



Department of
Primary Industries

Southern Cropping Systems – Research & Development Prospectus



November 2015

www.dpi.nsw.gov.au

Published by the NSW Department of Primary Industries

Southern Cropping Systems – Research & Development Prospectus

First published May 2015. Second edition published November 2015.

ISSN 2205-9946 (Print)

ISSN 2205-9954 (On-line)

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www.dpi.nsw.gov.au

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Acknowledgments

Photos: NSW DPI Image Library and NSW DPI staff

Reference number 13081

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Foreword

The 'Southern Cropping Systems–Research & Development Prospectus' provides stakeholders with an overview of the Southern Cropping Systems Unit's purpose, people, structure, programs and projects. It also illustrates the structure of NSW DPI's current research and development model.

The Prospectus is available as an electronic document on the Department's website at www.dpi.nsw.gov.au.

The Southern Cropping Systems Unit is one of four units located within the Plant Systems Branch. Its purpose is to contribute to the profitability of cropping systems in southern NSW by conducting research projects developed and partnered with industry stakeholders and collaborators. The other three units include Northern Cropping Systems, Horticulture, and Water Research and Development.

Some of our stakeholders and collaborators include the Grains Research & Development Corporation, Rural Industries Research & Development Corporation, Pulse Breeding Australia, Cotton Research and Development Committee, Cooperative Research Centres, research organisations, private industry and growers.

For more than 100 years NSW DPI has been a significant contributor to agricultural production through its research, development and extension activities across the State. This has been achieved thanks to the foresight of previous generations to develop and resource research facilities. Notably, the Department's research outputs are both nationally and internationally recognised.

Deb Slinger
Director Southern Cropping Systems
Wagga Wagga

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Our Purpose

To increase the capacity of primary industries and communities to drive economic growth across NSW

The Southern Cropping Systems Unit is part of the Plant Systems Branch and is located within Agriculture NSW, a Division of the NSW Department of Primary Industries (NSW DPI). NSW DPI supports the development of profitable primary industries that create a more prosperous New South Wales and contributes to a better environment through the sustainable use of natural resources.

Agriculture NSW works with agricultural industries, other collaborators and stakeholders to improve the profitability, sustainability and skills of the agriculture and private forestry sectors. Our officers conduct research and deliver industry development programs in the fields of agricultural productivity, food security, climate, water and soil.

NSW has an excellent reputation for producing high quality food and fibre from modern and innovative crop production systems. The State has an extremely diverse climate and geographies, leading to a wide range of plant industries based on winter and summer grain and fibre crops. NSW is also one of the largest producers of irrigated crops, including rice and cotton. NSW currently produces sufficient plant products for most domestic needs and in many cases a large and potentially increasing export trade.

The ABS gross value of production from five major broadacre crops (wheat, barley, oats, cotton, and grain sorghum) was \$4.8 billion for NSW in 2012–13. This figure excludes maize, rice and winter pulses such as chickpeas and lupins. In the same period, wheat was the State's highest value agricultural export at \$2.2 billion.

Demand for food that is affordable, locally produced, nutritious and free from contaminants is increasing at a time when production systems face a complex array of challenges. These include climate variability, biosecurity risks, increasing cost of production, competition for land and water resources, and barriers to international trade. Meeting domestic demand and capturing export market opportunities is a state and national priority for plant industries.

NSW producers need access to solutions from applied and strategic research and development to deal with issues that limit their ability to profitably grow commodities whilst maintaining the natural resource base. This includes the development of crops with improved productive performance across NSW and integrated management packages that ensure crops reach genetic production potential.

Research and development also underpins the ability to identify and optimise practices and traits that enhance the value of NSW commodities and ensure they meet domestic and international market requirements.

Agriculture NSW has a clear role in ensuring domestic and global food supply through the development of technologies to improve productivity and profitability, and to promote the integrity and nutritive value of food through the supply chain.



Our Research Team

The Cropping Systems Units conduct research to develop and deliver improved technologies that underpin productive and profitable cropping industries. The Cropping Systems Program is delivered by the NSW DPI Northern and Southern Cropping Systems Units that sit within the Plant Systems Directorate. With more than 73 professional and technical staff across four regional locations, the Southern Cropping Systems Unit is one of the largest cropping research and development teams in southern NSW.



The Cropping Systems Research Program is currently conducted on eight of NSW DPI's network of 16 Research Stations. Research and development is also supported by NSW DPI's ISO accredited analytical laboratories and specialist research laboratories, and long-term field and trial sites located across a range of agro-ecosystems and agro-climatic zones. The Southern Cropping Systems Unit works with grains, fibre and oilseeds cropping industries across southern NSW.



Our Research Team include plant breeders, research agronomists, physiologists, pathologists, entomologists, molecular scientists, chemists, and research & development agronomists. We work closely with soil scientists, irrigation specialists, climatologists and biometricians from other groups within the Department and have a broad network of research partnerships within Australia and internationally.

Our Research & Development Agronomists translate the latest research and industry intelligence into practical opportunities for agribusiness and consultants. They work closely with NSW Local Land Services, peak industry bodies, commercial service providers and others.



We rely on the NSW State Government, industry contributions and Commonwealth funding to provide the resources we need to provide benefit to NSW southern cropping industries, our environment and the regional communities in which we live.

This research and development is delivered across four program areas:

1. Germplasm Improvement
2. Farming Systems Management
3. Plant Protection
4. Supply Chains and Market Access.



The Unit collaborates with industry, government, research and development organisations and communities to foster profitable and innovative plant production. The Plant Systems Branch conducts research and development aligned with the Department's Corporate Plan, State legislation and national initiatives. These include:

- NSW DPI Key Results Area 1: Competitive primary industries operating in a positive business environment
- NSW DPI Key Results Area 2: Natural resources sustainably managed
- NSW DPI Key Results Area 3: Safe, healthy and biosecure primary industries
- NSW DPI Key Results Area 4: Excellence in client service and delivery
- National Frameworks for Research Development and Extension: The Cropping Systems Unit (located within the Plant Systems Branch) delivers research and development under the frameworks for grains, cotton, horticulture, wine, plant biosecurity, new emerging industries and water use in agriculture.

Our Structure

Director Southern Cropping Systems – Deb Slinger, Wagga Wagga			
Leader Dryland Cropping Systems, Luke Gaynor, Wagga Wagga			
Pulse Research Agronomist, Mark Richards, Wagga Wagga Technical Officers: Karl Moore, Ollie Owen, Russell Pumpa. Technical Assistants: Scott Clark, Jon Evans.	Cereal Chemist, Vacant Wagga Wagga Technical Officer: Denise Fleming. Technical Assistants: Fiona Bennett, Natalie Taber.	Entomologist, Dr Jo Holloway, Wagga Wagga Technical Officer: Rachel Wood. Technical Assistant: Julieanne Clark.	Cereal Pathologist, Dr Andrew Milgate, Wagga Wagga Professional Officer: Dr Dante Adorada. Technical Officers: Brad Baxter, Antony Goldthorpe, Joel Gray, Michael McCaig, Melanie Renkin, Merrin Spackman.
Research Agronomist, Eric Koetz, Wagga Wagga Professional Officer: Tania Moore. Technical Officer: Hugh Kanaley. Technical Assistant: Greg McMahon.	Canola Pre-breeder, Dr David Luckett, Wagga Wagga Crop Physiologist, Felicity Harris, Wagga Wagga	Research & Development Agronomist Dryland, Colin McMaster, Cowra Technical Officer: Adam Coleman.	Research & Development Agronomist Dryland, Rohan Brill, Wagga Wagga Technical Officer: Paula Charnock. Technical Assistants: Warren Bartlett, Sharni Hands.
Pulse Pathologist, Dr Kurt Lindbeck, Wagga Wagga Professional Officer: Canola Pathology, Audrey Leo. Technical Officer: Gerard O'Connor.	Molecular Biologist (Canola), Dr Harsh Raman, Wagga Wagga Crop Physiologist: Dr Rajneet Uppal. Professional Officer: Dr Rosy Raman. Technical Officers: Michael Qiu, Danielle Malcolm. Technical Assistants: Chris Fuller, Ros Prangnell	Research Agronomist, David Burch, Condobolin Technical Officers: Nicholas Moody, Daryl Reardon. Technical Assistants: Sarah Baxter, Linda Brangwin.	Research & Development Agronomist Dryland, Ian Menz, Condobolin Technical Officer: Nick Hill Research Agronomist, Richard MacCallum, Condobolin Technical Assistant: Susannah Brangwin, Research Officer, Dr Neroli Graham, (located Tamworth)
Leader Irrigated Cropping Systems, Dr Sandra McDougall, Yanco			
Rice Breeder, Dr Peter Snell, Yanco Technical Officers: Fred Ciccio, Greg Napier, Kim Philpot. Technical Assistants: Nathan Doss, Minna Russell.	Rice Breeder, Ben Ovenden, Yanco Technical Officer: Kylie Elliott.	Cereal Chemist, Dr Laura Pallas, Yanco Cereal Chemist, Dr Rachelle Ward, Yanco Technical Officer: Margrit Martin. Technical Assistants: Leanne Johnston, Yuki Sims.	Cereal Geneticist, Rice Molecular Markers, Dr Livinus Emebiri, Wagga Wagga Technical Officers: Kerry Taylor, Shane Hildebrand.
Technical Officer, (Managed Environment Facility), Kathryn Bechaz, Yanco Technical Assistants: Peter Davidson, Dionne Wornes.	Research & Development Agronomist Irrigated, David Troidahl, Yanco	Research & Development Agronomist Irrigated, Tony Napier, Yanco Professional Officer: Cynthia Podmore Technical Officer: Daniel Johnston. Technical Assistant: Glen Morris.	Soybean Research Agronomist, Mathew Dunn, Yanco Field Officer: John Dando.

Management

Deb Slinger, Director Southern Cropping Systems (Wagga Wagga)



Deb Slinger is the Centre Director of the Wagga Wagga Agricultural Institute and manages the Southern Cropping Systems Unit. She has worked in agriculture and natural resources for the past twenty years including the Soil Conservation Service and the Department of Land and Water Conservation. Deb joined NSW DPI in 2001 as Salinity Team Leader and was promoted in 2007 to manage the Natural Resources Advisory Services Unit which delivered over 15 externally funded projects ranging from \$50 000 to \$20 million in the areas of irrigation efficiency, soil and salinity management, climate adaptation and private forestry. Since 2011 she has managed the diverse Dryland and Irrigated Southern Cropping Systems Unit. She has supported the Unit's researchers in significantly increasing the number and

quality of their funded projects. The Unit currently manages approximately 30 research projects across southern NSW and leads research projects across three states. Deb has built extensive skills in project management, monitoring and evaluation, and administration procedures that assist researchers with project outcomes.

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Luke Gaynor, Leader Southern Dryland Systems (Wagga Wagga)



Luke Gaynor leads a diverse team of researchers focused on grain production in southern NSW. Joining NSW DPI's Yanco Agricultural Institute in 1999 as a Research Agronomist he researched irrigated soybeans and has released three soybean varieties for southern NSW and northern Victoria. Luke was also the NSW leader for the Pulse Agronomy Project developing management practices for winter pulses. Luke has extensive research experience across both dryland and irrigated-farming systems. He has worked successfully with Research and Development Corporations developing new projects and new directions in existing projects. Luke's proven research capabilities and experience, along with his strong general crop agronomy knowledge and a broad agricultural background make him a valuable asset to the Southern Cropping Systems Team. The GRDC recognised Luke's expertise with

his appointment to the Irrigated Regional Cropping Solution Committee.

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Dr Sandra McDougall, Leader Southern Irrigated Systems (Yanco)



Dr Sandra McDougall is a member of the Southern Cropping Systems Management Team and leads the irrigated broadacre research and development staff in southern NSW. She works collaboratively with growers, industry, research scientists and extension specialists to find science-based, practical solutions to grower recognised production issues. Sandra's professional interests are in developing integrated pest management systems, including turning research outputs into practical information, and training tools to facilitate adoption of new practices. This has recently broadened from vegetable integrated pest management to integrated crop management and broadacre irrigated crops. A recent achievement is obtaining funding for a Southern Cotton Integrated Pest Management project. This project will

focus on thrips management and review whether the integrated pest management recommendations developed in the north are applicable in the southern cotton production areas.

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Wagga Wagga Agricultural Institute

The Wagga Wagga Agricultural Institute (WWAI) is a significant contributor to profitable and sustainable agricultural systems research and development in southern NSW. Through many collaborative projects and partnerships the Institute influences farming activities not only in Australia but many parts of the world.

The Institute's business focus is on improving the productivity of NSW mixed farming systems through our industry-driven research and regulatory services.

From a research perspective, the Institute is well placed to play a major role in addressing issues such as the impact of climate change on food and fibre production in southern NSW, and will continue to have a significant influence on agriculture and sustainable farming practices into the future.

Our research facilities include six NATA-accredited laboratories (molecular biology and biotechnology laboratory, plant health laboratory, edible oil laboratory, cereal science laboratories, and two training laboratories), 900 ha of land developed to facilitate both dryland (850 ha) and irrigation (50 ha) research, and well-appointed office and meeting facilities.

In total, 130 WWAI staff, of which 55 are professional officers, conduct research and provide services in a diverse range of areas from this site.

The Institute is the NSW DPI Centre of Excellence for Southern Farming Systems. Located 10 km north-west of Wagga Wagga on the western side of the Great Dividing Range where the slopes merge into the plains (Latitude: 35.05°S, Longitude: 147.35°E, Elevation: 219 m), it is on the edge of the sheep-wheat, mixed-farming belt and in the midst of a productive horticultural region.

