



Former Minister Kim Chance celebrates the opening of the International Centre for Plant Breeding Education and Research at UWA with the Director, Prof William Erskine, and Deputy Director, Associate Prof Wallace Cowling.

UWA Plant Breeding Centre to help address global food shortages

The University of Western Australia established an International Centre for Plant Breeding Education and Research (ICPBER).

This centre was launched on Friday, August 29 by Mr Kim Chance, former

Minister for Agriculture and Food; Forestry; the Midwest and Wheatbelt. UWA Vice-Chancellor, Professor Alan Robson, said the centre would play a vital role in addressing the looming global shortage in plant breeding expertise.

“There is growing recognition that there is a need to develop rapid crop breeding skills to help us adapt to climate change and to secure the world’s food supplies,” he said.

“The new centre will provide much needed integrated expertise in genetics, biotechnology and plant breeding. In effect, it will help provide the next generation of professional plant breeders for Australia, the Asia-Pacific region, and the Indian Ocean rim.

“The Centre will form part of the University’s Institute of Agriculture (IOA) and will significantly strengthen UWA’s contributions to Australian and international agriculture.”

The ICPBER has joined with the Food and Agriculture Organisation of the United Nations (FAO), in working with many organisations globally to assess national plant breeding and biotechnology capacity worldwide. Capacity in plant breeding is either insufficient or lacks integration to fully capture the benefits of modern biotechnology and conserved plant genetics.

This Centre will offer a four-year undergraduate science degree in genetics and breeding – the only one of its kind at an Australian university – and an undergraduate degree in agricultural science, with a component of genetics and breeding. Both degrees include training in crop agronomy, disease and pest resistance, plant physiology, biometrics and related disciplines. It will also offer post-graduate study in genetics and plant breeding, as well as in-service training for practising plant breeders and seeds industry personnel.

In this issue

- P3** Plant production improvements
- P4** 2020 Vision: the face of WA broadacre farming
- P7** UWA — All-rounder in agriculture and natural resource management
- P8** Birds of a feather ...

Director's Column



Professor Kadambot Siddique
(ksiddique@fnas.uwa.edu.au)

Time is flying and we are into the last quarter of 2008, and the Institute of Agriculture (IOA) is moving forward in its mandate towards integrating agricultural and natural resource management research, education, training and communication across the university and externally.

Since the first quarter of the year, the IOA has had several events that covered various aspects of agriculture and natural resource management. At the "Frontiers in Agriculture" Postgraduate showcase (page 7) on

June 10, students presented cutting edge research in soil science, plant biology, animal biology, agricultural economics and natural resource management. They covered topics from perennial pastures, crop root systems, on-farm animal welfare, grainbelt drainage, natural resource management and disease resistance in crop plants and animals. This event brought together students, industry and potential employers. In his opening address Professor Don Markwell, UWA Deputy Vice-Chancellor (Education) said that UWA was deeply dedicated to fostering high quality research training.

The IOA values making links with the industry. This commitment was clear at the Industry Forum titled: *2020 Vision: The face of WA broadacre farming* (see page 4).

Farmers and industry leaders had the opportunity to interact with leading researchers at UWA during the Agriculture Open Day at Shenton Park on August 8 (see page 12). Aquaculture and native fish breeding, alternative oilseeds, salt tolerant wheat, legumes, emus and game birds were but a few displays to choose from.

Globally there is a growing realisation that we need to develop rapid crop breeding skills to help us keep up with global food demands, and to adapt to climate change. Training future generation plant breeders with expertise in genetics, biotechnology and plant breeding are essential to secure the world's food supplies. The new International Centre for Plant Breeding Education and Research

(ICPBER) was launched in August. In establishing this Centre the IOA is leading the way in equipping and providing the next generation of professional plant breeders for Australia, the Asia-Pacific region, and the Indian Ocean rim. The new centre within the School of Plant Biology at UWA forms part of the IOA and will significantly strengthen UWA's contributions to Australian and international agriculture.

This year the IOA organised four public lectures which was well attended by a wide range of audience. We have four more exciting public lectures scheduled for the rest of the year (see page 15).

In August I met 25 young growers from the Liebe Group and South East Premium Wheat Growers Association (SEPWA) at a breakfast organised by Rural Media Association of WA. I presented a seminar on "Global Trends in Agricultural Production and Opportunities for Australia". The level of knowledge and optimism showed by these young farmers of WA were impressive. At the IOA, not only do we strive to stay at the forefront of agriculture education and research, but we continue to be inspired by local knowledge and expertise. Turn to our articles on the Dowerin Field Day (page 11), plant productions workshop (page 3), and ratite symposium (page 8) for much food for thought from local and global agricultural experts.

Keep in touch with what is happening in agriculture and natural resource management at UWA by visiting our website at www.ioa.uwa.edu.au.

UWA Plant Breeding Centre

continued from page 1

UWA is one of the few remaining institutions worldwide that has the range of academic expertise to provide holistic training in genetics and plant breeding linked to applied areas. The Centre will broaden knowledge of, and interest in, UWA as a place for training and research among potential students in the Middle East, Africa, the Indian Sub-Continent and South-East Asia. It is expected to attract high-quality postgraduates and in-service trainees from international agricultural research centres, national agricultural programs and universities in those regions. The Centre has received funding from the Grains Research and Development Corporation (GRDC) for "Capacity building in Plant Breeding". For more information on the ICPBER go to www.icpber.plants.uwa.edu.au

IOA Mission

"To advance research, education, training and communication in agriculture and resource management, for the benefit of mankind".

If you wish to be included on the mailing list or receive this publication by email please contact us.

Editor: Erika von Kaschke
Institute of Agriculture
Tel: +61 (08) 6488 4717
Email: ioa@fnas.uwa.edu.au

Erika.vonKaschke@uwa.edu.au
Fax: +61 (08) 6488 7354
Web: www.ioa.uwa.edu.au

The University of Western Australia
MDG M082, 35 Stirling Highway Crawley, WA, 6009

Sustaining productive agriculture for a growing world

Plant production improvements

The annual UWA Institute of Agriculture Plant Production Systems Program workshop was held on July 7 to discuss plant improvement research and education in Western Australia.

The aim of the workshop was to get a better understanding of current crop improvement activities in WA, look at the main challenges and opportunities, and how to advance education and research collaboration. The forum was chaired by Prof. Steve Powles, Leader of the IOA Plant Production Systems Program and Prof. Lyn Abbot, Acting Dean of FNAS. Concluding comments were made by Dr Robert Loughman, Leader of the Cereal Breeding Program, DAFWA and Dr Guijun Yan, Deputy Leader of the IOA Plant Production Systems Program.

Wheat

Mr Robin Wilson, senior wheat breeder with InterGrain said that their objectives are to breed for yield and adaptation against abiotic stress tolerance and disease resistance.

Integrain's success stories include genetic gain for yield of 1% per annum, and an improvement in quality. "All our varieties are eligible for premium grades", Mr Wilson said.

In future Integrain hopes to improve by utilising new technologies like a new quality test for micro-water absorption that allows measurement earlier in the program and on only 10grams of seed.

Barley

Dr Reg Lance, barley breeder at DAFWA said that Barley Breeding Australia (BBA) wants to see "a productive, profitable and sustainable Australian barley industry supported by the release of commercially successful, targeted-to-market, elite malting and feed barley varieties developed through the Western Node of BBA."

In order to achieve this they target breeding objectives for disease standards, expected improvement in yield and a balance in activities between feed & malting variety development. Dr Lance predicted a "bullish" future for barley in Australia.

Canola

Associate Professor Wallace Cowling, Deputy Director of ICPBER and Canola



L to R: Dr Guijun Yan (School of Plant Biology), Dr Steve Milroy (CSIRO), Mr Robin Wilson (InterGrain), Dr Bevan Buirchell (DAFWA), Prof William Erskine (CLIMA), Dr Susan Barker (School of Plant Biology), Dr Reg Lance (Adjunct Prof UWA/DAFWA), and Prof Kadambot Siddique (IOA), Adjunct Prof Tim Setter (UWA/DAFWA).

Breeders Western Australia (CBWA) Principal Research Scientist, said that canola breeding has had many triumphs and tribulations. During the 70's breeders concentrated on blackleg resistance. In 2000 Australia had a "closed" canola population with only four varieties making up 50% of the ancestry.

In 2001 the CBWA started in WA and used genetic diversity from Australia and Europe. Their primary selection was in the low rainfall grainbelt with rapid cycles of recurrent selection.

CBWA aims to breed a tough "WA Canola" by 2020. It will be high yielding hybrids with better nitrogen efficiency, rapid maturity, and rapid translocation of nutrients under drought stress conditions.

Lupins

Lupin's value as a dietary fibre makes it an exciting crop for the health food market. Dr Bevan Buirchell, Senior Lupin Breeder at DAFWA looked at the state of the industry, the breeding process, drivers, and objectives and future directions.

He said that DAFWA concentrates on breeding narrow-leafed, yellow and albus lupins. Although the current situation is "challenging", mainly because the incentive for farmers to grow lupins is low, Dr Buirchell believes that the underlying demand in the lupin market is upward. Some of the market drivers include dominance of soybean meal in the US and Brazil and the increasing meat consumption in Asia.

Pulse

If one talks about dietary health one cannot exclude pulses. Field peas and chickpeas contain 26% and 23%

proteins respectively. They are packed with vitamins and minerals. How could breeders improve on this? According to Professor Willie Erskine, Director of CLIMA and Adjunct Professor Tanveer Khan, Chickpea breeder of DAFWA they aim to achieve integrated gene management, consistency of yield and profitability, and sustainability of cereal-legume systems in a drying, variable climate with escalating input costs.

