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THE UNIVERSITY OF WESTERN AUSTRALIA

Farmers' markets have the potential to be a significant contributor to small scale farm businesses.

Farmers' markets fuel local economy

The Albany Farmers' Market is a hive of activity as locals and visitors make a bee-line to purchase fresh produce from the region every Saturday morning.

UWA is working with the Western Australian Farmers' Market Association (WAFMA) to develop new information on the importance of farmers' markets for regional development.

UWA Master of Urban and Regional Planning student Ms Helena Shojaei, who was awarded the Agribusiness Connect Honours/Masters Regional Research Scholarship is investigating the reasons why food producers choose to sell at farmers' markets.

She is investigating the economic and social drivers and constraints for participation in farmers' markets, the potential multiplier effects for regional agribusinesses, and will survey farmers' market consumers.

"Farmers' markets have the potential to be a significant contributor to small scale farm businesses. They are an excellent outlet for fresh produce sales, networking opportunities and market testing. I'm very passionate about the relationship between the sustainability of the agricultural sector and urban and regional planning," Helena said.

WAFMA Chairperson Ms Jenny Payet said the Association is keen to support this research as there has been very little academic research on farmers' markets in WA, despite its rapid growth over the last five years.

"The research will seek answers to whether the potential economic and social opportunities of farmers' markets are actually afforded to participants and will serve as useful evidence for decision making around farmers markets, for example with local government," Ms Payet said.

The research is supervised by Dr Natasha Pauli and Professor Fiona Haslam McKenzie from the UWA School of Agriculture and Environment and Centre for Regional Development.

Director's column

Hackett Professor Kadambot Siddique AM, CitWA, FTSE, FAIA, FNAAS, FISPP
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Recruitment is underway for a Professor, or Professor of Practice of Dryland Farming Systems. We are seeking an outstanding academic to expand farming systems research and teaching across UWA. The incumbent will provide leadership and develop research capacity nationally and internationally including developing interdisciplinary links in farming systems. The position will bring significant strength to the University and Western Australia. For further information, visit jobs.uwa.edu.au.

The Worldwide Universities Network (WUN) conference is being hosted by UWA in May. The program, Responding to Climate Change Workshop, Water for sustainable food, renewable energy and biodiverse ecosystems under a changing climate opens with a visit to UWA Farm Ridgefield, and we look forward to welcoming members of WUN's Global Farm Platform to the farm.

Five students from UWA studying grains related research at the doctoral, masters and undergraduate level received scholarships from the Australian Grains Institute's Capacity Building Project, Careers in Grain to attend the GRDC Grains Research Update, Perth. UWA was well represented with several academics and students presenting their research (see page 9).

At the event, GRDC Chairman Mr John Woods announced that the GRDC had increased its investment into WA soils and crop nutrition research in response to grassroots feedback. UWA is leading a project investigating soil nitrogen, phosphorus and potassium supply to crops, with a focus on providing

a better understanding of fertiliser requirements. The SoilsWest project brings together partners from DPIRD, Murdoch University, The University of Adelaide and industry.

UWA is also involved in a soil sampling project funded by the GRDC. Led by CSIRO with input from DPIRD and industry, the research will improve soil sample collection protocols to boost the accuracy of determining what soil nutrients are available to plants.

Each year the Industry Advisory Board steers a half day forum on a topical agricultural theme. I am pleased to announce this year's industry forum topic Disruptive technologies: a new revolution in agriculture. Scheduled for Thursday, 26 July at the University Club of WA the forum will no doubt stimulate some interesting discussions.

Another key event to mark in your calendar is the annual Postgraduate Showcase: Frontiers in Agriculture on Wednesday, 6 June in the Bayliss Lecture Theatre at UWA. The Postgraduate Showcase brings together some of UWA's best PhD students at an advanced stage of their research. It highlights relevant research and progress being made in the area of agriculture, food science and related natural resource management at UWA.

Finally, we bid farewell to Ms Brenda Dagnall, Personal Assistant to IOA Director. Brenda has spent the last 12 months supporting the IOA team and we wish her all the best in her future endeavours.

MLP Field Day held at UWA Farm Ridgefield

Professor Graeme Martin
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UWA Farm Ridgefield hosted the Merino Lifetime Productivity Project (MLP) field day on 28 March 2018. The project is a $13m investigation over ten years that involves five sites across Australia, with UWA Farm Ridgefield, Pingelly being the WA site.

The project is testing whether the performance of sires selected at very young ages is carried into adult performance. It is funded by Australian Wool Innovation and managed through Murdoch University and the Australian Merino Sire Evaluation Association (AMSEA).

The WA Field Day attracted about 75 producers who were brought up to date on progress for the first two years. Thirty rams from across Australia, including some used as 'link sires' to help describe differences between sites and years, are being compared at Ridgefield. For each ram, semen is used to inseminate 90 ewes.

The producers examined the sheep born in 2016 and 2017, and were given copies of the data for a wide range of measures including weight, fleece weight, visual components, staple length and strength, fibre diameter, CV fibre diameter, muscle and fat, fetus number, breech wrinkle, and worm egg count.

AWI's Program Manager Genetics and Animal Welfare Advocacy, Geoff Lindon addressed the crowd and geneticist Dr Bronwyn Clarke explained the way the data were processed. AMSEA Executive Officer Ben Swain presented some preliminary data on reproductive performance, with fascinating observations on syndicate mating that were derived from DNA analysis of parentage.

The Merino Lifetime Productivity Project field day was held at UWA Farm Ridgefield.

Sheep course guides students' career path

Justin Hardy, DPIRD, Robert Kelly, Kojonup, Jamie Nykiel, Murdoch, Clair Payne, Murdoch, Jie Deng, UWA and John Crabb, Livestock Shipping Services at a field visit in Kojonup.

UWA Animal Science student Jie Deng completed an intensive one-week training program in January, aimed at encouraging tertiary students to pursue a career in the agrifood sector.

The Sheep Meat Value Chain training program focuses on sheep meat production and markets and was designed by the Department of Primary Industries and Regional Development's Sheep Industry Business Innovation (SIBI) project.

The five-day residential program in Katanning and Albany was presented to 20 participants, the majority of whom were currently studying or working in the Western Australian sheep industry.

Department senior development officer Justin Hardy said the course, now in its second year, was a balance between the theoretical concepts of agrifood supply chain management and an intensive 'walk-the-chain' process incorporating field visits and presentations from key industry practitioners and leaders.