Mixed farming in southern NSW consists of approximately 60% winter cropping (mainly wheat) and 40% livestock (mainly sheep). In 2012, as an industry it employed approximately 8000 people, and produced around 15% of the national agricultural output, with a farm-gate value of approximately \$5.2 billion.

To improve the profitability and competitiveness of mixed-farming systems in ways that protect the natural-resource base and assist land managers in adapting to climate variability, the WWAI implements major programs in Farming Practices and Agronomy; Crop Germplasm Development and Variety Evaluation; Crop Protection; Pastures; Beef Production and Animal Nutrition; Weed Science; Entomology; Vine Management; Natural Resource Management; Cereal and Oil Science.

Our research model provides a clear pathway from ideas, through to innovation and delivery. And our research teams deliver results to land managers and private and public agricultural extension organisations that enable the sustainable development of the State's southern cropping industry.



Research Officers

Dr Dante Adorada, Plant Pathologist (Cereals)



Dr Dante Adorada joined NSW DPI in 2012 and was involved in the Winter Cereals Multi-environment (GxE) Yield Trials. In 2013 he moved to a project that forms the NSW component of the National Barley Foliar Pathogen Variety Improvement Program. At this time, Dante also worked on the disease component of the National Variety Trials for wheat and barley. His present research focuses on disease management issues for winter cereals in southern NSW and northern Victoria, with emphasis on variety disease resistance. His research interests are in plant pathology and plant breeding, and he also has experience in environmental-molecular biology and microbiology. Dante holds a BSc, a MSc and a PhD degree in Plant Pathology from the University of the Philippines Los Baños, the New Mexico State University USA, and Charles Sturt University Australia, respectively. His PhD thesis examines the pathogenicity, diversity, biology and sources of resistance of *Pseudomonas fuscovaginae* in rice. Dante has worked in the government, private and academic sectors, such as the Philippine Rice Research Institute, Los Alamos National Laboratory, Plantek Hybrid Corn, and the International Rice Research Institute.

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Rohan Brill, Research & Development Agronomist Dryland



Rohan Brill commenced employment with NSW DPI as a Technical Officer in 2007. Rohan soon became a Research Agronomist at the Trangie Agricultural Research Centre before taking on the District Agronomist position at Coonamble (2008–13). His professional interests include the development of cropping systems adapted to climate variability across a range of crops (focusing on canola, wheat and barley), early sowing, improved establishment, nitrogen and plant population management, and variety selection. Rohan has the professional skills to manage research projects across a wide range of disciplines, source research funding, implement research projects, manage agronomy trials, and analyse trial data and report findings to audiences from growers to researchers. His current projects are Optimised Canola Profitability, Farming Systems to Improve Crop Tolerance to Frost, Variety Specific Agronomy Packages and the Southern Barley Agronomy Project. Rohan's recent achievements include delivering regular presentations at GRDC updates for advisors and growers (QLD to Vic.), presenting at the Australian Barley Technical Symposium–2013, and regular presenter at agribusiness pre-season planning meetings.

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Dr Livinus Emebiri, Cereal Geneticist



Dr Livinus Emebiri received his doctoral degree in forest genetics from the Australian National University, Canberra. He has over 20 years of experience in basic and applied plant genomics and molecular breeding, the development and implementation of markers in plant breeding, applied bioinformatics, and field experimental design and analysis. His previous accomplishments include mapping and elucidating the molecular genetic basis for variability in barley economic traits, and ways to create novel germplasm in wheat by use of synthetic hexaploids. Currently Livinus works on collaborative research partnerships with national and international organisations on molecular marker-assisted selection for genetic variation for heat tolerance in Durum and bread wheat; managing on-farm biosecurity risk in wheat through pre-emptive breeding; wheat germplasm development with rapid grain filling (RGF) trait for climate change adaptation; characterisation of Waagan wheat and population development for drought tolerance; genetic potential for Acrylamide mitigation in processed wheat products from Australian grains.

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Felicity Harris, Crop Physiologist

Felicity Harris joined the Southern Cropping team at Wagga Wagga in July 2015 as a Crop Physiologist. Felicity graduated with a Bachelor of Applied Science (Agriculture) (Hons1) from Charles Sturt University (CSU), and recently completed her PhD studying the relationship between development and early vigour in wheat, with emphasis on the effects of VRN1 and PPD1 genes. While at CSU she also lectured for the School of Agricultural and Wine Sciences in undergraduate course subjects including agricultural systems, weed and pesticide science, and crop science. Prior to this, Felicity co-ordinated research projects for a local farming systems group (FarmLink Research) based in Junee. These projects included the Management of Canola Diseases, Grazing Dual-purpose Wheats, and Subsoil Constraints. Felicity is currently working with the Variety Specific Agronomy Packages Project, focusing on optimising crop phenology for increased grain yield potential.

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Dr Jo Holloway, Entomologist

Dr Jo Holloway is the leader of the Stored Grain Entomology Group in Wagga Wagga. This Group is responsible for the investigation and extension of controlling insects and chemical resistance management within grain storages throughout south-eastern Australia. She is also responsible for research into insect management in broadacre field crops throughout NSW. Current projects include trapping stored-grain insects to determine dispersal throughout the environment, both within and away from storage sites; resistance bioassays against phosphine and several other insecticides; determining if resistance genes have any effect on reproductive fitness; determining the effectiveness of alternative fumigants in grain bunkers and other commodities such as rice; and investigating integrated pest management strategies, such as stubble management in broadacre field crops that may improve beneficial insect populations. Her recent achievements include participating in several recently negotiated national projects investigating stored grain insect resistance, ecology and alternative treatments.

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Eric Koetz, Research Agronomist

Eric Koetz has over 20 years experience working in crop and pasture agronomy in southern NSW farming systems. He joined NSW DPI in 1996 after working with CSIRO from 1990 to 1996 on break crops and nitrogen management of cereals. With NSW DPI, Eric initially worked on lucerne establishment in mixed-farming systems and evaluating a range of grasses (native and exotic) for low rainfall environments. From 2000, he worked on integrated weed management including six years with the CRC for Australian Weed Management. Eric's research from 2008 to 2012 focused on herbicide resistance and involved three surveys across southern and central NSW identifying resistance levels to the major herbicide groups. From 2012 to 2014, Eric was responsible for the pulse agronomy trials in southern NSW assessing the use of brown manuring in cropping systems and its role in controlling resistant weeds as well as the benefits of increased nitrogen and soil water from manured pulses to the following crops. His current role is project leader of the VSAP Project and he is responsible for the Southern NSW agronomy packages for cereals covering time of sowing, and nitrogen rates and timing.

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Audrey Leo, Plant Pathologist



Audrey Leo joined NSW DPI in 2014 and works on oilseed disease providing pathology support to the NSW canola industry. This includes monitoring major diseases such as blackleg and sclerotinia stem rot to develop better disease management strategies. She has a Bachelor of Science (Hons) and Masters of Science from Melbourne University where she developed diagnostic molecular markers to detect water- and food-borne pathogens before completing her PhD in plant science. Her PhD focused on improving the disease management strategy of *Ascochyta* blight of chickpea. Audrey has developed the largest *Ascochyta rabiei* collection in Australia, which is used by pathologists and research groups. She has extensive experience in population genetics and provided genetic information on *Ascochyta rabiei* fungal haplotypes in Australia to determine the variation in pathogenicity within the fungal population diversity. This result provided chickpea breeders with a set of pathogenic isolates for use in resistance breeding. She also has a background in plant pathogen interactions, specifically looking at the gene expressions of minor quantitative genes in chickpea to provide better understanding of the defence mechanisms crucial for host resistance.

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Dr Kurt Lindbeck, Pulse Pathologist



Dr Kurt Lindbeck is the Pulse and Oilseed Pathologist for southern NSW and is based at the Wagga Wagga Agricultural Institute. His current research includes the development of disease management strategies for canola in southern NSW and northern Victoria with a focus on blackleg and sclerotinia stem rot. Kurt also collaborates nationally to develop disease-prediction and decision-making tools for use by the grains industry, and leads the screening of field pea breeding lines for resistance to bacterial blight. Kurt has worked in plant pathology since 1996 and during his career he has largely focused on the development of pulse varieties (including lupin, lentil and chickpea) with improved levels of disease resistance and the development of integrated disease management strategies for pulse and oilseed producers. Kurt has previously worked with the Victorian Department of Environment and Primary Industries at Horsham, and was seconded to the Federal Department of Agriculture, Fisheries and Forestry in Canberra to review import conditions for pulse seed entering Australia.

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Dr David Luckett, Canola Pre-breeder



Dr David Luckett has more than 30 years experience in plant breeding and genetics. Following his PhD on barley population genetics, David worked on cotton breeding with CSIRO. At NSW DPI he researched tissue culture of barley, wheat and canola. This work resulted in the release of the very first doubled haploid variety in Australia. After 10 years, David moved to lupin breeding and worked with two species: albus lupin and narrow-leaf lupin. The research involved plant breeding, genetics, pathology, and grain quality. In 2006 David moved to managing a canola pre-breeding project focused on improving drought tolerance, blackleg resistance, frost tolerance, and grain quality. David has also worked on several minor agricultural species: kikuyu grass, spelt wheat, sesame and jojoba. David has jointly supervised Honours and PhD students at Charles Sturt University. David has extensive experience in designing, conducting and analysing plant experiments, and has significant expertise with the R software suite used for data handling, analysis and visualisation.

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Colin McMaster, Research & Development Agronomist Dryland

Colin McMaster joined NSW DPI in 2005 as a Healthy Soils, Healthy Landscapes Project Officer and has held positions as the Farming Systems Agronomist and the District Agronomist (Forbes). In his current position as a Research and Development Agronomist, Col's brief is to conduct research and facilitate development and delivery of research outcomes that enhance the productivity of dryland cropping systems for NSW farming enterprises. Colin's professional interests and skills include crop water-use efficiency (CWUE), summer-fallow management, crop nutrition and general dryland broadacre farming systems research. He is working on four projects: Variety Specific Agronomy Packages, More Profit from Crop Nutrition, Optimised Canola Profitability, and Farming Systems to Improve Crop Tolerance to Frost. His recent achievements include demonstrating that summer-weed control is a consistent key driver to increase CWUE and profitability in southern NSW cropping systems, and the development of research results that helped growers and advisors base fertiliser decisions on science when selecting alternative fertiliser sources.

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Dr Andrew Milgate, Cereal Pathologist

Dr Andrew Milgate obtained a Bachelor of Science (Hons) from the University of Newcastle and specialised in plant science before undertaking PhD studies in plant pathology and molecular genetics at the University of Tasmania. He was appointed Wheat Breeder with NSW DPI at the Wagga Wagga Agricultural Institute in 2000. In 2007 Andrew accepted the position of Research Plant Pathologist with a brief to develop and lead the NSW DPI research program investigating diseases of winter cereals grown in southern NSW and he currently holds this position. Andrew works on the following projects with a number of collaborators: National variety testing for wheat and barley foliar pathogens – NSW; Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in southern NSW; National barley foliar pathogen variety improvement program; National crown rot epidemiology and management program – southern NSW; In vivo gene expression of *Septoria tritici* and discovery of genes involved in host evasion during the endophytic phase.

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Dr Harsh Raman, Molecular Biologist, Canola Molecular Markers

Dr Raman holds a PhD from the Punjab Agricultural University, India. He now conducts and oversees plant molecular biology research at the Wagga Wagga Agricultural Institute. Dr Raman joined NSW DPI in 1996 and has undertaken and managed research projects in wheat, barley and canola. His interests include applying molecular-biology tools to the development of improved crop varieties, investigating genetics and tag loci underlying complex traits of agronomic importance, and determining genetic diversity in cultivated and landrace germplasm. Genome mapping and the development of molecular markers for crop improvement are among Dr Raman's professional skills. Currently he is working on a number of projects: Development of Molecular Marker for Application in Australia Canola, National Brassica Germplasm Improvement Program, Establishing Novel Breeding Methods for Crop Improvement (Australian Research Council linkage grant with University of Queensland), and Discovery of Novel Alleles for Wheat Improvement (Collaboration with the International Maize and Wheat Improvement Centre). Dr Raman has written chapters for plant molecular-biology books and published more than 80 peer reviewed scientific papers. During the last five years his team has mapped loci associated with flowering time, and resistance to blackleg disease and pod shattering in diverse germplasm of canola.

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Dr Rosy Raman, Research Scientist, Canola Molecular Markers



Dr Raman holds a Bachelor of Science, a Masters of Science in Plant Genetics and a PhD in Plant Breeding from the Punjab Agricultural University, India. Since joining NSW DPI in 1997, she has worked on various projects developing trait-marker associations in barley, wheat and canola. Dr Raman is working on the 'National Brassica Germplasm Improvement Program–Phase II Project'. The Project involves evaluating germplasm for pod-shatter tolerance and drought-related traits and identifying molecular markers for key priority traits (blackleg resistance, pod shatter, drought and heat tolerance) in *Brassica napus* in conjunction with organisations such as the Victorian Department of Environment and Primary Industries, University of Western Australia and Australian canola breeding companies. Her research interests include identifying genetic variation for agronomically important traits for crop improvement, studying the genetics of these traits and developing trait-marker associations. Dr Raman has skills in the development of molecular markers for agronomically important traits, genetic diversity analysis, linkage and association mapping. She also has expertise in screening germplasm for various biotic and abiotic stresses.

