Good prices for sheep and cattle this year have provided a much needed boost for producers. Winter crop planting was aided by some good widespread rain across the region, and as I write this there has been some useful follow up rains across much of southern Australia. While Bureau forecasts are for an el Niño event in spring, producers have become skilled at managing dry springs when they do eventuate, and using the latest outcomes from research, whether that be crop and pasture cultivars adapted to dry finishes, or animals selected for higher growth rates, have become an important part of adapting to the variable climate.

A key theme for our upcoming Sheep (Friday 10 July) and Beef forums (Friday 14 August) is managing a profitable business. The committees for this year’s forums decided to break from the traditional approach of presenting the latest R&D from the Graham Centre (although there are a couple of presentations that do highlight some recent research) in favour of this year’s themes. Given the increasing interest in sheep and beef enterprises, the topics and speakers were chosen to highlight the important issues to consider in running a profitable sheep or beef enterprise. We hope to see you at these forums and look forward to your feedback.

Recently we met with Dr Mirjana Prica and Peter Shultz from Food Industry Australia Ltd (FIAL). FIAL have been established as one of the Government supported Industry Growth Centres, which aim to drive innovation in key industries, of which food and agribusiness is one. A key role of FIAL is to work with industry to establish innovation opportunities, and encourage industry to partner with research providers and others to work on these innovations. FIAL were clearly impressed with the breadth of our research and training activities, and our close links with both farming systems groups and grains industry companies (through the Functional Grains Centre). Our efforts to establish and foster links with industry sets us in good stead as the Government continues its push to strengthen industry links with research and training providers.

This year the University will review all the research centres, with the nature of the review being similar to the last review some five years ago. The review will focus on whether the objectives of a Centre aligns with the Universities’ research narrative, the performance of continued on page 2
the centre (publications, research income, esteem and industry impact), as well as the Centre’s management. The review will rely on material provided by the Centre, data held by the University, and other submissions. Given the performance of the Graham Centre over the past five years (since it was last accredited), I am very positive regarding the likely outcome of the review. I’d also welcome your independent submissions to the process - we will advise when the call for these is made.

There have been some significant changes at CSU in research leadership of late. Earlier this year, the Research Director, Andrea Bishop resigned to take up a similar position at Griffith University. Alain Deloire and Frank Marino have been sharing the role of Acting Director since Andrea’s departure, and a substantive replacement is expected to be announced shortly. Recently, Sue Thomas resigned as Deputy Vice-Chancellor (Research) to take up a Provost and Deputy Vice-Chancellor at UNE. Dr Mary Kelly has been appointed as Acting Deputy Vice-Chancellor (Research, Development and Industry) at CSU, with a redefined portfolio to reflect the importance to the University of engaging with industry. Having worked with Mary on several initiatives over the past few months in her capacity as Director of Major Grants and External Links, I look forward to continue working with her. I’d also like to take this opportunity to thank both Andrea and Sue for their substantial contributions to CSU over the years, and wish them well in the future.

On that note, while this is my first column as Acting Director, it will also likely be my last, as by the time of the Spring edition, the new Director should be in place. I have enjoyed my brief stint as Acting Director, and look forward to a bright future for the Centre.

Our most recent member of the Industry Advisory Committee, Cindy Cassidy (CEO of FarmLink), was recently announced as NSW Rural Woman of the Year. Congratulations Cindy on an outstanding achievement!

In this edition of the Innovator you will see an insert from the Functional Grains Centre (FGC). Given the significant level of activity within the FGC, it was deemed timely to include a regular insert from the FGC in the Innovator, so you will see this insert continued in future editions.

I trust you will enjoy reading the Winter 2015 edition of the Innovator.

Associate Professor Michael Friend

SEEDS
I hold a forest
In my hand
A meadow a
Garden a
Field
Of wheat
Potential there
Asleep
Travellers
Through time
And space
Waiting patiently
The world to
Embrace
Place them
Lovingly in
The soil
And watch them
Transform
Rain
Wind
Soil
Sun
Magical life
Powered by
The light
Of a
Star
By Dr John Harper
Students role up their sleeves to test out agriculture

Almost 200 agriculture, primary industries and science students from across the Riverina converged on the Graham Centre on Friday 12 June for the Centre’s annual Science and Agriculture Enrichment Day.

Since the first Graham Centre Science and Agriculture Enrichment Day in 2006, high school students have received an insight into the work of agricultural and veterinary scientists. The day gives student’s hands-on experience working with researchers from Charles Sturt University and NSW Department of Primary Industries in 45-60 sessions.

This year gained hands on experience in four workshops looking at animal production systems around the globe; problem plants and fierce fungi friends; the wonderful world of parasites and the history of fuels - from caveman to fuel cells.

With the current skills shortage in agriculture escalating, this day provides a great opportunity for students to see the science in action, encouraging them to consider a future career in the agricultural supply chain.

Contact: Ms Toni Nugent
E: tnugent@csu.edu.au; T: 02 6933 4402

Platypus disease on the program at Human and Animal Mycology Conference

The International Society for Human and Animal Mycology (ISHAM) is a world-wide organisation that represents all clinical scientists and fundamental researchers with an interest in fungal diseases and fungus-like infections. ISHAM was founded in 1954 with 150 members and has subsequently expanded to become an international body representing more than 1000 individuals who work professionally with fungal diseases and pathogenic fungi.

