# The UWA Institute of Agriculture

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Team members of the ACIAR project 'Rapid breeding for reduced cooking time and enhanced nutritional quality in common bean *(Phaseolus vulgaris)*' at the inaugural project meeting in Uganda in December 2019, including Australia Project Leader Professor Wallace Cowling, IOA Director Professor Kadambot Siddique, Africa Project Leader Dr Clare Mukankusi, and ACIAR Research Program Manager Dr Eric Huttner.

# UWA partnership on bean breeding innovations in East Africa


**Professor Wallace Cowling**
**wallace.cowling@uwa.edu.au**


**Professor Wallace Cowling from The UWA Institute of Agriculture is leading a new project launched by the Australian Centre for International Agricultural Research (ACIAR) to improve common bean varieties in East Africa. The project, titled 'Rapid breeding for reduced cooking time and enhanced nutritional quality in common bean *(Phaseolus vulgaris)*' will be implemented in Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. The project was launched in Uganda in December last year.**

Current varieties of the common bean have long cooking times (from one to three hours), and require large amounts of water, fuel and time. In order to reduce the cooking time and improve the nutritional quality of common beans, the project will apply innovative rapid methods of variety selection that have never before been applied to bean breeding.

"We're aiming to deliver new varieties of common bean with 30% shorter cooking time, 15% higher iron and 10% higher zinc content than current varieties," Professor Cowling said. "The project also sets out to train plant breeders from East Africa in the new rapid breeding methodology through gender-inclusive training programmes, and ensure equitable access to new varieties developed in the project."

In November 2019, IOA hosted members of a related African ACIAR project "Demand-Led Breeding", including several bean breeders from Africa, at UWA for a workshop on Crop Research and Development (R&D) Funding. The workshop aimed to explore sustainable R&D funding mechanisms currently used in Australia in order to identify possible funding models with potential in Africa.

# Director's Column

**Hackett Professor Kadambot Siddique AM, CitWA, FTSE, FAIA, FNAAS, FISPP, FAAS**
**kadambot.siddique@uwa.edu.au**

**We have faced some troubling times recently, here in Australia and globally. The devastating bushfires, drought and flooding that have occurred in Australia, and now the COVID-19 pandemic, are having significant impacts.**

**Our thoughts are with all the communities who have been affected by these events, and we are particularly thinking of the farmers, agricultural industry in Australia, and our national and international collaborators. We are a resilient group and I am confident that we will overcome the current situation.**

In late 2019, IOA welcomed Professor Gabrielle Persley to UWA to deliver the annual Hector and Andrew Stewart Memorial Lecture (see page 8). In late 2019 and early 2020, I travelled to India (see pages 7, 13 and 15), Uganda (see page 1), and Saudi Arabia (see page 9), and was pleased to meet with researchers, industry and farmers, and strengthen UWA's collaborations overseas.

At the annual GRDC Grains Research Updates, Perth, held in February this year, UWA was well represented with several academics having presented their research (see page 12). Four UWA students involved in grains related research were awarded scholarships to attend, from the Australian Grains Innovation Capacity Building Project, as part of their Careers in Grain initiative.

On behalf of IOA and the Industry Advisory Board, I am pleased to announce that this year's Industry Forum topic is *Climate change and agriculture*. The forum is currently scheduled for Tuesday 21 July this year (further details to come). We will continue to carefully monitor the advice from the government and UWA regarding the COVID-19 pandemic, and will keep you updated regarding this forum and other IOA events and activities.

I would like to congratulate all those who were recognised for their work and contributions in agriculture and related areas, particularly UWA student Cassandra Howell for winning first place in the Science category of the 2019 AgriEducate Essay Competition (see page 11). Congratulations also to all projects supported in recent funding rounds (see pages 17-18), including the recently launched ACIAR project on rapid breeding of beans (see page 1) and the Australia-India project on enhancing drought tolerance in chickpea (see page 13).

*continued from page 1*

"The programme focussed on R&D funding and levy systems operating in Australia, particularly for cereals and pulses," Professor Cowling said. "Workshop participants heard from several UWA researchers and members of IOA's Industry Advisory Board, and were given tours of UWA's plant breeding facilities, the Kwinana CBH Grain Terminal and Intergrain Pty Ltd."

The workshop participants included Dr Viv Anthony (Syngenta Foundation for Sustainable Agriculture), Dr Julianne Biddle and Dr Gabrielle Persley (University of Queensland), Prof Shimelis Hussein (ACCI, South Africa), Dr Jean Claude Rubyogo and Dr Clare Mukankusi (International Centre for Tropical Agriculture, Uganda), Dr Berhanu Amsalu Fenta and Dr Taye Tadesse (Ethiopian Institute of Agricultural Research), Dr Stanley Nkalubo (National Crops Resources Research Institute, Uganda), and Associate Professor Firew Mekbib (Haramaya University, Ethiopia).

For more information on the ACIAR bean project, go to www.aciar.gov.au/project/CROP-2018-132

# UWA Agriculture Alumni 1970 visit UWA Farm Ridgefield

L-R: Dr Jim Stoddart, Paul Frapple, Prof Graeme Martin, James Thompson, Nick Watson and Adj Prof David Masters.

**Professor Graeme Martin**
**graeme.martin@uwa.edu.au**

**In November last year, a group of six UWA graduates from the seventies visited UWA Farm Ridgefield. All had enrolled for a BSc (Agriculture) in 1970 and graduated in 1974, although one of the group had transferred to zoology. The party was led by Professor Graeme Martin (Project Leader, UWA Future Farm 2050) and included:**

- Dr David Masters, former Senior Principal Research Scientist, now Honorary Fellow, in the Division of Animal, Food & Health Sciences CSIRO, and Adjunct Professor in the UWA Faculty of Science;
- Mr Nick Watson, Commissioner of Soil and Land Conservation in the Department of Primary Industries and Regional Development, and 2019 Boodja Lecturer (http://bit.ly/36klgY2);
- Mr Paul Frapple, Director of Agribusiness Development in the Department of Primary Industries and Regional Development (now retired);
- Mr James Thompson, Fertiliser Agronomist and Business Analyst (now retired);
- Dr Jim Stoddart, Chief Scientist at MScience, and Adjunct Associate Professor in the UWA Faculty of Science.

A major area of interest was the value of the integration of native flora into the farming operation, with projects ranging from full ecosystem restoration on non-profitable parts of the landscape to native shrubs planted as fodder for sheep with a variety of benefits: reduction of methane emissions, inhibition of gastro-intestinal worms, provision of shelter for new-born lambs, improvement of biodiversity.

The group was also impressed with the way the Farm had catalysed a high level of interaction between the broader UWA and the local community. They saw great value in the engagement with local communities and traditional landowners as part of the process of identifying and testing alternative land and resource use on a commercial farm.

# International Water Course visits UWA Farm Ridgefield

**Professor Susana Neto**
**susana.neto@uwa.edu.au**

**In December 2019, nine Masters of Integrated Water Management students from Griffith University's International Water Centre (IWC) visited UWA for the 8th annual intensive course in *Water, Agricultural Landscapes and Food Security*, coordinated by Professors Susana Neto and Jeff Camkin.**

Professor Graeme Martin (UWA Future Farm 2050 Project Manager) hosted the students from Chile, Peru, Nepal, Bangladesh, USA and Australia, as well as the IWC Program Director Dr Brian McIntosh, for a day at UWA Farm Ridgefield. The students learnt about the new 5500 cubic metre dam, the success of tree plantings around the catchment, and the International Critical Zone Observatory and Flux Tower projects on UWA Farm Ridgefield.

"We discussed the problems of farming with unpredictable rainfall, and the innate ability of Australia's native plants to thrive with minimal water," Professor Martin said. "The students were able to see first-hand the challenges facing a typical dryland, mixed-farming enterprise in the WA Wheatbelt."

