.* (2018) Initial bud outgrowth occurs independent of auxin flow out of buds. Plant Physiology, 179(1): 55-65.

Chakanya, C., Arnaud, E., Muchenje, V. & Hoffman, L. (2018) Changes in the physico-chemical attributes through processing of salami made from blesbok (Damaliscus pygargus phillipsi), eland (Taurotragus oryx), fallow deer (Dama dama), springbok (Antidorcas marsupialis) and black wildebeest (Connochaetes gnou) in comparison to pork. Meat Science, 146: 87-92.

Chakanya, C., Arnaud, E., Muchenje, V. & Hoffman, L. (2018) Fermented meat sausages from game and venison: what are the opportunities and limitations? : Fermented meat sausages from game and venison. Journal of the Science of Food and Agriculture.

Chamara, B., Marambe, B., Kumar, V., Ismail, A., Septiningsih, E. & Chauhan, B.* (2018) Optimizing sowing and flooding depth for anaerobic germination-tolerant genotypes to enhance crop establishment, early growth, and weed management in dry-seeded rice (Oryza sativa L.). Frontiers in Plant Science, 9

Chauhan, B.*, Manalil, S.*, Florentine, S. & Jha, P. (2018) Germination ecology of Chloris truncata and its implication for weed management. PLoS One, 13(7)

Cheng, B.*, Furtado, A.* & Henry, R.* (2018) The coffee bean transcriptome explains the accumulation of the major bean components through ripening. Scientific Reports, 8(1)

Cheng, M., Kopittke, P.*, Wang, A., Sale, P. & Tang, C. (2018) Cadmium reduces zinc uptake but enhances its translocation in the cadmium-accumulator, Carpobrotus rossii, without affecting speciation. Plant and Soil, 430(1-2): 219-231.

Chen, S.*, Lopez-Sanchez, P.*, Wang, D.*, Mikkelsen, D.* & Gidley, M.* (2018) Mechanical properties of bacterial cellulose synthesised by diverse strains of the genus Komagataeibacter. Food Hydrocolloids, 81: 87-95.

Chenu, K.*, van Oosterom, E.*, McLean, G., Deifel, K.*, Fletcher, A.*, Geetika, G.* et al. (2018) Integrating modelling and phenotyping approaches to identify and screen complex traits : transpiration efficiency in cereals. Journal of Experimental Botany, 69(13): 3181-3194.

Chen, W.*, Zuo, H.*, Li, B.*, Duan, C., Rolfe, B.*, Zhang, B.* et al. (2018) Clay nanoparticles elicit long-term immune responses by forming biodegradable depots for sustained antigen stimulation. Small, 14(19)

Chen, W.*, Zuo, H.*, Rolfe, B.*, Schembri, M.*, Cobbold, R.*, Zhang, B. et al. (2018) Clay nanoparticles co-deliver three antigens to promote potent immune responses against pathogenic Escherichia coli. Journal of Controlled Release, 292: 196-209.

Chen, W.*, Zuo, H.*, Zhang, E., Li, L., Henrich-Noack, P., Cooper, H.* et al. (2018) Brain targeting delivery facilitated by ligand-functionalized layered double hydroxide nanoparticles. ACS Applied Materials and Interfaces, 10(24): 20326-20333.

Chin, A.*, Schmidt, S.*, Buckley, S.*, Pirie, R.*, Redding, M., Laycock, B.* et al. (2018) Sorbents can tailor nitrogen release from organic wastes to match the uptake capacity of crops. Science of the Total Environment, 645: 1474-1483.

Chiurugwi, T., Kemp, S., Powell, W. & Hickey, L.* (2018) Speed breeding orphan crops. Theoretical and Applied Genetics, 132(3): 607-616.

Chua, E.*, Eltanahy, E.*, Jung, H., Uy, M., Thomas-Hall, S.* & Schenk, P.* (2018) Efficient harvesting of Nannochloropsis microalgae via optimized chitosan-mediated flocculation. Global Challenges, 3(1)

Coates, T., Benvenutti, M.*, Flesch, T., Charmley, E., McGinn, S. & Chen, D. (2018) Applicability of eddy covariance to estimate methane emissions from grazing cattle. Journal of Environmental Quality, 47(1): 54-61.

Conrad, K., Dalal, R., Allen, D., Fujinuma, R. & Menzies, N. (2018) Free light fraction carbon and nitrogen, a physically uncomplexed soil organic matter distribution within subtropical grass and leucaena-grass pastures. Soil Research, 56(8): 820-828.

Conrad, K.*, Dalal, R.*, Dalzell, S.*, Allen, D., Fujinuma, R.* & Menzies, N.* (2018) Soil nitrogen status and turnover in subtropical leucaena-grass pastures as quantified by δ15N natural abundance. Geoderma, 313: 126-134.

Conrad, K.*, Dalal, R.*, Fujinuma, R.* & Menzies, N.* (2018) Soil organic carbon and nitrogen sequestration and turnover in aggregates under subtropical leucaena-grass pastures. Soil Research, 56(6): 632-647.

Constantinoiu, C.*, Lew-Tabor, A., Jackson, L., Jorgensen, W.*, Piper, E.*, Mayer, D. et al. (2018) Local immune response to larvae of Rhipicephalus microplus in Santa Gertrudis cattle Immune response against Rhipicephalus microplus. Parasite Immunology, 40(4)

Cooper, J., Hu, Y., Beyyoudh, L., Yildiz Dasgan, H., Kunert, K., Beveridge, C.* et al. (2018) Strigolactones positively regulate chilling tolerance in pea and in Arabidopsis. Plant, cell & environment, 41(6): 1298-1310.

Coquery, N., Meurice, P., Janvier, R., Bobillier, E., Quellec, S., Fu, M.* et al. (2018) fMRI-based brain responses to quinine and sucrose gustatory stimulation for nutrition research in the Minipig Model: a proof-of-concept study. Frontiers in Behavioral Neuroscience, 12

Coradetti, S., Pinel, D., Geiselman, G., Ito, M., Mondo, S., Reilly, M. et al. (2018) Functional genomics of lipid metabolism in the oleaginous yeast Rhodosporidium toruloides. eLife, 7.

Corbet, N.*, Allen, J., Laing, A., Fordyce, G.*, McGowan, M.* & Burns, B.* (2018) Using ultrasound to derive new reproductive traits in tropical beef breeds: implications for genetic evaluation. Animal Production Science, 58(9): 1735-1742.

Cornwell, W., Wright, I., Turner, J., Maire, V., Barbour, M., Cernusak, L. et al. (2018) Climate and soils together regulate photosynthetic carbon isotope discrimination within C3 plants worldwide. Global Ecology and Biogeography, 27(9): 1056-1067.

Costa, D. (2018) Cattle responses to small inclusions of lipids in the diet. Applied Food Science Journal, 02(01): 14-14.

Dann, E. (2018) Does silicon amendment benefit avocado tree health or fruit quality?. Talking Avocados, 28(4): 53-56.

Dann, L. (2018) Ongoing rootstock trial Tristate region. Talking Avocados, 29(2): 58-59.

Darnell, R., Harvey, J., Fox, G.*, Fletcher, M.*, Wainaina, J., Wanjuki, I. et al. (2018) NIRS calibration of aflatoxin in maize. Australian Journal of Chemistry, 71(11): 868-873.

Davoodi, Z., Bejerman, N., Richet, C., Filloux, D., Kumari, S., Chatzivassiliou, E. et al. (2018) The westward journey of alfalfa leaf curl virus. Viruses, 10(10): 542-16 of 16.

de Araujo, L., Santos, P., Rodriguez, D.* & Macedo Pezzopane, J. (2018) Key factors that influence for seasonal production of Guinea grass. Scientia Agricola, 75(3): 191-196.

DeAtley, K., Colgrave, M., Cánovas, A., Wijffels, G., Ashley, R., Silver, G. et al. (2018) Neuropeptidome of the hypothalamus and pituitary gland of indicine × taurine heifers: evidence of differential neuropeptide processing in the pituitary gland before and after puberty. Journal of Proteome Research, 17(5): 1852-1865.

Dejene, M.*, Dixon, R.*, Duncan, A., Wolde-meskel, E., Walsh, K. & McNeill, D.* (2018) Variations in seed and post-harvest residue yields and residues quality of common bean (Phaseolus vulgaris L.) as a ruminant feedstuff. Animal Feed Science and Technology, 244: 42-55.

de Langhe, E., Laliberte, B., Chase, R., Domaingue, R., Horry, J., Karamura, D. et al. (2018) The 2016 Global Strategy for the conservation and use of Musa genetic resources – key strategic elements. Acta Horticulturae, 1196(1196): 71-78.

Deng, K., Zeng, J., Cheng, G., Gao, J., Sale, K., Simmons, B. et al. (2018) Rapid characterization of the activities of lignin-modifying enzymes based on nanostructure-initiator mass spectrometry (NIMS). Biotechnology for Biofuels, 11(1).

Deng, Q.*, Wei, Y.*, Zhao, Y.*, Han, X. & Yin, J. (2018) Understanding the natural and socioeconomic factors behind regional longevity in Guangxi, China: is the centenarian ratio a good enough indicator for assessing the longevity phenomenon?. International Journal of Environmental Research and Public Health, 15(5)

Devadas, R., Huete, A., Vicendese, D., Erbas, B., Beggs, P., Medek, D. et al. (2018) Dynamic ecological observations from satellites inform aerobiology of allergenic grass pollen. Science of the Total Environment, 633: 441-451.

Dhillon, A., Sharma, N., Dosanjh, N., Goyal, M. & Mahajan, G. (2018) Variation in the nutritional quality of rice straw and grain in response to different nitrogen levels. Journal of Plant Nutrition, 41(15): 1946-1956.

Dhital, S.*, Baier, S., Gidley, M.* & Stokes, J.* (2018) Microstructural properties of potato chips. Food Structure, 16: 17-26.

Dietzgen, R.*, Freitas-Astúa, J., Chabi-Jesus, C., Ramos-González, P., Goodin, M., Kondo, H. et al. (2018) Dichorhaviruses in their host plants and mite vectors. Advances in Virus Research, 102: 119-148.

Dietzgen, R.*, Freitas-Astúa, J., Salaroli, R. & Kitajima, E. (2018) Tomato spotted wilt virus infects spider lily plants in Australia. Australasian Plant Disease Notes, 13(1).

Dietzgen, R.*, Tassi, A., Freitas-Astúa, J. & Kitajima, E. (2018) First report of orchid fleck virus and its mite vector on green cordyline. Australasian Plant Disease Notes, 13(1): 1-4.

DiGiacomo, K., Norris, E., Dunshea, F., Hayes, B.*, Marett, L., Wales, W. et al. (2018) Responses of dairy cows with divergent residual feed intake as calves to metabolic challenges during midlactation and the nonlactating period. Journal of Dairy Science, 101(7): 6474-6485.

Dinglasan, E.*, Godwin, I.*, Phan, H., Tan, K., Platz, G. & Hickey, L.* (2018) Vavilov wheat accessions provide useful sources of resistance to tan spot (syn. yellow spot) of wheat. Plant Pathology, 67(5): 1076-1087.

Dinglasan, E.*, Singh, D.*, Shankar, M., Afanasenko, O., Platz, G., Godwin, I.* et al. (2018) Discovering new alleles for yellow spot resistance in the Vavilov wheat collection. Theoretical and Applied Genetics, 132(1): 149-162.

Diop, A., Barker, S.*, Eberhard, M.*, Barker, D., Nguyen, T., Di Pinto, F. et al. (2018) Rickettsia fournieri sp. nov., a novel spotted fever group rickettsia from Argas lagenoplastis ticks in Australia. International Journal of Systematic and Evolutionary Microbiology, 68(12): 3781-3784.

Diop, S., Geering, A.*, Alfama-Depauw, F., Loaec, M., Teycheney, P. & Maumus, F. (2018) Tracheophyte genomes keep track of the deep evolution of the Caulimoviridae. Scientific reports, 8(1): 1-9.

Dix, C.* & Wright, O.* (2018) Bioavailability of a novel form of microencapsulated bovine lactoferrin and its effect on inflammatory markers and the gut microbiome: a pilot study. Nutrients, 10(8)

Dixon, R.*, Fletcher, M.*, Goodwin, K., Reid, D., Yong, K.*, McNeill, D.* et al. (2018) Learned behaviours lead to bone ingestion by phosphorus-deficient cattle. Animal Production Science, 59(5): 921-932.

Dolan, G., Cartwright, B., Bonilla, M., Gidley, M., Stokes, J. & Yakubov, G. (2018) Probing adhesion between nanoscale cellulose fibres using AFM lateral force spectroscopy: the effect of hemicelluloses on hydrogen bonding. Carbohydrate Polymers, 208: 97-107.

Doolette, C., Read, T., Li, C.*, Scheckel, K., Donner, E., Kopittke, P.* et al. (2018) Foliar application of zinc sulfate and zinc EDTA to wheat leaves: differences in mobility, distribution and speciation. Journal of Experimental Botany, 69(18): 4469-4481.

Doungsa-ard, C.*, McTaggart, A.*, Geering, A.* & Shivas, R. (2018) Diversity of gall-forming rusts (Uromycladium, Pucciniales) on Acacia in Australia. Persoonia, 40(1): 221-238.

Duan, C., Liang, L., Li, L., Zhang, R.* & Xu, Z.* (2018) Recent progress in upconversion luminescence nanomaterials for biomedical applications. Journal of Materials Chemistry B, 6(2): 192-209.

Dutta, T., Papa, G., Wang, E., Sun, J., Isern, N., Cort, J. et al. (2018) Characterization of lignin streams during bionic liquid-based tretreatment from grass, hardwood, and softwood. ACS Sustainable Chemistry and Engineering, 6(3): 3079-3090.

Du, Z.*, Johnston, S.*, Janssen, T., Phillips, C.*, Lisle, A.* & Keeley, T.* (2018) Behavioral and endocrine responses to season and social dynamics of captive male southern hairy-nosed wombats (Lasiorhinus latifrons). General and Comparative Endocrinology, 261: 40-50.

Du, Z., Zhang, R.*, Song, B., Zhang, W., Wang, Y., Liu, J.* et al. (2018) Iridium(III) complex-based activatable probe for phosphorescent/time-gated luminescent sensing and imaging of cysteine in mitochondria of live cells and animals. Chemistry: A European Journal, 25(6): 1365-1365.

Earles, J., Buckley, T., Brodersen, C., Busch, F., Cano, F., Choat, B. et al. (2018) Embracing 3D complexity in leaf carbon–water exchange. Trends in Plant Science, 24(1): 15-24.

Eimer, H., Sureshkumar, S., Singh Yadav, A., Kraupner-Taylor, C., Bandaranayake, C., Seleznev, A. et al. (2018) RNA-dependent epigenetic silencing directs transcriptional downregulation caused by intronic repeat expansions. Cell, 174(5): 1095-1105.e11.

El Hassouni, K., Alahmad, S., Belkadi, B., Filali-Maltouf, A., Hickey, L.* & Bassi, F. (2018) Root system architecture and its association with yield under different water regimes in Durum wheat. Crop Science, 58(6): 2331-2346.

Ellinghaus, T., Pereira, J., McAndrew, R., Welner, D., DeGiovanni, A., Guenther, J. et al. (2018) Engineering glycoside hydrolase stability by the introduction of zinc binding. Acta Crystallographica Section D: Structural Biology, 74(7): 702-710.