Participants experienced all levels of the chain from sheep production (genetics, breeding, and nutrition), feedlots, trading, processing, value-adding, retail and live export.

"This enabled the participants to consider a wide range of supply chain issues for both domestic and export of sheep meat including consumer demand and preference, markets, production systems, animal welfare, quality assurance, traceability, pricing, trust, business structures and product development," Mr Hardy said.

"By successfully attracting graduating professionals, the course achieved its aim to influence their early career choices towards the sheep industry."

As part of their training, the students worked in groups towards a competitive presentation on the last day which looked at what the current state of the chain was and what the future state should aim to be via a sustainable business plan.

Some named participants of the GIL project at the Shenzhen meeting: (from left) Professor Yong Wang of Gansu Academy of Agricultural Sciences (GAAS), Dr Daniel Mullan, Lead Breeder of InterGrain Pty Ltd, Dr Shancen Zhao, Beijing Genomics Institute (BGI), Professor Zhanyuan Lu, Inner Mongolia Academy of Agricultural and Animal Husbandry Sciences (IMAAAHS), Professor Guijun Yan, The University of Western Australia, Professor Aimin Zhang, Chinese Academy of Sciences (CAS), Professor Yong Zhang, Chinese Academy of Agricultural Sciences (CAAS) and Professor Haibo Wang, Hebei Academy of Agricultural and Forestry Sciences (HAAFS)

UWA global innovation linkage project participants meet in China

Professor Guijun Yan
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UWA has been awarded the Global Innovation Linkage (GIL) project to improve wheat production from the Australian federal government's Department of Industry, Innovation and Science (AusIndustry). The project includes support from seven global partners including InterGrain, Chinese Academy Sciences (CAS), Chinese Academy of Agricultural Sciences (CAAS), Inner Mongolia Academy of Agricultural and Animal Husbandry Sciences (IMAAAHS), Gansu Academy of Agricultural Sciences (GAAS), Hebei Academy of Agricultural and Forestry Sciences (HAAFS) and Beijing Genomics Institute (BGI).

The inaugural GIL meeting was held in Shenzhen, China on 20-21 November 2017 where twenty scientists from participating organisations mapped out the basic pathway of this four year project. Representing UWA were Professors Guijun Yan, Jacqueline Batley, David Edwards and Dr Helen Liu.

The aim of the project is to improve wheat production in response to rising global demand, food security, and environmental changes. Wheat is one of the most important crops in the world and breeding for higher yield, better quality and more adaptability has been a constant aim of wheat improvement.

Professor Guijun Yan from the School of Agriculture and Environment and IOA said although wheat yield has increased over time as a direct result of the new varieties produced by breeders, there is still substantial room to improve.

He said the project combines the strengths of resources and technologies in Australia and China to address the industry's demand for significantly improved wheat yield, through germplasm exchange, high-throughput molecular marker development, bioinformatics technologies, and multi-environment trial analyses.

"The expected outcomes include improved breeding efficiency, novel plant material for generating high-yield cultivars adapted to target environments, and commercialisation of the developed technologies including a population development service and DNA marker genotyping service internationally.

"The research outcomes will be broadly available to the breeding and genetic research community and lead to high impact scientific publications," Professor Yan said.

With improved wheat cultivars, this project will not only meet the demands of Australian breeding industry, but also contribute to the world demand for food security and sustainability through enhanced production.

Beefing up the West with Genetics

How genetics and selection can be used across the beef supply chain to increase productivity and profitability was the topic of the inaugural Alan Sevier Memorial Lecture, held on Thursday, 15 March 2018.

The lecture, *Beefing up the West with Genetics*, was attended by approximately 60 people and delivered by beef cattle geneticist Dr David Johnston from the University of New England.

Dr Johnston is currently leading a large MLA-funded breeding project in Queensland and the Northern Territory to develop enhanced genetic evaluation of female reproduction traits, through the implementation of new genomic selection techniques in tropically-adapted beef.

Focusing on northern systems, the presentation covered recent advances in beef cattle genetics including the evolving field of DNA and genomics, new genetic evaluation systems and the development of novel traits.

"Advances in beef cattle genetics have the potential to change beef breeding," Dr Johnston said.

"They can enable seedstock breeders to significantly increase rates of genetic progress and importantly at the commercial sector, allow producers to better match genetics to their production systems and markets."

Dr David Johnston and Prof Philip Vercoe at the inaguaral Alan Sevier Memorial Lecture.

The Alan Sevier Memorial Lecture is in memory of Dr Alan Sevier, an animal scientist with the Department of Food and Agriculture WA who passed away in 2013.

This memorial lecture has been established with the funds set aside in his will which he bequeathed to UWA.

Widespread strain-specific virus resistance protects the potato crop from disease


Potato virus Y hypersensitive reaction

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Due to the recent appearance of its highly virulent strains, *Potato virus Y* (PVY) currently poses a major threat to potato production in developed and developing countries worldwide. This is because it greatly decreases yield and disfigures potato tubers.

Adjunct Professor Roger Jones and Mr Stuart Vincent established the PVY resistance of 39 potato cultivars currently grown in Australia by infecting them with Australian PVY isolates and studying the resulting phenotypic reactions. They used potato cultivars originally bred in Australasia, Europe and North America. These cultivars were released over a 117 year period with the oldest released in 1893.

Two types of strain-specific hypersensitive (HR) phenotypes elicited by HR genes Ny or putative Nd were found in 23 and 34 cultivars respectively, protecting these cultivars from spread of PVY ordinary (gene Ny) and D (gene Nd) strains. Resistance genes Ny and putative Nd were present in cultivars released between 1939 and 2010, or 1893 and 2010, respectively, occurring in cultivars from all three world regions.

Only two potato cultivars, both European, carried extreme resistance gene Ry so they never became infected. Also, only three cultivars, one Australasian and two European, always developed susceptible phenotypes so lacked genes Ry, Ny and putative Nd.

The findings, published recently in the prestigious international research journal *Plant Disease*, have important implications concerning breeding new PVY-resistant potato cultivars, especially for countries lacking healthy seed potato stocks, or where subsistence farmers cannot afford them. An alternative to using gene Ry is incorporating as many strain-specific PVY resistance genes as possible.

This research was funded by the Australian Produce Commission Potato Producers' Committee, UWA and DPIRD.

Gene discovery for flood tolerance in rice

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The silvery sheen along submerged portions of rice leaves is the gas layer. Credit: Ole Pedersen

Floods can devastate crop production. Even rice, a wetland crop which grows in shallow water, frequently suffers damage or loss in flood-prone regions. Inundation by water impedes shoot gas exchange, which slows carbon dioxide entry restricting photosynthesis during the day, and slows oxygen uptake resulting in tissue hypoxia during the night.

