From the Director

During the last couple of weeks the Graham Centre has moved into new offices in Pugsley Place (off Pine Gully Road). This will provide accommodation for the administrative unit and create space for visiting scientists, a postgraduate student ‘writing-up’ area, a meeting room with capacity for 30 people, and a tea room for members and postgraduate students. The new hub will be a place to meet and discuss research plans and activities.

We invite all Graham Centre members to attend the official opening of the new offices by Mr Michael McCormack MP, and the launch of the Graham Centre Monograph 2 ‘Water Resource Protection in Australia: Water Quality and Quantity as a Feature of Agricultural Land Management Systems’, on Wednesday 22 May, commencing at 9 am.

Over the last few months we have showcased our research facilities, members and students to a number of important visitors, including the Governor General. We continue to receive very positive feedback about our growing capacity for research and our close and sharp links with grower groups.

We have recently allocated our 14 Research Centre Fellows (RCFs) for 2013, which will significantly boost our research activities, especially in our Animal Health and Welfare Research Pathway. Charles Sturt University gives $40,000 for each RCF to free up academics from teaching, allowing them to focus on their research for a six month period.

We continue to organise and support major national and international conferences including the 22nd International Grasslands Congress, 15-19 September in Sydney. Registrations are now open http://www.igc2013.com/ This edition updates some of our research on current projects, news of recent Centre workshops and events, travel reports, staff profiles and upcoming events.

Enjoy reading this edition of the Innovator.

Professor Deirdre Lemerle
Introducing the Centre’s new logo
The ‘EH’ has been dropped from the Centre’s name and the Centre is now known as the Graham Centre for Agricultural Innovation. New stationery has been printed and the PowerPoint and Poster templates have been updated.

For further information contact Toni Nugent, tnugent@csu.edu.au

Efficiency of Production

Graham Centre Sheep Forum
Friday 28 June 2013

&

Graham Centre Beef Forum
Friday 9 August, 2013

Footage from the Crops Rumps and Woolly Jumpers, including the Farmer Panel videos, can be viewed on the Graham Centre’s YouTube Channel. Follow this link http://www.youtube.com/user/grahamCentre05

YouTube Channel

Graham Centre Sheep Forum
For Agricultural Innovation

Graham Centre Beef Forum
David set to head to The Philippines

We continue our involvement in the forthcoming 2013 International Rice Research Institute (IRRI) rice production course - a 3-week workshop aiming to create a new generation of plant scientists who are well networked into the international community and understand the importance of innovative plant science in addressing global problems. David Gale (CSU PhD student) has been selected for a place. The course will cover topics such as the basics of rice production in Asia; the germplasm collection at IRRI and current issues related to its exchange and intellectual property; and research issues at IRRI and its partners. The course also aims to develop participant skills in rice breeding, molecular genetics and genomics; as well as an understanding of how to structure effective international collaborations.

David’s place in the course is supported by The Crawford Fund and the Graham Centre. We wish David all the best when the course starts on 20th May in The Philippines.

R helps data analysis

The Graham Centre has over 70 postgraduate students and many members of staff - all working in the biological and social sciences. These scientists each generate data as part of their research, and these data have to be recorded, stored, analysed, and summarised (usually in various graphs and diagrams). With this in mind, a Postgraduate Knowledge Sharing Workshop was held on 22 March which attracted about 25 participants.

The Workshop, organised by Aaron Preston (CSU) with Dr David Luckett (NSW DPI) as the presenter, demonstrated how to start using the open-source software package called "R". The main aim was to help users successfully import their data (usually from Excel spreadsheets but also from other sources such as SPSS or GenStat files). The open-source 'frontend' for R (RStudio) was installed on each user's machine as part of the workshop.

One of the strengths of R (apart from it being free) is its ability to produce high-quality graphics which are ready for publication, either in a thesis, presentation, or a paper. Some of these capabilities were demonstrated at the workshop, and a hearty pizza lunch was enjoyed by all.

R users in Wagga have formed a local R Users' Group called cRow. The group meets periodically to discuss data processing issues, and all Graham Centre, CSU and NSW DPI members are welcome to attend. There is a website for cRow (sites.google.com/site/crowwagga/). Simply navigate there and ask to join. Then, please post comments and questions, suggest a topic for a future meeting, or ask for help on 'how-to-do-such-and-such'.

Contact: Dr David Luckett
T: 02 6938 1835, E: david.luckett@dpi.nsw.gov.au

Boosting knowledge to enable practice change

The Centre’s DAFF Action on the Ground project that explores the relationships between different stubble levels and nutrient amendment practices. Stubble Technical Forum was held on Wednesday 13 February, 2013.

The forum provided a platform for 90 growers, researchers and industry experts in attendance to engage and network, building knowledge and understanding about the use of stubble for carbon sequestration and reducing greenhouse gas emissions.

National experts addressed issues pertinent to land managers. Dr Clive Kirkby (CSIRO) spoke about the influence of nutrient availability on changes in stable soil organic matter levels following crop stubble retention, while Dr Mark Conyers (NSW DPI) debated whether it is possible to store soil carbon under annual crops and pastures.
The forum also included two interactive workshops by Dr Iain Hume, NSW DPI and Dr Harm van Rees, Cropfacts, looking at practical soil sampling techniques and Dr Jeff Baldock and Dr Mark Farrell, CSIRO, addressed current and future techniques for estimating carbon content of soils.

Contact: Professor Deirdre Lemerle  
T: 02 6933 4398, E: dlemerle@csu.edu.au

Ediors Note: This project is supported by funding from the Australian Government Department of Agriculture, Fisheries and Forestry as part of its Carbon Farming Futures – Action on the Ground program.

Project partners include Central West Farming Systems, FarmLink Research Limited, Holbrook Landcare Network, Rice Research Australia Pty Ltd, Rural Management Strategies Pty Ltd, Southern Farming Systems, the Murrumbidgee Catchment Management Authority and Murrumbidgee Landcare.

International researcher joins Pasture Research Team

Dr Yantao Song, Northeast Normal University, has joined the Pasture Research Group at NSW DPI, Wagga for the next 12 months. Dr Song will conduct 1-2 field/glasshouse experiments related to weed management under break crops during his time here. He will also participate in various other research activities within the Pasture Research Group, including the Crop Sequence, Nitrous Oxide, EverCrop, EverCrop Carbon Plus, Lotus Feedbase and P Efficiency projects.