Graham Centre member Joanne Connolly was an invited speaker at the 19th ISHAM Congress in Melbourne, 4-8 May 2015, hosted by the Australian New Zealand Mycology Interest Group (ANZMIG) of the Australasian Infectious Diseases Society (ASID). The meeting was opened by the Lord Mayor of Melbourne Robert Doyle and the ASID President Professor Cheryl Jones. The opening plenary by Professor Sarah Gurr, Chair in Food Security at Exeter University, seamlessly linked environmental, food safety, agricultural and medical mycology.
Six hundred and sixty seven delegates from 48 countries attended the congress and pre-congress workshops as part of the Mycology Masterclass. There were four parallel session themes within the mycology program: clinical, translational, health, and basic science, featuring 323 oral presentations in 36 symposia, and 439 posters, showcasing high quality original research and state of the art reviews. Workshops included topics such as MALDI-TOF, histopathology, therapeutic drug monitoring, antifungal susceptibility testing and infections in the immunocompromised host.

Dr Connolly presented a seminar on ‘Mucormycosis in the platypus and amphibian’ in the Veterinary Mycology session chaired by Seyedmojtaba Seyedmousavi from The Netherlands and Mark Krockenberger from Australia. Mucormycosis in the platypus and the anuran (frogs and toads) is a serious fungal disease affecting these aquatic taxa. *Mucor amphibiorum* infection causes significant morbidity and mortality in free-living platypuses in Tasmania. Infection has also been reported in free-ranging cane toads and frogs from mainland Australia, but not confirmed in platypuses from the mainland. The seminar reviewed mucormycosis in the platypus and anuran, including consideration of the clinical, epidemiological, pathological and diagnostic features.

The research was supported by the Graham Centre and was carried out in conjunction with Tasmanian wildlife pathologist David Obendorf, Ben Stodart, Gavin Ash and Natalie Allison, CSU, and Professor Paul Canfield, Sydney University. A special edition of *Microbiology Australia* and *The Veterinarian* promoting mycology in Australia and containing an article on mucormycosis by Dr Connolly was published ahead of the ISHAM conference (http://microbiology.publish.csiro.au/).

Dr Connolly also attended the meeting of ISHAM-Veterinary Mycology Working Group (ISHAM-VMWG), which currently has more than 70 members from over 25 countries. Participation in this working group is open to everybody who is interested in joining this international network on the area of veterinary mycology.

Dr Connolly said it was a great international scientific meeting and she is looking forward to participating in the ISHAM Veterinary Mycology Working Group (ISHAM-VMWG) and attending the 20th ISHAM Congress, 2-6 July 2018, Amsterdam in The Netherlands.

Further important items about ISHAM can be found on the websites listed below:

http://www.isham.org/index.html

http://www.veterinarymycology.org/

Contact: Dr Joanne Connolly
E: jconnolly@csu.edu.au; T: 02 6933 2218

Exiled in the bush: a history of landscape transformation in post-settlement Australia

Botany Bay, the intended site of the first European settlement in Australia, has been described as a ‘landscape of encounter’ - an encounter not only between Indigenous Australians and European colonisers, but also between colonisers and the bush. The Australia that confronted the settlers was alien and untamed, a far cry from the pastoral English landscape they had left behind. In part, the history of the development of Australia is the history of this confrontation, between a European aesthetic and a sometimes harsh Australian reality. More generally, the history of development in Australia is the history of demographic and socioeconomic change. The bush has been viewed not as a set of ecosystems to be preserved, but as an object to be transformed to meet the needs of its inhabitants, or as the raw materials from which an economic machine could be constructed. The history of landscape transformation in post-European Australia can be divided roughly into four eras:

- **The era of exploitation** begins with the landing at Botany Bay and continues into the 19th century. It represents a period of unrestrained expansion.

- **The era of acclimatisation** belongs to the free settlers who followed. Feeling themselves ‘exiled in the bush’, they sought to sculpt the land into an image of their former homes.

- **The era of economic conservation** reflects a conflict between expansionism and an increasing awareness of the uniqueness and (principally economic) value of the native flora and fauna.

- **The modern era** represents an ambivalence about the bush, a struggle between the need to conserve the bush and the desire to fully exploit its economic resources.

It should be noted that these era changes are not paradigm shifts. Each new era did not make extinct the ethos of the previous era. They only reflect a change in emphasis.
By surveying Australia’s environmental history in this way we can uncover the drivers of change in attitudes towards the environment, providing a context and perspective for future change.

Contact: Dr Peter Orchard
E: porchard@csu.edu.au

Editor’s note: This abstract is taken from the paper Peter Orchard and David Orchard (NSW DPI) presented at the Nature Conference, Massey University, New Zealand, 10-11 April, 2015.

Graham Centre Sheep Forum
Friday 10 July 2015 | 9.00am – 1.00pm (8.30am for 9.00am start)
Charles Sturt University Convention Centre, Wagga Wagga

How many sheep are out there and why this matters
Andrew Woods (Independent Commodity Services)

Planning a profitable sheep enterprise
Sandy McEachern (Holmes Sackett)

Producer case study: Pushing the boundary of merino genetics (the composite approach)
Tim Mullholland (Swan Hill)

Biosecurity of the ovine persuasion
Louise Pearce (Livestock Biosecurity Network) and Tim Biffin (Local Land Services Riverina)

Producer case study: Contract ram breeding and wool handling
Michael Field (Jugiong)

Hard-seeded legumes – their fit in mixed farming systems
Belinda Hackney (Charles Sturt University) and Mike O’Hare (Beckom)

Register now!

$25 per person
Pre-pay at: www.trybooking.com/HROF
or pay on the day. Includes morning tea and lunch.

RSVP by 3 July 2015
www.grahamcentre.net
Toni Nugent: sfd@csu.edu.au | 02 6933 4402
A ripping good yarn

There are large areas of cropping land within southern NSW that commonly achieve grain yields far below their yield potential as a result of chemical and physical subsoil constraints. One technique that has been identified as potentially suitable to overcome these constraints is the deep incorporation of organic amendments. This technique, although untested on soils across southern NSW, has shown promising results in terms of crop yield increases and economic viability in studies conducted on the dense sodic-clay subsoils of southern Victoria.