A mechanism to enhance plant gas exchange with water is hydrophobic leaf surfaces that retain a thin layer of gas. The surface of rice leaves is hydrophobic and the leaves initially retain gas films when submerged. This gas layer, however, diminishes with time under water.

Together with colleagues from Nagoya University, Professor Tim Colmer and Adjunct Professor Ole Pedersen from the UWA School of Agriculture and Environment and IOA have identified the gene responsible for determining rice leaf gas film retention. The team demonstrated that the *Leaf Gas Film 1 (LGF1)* gene determines leaf wax composition, epicuticular wax platelet abundance, surface hydrophobicity, and thus gas film retention and underwater photosynthesis for leaves of rice.

Professor Colmer said this leaf trait is essential for survival of rice even in paddy field conditions during the wet season and contributes to submergence tolerance.

"If any variation in the gene or its expression exists and is associated with leaf gas film retention, this could be a future breeding target for further improvement of rice submergence tolerance and yield stability of crops in flood-prone areas," Professor Colmer said.

The discovery was only possible because of the multidisciplinary collaboration which combined plant physiology at UWA and U Copenhagen with the expertise in genetics and molecular biology of Professor Motoyuki Ashikari and his PhD student Yusuke Kurokawa who is the first author of the paper in *New Phytologist*. Several other Japanese scientists made important contributions in specific components of the study, for example leaf wax chemical analyses, which is reflected in the co-authorships.

Grains research to boost crop production and reduce

Significant investment into WA soils and crop nutrition is set to increase profit from nitrogen, phosphorus and potassium fertiliser inputs in modern WA cropping systems.

Involving extensive collaboration between government, universities and grains industry stakeholders, three major new projects worth a total of $14.6 million were announced by GRDC chairman John Woods at the GRDC Grains Research Update, Perth held in February (see page 9).

The three projects will focus on efficient soil nutrient supply leading to more efficient fertiliser use, soil amelioration, and developing new soil sampling methods.

UWA is leading the biggest of the three projects to improve WA grower profitability through more efficient nutrient use. Worth a total of $9.7 million across five years, the project will be led by UWA through the SoilsWest alliance with DPIRD, and will involve partners from Murdoch University, University of Adelaide, and other grains industry stakeholders.

Mr Woods said the project will improve knowledge about nitrogen cycling and availability, soil phosphorus and potassium storage, sources of nutrient

Increased surveillance for viral pathogens in Australia's northern regions needed

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The arrival of damaging new crop virus diseases via viruiferous insect vectors blown in wind currents from Indonesia, East Timor and Papua New Guinea poses a biosecurity threat to Australian crops.

Solomon prepares FTA cards containing sample extracts from East Timor crop plants preserved on them.

PhD student Solomon Maina from the UWA School of Agriculture and Environment and IOA tested the hypothesis that economically important viral crop pathogens are arriving in northern Australia via wind-borne insect virus vectors, blown across the sea by prevailing wind currents.

Solomon obtained multiple complete virus genomes from plant samples collected across northern Australia and from the same crops in East Timor and Papua New Guinea. He used these virus genomes to investigate the genetic connectivity between isolates of the same viruses from the three countries. His main focus was viruses of cucurbits and sweet potato as these both produced many virus genomes, but several additional genomes were also obtained other crops.

Evidence of genetic connectivity was obtained between genomes of *Zucchini yellow mosaic virus* from cucurbit plants from Kununurra and East Timor, *Papaya ringspot virus* from cucurbits from across northern Australia and Papua New Guinea, and *Sweet potato feathery mottle virus* from sweet potato from East Timor and Kununurra.

PhD Supervisor Adjunct Professor Roger Jones from IOA said Solomon's findings emphasise the need to increase surveillance for viral pathogens in Australia's northern regions.

"Rapid action to eradicate new virus incursions is needed to avoid the establishment of damaging viruses," Adjunct Professor Roger Jones said.

"In addition, the widespread occurrence of virus in Australian sweet potato emphasises the need for enhanced virus testing in the Australian national sweet potato pathogen-tested stock program."

Solomon's research is funded by the CRC for Plant Biosecurity, and supervised by Adjunct Professor Roger Jones, Professor Martin Barbetti, Dr Mingpei You, and Dr Owain Edwards, CSIRO.

fertiliser costs

supply and responsiveness of crops. "Quantifying soil nitrogen supply is crucial for grain growers, given it affects the rate of nitrogen fertiliser required and is one of the few in-season management strategies available to improve returns on all variable and fixed costs."

UWA is also involved in the soil sampling project, worth a total of $1.4 million over three years. Led by CSIRO, with input from DPIRD and industry partners, new ways to collect soil samples will be investigated.

"Current soil sample collection protocols were developed in an earlier era when farming practices differed significantly from those in current use," Mr Woods said. "New ways to collect soil samples are needed by WA growers to boost the accuracy of determining what soil nutrients are available to plants and help them make better, more cost-effective fertiliser decisions – ultimately increasing their profitability," he said.

DPRID Managing Director of Research, Development and Innovation Dr Mark Sweetingham said collaboration between research agencies was an important feature of the projects, bringing together GRDC, DPIRD, UWA, Curtin University, Murdoch University, CSIRO, the University of South Australia, CSBP and Summit Fertiliser.

Marie-Louise Carroll, Candy Taylor, Mary-Anne Lowe and Helen Carroll at the Mike Carroll Travelling Fellowship Award Ceremony.

Mike Carroll Fellowship

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Two PhD candidates Ms Mary-Anne Lowe and Ms Candy Taylor were awarded the 2016 and 2017 Mike Carroll Travelling Fellowship respectively at a ceremony at UWA's Faculty of Science in February.

The Mike Carroll Travelling Fellowship was established by donations from family, friends, colleagues and benefactors, as a memorial to the late Dr Mike Carroll, who was associated with the WA Department of Agriculture for over 20 years, serving as Director-General from 1990 to 1994.

The students, both from Bunbury, shared details of their travels and how it has improved their research studies to a small group of Carroll family, friends and associates.

Under the supervision of Dr Matthias Leopold, Dr Gavan McGrath, Dr Falko Mathes, Dr Meng Heng Loke and Professor Daniel Murphy, Mary-Anne is investigating soil water repellence.

