# The UWA Institute of Agriculture

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UWA PhD graduate Dr Hebba Al-Lami. Photo: Rosanna Candler

# Transformative UWA experience for Iraqi postgraduate students

**After five life-changing years studying at The University of Western Australia (UWA), Dr Hebba Al-Lami was eager to share the experience with her students at Mustansiriyah University in Baghdad.**

Thanks to the strong partnership between The UWA Institute of Agriculture (IOA) and the Higher Committee for Education Development in Iraq, Dr Al-Lami and Dr Rasha Al-Saedi recently joined the growing list of academics to complete their PhDs and return home to Iraq.

Fully-funded by the Iraq Government, 12 Iraqi students have now completed English language training and their postgraduate studies in agriculture and related areas at UWA.

With support from her UWA supervisors Professor Martin Barbetti and Dr Mingpei You at the School of Agriculture and Environment and IOA, Dr Al-Lami published six research papers and completed her thesis on Alternaria leaf spot in Australian canola.

"By isolating the disease from the leaves, I was able to find 11 species – including some that had never before been reported in all of Australia, Western Australia (WA) and other states," she said.

"Among those species were two that are highly pathogenic – Alternaria brassicae and Alternaria japonica.

"My studies included finding the temperature stage for Alternaria japonica that it is highly desirable for a pathogen. We also managed to find a resistant genotype that can naturally resist japonica. It was an amazing feeling, to get that result."

Dr Al-Lami said her research provided a new understanding of the prevalence of Alternaria leaf spot in Australia, and would help WA avoid an outbreak of the devastating disease in the future.

In addition to developing new skills in statistics and agricultural science, Dr Al-Lami said living and studying in WA helped her grow as a person.

"I am now more independent, more confident and more responsible," she said.

"I look forward to teaching my students that they can learn new techniques like me, so they can get scholarships and fellowships and be in demand worldwide.

"I will tell them: be good at English, travel to study, and all the doors will open to you."

Fellow PhD graduate Dr Al-Saedi said her time living and studying at UWA had helped her greatly in her lecturing and research at Mustansiriyah University.

*Continued on page 2*

# Director's Column

**There is no question that 2020 has been an extraordinary year.**

Together, we have weathered the unprecedented storm of the global COVID-19 pandemic with grace and resilience. I am proud to have witnessed the ways in which my colleagues in the agricultural industry, government, university and research sectors have risen to face the many challenges of 2020.

In response to travel restrictions and border closures, we have embraced the 'new normal' of online meetings and events, including our successful recent Zoom webinar *Challenges and Opportunities for Indian Agriculture*, which 300+ people around the world tuned-in to watch. We were very fortunate to be able to host a number of socially-distanced events in the last three months, including our annual Postgraduate Showcase (page 14), much-anticipated Industry Forum exploring the topic of climate change and agriculture (page 10), Mike Carroll Travelling Fellowship presentations (page 13) and Hector and Andrew Stewart Memorial Lecture on Food Security in Western Australia delivered by Dr Graeme Robertson (page 5). You are invited to view online recordings of all our events by visiting our *YouTube*.

In July, we welcomed our 19th Vice Chancellor Professor Amit Chakma, who has committed strong support for the roles of institutes at UWA. It was wonderful to host Professor Chakma at a special morning tea to meet members of The UWA Institute of Agriculture (IOA). Professor Chakma also joined the IOA Industry Advisory Board meeting in September and delivered the opening address at our Industry Forum.

I am immensely pleased to report that IOA researchers have contributed more than 300 research publications in 2020 – well exceeding our output in 2019, and with still more to be published before the end of the year. We also celebrated a number of academics named on the annual Highly Cited Researchers list for 2020 (pages 18-24). These achievements are a strong reflection of our status as number one in Australia and 17th in the world for agricultural sciences in the Academic Ranking of World Universities 2020.

There is much to look forward to in 2021. Following extensive consultation, including a workshop attended by key university and industry leaders in August, we are currently finalising our Strategic Plan 2021-2025.

Read about UWA Business School students' investigation into the horticultural industry's labour shortage (page 7), tracking root morphology in soybeans (page 8), better predicting soil water in the Wheatbelt (page 11) and the latest from UWA Farm Ridgefield (pages 3, 11 and 12). In addition to this newsletter, you will always find plenty of exciting IOA research and news via our many communication channels, including our regular media releases, *Twitter*, and recently-launched new *website* and *LinkedIn* page.

My warmest thanks to our Industry Advisory Board, Theme Leaders, UWA Farm Ridgefield committees, IOA members and staff for their hard work and dedication this year.

I wish you and your loved ones best wishes for the festive season and New Year.

***Hackett Professor Kadambot Siddique AM, CitWA, FTSE, FAIA, FNAAS, FISPP, FAAS***
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*Continued from page 1*

"I learned many things about my profession that I have taken back to my country, such as how to conduct high-quality research, publish high-impact papers and work with people from culturally-diverse backgrounds," she said.

Dr Rasha Al-Saedi

Dr Al-Saedi completed her thesis last year at the School of Civil, Environmental and Mining Engineering in collaboration with IOA.

Her research conducted various experiments on vertical flow constructed wetlands (VFCW) – a natural alternative to traditional methods of wastewater treatment.

Dr Al-Saedi examined the performance of VFCWs on removing nitrogen under both unsaturated and saturated conditions, then manipulating the substrate conditions to enhance removal processes.

She published three papers from her thesis in high-quality international journals.

"My time at UWA has helped me a lot in my career back home," she shared.

"Learning from research experts, such as Professor Keith Smettem and Professor Kadambot Siddique, has helped me strengthen my scientific skills and practical experience."

Professor Siddique said it was very pleasing to see talented and enthusiastic graduates return home to share their experiences at UWA.

"We look forward to continuing to strengthen our relationship with the Iraqi Government through this postgraduate program," he said.

"During the past 10 years we have trained numerous Masters students from Iraq, and delivered several master classes to Iraqi professionals with funding support from the Iraqi and Australian governments."

# Shift towards non-mulesed sheep

**UWA Farm Ridgefield is helping blaze the trail to end the practice of mulesing sheep.**

The farm is one of six Meat & Livestock Australia (MLA) Producer Demonstration Sites (PDS) for a four-year project run by UWA alumni Georgia Reid and Ed Riggall of AgPro Management.

UWA Emeritus Professor Graeme Martin said the project would demonstrate the impact of shifting to non-mules enterprises – on management and measures of production – to more than 100 producers and the wider industry.

"At each site, we will measure weaner weight, wool value, animal price, and husbandry costs, thus enabling a benefit-cost assessment of the financial outcome compared to traditional management, while also capturing qualitative data to analyse the social impact and changes required to management," Ms Reid-Smith said.

"Recognising the inevitability of the technique being banned, UWA Farm Ridgefield stopped mulesing in 2010," Professor Martin said.

"We now have 10 years' experience in managing non-mulesed Merino sheep, placing us in a good position to discuss the issues with producers."

Professor Martin said the PDS project would address the mulesing-related problems that cost Merino-based industries about $600 million per year.

UWA Farm Ridgefield is also collaborating with DPIRD to investigate the processes that sheep use to resist worm infection, forages that combat worm development in the gut, and the odours produced by sheep that attract blowflies.

"The gastro-intestinal worms cause massive losses, and cause diarrhoea that attracts the blowfly (*Lucilia cuprina*), leading to flystrike," Professor Martin said.

"In addition, mulesing to prevent flystrike is becoming socially unacceptable, and worms are becoming increasingly resistant to drench medication.

"In the long-run, the ultimate solution to stop mulesing is breeding for lower dag score, low worm egg count in faeces, low skin wrinkle, and resistance to flystrike."

Professor Martin cautioned that the industry needed to stop mulesing as a matter of urgency.

"This is challenging because it requires significant changes in management, including worm control, the timing of shearing and crutching, flock monitoring, pasture management and rotation, and strategies for the use of drenches and insecticides," he said.

"Many producers who have stopped mulesing have been successful, but it is fair to say that many others failed to sustain the change because the management issues were too difficult to adopt.

"Moreover, there were no support networks to help the transition.

Among producers, there is a mix of success stories and failures."

Professor Martin said the PDS project would show producers how a non-mulesed system worked, and equip them with the tools, skills and confidence to try adopt changes in management.

"The project does not aim to force change but rather to show producers what the system looks like so they can decide for themselves," he said.