One of the challenges in chickpea breeding is a lack of diversity in cultivated chickpeas. Recent advances show novel genetic variation identified for salinity and boron tolerance, and ascochyta blight resistance.

Pre-breeding

Dr Steve Milroy, sub-program leader at CSIRO Plant Industry, Perth covered pre-breeding in wheat and legumes. He said: "We know what we need in terms of key adaptive traits identified in target environments in chickpea and lupin using G x E ground truthing. We know where to look for it, because habitat characterization allows us to select germplasm from contrasting environments in both species, but can we find it?"

He said that solutions should be found for eco-physiology of phenological mechanisms in chickpea and lupins e.g. chilling tolerance in chickpea, and photoperiod/temperature responsiveness in chickpea and lupins.

In terms of wheat adaptation Dr Milroy said that his group is interested in water and N uptake by contrasting root systems and implications, and evaluating traits for production in water limited environments

2020 Vision

The face of WA broadacre farming

History tells us that the great leaders of the past always consulted wise men before they made any predictions and decisions. It seemed more than apt that the Institute of Agriculture at UWA drew upon more than 200 years of combined knowledge from farmers and other industry experts at the Industry Forum, 2020 Vision: the face of WA broadacre farming in June.

Speakers explored current and future trends in broad acre farming systems in WA, and predicted what future research and development strategies for integrated cropping and livestock systems might look like.

Economic perspective

Chief Economist and Associate Professor Ross Kingwell (DAFWA and the School of Agricultural and Resource Economics) predicted that WA farmers will face opportunities and challenges in 2020 with inflation and price volatility expected to be a serious hurdle in the near future. He envisages fewer but bigger farms.

A/Prof Kingwell made it clear that even places that have always been crop dominant like the southern and central areas of WA have intensified their cropping outfits. "We have moved even more strongly into crop dominance, but there is no strong evidence that technical efficiency has improved", he said. At the moment there are 25% less sheep on farms.

He expects one of the biggest challenges will still be making farming in dry inland areas more socially attractive, and providing access to affordable skilled and unskilled labour. "Maintaining the human infrastructure support for agriculture will be both an opportunity and a challenge", he said.

Diversification is the name of the game according to A/Prof Kingwell. He said that farmers are looking for more income options like wind farms and the carbon supply chain.

Farming perspective

Three of WA's farmers, Mr Dawson Bradford, Mr Gary Lang and Mr Colin Hutchinson brought three different perspectives on broadacre agriculture.

Mr Dawson Bradford, a well established farmer from Narrogin, believes in making the most of his farm, yet maintaining a balanced lifestyle. He sees farming with grain and livestock as a profitable combination.

This third generation farmer started out share farming in 1965. "It was clear from the start that the farm was unviable if it was farmed in the normal grain and sheep way", he said. This meant intensification, diversification and integration were necessary if they were to survive. Since then he has bought seven properties to make up the current "Hillcroft Farms". They have eight different income streams e.g. grain, hay, prime lamb, terminal sire, wool, oil seed, pig and clover seed production.

The piggery alone is a 650 sow — farrow to finish operation. They turn off approximately 14500 heavy weight baconers each year. His support system allows the pigs to have a ready supply of grain, close to processing works which means less freight.

All the grain produced is for livestock production with only the surplus sold. The Bradfords use a basic crop rotation of two in one out (wheat, barley and pasture). Globally, there are few people who maintain such a diverse enterprise, and yet, Mr Bradford sees room for improvement in future. He aims to reduce costs whilst increasing production by: reducing labour required, reduce supplementary feeding and increase lambings. "We are developing a 2000 wool shedding ewe flock to produce a self-replacing, hardy, high performance, low input breed of sheep, using the latest technology and DNA to identify and select the right genetics".

Mr Gary Lang, a farmer from Wickiepin explored the advantages of a cropping operation and a livestock operation but on different parts of the farm.

Mr Lang has been able to achieve higher yields, higher stocking rates and higher profits by keeping crops and livestock separate.

Plant Production

continued from page 3

Education

Dr Susan Barker, Senior Lecturer School of Plant Biology and Professor Kadambot Siddique, Director of the IOA, brought the UWA perspective to the day. Dr Barker looked at genetics and breeding education at UWA. After reviewing training needs in Australia, she found that the industry required six to ten new breeders per year, but only two to three graduated each year. The educational shortfall is visible at the undergraduate level.

UWA is offering a course in genetics and breeding with the core units in BSc. This includes introductions to genetics and biometrics1 in level 2. Students will cover genetic and plant/animal breeding, genetics and evolutions, biometrics2, and biotechnology and breeding in level 3. At level 4 (Grad Dip and MSc (Gen and Breeding)) students will do a research project.

Prof Siddique gave an overview of the current food crisis in the world, and the role plant breeders have in making a difference. He explained how the new International Centre for Plant Breeding Education and Research (ICPBER) came about. UWA seeks to educate and supply the "Professional Plant Breeders for Tomorrow". For more on the ICPBER go to page 1.

For more information on the presentations, go to http://www.ioa.uwa.edu.au/programs/plant_production_systems/activities.

Sustaining productive agriculture for a growing world



Front L to R: Mr Kevin Goss (FFI CRC), Mr Gary Lang, Prof Kadambot Siddique (IOA), Dr Ken Flower (School of Plant Biology), and A/Prof Ross Kingwell (DAFWA and the School of Agricultural and Resource Economics). Back L to R: A/Prof Mike Ewing (FFI CRC), Mr Dawson Bradford, Dr Roger Lawes (CSIRO Sustainable Ecosystems) and Mr Colin Hutchinson.

"In the mid 1990s we started farming to our soil type. In order to reduce soil erosion, we continuously cropped in sandy soils while we run sheep on the clay, granite and slat challenged areas of the property", he said.

When selecting paddocks for livestock and cropping, he also evaluated the paddock profitability, ease of cropping, land care and sheep suitability, but kept in mind the logistics of fences, water, distance to shearing sheds, and location to other sheep paddocks. He also considered yield potential, grain and legume suitability.

"Our profit summary revealed that our 2007 gross margin was much higher than our five year average for wheat and barley, but only slightly higher for sheep", he said.

This is why Mr Lang chose to keep 83% of his property under crops.

While he achieves high yields, higher stocking rates and higher profit by keeping livestock and crops apart, weed management remains a challenge.

Selecting one of the best in continuous no-till cropping, one name stands out — **Mr Colin Hutchinson** from Yorkrakine. Even in an area where they only received 328mm rainfall last year, he has experienced major advantages of excluding livestock from his property. The impact of soil compaction is reduced while giving farmers more freedom to extend their cropping programs.

Mr Hutchinson said that he did not realise the real impact of soil compaction until livestock was excluded from his property. He showed the audience photos of vehicle tracks cutting

across his field still visible at harvest time. "Compaction from vehicles and sheep can make a massive difference", he said.

His fully controlled traffic system operation starts at harvest time when everything is set up for the next season. He is ever mindful of weeds and has made some adjustments to help with control. Mr Hutchinson attached small yellow fingers to his harvester which skimmed the ground, helping to pick up weeds.

Ever fine-tuning his operation, he is taking out more fences, using smaller tractors, and moved to armsteer on his tractor to make spraying and steering easier. The tramline system enables him to get down to the moisture at the bottom of the furrows. His long-term view is that people who are still farming for good

years should start farming for dry years.

Other speakers included Dr Ken Flower (School of Plant Biology), Mr David Falconer (Consult Ag, consultant), A/Prof Mike Ewing (Research Director, Future Farm Industries CRC) and Dr Roger Lawes (Research Scientist, CSIRO Sustainable Ecosystems).

Peering into the future two messages stand out:

"In the longer term, successful research and development will remain crucial to agricultural productivity and prosperity"
A/Prof Ross Kingwell

"Be ready mentally, physically and financially to take on the changing opportunities"
Mr David Falconer

To view all the presentations visit www.ioa.uwa.edu.au

"... farmers are looking for more income options like wind farms and the carbon supply chain ..."

Letter to the Director

Thank you for the opportunity to join UWA Institute of Agriculture Industry Forum on 27th June and as always I found some takeaway thoughts.

What's written below is not in anyway criticism of what has been said but the process of tinkering with it for my own benefit. I might add that as the years have passed almost all of the subject matter of the day had been visited, if not practiced. "Not all but most."

Associate Prof. Ross Kingwell. On climate we should take in 1895-1915 and the change of rainfall might look less significant? I would look at the East coast also? I suspect that the impact of emissions is a subject we would be wise to be sure of so that we are supporting the known and not the popular view, and that we must agree on what is normal climate change and what is human cause! If we are to produce food and fiber in competition with the rest of the world we should only load our industry at the same rate, because Australia is not much influence on the big picture. One percent of the global problem has a rather small impact but could be big in cost to Australian agriculture when agriculture is said to represent sixty percent of the carbon emissions? I felt A/Prof Ross Kingwell was spot-on with his paper and it was not all about science. UWA could apply his thoughts and make very sure the political behavior on carbon and green issues is challenged and a high input into agricultural economics for long term planning is pushed.

Mr Dawson Bradford is my idea of a great farmer and businessman who probably has more enjoyment than me from farming, because he stays focused and is not always thinking completely outside the square. Very few farmers are as good as Dawson and it may not (will not) be the answer for all. I only know about three farmers as good as Dawson. (He's got it!)

Mr Gary Lang, Mr Colin Hutchinson and Dr Ken Flower. These three are all focused on a concept and concept it is! Colin and Gary will change again, as I have, based on encountering the effects and shortcomings of our systems; so make a note, to meet with them in 2020 to discuss the new look. We change our soil/weed burden/crops/financial rewards/etc but also right at the beginning we are facing the fact that all paddocks are different in their needs and it is to some extent a blend that is required and it all has a place. I felt Ken may have overstated the challenges but I seem not to have taken many notes?