The Mike Carroll Travelling Fellowship enabled her to participate in the European Geosciences Union General Assembly 2017 in Vienna, Austria where she gave an oral presentation and presented a poster.

She then travelled to the Technical University of Munich in Germany where she spent time engaging with soil scientists and other PhD students.

Candy is investigating flowering time to create adapted and high yielding narrow-leafed lupin crops. She attended the International Conference on Legume Genetics and Genomics in Siofok, Hungary, where she presented a flash-talk and a poster on her research.

Candy then spent two weeks in England with one of her supervisors Dr Matthew Nelson to discuss her flowering time data, write some thesis chapters and an invited book chapter review.

Rounding off the trip, Candy spent three days visiting Professor Petr Smykal at Palacky University in Olomouc, Czech Republic. Whilst there, she presented some of her work and learnt about phenotyping domestication traits. Candy is also supervised by Prof Wallace Cowling, Dr Lars Kamphuis, CSIRO and Dr Jens Berger, CSIRO.

Mrs Helen Carroll, who presented the awards with her daughter, Ms Marie-Louise Carroll said the Fellowship reflects the great value her late husband placed on international relationships, and his devotion to agriculture, the wider community and his scientific colleagues.

Applications are currently open for the 2018 travelling fellowship and close on 25 May 2018. Further details and information about how to apply are available online at ioa.uwa.edu.au

Agricultural Innovations for Communities in Timor-Leste

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Researchers from UWA including Professor William Erskine, Dr Amin Mugera, Professor Anu Rammohan, Hackett Professor Kadambot Siddique and Ms Pyone Myat Thu visited Timor-Leste in April for the planning workshop of the Agricultural Innovations for Communities (AI-Com) project.

AI-Com is a four-year collaborative research program between Timor-Leste's Ministry of Agriculture and Fisheries (MAF), the National University of Lorosa'e (UNTL), World Vision TL, the University of the Sunshine Coast (USC) and UWA, with funding from the Australian Centre for Agricultural Research (ACIAR).

The aim of the project is to improve agricultural productivity and profitability in pilot communities in Timor-Leste by addressing technical and social impediments to annual crop intensification and establishing fodder tree legumes and sandalwood as a sustainable income source and land management practice.

During the workshop HE Estanislau Da Silva, Minister for MAF Ministry of Agriculture and Fisheries launched a new book on Sandalwood Production and Host-plants in Timor-Leste by Dr Tony Page, Senior Research Fellow, USC.

Ministerial book launch in Dili, Timor-Leste: L to R: Mr Dan Woods (DFAT), Dr Eric Huttner (ACIAR), HE Estanislau da Silva (Minister of Agriculture), Prof William Erskine (UWA) and Dr Tony Page (First author, USC)

UWA well represented at GRDC Grains Research Update, Perth

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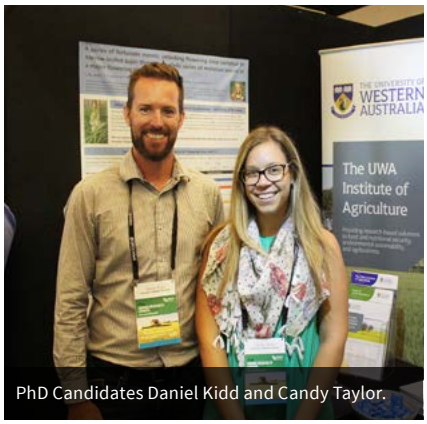
UWA was once again well represented by staff and students at the annual Grains Research and Development Council (GRDC) Grains Research Update in Perth. Facilitated by the Grains Industry Association of WA (GIWA), over 600 attendees participated in the event at Crown Towers, Burswood from 26-27 February 2018.

Five UWA students studying agriculture including PhD candidates Candy Taylor, Daniel Kidd, and Jinyi Chen, Master of Agricultural Science student Guido Ramirez Caceres and undergraduate student Laura Bryant were supported by the Careers in Grain capacity building project to attend the event.

Candy, who also attended the 2017 Research Update said she was grateful for the opportunity to come again. "I had to work hard last year to meet key people in the industry and this year there were many more familiar faces. I was able to have more meaningful discussions which has proved beneficial for my research," Candy said.

During the meeting, GRDC chairman John Woods assured WA growers they would not miss out on investment opportunities. He said the GRDC is investing in three soils and crop nutrition research projects in WA in response to grassroots feedback.

The biggest of the three soils and nutrition projects is worth a total of $9.7 million across five years and aims to improve WA grower profitability through more efficient nutrient use.



PhD Candidates Daniel Kidd and Candy Taylor.

"This investment will be led by UWA - through the SoilsWest alliance with DPIRD - and Murdoch University and UA, with involvement from other grains industry stakeholders," he said. "The project will improve knowledge about nitrogen cycling and availability, soil phosphorus and potassium storage, sources of nutrient supply and responsiveness of crops."

A copy of all presentations can be downloaded at www.giwa.org.au/2018researchupdates.


Group photo at the inaugural session of the Crop Genomics: Present and Future conference.

Crop Genomics: Present & Future

The conference on Crop Genomics: Present and Future held in Hyderabad in December brought together an impressive list of speakers from the field to discuss how agricultural breeding and research programs can fully utilize modern genomics tools in developing countries.

370 participants from 139 institutes from 34 countries contributed to the 22 presentations in five sessions, two panel discussions and a poster session with 80 posters that enabled young researchers to present their work and interact with eminent scientists.

Hosted by the International Crops Research Institute for the Semi-Arid Tropics, ICRISAT, the conference formed part of 10th anniversary celebrations of ICRISAT's Center of Excellence in Genomics (CEG). Topics discussed included advances in genomics, genome and germplasm diversity, sequencing base trait mapping, genomics-assisted breeding, and decision support tools and databases.

Professor Rajeev Varshney from ICRISAT and IOA said anticipated advances, requirements and challenges for sequencing data generation, analysis as well as application of genomics for understanding plant biology and crop improvement were discussed.

UWA was represented at the conference by Hackett Prof Kadambot Siddique and Professor David Edwards.

Agricultural development in China

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China is entering an impressive era of grain production since the reform and opening up in 1978. Currently, China has 9% of the world's arable land but feeds 22% of the world population.

Grain production has increased dramatically from about 300 Mt in 1978 to 621 Mt in 2016, an annual increase of 9%. The increased rate of grain production has surpassed the population growth rate, resulting in an evident decrease in the proportion of malnourished people in China.

