

# the INNOVATOR

The Newsletter from the EH GRAHAM CENTRE for Agricultural Innovation



Off to a flying start: the 2011 season has kicked off well with crops sown into almost full soil profiles and emerging well.  
Photo: P Lawson.

## From the Director's desk

Welcome to the new look Winter 2011 Edition of *the Innovator*. The season has started with the timely sowing of crops, providing an optimistic start.

The Grains Industry National RD&E Strategy was released in April and the Graham Centre has been named as a major regional network node for the mixed farming systems of the NSW Central zone and NSW-Victorian slopes. This will strengthen our links and collaboration with other research providers, farmer groups and Research and Development Corporations.

The Charles Sturt University Rhyziolysimeter was officially opened by the Minister for Regional Australia and Regional Development, the Honourable Mr Simon Crean MP on Thursday, 14 July. During his opening address Mr Crean reinforced the Government's support for regional development.

The rhyziolysimeter facility is a world-leading facility in soil and plant interactions. The research will focus on water and nutrient use efficiency, and management for climate change.

This plump issue of *the Innovator* contains new research projects, current research project updates, details of the Graham Centre's 2011 Research Centre Fellows, conference reports and details of a number of important upcoming events.

The Graham Centre field site is set up this year with a range of interesting demonstrations including crop sequencing, stubble management options, new herbicide options and the impact of diet on ewe fertility. The annual Field Day will be held on 7 September 2011.

I hope you find it useful and an interesting read!

Regards

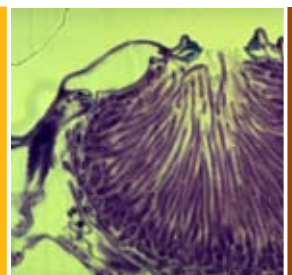
Professor Deirdre Lemerle

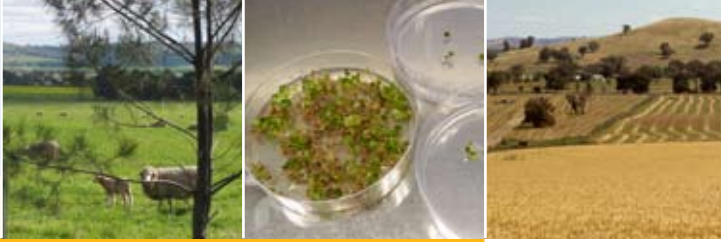
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Seminar series  
CSU website  
NSW DPI website





## NEWS

### ‘New’ cattle pathogen detected by CSU Researchers

The first detection in Australia of *Ureaplasma diversum*, a pathogen which can cause costly reproductive problems in cattle herds, has been achieved by a School of Animal and Veterinary Science team led by Professor Peter Chenoweth and Dr Kapil Chousalkar.

First suspicion that this organism might be active in Australia came with reports of bull genital lesions from local veterinary practitioners, Dave Hall and Bill Graham, who sought advice from the Charles Sturt University reproduction team. The lesions had similarities to lesions seen in Florida beef cattle and linked with *U. diversum*. This resulted in research over nearly two years culminating in the first culture of the organism in May 2011. Honours students who have played a pivotal role in the research include Ashleigh Smith, Naomi Hobson and Brodie Argue. Other key players include Michelle Ayton - technical expertise in establishing culture work; Helen McGregor - providing field samples; and Craig (Joe) Farish - taking photos under the microscope.

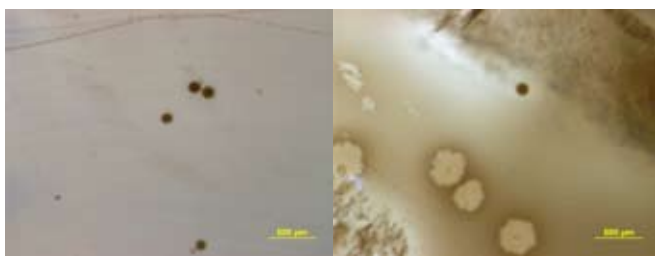
#### Challenge for producers

*Ureaplasma diversum* presents a challenge to cattle producers as it causes a variety of problems including infertility, early pregnancy loss and birth of low viability calves. It can also be a benign inhabitant of the reproductive tract.

In the Upper Murray and Jugiong regions, *U. diversum* has been linked to severe bull penile lesions that can interfere with normal mating.

“While it is good, in some respects, to be able to link a particular pathogen with a frustrating problem, more work is needed to establish just how important *U. diversum* might be to Australian cattle producers,” Dr Chenoweth said.

**Contact:** Professor Peter Chenoweth, T: 02 6933 2652, E: [pchenoweth@csu.edu.au](mailto:pchenoweth@csu.edu.au)



Reproduction problems: *Ureaplasma diversum* has been detected in Australia as a pathogen that can lead to reproductive problems in cattle. Photos: C Farish.

### Climate Symposium Wrap-up

The Department of Primary Industries (DPI) and the Graham Centre held a very successful two day symposium in June on agricultural climate adaptation.

Some of Australia’s leading climate researchers updated DPI and Charles Sturt University researchers and extension staff on the latest climate science and its implications for agriculture.

“The increasing climate variability is putting huge stress on farmers, but the stress could be reduced by spreading the farming risk across several strategies. Despite this stress, farmers are leading the way in Australia in devising ways to slash their carbon emissions,” Dr Anthony Hogan, Australian National University’s School of Sociology said.

#### Lower Rainfall

Dr Bertrand Timbal from the Bureau of Meteorology Research Centre reported on findings from the first phase of the South Eastern Australian Climate Initiative (SEACI1).

“Current rainfall decline in south-eastern Australia, particularly in autumn, is partly due to climate change, caused by expansion of the tropics and intensification of the subtropical ridge which influences the region’s climate,” Dr Timbal explained.

“The SEACI findings indicate an increasing risk of below average rainfall for south-eastern Australia, and short-duration storms may become more intense across the region, especially over the inland plains.

Other keynote speakers covered climate modelling for NSW, recent climate science findings, and farmers’ capacity to adapt.

DPI and CSU research and extension staff reported on their activities assisting agricultural industries to adapt to a warmer, drier and more variable climate. These covered viticulture, carbon stocks, methane emissions, water, weeds, livestock, fruit, rice, wheat and other grains, soil carbon sequestration and financial risk.

#### Learning environment

“The symposium provided a timely opportunity for DPI and CSU staff to learn about the latest climate science and present their own adaptation research,” said Kate Lorimer-Ward, DPI’s Climate Smart Agriculture leader, and one of the symposium organisers.

Graham Centre Director, Professor Deirdre Lemerle, said “It was an opportunity to strengthen our joint commitment to provide practical solutions backed up with rigorous research.”

## Neoscope Scanning Electron Microscope (SEM) ready for 'action'

The Neoscope Scanning Electron Microscope (SEM) that was purchased from a Research Infrastructure Block Grant to Graham Centre Members John Harper, Geoff Burrows, Jane Quinn and Shane Raidal is now ready for use.

The SEM, critical point drier and sputter coater are located in the Plant Pathology lab.

Until now, the SEM has been used mostly by PhD student Xiacheng Zhu to look at the dried leaves of the invasive weed Silverleaf Nightshade, which do not need special specimen preparation. Silverleaf Nightshade has amazingly dense stellate hairs (trichomes) that give the leaves their silvery sheen and enable plants to cope with arid environments.