Mr David Falconer is a professional consultant whose role is making clients face reality for their own personal financial health and that translates to other things like good mental health and happiness? I only mention this



Mr Rob Hyde, farmer, Wongan Hills, WA

because he sees proof of the importance of what I determine as honesty in moving forward and acceptance of reasonable risk. The agricultural industry must have a counter balance to the doubt that slows the use of good opportunities like GM. technology/ tidying up of paddocks by removal of trees/live shipping/drainage/government interference in free marketing, etc. That is not David's list nor mine but there are many issues that our universities could be taking a strong public stand on helping to remove, for farmers, the small but significant and growing hill (resistance to progress) that we must climb for advancement.

Farmers are their own worst enemy when it comes to Return on Investment (ROI) but somehow that does not matter much as has been proven over a long time, but as the purchaser of several properties that have been leased it does seem to me that if farms have owner management the farmer, farm and Australia will be well in front! Our new breed of young well educated farmers should to be taught to expand and be kept informed on strategies to achieve this with minimum risk. That is a subject worthy of study. Leasing land is a valuable tool in growing property size and there is no doubt in my mind that farmers should be taught to address, where they wish to be ten years out, and understand the sacrifices that may be needed for our short term desires. Being successful is only partially about good paddock practice. (Oh yes! and farmers mostly have far too high percentage of their wealth invested in agriculture.)

The remaining speakers were, as was intended, approaching the 2020 Vision from another perspective and I would not like to say much about their presentations as I do not have the same personal understanding but I did enjoy them all.

Thank you for having me along at the most enjoyable Industry Forum and lunch.

As promised a reflection on the day and I hope you are able to find some stimulant somewhere in this.

Kind regards

Mr Rob Hyde,
Farmer Wongan Hills

UWA ...

All-rounder in agriculture and natural resource management

Whether it is soil science, plant biology, animal biology, agricultural economics or natural resource management, the 2008 *Frontiers in Agriculture* postgraduate showcase on June 10 proved that UWA is an all-rounder.

Eight students from the four schools within the Faculty of Natural and Agricultural Sciences presented their work at the showcase, displaying a high quality of research and communication skills.

In his opening address Professor Don Markwell, Deputy Vice-Chancellor (Education), said that UWA was deeply committed to fostering high quality research training. He also said that the postgraduate showcase highlighted recent research developments and brought together students, industry and potential employers.

Students covered topics from perennial pastures, crop root systems, on-farm animal welfare, grainbelt drainage, natural resource management and disease resistance in crop plants and animals.

Mr Andrew Williams presented research on mechanisms of scouring in parasite resistant merino sheep. He said that scouring was a major health issue for sheep in southern Australia. "Breeding sheep that were naturally resistant to parasitic nematodes, the life of worming agents, or anthelmintics, could be extended", he said.

Ms Aprille Chadwick is researching the animal welfare aspects of semen collection in cashmere goats. Her research has demonstrated that using an electrode to stimulate ejaculation by bucks, rather than an artificial vagina, was more stressful to the animal's physiology and general well-being.

Mr Richard Bennett showed that some species of legumes in the genus *Cullen* have potential as perennial pastures for



Postgraduate students presented their work to staff, students, industry and potential employers at the Postgraduate showcase. Front L to R: Mr Craig Scanlan, Ms Georgina Holbeche, Ms Harsh Garg, Ms Helena Clayton and Ms Aprille Chadwick. Back L to R: Dr Stephen Loss (Member IOA External Advisory Board), Mr Richard Bennett, Mr Andrew Williams, Ms Natasha Teakle and Ms Naomi Arrowsmith (Member IOA External Advisory Board).

areas with acidic soil and low rainfall. He collected wild germplasm of *Cullen* from sites throughout Australia. He pointed out that the plants that were predicted to be unsuitable were the ones that showed the most promise in the end.

"Trials using *Cullen* species at Buntine in WA's north-east, on deep acid sand with an annual average rainfall of 320 millimetres, but less than 200 millimetres in 2007, have been promising," he said.

Ms Natasha Teakle, has been studying tolerance of salinity and waterlogging in the perennial pasture legume, Narrow-leaved bird's foot trefoil or *Lotus tenuis*.

She said that *L. tenuis* was identified as a priority species by the Cooperative Research Centre for Future Farm Industries (CRC FFI). She demonstrated that the gene NHX brings about salt tolerance and improves sodium transport in the plant.

Harsh Garg's PhD study investigated the fungal disease, *Sclerotinia sclerotiorum*. This disease poses a serious threat to canola production and could cause yield loss of up to 100 per cent, and along the line because of dormancy.

"I'm looking for novel sources of resistance and a rapid method of screening for the disease," she said. Ms Garg has successfully developed a method of screening plants for their resistance to *Sclerotinia* based on using the cotyledons of an emerging plant.

The afternoon session drew the soil and agriculture economics experts. Ms Georgie Holbeche indicated there was more than 100,000 kilometres of drainage in WA's grainbelt and she was investigating the mineral content of soils in agricultural drains by using x-ray diffraction.

Realising that drains are very expensive and any savings in efficiency will assist farmers, she aims to identify the preferred soil characteristics for drain construction.

Mr Craig Scanlan focused on how crops change the way water is stored and flows through soils and he is assessing where this has a positive or negative effect on crop growth. He used some innovative computer modeling and controlled experiments to test his hypothesis.

He aims to identify situations where crop management can be changed to either maximize the positive effect or avoid the negative.

Ms Helena Clayton discussed how landholders might be motivated to participate in environmental conservation and natural resource management.

Her research involves looking at a trial of an auction, which provides economic incentives to motivate farmers to undertake on-farm projects that will achieve specific environmental outcomes.

Professor Lyn Abbott, Interim Dean of FNAS, summed up the day saying that UWA had a reputation for leading edge scientific research linked with industry priorities.

Birds of a feather...



Dr Irek Malecki, Research Fellow, School of Animal Biology

Experts on the rhea, ostrich and emu came to the Institute of Agriculture at UWA for a symposium on June 26, and went onto Brisbane for the 4th International Ratite Science Symposium that accompanied the XXIII World Poultry Congress (June 30 to July 4, www.wpc2008.com).

Dr Irek Malecki (Research Fellow, School of Animal Biology), organiser of the event, introduced participants to the complexity of ratite farming, and provided an opportunity to share new knowledge about improving ratite welfare, reproductive performance and breeding technology to name but a few.

Ratite farming has increased globally since the mid-1980s and is drawing more attention to the quality of the products produced. Consumers worldwide are beginning to demand products that are 'CGE': Clean, Green and Ethical.

Prof. Graeme Martin (School of Animal Biology and Leader of Animal Production Systems Program IOA) concluded the event saying that "every step in the production chain needs to be clean, green and ethical e.g. feed producers, transport companies, abattoirs, food processors, and food distributors. He said that industry practice could and should be measured. "If only because of a basic tenet of business: if it is important, to your business, measure it so that you can see if you are improving", he said.

Finally, Prof Martin made an obvious point... farmed species rarely become extinct, so there will be some natural synergies between producing from native animals and the conservation and restoration of the natural populations of these animals.

Prof. Martin predicted that "this meeting might be viewed in future as the starting point of an industry in which all participants, from producer to consumer, can be proud; thanks to the farmers who may have often despaired but never lost faith in either the industry or the scientists that they support; and thanks to the ratites ... a group of birds that is simply fascinating in natural history and in productive possibilities."



Prof. Louwrens Hoffman, University of Stellenbosch.

Life for the ostrich farmer will be more stable if they follow the advice of **Prof Louwrens Hoffman** (University of Stellenbosch, South Africa) when they value add – and make the most of the bird. He said that after the collapse of the feather industry, ostrich skin generated

the most income. During the late 1980's, the income from skin/leather was insufficient to cover all the costs and an alternative income was sought. Farmers turned to the meat market on a rather informal basis. Marketing was focused on selling individual muscles. As market value of the meat increased, marketing became more organized and scientific research became increasingly important. In the 80's and 90's research focused on the yield and nutritional value of the individual muscles and factors that could influence these.

The industry focused on exporting the meat to Europe with a focus on the higher income groups. Professor Hoffman explained that the outbreak of Bovine spongiform encephalopathy (BSE) also strengthened the market section of this exotic meat type. With the advent of avian influenza, this market became temporarily closed. This forced processors to seek alternative products that could be exported to the EU. Scientists developed a number of value added products. Presently, research in South Africa focuses on value added products that will enhance the healthy image of ostrich meat. "The consumer is driving what the end product will be, and people are looking for healthier alternatives all the time", he said.



Dr Phil Glatz, South Australian Research & Development Institute.

Dr Phil Glatz

brought the Australian perspective on how best practice ratite welfare can improve industry development. Welfare issues for ratites are not inherently different to those in other domestic poultry. Careful management of diets, particularly protein and energy intake during the first 3-4 months of life will minimise problems associated with fast growth such as muscular and skeletal disorders. Toe trimming is done on emus and ostriches and could result in a large economic benefit to farmers through improved skin grades. It does not compromise the locomotor ability of emus and ostriches but birds could slip easier. He said that extra yard cleanliness is required. Dr Glatz said toe trimming could reduce stereotype behaviour and aggression. It makes the birds easier to handle, reducing the risk of injury to farmers. He touched on the benefits of conditioning ratites to human presence.



Prof. Schalk Cloete, Institute of Agriculture – Elsenburg

Prof. Schalk Cloete (Institute of Agriculture – Elsenburg/ University of Stellenbosch, South Africa) talked about the selection for reproductive

performance in ostriches. Although ostrich farming is a relatively small industry (about R1.5billion), South Africa produces 60% of the world’s global ostrich produce.

