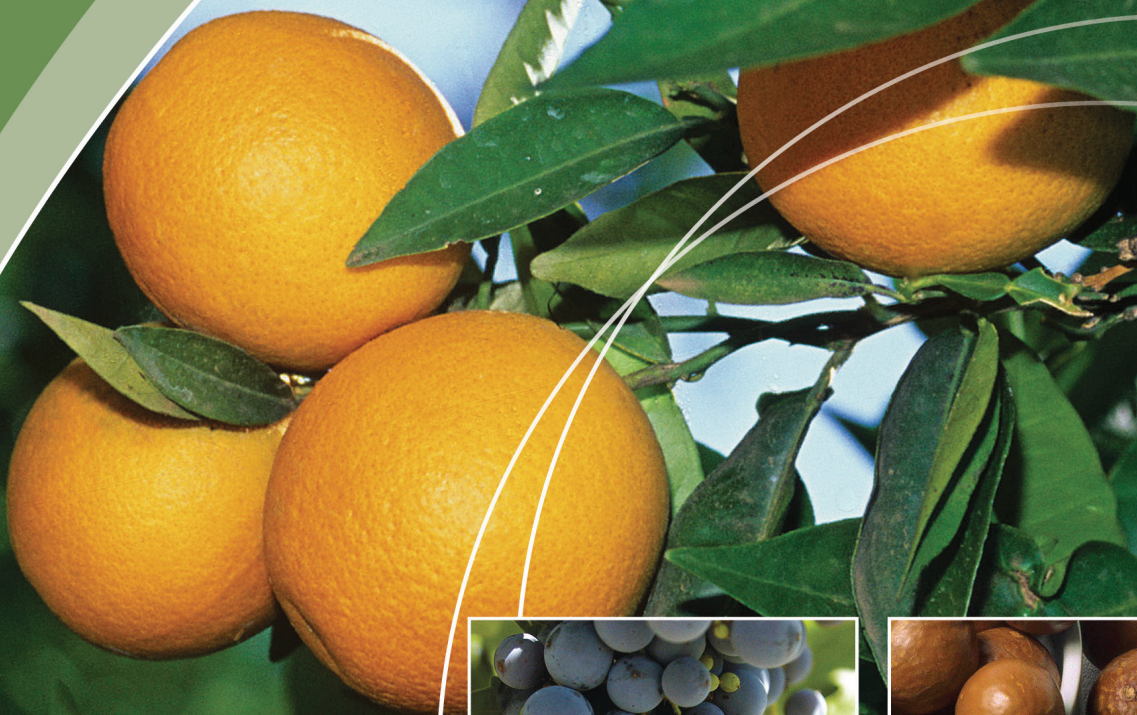




Department of
Primary Industries

Horticulture – Research & Development Prospectus



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Horticulture – Research & Development Prospectus

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More information

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www.dpi.nsw.gov.au

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Foreword

The 'Horticulture – Research & Development Prospectus' provides our stakeholders with an overview of the NSW DPI Horticulture Unit. It details the purpose, people, structure, programs and projects of the Horticulture Unit and illustrates our place within the Department's current research and development portfolio.

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

Key players in providing direction and resources for the Unit's successful operation are our stakeholders and collaborators. These include growers, industry bodies, research and development corporations, commercial horticultural companies and research organisations.

The Horticulture Unit is one of four units located within the Plant Systems Branch. Its purpose is to contribute to the profitability of horticultural systems in NSW by conducting research projects developed and delivered using co-investment from industry stakeholders and collaborators. The other three units within this Branch are Southern Cropping Systems, Northern Cropping Systems, and Water Research and Irrigation.

For more than 100 years NSW DPI has been a significant contributor to agricultural production through its research and development activities across the State. This has been achieved through the development and resourcing of research facilities, and continued investment in a diverse and highly skilled workforce. The Department's research outputs are both nationally and internationally recognised.

Dr Deborah Hailstones

Manager Horticulture Unit

Menangle

Our Purpose

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

The Horticulture Unit is part of the Plant Systems Branch within DPI Agriculture, which is 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 contribute to a better environment through the sustainable use of natural resources.

Horticulture is a major contributor to the NSW economy at over \$1 billion annually in farm-gate value and NSW horticultural production is almost 20% of the national total. The industry in NSW is characterised by its diversity which reflects the State's climatic extremes.

The Horticulture Unit delivers research and development (R&D) to increase the productivity and competitiveness of the horticultural industries of NSW, whilst fostering good management of resources and practices that minimise risks of contaminants and biosecurity concerns. While domestic consumption is critical to industry profitability, almost all horticultural sectors have export aspirations so production efficiency, product quality, market access and biosecurity are high priorities. Our R&D is focused through our programs in germplasm evaluation, farming systems, plant protection, supply chains and market access, and development and delivery.

Under the National Research, Development and Extension Framework for Horticulture, NSW DPI has committed to an ongoing and major investment in the citrus, blueberry, olive, leafy vegetable, protected cropping and melon sectors, and jointly leads (with the South Australian Research and Development Institute) the wine and (with the Department of Agriculture, Fisheries and Forestry) the macadamia sectors.

We also have a strong commitment to a support role through active research on a wide range of other commodities important to the NSW economy including temperate nuts, bananas, raspberries, apples, cherries and edible oils. Lastly, NSW DPI also retains a linking role in the mango, persimmon, pineapple, tropical fruits, asparagus, pea and sweet potato sectors.

Our service model provides a clear pathway from ideas, through innovation to delivery. Our research teams deliver results to development officers with specific responsibilities to assist the growth of the State's horticultural industries.



Our Research and Development Team

The Horticulture Unit is one of Australia's largest, most well-equipped and industry-responsive research providers. Our highly qualified staff are industry-focused and provide internationally recognised applied research, with a strong regional focus.

By linking industry with the latest management techniques, tools and markets, our Unit is a key player in the future of horticulture in NSW and Australia.

Currently our broad range of expertise includes pre- and postharvest plant physiology, pathology, entomology, agronomy, analytical chemistry, sensory science and food safety, and covers both viticulture and horticulture.



The Horticulture Unit has approximately 50 staff at eight regional locations with research and development specialists supported by management and administrative staff.