Engel, J., Widowski, T., Tilbrook, A.*, Butler, K. & Hemsworth, P. (2018) The effects of floor space and nest box access on the physiology and behavior of caged laying hens. Poultry Science, 98(2): 533-547.

Engle, B., Herring, A., Sawyer, J., Riley, D., Sanders, J. & Gill, C. (2018) Genome-wide association study for stayability measures in Nellore-Angus crossbred cows. Journal of Animal Science, 96(4): 1205-1214.

Erasmus, S., Muller, M., Butler, M. & Hoffman, L. (2018) The truth is in the isotopes: Authenticating regionally unique South African lamb. Food Chemistry, 239: 926-934.

Etebari, K.*, Afrad, M., Tang, B., Silva, R., Furlong, M.* & Asgari, S.* (2018) Involvement of microRNA miR-2b-3p in regulation of metabolic resistance to insecticides in Plutella xylostella. Insect Molecular Biology, 27(4): 478-491.

Falade, T.*, Chrysanthopoulos, P.*, Hodson, M.*, Sultanbawa, Y.*, Fletcher, M.*, Darnell, R. et al. (2018) Metabolites Identified during Varied Doses of Species in Grains, and Their Correlation with Aflatoxin Levels. Toxins, 10(5)

Farah, M., Fortes, M., Kelly, M., Porto-Neto, L., Meira, C., Duitama Carreno, L. et al. (2018) Accuracy of genomic selection predictions for hip height in Brahman cattle using different relationship matrices. Pesquisa Agropecuaria Brasileira, 53(6): 717-726.

Feng, G.*, Flanagan, B.*, Mikkelsen, D.*, Williams, B.*, Yu, W., Gilbert, R.* et al. (2018) Mechanisms of utilisation of arabinoxylans by a porcine faecal inoculum: competition and co-operation. Scientific Reports, 8(1)

Feng, G.*, Flanagan, B.*, Williams, B.*, Mikkelsen, D.*, Yu, W.* & Gidley, M.* (2018) Extracellular depolymerisation triggers fermentation of tamarind xyloglucan and wheat arabinoxylan by a porcine faecal inoculum. Carbohydrate Polymers, 201: 575-582.

Feng, Z., Zhang, Z., Hua, K., Gao, X., Mao, Y., Botella, J.* et al. (2018) A highly efficient cell division-specific CRISPR/Cas9 system generates homozygous mutants for multiple genes in Arabidopsis. International Journal of Molecular Sciences, 19(12)

Ferguson, J.*, Chechetto, R.*, Adkins, S.*, Hewitt, A.*, Chauhan, B.*, Kruger, G. et al. (2018) Effect of spray droplet size on herbicide efficacy on four winter annual grasses. Crop Protection, 112: 118-124.

Fernandes, J.*, Dos Santos, L., Chouin-Carneiro, T., Pavan, M., Garcia, G., David, M. et al. (2018) Rapid, noninvasive detection of Zika virus in mosquitoes by near-infrared spectroscopy. Science Advances, 4(5)

Fernandes, J.*, Moise, I., Maranto, G. & Beier, J. (2018) Revamping mosquito-borne disease control to tackle future threats. Trends in Parasitology, 34(5): 359-368.

Ferrari, V., Diaz, A., Cônsolo, N., De Sousa, R., Rodriguez, F. & Silva, L. (2018) Effect of different sources of non-fiber carbohydrate on ruminal pH and in vitro digestibility of tropical forage. Brazilian Journal of Veterinary Research and Animal Science, 55(3).

Fikere, M., Barbulescu, D., Malmberg, M., Shi, F., Koh, J., Slater, A. et al. (2018) Genomic Prediction Using Prior Quantitative Trait Loci Information Reveals a Large Reservoir of Underutilised Blackleg Resistance in Diverse Canola (Brassica napus L.) Lines. The Plant Genome, 11(2).

Finn, D.*, Catton, K., Heenan, M., Kopittke, P.*, Ouwerkerk, D.*, Klieve, A.* et al. (2018) Differential gene expression in the model Actinomycete Streptomyces coelicolor A3(2) supports nitrogen mining dependent on the plant carbon to nitrogen ratio. Agriculture, 8(12)

Fletcher, A.*, Christopher, J.*, Hunter, M., Rebetzke, G. & Chenu, K.* (2018) A low-cost method to rapidly and accurately screen for transpiration efficiency in wheat. Plant Methods, 14(1)

Fletcher, S.*, Boden, M.*, Mitter, N.* & Carroll, B.* (2018) SCRAM: a pipeline for fast index-free small RNA read alignment and visualization. Bioinformatics, 34(15): 2670-2672.

Florentine, S., Weller, S., King, A., Florentine, A., Dowling, K., Westbrooke, M. et al. (2018) Seed germination response of a noxious agricultural weed Echium plantagineum to temperature, light, pH, drought stress, salinity, heat and smoke. Crop and Pasture Science, 69(3): 326-333.

Fonseca, P., Id-Lahoucine, S., Reverter, A., Medrano, J., Fortes, M.*, Casellas, J. et al. (2018) Combining multi-OMICs information to identify key-regulator genes for pleiotropic effect on fertility and production traits in beef cattle. PLOS ONE, 13(10)

Fordyce, G.*, McMillan, H. & McGrath, N.* (2018) Postoperative healing and behaviour when surgical swabs are applied to calf dehorning wounds. Australian Veterinary Journal, 96(12): 508-515.

Forough, A., Lau, E., Steadman, K.*, Cichero, J.*, Kyle, G., Santos, J. et al. (2018) A spoonful of sugar helps the medicine go down? A review of strategies for making pills easier to swallow. Patient Preference and Adherence, 12: 1337-1346.

Forough, A., Wong, S., Lau, E., Santos, J., Kyle, G., Steadman, K.* et al. (2018) Nurse experiences of medication administration to people with swallowing difficulties living in aged care facilities: a systematic review of qualitative evidence. JBI Database of Systematic Reviews and Implementation Reports, 16(1): 71-86.

Fortes, M.*, Enculescu, C.*, Porto Neto, L., Lehnert, S., McCulloch, R. & Hayes, B.* (2018) Candidate mutations used to aid the prediction of genetic merit for female reproductive traits in tropical beef cattle. Revista Brasileira de Zootecnia, 47.

Fortes, M.*, Zacchi, L.*, Nguyen, L.*, Raidan, F., Weller, M., Choo, J.* et al. (2018) Pre- and post-puberty expression of genes and proteins in the uterus of Bos indicus heifers: the luteal phase effect post-puberty. Animal Genetics, 49(6): 539-549.

Fraser, S., McTaggart, A., Chan, J., Nxumalo, T., Shuey, L., Wingfield, M. et al. (2018) An artificial inoculation protocol for Uromycladium acaciae, cause of a serious disease of Acacia mearnsii in southern Africa. Southern Forests, 81(1): 1-6.

Fritz, S., Hoze, C., Rebours, E., Barbat, A., Bizard, M., Chamberlain, A. et al. (2018) An initiator codon mutation in SDE2 causes recessive embryonic lethality in Holstein cattle. Journal of Dairy Science, 101(7): 6220-6231.

Fujinuma, R.*, Kirchhof, G.*, Ramakrishna, A., Sirabis, W., Yapo, J., Woruba, D. et al. (2018) Intensified sweetpotato production in Papua New Guinea drives plant nutrient decline over the last decade. Agriculture, Ecosystems & Environment, 254: 10-19.

Furlong, M.*, Ang, G.*, Silva, R.* & Zalucki, M.* (2018) Bringing Ecology Back: How Can the Chemistry of Indirect Plant Defenses Against Herbivory Be Manipulated to Improve Pest Management?. Frontiers in Plant Science, 9

Fyfe, S.*, Netzel, G.*, Netzel, M.* & Sultanbawa, Y.* (2018) Buchanania obovata: functionality and phytochemical profiling of the Australian native green plum. Foods, 7(5).

Fyfe, S.*, Netzel, G.*, Netzel, M.* & Sultanbawa, Y.* (2018) Buchanania obovata: functionality and phytochemical profiling of the Australian native green plum. Foods, 7(5): 1-10.

Fyfe, S., Netzel, M., Tinggi, U., Biehl, E. & Sultanbawa, Y. (2018) Buchanania obovata : An Australian Indigenous food for diet diversification : Buchanania obovata : An Australian Indigenous food. Nutrition & Dietetics, 75(5): 527-532.

Gao, W., Xu, F., Guo, D., Zhao, J., Liu, J., Guo, Y. et al. (2018) Calcium-dependent protein kinases in cotton: insights into early plant responses to salt stress. BMC Plant Biology, 18(1): 1-15.

Garsmeur, O., Droc, G., Antonise, R., Grimwood, J., Potier, B., Aitken, K. et al. (2018) A mosaic monoploid reference sequence for the highly complex genome of sugarcane. Nature Communications, 9 (1)

Gartaula, G.*, Dhital, S.*, Netzel, G.*, Flanagan, B.*, Yakubov, G.*, Beahan, C. et al. (2018) Quantitative structural organisation model for wheat endosperm cell walls: Cellulose as an important constituent. Carbohydrate Polymers, 196: 199-208.

Gartner, C.*, Bromberg, M., Musgrove, T. & Luong, K.* (2018) Vape club: exploring non-profit regulatory models for the supply of vaporised nicotine products. International Journal of Environmental Research and Public Health, 15(8)

Geering, A.* (2018) A review of the status of Avocado sunblotch viroid in Australia. Australasian Plant Pathology, 47(6): 555-559.

Georges, M., Charlier, C. & Hayes, B.* (2018) Harnessing genomic information for livestock improvement. Nature Reviews Genetics, 20(3): 135-156.

Ghanipoor-Samami, M., Javadmanesh, A., Burns, B.*, Thomsen, D., Nattrass, G., Estrella, C. et al. (2018) Atlas of tissue- and developmental stage specific gene expression for the bovine insulin-like growth factor (IGF) system. PLoS One, 13(7)

Ghorbani, A.*, Izadpanah, K. & Dietzgen, R.* (2018) Changes in maize transcriptome in response to maize Iranian mosaic virus infection. PLoS One, 13(4)

Ghorbani, A.*, Izadpanah, K. & Dietzgen, R.* (2018) Gene expression and population polymorphism of maize Iranian mosaic virus in Zea mays, and intracellular localization and interactions of viral N, P, and M proteins in Nicotiana benthamiana. Virus Genes, 54(2): 290-296.

Ghorbani, A.*, Izadpanah, K., Peters, J.*, Dietzgen, R.* & Mitter, N.* (2018) Detection and profiling of circular RNAs in uninfected and maize Iranian mosaic virus-infected maize. Plant Science, 274: 402-409.

Ghosh, S., Watson, A.*, Gonzalez-Navarro, O., Ramirez-Gonzalez, R., Yanes, L., Mendoza-Suárez, M. et al. (2018) Speed breeding in growth chambers and glasshouses for crop breeding and model plant research. Nature Protocols, 13(12): 2944-2963.

Godwin, R.*, Mayer, D., Brown, G., Leemon, D. & James, P.* (2018) Predicting nuisance fly outbreaks on cattle feedlots in subtropical Australia. Animal Production Science, 58(2): 343-349.

Goff, H., Repin, N., Fabek, H., El Khoury, D. & Gidley, M.* (2018) Dietary fibre for glycaemia control: towards a mechanistic understanding. Bioactive Carbohydrates and Dietary Fibre, 14: 39-53.

González-González, L.*, Zhou, L.*, Astals, S.*, Thomas-Hall, S.*, Eltanahy, E.*, Pratt, S.* et al. (2018) Biogas production coupled to repeat microalgae cultivation using a closed nutrient loop. Bioresource Technology, 263: 625-630.

Gonzalez-Rivas, P., Sullivan, M.*, Cottrell, J., Leury, B., Gaughan, J.* & Dunshea, F. (2018) Effect of feeding slowly fermentable grains on productive variables and amelioration of heat stress in lactating dairy cows in a sub-tropical summer. Tropical Animal Health and Production, 50(8): 1-7.

Goraya, M., Ziaghum, F., Chen, S., Raza, A.* & Chen, Y. (2018) Role of innate immunity in pathophysiology of classical swine fever virus infection. Microbial Pathogenesis, 119: 248-254.

Gordon, R., Chapman, J., Power, A., Chandra, S., Roberts, J. & Cozzolino, D. (2018) Comparison of Ultrasound-Assisted Extraction with Static Extraction as Pre-Processing Method Before Gas Chromatography Analysis of Cereal Lipids. Food Analytical Methods, 11(11): 3276-3281.

Gordon, R.*, Power, A., Chapman, J., Chandra, S. & Cozzolino, D. (2018) A review on the source of lipids and their interactions during beer fermentation that affect beer quality. Fermentation, 4(89)

Gumulya, Y.*, Baek, J.*, Wun, S.*, Thomson, R.*, Harris, K.*, Hunter, D.* et al. (2018) Engineering highly functional thermostable proteins using ancestral sequence reconstruction. Nature Catalysis, 1(11): 878-888.

Guo, J., Li, K., Jin, L., Xu, R., Miao, K., Yang, F. et al. (2018) A simple and cost-effective method for screening of CRISPR/Cas9-induced homozygous/biallelic mutants. Plant Methods, 14(1)

Guo, W., Zheng, B., Potgieter, A.*, Diot, J., Watanabe, K., Noshita, K. et al. (2018) Aerial imagery analysis – quantifying appearance and number of sorghum heads for applications in breeding and agronomy. Frontiers in Plant Science, 9

Gurr, G., Reynolds, O., Johnson, A., Desneux, N., Zalucki, M.*, Furlong, M.* et al. (2018) Landscape ecology and expanding range of biocontrol agent taxa enhance prospects for diamondback moth management. A review. Agronomy for Sustainable Development, 38(3).

Hajjarpoor, A., Vadez, V., Soltani, A., Gaur, P., Whitbread, A., Suresh Babu, D. et al. (2018) Characterization of the main chickpea cropping systems in India using a yield gap analysis approach. Field Crops Research, 223: 93-104.

Ha, L.*, Mitchell, J.* & Fukai, S.* (2018) Genotypic consistency for low temperature tolerance at the booting stage in rice grown under flooded and non-flooded conditions. Field Crops Research, 220: 19-26.

Hanif, Z., Ali, H., Rasool, G., Tanveer, A. & Chauhan, B.* (2018) Genus Salsola: its benefits, uses, environmental perspectives and future aspects - a review. Journal of Rangeland Science, 8(3): 315-328.

Han, P.*, Keast, R. & Roura, E.* (2018) TAS1R1 and TAS1R3 polymorphisms relate to energy and protein-rich food choices from a buffet meal respectively. Nutrients, 10(12)

Han, Q., Liu, J.*, Meng, Q., Wang, Y., Feng, H., Zhang, Z. et al. (2018) Turn-on fluorescence probe for nitric oxide detection and bioimaging in live cells and zebrafish. ACS Sensors, 4(2): 309-316.

Hao, G., Xu, Z.* & Li, L.* (2018) Manipulating extracellular tumour pH: An effective target for cancer therapy. RSC Advances, 8(39): 22182-22192.