Ostrich farming has shown that it is highly detrimental to the vulnerable succulent Karoo ecotypes (an International biodiversity hotspot). Research has shown that browsing by ostriches is a lot more damaging to the natural bush than grazing by other livestock species or game. This has implications for long-term sustainability.

The intensification of the industry resulted in high levels of concentrate feeding, and associated problems typical of rigorous production systems. Ostrich reproduction has fairly high levels of genetic variation, and marked responses to directed genetic selection have been shown.

Repeatability of ostrich reproduction is fairly high. Substantial flock gains may be expected. Currently, the ratio of male to female is 6:10. Replacing less productive breeding birds with animals of a higher genetic merit for reproduction could potentially relieve the pressure on the resources, while still yielding similar outputs.



Dr Irek Malecki from the School of Animal Biology, UWA.

Dr Irek Malecki had to gain the trust of his ratites in proving a new approach for artificial insemination (AI). Interest in breeding ostriches by artificial insemination goes back 30

years ago when methods for semen collection and AI were proposed. These days this is considered unethical because both male and female ostriches have to be restrained for the procedures posing the risk to animals and their handlers.

The lack of reliable methods of semen collection hampered the development of AI technology for emus and ostriches until 1997. Since then semen collection and AI methods were developed by taking advantage of desirable bird-human interactions and sexual behaviour directed towards humans.

Despite considerable body size and reproductive behaviour differences between emus and ostriches the same principles were used to develop the teaser and the non-teaser methods. Final results showed that trained birds express their sexual behaviour on their own accord making these methods both animal and human friendly. Since this method is no longer labour intensive, it will be more feasible for the ratite industries to adopt this method. Once adopted, these new approaches will enable the ratite industry to realise their full potential through AI-based selective breeding programs to improve reproduction. It will make significant genetic progress in the production of eggs, chicks, oil, meat and leather.



Prof. Joaquin Navarro from the University of Cordoba, Argentina, an expert on the rhea said that conservation is key for many species in the world. First attempts to breed rheas in captivity occurred in the 1950s and commercial farming started in the 1990s. “The Rhea industry focuses on

production of meat, hides and, to a lesser degree, feathers and fat. Wild populations of rheas are at a critical status, due to intense illegal hunting and an increase in croplands”, he said. He thinks captive breeding may play a part in conserving the species.

Prof Navarro and his team tested if translocating captive-bred rheas (*Rhea americana* and *Pterocnemia pennata*) into the wild is a feasible strategy for ensuring viability of wild populations. A group of greater rheas and some lesser rheas raised on farms were released in central Argentina and NW Patagonia. ‘Hard’ and ‘soft’ releases were conducted in reserves and areas not protected from illegal hunting.

The release methods had no difference on the survival of rheas. Almost all the rheas released at private reserves and ranches where hunting was actively forbidden, survived. The released birds joined the existing population. Their behaviour and chick production indicated that both types of rheas reproduced. No birds survived where hunting and predators (puma) occurred. Navarro suggested that captive-bred rheas should be trained against predator attack, prior to release and/or raised under minimum human contact.



Dr Geraldo Stachetti Rodrigues, Embrapa Labex Europe, France.

Dr Geraldo Stachetti Rodrigues

(Embrapa Labex Europe, France) opened attendees’ eyes to the environmental management in ostrich farming. He said that the ratite farming sector wants to convey an environment-friendly image, in response to manifested demands of its sophisticated consumers. In order to support this movement, appropriate environmental assessment tools are

warranted for motivating, preparing and guiding producers in the adoption of best management practices. Many methodological options are available to do sustainability assessment and the ensuing environmental management of rural activities. The ‘System for Weighed Environmental Impact Assessment of Rural Activities’ (APOIA-NovoRural) was validated for the specificities of ostrich husbandry. Assessments carried out with this system in selected establishments with contrasting scales of operation have resulted in direct environmental management recommendations. Best management practices were proposed to promote landscape ecology and natural resources conservation, and socio-cultural, economic and managerial improvements. The participatory approach carried out was comprehensive and adequate for performance assessment and environmental management of struthioculture, according to local conditions, farmers’ productive capabilities, and market settings. The criteria and indicators included in the environmental assessment system can be proposed as a basis for defining ‘Terms of Reference’ for sustainable ratite farming.

Conservation and utilisation of legume plant genetic resources in Oman

Mr Richard Snowball
(rsnowball@agric.wa.gov.au)

From April 13 to 23, 2008 a seed collecting mission was undertaken in the north of Oman in regions surrounding Nizwa and Ibri. This was part of a joint project between Sultan Qaboos University (SQU) and UWA, led by Associate Professor Nadiya Al Saady (SQU) and Professor Kadambot Siddique (UWA). Participants of the collecting mission included Mr Ali Masoud Saed Al-Subhi, Mr Khamis Ahmed Saif Al-Hapsi and Mr Walid Nasser Al-Naabi from the (all form SQU), Mr Saleem Kaseem Saheb Nadaf, Mr Saleh A Al-Hinai and Ms Safaa M Al-Farsi from the Ministry of Agriculture and Fisheries, Oman and Mr Richard Snowball from DAFWA. The mission targeted landraces of legume crops with an emphasis on chickpea, mung bean, alfalfa and fenugreek. Wild forage legumes were also collected when encountered.

Cultivated legume crops of chickpea, lentil, field pea, mung bean, faba bean and cowpea are in decline, hence the need to rescue landraces before they disappear. Good quality water sourced from springs or ground water, is in high demand, but in short supply because of declining rainfall. Alfalfa is competing strongly with legume crops because of the high price being paid in neighbouring countries, United Arab Emirates in particular. The conservation and utilisation of Oman's rich and threatened genetic diversity is a high priority. Wild forage legumes including species of *Indigofera*, *Lotus* and *Taverniera* are also being targeted for conservation.

Thirty four farmers were interviewed and all provided seed from their existing stores or access to their fields to collect unharvested seed. Wild forage legumes were collected from five sites. In total, 96 accessions from nine species of cultivated crop and forage legumes, and 20 accessions from eight species of wild forage legumes were collected (Table 1). Seed will be conserved in the new gene bank located at the Ministry of Agriculture and Fisheries, Muscat, Oman. Plants will be raised from collected seed and grown and characterised in nursery plots as part of the Ministry's ex situ



Mr Richard Snowball and colleagues from Oman discussing the significance of legume landraces with an Omani farmer during the collection mission.

field gene bank. Subsamples will be provided to SQU as a backup conservation collection and small quantities used for molecular characterisation studies in collaboration with UWA.

Australia has an interest in both crop and pasture legumes. Molecular characterisation of the cultivated

species will hopefully identify novel lines with traits of interest to breeding programs. Wild species and landraces have special adaptation to drought and may provide potential for the grainbelt of WA. Access to germplasm for use in Australia will only occur once a Material Transfer Agreement is signed between SQU and UWA.

TABLE 1

Genus Cultivated	Species	Common Name	Local Name	Number of accessions
<i>Cajanus</i>	<i>cajan</i>	Pidgeon pea		2
<i>Cicer</i>	<i>arietinum</i>	Chickpea	Dengo	9
<i>Lens</i>	<i>culinaris</i>	Lentil	Adis/Dal	8
<i>Medicago</i>	<i>sativa</i>	Alfalfa/Lucerne	Qat	14
<i>Pisum</i>	<i>sativum</i>	Field pea	Gourgour	13
<i>Trigonella</i>	<i>foenum-graecum</i>	Fenugreek	Helba	21
<i>Vicia</i>	<i>faba</i>	Faba bean	Baqal	14
<i>Vigna</i>	<i>aureus</i>	Mung bean	Ming	4
<i>Vigna</i>	<i>unguiculata</i>	Cowpea	Lobia	11
Wild				
<i>Acacia</i>	<i>gerardi</i>			1
<i>Indigofera</i>	<i>arabica</i>	Neela		2
<i>Indigofera</i>	<i>oblongifolia</i>	Neela		2
<i>Indigofera</i>	<i>sp</i>	Neela		2
<i>Lotus</i>	<i>arabicus</i>			1
<i>Lotus</i>	<i>halophilus</i>	Krwan al Gazelle		1
<i>Senna</i>	<i>italica</i>	Sana' maky	Ishrig al bar	4
<i>Taverniera</i>	<i>aegyptiaca</i>	Aelijaan		1
<i>Tephrosia</i>	<i>apollinea</i>	Dhafra		6

UWA links with growers and the industry at Dowerin Field Day



Mr Neil Young, a member of the IOA External Advisory board and GRDC WA Panel Chair, speaks to Prof Kadambot Siddique during his visit to the IOA booth at the Dowerin Field Day.

The Institute of Agriculture (IOA) participated at the Dowerin Field (August 27-28), and is fast becoming a familiar face.

This year the IOA displayed under the theme: healthy crops and healthy land. IOA Director, Professor Kadambot Siddique and staff from the IOA, Centre for Legumes in Mediterranean Agriculture (CLIMA) and Western Australian Herbicide Resistance Initiative (WAHRI) showed field day visitors a glimpse of the latest research in agriculture at UWA.

Visitors to the IOA booth could inspect bugs in the soil under a microscope, a soil quality website, a variety of turf grasses, roundup and resistant rye grass, salt tolerant wheat, the potential benefits of native perennial legumes in

low phosphorous soil, oil seeds, research by Associate Professor Tim Colmer, and the herbicide work on lupins by Research Fellow, Dr Ping Si.

Another attraction was the alternative oilseeds by Research Officer, Ms Margaret Campbell. Ms Campbell said that "as a networking opportunity, the Dowerin Field Day is almost unsurpassed".

Some growers showed interest in being part of future collaboration on the Soil Quality website project between UWA and DAFWA.

