

# the Innovator

The Newsletter from the EH Graham Centre for Agricultural Innovation

WINTER 2009 EDITION

CHARLES STURT  
UNIVERSITY



NSW DEPARTMENT OF  
PRIMARY INDUSTRIES

Welcome to the Winter edition of the Innovator. The 2009 growing season is off to a flying start and we are optimistic that this year grain yields and animal production will finally produce some profits for our farmers. Also, the good conditions will hopefully allow successful, high yielding field experiments with useful results. We are very pleased and excited to report our success in gaining Federal funds (\$34m) for a major infrastructure development in the National Life Sciences Hub to be located at Wagga Wagga – see details on page 3.

We welcome four new members to our Industry Advisory Committee (IAC) – Steve Thomas, Andrew Vizard, Mike O'Hare and Mark Harris. The next IAC meeting will be held in September with the Board of Management. We look forward to their input in our strategic planning and improving communication with our stakeholders.

Graham Centre members continue their involvement with local schools by participating in activities with the "Science in the Bush" on 23 June and our Agricultural Enrichment Day on 6 July. These activities are extremely important for helping overcome the skills shortage in agriculture.

As the Graham Centre continues to grow, we look forward to your ongoing support and input. We are continuing to update our website to keep you informed. You are invited to two important events – "A Dry Argument" on 29 July and the launch of our field site on 21 October (more information on page 2). See you there!

Professor Deirdre Lemerle



CSU Agricultural Science student, David Gale, demonstrates 'Supermarket Botany' to primary school students at the annual 'Science in the Bush' run by the Australian Museum. [Photo: Deirdre Lemerle].



Dr Michael Friend explains animal production research to high school students at the Agricultural Enrichment Day held in early July. [Photo: Raylene Heath].

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## 'A Dry Argument' - Public Seminar and Discussion, Wednesday 29 July

An important event comprising seminars and a panel discussion for all agricultural professionals, presented by the Australian Institute of Agricultural Science and Technology, the EH Graham Centre for Agricultural Innovation, Wagga Wagga City Council and other potential sponsors

**Venue:** Convention Centre (CSU Wagga) and Wagga Wagga Civic Centre

**Date:** Wednesday July 29

**Time:** 2.00 – 4.30 pm (seminars from farmers, researchers, advisers and agribusiness)  
6.00 – 7.15 pm (interactive public discussion)

The districts in southern NSW around Wagga, once a safe region for mixed farming, are enduring an unprecedented period of low rainfall. Only time will tell whether such a sequence, affecting both dryland and irrigated farmers, is due to chance or if the sequence is a more permanent feature of local agriculture.

The objective of the meeting 'A dry argument' is to inform agricultural scientists, agribusiness, farmers, students and the public about some of the consequences of drought, and examine the difficulties that farmers are having in adjusting to dry periods.

"Agricultural scientists, agribusiness and policy makers are often swept up in the technology of coping with drought and maintaining production, rather than considering their response to the 'big picture' travails of farmers. The future of farming is a topic worthy of careful consideration by governments, organisations, corporations and farmers", said organiser, Prof Ted Wolfe.

The meeting will feature the following set of experienced speakers:

- **Alexandra Gartmann** (CEO, Birchip Group) will draw on research conducted for the Birchip Cropping Group's 'Critical Breaking Point' study in Victoria, a study that revealed climate change to be a management challenge of unprecedented magnitude, presenting a serious challenge to farming families' identities.
- **Helen Burns** (Research Liaison Officer, Graham Centre) will present some findings from her preliminary analysis of the challenges facing farmers in the Lockhart and Holbrook districts.
- **Yvonne Hitchener** is a project officer with the NE Riverina Rural Counselling Service. As a specialist in preparing families for rural adjustment, she is in a unique position to outline the likely consequences of extended drought on farm families and businesses.
- **Lloyd Kingham** coordinates a NSW DPI task force to address the impacts of drought on farm families and production, providing technical and business options to help farmers adjust to climate change
- **Ruth Wade**, Executive Director of the Ricegrowers' Association of Australia will outline the painful path of adjustment for the rice industry in the Murrumbidgee and Murray Valleys.
- A prominent Wagga agribusiness banker will chair the discussion sessions and sum up.

The meeting will be held according to a unique format. During the afternoon (starting at 2.00 pm at the CSU Convention Centre), the speakers will give detailed presentations on aspects of the topic 'A dry argument – adjusting to climate change'. These seminars will be followed by questions and discussion. Then, the meeting will adjourn to the Wagga Wagga Civic Chambers where, from 6.00 pm, each panel member will give a short introduction and summary and the audience will be invited to discuss the topic 'A dry argument – which way for rural adjustment?'

More information: Prof Ted Wolfe, [twolfe@csu.edu.au](mailto:twolfe@csu.edu.au), t: 02 6922 4347.



**CLAIMING THE DATE**  
Wednesday, 21 October 2009  
9:00 AM - 12.00 PM  
Launch of the Graham Centre Field Site

- Outline the possible short and long term trials
- Get people's input
- Form a steering committee
- View weed control trials

## Controlled Traffic Farming

The Graham Centre hosted an in-paddock seminar on 22 May to outline CSU's move to controlled traffic farming (CTF). Greg Condon from Grassroots Agronomy showed staff and students what is involved with farming using permanent wheel tracks for all machinery traffic including the header, boom spray, seeder and spreader. At farm level, the adoption of CTF practices is starting to gather significant momentum and what was previously a northern farming technique will become common practice in the south.

