From the Director’s desk

Happy New Year and welcome to the Summer 2013 Edition of the Innovator.

Invasive plant and animal pests cost billions of dollars annually to the Australian economy in lost production and management costs.

The impact of climate change on invasive species will influence distribution and our ability to control them.

Our research is looking at new techniques to retard the rate of spread of resistance to chemicals, and develop integrated pest management strategies.

The Centre has one of the largest agricultural research teams across weeds, diseases and insects in Australia for cropping and pasture systems. We are also currently building our strength in animal health and welfare, specifically for parasites and diseases of production animals, for example, liver fluke.

Visit the Centre’s website www.grahamcentre.net for detailed information about our research including the recent breakthrough with the successful sequencing of the diamond moth’s genome, as reported by Professor Geoff Gurr in Nature Genetics, in collaboration with the Fujian Agriculture and Forestry University in China.

This edition showcases some of our research, with current project updates, news of recent Centre workshops and events, travel reports, staff profiles and upcoming events.

Enjoy reading this edition of the Innovator.

Professor Deirdre Lemerle
18th Australasian Weeds Conference

The 18th Australasian Weeds Conference saw nearly 300 delegates attending, when it was held in Melbourne during October 2012. Nine Graham Centre members, including three students and one adjunct, presented oral and poster presentations at the conference.

The conference heard 91 oral presentations, including eight keynote talks, and 52 posters presented. The Council of Australasian Weed Societies Inc (CAWS) Oration was delivered by Professor Richard Mack, Washington State University. Professor Mack urged weeds workers to be more proactive in publicly discussing the consequences of not adequately resourcing invasive weed control.

Professor Paul Martin and Dr Rachel McFadyen provided sobering keynote presentations on the need to secure ongoing funding for weeds research, and the need to utilise our limited research and management resources to the best effect. Dr John Dwyer further reflected on the impact that choice of language and metaphors have on the ability to sell a positive message.

Professor Richard Hobbs reminded delegates of the paradox that change is a constant. Weed management needs to be flexible and address fundamental solutions. Professor Chris Johnson and Jarvis Weston later challenged delegates to think outside the square with the impact of weed management on the whole ecosystem. Professor Johnson drew the audience into a journey through time and the close relationship between floral diversity and faunal evolution. Jarvis Weston focused on the present day challenges posed with rehabilitating vegetation on Philip Island to enable the fairy penguin population to recover.

The final keynote presentation was by Anthony Kachenko, highlighting the range of activities the Nursery and Garden Industry Australia has undertaken over the past six years, to address the issues relating to many weeds starting life as a garden plant.

Charles Sturt University and Graham Centre PhD student Razia Shaik was awarded equal Best Student Poster for her studies in biology and genetic diversity in wild cucurbitaceous weeds.

Contact: Dr Rex Stanton
T: 02 6938 1618, E: rstanton@csu.edu.au

New Outstanding & Objective World University Ranking for CSU

Charles Sturt University (CSU) has ranked well at 184 for Agricultural Sciences, in the 2012 Performance Ranking of Scientific Papers for World Universities.

The 2012 Performance Ranking of Scientific Papers for World Universities is released by the National Taiwan University Ranking (NTU Ranking). The ranking program offers annual performance rankings for world universities based on the production and impact of their scientific papers.

The Performance Ranking of Scientific Papers for World Universities is a stable and reliable ranking for universities devoted to scientific research. It is based entirely on statistics of scientific papers that reflect three major performance criteria—research productivity, research impact, and research excellence.

Further information about the National Taiwan University Ranking can be found at http://nturanking.lis.ntu.edu.tw/
Agribusiness and advisor field day

The NSW Department of Primary Industries Wagga Agricultural Institute and Graham Centre Agribusiness and Advisor Field Day was held on 17 October.

Over 50 people attended including resellers, plant breeders, seed company representatives and growers. The field day showcased research trials at the Institute including:

- Wheat - sowing time x variety; nitrogen x variety
- Canola - variety x sowing time x seeding rate
- Plant pathology - stripe rust, yellow leaf spot
- Herbicide tolerance in wheat and barley
- Canola - drought tolerance screening
- Green manure - time of sowing x variety x species
- Blackleg in canola
- Wild radish control

Recognition of achievements

Graham Centre members gathered on 4 December to celebrate and recognise the achievements of Centre members during 2012. The afternoon provided an opportunity for networking and research pathway teams to touch base and review their progress over the last six months.

2012 Graham Centre Awards

Award for the highest research income: Professor Peter Wynn (CSU); Honorary mention Dr Michael Friend (CSU)

Award for Publications Excellence: Dr Hanwen Wu (DPI) and Professor David Kemp (CSU)

The Associate Professor Samson Agboola Memorial Award: Dr David Luckett (DPI) and Professor Gavin Ash (CSU)

Certificate of appreciation for Postgraduate student support: Randy Adjonu and Joe Moore

Certificate of appreciation for research leadership: Associate Professor Gavin Ramsay (CSU) and Dr Rob Woodgate (CSU)

Certificate of appreciation for strong team function: Bioprotection entomology group

Certificate of appreciation for outstanding media coverage and research promotion: Dr Simon Speirs (DPI) and Dr David Jenkins (CSU)

Certificate of engagement and enthusiasm: Dr Rebecca Doyle (CSU) and Dr Peter Martin (DPI)
International collaboration and opportunities

As part of a week long Australian visit, a delegation of Chinese agricultural officials visited the Graham Centre on 12 October. The delegation began their visit in Canberra attending the 2012 Crawford Fund International Conference at Parliament House. This year’s theme ‘More food, less land’ focused on the dynamic interactions between a range of competing uses for land and natural resources, while addressing the need to feed the world’s growing population in the face of the constraints and challenges of climate change.

Celebrating cultural diversity: The 3rd Annual International Food and Trade Exhibition was held on 24 October, United Nations Day, to celebrate the cultural diversity of Charles Sturt University. Over 11 nations including China, Papua New Guinea, Bangladesh, Philippines, India, Ghana, Pakistan and Australia were represented showcasing their national dress and providing a banquet of food from their native countries. The International Food and Trade Exhibition was supported by the Graham Centre and the International Student Club. Photo: Toni Nugent.

Graham Centre Stubble Research Forum

Wednesday, 13 February 2013
Convention Centre, Charles Sturt University
8.30 am — 2.00 pm

Speakers include:
○ Clive Kirkby
○ Mark Conyers & Susan Orgill
○ Andrew Whitlock

Workshops by:
○ Harm van Rees & Iain Hume
○ Jeff Baldock & Mark Farrell

RSVP and further information:
Deirdre Lemerle: dlemerle@csu.edu.au or
Toni Nugent: tnugent@csu.edu.au

Visiting NSW Department of Primary Industries and Charles Sturt University allowed members to explore possible collaboration and opportunities for projects and placements for post-graduate students, while also maintaining connections with current Australian Centre for International Agricultural Research (ACIAR) project leaders.
A delegation of eight Vietnamese Department of Agriculture staff visited Charles Sturt University in November as part of their rural development tour of Australia. The group met with CSU and Graham Centre members Professors Deirdre Lemerle, Gavin Ash and John Mawson, Associate Professors Chris Blanchard and Phil Eberbach and Drs Jason Condon and Sergio Moroni, to hear about current CSU Vietnam collaborations, new technologies in agriculture, rice research and post harvest grain quality research.