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Mark Richards, Pulse Research Agronomist



Mark Richards became the Pulse Research Agronomist at Wagga Wagga in 2015. With 25 years of experience in agricultural research with NSW DPI, Mark started his career with the Department as a Technical Assistant on sub clover evaluation in 1989. In 1992 he moved to the Lupin Breeding Program as a Technical Officer. In 2009 Mark became leader of the NSW evaluation node for narrow-leaf lupin improvement in Australia as well as a project evaluating the remaining *albus* breeding program material from the closed NSW Breeding Program. In 2014 he took leadership of the Southern Irrigated Soybean Agronomy Project and is the Southern Node Leader for the Australian Soybean Breeding Program. In 2015, he added chickpea, lentil, faba bean and field pea to his portfolio. Mark was involved in the release of *Goulburn* and *Riverina* sub clover, and numerous lupin varieties, namely *Wonga*, *Jindalee*, *Quilinoch*, *Jenabillup*, *Mandelup*, *PBA Gunyidi*, *PBA Barlock*, *Luxor* and *Rosetta*. His work requires skills in project management and a capacity to work with a diverse range of stakeholders. Mark has developed a sound understanding of southern cropping systems by working closely with individual producers, producer groups, advisors and researchers.

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Dr Rajneet Uppal, Crop Physiologist



Dr Uppal's research work focuses on agronomy and physiology of crop species, spanning different ecological environments in the UK, India and Australia. Her current and established research seeks to: improve understanding of resource capture and use-efficiencies; facilitate the development of germplasm that can mitigate and/or adapt to abiotic stress; sustainable intensification of tropical cropping systems and to improve the nutritional quality of cereals. Joining NSW DPI in 2015 as crop physiologist, she is responsible for screening components of drought tolerance in diverse sets of Brassica germplasm in National Brassica Germplasm Improvement Program (NBGIP). Rajneet comes to NSW DPI from University of Reading, UK where she was a PhD fellow. She has developed her academic career through positions held as Visiting Scientist at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); a member of CGIAR consortium; Post-doctoral Research Associate at University of Reading and Research Fellow at Punjab Agricultural University.

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Project Officers

Tania Moore, Project Officer

Since joining NSW DPI in 2002 Tania Moore has worked on a variety of farming systems and natural resource management projects. She has a broad range of experience that includes the provision of agricultural extension and advisory services, development of industry focused education programs, and implementation of project-specific monitoring and evaluation strategies. In her current position Tania is responsible for managing the ongoing monitoring, evaluation and reporting for two research projects. Her main tasks include preparation and maintenance of project monitoring and evaluation plans, designing and implementing evaluations, supervising and supporting data collection, generating evaluation reports and disseminating findings. She also collaborates with other members of the Southern Cropping Systems Unit to build into projects the capacity to undertake robust evaluation activities.



Cynthia Podmore, Project Officer

Cynthia Podmore joined NSW DPI as a Project Officer in 2005. She has a degree in Agricultural Science from the University of Adelaide and 10 years experience as a project officer in the Southern Cropping Unit. She has worked on a number of dryland projects covering topics such as best management practices for weed and disease management in dryland cropping systems, stubble management, break crops, grower training and e-learning course development. Her role has included managing on-farm trials, producing a range of publications from Primefacts to technical reports, and administering multi-site projects. Cynthia is currently working on an irrigated cereal and canola variety project (Southern irrigated cereal and canola varieties achieving target yields, 2014–17) that spans southern NSW, Victoria, South Australia and Tasmania.



Technical Officers

Brad Baxter, Technical Officer (Pathology)



Brad Baxter commenced employment with NSW DPI in April 2015 with the brief to work on the 'National crown rot management program–Southern NSW component'. His primary roles include a longitudinal study of crown-rot levels in Southern NSW farming systems using PreDictaB sampling method, yield loss and crop rotation, and sequencing trials as well as the associated trial-management activities. Prior to commencing work with the NSW DPI, Brad spent seven years working in the forestry sector gaining experience working in various agricultural landscapes across NSW, Vic. and WA. His main responsibilities were to manage and oversee the successful on-ground establishment of large-scale plantations. In WA, Brad managed 10 000 ha of plantations. Brad completed a Bachelor of Environmental Science (Land and water) through Charles Sturt University in 2008.

Paula Charnock, Technical Officer (Agronomy)



Working with NSW DPI for 16 years, Paula Charnock initially managed the Stored Grains Laboratory. She then moved to the Soils and Salinity Team where she developed and delivered a number of training packages: Salinity, Farm Water Supply and Climate Risk, Managing Land Capacity, Soil Erosion and Groundcover, Soil Biology and Soil Carbon. As Project Coordinator for two projects aimed at building the soil-management capacity of landholders through Soil Carbon and Soil Biology workshops to better manage soils, over 450 landholders were trained across Southern NSW. She is currently working with Rohan Brill on the following projects: Optimised Canola Profitability, Farming Systems to Improve Crop Tolerance to Frost Variety Specific Agronomy Packages and the Southern Barley Agronomy. Paula's qualifications include: Bachelor of Applied Science, Diploma of

Education, Certificate IV in Assessment and Workplace Training, Certificate IV in Carbon Management and Certificate II in Bushland Regeneration. Soil biology and the integration of natural resource management into current agricultural practices are two of Paula's professional interests.

Adam Coleman, Technical Officer (Agronomy) Cowra



Adam Coleman joined NSW DPI at Cowra in 2015. For the past 19 years he has been involved in both dryland and irrigated cropping as an agronomist and owner/manager of a mixed-farming enterprise in the northern production region of NSW. Throughout this time he has focused on his interest in profit drivers and the pivotal role research plays in the development of farming systems. His current projects include Variety Specific Agronomy Packages, More Profit from Crop Nutrition, Farming Systems to Improve Crop Tolerance, and Optimising Canola Profitability. These projects are located in medium to high rainfall zones. His professional interests include farming-systems advancements in agronomic packages and technology; crop sequencing; water use efficiency—making every drop count in a changing environment; and the role precision agriculture will play in fine tuning these in

the future. Adam's aim is to ensure that research outcomes form the foundation for advancements in crop production and producer profitability.

Antony Goldthorpe, Technical Officer (Pathology)

Since his employment with NSW DPI in 2001, Tony Goldthorpe has worked on a number of industry-funded projects. These projects focused on wheat and barley diseases requiring his involvement in field and glasshouse trials, and working in both the pathology and the molecular-biology laboratory. Tony completed a Diploma in Horticulture and is highly skilled in assessing the disease symptoms and disease levels of wheat and barley plants. Currently Tony works in Plant Pathology where a wide range of disease trials on both wheat and barley are under way. Some of the trials include: Yellow Leaf Spot Epidemiology trials (dryland and irrigated), Stripe Rust effects on yield versus sowing time, and Crown Rot resistance/tolerance effect on yield.



Joel Gray, Technical Officer (Pathology)

Joel Gray started with NSW DPI in 2013 undertaking an internship working with molecular techniques in rice genetics for Dr Livinus Emibiri. This was a course requirement for his Medical Science and Biotechnology Degree, which was completed by the end of that year. During that time Joel also assisted in a canola project before moving to plant pathology to utilise his laboratory skills. Eager to engage further with science and the cropping industry, Joel was able to expand his experience into a range of field and glasshouse activities whilst continuing with laboratory work. In 2015 he started as a Technical Officer in field operations for cereal pathology helping to manage the National Variety Trials, which evaluates the level of resistance to key diseases across common and novel wheat and barley varieties. Tasks undertaken in this role include seed and nursery management, weed management, data collection and analysis, and machinery operation and maintenance.



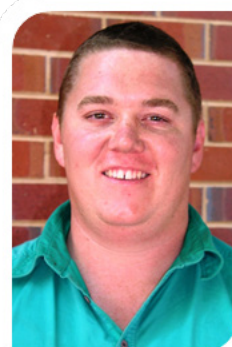
Shane Hildebrand, Technical Officer (Cereals)

Before gaining his current position as a Technical Officer in cereal research in 2015, Shane Hildebrand had worked with the Department's Pasture Unit from September 2012. In this position Shane successfully managed the field trials of four projects. Shane obtained his Bachelor of Science (Agriculture) from Charles Sturt University and after graduating held a number of positions with the University, progressing from Technical Assistant to Technical Officer. During his career Shane has worked on several projects with funding from MLA and AWL as well as projects associated with the CRC for Plant-based Management of Dryland Salinity and the Future Farm Industries CRC in the areas of plant biology, native pastures and allelopathy. Shane has extensive skills and experience in glasshouse and laboratory operation, and conducting field research (trial design, field work coordination, staff organisation, and data collection and management).



Hugh Kanaley, Technical Officer (VSAP)

Hugh Kanaley commenced employment with NSW DPI in May 2014 as Technical Officer (Canola) with the National Brassica Germplasm Improvement Program conducting field trials. He was primarily working on canola drought tolerance and pod-shatter resistance research. In his current position with the Variety Specific Agronomy Packages Project Hugh tests winter-crop varieties (wheat, barley, canola and lupins) in different agronomy trials. This is Hugh's second position since graduating from university and he enjoys the challenge of research. Hugh studied in Tasmania, and holds a Bachelor of Applied Science (Marine Environment) from the Australian Maritime College, Launceston where he majored in Fisheries Management. Coming from an agricultural background, Hugh has extensive experience and a passion for working in the areas of livestock and dryland cropping.



Michael McCaig, Technical Officer (Pathology)

Since joining NSW DPI in 1999, Michael McCaig has worked on three major projects: Wheat Breeding, Barley Evaluation and Plant Pathology. As well as a Diploma in Agribusiness, he has extensive laboratory, glasshouse and field-trial experience. Michael is interested in evaluating plant reactions to the pathogens screened in the disease nurseries and gaining expertise in pathogen identification. He is currently working on projects which involve establishing eight field nurseries at Wagga Wagga to screen for wheat and barley reactions to different pathogens. This project also includes screening for resistance ratings for the National Variety Trials.

Danielle Malcolm, Technical Officer (Canola)

Danielle Malcolm's career began in the horse industry (Stud Assistant and Office Manager) and agricultural research (Project Biologist and Office Manager) before taking on a NSW DPI position as a Technical Assistant in March 2014. Danielle initially worked on the National Variety Trials Program and then moved to the Feed Quality Laboratory until she obtained her current position as a Technical Officer with the National Brassica Germplasm Improvement Program. In this position, Danielle is primarily working on canola drought tolerance and pod-shatter resistance research. She conducts field trials with the majority of these trials being located on the Wagga Wagga Agricultural Institute site. Danielle studied at Charles Sturt University and holds both a Bachelor of Applied Science (Equine Science) and a Bachelor of Agricultural Science.

Karl Moore, Technical Officer (Pulse)

Karl Moore completed an Advanced Diploma of Agribusiness in 1999, before commencing work at the NSW DPI Pastures Section for six months. After working on the family property he returned in 2008 as a Technical Officer for the Variety Specific Agronomy Packages Project (VSAP). Karl brought to this Project his management, farm machinery, and cropping skills to successfully test a number of winter-crop varieties (wheat, barley, canola and lupins) in different agronomy based trials such as time of sowing, seeding rates, row spacing and fertiliser applications. In his current position Karl is responsible for the southern NSW evaluation and agronomy of pulse breeding material emanating from the national Pulse Breeding Australia networks for field pea, chickpea, lentil and faba bean. His professional interests include farmer focused research, liaising with like-minded people and leading a

skilled and well organised team that provides effective results. Growers have used the VSAP Project's findings for variety selection and a significant amount of the data helped to formulate the recently published Graham Centre 'Row Space Monograph'.

Ollie Owen, Technical Officer (Pulse)

Ollie Owen obtained his Bachelor of Applied Science (Agriculture) from Charles Sturt University. Ollie initially worked at the Wagga Wagga Agricultural Institute on a Lucerne Evaluation Project for four years starting in 1997 before leaving to explore other endeavours in 2001. After managing his grain and produce business for 13 years Ollie returned to work with the NSW DPI Lupin Evaluation Team in early 2015. This project involves the selection of improved lines of genetic material for South Eastern Australia and aims to release superior producing lupin varieties for growers. Lines are sent from WA for evaluation and after seed increase in quarantine, move through the selection process to the National Variety Trial Program. From this point the successful lines will proceed through the requirements for release.

Russell Pumpa, Technical Officer (Pulse)

Russell Pumpa started working as a Technical Officer with the Pulse Agronomy Team in 2015. Prior to this appointment, Russell worked as a casual Technical Assistant with the National Variety Trials and VSAP Project. In his current position Russell is responsible for sowing, machine maintenance, weed control and harvest of various pulse trial crops. Russell has a Diploma of Agriculture and extensive experience in the agricultural industry having first managed the cropping component and then the total operation of a 7500 ha dryland and irrigated property owned by Macquarie Bank over 14 years. This was a complex operation with eight centre pivots producing, for example, corn for the Gunnedah Maize Mill and seed canola. Russell also worked for three years with the Murrumbidgee Catchment Management Authority undertaking earthworks for erosion control, tree planting, dam building and roadworks. He also has practical experience in the maintenance and management of machinery.



Gerard O'Connor, Technical Officer (Pathology)

Since 1983 Gerard O'Connor has performed a range of roles within NSW DPI and is experienced in both pulse and pasture agronomy. Gerard has a Masters Degree in Agricultural Science and a Bachelor of Applied Science. His research investigations include soil acidity effects on crop and pasture systems, soil microbiology, plant pathology, pulse nitrogen fixation, quantifying soil nitrogen benefits from pulses, and conducting regional pulse variety evaluation trials. Gerard is currently working in the Wagga Wagga Agricultural Institute Plant Pathology Group which conducts field evaluation of bacterial blight tolerance within field pea cultivars for the national breeding program, and epidemiological studies and control measures for fungal diseases of canola and pulse crops across southern NSW.