CSU Farm Manager, Jim Mellor said:

"The change is driven by the drought and the need for better crop gross margins.

- Logical progression following five years of Tramlining that aimed to improve accuracy of inputs.
- Really motivated after attending CTF conference at Dubbo last year.
- Able to get in at an affordable price by using a contractor with similar ideals for desired outcomes.

It seems you wouldn't random drive over your vegie garden and expect good results ... why random drive over your cropping area!"

A three metre tractor and GPS guided airseeder were in action sowing into stubble with presswheels on marginal moisture. The objective was to keep wheels on hard ground and plants in soft soil, which in turn eliminates soil compaction and helps to increase water use efficiency (WUE) and yield. This is a major shift in farming practice as previously the header could not match where the seeder or boomspray had travelled during the season, causing partial compaction across the whole paddock. GPS guidance is what makes all this possible with two centimetre autosteer in every implement including the header, to allow fully repeatable farming where the GPS logs exact locations which are carried forward into the next operation or season.



Controlled traffic farming field day 22 May 2009. [Photo: Gordon Murray].

Therefore, to match machinery, all wheel axles are extended to three metre widths to line up with the header which is the most difficult to change. The axles on the tractor have been moved out to three metre centres. All implements are multiples of the header and seeder width to allow repeatability with operations. For example, CSU Farm are operating on a nine metre system with a nine metre header front, nine metre seeder and 18 metre boom spray.

Overriding all these logistical changes is the focus on best practice agronomy in order to achieve potential WUE and yield. This may seem a given but combined with key practices such as complete stubble retention (facilitated by inter row sowing), summer weed control, calendar sowing, canopy management, weed/disease control, rotation, no grazing, farm zoning and risk management the use of CTF is driving WUE and yields higher in both decile 1 or 8 years.

The CSU farm transition to CTF will be discussed at the launch of the Graham Centre Field Site on 21 October.

More information: Jim Mellor, [jmellor@csu.edu.au](mailto:jmellor@csu.edu.au), t: 02 6933 1661 or Helen Burns, [hburns@csu.edu.au](mailto:hburns@csu.edu.au), t: 02 6938 1947.

## National Life Sciences Hub

**(Total Cost: \$44.17m; Commonwealth Contribution: \$34m; NSW Government Contribution: \$2.5m)**

Charles Sturt University will construct a world-class integrated, fundamental–applied science hub in Wagga Wagga that will link Charles Sturt University's and the NSW Department of Primary Industries' existing applied science facilities through a new basic science laboratory and teaching hub. The new facility will include:

- **Life Sciences Learning and Teaching Complex (\$11.5m)** including three 120 student teaching laboratories, PC2 compliant preparation/support facilities, offices, audio visual/information communications technology (ICT) capacity supporting e-learning and remote delivery of large classes to and from the complex with partner laboratories in Australia and internationally.
- **Life Sciences Collaborative Research Complex (\$15.5m)** including 45 PC2 level modules configured for undergraduate,

Honours and research students to support novel studies in molecular biology, proteomics, biomarker analyses, high throughput nanobody generation, protein crystallography, recombinant vaccines and genetic analysis of plant pathogen virulence and parasite drug resistance.

- **Glasshouse Complex (\$2.1 million)** and Controlled-Environment Facilities (\$2.2m) to support fundamental research and advanced plant phenotyping to understand the interactions within and between the soil, climate and plant biology.
- **Integrated Field Laboratory (\$4m)** including Rhizolysimeters and Automated Rainout Shelters to support field analysis of ecosystem interactions with crop species and crop-based farming systems.
- **Laboratory Support Facilities (\$1.4m); Office Accommodation (\$2.9m); Key Support Services and Infrastructure (IT, Optic Fibre, Electrical Substation, Utilities) (\$2m).**

The Department of Primary Industries has committed a further \$2.5m for the construction of glasshouses and refurbishment of older laboratories on their immediately adjacent premises.

## 2009 Graham Centre New Initiative Grants

After assessment by four members of the Research Management Committee and review against 10 criteria, we are pleased to advise the following nine proposals have been selected for funding:

Project	Researcher(s)
Rhizogenesis in canola roots - a method of improving drought tolerance	Dr John Harper, Dr Sergio Moroni, Dr David Lockett
Mapping a vital water resource to enhance water availability for mixed farming systems	Dr Remy Dehaan, Dr Iain Hume, Dr Rod Rumbachs
Genetic potential for acrylamide mitigation in processed wheat products from Australian grains	Dr Livinus Emebiri
Dairy goats - a rare species or a suitable animal model to study intra mammary infections in dairy cattle	Jan Lievaart, Dr Helen McGregor, Karianne Lievaart-Peterson, Dr Ian Links
Toxoplasmosis - how significant are the risks for wildlife and human health	Dr Helen McGregor, Jan Lievaart, Karianne Lievaart-Peterson, David Jenkins, Sarah Robinson
Molecular ecology of Diamondback moth in <i>brassicac</i> s	Dr Andrew Mitchell, Prof Geoff Gurr
Defining the transcriptome of juvenile liver fluke to underpin mass spectrometric analysis of candidate vaccine antigens	Prof Terry Spithill, Prof Nick Sangster
Improving the efficiency of livestock production: Manipulation of sex ratio of lambs by altering omega-3 intake of ewes	Dr Ed Clayton, Dr Michael Friend, John Piltz, Catherine Gulliver
Milk - a healthy product but is it also safe?	Christopher Petzel, Natasha Lees, Dr Ian Links

