



Dr Andrew Guzzomi with the award-winning Weed Chipper.

Weed Chipper wins WA Innovator of the Year award

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A mechanical weed chipper designed by engineers and researchers from UWA and The University of Sydney has won the Rio Tinto Emerging Innovation award category at the 2019 WA Innovator of the Year awards.

The weed chipper serves as a ground-breaking alternative to the use of herbicides for weed management in large-scale cropping operations. The technology uses specifically designed rapid response 'tynes', which

behave like mechanical hoes, coupled with commercially available sensing technology to detect and chip out weeds.

The WA Innovator of the Year (IOTY) awards showcase innovative and entrepreneurial individuals, businesses and creative minds and provide support to innovators and entrepreneurs across the State.

Dr Andrew Guzzomi and Dr Carlo Peressini from UWA's School of Engineering and IOA worked closely with David Nowland Hydraulics to design the

mechanical system. The University of Sydney's Associate Professor Michael Walsh led the weed control testing in partnership with researchers from The University of Queensland and the Queensland Department of Agriculture and Fisheries.

UWA's inaugural agricultural engineer and co-leader of the IOA theme *Engineering Innovations for Food Production* Dr Guzzomi said the award was an excellent outcome for Australian grain growers and testament to farmer innovation.



Director's Column

Hackett Professor Kadambot Siddique,
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The UWA Institute of Agriculture (IOA) has had a busy and productive 2019. Several new students commenced their PhD studies at UWA in agriculture and related areas, and many successfully completed their PhD theses. During the year, we had numerous visitors from Australia and overseas on collaborative projects and new initiatives.

I recently travelled to Thailand (see page 4), China (see page 8) and Indonesia (see page 15) to present recent research at conferences and work on various collaborative research projects,

and I was delighted to be awarded the Friendship Award from the Chinese Central Government (see page 10).

I would like to congratulate Dr Andrew Guzzomi and the Weed Chipper team on their win at the WA Innovator of the Year Awards (see cover story), and PhD student Soodeh Tirnaz on winning the Mike Carroll Travelling Fellowship 2019 (see page 14) as well as the Craig Atkins Travel Award in Botany 2019 and the Underwood PhD Scholarship 2019.

Engineering Innovations for Food Production has been a hot topic this year, with engineering students working on projects at UWA Farm Ridgefield (see page 3) and agricultural engineering being a key focus of the IOA display at Dowerin Field Days this year (see page 16).

I sincerely thank Professor Robyn Owens, Deputy Vice Chancellor Research, for her support over the years and the mentorship she has given to me. I wish her all the best in her future endeavours.

My sincere thanks go to IOA's Industry Advisory Board for their dedication and support, and to the UWA Executive, Theme Leaders, UWA Farm Ridgefield committees, IOA members and staff for their hard work throughout 2019.

Season's greetings and best wishes for a happy new year to you and your family.

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"This will help us accelerate the progression of research into an implement that will soon be commercially available to growers," Dr Guzzomi said. "It is a fantastic outcome for Australian cropping and continues to demonstrate how innovative Australian farmers are."

Associate Professor Walsh, Director of Weed Research at The University of Sydney, said the initial concept was conceived during a visit to the northern

grain growing regions of NSW and Queensland in 2012 while he was working at UWA, with Western Australian growers Ray Harrington, Andrew Messina and Lance Turner.

"Progressing this research through a multidisciplinary partnership with financial support from the Grains Research and Development Corporation has allowed us to develop an alternative weed control technology that reduces our reliance on herbicides, which

is a growing problem in Australia's agricultural sector," Associate Professor Walsh said.

Dr Guzzomi presented the Weed Chipper at Southern Dirt TECHSPO in August this year. This was his second time at TECHSPO, having presented in 2017 on the 'seed flamer' native seed technology, co-developed with researchers at Kings Park Science, which won the WA Innovator of the Year emerging category in 2016.

Engineering innovations at UWA Farm Ridgefield

Professor Dilusha Silva dilusha.silva@uwa.edu.au

Over the last four months, two student teams from the UWA Department of Electrical, Electronic and Computer Engineering, have been working hard to complete engineering-design projects at the UWA Farm Ridgefield in Pingelly, supervised by Professor Dilusha Silva.



The two student teams with Professor Dilusha Silva (right) at the UWA Farm Ridgefield.

These design projects are part of UWA Institute of Agriculture's increasing push into the area of Agricultural Engineering, under the research theme *Engineering Innovations for Food Production*.

One team of students worked on a project to create a WiFi deployment at key locations on the Farm, while the other team worked on developing a camera system for monitoring vehicles entering and departing from the gate at Lamard Rd.

Professor Graeme Martin, Project Leader for the UWA Future Farm 2050 Project, said that the projects would advance the technological capabilities of UWA Farm Ridgefield, and that it was a great opportunity for students to engage with the Farm and develop solutions to real-world issues.

Both student teams completed their design and full-prototype demonstrations at the end of Semester 2 2019, and the systems are awaiting replication and deployment on the farm. A group of summer interns will be tasked with completing the deployment activities on the farm over the summer of 2019-2020.

Architecture award for Pingelly Recreation and Cultural Centre

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UWA Institute of Agriculture Honorary Research Fellow Patrick Beale has won the 2019 An Architecture of Necessity Award in Sweden, for his design of The Pingelly Recreation and Cultural Centre (PRACC). Mr Beale also led the design of the new farmhouse on UWA Farm Ridgefield, in Pingelly.

The judges commended the PRACC design for "its informal lightness in creating a low-threshold meeting place based on local culture, built in local materials and with the complex of

different spaces held together by an open verandah, which forms a welcoming 'breezeway', tempering the hot climate."

The PRACC contains a function centre and bar, sports hall and change rooms, a gym and storage spaces overlooking established sports fields. Iredale Pedersen Hook Architects and Advance Timber Concepts Studio built the PRACC.

For more information, please visit www.virserumskonsthall.com/archnec-2019-winners



UWA Institute of Agriculture Honorary Research Fellow Patrick Beale (left) accepts the 2019 An Architecture of Necessity Award.

Biodiversity Mainstreaming across Agricultural Sectors for Asia and the Pacific

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

The Regional Consultative Meeting on Biodiversity Mainstreaming across Agriculture Sectors of Asia and the Pacific was held in Bangkok on 17-19 July 2019, organised by the Food and Agricultural Organization (FAO) of the United Nations. Hackett Professor Kadambot Siddique delivered an invited talk at the conference, entitled “The potential of future smart food for diversified and sustainable food system”.