Other equipment necessary to prepare the bulk of samples, has been purchased thanks to Research Centre Fellow Infrastructure grants to John Harper, Gavin Ash and Samson Agboola along with other monies kindly donated by Jim Hardie (Director of the National Wine and Grape Research Institute) and Deirdre Lemerle (Director of the Graham Centre) and users.

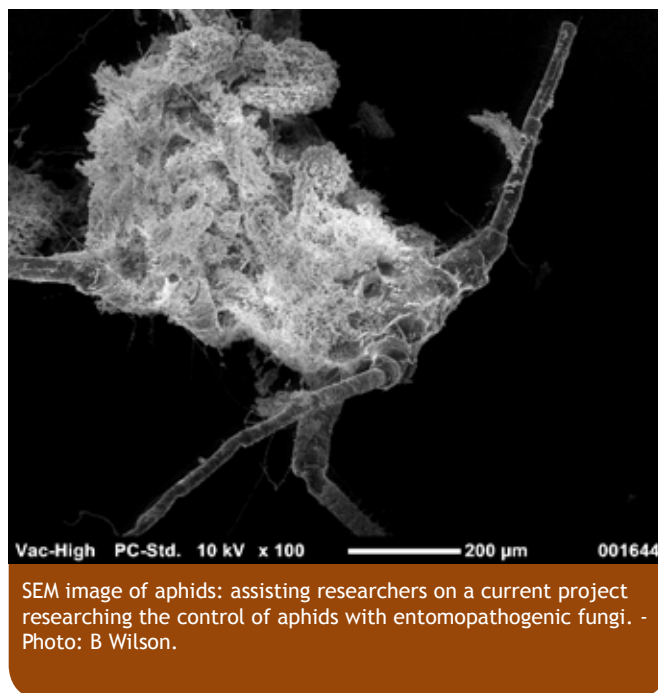
The equipment is up and running thanks to the efforts of Post Doc Bree Wilson, and will enable a diversity of projects to be undertaken. At this point in time, only minimal training will be provided and it will be up to the individual to prepare samples and develop methodology to use the equipment.

### Current projects

Some current projects using the SEM and associated equipment include:

- Silverleaf nightshade trichomes: Xiacheng Zhu (PhD student), Geoff Burrows, Harsh Raman, Deirdre Lemerle and Hanwen Wu.
- Canola root development in drying soils: John Harper, Sergio Moroni and David Luckett.
- Control of aphids with entomopathogenic fungi: Bree Wilson (Postdoc), Ben Stodart (Postdoc) and Gavin Ash.
- Animal parasites: Peter Andrews (PhD student) and Shane Raidal.
- High resolution imaging of grapevine bud development: Peter Noyce (Honours student), John Harper, Chris Steel, Robyn Wood and Denis Greer.

Other general research areas that will use the SEM include plant structure, plant pathology, insect pathology, biocontrol and nematology, entomology, animal cell and tissue biology pathology, bio-medical and therapeutic Gels and



antimicrobial oils, human cell biology, food microstructure and carbon sequestration.

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## Honours Project: 'The People Chapter'

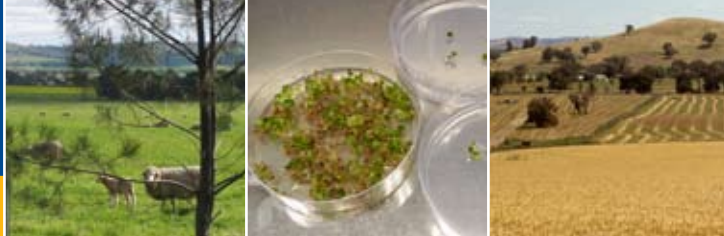
In the last edition of The Innovator we read about the work David Gale was doing in Vietnam as part of his honours project and some of the outcomes from that. In this edition we talk to David about the final third of the project, the 'people chapter', as he calls it.

### Can we have a quick re-cap for those just joining the story?

Honours, compost, barley, Vietnam and baby corn. All in a bid to investigate whether we can reduce our usage of synthetic phosphorus fertilisers. The key findings from glasshouse work in Australia showed that compost worked well but large amounts would be required. Field trials in Vietnam showed volume is important and that rates presently used by local people are not sufficient to replace synthetic phosphorus fertilisers.

### Why don't the Vietnamese farmers just use more?

That's a good question because it seems like a logical progression of thought to us. To give some background to my answer, before I set out on the Vietnamese component of my honours project, I firmly believed that if farmers are not going to use a new technology, compost in this case, then we as a scientific community can research as much as



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Size does matter: Small land holders perceive they have insufficient time to use and apply compost.

we like about what effects it has on the soil or plants, but it might never be used.

For this reason I decided to ask Vietnamese farmers if they would use compost in larger quantities, if the agronomic research pointed towards it being a 'good idea'. A kind of 'people chapter', looking more holistically at the farming system. The answer I got was essentially 'no'. I believe the reason for this is that the farmers surveyed, 50% of whom have farms less than one hectare in size, perceive they have insufficient time.

### What do you mean when you say 'the farmers you surveyed'?

Whilst I was in Vietnam working on the field trial and systems research components of my honours project for nearly four months, my Vietnamese still was not good enough to survey on my own. I combined my questions with questions from a Vietnamese researcher from the university I was based at and essentially 'piggy-backed' on the fact that about six staff from the university were going to be doing these surveys anyway.

The process was not without its challenges though. The translation of my questions was a bit interesting at times and instead of 'Do you have any off farm income?' the survey was translated to the equivalent of 'Do you have any income off your farm?'. The difference in answers given was obviously significant.

### How does this result impact on the rest of your project?

In terms of what the findings regarding the benefits of compost used to crop production, the results from the rest of the project still stand on their own, but with some limitations associated with the volumes generally involved.

However, the findings in the survey component add to the case for a need to reduce the volumes of compost that

need to be applied through increasing the concentrations of essential nutrients. This is because it is thought that if the volumes needed to be applied were smaller, it would not take farmers the same amount of time to apply the compost product.

The survey results also help in understanding how an extension program could be framed, based on a better understanding of how farmers use their time and resources.

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**Editor's note:** David has recently had a condensed paper accepted for presentation of some of his honours work at the World Congress on Conservation Agriculture in Brisbane in September where he will again discuss his project supported by the Graham Centre.

## Research Centre Fellows highlight the breadth of Graham Centre research

Charles Sturt University (CSU) is committed to providing funding to Research Centre's to support the full-time release from teaching commitments of key researchers for a period of six months.

The Graham Centre 2011 Research Centre Fellows were honoured at a luncheon on Monday 16 May, 2011.

The Graham Centre identified 14 Research Centre Fellows for 2011 that will focus on a broad range of research areas including plant and animal diseases, animal physiology and production, animal reproduction, food security, sustainable pasture systems, weeds, canola, biosecurity and environmental health, water, stubble and conservation cropping.

The Research Centre Fellows have been provided \$40,000 each to focus on research in their chosen area.

Mayor of Wagga, Councillor Kerry Geale; Deputy Director General, Department of Primary Industries, Dr George Davey; Principal Director Science and Research, Dr Phil Wright, and Dean, Faculty of Science, CSU, Professor Nick Klomp attended the event. Members from the Graham Centre Industry Advisory Committee, including Chairperson Ms Lucinda Corrigan, also attended.