Our research is strengthened by our access to a wide range of expert staff in supporting fields across NSW DPI including soil scientists, irrigation specialists, climatologists, taxonomists and biometricians.



Our industry development team effectively translates the latest research and industry intelligence into practical opportunities for farmers and co-operates with NSW Local Land Services, industry peak bodies, commercial service providers and others.

Our research and development is supported by world-class human and physical resources located strategically across the State, including NSW DPI ISO 17025 accredited diagnostic laboratories, ISO 9001 certified research laboratories, biometricians, taxonomists, field sites and greenhouse complexes.



We have built a broad network of productive research partnerships within Australia and internationally. Some notable examples include Horticulture Innovation Australia Ltd (HIA), the Australian Centre for International Agricultural Research (ACIAR), the Rural Industries Regional Development Corporation (RIRDC), other state agencies and CSIRO.

Our research and development is delivered across five strategic program areas designed to address industry-identified needs:

1. Germplasm improvement
2. Farming systems management
3. Plant protection
4. Supply chains and market access
5. Development and delivery



Our cohesive team of researchers and R&D officers deliver to industries across the state, from the Mediterranean climate of the Murrumbidgee Irrigation Area and Sunraysia, to the temperate Central and Southern Ranges, and the Subtropics of the Northern Rivers.

We successfully work within our funding framework of co-investment from the NSW state government, industry and the Commonwealth to provide the resources we need to provide benefit to NSW horticultural industries, our environment and the regional communities in which we live.

Our Structure

Manager Horticulture Unit—Deborah Hailstones, Menangle			
Leader Horticulture Development, Myles Parker, Orange		Leader Southern Horticulture, Shane Hetherington, Orange	
Development Officer Blueberries, Phillip Wilk & Melinda Simpson, Wollongbar	Development Officer Temperate Fruits, Kevin Dodds, Tumut	Research Horticulturist Temperate Nuts, Jacquelyn Simpson, Yanco Technical Officer: Alan Boulton, Yanco	Technical Officer Temperate Fruits, Lester Snare, Orange Technical Assistant: Stephen Gottschall, Orange
Development Officer Macadamias, Jeremy Bright, Wollongbar	Development Officer Viticulture, Darren Fahey, Wagga Wagga	Entomologist, Jianhua Mo, Yanco Technical Assistant: Scott Munro, Yanco	Oils Chemist, Jamie Ayton, Wagga Wagga Technical Officer: Kerrie Graham, Wagga Wagga
Development Officer Bananas, Matthew Weinert, Wollongbar	Development Officer Citrus Industry, Andrew Creek, Yanco	Research Horticulturist Citrus, Graeme Sanderson, Dareton	Organic Liaison Officer, Vacant, Berry
Development Officer Protected Cropping, Jonathan Lidbetter, Ourimbah	Development Officer Citrus, Steven Falivene, Dareton	Technical Assistant: Troy Witte, Dareton Professional Officer: Valerie Draper, Yanco	Research Horticulturist Citrus, Tahir Khurshid, Dareton
Leader Northern Horticulture, Mark Hicky, Wollongbar		Leader Viticulture, Greg Dunn, Wagga Wagga	
Research Horticulturist, Food Safety, Sukhvinder Pal (SP) Singh, Ourimbah	Research Horticulturist Sensory, Roberto Marques, Ourimbah	Research Physiologist, Suzie Rogiers, Wagga Wagga	Research Physiologist, Bruno Holzapfel, Wagga Wagga
Research Horticulturist, John Golding, Ourimbah Technical Officer: Shashirekha Satyan, Ourimbah	Research Horticulturist, Sophie Parks, Ourimbah Technical Officer: Joshua Jarvis, Ourimbah	Research Pathologist, Melanie Weckert, Wagga Wagga	Professional Officer, Ashley Radburn, Wagga Wagga
Research Horticulturist, Trevor Olesen, Wollongbar Technical Officer: David Robertson, Wollongbar	Research Horticulturist, Entomology, Ruth Huwer, Wollongbar Technical Officer: Craig Maddox, Wollongbar	Technical Officer: Robert Lamont, Wagga Wagga	
Tea Tree Breeder, Gary Baker, Wollongbar	Technical Assistant: Ian Purdue, Wollongbar		

*Note that casual staff are not included in this table.

Management

Dr Deborah Hailstones, Manager, Menangle



Dr Deborah Hailstones manages the research and development activities of the Horticulture Unit to support a sustainable and profitable horticulture industry and the achievement of DPI Agriculture's corporate objectives. Deborah's professional interests include ensuring the scientific excellence and professional development of the team, and demonstrating the impact of their work in assisting the horticultural industry to thrive. Deborah seeks to ensure the Unit is accountable for the public funding that underpins R&D activities and that limited resources are used effectively. Deborah is passionate about the Horticulture Team making a difference to NSW and the horticulture industry. Her recent achievements include a research career of over 20 years, where she led a range of research and diagnostic projects providing protection for horticultural industries through the development and implementation of genetic technologies. From 2008 to 2012 Deborah was the Program Leader for Diagnostics Research in the CRC for National Plant Biosecurity. Deborah has built extensive skills in research, leadership, and assisting staff in delivering project outcomes.

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Dr Gregory Dunn, Leader Viticulture, Wagga Wagga



Dr Gregory Dunn provides high level research and development support to develop the NSW Wine Industry. His professional interests and skills are in improving vineyard management in order to reduce costs and improve wine quality. After completing his PhD (Melbourne University) he took up a post-doctoral fellowship researching tree water use and forest hydrology. From 1993 until 1997 Greg was based at the Queensland Forest Research Institute where he was responsible for the State's native forest and plantation forest silviculture research programs. In 1997 he returned to Victoria to work on yield forecasting and yield regulation projects in Viticulture for DPI Victoria. From 2005 until 2010 Greg was Associate Professor (Viticulture) and CR Roper Fellow in Agricultural Science at The University of Melbourne. His research interests are grapevine reproduction and yield development, and a recent achievement includes significantly improving the ability of wineries to make regional yield forecasts (from +/-20% to +/-5%).