The IOA team had many enquiries from interested past and prospective students and parents on undergraduate and postgraduate courses within the agricultural disciplines at UWA.

New appointments

Dr Rowena Long started work as a Research Associate in WAHRI and researcher at Kings Park & Botanic Garden in June 2008. She will research the potential application of a smoke-derived seed germination stimulant, karrikinolide, for broad-acre weed control on a project supported by an ARC linkage grant. Dr Long completed her PhD in weed seed biology at the University of Queensland in 2007 and worked as a technical office for the Queensland Department of Primary Industries prior to starting her position at UWA.

9480 3622 (Kings Park)
6488 7980 (UWA)
Email: rowena.long@uwa.edu.au

Ms Sarah Mawson, Project Officer at the International Centre for Plant Breeding Education and Research (ICPBER), received her business degree from England. Ms Mawson was the bank manager for Hong Kong and Shanghai Bank during the 1980s in London. After moving to Australia she did a BSc(Hons) Biotechnology from Murdoch University. Ms Mawson worked in Plant Molecular Biology/Breeding research for 6 years at the State Agricultural Biotechnology Centre at Murdoch University, in collaboration with Agriculture WA. Then she moved into Pharmaceuticals with Bristol Myers Squibb in Perth, for three years, Ms Mawson later moved to Adelaide to be with her son, who is a medical student, and worked for with GlaxoSmithKline for 2 ½ years before coming back to Perth and joining ICPBER.

Tel: 6488 1432
Email: smawson@cyllene.uwa.edu.au

Dr. Tefera Tolera Angessa was appointed as barley germplasm Research Officer within the School of Plant Biology in June 2008. He is leading the GRDC funded "Barley Improvement through germplasm: co-ordination, introduction and evaluation" project. Dr. Angessa was born in Ethiopia and joined Awassa College of Agriculture of Ethiopia for his undergraduate study. After graduating in 1998 with a BSc in Plant Production and Dryland Farming, he served as a graduate assistant at the same College.

continued on page13

Fish grains and game on UWA agriculture open day menu



Mrs Christy Grimes talking to a group on barley genetic improvement.

Aquaculture and native fish breeding, alternative oilseeds, salt tolerant wheat, new legumes, emus and game birds, turf and super brassicas were on the menu at the 2008 Institute of Agriculture (UWA) Agriculture Open Day.

Variety was the defining characteristic of the smorgasbord of research presented to more than 75 visitors, including farmers, industry groups, students and scientists, at UWA's Shenton Park Field Station.

Opening the event, Dean of UWA's Faculty of Natural and Agricultural Sciences, Professor Tony O'Donnell said it was important because of the many challenges facing farmers, including escalating input costs, climate change and global food shortages.

"We want more events such as this, where the IOA reaches out and opens its door to the agricultural community," he said.

"It's important we interface with the agricultural sector locally, nationally and internationally."

IOA Director, Professor Kadambot Siddique said the field station, established in the early 1960s, had been instrumental in developing and releasing numerous varieties of cereals, pastures, oilseeds and legumes and was still developing and advancing agricultural practices and plant types.

"IOA, which aims to strengthen UWA's linkage to rural communities, is already home to the Grower Group Alliance, Western Australian No Tillage Farmers Association and Food Industry Association WA.

"At Shenton Park there are about 25 hectares of land, including five hectares of arable irrigated plot land, numerous glasshouses, growth room, quarantine facility, poly plant houses and laboratory," he said.

UWA has also recently purchased a large farm, 'Ridgefield' at Pingelly, to



Professor Lyn Abbott and Dr Daniel Murphy, Senior Research Fellow, both from the School of Earth and Geographical Sciences at the Institute of Agriculture Open Day.

expand its animal, crop, soil and pasture related teaching and research.

Professor Siddique said the IOA intends holding an Open Day at Shenton Park every two years, with researchers showcasing their projects.

The Open Day attracted many farmers from WA's grainbelt, including Dalwallinu farmer and Liebe Group committee member, Keith Carter, who was particularly interested in Dr Ping Si's GRDC funded project at the Centre for Legumes in Mediterranean Agriculture at UWA on metribuzin tolerant lupins.

"We really need a herbicide resistant lupin and it's good to see what's being done at the IOA," he said.



(L to R) Prof Kadambot Siddique (Director of the Institute of Agriculture, UWA) and Prof Yuan Yongbing (Vice-President, Qingdao Agricultural University) affirming ties between UWA and Qindao during his visit in April. The two universities will be developing a horticulture program on apple breeding and physiology.

Sustaining productive agriculture for a growing world

A close-up of rangelands and grasslands



Participants inspecting the forage nursery trials at the Grassland Research Institute of the Chinese Academy of Agricultural Sciences

Dr Sarita Bennett
(sarita@cyllene.uwa.edu.au)

At the end of June six Western Australian scientists attended the IGC-IRC 2008 meeting in Inner Mongolia, China.

Dr Sarita Bennett (FFI CRC) and Adjunct Professor Ed Barrett-Lennard (DAFWA) presented papers and Dr Daniel Real (DAFWA), Dr Kioumars Ghamkhar (CLIMA), Mr Richard Bennett (Plant Biology and FFI CRC) and Mr Dion Nichol (Plant Biology and FFI CRC) presented posters. All of us had obtained AW Howard Memorial Inc. travel grants to attend the congress.

About 1700 people attended the congress in Inner Mongolia in the north of China. It was held at the International Convention Centre on the outskirts of Hohhot. The congress started each day with a plenary session in a very

impressive room large enough to accommodate all the participants, and then split into three concurrent sessions for the remainder of the day. A translation service was available throughout the congress allowing speakers to present their talks in either English or Chinese.

Field Tours were held in the middle of the week. A choice of four tours were available, which given the number of participants meant that each tour consisted of between eight and 13 buses. These were again accompanied by flashing police cars at the start, middle and end of the convoy, and by policemen and women along the route, stopping the traffic at every intersection we passed. The organisation this must have taken was phenomenal. Each tour took the participants to view some of the agricultural research and production being undertaken in the area before finishing at various cultural heritage sites. I selected a tour which took us to

the Grassland Research Institute of the Chinese Academy of Agricultural Sciences (CAAS), where we saw the field nurseries of their forage grass and legume improvement programme. Nearly all of the species we saw were different to those we are familiar with here in Australia, with many showing extreme drought tolerance. However, they are also extremely cold tolerant as the winter temperatures of Inner Mongolia drop to -35°C and require a strong cold vernalisation to flower the following year.

The highlight of the congress for the majority of the participants, other than the many international connections made during the week, was a night of Mongolian singing and dancing which was held at the Hohhot Opera House. My first visit to China has certainly left me with a desire to see more of the country and also to visit neighbouring Mongolia.

New appointments

continued from page 11

2000 saw him go to Germany for his MSc at Goettingen University. His MSc thesis was titled "Genotypic differences between elite European faba bean (*Vicia faba* L.) cultivars for drought tolerance". Dr Angessa did his PhD at the same university. After obtaining his PhD in 2006, he returned briefly to Ethiopia as Assistant Professor at the College of Agriculture of Hawassa University.

Tel: 9387 3646

Email: tangessa@cyllene.uwa.edu.au

Dr Zhiqun Huang commenced work as a Graduate Research Assistant in CLIMA in July 2008. He will conduct experiments on the physiology of salt tolerance in chickpea in glasshouse and field conditions on a project supported by an ARC linkage grant. Dr Huang was a senior scientist in forest ecology in the Chinese Academy of Science. He moved to Brisbane in 2004 and completed his PhD in tree physiology at Griffith University in April 2008.

Tel: 64881432

Email: z-huang@cyllene.uwa.edu.au

Alumni



Mr Bevan Addison

*Manager, Technical Services
Elders*

Mr Bevan Addison studied BSc(Agric) honours degree at UWA from 1983 to 1986. "I then went out to the big world of Ag advising with the WA Department of Agriculture," he said.

After three years of that at Moora and a short stint at Department's Dryland Research institute in Merredin, Elders enticed him back to Moora as they put on their massive agronomy team of four to cover the whole state.

"I managed four years of driving all over the countryside conducting farmer meetings, paddock inspections, field days etc before the travel bug caught me and I headed overseas for 18 months and travelled extensively and worked minimally", he said.

After returning home, Mr Addison married and set up a home base in Northam where he rejoined Elders and the agronomy group. After five years of plenty of paddock work, he moved to Perth to take on Manager of Technical Services role with Elders. Since then, this has evolved and morphed into a combination of technical services, seed business management, a livestock technical development role and regional business responsibility for several stores, including our two extremes of Esperance and Derby," he said.

With an Elders restructure happening at the moment, and this current role being removed, Mr Addison can only speculate as to what the future will bring. "Who knows what the next phase of my agricultural life brings, maybe in the Elders network in another role or maybe a ringer for some of the Kimberley clients. Whatever it may be, bring it on and let the games begin."



Mr David Falconer

ConsultAg

Mr David Falconer completed his BSc (Agric) Hons in 1983. After completing his studies, he initially worked in the dairy branch at the WA Department of Agriculture with exposure to the livestock industries. He then moved to the marketing and economics branch on the MIDAS models.

In 1988 he was employed by Peter Hackett as a farm management consultant, completed a commerce degree in 1991 after five years of

part-time study, and in 1992 he formed Falconer and Associates – Consultants to Agriculture. Today, there are twelve professionals plus support staff involved. This business now operates under two banners. ConsultAg provides technical, succession and business planning services to farm family businesses. AccountAg provides tax, compliance and planning strategies to agriculture. Recently, InvestAg was established to cater for demand in financial services and planning.