As part of their visit they also toured the research facilities at the School of Agriculture and Wine Sciences, including the National Life Sciences Hub.

Identification of three invasive melons in Australia - a morphological and molecular approach

Camel melon (Citrullus lanatus), prickly paddy melon (Cucumis myriocarpus) and colocynth (Citrullus colocynthis) are summer growing invasive weeds of crops and fallows that are declared noxious weeds in parts of Australia. Colocynth is a summer growing perennial that perenniates during winter through a swollen taproot. Camel melon and prickly paddy melon are annuals.

The three melons share similar morphology and life history, and are often confused. Their taxonomic identity remains inconsistent across Australia. To successfully manage these weeds, correct identification is critical.

Razia’s PhD research aims to investigate and describe the distinguishing morphological characteristics of the three species, and to use the informative gene regions for their molecular taxonomic identification.

For morphological characterisation, populations of each species from selected Australian states were grown in a glass house over a four month period in 2011. This study revealed that each species exhibited distinct leaf lobation, branching of tendrils, floral, fruit and seed attributes, all of which are presented as useful identifying features. In addition, each weed can also be identified to species level using multi locus DNA sequence analysis, demonstrating the utility of this approach for resolving nomenclatural errors and taxonomic mis-identification issues.

Camel melon in Australia is currently reported as Citrullus lanatus var. lanatus. But Razia’s sequence analysis at nuclear G3pdh and ycf6-PsbM intergenic spacer region indicates its synonymy with overseas citron melon identified by authorities as C. lanatus var. citroides.

At the recent 18th Australasian Weeds Conference, Razia presented a paper showing the gene regions and key distinguishing morphological characters that can be used for identification of the three species in Australia.

Contact: Razia Shaik, T: 02 6933 2749; E: rshaik@csu.edu.au
Enough soil carbon to mitigate climate change is a ‘big ask’

Expectations are unrealistic for delivering increases in sequestration of carbon in soil, according to one of Australia’s most respected soil scientists.

In a science where progress is generally slow and unspectacular, research and extension in soil management seems to go through boom and bust cycles in subjects such as erosion, salinity, acidity, phosphorus and now carbon, says Mark Conyers.

“This is ironic given that these are mostly issues of sustainability,” said Dr Conyers, a Department of Primary Industries (DPI) principal research scientist based at Wagga Wagga Agricultural Institute.

“The cycle is fed by political thresholds for funding that require sometimes extravagant claims, followed by feeding frenzies from resource-starved scientists, followed by a lack of immediate outcomes within a politically useful time frame.

“This means the core ethical responsibilities within the profession of soil science are not always achieved.”

The NSW Branch of the Australian Society of Soil Science invited Dr Conyers to deliver the annual Harald Jensen lecture, a premier annual event on Australia’s soil science calendar in Sydney during September.

Dr Conyers delivered the lecture to a live audience at the Camperdown venue and simultaneously as a real-time online webinar which is now available as an audio download.

It is a “big ask” in Dr Conyers’ view to deliver increases in sequestration of carbon in soil that would be adequate to decrease concentrations of carbon dioxide (CO$_2$) in the atmosphere and thus minimise climate change.

“A lot of people might be very disappointed in the magnitude and rate of the outcome, especially against a background of ongoing fossil fuel use and continuing deforestation in South America, Africa and Southeast Asia,” Dr Conyers said.

“Data from several long term trials in southern NSW and Victoria show that changes in soil C under agricultural management range from -200 to +500 kilograms of carbon per hectare.

“These rates of change are significant statistically but from a practical point of view they are likely to be too slow to be of economic value to a farmer, and might be too slow to keep pace with emissions from other sectors of the economy.”

Hence, despite the ability of agriculture to have an impact on carbon sequestration in soil, the rate is unspectacular.

There are many forms of carbon in soil and many methods for trying to measure those forms.

Dr Conyers said some pools of C were more stable than others “so we need to know how to distinguish between long-lived and transient forms of soil C.

“But there remains a difference between the pools of carbon that we talk about in soils and those that we can reliably measure.

“While soil scientists need public funding to research soil carbon, we are going to have to communicate better with politicians, public sector administrators and the general public so that realistic expectations can be met.”

Dr Conyers said the boom and bust cycle in soil research and extension was also disruptive to the retention of staff and resources required to tackle these public domain issues.

“Further, more constructive criticism is necessary within the soil science community on the methods to collect data and in the interpretation of that data.”

The Australian Society of Soil Science provides such a forum and members are encouraged to contribute their expertise at such meetings for the good of both the subject field and the public purse that funds such work.

The Harald Jensen lecture is presented each year by a guest speaker nominated as a contemporary leader among the soil science community who has made significant contributions to the field.

Dr Conyers works primarily in the Riverina and south western slopes of NSW, but his responsibilities have taken him around Australia.

He has wide experience with delivering soil science and agronomy to the agricultural communities of NSW especially in the fields of nutrients, soil acidity, soil salinity and soil carbon.
Dr Conyers is currently leading collaborative trials for the next five years in southern NSW on the strategic use of tillage in conservation systems.


Contact: Dr Mark Conyers, T: 02 6938 1830, E: mark.conyers@dpi.nsw.gov.au

Acknowledgement: This article has been reproduced with permission from NSW DPI’s Agriculture Today.

**Prestigious award for local research scientist**

Recently retired NSW DPI senior principal research scientist, Dr Brian Dear, has won this year’s prestigious Donald Medal.

The medal, presented at the Australian Agronomy Conference in Armidale in October, is awarded every two years by the Australian Society of Agronomy to an eminent agriculturalist.

Dr Dear, who retired from NSW DPI last year, said the award was a great surprise and a wonderful honour.

Brian joined the NSW Department of Agriculture in 1971 as a trainee while at the University of New England. After graduation, he started work on irrigated wheat at Yanco in 1974, before moving to the Cooma Monaro area where he spent the next eight years working on pasture legume selection while based out of the CSIRO Division of Plant Industry at Canberra.

In 1984, he moved to the Agricultural Research Institute at Wagga Wagga to lead the NSW subterranean clover improvement program.

In collaboration with interstate colleagues, Brian has released at least 17 new legume cultivars, including 12 new cultivars of subterranean clover. From 2008 to 2010, Brian and his collaborators released two new red-legged earth mite resistant subterranean clover cultivars Bindoon and Rosa Brook.

In 1993, he commenced a research program to increase the use of perennials in farming systems as a way of improving the sustainability of pasture crop rotations. This led to the national Herbaceous Plant Improvement Program, which Brian led from 2001 to 2007.

From 2008 until his retirement, he led the Uniform Rainfall Zone component of the EverCrop project within the Future Farm Industries CRC, which explored new farming systems that incorporated perennial pasture species to improve the profitability and sustainability of farming.

Dr Dear can also lay claim to an extensive publication record of 177 peer reviewed papers including 96 conference papers and 74 journal papers in the top ranked scientific journals within his discipline.

Source: NSW DPI.