Mathew Dunn is a fourth year Agricultural Science Honours student investigating the changes in soil physical and chemical properties following the deep application of organic amendments into a hostile, poorly structured subsoil of southern NSW. Mathew’s project will examine the influence of these changes on crop development and yield.

A field based experiment was developed by the Holbrook Landcare Network with Dr’s Jim Virgona and Jason Condon in early 2014. The site is located near Holbrook in the high rainfall zone (690 mm average annual rainfall) of southern NSW, on soils that display poor subsoil structural stability, low permeability and poor root exploration. Treatments were chosen based on previous research conducted in southern Victoria and comprised of a control, deep ripping to a depth of 50 centimetres, ripped plus lime and ripped with either pig manure, chicken manure or garden compost. The treatments were applied in April 2014.

In 2015, the field based experiment site was sown to canola and is now part of a GRDC funded project involving a team from the Graham Centre led by Dr Guangdi Li (NSW DPI). A number of measurements and observations are being taken to determine the soil and crop response to treatments. These will include a suite of chemical and physical analyses, crop biomass and grain yield measurements.

Mathew has been awarded a Holbrook Landcare Network Scholarship administered through the Graham Centre to support his honours research project for 2015. His project is supervised by Dr Jason Condon (Primary supervisor, CSU) and Dr J Sergio Moroni (Co-supervisor, CSU).

Mathew has found his honours year enriching and engaging and is looking forward to the future challenges and experiences his research will bring. He would also like to thank the Graham Centre and the Holbrook Landcare Network for their continuing support and funding.

Contact: Mr Mathew Dunn
E: madunn@csu.edu.au

Endeavour fellowship boosts entomology bioprotection research

Dr Jakub Baranek is working with Professor Gavin Ash and his team at CSU, Wagga for the coming five months as part of his 2015 Endeavour Research Fellowship.

Dr Baranek is from the Department of Microbiology, Faculty of Biology at Adam Mickiewicz University, Poland.

While at CSU he is working on a project looking at a set of *Metarhizium anisopliae* isolates that will be screened to search for genes encoding virulence factors active during pathogenesis of the fungus in insects.

Initially, *M. anisopliae* strains from the CSU collection were isolated from different habitats and locations in Australia. Methods used to isolate the fungi include ‘mealworm bait’ and sample dilution methods.

A set of primers needed for PCR screening reactions will be designed on genes encoding putative effector proteins or degradative enzymes deduced from whole genome sequence analysis of *M. anisopliae* BRIP 53293 EFD69 55C31 (Ma69) from previous work (Pattemore et al, 2014). A second set of primers will be designed on genes that are estimated to be extensively up-regulated during insect pathogenesis in *Tenebrio molitor* (mealworm) caused by the fungus (unpublished data).
Based on the results of screening tests, a number of effector genes will be selected and deleted from *M. anisopliae* genome. The gene knockout will be performed using sequence specific CRISPR/Cas9 system. The *M. anisopliae* negative mutants (lacking single effector genes or genes deleted in combinations) will be created.

The role of the selected genes in pathogenesis will be determined by bioassays. Insecticidal activity of *M. anisopliae* wild strain and the negative mutants will be determined towards *T. molitor* imago, and statistical differences will be computed.

Although basic in nature, this research will have implications for the selection of virulent strains of *Metarhizium* for the management of a range of insect pests in Australia, and will contribute to our knowledge of the virulence of these fungi.

Contact: Dr Jakub Baranek
E: jbaranek@csu.edu.au

Impact of parasites on buffalo

Thomas Williams recently commenced his PhD studies looking at the impact of parasites on buffaloes. Buffalo supply milk, meat and draught power in many Asian countries, are often the sole asset of farmers, and are utilised as a source of security. Heat and tick tolerance makes the species desirable in many tropical and subtropical regions.

Buffalo milk is highly valued in sub-continental countries. It has higher fat and lactose percentages compared to cow’s milk, making it also increasingly popular for the production of gelato and cheeses.

Pakistan’s dairy sector is of high value to the developing nation. Globally, it is the fourth largest dairy producer and currently provides jobs to 42 percent of the population. Milk produced from buffaloes provides a highly valued and complete source of nutrients for a hungry nation. With buffalo making up 62% of Pakistan’s 62.9 million strong milking herd and contributing 67% of milk production, the importance of buffalo to the Pakistani dairy system becomes apparent.

Pakistan’s current livestock research is primarily focused on cattle. Because of this, literature elaborating on the parasitic impact in buffalo production is few and far between. The economic impact parasites have in developed agricultural regions portrays the importance of a thorough investigation in the developing world.

Australian buffalo production is an evolving industry with livestock numbers increasing annually. Due to the relatively young age of the industry, there is little information regarding the prevalence and impact of parasites on Australian buffalo. International publications have identified a number of recurring parasite species that utilise buffalo as hosts, and many of these species are multi-host and endemic to Australia. With sheep and livestock acting as perpetuate reservoirs of infection, it is hypothesised that Australian buffalo host a variety of parasitic species that are also detrimental to buffalo production.

Thomas’ research aims to:
- Identify parasites found in Australian buffalo through the use of morphological and molecular methods.
- Determine the species that have most impact.
- Determine pharmacokinetic factors of readily available parasiticides in buffaloes.
**INNOVATOR** WINTER 2015 [www.grahamcentre.net](http://www.grahamcentre.net)

**RESEARCH ACTIVITIES**

- Develop a parasite control and management strategy for Pakistani and Australian farmers.

Thomas’ PhD supervisors are Dr’s Shokoofeh Shamsi and David Jenkins, with considerable support from David McGill.