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*"Recognising the inevitability of the technique being banned, UWA Farm Ridgefield stopped mulesing in 2010. We now have 10 years' experience in managing non-mulesed Merino sheep, placing us in a good position to discuss the issues with producers."*

Sheep at UWA Farm Ridgefield. Photo: Richard McKenna

# BeefLinks discussion at GCG Pastoral Forum

Northern cattle. Photo: Dean Revell

**There was plenty of interest and excitement surrounding BeefLinks at the Gascoyne Catchments Group (GCG) Annual Pastoral Forum from November 12-13 in Coral Bay.**

The UWA Institute of Agriculture Associate Director Phil Vercoe and fellow program members presented on BeefLinks – the four-year partnership between UWA and Meat & Livestock Australia (MLA).

Professor Vercoe explained that, through research and practice change programs, BeefLinks was established to enhance the red meat value chain and foster productivity within WA's beef industry. It follows a model of collaboration, engagement, discussion and information-sharing among producers, industry, State Government and researchers.

Professor Vercoe also explored the MLA and BeefLinks' commitment to Carbon Neutral 2030 (CN30).

"I was really pleased GCG gave us the opportunity to join in their annual forum to talk about BeefLinks and the benefit I'm hoping the partnership between UWA and MLA will bring them," said.

"Rachel Thompson and Sean D'Arcy did an incredible job to get the pastoral forum organised in a short space of time in what has been a challenging year.

"It was so valuable for people involved in the BeefLinks projects to talk with such an active producer community, field questions and get feedback from them, and take on board their thoughts and ideas about research needs and challenges to adoption."

GCG Vice President Justin Steadman welcomed everyone to the forum before handing over to MC Cath Walsh.

The forum opened on the topic of WA's beef supply chain and market opportunities, with a virtual update by MLA's Dr David Beatty and a prerecording analysing global markets and trends, as well as the supply chain and opportunities for northern WA beef.

Rabobank Senior Analyst Angus Gidley-Baird spoke on climate friendly supply chains, followed by a talk from a processors' perspective by Avon Valley Beef owner Mark Grant.

Session two featured Courtney Martino from Select Carbon detailing research on Diet ID and Nutritional mapping, and The West Midlands Group's Nathan Craig and Charles Callaghan discussing backgrounding and transitioning cattle from north to south.

Read a complete overview of presentations at the GCG Annual Pastoral Forum *online*.

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# Australia India Centre synergy to solve water challenges

The Ord River in the Kimberley, WA.

**The new Australia India Water Centre (AIWC) will stimulate longer-term and more powerful collaboration in research and education, according to The UWA Institute of Agriculture Director Kadambot Siddique.**

A consortium of 24 Australian and Indian research institutions, including The University of Western Australia, launched AIWC last month to address critical water security and sanitation challenges.

Recent years have seen significant impacts on water supplies in both countries as droughts, flash floods, prolonged heat and surging demand have resulted in water shortages and river ecosystem health issues.

The partners will collaborate in water research, a joint Master's-level program in water futures, training of PhD students, student and staff exchanges, workshops and conferences, and provide short-term training in the water sector to government agencies and other participants.

Professor Siddique said the partnership between Australia and India was a natural fit, as they shared many common challenges in relation to water security, policy, technological innovation and sustainability.

"The combined effects of growing populations, expanding cities and urbanisation of rural areas will see the need for more secure and sustainable water sources continue to rise in Australia and India," he said.

"In the meantime, reliable water supply is becoming less certain due to increasing competition, deterioration in the water quality and extreme weather pressures due to climate change.

"By working together, I believe we have never been better equipped to address the significant challenge of providing safe and plentiful water to millions of people in Australia, India and beyond."

IOA Director Professor Kadambot Siddique (left) with Stewart family and friends. Photo: Rosanna Candler

# Lecture explores threats to food security

**While the impact of COVID-19 border closures have exposed weaknesses in our food production and imports, climate change continues to be the greatest challenge to food security in Western Australia (WA).**

This was the overarching message Dr Graeme Robertson delivered to a sold-out audience at The UWA Institute of Agriculture's 27th Hector and Andrew Stewart Memorial Lecture on 17 November.

The lecture is held in honour of Country Party Member of the Legislative Council, the late Hon Hector Stewart MLC, and his late son Andrew Stewart, former President of UWA's Guild of Undergraduates and twice Dean of Faculty of Agriculture.

As WA's only Rhodes Scholar in agriculture and having served as the Director General of WA Department of Agriculture for a decade, Dr Robertson was well-positioned to present his lecture on the reality of food security and agriculture in WA.

Although WA exports significant amounts of grains and some meat, Dr Robertson cautioned that the State's production was a very small proportion of the world's food supply.

"We produce enough calories to feed about 10 million people, which is just 0.13 per cent of the world population," he said.

So how secure is our supply of food?

According to Dr Robertson, you only need to walk down the supermarket aisles to see just how reliant we are on food being transported long distances to Perth especially from eastern Australia.

"An important driver of the profitability of food retailing is the amount of stocks in the system," he said.

"This year we had two disruptions – bushfires closed the Eyre highway (the only feasible truck route to Perth) for 12 days in January and this began to affect supermarket supplies.

*"Are we really a producer of food for the world? We do export significant food, mainly grains and some meat, but our production is a very small proportion of the world's food supply."*

"COVID-19 also resulted in shortages or absence of some products as production facilities and distribution centres were affected. No one starved, but it was a reminder that relying on food being shifted 3000kms and with in-state storage limited to less than a week for many products is a vulnerable food security situation."

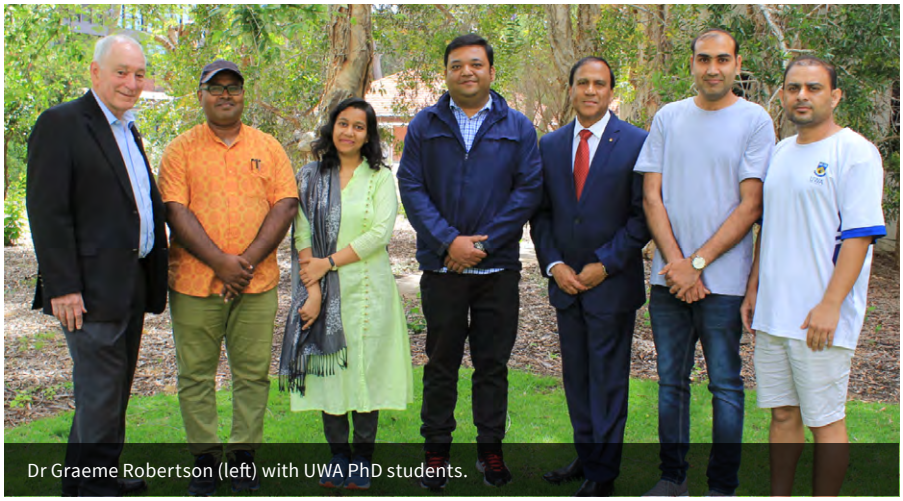
Dr Robertson said climate change was the greatest medium to long-term threat to WA's agricultural production.

"Continuing agriculture in the face of expected impacts on temperature, rainfall and water availability will require a very significant planning and research and development response," he said.

"The government and industries will need to collaborate to take a leading role in developing the strategy and the options."

Earlier in the day, Dr Robertson met with a group of UWA PhD students to discuss their research over morning tea.

Following the lecture, he joined the Stewart family and friends for discussion and refreshments.



Dr Graeme Robertson (left) with UWA PhD students.

# Field testing flowering time genes in lupin

L-R: Dr Candy Taylor, Dr Matthew Aubert, Dr Lars Kamphuis, Julian van der Zanden, Professor Wallace Cowling, Professor Karam Singh and Dr Dion Bennett. Photo: Dr Renu Saradadevi

**Lupins were the stars of the show at a field day held by The UWA Institute of Agriculture researchers in late August.**

The field day was held at the Council of Grain Growers Organisations (COGGO)-funded UWA field trial at Australian Grain Technologies' (AGT) lupin breeding site in Mumberkine, WA.

The UWA Institute of Agriculture Research Officer Dr Candy Taylor worked on the COGGO project by field-testing two new genes for flowering time in lupins that she identified during her PhD studies at UWA.

Industry partners Dr Matthew Aubert and Dr Dion Bennett from AGT were particularly excited to see these new genetic variations in lupins, as they showed a range of flowering dates and plant vigour that they had not encountered before.