Denise Pleming, Technical Officer (Cereal Chemistry)

Denise Pleming completed a Bachelor of Applied Science in 1982 and was employed in the Cereal Chemistry Section at the Wagga Wagga Agricultural Institute as a Technical Assistant in 1987. After progressing through Technical Officer positions on research projects into late maturity alpha-amylase and noodle quality method development, Denise was appointed Technical Officer, Cereal Chemistry, in 1999. Working predominantly in the field of quality assessment of wheat through grain, flour, dough and end-product testing, she has gained extensive experience and knowledge of specialist cereal chemistry instrumentation and methods including quadrumat and Buhler milling, dough rheology and test baking. Denise's current projects include investigating the genetic basis for heat tolerance in Durum and bread wheats; the assessment of breeding program material to provide data for classification and subsequent release to growers of new varieties with desired quality for target markets; collaborative research into the effect of D-genome related gluten proteins on Durum wheat pasta and bread making quality.



Ros Prangnell, Technical Officer (Pre Breeding)



Since 1983 Ros Prangnell has worked for NSW DPI on soils and cereals in field, glasshouse and laboratory environments. She holds a Diploma in Applied Science (Agriculture) and from 1983 to 1991 was involved in managing projects for nitrogen and phosphorus determinations in soils, and cereal and tropical legume crops. She then managed a Barley Tissue Culture Project from 1991 to 2003, where she was responsible for the culturing of the feed variety *Binalong*. Ros has also managed the Canola Tissue Culture Program and implemented a soil-carbon project, resulting in the publication of the booklet, 'A farmer's guide to increasing soil organic carbon under pastures'. Since 2004 she has worked with various molecular biology projects including the extraction and identification of proteins in wheat and genotyping of wheat, barley and canola for varying traits. Ros has also managed quality management projects and has extensive experience managing trials in growth room and glasshouse environments such as legume nutrition trials and canola flowering trials.

Michael Qiu, Technical Officer (Pre Breeding)



Since 2012 Michael Qiu has worked as a Technical Officer in the Canola Molecular Marker Program. His main duties include DNA genotyping and genetic mapping activities, such as high throughput DNA extraction, high throughput DNA genotyping with different molecular markers and data analysis for genetic mapping; performing shatter tests on canola pods; maintaining and calibrating laboratory equipment; carrying out and managing trials under glasshouse and field environments; developing standard operating procedures (SOP); and working with visiting scientists and demonstrating for students. Michael has knowledge of and interest in plant pathology, microbiology, genetics, molecular biology, nematology and entomology. He has extensive work experience in laboratory, glasshouse and field trials obtained through working in scientific institutes. Michael can design, carry out and analyse laboratory, glasshouse and field experiments and has high level computer skills in both general and professional areas. Michael's qualifications include a Bachelor of Plant Protection, Zhongkai Agritechnology University, GaungZhou, China (2001), and a Master of Applied Science (Agriculture), Charles Sturt University, Wagga Wagga (2005).

Melanie Renkin, Technical Officer (Pathology)



Melanie joined the Plant Pathology Team in July 2014. She received a Bachelor of Science (Microbiology (Hons) and Genetics) in 2008 from the University of New South Wales. She is currently involved in monitoring fungicide resistance in *Septoria tritici* blotch in wheat. Her role includes isolating *Septoria tritici* from samples collected from around Australia, phenotyping isolates in order to establish fungicide resistance levels, and assisting with genotyping isolates to look for known and novel mutations associated with fungicide resistance. Melanie has previously worked in diagnostic microbiology with NSW Health.

Dr Merrin Spackman, Technical Officer (Pathology)

Dr Merrin Spackman obtained her PhD from Monash University in molecular population genetics. She has come from a background in molecular diagnostics at the Victorian Department of Primary Industries (Vic. DPI) based in Horsham. At Vic DPI, she led the development of several molecular diagnostic tests for exotic fungal and viral pathogens. Of these, the barley stripe rust test has been adopted as a national protocol. Merrin has been working in the pathology team at NSW DPI for 12 months on the *Septoria tritici* blotch (STB) fungicide resistance project, phenotyping and genotyping of *Zymoseptoria tritici* isolates collected from around Australia in order to monitor the current levels of fungicide resistance and possible source of resistance.



Kerry Taylor, Technical Officer (Cereals)

Working in Cereal Genetics and Improvement, Kerry Taylor has been with NSW DPI since 1974. She holds an Associate Diploma in Laboratory Technology, an Associate Diploma of Applied Science (Farming) and a Bachelor of Applied Science (Agriculture). For most of her career Kerry has worked with cereals (field, glasshouse and laboratory). From 1976 to 2008 she enjoyed being part of the Wheat Breeding Team—breeding wheats for yield, disease resistance and quality suited to domestic and export markets. In 2008 her involvement in the Wheat Breeding Program moved to pre-breeding development of agronomic and quality traits and breeding tools for improved terms of trade for northern and eastern Australian growers. Kerry's current projects include: Identification of Genetic Variations for Heat Tolerance in Durum and Bread Wheat, and Managing On-Farm Biosecurity Risk in Wheat through Pre-emptive Breeding.



Rachel Wood, Technical Officer (Entomology)

With over 15 years experience as a Technical Officer, Rachel Wood has worked for NSW DPI for 11 years. Initially employed as a Technical Officer for the Molecular Biology Laboratory, she became Technical Officer/Laboratory Manager for the Entomology Laboratory in 2007. Rachel has a Degree in Applied Science (Medical & Applied Biotechnology) and extensive technical experience in all areas of Biotechnology (Molecular Biology, Genetics, Immunology, Microbiology, Mammalian Tissue Culture, Entomology, glasshouse work and small-animal experiments). Rachel's current work involves resistance monitoring of stored grain insects. She regularly liaises with growers and industry to collect and identify field-crop insects and determine resistance through bioassays using existing pesticides, with a focus on phosphine. Rachel has also designed and conducted experimental methods for testing new pesticides and validation of industry chemical treatments on insects. Rachel is the sole controller and data manager of the NSW Master Copy of the Australian Grain Insect Resistance Database, which provides a national approach to resistance data management.



Technical Assistants

Warren Bartlett, Technical Assistant (Agronomy)



Warren Bartlett initially worked with NSW DPI as a casual Technical Assistant on the Barley Breeding Program from November 2008 to July 2011. In this position he was responsible for assisting with all aspects of trial establishment and management including seed packing, sowing, weed control and harvest. Warren returned to the Department in 2013 to work on the VSAP and National Variety Trials Projects. In 2015 Warren obtained a temporary Technical Assistant position on the Optimised Canola Profitability Project managed by Rohan Brill. Warren has gained valuable technical experience and skills through his work with the Department. He holds a Truck Licence (HR) and certificates in chemical use and tractor use.

Fiona Bennett, Technical Assistant (Cereal Chemistry)



Before gaining her position with NSW DPI in 2013, Fiona Bennett obtained her Agricultural Science Degree from Charles Sturt University, Wagga Wagga. While still a student, Fiona worked with the commercial business, Agrisearch Services, carrying out National Variety Trials (NVT) and other trial-maintenance tasks. In her Technical Assistant role with NSW DPI, Fiona again worked on NVT projects carrying out seed packing and grain testing at harvest. Since 2014 Fiona has worked in the Cereal Chemistry Laboratory and conducts quality testing on grain, flour, dough and end-products. Fiona has completed a Laboratory Course through NSW DPI and enjoys working in such a well-managed Laboratory/workplace.

Julieanne Clark, Technical Assistant (Entomology)



Working in Stored Grains Entomology, Julieanne Clark conducts an annual survey of farms, bulk handlers and resellers of grain across NSW. The survey involves interviews, mini workshops and the collection of grain and insect samples that are tested for resistance, with phosphine the mainstay of the Project. She also collects data and live samples for the DAFF/UQ Project on population genetics of the lesser grain borer and flour beetle across NSW and Victoria. Having worked with NSW DPI for 14 years, Julieanne also has experience as a Regulatory Officer. She has also operated her own nursery for 12 years and has a background in irrigation and dryland farming and grazing.

Scott Clark, Technical Assistant (Pulse)



Scott Clark has worked on a range of projects at the Wagga Wagga Agricultural Institute as a Technical Assistant since 2009. After a year on the Fruit Fly Project and two years on Canola Germplasm development Scott is now a Technical Assistant on the Lupin Evaluation Projects. Combined with his Trade Certificate III in sheet-metal fabrication, he is well skilled and experienced to fulfil his role in carrying out the daily field operations of the Lupin Evaluation Programs. These operations involve assisting with trial sowing, management, harvest, data collection, seed increase, and storage of germplasm and maintenance of all research equipment. Scott's work contributes to the release of superior lupin varieties for NSW growers.

Jon Evans, Technical Assistant (Pulse)

Jon Evans has a background in construction and has worked in agricultural research with NSW DPI since 2011. He assists in the evaluation of pulse breeding material for the Southern NSW area of 'Pulse Breeding Australia' (field pea, chickpea, lentil and faba beans). Jon has worked on the Southern Pulse Agronomy Project which identifies management effects on commercial and newly developed cultivars of pulses. In this role, his tasks include the use and maintenance of machinery (headers, cone seeders, spray equipment and seed cleaners); monitoring paddocks and taking appropriate herbicide, pesticide and fungicide action; dry matter cuts; recording and logging trial data; sowing and harvesting trials.



Chris Fuller, Technical Assistant (Canola)

Chris Fuller began his Technical Assistant position with the NSW DPI Pastures Unit in 2013. In this position Chris was responsible for organising and conducting the collection of field samples. He used his skills in computing, and the planning and monitoring of field trials to successfully carry out this role. Chris is currently the Technical Assistant with the Canola Group where he works on planning and carrying out the daily operations required for the management of trials including sowing, weed and pest control, harvesting, data collection, seed increase, and the use and maintenance of research equipment. Chris brings to this role his valuable skills and knowledge gained through his Diploma of Agriculture, farming background and previous positions as a Greens Superintendent, Engineering Assistant, Small Motor Mechanic and Farm Overseer.



Sharni Hands, Technical Assistant (Agronomy)

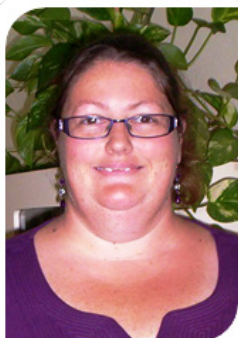
Sharni Hands initially worked with the Department as a casual during harvest in 2014 on the NVT Project. In March 2015 Sharni joined the VSAP Team for six months carrying out sowing, harvest, plant sampling and processing, data entry, and plant-trial husbandry and management. She is currently with the Canola Optimisation and Profitability Team working on canola and barley trials. Her Certificate 3 in Horticulture qualification and current Horticulture Diploma studies equip Sharni with knowledge that is relevant to her workplace. Previously Sharni has worked at the State Forests Nursery (Narrandera), Masters Nursery (Wagga Wagga), private gardens and grazing properties.



Greg McMahon, Technical Assistant (Agronomy)

Before gaining his Technical Assistant position, Greg McMahon worked in the building industry for 20 years as a wall and floor tiler. Greg started with NSW DPI in February 2014 on the VSAP Project which investigates time of sowing, and fertiliser rates and timing for cereals. His responsibilities include assisting with sowing, harvest, plant sampling and processing, and basic plant-trial husbandry and management. Greg's training record includes tractor and quad bike use, project management, Chemical Users Certificate 3 and first aid.



Natalie Taber, Technical Assistant (Cereal Chemistry)

Natalie Taber started with NSW DPI in 2003 on a traineeship in Certificate III Laboratory Skills. She has also gained a Certificate IV in Laboratory Techniques. After completing her traineeship, Natalie worked in a number of different sections at Wagga Wagga Agricultural Institute as a casual Technical Assistant. In 2007 she became a regular team member of the Cereal Chemistry Section, assisting with quality testing of wheat through grain, flour, dough and end-product testing such as noodles. Natalie has considerable experience in specialised cereal chemistry equipment and methods including quadrumat and Buhler mills. She has worked on a BioFirst Project on heat-stress tolerance and is currently working on a GRDC-funded project to identify genetic sources of heat tolerance in Durum and bread wheat as well as conducting quality testing of breeding program lines.

Condobolin Agricultural Research and Advisory Station

The Condobolin Agricultural Research and Advisory Station located in the centre of the NSW cereal belt has made an important contribution to farming systems practice in the Central West. It is renowned for its studies on wheat and barley production, as well as best management practices for canola in low rainfall and moisture limited environments. In addition to agronomic studies; extensive basic research into plant physiology, water use efficiency, and the management of phosphorus and nitrogen is also being undertaken. Research capability includes the scope to conduct large scale replicated trials in a low rainfall environment, with the ability to irrigate if necessary. There is also the capacity to carry out commercial, farm scale trials using modern broad acre equipment and technology.

The Station is situated adjacent to the Lachlan River—just above its floodplain. It covers 1722 ha, predominantly of red gradational and red brown earths typical of the wheat-sheep zone of NSW. At an elevation of 195 m, it has an average rainfall of 424 mm (1914–2006), which is non-seasonal and highly variable. However, high summer evaporation rates which average between 8 and 10 mm a day from the start of November to the end of February mean much of the rain during the summer months is ineffective. Cool season rainfall (April–October) is most effective and is used for winter cereal growing as the main cropping period. Pastoral enterprises rely on naturalised medics (*Medicago* spp.) and some native grasses that also grow in autumn and spring.

Temperatures at Condobolin range from 33.5°C (average January maximum) with an average of more than five days annually above 40°C, through to 2.7°C (average July minimum) with an average of 23 days below 0°C. There is a frost period extending from mid-May to mid-September when minimum temperatures can fall to –3°C and occasionally lower.