"The experience at UWA's Faculty of Agriculture in a wide range of disciplines led by outstanding lecturers and tutors who provided motivation to succeed combined with a large number of contacts established during my time at the WA Department of Agriculture has provided an excellent resource during my career", Mr Falconer said. He feels that involvement in professional associations particularly the Australian Association of Agricultural Consultants (WA) Inc provides continual exchange of ideas and development.

"Agriculture is a challenging industry with a diverse range of disciplines but for me it is the genuine people who are involved and the privilege we are afforded as consultants to be part of a family and help contribute to its success that makes this career rewarding", Mr Falconer said.



Ms Megan Abrahams

*Farming Systems Development Officer
Department of Agriculture and Food
WA (DAFWA)*

Ms Megan Abrahams, farming systems development officer for the Department of Agriculture and Food WA (DAFWA) in the Geraldton District office, started her journey at UWA as an undergraduate (a Bachelor of Science (Honours) degree majoring in Microbiology and Biochemistry) in the eighties. Her honours project focused on different molecular biology detection

techniques to identify papillomavirus (i.e. wart virus) DNA in genital tumours. Following her degree, she worked as a Research Assistant at UWA's Dept of Microbiology for a number of years furthering her Honours work and then researching mosquito-borne viruses such as Ross River Virus. "A friend told me about the School of Agriculture's new (then) postgraduate course, Masters in Natural Resource Management, consisting of both coursework and thesis, which I could complete in one year. I bit the bullet and enrolled as

one of a group of ten students", she said. "For the first two-thirds of the year we attended four coursework sessions per week outside of normal working hours. In this time we did a crash course in micro-economics and completed five case study projects on various natural resource management (NRM) topics from forestry and mining rehabilitation issues to fisheries economics".

After completing her Masters in 1995 she moved up to Geraldton. Megan has been working at DAFWA for about ten years. "I have been involved in different projects focussing either on NRM issues such as salinity and more recently, on analysis of different farming systems", she said. Megan's current project, funded by the Department of Climate Change, is looking at the impact of climate change on farming systems in the northern agricultural region and the economic viability of potential alternative land uses.

"I thoroughly enjoyed my time at UWA's Faculty of Agriculture. Our study group was a fantastic bunch of people from all walks of life. Apart from the great on-campus staff, various other industry professionals shared their expertise with us and participated in the delivery of the case studies. They also provided good guidance for piecing together an achievable thesis topic."

Sustaining productive agriculture for a growing world

Food and Agriculture Lecture Series



Reserves Growth – the myth in the peak oil debate

Mr Jeremy Gilbert
Managing Director, Barrelmore Ltd

Monday, 6 October 2008
5 - 6pm. Geology Lecture Theatre (G21, Ground Floor)

Fairway Entrance 1: Car parks 18, 19 and 20

Although there is general acceptance now that oil supply will reach a peak soon enough to cause us problems there is still much argument about the timing of the peak, and the subsequent decline rate in supply. The uncertainties are partly over the amount of oil still to be discovered. Perhaps even more significant is whether the amount of 'reserves growth' predicted by some authorities will really occur. What is this 'reserves growth'? How does it arise and how likely is it that it can contribute to filling some of the gaps between supply and business-as-usual demand?



Opportunities and challenges for agriculture in a future low carbon world

Mr Steve Waller
Director of the Office of Climate Change in the Western Australian Department of Environment and Conservation

Monday, 27 October 2008
5 - 6pm. Geology Lecture Theatre (G21, Ground Floor)

Fairway Entrance 1: Car parks 18, 19 and 20

Western Australia's agricultural sector is already experiencing some the unavoidable impacts of climate change. Forecasts for climate change indicate significant implications for productivity through increased average temperatures, changed rainfall patterns, increased levels of atmospheric carbon dioxide and increased climate variability. The economics of agriculture in Western Australia is also expected to change over the next decade, providing opportunities for revenue diversification.



Evolution in Action: My 25 years in herbicide resistance research

Prof Stephen Powles
Director, WA Herbicide Resistance Initiative (WAHRI)

Monday, 10 November 2008
5 - 6pm. Molecular & Chemical Sciences Lecture Theatre (G.33)

Fairway, Entrance No. 4, Car Park 14 and 21

In the past two decades the Australian cropping industry has faced a major challenge posed by the widespread evolution of crop weeds resistant to herbicides. No other country has thus far experienced a herbicide resistance problem of such magnitude. However, herbicide resistance is being successfully managed and Australian research and savoir-faire has been pivotal in this success. Prof Powles will give an overview of Australian knowledge on herbicide resistance, from understanding at the molecular level through to management in the field. He will contrast the Australian herbicide resistance situation with the looming resistance (glyphosate) problems in GM crops in the USA, Argentina and Brazil.



Man Should Not Live by Bread Alone!

Professor Dyno Keatinge
Director General, AVRDC- The World Vegetable Centre, Taiwan

10 December 2008
5-6pm. Molecular & Chemical Sciences Lecture Theatre (G.33)

Fairway, Entrance No. 4, Car Park 14 and 21

The seminar will be an evocation of the importance of horticulture as a means for small-holders in the developing world to grow themselves out of poverty and to ensure that their families are neither undernourished nor malnourished. The importance of good nutrition for all as the rising tide of obesity and related ill-health problems, such as type 2 diabetes in both the developed and the developing world, can and should be effectively diet controlled. The importance of indigenous vegetables such as *Momordica spp.* (Bitter gourd) will be mentioned.

Upcoming meetings and events

7th International Safflower Conference, Wagga Wagga, NSW
3-6 November 2008
www.australianoilseeds.com

Mixed models for plant improvement
2-5 November 2008
www.icpber.plants.uwa.edu.au

9th International Conference on Dryland Development.
Bibliotheca Alexandrina, Egypt
7-10 November 2008
<http://www.icarda.org>

Greenhouse 2009: Climate change and Resources
23-26 March 2009
Burswood Convention Centre, Perth, WA www.greenhouse2009.com
Abstracts due: 14 November 2008 and Registration before 19 December 2008

Australian Forestry Genetics Conference
15-18 April 2009
www.icpber.plants.uwa.edu.au

Sustaining productive agriculture for a growing world

New research projects

TITLE	FUNDING PERIOD	FUNDING BODY	SUPERVISOR(S)
Physiological and molecular characterisation of salinity tolerance in chickpea	2007-2010	Australian Research Council Linkage Project, Council of Grain Growers Organisation, International Crops Research Institute for the Semi Arid Tropics, and the University of Sussex	A/Prof Tim Colmer, , Prof Kadambot Siddique, Prof Timothy Flowers , Dr Vincent Vadez, Dr Rajeev Varshney, Dr Pooran Gaur and A/Prof Michael Burton
Divergence between community and expert valuation of ecosystems	2007-2010	ANU ex Environment and water resources and CERF	
Benchmarking soil characteristics in the Kulin and Hyden districts	2008	Avon Catchment Council	Dr Daniel Murphy
Improved direct seeding establishment of commercial native plants through improved germination moisture management and weed control	2008-2010	Future Farm Industries ex RIRDC	Dr Geoff Woodall
Support role for a pilot project to investigate the applicability of the SIF3 State salinity investment framework model to the South West NRM Region	2008	South West Catchments Council NHT	Prof David Pannell
Evaluating a biogeochemical mechanism for soil anomaly formation using diffusive thin-film samplers in geochemical exploration	2008-2011	ARC Newmont Mining Corporation	Dr AW Rate and Dr NW Radford
Optimising biodegradation and removal of organic and inorganic pollutants in wastewater using constructed wetlands	2008-2011	ARC Syrx Environmental Pty Ltd Australian Laboratory Services Pty Ltd King Island Council Department of Water	Prof Z Rengel and Dr KA Meney
LTER Pastoral Station Research UWA-ERGo	2008	ARC Pilbara Iron Pty Ltd	Dr Pauline Grierson
Provision of soil analysis and the interpretation of results	2008	Department of Environment and Conservation WA	Prof Bob Gilkes
Development of conservation cropping systems in the drylands of northern Iraq - UWA component	2008- 2011	ACIAR and AusAID	Professor Kadambot Siddique

New MSc and PhD students

NAME	TOPIC	SCHOOL	SUPERVISOR(S)	FUNDING BODY
<i>Grad Dip Sci</i> Mr Roger Jebaraj Dharmarajan	Regulation of total antioxidant capacity and shelf-life in table grape by plant innate defence compounds, salicylic acid and methyl jasmonate	Plant Biology	Dr Michael Considine	
<i>PhD Students</i>				
Mr Kevin Foster	Drought tolerance of <i>Bitumanaria bituminosa</i> var <i>albomarginata</i>	Plant Biology	Dr Megan Ryan	FFI CRC
Ms Fazilah Abd Manan	Proteins that interact with mitochondrial nucleic acids in <i>Arabidopsis</i>	Plant Biology	Dr Pat Finnegan and Dr Susan Barker	Gov't of Malaysia, ARC Discovery
Ms Jillian Ooi Lean Sim	Seagrass Biogeography	Plant Biology	A/Prof Gary Kendrick, Dr Kimberly Van Niel	Endeavour IPRS, UPAIS
Mr Sharif-Ar Raffi	Physiology and Genetics of salinity and waterlogging tolerance in <i>Hordeum marinum</i> and <i>H. marinum</i> x Wheat cytogenetic stocks	Plant Biology	A/Prof Tim Colmer and Dr. AKM Rafiq Islam, University of Adelaide	Endeavour IPRS, UPAIS
Mr Louis Moir-Barnetson	Ecophysiology of samphires subject to changes in salinity and water availability: distinguishing natural dynamics from potential mine-related impacts	Plant Biology	A/Prof Tim Colmer and Dr Erik Veneklaas	ARC-Linkage, Fortescue Metals Group LTD
Mr Saiful Hamdani	Herbicide resistance mechanism in wild oats	Plant Biology	Professor Stephen Powles and Dr Yu Qin	Universiti Putra Malaysia