Your feedback on the content and layout of our newsletter will help us deliver what you want. It will take less than 5 minutes of your time to complete a few short questions.
Graduation honours

Congratulations to the following Graham Centre members and students who graduated from Charles Sturt University in December 2012.

Faculty of Science

Doctor of Philosophy
- Siem Siah
- Pematso Baimacuo
- Raymond Cowley
- Clive Kirkby
- Abdel Qawasmeh
- Balwinder Singh
- Margaret Watson

Bachelor of Biotechnology (Medical) (Honours)
- Kyle Reynolds

Master of Philosophy
- Sahibzada Shafiullah
- Xiangba Zhuoga

Royal Australian Chemical Institute NSW Analytical Chemistry Group Prize
- Clare Flakelar*

*Clare has been awarded a Graham Centre Honours Scholarship for 2013.

Siem Siah’s thesis was titled ‘Health benefits of Australian grown Faba Beans (Vicia faba): effects of food processing’. She has published one paper and has three more in preparation.

Clive Kirkby’s studies looked at the influence of nutrient availability on changes in stable soil organic matter levels. He has published one paper, has another accepted and two in review. He has also made two presentations at international conferences.

Ray Cowley’s thesis was titled: “Identification of genetic resistance to Diaporthe toxica in Lupinus albus.” Ray’s thesis was submitted “by publication”. There were four papers from the work published in peer reviewed journals, and there is one in preparation, in addition to three conference papers and an extension article.
Internal Grants Scheme

The Centre’s Internal Grants Scheme provides financial support to members. Since 2005, the Centre has provided around $1.2 million through a variety of scholarships and other financial incentives to support and encourage excellence in research. Congratulations to the Centre’s 2012/13 New Initiatives grant and scholarship recipients.

New Initiatives 2012/13*

<table>
<thead>
<tr>
<th>Principal Applicant</th>
<th>Collaborators</th>
<th>Full Project Title</th>
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<tr>
<td>Gavin Ash</td>
<td>Ben Stodart, Philippe Rott, Vittorio Venturi</td>
<td>Virulence factors in <em>Pseudomonas fuscovaginae</em> contributing to host plant colonisation.</td>
</tr>
<tr>
<td>Chris Blanchard</td>
<td>Padraig Strappe, Jennifer Wood</td>
<td>Development of cell culture based high throughput screening (HTS) assay for potential health benefits of pulses</td>
</tr>
<tr>
<td>David Gopurenko</td>
<td>Josie Catindig, Kong Luen Heong, Craig Maddox, Geoff Gurr</td>
<td>Detection of cryptic diversity and host preference in agriculturally important parasitoid wasps, using DNA barcoding.</td>
</tr>
<tr>
<td>Geoff Gurr</td>
<td>David Gopurenko, Andrew Mitchell, Murray Fletcher</td>
<td>Phytoplasmas, host plants and vector insects: a novel molecular approach for understanding evolutionarily relationships and predicting risks to agriculture</td>
</tr>
<tr>
<td>David Jenkins</td>
<td>Nigel Urwin, Kate Mitchell (student), Thomas Williams</td>
<td>The importance of foxes in transmission of <em>Taenia ovis</em> (sheep measles) to sheep</td>
</tr>
<tr>
<td>Paul Prenzler</td>
<td>David Luckett, Jamie Ayton, Ray Cowley, Greg Doran, Julia Howitt</td>
<td>Development of Analytical Tools for Screening Canola Oil in Pre-Breeding Programs for Quality and Health Benefits</td>
</tr>
<tr>
<td>Shane Raidal</td>
<td>Andrew Peters, Gariba Danbaro, Sinafa Robby, Jeffrey Warner</td>
<td>A regional approach to animal health biosecurity in Australasia: preparing Australia by preparing PNG</td>
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<tr>
<td>Olivia Reynolds</td>
<td>Geoff Gurr, Paul Weston, Min An, Mark Stevens</td>
<td>Silicon-induced plant chemical defence: the plant volatile profile and attraction of natural enemies</td>
</tr>
<tr>
<td>Shokoofeh Shamsi</td>
<td>Rob Woodgate, Nigel Urwin, Ali Ghorashi, Michelle Ayton</td>
<td>Developing quantitative molecular techniques for the study and diagnosis of parasite infections in sheep</td>
</tr>
<tr>
<td>Leslie Weston</td>
<td>Jane Quinn, John Piltz, Belinda Hackney</td>
<td>Understanding the mechanisms of toxicity and photosensitisation in livestock grazing biserrula (<em>B. pelecinus</em>)</td>
</tr>
<tr>
<td>Rob Woodgate</td>
<td>Shokoofeh Shamsi, Nigel Urwin</td>
<td>Preliminary investigation of the genome of <em>Bovicola ovis</em>, the sheep body louse.</td>
</tr>
<tr>
<td>Hanwen Wu</td>
<td>Rex Stanton, Geoff Burrows, David Gopurenko, John Harper, Leslie Weston</td>
<td>Molecular and morphological identification of <em>Conyza</em> species (fleabane) in southeast Australia</td>
</tr>
</tbody>
</table>

*Valued at $10,000.
### 2013 University Research Centre Higher Degree by Research Scholarships

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<thead>
<tr>
<th>Name</th>
<th>School</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>Sebastian De Mattia</td>
<td>Agriculture &amp; Wine Sciences</td>
<td>Masters by Research</td>
</tr>
<tr>
<td>Erin Lennox</td>
<td>Animal &amp; Veterinary Sciences</td>
<td>PhD</td>
</tr>
<tr>
<td>Kyle Reynolds</td>
<td>Biomedical Sciences</td>
<td>PhD</td>
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### Honours Scholarships 2013

<table>
<thead>
<tr>
<th>Name</th>
<th>Project Title</th>
<th>Supervisors</th>
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</thead>
<tbody>
<tr>
<td>Karen Alpen</td>
<td>The aim of the project is to gain information on the population genetics of the invasive weed <em>Conyza</em> spp. (fleabane), to assist facilitate its management and reduce its spread. The project will conduct DNA sequence analysis to evaluate the genetic variability of <em>Conyza</em> spp. and the development of molecular markers to improve species identification and taxonomy.</td>
<td>Leslie Weston (CSU) Hanwen Wu (DPI) David Gopurenko (DPI)</td>
</tr>
<tr>
<td>Maria Boesiger</td>
<td>Investigating the antibacterial activities of essential oils, antibiotics and disinfectants on bacteria that cause Bovine mastitis.</td>
<td>Nigel Urwin (CSU) Rob Woodgate (CSU)</td>
</tr>
<tr>
<td>Clare Flakelar</td>
<td>The project will be complementary to work conducted this year involving quantitative determination of tocopherols and carotenoids.</td>
<td>Paul Prenzler (CSU) David Luckett (DPI)</td>
</tr>
<tr>
<td>Leah Garnett</td>
<td>The project investigates nutrient cycling in rice systems under the recently introduced Alternate Wetting and Drying method of water management.</td>
<td>Jason Condon (CSU) Ben MacDonald (CSU)</td>
</tr>
<tr>
<td>Emily Sims</td>
<td>The national Lifting The Limits Project commenced in 2012, and the CSU sub-component currently collects ewe and lamb production and parasitology data from two properties in the Riverina.</td>
<td>Bruce Allworth (CSU) Rob Woodgate (CSU)</td>
</tr>
<tr>
<td>Ashleigh Wildridge</td>
<td>The project is designed to collate the number and type of contacts monitored between beef cattle within a small pasture based herd. The cattle will also be regularly sampled to determine the level of E. coli O157:H7 shedding in their faeces.</td>
<td>Jane Heller (CSU) Alistair Smith (CSU)</td>
</tr>
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### Summer Scholarships 2012/13