The students also completed a module on *Water and Agricultural Landscapes* (WATR7800) at UWA, participated in a range of workshops and highly interactive lectures delivered by Professors Kadambot Siddique, Graeme Martin and Edward Barrett-Lennard,


International Water Course participants hearing from Professor Graeme Martin during a visit to UWA Farm Ridgefield.

and spent a day in the Swan Valley with Department of Water and Environmental Regulation staff examining the interactions between agriculture and urban planning.

For further information on the Master of Integrated Water Management, please visit watercentre.org/courses/master-of-integrated-water-management/

# UWA represented at Malaysia–UNESCO Cooperation Programme

**Professor Jeff Camkin jeff.camkin@uwa.edu.au**

**In November 2019, Adjunct Professors Jeff Camkin and Susana Neto were invited to UNESCO Headquarters in Paris to participate in the Malaysia-UNESCO Cooperation Programme (MUCP) titled '*Roundtable Discussion on Innovative Models for Promoting South-South Cooperation through Education, Sciences, Culture and Communication and Information*'.**

Adjunct Professors Jeff Camkin and Susana Neto at the UNESCO Headquarters in Paris.

The Roundtable Discussion was a side-event to the 40th Session of UNESCO's General Conference and aimed to bring together well-renowned actors supporting the SDGs and promotion of South-South Cooperation from Asia, the Pacific and Africa.

Professor Camkin chaired the MUCP Roundtable Discussion and has been supporting UNESCO to synthesise the lessons learnt from the 29 MUCP research projects.

"Since its inception a decade ago, MUCP has engaged nearly 8,000 individuals from 80 countries and established cooperation with at least 160 institutions worldwide," Professor Camkin said. "It is an outstanding example of the benefits of South-South Cooperation."

For further information on MUCP, please visit mucp-mfit.org

# Labs on the Lawn at ConocoPhillips Science Experience

**Sandra Mata sandra.mata@uwa.edu.au**

**In January this year, UWA hosted the ConocoPhillips Science Experience. This three-day program offered Year 9 and Year 10 students with a passion for Science, Technology, Engineering and Maths (STEM) the opportunity to explore and experience a wide range of STEM subjects and insights into exciting new technologies and scientific discoveries.**

Students were able to experience UWA's campus lifestyle, meet and learn about world-leading research from UWA scientists, and participate in hands-on laboratory activities and demonstrations.

IOA's Future Farm 2050 Project Officer Sandra Mata, PhD Student Jen Middleton and Masters Student Suma Karki hosted the *Labs on the Lawn*: *The Crop is Right* activity, which challenged students to match cropping plants (wheat, barley, oats, chickpea, clover, cowpea, and canola) to products (bread, beer, Anzac cookies, hummus, animal feed, and oil).

The activity provided students with the opportunity to discuss the value of broadacre agriculture to the West Australian economy and to highlight opportunities for tertiary career pathways in Agriculture.

To find out more about the event, go to fbwat.ch/10JEWaUdOc46l3W3

Students taking part in the "Crop is Right" activity at UWA.

L-R: Jon Marx Sarmiento, Roopali Bhoite, Josephine Tay, Rodrigo Pires, Kit Prendergast, Ana Manero, Toto Olita. Not pictured: Steel West.

# Early Career Researchers 3-minute presentation competition

**Ana Manero ana.maneroruiz@uwa.edu.au**

**Rodrigo Pires rodrigo.pires@uwa.edu.au**

**Alicea Garcia alicea.garcia@research.uwa.edu.au**

**In August last year, Researchers in Agriculture for International Development (RAID, a group of the Crawford Fund) organised a 3-minute presentation competition for Early Career Researchers (ECRs), hosted by the Ag Institute of Australia. The event was part of the Ag Futures 2035 conference '*What is the future of Western Australia Agriculture?*', which brought together senior experts, academics and ECRs from a range of agricultural disciplines.**

WA RAID representative Ana Manero said that the presentation competition gave ECRs the opportunity to showcase their cutting-edge work and interact with likeminded professionals from across WA.

"Effective science communication is an essential ingredient in the recipe for a researcher's success," Ana said. "Six Early Career Researchers from UWA and Curtin University know this well, as they demonstrated though their outstanding 3-Minute presentations of their work."

Each presentation covered a wide range of exciting innovations, from genetics to economics:

- Josephine Tay (M.Sc. student, UWA Business School): *Impact of the Seeds of Life Program on health outcomes in Timor-Leste*
- Kit Prendergast (PhD researcher and Forrest Scholar, Curtin University): *Are honeybees outcompeting our native bee pollinators?*
- Steel West (PhD researcher, UWA): *Measuring partial inefficiency in the presence of debt repayment obligations generated as a by-product of input use*
- Toto Olita (PhD researcher, UWA): *The Survivors of Conservation Auctions*
- Roopali Bhoite (PhD researcher, UWA): *Genetic and genomic analyses of herbicide tolerance in bread wheat*
- Jon Marx Sarmiento (PhD researcher, UWA): *Prospects for participation of smallholder farmers in modern agribusiness value chains in Mindanao, Philippines.*

"Distilling years of front-line research into a 180-second talk, with only one slide, is certainly a tough task," Ana said. "But it was actually the judges' panel who had the most difficult job in selecting only one winner among the six absolutely exceptional presentations!"

After much deliberation, RAID and the Ag Institute of Australia were pleased to award a $400 conference travel award to Josephine Tay. The people's choice $100 prize was awarded to Kit Prendergast. The presentations were followed by a networking session over nibbles, sponsored by the Ag Institute of Australia. Presenters and over 50 attendees from diverse levels of experience and backgrounds enjoyed friendly discussions on their shared interests and future opportunities in the field of agricultural research.

WA RAID representatives, Ana Manero, Rodrigo Pires and Alicea Garcia, thank all attendees for their enthusiasm in making this event a great success. To join RAID Australia and find out about upcoming RAID events, please get in touch with Ana, Rodrigo or Alicea or visit raidnetwork.crawfordfund.org

# Combatting plant virus diseases vital for global food security

**Adjunct Professor Roger Jones roger.jones@uwa.edu.au**

**Recently, the *Annual Review of Virology* invited Adjunct Professor Roger Jones of the UWA Institute of Agriculture and Professor Rayapati Naidu of Washington State University, USA, to provide the first comprehensive global review of plant virus diseases, their transmission pathways, factors influencing virus disease outbreaks, beneficial new and emerging technologies, and the most effective plant virus disease management options. Professors Jones and Naidu are both former CGIAR (formerly Consultative Group for International Agriculture Research) plant virologists with more than 40 years experience in this arena, having lived and worked on the epidemiology and management of crop viruses for extended periods in South America, Europe and Australia (Professor Jones), and Asia, Africa and North America (Professor Naidu).**

By causing reduced crop yields and spoiling produce quality, plant virus disease outbreaks constitute a serious threat to global food security. They have a global economic impact of more than $30 billion annually, and they also threaten endangered wild plant populations growing in natural ecosystems.

In the review, Professors Jones and Naidu concluded that climate change and human population pressures combined with increasing agricultural globalization and international trade in plants and plant products are driving rapid alterations in agricultural practices and cropping systems that favour destructive viral disease epidemics. Moreover, plant virus diseases and their vectors are expanding their bioclimatic envelopes, crossing national borders into new geographic regions and triggering virus disease epidemics that lead to devastating crop losses. Such epidemics are at their worst in food insecure world regions.

“Minimizing risks to crops caused by plant virus diseases is crucial if humankind is to reach the 60% increase in food production needed to meet future nutritional requirements,” Professor Jones said. “However, the remarkable diversity of plant viruses and their vectors makes it impossible to implement ‘one-size-fits-all’ control solutions.”

Fortunately, robust solutions that are economically, environmentally and socially sustainable can be delivered through appropriate sustainable integrated virus disease management approaches. Losses are mitigated most effectively by combining diverse types of control measures differing in the ways they operate and tailoring them so they target each individual pathosystem and situation effectively.

“These approaches need to be intelligent and adaptable, and the people devising them need to make locally appropriate choices and take any local ecosystem impairment into account,” Professor Jones said.