## NSW Soils Strategy



*The importance of soil management for food security in NSW will be a key element in the development of the new policy document called the NSW Soils Strategy. [Photo: NSW DPI PhotoLibrary].*

The NSW Government is developing a policy for the management of soils in NSW. A meeting was held in Sydney in June with representation from major players in soil science and soil management. This included four government departments and three universities. The Graham Centre was represented by Associate Professor Phil Eberbach (CSU) and Adjunct Professor Mark Conyers (NSW DPI). The meeting was chaired by Adrian Harte, Deputy Commissioner of the NSW Soil Conservation Service. The Facilitator was Andrew Campbell of Triple Helix Consulting and a Director of the Future Farm Industries CRC (former CEO of Land & Water Australia and Former National Landcare Facilitator).

Adrian gave an overview of the need to develop the State Soils Strategy under Priority E4 of the NSW State Plan. Andrew then gave an excellent background on the political and economic pressures relating to climate change and consequent impacts on water supply in capital cities, on energy supply (including the potential contribution from biofuels) and on food security. Details are available on the website [www.triplehelix.com.au](http://www.triplehelix.com.au). Soil management is seen as contributing to all of these emerging issues, hence there was renewed political interest in developing a plan for management of the soil resource.

A revised policy document and policy targets will become available for general comment later this year. The recent investment developments at CSU and the growth in student enrolments, means that CSU will be well placed to take a lead role in the State's Plan for soil management.

More information: Dr Mark Conyers, [mark.conyers@dpi.nsw.gov.au](mailto:mark.conyers@dpi.nsw.gov.au) t: 02 6938 1830 or A/Prof Philip Eberbach, [peberbach@csu.edu.au](mailto:peberbach@csu.edu.au) t: 02 6933 2830.

## Progress with Perennials and Roots

Professor Len Wade recently presented an invited paper at the 26th Interdisciplinary Plant Group (IPG) Symposium on Root Biology, hosted by the University of Missouri in Columbia, entitled, "Roots, the regulation of water use, and the implications for adaptation and selection". The paper dealt with how plants use signals from roots to regulate water loss from leaves during periods of water deficit. The good news is that varieties differed in these traits, in a manner consistent with their patterns of yield performance over contrasting field environments. This raises the prospect of selecting for root signals as one way of improving plant performance under drought. Weaker signals may be better if water deficit is mild and rewatering is likely, but strong signals are safer in severe water deficit.

While in the USA, Len also visited Washington State University (WSU) in Pullman and The Land Institute (TLI) in Kansas, to check progress with development of perennial crops. While TLI has more progress overall because of the number of species they are examining, WSU has perennial wheats (derived from complex crosses between wild perennial grasses and bread wheat) which have survived several winters (with snow) in the field. The challenge remains to see if we can identify suitable materials for Australian conditions. Richard Hayes (NSW DPI) is currently evaluating a number of lines from WSU, TLI and elsewhere to see if they offer promise. Phil Larkin (CSIRO collaborator) is studying the cytogenetics and Nicole Hyde is examining the underpinning physiology for her PhD to assist these efforts. This work is supported by the Future Farm Industries CRC. Len recently obtained funds to form a global alliance in perennial crops, and WSU, TLI, and the Yunnan Academy of Agricultural Sciences in Kunming China (Wagga's sister city) have expressed interest.

This is an exciting time for the Graham Centre, its research partners and its farmers. The recent announcement of the \$34 million grant from the Education Investment Fund for a National Life Sciences Hub (NaLSH) at Wagga, will provide the state-of-the-art infrastructure needed to support our research. Although the Graham Centre is only four years old, some exciting international projects are now being established, which bode well for the future of the Centre.

More information: Prof Len Wade, [lwade@csu.edu.au](mailto:lwade@csu.edu.au) t: 02 6933 2523.

## Integrating Biological and Herbicidal Control of Paterson's Curse and Horehound

Biological control using insects and diseases is a cost-effective way to reduce weed populations, especially in remote or the lower productive areas on farm. Biological control is likely to be most effective when integrated with other control tactics including herbicides. Research is required to determine possible positive and negative impacts of herbicides on biocontrol effectiveness.

Preliminary studies have commenced examining the impact of herbicides on the spread and effectiveness of biocontrol agents on Paterson's Curse and horehound.

More information: Prof Deirdre Lemerle, [dlemerle@csu.edu.au](mailto:dlemerle@csu.edu.au) t: 02 6938 1667, Dr Hanwen Wu, [hanwen.wu@dpi.nsw.gov.au](mailto:hanwen.wu@dpi.nsw.gov.au) t: 02 6938 1602, Barry Sampson, [barry.sampson@dpi.nsw.gov.au](mailto:barry.sampson@dpi.nsw.gov.au) t: 02 6938 1955.