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree Course</th>
<th>Project Title</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leah Brunt</td>
<td>Bachelor of Veterinary &amp; Biomedical Sciences</td>
<td>Development of microscopic and molecular diagnostic techniques for rapid identification of helminthic worm parasites of food animals</td>
<td>Shokoofeh Shamsi (CSU) John Harper (CSU)</td>
</tr>
<tr>
<td>Kathryn Minehan</td>
<td>Bachelor of Pharmacy</td>
<td>Biophenols and Food Quality</td>
<td>Hassan Obied (CSU) Paul Prenzler (CSU)</td>
</tr>
<tr>
<td>Thomas O’Brien</td>
<td>Bachelor of Veterinary Science</td>
<td>The annual economical loss in Australian animal production industries are huge. In spite of effective treatment, control and preventive strategies often fail due to several factors such as existence of reservoir hosts for parasites. This project is a survey on parasitic infection of wildlife and terrestrial animals in NSW and will look at the role of reservoir hosts for common parasites of production animals.</td>
<td>Shokoofeh Shamsi (CSU) Rob Woodgate (CSU)</td>
</tr>
<tr>
<td>Brigette Ryan</td>
<td>Bachelor of Agriculture</td>
<td>Biserula toxicity project - Graham Centre Initiative Grant</td>
<td>Leslie Weston (CSU) Hanwen Wu (DPI)</td>
</tr>
</tbody>
</table>
Emergence cohorts significantly impact silverleaf nightshade development and growth

Silverleaf nightshade is a Weed of National Significance in Australia, infesting more than 350,000 hectares. Improved understanding of the weeds lifecycle will be useful for its management.

Research by Graham Centre PhD student Xiaocheng Zhu has shown that the development and growth of silverleaf nightshade is significantly affected by time of emergence. Delayed emergence significantly affects the development and growth of silverleaf nightshade. Plants, both root and seed generated, that emerged early in the season - in September and November, were significantly taller and produced more dry weight and fruits compared to those plants that emerged in the January and March cohorts.

In addition, silverleaf nightshade that emerged in September produced large amount of fruits (22.9 and 126.0 fruits per plant for seed and root generated silverleaf nightshade, respectively).

Management of early emerged plants is important, and herbicide application should be carried out before December to avoid seedbank replenishment.

Xiaocheng Zhu recently presented his research findings at the 18th Australasian Weeds Conference to colleagues and weed scientists from Australia and around the world.

In the field tour focused on mixed cropping and grazing systems, which included a visit to a commercial chicken farm during the 16th Australian Agronomy Conference in Armidale.

Contact: Xiaocheng Zhu
T: 0413 205 172, E: xzhu@csu.edu.au

16th Australian Agronomy Conference

The Australian Agronomy Conference, held every two years, presents a forum/platform for researchers, extension personnel, students and farmers to communicate and discuss the latest scientific research updates and findings.

The 16th Australian Agronomy Conference in October provided a unique opportunity for Dr Guangdi Li to develop linkages with researchers from other research organizations and universities. There were nearly 300 delegates from New South Wales, Victoria, Western Australia, South Australia, Tasmania, the Australian Capital Territory and the Northern Territory. During the conference, Dr Li discussed with many scientists the various topics related to his research interests and explored research opportunities for future collaboration.

These activities broadened Dr Li’s understanding of research and development in the field of climate change, crop and pasture management, soil and water management, weeds, pests and diseases, which results in increased research capacity for current and future research.

There were about 280 papers presented, with Dr Li presenting two oral papers titled “Success of perennial pasture establishment at different sowing times and under a cover crop in the mixed farming zone” and “Companion legume species maximise productivity of chicory (Cichorium intybus),” and co-authored a further eight papers at the conference.

The plenary sessions invited high profile scientists to deliver ‘hot topics’ including: “What has Australian agronomy contributed to world food security in the last 20 years and what lies ahead?” and “Capturing opportunities and overcoming obstacles for Australian agronomy”.

There were a number of concurrent sessions covering topics such as climate change, soil and water management, nutrition, pastures, precision agriculture, plant breeding, crop production, crop development, weeds, pests and diseases.
Guangdi joined the field tour focused on mixed cropping and grazing systems and visited trials and facilities at the Tamworth Agricultural Institute as well as a number of on-farm trials, including a commercial chicken farm.

Contact: Dr Guangdi Li  
T: 02 6938 1930, E: guangdi.li@dpi.nsw.gov.au

**Puffing performance of Australian and Indian desi chickpea**

The theme of the 62nd Australian Cereal Chemistry Conference “Future Cereals for Australia” provided the latest developments and current trends in cereal science and technology.

The conference was held on the Gold Coast, 26-29 August. A team of four researchers from the Graham Centre, including Associate Professor Chris Blanchard, Dr Jennifer Wood and PhD students Christina Chin and Soumi Mukhopadhyay participated in the four day conference.

Soumi presented part of her research project as a poster in the conference, which was well received by the delegates and fellow researchers. Her poster was based on pulse research (Break crops), with feedback received from industry experts being extremely valuable in further improving and refining her on-going research.

Soumi said she gathered ideas and skill sets required for good oral presentation and scientific communication. The opportunity to meet and talk with the conference delegates has increased Soumi’s networks for future research.

Contact: Soumi Mukhopadhyay  
T: 02 6933 2085, E: smukhopadhyay@csu.edu.au

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**Learning from researchers around the globe**

Dr Clive Kirkby travelled to Vienna and Copenhagen during July-August 2012 to present at conferences and meet with researchers at Kassel University, The University of Copenhagen and the Danish Technical University.

Clive attended the joint FAO/IAEA International Symposium “Managing Soils for Food Security and Climate Change Adaptation and Mitigation” in Vienna and gave a presentation titled “Inorganic nutrients mediate the sequestering of soil carbon as humus”.

The main messages of his presentation were that sequestering humus carbon also requires that nitrogen, phosphorus and sulphur will also have to be sequestered (in known amounts) and that the cost of these nutrients needs to be considered.

“The general gist of the conference was that food security would become increasingly threatened as the global population increases, the effects of climate change strengthen, and that knowledge about soils will play an increasingly important role in mitigating adverse effects by furthering sustainable food production in the future,” Dr Kirkby explained.

“Although a number of ordinary session presentations, generally by younger researchers, suggested that conservation agriculture could provide many of the answers, including always increasing carbon sequestration, a plenary presentation by a more experienced researcher (B. Vanlauwe, International Institute of Tropical Agriculture, Kenya) suggested that conservation agriculture does not necessarily increase soil carbon levels.”

Following on from the conference Clive visited Professor Rainer Georg Joergensen’s laboratory at the Witzenhausen campus of Kassel University. He undertook training and discussions on an HPLC method to analyse soils for amino sugars known to be of microbial origin.