Hao, Y., Ma, C., Zhang, Z., Song, Y.*, Cao, W., Guo, J. et al. (2018) Carbon nanomaterials alter plant physiology and soil bacterial community composition in a rice-soil-bacterial ecosystem. Environmental Pollution, 232: 123-136.

Harris, K.*, Thomson, R.*, Strohmaier, S.*, Gumulya, Y.* & Gillam, E.* (2018) Determinants of thermostability in the cytochrome P450 fold. Biochimica et Biophysica Acta - Proteins and Proteomics, 1866(1): 97-115.

Hayward, J., Sanchez, J., Perry, A., Huang, C., Valle, M., Canals, M. et al. (2018) Correction: Ticks from diverse genera encode chemokine-inhibitory evasin proteins (vol 292, pg 15670, 2017). Journal of Biological Chemistry, 293(41): 15888-15888.

Healey, A.*, Lee, D., Furtado, A.* & Henry, R.* (2018) Evidence of inter-sectional chloroplast capture in Corymbia among sections Torellianae and Maculatae. Australian Journal of Botany, 66(5): 369-378.

Heim, R., Wright, I., Chang, H., Carnegie, A., Pegg, G., Lancaster, E.* et al. (2018) Detecting myrtle rust (Austropuccinia psidii) on lemon myrtle trees using spectral signatures and machine learning. Plant Pathology, 67(5): 1114-1121.

Henry, R.*, Furtado, A.* & Rangan, P.* (2018) Wheat seed transcriptome reveals genes controlling key traits for human preference and crop adaptation. Current Opinion in Plant Biology, 45(Pt B): 231-236.

Henry, R.* & Wrigley, C. (2018) Towards a genetic road map of wheat-processing quality. Journal of Cereal Science, 79: 516-517.

Hereward, J., Werth, J., Thornby, D., Keenan, M., Chauhan, B. & Walter, G. (2018) Complete chloroplast genome of glyphosate resistant Sonchus oleraceus L. from Australia, with notes on the small single copy (SSC) region orientation. Mitochondrial DNA Part B, 3(1): 363-364.

Hernandez-Soriano, M.*, Dalal, R.*, Warren, F.*, Wang, P.*, Green, K.*, Tobin, M. et al. (2018) Soil organic carbon stabilization: Mapping carbon speciation from intact microaggregates. Environmental Science and Technology, 52(21): 12275-12284.

Higgins, D., Young, M., Tremaine, M., Sardi, M., Fletcher, J., Agnew, M. et al. (2018) Natural variation in the multidrug efflux pump SGE1 underlies ionic liquid tolerance in yeast. Genetics, 210(1): 219-234.

Hiti Bandaralage, J.*, Hayward, A., O'Brien, C., Beveridge, C. & Mitter, N.* (2018) Acclimatization of micropropagated mature avocado. Acta Horticulturae, 1224: 13-20.

Hoang, N., Furtado, A.*, Thirugnanasambandam, P.*, Botha, F.* & Henry, R.* (2018) De novo assembly and characterizing of the culm-derived meta-transcriptome from the polyploid sugarcane genome based on coding transcripts. Heliyon, 4(3)

Hoffman, L.*, Hildebrandt, W. & Leslie, A. (2018) Chemical composition of African Savanna Buffalo (Syncerus caffer) meat. African Journal of Wildlife Research, 48(1)

Howell, E., Russell, D., Alam, M.* & Topp, B.* (2018) Variability of initial and final nut set in elite macadamia selections using different pollination methods. Acta Horticulturae(1205): 617-622.

Humphries, T., Chauhan, B.* & Florentine, S. (2018) Environmental factors effecting the germination and seedling emergence of two populations of an aggressive agricultural weed; Nassella trichotoma. PLoS One, 13(7)

Hunt, C., van Eeuwijk, F., Mace, E.*, Hayes, B.* & Jordan, D. (2018) Development of genomic prediction in sorghum. Crop Science, 58(2): 690-700.

Hu, P., Chapman, S.*, Wang, X.*, Potgieter, A.*, Duan, T., Jordan, D.* et al. (2018) Estimation of plant height using a high throughput phenotyping platform based on unmanned aerial vehicle and self-calibration: Example for sorghum breeding. European Journal of Agronomy, 95: 24-32.

Hu, Z., Deng, B., Tan, X.*, Gan, H., Li, C., Nada, S.* et al. (2018) Diurnal changes of glycogen molecular structure in healthy and diabetic mice. Carbohydrate Polymers, 185: 145-152.

Igwe, E., Charlton, K., Probst, Y., Kent, K. & Netzel, M.* (2018) A systematic literature review of the effect of anthocyanins on gut microbiota populations. Journal of Human Nutrition and Dietetics, 32(1): 53-62.

Iqbal, N.*, Manalil, S.*, Chauhan, B.* & Adkins, S.* (2018) Germination biology of Sesbania (Sesbania cannabina): An emerging weed in the Australian cotton agro-environment. Weed Science, 67(1): 68-76.

Jackson, A., Dietzgen, R.*, Goodin, M. & Li, Z. (2018) Development of model systems for plant rhabdovirus research. Advances in Virus Research, 102: 23-57.

Jamtgard, S.*, Robinson, N.*, Moritz, T., Colgrave, M. & Schmidt, S.* (2018) Optimising methods for the recovery and quantification of di- and tripeptides in soil. Soil Research, 56(4): 404-412.

Janke, C., Fujinuma, R.*, Moody, P.* & Bell, M.* (2018) Biochemical effects of banding limit the benefits of nitrification inhibition and controlled-release technology in the fertosphere of high N-input systems. Soil Research, 57(1): 28-40.

Javaid, M., Florentine, S., Ali, H. & Chauhan, B.* (2018) Environmental factors affecting the germination and emergence of white horehound (Marrubium vulgare L.): A weed of arid-zone areas. Rangeland Journal, 40(1): 47-54.

Jiang, L., Liu, J., Zuo, K., Zou, L., Li, Y., Qian, G. et al. (2018) Performance of layered double hydroxides intercalated with acetate as biodenitrification carbon source: the effects of metal ions and particle size. Bioresource Technology, 259: 99-103.

Jighly, A., Lin, Z., Forster, J., Spangenberg, G., Hayes, B.* & Daetwyler, H. (2018) Insights into population genetics and evolution of polyploids and their ancestors. Molecular Ecology Resources, 18(5): 1157-1172.

Jun, D.*, Johnston, V.*, Kim, J.* & O'Leary, S.* (2018) Cross-cultural adaptation and validation of the Depression, Anxiety and Stress Scale-21 (DASS-21) in the Korean working population. Work (Reading, Mass.), 59(1): 93-102.

Kanokudom, S., Mahony, T.*, Smith, D. & Assavalapsakul, W. (2018) Modulation of bovine herpesvirus 1 infection by virally encoded microRNAs. Virus Research, 257: 1-6.

Karbanowicz, T.*, Nouwens, A.*, Tabor, A.* & Rodriguez-Valle, M.* (2018) Comparison of protein gut samples from rhipicephalus spp. using a crude and an innovative preparation method for proteome analysis. Veterinary Sciences, 5(1)

Kasirajan, L.*, Hoang, N.*, Furtado, A.*, Botha, F.* & Henry, R.* (2018) Transcriptome analysis highlights key differentially expressed genes involved in cellulose and lignin biosynthesis of sugarcane genotypes varying in fiber content. Scientific Reports, 8(1)

Kaur, S., Kaur, R. & Chauhan, B.* (2018) Understanding crop-weed-fertilizer-water interactions and their implications for weed management in agricultural systems. Crop Protection, 103: 65-72.

Kazan, K. (2018) A new twist in SA signalling. Nature Plants, 4(6): 1-2.

Kazan, K.* (2018) Plant-biotic interactions under elevated CO2: a molecular perspective. Environmental and Experimental Botany, 153: 249-261.

Kazan, K.* & Gardiner, D.* (2018) Fusarium crown rot caused by Fusarium pseudograminearum in cereal crops: recent progress and future prospects. Molecular Plant Pathology, 19(7): 1547-1562.

Kazan, K.* & Gardiner, D. (2018) Transcriptomics of cereal-Fusarium graminearum interactions: what we have learned so far. Molecular Plant Pathology, 19(3): 764-778.

Kemper, K.*, Bowman, P., Hayes, B.*, Visscher, P.* & Goddard, M.* (2018) A multi-trait Bayesian method for mapping QTL and genomic prediction. Genetics Selection Evolution, 50(1)

Kent, M., Zeng, J., Rader, N., Avina, I., Simoes, C., Brenden, C. et al. (2018) Efficient conversion of lignin into a water-soluble polymer by a chelator-mediated Fenton reaction: optimization of H2O2 use and performance as a dispersant. Green Chemistry, 20(13): 3024-3037.

Khan, A., Pan, X., Najeeb, U.*, Tan, D., Fahad, S., Zahoor, R. et al. (2018) Coping with drought: stress and adaptive mechanisms, and management through cultural and molecular alternatives in cotton as vital constituents for plant stress resilience and fitness. Biological Research, 51(1)

Khan, N.*, Hanif, Z.*, Khan, I., Naveed, K., Shabbir, A.* & Adkins, S.* (2018) Root growth responses of parthenium weed and different pasture plants under elevated atmospheric carbon dioxide. Journal of the National Science Foundation of Sri Lanka, 46(3): 303-310.

Kimbrel, J., Ballor, N., Wu, Y., David, M., Hazen, T., Simmons, B. et al. (2018) Microbial community structure and functional potential along a hypersaline gradient. Frontiers in Microbiology, 9(JUL).

Kim, K., Dutta, T., Sun, J., Simmons, B. & Singh, S. (2018) Biomass pretreatment using deep eutectic solvents from lignin derived phenols. Green Chemistry, 20(4): 809-815.

Kim, N., Jayakodi, M., Lee, S., Choi, B., Jang, W., Lee, J. et al. (2018) Genome and evolution of the shade-requiring medicinal herb Panax ginseng. Plant Biotechnology Journal, 16(11): 1904-1917.

King, T., Osmond-McLeod, M. & Duffy, L. (2018) Nanotechnology in the food sector and potential applications for the poultry industry. Trends in Food Science and Technology, 72: 62-73.

Kjærbølling, I., Vesth, T., Frisvad, J., Nybo, J., Theobald, S., Kuo, A. et al. (2018) Linking secondary metabolites to gene clusters through genome sequencing of six diverse species. Proceedings of the National Academy of Sciences of the United States of America, 115(4): E753-E761.

Kohler, A., Simmons, B. & Sale, K. (2018) Structure-based engineering of a plant-fungal hybrid peroxidase for enhanced temperature and pH tolerance. Cell Chemical Biology, 25(8): 974-983.e3.

Kolinko, S., Wu, Y., Tachea, F., Denzel, E., Hiras, J., Gabriel, R. et al. (2018) A bacterial pioneer produces cellulase complexes that persist through community succession. Nature Microbiology, 3(1): 99-107.

Koochakzadeh, A., Zahraei Salehi, T., Dehghan Rahimabadi, P., Askari Badouei, M., Blackall, P.* & Zarepour, H. (2018) Molecular investigation of Lawsonia intracellularis in diarrheic and healthy captive ostriches (Struthio camelus) in Iran. Comparative Clinical Pathology, 28(1): 249-252.

Kopittke, P.*, Dalal, R.*, Wang, P.* & Menzies, N.* (2018) Effects of long-term cultivation on phosphorus (P) in five low-input, subtropical Australian soils. Agriculture Ecosystems and Environment, 252: 191-199.

Kopittke, P.*, Punshon, T., Paterson, D., Tappero, R., Wang, P.*, Blamey, P.* et al. (2018) Synchrotron-based X-ray fluorescence microscopy as a technique for imaging of elements in plants. Plant Physiology, 178(2): 507-523.

Koufariotis, L.*, Chen, Y., Stothard, P. & Hayes, B.* (2018) Variance explained by whole genome sequence variants in coding and regulatory genome annotations for six dairy traits. BMC Genomics, 19(237)

Koufariotis, L.*, Hayes, B.*, Kelly, M., Burns, B., Lyons, R.*, Stothard, P. et al. (2018) Sequencing the mosaic genome of Brahman cattle identifies historic and recent introgression including polled. Scientific Reports, 8(1)

Krupovic, M., Blomberg, J., Coffin, J., Dasgupta, I., Fan, H., Geering, A.* et al. (2018) Ortervirales: a new viral order unifying five families of reverse-transcribing viruses. Journal of Virology, 92(12): e00515-18.

Kudrnácová, E., Barton, L., Bureš, D. & Hoffman, L. (2018) Carcass and meat characteristics from farm-raised and wild fallow deer (Dama dama) and red deer (Cervus elaphus): a review. Meat Science, 141: 9-27.

Kyu, H., Abate, D., Abate, K., Abay, S., Abbafati, C., Abbasi, N. et al. (2018) Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet, 392(10159): 1859-1922.

Lai, Y.*, Pringle, M., Kopittke, P.*, Menzies, N.*, Orton, T.* & Dang, Y.* (2018) An empirical model for prediction of wheat yield, using time-integrated Landsat NDVI. International Journal of Applied Earth Observation and Geoinformation, 72: 99-108.

Lambert, B., Sikulu-Lord, M.*, Mayagaya, V., Devine, G.*, Dowell, F. & Churcher, T. (2018) Monitoring the age of mosquito populations using near-infrared spectroscopy. Scientific Reports, 8(1)

Lau, E., Steadman, K.*, Cichero, J.* & Nissen, L. (2018) Dosage form modification and oral drug delivery in older people. Advanced Drug Delivery Reviews, 135: 75-84.

Lau, E., Steadman, K.* & Nissen, L. (2018) Crushing and dispersing medicines. Australian Pharmacist, 37(3): 46-50.

Lee, C.* & Carroll, B.* (2018) Evolution and Diversification of Small RNA Pathways in Flowering Plants. Plant and Cell Physiology, 59(11): 2169-2187.

Lees, J.*, Lees, A.* & Gaughan, J.* (2018) Developing a heat load index for lactating dairy cows. Animal Production Science, 58(8): 1387-1391.

Liang, L., Yan, J., He, Q., Luong, T., Pray, T., Simmons, B. et al. (2018) Scale-up of biomass conversion using 1-ethyl-3-methylimidazolium acetate as the solvent. Green Energy and Environment.

Liao, Y., Zhang, X., Li, B., Liu, T., Chen, J., Bai, Z. et al. (2018) Comparison of Oryza sativa and Oryza brachyantha genomes reveals selection-driven gene escape from the centromeric Regions. The Plant Cell, 30(8): 1729-1744.

Li, B.*, Tang, J.*, Chen, W.*, Hao, G., Kurniawan, N.*, Gu, Z. et al. (2018) Novel theranostic nanoplatform for complete mice tumor elimination via MR imaging-guided acid-enhanced photothermo-/chemo-therapy. Biomaterials, 177: 40-51.

Li, C.*, Wang, P.*, Lombi, E., Cheng, M., Tang, C., Howard, D. et al. (2018) Absorption of foliar applied Zn fertilizers by trichomes in soybean and tomato. Journal of Experimental Botany, 69(10): 2717-2729.

Li, C.*, Wang, P.*, Lombi, E., Wu, J.*, Blamey, F.*, Fernández, V. et al. (2018) Absorption of foliar applied Zn is decreased in Zn deficient sunflower (Helianthus annuus) due to changes in leaf properties. Plant and Soil, 433(1-2): 309-322.