### Interest remains high

Applications for Research Centre Fellows were of an exceptionally high standard again this year, with 29 expressions of interest received for the final 14 places.

2011 Graham Centre Research Centre Fellows:

- Professor Gavin Ash - biosecurity and improved biological control of plant diseases.

- Dr Chris Blanchard - Healthy foods initiative; chickpeas.
- Associate Professor Geoff Burrows - anatomy of silverleaf nightshade trichomes; implications for herbicide uptake and crop and pasture plant recognition student book/guide.
- Dr Joanne Connolly - assess the impact of agricultural practice on the platypus as an indicator of environmental health.
- Associate Professor Phil Eberbach - effect of stubble on evaporative loss of soil moisture and the effect of flooding regime on canopy temperature abatement of rice grown under conditions with elevated atmospheric temperature.
- Dr Michael Friend - sustainable pasture systems; feedbase investment plan and omega-3 effects in the diet of sheep.
- Professor Geoff Gurr - ecological pest management; using chemical ecology to manipulate the movement of natural enemies of pests and reduce crop damage.
- Dr John Harper - canola anatomy and scanning electron microscopy.
- Dr Gaye Krebs - sustainable pasture systems/meat and milk; the estimation and importance of pasture and forage quality in sheep meat production systems.
- Associate Professor Scott Norman - animal production (beef) - reproduction; identification of areas of calf and production loss.
- Dr Jane Quinn - Investigation of ryegrass staggers and avenues of therapeutic potential.
- Associate Professor Shane Raidal - mechanisms of chronic infection, immunotolerance and coevaluation in avian circovirus infections.
- Dr Jim Virgona - sustainable pasture systems; evidence-based agriculture, can we get there? Pasture production in the mixed farming zone.
- Professor Peter Wynn - provide extension support for staff servicing the needs of small-holder dairy farmers in Pakistan and the development of new research programs for the pork industry.

## New Appointments

**Sharon Fuller** commenced with the Graham Centre in June as Administration Assistant, Communications. Sharon works closely with Toni Nugent, Research Liaison Officer - Communications, assisting with updating the website, marketing and events. Sharon also works with Emma Wordsworth, Science Education Officer, with the Primary Industry Centre for Science Education (PICSE) program.

Sharon has previously worked in administrative, accounting and marketing roles.

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where he obtained a BSc (Hons) degree from Wye College, University of London.

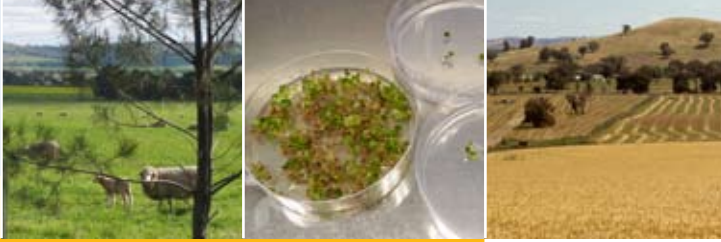
Jonathan's recent research has exposed him to a range of soils across NSW wine regions. The work included a focus on nutrient movement and the different pools of soil potassium. The role of irrigation management was appreciated in this role as well as the growth and interactions with vine roots.

Jonathan's position focuses on the significant challenge that is currently facing Australian agriculture as it investigates the trade-offs with the environment. Indeed there is a great need to achieve a healthy balance between efficient production systems and those practices that minimise environmental impact. This research program has been formed with scientists from CSU (Graham Centre and the Institute for Land Water and Society) and the NSW Department of Primary Industries. Areas identified that require critical attention include: nutrients and off-site effects, agricultural water use and landscape degradation issues such as salinity and acidification.

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**Dr Jonathan Holland** has been appointed as a Research Officer for the Graham Centre and Charles Sturt University's Institute of Land and Water. Jonathan arrives at the Graham Centre having spent three and a half years working on vineyard soils with the National Wine and Grape Industry Centre. Previously he completed a PhD in soil science at the University of Melbourne where he worked on raised beds in the Western District of Victoria. Before starting his PhD, Jonathan lived in the UK



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### Australian wool back on track

Amid the dramatic 50 percent improvement in wool prices over the past 12 months and the profitability of growing wool, Professor of Animal Production at Charles Sturt University (CSU) Peter Wynn has warned the industry to avoid complacency.

The possible future directions for the Australian wool industry were outlined during a seminar on 18 May organised by the Graham Centre.

### Young and old minds combine

The event brought together over 50 animal science students from CSU and the universities of Melbourne and Sydney with 30 local wool growers at the Wool Education Centre, Shear Outback, Hay.

The Australian Wool Education Trust Fund provided financial resources to support students to attend the event.



Don't be complacent: Effective communication along the supply chain is essential to the survival of the wool industry in Australia. Photo: M McClelland.

### Be responsive

"In order to sustain the consumption of the wonderful raw wool we produce in Australia it is critical we communicate effectively with our wool buyers, processors and consumers," Professor Wynn said.

"Responding instantly to changes in requirements at any of these levels is important in business: consumer perceptions of apparel can change overnight. Inevitably blending of wool with other fibres will help boost consumption and the versatility of available products."

The Australian Wool Innovation Limited has carefully adjusted its budget to invest equally in research and marketing. The 'no finer feeling' slogan has captured the imagination of the high fashion end of the market, while

there is a major push to increase consumer awareness of the virtues of wool for middle income earners. The sports active market is also proving to be a profitable target for the industry with wool's unique wearability attributes.

The Cooperative Research Centre for Sheep Industry Innovation (Sheep CRC) has committed a major investment to the development of the fabric 'comfort meter', which has provided an extremely sensitive measure of the wearability of any fabric. This has accentuated the value of wool as the fibre of choice for flexible everyday wearing.

### Balancing Act

"While the wool broker provides an important conduit for the producer to market his wool profitably, this important middleman is increasing the range of services that are provided for the wool producer. This may include advice on the use of future genetics, feeding and animal health regimes that impact on wool quality. Responding to the requirements of the consumer right down the marketing chain will be important for the future success of the industry," Professor Wynn explained.

"The industry needs to adopt the latest in technologies associated with the molecular genetic revolution and with more practical issues such as mulesing and shearing.

"It is also important producers realise they cannot always provide the very best for both the meat and apparel fibre marketplace. The best wool may not come from the meatiest animal. It is a matter of choice for producers as to which way they want to focus their flock," Professor Wynn said.

"One of the most important issues raised was that the average age of wool producers in Australia is around 60 years. With almost half the audience at the seminar under the age of 25, it is hoped that many innovative young minds will be entering the industry over the coming decade."

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### When an old dog is a wolf ...

"You can't teach an old dog new tricks" or so the saying goes. But the Graham Centre has exceptions, especially the senior adjunct staff who participate in Graham Centre activities.

An ongoing contributor is Emeritus Professor Ted Wolfe, who celebrates 10 years of 'retirement' this September. Ted is busier than ever with a consultancy, contract and three honorary positions on the go.

### Embracing computers

"The biggest change in my professional life came with my adoption of computers and the internet, things that took a few months of serious adjustment," he reflects.

“The year 1997 was a big one, when I learnt to type and use a computer while on sabbatical leave. The ability to undertake library and internet searches, and the contacts available through the web have been vital to my ongoing enthusiasm as an active member of the Graham Centre,” Ted continued.