However, the doubling of agricultural food production since 1978 is partly attributed to a 3-fold increase in N fertilisation, an 11-fold increase in P fertilisation, and a 1.5-fold increase in the amount of irrigated cropland. Huge inputs of various agricultural resources (fertilizers, water, insecticides etc.) for grain production have caused enormous wastes of resources. This is contrary to the goal of green development of agriculture and sustainable grain production in the future.

Excessive fertilisation due to the mismanagement of chemical fertiliser in grain production has resulted in high environmental costs. For example, the overuse of NH_4^+- or urea-based of N fertilizer caused soil pH to decrease by 0.5 in the 2000s. Meanwhile, N overuse can lead to high GHG emissions in grain production and other environmental impacts such as N deposition, N leaching, and high nitrate concentration in groundwater.

Lack of awareness of nutrient management and inappropriate policy guidelines could explain the excessive fertilisation in China's major croplands. In most rural area of China, farming is conducted by untrained workers who do not recognise the importance of nutrient management, due to a lack of efficient knowledge transfer.

China's government has made grain production and food security a top priority. In the 2000s, China produced enough food to feed its enormous population. Now, China has a new target for green growth in grain production, with high efficiency and low environmental risk, whilst maintaining a relatively high grain yield.

There is an urgent need for China to develop strong policy incentives for environmental protection and green growth in grain production. Going forward, China agriculture will continue to put into practice the vision of innovative, coordinated, rural revitalization and green development.

The model for science and technology backyard established by scientists from China Agricultural University could provide an effective approach to realizing green development of agriculture, by closing yield gaps in china, by empowering smallholder farmers through integrating researchers, farmers, government and agro-enterprises.

The Chinese government has initiated a series of programs to promote the transformation of China's grain production. One of the most influential plans is zero growth of fertiliser consumption, whereby the annual increase in total fertiliser used is less than 1% from 2015 to 2019 (with no further increases from 2020) without yield penalty.

A novel model to address these challenges by improving the sustainability of nutrient use in intensive agriculture has been proposed. This method is based on precise soil nutrient supply to the root zone that does not exceed its capacity, optimal root responses and root–soil interactions, efficient genotypes, and appropriate soil management.

No doubt, China's success in improving sustainable resource use and increasing grain production will enhance food security and decrease poverty and the environmental footprint, contributing to the global goal of sustainable development.

Chinese agricultural development is likely to provide valuable experience to other developing countries that are facing or will soon face similar challenges.

Sampling program to investigate sub clover red leaf syndrome

Researchers from DPIRD and UWA have been collecting samples to identify which plants are hosting a virus linked to subterranean clover red leaf syndrome, where large patches or whole paddocks of clover turned red and died last season.

Co-led by DPIRD research officer Paul Sanford and UWA researcher Kevin Foster, the project is part of a broader study also funded by Meat and Livestock Australia and Australian Wool Innovation to better understand the virus and its impact on sub clover.

Paul Sanford taking paddock samples of red clover in late 2017.

Mr Sanford said the syndrome had occurred in the central and southern agricultural areas of WA for decades but testing last season was initiated after severe losses occurring in some areas for the first time.

"The probable cause was identified as soybean dwarf virus, after the department's laboratory tests revealed that 80 per cent of the plants with visual symptoms tested positive for the virus, compared to only two per cent of the plants that appeared healthy," he said.

"We suspect other factors including environmental stress, time of infection and root diseases contribute to the severity of the syndrome. Soybean dwarf virus is not a seed borne virus but is spread by aphids. If we can control the aphids there is a good chance we can manage the syndrome."

Mr Sanford said as part of the upcoming sampling program, plant and soil samples would be collected from up to 50 properties across the southern agricultural region.

"Sampling will focus on properties previously identified as having the syndrome in 2017, including an area from Brookton to Esperance, sites from the department's green bridge survey and farmer and grower group properties identified through UWA research," he said.

Mr Sanford said soybean dwarf virus survived over summer in live plants such as summer weeds and native vegetation.

"It is likely that rainfall in summer which results in a green bridge that persists until autumn increases the risk of sub clover red leaf syndrome," he said

"If we get further summer rain the risk this season will be higher. Growers may like to consider spraying for aphids using an anti-feeding insecticide at two and six weeks after sub clover seedlings emerge. This group of insecticides prevent aphids feeding and therefore, reduce the risk of virus infection. Oats can also be sown as a barrier around pasture paddocks to disperse aphids and slow early spread into pasture from outside sources."

Vale Dexter Davies

10 APRIL 1951 – 17 MARCH 2018

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Former Wyalkatchem farmer and one of regional Western Australia's greats Dexter Davies has passed away, aged 66. He died surrounded by family after a battle with illness.

Mr Davies held the position of President of The Nationals WA for ten years. He was elected to the WA Legislative Council as a member for the Agricultural Region in 1998. A life member of the party, he continued to provide The Nationals trusted advice and guidance as Vice President of the party until his passing.

Mr Davies will be remembered as a champion of regional WA and for his devotion to rural communities. He leaves behind his wife Leonie, daughters Mia and Emma, and grandchildren Harry and Ella. His daughter, Hon Mia Davies has led The Nationals WA party since last year and is the first woman to do so.

Nationals federal vice-president Dexter Davies with his daughter and WA Nationals leader Mia Davies.

How do farmers use weather and forecast information?

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Weather forecasts are assumed to be important for productivity by allowing more accurate and timely operations to be conducted. However, little is known about how the available weather and forecast information actually impacts the management decisions of farmers.

Interviews with 51 farmers from 37 farms across the WA grainbelt were conducted to investigate what sources of weather information farmers use and why, how it informs farming decisions, and what factors make a farmer choose one source over another.

Dr Myrtille Lacoste who conducted the study said the majority of farmers interviewed expressed great confidence in the competence of the Bureau of Meteorology (BoM) and considered forecasts skills to have greatly improved over the years.

"Confidence in forecast was very high for forecasts up to four days, and a large proportion of farmers acknowledged the difficulties of achieving reliable predictions at longer horizons," Dr Lacoste said.

"The shorter the predicted forecast horizon, the more confidence farmers have in its reliability and accuracy, and the more that forecast influences their decisions."

Most farmers accessed multiple weather and forecast products such as BoM's radar, Elders' app, BoM's 1 to 7-day forecasts, WillyWeather, Weather Zone, BoM's MetEye, OCF via AWN, and BoM's 4-day agricultural forecasts.

Dr Lacoste said these choices were mainly determined by ease-of-use, performance, requirements for specific features, and the need to build an 'overall picture' by comparing several perspectives.