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Dr Shane Hetherington, Leader Southern Horticulture, Orange



Dr Shane Hetherington's brief with NSW DPI is to lead a diverse team of horticultural researchers in southern NSW. Shane joined NSW Agriculture in 1995 and has a broad knowledge of horticulture. His initial research focused on developing bio-control agents for grass weeds in Australia and Vietnam. He then spent a period as a temperate fruit research officer focussing on management of diseases affecting apples, stone fruit and cherries. He has a particular interest in the development and application of IPM systems and disease epidemiology. Shane studied at the University of Queensland and holds a B.Sc. (Hons 1) and a PhD (Plant Pathology).

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Mark Hickey, Leader Northern Horticulture, Wollongbar

Mark Hickey leads the horticultural research team in the north of the state, focussing on the Ourimbah and Wollongbar sites. He has worked in this field and with NSW DPI for over 30 years. Mark enjoys working with people and undertaking challenges that result in positive change for farmers. Mark is effective at harnessing people's strengths and skills, and encouraging teams to function well together for a good collective outcome. His passion is to improve livelihoods of farmers through the provision of relevant and substantial information which provides a boost to their bottom line. His recent achievements include the successful negotiation of a large four-year ACIAR project which will provide assistance to Cambodian and Australian mango farmers, and improve the likelihood of the development of a successful biological control for one of subtropical horticulture's biggest pests, the fruit spotting bug.



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Myles Parker, Leader Horticulture Development, Orange

Myles Parker leads innovative development in NSW horticulture. His professional interest is in leading a team of horticulturalists working across seven key NSW horticultural industries. His recent achievements include 25 years of professional agronomy experience across a broad range of agricultural industries including cotton, pastures, grains, pulses, apples and vegetables. Myles has extensive experience in development and extension (Australia, Africa and central Asia), managing state-wide extension and development programs, and maximising the impact of programs through the use of e-technologies. Myles studied agricultural science at Sydney University and has worked with NSW DPI for 12 years at three different locations: Hillston, Walgett and Orange.



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Vivienne Touzell, Branch Support Officer, Orange

Vivienne provides administrative support to the Manager, Leaders and Staff of the Horticulture Unit. Vivienne has worked within the Plant Industries Branch of Agriculture since 1983 and has extensive experience and formal qualifications in office management. She has supported the Weeds, Pastures and Broadacre Cropping Sections of the Branch. Before her appointment to the Horticulture Unit in 2012, she held the position of secretary to the Chief (Division of Plant Industries), and supported both the Principal Director (Industry Development, Agriculture & Forestry) and the Assistant Deputy Director General (DPI Agriculture).



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Our Programs and People

Program 1: Germplasm improvement



Breeding and selection of superior varieties is one of the most effective methods to improve crop productivity and performance. Through NSW DPI's network of horticultural facilities in diverse locations, germplasm collections are maintained in support of national plant improvement programs in citrus, macadamias, tea tree, apples, grape vines and hazelnuts. As well as providing plant material and seed for breeding and evaluation purposes, these collections provide ideal sites for screening material for productivity, pest and disease resistance, and fruit quality.

Activities in this program involve the evaluation, and to a lesser extent the development of genetic material and varieties with improved tolerance and resistance to biotic and abiotic stresses. Except for citrus and tea tree, and to a degree macadamias, the maintenance of this germplasm is not supported by industry and the plantings are not consolidated at single sites.

The objectives of this program are to:

1. Maintain collections with the support of industry co-investment
2. Evaluate germplasm to determine agronomic performance and consumer acceptability
3. Source promising germplasm from our global research partners for evaluation under Australian commercial conditions
4. Work with collaborators to provide commercial quantities of known health-status germplasm to industry
5. Provide support for commercialisation

The two themes within this program are Breeding, where our Unit has limited involvement; and Germplasm Evaluation, where we are active. Our Germplasm Evaluation Program evaluates material under controlled and Australian commercial conditions and includes citrus, macadamias, hazelnuts and wine grapes. Several of these, such as the citrus rootstock collection and macadamia germplasm block are the best of their kind and are highly valued by industry. NSW DPI hosts the National Citrus Germplasm Repository which amongst other holdings has consolidated material previously held at the NSW DPI Gosford facility and CSIRO.

Research Officers

Gary Baker, Tea Tree Breeder, Wollongbar

Gary Baker has more than 20 years experience in tea tree breeding. His research interests include the areas of tea tree breeding and genetics, and tea tree germplasm development. Gary has served as Principal Project Officer since the start of the tea tree breeding activities in 1993 and is currently the Principal Researcher for the RIRDC/ATTIA funded project 'Developing elite tea tree clones and seed for improvements in plantation productivity and profit'. This program has released genetically improved seed to industry since 1997 and has progressively increased oil yield from 150 kg/ha to 270 kg/ha. Gary's work provides the on-going genetic improvement essential for a competitive and sustainable Australian rural industry. Gary holds a Bachelor of Rural Science (Hons) from the University of New England and a Masters in Agricultural Science from the University of Queensland.



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Dr Tahir Khurshid, Research Physiologist, Dareton

Dr Tahir Khurshid's brief within NSW DPI is to evaluate rootstocks and conduct projects for the development of the NSW Citrus industry. Tahir specialises in citrus crops and has been with NSW DPI for 17 years. His professional interests and skills are in projects on flowering physiology and citrus phenology, climate change, heat-unit mapping, fruit-size modelling, and rootstock evaluation. Tahir has led a large program for the past 12 years evaluating Chinese and Vietnamese rootstock for their suitability to Australian conditions. He is now trialling US, Spanish, Chinese and Vietnamese rootstock on growers' properties in NSW, Vic., QLD, SA and WA. His recent achievements include overcoming complex international conditions to lead successful overseas aid projects, recommending a number of rootstocks for the second phase of testing, working with Pakistani scientists and growers to improve capacity within the industry, and delivering honorary lectures on climate change and citrus in Australia and abroad.



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Graeme Sanderson, Research Horticulturist, Dareton

Graeme Sanderson's role within NSW DPI is to provide national evaluation of new varieties for the Australian citrus industry, and to coordinate and undertake specific tasks to improve mandarin production in Bhutan and Australia. His professional interests and skills are in determining field performance, fruit style and quality characteristics to meet market and consumer demand; nursery propagation management and field-trial establishment; conservation of citrus germplasm; interaction with scientists in Australia and internationally; and working with agricultural staff from third world countries. Graeme's recent achievements include the completion of HAL co-investment project CT10012 and CT12026, presentations at world citrus congress, and eight industry presentations to citrus groups (often in collaboration with Citrus Australia Ltd).