Li, C.*, Wang, P.*, Menzies, N.*, Lombi, E. & Kopittke, P.* (2018) Effects of methyl jasmonate on plant growth and leaf properties. Journal of Plant Nutrition and Soil Science, 181(3): 409-418.

Li, C.*, Wang, P.*, van der Ent, A.*, Cheng, M., Jiang, H., Lund Read, T. et al. (2018) Absorption of foliar-applied Zn in sunflower (Helianthus annuus): importance of the cuticle, stomata and trichomes. Annals of Botany, 123(1): 57-68.

Liddle, R., Akinsanmi, O.* & Galea, V.* (2018) Non-host specificity of Botryosphaeriaceae on macadamia and blueberry. Australasian Plant Pathology, 48(1): 65-73.

Li, H. & Gilbert, R.* (2018) Starch molecular structure: the basis for an improved understanding of cooked rice texture. Carbohydrate Polymers, 195: 9-17.

Li, H., Li, K., Guo, Y., Guo, J., Miao, K., Botella, J.* et al. (2018) A transient transformation system for gene characterization in upland cotton (Gossypium hirsutum). Plant Methods, 14(1)

Li, H., Rasheed, A., Hickey, L.* & He, Z. (2018) Fast-Forwarding Genetic Gain. Trends In Plant Science, 23(3): 184-186.

Li Jing, ., Rodriguez, D.*, Wang Hao-xiang, . & Wu Liu-san, . (2018) Designing price-contingent vegetable rotation schedules using agent-based simulation. Journal of Integrative Agriculture, 17(2): 461-472.

Li, L., Zhang, C.*, Zhang, R.*, Xu, Z., Xu, Z.* & Whittaker, A.* (2018) Multifunctional magnetized porous silica covered with Poly(2-dimethylaminoethyl methacrylate) for pH controllable drug release and Magnetic Resonance Imaging. ACS Applied Nano Materials, 1(9): 5027-5034.

Lin, D., Lopez-Sanchez, P.*, Selway, N.* & Gidley, M.* (2018) Viscoelastic properties of pectin/cellulose composites studied by QCM-D and oscillatory shear rheology. Food Hydrocolloids, 79: 13-19.

Lin, J., Kuo, C., Yang, I., Tsai, W., Shen, Y., Lin, C. et al. (2018) MicroRNA160 modulates plant development and heat shock protein gene expression to mediate heat tolerance in Arabidopsis. Frontiers in Plant Science, 9.

Li, P., Dhital, S.*, Zhang, B., He, X., Fu, X. & Huang, Q. (2018) Surface structural features control in vitro digestion kinetics of bean starches. Food Hydrocolloids, 85: 343-351.

Li, S., Zeng, W., Li, R., Hoffman, L., He, Z., Sun, Q. et al. (2018) Rabbit meat production and processing in China. Meat Science, 145: 320-328.

Liu, C., Xu, Y., Cadavid-Restrepo, A., Lou, Z., Yan, H., Li, L. et al. (2018) Estimating the prevalence of Echinococcus in domestic dogs in highly endemic for echinococcosis. Infectious Diseases of Poverty, 7(1)

Liu, D., Kim, K., Sun, J., Simmons, B. & Singh, S. (2018) Cascade production of lactic acid from universal types of sugars catalyzed by lanthanum triflate. ChemSusChem, 11(3): 598-604.

Liu, D., Sun, J., Simmons, B. & Singh, S. (2018) N-Heterocyclic carbene promoted decarboxylation of lignin-derived aromatic acids. ACS Sustainable Chemistry and Engineering, 6(6): 7232-7238.

Liu, H.*, Carvalhais, L.*, Schenk, P.* & Dennis, P.* (2018) Activation of the salicylic acid signalling pathway in wheat had no significant short-term impact on the diversity of root-associated microbiomes. Pedobiologia, 70: 6-11.

Liu, Y., Wang, S., Ren, J., Yuan, G., Li, Y., Zhang, B. et al. (2018) Characterization of free and bound volatile compounds in six Ribes nigrum L. blackcurrant cultivars. Food Research International, 103: 301-315.

Liu, Y., Wang, S., Ren, J., Yuan, G., Li, Y., Zhang, B. et al. (2018) Data on free and bound volatile compounds in six Ribes nigrum L. blackcurrant cultivars. Data in Brief, 17: 926-937.

Li, Z., Furlong, M.*, Yonow, T., Kriticos, D., Bao, H., Yin, F. et al. (2018) Management and population dynamics of diamondback moth (Plutella xylostella): planting regimes, crop hygiene, biological control and timing of interventions. Bulletin of Entomological Research, 109(02): 1-9.

Loh, Z., Oh, H. & Lim, Y. (2018) Relationship between polyphenol oxidase activity and phenolics degradation on ambient air-drying of herbal plants. Journal of Food Processing and Preservation, 42(7)

Long, L., Guo, D., Gao, W., Yang, W., Hou, L., Ma, X. et al. (2018) Optimization of CRISPR/Cas9 genome editing in cotton by improved sgRNA expression. Plant Methods, 14(1)

Lopes, S., Garcia, F., Souza, V., Costa, D. & Malafaia, P. (2018) Bio-economic evaluation of a reduced phosphorus supplementation strategy for a cow-calf system in Brazil: a case study. Tropical Animal Health and Production, 50(1): 205-208.

Lopez, G., Da Silva, D., Auzmendi, I., Favreau, R. & DeJong, T. (2018) Demonstrative simulations of L-PEACH: a computer-based model to understand how peach trees grow. Acta Horticulturae, 1228: 13-19.

Lo, R.*, Ho, V.*, Bansal, N.* & Turner, M.* (2018) The genetic basis underlying variation in production of the flavour compound diacetyl by Lactobacillus rhamnosus strains in milk. International Journal of Food Microbiology, 265: 30-39.

Lozano, R., Fullman, N., Abate, D., Abay, S., Abbafati, C., Abbasi, N. et al. (2018) Measuring progress from 1990 to 2017 and projecting attainment to 2030 of the health-related Sustainable Development Goals for 195 countries and territories: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet, 392(10159): 2091-2138.

Lv, S., Wu, W., Wang, M., Meyer, R., Ndjiondjop, M., Tan, L. et al. (2018) Genetic control of seed shattering during African rice domestication. Nature Plants, 4(6): 331-337.

Macanawai, A.*, Day, M. & Adkins, S.* (2018) Seed biology of Mikania micrantha in Viti Levu, Fiji. Weed Research, 58(3): 229-238.

Mace, E.*, Innes, D., Hunt, C., Wang, X.*, Tao, Y.*, Baxter, J. et al. (2018) The Sorghum QTL Atlas: a powerful tool for trait dissection, comparative genomics and crop improvement. Theoretical and Applied Genetics, 132(3): 751-766.

Mahajan, G., George-Jaeggli, B.*, Walsh, M. & Chauhan, B.* (2018) Effect of Soil Moisture Regimes on Growth and Seed Production of Two Australian Biotypes of Sisymbrium thellungii OE Schulz. Frontiers in Plant Science, 9

Mahajan, G.*, Matloob, A., Singh, R., Singh, V. & Chauhan, B.* (2018) Basmati rice in the Indian subcontinent: strategies to boost production and quality traits. Advances in Agronomy, 151.

Mahajan, G.*, Matloob, A., Walsh, M. & Chauhan, B.* (2018) Germination ecology of two Australian populations of African turnipweed (Sisymbrium thellungii). Weed Science, 66(6): 752-757.

Mahajan, G.*, Mutti, N.*, Jha, P., Walsh, M. & Chauhan, B.* (2018) Evaluation of dormancy breaking methods for enhanced germination in four biotypes of Brassica tournefortii. Scientific Reports, 8(1)

Mahajan, G.*, Singh, K., Singh, N., Kaur, R. & Chauhan, B.* (2018) Screening of water-efficient rice genotypes for dry direct seeding in South Asia. Archives of Agronomy and Soil Science, 64(1): 103-115.

Makanza, R., Zaman-Allah, M., Cairns, J., Eyre, J.*, Burgueño, J., Pacheco, Á. et al. (2018) High-throughput method for ear phenotyping and kernel weight estimation in maize using ear digital imaging. Plant Methods, 14(1).

Malafaia, P., Garcia, F., Lopes, S., Souza, V., Canella Filho, C., Costa, D. et al. (2018) Evaluation of an inexpensive needle test for the diagnosis of phosphorus deficiency and management of phosphorus supplementation for cattle: a multiple case study. Anais da Academia Brasileira de Ciencias, 90(4): 3337-3352.

Malde, A.*, Stroet, M.*, Caron, B.*, Visscher, K. & Mark, A.* (2018) Predicting the prevalence of alternative Warfarin tautomers in solution. Journal of Chemical Theory and Computation, 14(8): 4405-4415.

Managa, M., Tinyani, P., Senyolo, G., Soundy, P., Sultanbawa, Y.* & Sivakumar, D. (2018) Impact of transportation, storage, and retail shelf conditions on lettuce quality and phytonutrients losses in the supply chain. Food Science and Nutrition, 6(6): 1527-1536.

Manalil, S.*, Ali, H. & Chauhan, B.* (2018) Germination ecology of Sonchus oleraceus L. in the northern region of Australia. Crop and Pasture Science, 69(9): 926-932.

Manalil, S.*, Haider Ali, H. & Chauhan, B.* (2018) Germination ecology of turnip weed (Rapistrum rugosum (L.) All.) in the northern regions of Australia. PLoS One, 13(7)

Mancera, K.*, Besson, M., Lisle, A.*, Allavena, R.* & Phillips, C.* (2018) The effects of mining machinery noise of different amplitudes on the behaviour, faecal corticosterone and tissue morphology of wild mice (Mus musculus). Applied Animal Behaviour Science, 203: 81-91.

Manjunath, B., Paramesh, V., Mahajan, G., Reddy, K., Das, B. & Singh, N. (2018) A five years study on the selection of rice based cropping systems in Goa, for west coast region of India. Journal of Environmental Biology, 39(3): 393-399.

Mao, Y., Yang, X., Zhou, Y., Zhang, Z., Botella, J.* & Zhu, J. (2018) Manipulating plant RNA-silencing pathways to improve the gene editing efficiency of CRISPR/Cas9 system. Genome Biology, 19(1)

Marquardt, A., Wathen-Dunn, K., Henry, R. & Botha, F. (2018) There's yellow, and then there's yellow-which one is YCS?. International Sugar Journal, 120(1432).

Ma, R.*, Thomas-Hall, S.*, Chua, E.*, Eltanahy, E.*, Netzel, M.*, Netzel, G.* et al. (2018) Blue light enhances astaxanthin biosynthesis metabolism and extraction efficiency in Haematococcus pluvialis by inducing haematocyst germination. Algal Research, 35: 215-222.

Ma, R., Thomas-Hall, S.*, Chua, E.*, Eltanahy, E., Netzel, M.*, Netzel, G.* et al. (2018) LED power efficiency of biomass, fatty acid, and carotenoid production in Nannochloropsis microalgae. Bioresource Technology, 252: 118-126.

Masalu, J., Okumu, F., Mmbando, A., Sikulu-Lord, M.* & Ogoma, S. (2018) Potential benefits of combining transfluthrin-treated sisal products and long-lasting insecticidal nets for controlling indoor-biting malaria vectors. Parasites and Vectors, 11(231)

Masry, A., Furlong, M.*, Clarke, A. & Cunningham, J. (2018) An improved culturing method for opiine fruit fly parasitoids and its application to parasitoid monitoring in the field. Insect Science, 25(1): 99-108.

McKenna, B.* & Kopittke, P.* (2018) Engagement and performance in a first year natural resource science course. Journal of Computer Assisted Learning, 34(3): 233-242.

McTaggart, A. & Aime, M. (2018) The species of Coleosporium (Pucciniales) on Solidago in North America. Fungal Biology, 122(8): 800-809.

McTaggart, A.*, Duong, T., Le, V., Shuey, L., Smidt, W., Naidoo, S. et al. (2018) Chromium sequencing: the doors open for genomics of obligate plant pathogens. BioTechniques, 65(5): 253-257.

McTaggart, A., Shuey, L., Granados, G., du Plessis, E., Fraser, S., Barnes, I. et al. (2018) Evidence that Austropuccinia psidii may complete its sexual life cycle on Myrtaceae. Plant Pathology, 67(3): 729-734.

Medrum, O., Yakubov, G.*, Bonilla, M.*, Deshmukh, O.*, McGuckin, M.* & Gidley, M.* (2018) Mucin gel assembly is controlled by a collective action of non-mucin proteins, disulfide bridges, Ca2+- mediated links, and hydrogen bonding. Scientific Reports, 8(1)

Melo, T., Fortes, M.*, Bresolin, T., Mota, L., Albuquerque, L. & Carvalheiro, R. (2018) Multi-trait meta-analysis identified genomic regions associated with sexual precocity in tropical beef cattle. Journal of Animal Science, 96(10): 4087-4099.

Milali, M., Sikulu-Lord, M.*, Kiware, S., Dowell, F., Povinelli, R. & Corliss, G. (2018) Do NIR spectra collected from laboratory-reared mosquitoes differ from those collected from wild mosquitoes?. PloS One, 13(5)

Mizani, A.*, Bally, I., Ibell, P., Wright, C., Maddox, C. & Kolala, R. (2018) Identifying vigour controlling rootstocks for mango. Acta Horticulturae, 1228: 167-174.

Mohammad Moner, A.*, Furtado, A.* & Henry, R.* (2018) Chloroplast phylogeny of AA genome rice species. Molecular Phylogenetics and Evolution, 127: 475-487.

Moner, A.*, Furtado, A.*, Chivers, I.*, Fox, G.*, Crayn, D. & Henry, R.* (2018) Diversity and evolution of rice progenitors in Australia. Ecology and Evolution, 8(8): 4360-4366.

Monkham, T., Jongdee, B., Pantuwan, G., Mitchell, J.*, Sanitchon, J. & Fukai, S.* (2018) On-farm multi-location evaluation of occurrence of drought types and rice genotypes selected from controlled- water on-station experiments in Northeast Thailand. Field Crops Research, 220: 27-36.

Montes de Oca-Jimenez, R., Vega-Sanchez, V., Morales-Erasto, V., Salgado-Miranda, C., Blackall, P.* & Soriano-Vargas, E. (2018) Phylogenetic relationship of Ornithobacterium rhinotracheale strains. Journal of Veterinary Medical Science, 80(6): 869-873.

Morgan, J.*, Sumpton, W., Jones, A., Campbell, A.*, Stewart, J., Hamer, P. et al. (2018) Assessment of genetic structure among Australian east coast populations of snapper chrysophrys auratus (sparidae). Marine and Freshwater Research, 70(7)

Mortlock, M. (2018) No-nonsense surveys: aspects of survey design which affect results. Agriculture for Development, 33(Spring): 33-37.

Mota, R., Silva, F., Guimarães, S., Hayes, B.*, Fortes, M.*, Kelly, M.* et al. (2018) Benchmarking Bayesian genome enabled-prediction models for age at first calving in Nellore cows. Livestock Science, 211: 75-79.

Moyle, R.*, Pretorius, L.*, Shuey, L.*, Nowak, E.* & Schenk, P.* (2018) Analysis of the Complete Genome Sequence ofStrain K. Genome Announcements, 6(7): 1-2.