However, a lack of awareness limited the use of many products, most notably those produced by BoM and DPIRD for extension and decision support purposes. For example, a large proportion of farmers were not aware of flagship products such as MetEye, radar rainfields or weather-related decision tools.

The practices most impacted by weather conditions and forecasts were general planning, spraying and sheep management; the least was harvesting. Impacts on seeding and fertiliser application varied greatly, with distinct farmer profiles identified.

Dr Lacoste said the study demonstrated that models must take into account the varied (and sometimes limited) scope for improvements to impact given practices, as well as the heterogeneity that may exist within farming populations.

Dr Myrtille Lacoste and Dr Marit Kragt.

"It is important to note that pragmatic farm constraints override some forecast benefits for a proportion of the farming population," Dr Lacoste said.

"Whilst weather and forecast information are an integral part of broadacre farming in Australia, some practices that were consensually thought to be highly dependent from the forecast appear disconnected from the weather for a large proportion of businesses, most notably the timing of seeding."

"We must also remember that Australian farmers already benefit from some of the best services in the world – including weather information. The margin for improved benefits is smaller than anticipated simply because much has already been achieved."

The report to the Bureau of Meteorology is available online.

H/Prof Siddique, Mr Watt, Prof Pareek and Prof Mark Reynolds in the glasshouse at JNU.

Collaboration with Jawaharlal Nehru University strengthened

Prof Ashwani Pareek
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Professor Ashwani Pareek, from Jawaharlal Nehru University (JNU) in New Delhi, India, has been appointed as an Adjunct Professor within IOA.

Dr Pareek is a Professor of Plant Molecular Biology and Biotechnology in the Stress Physiology and Molecular Biology laboratory, in the School of Life Sciences. His expertise is to delineate abiotic stress tolerance mechanism in plants using functional genomics

Plant disease workshop in the Ord River Irrigation Area

Adjunct Professor Roger Jones
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A workshop on crop diseases in Western Australia's tropical East Kimberley region was held at DPIRD's Kununurra Research Station in March 2018. In attendance was Ord River Irrigation Area (ORIA) growers, and staff from the Ord River Co-operative (ORDCO), Living farms, Raitech Ltd, UWA and DPIRD.

Presenting at the workshop were IOA's Adjunct Professor Roger Jones and Professor Martin Barbetti from UWA's School of Agriculture and Environment and IOA.

Presenting findings from fungal disease research he conducted with Dr Ming Pei You, Professor Barbetti described the types of fungal disease found in the ORIA which attack grain legumes (chickpea, borlotti bean, mung bean), cereals (especially millet) and cucurbits (melons, pumpkin). Common diseases included root rot, crown rot and sudden death of melons, damping-off, seedling and mature plant deaths in chickpea and borlotti bean, and severe powdery mildew in mung bean.

He concluded by describing short and long term control options for the fungal diseases damaging these annual crops. Growers were most appreciative as little information has been available on local fungal disease problems in ORIA.

The aphid-borne virus, *Zucchini yellow mosaic virus* (ZYMV), causes major losses in yield and quality of cucurbit crops in the ORIA. Severe ZYMV epidemics in ORIA melon and pumpkin crops threaten the industries long-term viability. Adjunct Professor Roger Jones summarised the in-depth understanding developed over ZYMV disease epidemics in the ORIA resulting from a three-year collaborative research project.

This project, which was funded by Royalities for Regions, the ORIA cucurbit industry, ORDCO and DPIRD, has helped explain the roles of climate and local sources of virus and aphid vectors in determining when and where ZYMV epidemics develop in different years.

Three presentations on management of ZYMV were given including another on cucurbit virus by DPIRD research officer Dr Craig Webster.

Adjunct Professor Jones also presented a revised integrated disease management (IDM) strategy for ZYMV in the ORIA which took into account all the findings arising from the research project.

The project team, which included DPIRD, ORDCO and Raitech Ltd staff, was very open to advice from growers which ensured its outputs were highly relevant to the cucurbit industry.

Overall, the presentations were well received by the growers who asked many insightful questions.

besides forward and reverse genetics approaches with a focus on rice, brassica and arabidopsis.

One of his major research works includes the identification and functional characterisation of putative osmosensory cascade "two component system" responsible for salinity stress tolerance in rice crop. In addition, he has identified few other potential candidate genes providing abiotic stress tolerance through diverse mechanisms. Prof Pareek has also developed various rice mutant germplasm using γ-irradiation showing tolerance against salinity, drought and heat stress.

UWA Pro Vice-Chancellor (International) Mr Iain Watt and IOA Director Hackett Professor Kadambot Siddique recently visited India where they visited several research institutions including JNU.

Prof Pareek's appointment as Adjunct Professor within IOA will greatly strengthen research and joint supervision collaboration of postgraduate research students between JNU and UWA in life science and agriculture.

Westpac Future Leader Sabrina Davies

Westpac Future Leader investigates germination

PhD candidate Sabrina Davies, from the School of Molecular Sciences is among 17 young Australians awarded a Westpac Future Leaders Scholarship to undertake postgraduate studies.

Sabrina's PhD will examine karrikins – the compounds that trigger plant germination after bushfires – to understand the germination process at the molecular level.

By understanding how plant germination processes take place, Sabrina's research will increase understanding on how to improve germination rates and help address global food shortages.

"Agriculture is a large driving force in our economy and there is a need for innovative, sustainable practices," she said. "My work addresses global challenges such as food shortage that are important not only for Australians but for the entire population.

"My research will contribute towards putting Australia at the forefront of science, leading to further growth and prosperity of our nation."

The scholarship will provide up to $120,000 for research or coursework studies, including a nine-month leadership development program and international experiences. She will also gain lifelong membership to the Westpac 100 Scholars Network, joining a select group of inspiring leaders.

Scholarship supports heat stress research

PhD Candidate Shilja Shaji from UWA's School of Human Sciences has received a scholarship from Western Dairy to support her research into identifying dairy cows with a propensity to suffer heat stress.

Heat stress has high impact on dairy businesses, ranging from loss in milk production and income; reduced in-calf rates, reduce milk and fat tests, and a higher rate of health problems associated with this.

The Australian dairy industry released its new breeding value for heat tolerance earlier this year and the research being undertaken through the UWA study will add another piece to the heat tolerance jigsaw.