*The flea beetle on Paterson's curse  
[Photos: Deirdre Lemerle]*

## Liver Fluke Training at the University of York, UK

Dr Janelle Wright is a Post Doctoral Research Fellow at the School of Animal and Veterinary Sciences CSU. Earlier this year she spent four weeks training at the Centre of Excellence in Mass Spectrometry at the University of York. On arrival, Janelle held detailed discussions with Professor Alan Wilson and Dr William Borges to plan what experiments could be completed in just four weeks. Janelle had access to the multi-million dollar Centre of Excellence in Mass Spectrometry which houses a wide range of technologies, services and expertise. Within this facility are specialist laboratories concentrating on analytical biochemistry, bioscience computing, genomics, microscopy, cytometry, molecular interactions, protein production and proteomics, with all labs fitted out with state-of-the-art equipment. She commenced work in the multi-million dollar Biology Technology facility and, on day one alone, began a tegument stripping experiment on some frozen *Fasciola hepatica* flukes, performed a protein assay on these samples and set up a trypsin digest.



Janelle Wright using the Ultimate LC system and Probot microfraction collector.

In the following weeks she collected live liver flukes from a local abattoir, received training in parasite-specific fractionation and extraction protocols, fixed flukes for electron microscopy analysis, performed gel electrophoresis, enzymatic shaving and liquid chromatography separation of protein fractions followed by mass spectrometry analysis. A searchable *F. hepatica* EST database was constructed by Dr Peter Ashton to assist with MS/MS results and peptide identification, and PhD student Sophie Manuel and Dr Naveed Aziz started preparing adult fluke cDNA for 454 sequencing. The experiments and protocols performed at the University of York have generated a significant amount of data; data that will enhance CSU's current knowledge of the liver fluke biology, including what proteins are found on the surface of the fluke that may facilitate immune evasion.

Janelle left the University of York re-energised and enthusiastic regarding the work that was accomplished and what needs to be done at CSU. Prof Wilson is planning to visit CSU later this year, at which time it is anticipated that he and Janelle will write a paper together on her findings.

More information: Dr Janelle Wright, [jawright@csu.edu.au](mailto:jawright@csu.edu.au) t: 02 6933 4348.

## Biochar Research: Mechanisms of Nutrient Retention under Dryland Broadacre Cropping in Southern NSW

Biochar is a stable form of carbon produced by pyrolysis under controlled temperature and limited oxygen conditions. It is essentially similar to charcoal produced from the carbonisation of biomass through fire. Biochar has at its core an aromatic chemical structure, which is far more resistant to microbial decomposition than any other form of soil carbon. However, while the core of the particle may be relatively inert, the surface is still susceptible to oxidation, and apparently more conducive to the development of functional groups such as carboxyls, hydroxyls and phenols. Under favourable conditions these functional groups may possess charges which can lead to a net negative or positive charge for the Biochar particle, thereby attracting nearby ions. This could have significant consequences for the efficiency of fertiliser use and, consequently, nutrient leaching and emissions.

The variability of Biochars (a function of biomass source and pyrolysing conditions) presents challenges to the development of Biochar benchmarks and this process is further complicated by climatic and soil conditions. This three year GRDC funded project is investigating the mechanisms underpinning the retention of nutrients in Biochar amended soils of southern NSW. A series of laboratory and glasshouse experiments have commenced, with a field trial planned for 2010 to



David Waters weighing out a sample of cow manure char for analysis. [Photo: Sharon Kiss].

validate results. Initial results have shown a dramatic difference in the characteristics of cow manure Biochar compared with green waste Biochar. Further funding has been obtained through Woolworths' Sustainable Farming Program to develop a field trial in Holbrook for 2010-2012. This will enable a more comprehensive analysis of the agronomic mechanisms behind Biochar-amended soils in southern NSW and enhance the rigour of the scientific outcomes of the project.

The first Asia-Pacific Biochar Conference was held at the Watermark Hotel at the Gold Coast from 17-20 May, 2009. The event attracted soil scientists, private industry and eager individuals from across Australia, Asia and as far away as North America. Participants were informed on the latest findings of Biochar research from a production and applied perspective. The author was funded by the EH Graham Centre to attend and present a poster detailing the initial results of the project. Read more on Biochar and research in Australia at: [www.anzbiochar.org](http://www.anzbiochar.org)

More information: David Waters, [david.waters@dpi.nsw.gov.au](mailto:david.waters@dpi.nsw.gov.au) t: 02 6938 1991.

## Project Updates

### Carbon - the facts for temperate farming systems

The Graham Centre recently partnered with the Eastern Riverina Landcare Network (ERLN) to present meetings at Henty and Lockhart focussing on soil carbon in local farming systems and the proposed Carbon Pollution Reduction Scheme on Australian agriculture.

The program included Graham Centre researcher, David Waters, who has delivered NSW DPI carbon awareness seminars throughout NSW, and Executive Director of the Australian Farm Institute, Mick Keogh, who has been involved in analyses used to shape the Australian Government's Carbon Pollution Reduction Scheme (CPRS).

David Waters presented local data and additional information from major scientists and institutions from Australia and overseas to clarify issues on soil carbon under local land management practices and soil types. He highlighted the importance of soil carbon in building soil 'health' and provided benchmarks of the climactic capacity of soils to accumulate soil carbon.