Mpai, S., du Preez, R., Sultanbawa, Y.* & Sivakumar, D. (2018) Phytochemicals and nutritional composition in accessions of Kei-apple (Dovyalis caffra): Southern African indigenous fruit. Food Chemistry, 253: 37-45.

Mukumbo, F., Arnaud, E., Collignan, A., Hoffman, L., Descalzo, A. & Muchenje, V. (2018) Physico-chemical composition and oxidative stability of South African beef, game, ostrich and pork droëwors. Journal of Food Science and Technology, 55(12): 4833-4840.

Murgia, M., Bell-Sakyi, L., de la Fuente, J., Kurtti, T., Makepeace, B., Mans, B. et al. (2018) Meeting the challenge of tick-borne disease control: a proposal for 1000 Ixodes genomes. Ticks and Tick-borne Diseases, 10(1): 213-218.

Najeeb, U., Tan, D., Bange, M. & Atwell, B. (2018) Protecting cotton crops under elevated CO2 from waterlogging by managing ethylene. Functional Plant Biology, 45(3): 340-349.

Nasim, W., Ahmad, A., Amin, A., Tariq, M., Awais, M., Saqib, M. et al. (2018) Radiation efficiency and nitrogen fertilizer impacts on sunflower crop in contrasting environments of Punjab, Pakistan. Environmental Science and Pollution Research, 25(2): 1822-1836.

Nasim, W., Amin, A., Fahad, S., Awais, M., Khan, N., Mubeen, M. et al. (2018) Future risk assessment by estimating historical heat wave trends with projected heat accumulation using SimCLIM climate model in Pakistan. Atmospheric Research, 205: 118-133.

Nawaz, M.*, Fukai, S.*, Prakash, S.* & Bhandari, B.* (2018) Effect of soaking medium on the physicochemical properties of parboiled glutinous rice of selected Laotian cultivars. International Journal of Food Properties, 21(1): 1896-1910.

Nawaz, M.*, Fukai, S.*, Prakash, S.* & Bhandari, B.* (2018) Effect of starch modification in the whole white rice grains on physicochemical properties of two contrasting rice varieties. Journal of Cereal Science, 80: 143-149.

Nawaz, M.*, Fukai, S.*, Prakash, S.* & Bhandari, B.* (2018) Effects of three types of modified atmospheric packaging on the physicochemical properties of selected glutinous rice. Journal of Stored Products Research, 76: 85-95.

Needham, T., Lambrechts, H. & Hoffman, L.* (2018) Application of immunocastration in a commercial Dohne Merino ram flock before weaning. South African Journal of Animal Sciences, 48(6): 1115-1120.

Neethling, J., Muller, M., van der Rijst, M. & Hoffman, L. (2018) Sensory quality and fatty acid content of springbok (Antidorcas marsupialis) meat: influence of farm location and sex. Journal of the Science of Food and Agriculture, 98(7): 2548-2556.

Neethling, N., Sigge, G., Hoffman, L. & Suman, S. (2018) Color Stability of Fallow Deer ( ) , , and Muscles During Refrigerated Storage. Meat and Muscle Biology, 2(1)

Netzel, M. & Sultanbawa, Y. (2018) Nutritional characteristics of native Australian fruits: Kakadu plum and green plum as examples. Nutridate, 29(3): 8-12.

Newton, J., Hayes, B.* & Pryce, J. (2018) The cost-benefit of genomic testing of heifers and using sexed semen in pasture-based dairy herds. Journal of Dairy Science, 101(7): 6159-6173.

Nguyen, H.*, Thai, P.*, Kaserzon, S.*, O'Brien, J.*, Eaglesham, G.* & Mueller, J.* (2018) Assessment of drugs and personal care products biomarkers in the influent and effluent of two wastewater treatment plants in Ho Chi Minh City, Vietnam. Science of the Total Environment, 631-632: 469-475.

Nguyen, L.*, Reverter, A., Cánovas, A., Venus, B.*, Anderson, S.*, Islas-Trejo, A. et al. (2018) STAT6, PBX2, and PBRM1 emerge as predicted regulators of 452 differentially expressed genes associated with puberty in Brahman heifers. Frontiers in Genetics, 9(MAR): 1-13.

Nguyen, L.*, Zacchi, L.*, Schulz, B.*, Moore, S.* & Fortes, M.* (2018) Adipose tissue proteomic analyses to study puberty in Brahman heifers. Journal of Animal Science, 96(6): 2392-2398.

Nguyen, Q.*, Tellam, R., Naval-Sanchez, M., Porto-Neto, L.*, Barendse, W.*, Reverter, A. et al. (2018) Mammalian genomic regulatory regions predicted by utilizing human genomics, transcriptomics, and epigenetics data. Gigascience, 7(3): 1-17.

Nichols, J., Conroy, G., Kasinadhuni, N.*, Lamont, R. & Ogbourne, S. (2018) In silico detection of polymorphic microsatellites in the endangered Isis tamarind, Alectryon ramiflorus (Sapindaceae). Applications in Plant Sciences, 6(11)

Nielsen, S.*, Russell, K., Kelly, A.* & Fox, G.* (2018) A data-driven near infrared calibration process including near infrared spectral thumbprints. Journal of Near Infrared Spectroscopy, 26(3): 169-185.

Niknafs, S.* & Roura, E.* (2018) Nutrient sensing, taste and feed intake in avian species. Nutrition Research Reviews, 31(2): 1-11.

Nirmal, N.*, Mereddy, R., Li, L.* & Sultanbawa, Y.* (2018) Formulation, characterisation and antibacterial activity of lemon myrtle and anise myrtle essential oil in water nanoemulsion. Food Chemistry, 254: 1-7.

Nirmal, N.*, Webber, D., Mereddy, R. & Sultanbawa, Y.* (2018) Biochemical and functional properties of indigenous Australian herbal infusions. Food Bioscience, 26: 133-138.

Noble, T., Tao, Y.*, Mace, E., Williams, B., Jordan, D.*, Douglas, C. et al. (2018) Characterization of Linkage Disequilibrium and Population Structure in a Mungbean Diversity Panel. Frontiers in Plant Science, 8: 1-15.

North, M., Zotte, A. & Hoffman, L. (2018) The effects of quercetin supplementation on New Zealand White grower rabbit carcass and meat quality - a short communication. Meat Science, 145: 363-366.

Novák, J., Vrana, B., Rusina, T., Okonski, K., Grabic, R., Neale, P.* et al. (2018) Effect-based monitoring of the Danube River using mobile passive sampling. Science of the Total Environment, 636: 1608-1619.

O'Brien, C.*, Hall-Mendelin, S., Hobson-Peters, J.*, Deliyannis, G., Allen, A., Lew-Tabor, A.* et al. (2018) Discovery of a novel iflavirus sequence in the eastern paralysis tick Ixodes holocyclus. Archives of Virology, 163(9): 1-7.

O'Brien, C., Hall, R. & Lew-Tabor, A. (2018) Could Australian ticks harbour emerging viral pathogens?. Microbiology Australia, 39(4): 185-190.

O'Connor, K.*, Hayes, B.* & Topp, B.* (2018) Prospects for increasing yield in macadamia using component traits and genomics. Tree Genetics & Genomes, 14(1).

Ola, A.*, Schmidt, S.* & Lovelock, C.* (2018) The effect of heterogeneous soil bulk density on root growth of field-grown mangrove species. Plant and Soil, 432(1-2): 91-105.

Olarte Mantilla, S.*, Collins, C., Patrick G. lland, G., Kidman, C., Ristic, R., Boss, P. et al. (2018) Shiraz (Vitis vinifera L.) berry and wine sensory profiles and composition are modulated by rootstocks. American Journal of Enology and Viticulture, 69(1): 32-44.

Olatunde, O., Obadina, A., Omemu, A., Oyewole, O., Olugbile, A. & Olukomaiya, O.* (2018) Screening and molecular identification of potential probiotic lactic acid bacteria in effluents generated during ogi production. Annals of Microbiology, 68(7): 1-11.

Onen, H., Farooq, S., Tad, S., Ozaslan, C., Gunal, H. & Chauhan, B.* (2018) The influence of environmental factors on germination of Burcucumber (Sicyos angulatus) seeds: implications for range expansion and management. Weed Science, 66(4): 494-501.

Orton, T.*, Mallawaarachchi, T.*, Pringle, M., Menzies, N.*, Dalal, R.*, Kopittke, P.* et al. (2018) Quantifying the economic impact of soil constraints on Australian agriculture: a case study of wheat. Land Degradation & Development, 29(11): 3866-3875.

Osgood-Zimmerman, A., Millear, A., Stubbs, R., Shields, C., Pickering, B., Earl, L. et al. (2018) Mapping child growth failure in Africa between 2000 and 2015. Nature, 555(7694): 41-47.

Pachas, A.*, Shelton, H.*, Lambrides, C.*, Dalzell, S., Murtagh, G. & Hardner, C.* (2018) Effect of tree density on competition between Leucaena leucocephala and Chloris gayana using a Nelder Wheel trial. II. belowground interactions. Crop and Pasture Science, 69(7): 733-744.

Page, K.*, Dalal, R.*, Wehr, J.*, Dang, Y.*, Kopittke, P.*, Kirchhof, G.* et al. (2018) Management of the major chemical soil constraints affecting yields in the grain growing region of Queensland and New South Wales, Australia – a review. Soil Research, 56(8): 765-779.

Parkinson, L., Dann, E. & Shivas, R. (2018) Black root rot of avocado – what do we know and how can we manage it?. Talking Avocados, 28(3): 35-39.

Parkinson, L. & Geering, A. (2018) Biosecurity update on ambrosia beetles associated with avocado tree dieback. Talking Avocados, 29(3): 54-56.

Parkinson, L., Shivas, R. & Dann, E. (2018) Dactylonectria lombard & crous. Australasian Plant Pathology Society Pathogen of the Month.

Pathak, M.*, Coombes, A.*, Ryu, B.*, Cabot, P.*, Turner, M.*, Palmer, C. et al. (2018) Sustained Simultaneous Delivery of Metronidazole and Doxycycline From Polycaprolactone Matrices Designed for Intravaginal Treatment of Pelvic Inflammatory Disease. Journal of Pharmaceutical Sciences, 107(3): 863-869.

Patriyawaty, N., Rachaputi, R.* & George, D. (2018) Physiological mechanisms underpinning tolerance to high temperature stress during reproductive phase in mungbean (Vigna radiata (L.) Wilczek). Environmental and Experimental Botany, 150: 188-197.

Pavetti, D., Benvenutti, M.*, Radke, Ó. & Cibils, Y. (2018) Long-term assessment of a new rotational-grazing management strategy called PUP-grazing (proportion of un-grazed pasture) Evaluación de un sistema de manejo de Axonopus catarinensis en rotación basado en el remanente de forraje no pastado (Renopa). Tropical Grasslands-Forrajes Tropicales, 6(1): 53-57.

Peng, C., Wang, H., Xu, X., Wang, X., Chen, X., Wei, W. et al. (2018) High-throughput detection and screening of plants modified by gene editing using quantitative real-time polymerase chain reaction. The Plant Journal, 95(3): 557-567.

Pennells, J.*, Yu Lin, T., Schmidt, S.*, Gamage, H.*, Godwin, I.*, Erickson, T. et al. (2018) Effects of the growth environment on the yield and material properties of nanocellulose derived from the Australian desert grass Triodia. Industrial Crops and Products, 126: 238-249.

Pham, H.*, Nhiep, N.*, Vu, T.*, Huynh, T., Zhu, Y., Huynh, A.* et al. (2018) Enhanced uptake of potassium or glycine betaine or export of cyclic-di-AMP restores osmoresistance in a high cyclic-di-AMP Lactococcus lactis mutant. PLOS Genetics, 14(8)

Phan, H., Rybak, K., Bertazzoni, S., Furuki, E., Dinglasan, E.*, Hickey, L.* et al. (2018) Novel sources of resistance to Septoria nodorum blotch in the Vavilov wheat collection identified by genome-wide association studies. TAG. Theoretical and Applied Genetics. Theoretische und angewandte Genetik, 131(6): 1223-1238.

Phelan, D., Harrison, M., McLean, G., Cox, H., Pembleton, K., Dean, G. et al. (2018) Advancing a farmer decision support tool for agronomic decisions on rainfed and irrigated wheat cropping in Tasmania. Agricultural Systems, 167: 113-124.

Piaskowski, J., Hardner, C.*, Cai, L., Zhao, Y., Iezzoni, A. & Peace, C. (2018) Genomic heritability estimates in sweet cherry reveal non-additive genetic variance is relevant for industry-prioritized traits. BMC Genetics, 19(1).

Pluschke, A.*, Jochems, P., Williams, B.* & Gidley, M.* (2018) Protection of α-amylase from proteolysis by adsorption to feed components in vitro and in the porcine small intestine. Animal Production Science, 58(4): 640-645.

Pluschke, A.*, Williams, B.*, Zhang, D.*, Anderson, S.*, Roura, E.* & Gidley, M.* (2018) Male grower pigs fed cereal soluble dietary fibres display biphasic glucose response and delayed glycaemic response after an oral glucose tolerance test. PloS One, 13(3): 1-18.

Pluschke, A.*, Williams, B.*, Zhang, D.* & Gidley, M.* (2018) Dietary pectin and mango pulp effects on small intestinal enzyme activity levels and macronutrient digestion in grower pigs. Food & function, 9(2): 991-999.

Pomraning, K., Bredeweg, E., Kerkhoven, E., Barry, K., Haridas, S., Hundley, H. et al. (2018) Regulation of Yeast-to-Hyphae Transition in Yarrowia lipolytica. mSphere, 3(6).

Poppi, D.*, Moore, S.* & Glencross, B. (2018) The effect of taurine supplementation to a plant-based diet for barramundi (Lates calcarifer) with varying methionine content. Aquaculture Nutrition, 24(4): 1340-1350.

Poppi, D.*, Quigley, S.*, da Silva, T.* & McLennan, S.* (2018) Challenges of beef cattle production from tropical pastures. Revista Brasileira De Zootecnia, 47.

Qureshi, H., Arshad, M., Bibi, Y., Ahmad, R., Osunkoya, O. & Adkins, S.* (2018) Multivariate impact analysis of Parthenium hysterophorus invasion on above-ground plant diversity in Pothwar region of Pakistan. Applied Ecology and Environmental Research, 16(5): 5799-5813.

Rabelo, C., Basso, F., Lara, E., Jorge, L., Harter, C., Mesquita, L. et al. (2018) Effects of Lactobacillus buchneri as a silage inoculant and as a probiotic on feed intake, apparent digestibility and ruminal fermentation and microbiology in wethers fed low-dry-matter whole-crop maize silage. Grass and Forage Science, 73(1): 67-77.

Rajinder-Pal, ., Mahajan, G.*, Sardana, V., Sharma, N. & Chauhan, B.* (2018) Grain quality of dry-seeded rice in response to sowing dates and genotypes. International Journal of Plant Production, 12(2): 95-106.

Ramezani-Etedali, H. & Ababaei, B. (2018) Impact of increased atmosphere CO2 concentration on crop yield, transpiration and water productivity of main cereals in the Qazvin Plain [in Persian]. Iranian Journal of Soil and Water Research, 11(38): 39-48.

