The UWA Institute of Agriculture

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The 13th consecutive annual Industry Forum looked at how to rebuild trust between innovative primary producers and ethically informed consumers.

Finding Common Ground: bringing food, fibre and ethics to the same table

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More than 160 people including members of the agriculture industry, government agencies, media, academia and students came together in July for the 13th UWA Institute of Agriculture Industry Forum, to discuss how to rebuild trust between innovative primary producers and ethically informed consumers.

UWA's Deputy Vice-Chancellor (Research) Professor Robyn Owens officially opened the forum, and Dr Terry Enright, Leader of the IOA Industry Advisory Board, acted as the Master of Ceremonies.

Dr Nin Kirkham, Discipline Chair of Philosophy at UWA, gave the keynote address, highlighting historical and contemporary issues in the ethics of food and fibre production. She delved into various schools of philosophical thought around ethics in agriculture, with a particular focus on the treatment of animals.

"Some may argue that it is species chauvinism or speciesism to think that membership of one species rather than another should, by itself, confer moral standing on a being," Nin said.

"However, using the notion of speciesism to make claims that animals have the same kinds of rights or moral status as humans is problematic. There are significant differences between humans and animals, and these differences are relevant in working out what kind of treatment is owed to each species."

Dr Kirkham's discussion on ethics in agriculture provided a thought-provoking framework for the subsequent talks in the forum.

Deanna Lush, Managing Director of AgCommunicators and a farmer based in South Australia, shared insights from her winning essay in the Australian Farm Institute 2018 John Ralph Essay competition and from her Churchill Fellowship investigating trust in agriculture.

"Building trust is about a commitment to food and fibre production involving transparency and sustainability, engaging with consumers and the broader community to become aligned with their values, and doing the right thing," Deanna said. "We need to learn to speak in a way that's relevant, clear and compelling, and lead with shared values."

Director's Column

Hackett Professor Kadambot Siddique, AM, CitWA, FTSE, FAIA, FNAAS, FISPP, FAAS
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Earlier this year, Vice-Chancellor Professor Dawn Freshwater announced the UWA 2030 Vision and UWA Strategic Plan 2020-2025. Agriculture and Food Security have been identified as a major area of research, and it perfectly matches with IOA's research objectives and the vision.

In the 2019 Shanghai Jiao Tong Academic Ranking of World Universities (ARWU), UWA was ranked 18th in the world and 1st in Australia for Agricultural Sciences. IOA's research and international collaboration has contributed towards the above achievement. Between April and July this year, IOA researchers have published more than 50 research papers.

I would like to congratulate Dr Andrew Guzzomi on being a semi-finalist in the Emerging Innovation category of the 2019 WA Innovator of the Year program, for "The Weed Chipper" technology, and Prof Hans Lambers for receiving the ISRR Dundee Medal for distinguished root research.

In June, seven of UWA's top postgraduate students studying agriculture and related areas presented their research at the annual Postgraduate Showcase: Frontiers in Agriculture (see page 12). The topics covered a wide range of topics, including science, social science, economics and law. All of the speakers did an excellent job engaging with the audience, which included members of the agriculture industry, academics, farmers, and students.

In July, we hosted the 13th annual Industry Forum, which discussed how to find common ground between innovative farmers and ethically informed consumers (see page 1). I was pleased to see so many lively discussions between attendees during the sundowner following the main event. This continues to be a major highlight in our calendar, supported by CSBP and Farmers Ltd Golden Jubilee of Agriculture Science Fellowship.

The next event on the horizon is the Dowerin Field Days, on Wednesday 28 to Thursday 29 August, where IOA will have a display in the DPIRD exhibition area. We look forward to interacting with members of the agricultural community and sharing some of the Institute's recent research and activities.

Finally, I would like to welcome two new staff members to IOA this year, including Dr Renu Saradadevi and Dr Joanne Wisdom. Dr Wisdom recently completed her PhD research (see page 15) and spoke at the IOA Postgraduate Showcase (see page 12).

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Following this, Professor Alan Tilbrook, Centre for Animal Science, Queensland Alliance for Agriculture and Food Innovation, The University of Queensland, presented the goals and strategies of The Animal Welfare Collaborative (see page 7).

"The primary goal is to improve the welfare of animals," Alan said. "The Animal Welfare Collaborative will act as a knowledge broker between stakeholders in government, industry, and the community."

CEO of Austral Fisheries, David Carter, shared insights from the company's initiatives aimed at ensuring all aspects of their fishing and trading operations are as environmentally sustainable as possible.

For example, in 2016, Austral Fisheries became the first seafood company in the world to achieve Carbon Neutral certification through the Australian Government Carbon Neutral program.

"Building trust is a continuous evolving conversation," David said. "As an industry, it's important to always remain part of the solution."

The final presenters of the forum were Dr Holly Ludeman, a veterinarian and Director of the Sheep Collective, and Nicolle Jenkins, Managing Director of The Hub Marketing. Together, they spoke on the goals of The Sheep Collective.

"The industry didn't have a united voice in a very public and emotive debate. We needed to change the hearts and minds of the community regarding live export, and openly share the facts about the industry," Holly and Nicolle said. "It's about being transparent and providing balanced information so that consumers can make informed choices about their personal food consumption choices."

The forum closed with a panel discussion and lively Q&A, facilitated by Professor Fiona Haslam-McKenzie, and followed by refreshments in The University Club of WA terraces.

The Industry Forum was supported by CSBP Fertilisers through the CSBP and Farmers Ltd Golden Jubilee of Agriculture Science Fellowship.

Non-invasive soil sensing – a cost-effective alternative to map soil moisture

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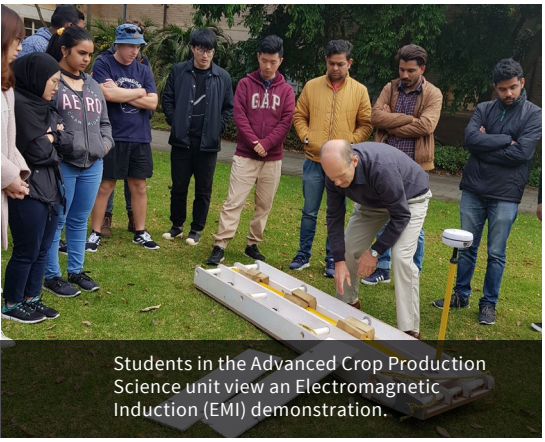
Hira Shaukat, a PhD student in the UWA School of Agriculture and Environment (SAgE) supervised by Assistant Professor Matthias Leopold and Associate Professor Ken Flower, is investigating non-invasive soil sensing as a cost-effective alternative to map soil moisture.



Students in the Advanced Crop Production Science unit view an Electromagnetic Induction (EMI) demonstration.

Agricultural land use and productivity of broadacre cropping systems are highly dependent upon the soil moisture content in space and time. Rapid and precise quantification of soil water in crop fields has always been challenging in farming because the soil moisture is highly variable and it depends on the interacting soil properties. The conventional method of extensive core sampling is not time and cost effective, especially in broadacre cropping systems of Western Australia.

Recent advances in geophysical techniques have created an opportunity to indirectly determine soil moisture with high-resolution and minimal soil intrusion. However, these methods need site-specific calibrations and have mainly been validated for homogenous soil conditions only. Currently, there is no accurate method for prediction of soil moisture aimed at large-scale variable-textured soils.

Use of electromagnetic induction (EMI) instruments to map soil properties through apparent electrical conductivity (ECa) is gaining importance because the method is economical, mobile and allows for the measurement of relatively large areas in a comparably short time. Therefore, the potential of EMI for developing broadacre soil moisture maps will be tested, in combination with Ground Penetrating Radar (GPR), Electrical Resistivity Tomography (ERT) and soil coring for initial physical assessments to ground truth and calibrate the data.

Multiple sites with different soil types have been selected in the WA Grainbelt, including one site at the UWA Farm Ridgefield. Subsurface properties will be estimated using 2D and 3D inversion techniques. If successful, this research will provide cost effective novel, detailed mapping of soil moisture in variable broadacre cropping sties, which will provide farmers with crucial soil moisture information to make informed crop management decisions.

Notre Dame USA visits UWA Ridgefield Farm

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Ten study-tour students on exchange from Notre Dame University in the United States visited the UWA Future Farm on Saturday 4 May this year, accompanied by Tania Phillips and Associate Professor Martin Forsey from UWA Anthropology and Sociology.

Professor Graeme Martin met the group at the UWA Ridgefield Farm, and spoke to the students about the Clean, Green and Ethical research projects being conducted at the farm.

"Native deep-rooted, perennial plants have been planted at the UWA Future Farm to add versatility to traditional pasture-based grazing systems," Professor Martin said. "These native plants can help to reduce methane emissions, fight gastro-intestinal worms, provide shelter during lambing, prevent soil erosion, fight salinity, and improve biodiversity."

The students were also interested to learn about Professor Martin's research on sheep health and reproduction, and the many innovative technologies being used at the farm.

"After years of working in a lab researching agricultural conservation practices at my home university, it was very cool to learn about the leading-edge techniques being used at UWA's Farm," said Notre Dame student Amelia Grose.

"It was a pleasure to have the opportunity to visit such a sustainable and innovative farm," said Delany Bolton, another of the Notre Dame students. "To see this type of farming displayed in such an attainable and relatable way gave me hope for a more sustainable and environmentally conscious future."

Amelia Grose from Notre Dame University, USA, at the UWA Ridgefield Farm.

Tania Phillips said that plans were already in place to bring another group of study tour students to the UWA Farm next semester.

"We really enjoyed the visit," Tania said. "We're planning to stay a bit longer next time, and spend some time in Pingelly too."

Climate change adaptation in Cambodia

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Researchers Dr Natasha Pauli and Dr Bryan Boruff from the UWA School of Agriculture and Environment recently contributed to two workshops on climate change adaptation in disaster-prone areas along the Mekong River in Cambodia, alongside research partners from the University of Auckland, Royal University of Phnom Penh, University of Sydney and the Cambodia Ministry of Rural Development.

Three years of research findings and policy implications were discussed with a broad group of stakeholders in Phnom Penh and the town of Kratie, including village leaders, commune chiefs, representatives from government and NGOs, academics and students.

"The research workshop in Phnom Penh generated lively discussions among participants and highlighted a pressing need for greater access to geospatial data and training in the application of remote sensing methods for disaster preparedness," said Dr Boruff. In Kratie, the local participants emphasised that the research team had "captured well their reality", and they were very pleased to see the results of the research returned to communities and local authorities.