Beneficial new and emerging technologies hold great promise for the future toward more effective management of plant viral diseases. For example, hyperspectral, multispectral, thermal, and other types of optical sensors are becoming increasingly effective at distinguishing virus-diseased from healthy plants, establishing virus and virus vector incidence, and assisting the prediction of yield losses caused by virus disease.

“Combining these tools with precision agriculture so that management measures can be targeted precisely where they will have greatest effect, instead of needing to treat the entire crop, holds exciting prospects for effective pre-emptive and cost-effective virus disease control in the future,” Professor Jones said.

“However, in order to optimise use of these technological innovations, knowledge of how plant virus epidemics develop and the climatic, cultural and other drivers involved must be taken into consideration, and the actual approaches selected for deployment have to be feasible and appropriate for each specific cropping situation.”

For further the information, the review can be found at doi.org/10.1146/annurev-virology-092818-015606

Diseased plant from a virus disease devastated cassava crop growing in Zanzibar showing leaf mosaic, deformation and defoliation symptoms caused by infection with *Cassava mosaic virus*.

# UWA-Kerala collaborations strengthened

**Hackett Professor Kadambot Siddique kadambot.siddique@uwa.edu.au**

**In January this year, Hackett Professor Kadambot Siddique was invited to deliver a special lecture on scientific writing at a Foundation Course for 240 newly recruited Assistant Professors at Kerala Agricultural University (KAU), Thrissur, Kerala, India.**

The aim of the foundation course was to orient KAU's newly recruited Assistant Professors on the mandates of KAU, provide professional development opportunities, and expose them to the latest advances in agricultural research, education, and extension. Professor Siddique spoke about how to write a publication-ready scientific research article, and interacted with course participants, Vice Chancellor Professor R. Chandrababu and senior academics at KAU.

The Hon S.V. Sunilkumar, Minister for Agriculture Development and Farmers Welfare, Government of Kerala & Pro-Chancellor, KAU, inaugurated the foundation course. During the course, the Minister also presented Professor Siddique with an award formally recognising his contributions to KAU, particularly in establishing ongoing research and teaching collaborations with UWA.

"I was very pleased to receive this award, and look forward to continuing to strengthen the collaborations UWA has with Kerala Agricultural University," Professor Siddique said.

While in Kerala, Professor Siddique also attended the Indian National Plant Physiology Conference at KAU in December 2019, where he was invited to deliver a keynote address titled *"Adaptation of chickpea to terminal drought: Physiological and molecular approaches"*.

Professor Kadambot Siddique with members of Kerala Agricultural University.

# UWA plant scientist recognised by BASF

**Professor Stephen Powles stephen.powles@uwa.edu.au**

**Professor Stephen Powles from UWA's School of Agriculture and Environment was recognised for his lifelong passion and contribution to the Australian agriculture and farming sectors at BASF's Annual Awards.**

As one of the world's most highly cited agriculture scientists, Powles career has spanned both industry and academia and includes research positions at some of the world's most prestigious universities. He is best known for establishing The Australian Herbicide Resistance Initiative (AHRI), one of the world's leading herbicide resistance research organisations.

"For over 30 years, Professor Powles has been one of the leading voices in the field of herbicide resistance, both here in Australia and internationally," said Gavin Jackson, Head of BASF Agricultural Solutions, Australia and New Zealand.

"Stephen's work has changed the way farmers across the world manage weeds, and it is an honour to recognise the contributions he has made to our industry through this inaugural award."

For more information, please go to crop-solutions.basf.com.au/news/pioneering-australian-plant-scientist-recognised-by-basf-for-outstanding-industry-contribution

Professor Stephen Powles was recognised at BASF's Annual Awards.

Professor Gabrielle Persley AM with attendees of the 2019 Hector and Andrew Stewart Memorial Lecture.

# Australia's role in International Agricultural Research and Development

**Laura Skates laura.skates@uwa.edu.au**

**On 19 November 2019, IOA hosted Professor Gabrielle Persley AM to deliver the annual Hector and Andrew Stewart Memorial Lecture, focused on *Australia's Role in International Agricultural Research and Development.* The Hector and Andrew Stewart Memorial Lecture is held each year in honour of the late Hon Hector J Stewart, MLC, and his son, the late Mr Andrew M Stewart, both Wagin wool growers. Mr Stewart Jr was President of UWA's Guild of Undergraduates in 1929, joined the teaching staff at the University in 1937, and was twice Dean of UWA's Faculty of Agriculture.**

Professor Persley is the Founder and Chair of the Doyle Foundation in Scotland, an Adjunct Professor at the Global Change Institute at the University of Queensland, and a former research program manager with the Australian Centre for International Agricultural Research (ACIAR). She is also a senior advisor to the International Livestock Research Institute and Biosciences eastern and central Africa.

During her lecture, Professor Persley discussed the geographic and scientific imperatives guiding Australia's role in international agricultural research and development. She said that the geographic scope of Australia's scientific contributions is wide ranging, including collaboration with global scientific networks such as the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the International Center for Agriculture Research in the Dry Areas (ICARDA). For successful investment in research for development, Professor Persley said that scientific leadership, research partnerships with mutual benefits, and continuity in investments over time, are the most important factors to consider.

"We must invest in people with ideas; innovators who are able to solve problems," Professor Persley said. "Long term partnerships with mutual benefits are preferable over short term, prescriptive projects."

To conclude her lecture, Professor Persley discussed the importance of looking to the future and finding new opportunities. She provided an example from her work in Africa, where mining and agriculture are the two principal users of land.

"Extractive mining is occurring in traditional agricultural areas and corridors with historically limited access to transport and markets," Professor Persley said. "There are opportunities for the two sectors of mining and agriculture to mutually gain through economies of scale, and diversify business and national interests in the growing economies of Africa."

Professor Persley also mentioned the upcoming Africa Down Under Conference 2020, to be held in Perth, Western Australia, as a timely opportunity to further discuss prospects for co-investment between mining and agriculture in Africa. For further information, the 2015 report "*Bread and Stones—Co-investing in mining and agriculture in Africa"* by Dr Mark P. McHenry and Professor Gabrielle Persley can be found at www.crawfordfund.org/about/resources

# Rare Breed Livestock and Poultry Farming Research at UWA

**Dr Catie Gressier catie.gressier@uwa.edu.au**

**Dr Catie Gressier, in UWA's Anthropology and Sociology discipline group, has been awarded a Discovery Early Career Researcher Award from the Australian Research Council to conduct an Australia-wide qualitative study of rare breed pig, cattle, sheep and poultry farming.**

Over the past three decades, the livestock and poultry industry's dependence on a limited number of high-productivity hybrids has resulted in the extinction of a domestic animal breed globally each month (FAO 2015). Yet, the heritage breeds under threat possess valuable qualities, including pest resistance and environmental adaptability, which may prove invaluable in the climate change era.

Recognising this, a subset of farmers are working to conserve animal genetic diversity within regenerative farming models through building niche markets for the meat, fibre, dairy and eggs of endangered breeds. Through a nationwide study of heritage breed farming, this project aims to advance knowledge of rare breed farmers' motivations, values and practices, while raising awareness of the challenges they face in their critical conservation work.

Two PhD stipends are currently being advertised as part of the project, and Dr Gressier is keen to connect with researchers within IOA.

*Reference:* FAO (2015). The Second Report on the The State of the World's Animal Genetic Resources for Food and Agriculture. Available at www.fao.org/3/a-i4787e.pdf

Dr Catie Gressier has been awarded a Discovery Early Career Researcher Award from the Australian Research Council to conduct an Australia-wide qualitative study of rare breed pig, cattle, sheep and poultry farming.

# Collaboration with King Faisal University, Saudi Arabia

**Hackett Professor Kadambot Siddique kadambot.siddique@uwa.edu.au**

L-R: Professor Dr Ahemd S. Alsaqufi, Dean College of Agriculture and Food Sciences; Professor Kadambot Siddique; Professor Dr Mohammad A. Alohali, President KFU and Professor Dr Ibrahim S. AlMssallem, Advisor for KFU President for Scientific Cooperation.