**Contact: Mr Thomas Williams**
**E:** twilliams@csu.edu.au

**The erosion risk of incorporating stubble to increase soil organic carbon**

In recent years, researchers of the Graham Centre have been involved in a DAFF funded project that evaluated the incorporation of crop stubble with added fertilisers and how this could potentially enhance the carbon sequestration. Obviously the move back to tillage to allow incorporation of stubble was a concern to farmers who have witnessed the structural benefits of no till systems. Many of the farmers involved in the research asked the question ‘will the incorporation of stubble damage the soil structure that we have built up over the years and increase the erosion risk of the soil?’

The question posed by farmers is the focus of a study conducted by Gregory Lord, a fourth year Bachelor of Agricultural Science Honours student at CSU. Gregory is investigating changes in soil structural stability and erosion risk of soil that has been cultivated to incorporate stubble with fertiliser.

The project has utilised the existing grower field trial established at the Graham Centre field site as part of the DAFF funded ‘Enabling Landholders to Adopt Profitable and Sustainable Carbon Cropping Practices’ project. The replicated treatments included a control of no stubble incorporation, and stubble incorporation with or without added fertiliser. Samples were taken to determine the treatment effects on soil carbon fractions and aggregate stability. Erosion risk was examined using a rainfall simulator in a series of 1 m² plots that enabled runoff and sediment load occurring in a 1 in 50 year storm intensity, which was determined from local weather records.

Results to date indicate that incorporation of stubble produces no greater erosion risk then stubble retention in a no-till system. This result in the field may be the result of the relatively good structural health of the soil due to years of stubble retention and pasture rotation. So based on this work it would appear that stubble incorporation is a relatively safe option in the short-term. Long-term studies would be required to determine if frequent implementation of stubble incorporation will eventually change the erosion risk.

Gregory has been awarded a GRDC Undergraduate Honours Scholarship and a top-up scholarship from the Graham Centre to support his Honours research in 2015. His Honours research is supervised by Dr’s Sergio Moroni (Main Supervisor, CSU), Jason Condon (Co-Supervisor, CSU) and Iain Hume (Co-Supervisor, NSW DPI).

Gregory has found his Honours experience challenging and rewarding. It has stretched his ability not only to understand research but also to apply it in a meaningful way. The Graham Centre has been a big support to Gregory through the top-up operating scholarship, allowing him to use the Centre’s resources and giving him access to some members expertise.

**Contact: Gregory Lord**
**E:** glord@csu.edu.au

**Solving salinity in the Mekong Delta region of Vietnam**

Brooke Kaveney is a fourth year Bachelor of Agriculture Science (Honours) student completing her honours project on soil salinity in the Mekong Delta region of Vietnam. Brooke is originally from a cropping and prime lamb production farm near Young but will spend the next six months in Vietnam studying methods of salt removal from in rice-shrimp farming systems.

The Mekong Delta region in Vietnam is a prominent rice producing area exhibiting two climatic seasons; the wet season (May to November) where approximately 90 percent of the 1800 millimetre annual rainfall occurs, and the dry season (December to April). Land use in the Mekong has been dominated by rice monoculture in the dry season, however changes in rainfall patterns have caused saline intrusion from nearby oceans. This has caused some rice production areas to become unsuitable for cropping. Farm diversification into a rice-shrimp system is becoming a common farming practice implemented by farmers to avoid income losses during periods of high salinity. The saline water during the dry season is suitable for shrimp to be...
grown intensively in ponds and extensively in small ditches surrounding rice paddies. Farmers rely on monsoon rains at the beginning of the wet season to flush the salts from the rice paddies in order to grow a single crop of rice. This technique is referred to as dilution, as salty water on the rice paddy is removed from the platform into the surrounding ditches and replaced with fresh rainfall. This washing process is repeated in an attempt to decrease the salt concentration via dilution until conditions are suitable for rice growth. The dilution technique is proving ineffective at sufficiently decreasing the soil solution salinity, thus rice crop failure due to salinity is common. It is hypothesised that inducing conditions that enhance leaching may act to better lower the salinity.

The aim of Brooke’s research is to test the electrical conductivity of ponded water and soil solution at various soil depths to determine the effectiveness of two different methods of salt removal (leaching and dilution) from a soil profile. The experiment will be performed in a farmer’s rice field near Ca Mau in the Mekong Delta region of Vietnam. The dilution technique will be used as a control that represents the current saline management technique used by rice farmers, as described above. The leaching technique will use dirt bunds (small square dams) built on the paddy fields to capture rain water, and will maintain a lower water height in the surrounding ditches. The fresh water within the bunds provides a constant hydraulic head to facilitate leaching of salt down the soil profile to the lower water levels in the ditches. Water outside the bunds will then be removed to drainage canals.

The experiment commenced on Brooke’s arrival in Vietnam (6 June, 2015) and will continue over the duration of the wet season. It will be conducted as part of an existing ACIAR trial being led by Dr Jason Condon. A laboratory pot experiment is currently being conducted under controlled conditions at CSU to test the hypothesis, which will then be validated in the field experiment.

Results to date indicate the leaching method facilitates the downward movement of salt in a soil profile whereas the dilution method does not. The project is funded by the Graham Centre and conducted under the supervision of Dr’s Jason Condon, Sergio Moroni and Greg Doran.

Brooke would like to sincerely thank the Graham Centre for their continued assistance towards honours students and also thank her supervisors for their continual support.

Contact: Ms Brooke Kaveney E: bkaveney@csu.edu.au

Progress towards biological control of sclerotinia diseases

*Sclerotinia sclerotiorum*, the causal organism of stem rot of canola and over 500 host plants is distributed worldwide. Canola production has been threatened by this yield-limiting disease in Australia. Recently it has been reported the pathogen causes potential threat to canola production around the wheat belt region of Western Australia.

In Kingaroy, Queensland, grain and peanut growers are tackling the scourge of sclerotinia head on with new trials testing a series of fungicides and soil ameliorants to combat the devastating soil-borne fungus. Julian Cross, a farmer from Kumbia, QLD says the damage from the disease ranges from 20-30% yield losses in an average year, up to 100% crop wipe out in very wet years. Sclerotinia stem rot disease causes yield losses in Canola as high as 24% under Australian conditions, with annual losses estimated to be $39.9 million.