Biodiversity for food and agriculture is the biological diversity that is needed to sustain food and agriculture productions. It includes all the components of biological diversity that makes up the agricultural ecosystems. These components include the variety and variability of animals, plants and microorganisms. This biodiversity, which exists within species, among species, and among ecosystems, is necessary to sustain the key functions, the structure and the process of agricultural ecosystems.

More than 100 scientists, policy makers, government and non-government representatives, farmers and FAO personnel attended the three-day event.

The majority of participants were from the Asia and the Pacific Region. Among the group of 17 countries identified as the most biodiversity-rich in the world, seven of them are located in the Region, namely Australia, China, India, Indonesia, Malaysia, Philippines, and Papua New Guinea.

The Regional Consultative Meeting focussed on the gaps and needs in the Region, and policies and incentives for mainstreaming biodiversity-friendly agricultural practices in sustainable food systems. The topics included sustainable fisheries and aquaculture, low carbon agriculture, forest landscape restoration, agro-biodiversity, sustainable rice production, conservation agriculture,



Professor Kadambot Siddique with Dr Kundhavi Kadiresan (Assistant Director General and Regional Representative FAO Regional Office for Asia and the Pacific) at the conference.

agroforestry, polycultures, seed banks, pollinators, climate adaptation and mitigation, value chain business models, value addition and certification schemes, migration and urbanization, gender equity and poverty alleviation, rural youth employments and green jobs, as well as food security, nutrition and health diets. The event also shared examples of strategies to value traditional knowledge of Indigenous peoples and local communities.

For more information, go to www.fao.org/asiapacific/perspectives/climate-change/biodiversity-across-agriculture-regional-meeting/en/

Reducing greenhouse gas emissions with Black Soldier Fly frass

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Silvestre Langa, a Master's student within UWA's School of Agriculture and Environment, is investigating the impact of soil amendment with Black Soldier Fly frass on greenhouse gas emissions, supervised by Dr Sasha Jenkins and Dr Deirdre Gleeson.

An increasing global population and associated wealth have led to increased food demand to feed a growing population.

This has led to mass production of livestock and poultry with concurrent generation of large quantities of animal waste manure. Amending soil with manure has many benefits including increased nutrient supply, enhanced soil structure and improved crop yield. However, there are increasing concerns in terms of the environmental risks associated with applying manure to land, particularly with respect to greenhouse gas (GHG) emissions.

Black Soldier Fly (BSF), *Hermetia illucens*, farming is an emerging technology that converts manure into protein for animal feed. This technology produces high quality larvae for the fish, pet and livestock industry while at the same time decreasing the volume of waste from poultry farming in half. Fly casting, or frass, is the major waste by-product of BSF farming but has the additional potential to be used as a soil amendment.

The challenge of mitigating abiotic stress for crop improvement

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UWA and ICRISAT, the International Crops Research Institute for the Semi-Arid Tropics, joined forces in early October 2019 to hold a workshop on abiotic stress tolerance in crops.

The workshop was motivated by the rising demand for food in the face of population and income growth, along with increasing climate volatility. By 2050, agricultural production must increase by an estimated 50% without greatly increasing water usage or expanding the total land area dedicated to agriculture. These challenges require new ways of breeding with greater flexibility, reduced breeding cycle time, and more efficient use of genetic variation leading to improved tolerance of abiotic stress in crops.

Her Excellency Ms Dantu Charandasi, Consul General of India for Western Australia and the Northern Territory, officially opened the UWA-ICRISAT workshop. The workshop aims were then outlined by co-hosts Professor Wallace Cowling, IOA Associate Director, and Professor Rajeev Varshney, Adjunct

Professor at UWA and Research Program Director for Genetic Gains at ICRISAT, India. Keynote speakers included ICRISAT researchers Dr Manish Roorkiwal and Ms Anu Chitikineni, Prof Harsh Nayyar (Panjab University), Prof Hon-Ming Lam (Chinese University of Hong Kong), Prof Wolfram Weckwerth (University of Vienna), and Prof Lee Hickey (University of Queensland). UWA contributors included Professor Harvey Millar, Professor Dave Edwards, Dr Janine Croser, Dr Jiayin Pang and Professor Wallace Cowling.

Professor Varshney outlined new genomic methods to enhance breeding of ICRISAT mandate crops such as chickpea, and Dr Pang highlighted the results of chickpea research at UWA. Professor Hon-Ming Lam described methods to develop climate

resilient soybean, and Professor Edwards outlined the role of bioinformatics and gene editing. Professor Hickey (cereals) and Dr Janine Croser (legumes) discussed speed breeding and Professor Cowling presented an overview of rapid breeding methods. Changes in metabolites of plants during stress and the impact of climate change were the topics of Professors Weckwerth, Nayyar and Millar. The role of genome sequencing and genomic selection was introduced by Dr Roorkiwal and Ms Chitikineni.

The many UWA students and staff who attended the workshop had many questions for the guest speakers. The key guests and hosts met at the end of the workshop to consider writing a critical review of research in this area.



Participants in the UWA-ICRISAT workshop, held at UWA on 1-2 October 2019.

However, the impact of amending soil with frass on GHG emissions is poorly understood and this could limit its potential as a soil amendment, due to strict regulation of its use.

Mr Langa's project aimed to assess GHG emissions following frass applications to soil compared to soil amended with untreated poultry manure. A microcosm experiment was established and run for 2 weeks to examine the impact of amendments on nitrous oxide (N₂O), carbon dioxide (CO₂) and methane (CH₄) emissions. Results showed that soil amended with frass cumulatively emitted less N₂O and CO₂ compared to soil amended with poultry manure. This could be attributed to the decreased

amount of mineral nitrogen and labile organic carbon in the soil amended with frass. There were no significant difference in CH₄ emissions between soil amendments.

These findings suggest that using BSF technology to treat poultry manure prior to land application has the potential to lower GHG to the atmosphere. The outcome of this investigation highlights that BSF frass could be utilized as a high-quality fertilizer whilst mitigating GHG emissions. This will likely result in more sustainable agricultural practices and a decreased carbon footprint.

Mr Langa's research is supported by a UWA Agribusiness Connect Regional

Research Project Scholarship, Australia awards Scholarship, The Western Australian Broiler Growers' Association (WABGA), and Future Green Solutions.



Mr Silvestre Langa is researching the impact of soil amendment with Black Soldier Fly frass on greenhouse gas emissions.

Study sheds light on wheat tolerance to subsoil acidity and aluminium toxicity

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Researchers from The University of Western Australia (UWA), CSIRO and visiting fellows from Indian Agricultural Research Institute (IARI) and Huazhong Agricultural University, China, are working together to find innovative approaches to improve crop tolerance to subsoil acidity with high aluminium (Al³⁺) content.