Mick Keogh presented a summary of the recent report released by the Primary Industries Ministerial Council (the Council of Commonwealth and State Primary Industries Ministers) into possible options for the 'coverage' of agriculture under the proposed CPRS. [Link to report.](#)

Mr Keogh also provided a preview of the FarmGAS Calculator, which is a tool developed in conjunction with NSW DPI, funded by the Department of Agriculture, Fisheries and Forestry, under the National Agriculture and Climate Change Action Plan's Implementation Program. The Calculator has been designed for farmers to use their own financial and production data to produce a greenhouse emissions profile for their specific farm enterprises and will be available free-of-charge on the Australian Farm Institute website [www.farminstitute.org.au](http://www.farminstitute.org.au) in the next month or so.

The 'carbon' meetings were a component of the ERLN project 'Environment and economic gains of changing land management to meet NRM targets', which is funded by the Federal Department of Agriculture, Fisheries and Forestry (DAFF) under its 'Caring for our Country' program. The project team is concentrating on collecting data and working closely with landholders to improve landholder knowledge and skills to achieve natural resource management (NRM) targets, in particular, soil carbon and groundcover. The technical component of the project provides a local focus to identify achievable NRM targets while maintaining production levels.

More information: Helen Burns, [hburns@csu.edu.au](mailto:hburns@csu.edu.au) t: 02 6938 1947.



David Waters (centre left) and Mick Keogh (centre right) with consultant Joel Murphy (Rural Management Strategies) on the left and Lockhart farmer, Jason Gooden (right). [Photo: Helen Burns].

## EverGraze Update

EverGraze is a national research and delivery project funded by Future Farm Industries CRC, MLA and AWI. The Graham Centre hosts two EverGraze projects – one investigating the use of native perennials (at Holbrook) and one investigating the use of improved perennials (based at Corienbob, near Ladysmith). This update refers to the improved perennial project.

At Corienbob, we have three research sites:

1. A 62ha 'systems' site, investigating the productivity, profitability and natural resource management (NRM) outcomes of several sheep production systems grazing a perennial pasture base;
2. A 60ha site where we are investigating the potential of summer-active perennials to increase the ovulation rate of sheep through targeted grazing, and the potential of shrubs to create a microclimate favourable to enhancing lamb survival;
3. A 5ha site where we are investigating the hydrology of a hillslope planted with perennial pastures (lucerne or phalaris) with or without shrub belts.

The aim of EverGraze in our region is to collect data to enable us to better recommend strategies for the profitable use of perennials in the higher (>550mm) rainfall zone while still achieving NRM outcomes, and to collect data to improve our modelling so systems can be tested over a wider range of climatic conditions and soil types than we can test in our fieldwork.

Pre-experimental modelling (using MIDAS based on average annual rainfall) was used to identify limitations to our current systems and also to identify systems which had the potential to most profitably utilise a perennial pasture base while also ensuring improved NRM outcomes. This modelling highlighted several key points:

1. Sheep systems based on a meat-merino (whereby merino ewes are joined to prime-lamb sires, eg Dorset, to produce first-cross lambs for sale) appeared to result in the most profitable use of perennial pastures (although in practice most producers will seek to continue joining some ewes to a merino sire to generate replacement ewes, due to increasing difficulty of sourcing quality sheep and biosecurity risks);
2. Improving the number of lambs weaned could significantly improve the profitability of a meat-merino system grazing perennial pastures;
3. Perennial pastures alone would not enable us to reduce recharge sufficiently in areas where this NRM issue was a priority, especially where soils were unsuitable for lucerne. Quick growing shrubs appeared to be the best option to achieve this;

Since the experiments started in 2006, annual and spring rainfall has been well below long term average, thus greatly affecting the interpretation of the results. However, the key findings to date have been:

1. While delaying lambing to September (compared with July) allows you to run more ewes/ha, and thus produce more lamb and wool/ha and achieve higher profits, in poor years the additional supplementary feed costs and difficulty of getting lambs to marketable weights (due to decline in pasture quality with a short spring), means that these systems can be highly unprofitable (Table 1).
2. A split-joining approach, whereby 50% of ewes are lamb to a meat-sire in July, while remaining ewes are lamb to a merino in September, appears to be a good compromise to capture potentially higher margins in better years, while not requiring excessive supplementary feeding in poorer years (Table 1). Flexibility in livestock systems will be critical in the face of climate change.
3. Giving oestrous-synchronised ewes access to green feed (in the form of lucerne or chicory) for a relatively short period of time (9 days) can result in increases in ovulation rate of up to 22%, and increases were observed even with relatively low levels of green feed on offer (200kg/ha). We are now investigating whether a similar response can be observed in unsynchronised ewes.
4. Provision of shelter in the form of belts of shrubs (10m wide, 50m apart) has created a microclimate more conducive to lamb survival by reducing windspeed and enhancing the ewe-lamb bond, although this has not yet resulted in significant increases in lamb survival on site due to mild winters.
5. Belts of shrubs (10m wide) planted across the slope in a phalaris/annual pasture has resulted in such a system behaving hydrologically similar to date (in relatively dry seasons) to an all-lucerne pasture.

Table 1. Gross margins for the various sheep systems tested.