Two of the presentations were based on dissertations completed by Master of Environmental Science students Savuti Henningsen (class of 2019) and Mark Williams (class of 2016). Both students were hosted by the rural communities that were the focus of the research, alongside small teams of students from the Royal University of Phnom Penh who acted as research assistants, facilitators and translators.

"Both Savuti and Mark were outstanding students who really immersed themselves in their research. Mark spent time with the communities working on participatory hazard mapping, and recording local adaptations to floods and droughts. Savuti compiled seasonal calendars of agricultural livelihoods and weather events, as well as interviewing women about their daily routines in times of flood and drought," said Dr Pauli. "Our wonderful Cambodian collaborators translated their work into policy briefs and presentations, delivered in Khmer, which were provided as a tangible output of the research," she added.

The research project was funded by the Asia Pacific Network for Global Change Research, and is led by Professor Andreas Neef at the University of Auckland. A Research Impact Grant from UWA, awarded to Dr Pauli and Dr Boruff, made a significant contribution towards the cost of running the two workshops.

Dr Natasha Pauli and Dr Bryan Boruff with workshop participants in Cambodia.

A reflection of the United Nations Special Rapporteur on the Right to Food

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On Tuesday 9 July this year, the UWA Institute of Advanced Studies hosted a public lecture by Professor Hilal Elver, on The Right to Food. Her visit to UWA was as a UWA Institute of Advanced Studies Visiting Fellow, and hosted by Dr Kynan Gentry (Lecturer, UWA School of Social Sciences).

Professor Elver is an international law professor and Global Distinguished Fellow at the Resnick Food Law and Policy Center, UCLA Law School; and a research professor at UC Santa Barbara, where she has been Distinguished Visiting Professor since 2002. Since 2014, Professor Elver has served as the Special Rapporteur on the Right to Food, who is responsible for carrying out the right to food mandate as prescribed by the United Nations Human Rights Council.

71 years ago, the Universal Declaration of Human Rights (UDHR) established the foundation for the right to food by declaring, 'Everyone has the right to a standard of living adequate for the health

Stress tolerant crops to feed the future

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In July this year, Dr Ashwani Pareek and Dr Sneh Singla-Pareek visited IOA from New Delhi, India.

Dr Ashwani Pareek is Professor of Plant Biology and Biotechnology in the School of Life Sciences at Jawaharlal Nehru University (JNU) and an Adjunct Professor at UWA within IOA. Dr Sneh Singla-Pareek leads the Plant Stress Biology group at the International Centre for Genetic Engineering and Biotechnology. In 2017, UWA and JNU signed a Memorandum of Understanding to collaborate in research and postgraduate training in plant/crop science, data management/computer science, and socioeconomics.

Dr Ashwani Pareek and Dr Sneh Singla-Pareek each gave a seminar on stress tolerance in plants at a special lecture hosted by IOA, at UWA on 1 July. Both seminars began with a reminder of the big challenges facing humanity today, including global population growth and increased atmospheric CO2, and sought to answer the question "How do we feed more people without further damaging our planet?"

Dr Ashwani Pareek discussed various approaches to designing crops for dry and saline soils, including forward genetics (from phenotype to gene, or mutation breeding) and reverse genetics (from gene to phenotype). To illustrate these approaches, he compared two contrasting rice genotypes: IR64 (salt sensitive) and Pokkali (salt tolerant land race from Kerala, India).

Dr Sneh Singla-Pareek and Dr Ashwani Pareek discussing drought tolerance experiments with Dr Yinglong Chen.

"Farmers need plants that are tolerant to multiple stresses, including salinity and drought," Dr Ashwani Pareek said. "Both GM and non-GM based solutions to this problem are available. For example, we developed Stress Tolerant Rice of the Next Generation (STRONG), which is able to overcome multiple stresses and has the potential to enhance the income of farmers."

For the development of STRONG, Dr Ashwani Pareek received an Award for Best Technology Development from the Honourable President of India Sh. Ram Nath Kovind Ji, in May last year.

Following on from Dr Ashwani Pareek's talk, Dr Sneh Singla-Pareek shared her research on developing high yielding, multiple stress tolerant rice.

"With increasing global population size and urbanisation, we have to be really smart with how we use land, and we need to train our crop plants to produce greater yield in stressful conditions," Dr Sneh Singla-Pareek said. "The next step is to translate our research from the lab to the industry, and field test some of the rice cultivars we have developed."

During their visit, Drs Pareeks also visited the glasshouses and Bayliss Building laboratories and discussed collaborative research opportunities with various groups at UWA.

and well-being of himself and his family'. Article 11 of the International Covenant of the Economic Social and Cultural Rights (ICESCR), ratified in 165 countries and going into force in 1966, then established binding obligations on States to respect, protect and fulfil the right to adequate food for all.

In her talk, Professor Elver emphasised the importance of a human rights based approach to food security, and the elimination of hunger and malnutrition, and reflected on the current status of the right to food worldwide. She discussed political, environmental and economic challenges that block successful implementation of the right to food in this time of economic globalization and climate change, and suggested policy options for a sustainable and equitable future for healthy people, as well as a healthy planet.

Professor Hilal Elver gave a public lecture on the *Right to Food*.

Find out more at hilalelver.org

Food security and local knowledge

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In April of this year, Hackett Professor Kadambot Siddique (IOA) and Professor Michael Blakeney (UWA Law School) travelled to Kerala, India, to meet with research collaborators and key stakeholders involved in the ARC Discovery Project DP170100747: Food security and the governance of local knowledge in India and Indonesia.

"UWA has an ongoing collaboration with Kerala," Professor Siddique said. "We have an active Memorandum of Understanding with Kerala Agricultural University (KAU), and this ARC Discovery Project will help to strengthen our ties further."

Professors Siddique and Blakeney discussed the progress of the project with Prof Dr R. Chandra Babu (Vice Chancellor, KAU), Professor Dr P. Indira Devi (Director of Research, KAU), Professor Dr Jayasree Krishnakutty and senior executives from KAU at the University's headquarters at Vellanikarra, Trichur.

"We will have a final workshop of the project at UWA in February 2020," Professor Siddique said. "There we will present the final results of the project and hear reports from research collaborators from India and Indonesia, as well as the School of Oriental and African Studies, University of London, Newcastle University and Monash University."

Professors Siddique and Blakeney, accompanied by Professor Dr Jayashree Krishnankutty and Rajesh K. Raju (College of Horticulture, KAU), travelled to the Malappuram and Palakkad districts to discuss the cultivation of traditional rice varieties and the Protection Plant Varieties and Farmers' Rights (PPV&FR) Act with local rice farmers.

"I am surprised to see that only a fifth of the 100-odd landrace varieties in Wayanad are registered," Professor Blakeney said. "While a Geographical Indication tag could help the marketing value of the product concerned, registration under the PPV&FR Act protects the right of the registered owner on the variety, which is far more important."

Professors Siddique and Blakeney were also invited to the National University of Advanced Legal Studies (NAUALS) at Kalamassery, Kochi, where they met with Professor Dr K.C. Sunny (Vice Chancellor, NAUALS). At the invitation of Dr Jacob Joseph (Director of the University's Center for Law and Agriculture), Professor Siddique made a presentation on research and teaching at UWA and Professor Blakeney presented on regulating food loss and waste.

Professors Siddique and Blakeney examining traditional rice varieties in the field, with Professor Dr Jayasree Krishnakutty and local farmers.

Calenup scholarship winner 2019

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The Calenup Postgraduate Research Fund was established by Dr Irwin Barrett-Lennard to support a postgraduate research project at UWA with the specific purpose of advancing agriculture in Western Australia. UWA PhD student Nooshin Shahbazi is the recipient of the 2019 Calenup Postgraduate Research Fund, for her project titled *Use of Light Detection and Ranging (LiDAR) to detect late weeds in wheat crops.*

Nooshin is a PhD student in the UWA School of Agriculture and Environment (SAgE) and the Australian Herbicide Resistance Initiative (AHRI), and her research on weed management is supervised by Associate Professor Ken Flower, Dr Mike Ashworth, Dr Nik Callow, and Professor Hugh Beckie.

"Weeds have a major impact on crop yields, and thus effective weed management plays a significant role in improving crop production and reducing the cost of weed control to industry," Nooshin said. "The majority of current weed control strategies are herbicide dominant and often lack diversity, resulting in herbicide resistance."

Harvest Weed Seed Control (HWSC) is one of the key non-herbicide control measures for weeds. However, a number of weed species such as brome grass (*Bromus spp.*) and wild oats (*Avena fatua*) shed most of their seeds before harvest, thereby avoiding this important method of non-herbicide weed control.

UWA researchers invited to Animal Welfare Summit in Sydney

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UWA academics Professor Graeme Martin, Dr Dominique Blache, and Professor Shane Maloney were invited to join an Animal Welfare Summit held in Sydney on 9 April this year, which brought together 60 stakeholder groups for an open discussion about current issues in animal welfare.

The summit was hosted by The Animal Welfare Collaborative (TAWC), a recently launched initiative from The University of Queensland (UQ), which is funded by UQ and supported by the Queensland Department of Agriculture and Fisheries and researchers from UQ, UWA, University of Newcastle and University of Adelaide.

Dr Dominique Blache said that it was great to be part of the discussion and share some of the recent research conducted at UWA.

"The research we conduct here at UWA, and research from other universities across Australia, will contribute to a growing scientific evidence base for improving animal welfare," Dr Blache said. "Through TAWC, we can then translate this research into useful, field-ready decision tools."

UQ Professor of Animal Welfare, Alan Tilbrook established TAWC, and said its aim is to provide scientific evidence and act as an independent facilitator amongst various policymakers, industry bodies, businesses, researchers, animal welfare organisations 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," Professor Tilbrook said. "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."

Professor Tilbrook presented on TAWC at the IOA Industry Forum in July this year (see page 1). Visit www.theanimalwelfarecollaborative.org for more information.

L-R: Professor Shane Maloney (UWA), Bronwyn Venus (UQ), Professor Graeme Martin, Dr Dominique Blache (UWA), Sharna Millar (UQ), Dr Jill Fernandes (UQ), Professor Alan Tilbrook (UQ), and Professor Rohan Walker (Uni Newcastle, NSW), at the Animal Welfare Summit in Sydney. Photo: Cam Neville, Cavan Images.