Clive left soil samples with Professor Joergensen for analysis. When the analyses are finalised he will be able to compare how well their laboratory is performing when using this methodology compared to a laboratory experienced in its use.

Clive also visited Frederiksberg (main campus) and Taastrup (agricultural campus) of the University of Copenhagen and the Danish Technical University campus at Roskilde. While at Taastrup he gave a presentation to researchers and students and inspected machinery used for incorporating heavy stubble loads (10 t/ha or more). Stubble incorporation is the normal method for handling heavy stubble loads in Denmark.

Visits with Jacob Magid and Sander Bruun at the Frederiksberg campus, and discussion of issues relating
to soil organic matter fractionation, has resulted in Clive returning home to develop a simplified method for soil OM fractionation.

A visit and presentation given at the Roskilde campus of the Danish Technical University has had a positive impact, with researchers indicating they intend to put in a trial investigating the effects of supplementary nutrient addition when stubble is retained and incorporated.

Dr Kirkby also gave a poster presentation at the 14th International Symposium on Microbial Ecology. There were 3000 people in attendance, with sessions covering a wide range of issues concerned with the general area of microbial ecology.

Contact: Dr Clive Kikby
T: 02 6246 5102, E: clive.kirkby@csiro.au

Asian-Australasian Associations of Animal Production Congress

Animal production across the vast expanse of Asia from New Zealand and Australia at one end to Pakistan, Iran and Egypt was the subject of review at the biennial Asian-Australasian Associations of Animal Production Congress held in Bangkok in November. This provided an opportunity to showcase some of the exciting advances Graham Centre member are achieving in Pakistan working with the nation’s 8.5 million small-holder dairy farmers. The Graham Centre dairy extension team presented a total of seven papers at the conference.

“Perhaps the most exciting outcome achieved in the first five years of the project has been the improvement in adoption rates achieved with our extension program. Our extension program is driven by young veterinary interns from the University of Veterinary and Animal Science in Lahore,” Professor Wynn explained.

“Our training program for these recent graduates is the most sought after opportunity for the graduating class of each year, and we are only able to hire 2-3 graduates annually. They are paid the equivalent of A$1,300 per year plus a field expenses allowance for this initial valuable field experience.

Initial success rates in teaching male farmers to build fences and so provide water and feed around the clock were around the 15-30% mark. But it did not take long to recognise the importance of the contribution of women to the farm work force and the management of the family finances on these enterprises.

“We developed a program where extension meetings for both men and women were run concurrently with the same extension messages being given to both meetings. This provoked discussion on the topic within the family which we felt started to lead to more effective adoption rates,” Peter said.

“But potentially the most potent force is to provide the same messages for the children of the family.

Given the natural affinity between children and calves, an extension program devoted to calf rearing was chosen as a popular way of engaging them in farm productivity. A calf rearing competition for children in the small-holder farming groups was run and was an instant success, with calves larger than any seen in the participating villages, providing a focal point for others to see.

The message is clear - get the children along to the women’s extension meetings, while the older boys attend the men’s meetings. Schoolteachers are also invited to all extension activities as they are the mentors most often trusted outside the family by their students.

Contact: Professor Peter Wynn
T: 02 6933 2938, E: pwynn@csu.edu.au

Sequencing humus carbon: N, P and S also need to be sequestered if humus C is to be sequestered.

Getting children involved: A competition was run for children to rear calves. The children reared larger calves than villagers had previously seen. A great way of engaging children in the farm business! Photo: Peter Wynn.
Research Updates

Group meeting paves the way forward for Entomology bioprotection group

The Entomology bioprotection Group met in Leura 24-25 September to review progress and plan new initiatives.

The 12 Charles Sturt University and NSW Department of Primary Industries staff had a total of 28 funding submissions pending with agencies as diverse as the CRC Plant Biosecurity, ARC Discovery and AusAID, as well as international bids with the United States, Chinese, Spanish and Swedish schemes and collaborators.

Major themes in the group’s current and emerging research include ecology of natural enemies, insects as vectors of plant pathogens, chemical ecology of plant defenses, and interactions between insects and microbes.

The group was successful in receiving three Graham Centre New Initiatives grants, each to the value of $10,000, to further develop aspects of these themes.

Increasing the number of research students within the group is also a high priority. A comprehensive website has been drafted and should go ‘live’ early in 2013.

The group met in Sydney for a second time during December.

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

Combating stem rot disease in canola through bacterial beating

The stem rot disease is caused by a polyphagous, necrotrophic fungus *Sclerotinia sclerotiorum* which infect more than 400 plant species including canola.

The disease is becoming increasingly important in south-eastern Australia with an increased intensity of canola production. Until recently, widespread sclerotinia stem rot epidemics were observed to occur once every five to eight years.. This reflects an increase in inoculum pressure from greater reliance on canola in the rotation.

In surveys conducted in 1998, 1999 and 2000, as part of a GRDC funded project at Charles Sturt University, the incidence of stem rot in some crops was found to exceed 30%. This correlated to yield losses in the range of 15 to 30%. Estimates of losses due to the disease in 1999 in New South Wales alone exceeded $170 million.

As there is no resistance currently available in Australian canola varieties, management of the disease solely rely on strategic use of fungicides combined with other management practices including stubble management.

Reduced performance of fungicides and environmental concern has lead to search an alternative bio-control strategy against stem rot disease in canola. Rigorous *in vitro* screening with more than 200 bacterial isolates from phylosphere, rhizosphere and sclerotia resulted in some very strong antagonists of *S. sclerotiorum* being identified. (Figure 1). These antimicrobes were identified as belonging to the genera *Burkholderia* and *Bacillus* according to 16S rRNA sequencing.

![Figure 1](image)

*Figure 1. Sclerotinia sclerotiorum* mycelial growth inhibition on PDA media through the strains of bacterial antagonists (A) *Burkholderia cepacia* (KM1, KM3, KM4) isolated from sclerotia and (B) *Bacillus amyloliquefaciens/ cereus/thuringiensis/weihenstephanensis* (W67, SC1, SC2) isolated from both canola petals and sclerotia.
Both of the genus inhibited radial expansion of hyphae of *S. sclerotiorum* through antibiosis which diffused through the agar and caused abnormal swelling of hyphae.

These strains are potential biological control agents against *S. sclerotiorum* and should be further studied and tested for sustainable management of stem rot disease of canola.

Contact: Mohd. Mostofa Kamal  
T: 02 6933 2749, E: mkamal@csu.edu.au

**Invasive plant success and multi-trophic level chemical ecology using Paterson’s curse as a model**

Invasive plant success and multi-trophic level chemical ecology using Paterson’s curse as a model

Congratulations to the Bioprotection and IPM research pathway team who recently received a prestigious discovery grant ($340,000) from the Australian Research Council to support additional work on Paterson’s curse.

The grant will be in effect from January 2013-2016 and was received by Professors Leslie Weston, Geoff Gurr and Ragan Callaway (ecologist, University of Montana, USA).

This study will consider multi-trophic interactions to assist in understanding why some plant species become exotic invaders, yet are present in low densities in their native habitat.

The study system is based on Paterson’s curse (*Echium plantagineum* L.), a native to the western Mediterranean area, that has become an economically serious invasive weed in temperate Australia. Paterson’s curse is estimated to cost the Australian agricultural industry over $125 million per year.