The topography is predominantly level with a small area of slightly undulating land in the north western corner. The soils (red gradational and red-brown earths) are near neutral pH with low inherent fertility and organic matter. They become shallow and stony on the undulating land. The natural vegetation was open savannah dominated by white cypress pine (*Callitris glaucophylla*) and bimbale box (*Eucalyptus populnea*) with scattered shrubs and a short grassy understorey. Much of the Station is now cleared of natural vegetation and used for farming and grazing of introduced pasture species.

The Station is well equipped with office and seminar facilities, frequently hosting groups of up to 200 people. Farm operations use modern machinery, including GPS technologies, to implement best practice farming techniques minimising the impact of agricultural activities on the environment. Modern facilities and infrastructure such as grain processing sheds, livestock handling facilities and more than 100 well fenced and watered paddocks ensure the station can reliably and efficiently conduct research activities to a high standard.



Research Officers

David Burch, Research Agronomist



David Burch accepted the Research Agronomist position at the Condobolin Agricultural Research and Advisory Station in March 2015. He is currently running a barley agronomy project, implementing different management techniques across a number of field environments and barley varieties. The results of these projects will be made available to growers in order to assist with on-farm decision making. Prior to this, David has worked as both a research scientist and a technical officer for the Department of Primary Industries Victoria, based in Horsham. During his time there he worked in breeding programs for wheat and barley, as well as conducting field trials into genetically modified wheat and canola. He has also worked on large scale genotyping projects, identifying genes of interest from thousands of wheat landraces for biotic and abiotic resistance, as well as improved grain quality.

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Dr Neroli Graham, Research Officer



Dr Neroli Graham is a Research Officer based at Tamworth and she works within the Southern Cropping Systems Unit. Neroli completed a PhD investigating the agronomy of chickpea in 2000. She joined NSW Agriculture in 1999 and has worked across a range of diverse cereal breeding and agronomy based projects. Neroli currently provides statistical support for two projects that cover four states—the Irrigated Cereal and Canola Project; and the Double Cropping and Canola Quality Project. She has recently completed a Master of Biostatistics from the University of Queensland and has a professional interest in plant genetics and biostatistics and their application towards plant improvement.

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Richard MacCallum, Research Agronomist



Richard MacCallum holds an Honours Degree in Agriculture and has over 15 years experience in applied agronomic research. Initially, his role within NSW DPI was to provide technical support for a range of winter crop agronomy and breeding trials across central western NSW. Following this, Richard managed a crop-modelling project in collaboration with the University of Western Sydney investigating fallowing and water use of wheat. More recently, he was Project Leader for a large scale trial using old man saltbush as part of the feed supply for sheep. Richard has written grower targeted reports and presented research findings at numerous field days and industry events. His overriding interest is in helping increase the productivity of Australian farms. He is currently the Project Leader for the southern Australian node of a national project investigating frost damage in winter crops.

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Ian Menz, Research & Development Agronomist Dryland

In the 16 years that Ian Menz worked with NSW DPI's Barley Breeding Project based at Wagga Wagga, he gained extensive experience in plot trials, and conducting trials in early generation material through to varieties on the point of commercial release. He has three years' experience in barley agronomy with the Southern Barley Agronomy Project. During this time he led the Southern NSW Node of the Project—conducting seed rate, time of sowing and nutrient trials. Ian's long-term research and development work on barley has led him to be recognised as an industry expert on varieties, culminating in the authorship of 'Australia Barley Varieties – A Reference Guide' for Barley Australia. Ian also has three years' experience in pulse agronomy while based at Wagga Wagga, where he conducted trials evaluating pulse agronomy, varieties and pulse pathology. His professional interests and passions are to increase the area sown to barley in Southern NSW and to promote the role of pulses within the cropping rotations.

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Technical Officers

Nick Hill, Technical Officer (Agronomy)



Nick Hill is a recent addition to the NSW DPI team based at Condobolin. He is primarily involved in the various aspects of field work, sample processing, and data entry/assessment for the Canola and VSAP projects. These projects identify the impacts of agronomic variables such as sowing time, seeding rates and fertiliser rates upon yield outcomes for identified varieties. Nick was previously employed by the farming systems group Central West Farming Systems, as a Farmer Trials and Extension Officer working on projects such as Maintaining Profitable Farming Systems with Retained Stubble, Soil Acidity and pH management for Central West Farming Districts, and Overdependence upon Agrochemicals. Nick has also worked as the Catchment Officer with the Lachlan Catchment Management Authority. Nick undertook Honours in Ecological Chemistry, and achieved a Bachelor of Applied Science at

the University of Canberra and is currently studying a Graduate Certificate of Sustainable Grains Production.

Nick Moody, Technical Officer



Nick Moody has been working on dryland winter cropping research projects since 1987. His interest is in working on research that provides producers in low rainfall cropping areas with the information they need to make decisions that will lead to improved yields and higher quality grain production. Nick is currently working on projects looking at the effect of different sowing times, seeding rates and fertiliser rates on the yield and quality of barley, wheat and canola; weather damage to grain due to delayed harvesting; and evaluating the performance of new varieties of barley and wheat in the central west of NSW.

Daryl Reardon, Technical Officer (Barley)



Daryl Reardon was recently appointed as a Technical Officer with the Barley Agronomy Team and he began working with NSW DPI at Condobolin as a Technical Assistant in 2013. His main tasks include field work (sowing, cuts, measurements and harvesting of trials), machinery maintenance, processing of samples and data entry. Daryl previously worked with NSW DPI and Central West Farming Systems from 1999 to 2008 on barley agronomy, the Sodic Sub Soils Project and the Regional Trial Sites. A local to the region, Daryl has obtained agricultural experience from working on his family's properties.

Technical Assistants

Sarah Baxter, Technical Assistant

Sarah Baxter started with NSW DPI in 2013 and has gained broad experience working with winter cereals and canola. Her work has encompassed all aspects of field work from preparing and sowing trials through to harvest. Sarah is currently part of the Frost Project where she is involved in monitoring and sampling trials; and processing grain, plant and soil samples. She has a sound knowledge and experience in the operation of field and laboratory equipment.



Linda Brangwin, Technical Assistant

Since joining NSW DPI as a casual in 1996, Linda Brangwin has worked on a broad range of winter cereal, canola and pulse research projects. In 2014 she was successful in securing her current position as a Technical Assistant. Through her work Linda has gained extensive experience in all aspects of field-trial work ranging from preparing trials for sowing; taking field measurements; processing soil, plant and grain samples; to data entry. Linda is from a local farming family and she is passionate about contributing to research that will improve the yield and quality of crops grown in lower rainfall areas.



Susannah Brangwin, Technical Assistant

Susi Brangwin has been working with NSW DPI since 2012. She has worked on a number of projects involving wheat, barley and canola. Working on these projects has given her a sound knowledge of all aspects of field-trial work including preparing and sowing field trials, monitoring and sampling plots, and the processing of samples and grain. Her current work on the Frost Project entails processing field samples and managing data. Susi has a background in dryland farming and grazing and is well known for her attention to detail.



Yanco Agricultural Institute

The Yanco Agricultural Institute (YAI) has been the major research institute supporting the development of irrigated agriculture within the Murrumbidgee Irrigation Area (MIA) for over 100 years. Development of profitable and sustainable irrigated farming systems remains a key focus. Research teams actively collaborate with local farming systems groups and industry partners, as well as with national and international research collaborators.

Broadacre irrigated and horticulture crop research and development teams from both Agriculture NSW and Biosecurity NSW are co-

located at the YAI along with the Murrumbidgee Rural Studies Centre, NSW DPI Regulatory Officers, and the Office of Environment and Heritage's Natural Resource Laboratory.



The Institute is situated in the centre of the Murrumbidgee Irrigation Area, and between Wagga Wagga and Griffith, on 813 ha of mixed irrigation and dryland farming country. It is primarily used for research into rice, wheat, soybean, canola, citrus, and vegetables; a new planting of hazelnuts and cotton in spring 2014 will broaden research opportunities. It has facilities and equipment for drip, flood, travelling and siphon irrigation, as well as row and broadacre cropping on a wide range of soils from grey self-mulching clays to light sandy soils. Rice physiology and entomology trials are conducted at the Institute and the Rice Breeding Program is concentrated at the Leeton Field Station, a separate 242 ha irrigation property located 7 km west of YAI. With an elevation of 136 m, the Institute experiences hot, dry summers and cool, damp winters. Temperature can range from a minimum of -3°C in winter to a maximum of 42°C in summer, with an average rainfall of 433 mm. Irrigation requirements are supplied from the Burrinjuck and Blowering Dams via the Murrumbidgee River and an extensive canal system.

YAI is well positioned to conduct industry relevant and scientifically valid research. Its ISO 9000 accredited laboratories are equipped for wet chemistry, agronomy, entomology, and plant pathology and physiology research. Glasshouses, shade houses, temperature-controlled rooms and large driers ensure that the challenges plant industries are facing with limited resources and a variable climate can be met by targeted applied research. A nine metre tall suction trap is available to monitor insects.

YAI is the home for the internationally renowned Temperate Rice Breeding Team, which is responsible for the breeding of all commercial rice varieties grown in Australia. The breeders work closely with the Cereal Chemistry Laboratory Team assessing the quality attributes of promising lines to ensure the varieties meet food processing and consumer requirements. With the recent development of molecular research capability and collaboration with the well-equipped molecular laboratory at the Wagga Wagga Agricultural Institute, the Rice Research Group is looking at reducing the time to release of new varieties.

The agronomy researchers design trials to provide recommendations on how best to optimise soil water and nutrient resources to maximise yields, as well as crop sequencing and double cropping trials. These trials are aimed at improving industry profitability and sustainability in a time of increasingly limited resources.

The Soybean Evaluation Team select varieties best suited to the MIA and conduct agronomy trials to develop recommendations for maximising the potential of the selected varieties. YAI is one of the three national GRDC funded cereal evaluation sites where research is focused on drought tolerance and understanding the interaction between the environments, water and cereal genetics. The Managed Environment Facility Group provide a service to the successful GRDC funded research teams to plant, manage and collect a wide range of data, primarily from wheat varieties, under a variety of water stress conditions, which is managed with a travelling irrigator and rainout shelters. The Breeding, Germplasm Evaluation, Agronomy, Crop Protection and Crop Development Groups each conduct trials to answer questions or provide information on the best performing varieties for growers.

Research Officers

Tony Napier, Research & Development Agronomist Irrigated

Tony Napier has a Bachelor of Applied Science (Agriculture) and has worked in the agricultural industry for over 30 years. Tony recently joined the Southern Cropping Systems Program and has a broad agricultural background with proven research capabilities. He spent the previous 15 years with NSW DPI working with the horticultural industry as an advisory officer for vegetables. As a District Horticulturist, Tony delivered a high quality advisory program and managed industry funded projects. Since joining the Southern Cropping Systems Unit as a Research and Development Officer, Tony has been working on two GRDC co-funded projects. The first project is aimed at increasing irrigated cereal and canola production by developing variety specific agronomic packages for the different southern irrigated growing regions. The second project is evaluating the agronomic and management factors required to best manage double cropping and crop sequencing under irrigation.

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Ben Ovenden, Rice Breeder

Ben Ovenden is a rice breeder for the Australian Rice Partnership, based at the Yanco Agricultural Institute in Southern NSW. The Australian Rice Partnership aims to release varieties with greater water use efficiency and seeks to achieve this through conventional selection for reproductive cold stress tolerance and shorter growth duration. Ben has previously been employed as a Research Officer working on an Irrigated Winter Cereals Project with NSW DPI evaluating elite bread wheat, Durum wheat, barley and triticale breeding material for performance under high-input conditions. Ben graduated with a Bachelor of Science and Bachelor Applied Science (Hons) from Charles Sturt University in 2005. He began his PhD program in 2009 studying the physiology and genetic architecture of carbohydrate accumulation in wheat. Ben's research interests include conventional plant breeding and quantitative genetics, marker assisted selection, genome wide association mapping and genomic selection, and extension of research to growers.

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Dr Laura Pallas, Cereal Chemist

Dr Laura Pallas leads the Grain Quality Evaluation Program in the development of new Australian rice varieties as part of the Australian Rice Partnership II Project based at Yanco. Laura has a BSc in Biological Engineering with processing emphasis from The University of Georgia (UGA). She received her Master's in Food Science from The University of California, Davis where she researched physical and chemical interactions of blended edible films. Laura returned to UGA for her PhD in Food Science, developing a blueberry drying process for South Georgia Blueberry Growers while studying the relationship between drying processes and antioxidant activity of blueberries relating to moisture, sensory and nutritional properties. In the past five years, Laura has applied her research knowledge to develop and improve a suite of gluten-free breakfast cereals, biscuits and bars for Freedom Foods (Stanbridge, NSW); and a children's rice-snack range and multigrain square cake range for SunRice (Leeton, NSW). Laura's passion is bridging research and development with industry to achieve quality products that exceed consumer expectations and provide economical returns for growers. Laura looks forward to continuing the research and measurements on potential rice varieties to ensure quality performance from plate to paddock.