Soil acidity is a significant factor limiting grain yield in the WA grain belt with 72% of topsoils and 45% of subsurface soils being acidic. More than 50 million ha of surface soil and 23 million ha of subsoils in Australia are acidic. Subsoil acidity due to high Al³⁺ content inhibits root growth and thus water and nutrient uptake. Liming is commonly used to ameliorate surface soil acidity; however, amelioration of subsoil acidity is particularly difficult.

Tetraploid durum wheat (AABB, *Triticum turgidum*) has high grain protein content and market prices, but only occupies ~8% of the worldwide wheat cropping area. In Australia, soil acidity is a key constraint preventing the growth and production of durum wheat, which is more sensitive to acid soils with a high Al³⁺ concentration resulting in poor shoot and root growth

and thus limited production. By contrast, bread wheat (AABBDD, *Triticum aestivum*) exhibits a large variation in shoot and root growth on acid soils with toxic Al³⁺. Early studies by Dr Emmanuel Delhaize's team from CSIRO found that the major gene *TaALMT1* located on chromosome 4D and minor genes such as *TaMATE1B* in bread wheat contributed to its tolerance to acid soils with high Al³⁺ concentration through encoding transport proteins that mediate the efflux of malate and citrate, respectively. The genes *TaALMT1* (malate gene) and *TaMATE1B* (citrate gene) for Al³⁺ tolerance from bread wheat have then introgressed into the durum wheat cultivar Jandaroi, which has been considered as an option for improving the tolerance of durum wheat to acid soils given the absence of genes for Al³⁺ tolerance in durum germplasm.

Preliminary studies in hydroponics and small pots found that Jandaroi-*TaMATE1B* showed greater tolerance to an Al³⁺-toxic acid soil than Jandaroi-*TaALMT1* which differs from bread wheat where *TaALMT1* is the more effective gene.

A glasshouse experiment using rhizoboxes packed with an acid soil layer collected from a field site in Merredin (31°64' S, 117°24' E), Western Australia was conducted at UWA by visiting Australian Endeavour Fellow Dr Vijay Pooniya from IARI in 2018. Restricted root growth and proliferation in durum wheat cv. Jandaroi grown in soils with subsoil acidity with high Al³⁺ content was liberated by introgression of an Al³⁺-tolerant allele of *TaMATE1B* into cv. Jandaroi. Root growth and proliferation in Jandaroi-*TaMATE1B* extended to 1.0 m, regardless of the significant decline in soil pH and increased Al³⁺ content, indicating an improvement in subsoil acidity and Al³⁺ tolerance.

Following this, IOA visiting research fellows Dr Lijun Liu (Huazhong Agricultural University, China) and Dr Chunming Bai (Liaoning Academy of Agricultural Science, China) are investigating whether the improvements in root growth and proliferation in the introgressed Jandaroi-*TaMATE1B* can increase shoot biomass and grain yields more than the Jandaroi-null (without *TaMATE1B* gene) in deep columns packed with the Merredin acid soil with high Al³⁺ content. Field trials are also in progress to validate the advantages of the introgressed lines for growth and grain yield under the acid soil with high Al³⁺ content in Merredin.



IOA visiting research fellows Dr Lijun Liu (right) and Dr Chunming Bai (left) inspecting plant performance of durum wheat cv. Jandaroi with or without Al³⁺-tolerant *TaMATE1B* gene in response to acid soil with high Al³⁺ content under varying soil water supply.

Mobile geospatial platform promoting climate-smart landscapes in Fiji and Tonga

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An international team including researchers from UWA are co-developing a geospatial platform to improve landscape management in Fiji and Tonga under changing climates.

Dr Bryan Boruff from UWA's School of Agriculture and Environment said that the platform will support effective, integrated and adaptive management of landscapes to enhance livelihoods and moderate climate impacts.

"Landscapes comprise multiple interconnected ecosystems that generate services to support people's livelihoods," Dr Boruff said. "Ecosystem provisioning in Pacific Island Countries is impacted by exposure to climatic shocks and a range of stressors, so effective landscape management is crucial."

The UWA team including Drs Eloise Biggs, John Duncan, Natasha Pauli and Bryan Boruff are focusing their expertise in Geography on landscape level solutions for data generation and analysis,

through integration of currently available multiscale data (e.g. plot level data, land cover maps), new data generation approaches (e.g. field data collection, remote sensing), and multiple sectoral data streams (e.g. agricultural, weather, socioeconomic data).

"We designed the platform to integrate data from multiple sectors and sources," Dr Duncan said. "Once we have finished our iterative field testing, the platform will be ready to be deployed and used by landscape managers and the communities in Fiji and Tonga."

The platform is being co-developed with stakeholders from landscapes across Fiji and Tonga, including the communities of Nawaqarua, Etatoko, and Koronubu Vunibaka (Fiji), and Kala'au, Talasiu,



Dr John Duncan testing the data integration prototype with the Ministry of Forestry in Fiji. Photo: Dr Natasha Pauli.

and Afa (Tonga), with support from the Pacific Community (SPC), the NGO community, and government ministries in Fiji and Tonga.

This research is funded by the Australian Centre for International Agricultural Research (ACIAR; ASEM/2016/101).

A research journey to UWA

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Ms Tanushree Halder, a PhD candidate in UWA's School of Agriculture and Environment and IOA, has recently been awarded a "Dean's Award" from Sher-e-Bangla Agricultural University of Bangladesh for her outstanding results (3.96/4.00) in her Bachelor of Science in Agriculture.

Prior to coming to UWA, Ms Halder completed her MS degree in Genetics and Plant Breeding from Sher-e-Bangla Agricultural University of Bangladesh under the supervision of Professor Md. Sharidur Rashid Bhuiyan. Ms Halder also completed her MSc in Applied Biotechnology from the University of Westminster (UK), where she developed research skills in the

production of antibacterial biopolymers by working with Professor Ipsita Roy, and was awarded a Distinction.



Ms Tanushree Halder working on her PhD project in the UWA glasshouses.

Ms Halder commenced her PhD at UWA earlier this year, under the supervision of Hackett Professor Kadambot Siddique, Dr Yinglong Chen, Dr Helen Liu and Professor Guijun Yan. Her research focuses on wheat root genetics, building on her prior experience with plant biotechnology, genetics and breeding of diverse crop species including mustard, peanut and chilli.

"I am excited to study wheat for my PhD, due to its global importance in reducing hunger," Ms Halder said. "My aim is to identify genes associated with important root-traits, to help contribute to the development of stress tolerant, high-yielding wheat varieties."