Stay engaged and active: After 10 years of ‘retirement’ Emeritus Professor Ted Wolfe still remains an active member of the Graham Centre. Photo: T Nugent.

### Editor-in-waiting

Ted is currently waiting for the appearance of two books later in 2011, one due out in July (Rainfed Farming Systems - Springer) and another in November (Crop Adaptation to Changing Climates - Wiley), both of which he has written a chapter for.

The first book, edited by a team from the University of Adelaide and the University of Queensland, contains a particularly important set of insights from scientists and farmers into rainfed agricultural systems around the world. Ted contributed a chapter on mixed and integrated crop-livestock systems. Local farmer Derek Ingold, Dirnaseer, also contributed a chapter on his mixed farming system.

Ted assisted Derek with his chapter and also encouraged Jeff Esdaile, Tamworth, to write about his experiences in developing no-till farming on Livingstone Farm (University of Sydney), Moree.

“My face-to-face and internet conversations with these two farmers were always interesting. Both Derek and Jeff have excellent ideas, which they continue to refine,” he said.

### Remain professionally engaged

In the Graham Centre, Jim Pratley, Brendan Scott and Gordon Murray are other ‘senior’ scientists who are ticking off new milestones in their careers.

“Like my experienced contemporaries, I do try to be positive and avoid controversy. But a certain amount of vigorous debate is part of the process of exchanging ideas,” Ted reflected.

“Overall, it is a most satisfying experience to remain professionally engaged,” Ted concluded.

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## Collaboration on nematode control

A new trans-Tasman research program will aim to develop a commercial biopesticide for the control of root lesion nematode, a serious pest of Australian cereal crops, particularly wheat.

Microbial product experts from New Zealand will join forces with plant pathologists from Charles Sturt University - headed up by Professor Gavin Ash, and nematologists from the Department of Agriculture and Food, Western Australia to form a research group with strong industry support and extensive knowledge of commercial biopesticide development.

“The project has three initial research targets: the identification and evaluation of existing commercial biopesticides with potential suitability for this crop/pathogen system, the development of a Trichoderma-based bionematicide for cereal root lesion nematodes and the identification of indigenous strains of selected microbe groups that may have potential as bionematicides,” Associate Professor Gavin Ash said.

“This is a great opportunity to further extend our research and work towards finding alternative means of managing these recalcitrant pests.”

The four year, \$1.9 million research project, including a PhD stipend (2012-2015) on indigenous biocontrol agents for nematodes, is funded by the Grains Research and Development Corporation and begins in July 2011.

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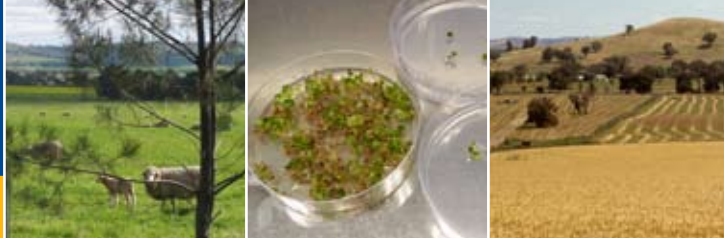
## Sheep Measles

### What’s the real cost of Sheep Measles to the industry?

Anecdotal data shows sheep measles causes major financial losses to the Australian sheep meat industry, but accurate data on the exact amount of these financial losses and recent data regarding parasite transmission on farms are not available.

A team of researchers led by Dr David Jenkins and Dr Jan Lievaart from the Graham Centre have been successful in gaining \$429,000 in funding from Meat and Livestock Australia to address these issues.

“Sheep measles is caused by infection with the larval stage of a dog tapeworm (*Taenia ovis*),” Dr David Jenkins, Senior Research Fellow in Parasitology with the Graham Centre and Charles Sturt University School of Animal and Veterinary Sciences explained.



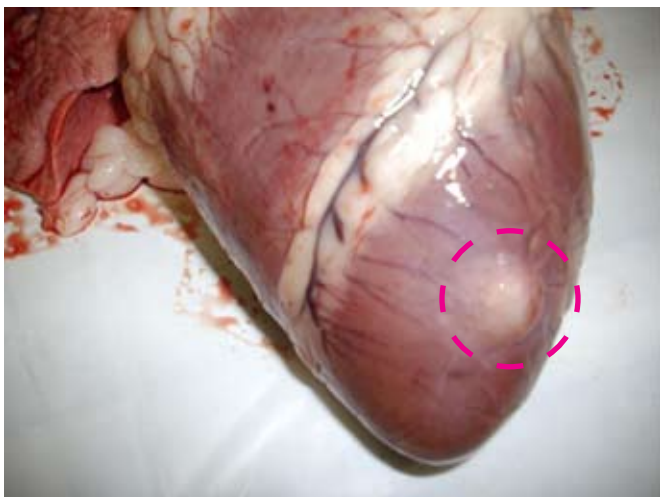
## NEWS

“The parasitic infection occurs mainly in the heart muscle of sheep but in heavy infestations, muscles throughout the body can be infected.

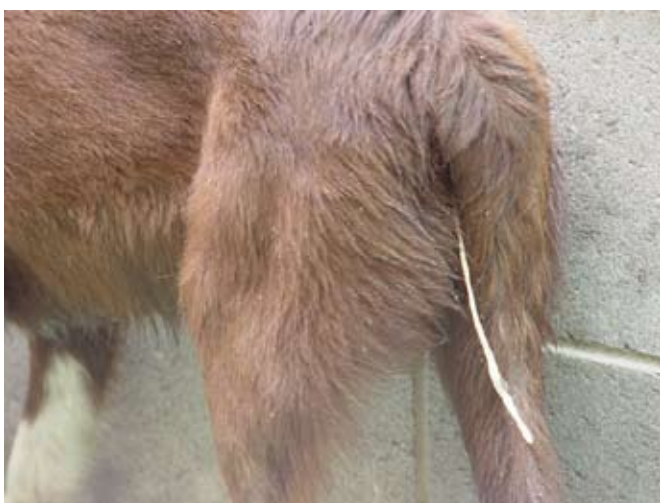
“While there are no public health issues related to the disease, it has important economic impacts on the Australian sheep meat industry,” Dr Jenkins said.

Historically sheep measles has led to the rejection of a major part of a consignment of Australian boned mutton to the United States and remains a potential international trade impediment.

“Recent data through the National Sheep Health Monitoring Survey (2006-2010), has identified sheep measles occurring more commonly than was previously realised, particularly



Not aesthetically pleasant: Sheep measles cyst (*Taenia ovis*) present in sheep heart muscle. Photo: Animal Health Australia.



Dog tapeworm is a major player: Sheep measles is transmitted to sheep via eggs passed in the faeces of domestic dogs infected with sheep measles tapeworms. Photo: D Jenkins.

in NSW, Victoria and WA, and more recently it has also been found to be common in sheep in SA. The disease causes tens of thousands of hearts to be condemned annually and many carcasses to be trimmed, downgraded or condemned with subsequent losses to both producers and processors.” Dr Jenkins said.

“For the period July 2007-June 2008 there were 1.3 million cases reported nationally”.

The two year project is due to commence within the next few months. Researchers from the Graham Centre will work closely with abattoirs and sheep producers across Australia, Livestock Health and Pest Authorities, NSW DPI, CSU, Department of Agriculture and Forestry WA and the Department of Primary Industries, Parks, Water and Environment, Tasmania.