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Professional Officer

Valerie Draper, Professional Officer, Yanco



Valerie Draper joined the Horticulture Unit in August 2014 to provide editorial and desktop publishing support to the development of a citrus production manual. In her current position she works in editing and project management. She is a skilled developer of on-line instructional design and learning environments for education packages. Valerie wrote, designed and gained accreditation for the on-line course Salinity Management; co-authored, designed and narrated the Soil Biology Course and a module of the Managing Climate Risk in Agriculture Course. She also developed and narrated an EverTrain induction tutorial. Valerie has been instrumental in marketing, coordinating clients, and reviewing and evaluating courses. Valerie has written various scientific, technical and advisory publications and edited the 'Salinity Training Manual' and field identification guides on Cucurbits, fruiting Solanaceae in Australia and Cambodia, and bunching vegetables. She has a Science Degree from Sydney University, teaching qualifications, experience and training in adult learning and design methodologies, and is proficient in the e-learning authoring tool Captivate and the desktop publishing application InDesign.

Technical Assistant

Troy Witte, Technical Assistant, Dareton



Troy Witte has provided technical support to the citrus program at Dareton since 2005. His main focus has been on the evaluation of new citrus varieties, field trial maintenance and data collection along with laboratory testing of fruit quality. Troy is qualified in the use of all farm machinery, is a member of the Workplace Health and Safety committee and a First Aid Officer. He is skilled in the operation and maintenance of sophisticated fruit grading equipment and also fulfils a role as 'trainer' of staff in the safe operation of farm and laboratory equipment related to soil sampling, label production, fruit grading and quality testing. Troy assists with duties related to farm walks, field days and seminars. He has also been a key participant in the horticultural training of overseas agricultural officers from Pakistan and Bhutan as part of Australian Centre for International Agricultural Research projects at Dareton.

Program 2: Farming systems management



The management of farming systems in horticulture leads to the development of robust and integrated practices and technologies that improve horticultural productivity and protect the natural environment. This includes improving the management of nutrients in extensive and intensive horticultural industries, such as protected cropping, citrus, and vines.

Production packages are developed and deployed to address issues such as orchard floor and canopy management for perennial tree crops (nuts and citrus), and productivity regimes in protected cropping, field vegetables, and emerging horticultural crops. Programs in

vine physiology address crop forecasting and the influence of management, the environment and climate variability on grapevine yield and productivity, and wine quality and styles. Some research has been conducted into water-use efficiency and irrigation management in perennial tree crops and vegetables. Labour costs are also a limiting factor for many horticultural industries and we seek to partner with co-investors to explore potential solutions to these issues.

The management of farming systems in horticulture involves the development of robust integrated practises and technologies that improve horticultural productivity and protect the natural environment. The objectives of this program are to:

1. Improve the management of nutrients
2. Develop and deploy agronomy packages
3. Improve water-use efficiency and irrigation practises
4. Reduce labour costs

The program is divided into the themes of Nutrient Management and Agronomy Packages. We conduct a range of research in the Nutrient Management Theme with an emphasis on vegetable systems and fertigation for citrus, nitrogen and carbohydrate management in vineyards and the management of berry ripening in grapes through nutrition manipulation.

Under the theme of Agronomy Packages we develop integrated systems approaches for intensive and extensive horticultural production systems, ensuring product yield and quality whilst reducing waste and environmental impacts. This includes the development of orchard floor and canopy management regimes, the development of production packages, crop forecasting, minimising water run-off, leaching and waste and the evaluation of new and emerging crops with strong potential for growth in NSW.

We work with large and small horticultural industries to improve their financial and environmental sustainability. Recent projects have developed innovations to industries including Asian vegetables (greenhouse production and nutrient accumulation), beetroots (stand management), wine (improving yield prediction), and macadamias (canopy management). We are in a strong position to offer guidance as the climate becomes more extreme.

Research Officers

Dr Bruno Holzapfel, Research Horticulturist Viticulture, Wagga Wagga



Dr Bruno Holzapfel's brief is to conduct viticultural research to support the NSW wine industry. His research focus is optimising vine performance, grape quality and adaptation to a changing and variable climate. His professional interests and skills are in carbohydrate physiology (carbohydrate reserves, reproductive development and vine productivity, management of yield and fruit composition), grapevine nutrition (nutrient uptake and management, root development and function, root influence on vine performance), and environmental physiology (berry ripening and composition, climate variability and climate change, rootstock and grape variety adaptability). Bruno's recent achievements include convening and presenting at a conference workshop on grapevine balance (AWITC), publication of scientific papers on vine nutrition and refereed conference articles on carbohydrate physiology, and delivering several lectures at universities in Montpellier (France) and Wagga Wagga on plant nutrition and carbohydrate physiology.

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Dr Trevor Olesen, Plant Physiologist, Wollongbar



Dr Trevor Olesen conducts research into the canopy management of subtropical woody perennials, especially macadamia. Currently his main focus is on developing ways to keep macadamia trees small and productive, to allow for the growth of groundcovers to mitigate erosion, and to facilitate efficient orchard operations, especially harvesting and spraying. Trevor has previously worked on the responses of subtropical trees to climate change and the development of canopy management strategies for the avocado, custard apple, Tahitian lime and litchi industries. His professional interests and skills are in studying the interactions between plants and the environment with a particular focus on flower development and crop production. Trevor received a B.Sc. (Hons) in Botany from the University of Adelaide and a PhD

in Plant Science from the University of Tasmania. Trevor's recent achievements include advancing the understanding of the phenology of recurrent flushing trees.