During her PhD, Dr Taylor found a unique gene in European lupin varieties, which will increase the genetic diversity of Australian lupins while maintaining early maturity.

She also found a new gene in a wild lupin from Israel that had the potential to extend the growing season and grain yield of lupin crops in mid to high rainfall environments across southern Australia through a slight delay in onset of flowering.

CSIRO collaborators Dr Lars Kamphuis and Professor Karam Singh, UWA Research Associate Dr Renu Saradadevi, and UWA School of Agriculture and Environment Master of Science (MSc) student Julian van der Zanden also attended the event.

Dr Saradadevi was UWA Research Officer on the COGGO project in 2019, where she identified the new genes in progeny of crosses with current lupin varieties.

Dr Taylor set up the field trial in 2020 with this seed.

Mr van der Zanden was recipient of a UWA Agribusiness Connect Scholarship funded by Royalties for Regions through DPIRD.

A highlight of the day was Mr van der Zanden's MSc progress report, in which he has developed a single efficient molecular marker that distinguishes between the old and new flowering time genes in lupin breeding.

Since the field day, Dr Taylor has harvested plants with the new flowering time genes and is now processing seed samples.

Seeds from this COGGO project will be shared with AGT in 2021 to assist in the potential future development of lupin varieties containing the new flowering time genes.

Professor Wallace Cowling leads the COGGO project to assess the potential value of new genes controlling flowering time in lupin crops.

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# Cruciferous veg staves off disease

**There is another reason to pile your plate high with cruciferous vegetables, thanks to a recent study led by UWA PhD graduate Dr Lauren Blekkenhorst.**

The research from Dr Blekkenhorst, who previously presented at The UWA Institute of Agriculture 2017 Postgraduate Showcase, found cruciferous vegetables (such as broccoli, Brussels sprouts and cabbage) could help prevent advanced blood vessel disease.

Using data from a cohort of 684 older WA women recruited in 1998, Edith Cowan University and UWA researchers found that a diet high in cruciferous vegetables was associated with less extensive blood vessel disease in older women.

The study, published in the *British Journal of Nutrition*, showed that participants who consumed more than 45g of cruciferous vegetables every day were 46 per cent less likely to have extensive build-up of calcium on their aorta in comparison to those consuming little to no cruciferous vegetables.

Calcium build-up in the aorta is a key marker for structural blood vessel disease.

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UWA Business School students James Parker and Michael Liu. Photo: Rosanna Candler

# Proactive research into horticulture labour shortage

**There is no question that COVID-19 border restrictions and the resulting labour shortage has had a devastating impact on the Australian horticultural industry.**

Rather than quoting statistics and placing blame, four UWA Business School students decided to take a proactive approach.

Master of Human Resources and Employment Relations students James Parker, Michael Liu, Johnny Pham and Zach Roberts recently completed a research project that assessed how the labour shortage had occurred, why locals weren't entering the industry, and offered potential solutions to Western Australian (WA) growers.

The group conducted one-on-one interviews with peak industry body vegetablesWA, one of Australia's largest horticultural companies, and a number of small independent growers.

"I grew up on a family farm in Gingin and currently work in the horticulture industry, so I have seen the issue firsthand," Mr Parker said.

"Before COVID-19, there had always been a labour surplus.

"We found plenty of research about the dependency on temporary migrant workers, but there was very little about what happens when that goes away."

*"Before COVID-19, there had always been a labour surplus. We found plenty of research about the dependency on temporary migrant workers, but there was very little about what happens when that goes away."*

The research report concluded that, in order to avoid shortages in future seasons, it was critical that growers produced labour plans that included alternative sources of labour such as WA locals and the Seasonal Worker Program (SWP).

Established in 2008, the SWP permits workers from nine Pacific Island countries and East Timor to work within Australia for up to nine months each year.

"The industry presumes working holiday makers will be able to return to the labour market at some given point next year," the report said.

"This could potentially be the case, but there are no guarantees amidst a global pandemic.

"Despite the challenges possibly preventing this adaption, the continued reliance on a dwindling pool of backpackers could be disastrous."

WA Labour Scheme Facilitator Melissa Denning, who contributed to the students' research, said there had been a significant reduction in the number of available workers.

"The majority of the workers in the horticulture space are on Working Holiday Visas, which have dropped Australia-wide from 145 thousand to 60 thousand," she said.

Ms Denning said both the State and Federal government had incentive schemes to encourage people to move to the regions to work in horticulture.

"Employing Australians is always the first priority, however if there is a gap, we are encouraging growers to look at the SWP – which currently has about 20 thousand workers available to come to Australia," she said.

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# Canola heat tolerance in action


Demonstrations at the UWA Shenton Park Field Station. Photo: Dr Sheng Chen

**Researchers and industry leaders were treated to an exclusive demonstration of a prototype facility being used to identify the genes that make canola heat tolerant at the UWA Shenton Park Field Station in September.**

The UWA-based research is part of a nationally coordinated five-year project that aims to provide heat tolerant germplasm to plant breeders, who would then incorporate it into new commercial varieties.

These more resilient varieties would help Australian canola growers maintain productivity as temperatures rise in response to climate change.

Project leader Dr Sheng Chen from The UWA Institute of Agriculture said heat stress was an issue of increasing global concern, with average temperatures projected to rise in coming decades.

"Canola is particularly sensitive to high temperature stress," Dr Cheng said.

"In current canola varieties grown in Australia, losses could be as much as 300kg per hectare for every 1°C increase in mean daily temperature at flowering."

The prototype facility for large-scale heat tolerance screening in canola breeding programs was established with financial support from the Grains Research and Development Corporation (GRDC) and UWA.

Industry representatives and researchers from the Department of Primary Industries and Regional Development, Commonwealth Scientific and Industrial Research Organisation, Curtin University and UWA – attended the open day to watch the screening in action.

Dr Cheng said the prototype facility had already successfully screened hundreds of canola genotypes.

"In this canola season, 200 canola genotypes with a total of 1680 plants in pots have been screened for heat tolerance at flowering stage," he said.

"These genotypes will directly contribute to the search for germplasm to help Australian growers stay ahead of increased heat stress on crops."

GRDC Senior Regional Manager (West) Peter Bird congratulated the successful initiative for bringing together canola researchers in WA.

"These opportunities strengthen research through cross-collaboration and the ability build on opportunities with collective thinking," Mr Bird said.

MineARC Business Development Manager Holger Plange said it was great to see dedicated research around heat stress in canola.

"The general public are only now waking up to the impacts of climate change, so it is pleasing to know that research is well underway to combat an issue that could devastate the canola industry in the future years," Mr Plange said.

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# Mapping soybean roots

**Researchers at The UWA Institute of Agriculture are using innovative tools to monitor soybean's root growth and development for improved adaptation to edaphic stress.**

A diverse germplasm of soybean was imported from Professor Henry Nguyen at the National Center for Soybean Biotechnology, University of Missouri, USA.

Some of these genotypes were selected for tolerance to drought, salinity and flooding under field conditions in the USA.

Variability of root system architecture was characterised among these genotypes using UWA's established semi-hydroponic phenotyping system.

Large diversity of root system architecture in the early growth stage has now been identified. Selected genotypes with contrasting root architecture traits are being further investigated by using 1.5m deep rhizoboxes with clear glass walls for visualising root growth.

Studies examining root responses and adaptation to low water and nutrient availability will then follow.

Genome-wide mapping analysis will be used to determine the quantitative loci and genes associated with root architecture traits and root traits in relation to water and nutrient use efficiency.


Soybeans of four different genotypes 40 days after planting. Photo: Mohammad Salim

The ongoing study is part of UWA student Mohammad Salim's PhD project, under a scholarship from the Bangabandhu Science and Technology Fellowship Trust in Bangladesh.

Mr Salim's research is supervised by Dr Zakaria Solaiman, Dr Yinglong Chen and Professor Kadambot Siddique.

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# Historical pathogen collections provide an invaluable resource

**Conducting research on plant pathogen specimens that he collected almost five decades ago has been a rewarding experience for The UWA Institute of Agriculture Adjunct Professor Roger Jones.**

As a young man working at the International Potato Centre in Peru in the 1970s, Professor Jones collected a series of virus isolates from diverse crops growing in the Andean region of South America.

The specimens were preserved over silica gel inside a tin can and sent to England in 1978.