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Dr Peter Snell, Rice Breeder



Dr Peter Snell has 13 years rice-breeding experience at Yanco since his appointment in 1998 and is responsible for the release of five commercial rice varieties. He has implemented a wide range of new techniques including increasing the number of quantitative measures recorded throughout small plot testing, and increased accuracy in determining breeding value through the use of restricted maximum likelihood statistical methods to account for field-based spatial variation and lab-based temporal variation. He has re-introduced backcrossing into the program for germplasm enhancement and stress tolerance. Peter is the lead researcher evaluating aerobic rice varieties for temperate and tropical production in Australia and has a Bachelor of Agricultural Science (Hons 1) and a PhD in crop physiology. His current projects include Rice Cold Tolerance for Yield Stability and Water Use Efficiency, Rice

Improvement, and Enhancing Rice Germplasm Development for Transforming Production Systems in Cambodia and Australia. Peter's interests include rice breeding and genetics, genetic improvements in rice water productivity, and genetic improvements through selection to abiotic and biotic stresses.

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David Troidahl, Research & Development Agronomist Irrigated



David Troidahl is a Research and Development Agronomist in Southern Irrigated Cropping Systems at Yanco. David works closely with the rice industry and other irrigated crops, and has been involved in the publication of various rice factsheets and the 'Rice Field Guide to pests, diseases and weeds in Southern NSW'. Previously he has been the NSW DPI, Riverina Fruit Fly Campaign Coordinator as well as the District Horticulturist (vegetables). Prior to this David worked for over 20 years in the NSW DPI Rice Breeding Program, which involved working with the rice industry and coordinating rice variety trials on site at Yanco and throughout the NSW rice growing region. During this time he was a Project Leader with the Rice Cooperative Research Centre investigating the effects of salinity on rice varieties. He has an excellent knowledge of the Riverina area and its diverse agricultural industries.

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Dr Rachelle Ward, Cereal Chemist



In 2008 Dr Rachelle Ward graduated from the University of Sydney with a PhD and started as a Rice Cereal Chemist with NSW DPI. Rachelle is primarily involved in the Australian Rice Partnership, and also has experience in co-supervision of PhD students with her links with Southern Cross University, The University of Western Sydney, Charles Sturt University and University of New South Wales. The Australian Rice Partnership is aimed towards the development of new Australian rice varieties that exceed agronomic and quality performance of existing varieties. Rachelle leads the grain quality arm that analyses breeding lines for a suite of molecular, physical, compositional and cooking qualities that are used by breeders to make breeding selections to meet various quality types. Underpinning these direct outcomes is a body of research that ensures the analyses conducted are relevant, efficient and sound.

Her work has been presented at conferences and in peer reviewed journal articles.

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Technical Officers

Kathryn Bechaz, Technical Officer (Managed Environment Facility)

Kathryn Bechaz is the Technical Officer managing the Managed Environment Facility (MEF) at the Yanco Agricultural Institute. Her brief is to manage and provide support for field research projects directed towards identifying adaptive traits and management strategies for improved productivity of wheat growing in water limited or drought-prone environments. Research projects from CSIRO, the Western Australia Department of Agriculture and Food, NSW Department of Primary Industries, University of Adelaide, University of Sydney and AGT Wheat Breeding are being evaluated at the Yanco MEF site. Kathryn's professional interests include being involved in research that benefits growers, liaising with other like-minded people and leading a team that is well organised, skilled and provides results efficiently. Kathryn is often called upon to provide technical advice to the Narrabri (NSW) and Merredin (WA) MEF sites.



Fred Ciccia, Technical Officer (Rice Breeding)

Fred Ciccia started with the NSW DPI Rice Breeders in 1985, carrying out field work and working on rice storage. He then moved to the Farm Section where he managed the irrigation of all crops including the Rice Breeding Program crops for six years. From 1991 to 1996, Fred worked as a Field Assistant and Technical Assistant with the Rice Breeding Program where he liaised with farmers, sowed trials, sampled and harvested plots, and recorded moisture. Fred currently works as a Technical Officer with the Rice Improvement and Rice Breeding Program where he is responsible for field setup, spraying, irrigation, fertilising, assisting with sampling, recording data and plot harvesting. He has completed several courses relevant to his position.



Kylie Elliott, Technical Officer (Rice Quality)

Kylie Elliott joined the Rice Cereal Chemistry Team at Yanco in 2014. Prior to this she had worked with NSW DPI intermittently since 1987. Kylie has worked at EMAI, Wagga Wagga, Orange and different sections at Yanco. In her current position, Kylie is working in the molecular section of the Plant Breeding Program. Kylie has always had an interest in plant improvement due to a long association with rice breeding and the rice industry. She has a Bachelor of Applied Science (Biotechnology) Degree from Charles Sturt University. Kylie's primary roles include DNA extractions, PCRs, running agarose gels and scoring for various marker validation projects. An interesting project she is currently involved with is finding molecular markers for coloured rice such as purple and red rice.



Daniel Johnston, Technical Officer (Agronomy)

Daniel Johnston works on the GRDC co-funded project evaluating the agronomic and management factors required to best manage double cropping and crop sequencing under irrigation. He undertakes all aspects of everyday management and preparation of field trials and the use of new technologies such as Greenseeker and GPS equipment. Daniel began on this project in 2015 and was previously with the Rice Breeding Team where he was primarily responsible for the management of district and breeding trials. Daniel also worked with yield stability for cold tolerance and water-use efficiency. Daniel has been with the Department since 2002, working on the Permanent Beds for Irrigated Rice-Wheat and Alternative Systems in Australia and India Project before joining the Rice Breeding Team in 2008. Daniel holds a Bachelor of Science (Ag) from Charles Sturt University and has been in the industry for 26 years, progressing from the private sector where he managed an irrigation property attaining high performing rice yields.



Margrit Martin, Technical Officer (Rice Quality)

Margrit Martin is the Senior Technical Officer for rice-grain quality in the Australian Rice Partnership. She has 18 years of experience in this field and previously worked on two GRDC funded wheat projects. In 1970 Margrit qualified as a Laboratory Technician with Ciba Geigy in Switzerland and in 1980 completed a Dipl. Ingenieur Agronom, Eidgenoessische Technische Hochschule in Zuerich. Her responsibilities range from training new technical staff, to improving and introducing new methods to measure rice-quality parameters. She works closely with the Rice Breeding Team and much of her work has been presented in reviewed journal articles or at conferences.

Greg Napier, Technical Officer (Rice Breeding)

As part of the Rice Breeding Team, Greg Napier is involved in the pre-breeding stage of the Rice Breeding Program. His duties include crossing rice varieties with different milling and agronomic traits to produce first generation (F1) material in a glasshouse environment. These F1 seeds will be grown and visually inspected in a field environment. He is also responsible for the maintenance and continual replacement of the rice seeds of the international rice varieties in the collection, which is held in cold storage. This collection of international rice varieties is the source of all the genetic material used in the breeding program. Greg's interest lies in the crossing program in the glasshouse that produces the F1 seeds for later field inspection. Recent achievements include upgrading the pre-breeding program to include a more significant number of F1 seeds with fragrant traits.

Kim Philpot, Technical Officer (Rice Breeding)

Kim Philpot joined NSW DPI in 2000 and worked as a Technical Assistant in citrus entomology and later in rice entomology. As a Technical Officer in 2002 she worked with the National Vegetable Industry Centre investigating irrigation systems for carrots and onions. From 2003, Kim worked in Cereal Chemistry on rice quality evaluation, assessing both physical and cooking properties of rice crossbreds and advanced breeding lines from the Rice Breeding Program. Kim was also responsible for implementing a DNA extraction technique for high purity DNA which allowed a wider range of molecular markers to be introduced into the Program. In 2011, Kim became a member of the Rice Breeding Team working in yield stability and investigating cold induced sterility. She has been directly involved in the introduction of an image-analysis system for detecting and counting viable and aborted pollen. Currently Kim is looking into *in vivo* pollen germination using

fluorescence microscopy.

Technical Assistants

Peter Davidson, Technical Assistant (Managed Environment Facility)



Peter Davidson is a Technical Assistant with the Managed Environment Facility Project at Yanco (appointed 2013). He carries out core measurements for the Project's field trials. Core measurements are establishment counts that include NDVI biomass data and photos, neutron probe moisture measurements, anthesis data, harvest-index data, and yield and quality traits at harvest. Peter's other responsibilities include general management and preparation of the trials (sowing, spraying, irrigating and harvesting). Research projects from CSIRO, the Western Australia Department of Agriculture and Food, NSW DPI, University of Adelaide, University of Sydney and AGT Wheat Breeding are being evaluated at the Yanco MEF site. Peter's interests lie in providing accurate information so that project milestones and aims are met.

Nathan Doss, Technical Assistant (Rice)



Nathan Doss joined the Rice Breeding Team as a Technical Assistant at Yanco in February 2013. He undertakes a range of duties supporting research trials from cleaning and packing seed, to sowing trials at both the Leeton and Jerilderie sites. Nathan also takes part in harvest preparation of individual trials, and the provision of documentation that is extremely important to the successful development and eventual release of commercially viable rice varieties. When required, Nathan is responsible for water management of the Leeton Field Station trials and maintenance of equipment used throughout the season. Nathan has undertaken training in various courses through both Tocal College and the private sector including safe tractor handling, senior first aid and forklift training.

Leanne Johnston, Technical Assistant (Rice Quality)



Leanne Johnston joined the NSW DPI Rice Cereal Quality Team in 2012 bringing 13 years of experience and training in the finance industry. Consequently she has an attention to detail, an aptitude for figures and an appreciation of accuracy. Living and working in the district for almost 20 years, Leanne understands the importance of superior quality and better agronomic rice varieties. Her focus is based around the production of quality data each year for breeder assessment through sample milling, and the measurement of physical and cooking properties of the various standards and breeding lines undergoing development. During the wet chemistry stage of the program she works primarily with the Rapid Visco Analyser and the Texture Analyser for assessment of cooking and texture attributes. Leanne is currently examining cooked grain texture and its correlation with existing

testing methods.

Glenn Morris, Technical Assistant (Irrigated Cereals and Canola)



Glenn joined NSW DPI at Yanco Agricultural Institute in 1995 as a Regulatory Officer in the Queensland Fruit Fly Eradication Program. In 2014 Glenn began work in the Southern Irrigated Cropping Program as a Technical Assistant on an irrigated cereals and canola project. The project aims to identify the most suitable varieties and the growing practices required to achieve maximum yields for irrigated cropping. Glenn's role in the project is to conduct the daily operations program where he is involved in the sowing, irrigating, monitoring, data collection and harvesting operations.

Minna Russell, Technical Assistant (Rice Breeding)

Since 2012 Minna Russell has worked closely with the Rice Breeding Team gaining experience in all areas of rice trial preparation. In this position her duties include all aspects of trial work such as sowing, harvesting, weighing and moisture testing, measuring lengths and heights of individual rice block/plots as well as labelling and packing rice trials. Minna is competent in operating both field and laboratory equipment and has completed courses relevant to her position.

Yuki Sims, Technical Assistant (Rice Quality)

Yuki Sims joined the Rice Breeding and Quality Program in 2010. She is a key member involved in the Quality Evaluation Program (QEP) within the Rice Cereal Chemistry Team, assisting with rice milling and wet chemistry measurements. Born in Japan where rice is widely grown and a staple of the diet, Yuki has a passion for and interest in the chemistry and mechanisms that affect the cooking and eating qualities of rice. In addition to QEP, one of Yuki's projects involves exploring the relationship between gel temperature and cooking time of rice to cooked rice texture. With the milling portion of the 2014 Rice QEP season recently completed, she is currently engaged in the subsequent wet chemistry side of the Rice QEP.

Dionne Wornes, Technical Assistant (Managed Environment Facility)

Appointed in 2012, Dionne Wornes is assigned to the Managed Environment Facility Project at Yanco. Dionne carries out core measurements for field trials included in the Managed Environment Facility Project. Core measurements are establishment counts that include NDVI biomass data and photos, neutron probe moisture measurements, anthesis data, harvest-index data, and yield and quality traits at harvest. Research projects from CSIRO, the Western Australia Department of Agriculture and Food, NSW DPI, University of Adelaide, University of Sydney and AGT Wheat Breeding are being evaluated at the Yanco MEF site. Dionne's interests lie in assessing a diverse range of varieties/lines for the respective projects and liaising with research leaders.

John Dando, Field Officer (Soybeans)

John Dando has excellent practical skills and a very good understanding of mixed-cropping systems. John started with NSW DPI at the Yanco Agricultural Institute in 1997 where he specialised in spray-application technology. John was involved with the SMARTtrain Program for six years, instructing in spray-application techniques. In 2004 John moved to the Soybean Breeding Program. He is now involved in conducting the daily operations of the Program where he conducts sowing, irrigation, monitoring, data collection and harvesting of trials. John's work has been invaluable in helping the Program release numerous soybean varieties for Australian growers. Recently John has been involved with the Irrigated Cereal and Canola Project as well as the Irrigated Crop Sequencing Project.

Our Programs

Program 1: Germplasm improvement



One of the most effective methods to improve plant productivity and efficiency is through breeding and selection. Germplasm developed overseas is not necessarily the best for use in Australia. The diversity of geographic and climatic zones in NSW means that new material must be evaluated in those zones.

NSW DPI continues a major investment role in evaluating canola, rice, pulse, chickpeas, durum and cereals under the National Primary Industries RD&E framework for Grains and Rice.

The Germplasm Improvement Program develops parental germplasm with improved tolerance and resistance to biotic and abiotic stresses. The Cropping Systems Unit currently leads three commercially focused breeding programs. These programs are developing improved varieties of rice in partnership with RIRDC and SunRice, and Durum and chickpeas in partnership with GRDC and other state departments and universities.

The Northern and Southern Cropping Systems Units also develop pre-breeding material and genetic markers for a range of traits including heat and moisture stress; and plant diseases in crops including wheat, durum, canola, winter pulses and rice.