Visit strengthens links with Vietnam

Dr Doan Du Lan and Dr Mai Anh Khoa from Vietnam visited the Graham Centre on 14-15 March, as part of their five week visit to Australia with the ACIAR John Dillon program for career development in research management.

The pair met with animal nutritionists, social science, plant and irrigation researchers, and grower groups, to discuss research/university management, including the outreach of the university to the community, especially farmers. They also toured the Charles Sturt University and NSW Department of Primary Industries’ soils, plant, animal, field and controlled environments during the visit.

Pictured above from left: Professor Peter Wynn (CSU), Dr John Wilkins (NSW DPI), Dr Doan Du Lan, Mr John Piltz (NSW DPI), Dr Mai Anh Khoa and Associate Professor Gavin Ramsay (CSU).

DAFF visit to Graham Centre

Department of Agriculture, Forestry and Fisheries Secretary Mr Andrew Metcalfe visited the Graham Centre and toured facilities including the National Life Sciences Hub and Rhizolysimeter on 14 March, 2013. Mr Metcalfe discussed the Graham Centre’s DAFF Action on the Ground project ‘Enabling landholders to adopt profitable and sustainable carbon cropping practices’ with staff during the visit.

Pictured: Dr Peter Orchard, Dr Guangdi Li, (NSW DPI), Professor Deirdre Lemerle and Mr Andrew Metcalfe. Photo: T Nugent.
Governor-General visits CSU Wagga

As part of their visit to Wagga in February, the Governor-General, Ms Quentin Bryce AC CVO, and Mr Michael Bryce AM AE visited the Schools of Agriculture and Wine Sciences and Animal and Veterinary Sciences at Charles Sturt University. Their visit included the Rhizolysimeter, Veterinary Clinical Centre, Phytotron and National Life Sciences Hub, where they met with researchers and students to discuss the role of agriculture and paddock to plate research.

The tour was based on a 'paddock-to-plate' theme, starting with the soils through to examining ways to improve the quality of food products produced in mixed farming systems.

The Governor-General was very impressed with the new facilities, and the energy and optimism of everyone especially the postgraduate and undergraduate students she met, along with the Centre’s strong industry links.

The Governor-General was very enthusiastic about the role of the Graham Centre to undertake critical research and development and capacity building for the agricultural industries of the Murray Darling Basin, as well as southeast Asia.

CSU agricultural scientist at ABARE Outlook

Charles Sturt University academic and Graham Centre member Dr Rebecca Doyle gave a first-hand account of her chosen career in science at the national ABARE Outlook 2013 Conference in Canberra on 5 March 2013.

Dr Doyle shared her passion and enthusiasm for agriculture in her talk, titled 'Science is golden: my experiences in agriculture'. She detailed her thoughts on why there aren’t enough people entering agricultural professions; how this can be improved; and gave examples of scientific work she has been involved in.

Dr Doyle believes one of the reasons students are not attracted to agricultural-based degrees is because they are not aware of the career opportunities on offer.

"Unlike other degrees, students enrolling in agricultural science degrees don’t know what they can 'be' at the end of it, but at the same time, these degrees are more specialised than an arts or general science degree," Dr Doyle said.

Dr Doyle hopes by giving students examples of what career paths they can take will encourage more students to study agriculture.

Contact: Dr Rebecca Doyle
T: 02 6933 4721, E: rdoyle@csu.edu.au
2013 Research Centre Fellows

Fourteen Research Centre Fellows (RCFs) for 2013 have been negotiated with CSU Heads of School to focus on key priorities of the Centre’s Research Pathways, leadership and team building, development of research funding proposals, and scientific publications. These have been allocated between the five Research Pathways and target the Centre’s key Fields of Research codes. Congratulations to the following:

<table>
<thead>
<tr>
<th>Dr Karl Behrendt</th>
<th>School of Agricultural and Wine Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate Professor Geoff Burrows</td>
<td></td>
</tr>
<tr>
<td>Dr Jason Condon</td>
<td></td>
</tr>
<tr>
<td>Professor Geoff Gurr</td>
<td></td>
</tr>
<tr>
<td>Dr Ketema Zeleke</td>
<td></td>
</tr>
<tr>
<td>Dr Chris Blanchard</td>
<td>School of Biomedical Sciences</td>
</tr>
<tr>
<td>Dr Rebecca Doyle</td>
<td></td>
</tr>
<tr>
<td>Associate Professor Michael Friend</td>
<td></td>
</tr>
<tr>
<td>Dr Ali Ghorashi</td>
<td></td>
</tr>
<tr>
<td>Dr Marta Hernandez-Jover</td>
<td></td>
</tr>
<tr>
<td>Dr Jane Quinn</td>
<td></td>
</tr>
<tr>
<td>Associate Professor Shane Raidal</td>
<td></td>
</tr>
<tr>
<td>Associate Professor Gavin Ramsay</td>
<td></td>
</tr>
<tr>
<td>Dr Remy Dehaan</td>
<td>School of Environmental Sciences</td>
</tr>
</tbody>
</table>

2013 Interns

The Graham Centre Student Internship Scheme aims to encourage undergraduate students to engage in research undertaken by the Centre. The scheme also enables students to become familiar with the types of projects and potential supervisors available through the Centre as an incentive to pursuing an Honours degree in the future. Applicants are required to spend the equivalent of one day per week, during semester, working with Graham Centre team members within one or more of the Centre’s Research Pathways. Twenty-eight applications were received with five internships being awarded to the following:

<table>
<thead>
<tr>
<th>Student</th>
<th>Degree</th>
<th>Research Pathway</th>
<th>Mentors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leah Adams</td>
<td>Bachelor Veterinary Biology/Bachelor of Veterinary Science</td>
<td>Ruminant Feedbase and Animal Health &amp; Welfare</td>
<td>Associate Professor Scott Norman, Dr Rebecca Doyle, Dr Marie Bhanugopan</td>
</tr>
<tr>
<td>Alice Birckhead</td>
<td>Bachelor of Veterinary Science</td>
<td>Animal Health &amp; Welfare</td>
<td>Dr David Jenkins, Dr Ali Ghorashi, Dr Rob Woodgate</td>
</tr>
<tr>
<td>Emily Birckhead</td>
<td>Bachelor of Veterinary Science</td>
<td>Animal Health &amp; Welfare</td>
<td>Dr Jane Quinn, Dr Marta Hernandez-Jover</td>
</tr>
<tr>
<td>Mathew Dunn</td>
<td>Bachelor of Agricultural Science</td>
<td>Conservation Cropping and Irrigated Cropping Systems</td>
<td>Professor Leslie Weston, Dr Mike Dyall-Smith, Dr Ketema Zeleke</td>
</tr>
<tr>
<td>Laura Kemmis</td>
<td>Bachelor of Animal Science</td>
<td>Ruminant Feedbase</td>
<td>Associate Professor Michael Friend, Mr John Piltz, Dr Ed Clayton</td>
</tr>
</tbody>
</table>
Conference Support Scheme Grants - Round 1

The aim of the Conference Support Scheme is to provide financial assistance for researchers to attend significant and relevant national and international conferences and workshops to enhance their knowledge, activity and performance within the Centre's research priority areas. The scheme is open to Graham Centre members, Associates and Higher Degree Research Students. The following people received support in Round 1 of the scheme for 2013.