Research & Industry Recognition

Associate Prof Ed Barrett-Lennard, Dr Sarita Bennett and Associate Prof Tim Colmer	Best poster at the 2nd International Salinity Forum in Adelaide (31st March to 4th April)
Mr David Feinberg, CBH and IOA External Advisory Board member	Appointed as member of GRDC Western Panel
Ms Tracey Gianatti	Appointed as member of GRDC Western Panel
Professor Kadambot Siddique	Appointed as Honorary Professor of Huanzhong Agricultural University 2008-2011

Visitors to Institute of Agriculture

NAME OF THE VISITOR	VISITOR'S ORGANISATION AND COUNTRY	HOST DETAILS	DATES
Mr Mick Keogh	Executive Director of the Australian Farm Institute	Dr Phil Vercoe	14 May
Prof Ying Cui	Yunnan Agricultural University, China	A/Prof Martin Barbetti	Jan 08 – Jan 09
Ms Jiyun Yang	Northeast Normal University, China	Dr Jiayin Pang	30 Jan – 30 May
Ms Yan (Kathleen) Tang	Northwest A&F University, China	Dr Guijun Yan Dr Soonchye Tan Mr Glynn Ward	Feb 08 – Jan 10
Mr Rik Kooke	Utrecht, Netherlands	A/Prof Tim Colmer	18 Feb – 30 Sept
Dr Becky Ostertag	University of Hawaii	Dr Pauline Grierson	4 Mar – 2 May
Ms Simone Godoi	Brazil	Prof Hans Lambers	Mar 08 – Jan 09
Ms Li Zhang	China	Dr Guijun Yan Dr Shaofang Wang	Apr 08 – Apr 09
Prof Yuan Yongbing	Vice President, Qingdao Agricultural University, China	Prof Kadambot Siddique	4 April
Mr Mohd. Tarmizi bin Ishak Mr Helmi Azro bin Mohd Hassan Mr Tajuddin bin Abdul Manap	Universiti Putra Malaysia	Prof Kadambot Siddique	7-14 June
Professor Michael Huston	Department of Biology, Texas State University on Biodiversity	Prof Lyn Abbott	17th June
Dr Colin Piggim,	ACIAR project Iraq, ICARDA	Prof Kadambot Siddique	24 – 27 June
Prof. Joaquin Navarro Prof. Schalk Cloete	University of Cordoba, Argentina Institute of Agriculture – Elsenburg/ University of Stellenbosch, South Africa	Dr Irek Malecki	26-27 June
Prof. Louwrens Hoffman Dr Geraldo Stachetti Rodrigues Dr Phil Glatz	University of Stellenbosch, South Africa Embrapa Labex Europe, France South Australian Research & Development Institute		
His Excellency Mr Mahmoud Movahhedi	Ambassador of the Islamic Republic of Iran	Prof Kadambot Siddique	8 July 2008
Dr Yong Wang	Gansu Academy of Agricultural Sciences, Lanzhou, Gansu Province, P.R. China	Dr Guijun Yan Prof Kadambot Siddique Dr Jairo Palta	23 May 2008- May 2009
Ms Ruqaiya Al Masoudi	Sultan Qaboos University, Oman	Dr Michael Walsh	17 June -29 July
Ms Safa Al-Hinaai	Sultan Qaboos University, Oman	Dr Heather Clarke	17 June -29 July
Mrs Zanell Brand	Institute of Agriculture – Oudtshoorn, South Africa	Dr Irek Malecki	25-28 June
Mrs Paulina Rybnik	Institute of Genetics and Animal Breeding, Polish Academy of Science, Poland	Dr Irek Malecki	14-19 July
Dr Yu Jia	Lanzhou University	Dr Dan Murphy Prof Kadambot Siddique	5 July – 29 December
Prof. Long Li	China Agricultural University	Prof. Hans Lambers	17 July – 16 October
Dr Xiangwen Fang	Lanzhou University	Prof Kadambot Siddique Dr Guijun Yan, Prof. Neil Turner, Dr Jairo Palta	1 April 2008- 31 March 2009

NAME OF THE VISITOR	VISITOR'S ORGANISATION AND COUNTRY	HOST DETAILS	DATES
Mr Henrik Hornstrup	Copenhagen University, Denmark	Prof Zed Rengel	01 July 2008 – 28 Feb 2009
Mr Ebrahim Sepehr	Tarbiat Modarres University, Tehran, Iran	Prof Zed Rengel	01 Nov 2007 – 27 June 2008
Dr Dan Rigby	University of Manchester	A/Prof. Michael Burton	Feb-May 2008
Professor Roberto Tuberosa	Department of Agro-Environmental Sciences and Technology (DiSTA), University of Bologna, Italy	Prof Kadambot Siddique	20th August 2008
Dr Toshihiro Hasegawa	National Institute for Agro-Environmental Sciences, Tsukuba, Ibaraki, Japan	Prof Kadambot Siddique	21 October 2008
Dr Jeremy Gilbert	Barrelmore Ltd	Prof Kadambot Siddique Mr Tim Shanahan	6 October 2008
Professor Dyno Keatinge	AVRDC- The World Vegetable Centre, Taiwan	Prof Kadambot Siddique	10 and 11 December 2008
Prof Bob Chambers	University of Maryland	Dr Atakelty Hailu	January 2009

Publications

(March – September 2008)

Refereed journals

Anderton N and Kingwell R (2008). Spatial and temporal aspects of grain accumulation costs for ethanol production: an Australian case study. *Biomass and Bioenergy* **32**: 109 – 119.

Banning NC, Grant CD, Jones DL and Murphy DV (2008). Recovery of soil organic matter, organic matter turnover and nitrogen cycling in a post-mining forest rehabilitation chronosequence. *Soil Biology & Biochemistry* **40**: 2021-2031.

Beeck CP, Wroth J and Cowling JA (2008). Additive genetic variance for stem strength in field pea (*Pisum sativum*). *Australian Journal of Agricultural Research* **59**: 80-85.

Bell LW, Ryan MH, Ewing MA, Moore GA, and Lane P (2008). Prospects for three *Dorycnium* species as forage plants in agricultural systems: a review of their agronomic characteristics. *Australian Journal of Experimental Agriculture* **48**: 467-479.

Bell LW, Byrne (née Flugge) F, Ewing MA and Wade LJ (2008). A preliminary whole-farm economic analysis of perennial wheat in an Australian dryland farming system. *Science Direct Agricultural Systems* **96**: 166-174.

Bell LW, Ryan MH, Ewing MA, Moore GA and Lane PA (2008). Prospects for three *Dorycnium* species as forage plants in agricultural systems: a review of their agronomic characteristics. *Australian Journal of Experimental Agriculture* **48**: 467-479.

Berger JD, Adhikari KN, Wilkinson D, Buirchell BJ, and Sweetingham MW (2008). Ecogeography of the Old World lupins. 1. Ecotypic variation in yellow lupin (*Lupinus luteus* L.) *Australian Journal of Agricultural Research* **59**: 691–701

Biswas WK, Barton L & Carter D (2008). Global warming potential of wheat production in Western Australia: a life cycle assessment. *Water and Environment Journal* doi:10.1111/j.1747-6593. 2008.00127.x.

Boersma JG, Li C, Leniewska K, Sivasithamparam K, and Yang H (2008). Identification of quantitative trait loci (QTLs) influencing early vigour, height, flowering date, and seed size and their implications for breeding of narrow-leafed lupin (*Lupinus angustifolius* L.) *Australian Journal of Agricultural Research* **59**: 527–535.

Bonnardeaux Y, Li C, Lance R, Zhang XQ, Sivasithamparam K and Appels R (2008). Seed dormancy in barley: identifying superior genotypes through incorporating epistatic interactions. *Australian Journal of Agricultural Research* **59**: 517-526.

Byrne OM, Hardie DC, Khan TN, Speijers J, and Yan G (2008). Genetic analysis of pod and seed resistance to pea weevil in a *Pisum sativum* P. fulvum interspecific cross. *Australian Journal of Agricultural Research* **59**: 854–862.

Chagas LM, Gore PJS, Graham G, Macdonald KA and Blache D (2008). Effect of Restricted Feeding and Monopropylene Glycol Postpartum on Metabolic Hormones and Postpartum Anestrus in Grazing Dairy Heifers. *Journal Dairy Science* **91**: 1822-1833.

Chen S, Nelson MN, Ghamkhar K, Fu T and Cowling WA (2008). Divergent patterns of allelic diversity from similar origins - the case of oilseed rape (*Brassica napus* L.) in China and Australia. *Genome* **51** (1): 1-10.

Cramer MD, Hoffmann V and Verboom GA (2008). Nutrient availability moderates transpiration in *Ehrharta calycina*. *New Phytologist* doi: 10.1111/j.1469-8137.2008.02510.x

Colmer TD and Flowers TJ (2008). Flooding tolerance in halophytes. *New Phytologist* doi: 10.1111/j.1469-8137.2008.02483.x.

Cookson WR, Murphy DV and Roper MM (2008). Characterizing the relationships between soil organic matter components and microbial function and composition along a tillage disturbance gradient. *Soil Biology & Biochemistry* **40**: 763-777.

Cookson WR, O'Donnell AJ, Grant CD, Grierson PF and Murphy DV (2008). Impact of ecosystem management on microbial community level physiological profiles of postmining forest rehabilitation. *Microbial Ecology* **55**: 321-332.

Coutts BA, Strickland GR, Kehoe MA, Severtson DL and Jones RAC (2008). The epidemiology of Wheat streak mosaic virus in Australia: case histories, gradients, mite vectors, and alternative hosts. *Australian Journal of Agricultural Research* **59**: 844–853.