The work in this area falls under four main sub-programs:

1: Maintaining Genetic Resources, 2: Pre-breeding, 3: Breeding, and 4: Germplasm Evaluation.

The scope of the pre-breeding, breeding and germplasm evaluation within NSW DPI include:

- emphasis on evaluation of varieties where we are the major providers of RD&E for those industries, under the National Framework for Grains
- evaluation of the agronomic and physiological characteristics of varieties for regional performance
- emphasis on breeding for new and emerging industries that will deliver benefit to NSW (e.g. soybeans).

The benefits of the pre-breeding, breeding and germplasm evaluation within NSW DPI include:

- increased abiotic and biotic stress resistance leading to increase yields, reduced use of pesticides, and increased water-use efficiency
- locally adapted varieties meeting market specifications.

Future directions

Maintaining Genetic Resources: this is unlikely to continue within five years as there is a continued move to nationalise crop genetics resources.

Pre-breeding: research will increase as rice and pulse pre-breeding capacity, in particular, is developed.

Breeding: NSW DPI will maintain its investment in the crop plant breeding programs while investigating different co-investment models such as public/private partnerships.

Germplasm Evaluation: the evaluation of new varieties and advanced breeding lines will continue to be a core research activity. It is likely the Yanco Managed Environment Facility will expand and continue to run as a full cost recovery venture. In 2015, the National Variety Trial (NVT) Program will re-tender for contractors and NSW DPI will need to evaluate the benefits and impacts of being a contractor for the NVT.

Program 2: Farming systems management



Advisers and growers are grappling with managing the entire farming system and not just on a paddock by paddock basis. Low wheat protein levels, increased disease threats and resistant weeds with continual canola/wheat rotations have created greater interest in crop rotation and sequencing management.

The Southern Cropping Systems Unit has completed an analysis for GRDC of the Break Crop, Crop Rotation and Crop Sequencing across the north, south and western GRDC regions. Results indicate that weed resistance and nitrogen management are the greatest concerns that can be addressed through crop rotation management.

The Farming Systems Management Program develops tools and information packages to enable growers and advisers to manage a farming system with confidence and flexibility. Research includes understanding the impacts of crop sequencing decisions including nutrition and water management. The data enables the development of management packages to maximise the water-limited yield potential of new varieties. Research is conducted across summer and winter broadacre crops. NSW DPI is a trusted provider of independent and evidence-based information to growers and advisers in this area.

The work in this area falls under four main sub-programs:

5: Nutrient Management, 6: Agronomy Packages, 7: Maximise Returns from Water, and 8: Crop Sequencing/Rotation Management.

The scope of farming systems management within NSW DPI includes:

- development of agronomy packages for cereals, pulses, summer crops, canola and irrigated crops
- evaluation of the agronomic management of varieties for regional performance
- emphasis on water-use efficiency and nutrient management.

The benefits of farming systems management within NSW DPI include:

- development of crop rotation options with management packages for individual crops and regions
- identification of best variety options for each region
- maximise returns from water through improved WUE in irrigated and dryland systems
- reduced use of inorganic crop inputs including fertilisers and pesticides.

Future directions

Nutrient Management: is an area of work that will grow in its own right for the Cropping Systems Units and the appointment of Crop Nutrition Research Scientists, co-funded by GRDC will increase research capacity in this area.

Agronomy Packages: it is expected NSW DPI will rebid for the Southern Pulse Agronomy Project, and develop stand-alone agronomy projects for cereals, pulses and oilseeds. Expertise is also building in the crop nutrition, dual purpose cereals and canola agronomy, with a post-doctoral position for each area starting at Wagga Wagga and Tamworth partnered with the GRDC.

Maximise Returns from Water: The current Cropping Systems Unit portfolio will be greatly increased with the development of projects within this sub-program. There is currently one cotton project in this sub-program—Cotton WUE Benchmarking Project that is leveraging off our commitment to irrigated agriculture in the new structure and funded by Cotton RDC.

Crop Sequencing/Rotation Management: this area of research is growing as advisers and growers realise that systems management contributes to addressing weed resistance, disease and pest issues, and nutrient management. The RDCs are considering investing as a group into these areas.

Program 3: Plant protection



Disease, weed and pest management are major issues for broadacre cropping enterprises. Blackleg in canola and diseases in wheat can destroy crop productivity if integrated management practices are not put in place. Environmental conditions and changing production systems can exacerbate disease and pests in any one year, so monitoring and surveillance is a critical industry need.

NSW DPI continues a major investment role in disease and pest management programs, including pre-breeding through to breeding resistant varieties under the National Primary Industries RD&E Framework for Grains, Cotton and Rice.

Developing integrated management strategies that incorporate cultural, chemical, biological and genetic options to manage key pests (insects, weeds and diseases) is critical for all NSW crop production regions. Management recommendations need to take into account cost-effectiveness, resilience of control strategies and flexibility to fit different farming systems. Research is aimed at developing cost-effective control options that prevent pests from reducing crop yield and quality, reduce the use of pesticides, and increase productivity and the profitability of growers. The work in this area falls under three main sub-programs:

9: Entomology and Integrated Pest Management (IPM), 10: Pathology and Integrated Disease Management, and 11: Weeds and Integrated Weed Management.

The scope of plant protection research within NSW DPI includes:

- a primary focus on those industries where we have a co-investment from other providers, agencies and industry partners and for those we are a major investor in under the National RD&E Framework for Grains, Cotton and Rice
- development of innovative plant protection strategies that deliver benefit to NSW cropping industries
- developing and conducting research projects to mitigate the effects of insect pests and fungal, bacterial and viral pathogens

The benefits of plant protection research within NSW DPI include:

- increased crop yields and water use efficiency
- implementation of disease, insect pest and weed integrated management strategies leading to reduced pesticide use
- monitoring and surveillance of new and emerging threats to NSW cropping industries
- crops meeting market requirements.

Future directions

Entomology and Integrated Pest Management: this program is expected to expand with the funding of a southern cotton IPM project and IPM principles being included in crop management packages developed by Research & Development Agronomists.

Pathology and Integrated Disease Management: this program aims to maintain its strong industry support in integrated disease management, and explore opportunities to develop projects that build capacity in our core plant pathology strengths.

Weeds and Integrated Weed Management: integrated weed management is an area NSW DPI intends to build in capacity over the next five years. The appointment of Cropping Weed Research Scientists co-funded by GRDC will increase research capacity for both Cropping Systems Units.

Program 4: Supply chains and market access



Quality of agricultural products determines the price paid for those products. This area of post-harvest/market access is important to the export and domestic markets and Australia's clean, green image. Research in this area is growing as consumers become more discerning over the quality of produce. Issues such as chemical use on products can impact on the sales of the product so correct post-harvest management of product is crucial.

The Australian grains industry also relies heavily on its quality to extract a high price and includes a 'no live insects' policy as a guarantee. However, insect resistance and limited chemical treatments available are becoming problematic to ensuring this

policy. NSW DPI grain storage research is a major component of several national projects that are funded through the Plant Biosecurity Cooperative Research Centre.

NSW DPI continues a major investment role in canola, rice, pulses, and cereals under the National Primary Industries RD&E framework for Grains and Rice.

The work in this area falls under three main sub-programs:

13: Edible Oils, 14: Grain storage, and 15: Post Harvest/Market Access.

The scope of post-harvest research within NSW DPI includes:

- emphasis on evaluation of quality attributes of new varieties where NSW DPI is the major provider of RD&E for those industries, under the National Framework for Grains and Rice
- emphasis on monitoring quality characteristics of rice and wheat
- ensuring crop products are internationally competitive.

The benefits of post-harvest research within NSW DPI include:

- development of quality standards to meet market requirements for rice, canola and wheat
- managing stored grain insect resistance to phosphine and other registered chemicals
- integrated pest management in post-harvest grains.

Future directions

Edible Oils: this area of research has current funding and has secured forward funding of the Canola Quality Program. A federally funded ARC grant through Charles Sturt University will provide further capacity building with post doc and PhD students.

Grain Storage & Post Harvest/Market Access: it is expected that funding for phosphine resistance monitoring and management will continue for several years as it is heavily supported by all in the grains industry. Further investment into the ecology of stored grain insects will also be supported as it provides a basis for some of the grain storage management protocols.

* Note that sub-program 12 covers the Wine Science Program

Our Projects



Program 1: Germplasm improvement

Sub-program 2: Pre-breeding

1. Pre-emptive Breeding for Exotic Pests and Pathogens. (30/06/13–31/05/18) Co-investor: Grains Research & Development Corporation (GRDC). DPI lead: Dr Livinus Emebiri

The project objective is to:

- reduce the risk of potential future economic loss to wheat growers due to the incursion of exotic pests and diseases by providing Australian wheat breeders with parental genetic stocks that carry genes for resistance to Karnal bunt, Hessian fly and Sunn pest.

The parental genetic stocks and associated diagnostic markers will be provided to Australian wheat breeders to facilitate rapid deployment in their breeding programs. Australian breeding entities and breeders will have long-term access to phenotyping sites where Karnal bunt, Hessian fly and Sunn pest are endemic for use in the development and validation of advanced elite lines with putative resistance to Karnal bunt, Hessian fly and Sunn pest.

2. Development of Molecular Markers for Application in Australia Canola Breeding. (30/06/08–30/06/16) Co-investor: GRDC. DPI lead: Dr Harsh Raman

This project aims to:

- develop a homozygous diversity panel for genetics and genomic research and make it available to the National Brassica Germplasm Improvement Program
- identify loci significantly contributing to the phenotypic variation for resistance to blackleg, pod shatter and tolerance to drought and heat
- develop germplasm for pod-shatter resistance and heat tolerance.

3. National Brassica Germplasm Improvement Program 2. (01/07/15–30/06/20) Co-investor: GRDC. DPI lead: Dr Harsh Raman

This program is designed to:

- develop and validate method(s) for accurate phenotypic assessment, and gain an understanding of the phenotypic variation for resistance to blackleg and tolerance to drought
- develop germplasm with improved resistance to blackleg (seedling and adult plant) and tolerance to drought (carbon isotope discrimination, early vigour (NDVI)/water-use efficiency and water-soluble carbohydrates content), and make this available to canola breeders
- contribute to identifying loci significantly contributing to the phenotypic variation for resistance to blackleg—both seedling and adult plant resistance (APR), and drought tolerance—water-soluble carbohydrates, carbon isotope discrimination, and NDVI.

4. Effective Genetic Control of Septoria tritici blotch. (01/07/15–30/06/20) Co-investor: GRDC. DPI lead: Dr Andrew Milgate

The project objective is to develop wheat varieties resistant to Septoria tritici blotch (STB) caused by the fungal pathogen *Zymoseptoria tritici*.

Currently control of the disease is through growing resistant wheat varieties and/or the use of fungicides. NSW DPI has recently discovered fungicide resistance evolution in the STB population in Australia which is going to impact on the effectiveness of many commonly used fungicides. This makes the discovery of new sources of plant-based resistance to STB important for the long-term protection of wheat crops in Australia. In this project researchers will be searching for novel sources of resistance which modern breeding has left untapped such as in ancient landraces of wheat, as well as studying how the pathogen is able to interact with its host and cause disease at the molecular level. The development of resistant germplasm that is high yielding and with quality attributes will assist growers achieve market potential.

Sub-program 3: Breeding**5. Rice Research Partnerships. (30/06/16–30/06/20) Co-investor: RIRDC. DPI lead: Dr Peter Snell**

The partnership between RIRDC, Sun Rice and NSW DPI funds a project with three facets:

1. develop rice varieties to meet specific market requirements
2. develop rice varieties to meet processing needs
3. explore opportunities for breeding new maturity and quality classes.

To cope with an evolving production environment, the varieties developed will enhance adaptation to the following southern issues, for example, improved cold tolerance, salinity tolerance, straight-head tolerance, drought tolerance and water productivity.

6. Pulse Breeding Australia: Field Pea Breeding Program. (31/01/11–31/10/16) Co-investor: GRDC. DPI lead: Mark Richards

This program aims to:

- develop and release new field pea varieties with improved yield, crop management (especially disease) and grain quality to NSW grain producers.

7. National Lupin Breeding for Australia. (01/07/14–30/06/16) Co-investor: GRDC. DPI lead: Mark Richards

By developing improved varieties of narrow-leaf lupin this project will:

- make available a profitable pulse crop that is needed to diversify crop rotations in south eastern Australia
- increase farmer profitability through higher yields and reduced input costs
- enable greater profit throughout the value chain with increased lupin suitability for premium-paying markets in aquaculture and food industries.

8. Australian Soybean Breeding Program. (30/06/12–30/06/17) Co-investors: GRDC, CSIRO. DPI lead (southern node): Matthew Dunn

Outcomes for this project include:

- new soybean varieties with improved yield, agronomic traits, disease resistance, weathering tolerance, broader adaptation to Australian production environments, and higher value culinary or functional traits
- greater profitability for growers through better varieties and expanded market access, including higher value markets
- increased area planted to new soybean varieties across new and existing Australian production regions
- closer alignment with all sectors of the soybean industry chain.

Sub-program 4: Germplasm Evaluation**9. Evaluating Remaining Albus Lupin Breeding Material at Wagga Wagga. (01/01/12–31/12/15) Co-investor: GRDC. DPI lead: Mark Richards**

The objective of this project is to:

- release high-yielding albus lupin varieties that combine *pleiochaeta* root rot resistance and *anthracnose* resistance, ultimately replacing *Luxor* and *Rosetta* varieties.

Breeding lines with these characteristics have already been developed at Wagga Wagga from the breeding program that was discontinued in 2009.