The can ended up in a historical virus isolate collection at FERA Science Ltd in York, England – where it remained for more than forty years.

In 2014, Professor Jones, Drs Adrian Fox and Ian Adams from FERA Science, and Newcastle University Professor Neil Boonham finally reopened the 'time capsule' can.

For the next six years, they used the historical specimens to conduct research into the disconnect between 'pre-sequencing' and 'post-sequencing' eras of virus research.

They addressed this disconnect by using high throughput sequencing to obtain the complete genomes of virus isolates preserved in the pre-sequencing era

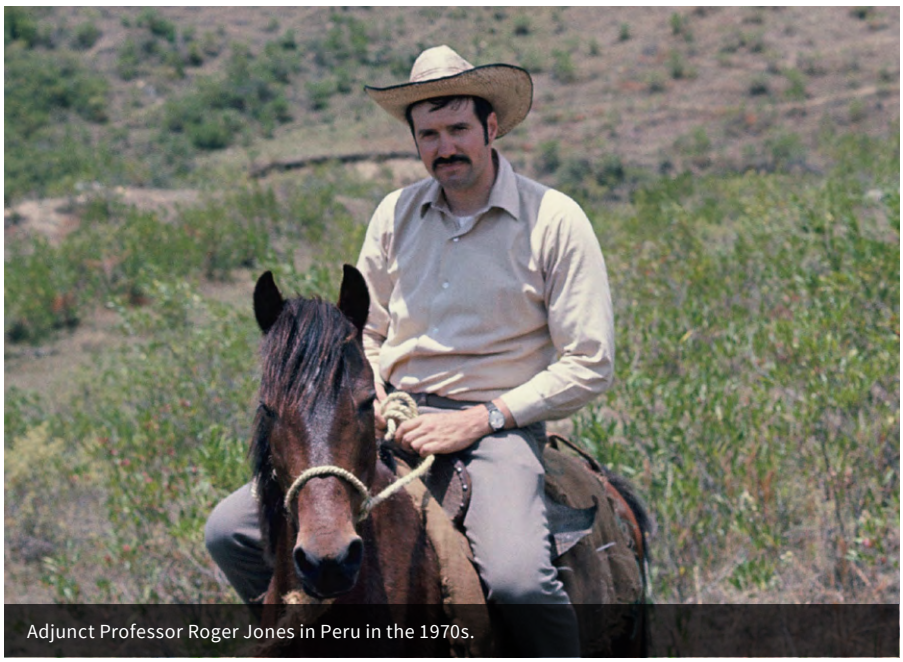
The specimens were preserved over silica gel in this tin can. Photo: Roger Jones

(1970s) collection, and then compared these genomes with more recent ones available in the global sequence database.

Their overall findings were published in the journal *Plant Pathology* last month.

"Plant viruses have been studied since the early 1900s, and for 80 years afterwards, research was focussed on their biological properties, epidemiology and management," Professor Jones explained.

"However, in the last 40 years, greater focus was placed on their molecular characteristics, including sequencing their nucleic acid genomes which was impossible previously".


Adjunct Professor Roger Jones in Peru in the 1970s.

*"Unfortunately, this disconnect (between the pre-sequencing and post-sequencing eras of virus research) is causing major practical problems in managing critical virus diseases, and developing effective plant health and biosecurity regulations."*

"This resulted in a serious disconnect between the pre-sequencing and post-sequencing eras of virus research.

Unfortunately, this disconnect is causing major practical problems in managing critical virus diseases, and developing effective plant health and biosecurity regulations."

Professor Jones said there were numerous benefits to this research; including the ability to correct errors in recent virus names, identify previously studied isolates of unnamed viruses, provide the old sequences needed to compare with recent ones for virus dating and other evolutionary research (and reveal alterations in virus populations within world regions) and avoid repeating previous research.

"It provides access to extensive biological data from the past that is crucial to assessing the plant health risk posed by a virus, thereby improving plant health regulations," he said.

"It can also facilitate biosecurity investigations – including providing vital data over likely virus introductions, pathways of entry, containment strategies and how best to conduct baseline surveillance."

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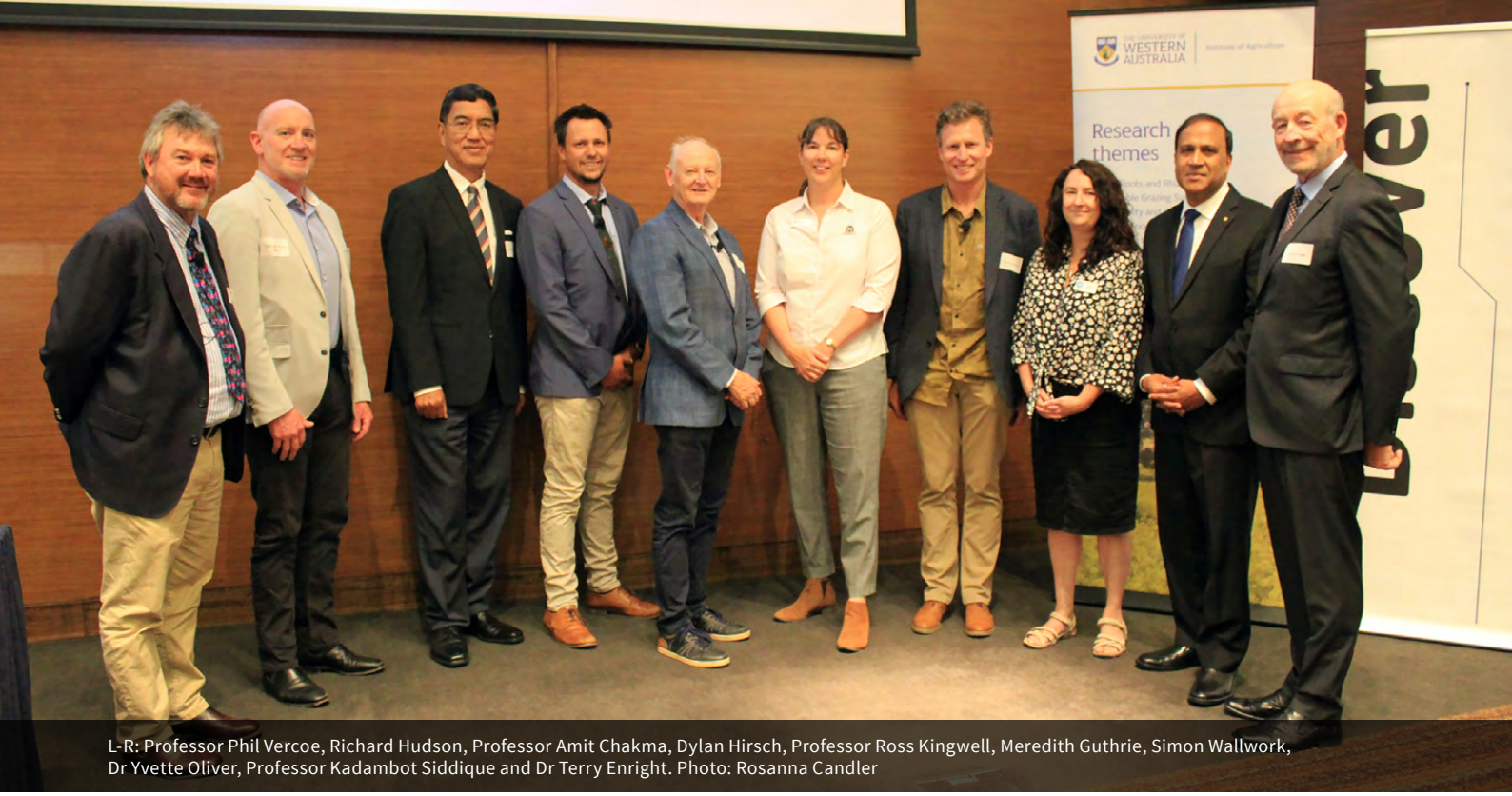


L-R: Professor Phil Vercoe, Richard Hudson, Professor Amit Chakma, Dylan Hirsch, Professor Ross Kingwell, Meredith Guthrie, Simon Wallwork, Dr Yvette Oliver, Professor Kadambot Siddique and Dr Terry Enright. Photo: Rosanna Candler

# Climate change challenges and solutions at Industry Forum

**Tackling the many challenges of climate change had everyone talking at The UWA Institute of Agriculture's 14th annual Industry Forum at the University Club Auditorium on 28 October.**

In his opening address, The University of Western Australia Vice Chancellor Professor Amit Chakma told the sold-out audience: "I am a strong supporter of The UWA Institute of Agriculture because of what it has done over the years, and what it will continue to do."