Paterson’s curse produces highly toxic pyrrolizidine alkaloids in the foliage, and recent studies of plant material collected in Australia has revealed that young roots produce large quantities of potently biologically active anthro- or napthoquinones in the outer layers of root periderm. The presence of these compounds has not been previously described in this species, but they are most likely involved in regulating plant defence mechanisms and interactions in the rhizosphere, including allelopathic effects on competing plants.

The key objectives of this proposal are to:

1. Study the production, regulation and direct effects of napthoquinones, including acetylshikonin, and 1,3 dihydroxy -3- methylanthraquinone in Australian and European populations of Paterson’s curse using LC/MS and GC/MS analyses and bioassays.
2. Quantify the effects of Paterson’s curse establishment and allelochemicals on competitors in Australian and European plant communities.
3. Assess the impacts of plant chemistry on above- and below-ground consumers (herbivorous arthropods including biological control agents) and their natural enemies.
4. Evaluate the genetic diversity of Paterson’s curse and closely related species both in Australia and in its native range (western Mediterranean).

Contact: Professor Leslie Weston,  
T: 02 6933 2429, E: leweston@csu.edu.au or  
Professor Geoff Gurr, T: 02 6365 7551, E: ggurr@csu.edu.au

**DNA barcoding assists species identification**

The agricultural community continually faces problems caused by onslaughts of crop affecting insect pests. The problem is now a major global concern - exotic pest outbreaks frequently emerge in major agricultural regions, causing extensive industry wide problems if not controlled at an early stage.

Rapid identification of insect pests at the early stages of an incursion is essential for biosecurity authorities to ensure rapid and appropriate mitigation schemes are implemented. Pest identifications are generally made by highly specialised taxonomists and based on specimen morphology. But morphological identification of many insect pests can be problematic, particularly when dealing with the immature stages of insects - the life stages that frequently damage crops, are most often intercepted by quarantine authorities and are the most difficult to accurately identify by traditional taxonomic methods.

DNA barcoding is a new technique that can provide rapid, accurate and repeatable identifications of most species, regardless of the life stage (Figure 1) or condition. Only small amounts of tissue sample, such as insect legs or eggs, are needed to accurately identify insects through their genetic make-up.
RESEARCH ACTIVITIES

In an attempt to improve and accelerate capacity for pest identifications and diagnoses, a centre for DNA barcoding and molecular systematics for genetic identification of economically important pests and pathogens was established by NSW DPI at Wagga Wagga Agricultural Institute. The facility was initiated in 2007 with funding provided by the NSW BioFirst Initiative, and is currently run by Dr David Gopurenko, who collaborates with specialist taxonomists to generate extensive DNA barcode libraries for genetic identification of a broad variety of insect pests.

Major projects completed or underway target economically important groups of biting midges, forest affecting moths, phloem feeding bugs and a variety of other important pests which are either endemic or exotic to Australia. In all these projects, DNA barcoding has identified novel species varieties and increased our understanding of evolutionary relationships within and among pest species.

Practical applications

DNA barcoding has immediate practical applications in biosecurity. Rapid detection of exotic species at countries’ borders and around commercial ports could facilitate suppression or even eradication of invasive species, saving many millions of dollars annually. The DNA barcoding facility at Wagga has on multiple occasions, provided accurate species diagnostics of suspected exotic pests found in northern Australia, to post-border biosecurity agencies operating in the country.

Looking to the future

A new project starting in 2013, funded by the Graham Centre, will proof DNA barcoding methods for identification of disease causing bacteria present in affected crops and vector insects which transmit the bacteria. Accurate species identifications and determination of disease competencies among vectors will inform management decisions where morphologically similar vector insects differ in some important aspect of their biology, such as host use, dispersal range and pesticide resistance.

Many other ecology applications of DNA barcoding can be exploited at the Wagga facility. For example, a New Initiative project, funded by the Graham Centre commencing in 2013, will use DNA barcoding to examine the species diversity of agriculturally important parasitoid wasps. These wasps, which act as bio-controls of crop affecting insect pests, are likely to contain complexes of morphologically cryptic species - with each species targeted to a narrow range of host pests. The DNA barcoding will identify unrecognised species diversity among these wasps, and defining their host preferences with much greater levels of accuracy.

The potential for new sequencing technologies to reduce the costs of DNA barcoding efforts will in some cases revolutionise the scale of analyses possible at the facility, and provide new avenues of enhanced research to investigate genetic and ecological processes relevant to agricultural and biodiversity research.

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

Environmental Impact on Biocontrol Agents and Secondary Chemistry of Paterson’s Curse

In an effort to gauge the impact of climate change on the distribution of weeds and insect biological control agents released for their management, Graham Centre researchers conducted a survey of Paterson’s curse and several biocontrol agents during the spring and summer of 2011-2012.

Figure 1: Genetic tree identifying morphologically ambiguous leafhopper nymphs.

Practical applications in biosecurity: Dr Kah Yaw Ee assists in the laboratory using DNA barcoding and molecular systematics for genetic identification of pests and pathogens. Photo: David Gopurenko.
The biocontrol agents included two species of weevils (the crown weevil and root weevil), an introduced flea beetle, and a lepidopteran leaf miner, all of which specialise on Paterson’s curse and were released 10-15 years ago.

The survey was conducted along three major transects running west to east in northern New South Wales (Broken Hill to Tamworth), southern NSW (Wentworth to Lithgow), and Victoria (Horsham to Corryong). About forty sites were visited twice, and at each sampling location were collected foliage and root samples of Paterson’s curse, soil, and insects present on the foliage and roots.

General site characteristics and GPS coordinates were recorded as well. Samples are still being processed, but early results show that the distribution of the biological control agents is not uniform.

Crown weevil tended to occur primarily in the north-eastern portion of the sample region, the flea beetle tended to occur in the central portion, and the leaf miner tended to occur in the west. The root weevil was found at very low abundance.

Additional sampling will help complete the picture of the distribution of the biocontrol agents.

Chemical analyses planned for the foliage and root samples includes quantifying pyrrolizidine alkaloids in the foliage and a novel group of napthoquinones recently discovered in the roots. The data will provide background information on the spread of insect biocontrol agents released for the management of Paterson’s curse, as well as the impact of climate and other factors on qualitative and quantitative aspects of secondary chemicals produced by this important weed.

Contact: Paul Weston  
T: 02 6933 4815, E: pweston@csu.edu.au or  
Professor Leslie Weston  
T: 02 6933 2429, E: leweston@csu.edu.au

Killer bean? Faba beans may help fight cancer

Compounds found in Nura and Rossa faba beans that may be lethal to some cancers have “astonished” a team of NSW scientists researching their health benefits.

Along with anti-cancer properties in faba bean extracts, the researchers also found effects that may have implications for treating hypertension and maintaining healthy weight.

Dr Siem Siah applied phenolic compounds from Nura and Rossa faba beans to five different cancer cell lines in laboratory experiments at the CSIRO Animal, Food and Health Division in North Ryde during a doctorate she has now completed.

The findings were published recently in the British Journal of Nutrition.

“Our findings proved that faba bean extracts possess high anti-oxidant properties, so we tried to look for the connections to anti-cancer properties,” said Ms Siah.