Infection occurs on canola leaves, stems and pods at different developmental stages and significant reductions in oil content and quality have been documented. The initial mycelial infection at the base of the stem looks like elongated water-soaked lesions that expand rapidly. Ascosporic infection through carposporic germination is common and occurs on the leaves or leaf axil. Effective pathogenesis by *S. sclerotiorum* requires the secretion of pathogenicity factors including oxalic acid and extracellular lytic enzymes. Germination of overwintered sclerotia, and release, survival and germination of ascospores are important factors for the development of disease and the lifecycle of this pathogen.

Management of *S. sclerotiorum* is a major challenge as it requires the correct timing for spraying chemical fungicides during the liberation of ascospores, whereas accumulation of pesticide residues in the edible parts threatens human health and limits the scope for export of the commodities to other countries. Most conventional methods are not effective in the management of *S. sclerotiorum*.

Recent research by PhD student Mohd Mostofa Kamal at CSU looking at the use of bacterial bio-control agents for the
management of \textit{S. sclerotiorum} shows that sclerotia inhabiting bacterium \textit{Bacillus cereus} SC-1 exert multiple modes of action and lead to the suppression of myceliogenic and carpogenic germination through the production of volatile and non-volatile antimicrobial antibiotics. Moreover, SC-1 triggers the destruction of fungal cell organelles via the production of hydrolytic enzymes. Strain SC-1 protects canola crops from infection of stem rot fungus under field conditions.

These research findings have been published in the peer reviewed journal of Plant Pathology (Doi:10.1111/ppa.12369). In addition, a significant reduction of lettuce drop caused by \textit{S. sclerotiorum} has been observed by the strain SC-1 in glasshouse studies. The detailed outcomes of this research have been accepted by the Acta Horticulture journal.

Since, mass multiplication of bacteria remains easier than fungal bio-control agents, the above-mentioned promising strain could pave the way for the successful management of \textit{S. sclerotiorum} in both agricultural and horticultural crops. Development of consortial formulations with multiple modes of action will lead to the genesis of suitable bacterial bio-control agents for controlling \textit{S. sclerotiorum} in different cropping systems.

Contact: Mohd Mostofa Kamal  
E: mkamal@csu.edu.au

Why do farmers partially adopt conservation farming practices?  
A sociological study of stubble retention in NSW and Victoria

Despite considerable investment in Australia and abroad to promote the benefits of conservation farming, rates of on-farm adoption have been slower than expected. Recent research suggests that this may be due to the preference by farmers for partial adoption of conservation farming practices. But such research provides limited insights into why farmers may prefer partial adoption.

A sociological study as part of the Graham Centre’s DAFF funded project ‘Enabling landholders to adopt profitable and sustainable carbon cropping practices’, reveals that while growers recognise the significant benefits in retaining crop stubbles, there exist a range of constraints in moving towards full stubble retention.

Growers seek to reconcile these benefits and constraints through partial adoption. They combine stubble retention with selective burning under a ‘flexible combined system’ as they recognise that moving towards full stubble retention would undermine their flexibility to manage biophysical and financial variability.

This finding suggests that improving the uptake of stubble retention requires greater accommodation of growers’ existing practices, as well as recognition that selective burning may be complementary to growers retaining crop stubbles.

Contact: Dr Vaughan Higgins  
E: vhiggins@csu.edu.au; T: 02 6051 9623 and  
Ms Caroline Love  
E: clove@csu.edu.au; T: 02 6933 2202

Editor’s note: This abstract is taken from the paper that will be presented at the 17th Australian Agronomy Conference, Hobart, 20-24 September, 2015.

Developing conservation agricultural innovations and practice change: a model for future RDE&T in a brave new world

Incorporating crop residues (stubble) after harvest and adding soil nutrients (fertiliser) is thought to increase soil carbon. However, this has not been quantified over a range of soil types, climates and farming systems.

The impact of this practice on grain yield and soil structure in broadacre cropping was tested in a large collaborative DAFF funded project undertaken by a consortium of farming systems and grower groups, extension personnel and researchers.
The project ‘Enabling landholders to adopt profitable and sustainable carbon cropping practices’ gauged growers’ attitudes to the benefits of stubble management and carbon farming; determined the need for, and provided training in soil chemistry and biology; and conducted a field experiment to measure the impact of stubble incorporation and nutrient addition on soil carbon and grain yield at 14 sites from the eastern wheat-belt central NSW to south-west Victoria.

Most growers were sceptical of stubble incorporation as a technique for sequestering carbon but recognised the need to quantify benefits and costs. Integration of stubble retention must provide financial returns and flexibility in farming systems.

Growers were keen to undertake broad training in soil biology rather than focusing on soil carbon alone.

The field experiment had variable success and identified the needs of such an ambitious approach to research. These include clear experimental protocols, careful site selection, excellent communication, sufficient resources, and the clear identification of the roles and responsibilities of partners. We identified both the benefits and problems of a collaborative consortium. The engaged partners are keen to further develop this model for future collaboration.