Professor Kadambot Siddique then introduced the Institute's Industry Advisory Board Chair Terry Enright, who served as Master of Ceremonies.

*"Our youngest son wants to know what we are doing for his future. We can see a steam train coming our way. We don't want to be unprepared for it."*

Farmer Simon Wallwork

Delivering his keynote address via video from Canberra, Australian National University Climate Change Institute research fellow Steven Crimp said climate change was a significant challenge to agricultural production.

Dr Crimp referred to long-term climate forecasts, which showed that temperatures in Australia could rise by 4.5 degrees by 2090 and – for every addition degree – WA's rainfall could decline between four and seven per cent.

UWA Professor Phil Vercoe then took to the stage to discuss the potential of capturing methane energy from ruminants and use it for production.

Professor Vercoe also explored the role that various Australian native shrubs play in reducing methane.

CSIRO Senior Research Scientist Dr Yvette Oliver presented on ways to increase the ability of soils to hold and capture water, reduce evaporation losses, and achieve early crop vigour.

Australian Export Grains Innovation Centre chief economist and UWA Professor Ross Kingwell introduced the idea that droughts on the east coast of Australia could be seen as a commercial opportunity for WA.

DPIRD research officer Meredith Guthrie then took the audience through data from the south-west land division that showed the shifts in climate since the mid-1970s.

The final two speakers were working farmers and UWA graduates Simon Wallwork and Dylan Hirsch.

2018 Nuffield Scholarship recipient Mr Hirsch detailed the ways he was mitigating drought risk on his farm in Latham.

"While our yields might not appear to be increasing, our water-use efficiency is slowly improving as we adopt better technologies and practices," he said.

Mr Wallwork, who was involved in the Climate Champion Program and jointly formed AgZero2030 in 2019, said his children inspired him to pursue carbon neutrality on his family's Corrigin farm.

"Our youngest son wants to know what we are doing for his future," he shared.

"We can see a steam train coming our way. We don't want to be unprepared for it."

The following sundowner brought agriculture industry leaders, stakeholders, researchers, students and farmers out into the University Club courtyard to enjoy refreshments and continue the very important conversation.

# Estimating soil moisture across the Wheatbelt

**Developing the first-ever model to estimate soil moisture across the Wheatbelt has proven a worthy challenge for UWA School of Agriculture and Environment PhD student Atbin Mahabbati.**

Mr Mahabbati said the model would make a significant difference to farmers, both economically and environmentally.

"As WA is located in a semi-arid region, knowing the amount of soil moisture across the Wheatbelt is generally quite important – particularly during special occasions when farmers want to decide whether to apply fertilisers, plant seeds or cultivate the field," he said.

"The model would give an assessment of the available water in the soil before doing any management practices.

"It would mean that farmers can avoid spending time and money on their fields when, based on the soil moisture profile, the field production would not be promising."

Mr Mahabbati said WA was one of the largest consumers of fertiliser in Australia, with approximately 240 thousand tonnes of urea used annually across the Wheatbelt.

"Farmers are spending hundreds of millions of dollars on fertilisers," he said.

"This cost could be reduced significantly if the farmers first had a better idea of the soil moisture situation in their fields.

"Not only would millions of dollars be saved, but less environmental pollution would occur."

Learning about how to apply a variety of state-of-the-art Artificial Intelligence (AI) algorithms to model complex problems has been the "most valuable finding" of his research so far.

"I have found that AI has progressed dramatically during the previous decade, and is capable of doing the jobs that we could not have thought of a few years ago," he said.

"I do believe that AI algorithms can be used in the field of agriculture as a real game-changer."

Mr Mahabbati said his interest in agriculture began during his childhood in Iran, watching his father work in their citrus garden.

PhD student Atbin Mahabbati. Photo: Rosanna Candler

"What inspired me to conduct my PhD research in this field was how much our safety and economy are associated with agriculture and the environment," he said.

Mr Mahabbati said he wished to thank his supervisors Professor Jason Beringer and Dr Matthias Leopold for their support.

***Atbin Mahabbati***
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# Many hands make light work at UWA Farm Ridgefield

Field day participants measuring trees. Photo: Professor Lynette Abbott

**An enthusiastic group weren't afraid to get their hands dirty during a field day at UWA Farm Ridgefield in September.**

Wheatbelt Natural Resource Management (NRM) and UWA coordinated the event to demonstrate 'fast-track restoration' of soil on a field site located on the western corner of the farm.

About 60 members of the agricultural community, UWA postgraduate students and rangers from the Noongar Boodja Ranger program (affiliated with Wheatbelt NRM) participated in the field day.

The soil restoration project was funded by the National Landcare Program: Smart Farms Small Grants Round 2.

Field day participants made observations and discussed the value of the restoration practices being trialled.

The group completed hands-on installation of permeable biomass barriers, planted new trees and measured existing trees for ongoing monitoring. They layered compost, biochar, straw and other biological amendments as either permeable biomass barriers or bio-resource wells.

The UWA Institute of Agriculture Emerita Professor Lynette Abbott said the restoration process was trialled to enhance the establishment and growth of trees and shrubs and to restore the soil condition in a degraded pasture.

"The degraded pasture was adjacent to a watercourse subjected to minor erosion and salinity," Professor Abbott said.

"The process is being trialled as a means of preventing further soil degradation and to restore plant productivity and biodiversity.

"The participants greatly contributed to restoration at the site, and their enthusiasm in getting involved was very much appreciated."

***Emeritus Professor Lynette Abbott***
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# High school students rise to the challenge

***This article was written by student Angelica Anastassiou***

**Three Shenton College students completed a four-day work placement at the UWA Institute of Agriculture from 29 September to 2 October.**

Year 10 students Tom Roberts, Alexander Wong and Angelica Anastassiou embraced the unique opportunity, which was organised through a longstanding partnership between UWA and Shenton College.

The placement gave students an insight into what they could expect from university life if they made the decision to study at UWA.

The students learnt about high-level research projects, worked on communications, observed the researchers and were even involved in helping with experiments.

They were also lucky to attend The UWA Institute of Agriculture's annual Postgraduate Showcase event, where eight PhD students presented their research and their findings. Angelica assisted with event management, social media promotion and communications projects.

"This placement has opened my eyes to other possibilities that can happen in my future," she said.

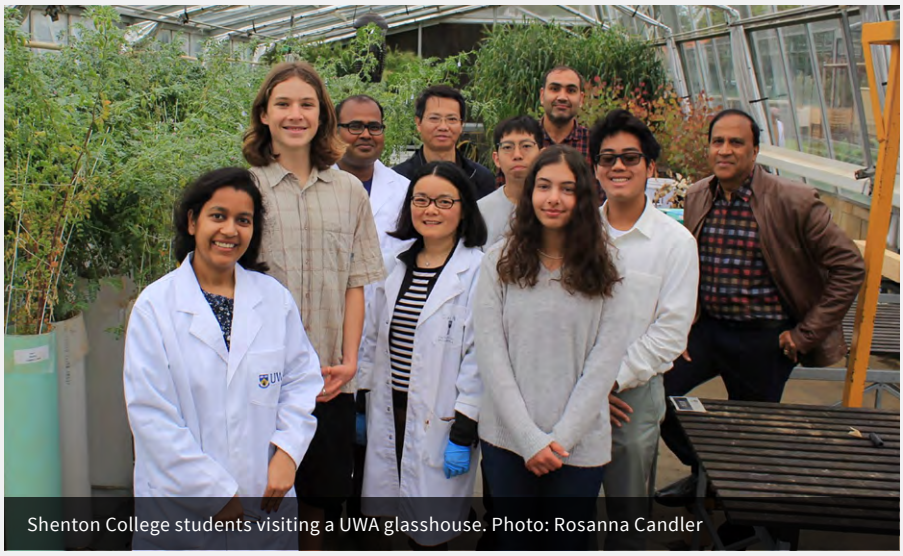
For the final two days, Tom and Alexander worked in a lab to help to process chickpea plant samples from a drought study.

The students said they thoroughly enjoyed their experience. Alexander said the placement had broadened his horizons and given him new opportunities and new things to look forward to in his future.