Ms Halder's PhD research is supported by a Research Training Program (RTP) scholarship.

Northwest Agriculture & Forestry University (NWAUFU) and UWA Partnership

Hackett Professor Kadambot Siddique
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In October, Hackett Professor Kadambot Siddique delivered a keynote presentation on *Climate change adaptation of dryland agriculture in Australia and China* at the Yangling 2019 International Agri-Science Forum.

During the visit, Professor Siddique had discussions on ongoing and future collaboration between UWA and Northwest Agriculture and Forestry University (NWAUFU) with Professor Li Xingwang (Chairman of the University), Professor Pute Wu (President of the University), Vice Presidents and Deans, researchers and postgraduate students.

Future activities discussed include joint publications in high quality journals, exchange of PhD students, thematic workshops and establishing a joint laboratory on “water for food production and environmental sustainability”.

Professor Siddique also visited apple farmers in the Yan An area in the northwest to gain firsthand knowledge on issues faced by the farmers and their sustainable production technologies.



Hackett Professor Kadambot Siddique visited apple farmers in the Yan An area of China.

Farmer-friendly performance indicators for sheep production

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In October this year, PhD student Andy Jones from the University of Bristol, UK, visited UWA to meet with researchers in the Sustainable Grazing Systems theme of The UWA Institute of Agriculture.

Mr Jones’s PhD research aims to develop farmer-friendly performance indicators for sheep production systems, supervised by Professor Michael Lee and Dr Taro Takahashi. He is working at Rothamsted Research based at the North Wyke Farm Platform in Devon, which is a member of the Worldwide Universities Network (WUN) Global Farm Platform.

Mr Jones has recently been awarded a Stapledon Travel Fellowship to visit Professor Paul Kenyon at Massey

University in New Zealand, also a member of the Global Farm Platform. In both Australia and New Zealand, Mr Jones is looking for exposure to a diverse range of farming systems so he can compare system-wide performances of sheep production in different systems globally.

The Global Farm Platform is an international network of model farms, which also includes the UWA Future Farm 2050 project based on UWA Farm Ridgfield, Pingelly. Since 2012, the ‘Global Farm Platform’ has been supported by the WUN. For more information on the Global Farm Platform, please visit www.globalfarmplatform.org



L-R: Professor Graeme Martin, Ms Amriana Hifizah, Dr Bidhyut Banik, Dr Zoey Durmic, Mr Andy Jones, Mr Shamshad Ul Hassan, Mr Suyog Subedi, and Mr Shoaib Khan.

Genetic regulation of flowering time in narrow-leafed lupins

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Miss Candy Taylor from the UWA School of Agriculture and Environment and IOA recently completed her doctorate in which she studied the genetic regulation of flowering time in narrow-leafed lupins under the supervision of Professor Wallace Cowling (IOA), Dr Matthew Nelson (CSIRO and IOA), Dr Lars Kamphuis (CSIRO, Curtin University, IOA) and Dr Jens Berger (CSIRO).

“Narrow-leafed lupins are the most important legume break crop in Western Australia and are currently the second most widely grown pulse crop in Australia after chickpea,” Candy said. “Historically, most elite domestic narrow-leafed lupins cultivars released within Australia have been early flowering. This makes them a good fit for traditional sowing windows in warm, short-season environments – for example in the north of the Western Australia (WA) wheatbelt.”

The goal of Candy’s research was to find genes that could be used to diversify flowering times and provide more options for farmers.

“Varieties that flower slightly later than current elite varieties may have better adaption to and yield higher within milder, long-season environments in the south of the WA wheatbelt and in the eastern states,” Candy said. “Additionally, they may provide more flexibility for early sowing in northern parts of the WA wheatbelt.”

Candy’s main experiments involved using genetic and genomic approaches to closely study the two main flowering time genes (*Ku* and *efl*) used within the Australian breeding program. Additionally, she sought to identify other novel genomic regions associated with the trait in domestic cultivars from Australia and Europe, plus wild germplasm originating from the Mediterranean region.



Candy Taylor recently completed her PhD on the genetic regulation of flowering time in narrow-leafed lupins.

“Comparing the gene sequences for *Ku* within a diverse set of about 40 narrow-leafed lupins enabled us to identify two other new variations of this gene,” Candy said.

“One of these variants corresponds to the *Jul* gene used in northern European breeding, which is functionally equivalent to *Ku* in that it creates very early flowering. Meanwhile, the second variant, which was observed in an Israeli wild type, creates a novel early-mid flowering time (roughly two weeks later than *Ku*), which is potentially quite valuable for breeding.”

A second important outcome from Candy’s research was identifying the genomic location of the *efl* gene. This work was done in collaboration with Dr Federico Ribalta and Dr Janine Croser (IOA), plus Dr Gagan Garg and Prof Karam Singh (CSIRO).

“The *efl* gene creates a unique mid-late season flowering time, but has only ever been incorporated into two now-obsolete Australian cultivars released

during the 1980’s. Tracing the genomic position of *efl* means genetic markers can now be designed to make it easier for breeders to use *efl* in the breeding programme,” Candy said.

As a newly appointed research officer within IOA, Candy is now in the process of further validating the molecular identity of *efl*. “Identifying the exact gene sequence for *efl* has the potential to create new opportunities to find other valuable variations of this gene, as was done with *Ku*, and understand more about how flowering time is regulated in legume crops”.

Candy’s PhD research was funded by the Grains Research and Development Corporation (GRDC), Australia, through project DAW00238.

Friendship Award for IOA Director

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IOA Director Hackett Professor Kadambot Siddique was awarded a prestigious Friendship Award at a ceremony in Beijing in October this year. The Friendship Award is the highest award established by the Chinese Central Government to recognise foreign experts who have made outstanding contributions to China's modernisation and reform.

Professor Siddique provided leadership in initiating and maintaining collaborations between UWA and several academic and research institutions in China, including Lanzhou University, Gansu Agricultural University, China Agricultural University, Northwest Agriculture and Forestry University, Zhejiang University, Huazhong Agricultural University, Guangzhou University, Nanjing Agricultural University, Chinese Academy of Agricultural Sciences, and Chinese Academy of Sciences.

IOA continues to have a strong relationship with Chinese Universities and research institutions, with recent visits to UWA by agricultural scientists from Jiangsu Academy of Agricultural Science, Yangzhou University, Lanzhou University, and Institute of Scientific and Technical Information of Gansu.