Contact: Prof Deirdre Lemerle
E: dlemerle@csu.edu.au; T: 0419 816 267

Editor’s note: This abstract is taken from the paper that will be presented at the 17th Australian Agronomy Conference, Hobart, 20-24 September, 2015.
IN THE LIMELIGHT

David McGill, PhD Student

Primary Supervisor: Dr Jan Lievaart (CSU)
Co-Supervisors: Dr Peter Thomson (University of Sydney) and Dr Han Mulder (University of Wageningen, The Netherlands)
Thesis Title: Genetic evaluation of Sahiwal cattle in Pakistan: progeny testing and future directions
Funding Body: APA Scholarship and my research/travel was supported by collaborating with the ASLP Dairy Project
Relevant Current Employment: Prior to starting my PhD, I had three years experience working in project management in Pakistan.
Career and Studies till now: I completed a Bachelor of Agricultural Science at the University of Sydney (2005) with a major in Animal Production. My honours thesis looked at the mathematical modelling of lactation curves to determine traits of economic importance in dairy animals. I then worked for the NSW DPI (Tamworth) where my main role was data processing and management. This led to an opportunity back at the University of Sydney (with the Reprogen Group lead by Prof Herman Raadsma), coordinating feeding and milking trials on sheep. In 2007 I was given an opportunity, as an employee of CSU, in Pakistan to manage a research for development project looking at extension in the dairy sector (the ASLP Dairy Project). This led to a three year role based in Lahore coordinating research activities, data collection and capacity building of local employees and field officers.
Currently Studying: I completed my PhD in August 2014 and just last month (finally) handed in the corrections - so it’s essentially done! The focus of my PhD was quantitative genetics, looking at the progeny testing and genetic analysis of Sahiwal cattle in Pakistan. I was lucky to spend some time in 2011-2012 looking at the progeny testing and genetic analysis of Sahiwal cattle in Pakistan. I was given an opportunity, as an employee of CSU, in Pakistan to manage a research for development project looking at extension in the dairy sector (the ASLP Dairy Project). This led to a three year role based in Lahore coordinating research activities, data collection and capacity building of local employees and field officers.

Research Interests:
- Research for development
- Genetic improvement of livestock in developing countries
- Extension and communication to enhance production and livelihoods
- The use of mobile/ICT for monitoring and evaluating project interventions
- A general interest in applied statistics, particularly, animal health, epidemiology, impact assessment.

Professional Links: I have a keen interest in research for development projects, in particular, linking with other researchers working in this same space. Along with a group of other early career researchers working on similar projects, I helped to establish the RAID network (Researchers in Agriculture for International Development www.raidaustralia.net/). This group has helped myself and the RAID group to create a functional working relationship with early career researchers, but has also strengthened relationships with ACIAR and other project leaders.

A Typical Day for Me Includes: Get up at 6am - coffee then push myself to sit at the computer for some writing/number crunching. At 7:30 the (literal) cry/whinge of the dog draws me (not unwillingly) outside to take him for a walk and kick the footy around. 9ish - get to the office and try to spend the morning sorting out emails/admin/travel/reports etc. 2-5 pm - these days I am using this time to focus on research outputs with our ASLP Dairy Team in Pakistan. Right now we have a lot of paper writing and data analysis to do. 5 till dinner - if I’m on a roll I like to use this time to get some serious programming in ‘R’ done. If not, I tend to go home and do some more exercise (depending on motivation levels) and then I cook up something for the household (if it’s my turn). Post dinner tends to be TV or movie, but if there’s deadlines to meet...sometimes you just have to get back into it.

My Main Project at the Moment is: Punching out papers and stats with the Pakistan team to showcase what we have achieved in our ASLP Dairy Project.

My Favourite Part of My Studies is: During my PhD I ran a study that looked at breeding objectives for the dairy sector in Pakistan. This can be a tricky exercise in any country, but in a developing country like Pakistan where data relating to markets and prices is scarce and highly variable - it was a real challenge. It got me out of the office and in the field and engaging with groups of small-holder farmers, breeders (generally larger farmers) and academics. The paper from this study has recently been submitted for publication, so keep an eye out for it.

When I am not Studying I like to do: Get outside and hang out with the family (this includes the dog). Cliché it may be, but with nine brothers and sisters and eighteen nieces and nephews there is seriously never a dull moment.

When I am Driving I like to Listen to: Generally I stick to Triple J, but of late have been getting more into Double J - they play some serious (recent history) classics on there. If the radio isn’t working though, my playlists are heavily laden with You Am I, Dallas Crane, Paul Kelly, Ryan (not Bryan) Adams, and the Beatles.

David McGill has a keen interest in research for development projects. He has been instrumental in establishing the RAID network (Researchers in Agriculture for International Development). Photo: Toni Nugent
Dr Mark Stevens

**Position:** Director and Principal Research Scientist, Yanco Agricultural Institute

**Organisation:** NSW Department of Primary Industries

**Career Brief:** I grew up in Sydney and did an honours degree in zoology and botany at Sydney University. I then spent a year working for CSIRO as a technical assistant in the Australian National Insect Collection, Canberra before returning to Sydney University in 1985 to start my PhD on the taxonomy of cicadellid leafhoppers. I was still finishing off my thesis when I was offered a research job in applied entomology at Yanco in late 1988. I started at Yanco in February 1989 and have been there ever since, working on various aspects of pest management in rice, citrus, stored grains, and more recently, cotton.

**Research Activities:** Rice pests have been my most consistent work area over the years, particularly the ecology and control of chironomid midges and water snails. Armyworm work in rice is planned for next season, and along with work on improved trapping techniques for stored grain pests, this will give me a chance to do more work in the area of chemical ecology, which I think still has a lot of untapped potential.

Biodiversity and community ecology in conventional and transgenic cotton are also being investigated in collaboration with the other entomologists (Jianhua Mo and Sandra McDougall) at Yanco. Gavin Ash, CSU, and I have started a project on the molecular biology of *Metarhizium* with Jakub Baranek, an Endeavour Research Fellow from Poland (see article page 6).

**Teaching Activities:** I’ve co-supervised a number of honours and postgraduate students from various universities in eastern Australia including Melbourne, Sydney, Western Sydney, and Macquarie, but the majority have been from CSU. Some of these students have worked on agricultural production issues, however many have done projects with a strong environmental focus. At present I have two PhD students, Ronnie Dotaona at CSU working on sweet potato weevil control, and Rod Ubrihein who is working on the sub-lethal effects of metals on water snails at the University of Canberra.