"I have really enjoyed the hospitality that the staff at UWA really take care of us as students and they really make us feel welcome especially in parts of the experiments," Alexander said.

Having always dreamt of studying at UWA, Tom said he could now "definitely picture" his future as a university student.

"To just be able to gain an understanding and to see how it all works, to see the functions of experiments and how Professors conduct it – I think that's a great experience," he said.



Shenton College students visiting a UWA glasshouse. Photo: Rosanna Candler

# UWA Engineering students help speed-up farm connectivity

**UWA Farm Ridgefield is set to receive a significant boost to its internet and mobile communications infrastructure next year.**

Groups of UWA Electronic Engineering Design students were tasked with designing a deployment of Wi-Fi communications across key locations on the farm.

"Present connectivity on the farm is very slow by modern standards and does not provide the communication bandwidth needed by the systems for a location that hosts the Future Farm 2020 project," School of Engineering senior lecturer Dr Silva said.

"The objective of each team was to complete a detailed design of the system, followed by a virtual verification that the design satisfies the requirements."

Dr Silva said the students' visit to the farm in October was a key aspect of the project.

"While COVID-related issues prevented more students from attending, the students who did attend commented that the visit was the single most useful day of their project work," he said.

Now that students have completed their designs and models, Dr Silva said the next step was to examine their work and select the final design – to be deployed on the farm in 2021.

***Dr Dilusha Silva***
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Engineering students visiting UWA Farm Ridgefield. Photo: Dilusha Silva

# Mike Carroll Fellowship boosts research collaboration

L-R: Helen Carroll, Marie-Louise Carroll, Yueqi Zhang, Suyog Subedi, Soodeh Tirnaz and Professor Kadambot Siddique. Photo: Rosanna Candler

**During a time in which international travel has been grounded by COVID-19, it was especially rewarding to hear from three Mike Carroll Travelling Fellowship recipients at the 17th annual presentation evening on 12 November.**

Twenty four UWA students have benefitted from the Fellowship since it was established in 2003 as a memorial to former Director General of the WA Department of Agriculture, the late Dr Mike Carroll, in recognition of his commitment to agriculture.

Following an introduction from The UWA Institute of Agriculture Director Professor Kadambot Siddique, Ms Helen Carroll introduced the 2020 Fellowship recipient Michael Young, who planned to visit the USA and Canada next year.

First to present was PhD student Suyog Subedi, who visited the University of Copenhagen in Denmark to research how African Mohogany could reduce worm load and improve gut health in livestock.

Although he planned to return home to his baby daughter after three months, the outbreak of the pandemic meant that he was stranded in Europe (and later his home country Nepal) for almost nine months.

Despite the significant changes to his plans, Mr Subedi achieved a great deal in the laboratory – forging partnerships and learning a new technique of harvesting parasite eggs that will save time, money and resources.

PhD student Yueqi Zhang spoke about her time at the Center of Plant Structural and Functional Genomics in the Czech Republic to explore single chromosome isolation in canola in 2018.

Thanks to the generous Fellowship, Ms Zhang said she was was fortunate enough to extend her stay from three to seven months.

After many long days and even staying awake overnight in the lab to record data every hour, she was able to achieve the highest chromosome yield in canola for the first time.

Finally, PhD student Soodeh Tirnaz discussed her time in Japan conducting research into diseases in canola and Japanese spinach.

Ms Tirnaz counted her greatest achievements during the fellowship to be learning new techniques, presenting her research to Kobe University and Graduate University for Advanced Studies (SOKENDAI), visiting other research groups and collaborating on publications.

# Hive of activity at Hackathon

**Helping create marketing buzz for innovative Australian honey products at the 2020 Honeybee Hackathon was a sweet experience for UWA Business School PhD student Kenneth Ho.**

The October event held at the Department of Primary Industries and Regional Development in South Perth brought together industry and innovators to develop new products for local and export markets.

On behalf of the Cooperative Research Centre (CRC) for Honey Bee Products, Mr Ho presented a talk on the labelling regulations for marketing honey products, as stipulated by Food Standards Australia New Zealand.

"I explored issues regarding the costs and conditions of acquiring some of the essential labels (such as country of origin, bioactivity ratings, Jarrah Association certification, Australian Manuka Association)," he shared.

"I also served as a consultant to the Hackathon teams and contributed to the development of potential business ideas.

"It was an eye opening experience for me to be exposed to the different proposed business ideas that can further value add to the honeybee industry."

CRC Chief Executive Officer and UWA academic Dr Liz Barbour said the WA honey bee industry was currently valued at $50 million, but aimed to grow to $100 million by 2030.

"To reach this industry goal, changes in strategies on honey bee product marketing are needed, with events such as this a great way to inspire innovative ideas and approaches," Dr Barbour said.

Kenneth Ho (right) at the Honey Bee Hackathon.

Mr Ho's postgraduate project (supervised by Associate Professor Fang Liu) will examine consumers' responses to label information and its effects on value and authenticity perception of Australian honey products.

He is also investigating consumers' purchase intentions and willingness to pay a price premium on local honey products.

***Kenneth Ho***
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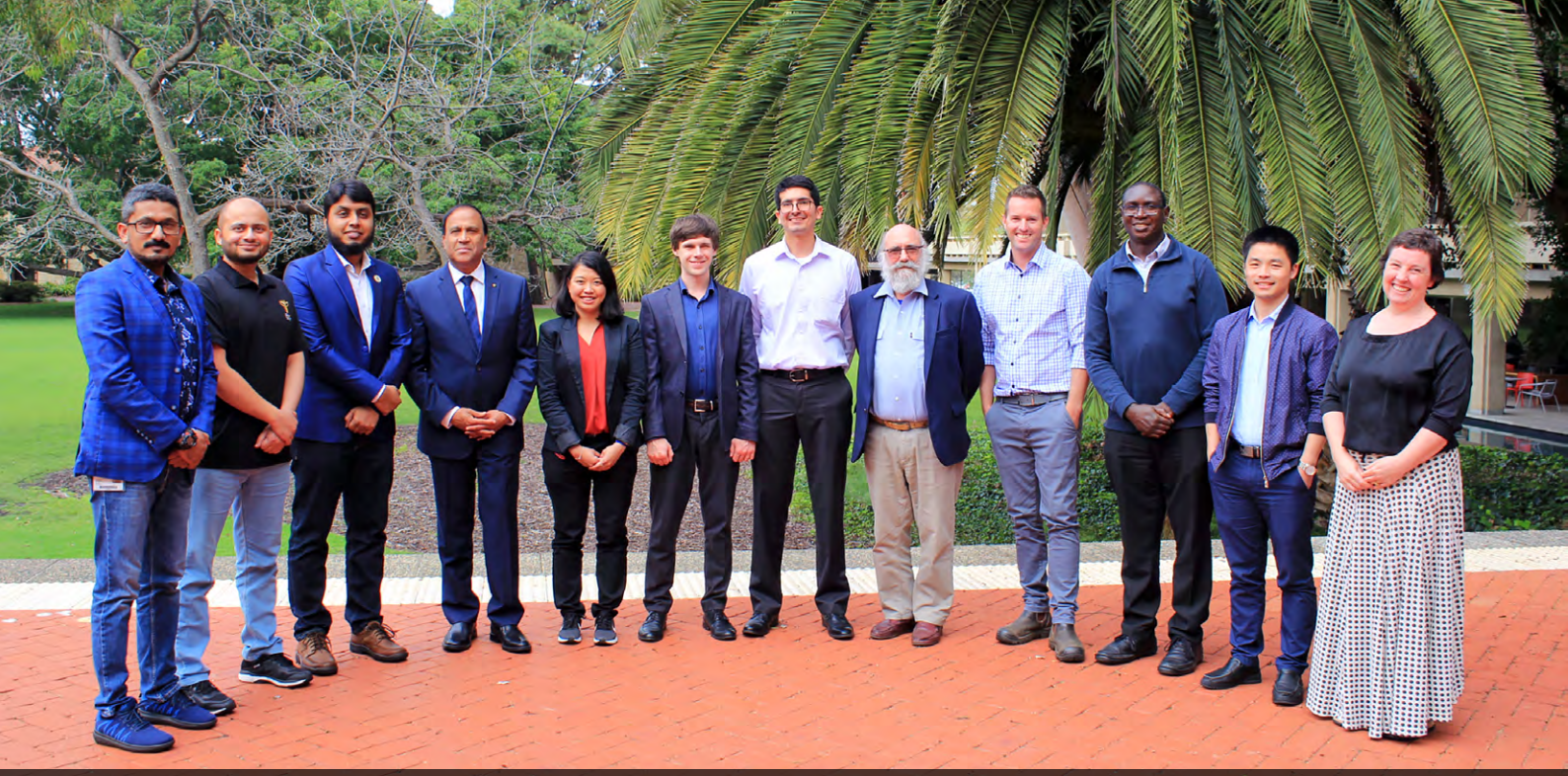

Presenters and contributors to the 2020 Postgraduate Showcase. Photo: Rosanna Candler

# UWA Postgraduates showcase new frontiers in agriculture

**Top postgraduate students presented their latest research in agriculture and related areas at The UWA Institute of Agriculture's 14th annual Postgraduate Showcase in September.**

The UWA Institute of Agriculture Director Kadambot Siddique said the event was an important opportunity for UWA students to engage with farmers, scientists, academics and the wider agricultural community.