Dr Siah conducted most of her PhD work at Charles Sturt University (CSU) Wagga Wagga, where her supervisor Dr Chris Blanchard from the School of Biomedical Sciences said the team was astonished by the findings from experiments on anti-cancer and enzyme-inhibiting properties.

“We were absolutely blown away by the results,” Dr Blanchard said.

Department of Primary Industries chemist Dr Jennifer Wood co-supervised Dr Siah’s PhD and Dr Izabela Konczak at CSIRO oversaw her experiments.

The Grains Research and Development Corporation funded the research.

In plants, phenolic compounds are chemicals largely responsible for colour, metabolism and defensive mechanisms. Because they play a strong protective role against insects, they are often found in seed coats and hulls.

Dr Siah grew cultures of four cancer cell lines - bladder, stomach, liver and colon cancers - in flasks, then applied the phenolic compounds to them directly and waited 24 hours to measure the proliferation of cells.

In all cases the rate of cancer cell multiplication was prohibited once the faba bean extracts were applied.

For a fifth type of cancer cell, acute promyelocytic leukemia, Dr Siah applied a method called flow cytometry.

Dr Wood says the experiment yielded an insight into the mechanism that inhibited the cancer cell multiplication.

Helping to fight cancer: As well as having anti-cancer properties, faba beans also have implications for treating hypertension and maintaining healthy weight. Pictured, DPI Chemist, Dr Jennifer Wood in a faba bean crop at Tamworth.
“Normal healthy cells are programmed to multiply, grow and die (cell death is called apoptosis),” Dr Wood said.

“On the other hand, cancer cells evade the process of apoptosis, continue to proliferate and become tumors.

“However, this work showed faba bean phenolics induced normal cell death in the cancer cells.

“Conversely, the extracts had no effect on the proliferation of normal human colon cells tested, a very favourable outcome.”

Additional experiments on the interaction with important human enzymes showed that phenolic extracts from faba beans inhibited angiotensin converting enzyme (ACE), a common target of pharmaceutical medication for hypertension.

These compounds also inhibited the action of the digestive enzymes alpha-glucosidase and lipase, which could mean slower digestion (and therefore a longer feeling of being full after a meal) and lower sugar and fat absorption by the digestive system.

Dr Blanchard says several avenues could be pursued to build on these findings and look for therapeutic human health applications, if funding becomes available.

“One is to generate large amounts of these extracts and undertake feeding trials to see if we can directly use extracts as a natural product to improve health outcomes,” he said.

“Or we could drill down further and find the exact compounds involved in these activities, synthesise them and have them approved for pharmaceutical use.

“Or we could do further testing in human trials, incorporating faba beans in diets to demonstrate exactly what happens when we consume them over a long period.”

Dr Siah’s project also dispelled a long-held theory that more colourful beans always contain more anti-oxidants.

Rossa is a bright red bean while Nura, one of Australia’s major commercial faba beans, is a light buff colour but her earlier findings showed both varieties contained equal amounts of anti-oxidants.

Dr Siah is now employed as a research scientist with GrainGrowers in Sydney.

Contact: Associate Professor Chris Blanchard
T: 02 6933 2364, E: cblanchard@csu.edu.au
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Greenhouse gases and liming

Net gains we make from carbon sequestration in acidic soils might be largely offset by carbon releases due to liming.

Mark Conyers, a Department of Primary Industries (DPI) principal research scientist based at Wagga Wagga Agricultural Institute, has just published a paper: Three long term trials end with a quasi-equilibrium between soil Carbon, Nitrogen and pH: an implication for C sequestration.

Limestone promotes plant growth in acidic soils and therefore increases the potential for organic matter (and carbon) to be added to soil as sequestered carbon.

The accumulation of C in soils is in turn associated with the lowering of soil pH (increasing acidity), so limestone is needed to maintain agricultural productivity.

“However, limestone contains geologically sequestered carbon,” said Dr Conyers.

“The reaction of limestone with soil acids releases carbon dioxide.

“For every tonne of limestone that reacts with soil, 440 kilograms of CO₂ is released, equating to 120 kg C.

“Further, liming promotes the activity of a wide range of soil microbes, in turn breaking down soil organic matter and releasing CO₂.

“Finally, the C cost of mining, milling, transporting and spreading limestone has to be factorised in to the calculations of net carbon benefit,” Dr Conyers said.

Therefore, on one hand liming promotes plant growth and the potential addition of organic C to soil, while on the other it releases large quantities of CO₂ to the atmosphere, both directly through its reaction with soil and indirectly via its production and distribution.

Contact: Dr Mark Conyers
T: 02 6938 1830, E: mark.conyers@dpi.nsw.gov.au
Acknowledgement: This article has been reproduced with permission from NSW DPI’s Agriculture Today.
Setting priorities and targets for 2013
The Ruminant Feedbase group met recently to discuss current activities and future directions. Activity amongst members was high with most heavily committed to their capacity, in related research.

Research project areas included farming systems and crop/livestock integration, forage crops, forage conservation, grazing systems, new legume species, feed testing, omega fatty acids and sheep reproduction, feed testing and basic ruminant nutrition/feed evaluation research.

The group endorsed previous activities and planned activities and projects, determined to support and proceed with research in these areas. Most members have continuing projects, are finalising projects and writing up and actively seeking new projects of some combination.

The group categorised research activities under three key areas/themes:
1. Integration of crop/livestock in the mixed farming zone was identified as the priority area for this group. This includes several component research subsets that the group is and should remain involved with — forage crops, new annual legumes, forage conservation (including weeds), grazing, perennial legumes/grasses.
2. Basic feed evaluation and ruminant nutrition research.
3. Nutritional effects on reproduction - sex linked effects.

Contact: John Piltz
T: 02 6938 1839, E: john.piltz@dpi.nsw.gov.au or
Associate Professor Gavin Ramsay
T: 02 6933 4795, E: gramsay@csu.edu.au

Targeting animal health and welfare
Members of the recently formed Animal Health and Welfare Research Pathway met at CSU.

This Research Pathway was formed during 2012 and the meeting provided an excellent opportunity for everyone to review member activities and interests. There is strong activity and member expertise in the livestock welfare, epidemiology, biosecurity, toxicology, parasitology and livestock production areas.

The group also discussed early priorities and plans for the pathway from 2013 onwards. Pathway members identified initial key priorities of interest for research teams from 2013 onwards including Johne’s Disease, perennial ryegrass toxicity, livestock supply chain welfare, lamb mortality prevention, diagnostics and therapeutics and biosecurity and emergency animal disease prevention. A research team is also going to investigate the development of an intensive animal production stream.

Initial investigations will be well supported by three New Initiative Grants, three Summer Student Scholarships and two Honours Scholarships, with the long term aim to expand into larger scale funding. Good linkages with the Ruminant Feedbase, Entomology and Sociology teams will also be developed further.

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

Informal milk value chains in Punjab of Pakistan - a small-holder dairy farmer’s perspective
The dairy sector in Pakistan offers enormous scope for economic growth and poverty alleviation. The country is the sixth most populous nation in the world and has a high population growth rate and strong rural-urban migration trend. Pakistan is also one of the top five milk producing countries in the world, though the yields per animal are very low, but the number of livestock is high. Of the country’s estimated 28 million households, nine million rear buffalo (62% of total milk production) and cattle (35% of total milk production) and 90% of these households have less than 10 animals.