UWA and the Lanzhou partners have agreed to establish scientific research collaborations in the areas of agricultural science and technology (S&T) development policies, deep learning in



Hackett Professor Kadambot Siddique receives Friendship Award from the Chinese Central Government.

the evaluation of agriculture S&T policies implementation, and research on the policy development of S&T innovation. More recently, IOA has signed the Tripartite Agreement of International Cooperation Base of Cooperation Strategies Analysis of Countries Along the Belt and Road, along with IAA and ISTIG.

Climate adaptation strategies in Fiji

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UWA geographers Dr Natasha Pauli and Dr Bryan Boruff were part of a global research team which hosted a workshop on local climate adaptation strategies in the town of Ba, Fiji, in September this year.



Participants at the local climate adaptation strategies workshop in Fiji.

More than fifty community members from the Fijian villages of Votua, Navala and Nautoto attended the workshop, which disseminated the results of four years of research into local climate adaptation strategies, funded by the Asia-Pacific Network for Global Change Research. The global research team also included researchers from the University of Auckland (including project leader Professor Andreas Neef), University of Sydney and the University of the South Pacific.

Dr Pauli said that the workshop participants were interested to hear how the research team had combined scientific methods with local knowledge to identify adaptation strategies and map resources important for livelihoods.

“Our collaborators at the University of the South Pacific in Fiji did a fantastic job in organising the research and the workshops, so it was a truly interdisciplinary effort,”

Kim Chance Fellowship research focuses on technology for food quality

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A research project to develop portable infrared scanning technology to assess food quality has won a University of Western Australia PhD student a fellowship from the State Government to further his research.

University of Western Australia PhD student Jorge Silva is the recipient of the Buy West East Best Kim Chance Fellowship Award for his research project to develop low-cost spectroscopic infrared scanning technology, to assess food quality. The Kim Chance Fellowship Award was established in recognition of Mr Chance's devotion to agriculture, and for his tireless and selfless efforts to improve the lot of farmers, the wider agricultural sector and regional communities.

The \$10,000 fellowship, funded through the Department of Primary Industries and

Regional Development, provides financial assistance to a PhD student whose research can advance agriculture in WA.

The award will support Jorge, a student in the Department of Electrical, Electronic and Computer Engineering at UWA, to travel to the University of Georgia, Athens, USA to gain hands on experience in food quality and safety assessment using infrared scanning technology.

Agriculture and Food Minister Alannah MacTiernan congratulated Jorge on receiving the fellowship and said she was keen to see his innovative technology used within our food industry here in WA.

"WA has some of the best produce in the world which is recognised for quality and freshness," Ms MacTiernan said.

"Buying local food drives the economic growth of WA and also supports our growers, producers, businesses and their communities."

Jorge will have the opportunity to work in a world-leading laboratory, and build US research connections with WA.

This innovative project aims to develop a portable, low-cost spectroscopy system for assessing the quality of food across the supply chain.

The technology is targeted at farmers, food processors, and retailers to support existing food safety practices, so only the best quality food reaches the consumer.

"This project will improve the quality control measures used to detect faecal contamination in poultry and surface contamination on vegetable crops, which will greatly benefit the WA food industry," Jorge said.

"This will also positively impact the health and wellbeing of consumers, by avoiding the consumption of contaminated food."

Ms MacTiernan said our food industry already had in place strict guidelines and practices to ensure the safety and quality of our food.

"However, the development of this infrared technology to make information on quality easier and quicker to access, will benefit both the consumer and the broader agriculture and food industry," she said.

Preliminary trials will be undertaken with poultry within the next two years, with the aim of having the technology to market within five years.



UWA PhD student Jorge Silva, recipient of the Buy West Eat Best Kim Chance Fellowship Award, with Agriculture and Food Minister Alannah MacTiernan and Buy West Eat Best program manager Melissa Worthington.

Dr Pauli said. "Observing the interactions at the dissemination workshops in Suva and Ba, it was clear that the respectful and thoughtful approach that our collaborators have to the regular interactions with the communities as well as their commitment to the research contributed enormously to the success of the workshops and the research project in general."

"The communities involved have been very generous with their time and sharing very knowledge, and attendees at the various workshops were very attentive and interested in the work discussed and in the interactions with the research team," Dr Pauli added.

The research team will continue to work in the Ba river delta under a project on climate-smart landscapes and livelihoods funded by the Australian Centre for International Agricultural Research (ACIAR).

UWA global innovation linkage (GIL) project participants met in Perth

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The second Project Meeting/Workshop of the Global Innovation Linkage Project (GIL53853) was held at Trinity College, Perth from 1st to 6th of October 2019. The workshop was organized by UWA and InterGrain Pty Ltd, hosting global partners from Institute of Genetics and Developmental Biology, Chinese Academy of Sciences (IGDB-CAS), Institute of Crop Sciences, Chinese Academy of Agricultural Sciences (ICS-CAAS), Inner Mongolia Academy of Agricultural & Animal Husbandry Sciences (IMAAHS), Gansu Academy of Agricultural Sciences (GAAS) and Beijing Genomics Institute (BGI). The workshop served as a platform for networking, exchanging ideas, identifying project priorities, and planning future milestones.

The Australian government (Department of Industry, Innovation and Science/ AusIndustry) is investing \$995,724 in this four-year project, with an additional \$1,552,081 contributed by global partners. The project aims to improve wheat production, in response to rising global demand for food in a changing and variable climate. The expected outcomes of this project will include improved breeding efficiency, novel breeding lines for generating high-yield cultivars adapted to target environments, and commercialisation of the developed technologies including a fast population development service, and an international DNA chip genotyping service.

Following the workshop, the delegates visited InterGrain Headquarters at Bibra Lake and several field sites including field trials at Dandaragan, Corrigin and Dudinin. The Inner Mongolia Academy of Agricultural and Animal Husbandry Sciences will host the third Project Meeting/Workshop at Hulunbeier, Inner Mongolia in 2021.



Dandaragan field visit.

UWA Alumnus wins GRDC Western Region Emerging Leader Award

Natalie Lee natalie.lee@grdc.com.au

Kirsty Smith, a young agronomist committed to improving the productivity and profitability of farm businesses, was honoured with a prestigious Grains Research and Development Corporation (GRDC) Western Region Emerging Leader Award at the Newdegate Machinery Field Days this year.

Ms Smith grew up on a farm at Dumbleyung in WA's Upper Great Southern region, and is currently employed by Landmark, based in Albany. She received her Bachelor of Science in Agriculture from UWA in 2010, and went on to achieve a Diploma of Agronomy from the Wodonga Institute of TAFE.