<table>
<thead>
<tr>
<th>Name</th>
<th>Section</th>
<th>Conference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor Gavin Ash</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>10th International Plant Pathology Conference, Beijing, China</td>
</tr>
<tr>
<td>Associate Professor Michael Friend</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>American Society of Animal Science, Indianapolis, USA</td>
</tr>
<tr>
<td>Dr David Gopurenko</td>
<td>NSW Department of Primary Industries</td>
<td>Biodiversity Genomics Conference, Canberra, ACT</td>
</tr>
<tr>
<td>Associate Professor Vaughan Higgins</td>
<td>School of Humanities &amp; Social Sciences</td>
<td>European Society of Rural Sociology Congress, Florence, Italy</td>
</tr>
<tr>
<td>Dr Sergio Moroni</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>InterDrought-IV Conference, Perth, WA</td>
</tr>
<tr>
<td>Dr Hassan Obied</td>
<td>School of Biomedical Sciences</td>
<td>Functional and Medical Foods with Bioactive Compounds: Science and Practical Application, Kyoto, Japan</td>
</tr>
<tr>
<td>Dr Shokoofeh Shami</td>
<td>School of Animal &amp; Veterinary Sciences</td>
<td>24th International Conference of the World Association for the Advancement of Veterinary Parasitology, Perth, WA</td>
</tr>
<tr>
<td>Professor Len Wade</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>American Society of Agronomy/Crop Science/Soil Science Society of America, Tampa, USA</td>
</tr>
<tr>
<td>Miss Saira Hussain</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>International Cereal Chemistry Conference (ICC), Perth, WA</td>
</tr>
<tr>
<td>Mr Mohd. Mostofa Kamal</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>10th International Plant Pathology Conference, Beijing, China</td>
</tr>
<tr>
<td>Mrs Soumi Paul Mukhopadhyay</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>10th Pangborn Sensory Science Symposium, Rio De Janeiro, Brazil</td>
</tr>
<tr>
<td>Mr Matthew Newell</td>
<td>School of Agricultural &amp; Wine Sciences</td>
<td>22nd Grasslands Conference, Sydney, NSW</td>
</tr>
<tr>
<td>Mr Emmanuel Quansah</td>
<td>School of Animal &amp; Veterinary Science</td>
<td>International Conference on Genetic Engineering and Genetically Modified Organisms, Raleigh, North Carolina, USA</td>
</tr>
<tr>
<td>Mr Syed Haris Omar</td>
<td>School of Biomedical Sciences</td>
<td>3rd International Conference on the Science of Nutrition in Medicine and Healthcare, Sydney, NSW</td>
</tr>
<tr>
<td>Miss Rebecca Wilson</td>
<td>School of Animal &amp; Veterinary Sciences</td>
<td>International Society of Applied Ethology, Florianopolis, Brazil</td>
</tr>
</tbody>
</table>
Conservation Cropping

The DAFF Action on the Ground project explores the relationships between different stubble levels and nutrient incorporation, and impacts on production.

Field trials have been designed for all 14 sites. These are based on the EM surveys in NSW, with the two Victorian sites designed on spatial patterns in soil, crop growth and management seen in Google Earth images. EM 38 and EM 31 surfaces were produced by kriging after removing measurements within 20 m of the edge of the paddock and trees past and present. Two EM zones were outlined in each paddock, and match well with yield maps at CSU, and patterns of soil colour at other locations.

All treatments will be repeated twice in each zone making statistical analysis of the results possible. The designs have been revised in conjunction with the grower groups.

Grower groups have soil sampled to measure the soil carbon values before treatments are applied. Estimates of stubble load are also being made.

Soil carbon will be analysed by the Office of Environment and Heritage laboratory at Yanco. The latest Mid Infra Red technique will be used to estimate the charcoal, particulate and humic fractions of soil carbon.

At CSU, Wagga, stubble load was estimated to be about 6 t/ha, but much of the stubble was from an earlier canola crop. Wheat yield was about 3.5 t/ha, so assuming a harvest index of 0.33, would result in an estimated stubble load of 7 t/ha. The harvest index approach overestimated stubble load at Wagga and is likely to be at most other locations, with the consequence of ‘luxury’ rates of fertiliser being applied, a better situation than under-fertilisation.

A simple spreadsheet calculator has been developed to estimate the blend of DAP, Sulphate of Ammonia and Urea needed to supply the quantity of nutrients for balanced breakdown of the stubble load.

GRDC Stubble Initiative

We have been successful in coordinating a project under the GRDC Stubble Initiative. The project builds on the Graham Centre’s Stubble Management Monograph, and involves an extensive literature review of past and current stubble research undertaken nationally by research organisations and grower groups. This will allow any research gaps to be clearly identified. The findings from this literature review will be presented at a workshop in July to the 10 grower groups who have been funded under the Stubble Initiative.

The team includes Deb Slinger, Colin McMaster, Cynthia Podmore, Phil Bowden (NSW DPI), Brendan Scott and Toni Nugent (Graham Centre).

Contact: Dr Iain Hume
T: 02 6938 1984, E: iain.hume@dpi.nsw.gov.au or Professor Deirdre Lemerle
T: 02 6933 4398, E: dlemerle@csu.edu.au

Ruminant Feedbase

Members of the Ruminant Feedbase group are involved in a number of ongoing and new projects. A number of other projects have been recently completed and other project submissions are being developed or have been submitted. A number of these projects involve strong collaborative links with other organisations and discipline groups.