“Data collected showing how the disease spreads will assist in identifying transmission risk factors and improve on-farm control through producer education,” Dr Jenkins said.

“Sheep measles is transmitted to sheep mainly by domestic dogs, so producers can assist in reducing the spread of the disease by regularly worming their dogs for tapeworm and freezing sheep meat for a minimum of two weeks to kill the parasite before it is fed to dogs,” Dr Jenkins concluded.

Drs Jenkins and Lievaart gratefully acknowledge the support of the Sheepmeat Council of Australia, Wool Producers Australia and Animal Health Australia during the preparation of this proposal.

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***Congratulations*** to Associate Professor Samson Agboola and Dr Paul Prenzler who are part of the Chemistry Teaching Team, who have received the Team Award for the 2011 CSU Vice Chancellors award for Teaching Excellence. The awards will be formally presented at the annual presentation ceremony at CSU's Wagga campus on 29 August.

## New snail biocontrol weapon soon to be trialled

Field trials of a new biological agent to control snails are expected to begin in South Australia and Victoria over the coming few months, with the aim of commercialising the biological control agent next year, depending on the success of the field trials.

Professor Gavin Ash and his team at the Graham Centre have achieved mortality rates of up to 90 percent in adult round and conical snails in about a week using nematodes isolated from Australian cropping soils.

### Native nematodes

The native nematodes are yet to be tested in the field but Professor Ash is optimistic about the potential of the biocontrol agents following successful field simulation trials.

“Nematodes have all the characteristics of a perfect biocontrol agent and they have been successfully developed for the biological control of other invertebrate pests in Australia,” Professor Ash said.

“The nematodes are naturally occurring, soil dwelling organisms which are harmless to mammals and other beneficial animals, but most suitable to use against pests, such as snails and slugs, which live all or part of their lifecycles in soil.”

“So unlike conventional bait, nematodes do not contaminate the food chain.”

### GRDC support

Through the Grains Research and Development Corporation (GRDC), Professor Ash and his team have approached a number of companies to produce commercial quantities of the nematodes to support field trials later this year.

It is likely that two trial sites will be established in South Australia, and at least one in Victoria.

The development of an alternative control for snails is encouraging news for grain growers in the southern region where snails are again presenting as a major pest issue this cropping season.

The unseasonal cool and wet conditions of the 2010-11 summer favoured snail populations which are now becoming active with a drop in the temperature and the onset of winter rainfall.

While a range of practices have been developed to assist growers to manage the snail problem on their farms, these are expensive, time consuming and may not fit with other farming practices being employed. Current snail control methods include stubble management, burning and baiting.

The last economic study commissioned by the GRDC to



Native nematodes hold the key: Native nematodes have all the characteristics of a perfect biocontrol agent to control natural infestations of Mediterranean snails in pastures. Photo: A Wang.

assess the impact of snails on farming systems showed a direct cost to farm businesses on the Yorke Peninsula and in the Lower North of South Australia was on average \$59,180 per farm or \$41 per cropped hectare.

GRDC believe the development and commercialisation of a biologically-based control agent has the potential to dramatically improve current control techniques and reduce farm costs.

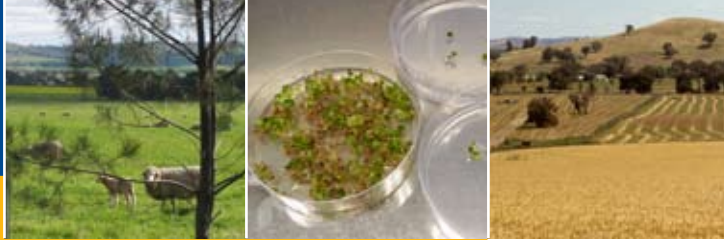
Professor Ash and his team have been awarded further funding to continue the work, including field trials during 2011-2012.

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## Field Site Update

The Graham Centre Field site has kicked off for the 2011 season with demonstration plots sown and starting to come through. Demonstrations and displays at the field site this year include:

- Managing herbicide resistance on firebreaks
- Stubble management systems
- New pasture and forage options
- Wheat disease control
- Spring and winter wheat options
- Pre-emergent herbicide damage to crops (including new herbicide releases)
- Genetic improvement in wheat and canola
- Brome grass seed bank reduction



## RESEARCH ACTIVITIES



Crop sequencing trial: The Yield Prophet® model estimates current available soil H<sub>2</sub>O is at about 30% of capacity. Photo: T Nugent.

- Canopy management
- Insect diversity in soil
- Biochar
- Soil pit
- Controlled traffic
- WeedSeeker - targeted herbicide application
- Impact of diet on ewe fertility

The paddock containing the field site has been registered with Yield Prophet®, using wheat crop details. Despite above average rainfall over the spring/summer period the Yield Prophet® model estimates that current available soil water under the simulated crop is at about 30% of capacity. Estimated moisture loss via evapotranspiration from time of sowing to mid July is at 52 mm, while rainfall recorded for the same period was 57 mm. For more estimates from the Yield Prophet® simulation model [click here](#).

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## Stable soil organic matter

Sequestering soil carbon (C) relies on the availability of stabilising elements, nitrogen (N), phosphorus (P) and sulphur (S) - essential components of the stable organic C pool.

Graham Centre PhD student Clive Kirkby investigated the stoichiometry of the soil organic matter (SOM) of freshly collected Australian soils. The soils were analysed for total C, N, P, organic phosphorus (OP) and S, and the ratios were compared with values for soils from numerous locations around the world (international soils).

Research suggests the amount of total SOM is essentially linearly related to the amount of the least limiting nutrient (N, P or S) available in the soil, and provides an explanation why there are many studies showing surprisingly little response of SOM to differences in residue input. If there is not any 'spare' available N, P or S when crop residues are

added to the soil, only a small percentage of the residue carbon will actually get transformed into stabilised humus carbon.

So, while a lack of nutrients can limit plant biomass production or, conversely, fertilisation can increase plant biomass production, which in turn increases the amount of crop residue available to be returned to the soil, it can be hypothesised that nutrient availability can affect SOM levels in ways unrelated to increased biomass production.

While it is generally recognised that only a small proportion of crop residue-C will ever be converted to humus, understanding what influences the humification efficiency (% plant-C converted into humus-C) is vital to understanding soil-C dynamics.

### Good news

Total N and S were found to be highly correlated with C for the International and Australian soils, with the relationships being similar for both sets. The correlation of C with P for Australian soils was not as strong as the correlations with N and S, but a stronger relationship was found for OP than P with C.

Overall, the C:N:OP:S ratios were constant for the stable portion of the soil organic material and these were consistent across a wide range of global soils.

The results suggest that an approximately equal C:N and C:S ratio is a key property of the organic material associated with the SOM or humus. There was consistency in the relationships of N and S with C in SOM, which may imply that SOM-C levels could be limited by the supply of N and S and not just C input.

Consistent stoichiometric ratios for these nutrients in the stable SOM pool across soils globally, could mean that all these nutrients will need to be supplied to stabilise higher C content in soils. But depending on the origin of the soil, not all nutrients would need to be supplied externally in all cases.

Given that these nutrients have to be 'locked up' for as long as the C is stored, the question arises about the economic value (or lost opportunity cost) of these required nutrients, however it occurs. The simplest assumption is to assume their value equals or is similar to the value of replacing them with fertiliser.