"I plan to continue working with growers as an agronomist/adviser and am also interested in agri-politics and technology

developments in agriculture, which will drive future gains in our industry," she said. "I am also passionate about promoting and maintaining agriculture's 'social licence to operate'."

Ms Smith will use the financial scholarship component of her GRDC Emerging Leader Award to travel overseas and investigate whether the commodity legume soybeans could be a suitable fit in WA farming systems.



Dr Rashmi Yadav met with the research groups of Professors Jacqueline Batley and David Edwards during her visit to IOA. L-R: Yueqi Zhang, Nur Shuhadah Mohd Saad, Soodeh Tirnaz, Professor Jacqueline Batley, Dr Philipp Bayer, Dr Rashmi Yadav, Professor Dave Edwards, Cassandra Tay Fernandez, Callum Corkill, Tingting Wu, Dimity Smith, Robyn Anderson, Xuesong Wang, and Monica Furaste Danilevicz.

Collaborations with India on Brassica crops

Laura Skates laura.skates@uwa.edu.au

Dr Rashmi Yadav, Principal Scientist in the Division of Germplasm Evaluation at the Indian Council of Agricultural Research (ICAR)-NBPGR, New Delhi, India, visited IOA in November this year to develop collaborations with IOA.

Dr Yadav has been involved in the characterization and evaluation of germplasm of oilseed crops such as Brassicas, linseed, and sesame for agronomic attributes, biotic and abiotic stresses, and nutrient use efficiency.

While at UWA, she gave a special seminar on Characterisation, evaluation and utilisation of rapeseed-mustard

crops in India. She shared that over 9,527 accessions of rapeseed-mustard germplasm have been characterized and evaluated at NBPGR, New Delhi. As a result, several promising genotypes have been identified in different species of oilseed Brassicas for desirable traits, such as high oil content, and Alternaria & white rust tolerance.

Dr Yadav also met with Professors Jacqueline Batley, David Edwards, Wallace Cowling, Martin Barbetti, Kadambot Siddique to discuss Brassica research and potential opportunities for collaboration between India and UWA.

“Limited profitable legume options consistently comes up as an issue for WA grain growers,” she said. “We do have legumes available to us, but generally they are not widely adopted due to issues such as soil type, market saturation, variable profitability and limited weed control options.”

“Given the large variation in current soybean genetics, I would like to know if it is possible to breed and develop a variety of soybean that could persist in our winters.”



Kirsty Smith of Landmark (left), holds her GRDC Western Region Emerging Leader Award with GRDC Western Region Panel member Gemma Walker, who presented the award at the Newdegate Machinery Field Days. Photo by GRDC.

Scientists gather at UWA for International Cereal Symposium

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Dr Nicolas Taylor and Dr Joanna Melonek, from the UWA School of Molecular Sciences and UWA Institute of Agriculture, hosted an International Cereal Mini-Symposium at UWA on 9 September 2019. Over fifty academics and students attended the event which was attended by, and included presentations from three invited speakers.

Professor Nils Stein from the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) Gatersleben spoke on the *albostrians*-type leaf variegation in barley.



L-R: Nils Stein, Alison Bentley and Martin Mascher enjoying the sun at UWA.

“Albostrians is a long known leaf-variegation mutant in barley that shows a non-perfect penetrance of the variegation phenotype,” Professor Stein said. “We isolated the underlying gene by map-based cloning and mutant analysis, and a single CCT domain protein was identified as the causal gene.”

Dr Martin Mascher, also from the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) Gatersleben, spoke on *Barley diversity now and 6000 years ago*. Using archaeogenetics and genebank genomics, Dr Mascher studied the genetic relationship between extant populations and 6000-year old barley grains found in a cave in the Judean Desert.

“Our findings showed the close affinity of ancient samples to extant landraces from the Southern Levant and Egypt,” Professor Mascher said. “This suggests that barley landraces grown in present day Israel have not experienced major lineage turnover over the past six millennia, although there is evidence for gene flow between cultivated and sympatric wild populations.”

Dr Alison Bentley from The John Bingham Laboratory, National Institute of Agricultural Botany (NIAB), Cambridge, spoke on the wheat pre-breeding program developed by NIAB in 2007. This program aimed to deliver systematically developed and validated resources for wheat improvement, and bridge the gap between fundamental discoveries in model plant species and commercial breeding.

“The material generated in the program encompasses sets of defined near-isogenic lines, advanced lines from CIMMYT synthetics, novel synthetics plus over 10,000 winter and spring derivatives,” Bentley said. “We have also created two MAGIC populations: a 1,000-line population sampling eight elite varieties and a 600-line population sampling variation from sixteen varieties released between 1930 and 2010.”

Dr Nicolas Taylor and Dr Joanna Melonek said it was a great opportunity to form new collaborations and build on cereals research at UWA.

2019 Mike Carroll travelling fellowship winners

Professor Jacqueline Batley
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The winners of the 2019 Mike Carroll travelling fellowship were announced this October as PhD candidates Soodeh Tirnaz from UWA’s School of Biological Sciences and IOA, and Suyog Subedi from UWA’s School of Agriculture and Environment.

Ms Tirnaz used the award to visit two research groups in Japan. She is identifying and characterizing 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 resistance genes in canola against blackleg disease, one of the most devastating diseases of canola in Australia and worldwide.

With support from the Mike Carroll travelling fellowship, Ms Tirnaz spent two weeks in Dr Ryo Fujimoto’s lab in Kobe University to learn new laboratory techniques for studying histone modification in plant pathogen interactions. During her stay she attended a conference in Kindai University in Nara, visited a plant diseases research group led by Dr Kentaro Yoshida, and presented her PhD research in the internal seminar series in Kobe University.

Future Smart Food for Bali, Indonesia

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

In early October, Professor Kadambot Siddique (as a partner investigator) joined a group of researchers from Udayana University, Bali Indonesia to explore diversity of underutilised and neglected crops (Future Smart Food) in Karangasem Regency, Bali. This is a three-year project led by Associate Professor Ida Ayu Astarini (Vice Director for Planning, Academic and Student Affairs Postgraduate Program). Professor Astarini did her Masters and PhD from UWA. UWA and Udayana University has signed a MoU last year.



A farmer proudly showing freshly harvested yam tubers from his farm.

Bali is a popular tourist destination around the world. Rapid development of the tourism industry has resulted in high rate of land conversion. Karangasem is one of nine regencies in Bali where rural areas are still reasonably natural and peoples are utilising native plants for their food sources and medicinal value. Recently a number of natural habitats around these rural areas have been converted into villas and restaurants, causing rapid reduction on biodiversity. Therefore there is an urgent need to study the diversity of local plants as food and medicinal purpose and its conservation to avoid extinction of critical biodiversity. The aim of this study is to explore and characterize underutilized and neglected plants in Karangasem, to analyze their bioactive profiles for health benefits and to study their propagation method for long term preservation and ecological sustainability.