Numerous studies have assessed the capability of remote sensing technologies in discriminating plant species based on their shape, texture and color. Additionally, images from UAV platforms and data from ultrasonic sensors have been used for vegetation detection. Sensor technology is growing fast and sensors such as LiDAR (Light Detection and Ranging) are becoming more reliable. This opens new horizons for detecting taller plants in a canopy at late phenological stages, by producing 3D data with higher resolution.

Nooshin's research will determine if LiDAR scans and the data generated can be used to map late-season weeds in the wheat fields.

"My research project includes various field surveys for weed/crop measurements, and trials will be set up to detect weeds above crop in the wheat crop fields using LiDAR," Nooshin said. "As a result, the weed species will be detected, located and mapped for weed management programs in the following growing seasons."

The Calenup Postgraduate Research Fund will enable Nooshin to perform trials at UWA and Shenton Park to develop the optimal configuration of the LiDAR and determine the ability of LiDAR to detect weeds in crops, and to then validate these findings with field surveys in the grain belt of WA.

UWA PhD student Nooshin Shahbazi is the recipient of the 2019 Calenup Postgraduate Research Fund.

Dr Muhammad Abdul Razzaque, Minister for Agriculture (2nd on the right) receiving memento from Professor Atiqul Islam, Vice Chancellor NSU.

Agribusiness Innovation: A Pathway to Sustainable Development in Bangladesh

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Bangladesh's economic success in recent decades and its consistent high growth have attracted the interest of researchers, academics, policy makers, development partner agencies and business entrepreneurs both nationally and globally.

North South University (NSU, Dhaka, Bangladesh) and The University of Western Australia's (UWA) Institute of Agriculture jointly organised the Agribusiness Innovation International Symposium during July 7-8 at NSU in Dhaka. Professor Nazrul Islam (NSU) and Honorary Research Fellow at The UWA Institute of Agriculture was the convenor of the symposium.

The symposium brought together more than 100 academics, researchers, practitioners and policymakers from Bangladesh and overseas. Dr Muhammad Abdur Razzaque (Minister for Agriculture, Bangladesh) was the Chief Guest. Professor Kadambot Siddique and Dr Amin Mugera from The UWA Institute of Agriculture delivered invited talks at the symposium.

Traditionally, farmers in Bangladesh have focused primarily on subsistence agriculture for home consumption, which is characterised by low productivity and localised limited market size, with little scope for realizing scale economies and scope economies in production, processing, marketing and distribution. A gradual commercialization of these activities in the form of production for markets and profits beyond meeting home needs is already happening (e.g. Pran, Bengal Meats). With appropriate institutional, structural, and policy reforms and infrastructure development taking place, domestic markets would widen and the global market opportunities could be explored.

The symposium identified several strategies for the development and future expansion of agribusiness in Bangladesh. Key recommendations from the workshop will be submitted to the Minister for Agriculture.

Her Excellency Julia Niblett, High Commissioner, Australian High Commissioner Bangladesh attended and addressed the closing session. Professor Siddique briefed her about the ongoing collaboration between UWA and Bangladesh.

While at NSU Professor Siddique met with Professor Atiqul Islam (Vice Chancellor NSU), to discuss the development of a joint MoU between UWA and NSU in research, and teaching collaborations in commerce, agribusiness and computer science.

Professor Siddique also visited Bangladesh Agricultural Research Institute (BARI) and met with Dr Abdul Kalam Azad (Director General) and other senior staff, and discussed ongoing and future collaborations with UWA.

UWA active in world water education

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Portugal-based members Professor Susana Neto and Professor Jeff Camkin continue to very actively represent The UWA Institute of Agriculture around the world.

Professor Camkin recently completed a report for UNESCO on the First Malaysia-UNESCO Cooperation Programme Experts Synthesis Meeting held in Langkawi, Malaysia. The Report summarises the discussions and lessons learnt from the experiences of 29 projects in Asia, the Pacific and Africa over the last 10 years, which aimed to help deliver the Millennium Goals and now the Sustainable Development Goals. Professor Camkin's report and guidelines will support consideration of future directions for the UNESCO-Malaysia partnership.

Professor Camkin was also recently invited to co-chair the *Managed Aquifer Recharge (MAR) and Integrated Water Resource Management* sessions at the 10th International Symposium on MAR (ISMAR10), in Madrid, Spain, along with Ms Alice Aureli, Head of Groundwater Systems and Settlements Section at UNESCO in Paris.

"Clearly MAR can be a great addition to the toolbox of water resource management, and it is heartening to see that there is generally a good understanding of MAR approaches and how they may fit within an IWRM framework," Professor Camkin said. "I was impressed with the conference. Co-chairing with Ms Alice Aureli was an added bonus, resulting in early plans for a UNESCO workshop in Portugal in 2020 in which a prominent role for UWA and IOA is anticipated."

In her capacity as President of the Portuguese Water Resources Association, and as Chair of the Scientific Committee, Professor Susana Neto is overseeing preparations for the 14th Hydrology and Water Resources Symposium for Portuguese Speaking Countries (SILUSBA), to be held in Praia, Cape Verde in September this year. The Symposium will bring together high-level policy representatives, university researchers and agency staff from Angola, Mozambique, São Tomé and Principle, Guinea, Cape Verde, East Timor, Brazil and Portugal. Professor Neto is also organizing a special session on the Organisation for Economic Co-operation and Development (OECD) Principles of Good Water Governance as part of this event, in her capacity as a member of the OECD Water Governance Initiative Group.

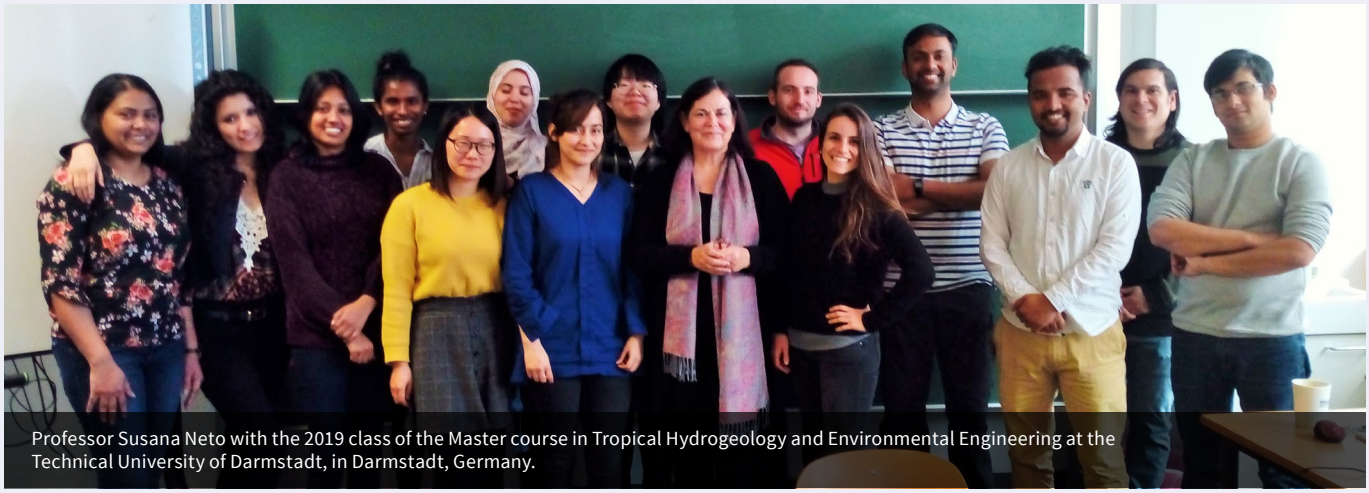
Continuing their work in delivering water education in Europe and Australia, Professors Neto and Camkin recently delivered their annual course on Water Governance and Integrated Water Resource Management as part of the Master course in Tropical Hydrogeology and Environmental Engineering at the Technical University of Darmstadt, Germany. They have now designed and delivered courses for over 250 students from more than 60 different countries.

Finally, in May 2019, Professors Camkin and Neto launched World Water Policy Journal, for which they are Co-Editors-in-Chief. This new collaboration with Wiley-Blackwell and Policy Studies Organization aims to broaden and deepen opportunities to engage researchers, policy-makers, industries and community stakeholders around the world, especially in developing countries.

"World Water Policy Journal is the next step in a journey we began in 2012 when we first explored with Policy Studies Organization from Washington DC the idea of a new water journal that focused on both policy and practice, and which aimed to provide a platform for the world's emerging water leaders and thinkers," said Professor Neto.

"Through the great support of Policy Studies Organization (the President, Prof Paul Rich, who studied for his PhD at UWA), a high level International Advisory Board, over 50 editors from around the world, and authors from 21 different countries so far, our Journal has started to build a presence in this important space" Professor Camkin added.

Further information on *World Water Policy Journal* is available at https://onlinelibrary.wiley.com/journal/2639541x.



Professor Susana Neto with the 2019 class of the Master course in Tropical Hydrogeology and Environmental Engineering at the Technical University of Darmstadt, in Darmstadt, Germany.

Genomic Selection for Crop Improvement

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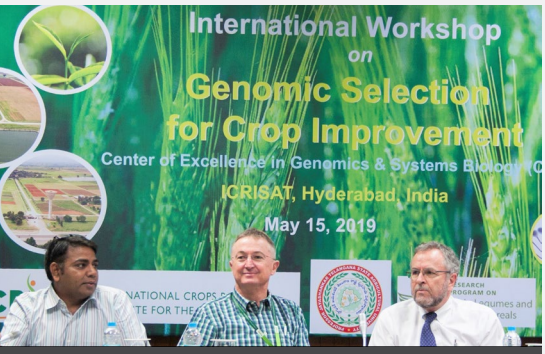
Professor Wallace Cowling was invited to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) headquarters in Hyderabad, India, to present a plenary talk at an international workshop on *Genomic Selection for Crop Improvement* in May 2019.

The objective of the workshop was to bridge the gap between genome science and crop breeding. The workshop brought together several international speakers, all whom challenged the status quo in crop breeding and proposed new methods based on relationship information.



Professor Wallace Cowling at ICRISAT workshop with Dr Rajeev Varshney, Director, Centre of Excellence in Genomics & Systems Biology, ICRISAT (left) and Dr Peter Carberry, Director-General of ICRISAT.

Professor Cowling gave a talk titled *Genomic pre-breeding with evolving gene banks*.