The C:N:P:S ratios used in Clive's research show that each tonne of humus-C will 'lock-up' 80kg N, 20kg P and 14kg S, and their potential value can be estimated by comparing the cost of the same quantity of nutrients provided by fertiliser. It should be noted that the crop residue does contain some N, P and S, and whatever N, P and S is in the residue can be deducted from the 80kg N, 20kg P and 14kg S that needs to be available to lock up a tonne of humus carbon.

The current trading prices of carbon dioxide (CO<sub>2</sub>) in existing markets range from \$5-\$10 per tonne (Chicago climate Exchange) to \$40 (EU/Kyoto compliance protocols). Based on these trading prices, a tonne of humus-C (equivalent to 3.7t CO<sub>2</sub>) would be worth \$20-\$150.

But it is important the 'hidden costs' are accounted for when considering any carbon trading scheme.

Clive's results provide a reliable basis for determining the level at which the availability of N, P and S may limit humus-C sequestration in terrestrial ecosystems, although further research is needed to more accurately determine the amount of OP in humus.

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The \$23 "carbon" price recently announced by the government is actually \$23 for a tonne of CO<sub>2</sub>-equivalent not \$23 for a tonne of actual carbon. \$23 for a tonne of CO<sub>2</sub>-equivalent equates to \$84 for an actual tonne of carbon.

## Whole genome sequencing of economically important fungal pathogens of plants and insects

The Wagga Wagga Plant Pathology Group is taking advantage of cutting edge technology to explore how plant and insect diseases occur. Fungi cause the loss of crop yields and profit through plant disease. But they can also attack and control insect pests (biocontrol) improving crop yields and profit.

Genome sequencing defines the genetic blueprint of an organism, allowing the genetic cause of differences in fungal virulence and host range to be found. It took an international research consortium 10 years to sequence the human genome, but now the whole genomes of fungi can be sequenced using next generation sequencing (NGS) technologies in a matter of months.

This project aims to generate whole genome sequences for Australian isolates of *Mycosphaerella graminicola*, causing Septoria tritici blotch (STB) of wheat, and *Metarhizium anisopliae*, an insect biocontrol fungus.

### Septoria sequencing project

*M. graminicola* (anamorph: *Septoria tritici*) causes STB of wheat and is a common and damaging disease in all wheat growing regions of southern Australia. Significant pathogenic variation occurs among Australian isolates of *M. graminicola* both between wheat growing regions and over time, but

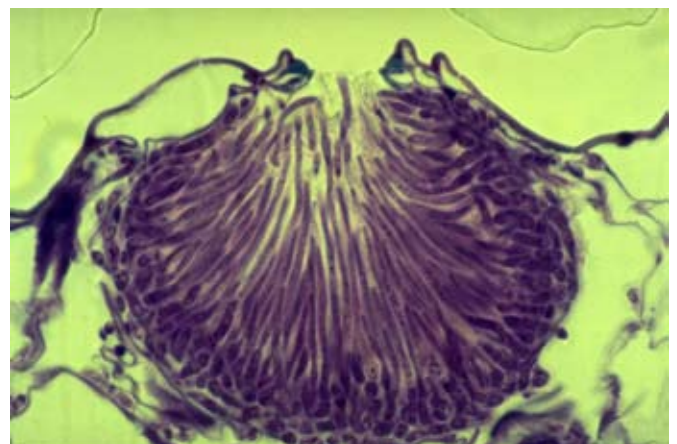
the genetic basis for pathotype variation in *M. graminicola* is not well understood. The Plant Pathology Group are using the recently published genome of *M. graminicola* and their own whole genome assemblies of Australian STB screening isolates in a comparative genomics study to find the genetic basis of pathogenic variation which will be of value to wheat breeding programs. The resulting whole genome sequences of STB isolates are already providing a valuable genetic resource for the group, their collaborative partners and for future projects.

### Metarhizium sequencing project

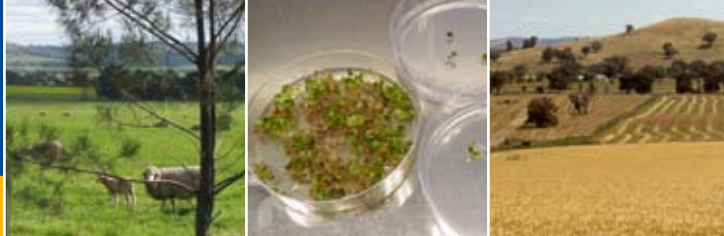
*M. anisopliae* is an important biological control agent of aphids and other insects. This genus has a wide host range. Its genome is being compared to other *Metarhizium* species with narrow host ranges, in order to gain a better understanding of the genes controlling host ranges in this species. Comparing the genomes and gene expression of *M. anisopliae* will enable the genes involved in the switch from hyphal to yeast-like spore production to be identified, facilitating and improving the commercial fermentation and production process and IP protection. Genome wide SNP detection will also allow a set of molecular markers to be developed to enable specific biotype environmental tracking and monitoring.

New sequencing technologies are being used by the Plant Pathology Group to stay one step ahead of rapidly evolving fungi. The genetic blueprint of these important fungi can be used to help develop resistant wheat varieties and improve the potency of biocontrol agents.

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*Septoria tritici* - cause of STB in wheat: A cross section of a pycnidium of *Septoria tritici* in leaf tissue. Source: A Ponomarenko SB Goodwin, and GHJ Kema. 2011. *Septoria tritici* blotch (STB) of wheat. Plant Health Instructor. DOI:10.1094/PHI-I-2011-0407-01.



## TRAVEL & CONFERENCE REPORTS

### Conference report: A Food Secure World: Researchers Challenged

Sosheel Godfrey, a Charles Sturt University PhD research student, attended the Crawford Fund Conference entitled ‘A Food Secure World-Challenging Choices for our North’, held at Brisbane’s parliament house in April.

The event was linked to another workshop organised by the Australian Centre for International Agricultural Research (ACIAR). Australian team leaders of different livestock production system projects in developing countries were brought together to discuss a medium term funding strategy. Sosheel represented the project ‘Strengthening dairy value chains in Pakistan through improved farm management and more effective extension services’ commissioned CSU and led by Professor Peter Wynn.

The Crawford Fund Conference brought together many Australian and foreign experts, including those from developing countries, from a diverse range of fields and disciplines.

#### Food security issues highlighted

The speakers highlighted significant and important issues related to food security, where Australia stands and how it can help.

Speakers highlighted that as the share of agriculture to GDP lowers, investment in the agriculture sector also lowers particularly in developing countries. An estimated 940 million people go hungry each year and the food crisis of 2009 requires renewed commitments.

As world population is rising and will likely touch nine billion by 2050, the food production should double as well, but we have nearly exhausted the possibilities for expanding the area of cultivable land. Climate change issues have emerged and gained importance, thus, sustainability is at the heart of food security and the need is sustainable intensification.

#### Small farms hold the key

Small farms in the developing world hold important keys to food security. There are 500 million farms of less than two hectares and two billion people depend on them. An aim should be to transform small holder agribusiness into profitable enterprises and explore their innovative spirit. There is a moral and social responsibility to develop the small holders through targeted interventions.

The world is losing six million hectares of forest every year, opening limited areas of new agricultural land in high rainfall areas. Fossil fuels and fertiliser are running out. Innovation is required beyond rice, maize, soya and wheat. Challenges in micronutrients, effective use of phosphorus

and potassium and positive carbon balance are significant. Questions on how small farmers can survive and generate profits are crucial. Family farms are labor intensive but with relatively lower carbon emissions.