**In February this year, Hackett Professor Kadambot Siddique visited King Faisal University (KFU) in Alhssa, Saudi Arabia, on an invitation from Professor Dr Mohammad A. Alohali (President KFU). KFU is one of the largest higher educational institutions in the Eastern province in Saudi Arabia.**

During the visit, Professor Siddique delivered two seminars to KFU academics and had discussions with KFU senior executives. He also visited the Date Palm Research Center, Camel Research Center, Water Research Center, various research laboratories, and KFU Research Farm (including greenhouses, field facilities, hydroponics, date farm plantation, dairy farm and milk processing plant).

At the Ministry of Environment, Water and Agriculture in Riyadh, Professor Siddique met with researchers, policy makers and administrators, and delivered a seminar on Future Farming for 2050 with examples from Australia and its relevance to Saudi Arabia.

Professor Siddique said that only two percent of land is arable in Saudi Arabia, and overgrazing and unsustainable agriculture practices are causing increasing rates of desertification.

"Scarce arable land, soils with low organic matter and nutrient contents together with substantial soil salinity and natural water resources limit Saudi Arabia's ability to meet demand through domestic production," Professor Siddique said.

"Promoting the value of water and natural resources and creating strategies to target wasteful consumption are critical to support enhanced food, nutritional and water security beyond 2025."

Professor Siddique made several recommendations to KFU's President regarding collaborative research and postgraduate training opportunities, with a view to develop a Memoranda of Understanding and research agreement between KFU and UWA.

For more information on KFU, go to www.kfu.edu.sa/Sites/Home/en/

Participants at the 'Seeing the unseen: visualising processes in aquatic and terrestrial rhizospheres' workshop led by Belinda Martin, Jen Middleton, Matthew Fraser and Hannes Schmidt (University of Vienna).

# Seeing the unseen: visualising processes in aquatic and terrestrial rhizospheres

**Belinda Martin belinda.martin@uwa.edu.au**

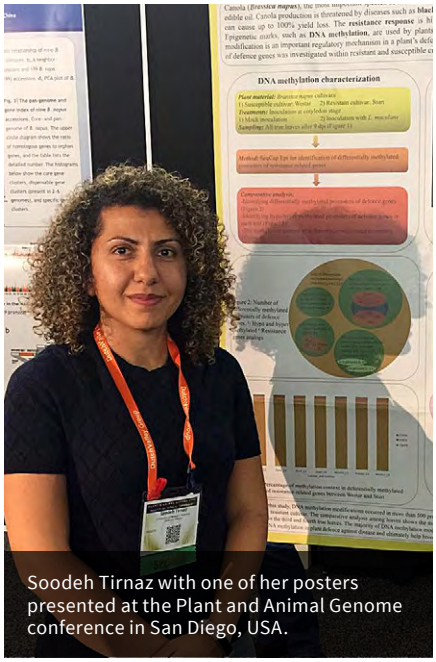
**In November 2019, UWA's School of Biological Sciences (SBS) in collaboration with IOA and the UWA Institute of Advanced Studies held a successful one day workshop *'Seeing the unseen: visualising processes in aquatic and terrestrial rhizospheres'* led by Belinda Martin, Jen Middleton, Matthew Fraser and visiting scientist from the University of Vienna; Hannes Schmidt.**

The day brought together a diverse mix of researchers from within UWA (including IOA, SBS, the School of Agriculture and Environment, Plant Energy Biology, the Centre for Microscopy and Analysis, and the Oceans Institute), Government (Department of Water and Environmental Regulation and Department of Biodiversity, Conservation and Attractions) and industry (Bioscience and Richgro).

The workshop introduced the importance of the rhizosphere as well as various state-of-the-art imaging techniques used to study this dynamic and important space (e.g. Fluorescence-confocal microscopy, Nano-SIMS, cryo-SEM).

"This workshop will enable cross-faculty collaboration within UWA to promote the use and integration of cutting-edge visualisation methods," Belinda said. "By building on new and existing national and international collaborations, we aim to position UWA as a leader in imaging techniques that contribute to collective challenges, such as sustainable food production and conserving the environment."

The workshop was supported by SBS's WIN-WIN strategic funding and IOA.




Soodeh Tirnaz with one of her posters presented at the Plant and Animal Genome conference in San Diego, USA.

# Craig Atkins Travel Award winner shares *Brassica* research at the 28th Plant and Animal Genome conference

**Soodeh Tirnaz soodeh.tirnaz@research.uwa.edu.au**

**PhD candidate Soodeh Tirnaz from UWA's School of Biological Sciences and IOA was awarded the Craig Atkins Travel Award in Botany 2019 and Graduate Research School (GRS) travel award to attend the 28th Plant and Animal Genome (PAG) conference in San Diego, USA in January 2020.**

# UWA student wins AgriEducate essay competition: Feeding the world with an Australian flavour

**Cassandra Howell 21965719@student.uwa.edu.au**

**UWA Botany student Cassandra Howell won first place in the Science category of the 2019 AgriEducate Essay Competition with her essay '*Tucker In: Feeding the world with an Australian flavour*'. Andrew Reagan from the University of New England and Kitty Cheng from the University of Melbourne won second and third place, respectively.**

The inaugural AgriEducate Essay Competition's Science category, sponsored by the Crawford Fund, aimed to re-engage urban Australia with agriculture and look for new ways of thinking about how to address global food security. With the future of our food systems under the spotlight, this competition called on students from all disciplines to share their solutions for the challenge of sustainably feeding a growing global population while minimising the impact on the environment.

Cassandra's winning essay focused on native Australian foods, commonly referred to as bush tucker, and their potential to revolutionise land management and food production in Australia. She argued that bush tucker has the potential to supply both mainstream and gourmet markets, and that increasing public knowledge of the nutritional value and sustainability of bush tucker foods will further increase market demand.

"There is already growing demand for Australian bush foods such as bush tomatoes, finger limes and lemon myrtle, and many Australian bush foods are highly nutritious," Cassandra wrote. "For example, Kakadu plums have been found to have high levels of antioxidants, folate, vitamins and essential minerals, while also being suitable for large-scale production and processing."

In addition to providing greater food and nutritional security, Cassandra argued that expanding the bush tucker industry has the potential to provide meaningful employment and increased cultural engagement.

"The incorporation of bush tucker into agriculture provides an opportunity to create positive social outcomes, particularly for Indigenous people and rural communities," Cassandra said. "Incorporating highly resilient species into agriculture will also improve job security and stability for many people in rural communities."

UWA student Cassandra Howell won the Science category of the AgriEducate essay competition.

Inspired by what she learned while researching the essay, Cassandra is now hoping to pursue future research into sustainable agriculture in Australia.

Cassandra's entire essay, and all other winning essays can be read here: agrieducate.com.au/wp-content/uploads/2019/12/Compilation.pdf

Soodeh's PhD project involves the identification and characterization of disease resistance genes in more than twenty species of the Brassicaceae plant family, including *Brassica napus* (canola), *B. rapa* (e.g turnip and bok choy) and *B. oleracea* (e.g kale, broccoli and cauliflower), along with the model plants *Arabidopsis thaliana, A. halleri* and *Lepidium meyenii*. She is also investigating the association of DNA methylation of these resistance genes to canola's resistance against blackleg disease, one of the most devastating diseases of canola in Australia and worldwide.

Soodeh presented her PhD project at the PAG conference through two poster presentations and one oral presentation.

"Attending PAG provided me with an excellent opportunity to expand my knowledge and skills through workshops and other presentations," Soodeh said. "It also allowed me to have face to face discussion with peers and experts to exchange ideas beyond my current research project, potentially influencing my future work and career."

PAG is the largest conference in the field of plant genomics, with more than 3,000 leading genetic scientists attending the conference yearly.