"An evolving gene bank is a source of continually improving economic traits in highly diverse germplasm, which acts as a genomic bridge between gene banks and elite crop breeding programs," Professor Cowling said.

"In evolving gene banks, high rates of crossing and recombination will shorten linkage blocks, reduce linkage drag, and reveal valuable new alleles for economic traits. Trained genomic markers will permit rapid transfer of valuable haplotypes into commercial crop breeding."

Professor Cowling provided three examples of evolving gene banks, including *Phaseolus* (common beans) research at the International Centre for Tropical Agriculture (CIAT) in Africa, the 3000 Chickpea Genome Sequencing Initiative at ICRISAT, and his own research on canola breeding at UWA.

Other plenary speakers at the workshop included Professor John Hickey (The University of Edinburgh, UK) and Professor Ben Hayes (The University of Queensland, Australia).

Agriculture Careers Night inspires students

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Students of all ages had the opportunity to learn about career opportunities in agriculture at the annual Ag Institute of Australia Careers Night, held on 3rd April this year at the Royal Agricultural Society Showgrounds in Claremont, Western Australia.

This speed-dating style event allowed students to network over pizza with several prospective employers in the agriculture sector and related fields, including 4Farmers, AAAC(WA), Careers in Grain, CBH Group, CSBP, Department of Education, Elders, Kalyx, Landmark, Muresk Institute, Rabobank, Rimfire Resources/GradLink, and Western Dairy.

Students also had the opportunity to network with The UWA Institute of Agriculture (IOA), represented by Professor Wallace Cowling, Professor Graeme Martin, Dr Ana Manero, and Ms Laura Skates. IOA was there to provide advice to high school students interested in further study at university, and to university undergraduates interested in undertaking Masters or PhD projects.

Eighteen students from the Kelmscott Senior High School Specialist Agriculture program attended the event, accompanied by their teachers Dawn Buchanan, Garry Lane and Madison Voak. Ms Buchanan said the students provided very positive feedback about the event, and they will be visiting UWA next term to explore agricultural study opportunities after high school.

"I was pleased at how many students now say they want to continue with their agricultural studies into upper school and beyond," Dawn said. "It was a great event for motivating young minds at the very start of their career pathways."

The Careers Night was also attended by undergraduate and postgraduate students from UWA, Murdoch University, Curtin University, and ECU. Rachel Darwin, President of the UWA Students of Natural and Agricultural Sciences society, said it was a great opportunity for students.

Students enjoying pizza at the AIA Careers Night with Prof Graeme Martin.

"The highlight of the night was seeing so many driven secondary and tertiary agricultural students have two-way discussions with some of the biggest industry organisations in the agricultural sector," Rachel said.

Many students stayed behind once the event was over to continue having lively discussions about further studies and career opportunities, and the future direction of the agriculture industry including the roles of technology and agribusiness.

Professor Kadambot Siddique and Dr Yinglong Chen with Professor Pute Wu, President of NWAFU, and other colleagues from NWAFU.

Collaborations in agricultural science with China enhanced

Yinglong Chen yinglong.chen@uwa.edu.au

Invited by our Chinese collaborators, Hackett Professor Kadambot Siddique and Dr Yinglong Chen made a fruitful visit to China Agricultural University (CAU), Northwest A&F University (NWAFU), and Shenyang Agricultural University (SYAU) in May.

The visit to the three agricultural universities involved meetings with senior leaders at both university and college levels, and staff and students in agricultural research, delivering lectures, and inspections of experimental trials and research stations.

Professor Siddique was appointed as a Distinguished Visiting Professor at SYAU and NWAFU, and received the Professorships from the Presidents of both universities. At CAU, Professor Fusuo Zhang and Professor Jianbo Shen are leading a national initiative in green agriculture development. They welcomed the support from UWA to the project via strengthening bi-lateral collaborations, and interactions with other universities in the west China, such as NWAFU and Lanzhou University, in particular.

NWAFU appointed Professor Siddique to serve as the Chair of the international academy committee on its "111" project. Dr Chen has an on-going collaborative project funded by the Chinese Academy of Sciences ("100 Talent" program since 2014) and National Science Foundation of China based at the Institute of Soil and Water Conservation (also under the roof of NWAFU). To date, more than 90 joint journal articles have been published by NWAFU and UWA researchers. Recently a Special Issue in the international journal *Plant and Soil* (June 2019) was published based on joint International Symposium on Crop Roots and Rhizosphere Interaction (9–13 October, 2017, Yangling) organised by NWAFU and UWA.

UWA has extended the existing Memorandum of Agreement (MoU) with CAU and NWAFU, and a new MoU with SYAU is currently being signed. Collaborative activities between UWA and the Chinese agricultural universities are increasing in recent years, including bi-lateral visits of academic staff and research students. There are common interests in a broad area in agricultural science, from crop physiology, agronomy, genetic and breeding, animal production to land and water management, and climate changes between UWA and the above three universities.

2019 Postgraduate Showcase: Frontiers in Agriculture

L-R: Professor Graeme Martin, Madlen Kratz, Luoyang Ding, Jeanette Jensen, Roopali Bhoite, Jo Wisdom, Alicea Garcia, Toto Olita, Professor Tim Mazzarol, Tress Walmsley, and Professor Kadambot Siddique at the Postgraduate Showcase.

Laura Skates laura.skates@uwa.edu.au

Seven postgraduate students shared their research on agriculture and related areas at the 13th annual Postgraduate Showcase: Frontiers in Agriculture in June.

Professor Imelda Whelehan, Dean of the UWA Graduate Research School, gave the opening address, and The Hon Alannah MacTiernan MLC, Minister for Agriculture and Food, delivered a special address. Both praised the high quality of research being produced by UWA students, and the importance of translating this research into practical outcomes for Western Australia and beyond.

Winthrop Professor Tim Mazzarol from the UWA Institute of Agriculture and UWA Business School chaired the first session, and Ms Tress Walmsley, CEO of InterGrain and member of the IOA Industry Advisory Board, chaired the second session.

Ms Jeanette Jensen from the UWA Law School gave the first seminar on *Law and the Conflicting Interests of Stakeholders Involved with Managing Diffuse Source Pollution from Agriculture.* Supervised by a multidisciplinary team including Prof Alex Gardner (UWA Law School), Prof Carolyn Oldham (UWA School of Engineering), and Prof Helle Tegner Anker (University of Copenhagen), Jeanette's research focuses on regulatory frameworks for reducing and preventing agricultural nutrient losses to water resources in Australia.

"Through surveys and interviews with stakeholders, I was able to identify some of the key barriers to the adoption of regulatory frameworks here in Australia," Jeanette said. "The next step is to determine how to address these barriers and regulate the conflicting interests with the least friction and waste."

Ms Madlen Kratz from the UWA School of Agriculture and Environment and UWA School of Molecular Sciences spoke on *The effects of nutrition on honey bee health and colony performance during crop pollination.* Supervised by Dr Dominique Blache, Dr Rob Manning, Prof Boris Baer, Prof Kingsley Dixon, and Prof Ian Small, Madlen's research examined the effect of four common floral sources on bee health.

"We collected honey and pollen frames from beekeepers based on Jarrah, Marri, Coastal, and Canola sites, and fed bees with one of each of these sources," Madlen said. "We found that despite a borderline deficiency in an amino acid of one of the pollen sources, the bees themselves had no nutrient deficiencies. The next step is to figure out how bees are balancing their diets."

Ms Toto Olita from the UWA School of Agriculture and Environment followed with her research on *Investigating the potential of insurance as a mechanism to enhance the performance of risky conservation tenders.* Supervised by Associate Prof Steven Schilizzi, Dr Md Sayed Iftekhar, Prof Uwe Latacz-Lohmann, and Prof Peter Boxall, Toto developed an Optimal Budget Allocation model and assessed the economic performance of a conservation tender under three insurance scenarios: uninsured, insured without a subsidy, and insured with a flat-rate premium subsidy.

"We've found that, in the presence of insurance, bidders tend to submit lower bids leading to more cost-effective contract allocations." Toto said.

Mr Luoyang Ding from the UWA School of Agriculture and Environment spoke on *Gene polymorphisms for temperament in sheep*. Supervised by Dr Dominique Blache, Prof Shane Maloney, Dr Jennifer Rodger, and Prof Mengzhi Wang, Luoyang's research investigated the genetic basis of sheep temperament.

"We found a specific gene marker which is linked to the production of serotonin, resulting in sheep that were calmer in nature and dealt with stress better," Luoyang said. "These findings could help farmers improve the care of sheep and farming efficiencies."

Ms Roopali Bhoite from the UWA School of Agriculture and Environment, supervised by Prof Guijun Yan, Dr Ping Si, and Prof Kadambot Siddique, gave the first talk of the second session on *Genetic and genomic analysis of herbicide tolerance in Bread Wheat (*Triticum aestivum L.*).*

"Weeds are a major problem in cropping systems, as they suppress the growth of crop plants and reduce yields. Metribuzin is used to control broad-spectrum weeds but narrow safety margin in wheat limit its wider use," Roopali said. "This research will assist in developing herbicide tolerant wheat cultivars and integrated weed management systems."

The final two speakers of the showcase were Ms Alicea Garcia and Dr Joanne Wisdom (who recently completed her PhD), both from the UWA School of Agriculture and Environment. Alicea spoke on *Gendered subjectivities and climate change adaptation processes: How gendered dynamics of social inequality affect farmers' capacities to adapt to climate change in Ghana's Central Region*, and Jo spoke on *Modelling ecophysiological processes deterministic for fruit composition within a grapevine canopy.* Find out more about Alicea's research on page 14 and Jo's research on page 15.

The showcase ended with refreshments in the Bayliss Building foyer, where the speakers mingled with fellow students, academics, and agriculture industry representatives excited to hear the latest research.

Celebrating twenty years of canola research partnership with NPZ Lembke Germany

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

Hackett Professor Kadambot Siddique and Professor Wallace Cowling attended the 15th International Rapeseed Congress in Germany in June this year. Whilst there, they met the Managing Director of plant breeding company NPZ Lembke, Mr Dietmar Brauer, to celebrate 20 years of research collaboration between UWA and NPZ in canola genetics and breeding.

The continuous investment by NPZ Lembke in canola breeding projects at UWA over this time has resulted in more than 50 registered canola varieties and hybrid parents, which have had wide adoption/impact in Australia and internationally. At the Conference, NPZ Lembke confirmed it will continue investment in canola genetics and breeding at UWA, with another three-year project about to be signed off.