#### International project links

There are opportunities to harness markets and increase food supplies. ICRISAT’s approach ‘inclusive market-oriented development’ is to accelerate growth through inclusiveness and for the benefit of poor. It is based on the principal that technical innovations and more effective connections to markets increase incomes that in turn motivate further investments in agricultural intensification and market orientation, in a positive self-reinforcing cycle. A good example is the ACIAR project ‘Stay green drought tolerant sorghum in India through crop simulation modelling science’. ‘Seed of life’ in East Timor is another successful initiative.

ACIAR is effectively helping food and agriculture research to reduce poverty. ACIAR projects are designed in partnership with developing countries and presently it has 170 bilateral and 25 multilateral projects. Overall, there is however, a declining trend in Official Development Assistance (ODA) to developing countries. The need is to stimulate development of agriculture in both Australia and developing countries. The Consultative Group on International Agricultural Research (CGIAR) with its 15 centres plays a significant role in sustaining major gene banks of the world’s staple crops that hold the key to food security issues through further research.

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In attendance: Dr K Nwanze (President of the International Fund for Agricultural & Development; Mrs S Atkinson AO; The Hon J Kerin AO (Chair of the Crawford Fund) and Prof R Batterham AO (President Australian Academy of Technological Sciences & Engineering Photo: M van Oostende.

## Graduation day at Papua New Guinea's University of Technology - a day of celebration

It is easy to underestimate the raw beauty of Papua New Guinea, until you fly into the city of Lae, towering forest-clad mountains enshrouded with mist loom all around. It is equally easy to underestimate the hospitality and generosity of Papuan culture until you find yourself a guest of the University of Technology (UniTech), Lae on their most celebratory day of the year - graduation.

### Pomp and ceremony

While Australian graduations are conducted with almost embarrassing modesty, Papua New Guinea celebrates the accomplishments of another generation of their finest and brightest with great ceremony and energy. The crowd that gathers for the 870 graduating students is huge, with many families travelling for days from remote islands and highland villages to attend. Several villages come dressed in traditional bilas (decoration), while several more lead the procession of academics and guests with beating kundu drums and chanting all the way to the enormous pavilion set up to accommodate the proceedings. The pride in traditional culture is seen in the graduates too, many of whom wear spectacular heirlooms. Undoubtedly the most impressive are the head-dresses of the Hagen graduates, which almost dwarf their wearers with their long black *Astrapia* feathers.

The guest of honour is no less than the Prime Minister, Hon. Sam Abal, who is confronted head on by the preceding speeches of the chancellor, Mr Stagg, and vice-chancellor, Dr Baloiloi. These long-serving gentlemen express pride in the work of the university but also concern over the inadequate funding provided to tertiary education in PNG. Furthermore they call on the government to ensure that competitive conditions are created for attracting staff to universities, and to ensure graduates have a future in the country. The acting Prime Minister, who has recently taken on his position, recognises and responds to this in his two hour speech and acknowledges that a problem exists.

Despite the sweltering heat and humidity, tempered by fans and iced bottled water handed around, the crowd, which is more than ten deep all around the great pavilion, remain attentive right through; and for good reason. Many of these graduates come from astonishingly poor backgrounds, with their families and communities investing everything into their education, a point made by Joel Koep, the Vice-Chancellor's awardee who spoke on behalf of the graduates. Here, after great obstacles, they have taken a step forward for each of their communities and represent the future of their nation.

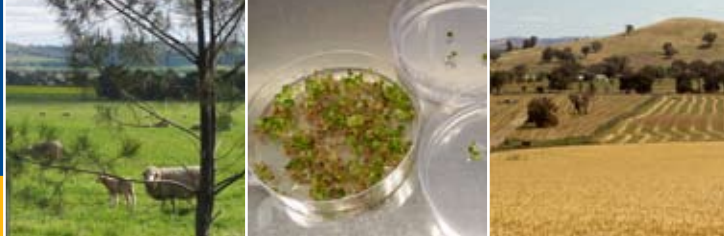


The traditional headdress of a Hagen graduate adds to the splendour of the graduation ceremony. Photo: A Peters.

### Links with Papua New Guinea

Prof Abdul Halim, the driving force behind the exemplary Department of Agriculture at UniTech, invited a representative of Charles Sturt University and the Graham Centre to the ceremony. Andrew Peters attended and took the opportunity to meet staff and discuss the current work and challenges facing his department as well as the Centre for Environmental Research. The current Memorandum Of Understanding between CSU and UniTech is for these academics a matter of hope and opportunity for bi-directional collaboration, especially in postgraduate applied research. With two highly regarded Department of Agriculture staff commencing PhDs at CSU this year, Ronnie Dataona and William Kerua, the collaboration has already begun in a very tangible way.

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## IN THE LIMELIGHT

### In the Limelight

#### Dr Simon Speirs

**Position:** Project Leader - Soils and Cropping

**Organisation:** Department of Primary Industries

#### Career Brief

- 1997-2000 - Agricultural Science, The University of Sydney
- 2001 - Trainee Agronomist, Landmark, Temora
- 2001-2005 - PhD thesis 'Characterising soil structural stability and form of sodic soil used for cotton production', The University of Sydney
- 2006-2007 - Research Agronomist, Trangie
- 2007-2009 - Conservation Manager-Farming Systems, Dubbo
- 2009 - Making Better Fertiliser Decisions for Cropping Systems, National Project Leader

#### Research Activities and Interests

The Making Better Fertiliser Decisions for Cropping Systems in Australia project (BFDC) aims to provide the fertiliser industry, agency staff and agribusiness advisors with knowledge and resources to improve nutrient recommendations for optimising crop production.

In this role I am leading the development of national and regional soil test-crop response calibrations for assessing the nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) status of soils used for the production of cereal, pulse and oilseed crops; development of a searchable national database of crop nutrient response trials and technical support documentation that is available online; development of training resources and publications communicating soil test-crop response calibrations and scientific findings to grain growers, the fertiliser industry and the scientific community through a range of media (eg GRDC updates, Fertcare, and peer reviewed scientific publications). The team is also identifying knowledge gaps for future research and development.

#### Professional Links

- Grains Research and Development Corporation
- Fertiliser Industry
- Agricultural research agencies across Australia
- Australian Soil Science Society

**A typical day for me is ...** quite variable - lots of consultation, data, and collaboration with project team.

**My main project at the moment is ...** Making Better Fertiliser Decisions for Cropping Systems, National Project Leader.

**My favourite part of my job is ...** working with, and learning from:

- Many senior researchers, including retired researchers, who've had long careers addressing aspects of crop nutrition.
- Members of the grains and fertiliser industries from across Australia.

**When I am not in the office I like ...** to spend time on the family farm, or go fishing, hiking or cycling.

**When I am driving I like to listen to ...** Bach, Beethoven or any number of informative podcasts.



Hiking is one of many activities Simon Speirs enjoys in his spare time.

#### Dr John Harper

**Position:** Senior lecturer Plant Science, School of Agricultural and Wine Sciences

**Organisation:** Charles Sturt University

#### Career Brief

I completed a PhD in 1986 in my home town of Belfast, Ireland, at Queen's University. My research involved cell biology and genetics study of the unicellular plant *Chlamydomonas*. I isolated and characterised cell division cycle mutants, defective in single genes. A friend's sister asked why I was working on pond scum!