Key happenings include:

- **ARCHE.Net**: a project funded by the EU and French government ‘Dynamic Adaptation of Ruminant production systems to a Changing Environment’. Countries from around the Indian Ocean have been invited to participate - Australia, Comoros, India, Madagascar, Mozambique, Reunion Island and South Africa. Michael Friend (CSU) represented the Graham Centre at the opening workshop in the Reunion Islands to develop a project plan. Australia was also represented by Dr Mark Howden (CSIRO).

- **Omega-3 and Omega-6 research**: Ed Clayton’s (NSW DPI) project looking at the effects of diets containing different ratios of omega-3 to omega-6 on sex ratios in sheep is at a busy time, with lambing occurring for one group of ewes, while a second group has commenced feeding and will lamb later this year. Results to date have shown inter-generational effects and further funding is being sought to look at the next group of lambs in greater detail.
Innovator AUTUMN 2013 www.grahamcentre.net

9

Bio-Protection and IPM of Crops and Pastures

In the past few months members of the team have been focussed on existing projects and reviewing opportunities for future funding.

Several members of the Plant and Insect Pathology group have been involved in the GRDC national review of plant pathology research conducted in 2012. The outcomes of the these reviews are now being used as guiding documents for the next five years of investment by GRDC in these areas of research.

As a result of the positive feedback the group received during the review about the work being conducted at Wagga, Dr Andrew Milgate and Mr Kurt Lindbeck (NSW DPI) are in direct negotiations with GRDC for a number of projects.

Professor Ash is taking opportunities to promote the groups work at a number of international institutions while on sabbatical in the US and Europe.

Some highlights of recent work and commencement of new post graduate students are:

- ‘Whole genome sequencing of economically important fungal pathogens of plants and insects’, Dr Julie Pattemore’s (CSU) genomic characterisation of Metarhizium anisopliae and Septoria tritici has made significant progress. A sequenced whole genome provides us with a better understanding of the lifestyle of the fungi and has the potential for improving strains and the development of a biopesticide by more rapidly identifying and targeting virulence/pathogenicity genes. Through the BioPlatform Australia linkage, direct linkages with Dr Paula Moohuijzen, Dr Roberto Barrero and Professor Matt Bellgard from the Centre for Comparative Genomics at Murdoch University, WA have been made. This provides us with access to both online bioinformatics pipelines and support.

Bio-Protection and IPm of Crops and Pastures

In the past few months members of the team have been focussed on existing projects and reviewing opportunities for future funding.

Several members of the Plant and Insect Pathology group have been involved in the GRDC national review of plant pathology research conducted in 2012. The outcomes of the these reviews are now being used as guiding documents for the next five years of investment by GRDC in these areas of research.

As a result of the positive feedback the group received during the review about the work being conducted at Wagga, Dr Andrew Milgate and Mr Kurt Lindbeck (NSW DPI) are in direct negotiations with GRDC for a number of projects.

Professor Ash is taking opportunities to promote the groups work at a number of international institutions while on sabbatical in the US and Europe.

Some highlights of recent work and commencement of new post graduate students are:

- ‘Whole genome sequencing of economically important fungal pathogens of plants and insects’, Dr Julie Pattemore’s (CSU) genomic characterisation of Metarhizium anisopliae and Septoria tritici has made significant progress. A sequenced whole genome provides us with a better understanding of the lifestyle of the fungi and has the potential for improving strains and the development of a biopesticide by more rapidly identifying and targeting virulence/pathogenicity genes. Through the BioPlatform Australia linkage, direct linkages with Dr Paula Moohuijzen, Dr Roberto Barrero and Professor Matt Bellgard from the Centre for Comparative Genomics at Murdoch University, WA have been made. This provides us with access to both online bioinformatics pipelines and support.

Bio-Protection and IPm of Crops and Pastures

In the past few months members of the team have been focussed on existing projects and reviewing opportunities for future funding.

Several members of the Plant and Insect Pathology group have been involved in the GRDC national review of plant pathology research conducted in 2012. The outcomes of the these reviews are now being used as guiding documents for the next five years of investment by GRDC in these areas of research.

As a result of the positive feedback the group received during the review about the work being conducted at Wagga, Dr Andrew Milgate and Mr Kurt Lindbeck (NSW DPI) are in direct negotiations with GRDC for a number of projects.

Professor Ash is taking opportunities to promote the groups work at a number of international institutions while on sabbatical in the US and Europe.

Some highlights of recent work and commencement of new post graduate students are:

- ‘Whole genome sequencing of economically important fungal pathogens of plants and insects’, Dr Julie Pattemore’s (CSU) genomic characterisation of Metarhizium anisopliae and Septoria tritici has made significant progress. A sequenced whole genome provides us with a better understanding of the lifestyle of the fungi and has the potential for improving strains and the development of a biopesticide by more rapidly identifying and targeting virulence/pathogenicity genes. Through the BioPlatform Australia linkage, direct linkages with Dr Paula Moohuijzen, Dr Roberto Barrero and Professor Matt Bellgard from the Centre for Comparative Genomics at Murdoch University, WA have been made. This provides us with access to both online bioinformatics pipelines and support.

Bio-Protection and IPm of Crops and Pastures

In the past few months members of the team have been focussed on existing projects and reviewing opportunities for future funding.

Several members of the Plant and Insect Pathology group have been involved in the GRDC national review of plant pathology research conducted in 2012. The outcomes of the these reviews are now being used as guiding documents for the next five years of investment by GRDC in these areas of research.

As a result of the positive feedback the group received during the review about the work being conducted at Wagga, Dr Andrew Milgate and Mr Kurt Lindbeck (NSW DPI) are in direct negotiations with GRDC for a number of projects.

Professor Ash is taking opportunities to promote the groups work at a number of international institutions while on sabbatical in the US and Europe.

Some highlights of recent work and commencement of new post graduate students are:

- ‘Whole genome sequencing of economically important fungal pathogens of plants and insects’, Dr Julie Pattemore’s (CSU) genomic characterisation of Metarhizium anisopliae and Septoria tritici has made significant progress. A sequenced whole genome provides us with a better understanding of the lifestyle of the fungi and has the potential for improving strains and the development of a biopesticide by more rapidly identifying and targeting virulence/pathogenicity genes. Through the BioPlatform Australia linkage, direct linkages with Dr Paula Moohuijzen, Dr Roberto Barrero and Professor Matt Bellgard from the Centre for Comparative Genomics at Murdoch University, WA have been made. This provides us with access to both online bioinformatics pipelines and support.
RESEARCH ACTIVITIES

- **New projects**: Three other projects (2 PhD, 1 Masters) have stemmed from the GRDC funded project, highlighting the expansion of biopesticide and entomology capacity of the group.
  - PhD candidate Ronnie Dotaona is examining the use of *Metarhizium* anisopliae as a biological control agent against sweet potato weevil in Papua New Guinea.
  - PhD candidate Ginger Korosi is investigating the suitability of entomopathogenic fungi, particularly *Beauveria bassiana*, as a biocontrol agent for endemic strains of root-feeding grape phylloxera.
  - Masters candidate Sebastian De-Mattia will investigate the transcriptomics involved in the secondary infection phase of *M. anisopliae* inside the host and external sporulation.