Rand, J.*, Lancaster, E., Inwood, G., Cluderay, C.* & Marston, L. (2018) Strategies to reduce the euthanasia of impounded dogs and cats used by councils in Victoria, Australia. Animals, 8(7)

Rangan, P., Furtado, A. & Henry, R. (2018) Differential response of wheat genotypes to heat stress during grain filling. Experimental Agriculture, 12/20/2018, pp.1-10 https://doi.org/10.1017/s0014479718000406

Rao, A., Mahajan, G.*, Singh, R. & Wani, S. (2018) Weed research issues, challenges, and opportunities in India. Crop Protection.

Ratanpaul, V.*, Williams, B.*, Black, J. & Gidley, M.* (2018) Apparent amylase diffusion rates in milled cereal grains determined in vitro: potential relevance to digestion in the small intestine of pigs. Journal of Cereal Science, 82: 42-48.

Raza, A., Qamar, A., Hayat, K., Ashraf, S. & Williams, A. (2018) Anthelmintic resistance and novel control options in equine gastrointestinal nematodes. Parasitology, 146(04): 1-13.

Raza, A.*, Rand, J.*, Qamar, A., Jabbar, A. & Kopp, S.* (2018) Gastrointestinal Parasites in Shelter Dogs: Occurrence, Pathology, Treatment and Risk to Shelter Workers. Animals, 8(7)

Rehman, S., Shahzad, B., Bajwa, A.*, Hussain, S., Rehman, A., Cheema, S. et al. (2018) Utilizing the Allelopathic Potential of Brassica Species for Sustainable Crop Production: A Review. Journal of Plant Growth Regulation, 38(1): 1-14.

Reilly, M., Kim, J., Lynn, J., Simmons, B., Gladden, J., Magnuson, J. et al. (2018) Forward genetics screen coupled with whole-genome resequencing identifies novel gene targets for improving heterologous enzyme production in Aspergillus niger. Applied Microbiology and Biotechnology, 102(4): 1797-1807.

Ren, J., Wang, S., Ning, Y., Wang, M., Wang, L., Zhang, B. et al. (2018) The impact of over-maturation on the sensory and nutritional quality of Gouqi (Chinese wolfberry) wine. Journal of the Institute of Brewing, 124(1): 57-67.

Richard, C.*, Christopher, J.*, Chenu, K.*, Borrell, A.*, Christopher, M. & Hickey, L.* (2018) Selection in early generations to shift allele frequency for seminal root angle in wheat. Plant Genome, 11(2).

Robinson, H.*, Kelly, A.*, Fox, G.*, Franckowiak, J., Borrell, A. & Hickey, L.* (2018) Root architectural traits and yield: exploring the relationship in barley breeding trials. Euphytica, 214(9).

Rodriguez, D.*, deVoil, P.*, Hudson, D., Brown, J., Hayman, P., Marrou, H. et al. (2018) Predicting optimum crop designs using crop models and seasonal climate forecasts. Scientific Reports, 8(1): 1-13.

Rodriguez-Valle, M., Moolhuijzen, P., Barrero, R., Ong, C., Busch, G., Karbanowicz, T. et al. (2018) Transcriptome and toxin family analysis of the paralysis tick, Ixodes holocyclus. International journal for parasitology, 48(1): 71-82.

Roura, E.* & Navarro, M.* (2018) Physiological and metabolic control of diet selection. Animal Production Science, 58(4): 613-626.

Rudman, M., Leslie, A., van der Rijst, M. & Hoffman, L. (2018) Quality characteristics of Warthog (Phacochoerus africanus) meat. Meat Science, 145: 266-272.

Ruegg, T., Pereira, J., Chen, J., DeGiovanni, A., Novichkov, P., Mutalik, V. et al. (2018) Author correction: Jungle Express is a versatile repressor system for tight transcriptional control (Nature communications (2018) 9 1 (3617)). Nature communications, 9(1)

Ruegg, T., Pereira, J., Chen, J., DeGiovanni, A., Novichkov, P., Mutalik, V. et al. (2018) Jungle Express is a versatile repressor system for tight transcriptional control. Nature Communications, 9(1)

Ruffell, A., Raza, A., Elliott, T. & Kotze, A. (2018) The use of the larval development assay for predicting the in vivo efficacy of levamisole against Haemonchus contortus and Trichostrongylus colubriformis. Veterinary Parasitology, 260: 6-11.

Rychlik, M.*, Zappa, G., Anorga, L., Belc, N., Castanheira, I., Donard, O. et al. (2018) Ensuring food integrity by metrology and FAIR data principles. Frontiers in Chemistry, 6(MAY)

Saleem, A.*, Steadman, K.* & Fejzic, J.* (2018) Utilisation of healthcare services and medicines by Pakistani migrants residing in high income countries: a systematic review and thematic synthesis. Journal of Immigrant and Minority Health.

Salgadoe, A., Robson, A., Lamb, D., Dann, E.* & Searle, C. (2018) Quantifying the severity of Phytophthora root rot disease in avocado trees using image analysis. Remote Sensing, 10(2)

Samarfard, S.*, Bejerman, N. & Dietzgen, R.* (2018) Distribution and genetic variability of alfalfa dwarf virus, a cytorhabdovirus associated with alfalfa dwarf disease in Argentina. Virus Genes, 54(4): 612-615.

Sarwar, M., Saleem, M., Ullah, N.*, Rizwan, M., Ali, S., Shahid, M. et al. (2018) Exogenously applied growth regulators protect the cotton crop from heat-induced injury by modulating plant defense mechanism. Scientific Reports, 8(1)

Schibrowski, M.*, Barnes, T.*, Wawegama, N., Vance, M.*, Markham, P., Mansell, P. et al. (2018) The performance of three immune assays to assess the serological status of cattle experimentally exposed to mycoplasma bovis. Veterinary Sciences , 5(1)

Schibrowski, M.*, Gibson, J.*, Hay, K.*, Mahony, T.* & Barnes, T.* (2018) Mycoplasma bovis and bovine respiratory disease: a risk factor study in Australian feeder cattle. Preventive Veterinary Medicine, 157: 152-161.

Schofield, B.*, Lachner, N.*, Le, O.*, McNeill, D.*, Dart, P.*, Ouwerkerk, D.* et al. (2018) Beneficial changes in rumen bacterial community profile in sheep and dairy calves as a result of feeding the probiotic Bacillus amyloliquefaciens H57. Journal of Applied Microbiology, 124(3): 855-866.

Schulz, B.*, Phung, T.*, Bruschi, M.*, Janusz, A., Stewart, J., Meehan, J. et al. (2018) Process Proteomics of Beer Reveals a Dynamic Proteome with Extensive Modifications. Journal of Proteome Research, 17(4): 1647-1653.

Sejian, V., Bhatta, R., Gaughan, J.*, Dunshea, F. & Lacetera, N. (2018) Review: adaptation of animals to heat stress. Animal, 12(s2): s431-s444.

Sejian, V.*, Prasadh, R., Lees, A.*, Lees, J.*, Al-Hosni, Y.*, Sullivan, M.* et al. (2018) Assessment of the carbon footprint of four commercial dairy production systems in Australia using an integrated farm system model. Carbon Management, 9(1): 57-70.

Seleznyova, A. & Hanan, J.* (2018) Mechanistic modelling of coupled phloem/xylem transport for L-systems: combining analytical and computational methods. Annals of Botany, 121(5): 991-1003.

Selle, P., Moss, A., Truong, H., Khoddami, A., Cadogan, D., Godwin, I.* et al. (2018) Outlook: Sorghum as a feed grain for Australian chicken-meat production. Animal Nutrition, 4(1): 17-30.

Semwogerere, F., Neethling, J., Muchenje, V. & Hoffman, L. (2018) Effects of production systems on the carcass and meat quality characteristics of spent laying hens. Poultry Science, 97(6): 1990-1997.

Seshadri, R., Leahy, S., Attwood, G., Teh, K., Lambie, S., Cookson, A. et al. (2018) Cultivation and sequencing of rumen microbiome members from the Hungate1000 Collection. Nature Biotechnology, 36(4): 359-367.

Seyfang, J., Kirkwood, R., Tilbrook, A. & Ralph, C. (2018) Sex bias of the birth litter affects surge but not tonic LH secretion in gilts. Journal of Animal Science, 96(6): 2195-2203.

Seyfang, J., Kirkwood, R., Tilbrook, A. & Ralph, C. (2018) The sex ratio of a gilt's birth litter can affect her fitness as a breeding female. Animal Production Science, 58(9): 1567-1574.

Seyfang, J., Ralph, C., Hebart, M., Tilbrook, A.* & Kirkwood, R. (2018) Anogenital distance reflects the sex ratio of a gilt's birth litter and predicts her reproductive success. Journal of Animal Science, 96(9): 3856-3862.

Seyoum, S.*, Rachaputi, R.*, Chauhan, Y.*, Prasanna, B. & Fekybelu, S. (2018) Application of the APSIM model to exploit G × E × M interactions for maize improvement in Ethiopia. Field Crops Research, 217: 113-124.

Shabbir, A.*, Bajwa, A.*, Dhileepan, K., Zalucki, M.*, Khan, N. & Adkins, S.* (2018) Integrated use of biological approaches provides effective control of parthenium weed. Archives of Agronomy and Soil Science, 64(13): 1-18.

Shange, N., Makasi, T., Gouws, P. & Hoffman, L. (2018) The influence of normal and high ultimate muscle pH on the microbiology and colour stability of previously frozen black wildebeest (Connochaetes gnou) meat. Meat Science, 135: 14-19.

Shi, B.* & Adkins, S.* (2018) Relative phytotoxicity of parthenium weed (Parthenium hysterophorus L.) residues on the seedling growth of a range of Australian native and introduced species. Crop and Pasture Science, 69(8): 837-845.

Sikulu-Lord, M.*, Devine, G., Hugo, L. & Dowell, F. (2018) First report on the application of near-infrared spectroscopy to predict the age of Aedes albopictus Skuse. Scientific Reports, 8(1)

Silva, R., Hereward, J.*, Walter, G.*, Wilson, L. & Furlong, M.* (2018) Seasonal abundance of cotton thrips (Thysanoptera: Thripidae) across crop and non-crop vegetation in an Australian cotton producing region. Agriculture, Ecosystems & Environment, 256: 226-238.

Singh, D., Ziems, L.*, Dracatos, P., Pourkheirandish, M., Tshewang, S., Czembor, P. et al. (2018) Genome-wide association studies provide insights on genetic architecture of resistance to leaf rust in a worldwide barley collection. Molecular Breeding, 38(4): 1-12.

Singh-Peterson, L.* & Iranacolaivalu, M. (2018) Barriers to market for subsistence farmers in Fiji - a gendered perspective. Journal of Rural Studies, 60: 11-20.

Singh, R., Mahajan, G., Kaur, S. & Chauhan, B. (2018) Issues and strategies for rice residue management to unravel winter smog in North India. Current Science, 114(12): 2419-2419.

Sisunandar, ., Alkhikmah, ., Husin, A., Julianto, T., Yuniaty, A., Rival, A. et al. (2018) Ex vitro rooting using a mini growth chamber increases root induction and accelerates acclimatization of Kopyor coconut (Cocos nucifera L.) embryo culture-derived seedlings. In Vitro Cellular and Developmental Biology - Plant, 54(5): 1-10.

Sivakumar, D., Chen, L. & Sultanbawa, Y.* (2018) A comprehensive review on beneficial dietary phytochemicals in common traditional Southern African leafy vegetables. Food Science and Nutrition, 6(4): 714-727.

Sivasakthi, K., Thudi, M., Tharanya, M., Kale, S., Kholová, J., Halime, M. et al. (2018) Plant vigour QTLs co-map with an earlier reported QTL hotspot for drought tolerance while water saving QTLs map in other regions of the chickpea genome. BMC Plant Biology, 18(1).

Smith, M., Daniells, J., Peasley, D., O'Neill, W., Samuelian, S., Wright, C. et al. (2018) Field evaluation of six Gros Michel banana accessions (Musa spp., AAA group) for agronomic performance, resistance to Fusarium wilt race 1 and yellow Sigatoka. Crop Protection, 113: 84-89.

Solberg, S., Seta-Waken, P., Paul, T., Palaniappan, G.* & Iramu, E. (2018) Patterns in the conservation and use of traditional vegetables from the New Guinean biodiversity hotspot. Agroecology and Sustainable Food Systems, 42(10): 1-13.

Soufizadeh, S., Munaro, E., McLean, G., Massignam, A., van Oosterom, E.*, Chapman, S.* et al. (2018) Modelling the nitrogen dynamics of maize crops - enhancing the APSIM maize model. European Journal of Agronomy, 100: 118-131.

Sousa, D., Oliveira, C., Velasquez, A., Souza, J., Chevaux, E., Mari, L. et al. (2018) Live yeast supplementation improves rumen fibre degradation in cattle grazing tropical pastures throughout the year. Animal Feed Science and Technology, 236: 149-158.

Stein, J., Yu, Y., Copetti, D., Zwickl, D., Zhang, L., Zhang, C. et al. (2018) Genomes of 13 domesticated and wild rice relatives highlight genetic conservation, turnover and innovation across the genus Oryza. Nature Genetics, 50(2): 285-296.

Stein, J., Yu, Y., Copetti, D., Zwickl, D., Zhang, L., Zhang, C. et al. (2018) Publisher Correction: Genomes of 13 domesticated and wild rice relatives highlight genetic conservation, turnover and innovation across the genus Oryza. Nature Genetics, 50 (11): 1618-1618.

Striegel, L., Chebib, S., Dumler, C., Lu, Y., Huang, D. & Rychlik, M.* (2018) Durian fruits discovered as superior folate sources. Frontiers in Nutrition, 5

Striegel, L., Chebib, S., Netzel, M.* & Rychlik, M.* (2018) Improved stable isotope dilution assay for dietary folates using LC-MS/MS and its application to strawberries. Frontiers in Chemistry, 6

Stroet, M.*, Caron, B.*, Visscher, K., Geerke, D., Malde, A.* & Mark, A.* (2018) Automated topology builder version 3.0: prediction of solvation free enthalpies in water and hexane. Journal of Chemical Theory and Computation, 14(11): 5834-5845.

Sultan, S.*, Giles, C., Netzel, G.*, Osborne, S., Netzel, M.* & Fletcher, M.* (2018) Release of indospicine from contaminated camel meat following cooking and simulated gastrointestinal digestion: implications for human consumption. Toxins, 10(9)

Sundstrom, E., Yaegashi, J., Yan, J., Masson, F., Papa, G., Rodriguez, A. et al. (2018) Demonstrating a separation-free process coupling ionic liquid pretreatment, saccharification, and fermentation with Rhodosporidium toruloides to produce advanced biofuels. Green Chemistry, 20(12): 2870-2879.

Sun, J., Liu, D., Young, R., Cruz, A., Isern, N., Schuerg, T. et al. (2018) Solubilization and upgrading of high polyethylene terephthalate loadings in a low-costing bifunctional ionic liquid. ChemSusChem, 11(4): 781-792.

Sun, L.*, Gidley, M.* & Warren, F.* (2018) Tea polyphenols enhance binding of porcine pancreatic α-amylase with starch granules but reduce catalytic activity. Food Chemistry, 258: 164-173.