I came to Australia do a Postdoc at the Australian National University, in June 1986. My PhD supervisor had moved there so I came to work with him on the further characterisation of the cell cycle mutations I had isolated during my PhD. I became intrigued as to how the protein fibre scaffolds in cells - the cytoskeleton were organised. I spent the next three years in Minnesota working on two proteins that organised the cytoskeleton.

I returned to ANU in 1993 for six months to work on one of these proteins called centrin, showing that it localised to specific cytoskeletal components in the infective zoospores of the oomycete *Phytophthora cinnamomi*, a relative of the organism that causes late blight in potatoes. I spent the next seven years at Sydney Uni working on various projects including an ARC grant to study centrin and the cytoskeleton in plant cells. During this time I also had the opportunity to teach first year biology, second year genetics and cell biology. I joined CSU in September 2001.

#### Research and Teaching Activities and Interests

My research activities have mainly focussed on the cell biology of plants and pathogens. I have been active in increasing microscopic imaging resources for researchers at CSU, through acquisition of a research fluorescence microscope, gene transformation facility and more recently a Scanning Electron Microscope and preparative equipment.

Since coming to CSU, I have continued to develop my cell biology interests in collaboration with plant pathology colleagues, Gavin Ash and Chris Steel and colleagues at other institutions - Adrienne Hardham (ANU), David Collings (University of Canterbury, Christchurch), Rosemary White (CSIRO, Canberra), Kevin Vaughn (USDA, Mississippi) and Anja Geitmann, University of Montreal.

I have worked on the cell biology of the oomycete pathogen *Plasmopara viticola*, the cause of downy mildew in grapevines. Using cell immunofluorescence techniques, I have revealed some zoospore structures that may be candidates for new drugs to control this pathogen. I coordinate first year Botany, co-teaching with Geoff Burrows and teach first year Microbiology to about 300 on-campus students and the same number of distance education students. I am looking forward to also teaching second year Genetics in 2012.

#### Professional Links

I am a member of the Australian Society of Plant Scientists and am on the steering committee for the Primary Industries Centre for Science Education (PICSE) as I have been involved in science outreach to primary schools, with Geoff Burrows, for a number of years.

**A typical day for me includes ...** Last session I would have lectured Botany on a Tuesday morning and run practical sessions in the afternoon or had meetings with PhD students or working on Honours student coordination.

I am also Education manager for the Future Farm CRC so I spend some time dealing with student issues and professional development for the four partner universities, CSU, The University of Melbourne, University of Western Australia and Adelaide University. There are about 50 postgraduate students.

**My main project at the moment is ...** looking at drought rhizogenesis in rapeseed/canola. This is also the focus of my Research Centre Fellowship. It has been known for some time that canola has the ability to form stubby roots in the top 5cm of soil in response to drought conditions. When it rains these stubby roots proliferate enabling plants to recover quite quickly. How do they do it and how widespread this phenomenon is in the germplasm are two questions I am exploring with Sergio Moroni and David Luckett.

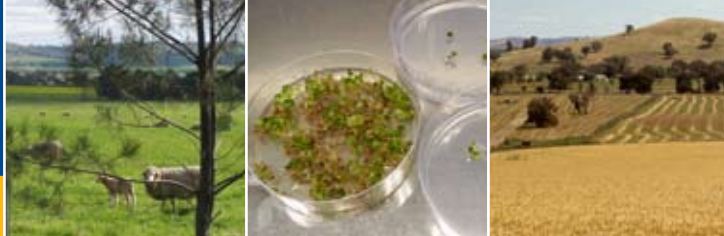
**My favourite part of my job is ...** working with colleagues and students and feeling I am making a positive difference.

**When I am not in the office I like ...** to relax at home with my wife and girls, Amali (10) and Katie (8). In the warmer weather I like to swim. I am always singing!

**When I am driving I like to listen to ...** Cold Play - one of my favourite groups at the moment. I am also currently listening to Geoffrey Gurrumul, Katie Noonan and Beethoven Adagios.



John Harper shares a special moment with his canola plants - part of a research project looking at drought rhizogenesis in canola. Photo: T Nugent.



## EVENTS CALENDAR 2011

Date	What	Where	More information
2 August	2011 Conservation Agriculture Conference	Dubbo RSL Club	<a href="http://www.canfa.com.au/">www.canfa.com.au/</a>
4-5 August	Rhizosphere Workshop	DPI Conference Room, Wagga	E: <a href="mailto:leweston@csu.edu.au">leweston@csu.edu.au</a>
4 August	Graham Centre Annual Beef Field Day	Joyes Hall, CSU, Wagga Wagga	Toni Nugent T: (02) 6938 1806 E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a>
5 August	Graham Centre Annual Sheep Field Day	Joyes Hall, CSU, Wagga Wagga	Toni Nugent T: (02) 6938 1806 E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a>
9 August	Graham Centre Plant Pathology Workshop	DPI Conference Room, Wagga	Helen Burns T: (02) 6938 1947 E: <a href="mailto:hburns@csu.edu.au">hburns@csu.edu.au</a>
12 August	Mixed Farming Forum	Temora	<a href="http://www.farmlink.com.au">www.farmlink.com.au</a>
15-17 August	17th Australian Research Assembly on Brassicas (ARAB)	Wagga Wagga	Don McCaffery T: (02) 6391 3648 E: <a href="mailto:don.mccaffery@industry.nsw.gov.au">don.mccaffery@industry.nsw.gov.au</a>
18-20 August	Inaugural Merino 2020 Conference	Joyes Hall, CSU, Wagga Wagga	<a href="http://www.merino2020.com.au/index.html">www.merino2020.com.au/index.html</a>
7 Sept	Graham Centre General Field Day	Graham Centre Field Site, Corner Coolamon & Prices Roads, Wagga Wagga	Deirdre Lemerle, T: (02) 6938 1667 E: <a href="mailto:dlemerle@csu.edu.au">dlemerle@csu.edu.au</a>
8 Sept	Seminar 'Developing national soil test calibrations for N, P, K and S for cereals, pulses and oilseeds in Australia', by Dr Simon Speirs, NSW DPI	DPI Conference Room, Wagga	E: <a href="mailto:leweston@csu.edu.au">leweston@csu.edu.au</a>
20-22 Sept	Henty Machinery Field Days		<a href="http://www.hmfd.com">www.hmfd.com</a>
4 October	Graham Centre Agribusiness Field Day	Graham Centre Field Site, Corner Coolamon & Prices Roads, Wagga Wagga	Deirdre Lemerle, T: (02) 6938 1667 E: <a href="mailto:dlemerle@csu.edu.au">dlemerle@csu.edu.au</a>
13 October	Seminar by Prof Alan Bell, CSIRO, Chief CSIRO Livestock Industries	CSU Convention Centre	E: <a href="mailto:leweston@csu.edu.au">leweston@csu.edu.au</a>
18-20 Oct	Australian National Field Days	Orange	<a href="http://www.anfd.com.au">www.anfd.com.au</a>

## Spring Edition of The Innovator

The Spring Edition of The Innovator will be available mid October 2011. Submission of articles for this edition closes on **Friday, 30 September 2011**. Please email articles to Toni Nugent or Sharon Kiss.

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Primary Industries