Since the early 2000s, NPZ Lembke has co-invested in several ARC Linkage projects at UWA. This helped to support the research of six PhD research students in Professor Cowling's group, and more than 20 papers in international journals have arisen from this research.

Hackett Professor Kadambot Siddique, Professor Wallace Cowling, Mrs Sabine Brauer, and Mr Dietmar Brauer (Managing Director of NPZ Lembke, Germany) celebrating 20 years of research collaboration between NPZ and UWA in canola genetics and breeding.

Visiting scientist to research sheep production

Dr Georgget Banchero Hunziker gbanchero@inia.org.uy | Professor Graeme Martin graeme.martin@uwa.edu.au

Dr Georgget Banchero Hunziker is a researcher visiting UWA for one year from the National Institute of Agricultural Research (INIA) in Uruguay. She completed her PhD at UWA in 2003, with a thesis focused on sheep production, and is now the first to take part in a new sabbatical program run by INIA.

"I'm glad to be back in sunny Perth for the year, along with my family," Dr Banchero Hunziker said.

As a visiting researcher at UWA, Dr Banchero Hunziker will be working with Professor Graeme Martin, Dr Katia Stefanova, and Dr John Milton, on two projects. The first project involves conducting a meta-analysis of existing literature on the role of lupins in sheep production in Australia, and the second involves an analysis of 22 experiments conducted in Uruguay. This research more broadly aims to combine knowledge on farming practices in both Australia and Uruguay.

"Lupins are used more in Australia than in Uruguay, so I'm interested to learn more about their effects on sheep production," Dr Banchero Hunziker said. "I'm also interested to learn from the teams here working on heat stress, as that's a big problem in Uruguay where it can be very humid."

Dr Banchero Hunziker also plans to make visits to the UWA Future Farm 2050 project at Ridgefield.

"I spent time at the UWA farm during my PhD, and I'm excited to see all of the new technologies in place there now. A strong relationship between research and farmers is really important", Dr Banchero Hunziker said. "When I return to Uruguay, I want to help push the development of sustainable farms because the INIA farm, Treinta y Tres, is part of the international network of Future Farms."

Dr Georgget Banchero Hunziker (right) is visiting UWA from the National Institute of Agricultural Research (INIA) in Uruguay to research sheep production.

Climate change research in Ghana

Alicea Garcia alicea.garcia@uwa.edu.au

During March and April this year, Alicea Garcia, a UWA School of Agriculture and Environment PhD student, spent six weeks in Ghana's Central Region to deliver educational activities on climate change adaptation to 107 men and women farmers across three rural communities.

Alicea teamed up with Professor Simon Mariwah, Dr Martin Bosompem, and Nana Afia Karikari from the University of Cape Coast (UCC) to deliver workshops in each community.

Professor Simon Mariwah delivering a story on adaptation for the future, with Nana Afia Karikari and Dr Martin Bosompem, in the Ayensudo community. Photo: Alicea Garcia.

"We wanted to offer the workshop participants an opportunity to learn about climate change, but to also educate us about their own experiences," Alicea said. "Then participants could deliberate and plan adaptation strategies for now and in the future."

As a Postgraduate Fellow for the Africa Research and Engagement Centre (AfREC) and a WA Representative for the Researchers in Agriculture for International Development (RAID) networking organisation, Alicea is passionate about the intersections between climate change, agriculture, and gender. In 2018, she conducted interviews, focus groups, and photovoice sessions with over 100 farmers in Ghana's Central Region as part of her PhD research.

"My initial research in Ghana demonstrated distinct power dynamics and gendered norms that can affect how different farmers access resources and education for adapting to climate change," Alicea said. "I was glad to have the opportunity to return to Ghana this year to explore and address this further, while also giving something back to the communities that have been involved in my research."

The workshops involved storytelling sessions and visual drawing activities, which offered a space where participants felt comfortable to share information, encourage and support one another, and confront challenges.

"The story-telling sessions were a co-learning process," Alicea said. "The facilitators shared stories with educational messages on climate change processes and adaptation, and in return, the participants shared their own stories and experiences with climate change and challenges for adaptation."

In the visual drawing activities, participants planned adaptation strategies for now and in the future, discussed and deliberated challenges and opportunities, and addressed norms that they saw as either empowering or disempowering for adaptation.

"We saw a real focus on unity and community togetherness in these activities."

Alicea presented part of her PhD research, supervised by Prof Petra Tschakert, Associate Prof Fay Rola-Rubzen, and Emeritus Prof Lynette Abbott, at the IOA Postgraduate Showcase in June this year (see page 12).

Kelmscott students inspired by agricultural science at UWA

Laura Skates laura.skates@uwa.edu.au

Year 10 Specialist Agriculture Program students from Kelmscott Senior High School visited UWA on Tuesday 18 June to learn from and meet UWA researchers and students from IOA and the UWA School of Agriculture and Environment, accompanied by Kelmscott SHS teachers Dawn Buchanan and Garry Lane.

The day visit started with a lecture from Professor Phil Vercoe on *The Future of Food and Agriculture*, followed by a lecture from Associate Professor Ken Flower, Coordinator of the Agricultural Science Major at UWA.

"The students of today and future generations have the greatest challenge to mankind ahead of them, trying to figure out innovative ways to satisfy the worlds demand for food as we head towards 2050," Professor Vercoe said. "We need the best, brightest and most passionate students studying agriculture to help meet that challenge."

Professor Ken Flower encouraged the students to consider pursuing higher education in agriculture after high school.

"There are a number of challenges we face to produce food in a more sustainable manner," Professor Flower said. "By studying agriculture, students can contribute to solving some of these issues. There are a wide variety of professional pathways in agriculture, with many new areas and opportunities opening up."

After these inspiring talks, the students took a look behind the scenes at experiments conducted in the UWA glasshouses, with tours from Dr Yinglong Chen, Dr Zakaria Solomon and PhD students Victoria Figueroa Bustos and Tanushree Halder.

Predicting fruit sugar, acid and flavour in grapes

Dr Jo Wisdom joanne.wisdom@uwa.edu.au

Dr Jo Wisdom from the UWA School of Agriculture and Environment and IOA recently completed her doctorate on the topic of ecophysiological processes within grapevines, supervised by E/ Professor John Considine, Dr Michael Considine and Associate Professor Megan Ryan at UWA. In her research, Jo used grapevines as a model for perennial crop systems.

"Grapevines have complex interactions between sources of assimilates and ultimate fruit composition, due to the nature of the growing cycle and canopy architecture," Jo said. "Grapes are a non-climacteric fruit, meaning they reach peak quality at the point of harvest. Estimating the best time for this is crucial for the production of high quality wines."

In Jo's experiment, individual grapevine shoots were treated as independent units and measures of biomass were related to fruit composition. A dataset at this scale was previously unavailable. These measures allowed for the development of a parsimonious sampling regime that more precisely estimates fruit maturity by incorporating both whole plant and within plant protocols.

Shoot measurements were assessed for their capacity to predict fruit sugar, acid, colour and flavour.

"In this Margaret River Cabernet Sauvignon management unit, average berry size of the grape bunch was the strongest predictor of maturity," Jo said. "The interaction with shoot measures such as stem leaf area and berry size and fruit maturity was significant when the whole vine vegetative biomass was incorporated as a covariate. These findings refute conventional understandings that the whole vine biomass is the best predictor of quality fruit."

Jo's experiments manipulating sources of assimilates such as leaf number, light quality and access to reserves indicated that the grapevine has a tremendous capacity to store and retranslocate carbohydrates as necessary and a potentially new pathway for the movement of these carbohydrates was demonstrated.

Following her PhD completion, Jo has recently started working with The UWA Institute of Agriculture and the Department of Primary Industries and Regional Development under the supervision of Associate Professor Michael Considine on mandarins and table grapes, in particular managing crop health and potential yield viability in new varieties and new climates.

Custom shade houses modify light quality in individual grapevine shoots.

"Perennial cropping systems efficiently utilise water and nutrients and result in lower soil erosion when compared to annual crops," Jo said. "Our market access to the Asian region for fresh fruit is unique. As such, these mainly tree based plants are a key component to future production sustainability for Western Australia."

Jo's PhD research was funded by the Australian Government Research Training Program, Evans and Tate Wines and Wine Australia.

"The students were so curious about the wheat plants we have growing inside wheelie bins in the glasshouse," Dr Chen said. "The plants are growing in slide panels made of perspex wrapped with black calico cloth, and the wheelie bin is equipped with an irrigation system to study their root system."

Dr Chen explained to the students how this innovative semi-hydroponic platform was developed, and how it is used to characterise root trait variability among a large set of genotypes. Currently, PhD student Tanushree Halder is using this system to search for some interesting root system traits and to identify the linked genes or quantitative trait locus in wheat populations.

Dr Chen and PhD student Victoria Figueroa also explained two drought experiments using deep PVC columns.

"In the first experiment, we are testing how bread wheat cultivars construct their root system in response to drought stress," Dr Chen said. "The second experiment is investigating introgressed TaMATE1B gene in durum wheat for enhanced adaption to low soil water content in aluminium-rich acidic soil."

To end the day, the students heard the perspective of a UWA student from PhD candidate Brenton Leske, who gave an overview of the agricultural science degree and life on UWA campus.

"The students were happy to ask lots of questions about the degree, like 'how many assignments do you get a semester, how many labs or tutorials per week?'," Brenton said. "We also discussed the sort of career prospects the students might expect with an agricultural science degree or with a combined degree."

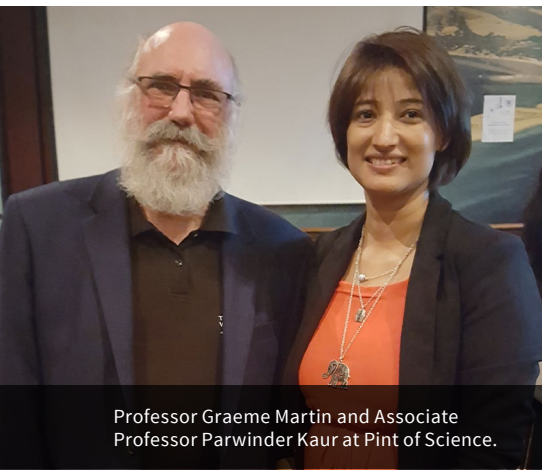
PhD student Victoria Figueroa Bustos discusses a drought experiment in the glasshouse with Kelmscott Senior High School students.