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Dr Sophie Parks, Research Horticulturist, Ourimbah



Dr Sophie Parks develops farming practices that improve the yield and quality of fruit and vegetable crops, and to increase efficiencies in the use of resources, such as fertilisers, in plant production. Sophie joined the Department in 2002 and her professional interests include the physiology of nitrate accumulation in leafy vegetables, agronomic practices that influence fruit quality in blueberries, and the development of new crops in hydroponic systems. Sophie also enjoys mentoring several research students through her role as Conjoint Senior Lecturer with the University of Newcastle. Her recent achievements include co-authoring five peer-reviewed publications in 2014 on the production and quality of two cucurbit fruits and co-authoring a conference paper on the Australian greenhouse industry at the International Horticulture Congress (Brisbane 2014). Sophie's qualifications include a Bachelor of Science from Macquarie University, and a Masters and a PhD (Horticulture) from the University of Western Sydney.

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Jacquelyn Simpson, Research Horticulturist, Yanco

Jacquelyn Simpson is the newly appointed Research Horticulturist responsible for planning and conducting research with the temperate nut industries. Her research interests include tree nutrition, soil nutrient cycling and optimising plant productivity. Jacquelyn has recently submitted a PhD thesis on understanding the role of organic nitrogen in the nutrition of Eucalyptus plantations for optimising fertiliser management. She has a Bachelor of Science (Plant Science and Biochemistry) and a Graduate Diploma (Biology) from the University of Sydney. Jacquelyn will develop research projects and work closely with the rapidly immersing NSW temperate nut industry.

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**Professional Officer****Ashley Radburn, Facilities Manager, Wagga Wagga**

Since 2009 Ashley Radburn has been a member of the Management Team at the National Wine & Grape Industry Centre. He has a sound understanding of the management implications of complex technical research projects and commercial operations and has skills in project management, agricultural production, financial management, marketing, and human resource management. Ashley is responsible for the management of the physical resources at the NWGIC and assists in the Centre's day-to-day operations. He also provides management and technical support to academic and research staff engaged in field trials, laboratory based viticulture investigations and wine science studies. Ashley graduated from Sydney University with a Bachelor of Management and holds formal qualifications in agribusiness, project management, marketing and procurement. Ashley has well developed professional capabilities in a broad range of business management areas with a focus on higher order creative thinking, problem solving, opportunity creation, business analysis, and strategic and tactical planning.

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**Technical Officers****Alan Boulton, Technical Officer, Yanco**

Alan Boulton has worked as a Technical Officer at Yanco Agricultural Institute since 1996. He initially worked for 12 months with the Rice Physiology Team and then for 15 years with the National Vegetable Industry Centre. For the last three years Alan has also worked on the Soybean Breeding and Agronomy Program. Alan has a Bachelor of Science from Monash University. He has expertise in planting, growing and managing the agronomy of a wide range of broadacre and vegetable crops grown under different management systems. He has considerable skills in trial design, data collection, data management and analysis. Alan also has specialist skills in aphid, thrips and weeds identification. Alan is currently working on both soybean and horticulture projects.



Joshua Jarvis, Technical Officer, Ourimbah

Joshua Jarvis' brief is to provide support to all researchers on a range of projects at Ourimbah. His professional interests and skills are focused on protected cropping and controlled-environment horticulture. He has a Bachelor of Science (Biology and Geography) from the University of Newcastle and has worked with NSW DPI since 2002 in a wide range of areas: electronics, environmental control, irrigation and fertigation, plant physiology, pathology and control strategies, entomology including bio-control, supply chain projects, and remote sensing and monitoring. Joshua was a Nursery Manager with Yates Botanicals previous to taking his position with NSW DPI. His recent achievements include the successful uptake of greenhouse designs and cropping systems in the Philippines; identification, sourcing and testing of ultra-filtration for recycled nutrients; the development and delivery of national energy efficiency workshops; and finalising two projects on greenhouse energy use and management systems.

David Robertson, Technical Officer, Wollongbar

Since completing an Associate Diploma in Horticulture at Hawkesbury Agricultural College in 1990 David Robertson has been employed by NSW DPI at Alstonville. His brief is to provide technical support for a number of externally funded research projects in subtropical crop production. David is currently implementing and monitoring four research projects investigating fruit spotting bug, macadamia canopy management, Idiophantis moth in blueberries, and Plautia bug in raspberries. David's skills and interests are in the logistics of effectively working across a number of projects; and developing new, cost-effective and accurate experimental methods. Working on a number of project areas has enabled David to connect aspects of one project with another, for example, canopy management with entomology work. David was the first to quantify the impact of the Sigastus weevil in macadamia in NSW.

Lester Snare, Technical Officer, Orange

Lester Snare joined NSW DPI in 1983 and has focused on temperate fruits. He has worked on the cultural aspects of production in pome, stone and temperate-nut species. His interests and research experience include varietal assessment of fruit crops and production techniques related to pome fruit and temperate-nut production. He has produced numerous extension articles related to hazelnut production and worked closely with this developing industry. Other interests include apple rootstock assessment, tree architecture, preservation of germplasm, and pest and disease management. Lester is currently working on apple and nut cultivar evaluation projects. His recent achievements include publication of a 'Hazelnut Growers Handbook', completion of a pest and disease study conducted on behalf of the Australian hazelnut industry, management of an apple rootstock breeding program, and contribution to promotional material related to nut production. Lester holds an Associate Diploma in Applied Science (Viticulture) and a Bachelor of Applied Science.

Technical Assistant

Steven Gottschall, Technical Assistant, Orange

Stephen Gottschall has supported temperate fruit and nut research for over 10 years with NSW DPI and he services the Institute's orchards at Orange. His interests and skills include all aspects of pest, disease and orchard management. Stephen has been involved in a number of projects including Breeding of Woolly Aphid Resistant Dwarfing Apple Rootstocks, Future Orchards Program, Field Evaluation of Hazelnut Varieties and Evaluation of Pome Fruit Varieties. He has worked in the areas of preservation and management of germplasm blocks, tree training, chemical thinning, and pest and disease management.



Program 3: Plant protection



Insect pests and microbial diseases impact on the commercial success of NSW horticultural industries in two major ways. Firstly, yield losses and downgrading occur as a direct result of infestation or infection. Secondly, the maintenance and development of lucrative export markets is governed by compliance with phytosanitary requirements and pest presence which, independent of any damage, can limit access to sensitive markets.