Sun, L.*, Sun, J., Liu, D.*, Fu, M.*, Yang, X. & Guo, Y. (2018) The preservative effects of chitosan film incorporated with thinned young apple polyphenols on the quality of grass carp (Ctenopharyngodon idellus) fillets during cold storage: correlation between the preservative effects and the active properties of the film. Food Packaging and Shelf Life, 17: 1-10.

Sun, L.*, Warren, F.* & Gidley, M.* (2018) Soluble polysaccharides reduce binding and inhibitory activity of tea polyphenols against porcine pancreatic alpha-amylase. Food Hydrocolloids, 79: 63-70.

Suwanmontri, P., Kamoshita, A., Jongdee, B., Fukai, S.* & Kishino, H. (2018) Comparative analysis of farmers engaged in participatory research to cope with climate change versus non-participants in Northeast Thailand. Plant Production Science, 21(4): 287-301.

Swinbourne, A.*, Johnston, S.*, Janssen, T., Lisle, A.* & Keeley, T.* (2018) Reproductive biology of captive southern hairy-nosed wombats (Lasiorhinus latifrons). Part 1: oestrous cycle characterisation. Reproduction, Fertility And Development, 30(11): 1412-1423.

Swinbourne, A.*, Phillips, C.*, Janssen, T., Lisle, A.*, Keeley, T.* & Johnston, S.* (2018) Reproductive biology of captive female southern hairy-nosed wombats (Lasiorhinus latifrons). Part 2: oestrous behaviour. Reproduction Fertility And Development, 30(11): 1424-1433.

Syed-Ab-Rahman, S.*, Carvalhais, L.*, Chua, E.*, Xiao, Y., Wass, T.* & Schenk, P.* (2018) Identification of soil bacterial isolates suppressing different Phytophthora spp. and promoting plant growth. Frontiers in Plant Science, 9

Syed Ab Rahman, S.*, Singh, E.*, Pieterse, C. & Schenk, P.* (2018) Emerging microbial biocontrol strategies for plant pathogens. Plant Science, 267: 102-111.

Tabor, A.*, Graves, S., Rodriguez Valle, M.* & Stenos, J. (2018) 'One Health' solutions for ticks and tick-borne diseases, and rickettsial pathogens of humans, domestic animals and wildlife. Ticks and Tick-borne Diseases, 9(6): 1604-1605.

Tabor, A. & Valle, M. (2018) Report from the 'One Health' 9th Tick and Tick-Borne Pathogen Conference and the 1st Asia-Pacific Rickettsia Conference, Cairns, Australia, 27 August-1 September 2017. Veterinary Sciences, 5(4).

Ta, H.*, Arndt, N.*, Wu, Y.*, Lim, H.*, Landeen, S.*, Zhang, R.* et al. (2018) Activatable magnetic resonance nanosensor as a potential imaging agent for detecting and discriminating thrombosis. Nanoscale, 10(31): 15103-15115.

Tang, J.*, Howard, C.*, Mahler, S.*, Thurecht, K.*, Huang, L. & Xu, Z.* (2018) Enhanced delivery of siRNA to triple negative breast cancer cells in vitro and in vivo through functionalizing lipid-coated calcium phosphate nanoparticles with dual target ligands. Nanoscale, 10(9): 4258-4266.

Tang, X., Zhao, Y.*, Zhang, Z., Feng, Q. & Wei, Y.* (2018) Cultivated oasis evolution in the Heihe River Basin over the past 2,000 years. Land Degradation and Development, 29(8): 2254-2263.

Tanveer, A., Ali, H., Manalil, S.*, Raza, A. & Chauhan, B.* (2018) Eco-biology and management of alligator weed [Alternanthera philoxeroides) (Mart.) Griseb.]: a review. Wetlands, 38(6): 1067-1079.

Tan, X.*, Sullivan, M.*, Nada, S.*, Deng, B., Schulz, B.* & Gilbert, R.* (2018) Proteomic investigation of the binding agent between liver glycogen beta particles. ACS Omega, 3(4): 3640-3645.

Tao, Y.*, Mace, E.*, George-Jaeggli, B.*, Hunt, C., Cruickshank, A., Henzell, R. et al. (2018) Novel grain weight loci revealed in a cross between cultivated and wild sorghum. The Plant Genome, 11(2).

Taranet, P.*, Kirchhof, G.*, Fujinuma, R.* & Menzies, N.* (2018) Root zone temperature alters storage root formation and growth of sweetpotato. Journal of Agronomy and Crop Science, 204(3): 313-324.

Thamm, I., Tiefenbacher, K. & Rychlik, M.* (2018) Quantification of δ-thujone and its metabolites in human urine after consumption of a sage infusion using stable isotope dilution assays. Toxins, 10(12)

Tharanya, M., Kholova, J., Sivasakthi, K., Seghal, D., Hash, C., Raj, B. et al. (2018) Quantitative trait loci (QTLs) for water use and crop production traits co-locate with major QTL for tolerance to water deficit in a fine-mapping population of pearl millet (Pennisetum glaucum L. R.Br.). Theoretical and Applied Genetics, 131(7): 1509-1529.

Thirugnanasambandam, P.*, Hoang, N. & Henry, R.* (2018) The challenge of analyzing the sugarcane genome. Frontiers in Plant Science, 9

Thomas, J.*, Geering, A.* & Maynard, G. (2018) Detection of "Candidatus Liberibacter solanacearum" in tomato on Norfolk Island, Australia. Australasian Plant Disease Notes, 13(1): 6-7.

Thompson, S., Grams, R., Neate, S., Shivas, R., Ryley, M., Tan, Y. et al. (2018) First reports of Diaporthe kongii, D. masirevicii, and D. ueckerae Associated with stem and peg dieback on peanut in Australia. Plant Disease, 102(7): 1459-1459.

Thompson, S., Tan, Y., Neate, S., Grams, R., Shivas, R., Lindbeck, K. et al. (2018) Diaporthe novem isolated from sunflower (Helianthus annuus) and other crop and weed hosts in Australia. European Journal of Plant Pathology, 152(3): 823-831.

Thong, M.*, Manrique, Y.* & Steadman, K.* (2018) Drug loss while crushing tablets: Comparison of 24 tablet crushing devices. PloS One, 13(3): 1-14.

Thornby, D., Werth, J., Hereward, J.*, Keenan, M. & Chauhan, B.* (2018) Herbicide resistance evolution can be tamed by diversity in irrigated Australian cotton: a multi-species, multi-herbicide modelling approach. Pest Management Science, 74(10): 2363-2375.

Toft, B.*, Alam, M.* & Topp, B.* (2018) Broad-sense heritability and inter-trait relationships in young macadamia architecture, flowering and yield. Acta Horticulturae(1205): 609-616.

Toft, B.*, Alam, M.* & Topp, B.* (2018) Estimating genetic parameters of architectural and reproductive traits in young macadamia cultivars. Tree Genetics and Genomes, 14(4).

Toft, B., Hanan, J.*, Topp, B.*, Auzmendi, I.* & Wilkie, J. (2018) Can greater understanding of macadamia canopy architecture lay the foundation for orchard productivity improvements?. Acta Horticulturae, 1228(1228): 51-58.

To, T., Procter, K., Simmons, B., Subashchandrabose, S. & Atkin, R. (2018) Low cost ionic liquid-water mixtures for effective extraction of carbohydrate and lipid from algae. Faraday Discussions, 206: 93-112.

Tran, H.*, Furtado, A.*, Vargas, C., Smyth, H.*, Lee, L.* & Henry, R.* (2018) SNP in the Coffea arabica genome associated with coffee quality. Tree Genetics & Genomes, 14(5).

Tran, H.*, Ramaraj, T., Furtado, A.*, Lee, L.* & Henry, R.* (2018) Use of a draft genome of coffee (Coffea arabica) to identify SNPs associated with caffeine content. Plant Biotechnology Journal, 16(10): 1756-1766.

Tran, K.*, Witt, T.*, Gidley, M.* & Fitzgerald, M.* (2018) Accounting for the effect of degree of milling on rice protein extraction in an industrial setting. Food Chemistry, 253: 221-226.

Tran, N.*, Miles, A.*, Smith, M., Dietzgen, R.* & Drenth, A.* (2018) Pathogenicity of Phyllosticta citricarpa ascospores on citrus spp.. Plant Disease, 102(7): 1386-1393.

Truong, T.*, Truong, V., Fukai, S.* & Bhandari, B.* (2018) Changes in physicochemical properties of rice in response to high-temperature fluidized bed drying and tempering. Drying Technology, 37(3): 1-10.

Turni, C., Singh, R. & Blackall, P.* (2018) Genotypic diversity of Pasteurella multocida isolates from pigs and poultry in Australia. Australian Veterinary Journal, 96(10): 390-394.

Turni, C.*, Singh, R. & Blackall, P. (2018) Virulence-associated gene profiling, DNA fingerprinting and multilocus sequence typing of Haemophilus parasuis isolates in Australia. Australian Veterinary Journal, 96(6): 196-202.

Valle, M.* & Guerrero, F. (2018) Anti-tick vaccines in the Omics era. Frontiers in Bioscience - Elite, 10(1): 122-136.

Van den Honert, M., Gouws, P. & Hoffman, L. (2018) Importance and implications of antibiotic resistance development in livestock and wildlife farming in South Africa: a review. South African Journal of Animal Science, 48(3): 401-412.

van Eeuwijk, F., Bustos-Korts, D., Millet, E., Boer, M., Kruijer, W., Thompson, A. et al. (2018) Modelling strategies for assessing and increasing the effectiveness of new phenotyping techniques in plant breeding. Plant Science, 282: 23-39.

Vanhercke, T., Belide, S., Taylor, M., El Tahchy, A., Okada, S., Rolland, V. et al. (2018) Up-regulation of lipid biosynthesis pathway increases the oil content in leaves of Sorghum bicolor. Plant Biotechnology Journal, 17(1): 220-232.

Vesth, T., Nybo, J., Theobald, S., Frisvad, J., Larsen, T., Nielsen, K. et al. (2018) Investigation of inter- and intraspecies variation through genome sequencing of Aspergillus section Nigri. Nature Genetics, 50(12): 1688-1695.

Villegas Calvo, M., Colombo, B., Corno, L., Eisele, G., Cosentino, C., Papa, G. et al. (2018) Bioconversion of giant cane for integrated production of biohydrogen, carboxylic acids, and polyhydroxyalkanoates (PHAs) in a multistage biorefinery approach. ACS Sustainable Chemistry and Engineering, 6(11): 15361-15373.

von Dürckheim, K., Hoffman, L., Leslie, A., Hensman, M., Hensman, S., Schultz, K. et al. (2018) African elephants (Loxodonta africana) display remarkable olfactory acuity in human scent matching to sample performance. Applied Animal Behaviour Science, 200: 123-129.

Vongxayya, K., Jothityangkoon, D., Ketthaisong, D., Mitchell, J.*, Xangsayyasane, P. & Fukai, S.* (2018) Effects of introduction of combine harvester and flatbed dryer on milling quality of three glutinous rice varieties in Lao PDR. Plant Production Science, 22(1): 1-11.

von Wettberg, E., Chang, P., Basdemir, F., Carrasquila-Garcia, N., Korbu, L., Moenga, S. et al. (2018) Ecology and genomics of an important crop wild relative as a prelude to agricultural innovation. Nature Communications, 9(1).

Voss-Fels, K.*, Cooper, M.* & Hayes, B.* (2018) Accelerating crop genetic gains with genomic selection. Theoretical and Applied Genetics, 132(3): 669-686.

Voss-Fels, K.*, Qian, L., Gabur, I., Obermeier, C., Hickey, L.*, Werner, C. et al. (2018) Genetic insights into underground responses to Fusarium graminearum infection in wheat. Scientific Reports, 8(1)

Voss-Fels, K.*, Snowdon, R. & Hickey, L.* (2018) Designer roots for future crops. Trends in Plant Science, 23(1717): 957-960.

Vyas, P., Singh, D.*, Singh, N., Kumar, V. & Dhaliwal, H. (2018) Nutrigenomics: advances, opportunities and challenges in understanding the nutrient-gene interactions. Current Nutrition and Food Science, 14(2): 104-115.

Walker, P.*, Blasdell, K., Calisher, C., Dietzgen, R.*, Kondo, H., Kurath, G. et al. (2018) ICTV virus taxonomy profile: Rhabdoviridae. Journal of General Virology, 99(4): 447-448.

Walter, G.*, Wilkinson, M.*, Aguirre, J.*, Blows, M.* & Ortiz-Barrientos, D.* (2018) Environmentally induced development costs underlie fitness tradeoffs. Ecology, 99(6): 1391-1401.

Wambugu, P., Ndjiondjop, M. & Henry, R.* (2018) Role of genomics in promoting the utilization of plant genetic resources in genebanks. Briefings in Functional Genomics, 17(3): 198-206.

Wambugu, Peterson ; Ndjiondjop, Marie-Noelle ; Furtado, Agnelo ; Henry, Robert (2018) Sequencing of bulks of segregants allows dissection of genetic control of amylose content in rice. Plant Biotechnology Journal, January 2018, Vol.16(1), pp.100-110

Wang, G., Zhang, J., Liu, L., Zhou, J., Liu, Q., Qian, G. et al. (2018) Novel multi-metal containing MnCr catalyst made from manganese slag and chromium wastewater for effective selective catalytic reduction of nitric oxide at low temperature. Journal of Cleaner Production, 183: 917-924.

Wang, H.*, Yang, H.*, Xu, Z.*, Liu, X.*, Roberts, M.* & Liang, X.* (2018) Anionic long-circulating quantum dots for long-term intravital vascular imaging. Pharmaceutics, 10(4)

Wang, M., Hancock, T., Chamberlain, A., Vander Jagt, C., Pryce, J., Cocks, B. et al. (2018) Putative bovine topological association domains and CTCF binding motifs can reduce the search space for causative regulatory variants of complex traits. BMC Genomics, 19(1)

Wang, M.*, White, N.*, Grimm, V., Hofman, H., Doley, D.*, Thorp, G. et al. (2018) Pattern-oriented modelling as a novel way to verify and validate functional-structural plant models: a demonstration with the annual growth module of avocado. Annals of Botany, 121(5): 941-959.

Wang, P., Lombi, E., Menzies, N.*, Zhao, F. & Kopittke, P.* (2018) Engineered silver nanoparticles in terrestrial environments: a meta-analysis shows that the overall environmental risk is small. Environmental Science: Nano, 5(11): 2531-2544.

Wang, P., Menzies, N.*, Chen, H., Yang, X., McGrath, S., Zhao, F. et al. (2018) Risk of silver transfer from soil to the food chain is low after long-term (20 years) field applications of sewage sludge. Environmental Science and Technology, 52(8): 4901-4909.

Wang, S.*, Li, S., Zhao, H., Gu, P., Chen, Y., Zhang, B. et al. (2018) Acetaldehyde released by Lactobacillus plantarum enhances accumulation of pyranoanthocyanins in wine during malolactic fermentation. Food Research International, 108: 254-263.

Wang, S., Li, Y., Ren, J., Gu, P., Li, T., Wu, Y. et al. (2018) Comparison on evolution of volatile compounds and aroma attributes in different pH-adjusted fermented bog bilberry syrup wines during bottle-aging period. Food Bioscience, 22: 121-128.