The long term goal is to maintain diversity of the underutilized and neglected plants in the agriculture ecosystem.

The project team visited a number of farmers in Karangasem and discussed constraints and potential opportunities for future smart crops in the region. The data collected so far is being analysed by the project team.

While at Udayana University, Professor Siddique met with Rector (Vice Chancellor) Prof. Dr. dr. A.A. Raka Sudewi, Director Postgraduate Program Prof Dr dr. I Puta Gede Adiatmika, Dean Faculty of Agriculture Prof. I Nyoman Rai and discussed various aspects of the collaboration. Professor Siddique also delivered several lectures to postgraduate students and early career researchers.

Later she spent two weeks in Dr Shohei Takuno's lab in The Graduate University for Advanced Studies in Hayama to learn data analysis techniques for the laboratory techniques that she learnt in Kobe University. Ms Tirnaz said that the visits were a great opportunity to broaden the spectrum of her PhD, build a professional network and create potential collaborations for her future career.

Mr Subedi plans to use the support of the Mike Carroll travelling fellowship to travel to Copenhagen and work under Associate Professor Andrew Williams at the Department of Parasitology and Aquatic Pathobiology in 2020.



Soodeh Tirnaz (right) with Helen Carroll.

High School Agriculture students visit UWA

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Seventy Year 11 students and their teachers from six Agriculture Colleges visited UWA on 28th October as part of a tour of Perth Universities, organised by Alysia Kepert (Principal Consultant-Agricultural Education, Department of Education, and a former UWA graduate).

Professor Graeme Martin and Associate Professor Louise Barton coordinated the visit to UWA, aiming to demonstrate to students the importance of agriculture.

“The focus of the visit is to stimulate interest in agricultural science and emphasise both its regional and global importance,” Associate Professor Barton said. “We are keen to encourage these

students to develop their passion for Agriculture and pursue further studies.”

Professor Graeme Martin led a short walking tour of UWA, including the historic Whitfield Court and Winthrop Hall, and outlined the need for Agricultural Scientists and the role of the UWA Future Farm project. Associate Professor Ken Flower discussed the role of technology in agricultural decision-making, and Professor Willie Erskine outlined the importance of plant breeding for food production while challenging students to identify ‘5 seeds in 5 minutes’. Professor Erskine and Mr Rob Creasy also took the students on a tour of UWA’s glasshouse facilities, and discussed some of the experiments currently underway.

The six colleges included in the tour were Western Australia College of Agriculture (WACOA) Cunderdin, WACOA Denmark, WACOA Harvey, WACOA Morawa, WACOA Narrogin, and Edmund Rice College.



Seventy ATAR Agriculture students visited UWA in October.

UWA links with growers, industry and community at Dowerin Field Days

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The UWA Institute of Agriculture (IOA) participated in the Dowerin Field Days (August 28-29) again this year, with a display showcasing the latest research in agriculture at UWA.

PhD students Wesley Moss (UWA School of Engineering) and Mohammad Moinul Islam (UWA School of Agriculture and Environment) joined IOA Communications Officer Laura Skates and UWA Future Farm 2050 Project Officer Sandra Mata at the IOA display.

Engineering innovations for food production was a major theme of the IOA display this year. Visitors to the IOA booth could view a video of the Weed Chipper in action (see page 1), see the results of the Seed Flamer technology for native seeds, and learn about the various

ways UWA scientists are using drones in their research.

Mr Moss said attending the Dowerin Field Days was a great opportunity to network with WA producers and industry, and to share his PhD research on machinery improvements for subclover and medic seed harvesting.

“I was blown away by all of the awesome machinery on display at Dowerin,” Mr Moss said. “It was an amazing experience to hear about the huge range of work going on in agriculture and to share some of the exciting research happening at UWA.”

Visitors to the IOA display took home UWA tote bags with the latest IOA newsletters, a pen, recipe cards, and stickers. They could also take part in a guessing game to match the correct

name to a variety of seeds and pulses, and go in the draw to receive a Passion for Pulses cookbook. Congratulations to Carla Tassone of Narrogin, who was drawn as the lucky winner!



The IOA team at Dowerin Field Days. L-R: PhD students Mohammad Moinul Islam and Wesley Moss, IOA Communicators Officer Laura Skates, and Future Farm 2050 Project Officer Sandra Mata.

Vale Roger F. Barroga

25 September 1964 – 23 September 2019

Hackett Professor Kadambot Siddique

Former UWA PhD student Mr Roger F. Barroga has passed away, aged 54. He leaves behind his son Gio and wife Karen, who received her PhD from UWA in 2010 under the supervision of Professor David Pannell.

Mr Barroga was Head of PhilRice's Information Systems Division, Deputy Director for Administrative Services and Finance, and managed PhilRice's FutureRice program in the Philippines. FutureRice is a 5-hectare farm in Nueva Ecija that served as a testbed for applications of agriculture 4.0 and an

integration of technologies for future farm scenarios, inspired by UWA's Future Farm.

Mr Barroga submitted his PhD thesis this year, titled "Cyber communities and agricultural development in the Philippines: Creating new social and economic opportunities for farmers", under

the supervision of Professor Matthew Tonts and Hackett Professor Kadambot Siddique. He was an excellent student with great communication and social skills.

He received his BS and MS Development Communication in 1986 and 1991, respectively, from the University of the Philippines Los Banos. In 2018, he was also one of the recipients of the Civil Service Commission's Pagasa Awards from the President of the Philippines.

When speaking of his father, Mr Barroga's son Gio said that he was very passionate about helping farmers through the use of innovative technologies that he often showcased at the FutureRice Farm.

"Despite obstacles and challenges thrown his way, he faced them head on and became a victor, which, ultimately, shaped the way PhilRice is right now," Gio said.

"He was an outstanding public servant whom, without fail, did his best to carry the name of PhilRice and bring honour to the institute through his initiatives, hard work and perseverance that led to multiple awards for himself, the institute and the people he mentored."