Contact: Dr Andrew Milgate  
T: 02 6938 1990, E: Andrew.milgate@dpi.nsw.gov.au

**Weeds Research Group**

The weeds working group is currently managing several GRDC projects including "New and Emerging Weeds in the Southern Region", which involves FarmLink and Central West Farming Systems research collaboration. It focuses on the study of weed biology and management of fleabane, witchgrass and windmill grass using both cultural and chemical practices. Dr Hanwen Wu (NSW DPI) is currently finishing his project on Integrated Weed Management Practices in the Southern Region for management of annual ryegrass and mustard spp.

NSW DPI continues to host the herbicide tolerance field trials for GRDC on a yearly basis. A new $3.25m project is now being prepared for GRDC/MLA co-investment in weed management and herbicide resistance in the southern region. It will be managed by CSU, NSW DPI and the University of Adelaide.

Professor Leslie Weston and Professor Geoff Gurr (CSU) are initiating genetics, biology and chemistry research on Paterson’s curse in its native range in the Mediterranean and also in Australia, as funded by ARC Discovery. This project focuses on biology, chemistry and ecology of the plant and its biocontrol organisms in two different environments.

Hanwen Wu and the weeds team have submitted a proposal to MLA for continued research and outreach extension on silverleaf nightshade. The proposal is now under full consideration by MLA for finalisation. Remy Dehaan is now completing construction and operation of three new UAVs equipped with hyperspectral and other imaging systems. The weeds team plans to have these fully operational in 2013.

Several new postgraduate students have joined the Weeds Research Program. In addition, Diego Zhu has completed and submitted his PhD thesis and Razia Shaik is now writing her thesis. Research initiatives from the Graham Centre were obtained to develop a barcoding system for fleabane identification and taxonomic study. This project is currently supporting a university scholarship funded honours student, Karen Alpen.

**Plant Toxicity Group**

The plant toxicity working group is developing an MLA funded proposal for further study of the causes and treatment of perennial ryegrass toxicity in sheep. This proposal will examine therapeutics to counteract toxicity in grazing livestock. Current work on this project, funded by MLA, is examining the mechanism of toxicity in Perennial Ryegrass toxicosis, work that is being carried out by PhD candidate and veterinary clinician Martin Combs supervised by Jane Quinn and Adam Hamlin neurophysiologists with a keen interest in neurotoxicity syndromes. Biochemical analysis for this project is supported by Leslie and Paul Weston who are working on the complex biochemistry of the plant/endophyte interaction and extraction and quantification of the toxins involved.

The plant toxicity group recently obtained a new research initiative project to study biserrula photosensitization and toxicity in sheep and grazing livestock, as developed by Leslie Weston/Jane Quinn (CSU) and John Piltz/Belinda Hackney (NSW DPI). Georgina Ladmore, funded by an Australian Wool Education Trust Scholarship, is performing her honours project in SAVs in association with this research initiative. Several new research interns are working with the weeds and plant toxicity working groups to gain research experience in 2013. These include Matthew Dunn (School of Plant Science) with his research focus on plant disease resistance and development of functional biocontrol agents for *B. bassiana* and *M. anisopliae*.

New and Emerging weeds: Fleabane is included in a study of weed biology and management of weeds in the southern region of NSW. Photo: Hanwen Wu.
of Agricultural and Wine Sciences) and Emily Birckhead (School of Animal and Veterinary Sciences). Members of the team have participated in an international neurobiology conference held in Melbourne in 2013, and are planning to present research findings related to perennial ryegrass toxicity and chemistry at the upcoming NSW Grasslands Association Meeting in Canberra in May.

Contact: Professor Leslie Weston, T: 02 6933 2429, E: leweston@csu.edu.au

Animal Health and Welfare

Activities within the Animal Health and Welfare Research Pathway have been progressing well in 2013.

Two student interns have been welcomed to work with the group this year - Alice and Emily Birckhead.

Alice will be working with Ali Ghorashi, David Jenkins and Rob Woodgate (CSU). Initial activities include investigating the potential for the development of molecular diagnostic testing for the liver fluke, *Fasciola hepatica*. Alice will also be involved in some of the parasite epidemiology work that is continuing within the Pathway.

Emily will be working with Jane Quinn, Marta Hernandez-Jover and Leslie Weston (CSU). This will include helping with projects investigating *Biserrula* photosensitisation and perennial ryegrass toxicity, and also getting involved in several ongoing epidemiology and biosecurity research activities.

In February the group hosted Dr Peter Hunt from CSIRO at Chiswick, near Armidale, NSW. Peter is an international scientist with experience in the molecular diagnosis and investigation of sheep nematodes. He presented some of his recent work in a seminar to the School of Animal and Veterinary Sciences, and also met with Veterinary Diagnostic Laboratory staff to discuss the potential of using PCR techniques as a replacement for faecal worm egg counts and sheep nematode larval cultures and morphological differentiation. It is hoped to develop a collaborative project with Peter investigating the epidemiology and anthelmintic resistance risk factors of barbers pole worm (*Haemonchus contortus*) in southern NSW and northern Victoria.

Thanks to summer scholarships from the Graham Centre, Leah Brunt and Tom O’Brien, undergraduate Veterinary Science students at CSU, did 10-week intensive research projects.

Under the supervision of Shokoofeh Shamsi and Rob Woodgate, Leah prepared two intensive literature reviews on anthelmintic resistance in sheep and food safety with a focus on parasites occurring in intensive animal production systems. Both these literature reviews are major parts of manuscripts that are being submitted for publications in peer reviewed journals. In addition Leah worked on three new species of acanthocephalan parasites with Shokoofeh Shamsi, CSU and Lesley Warner from the South Australian Museum. Leah is presenting her work in the international conference of the World Association for Advancements in Parasitology (WAAVP) in Perth in August 2013, and submitting a manuscript in a peer reviewed journal. Leah also learnt scanning electron microscopy under the supervision of Dr John Harper and Dr Bree Wilson, School of Agriculture and Wine Sciences.