# Agricultural graduate gives inspiring Valedictorian speech

**Dr Joanne Wisdom**
**joanne.wisdom@uwa.edu.au**

**Dr Joanne Wisdom was invited to give the Valedictorian speech at her PhD graduation on December 13, 2019. After completing a Bachelor of Arts, and a Bachelor of Science majoring in Horticulture and Viticulture, Dr Wisdom went on to gain her PhD on *Modelling ecophysiological processes deterministic for fruit composition within a grapevine canopy* at UWA.**

Dr Wisdom comes from a family who pioneered farming in the Wagin Dumbleyung district of the grain belt in Western Australia. This led to an interest in food production science and inspired a sense of wonder at the whole biological world.

In her Valedictorian speech, Dr Wisdom discussed her experiences in science and finding her place in the working world.

"Science is rarely done in a vacuum," Dr Wisdom said. "We need to foster our ability to communicate what we have learned to the world, and we need to build working relationships and hold our scientific community together."

Dr Wisdom pointed out that UWA is one of the most geographically isolated places in the world to complete a first class tertiary degree. While some see this as a challenge, she sees it as a gift.

"In a connected world, UWA graduates embody a pioneering spirit that will allow us to boldly face new frontiers of science in this rapidly changing world," Dr Wisdom said. "Say yes to even more challenges. Keep the pioneering spirit you have nurtured here at UWA and take it with you."

Dr Wisdom is currently a Research Associate within IOA, and was one of the presenters in IOA's Postgraduate Showcase last year. You can find out more about her research in the August 2019 issue of IOA News.

Dr Joanne Wisdom gave an inspiring Valedictorian speech at her December 2019 graduation.

# UWA highlights at GRDC Grains Research Update Perth

**Sandra Mata sandra.mata@uwa.edu.au**

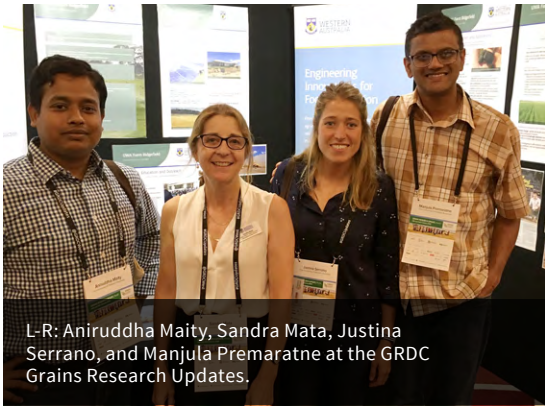
**The 2020 Grains Research and Development Corporation (GRDC) Grains Research Update Perth was held at Crown Perth Burswood in February this year. The two-day program included over fifty presenters sharing their latest research results and innovations to assist on-farm production and profitability.**

Four UWA students were awarded funding from the Grain Industry Association of Western Australia (GIWA) to attend the event, including Justina Serrano, Martina Badano, Julian van der Zanden, and Harmanpreet Kaur. These scholarships provide opportunities for students to advance their understanding of the latest grains research and development, and to network with local and international researchers, agribusinesses and farmers.

Several UWA researchers presented their latest research and developments at the GRDC Grains Research Updates, including Dr Andrew Guzzomi (UWA School of Engineering and IOA), Daniel Kidd (UWA School of Agriculture and Environment), and Australian Herbicide Resistance Initiative members Professor Hugh Beckie, Mechelle Owen, Peter Newman, Dr Roberto Busi, Huan Lu, Facundo Cortese and Roberto Lujan.

In his presentation, Dr Guzzomi announced that the Weed Chipper design will now be commercialised and offered to Australian farmers by Precision Agronomics Australia. He said that commercialisation of the research is a significant development for Australian grain growers and the grains industry in general, as it allows for a reduced reliance on herbicides.

Copies of all GRDC Research Updates presentation papers are available at grdc.com.au/resources-and-publications/grdc-update-papers



L-R: Aniruddha Maity, Sandra Mata, Justina Serrano, and Manjula Premaratne at the GRDC Grains Research Updates.

# Australia–India project to improve drought tolerance in chickpea

**Professor Harvey Millar harvey.millar@uwa.edu.au**

**Under the Australia India Strategic Research Fund (AISRF), researchers from UWA, ICAR-Indian Agricultural Research Institute (IARI), Jawaharlal Nehru University (JNU) and The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have joined forces to enhance drought tolerance in Chickpea *(Cicer arietinum)*. Professor Harvey Millar (Director, ARC Centre of Excellence in Plant Biology, UWA) is the Australian lead of the multi-institutional project, which is titled *'Functional Genomics of Chickpea to enhance drought tolerance'*.**

Chickpea crops are a rich source of protein (20–30%), carbohydrates (~40%) and minerals, and provides an important source of dietary nutrients for people in the semi-arid tropical regions of the world, including the Indian sub-continent. Chickpea is also an important grain legume crop in rotation with cereals in Australia. Professor Millar said that drought is a major constraint to chickpea productivity, and can cause significant economic losses globally for chickpea farmers.

"Terminal drought is one of the major abiotic stresses limiting chickpea production and causes up to 50% yield losses in Australia and India," Professor Millar said. "Improving drought tolerance in chickpea is critical for improving its productivity in the context of changing climatic scenarios for both India and Australia."

The project will involve the development of genome and gene–linked proteomics and metabolomics focused on drought tolerance.

"This project will cross the genome to phenome divide in chickpea," Professor Millar said. "By working together with our Indian partner organisations, we can share chickpea genetic resources and expertise in the development of genome, protein, and metabolite datasets."

In January of this year, ICRISAT's Centre of Excellence in Genomics & Systems Biology hosted a meeting in New Delhi for all partnering institutions to discuss the project's next steps. Professors Harvey Millar and Kadambot Siddique represented UWA at the meeting, and were joined by Dr Peter Carberry (Director General, ICRISAT), Dr KK Sharma (Deputy Director General-Research, ICRISAT), Professor Rajeev K Varshney (Research Program Director, Genetic Gains, ICRISAT), Dr Bharadwaj Chellapilla (Principal Scientist, Division of Genetics, IARI), and Professor Ashwani Pareek (School of Life Sciences, JNU).


Professors Harvey Millar and Kadambot Siddique with members of the Australia-India project inspecting chickpea breeding trials at ICAR-Indian Agricultural Research Institute, New Delhi (above), and at the ICRISAT Center of Excellence in Genomics and Systems Biology, Hyderabad (below).

Professor Siddique said that the project continues UWA's long-term research partnerships with India.

"UWA and ICRISAT share over two decades of collaboration," Professor Siddique said. "Our work with researchers, organisations and communities in India is central to our mission to advance research, education, and training in agriculture worldwide."

The Australian Government's Department of Industry, Innovation and Science and the Government of India's Department of Biotechnology are funding the project through the Indo-Australia Biotechnology Fund (IABF) scheme.

# Engineering innovations to improve sub-clover harvesting

**Wesley Moss**
**wesley.moss@research.uwa.edu.au**

**Wesley Moss, a PhD student within UWA's Faculty of Engineering and Mathematical Sciences, is working to develop new technology for Australia's sub-clover harvesting industry. Sub clover and annual medics are Australia's most widely sown pasture legumes, however harvesting their seed presents significant practical challenges.**

"Sub clover buries its burrs and annual medics drop their pods, which complicates seed harvesting," Wes said. "Vacuum harvesters are the main technology used to collect these valuable seeds, but anyone who has worked with these machines know they literally suck," he joked.

The Horwood Bagshaw Clover Harvester was released in the early 1960s and used suction to harvest seed from the ground. Based on a Western Australian invention, this machine was a big step forward for the industry. However, there has been little technological progress since then and many seed producers still use the original harvesters made in the 1960s.

"These machines are slow, dusty and prone to breakdown, and they haven't been made in over 30 years so even the newest models are old by modern standards," Wes said. "These issues and particularly soil degradation concerns have impacted the industry and contributed to a decline in the number of seed producers."

In response to these issues, AgriFutures Australia funded the project '*Profitable and environmentally sustainable subterranean clover and annual medic seed harvesting*' to research solutions to improve harvest efficiency and environmental outcomes. Wesley's PhD research forms part of this project and fits into a team with experience in plant breeding, pasture agronomy, plant physiology and agriculture engineering.