In most cases chemical control is well implemented on-farm, but factors such as reduced pesticide availability, and consumer attitudes and the increasing resistance of insects to those pesticides are driving the development of new approaches. This program develops innovative pest disinfestation protocols for seamless integration into the value chain and focuses on developing systems approaches to the management of the major pests of our most important crops. This involves combining available and novel techniques to provide effective control with minimal off-target impact.

Pest management is further confounded by farmers now bearing greater liability for off-target pesticide impacts and the diminishing number of registered pesticides available for use, at a time when consumers are becoming increasingly concerned with the nutritive value of their food and a growing desire to eat 'clean and green'.

Within this context the objectives of this program are to:

1. Develop integrated management programs for pests and diseases that augment systems approaches for the State's high priority horticultural crops
2. Evaluate and promote the commercial, environmental and social benefits of innovative, integrated control strategies for key pests in horticulture

The program is divided into two themes: Entomology and Integrated Pest Management (IPM), and Pathology and Integrated Disease Management (IDM). Integrated systems allow farmers to control the pests and diseases that would devastate their crops, but these systems must be built on a full understanding of the pest's lifecycle. Integrated Pest and Disease Management (IPDM) approaches almost always result in a reduction in the use of synthetic pesticides, providing benefits to our environment and on-farm profitability.

Our teams have also worked on developing an understanding of why some pesticides gradually lose effectiveness as pests develop tolerance or resistance. We also have an interest in the use of alternative chemistries including horticultural mineral oils and GRAS (Generally Recognised as Safe) pesticides.

Research Officers

Dr Ruth Huwer, Entomologist, Wollongbar

Dr Ruth Huwer leads the Entomology Team at Wollongbar, and her brief is to develop and conduct research programs into sustainable pest management in subtropical and tropical horticultural fruit and nut crops. Her professional interests and skills are in integrated pest management systems; investigating holistic approaches including biological, chemical and cultural controls; understanding the ecosystem and insect behaviour; and chemical ecology. Ruth works to meet the challenge of developing practical pest management solutions using good collaboration and team work. Her recent achievements include leadership of a large, multi-disciplinary, multi-agency, national project on fruit-spotting bug. Ruth has worked with NSW DPI since 2002 and previously was a post-doctoral fellow with the CRC for Weed Management Systems/CSIRO Entomology (ACT). After completing her B.Sc. (Hons) and PhD (Agricultural Science) at the Justus-Liebig-University in Germany she worked as an Experimentalist at the Tropical Weeds Research Centre, Charters Towers (QLD).



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Dr Jianhua Mo, Entomologist, Yanco

Dr Jianhua Mo's brief is to lead with integrity and work towards a productive, sustainable and biosecure NSW Agriculture. His professional interests and skills are in integrated pest management including chemical, biological and cultural management. He has project experience with the key pests of onions, cotton, citrus and brassicas; vector disease interactions; insecticide efficacy trials; modelling insect population dynamics, dispersal and movements, and phenological processes; sampling statistics in pest monitoring and detection; qualitative risk analysis of pest incursions; and data mining. Jianhua's recent achievements include obtaining more than \$1.8 million in industry funding since 2001, publishing 31 papers in peer-reviewed journals, and co-authorship of a paper awarded as highly commended by Emerald Publishing Group. Prior to joining NSW DPI in 2000 he held entomologist positions at SARDI, SA; the CRC for Tropical Pest Management, QLD; and the Tropical Weeds Research Centre, QLD. Jianhua studied Agricultural Science (B.Sc. and M.Sc.) at the Central-south University of Forestry and Technology (China), and received a PhD in Forest Entomology from the Australian National University. E: jianhua.mo@dpi.nsw.gov.au P: (02) 6951 2537



Dr Melanie Weckert, Plant Pathologist, Wagga Wagga

Dr Melanie Weckert has 20 years research and teaching experience in the wine industry. She was appointed to NSW DPI in 2002 with the brief to conduct first class science in viticultural plant pathology and soil microbiology. Her professional interests include the enhancement of grapevine and soil health using environmentally sustainable methods. Melanie's recent achievements include the discovery that soil amendments (including biochar) increase vineyard populations of fungi, bacteria and beneficial nematodes, while decreasing pest nematodes. She also discovered that the grapevine disease, Bacterial Inflorescence Rot is caused by a *Pseudomonas* bacterium. Melanie solved the puzzle of 'young vine decline' in the Riverina, showing it to be caused by contamination of nursery material by two fungi, one in the roots and one in the trunk. Melanie studied Chemistry (B.Sc.) at Charles Sturt University, Education (Grad. Dip.) at the Hawthorn Institute, and received a PhD from CSU. E: melanie.weckert@dpi.nsw.gov.au M: 0447 219 991



Technical Officers

Craig Maddox, Technical Officer, Wollongbar



Craig Maddox provides technical support to the Entomology Unit in subtropical crops by carrying out field-work diagnostics, lab and field chemical efficacy testing, varietal susceptibility work, and liaising with industry on emerging issues. He has a passion for finding the means to control pests and keeping local industries profitable. His professional interests and skills are in entomology, understanding pest population dynamics, finding the right product and timing to intervene in pest/crop issues, understanding biocontrols and pheromones. Craig has worked for the Department for over 30 years at three sites (Alstonville, Pearces Creek and Wollongbar) and worked on a number of different crops. His recent achievements include the identification of pest species and management strategies for macadamias, and determining the economic impact of thrips in macadamia. Craig

holds a Science Degree (Zoology) from NSW University and he completed a research Masters at the University of Queensland on *Paropsisterna tigrina* which is the main leaf-eating pest of tea tree.

Technical Assistants

Scott Munro, Technical Assistant, Yanco



Scott Munro is a Technical Assistant with 11 years experience in insect pest management of Australian horticulture crops. He has been involved in a number of research projects including light brown apple moth, Fuller's rose weevil and citrus gall wasp, onion thrips, and *Heliothis* grub in sweet corn. The areas of research he has been involved in include chemical and biological control, mating disruption, cultural control through crop hygiene, pruning and use of mulch, insect rearing and phenology studies, monitoring and sampling of a range of horticulture crops and Integrated Pest Management. Scott is currently working on the Management of Red Scale in Citrus and Iris Yellow Spot Virus in Onions. Scott holds a Certificate III in Horticulture from the TAFE NSW Riverina Institute, Leeton Campus.