In collaboration with NSW DPI and Wagga Wagga City Council, Tom worked on parasites of wildlife associated with farmed animals. He is presenting the results of this collaboration in WAAVP 2013. His work brought various experts from different disciplines together, including Matthew McLellan from NSW DPI, Narrandera Fisheries Centre and David Read, biodiversity officer from Wagga City Council, Shokoofeh Shamsi, Nigel Urwin and Rob Woodgate from CSU.

PhD candidate Walide Saad from Libya joined the team to work on developing reliable and practical molecular diagnostic techniques for selected parasites of production animals under Shokoofeh’s supervision.

Anna Turner started an Honours Project with Shokoofeh Shamsi and Skye Wassens (CSU), looking at parasites of introduced species and their impacts on endemic species of fish and aquaculture development. Anna has already found previously unreported parasites in Murrumbidgee basins. Some of these parasites could potentially be deadly for aquaculture species.

Finally, the Research Pathway management team (Bec Doyle, Ali Ghorashi, Marta Hernandez-Jover, Jane Quinn, Shane Raidal, Shokoofeh Shamsi and Rob Woodgate) have held a
couple of meetings to discuss effective usage of Research Pathway funding. The group are currently investigating the development of staff and research student training courses for the confocal microscope and LTMS/QTOF equipment that have recently been commissioned in the NaLSH.

Contact: Dr Rob Woodgate  
T: 02 6933 4905, E: rwoodgate@csu.edu.au

Irrigated Cropping Systems

To accommodate the range of irrigated crops, the Rice Based Research Pathways Leaders have decided to broaden the scope of the pathway to include irrigated cropping systems.

There are already a large number of rice based research projects with NSW DPI and CSU, with little opportunity for value adding by the Graham Centre.

Broadening the scope of the research, allows more opportunity to work with crops that have little funding, and issues that need addressing such as break crops in irrigated systems.

On 10 May there will be a large irrigated cropping systems meeting in Yanco to determine research gaps that require further investigation. Current projects will be presented and issues for research projects identified.

Contact: Ms Deb Slinger  
T: 02 6938 1901, E: deb.slinger@dpi.nsw.gov.au  
Professor Len Wade  
T: 02 6933 2523, E: lwade@csu.edu.au  
Dr Mark Stevens  
T: 02 6951 2644, E: mark.stevens@dpi.nsw.gov.au  
Associate Professor Phillip Eberbach  
T: 02 6933 2830, E: peberbach@csu.edu.au

New research tool to investigate calf deaths

Charles Sturt University (CSU) is developing a new research tool to help the northern Australian beef industry understand more about the timing and causes of calf deaths.

A team led by Associate Professor Scott Norman, CSU School of Animal and Veterinary Sciences is refining technology that will tell researchers when a cow has had a calf in a remote location to allow them to check on the birth.

Professor Norman said the large scale and remote nature of many northern Australia beef operations means there’s little information about the extent of losses during calving.

Many northern producers do not know how many calves have survived until the annual muster but losses of more than 20 per cent from maiden heifers have been recorded. This research aims to find out when the loss is occurring; late term, during calving or the post calving period.

While calving difficulty in beef heifers has been around for a long time, there has not been a lot of investigation into the financial impact in the extensive northern industries. Some of the most recent data is now 20 years old and that indicates a cost to the Australian beef industry of between $30 and $200 million.

“If we can identify where the losses are occurring and the reasons for these losses, and implement management strategies to address those problems, it will be a significant benefit to the industry,” Professor Norman said.

The research is based around a small device that emits a low energy wireless signal that can be picked up in paddocks as large as 50 square kilometres.

Once the cow calves, or the device is triggered, towers will pick up the signal and triangulate the location so researchers can investigate if she has had a live calf.

The first step is to refine the technology to ensure the device is compatible with the cow, that it will stay where it is positioned and that it does not cause problems with its presence.

A small scale trial will be held at the Charles Sturt University farm in spring before testing in a larger herd in central Queensland.

It’s hoped the device can be used more widely for research in the industry by 2014.

The Remote Calving Alert for Beef Cattle project has received more than $300 000 in funding from Meat & Livestock Australia (MLA) and involves researchers from CSU, through the Graham Centre.

Contact: Associate Professor Scott Norman  
T: 02 6933 2088, E: snorman@csu.edu.au

Editors note: This article was reprinted from CSU News, www.csu.edu.au/news
Using stealth to combat weed invasion

Unmanned aerial vehicles (UAV) are often associated with the military but new research at Charles Sturt University (CSU) shows their increasing importance in civilian life.

Researchers at CSU are examining how the latest remote sensing technology can be used in UAVs to produce a detailed map of weeds invading the Australian rural landscape.

CSU academics and Graham Centre members, Dr Remy Dehaan and Professor Leslie Weston, secured a grant of $330,000 from the Federal Government’s Rural Industries Research and Development Corporation (RIRDC) to develop remote sensing technology to apply to the agricultural sector.

The team has been working on the development of several automated UAV’s including a plane with a three metre wing span, a two metre long helicopter and several multicopters, which will be equipped with sensitive imaging systems to detect weeds and monitor crops in paddocks below.

Once developed, the UAV with hyperspectral remote sensing equipment on board will take to the skies to capture one of the most serious threats to Australia’s environment and primary production.

This remote sensing technology allows plant material to be clearly separated through their unique spectral signatures. The team initially plans to map weeds such as Paterson’s curse and silverleaf nightshade but there are many other agricultural issues that the technology can be used for.

The research team, including collaborators the universities of Adelaide, New England and Sydney and the University of North Dakota in the USA, has been working with an Australian UAV company, Cyber Technology.

Dr Dehaan embarked on a world-wide search for suitable UAVs, automated guidance system and remote sensing equipment.

A remote control plane was purchased from Bruce Tharpe Engineering in the Unites States. Known as a BTE Super Hauler, the aircraft was originally designed for the University of North Dakota and has been used by NASA and the US Department of Defence for research activities. Dr Dehaan then purchased the guidance systems from Cyber Technology, who installed and integrated the system into the UAV.

Dr Dehaan said, “One of the novel parts of our research is that it is one of the first hyperspectral remote sensing systems that involves the capture of very detailed images (10 centimetre pixels) from the air. This enables us to look at a smaller area with high detail. We can use this information to separate the different types of weeds.”