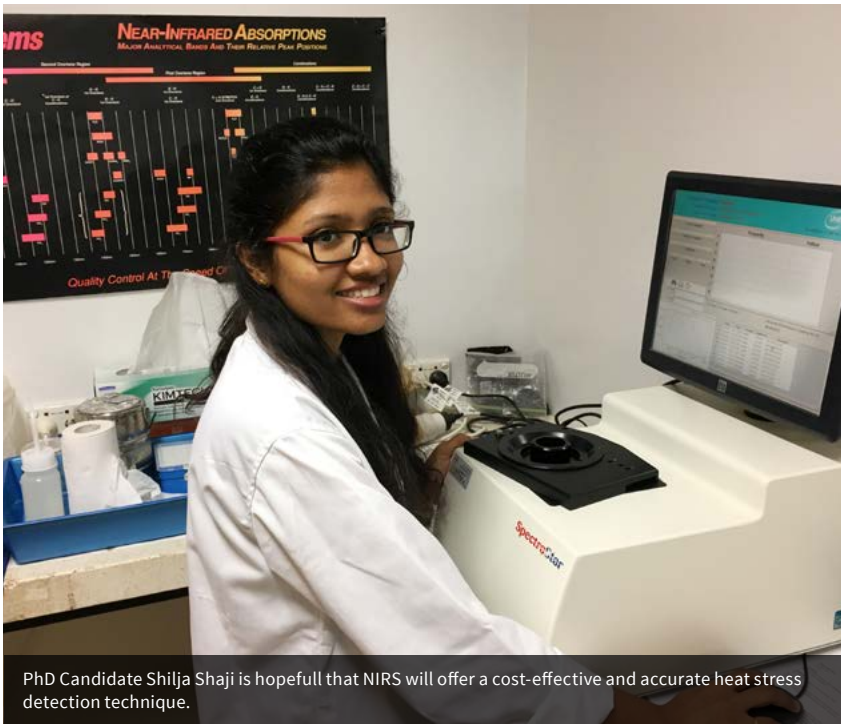
Under the supervision of Professor Shane Maloney from the School of Human Sciences and Associate Professor Dominique Blache from the UWA School of Agriculture and Environment and IOA, Shilja will be exploring the capacity for Near Infrared Spectroscopy (NIRS) to detect heat stress in lactating dairy cattle, using samples from milk, saliva and blood.

NIRS technology is a proven method of estimating milk components in herd testing laboratories and so the research work hopes to capitalise on this technology opportunity.

"If we can prove a system that enables rapid and easy identification of cows that suffer more from heat stress, that will allow the farmer to take early intervention and reduce the impact on that animal," Shilja said.

"For example that may mean ensuring cows with higher propensity to suffer from heat stress have greater access to shade and shelter."

Shilja is hopeful that NIRS will offer a cost-effective and accurate heat stress detection technique. She will attend the Innovation Day on 3 May where she will speak to farmer about the impact of heat stress on their dairy herds during summer.



PhD Candidate Shilja Shaji is hopefull that NIRS will offer a cost-effective and accurate heat stress detection technique.

L to R: Mrs Pfano Mbedzi, University of Pretoria, Dr Berhanu Fenta, Ethiopian Institute of Agricultural Research, Prof Wallace Cowling, UWA and Mrs Yuckmila Chooneea, FAREI, Mauritius

New plant breeding methods discussed in Mauritius

Professor Wallace Cowling
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The Australia Africa Universities Network (AAUN) workshop *New plant breeding methods for sustainable use of genetic resources and security of food production* was held at the University Mauritius in January and was officially opened by the Hon Mahen Kumar Seerutten, Minister of Agro-industry and Food Security, Mauritus.

More than 38 delegates of which 30 were from Africa, and the rest from Australia, Switzerland, UK and USA attended, including several African early career researchers supported by AAUN, the Crawford Fund and Syngenta Foundation for Sustainable Agriculture. UWA was represented by Hackett Professor Kadambot Siddique and workshop leader Professor Wallace Cowling.

During the workshop new methods for sustainable genetic improvement in important food crops for AAUN partner countries were evaluated. New animal breeding methods such as optimal contributions selection and genomic selection may enhance long-term crop improvement based on genetic diversity from crop genebanks and elite crop varieties. The ability for new methods to improve adaptation of crops to changing climates, and thereby improve future food security was also evaluated.

Keynote speaker E/Prof Brian Kinghorn from the University of New England and Dr Raphael Mrode from the International Livestock Research Institute, Kenya contributed substantially to the workshop by providing examples from their experience where the new methodology had contributed to substantial genetic gains in animals, trees and crops.

The AAUN project principal investigators from UWA, University of Pretoria, The University of Sydney and University of Mauritius led discussion groups for future publications and grant proposals.

Professor Christine Foyer from the University of Leeds and UWA encouraged participants to prepare papers for submission to a future issue of the journal *Food and Energy Security*, with a focus on adapting the new methodology to improve crop yields in future changing climates.

The workshop was supported by the Partnership Research & Development Fund of the AAUN.

Ag engineer wins 40Under40 Award

Dr Andrew Guzzomi, senior research fellow in the Faculty of Engineering and Mathematical Sciences has been recognised in the 2018 40under40 Awards, announced on 7 March 2018.

Established by Business News in 2002, the 40under40 Awards celebrate the passion, vision and achievements of Western Australia's finest young business people and the contribution they are making to the future of WA.
Dr Guzzomi, who co-leads IOA's Engineering Innovations for Food Production research theme is an agricultural engineer whose research is helping develop engineering solutions to challenging and complex global agricultural problems.

In 2016, he was named WA Innovator of the Year for co-inventing a tool that helps regenerate mine sites and degraded farmland. It works by repeatedly exposing plant seeds to flames, removing fluffy appendages and making them easier to handle, store and transport. The tool which was delivered in partnership with the Botanic Gardens and Parks Authority enables mechanised planting and reduces costs.

Dr Guzzomi is currently designing a new Master of Agricultural Engineering program at UWA which will be rolled-out in 2019.

Dr Guzzomi (third from left) with UWA winners.

New Appointments


Mr Richard McKenna

Mr Richard McKenna
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Mr Richard McKenna has joined UWA as Farm Manager at UWA Farm Ridgefield. Richard holds a Bachelor of Agricultural Science from UWA and has been farming at Mullewa since the 1980s. He brings with him excellent experience in the theory and practicalities of cropping and great enthusiasm for the future of farming.

Richard has been an active member of the WA No-Till Farming Association and participated in the Weeds CRC and is well placed to manage the farm and accommodate the Future Farm 2050 Project. He and his wife, Cathy also a UWA graduate in Agricultural Science will make UWA Farm Ridgefield their home from the end of April.