Wang, S., Zhao, W., Lee, T., Singer, S., Simmons, B., Singh, S. et al. (2018) Dimethyl sulfoxide assisted ionic liquid pretreatment of switchgrass for isoprenol production. ACS Sustainable Chemistry and Engineering, 6(3): 4354-4361.

Wang, W., Mauleon, R., Hu, Z., Chebotarov, D., Tai, S., Wu, Z. et al. (2018) Genomic variation in 3,010 diverse accessions of Asian cultivated rice. Nature, 557(7703): 43-49.

Wang, Y., Yong, M., Wei, S., Zhang, Y., Liu, W. & Xu, Z.* (2018) Performance improvement of hybrid polymer membranes for wastewater treatment by introduction of micro reaction locations. Progress in Natural Science, 28(2): 148-159.

Wan, Y., Xu, M., Gilbert, R.*, Yin, J., Huang, X., Xiong, T. et al. (2018) Colloid chemistry approach to understand the storage stability of fermented carrot juice. Food Hydrocolloids, 89: 623-630.

Warman, N.* & Aitken, E.* (2018) The movement of Fusarium oxysporum f.sp cubense (sub-tropical race 4) in susceptible cultivars of banana. Frontiers in Plant Science, 9

Warren, F.*, Fukuma, N.*, Mikkelsen, D.*, Flanagan, B.*, Williams, B.*, Lisle, A.* et al. (2018) Food starch structure impacts gut microbiome composition. mSphere, 3(3).

Watson, A.*, Ghosh, S., Williams, M., Cuddy, W., Simmonds, J., Rey, M. et al. (2018) Speed breeding is a powerful tool to accelerate crop research and breeding. Nature Plants, 4(1): 23-29.

Webber, H., Ewert, F., Olesen, J., Mueller, C., Fronzek, S., Ruane, A. et al. (2018) Diverging importance of drought stress for maize and winter wheat in Europe. Nature Communications, 9(1)

Webber, H., White, J., Kimball, B., Ewert, F., Asseng, S., Eyshi Rezaei, E. et al. (2018) Physical robustness of canopy temperature models for crop heat stress simulation across environments and production conditions. Field Crops Research, 216: 75-88.

Werner, C., Qian, L., Voss-Fels, K., Abbadi, A., Leckband, G., Frisch, M. et al. (2018) Genome-wide regression models considering general and specific combining ability predict hybrid performance in oilseed rape with similar accuracy regardless of trait architecture. Theoretical and Applied Genetics, 131(2): 299-317.

Werner, C., Voss-Fels, K., Miller, C., Qian, W., Hua, W., Guan, C. et al. (2018) Effective genomic selection in a narrow-genepool crop with low-density markers: Asian rapeseed as an example. The Plant Genome, 11(2).

Whitfield, A. & Dietzgen, R. (2018) Editorial overview: Plant virus–vector interactions. Current Opinion in Virology, 33: iii-v.

Whitfield, A., Huot, O., Martin, K., Kondo, H. & Dietzgen, R.* (2018) Plant rhabdoviruses—their origins and vector interactions. Current Opinion in Virology, 33: 198-207.

Widana Gamage, S.*, Rotenberg, D., Schneweis, D., Tsai, C. & Dietzgen, R.* (2018) Transcriptome-wide responses of adult melon thrips (Thrips palmi) associated with capsicum chlorosis virus infection. PLoS One, 13(12)

Wilkus, E.*, Berny Mier Y Teran, J., Mukankusi, C. & Gepts, P. (2018) Genetic patterns of common-bean seed acquisition and early-stage adoption among farmer groups in western Uganda. Frontiers in Plant Science, 9.

Wing, R., Purugganan, M. & Zhang, Q. (2018) The rice genome revolution: from an ancient grain to Green Super Rice. Nature Reviews Genetics, 19(8): 505-517.

Worrall, E.*, Hamid, A., Mody, K.*, Mitter, N.* & Pappu, H. (2018) Nanotechnology for plant disease management. Agronomy, 8(12)

Worrall, E.*, Hayward, A.*, Fletcher, S.* & Mitter, N.* (2018) Molecular characterization and analysis of conserved potyviral motifs in bean common mosaic virus (BCMV) for RNAi-mediated protection. Archives of Virology, 164(1): 181-194.

Wright, G.*, Borgognone, M., Connor, D., Rachaputi, R.*, Henry, R.*, Furtado, A.* et al. (2018) Breeding for improved blanchability in peanut: phenotyping, genotype × environment interaction and selection. Crop & Pasture Science, 69(12): 1237-1250.

Wu, M., Wu, J., Zhang, J., Chen, H., Zhou, J., Qian, G. et al. (2018) A review on fabricating heterostructures from layered double hydroxides for enhanced photocatalytic activities. Catalysis Science and Technology, 8(5): 1207-1228.

Wu, S.*, Wei, Y.*, Zhao, Y.*, Huang, S., Duffield, C., Tang, W. et al. (2018) A longitudinal analysis on the perspectives of major world newspapers on the Three Gorges Dam project during 1982-2015. Water Science and Technology: Water Supply, 18(1): 94-107.

Wu, Y.*, Gu, W.*, Chen, C.*, Do, S. & Xu, Z.* (2018) Optimization of formulations consisting of layered double hydroxide nanoparticles and small interfering RNA for efficient knockdown of the target gene. ACS Omega, 3(5): 4871-4877.

Wu, Y.*, Yang, Y.*, Zhao, W.*, Xu, Z.*, Little, P.*, Whittaker, A.* et al. (2018) Novel iron oxide-cerium oxide core-shell nanoparticles as a potential theranostic material for ROS related inflammatory diseases. Journal of Materials Chemistry B: Materials for Biology and Medicine, 6(30): 4937-4951.

Xangsayasane, P., Phongchanmisai, S., Vuthea, C., Ouk, M., Bounphanousay, C., Mitchell, J.* et al. (2018) A diagnostic on-farm survey of the potential of seed drill and transplanter for mechanised rice establishment in Central Laos and Southern Cambodia. Plant Production Science, 22(1): 1-11.

Xangsayasane, P., Vongxayya, K., Phongchanmisai, S., Mitchell, J.* & Fukai, S.* (2018) Rice milling quality as affected by drying method and harvesting time during ripening in wet and dry seasons. Plant Production Science, 22(1): 1-9.

Xiang, R., Hayes, B.*, Vander Jagt, C., MacLeod, I., Khansefid, M., Bowman, P. et al. (2018) Genome variants associated with RNA splicing variations in bovine are extensively shared between tissues. BMC Genomics, 19(1)

Xiong, L.*, Wang, P.*, Hunter, M.* & Kopittke, P.* (2018) Bioavailability and movement of hydroxyapatite nanoparticles (HA-NPs) applied as a phosphorus fertiliser in soils. Environmental Science: Nano, 5(12): 2888-2898.

Xiong, L.*, Wang, P.* & Kopittke, P.* (2018) Tailoring hydroxyapatite nanoparticles to increase their efficiency as phosphorus fertilisers in soils. Geoderma, 323: 116-125.

Xu, F., Sun, J., Wehrs, M., Kim, K., Rau, S., Chan, A. et al. (2018) Biocompatible choline-based deep eutectic solvents enable one-pot production of cellulosic ethanol. ACS Sustainable Chemistry and Engineering, 6(7): 8914-8919.

Yang, M., Zhao, W., Singh, S., Simmons, B. & Cheng, G. (2018) On the solution structure of kraft lignin in ethylene glycol and its implication for nanoparticle preparation. Nanoscale Advances, 1(1): 299-304.

Yan, S.*, Xu, K., Li, L.*, Gu, W.*, Rolfe, B.* & Xu, Z.* (2018) The pathways for layered double hydroxide nanoparticles to enhance antigen (cross)-presentation on immune cells as adjuvants for protein vaccines. Frontiers in Pharmacology, 9(SEP)

Yap, J.*, Rossetto, M.*, Costion, C., Crayn, D., Kooyman, R., Richardson, J. et al. (2018) Filters of floristic exchange: How traits and climate shape the rain forest invasion of Sahul from Sunda. Journal of Biogeography, 45(4): 838-847.

Yee, S.*, Blackall, P.* & Turni, C.* (2018) Genetic diversity and toxin gene distribution among serovars of Actinobacillus pleuropneumoniae from Australian pigs. Australian Veterinary Journal, 96(1-2): 17-23.

Ye, M., Liu, J., Ma, C., Li, Y., Zou, L., Qian, G. et al. (2018) Improving the stability and efficiency of anaerobic digestion of food waste using additives: a critical review. Journal of Cleaner Production, 192: 316-326.

Yu, C., Shao, Z.*, Zhang, J., Liu, B., Kong, L., Zhang, Y. et al. (2018) Dual Effects of Creatinine on the Formation of 2-Amino-1-Methyl-6-Phenylimidazo [4,5-b] pyridine (PhIP). Journal of Food Science, 83(2): 294-299.

Yu, L., Muralidharan, S., Lee, N., Lo, R.*, Stokes, J.*, Fitzgerald, M.* et al. (2018) The impact of variable high pressure treatments and/or cooking of rice on bacterial populations after storage using culture-independent analysis. Food Control, 92: 232-239.

Yu, L.*, Yakubov, G.*, Martinez-Sanz, M., Gilbert, E.* & Stokes, J.* (2018) Rheological and structural properties of complex arabinoxylans from Plantago ovata seed mucilage under non-gelled conditions. Carbohydrate Polymers, 193: 179-188.

Yu, W.*, Li, H.*, Zou, W.*, Tao, K.*, Zhu, J.* & Gilbert, R.* (2018) Using starch molecular fine structure to understand biosynthesis-structure-property relations. Trends in Food Science and Technology, 86: 530-536.

Yu, W., Quek, W., Li, C., Gilbert, R.* & Fox, G.* (2018) Effects of the starch molecular structures in barley malts and rice adjuncts on brewing performance. Fermentation, 4(4)

Yu, W.*, Tao, K.* & Gilbert, R.* (2018) Improved methodology for analyzing relations between starch digestion kinetics and molecular structure. Food Chemistry, 264: 284-292.

Yu, W.*, Zou, W.*, Dhital, S.*, Wu, P.*, Gidley, M.*, Fox, G.* et al. (2018) The adsorption of alpha-amylase on barley proteins affects the in vitro digestion of starch in barley flour. Food Chemistry, 241: 493-501.

Yuzawa, S., Mirsiaghi, M., Jocic, R., Fujii, T., Masson, F., Benites, V. et al. (2018) Short-chain ketone production by engineered polyketide synthases in Streptomyces albus. Nature Communications, 9(1)

Zaugg, J.*, Gumulya, Y.*, Bodén, M.*, Mark, A.* & Malde, A.* (2018) Effect of Binding on Enantioselectivity of Epoxide Hydrolase. Journal of Chemical Information and Modeling, 58(3): 630-640.

Zdanowska-Sasiadek, Z., Marchewka, J., Horbanczuk, J., Wierzbicka, A., Lipinska, P., Józwik, A. et al. (2018) Nutrients composition in fit snacks made from ostrich, beef and chicken dried meat. Molecules, 23(6)

Zeng, X., Guo, Y., Xu, Q., Mascher, M., Guo, G., Li, S. et al. (2018) Origin and evolution of qingke barley in Tibet. Nature Communications, 9(1)

Zhang, H., Jiang, H., Fan, Y., Chen, Z., Li, M., Mao, Y. et al. (2018) Transcriptomics and iTRAQ-proteomics analyses of bovine mammary tissue with Streptococcus agalactiae-induced mastitis. Journal of Agricultural and Food Chemistry, 66(42): 11188-11196.

Zhang, H., Schafer, C., Wu, P.*, Deng, B., Yang, G., Li, E. et al. (2018) Mechanistic understanding of the relationships between molecular structure and emulsification properties of octenyl succinic anhydride (OSA) modified starches. Food Hydrocolloids, 74: 168-175.

Zhang, J., Zhang, H., Botella, J.* & Zhu, J. (2018) Generation of new glutinous rice by CRISPR/Cas9-targeted mutagenesis of the Waxy gene in elite rice varieties. Journal of Integrative Plant Biology, 60(5): 369-375.

Zhang, L., Xie, X., Liu, D., Xu, Z. & Liu, R. (2018) Efficient co-delivery of neo-epitopes using dispersion-stable layered double hydroxide nanoparticles for enhanced melanoma immunotherapy. Biomaterials, 174: 54-66.

Zhang, P., Nada, S.*, Tan, X.*, Deng, B., Sullivan, M.* & Gilbert, R.* (2018) Exploring glycogen biosynthesis through Monte Carlo simulation. International Journal of Biological Macromolecules, 116: 264-271.

Zhang, R.*, Liang, L., Meng, Q., Zhao, J., Ta, H.*, Li, L.* et al. (2018) Responsive upconversion nanoprobe for background-free hypochlorous acid detection and bioimaging. Small, 15(2)

Zhang, R.*, Li, L.*, Sultanbawa, Y.* & Xu, Z.* (2018) X-ray fluorescence imaging of metals and metalloids in biological systems. American Journal of Nuclear Medicine and Molecular Imaging, 8(3): 169-188.

Zhang, Y., Massel, K.*, Godwin, I.* & Gao, C. (2018) Applications and potential of genome editing in crop improvement. Genome Biology, 19(1)

Zhao, Y.*, Wei, Y.*, Wu, B., Lu, Z.* & Fu, L. (2018) A connectivity-based assessment framework for river basin ecosystem service management. Current Opinion in Environmental Sustainability, 33: 34-41.

Zheng, B., Chapman, S.* & Chenu, K.* (2018) The value of tactical adaptation to El Niño–southern oscillation for east Australian wheat. Climate, 6(3)

Zheng, S., García-Bastidas, F., Li, X., Zeng, L., Bai, T., Xu, S. et al. (2018) New geographical insights of the latest expansion of Fusarium oxysporum f.Sp. cubense tropical race 4 into the Greater Mekong subregion. Frontiers in Plant Science, 9

Zhou, Y.* & Underhill, S.* (2018) Plasma membrane H -ATPase activity and graft success of breadfruit (Artocarpus altilis) onto interspecific rootstocks of marang (A. odoratissimus) and pedalai (A. sericicarpus). Plant Biology, 20(6): 978-985.

Zou, L., Zhang, S., Liu, J., Cao, Y., Qian, G., Li, Y. et al. (2018) Nitrate removal from groundwater using negatively charged nanofiltration membrane. Environmental Science and Pollution Research.

Fu, C., Lora, N., Kirchhoefer, P., Lee, D., Altenhofer, E., Barnes, C. et al. (2017) (4+3) Cycloaddition Reactions of N-Alkyl Oxidopyridinium Ions. Angewandte Chemie, 129(46): 14874-14879.

Hayes, M. & Swift, R.* (2017) An appreciation of the contribution of Frank Stevenson to the advancement of studies of soil organic matter and humic substances. Journal of Soils and Sediments, 18(4): 1-20.

QAAFI
Queensland Alliance for Agriculture and Food Innovation

Queensland Alliance for Agriculture and Food Innovation

qaafi.uq.edu.au
qaafi@uq.edu.au
+61 7 3346 0550

Queensland Alliance for Agriculture and Food Innovation is a research institute of The University of Queensland supported by the Queensland Department of Agriculture and Fisheries.

Queensland Government