	<b>July lambing Merino (all joined to Merino)</b>	<b>Sept lambing, high lucerne (50% joined to Merino)</b>	<b>Sept lambing (50% joined to Merino)</b>	<b>Split-Joined (lamb in July and Sept) (50% joined to Merino)</b>
Feed base (% total farm)	60 Phalaris 20 Fescue 20 Lucerne	45 Phalaris 15 Fescue 40 Lucerne	60 Phalaris 20 Fescue 20 Lucerne	60 Phalaris 20 Fescue 20 Lucerne
Predicted Gross Margin in average year (\$/ha)	350	440	440	420
Provisional Gross Margin (2006-2008 mean) \$/ha	52	11	-6	105
NB: While ewes/ha varies between systems (due to differences in lambing time), mid-winter stocking rate (DSE/ha) is similar in all systems.				

Measurement at the sites is due to conclude at the end of 2010.

More information: Dr Michael Friend, [mfriend@csu.edu.au](mailto:mfriend@csu.edu.au) t: 02 6933 2285.

## Optimising the quality and yield of spelt and other speciality grains under organic production

Spelt (*Triticum aestivum* var. *spelta*), an ancient relative of wheat, is one of the oldest cultivated grains. Spelt is in high demand in the health food industry and has become a popular choice for organic farmers due to its lower nitrogen requirements.

Despite lower yields compared to other cereals, returns of \$1000 per tonne (hulled, on-farm, 2008/09) has encouraged organic farmers to continue to include spelt in their rotations. However supply constraints were frustrating industry expansion and this prompted researchers from the Graham Centre to commence trials in 2005 to try and identify new and more reliable cultivars of spelt which are better adapted to organic production techniques and which exhibited superior quality attributes.

Funded by the Rural Industries Research and Development Corporation, the project has now identified three spelt genotypes (from an initial evaluation of more than 90 genotypes) as potential replacements for the industry standard 'Kamarah'.

The selected genotypes were shown to have a number of notable features including superior yield, quality and disease resistance characteristics. The average yield for the new genotypes (2.73 t/ha) was on average 0.67 t/ha above those of 'Kamarah', but below those of wheat (3.77 t/ha) and barley (4.42 t/ha). Research results showed that early maturing spelt genotypes out-yielded later maturing genotypes and that early sowing (April to June) is the preferred option. The three selected spelt genotypes reached anthesis an average of 15 days before 'Kamarah'.

Whilst it is well known that spelt has lower nitrogen requirements than wheat, little was known about its phosphorus requirements. Phosphorous response trials found that spelt wheats were lower yielding and generally prone to more biomass and tillering, lower grain harvest index and lower P efficiency, compared to common wheat cultivars. Two of the newly selected genotypes (ST1040 and ST1041) produced increased tillering, superior biomass and reasonable grain yield and both could be considered potential candidates for a grain and graze option. It should be noted however that the impact of grazing on yield was not considered.

Screening of spelt genotypes for disease susceptibility indicated that the three selected genotypes showed Moderately Resistant (MR) to Resistant (R) levels of susceptibility to both stripe and stem rust. The resistance identified in some spelt genotypes may have implications for breeding resistance to these diseases into commercial wheat varieties.



Spelt wheat genotypes. [Photo: Robyn Neeson].

Spelt genotypes were also evaluated for their quality characteristics: hull and kernel characteristics, milling performance, pasting properties and dough properties. The hull of spelt is notoriously difficult to remove, necessitating special processing facilities. Difficulties in sowing hulled grain may also be experienced. One of the selected genotypes (ST1019) produces naked grain thus alleviating the need for de-hulling. Some in industry have indicated a preference for hulled spelt, citing improved disease resistance and storing ability, so producers and processors will need to weigh up the benefits of the naked genotype over hulled genotypes. The spelt genotypes achieved (on average) 16.7% grain protein, with only two of the twenty genotypes tested achieving lower grain protein than the reference wheat (15.7%). Flour extraction (FE) data identified several lines with comparable or better milling yield than the reference wheat.



Forest plantations, open woodland grazing, urban communities, irrigated crops, and wetland environments are all rival users of water. [Photos: Tom Nordblom, all taken within the Macquarie Catchment area].

Evaluations of the spelt genotypes are continuing in a number of locations during 2009/10.

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### Developing environmental service policy for salinity and water

Results are now available from the project, *Developing environmental service policy for salinity and water*. The project deals with land use change affecting water-yields and salt-loads from two catchments: the 64,000 ha Bet Bet in north-central Victoria (Chapter 1), and 2.8 million ha of the Macquarie in NSW (Chapters 2 and 3). Particular attention is paid to the role of new forest plantations in the water economy.

Chapter 1 demonstrates ways to link land use decisions in the upper catchment to downstream changes in river flow and quality. It adds the extra dimension of economic analysis to an existing biophysical model, providing a means to identify land use changes which will modify catchment hydrology to deliver catchment-wide outcomes at least cost. This process estimates whole catchment income as net present value (NPV), water yield, salt load and the degree and location of land use to change to achieve these values.

Chapter 2 builds on earlier such results in the Macquarie Catchment to estimate economic demand for water by new tree plantations in the high rainfall areas. Trees displace current land uses in the upstream watershed and reduce river flow to downstream communities, agricultural industries and wetland areas. Economic gains are calculated for the upstream areas of new plantations as are economic losses for the downstream agricultural industries. Calculated with a supply and demand model are the economic surpluses for both upstream and downstream water users given a policy requiring purchase of permanent water entitlements to permit establishing tree plantations.