The majority (97%) of milk produced goes to consumers through traditional informal value chains that can be characterised as those operating with minimal cool chain infrastructure and technology. But development strategies have not been able to tap the pro-poor potential these chains offer, targeting instead high profile processors. These large scale processors service only the most accessible and larger farmers without considering the predominant population of small-holder farmers.

Graham Centre PhD student Sosheel Godfrey is conducting research under the auspices of an ongoing project, funded by the Australian government, to support the small dairy holders. His research explores key attributes of traditional chains and the opportunities and risks associated with their evolution and potential to assist the profitability of small farmers, contributing milk production and supply to consumers.

The rural-urban milk value chains are characterised by the collection of milk on farm, and selling this to a primary milk vendor (a dhodi). The milk is then on-sold to 2-3 larger milk vendors in a chain who collect and transport the milk to commercial retail outlets in large urban centres. During these transfer processes, milk may be diluted to ensure each vendor is able to make a profit from their transactions. Milk is sold either by volume or weight, since the density of milk...
is greater than that of water there is a small incremental profit that accumulates with these transactions. The volumes of vessels used for the assessment of payments are also not standardised.

In order for these chains to survive it is imperative the quality of product reaching the consumer is improved to meet acceptable standards. Failure to do so will result in their demise as consumers pursue alternative sources of milk they can rely on.

Increased competition from corporate producers and associated supermarket chains will hasten their collapse, with only the most efficient chains producing high quality milk, with products likely to persist. The Graham Centre team will be working to assist them through an ACIAR funded small-holder dairy extension program.

Contact: Sosheel Godfrey  
T: 02 6933 2959, E: sgodfrey@csu.edu.au

Recent Publications

Conference papers


Journals


Books


My main project at the moment is ... Developing a training programme for the live export industry. In an initiative funded by MLA, I am working with a team of people to develop a training package that teaches people in the supply chain about animal welfare. This programme has been developed for animal welfare officers and general staff of trucking companies, feedlots and abattoirs. It teaches them about animal handling and how to improve welfare during transport, feedlotting and slaughter. I ran a pilot trial of this programme for cattle in Indonesia during October, 2012. In February I will be going to the Middle East to do the same thing for the sheep programme.

My favourite part of my job is ... the variety in my day-to-day activities - while all of my research and teaching is focused around the one area, I really love that I can be doing research on cattle welfare one day and teaching students about it the next.

When I am not in the office I like ... eating Asian food and travelling.

When I am driving I like to listen to ... the radio - either the ABC or Triple J. I really love Conversations with Richard Fidler, but I also can’t stop listening to the Black Keys at the moment.
Dr Harsh Raman

Position: Principal Research Scientist (Molecular Biology)

Organisation: NSW Department of Primary industries

Career Brief

I completed my PhD at the Punjab Agricultural University (PAU), Ludhiana, India in 1990 and migrated to Australia in 1995. I worked as a Visiting Scholar with the University of Sydney until February 1996 on genetic transformation in apple with Dr Peter Goodwin. I joined NSW Agriculture (now NSW DPI) in 1996 and undertook and managed research projects in barley, common wheat, and durum. Currently, I am leading the Australian Canola Molecular Marker Program (2008-13) which aims to deliver molecular markers associated with resistance to blackleg, shatter and drought to the Australian canola breeding programs. This project is funded by GRDC, NSW DPI and the University of Queensland.

Research activities

Molecular research includes genome mapping, identification of genotype-phenotype associations, comparative mapping, validation of molecular markers to test their usefulness in crop improvement programs, analysis of genetic diversity, characterisation of germplasm for agronomic traits and the development of technologies amenable for high throughput marker screening.

Teaching activities

I have taught biotechnology courses to post-graduate students in PAU. I supervised research students enrolled at CSU and University of Tasmania. Currently, I co-supervise molecular research of Mr Xiaocheng Zhu (PhD student), Mr Brett McVittie (MSc Student) and Ms Cina Zacharia (MSc Student).

Professional Links

- Previous member of AIAST
- Society of Biology

A typical day for me includes … observing experiments, recording data, analysing and interpreting results, communicating with collaborators, planning research, writing research papers, watering and stop watering plants …

My main project at the moment is … the development of molecular markers for application in Australian Canola breeding. This project requires extensive phenotyping, genetic analysis of canola lines with a range of molecular markers, interaction with other project participants that are based in Wagga and the University of Queensland and overseas collaborators. As a team, this project has developed a suite of molecular markers associated with different genes involved in blackleg and shatter resistance, and made them available to the canola breeding programs.

My favourite part of my job is … working with people to achieve target outcomes.

When I am not in the office I like … to visit experimental trials, talk with other collaborators such as Biometricians and other people (office staff) who make life so easy!

When I am driving I like to listen to … ABC radio, instrumental and bollywood songs.

Harsh Raman in the The Sedlec Ossuary (UNESCO listed site, Kutna Hora, Czech Republic) containing the skeletons of between 40,000 and 70,000 people, whose bones have in many cases been artistically arranged to form decorations and furnishings for the chapel.
## Events Calendar 2013

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<th>Date</th>
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<tr>
<td>13 Feb</td>
<td>Graham Centre Stubble Research Technical Forum</td>
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<td>28 Feb</td>
<td>Australia India: Partners in Research and Innovation Business Briefing</td>
<td>Sydney</td>
<td>Sandra Johansson, Ph 02 8246 7412, E: <a href="mailto:sandra@roxbymedia.com.au">sandra@roxbymedia.com.au</a></td>
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<td>5-6 Mar</td>
<td>ABARES Outlook 2013 - future food, future farming</td>
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<td>26 Mar</td>
<td>FarmLink AGM</td>
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<td>18-22 Aug</td>
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<td>4 Sept</td>
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### Autumn Edition of the Innovator
The Autumn Edition of the Innovator will be available April 2013. Submission of articles for this edition closes on **Friday, 15 March 2013**. Please email articles to Toni Nugent or Sharon Kiss.

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### Innovator Contacts

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<tr>
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<tr>
<td>Deirdre Lemerle</td>
<td>(02) 6938 1667</td>
<td><a href="mailto:dlemerle@csu.edu.au">dlemerle@csu.edu.au</a></td>
</tr>
<tr>
<td></td>
<td>M 0419 816 267</td>
<td></td>
</tr>
<tr>
<td>Toni Nugent</td>
<td>(02) 6938 180</td>
<td><a href="mailto:tnugent@csu.edu.au">tnugent@csu.edu.au</a></td>
</tr>
<tr>
<td></td>
<td>M 0418 974 775</td>
<td></td>
</tr>
<tr>
<td>Sharon Kiss</td>
<td>(02) 6938 1803</td>
<td><a href="mailto:sharon.kiss@dpi.nsw.gov.au">sharon.kiss@dpi.nsw.gov.au</a></td>
</tr>
</tbody>
</table>

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Our Location:
Wagga Wagga Agricultural Institute
Department of Primary Industries
Pine Gully Road
Wagga Wagga NSW 2650 Australia

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