"We are looking into making improvements to the current Horwood Bagshaw harvesters, which can then be adopted by producers to help their operations," Wesley said. "Our ultimate aim though is to develop completely new technology for seed harvesting."

In the current system, many machinery passes (mainly harrowing and raking) are required to bring burr/pods to the surface so they can be vacuum harvested. This process, combined with sucking up soil from the ground, can leave the paddock bare and prone to erosion. To overcome this, an entirely new method of harvesting may be necessary.

The project has procured its own Horwood Bagshaw harvester, and the team has been busy testing it during the February harvest window.

"At a collaborator's property in Capel, we were able to run our harvester and baseline it with two of the producer's own machines," Wesley said. "We hope to be back next year with new equipment to test."

Wesley's PhD research is supervised by Dr Andrew Guzzomi (UWA School of Engineering) and Associate Professor Phillip Nichols (UWA School of Agriculture and Environment). Other members of the project team include Dr Kevin Foster, Associate Professor Megan Ryan and Professor Willie Erskine.

The project's red machine, harvesting with two others at Bell Seeds in Capel.

# Climate Smart Agriculture international training workshop

**Hackett Professor Kadambot Siddique**
**kadambot.siddique@uwa.edu.au**

Professor Siddique addressing the workshop on Climate Smart Agriculture approaches.

**A new joint project entitled *'Building capacity to enhance farmer's capabilities to address the challenges of climate change using Climate Smart Agriculture strategies'* between UWA, Amity University (India), Kabul University (Afghanistan) and Kernel Group of Companies (Bangladesh) was formally launched on 10th February this year. The project is funded by the Asia Pacific Network for Global Change Research (headquarters in Tokyo, Japan).**

As part of the project, Professor Kadambot Siddique and Dr Amin Mugera from IOA delivered lectures at a six-day project workshop at Amity University, Noida, India. Professor Siddique said that the recently developed Climate Smart Agriculture (CSA) approach provides promising opportunities to feed a growing world population under climate change. The CSA concept relies on three components: productivity, adaptation, and mitigation.

"Different training programs for farmers have focused on any one of these aspects, however, the present alarming situation demands an integrated approach to address the massive challenge of climate change," Professor Siddique said. "An integrated approach could be possible by capacity building of small farmers by providing hands on training about new mitigation and adaptation approaches in agriculture."

Project participants from India, Afghanistan and Bangladesh were trained on CSA approaches, and will go on to train their local institutes and farmers about the approaches and benefits of CSA. Following the workshop, a farmer training manual is currently being prepared.

During the visit, Amity University's Vice Chancellor appointed Professor Siddique as a Visiting Professor at Amity University.

# Vale Noel Fitzpatrick
## 1929 – 2019

**Noel Fitzpatrick, who led the Western Australian Department of Agriculture for 13 years in the 1970s and 1980s, passed away on Friday 6 December 2019. A farmer's son, Noel was born in 1929 in the eastern WA grainbelt town of Narembeen. He graduated with a Bachelor of Science in Agriculture from UWA in 1951 and joined the then Department of Agriculture.**

This was the start of an illustrious scientific career with important research into pastures and soil nutrition of the newly cleared land in the State's south in the 1950s and 1960s. In 1963, he moved into administration as the first Scientific Liaison Officer. He was appointed Deputy Director General in 1969 and then Director General in 1971, a role he held for 13 years.


Former WA Department of Agriculture Director General Noel Fitzpatrick, pictured in his study at home shortly after his retirement when he was researching a history of the department.

In 1984, he moved on to become the Deputy Secretary of the Commonwealth Department of Primary Industry. A highlight of this period was the establishment of the Bureau of Rural Science. In 1988, he was invited to become the inaugural President of the Murray-Darling Basin Commission.

Noel received many accolades for his work, including being appointed a Member of the Order of Australia and inducted into the Royal Agricultural Society's Hall of Fame in 2006. He was a long-time member and Fellow of the WA division of Ag Institute Australia.

During his retirement, Noel wrote *'In Response to Need: A history of the Western Australian Department of Agriculture from 1894 to 2008'* – a great reference source that sits on many a bookshelf at South Perth and other department offices across the State.

# New Appointments

**Dr Renu Saradadevi renu.saradadevi@uwa.edu.au**

Dr Renu Saradadevi has been appointed as Research Associate within The UWA Institute of Agriculture in the ACIAR CROP/2018/132 project titled 'Rapid breeding for reduced cooking time and enhanced nutritional quality in common bean *(Phaseolus vulgaris)*', under the direction of Project Leader Professor Wallace Cowling.

Dr Saradadevi will administer the project at UWA and assist in coordinating research activities in six countries in Africa. Together with Professor Cowling, Renu will establish a system of quantitative genetics analysis that will optimise breeding of beans in East Africa for reduced cooking time, improved micronutrients, seed protein and disease resistance in bean over the next five years. She will also be involved in setting up and management of a Breeding Management System for the project.

After completing her PhD at UWA, Dr Saradadevi worked on canola pre-breeding research and as Research Officer at UWA on a project supported by the Council of Grain Grower Organisations to explore new flowering time genes in lupin.

**Dr Manish Roorkiwal manish.roorkiwal@uwa.edu.au**

Dr Manish Roorkiwal has been appointed as Adjunct Associate Professor within The UWA Institute of Agriculture, as formal recognition of his significant contribution to the work and activities of the University. Manish has been associated with IOA as Co-PI and actively worked with the chickpea team on joint Indo-Australia projects, responsible for the drought, salinity, and modern breeding aspects. In addition, Manish has been associated with various other UWA projects related to chickpea genome sequencing and genetic mapping.

Currently, Manish is Senior Scientist (Genomics and Molecular Breeding) at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) based in Hyderabad, India. With a background in molecular genetics and applied genomics, Manish has over 15 years of research experience. At the core of his work is the improvement of crop productivity of legumes in marginal environments using modern genetics and breeding approaches, including genomic selection and genome-wide association studies.

Manish has a strong interest in the areas of genomic selection, next generation sequencing-based re-sequencing, and low-cost genotyping for enhancing the use of markers in routine breeding.

Through the Adjunct Associate Professor position, Manish will continue to contribute to chickpea research in the form of joint publications and PhD co-supervision.

## AWARDS AND INDUSTRY RECOGNITION

| NAME | AWARD |
|---|---|
| Prof Kadambot Siddique | Visiting Professorship from Amity University, India |
| Cassandra Howell | First place, Science category, 2019 AgriEducate Essay Competition |
| Prof Kadambot Siddique | Outstanding contributions in the field of agriculture, Kerala Agricultural University |
| Prof Stephen Powles | BASF industry recognition award |

## VISITORS TO IOA

| NAME OF VISITOR | VISITOR'S ORGANISATION AND COUNTRY | HOST DETAILS | DATES OF VISIT |
|---|---|---|---|
| 7 undergraduate students from South China Agriculture University (SCAU) | China | UWA Study Tours | 13-19 January 2020 |
| A/Prof Yifei Liu | Shenyang Agricultural University, China | Prof Hans Lambers, Dr Jiayin Pang and Prof Kadambot Siddique | 2019-2020 |
| Minghui Zhang (PhD student) | UC Berkeley | Prof Sally Thompson | 2020 |
| Liya Weldegebriel (PhD student) | UC Berkeley | Prof Sally Thompson | 2020 |

## POSTGRADUATE RESEARCH STUDENTS (PhD)

| STUDENT NAME | TOPIC | SCHOOL | SUPERVISOR(S) | FUNDING BODY |
|---|---|---|---|---|
| Mr Tsubasa Kawai | Genetic and functional analysis of compensatory growth of lateral roots in rice | UWA School of Agriculture and Environment and IOA | Profs Kadambot Siddique, Hirokazu Takahashi (Nagoya University), Yoshiaki Inukai (Nagoya University) and Dr Yinglong Chen | Joint PhD Program |
| Mr Mukesh Choudhary | Genetics of heat tolerance in wheat | UWA School of Agriculture and Environment and IOA | Profs Wallace Cowling, Prof Guijun Yan and Kadambot Siddique | |