This is an exciting project; not many universities have access to UAVs and this access is providing opportunities to look at new research.

The technology is also being used to quantify nitrogen in rice so the amount of fertiliser applied can be reduced, while maintaining high yields. Plant diseases are also being looked at including stripe rust to see if it can be identified and its incursion in paddocks mapped. There are numerous areas in agriculture where this technology could be applied.

It is hard to imagine few areas in Australia where weeds do not exist. In fact the RIRDC estimates the impacts of weeds on the Australian economy are more than $4 billion per year for control and loss of agricultural productivity.

This technology gives Charles Sturt University a unique capacity to study the movement of invasive plants over time, particularly in areas that might be difficult to access by traditional methods.

Over time, it is hoped to quantify or measure the invasion front, the distance invasive weeds travel in newly infested landscapes. This will provide valuable information when assessing a weed’s capacity to invade new territory and determine if management strategies are effective on a broader scale.

The project has the additional support of the University’s Spatial Data Analysis Network (SPAN). Research Support Programmer, Mr Gary McKenzie, SPAN helped build the computer that records the pictures in a data acquisition system.

Contact: Dr Remy Dehaan
T: 02 6933 2499, E: rdehaan@csu.edu.au or Professor Leslie Weston
T: 02 6933 2429, E: leweston@csu.edu.au

Editors note: This article was reprinted from CSU News, www.csu.edu.au/news
**Australian scientists take on worldwide agricultural scourge**

Two Australian scientists have helped reveal the “evolutionary trick” which makes the diamondback moth one of the world’s worst agricultural pests. Charles Sturt University Professor Geoff Gurr, from the Graham Centre, and University of Adelaide Ramsay research fellow Dr Simon Baxter were part of an international consortium which recently revealed the genetic blueprint of the moth in a paper in the international journal Nature Genetics.

Diamondback moth wreaks billions of dollars worth of damage to crops around the world each year, costing producers $4-5 billion in crop loss and control measures, and has caused major problems for the Australian canola industry.

The caterpillars feed on cabbage and related plants and are difficult to control because they can quickly develop resistance to all types of insecticide.

Professor Gurr said the successful sequencing of the moth’s genome revealed the moth’s “evolutionary trick”; its ability to detoxify the defence compounds produced by plants in the cabbage family.

These are the same compounds that make mustard so pungent and cabbage so smelly.

Remarkably, it appears that the very genetic adaptations that allow diamondback moth to cope with these natural compounds also allow it to detoxify the insecticides used against it.

The moth had spread throughout the world and can be found in vegetable gardens and farms across Australia.

They have an incredible ability to migrate long distances and adapt quickly to the environments they encounter, making outbreaks of these insects difficult to predict and control.

This project has helped identify the genes that make diamondback moth such a successful pest and will enable new insecticide resistance monitoring techniques and pest management strategies to be developed.

Research team leader Professor You Minsheng, from the Fujian Agriculture and Forestry University in China, said the genetic blueprint had taken more than 40 scientists several years to develop using specially designed software and had identified more than 18,000 separate genes.

Contact: Professor Geoff Gurr
T: 02 6365 7551, E: ggurr@csu.edu.au

Editors note: This article was reprinted from CSU News, www.csu.edu.au/news

**International arthropod taxonomist shares her expertise**

Josie (JO) Lynn Catindig, an arthropod taxonomist from the International Rice Research Institute (IRRI) in The Philippines, visited the molecular biology laboratory at the Wagga Wagga Agricultural Institute for three weeks during February, to learn the rudiments of DNA barcoding analysis from Dr David Gopurenko (Research Scientist, Molecular Systematics), and to participate in a recent devised project using DNA barcoding to identify cryptic species diversity among agriculturally important parasitoid wasps.

This project is funded by the Graham Centre, as part of the Centre’s 2013 New Initiative grant scheme.

During her stay, JO and Dr Gopurenko completed the initial stages of the project, cataloguing and extracting DNA from approximately 700 wasp specimens, in preparation for downstream DNA barcoding. The specimens include a wide variety of important parasitoid wasps sampled from diverse areas. These wasps parasitise agriculturally important arthropod pests by laying eggs into them; in effect, the wasps act as naturally available pest-biocontrols, suppressing and regulating outbreaks of pest insects where they co-occur in agricultural zones.

The alpha taxonomy of these wasps is often poorly understood. It is likely, as has been shown elsewhere, that many of the cosmopolitan or widespread wasp morphs are complexes of discreet species, with each discreet species parasitising a narrow range of pest hosts.
DNA barcoding provides a reliable means to rapidly identify alpha taxonomic diversity among wasps, and is being used to identify the species diversity among important wasp biocontrols, and help untangle the complex relationships among the wasp species and their targeted pest hosts.

This will provide researchers with a better understanding of the ecological relationships that exist among the biocontrols, and pests can be established and used to develop practises that promote closer integration of natural biodiversity and agricultural systems management.

Other researchers participating in this project include Craig Maddox (Entomologist, NSW DPI), Dr Kong Luen Heong (Principle Scientist/Insect Ecologist, IRRI), and Professor Geoff Gurr (Professor Applied Ecology, CSU).

Contact: Dr David Gopurenko
T: 02 6938 1946, E: david.gopurenko@dpi.nsw.gov.au
Emma Hand, PhD Student

Supervisors: Dr Edward Clayton (DPI), Dr Michael Friend (CSU), Dr Belinda King (CSU)

Thesis title: Mechanisms behind the alteration of lamb sex ratio when ewes are fed a diet high in omega-3 or omega-6 fatty acids at mating.

Funding body: My research is funded under a broader MLA funded project.

Career and studies till now: After finishing school I enrolled in a Bachelor of Animal Science course at Charles Sturt University. I was then lucky enough to be given the opportunity to undertake an honours project as part of this degree, which involved travelling to Pakistan and completing the practical part of my honours there. I graduated with honours from Animal Science in 2011 and started my PhD with CSU in conjunction with NSW DPI and the Graham Centre in 2012.

Currently studying: Doctor of Philosophy (Science)

Research Interests: My main research interest is animal reproduction, with a focus on using reproductive technologies to improve the efficiency of production systems. Through both my honours research and now my PhD research, this interest has extended to include the effect of nutrition on reproduction, as more is being discovered about the interaction between nutrition and reproduction by the scientific community.