**Professional Links:** I’m an Adjunct Professor at CSU, a member of the Graham Centre Research Management Committee, and am on the Editorial Board of *General and Applied Entomology*. I’ve worked with the CSU analytical chemists for many years, initially Stuart Helliwell, but since he’s retired Greg Doran has had to put up with me! My closest overseas linkages are with midge specialists and rice entomologists in the United States and Spain. I’m hoping to develop more international projects now my sons are older and travel is a bit easier to organise.

**A Typical Day for Me Includes:** Coffee, wading through emails, organising technical staff, looking at accounts to see where we are at financially, reconciling purchase cards, and approving time sheets...more coffee, writing/editing reports for funding bodies, reviewing papers and/or thesis chapters for journal editors and/or postgraduate students...more coffee.

A good day will involve working on a paper of my own, and maybe even an hour or so at the microscope...coffee...and an hour at the gym on the way home (If I’m feeling enthusiastic!).

**My Main Project at the Moment Is:** There are two that take up most of my research time - developing a new pesticide for snail control in rice, and looking at plant volatiles as co-attractants for use with commercial pheromone lures to trap the rice weevil, *Sitophilus oryzae*.

**My Favourite Part of My Job Is:** Getting a journal paper through the publication process and finally seeing it in print. But I do like doing hands on lab work, especially identifications.

**When I Am Not in the Office I Like:** Fishing, road cycling, surfing and bushwalking. I’d like to travel more (for pleasure rather than work) and learn to play bass guitar.

**When I Am Driving I Like to Listen To:** A mixture of old and new stuff - Hilltop Hoods, Placebo, Led Zeppelin, Rolling Stones, and Cream, Triple J, ABC News Radio occasionally...but only when they’re not broadcasting federal parliament.

**When I Am Fishing I Like To:** I enjoy a guitar.

**When I Am Not Fishing I Like To:** I like learning to play bass guitar.

Spring Edition of the Innovator

The Spring Edition of *the Innovator* will be available September 2015. Submission of articles for this edition close on Friday, 4 September 2015.

Please email articles to Toni Nugent.
Functional Grains Centre News

Director’s Column

Welcome to the FGC News. The aim of this newsletter is to communicate some of the exciting activities within the ARC Industrial Transformation Training Centre for Functional Grains (or FGC for short). I’m grateful to the Graham Centre communication team for helping us put this together and distribute as part of the Innovator.

The first six months of 2015 has been busy for the Centre. In January, we finalised the signing of the multi-institutional agreement between all partners, which signified the commencement of the Centre. This was followed in February by our official launch. It was great to get all the newly recruited students to meet our existing students and start forming life-long friendships. We were also very honoured to have Dr Fiona Cameron from the ARC to officially open the Centre and also party on that night with us at the Thirsty Crow!

I’d like to officially welcome our newly recruited PhD students to the Centre:

- Neeta Karve (Modification of Pulse proteins – Flavour Makers)
- Rebecca Barnett (Nutritional Properties of canola meal – MSM Milling)
- David Lean (New uses for pulse proteins – Woods Grains)
- Sabrina Wang (Functional properties of rice bran – Sunrice)
- Esther Callcott (Bioactive properties of rice – NSW DPI)
- Michelle Toutounji (Functional properties of low gliadin wheat – NSW DPI)
- Chris Florides (Predicting wheat allergenicity – AGT)
- Kyah Hester (Psychology of non-coeliac gluten avoidance – Grain Growers)

We are in the final stages of recruiting our post-doctoral fellows and hope to have them on board soon.

We have also had some additional funding successes, being the successful tenderer in collaboration with AEGIC and Grain Growers, to undertake an international pulse market analysis. We will be recruiting later in the year for a post-doctoral fellow for this position. Centre staff have also been successful in securing funding in collaboration with NSW DPI to develop rapid methodology for measuring a glycaemic index for the rice breeding program. This three year project will also employ a post-doctoral scientist.

Professor Chris Blanchard
Comings and Goings
Welcome to Prof SM Saqlan Naqvi, who has joined CSU as a visiting Professor for nine months. He is a Professor of Biochemistry and Dean of the Faculty of Sciences, PMAS-Arid Agriculture, University Rawalpindi, Pakistan. While at CSU, Professor Naqvi will be continuing Saira Hussain’s work to study protease inhibitors from canola.

We bid farewell to Dr Adeola Alashi who will has taken up a post-doctoral fellowship at the University of Manitoba, Canada. During her PhD Adeola, pioneered the development of bioactive peptides and demonstrated their effectiveness in cellular and whole animal systems. We wish her all the best in her next adventure.

Congratulations to Soumi Paul Mukhopadhyay and Saira Hussain for submitting their theses. Saira’s thesis focused on the characterisation of bioactive compounds from canola, while Soumi’s thesis focused on the quality of chickpeas. Both Saira and Soumi have received writing-up awards so they can publish their results while they wait for the examination of their thesis.

Tabby’s Blog
What do vegan zombies eat? Check out Tabby’s blog for the answer:  
https://fgcwaggagrainscience.wordpress.com/category/functional-grains/

Some of Tabby’s latest additions include interviews with Honours student Meg Ryan and PhD student Esther Callcott, along with her own article explaining why grains are so important for our health.

Student Profile

Esther Callcott
Esther Callcott is a first year PhD student with the FGC. Esther graduated from Macquarie University, Sydney in 2009 with a Bachelor Degree in Medical Science (Honours). She then worked for a biotechnology company in Sydney working with Adipose-derived Mesenchymal Stem Cells (MSC’s). Her main area of research for the company was identifying and optimising the therapeutic uses of MSC’s for the treatment of osteoarthritis in animals and humans. Esther worked in the company’s veterinary division optimising their now commercialised stem cell therapy, as well as working on other research and product development projects. She also represented the company at conferences and trained veterinary professionals in their stem cell procedure in Australia, while endorsing the procedure overseas in the United Kingdom.