Roger F. Barroga (middle) with wife Karen and son Gio during the awards ceremony in Malacanang Palace

AWARDS AND INDUSTRY RECOGNITION

NAME	AWARD
Hackett Professor Kadambot Siddique	Friendship Award
Jorge Silva	Buy West East Best Kim Chance Fellowship Award
Dr Muhammad Khalid Bashir (UWA Alumnus)	Best Young Research Scholar Award 2017
Kirsty Smith (UWA Alumnus)	Grains Research and Development Corporation (GRDC) Western Region Emerging Leader Award
Patrick Beale	2019 An Architecture of Necessity Award
Dr Andrew Guzzomi	2019 UWA nominee for the Australian Awards for University Teaching (AAUT) for Outstanding Contributions to Student Learning
Dr Andrew Guzzomi and the Weed Chipper team	Rio Tinto Emerging Innovation award category at the 2019 WA Innovator of the Year awards
Omar Anwar	Western Australian Government Science Industry PhD Fellowship, partnering with Elixir Honey
Katarina Doughty	Western Australian Government Science Industry PhD Fellowship, partnering with Aquatic Life Industries
Gereltsetseg Enkhbat	Western Australian Government Science Industry PhD Fellowship, partnering with PGW Seeds
Soodeh Tirnaz	Mike Carroll Travelling Fellowships 2019
Soodeh Tirnaz	Craig Atkins Travel Award in Botany 2019
Soodeh Tirnaz	Underwood PhD Scholarship 2019

VISITORS TO IOA

NAME OF VISITOR	VISITOR'S ORGANISATION AND COUNTRY	HOST DETAILS	DATES OF VISIT
Profs Lihong Xue, Linzhang Yang	Jiangsu Academy of Agricultural Science, Nanjing, China	Dr Yinglong Chen	17– 19 Aug 2019
Profs Feng Zhang, Jiansheng Ye, Assoc/Prof Min Wei and Dr Wei Xue	Institute of Arid Agroecology, Lanzhou University, Lanzhou, China	Dr Yinglong Chen	23-29 Aug 2019
Profs Yan Changjie, Guo Wenshan, Yang Zefeng, Lu Dalei, Li Tao, Zhu Min	Yangzhou University, Yangzhou, China	Dr Yinglong Chen	25 Sept 2019
Delegation from ICRISAT	India	Prof Kadambot Siddique	1-4 Oct 2019
Dr Piotr Trebecki	Agriculture Victoria, Grains Innovation Park, Horsham, Victoria	Adj Prof Roger Jones	3 Oct 2019
Ms Fatima Bibi	PMAS Arid Agriculture University, Pakistan	Prof Jacqui Batley	Oct 2019-Apr 2020
Dr Manny Delhaize	CSIRO Canberra	Dr Yinglong Chen, Prof Kadambot Siddique	7 Oct 2019
Prof Meilan Li	Shanxi Agricultural University, Taigu, China	Dr Yinglong Chen	8 Oct 2019 – 7 Apr 2020
Prof Shaoting Shi, Assoc/Profs Xiaoning Zhang, Lubing Wei, Xiaoling Cheng, Jidong Bao, and Dr Wenjing Yang	Institute of Scientific and Technical Information of Gansu, Lanzhou, China	Prof Kadambot Siddique	15-18 Oct 2019
Dr Rashmi Yadav	ICAR-National Bureau of Plant Genetics Resources, India	Prof Kadambot Siddique	11-15 Nov 2019
Profs Yuchun Ai and Hongying Huan, and A/Profs Changfu Wu, Feng Zhang and Jidong Wang	Jiangsu Academy of Agricultural Science, Nanjing, China	Dr Yinglong Chen, Prof Kadambot Siddique	13– 16 Nov 2019
Delegation from East Africa		Prof Wallace Cowling	18-19 Nov 2019
Dr Angela Van de Wouw	University of Melbourne	Prof Jacqui Batley	11-13 Dec 2019
Dr Susie Sprague	CSIRO	Prof Jacqui Batley	11-13 Dec 2019

POSTGRADUATE RESEARCH STUDENTS

STUDENT NAME	TOPIC	SCHOOL	SUPERVISOR(S)	FUNDING BODY
Junrey C. Amas	Identification of Resistance Genes against Blackleg disease of Canola	Biological Sciences	Jacqui Batley; Wallace Cowling; Dave Edwards; Philipp Bayer	UIFS - UWA International Fee Scholarship; University Postgraduate Award (International Students)
Tingting Wu	Identification novel resistance gene against Blackleg disease in Brassica napus cultivar and wild species	Biological Sciences	Jacqui Batley; Wallace Cowling; Dave Edwards; Philipp Bayer	CSC-UWA Scholarship
Linh Ton	CRISPR/Cas9 platform for controlling viral pathogens in Chilli plants	Biological Sciences	Jacqui Batley; Dave Edwards; Philipp Bayer	UIFS - UWA International Fee Scholarship; University Postgraduate Award (International Students)

UWA IOA 2019 Publications

Peer Reviewed Journals

Adams IP, Fribourg C, Fox A, Boonham N, Jones RAC (2019). Complete coding sequence of Andean Potato Mottle Virus from a 40-year-old sample from Peru. *Microbiology Resource Announcements* **8**(40): e00871-19.

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Ahmed W, Xia Y, Zhang H, Li R, Bai G, Siddique KHM and Guo P (2019). Identification of conserved and novel miRNAs responsive to heat stress in flowering Chinese cabbage using high-throughput sequencing. *Scientific Reports* **9**: 14922.

Anderson R, Edwards D, Batley J and Bayer PE (2019). Genome-wide association studies in plants. *eLS*.

Barua P, You MP, Bayliss KL, Lanoiselet V and Barbetti MJ (2019). Disinfestation of diverse fungal pathogen spores on inert contaminated materials. *European Journal of Plant Pathology* **155**: 135-150.

Bayer PE, Golicz A, Tirnaz S, Chan KCC, Edwards D and Batley J (2019). Variation in abundance of predicted resistance genes in the Brassica oleracea pangenome. *Plant Biotechnology Journal* **17**(4): 789-800.

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- Fan JW, Solaiman ZM, Mickan BS, Du YL, Li FM and Abbott LK (2019). Sequential defoliation impacts on colonisation of roots of *Lolium rigidum* by arbuscular mycorrhizal fungi were primarily determined by root responses. *Biology and Fertility of Soils* 1-12.
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- Farahani S, Maleki M, Mehrabi R, Kanouni H, Scheben A, Batley J and Talebi R (2019). Whole genome diversity, population structure, and linkage disequilibrium analysis of chickpea (*Cicer arietinum* L.) genotypes using genome wide DArTseq-based SNP markers. *Genes* **10**: 676.
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UPCOMING EVENTS

Australasian Agricultural and Resource Economics Society (AARES) 64th annual conference

11-14 February 2020
Perth, Western Australia
www.aares2020.org

Australian Grasslands Association Inc Symposium

6-9 July 2020
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