10. Pulse Breeding Australia: Lentil Evaluation. (31/01/11–31/10/16) Co-investor: GRDC. DPI lead: Mark Richards

In this project, lentil varieties specifically adapted to southern and central NSW will be:

- identified from breeding lines developed in Horsham
- evaluated for commercial release.

11. Pulse Breeding Australia: Faba Bean Breeding Program. (30/06/11–30/06/16) Co-investor: University of Adelaide. DPI lead: Mark Richards

In this project, faba bean varieties specifically adapted to southern and central NSW will be:

- identified from breeding lines developed in South Australia
- evaluated for commercial release.

12. Managed Environment Facility. (30/06/10–30/06/16) Co-investor: GRDC. DPI lead: Kathryn Bechaz

A Managed Environment Facility established at the Yanco Agricultural Institute has enhanced the Department's research capacity for water-limited environments. The establishment of research facilities and engagement of support staff will ensure the use of the facility by research projects.

13. Genetic Variation for Heat Tolerance in Wheat. (01/07/15–30/06/18) Co-investor: GRDC. DPI lead: Dr Livinus Emebiri

This project is to use molecular markers for heat tolerance related quantitative trait locus (QTL) with characterised yield effects in the field to determine if heat tolerant wheat varieties will:

- allow more grain production on less land, leaving more land to nature. Other inputs required per tonne of grain produces will also be reduced (oil, pesticides, herbicides and fertiliser), decreasing pollution.
- bring more export dollars to Australia, worth AUD 5 billion annually.
- help keep farmers' businesses and rural communities viable. Improved yield stability will minimize psychological stress to farmers. Improved quality of pasta and bread will add to consumer satisfaction.

14. Grain Quality Testing. (01/07/15–30/06/20) Contract Services DPI lead: Denise Fleming

Provision of data to breeding companies to enable classification and release of new wheat varieties that meet quality demands for Australian domestic and export markets.

**Program 2: Farming systems management****Sub-program 6: Agronomy Packages****15. Variety Specific Agronomy Packages for NSW. (30/06/12-30/06/17) Co-investor: GRDC. DPI lead: Eric Koetz**

This project aims to:

- continue to develop Variety Specific Agronomy Packages (VSAP) for wheat, canola and lupins in southern NSW and for wheat, barley and canola in northern NSW
- focus on issues that improve the potential of a variety in a farming system rather than issues that improve farming systems as a whole
- place emphasis on agronomic practices likely to have a genotype by environment interaction.

Issues to be dealt with will be proposed by experienced NSW DPI research staff and reviewed in collaboration with producers and regional agronomists.

Agronomic issues to be tested are expected to include sowing time, seeding rates, nutrition and sowing depth. Field research trials will investigate practices required to profitably manage and manipulate crop environments typical of NSW. These will include field trials that provide data for Variety x Environment x Management Packages to advise on the potential opportunities and weaknesses of varieties.

16. Management of Barley and Barley Cultivars for the Southern Region. (01/06/13-01/12/18) Co-investor: GRDC. DPI lead: David Burch

The overall objective of the project is:

- to improve grower productivity and industry sustainability through the successful adoption of improved barley cultivars.

The objective will be achieved through the development of improved agronomy practices and packages for new and current varietal releases and by aligning production with market and industry requirements.

By project end, 1000 barley growers (> 100 ha) in the GRDC Southern Region will be using project outputs with 100 examples of practice change to be recorded annually. Surveyed annually, will be at least 20% of the growers and next users using the technical information from this project to assist them select barley cultivars and adopt management practices best suited to their business structure, location and market requirements.

17. Southern Irrigated Soybean Agronomy Project. (01/01/14–30/06/18) Co-investor: GRDC. DPI lead: Luke Gaynor

The project aims to:

- improve grower and advisor understanding of the factors limiting soybean productivity across southern NSW by developing management packages for new and existing soybean varieties, and increasing the reliability and profitability of soybeans.

18. Expanding the Use of Pulses in the Southern Region. (01/07/10–30/06/15) Co-investor: GRDC. DPI lead: Mark Richards

This project will contribute to the expansion of the use of pulses in the southern region through:

- research and development that delivers Variety Specific Agronomy Packages, and profitable pulses for modern farming systems.

19. Correct Crop Sequencing for Irrigated Double Cropping. (01/06/14–30/06/16) Co-investor: GRDC. DPI lead: Luke Gaynor

Key potential areas for improving the reliability and profitability of double-cropping systems have been identified, along with any barriers to adoption which will be investigated:

- Herbicides. The use of herbicides in irrigation-crop sequences and double-cropping situations with the aim to harvest and sow the next crop in a short period of time without herbicide issues. Currently some suitable herbicides have no information available as to their plant-back periods under irrigated, double-cropping regimes.
- Irrigation layouts, delivery systems and scheduling. There is a need to test double-cropping systems using modern irrigation layouts, and those using current irrigation delivery systems and scheduling.

20. Dual Purpose Crops Agronomy. (01/07/13–20/06/18) Co-investor: GRDC. DPI lead: Peter Matthews

This project will:

- provide data and information to maximise the productivity of the dual purpose cereal variety, species and production system
- provide and extend information on the most profitable combination of species and varieties in the context of regionally relevant stocking rates and environmental conditions.

21. Farming Systems to Improve Crop Tolerance to Frost. (01/07/15–30/06/20) Co-investor: GRDC. DPI lead: Richard MacCallum

This project aims to implement management practices that minimise financial impacts of frost events on wheat growers in frost prone areas of the southern wheat cropping region.

Sub-program 7: Maximise Returns from Water**22. Southern Irrigated Cereal and Canola Varieties Achieving Target Yields. (30/06/14–30/06/17) Co-investor: GRDC. DPI lead: Deb Slinger**

The purpose of this project is to:

- improve southern-irrigated growers' knowledge of cereal and canola variety selection and best irrigation management practice through the promotion of the results of the high yielding irrigated cereals and canola trials.

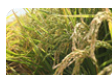
By 2017, the aim of the project is to have:

- 300 grain growers and 30 advisers implement management decisions that have been shown to increase production for irrigated cereal and canola varieties
- development of regional variety specific management packages and an Irrigated Wheat and Canola Manual that will increase grower and advisers' knowledge.

Sub-program 8: Crop Sequencing/Crop Rotation

The three projects under Sub-program 6: Agronomy Packages include research and development work on crop rotations and crop sequencing. The projects are:

- Southern Irrigated Soybeans
- Expanding the Use of Pulses in the Southern Region
- Correct Crop Sequencing for Irrigated Double Cropping.



Program 3: Plant protection

Sub-program 9: Entomology and Integrated Pest Management

23. Establishing Southern Cotton – IPM. (01/07/14–30/06/17) Co-investor: Cotton Sector National RD&E. DPI lead: Dr Sandra McDougall

The objective of this project is to answer the following questions:

1. How do thrip communities in southern cotton differ from those in northern cotton growing areas?
2. Are treatment thresholds for thrips developed in the north applicable in southern areas?
3. What is the pesticide resistance status of Western Flower thrips (WFT) populations in southern cotton?
4. Are there better alternative treatments for managing WFT and other sucking pests in southern cotton?
5. How effectively does cotton compensate for pest-related defoliation under a shorter growing season?
6. Are the pest and beneficial profiles in southern cotton different from the north?
7. Are mirid and green vegetable bug thresholds and management options developed in the north applicable in the south (populations permitting)?
8. Is the OZCOTT cotton development model suitable for southern cotton regions?

24. New Knowledge to Improve Timing of Insect Management Decisions. (01/07/15–30/06/20) Co-investor: GRDC. DPI lead: Dr Jo Holloway

By generating new knowledge on the life cycle and biology of a range of pest and beneficial species the project will enable pathways for better spray decision-making and the proactive management of pests.

The project aims to answer:

- When do I need to watch for that pest species?
- When do I need to control for that pest species?
- What can I do to protect and support beneficial insects?

Sub-program 10: Pathology and Integrated Disease Management

25. Improving Grower Surveillance, Management, Epidemiology Knowledge and Tools to Manage Crop Disease in Southern NSW. (30/06/13–30/06/18) Co-investor: GRDC. DPI lead: Dr Andrew Milgate

This project aims to minimise the impact of crop diseases in the southern NSW and northern Victorian region by:

- developing integrated disease management (IDM) strategies for plant diseases of importance to southern farming systems
- provision of diagnostic services and surveillance to industry in the management of endemic and emerging disease threats
- extension of IDM options to support growers to understand and better manage winter cereal and broadleaf crop diseases in the GRDC southern region.

26. National Barley Foliar Pathogen Variety Improvement Program. (30/06/13–30/06/18) Co-investor: GRDC. DPI lead: Dr Andrew Milgate

The National Barley Pathology Program is focused on providing sustainable options to growers to manage current and emerging pathogen threats to barley through delivering effective strategic and tactical management options, and using genetic technologies to reduce both crop losses and costs of control. This nationally co-ordinated program has been developed with partners from all states and universities with active germplasm development or disease research in barley foliar pathogens.

These projects will:

- provide a base for interactions with barley breeders and industry stakeholders to deliver outcomes at a regional and national level.

27. National Variety Trials Pathology Services Agreement. (30/06/13–30/06/18) Co-investor: GRDC. DPI lead: Dr Andrew Milgate

The National Variety Trials Pathology Agreement enhances the biosecurity of the NSW winter cereal crops. It aims specifically to:

- reduce the impact of endemic diseases of wheat and barley in NSW by the provision of robust variety ratings
- communicate these ratings to encourage growers and agronomists to choose, where possible, varieties with improved pathogen resistance.

28. National Canola Pathology Program. (30/06/13–30/06/18) Co-investor: GRDC. DPI lead: Dr Kurt Lindbeck

The objective of this project is to develop a National Canola Pathology Program to maintain the canola industry and allow expansion of the crop into new regions, in particular northern NSW. This will be achieved by reducing yield losses in canola due to disease, with a focus on blackleg and sclerotinia.

The project aims to:

- deliver sound disease management practices to industry
- monitor all diseases of canola and provide information to farmers regarding management of these diseases and risk of yield loss
- focus on blackleg disease to determine the risk of breakdown of resistance by monitoring the levels of blackleg disease across all canola growing regions.

29. National Pathogen Modelling and Decision Support Program. (30/06/13–30/06/18) Co-investor: GRDC. DPI lead: Dr Kurt Lindbeck

This project will reduce costs and losses through improving grower management of crop diseases. This will be achieved through delivery of the following objectives:

- new knowledge, tools and technologies that provide an effective balance of genetic, cultural and chemical options for control and that support the integrated management of crop disease and impacts on yield, quality and crop returns
- increased grower and advisor use of an integrated approach using resistant varieties, cultural management and fungicide use options to support crop planning and in-crop disease minimisation
- advisers will have targeted plant-disease training so growers can access independent information to manage crop disease appropriate to their geographic circumstances and crop rotations.

**Program 4: Supply chains and market access****Sub-program 14: Grain Storage****30. Integrated Approach to Manage Stored Grain. (30/06/12–30/06/16) Co-investor: National Plant Biosecurity CRC. DPI lead: Dr Jo Holloway**

The Integrated Approach to Manage Stored Grain Project aims to:

- ensure Australian grain remains free of live insects by confirming fumigation protocols for sulfuryl fluoride.

Sulfuryl fluoride is an alternative fumigant to phosphine that can be used as part of a package to control chemical resistance in stored grain insect pests.

31. Ecology of Sitophilus and Cryptolestes Species. (01/01/13–31/12/15) Co-investor: National Plant Biosecurity CRC. DPI lead: Dr Jo Holloway

The aim of this project is to provide ecological information on two key stored grain insect pests, *Sitophilus oryzae* and *Cryptolestes ferrugineus*, to assist in developing integrated pest management strategies to control them.

Questions asked will include:

- Are these pests limited to the storage environment?
- How far do they disperse?
- How quickly do they reinfest stored grain?
- How does resistance develop and can it be slowed?

Seasonal patterns of abundance, dispersal and gene flow will be determined in field studies. Fitness studies will be undertaken in the laboratory to determine whether carrying resistance genes affects processes such as larval development, reproduction and overwintering.

Sub-program 15: Post Harvest/Market Access**32. Wheat Grain Quality Under Heat Stress. (01/11/11–31/12/16) Co-investor: GRDC.
DPI lead: Denise Pleming**

Using growth chamber and greenhouse methods this project aims to:

- identify different mechanisms of heat tolerance in bread wheat and Durum wheat
- apply these methods to screen a large collection of national and international bread and Durum wheat germplasm for heat tolerance.

The project will also:

- validate results under field conditions to confirm that tolerant lines are able to maintain grain yield and grain quality under heat stress in the field
- identify heat-tolerant bread and Durum wheats suitable for genetic mapping of heat tolerance loci, to allow tagging of the tolerance genes with molecular markers.

**Program 5: Agricultural education****Sub-program: Workforce Capacity and Development****33. Building Capacity in the Southern Grains Region (01/07/14–30/06/19) Co-investor: GRDC.
DPI lead: Deb Slinger**

This project will recruit staff to increase the level of R&D capacity within the southern grains region. This will be undertaken in a partnership between NSW DPI and GRDC to appoint up to six positions over a five-year period. Four fixed-term positions will be funded by GRDC for three years with a further two fixed-term positions funded by NSW DPI for three years during the five-year period of this project.

From 2018–19, NSW DPI will create up to six positions that will be ongoing. The recruitment of staff for ongoing research positions will be in close consultation with GRDC representatives.

The positions are being developed for a range of different reasons:

- build new research capacity in priority areas
- develop succession-plan strategies for the retirement of key researchers to provide additional support to key researchers in the region, enable mentoring of young scientists and increase research outcomes.