Ian Purdue, Technical Assistant, Wollongbar



Ian Purdue is currently involved in the multi-industry fruit spotting bug project at Wollongbar, and projects in blueberries and raspberries. Ian has undertaken a technical assistance role in horticulture since joining NSW DPI at Alstonville in 1996. Ian initially worked with the Physiology Group investigating nursery leachates, then moved on to canopy management in macadamias, where he assisted with orchard management. In 2000 Ian joined the Entomology Team at Alstonville who were working on *Trichogammatoidea cryptophleiae*, an egg parasitoid of macadamia nutborer; and development of an IPM system in macadamias. This position entailed maintaining insect colonies, rearing macadamia nutborer and its egg parasitoid, monitoring pest and wasp populations in the orchard, assisting with setting up and monitoring chemical assays in the laboratory, as well as working on field trials.

Program 4: Supply chains and market access



Whilst achieving optimal productivity and managing natural resources are cornerstones of thriving and enduring horticultural industries, produce must also meet consumer expectations in terms of visual appeal, price point and sensory experience. This program conducts research to underpin access of horticultural produce to domestic and international markets.

The objectives of this program are to:

1. Define the parameters that optimise the quality attributes of horticultural products
2. Identify production and postharvest practises such that products satisfy consumer requirements
3. Maximise product out-turn following harvest, packaging, transport, storage and display
4. Proactively develop novel disinfestation and disinfection protocols which meet phytosanitary requirements and can be easily and seamlessly integrated into existing value-chain practices, allowing NSW to gain, maintain and retain market access

The program is divided into two themes. The first theme is Product Value Chains which looks at harvest, cooling, cleaning, sorting, packing, and storage practises, and the control of pests, diseases and physiological disorders following harvest. In most cases, product quality begins to deteriorate immediately after harvest, and so the postharvest handling of produce has an important positive influence on their longevity, nutritional value, appearance, taste and consumer appeal. Overall, research and development in this theme seeks to develop processes and systems along the entire value chain to maximise produce quality, shelf life and consumer appeal, including reducing chemical spray applications and other inputs by developing and utilising more environmentally friendly methods and products.

The second theme is Market Specifications and Compliance, in which we provide research to ensure that horticultural products meet the specifications of their target markets, and comply with pesticide residue limits, quality standards, food handling and safety standards. This includes the proactive development of novel disinfestation and disinfection protocols to meet phytosanitary requirements and yet preserve product quality. A second focus is edible oils, specifically the analysis of olive and canola oil with an emphasis on the effects of production and processing on oil quality as measured through both chemical and sensory analysis. The Australian olive oil industry focuses on standards and authenticity so this work concentrates on the detection of adulterated oils and maintenance of authenticity particularly for Extra Virgin Olive Oil.

Research Officers

Dr John Golding, Research Horticulturist, Ourimbah



Dr John Golding's role is to provide practical and cost-effective solutions to ensure the market access of NSW horticultural produce. John's professional passions are in the postharvest management of product quality, including following treatment for quarantine pests. His current work involves market access and postharvest research; development and extension on a range of horticultural crops, predominantly blueberries, cherries and citrus. John is a conjoint appointment with the University of Newcastle, where he co-supervises three PhD students in food science. He also has two PhD students in horticulture at UWS. His recent achievements include the completion of eight projects funded by Horticulture Australia Ltd, co-authoring eight international refereed research papers and one book chapter, presenting his research findings at the national cherry apple and citrus industry conferences, and presenting his work at international horticultural science conferences.

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Dr Roberto Marques, Research Horticulturist Sensory, Ourimbah



Dr Roberto Marques brief is to develop applied horticultural research on postharvest quality (particularly sensory evaluation) to determine which fruit and vegetable traits consumers value and want, and to examine supply chain impacts on these traits. After obtaining his postgraduate qualifications from Massey University (New Zealand) and the University of Queensland, Roberto worked for more than 10 years with QLD DAFF before joining NSW DPI in May 2014. Roberto is passionate about supporting the NSW horticulture industry through effective research and development work. His research interests and experience include sensory evaluation (for example, flavour) of fresh horticultural produce, and pre- and postharvest interactions which may enhance product quality throughout the supply chain. His recent achievements include securing a research and development project with the vegetable industry, as well as developing a proposal with the citrus industry which is currently under evaluation.

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Dr Suzy Rogiers, Research Horticulturist Viticulture, Wagga Wagga



Dr Suzy Rogiers is a Principal Research Scientist located at the National Wine and Grape Industry Centre. She has researched fruit development and plant water relations for the last 15 years. She completed her PhD on the physiology and biochemistry of *Amelanchier alnifolia* (saskatoon) berry ripening through the University of Alberta, Canada. Subsequently she joined the NSW Department of Primary Industries to study viticulture and she has a particular interest in plant responses to abiotic stresses. She has published on topics such as cell senescence, Shiraz berry shrivel, fruit split, source-sink relations on fruit-set, water-use efficiency, night-time transpiration and root-zone temperature effects on grapevine physiology and berry development. Her work relies on a combination of field based and controlled environment studies. Currently she is involved in an ARC Industry Transformation Training Centre project in conjunction with the University of Adelaide exploring viticultural methods to reduce alcohol levels in wine.

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Dr Sukhvinder Pal (SP) Singh, Research Horticulturist Food Safety, Ourimbah

Dr SP Singh undertakes research into food safety risks and their mitigation during on-farm production and postharvest supply chain of fresh horticultural produce. SP has scientific expertise in horticulture and pre- and postharvest food safety systems. After completing his PhD at Curtin University SP was appointed Research Scientist at the National Agri-Food Biotechnology Institute, India where he initiated and lead a postharvest biotechnology program. He joined NSW DPI in 2014 and also holds a Conjoint Senior Lecturer position at the University of Newcastle. SP is keen to offer industries through-chain food safety solutions through the identification and quantification of sources and/or routes of physical, chemical and microbial contamination; and provision of methods to prevent and minimise contamination thus assuring the supply of safe produce. His recent achievements include research publications, book chapters, presentations at national and international conferences, and the application of 'omics' technologies to underpin the quality and safety of fresh produce.