## POSTGRADUATE RESEARCH STUDENTS (PhD)

| STUDENT NAME | TOPIC | SCHOOL | SUPERVISOR(S) | FUNDING BODY |
|---|---|---|---|---|
| Mr Sina Nouraei | Super genes and transcription factors associated with abiotic stress in wheat | UWA School of Agriculture and Environment and IOA | Prof Guijun Yan and Dr Helen Liu | |
| Mr Aldrin Cantilla | Exploring the genetic potential in Brassica napus cultivars and its wild relatives for Blackleg resistance genes | UWA School of Biological Sciences | Profs Jacqueline Batley, Wallace Cowling, Dave Edwards and Dr Philipp Bayer | GRDC |
| Agyeya Pratap | Revealing the role of G-proteins in heat and drought stress response in Wheat | UWA School of Agriculture and Environment and IOA | Prof Kadambot Siddique and Dr Nicolas Taylor | School for International Research Fees and University Postgraduate Award |
| Mr Md Shahin Iqbal | Mungbean salinity tolerance | UWA School of Agriculture and Environment and IOA | Prof William Erskine, Dr Lukacs Kotula and Adj A/Prof Imran Malik | ACIAR - John Allwright Fellow |

## RESEARCH GRANTS

| TITLE | FUNDING PERIOD | FUNDING BODY | SUPERVISORS |
|---|---|---|---|
| A new Western Australian flavonoid-rich apple, BravoTM, and vascular health | 2019 | Edith Cowan University ex Fruit West Co-Operative Ltd | Dr Kevin Croft |
| Increasing knowledge and profitability of cropping on Ironstone gravel soils | 2019-2020 | GRDC | Prof Daniel Murphy, Ms Frances Hoyle, A/Prof Peta Clode, Prof Andrew Whiteley, Dr Matthias Leopold, A/Prof Martin Saunders, Dr Andrew Rate, Dr Talitha Santini, Prof David Jones, Prof Matthew Kilburn |
| Soil sulfur influence on microorganisms | 2019-2020 | DPIRD | Dr Deirdre Gleeson |
| Proof of concept for Flash Farming and Benchmarking | 2019 | DPIRD | Prof Philip Vercoe, Dr Zorica Durmic |
| Managing flies for crop pollination | 2018-2020 | DPIRD ex Horticulture Innovation Australia | Dr David Cook, Dr Romina Rader, Prof James Cook, Dr Rakhesh Nisha, Dr Sasha Voss, A/Prof Markus Riegler, Dr Jonathan Finch, Dr Cameron Spurr, E/Prof Lynette Abbott |
| Who's who in the plant gene world? | 2020-2022 | ARC Discovery Project | Prof Dave Edwards, Prof Jacqueline Batley |
| Deciphering organelle transport mechanisms in plants | 2020-2022 | ARC Discovery Project | Dr Monika Murcha, Assoc/Prof Joshua Heazlewood, Prof Alison Baker |
| Benefits and costs of non-market valuation for environmental management | 2020-2022 | ARC Discovery Project | Prof David Pannell, Dr Abbie Rogers, Assoc/Prof Michael Burton, Mr MD Sayed Iftekhar, Prof Robert Johnston |
| Facilitation of high leaf phosphorus-use efficiency by nitrate restraint | 2020-2022 | ARC Discovery Project | E/Prof Hans Lambers, Dr Patrick Finnegan, Assoc/Prof Maheshi Dassanayake |
| Collective Action for Sustainable Development: The Case of Smallholder Dairy Cooperatives in ODA Countries | 2019 | Australia Africa Universities Network | Dr Amin Mugera, Prof George Gitau, Prof Frederick Obese, Prof John Tarlton |
| Rapid breeding for reduced cooking time and enhanced nutritional quality in common beans *(Phaseolous vulgaris)* | 2019-2023 | ACIAR | Prof Wallace Cowling, Prof Kadambot Siddique |
| Closing the loop, Black Soldier Fly technology to convert agricultural waste into high quality fertiliser and soil improvers from DAWR | 2019-2022 | Australian Pork Ltd ex R&D4P | Dr Sasha Jenkins, Dr Martit Kragt, Assoc/Prof Megan Ryan, Dr Andrew Guzzomi, Dr Fiona Dempster, Prof Phil Vercoe, I Waite, Mr Daniel Kidd, Dr Tabitha Santini, Prof Kadambot Siddique, E/Prof Lyn Abbott |
| Enhancing the understanding of the value provided to fisheries by man-made aquatic structures | 2019 | Curtin University Ex Fisheries Research and Development Corporation FRDC | Assoc/Prof Michael Burton, Dr Julian Clifton |
| Functional Genomics of Chickpea to enhance drought tolerance | 2019-2021 | DIIRS, AISRF Indo-Australian Biotechnology Fund | Prof Harvey Miller, Prof Dave Edwards, Prof Kadambot Siddique |
| Essays on the Economics of Soil Quality: Agriculture Productivity, Adoption (or Dis-adoption) and Willingness to Pay for Land Restoration Schemes in Pakistan's Punjab | 2019 | International Food Policy Research Institute IFPRI | Asst/Prof Ram Pandit, Dr Amin Mugera, Mr Asjad Sheikh |
| BeefLinks Program | 2019-2022 | MLA Donor Company | Prof Philip Vercoe |
| Smart Farms Small Grants Round 2 - Farm Demonstration to fast-track restoration of soil condition using pereable biomass barriers | 2019 | National Landcare Program | E/Prof Lynette Abbott, Dr Sasha Jenkins, Dr Zakaria Solaiman |
| Smart Farms Small Grants Round 2 - Engaging digital media to more effectively build confidence in use of sustainable land management practices | 2019 | National Landcare Program | E/Prof Lynette Abbott |

## RESEARCH GRANTS

| TITLE | FUNDING PERIOD | FUNDING BODY | SUPERVISORS |
|---|---|---|---|
| Nexgen-UWA Herbicide Partnership | 2019 | Nexgen Plants | Dr Joshua Mylne, Dr Keith Stubbs, Dr Joel Haywood |
| Program 2 - Towards Effective Control of Blackleg of Canola: Coordinating international blackleg research and development | 2019-2022 | University of Melbourne Ex GRDC | Prof Jacqueline Batley |
| Dung beetle ecosystem engineers: taking the science to the paddock | 2020 | UWA Research Impact Grants | Mr Jacob Berson, Dr Winn Kennington, Prof Leigh Simmons, Prof Raphael Didham, Assoc/Prof Theodore Evans |
| Disease Epidemiology and Management Tools for Australian Grain Growers | 2018-2020 | DPIRD Ex GRDC | Dr Michael Renton |
| Provision of Research Services for the Wheatbelt Development Commission 2019 | 2019 | Wheatbelt Development Commission | Prof Fiona McKenzie |

## UWA IOA 2019 Publications
*(Not yet reported)*

**Peer Reviewed Journals**


*Al-lami HF, You MP and Barbetti MJ (2019). Role of foliage component and host age on severity of Alternaria leaf spot (caused by Alternaria japonica and A. brassicae) in canola (Brassica napus) and mustard (B. juncea) and yield loss in canola. Crop and Pasture Science* **70***: 969-980.*

*Arief OM, Pang J, Shaaltout KH and Lambers H (2019) Performance of two Lupinus albus L. cultivars in response to three soil pH levels. Experimental Agriculture doi: 10.1017/S0014479719000383*

*Atri C, Akhatar J, Gupta M, Gupta N, Goyal A, Rana K, Kaur R, Mittal M, Sharma A, Singh MP, Sandhu PS, Barbetti MJ and Banga SS (2019). Molecular and genetic analysis of defensive responses of Brassica juncea – B. fruticulosa introgression lines to Sclerotinia infection. Scientific Reports* **9***: 17089.*

*Crompton O, Sytsma A and Thompson S (2019). Emulation of the Saint Venant Equations Enables Rapid and Accurate Predictions of Infiltration and Overland Flow Velocity on Spatially Heterogeneous Surfaces. Water Resources Research* **55***(8): 7108-7129.*