Raising a glass to agriculture at Pint of Science

Laura Skates laura.skates@uwa.edu.au

Several researchers from UWA took to the stage to share their stories with the public at the annual Pint of Science Festival in May this year. Agricultural research was highlighted at three events: Unlocking the Building Blocks of Life at Rosie O'Grady's in Northbridge, Feeding Our Future at the Brisbane hotel in Highgate, and Facts from Food to Faces at The Newport hotel in Fremantle.

Professor Graeme Martin presented on "The 3 Ps of Sex: Pheromones, Photons, and Phood", exploring the roles of odour, night length, and food consumption on the reproductive success of sheep.



Professor Graeme Martin and Associate Professor Parwinder Kaur at Pint of Science.

"We'll use the humble sheep to reveal three revolutions in thought about the way the environment affects the reproductive system," Professor Martin said. His three revolutions were 1) brain cells can divide, 2) "junk DNA" is not junk, it helps control gene expression, and 3) clean, green and ethical production is the only way forward.

Associate Professor Parwinder Kaur (UWA) shared insights from the recently launched DNA Zoo Australia initiative, which aims to translate fundamental science into ready-to-use solutions across the medical, agricultural, and conservation sectors.

"Since we started in late 2018, the DNA Zoo team has assembled and upgraded genomes for more than 65 species," she said. The assembled genomes are freely available via the DNA Zoo website at www.dnazoo.org

Dr Nicolas Taylor (UWA, IOA) shared research on how crops respond to a changing climate.

"Two big challenges for wheat crops in WA are climate change and dryland salinity," Dr Taylor said. "We're developing a wheat protein database that offers new insights into these challenges and identifies key proteins involved in yield production of wheat."

Dr Heather Bray (UWA) spoke about her research on community attitudes to science and technology in food production.

"Everyone is talking about how our food should be produced," Dr Bray said. "But with so many conflicting ideas about science and technology in agriculture, can we ever agree? The main aim of my work is to improve the kinds of conversations we have about science in food."

The audience at these three events also heard from Dr Verena Schoepf (UWA and the ARC Centre of Excellence for Coral Reef Studies), Dr Heng Chooi (UWA), Mr Frank D'Emden (Decipher Product Manager and UWA graduate), Associate Professor Julia Powles (UWA), and Mr Derek Swe (UWA).

The annual *Pint of Science Festival* is supported by volunteers and sponsors, and aims to build the Australian public's appreciation of science, and celebrate excellence in Australian science and science engagement.

Find out more at www.pintofscience.com.au

UWA scientist honoured in Scotland and China

Professor Hans Lambers
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Professor Hans Lambers from the UWA School of Biological Sciences and IOA has received two prestigious honours this year.

On 15 May, Professor Lambers was awarded the International Society of Root Research (ISRR) Dundee Medal, at an event organised by the Dundee Roots Group at the James Hutton Institute, Dundee, Scotland. The event brought together scientists interested in root research and the plant-soil interface, with several researchers presenting short talks and posters. Professor Lambers gave the 2019 ISRR Dundee Medal Lecture on Root Research on *Cluster roots and their functional equivalents: ecological and agronomic significance.*

On 14 June, Professor Lambers was awarded the title of Honorary Professor of Jiangxi Agricultural University, China. President Prof Xiaomin Zhao hosted the award ceremony, which was held preceding the International Conference on Forest Resource Cultivation and Protection, 14-16 June this year, in Nanchang Jiangxi Province, China. Professor Lambers gave the keynote presentation on Plant *mineral nutrition in biodiversity hotspots*.

Dr Glyn Bengough presents Professor Hans Lambers with the ISRR Dundee Medal for distinguished root research.

New Appointments

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

Dr Renu Saradadevi has been appointed as Research Officer on a project supported by the Council of Grain Grower Organisations (COGGO) to explore new flowering time genes in lupin, supervised by Professor Wallace Cowling.

The project builds on the work of PhD student Candy Taylor, under the supervision of Professor Cowling, who discovered a new gene in wild lupins that provides new flowering time options for growers. Dr Saradadevi will study the impact of the new gene on flowering time in lupins in the field in Western Australia over the next two years.

Dr Saradadevi completed her undergraduate and postgraduate studies in India and then worked as Agronomist in a leading Agricultural Research Company in Kerala, India before doing her PhD at the University of Western Australia. After completing her PhD, she has been working with canola pre-breeding research at UWA and NPZ Australia Pty Ltd.

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

Dr Joanne Wisdom has been appointed as a Research Associate at The UWA Institute of Agriculture in conjunction with the Department of Primary Industries and Regional Development under the supervision of Associate Professor Michael Considine.

Jo recently completed her PhD in plant ecophysiology in the UWA School of Agriculture and Environment, specialising in fruit tree crops. She is looking forward to working on managing genetic and environmental variation in citrus and table grape performance. Jo has a keen interest in food production security and the opportunities available to the horticultural industry in the whole of Western Australia.

POSTGRADUATE RESEARCH STUDENTS

STUDENT NAME	TOPIC	SCHOOL	SUPERVISOR(S)	FUNDING BODY
Robyn Anderson	Using Deep Learning for trait prediction in *Brassica napus* (Canola)	School of Biological Sciences	Prof Dave Edwards, Prof Jacqueline Batley, Dr Philipp Bayer, Prof Mohammed Bennamoun and Dr Kosala Ranathunge	RTP
Cassandria Tay Fernandez	Assessing gene presence/absence diversity within and across legume species by constructing a legume pan pangenome	School of Biological Sciences	Prof Dave Edwards, Dr Philipp Bayer, Prof Jacqueline Batley	RTP and ARC top-up
Jacob Marsh	Soybean genomic variation analysis in order to identify candidate alleles for targeted introduction into cultivar lines	School of Biological Sciences	Prof Dave Edwards, Dr Philipp Bayer, Prof Jacqui Batley, Dr Kosala Ranathunge	RTP
Monica Furaste Danilevicz	Deep learning application in plants stress and disease detection	School of Biological Sciences	Prof Dave Edwards, Prof Mohammed Bennamoun, Prof Jacqueline Batley and Dr Philipp Bayer	RTP and Forrest Research Foundation
Aldrin Cantila	Genetic characterisation of the introgressed hybrids, wild relatives, and Brassicaceae family of *Brassica napus* to Blackleg Disease Resistance	School of Biological Sciences	Prof Jacqueline Batley, Prof Dave Edwards, Prof Wallace Cowling and Dr Philipp Bayer	RTP
James Kelly	The application of portable spectroscopy for on-site wheat grain quality analysis and varietal identification	School of Molecular Sciences	Dr Nic Taylor, Dr Bjorn Bohman	RTP and GRDC Research Scholarship

VISITORS TO IOA

NAME OF VISITOR	VISITOR'S ORGANISATION AND COUNTRY	HOST DETAILS	DATES OF VISIT
Profs Shu Bie, Jiaohai Zhang & Xiaogang Wang	Hubei Academy of Agricultural Sciences, China	Dr Sheng Chen	17 June 2019
Axel de Borda (intern)	Agronomy Engineering School of Purpan, France	Prof Kadambot Siddique and Dr Jiayin Pang	June 2019 - September 2019
Leyla Sharifi (visiting research student)	University of Tehran	Profs Kadambot Siddique & Michael Blakeney	April 2019 - October 2019
Maia Uphoff (visiting student)	United States	Prof Dave Edwards	19 June - 20 August 2019
Dr Ashwani Pareek & Dr Sneh Singla-Pareek	India	Prof Kadambot Siddique	28 June – 2 July 2019
Mr Chao Wang (visiting research student)	Sichuan Agricultural University, China	Prof Kadambot Siddique	1 October 2019 – 30 September 2021
Mr Yinghao Li (visiting research student)	Shenyang Agricultural University, China	Prof Kadambot Siddique and Dr Yinglong Chen	1 October 2019 – 30 September 2020
Prof Theodora Hyuha, Gertrude Atukunda, Dr Joyce Maina	Makerere University, Uganda, and University of Nairobi, Kenya	Prof Richard Vokes	15-19 July 2019

NEW RESEARCH GRANTS JANUARY 2019 – JULY 2019

TITLE	FUNDING PERIOD	FUNDING BODY	SUPERVISORS
Building capacity to enhance farmer's capabilities to address the challenges of climate change using Climate Smart Agriculture strategies	2019-2020	Asia Pacific Network for Global Change Research (APN)	Dr Nuthan Kaushik (Amity University, New Delhi), Prof Kadambot Siddique
Comparisons of locally produced premium sulphate of potash and imported potash fertilisers on yield, quality of grain and soil biology	2019-2020	Australian Potash Ltd	Prof Kadambot Siddique, Dr Zakaria Solaiman
Ground-truthing field expression and value of new flowering time genes in lupins for Western Australia	2019-2020	COGGO	Prof Wallace Cowling
Fit-for-purpose biochar to improve efficiency in ruminants	2019-2021	CSIRO ex MLA	Prof Philip Vercoe, Dr Zorica Durmic, Miss Kobporn Vadhanabhuti
Postdoc Research Fellowship: Maximising crops and minimising weeds with smart phase farming	2018-2021	GRDC	Dr Michael Ashworth, Dr Yaseen Khalil
Phase 2: Maximising the reproductive potential of the meat sheep industry by eliminating high oestrogen clovers, more live lambs on the ground	2019-2021	MLA Donor Company	Mr Kevin Foster, A/Prof Megan Ryan, Prof Philip Vercoe,Dr Zorica Durmic, Dr Dominique Blache, Prof Graeme Martin, Dr Caitlin Wyrwoll
Rio Tinto Australia-Japan Collaboration Program Grants - Understanding the role of glutathione S- transferase: an important enzyme to protect crops and fight weeds	2019	Foundation for Australia-Japan Studies (FAJS)	Dr Roberto Busi, Dr Danica Goggin, A/ Prof Satoshi Iwakami, A/Prof Todd Gaines, Dr Eric Patterson
Exploiting the Potential of a Novel Fungal Biofertiliser	2019-2021	GRDC	Dr Khalil Kariman, Prof Zdenko Rengel, Dr Craig Scanlan
Program 3: Towards effective control of blackleg of canola: Identification of novel sources of blackleg resistance genes	2019-2022	GRDC	Prof Jacqueline Batley, Prof David Edwards, Prof Martin Barbetti
PROC-9175855 Program 2 – Towards effective control of blackleg pathogen of canola - Coordinating International Blackleg R&D	2018-2023	GRDC	A Van de Wouw, Prof Jacqueline Batley
Institutions to Support Intensification, Integrated Decision Making and Inclusiveness in Agriculture in the East Gangetic Plain	2018-2019	University of South Australia ex ACIAR	A/Prof Michael Burton
Synergising Pedodiversity and Biodiversity to Secure Soil Functionality	2019-2021	University of Sydney Ex ARC Discovery Projects	Prof Alexander McBratney, Prof Anthony O'Donnell, Prof Budiman Minasny
Improving canola heat tolerance – a coordinated multidisciplinary approach	2019 - 2023	GRDC	Dr Sheng Chen, Prof Wallace Cowling and Prof Kadambot Siddique