NEW POSTGRADUATE RESEARCH STUDENTS

STUDENT NAME	TOPIC	SCHOOL	SUPERVISOR(S)	FUNDING BODY
Ms Khin Lay Kyu	Combined salinity and waterlogging tolerance in mungbean	UWA School of Agriculture and Environment and IOA	Prof William Erskine; Hackett Prof Kadambot Siddique; Prof Tim Colmer	John Allwright Award; ACIAR
Mr Muhammad Azam Khan	Understanding and mapping of genes responsible for resistance against the fungal pathogen Sclerotinia sclerotiorum in canola (Brassica napus)	UWA School of Agriculture and Environment and IOA	Prof Martin Barbetti, Prof. Wallace Cowling, Dr Ming Pei You, Prof. Jacqui Batley	UWA-UAF Scholarship
Ms Pratima Gurung	Screening for drought tolerance in wheat at different stages of development	UWA School of Agriculture and Environment and IOA	Prof Guijun Yan; Adj Prof Neil Turner	Self-funded
Nur Shuhadah Mohd Saad (Shu)	Characterisation of disease resistance gene in Brassicas	School of Biological Sciences and IOA	Prof Jacqueline Batley	RTP scholarship

VISITORS TO IOA

NAME OF VISITOR	VISITOR'S ORGANISATION AND COUNTRY	HOST DETAILS	DATES OF VISIT
Dr Vijay Pooniya	Endeavour Research Fellow, Indian Agricultural Research Institute, India	Dr Yinglong Chen, Hackett Prof Kadambot Siddique, Dr Jairo Palta	April – September 2018
Dr David Johnston	University of New England	Prof Philip Vercoe	March 2018
Mr Zhihui Wen	China Agriculture University	Prof Hans Lambers, Assoc/Prof Megan Ryan, Dr Jiayin Pang, Hackett Prof Kadambot Siddique	January 2018 - January 2019
Dr Piotr Trębicki,	Department of Economic Development Jobs, Transport and Resources (DEDJTR),	Adjunct Prof Roger Jones	February 2018
Professor Yongzhong Luo	Gansu Agricultural University, Lanzhou, China	Dr Guijun Yan, Adjunct Prof Neil Turner, Dr Hui Liu	March 2018-March 2019
Mrs Shaghayegh Mehravi	Sari Agricultural Science and natural Resources University, Sari, Iran	Prof Jacqueline Batley	March 2018 – August 2018

AWARDS AND INDUSTRY RECOGNITION

NAME	AWARD
Dr Andrew Guzzomi	40 Under 40 Award
Assoc/Prof Muhammad Farooq	Best University Teacher Award, Higher Education Commission of Pakistan
Ms Sabrina Davies	Westpac Future Leaders scholarship

NEW RESEARCH GRANTS DECEMBER 2017 – MARCH 2018

TITLE	FUNDING PERIOD	FUNDING BODY	SUPERVISORS
Understanding environmental drivers of flora and honey bee product production: development of Remote Sensing approaches for predicting flowering events	2017-2020	CRC for Honey Bee Products	Dr Bryan Boruff, Mr John Callow, Dr Clare Mouat, Dr Natasha Pauli, Dr Eloise Biggs, Assoc/Prof Samantha Setterfield
Development of methane sensors	2018	CSIRO	Dr Buddhika Silva, Assoc/Prof Gino Putrino, Prof Lorenzo Faraone
Structure-based investigations into new modes of action for herbicides	2018-20	ARC Discovery Early Career Researcher Awards	Dr Joel Haywood
Phase 2 Proof of Concept	2017	FutureSeed Technologies	Dr Janine Croser
Developing sustainable cropping systems for cotton, grains and fodder	2017-2019	North Australia Crop Research Alliance Ex CRC Project	Dr Janine Croser; Prof William Erskine
Joint Venture Agreement: Annual Legume Breeding Australia	2018-26	PGG Wrightson Seeds Australia	Prof William Erskine; Assoc/Prof Megan Ryan; Dr Phillip Nichols
Using improved markets to reduce over-extraction of groundwater	2018-20	ARC Discovery Early Career Researcher Awards	Mr MD Sayed Iftekhar
Defining factors in the control of protein turnover in plants	2018-20	ARC Discovery Projects	Prof Harvey Millar
Innovative seed technologies for restoration in a biodiversity hotspot	2018-2022	ARC Linkage Projects	Prof Richard Hobbs, Dr Todd Erickson, Dr Jason Stevens, Associate Professor Matthew Madsen, Dr Michael Forster, Mr Vernon, Mr Anthony Pekin, Mr Alan Savage
Climate-smart landscapes for promoting sustainability of Pacific Island agricultural systems - Phase 2	2018-21	Australian Centre for International Agricultural Research ACIAR	Dr Eloise Biggs, Mr Jan Helsen, Dr Eleanor Bruce, Dr Bryan Boruff, Dr Nathan Wales, Dr Viliami Manu, Prof John Connell, Ms Pyone Thu
Structure-based investigations into new modes of action for herbicides	2018-20	ARC Discovery Early Career Researcher Awards	Dr Joel Haywood
Increasing profit from N, P and K fertiliser inputs into the evolving cropping sequences in the Western Region	2017-21	GRDC	Mr Craig Scanlan, Prof Daniel Murphy, Dr Frances Hoyle, Dr Louise Barton, Prof Zdenko Rengel
Understanding the effect of air flow on fertiliser distribution	2018	Department of Industry Innovation and Science – AusIndustry: Innovation Connections	Dr Andrew Guzzomi, Dr Carlo Peressini

IOA 2017 Publications

(Not yet reported)

Alamery S, Tirnaz S, Bayer P, Tollenaere R, Chaloub B, Edwards D and Batley J (2017). Genome wide identification and comparative analysis of NBS-LRR resistance genes in Brassica napus. *Crop and Pasture Science*. **69:** 72-93

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Behr J, Bouchereau A, Berardocco S, Seal C, Flowers T, Zörb C (2017). Metabolic and physiological adjustment of *Suaeda maritima* to combined salinity and hypoxia. *Annals of Botany* **119** (6):965-976

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IOA 2018 Publications

(January – March)
Refereed Journals

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UPCOMING EVENTS

DAIRY INNOVATION DAY 2018
3 May 2018
Giumelli Family Farm, Benger, WA

POSTGRADUATE SHOWCASE
6 June 2018
Bayliss LT, UWA

INDUSTRY FORUM
26 July 2018
University Club of WA, UWA

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