This year (2015), Esther joined the FGC to utilise stem cells to identify health properties of bioactive compounds found in coloured rice and rice bran. Her aim is to identify what the individual bioactive compounds are and how they can assist with the reduction and/or prevention of lifestyle diseases such as obesity and Diabetes. Esther is using adipose-derived stem cells to model lifestyle diseases and investigate how these bioactive compounds affect them.

Esther is looking into how these bioactive compounds can assist with treating neurodegenerative diseases, in particular, Motor Neuron Disease (MND), as currently there is no known cure for this disease. She is hoping to see if the rice bioactive compounds can assist with delaying the progression of the disease or assist with neural regeneration of the motor neurons.

The long-term goals of the project are to identify the health properties of coloured rice and rice bran that will hopefully result in the development of a neutraceutical containing rice or rice bran bioactive compounds that can help treat and prevent lifestyle diseases. An additional goal is to develop a rice neutraceutical to, at the very least, delay the progression of neural degeneration in MND patients and hopefully find an effective treatment for this devastating disease.

In addition to the medical based outcomes, another aim of the project is to highlight to the Australian rice industry, the importance of sustaining Australia’s high quality rice yields. The project ultimately aims to produce a variety of
rice that contains a high concentration of the bioactive compounds required to manufacture the nutraceuticals to treat the diseases being researched. Hopefully this rice variety will be offered exclusively to Australian rice farmers and boost the economy, supporting the Australian Rice industry.

Staff Profile
Simone Crawford

Simone Crawford has recently been appointed the Administration Officer for the FGC. Prior to joining the FGC, Simone was employed as an Administration Officer in the School of Biomedical Sciences, CSU for the past four years. Previous to this, Simone worked for the Commonwealth Bank for 15 years. Simone lives in Wagga Wagga, is married and has two children.

Simone is looking forward to the opportunity to working with everyone and can be contacted on E: fgc@csu.edu.au or T: 02 6933 2506.

Industry visits
MSM Milling

Rebecca Barnett and Siong Tan recently visited MSM Milling in regional NSW. The trip provided them first hand insight of how canola oil, meal and pellets are produced by a privately owned refinery.

Rebecca and Siong spent a week on-site gaining knowledge of MSM Milling’s operations. In addition, the pair toured Moxey Farms, Australia’s second largest dairy, located in Gooloogong, NSW. Visiting Moxey Farms allowed the pair to observe post-production supplementation of MSM Milling’s canola meal in dairy cattle feed.

The visit provided a unique and highly valuable opportunity to gain an understanding of commercial practicalities and operational restraints associated with managing a profitable Australian business.

2015 Rice Field Day

Earlier this year Chris Blanchard, Asgar Farahnaky and Esther Callcott attended the 2015 Rice Field day at Jerilderie, NSW. The event started with tours of the rice paddocks and an introduction to the research being conducted to resolve issues in rice cultivation in NSW.

The day also looked at the utilisation of technology to map the highest yield producing areas of paddocks and their management to ensure effective crop yields. Different sowing techniques and other agronomic techniques to maximise crop yields were also explored.
Field day participants were introduced to different rice varieties and their production of end products on the supermarket shelf.

Over lunch attendees spoke with key industry stakeholders and explored the trade displays including large-scale machinery used in rice harvesting and solar powered irrigation technology.

The Sunrice marketing team and CEO Rob Gordon also addressed the field day, giving an update on Topaz rice and an economic update on international supply and demand.

Conferences
In January Siong, Rebecca, Neeta, Clare, Meg, Tabby, David and Prakash travelled to Melbourne to attend the Australian Institute of Food Science Technology (AIFST) student conference. The conference gave students and postdoctoral fellows an opportunity to share some of their latest results with colleagues, and hear from leading food science researchers. Next year, the FGC will host the AIFST conference in Wagga, providing the FGC with an opportunity to showcase our research and introduce our colleagues to Wagga.
Graham Centre Beef Forum
Friday, 14 August 2015 | 9.00am - 1pm (8.30am for 9.00am start)
Charles Sturt University Convention Centre, Wagga Wagga

**Are increasing cattle prices the signs of good things to come for the beef industry?**
Angus Gidley-Baird (Rabobank)

**BREEDPLAN – 30 years of taking the guesswork out of cattle breeding**
Brian Cumming (Brian Cumming Agriculture)

**Planning a profitable beef enterprise**
Sandy McEachern (Holmes Sackett)

**Producer case study: Show me the money**
Charlie Cey (Growth Farms Australia)

**Biosecurity – your herd and your country**
Bruce Allworth (Charles Sturt University)

**Producer case study: Lessons learnt**
Matt Pearce (Adelong)

**JBS Farm Assured: Giving customers guarantees**
Mark Inglis (JBS Australia)

**Register now!**
$25 per person
Pre-pay at: www.trybooking.com/HROF or pay on the day. Includes morning tea and lunch.

RSVP by 7 August 2015
**www.grahamcentre.net**
Toni Nugent: sfd@csu.edu.au | 02 6933 4402

---

**CONTACTS**

**Associate Professor Michael Friend**
Acting Director
T +61 2 6933 2285
M 0429 407 725
E mfriend@csu.edu.au

**Ms Toni Nugent**
Industry Partnerships and Communications Manager and Editor
T +61 2 6933 4402
M 0418 974 775
E tnugent@csu.edu.au

**Ms Maree Crowley**
Centre Manager
T +61 2 6933 4399
E mcrowley@csu.edu.au

---

Conzya (fleabane - a prolific and widespread weed) fruits dispersed + caterpillar.
Photo: Geoff Burrows