UWA School of Agriculture and Environment Senior Research Officer Daniel Kidd presented his PhD research on improving phosphorus efficiency of pastures in southern Australia.

"We want to reduce the use of fertiliser in our cropping and pasture systems because overuse has a negative effect on our environment and waterways," Dr Kidd said.

School of Molecular Sciences PhD student Kirill Sukhoverkov then presented his research into predicting new herbicides from phys-chem parameters.

"The rise of herbicide resistance in recent decades has put the global food security under serious threat," Mr Sukhoverkov said.

"Therefore, finding novel modes of action of herbicides is a fascinating challenge."

Buy West East Best Kim Chance Fellowship Award recipient Jorge Silva's project was to develop a low-cost portable spectral imaging system to detect faecal matter on chickens as part of PhD research in the School of Engineering.

School of Agriculture and Environment PhD student Maria Purnamasari's research analysed how plant defence mechanisms are compromised when plants are left under shade.

"Just like humans, plants that don't get enough sun are more susceptible to disease and pathogens," Ms Purnamasari said.

*"In order to maximise their findings, postgraduate students must be able to sell the benefits of their research to industry."*

Professor Kadambot Siddique

Veterinarian Shamshad Ul Hassan's PhD research looked into understanding diarrhoea and worm resistance in sheep through gene expression.

"Animal health and wellbeing is one of my greatest priorities, and that is why my research focus is to rectify these issues," Mr Hassan said.

PhD candidate Mohammad Golam Kibria's project explored how foliar magnesium application enhanced wheat growth in acidic soil.

Hui Cao from School of Molecular Sciences looked at why making proteins fast could help modern wheat agriculture.

"As I grew up in a farm family, the dream of helping farmers yield more with less costs has guided me to this path," Mr Cao said.

Department of Electronics and Computer Engineering student Omar Anwar said his research combined technology and agriculture to develop low-cost, low-power and long-range remote beehive health monitoring solutions.

"Using new technologies, we will be able to take better care of bees and enhance our future food supply," Mr Anwar said.

# Next gen plant identification


Professor Hamlyn Jones using a plant ID app.

**UWA School of Agriculture and Environment Adjunct Professor Hamlyn Jones can thank his young grandson for inspiring his latest research into automatic plant ID apps.**

After watching a video of his grandson using a smartphone to identify plants in Switzerland, Professor Jones decided to test 10 free smartphone apps on British flora near his home in the UK.

His research findings were recently published in the journal *AoBPlants*.

The apps require the user to take a photo of the plant in its natural environment, after which they attempt to identify its family and genus.

Although cautioning that an app could never replace the accuracy of a botanical expert or rigorous key, Professor Hamlyn said he was amazed by how accurate some of the apps were.

"These apps are continually improving, but the best ones already show an outstanding success rate identifying up to three quarters of samples to family and half to species," he said.

"The automatic ID apps are likely to be a real benefit to amateur botanists in the short term.

"In the longer term they will have a role to play in more rigorous scientific biodiversity modelling, but refinements for this purpose are still needed."

Although his initial study focussed exclusively on British flora, Professor Hamlyn said it would be challenging and interesting to extend the research to Australian native plants.

"The great diversity of Western Australian (WA) flora presents particular challenges for plant identification," he said.

"Unfortunately most app development has been in Europe and the US, so they do not perform well on Australian plants.

"This will improve as apps are 'trained' by local users in WA, particularly through citizen science approaches."

***Adjunct Professor Hamlyn Jones***
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# Propagating an industry: improving table grape rootling viability


Table grapes at Carnarvon Nursery.

**The high quality of Western Australian (WA) table grapes commands a price premium, driving demand in new plantings and excellence in cultivar selection.**

This industry growth promotes rapid production of grafted table grape rootlings.

However, nurseries are reporting unacceptable graft union failures.

The UWA Institute of Agriculture's Research Associate Dr Jo Wisdom recently met with producers and nurseries in Carnarvon and the Swan Valley to present findings from experiments designed to understand the effects of climate, physiology and genetics on the readiness state of grapevines to graft.

The diversity of table grape growing latitudes in WA provided a unique opportunity to assess the ecophysiological effects on the 'growth readiness' status of the grapevine.

Grafting is commonly used in woody perennial propagation to provide resistance to pathogens and improved plant performance.

Grafting success requires a connection between a rootstock and the scion, and the formation of callus (soft tissue that forms over a wound) on both sides of the union.

However, the plant needs to be in a 'pluripotent state' to be ready for this type of cell growth. Dr Wisdom investigated several aspects of grapevine growth readiness.

As anticipated, plant material for propagation harvested from the lower latitude site in Carnarvon was slower to generate callus formation than material from the higher latitude Swan Valley.

This was particularly noticeable at an earlier cane harvest time.

"We found that we could promote callus formation by exposing the plant to a chemical that promotes DNA de-methylation," Dr Wisdom said.

"This process essentially de-differentiates the cells making them ready to grow in a different way. Application of a commonly applied bud growth-promoting chemical was also found to be counterproductive to callus formation."

Dr Wisdom said the findings suggested that the time of propagation material harvest, climate and cultivar were important in influencing the readiness state of the grapevine to grow.

"Preliminary results suggest that plant material can be manipulated to ensure greater propagation success," she said.

***Dr Joanne Wisdom***
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The students visited barley, canola and wheat paddocks and discussed crop management. Photo: Ken Flower

# No substitute for on-the-field understanding

**Swapping lecture theatres for paddocks and textbooks for conversations with a working farmer proved to be a rewarding experience for UWA Agriculture Science students.**

In September, Associate Professor Ken Flower and Professor Martin Barbetti accompanied a group of third-year students to visit Rodney and Jane Rogers' farm in the Cunderdin area.

The field trip was for students to gain an overview of current cropping practices and discuss issues and trends with the farmer.

The day started with students viewing Mr Rogers' machinery shed and discussing land prices and machinery costs.

Mr Rogers then gave a summary of the livestock and crop enterprises, and highlighted the continuing high investment in machinery that most farmers need to improve the productivity of cropping and expand their cropped area.

He explained that no-tillage and stubble retention were a key part of the system, especially as the last 10 years, which had been relatively dry.

Nonetheless, some paddocks were ripped and/or spaded to bring some heavier textured soil to the surface and reduce non-wetting.

Mr Rogers emphasised that pastures with a high legume component (largely sub-clover, medic and yellow serradella) and good grass control were a key component of the system – for both livestock feed and to maintain the fertility of the cropping paddocks.

The students then visited barley, canola and wheat paddocks so Mr Rogers could explain his crop management.

Professor Barbetti was keen to find some diseases to show the students and discuss their control.

However, due to the relatively dry growing conditions, only a few diseased leaves could be found.

In the wheat, it was noted the few ryegrass plants observed were growing along the side of the crop rows, with virtually no weeds in the inter-row.

Rodney Rodgers and students at a canola field.

*Farmer Rodney Rogers emphasised that pastures with a high legume component and good grass control were a key component of the system – for both livestock feed and to maintain the fertility of the cropping paddocks.*

Mr Rogers explained that this was because the herbicide was thrown out of the crop row at seeding by the tyne and knifepoints.

A discussion ensued about the potential of some upcoming herbicides which could be applied soon after seeding the wheat to control this issue of 'in furrow' weeds.

The students benefited greatly from the field trip, in particular hearing Mr Rogers' first-hand account of his farming enterprises, reasoning behind management decisions and focus on practical, in-field agronomy.