AWARDS AND INDUSTRY RECOGNITION

NAME	AWARD
Prof Hans Lambers	Honorary Professor from Jiangxi Agricultural University
Prof Hans Lambers	ISRR Dundee Medal for distinguished root research
Dr Deirdre Gleeson	Science Faculty 2019 Award for Excellence in Postgraduate Research Supervision
Prof Petra Tschakert	Piers Sellers Prize, from the Priestley International Centre for Climate, for a world leading contribution to solution focused climate research
Dr Philipp Bayer	Finalist for Woodside Early Career Scientist of the Year
Jin Yi Chen and Mary-Ann Lowe	Honourable mention from the Dean of Graduate Research School for outstanding PhD theses
Dr Andrew Guzzomi	Semi-finalist in the Emerging Innovation category of the 2019 WA Innovator of the Year program, for "The Weed Chipper"
Prof Kadambot Siddique	Distinguished Visiting Professor from Shenyang Agricultural University, China
Prof Kadambot Siddique	Visiting Professor from Northwest Agricultural and Forestry University, Yangling, China

UWA IOA 2019 Publications

(April – July)

Peer Reviewed Journals

Al-Saedi R, Smettem K and Siddique KHM (2019). The impact of biodegradable carbon sources on microbial clogging of vertical up-flow sand filters treating inorganic nitrogen wastewater. *Science of The Total Environment* **691**: 360-366.

Arefian M, Vessal S, Malekzadeh-Shafaroudi S, Siddique KHM and Bagheri A (2019). Comparative proteomics and gene expression analyses revealed responsive proteins and mechanisms for salt tolerance in chickpea genotypes. *BMC Plant Biology* **19**(1):300.

Bagavathiannan MV, Graham S, Ma Z, Barney JN, Coutts SR, Caicedo AL, De Clerck-Floate R, West NM, Blank L, Metcalf AL and Lacoste M (2019). Considering weed management as a social dilemma bridges individual and collective interests. *Nature Plants* **5**(4):343.

Banik BK, Durmic Z, Erskine W and Revell C (2019). Anti-methanogenic advantage of biserrula (*Biserrula pelecinus*) over subterranean clover (*Trifolium subterraneum*) from *in vitro* fermentation is maintained across growth stages and cutting treatments. *Crop and Pasture Science* **70**: 263-272.

Cao X, Wu T, Sun S, Wu C, Wang C, Jiang B, Tao J, Yao W, Hou W, Yang W, Siddique KHM and Han T (2019). Evaluation by grafting technique of changes in the contribution of root-to-shoot development and biomass production in soybean (Glycine max) cultivars released from 1929 to 2006 in China. *Crop and Pasture Science* **70**: 585-594.

Chen A, Sun J, Matthews A, Armas LE, Chen N, Hamill S, Mintoff S, tran-Nguyen LTT, Batley J and Aitken EAB (2019). Assessing variations in host resistance in *Fusarium oxysporum* f sp. *Cubense* race 4 in *Musa* species, with a focus on subtropical race 4. *Frontiers in Microbiology*. (accepted April 2019)

Chen S, Guo Y, Sirault X, Stefanova K, Saradadevi R, Turner NC, Nelson MN, Furbank RT, Siddique KHM and Cowling WA (2019). Nondestructive phenomic tools for the prediction of heat and drought tolerance at anthesis in *Brassica* species. *Plant Phenomics* doi: 10.34133/2019/3264872

Chen X, Liu H, Zhang J, Hong H, Lan H, Li H, Wang J, Liu H, Li S, Pandey MK, Zhang Z, Zhou G, Yiu J, Zhang G, Yuan J, Li X, Wens S, Meng F, Yu S, Wang X, Siddique KHM, Liu ZJ, Paterson AH, Varshney RK and Liang X (2019). Sequencing of cultivated peanut, *Arachis hypogea*, yields insights into genome evolution and oil improvement. *Molecular Plant* doi: 10.1016/j.molp.2019.03.005

Chen Y, Palta JA, Wu P and Siddique KHM (2019). Crop root systems and rhizosphere interactions. *Plant Soil* **439**: 1-5.

Che-Othman MH, Jacoby RP, Millar AH and Taylor NL (2019). Wheat mitochondrial respiration shifts from the tricarboxylic acid cycle to the GABA shunt under salt stress. *New Phytol* doi: 10.1111/nph.15713

Cowling WA, Li L, Siddique KHM, Banks RG and Kinghorn BP (2019). Modeling crop breeding for global food security during climate change. *Food and Energy Security* doi: 10.1002/fes3.157

Djanaguiraman M, Prasad PVV, Kumari J, Sehgal SK, Friebe B, Djalovic I, Chen Y, Siddique KHM and Gill BS (2019). Alien chromosome segment from *Aegilops speltoides* and *Dasypyrum villosum* increases drought tolerance in wheat via profuse and deep root system. *BMC Plant Biology* **19**: 242. doi: 10.1186/s12870-019-1833-8

Farooq M, Hussain M, Ul-Allah S and Siddique KHM (2019). Physiological and agronomic approaches for improving water-use efficiency in crop plants. *Agricultural Water Management* **219**: 95-108.

Flower KC, Hüberli D, Collins SJ, Thomas G, Ward PR and Cordingley N (2019). Progression of plant-parasitic nematodes and foliar and root diseases under no-tillage with different crop rotations. *Soil and Tillage Research* **191**:18-28.

Gaebelein R, Schiessl S, Samans B, Batley J and Mason A (2019). Inherited allelic variants and novel karyotype changes influence fertility and genome stability in *Brassica allohexaploids*. *New Phytologist* **223**: 965-978.

Gao P, Nan ZB, Christensen MJ, Barbetti MJ, Duan TY, Liu QT, Meng FJ and Huang JF (2019). Factors influencing Rust (*Melampsora apocyni*) intensity on cultivated and wild *Apocynum venetum* in Altay Prefecture, China. Phytopathology. *Phytopathology* **109**: 593-606.

He J, Jin Y, Turner NC, Chen Z, Liu HY, Wang XL, Siddique KHM and Li FM (2019). Phosphorus application increases root growth, improves daily water use during the reproductive stage, and increases grain yield in soybean subjected to water shortage. *Environmental and Experimental Botany* **166**:103816.

Houshmandfar A, Ota N, Siddique KHM and Tausz M (2019). Crop rotation options for dryland agriculture: An assessment of grain yield response in cool-season grain legumes and canola to variation in rainfall totals. *Agricultural and Forest Meteorology* **275**:277-82.

Hussain HA, Men S, Hussain S, Chen Y, Ali S, Zhang S, Zhang K, Li Y, Xu Q, Liao C and Wang L (2019). Interactive effects of drought and heat stresses on morpho-physiological attributes, yield, nutrient uptake and oxidative status in maize hybrids. *Scientific reports* **9**(1): 3890.

Islam N, Kingwell R, Xayavong V, Anderton L, Feldman D and Speijers J (2019). Broadacre farm productivity trajectories and farm characteristics. *Australasian Agribusiness Review* **26**(6).

Jiang J, Zhu S, Yuan Y, Wang Y, Zeng L, Batley J and Wang Y (2019). Transcriptomic comparison between developing seeds of yellow and black seeded *Brassica napus* reveals that genes influence seed quality. *BMC Plant Biology* **19**: 203.

Jones RA and Naidu RA (2019). Global Dimensions of Plant Virus Diseases: Current Status and Future Perspectives. *Annual Review of Virology* doi: 10.1146/annurev-virology-092818-015606

Kerbler SM, Taylor NL and Millar AH (2019). Cold sensitivity of mitochondrial ATP synthase restricts oxidative phosphorylation in Arabidopsis thaliana. *New Phytol* **221**: 1776-1788.

Kingwell R (2019). Disruptive change in the international grain trade: Implications for Australia. *Farm Policy Journal* **16**: 55-62.

Kotula L, Clode PL, Jimenez JD and Colmer TD (2019). Salinity tolerance in chickpea is associated with the ability to 'exclude' Na from leaf mesophyll cells. *Journal of Experimental Botany* doi: 10.1093/jxb/erz241

Luo X, Xu L, Wang Y, Dong J, Chen Y, Tang M, Fan L, Zhu Y and Liu L (2019). An ultra high density genetic map provides insights into genome synteny, recombination landscape and taproot skin color in radish (*Raphanus sativus* L.). *Plant Biotechnology Journal* doi: 10.1111/pbi.13195

Mazzarol T, Soutar GN and Mamouni-Limnios E (2019). Member Loyalty and WOM in co-operative and mutual enterprises. *Journal of Services Marketing* (accepted and in press).

Mousavi-Derazmahalleh M, Chang S, Thomas G, Derbyshire M, Bayer PE, Edwards D, Nelson M, Erskine W, Lopez-Ruiz FJ, Clements J and Hane JK (2019). Prediction of pathogenicity genes involved in adaptation to a lupin host in the fungal pathogens *Botrytis cinerea* and *Sclerotinia sclerotiorum* via comparative genomics. *BMC Genomics* (accepted May 2019)

Moshfeghi N, Heidari M, Asghari HR, Abadi MB, Abbott LK and Chen Y (2019). Effect of zinc foliar application and mycorrhizal inoculation on morpho-physiological traits and yield parameters of two barley cultivars. *Italian Journal of Agronomy* **14**(2): 67-77.