Chapter 3 uses the marginal values of water from Chapter 2 in a series of market experiments with human subjects blindly participating in the roles of the various upstream catchments and downstream parties. Results are comparable with those of Chapter 2 except for a bias called the 'endowment effect' in which those initially owning property (i.e., water rights) tend to retain more units than predicted by theory.

More information: Dr Tom Nordblom, [tom.nordblom@dpi.nsw.gov.au](mailto:tom.nordblom@dpi.nsw.gov.au) t: 02 6938 1627.

## Stubble Management Initiative

Activities in Stubble Management are increasing. The Murrumbidgee Catchment Management Group, with Phil Bowden and Tony Pratt, are seeking funds to extend the stubble grazing experiments for an extra year. Peter Martin has received support from GRDC for variety-specific agronomy, including the use of wide rows to improve trafficability under heavy stubble. Brendan Scott and Phil Eberbach are analysing data on seasonal interactions with wheat performance under different stubble loads. There has also been progress in analysing and reporting systems studies with lucerne in the rhizolysimeter. There will be a meeting to discuss progress and future directions in the Conservation Farming and Stubble Management Initiative on 3-4 August at Wagga. This will be important as we focus our research efforts. A DECC-funded Air Policy and Programs Project Officer will commence in August, located with Professor Deirdre Lemerle to facilitate coordination between agriculture, environment and human health aspects of the program.

More information: Prof Len Wade, [lwade@csu.edu.au](mailto:lwade@csu.edu.au) t: 02 6933 2523.



*The Stubble Management Initiative is focusing on economic and environmental benefits in the temperate farming zone. [Photo: Deirdre Lemerle]*



*Visiting scientist Dr Jinbiao Zhang and EH Graham Centre researcher Dr Rex Stanton inspect the effect of eucalyptus essential oils on silverleaf nightshade seedlings. [Photo: Maree Crowley].*

## Visiting Scientists

### Dr Jinbiao Zhang

Dr Zhang joined the Weeds Research Team in October 2008 as a visiting fellow through the Graham Centre and is working with Dr Hanwen Wu, Dr Rex Stanton and Professor Deirdre Lemerle. Dr Zhang comes from the Fujian Agriculture and Forestry University, China and his interests are in the field of analytical chemistry and environmental biochemistry. During his one-year term in Wagga Wagga Dr Zhang aims to identify allelochemicals from Eucalyptus trees and Brassica species.

Dr Zhang also spent one year in 2001 as a visiting scholar in the Polytechnic University of Madrid and the following two years as a postdoctoral research fellow in the Complutense University of Madrid in the field of electrochemical biosensor research.

### Dr Devendra Ram Malaviya

Dr Devendra Ram Malaviya, Principal Scientist and Head Seed Technology Division, Indian Grassland and Fodder Research Institute, Jhansi, India, worked for four months at the Graham Centre (March – June) on molecular characterisation and improvement of Egyptian clover. He worked with Dr Brian Dear and Dr Harsh Raman. His visit was supported by the Department of Biotechnology India and Charles Sturt University.

For the last 23 years Dr Malaviya's research has been on improvement of Egyptian clover, Guinea grass, fodder maize utilizing conventional as well as biotechnological methods for gene transfer in addition to apomixis research. As part of genetic improvement of Egyptian clover he has collected and evaluated germplasm, identified lines with variable degree of self-fertility (self compatible to incompatible), crossability of *T. alexandrinum* with other species, identified potential donors for various traits, developed autotetraploid Berseem, pentafoolate lines, phylogenetic studies in genus *Trifolium* and developed interspecific hybrids using embryo rescue. He has developed two varieties each of Berseem and guinea



*Dr Devendra Ram Malaviya*

grass. He developed poildy series in guinea grass utilising partitioning apomixis components in guinea grass (3x, 4x, 5x, 6x, 8x, 9x), high BIII seed producing lines, sexual lines, shade tolerant lines). Interspecific cross in maize and Lens have also been developed by him. Dr Malaviya has published research papers in national and international journals.

## Awards

### Farrer Memorial Medal Award

Congratulations to **Dr Rodney Mailer**, Principal Research Scientist with NSW DPI and Adjunct Professor, for being awarded the 2009 Farrer Memorial Medal. Dr Mailer's award recognises his outstanding contribution to edible oils research in Australia, in particular his work on canola and olive oil. Dr Mailer is internationally recognised for his work on variety breeding and quality testing and has been involved with the release of 22 canola cultivars, which have at times made up 50% of Australia's \$600 million canola crop.



*Dr Rod Mailer evaluating olive oil test results from the gas chromatograph. [Photo: Sharon Kiss]*

Dr Mailer will receive the Farrer Memorial Medal in Sydney on 28 September 2009 during the World Congress on Oils and Fats and the 28<sup>th</sup> International Society for Fat Research Congress, where he will also be invited to give the 2009 Farrer Memorial Oration.

The Farrer Memorial Medal was established in 1911 to perpetuate the memory of William Farrer and to encourage and inspire agricultural scientists. William Farrer was a former employee of the NSW Department of Agriculture.