A typical day for me includes … being a research student means that every day is different. Some days I will be in front of a computer ALL day, reading and writing or analysing data, and other days I will be outside all day, feeding sheep and collecting data. Some days even involve all of these things.

My main project at the moment is … My PhD research is an extension of research conducted by my supervisor, Dr. Edward Clayton, over the past few years, which has shown that feeding an oats based diet (high in omega-6 fatty acids) to ewes in the lead up to joining, produces a significantly higher proportion of female lambs. The aim of my research is to discover why this change in sex ratio is occurring. My next trial, which is starting in a couple of weeks, will involve feeding three diets of the same composition with either omega-6, omega-3 or saturated fatty acids added to the ration. This trial will hopefully tell me whether it is the fatty acids in the diets that cause the changes in sex ratio, or if it is another component of the diet.

My favourite part of my studies is … being able to see my ideas through to the end. I can come up with a theory; form a plan on how to test the theory and carry out the experiment myself (with help from my supervisors of course!).

When I am not studying I like to … travel as much as possible and spend time with my friends.

When I am driving I like to listen to … Triple J. I love hearing lots of new, Australian music.

Research and education: Emma Hand, Carlee Coombes and Michaela Woolford on their daily walk to the calf shed in Okara, Pakistan. The girls spent a month in Pakistan running research trials and visiting villages to help educate farmers on the basics of animal husbandry and dairy production.
Soumi Paul Mukopadhyay, PhD Student

Supervisors: Associate Professor Paul Prenzler, Associate Professor Anthony Saliba, Associate Professor Chris Blanchard (CSU), Dr Jenny Wood (NSW DPI), and the late Associate Professor Samson Agboola (CSU)

Thesis title: Eliciting sensory preferences for cooked chickpea and field pea amongst Indian and Australian Consumers

Funding body: Grains Research and Development Corporation (GRDC), Australia

Career:
- Whirlpool Corporation: Food Scientist for Asia Pacific region
  - Leading food technology projects and proof of concept studies in refrigeration platform
- Global Calcium Pvt. Ltd: Research Officer
  - Coordinating various research projects in formulating and sensory profiling of vitamin and mineral premixes
- Central Food Technological Research Institute (CFTRI), India: Senior Project Assistant
  - Food engineering expert in a Council of Scientific and Industrial Research (CSIR) funded, national grid project on Computational Fluid Dynamics (CFD) of baking technology
- Nestle India Pvt. Ltd: Quality Assurance Officer
  - Sensory and Compliance coordinator for infant milk and cereal products

Education:
- Currently studying: Doctor of Philosophy, School of Agricultural and Wine Sciences at Charles Sturt University, Wagga Wagga.
- Masters of Science in Food Technology, Central Food Technological Research Institute (CFTRI), Mysore, India.
- Bachelor of Science (Honours) in Agriculture, Bidhan Chandra Krishi Viswa Vidyalaya (BCKV), West Bengal, India.

Research Interests: Research areas related to food processing and technology, understanding science behind sensory analysis, exploring consumer perception and preferences for foods from different countries.

Professional Links:
- Society of Sensory Professionals (SSP)
- Association of Food Scientists & Technologists, India (AFST (I))
- Graham Centre for Agricultural Innovation

A typical day for me includes: Reading, writing and review of scientific literature, conducting laboratory/sensory experiments, survey questionnaires and data analysis, meetings and updates with my supervisors.

My main project at the moment is: Sensory and consumer evaluation of cooked chickpeas.

My favourite part of my studies is: Sensory...especially working with consumers to understand their preferences and attitudes.

When I am not studying I like to: Spend time with my family...travelling and visiting new places, eating out...singing, reading and playing with my son.

When I am driving I like to listen to (music): Local music playing either on the local FM-radio station or Favourite tunes on our smart phone device.

Soumi has a keen interest in food processing and technology. She likes to explore consumer perceptions and food preferences.
### EVENTS CALENDAR

<table>
<thead>
<tr>
<th>Date</th>
<th>What</th>
<th>Where</th>
<th>More information</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 Jun</td>
<td>Graham Centre Ag Enrichment Day</td>
<td>Graham Centre, Wagga Wagga</td>
<td>Toni Nugent E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a></td>
</tr>
<tr>
<td>28 Jun</td>
<td>Graham Centre Sheep Forum</td>
<td>Convention Centre, CSU, Wagga Wagga</td>
<td>Toni Nugent E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a></td>
</tr>
<tr>
<td>9 Aug</td>
<td>Graham Centre Beef Forum</td>
<td>Convention Centre, CSU, Wagga Wagga</td>
<td>Toni Nugent E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a></td>
</tr>
<tr>
<td>18-22 Aug</td>
<td>FarmLink Bus Tour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Sept</td>
<td>Graham Centre Cropping and Pasture Systems Field Forum</td>
<td>Graham Centre Field Site, Coolamon Road, Wagga Wagga</td>
<td>Toni Nugent E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a></td>
</tr>
<tr>
<td>11 Sept</td>
<td>FarmLink EXPO</td>
<td>Temora, Agricultural Innovation Centre</td>
<td><a href="http://www.farmlink.com.au">www.farmlink.com.au</a></td>
</tr>
<tr>
<td>15 Oct</td>
<td>Graham Centre and NSW DPI Wagga Wagga Agricultural Institute Agribusiness and Advisor Field Day</td>
<td>Wagga Wagga Agricultural Institute</td>
<td>Toni Nugent E: <a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a></td>
</tr>
</tbody>
</table>

**Winter Edition of the Innovator**

The Winter Edition of the Innovator will be available July 2013. Submission of articles for this edition close on **Friday, 14 June 2013**. Please email articles to Toni Nugent or Sharon Fuller.

---

**INNOVATOR CONTACTS**

**Deirdre Lemerle**  
Director  
P (02) 6933 4398  
M 0419 816 267  
E dlemerle@csu.edu.au

**Toni Nugent**  
Editor  
P (02) 6933 4402  
M 0418 974 775  
E tnugent@csu.edu.au

**Sharon Fuller**  
Layout & Production  
P (02) 6933 4401  
E sfuller@csu.edu.au

---

**GRAHAM CENTRE**

*for Agricultural Innovation*

---

**Our Location:**  
Pugsley Place (off Pine Gully Road)  
Wagga Wagga NSW 2650 Australia

**Mailing Address:**  
Graham Centre for Agricultural Innovation  
Charles Sturt University  
Locked Bag 588  
Wagga Wagga NSW 2678 Australia