Munns R, Day DA, Fricke W, Watt M, Arsova B, Barkla BJ, Bose J, Byrt CS, Chen ZH, Foster KJ, Gilliham M, Henderson SW, Jenkins CLD, Kronzucker HJ, Miklavcic SJ, Plett D, Roy SJ, Shabala S, Shelden MC, Soole KL, Taylor NL, Tester M, Wege S, Wegner LH and Tyerman SD (2019). Energy costs of salt tolerance in crop plants. *New Phytol* doi: 0.1111/nph.15864

Nock CJ, Hardner CM, Montenegro JD, Termizi AAA, Hayashi S, Playford J, Edwards D and Batley J (2019). Wild origins of macadamia domestication identified through intraspecific chloroplast genome sequencing. *Frontiers in Plant Science* (accepted March 2019)

Palta JA and Turner NC (2019). Crop root system traits cannot be seen as a silver bullet delivering drought resistance. *Plant and Soil* **439**: 31–43.

Pooniya V, Palta JA, Chen Y, Delhaize E and Siddique KHM (2019). Impact of the TaMATE1B gene on above and below-ground growth of durum wheat grown on an acid and Al3+-toxic soil. *Plant Soil* doi: 10.1007/s11104-019-04231-6

Pour-Aboughadareh A, Yousefian M, Moradkhani H, Poczai P and Siddique KHM (2019). *i*PASTIC: an online toolkit to calculate plant abiotic stress indices. *Applications in Plant Sciences* **7**(7): e11278.

Prihatna C, Chen R, Barbetti MJ and Barker SJ (2019). Optimisation of regeneration parameters improves transformation efficiency of recalcitrant tomato. *Plant Cell, Tissue and Organ Culture (PCTOC)* **137**: 473-483.

Priya M, Sharma L, Singh I, Bains TS, Siddique KHM, Bindumadhava H, Nair RM and Nayyar H (2019). Securing reproductive function in mungbean grown under high temperature environment with exogenous application of proline. *Plant Physiology and Biochemistry* **140**: 136-150.

Priya M, Sharma L, Kaur R, Bindumadhava H, Nair RM, Siddique KHM and Nayyar H (2019). GABA (-aminobutyric acid), as a thermo-protectant, to improve the reproductive function of heat-stressed mungbean plants. *Scientific Reports* **9**: 7788

Qiao S, Fang Y, Wu A, Xu B, Zhang S, Deng X, Djalovic I, Siddique KHM and Chen Y (2019). Dissecting root trait variability in maize genotypes using the semi-hydroponic phenotyping platform. *Plant and Soil* **439**: 75-90.

Qin X, Feng F, Wen X, Siddique KHM and Liao Y (2019). Historical genetic responses of yield and root traits in winter wheat in the yellow-Huai-Hai River valley region of China due to modern breeding (1948–2012). *Plant and Soil* **439**: 7-18.

Qin X, Li Y, Shi C, Song D, Wen X, Liao Y and Siddique KMH (2019). The number of cultivars in varietal winter-wheat mixtures influence aboveground biomass and grain yield in North China. *Plant and Soil* **439**: 131-143.

Rana K, Atri C, Akhatar J, Kaur R, Goyal A, Singh MP, Kumar N, Sharma A, Sandhu PS, Kaur G, Barbetti MJ and Banga SS (2019). Detection of first marker trait associations for resistance against *Sclerotinia sclerotiorum* in *Brassica juncea-Erucastrum cardaminoides* introgression lines. *Frontiers in Plant Science* doi: 10.3389/fpls.2019.01015

Rehman M, Gang D, Liu Q, Chen Y, Wang B, Peng D and Liu L (2019). Ramie, a multipurpose crop: potential applications, constraints and improvement strategies. *Industrial Crops and Products* **137**: 300-7.

Ryan MH, Kaur P, Nazeri NK, Clode PL, Keeble Gagnère G, Doolette AL, Smernik RJ, Van Aken O, Nicol D, Maruyama H and Ezawa T (2019). Globular structures in roots accumulate phosphorus to extremely high concentrations following phosphorus addition. *Plant, cell & environment*. doi: 10.1111/pce.13531

Shi Q, Pang J, Yong JWH, Bai C, Pereira CG, Song Q, Wu D, Dong Q, Cheng X, Wang F, Zheng J, Liu Y and Lambers H (2019). Phosphorus-fertilisation has differential effects on leaf growth and photosynthetic capacity of *Arachis hypogaea* L. *Plant and Soil* doi: 10.1007/s11104-019-04041-w

Tabssum F, Zaman Q, Chen Y, Riaz U, Ashraf W, Aslam A, Ehsan N, Nawaz R, Aziz H and Shah SS (2019). Exogenous application of proline improved salt tolerance in rice through modulation of antioxidant activities. *Pakistan Journal of Agricultural Research* **32**(1): 140-51.

Tang H, Niu L, Wei J, Chen X and Chen Y (2019). Phosphorus limitation improved salt tolerance in maize through tissue mass density increase, osmolytes accumulation, and Na+ uptake inhibition. *Frontiers in Plant Science* doi: 10.3389/fpls.2019.00856

Turner NC (2019). Imposing and maintaining soil water deficits in drought studies in pots. *Plant and Soil* **439**: 45-55.

Tyerman SD, Munns R, Fricke W, Arsova B, Barkla BJ, Bose J, Bramley H, Byrt C, Chen Z, Colmer TD, Cuin T, Day DA, Foster KJ, Gilliham M, Henderson SW, Horie T, Jenkins CLD, Kaiser BN, Katsuhara M, Plett D, Miklavcic SJ, Roy SJ, Rubio F, Shabala S, Shelden M, Soole K, Taylor NL, Tester M, Watt M, Wege S, Wegner LH, and Wen Z (2019). Energy costs of salinity tolerance in crop plants. *New Phytol* **221**: 25-29.

Varshney RK, Thudi M, Roorkiwal M, He W, Upadhyaya HD, Yang W, Bajaj P, Cubry P, Rathore A, Jian J, Doddamani D, Khan AW, Garg V, Chitikineni A, Xu D, Gaur PM, Singh NP, Chaturvedi SK, Nadigatla GVPR, Krishnamurthy L, Dixit GP, Fikre A, Kimurto PK, Sreeman SM, Bharadwaj C, Tripathi S, Wang J, Lee S-H, Edwards D, Polavarapu KKB, Penmetsa RV, Crossa J, Nguyen HT, Siddique KHM, Colmer TD, Sutton T, Wettberg E, Vigouroux Y, Xu X and Liu X (2019). Resequencing of 429 chickpea accessions from 45 countries provides insights into genome diversity, domestication and agronomic traits. *Nature Genetics* doi: 10.1038/s41588-019-0401-3

Yuan ZQ, Fang C, Zhang R, Li FM, Javaid MM and Janssens IA (2019). Topographic influences on soil properties and aboveground biomass in lucerne-rich vegetation in a semi-arid environment. *Geoderma* **344**:137-43.

Zaid A, Mohammad F, Wani SH and Siddique KHM (2019). Salicylic acid enhances nickel stress tolerance by up-regulating antioxidant defense and glyoxalase systems in mustard plants. *Ecotoxicology and Environmental Safety* **180**: 575-587.

Zhang S, Yang C, Chen M, Chen J, Pan Y, Chen Y, Rahman SU, Fan J and Zhang Y (2019). Influence of nitrogen availability on Cd accumulation and acclimation strategy of *Populus* leaves under Cd exposure. *Ecotoxicology and environmental safety* **180**: 439-48.

Zhang Z, Yu K, Jin X, Nan Z, Wang J, Niu X, Whish JPM, Bell LW and Siddique KHM (2019) Above- and belowground dry matter partitioning of four warm-season annual crops sown on different dates in a semiarid region. *European Journal of Agronomy* **109** doi: 10.1016/j.eja.2019.125918

Zhao W, Dong H, Zahoor R, Zhou Z, Snider JL, Chen Y, Siddique KHM and Wang Y (2019). Ameliorative effects of potassium on drought-induced decreases in fiber length of cotton (*Gossypium hirsutum* L.) are associated with osmolyte dynamics during fiber development. *The Crop Journal* doi: 10.1016/j.cj.2019.03.008

Zheng K, Wei JZ, Pei JY, Cheng H, Zhang XL, Huang FQ, Li FM and Ye JS (2019). Impacts of climate change and human activities on grassland vegetation variation in the Chinese Loess Plateau. *Science of the Total Environment* **660**:236-44.

Zheng K, Ye JS, Jin BC, Zhang F, Wei JZ and Li FM (2019). Effects of agriculture, climate, and policy on NDVI change in a semi-arid river basin of the Chinese Loess Plateau. *Arid Land Research and Management* **33**(3):321-38.

Zhuang W, Chen H, Yang M, Wang J, Pandey MK, Zhang C, Chang WC, Zhang L, Zhang X, Tang R, Garg V, Wang X, Tang H, Chow CN, Wang J, Deng Y, Wang D, Khan AW, Yang Q, Cai T, Bajaj P, Wu K, Guo B, Zhang X, Li J, Liang F, Hu J, Liao B, Liu S, Chitikineni A, Yan H, Zheng Y, Shan S, Liu Q, Xie D, Wang Z, Khan SA, Ali N, Zhao C, Li X, Luo Z, Zhang S, Zhuang R, Peng Z, Wang S, Mamadou G, Zhuang Y, Zhao Z, Yu W, Xiong F, Quan W, Yuan M, Li Y, Zou H, Xia H, Zha L, Fan J, Yu J, Xie W, Yuan J, Chen K, Zhao S, Chu W, Chen Y, Sun P, Meng F, Zhuo T, Zhao Y, Li C, He G, Zhao Y, Wang C, Kavikishor PB, Pan RL, Paterson AH, Wang X, Ming R and Varshney RK (2019). The genome of cultivated peanut provides insight into legume karyotypes, polyploid evolution and crop domestication. *Nature Genetics* doi: 10.1038/s41588-019-0402-2

Zhu YH, Weiner J, Yu MX and Li FM (2019). Evolutionary agroecology: Trends in root architecture during wheat breeding. *Evolutionary applications* **12**(4):733-43.

Reports

Kingwell R, Elliott P, Cowman S, Carter C and White P (2019). The Indonesian noodle market: its importance to Australian wheat exports. DOI: 10.13140/RG.2.2.21845.06884 Available at: https://www.aegic.org.au/wp-content/uploads/2019/04/AEGIC-The-Indonesian-noodle-market_LR.pdf

White P, Carter C, Kingwell R, Cowman S and Elliott P (2019). Wheat and barley markets in Vietnam: Their strategic importance to Australia. AEGIC Industry Report, June 2019. Available at https://www.aegic.org.au/wp-content/uploads/2019/06/AEGIC-Wheat-and-barley-markets-in-Vietnam-FULL-REPORT.pdf

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