The Medal is awarded annually to a person who has provided distinguished service in agricultural science in the areas of research, education, extension or administration.

### ATSE Crawford Fund Training Award

Recognising that the future of agricultural research relies on the quality of scientists, technologists and decision makers able to undertake and deliver on research, the Crawford Fund offers short-term practical training to teach and inspire men and women in developing countries to improve their farming, research and management.

Graham Centre PhD student, **Ray Cowley**, was competitively chosen to attend the "Rice Research to Production course" at the International Rice Research Institute (IRRI), The Philippines, and is the first Australian chosen to attend the course.

This was the third year that this training course has been offered. The rationale behind the course was to introduce young scientists to rice research and also to provide them with the opportunity to meet fellow scientists with a view to potentially engaging in international collaborative research in the future. There were 28 students from 16 countries at the course, held between 18 May and 5 June. It was a very diverse group, not only in terms of nationality, but also in terms of interests, experience and scientific disciplines. Ray hopes that this opportunity will be available for future Graham Centre students.

It was clear that considerable work had gone into developing and conducting the training, and the staff at IRRI should be applauded for their efforts. The vast range of research being conducted on rice at the IRRI is staggering. The intensive 3-week course allowed Ray the opportunity to experience the integration of 'hard' sciences and more social based science at IRRI. Clearly, adoption of new technologies in a rapid and streamlined manner, by necessity, involves combining both disciplines. The sequencing of the rice genome offers many advantages for the researchers and underpins much of IRRI's current and future progress. Ray certainly found that growing rice is hard work and was amazed at how much time is dedicated to the preparation, growing, management and harvesting of rice by the poorer farmers.



*Ohh the fun you can have with a Carabao!  
[Photo: Macario Montecillo]*

## In The Limelight

### Felicity Gummer

**Position:** PhD Student

**Supervisors:** Dr Jim Virgona (CSU), Dr John Angus (CSIRO), Dr Peter Martin (NSW DPI), Dr Jason Condon (CSU)

**Thesis Title:** The relationship between earliness and vigour in cereals

**Funding Bodies:** GRDC and Future Farm Industries CRC

#### Career and studies till now

I gained my Bachelor of Applied Science (Agriculture) and honours at CSU. In 2005, I commenced employment at FarmLink Research, a farming systems group based in Junee. My role at FarmLink was to coordinate and extend the group's research activities to farmers, agronomists and researchers. After a short break to experience motherhood, I began studying my PhD at CSU in 2008.

#### Currently studying

Doctor of Philosophy (Agriculture)

#### Research Interests

Agronomy, more specifically crop physiology

#### Professional Links

- Agronomy Society of Australia
- FarmLink Research

**A typical day for me includes ...** it varies which is nice ... working on my never-ending literature review, data collection and analysis ... and lots of procrastination!

**My main project at the moment is ...** to complete my PhD! The aim of my research is to explore the relationship between early whole-plant growth and development in cereals. My current focus is on how the major genes controlling vernalisation and photoperiod responses affect early growth.

**My favourite part of my studies is ...** being challenged and learning new things.

**When I am not studying I like to ...** relax, spend time with family and friends, play netball.

**Current CD in my car is ...** sadly, the best ever kids songs CD ... to keep Bailey amused in the car.



### David Waters



**Position:** PhD Student

**Supervisors:** Dr Jason Condon (CSU), Dr Lukas Van Zwieten (NSW DPI), Dr Sergio Moroni (CSU)

**Thesis Title:** Mechanisms for nutrient retention under Biochar-amended dryland cropping soils

**Funding Bodies:** GRDC and Future Farm Industries CRC

**Relevant Current Employment:** Soils Extension Officer, NSW DPI

#### Career and studies till now

Bachelor of Applied Science (Honours) and University Medal, CSU

Career has been varied over more years than I'd care to mention, ranging from small business owner to ski instructor and landscaper. More recently, Research Assistant/ Technical Officer for an anatomy project (CSU), Soils Project Officer (Healthy Soils for Healthy Landscapes – NSW DPI).

#### Research Interests

Soil carbon and organic amendments and their effect on soil health.

#### Professional Links

- Member of the Riverina Branch of Australian Society of Soil Science Inc

**A typical day for me includes ...** talking to farmers about their soil. Reading papers on Biochar/soil carbon. Developing/implementing my research plans.

**My main project at the moment is ...** getting my experiments happening

**My favourite part of my studies is ...** learning

**When I am not studying I like to ...** chill out with my family

**Current CD in my car is ...** a Tool album



## Thank you

**Alexa Seal** and **Bree Wilson** have been responsible for coordinating the Graham Centre Seminar Series for the past two and a half years. A big thank you is extended to Alexa and Bree for the fantastic effort they have put in which has helped make the Seminar Series very successful. **Gaye Krebs** ([gkrebs@csu.edu.au](mailto:gkrebs@csu.edu.au)) and **Nicole Hyde** ([nhyde@csu.edu.au](mailto:nhyde@csu.edu.au)) have now taken over the coordination of the series.

## Spring Edition of The Innovator

The Spring Edition of The Innovator will be released early October 2009. Submission of articles for this edition closes on **Friday, 18 September 2009**. Please email articles to Sharon Kiss.

## Secretariat

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