Coutts BA, Hammond NEB, Kehoe MA and Jones RAC (2008). Finding Wheat streak mosaic virus in south-west Australia. *Australian Journal of Agricultural Research* **59**, 836–843.

continued on page 20

Publications

continued from page 19

- D'Emden F, Llewellyn RS and Burton MP (2008). Factors influencing adoption of conservation tillage in Australian cropping regions. *The Australian Journal of Agricultural and Resource Economics* **52(2)**: 169-182
- Dens KR, Romero RA, Swennen R and Turner DW (2008). Removal of bunch, leaves, or pseudostem alone, or in combination, influences growth and bunch weight of ratoon crops in two banana cultivars. *Journal of Horticultural Science and Biotechnology* **83 (1)**: 113-119.
- Diaz A, Green I and Tibbett M (2008). Re-creation of heathland on improved pasture using top soil removal and sulphur amendments: Edaphic drivers and impacts on ericoid mycorrhizas. *Biological Conservation* **141**: 1628-1635.
- Donaldson FR and Vercoe PE (2008). Cross-family amplification: microsatellites isolated from Macropodidae are polymorphic in Potoroidae. *Molecular Ecology Resources* **8**: 452-454
- Doole GJ and Pannell DJ (2008). Role and value of including lucerne (*Medicago sativa* L.) phases in crop rotations for the management of herbicide-resistant *Lolium rigidum* in Western Australia. *Crop Protection* **27**: 497-504.
- El-Bouhssini M, Sarker A, Erskine W and Joubi A (2008). First sources of resistance to Sitona weevil (*Sitona crinitus* Herbst) in wild *Lens* species. *Genet Resour Crop Evol* **55**:1-4.
- El-Tarabily KA, Nassar AH and Sivasithamparam K (2008). Promotion of growth of bean (*Phaseolus vulgaris* L.) in a calcareous soil by a phosphate-solubilizing, rhizosphere-competent isolate of *Micromonospora endolithica*. *Applied Soil Ecology* **39**: 161-171.
- Flowers TJ and Colmer TD (2008). Salinity tolerance in halophytes. *New Phytologist* doi: 10.1111/j.1469-8137.2008.02531.x
- Green ID & Tibbett M (2008). Differential uptake, partitioning and transfer of Cd and Zn in the soil-pea plant-aphid system. *Environmental Science & Technology* **42**: 450-455.
- Isenegger DA, Macleod WJ, Ford R and Taylor PWJ (2008). Genotypic diversity and migration of clonal lineages of *Botrytis cinerea* from chickpea fields of Bangladesh inferred by microsatellite markers. *Plant Pathology* **57**: 967-973
- Johansen C, Bakr MA, Sirajul Islam M, Mondal NA, Afzal A, MacLeod WJ, Pande S, Siddique KHM (2008). Integrated crop management of chickpea in environments of Bangladesh prone to *Botrytis* grey mould. *Field Crops Research* **108**: 238-249.
- Jones RAC, Pearce RM, Prince RT and Coutts BA (2008). Natural resistance to Alfalfa mosaic virus in different lupin species. *Australasian Plant Pathology*. **37**: 112-116.
- Jones RAC, Coutts BA, Latham LJ and McKirdy SJ (2008). Cucumber mosaic virus infection of chickpea stands: temporal and spatial patterns of spread and yield-limiting potential. *Plant Pathology* Doi: 10.1111/j.1365-3059.2008.01838.x.
- Kopke E, Young J and Kingwell R (2008). The relative profitability of different sheep systems in a Mediterranean environment. *Agricultural Systems* **96**: 85-94.
- Kaur P, Sivasithamparam K and Barbetti MJ (2008). Pathogenic behaviour of strains of *Albugo candida* from *Brassica juncea* (Indian mustard) and *Raphanus raphanistrum* (wild radish) in Western Australia. *Australasian Plant Pathology* **37**: 353 - 356.
- Li H, Shen J, Zhang F, Tang C and Lambers H (2008). Is there a critical level of shoot phosphorous concentration for cluster-root formation in *Lupinus albus*? *Functional Plant Biology* **35**: 328-336.
- Li H, Sivasithamparam K, Barbetti MJ, Wylie SJ and Kuo J (2008). Cytological responses in the hypersensitive reaction in cotyledon and stem tissues of *Brassica napus* after infection by *Leptosphaeria maculans* 2008. *General Plant Pathology* **74**: 120 -124.
- Lin R, Yang H, Khan TN, Siddique KHM and Yan G (2008). Characterisation of genetic diversity and DNA fingerprinting of Australian chickpea (*Cicer arietinum* L.) cultivars using MFLP markers. *Australian Journal of Agricultural Research* **59**: 707-713.
- Luxhoi J, Fillery RP, Murphy DV, Bruun S, Jensen LS and Recous S (2008). Distribution and controls on gross N mineralization-immobilization-turnover in soil subjected to zero tillage. *European Journal of Soil Science* **59**: 190-197.
- Ma Q and Rengel Z (2008). Phosphorus acquisition and wheat growth are influenced by shoot phosphorus status and soil phosphorus distribution in a split-root system. *Journal of Plant Nutrition* **171**: 266-271.
- McGrath GS, Hinz C and Sivapalan M (2008). Modelling the impact of within-storm variability of rainfall on the loading of solutes to preferential flow pathways. *European Journal of Soil Science* **59**: 24-33.
- Nasar-Abbas SM, Plummer JA, Siddique KHM, White P, Harris D and Dods K (2008). Cooking quality of faba bean after storage at high temperature and the role of lignins and other phenolics in bean hardening. *LWT Food Science and Technology* **41**: 1260-1267.
- Nichols PGH, You MP and Barbetti MJ (2008). Resistance to race 1 of *Kabatiella caulivora* in subtterranean clover (*Trifolium subterraneum* L.) cultivars and breeding lines. *Australian Journal of Agricultural Research* **59**: 561-566.
- Pannell DJ, Hailu G, Weersink A and Burt A (2008). More reasons why farmers have so little interest in futures markets. *Agricultural Economics* **39(1)**: 41-50.
- Pannell DJ (2008). Public Benefits, Private Benefits, and Policy Mechanism Choice for Land-Use Change for Environmental Benefits. *Land Economics* **84(2)**: 225-240.
- Pluske JM and Schlink AC (2008). Water management as a future necessity in sheep feedlots. *Australian Journal of Experimental Agriculture* **48**: 641-647
- Powles S (2008). Evolved glyphosate-resistant weeds around the world: lessons to be learnt. *Pest Management Science* **64**: 360 -365.
- Powles S (2008). Glyphosate: a once-in-a-century herbicide. *Pest Management Science* **64**: 319-325.
- Prakongkep N, Suddhiprakarn A, Kheoruenromne I, Smirk M and Gilkes RJ (2008). The geochemistry of Thai paddy soils. *Geoderma* **144**: 310-324.
- Riley IT and Barbetti MJ (2008). Australian anguinids: their agricultural impact and control. *Australasian Plant Pathology* **37**: 289-297.
- Rose TJ, Rengel Z, Ma Q and Bowden JW (2008). Hydraulic lift by canola plants aids P and K uptake from dry topsoil. *Australian Journal of Agricultural Research* **59**: 38-45.
- Rose TJ, Rengel Z, Ma Q and Bowden JW (2008). Post-flowering supply of P, but not K, is required for maximum canola seed yields. *European Journal of Agronomy* **28**: 371-379.
- Shane MW, Lambers H, Cawthray GR, Kuhn AJ and Schurr U (2008). Impact of phosphorus mineral source (Al-P or Fe-P) and pH on cluster-root formation and carboxylate exudation in *Lupinus albus* L. *Plant Soil* **304**: 169-178.
- Smith MTE, Smernik RJ, Merrington G & Tibbett M (2008). Changes in sewage sludge carbon forms along a treatment stream. *Chemosphere* **72**, 981-985.
- Solaiman ZM and Abbott LK (2008). Influence of arbuscular mycorrhizal fungi, inoculum level and phosphorus placement on growth and phosphorus uptake of *Phyllanthus calycinus* under jarrah forest soil. *Biology and Fertility of Soils* **44**: 815-821.
- Turner NC, Schulze E-D, Nicholle D, Schumacher J and Kuhlmann I (2008). Annual rainfall does not directly determine the carbon isotope ratio of leaves of *Eucalyptus* species. *Physiologia Plantarum* **132**: 440-445.
- Underdown, RS, Sivasithamparam, K and Barbetti, MJ (2008). Inhibition of the pre- and postinfection processes of *Plasmopara viticola* on *Vitis Vinifera* leaves by one protectant and four systemic fungicides. *Australasian Plant Pathology* **37**: 335-343.
- Vincenot L, Balesdent MH, Li H, Barbetti MJ, Sivasithamparam K, Gout L and Rouxel T (2008). Occurrence of a New Subclade of *Leptosphaeria biglobosa* in Western Australia. *The American Phytopathological Society* doi: 10.1094/PHYTO-98-3-0321.
- Vinale, F, Sivasithamparam, K, Ghisalberti, EL, Marra, R, Woo, SL and Lorito, M (2008). *Trichoderma*-plant-pathogen interactions. *Soil Biology and Biochemistry* **40**: 1-10.
- Wongpokhom, N, Kheoruenromne, I, Suddhiprakarn, A, Smirk, M and Gilkes, RJ (2008). Geochemistry of salt-affected aquifers in northeast Thailand. *Soil Science* **173**: 143-167.
- You MP, Lancaster B, Sivasithamparam K and Barbetti MJ (2008). Cross-pathogenicity of *Rhizoctonia solani* strains on pasture legumes in pasture-crop rotations. *Plant Soil* **302**: 203-211.