*Duke SO (2019). Enhanced Metabolic Degradation: The Last Evolved Glyphosate Resistance Mechanism of Weeds? Plant Physiology* **181***(4): 1401-1403.*

*Feng F, Dang P, Pu X, Wen X, Qin X, Chen Y and Siddique KHM (2019). Contribution of Proximal and Distal Grains Within Spikelets in Relation to Yield and Yield Components in the Winter Wheat Production Region of China From 1948 to 2012. Agronomy* **9** *doi: 10.3390/agronomy9120850*

*Feng X, Thompson SE, Woods R and Porporato A (2019). Quantifying asynchronicity of precipitation and potential evapotranspiration in Mediterranean climates. Geophysical Research Letters*

*He H, Pang J, Lambers H and Wu G (2019). The application potential of coal fly ash for selenium biofortification. Advances in Agronomy* **157***: 1-54.*

*Huang Y, Fan G, Zhou D and Pang J (2019). Phenotypic plasticity of four Chenopodiaceae species with contrasting saline-sodic tolerance in response to increased salinity-sodicity. Ecology and Evolution* **9***: 1545-1553.*

*Iqbal MM, Huynh MD, Udall JA, Kilian A, Adhikari KN, Berger JD, Erskine W and Nelson MN (2019). The first genetic map for yellow lupin enables genetic dissection of adaptation traits in an orphan grain legume crop. BMC Genetics doi: 10.1186/s12863-019-0767-3*

*Khan AW, Garg V, Roorkiwal M, Golicz AA, Edwards D and Varshney RK (2019). Super-Pangenome by Integrating the Wild Side of a Species for Accelerated Crop Improvement. Trends in Plant Science doi: 10.1016/j.tplants.2019.10.012*

*Kingwell R, Loxton R and Mardaneh E (2019). Factors and scenarios affecting a farmer's grain harvest logistics. Australian Journal of Agricultural and Resource Economics doi: 10.1111/1467-8489.12355*

*Kotula L, Kwa HY, Nichols PGH and Colmer TD (2019). Tolerance and recovery of the annual pasture legumes Melilotus siculus, Trifolium michelianum and Medicago polymorpha to soil salinity, soil waterlogging and the combination of these stresses. Plant and Soil* **444***: 267-280 doi: 10.1007/s11104-019-04254-z*

*Li Y, Hu Y, Song D, Liang S, Qin X and Siddique KHM (2020) The effects of straw incorporation with plastic film mulch on soil properties and bacterial community structure on the loess plateau. European Journal of Soil Science doi: 10.1111/ejss.12912*

*Li K, Kingwell R, Griffith G and Malcolm B (2019). Measuring the returns to investment in RD&E in the WA Grains Industry. Australasian Agribusiness Review* **27***: 4.*

*Liu Y, J Zhu, Gao W, Guo Z, Xue C, Pang J and Shu L (2019). Effects of biochar amendment on bacterial and fungal communities in the reclaimed soil from a mining subsidence area. Environmental Science and Pollution Research doi: 10.1007/s11356-019-06567-z*

*Lu H, Yu Q, Han H, Owen MJ and Powles SB (2019). Evolution of resistance to HPPD-inhibiting herbicides in a wild radish population via enhanced herbicide metabolism. Pest Management Science doi: 10.1002/ps.5725*

*Lu H, Yu Q, Han H, Owen MJ and Powles SB (2019). Non-target-site resistance to PDS-inhibiting herbicides in a wild radish (Raphanus raphanistrum) population. Pest Management Science doi: 10.1002/ps.5733*

*Lu M, Chen M, Song J, Wang Y, Pan Y, Wang C, Pang J, Fan J and Zhang Y (2019). Anatomy and transcriptome analysis in leaves revealed how nitrogen (N) availability influence drought acclimation of Populus. Trees – Structure and Function doi: 10.1007/s00468-019-01834-5*

*Melandri G, Prashar A, Mccouch SR, Van Der Linden G, Jones HG, Kadam N, Jagadish K, Bouwmeester H and Ruyter-Spira C (2019). Association mapping and genetic dissection of drought-induced canopy temperature differences in rice. Journal of Experimental Botany doi: 10.1093/jxb/erz527*

*Minemba D, Gleeson DB, Veneklaas E and Ryan MH (2019). Variation in morphological and physiological root traits and organic acid exudation of three sweet potato (Ipomoea batatas) cultivars under seven phosphorus levels. Scientia Horticulturae* **256***: 108572.*

*Mousavi-Derazmahalleh M, Bayer P, Hane J, Valliyodan B, Nguyen HT, Nelson M, Erskine W, Varshney RK, Papa R and Edwards D (2019). Adapting legume crops to climate change using genomic approaches. Plant, Cell and Environment* **42***(1): 6–19 doi: 10.1111/pce.13203*

*Mousavi-Derazmahalleh M, Nevado B, Bayer PE, Filatov D, Hane JK, Edwards D, Erskine W and Nelson MN (2019). The western Mediterranean region provided the founder population of domesticated narrow-leafed lupin. Theoretical and Applied Genetics* **131***: 2543-2554 doi: 10.1007/s00122-018-3171-x*

*Murphy J, Gretzel U, Pesonen J and Elorinne AL (2019). Wicked Problem: Reducing Food Waste by Tourist Households. Journal of Gastronomy and Tourism* **3***(4): 247-260.*

*Naidu PSR, Gavriel N, Gray CGG, Bartlett CA, Toomey LM, Kretzmann JA, Patalwala D, McGonigle T, Denham E, Hee C, Ho D, Taylor NL, Norret M, Smith NM, Dunlop SA, Iyer KS and Fitzgerald M (2019). Serum protein interactions diminish the ability of functionalized nanoparticles to cross the blood brain barrier and enter target cells. ACS Applied Materials & Interfaces In Press*

*Neto, Susana (2019). Alqueva Dam in the Guadiana River Basin - past and future of illusive water abundance. World Water Policy Journal doi: 10.1002/wwp2.12001*

*Powell J, Welsh J, Pannell D and Kingwell R (2019). Energy innovation in Australian irrigated sugarcane - can energy costs be reduced? A case study approach. Journal of Cleaner Production* **240** *doi: 10.1016/j.jclepro.2019.118177*

*Robles Aguilar AA, Pang J, Postma JJ, Schrey SD, Lambers H and Jablonowski ND (2019). The effect of pH on morphological and physiological root traits of Lupinus angustifolius treated with struvite as a recycled phosphorus source. Plant and Soil* **434***: 65-78.*

*Ryan MH, Graham JH, Morton JB and Kirkegaard JA (2019). Research must use a systems agronomy approach if management of the arbuscular mycorrhizal symbiosis is to contribute to sustainable intensification. New Phytologist* **222***(3):1176-8.*

*Sandral GA, Price A, Hildebrand SM, Fuller CG, Haling RE, Stefanski A, Yang Z, Culvenor RA, Ryan MH, Kidd DR and Diffey S (2019). Field benchmarking of the critical external phosphorus requirements of pasture legumes for southern Australia. Crop and Pasture Science* **70***(12):1080-96.*

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*Song J, Wang Y, Pan Y, Pang J, Zhang X, Fan J and Zhang Y (2019). The influence of nitrogen availability on anatomical and physiological responses of Populus alba × P. glandulosa to drought stress. BMC Plant Biology* **19***: 63.*

*Taghighi H, Erskine W, Bennett R, Bayer PE, Pazos-Navarro M and Kaur P (2019). Genetic diversity linked to haplotype variation in the world core collection of Trifolium subterraneum for boron toxicity tolerance provides valuable markers for pasture breeding. Frontiers in Plant Science* **10***: 1043 doi: 10.3389/fpls.2019.01043*

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Editor: Laura Skates
laura.skates@uwa.edu.au
The UWA Institute of Agriculture
+61 8 6488 4717 | ioa.uwa.edu.au
The University of Western Australia
M082, Perth WA 6009 Australia