***Associate Professor Ken Flower***
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# Changing food and nutrition security in rural India

**As households in rural India increasingly shift away from farming, what impact will this have on food and nutrition security?**

UWA Professor of Economics Anu Rammohan explored this important question in her recently published study, which empirically investigated the relationship between land, food, and nutrition security in rural India.

Non-farm income now makes up approximately half of a total farm household's income, suggesting that rural households in India are increasingly less reliant on land and agricultural livelihoods.

Professor Rammohan said the study was the first in India to follow the same cohort of children over an 11-year period.

It provided robust quantitative evidence of the impact of land ownership on child anthropometrics.

"The key point is that rural livelihoods are evolving," she said.

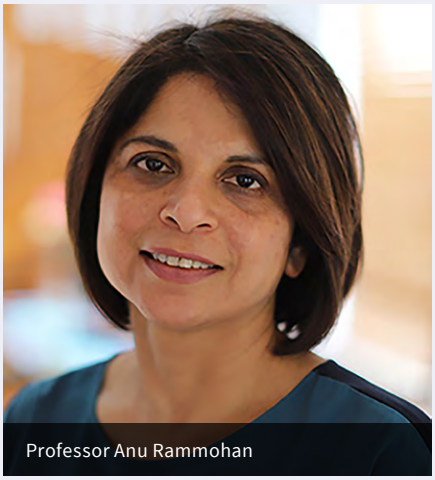
"As individuals move towards non-farm livelihoods, it is critical to understand the role that remittances may play in supporting household food and nutrition security."

Using a sample of 1311 children (and their households) who were aged one year in 2002, Professor Rammohan and research colleagues Lili Vu and Srinivas Goli measured child nutritional status using a height-for-age z-score (haz).

The haz is calculated using children's height/length and date of birth and refers to the number of standard deviations below or above the median height of reference population used by 2006 WHO Children Growth Standard.

The results showed that large agricultural land ownership was significantly associated with better child nutrition and household food security.

There was also strong evidence of the influence of field crop production and livestock ownership on the consumption of fruits, vegetables, pulses, milk, and dairy products.



Professor Anu Rammohan

Given that the study used a random sample, Professor Rammohan said the findings had implications both for India and more widely.

"We have observed similar trends in Myanmar," she said.

"Allowing for different contexts, this research can certainly be applied to different countries, and fits in with the international literature that sees a growing trend towards non-farm livelihoods among agricultural households."

***Professor Anu Rammohan***
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# Fruit and veg key to preventing Alzheimer's

**A UWA Medical School researcher, who recently found that a diet rich in certain antioxidants and nutrients could help prevent Alzheimer's disease, is hoping agricultural science researchers will build upon his findings.**

Dr Gerald Veurink is the co-author of study published in *Open Biology* that found taking a combination of antioxidants at increasing doses was more beneficial at preventing Alzheimer's disease than any other treatment currently available.

Dr Veurink said the complex phenolic carotenoid (found in fruits and vegetables), as well as antioxidants

such as vitamin C and vitamin E in high concentrations, were most effective at reducing the risk of Alzheimer's disease.

"It is most important to have optimal nutrition that is rich in antioxidants both water and fat soluble," he said.

"It would therefore be interesting and worthwhile to further develop research in agriculture whereby the antioxidant levels in plants may be increased."

Dr Veurink said a nutrient-rich diet and the simultaneous supplementation of an antioxidant combination cocktail was effective at managing the chronic degenerative disease.

"The combination of antioxidants at high, personalised doses and a nutrient-rich, low-carbohydrate diet appears to have the biggest impact," he said.

***Dr Gerald Veurink***
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## AWARDS AND INDUSTRY RECOGNITION

| NAME | AWARD |
|---|---|
| Prof Kadambot Siddique | Clarivate Highly Cited Researchers 2020 |
| Em/Prof Hans Lambers | Clarivate Highly Cited Researchers 2020 |
| Prof Harvey Millar | Clarivate Highly Cited Researchers 2020 |
| Prof Davey Jones | Clarivate Highly Cited Researchers 2020 |
| Prof Dave Edwards | Clarivate Highly Cited Researchers 2020 |
| Prof Ryan Lister | Clarivate Highly Cited Researchers 2020 |
| Adjunct Prof Rajeev Varshney | Clarivate Highly Cited Researchers 2020 |
| Dr Karen Frick | Functional Plant Biology Best Paper Award for 2019: The Australian Society for Plant Scientists |
| Adjunct Prof Ashwani Pareek | Tata Innovation Fellowship 2020: Department of Biotechnology, Government of India |

## VISITORS TO IOA

| NAME OF VISITOR | VISITOR'S ORGANISATION AND COUNTRY | HOST DETAILS | DATES OF VISIT |
|---|---|---|---|
| Three Shenton College Year 10 students | Shenton College, WA | The UWA Institute of Agriculture | 29 September – 2 October |
| 24 members of the 1970 graduating class of Agriculture at UWA | The University of Western Australia graduates | UWA School of Agriculture and Environment | 26 November |

## NEW POSTGRADUATE RESEARCH STUDENTS (PhD)

| STUDENT NAME | TOPIC | SCHOOL | SUPERVISOR(S) | FUNDING BODY |
|---|---|---|---|---|
| Michael Robert Young | Optimal Sheep Stocking Rates for Broadacre Farm Businesses in Western Australia | Agriculture and Environment | Prof Phil Vercoe and Prof Ross Kingwell | DPIRD Sheep Industry Business Innovation Scholarship |

## RESEARCH GRANTS

| TITLE | FUNDING PERIOD | FUNDING BODY | INVESTIGATORS |
|---|---|---|---|
| Developing strong restorer-of-fertility genes for hybrid wheat breeding | 2021-2023 | Australian Research Council Linkage Projects | Prof Ian Small, Mr Pascual Perez and Dr Tristan Coram |
| Tightening the phosphorus cycle for grain legumes | 2021-2025 | Australian Research Council Linkage Projects | E/Prof Hans Lambers, Prof Kadambot Siddique, Professor Megan Ryan, A/Prof Peta Clode, Dr Rajeev Varshney, Prof Fusuo Zhang, Dr Wenfeng Cong and A/Prof Yifei Liu |
| Does plasma membrane perception of 2,4-D influence auxin resistance? | 2021-2024 | Australian Research Council Linkage Projects | Prof Stephen Powles and Mr Chad Sayer |
| Identifying Control Elements In Chloroplast Gene Expression | 2021-2023 | Australian Research Council Discovery Projects | Prof Ian Small |
| Ascorbate and glutathione integrate the control of grapevine development | 2021-2024 | Australian Research Council Discovery Projects | A/Prof Michael Considine, Dr Amanda Walker, Dr Joanne Wisdom and Prof Christine Foyer |
| Understanding disease resistance gene evolution across the Brassicaceae | 2021-2023 | Australian Research Council Discovery Projects | Prof Jacqueline Batley and Prof David Edwards |
| Advancing programmable genetic computation to control plant gene activity | 2021-2023 | Australian Research Council Discovery Projects | Prof Ryan Lister |
| The roles and regulators of new plant cells linked to root transport | 2021-2023 | Australian Research Council Discovery Projects | Prof Ryan Lister and Prof Justin Borevitz |

## UWA IOA 2020 Publications
*(Not yet reported)*

**Peer Reviewed Journals**


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Ahmad Rashid FA, Scafaro AP, Asao S, Fenske R, Dewar RC, Masle J, Taylor NL and Atkin OK (2020). Diel and temperature driven variation of leaf dark respiration rates and metabolite levels in rice. *The New Phytologist* https://doi.org/10.1111/nph.16661

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Barrow NJ, Sen A, Roy N and Debnath A (2020). The soil phosphate fractionation fallacy. *Plant and Soil* https://doi.org/10.1007/s11104-020-04476-6

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Chew J, Zhu L, Nielsen S, Graber E, Mitchell DRG, Horvat J, Mohammed M, Liu M, van Zwieten L, Donne S, Munroe P, Taherymoosavi S, Pace B, Rawal A, Hook J, Marjo C, Thomas DS, Pan G, Li L and Fan X (2020). Biochar-based fertilizer: Supercharging root membrane potential and biomass yield of rice. *Science of the Total Environment* **713** https://doi.org/10.1016/j.scitotenv.2019.136431

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## UWA IOA 2020 Publications
*(August-December)*

**Peer Reviewed Journals**


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