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Jamie Ayton, Oils Chemist, Wagga Wagga

Jamie Ayton's brief within NSW DPI is to research oilseed quality, particularly olive oil and canola. Jamie started with the Department in 1995 and initially worked on soil, plant and water chemistry before moving to oil chemistry in 1997. His professional interests and skills are in oils research, particularly postharvest quality of olive oil including storage and adulteration analysis. Jamie also has a keen interest in improving the quality of Australian canola for improved returns to Australian producers and he is an American Oil Chemists' Society Approved Chemist. His recent achievements include his successful completion of research projects on time and within budget, as well as maintaining accreditation with the International Olive Council for over a decade. After receiving a Bachelor of Applied Science Degree (Medical laboratory Science) at CSU, Wagga Wagga he completed a Masters Degree at the University of Western Sydney investigating the effect of irrigation on olive oil quality.



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Technical Officers

Kerrie Graham, Technical Officer, Wagga Wagga



Kerrie Graham's brief within NSW DPI is to conduct research analysis within the Edible Oils Research Program, focusing on olives and canola. Kerrie's professional interests and skills are in developing improved oil quality for producers and consumers. Kerrie has a sound knowledge base of the analytical instruments essential to the work conducted and the management of research projects, including overseeing planning, analysis, report writing and method development. Her recent achievements include ensuring the Oil Laboratory obtains and maintains its accreditation in the American Oil Chemists' Society, the German Society for Fat Science, and the International Olive Council.

Rob Lamont, Technical Officer, Wagga Wagga



Robert Lamont's brief is to provide technical support in the areas of grapevine physiology and plant pathology. This includes all aspects of field trials and laboratory analysis. Robert's current focus is primarily the establishment and management of an experimental vineyard based at the National Wine and Grape Industry Centre (NWGIC). Robert has worked with NSW DPI since 1990, initially as a laboratory assistant working in microbiology and tissue culture, and soil chemistry at Wagga Wagga. He then relocated to the Elizabeth Macarthur Research Institute working on virology in stone and pome fruits as a Technical Assistant and later as a Technical Officer. Robert has worked for the NWGIC since returning to Wagga Wagga in 2000. He holds an Associate Diploma of Applied Science (Horticulture) from Charles Sturt University, Wagga Wagga.

Dr Shashi Satyan, Technical Officer, Ourimbah



Shashi Satyan is responsible for the technical facility in the Market Access Unit which includes staff training, equipment maintenance and the purchase of technical materials. Shashi supports industry-funded projects by conducting research and publishing articles. Her professional interest is in postharvest physiology of horticultural commodities. Shashi has laboratory technical skills relevant to postharvest research such as setting up and maintaining analytical instruments for measuring storage atmospheres and fruit quality parameters, for example, colour, texture, firmness, acidity and sugars. She was responsible for setting up the Gas Chromatograph to measure fruit volatiles, developing specifications for a fumigation chamber, setting up a postharvest laboratory, and establishing procedures for routine postharvest research. A recent achievement includes designing gas connections to maintain a controlled atmosphere for the storage of horticultural crops.

Program 5: Development and delivery



Innovation and opportunities for farm business improvement arise from many sources and to effectively develop industry capacity, information must be packaged and made accessible to NSW horticultural producers and agribusinesses. Our industry development team provides a vital link between research outputs and our priority industries by developing and delivering appropriate tools and packages. Delivery is also facilitated through key extension agents such as commercial operators, delivery agents including private consultants, agricultural product retailers and Local Land

Services.

Well known flagship publications include the long-running and highly respected 'Orchard Plant Protection Guide for Temperate Fruits' and the 'Grapevine Management Guide'. We are continuing to expand this range with similar packages for the macadamia, blueberry, protected cropping and citrus industries.

Increasingly, we deliver our messages using digital technologies and web-based platforms to maximise the impact of key research and development information. These include our Department's web site and social media including YouTube videos with transcripts, and webinars such as 'virtual field days'. DPI Horticulture will shortly be launched on Twitter to promote our activities, latest research and outputs from a range of sources. We are also developing the mobile phone app 'Procit' for the citrus industry, to make web information more accessible in field situations.

DPI Agriculture has developed performance benchmarking studies to allow individual farmers to evaluate their performance against their peers. Recent examples include the National Greenhouse Business Analysis Project and benchmarking for the macadamia industry.

DPI Agriculture delivers a Skills Development Program specifically tailored for the NSW wine grape industry. The program delivers research findings and information to build the industry's resilience and capacity through regular information bulletins, strategic workshops, applied research trials, and an electronic weather station network that allows timely disease alerts.

The objectives of this program are to:

1. Develop and deliver flagship publications and digital resources for our priority industries
2. Deliver agronomy packages for 'fit for purpose' varieties in priority industries
3. Encourage the use of integrated pest, weed and disease management packages
4. Develop tools for crop nutrition and fertiliser management for consultants
5. Maximise the impact of key research messages through digital portals

Development Officers

Jeremy Bright, Development Officer Macadamias, Wollongbar



Jeremy Bright's brief is to identify and develop opportunities for orchard expansion and development, and to share knowledge and facilitate adoption of best practice for the macadamia industry. His professional interests and skills are in delivering information to industry stakeholders in a format that is easily understood and adopted, resulting in practice change that leads to industry improvement. Jeremy is experienced in developing agriculture and extension techniques in poorer countries. His recent achievements include facilitating spray workshops which included information on spray timing, coverage and equipment calibration. He recently authored the 'Macadamia Plant Protection Guide' and delivered five YouTube videos to growers on productivity, pest management and innovations. Jeremy has 23 years experience in a variety of horticultural industries and holds a B.Sc. from Griffith University and an Assoc.Dip.(Farm Management) from the University of QLD.

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Andrew Creek, Citrus Industry Development Officer Riverina, Yanco



Andrew Creek's role is to develop the Riverina citrus industry by working through industry grower groups, processors and packers in the Riverina. Andrew works with a project reference group from these organisations on a three-year citrus development project aiming to improve long-term profitability and sustainability of Riverina citrus enterprises. The challenge of his role is to build industry capacity to access new export and domestic-market opportunities. Andrew assists growers to meet market protocols through improved farm management, new varieties and IPM. Andrew is also involved in citrus trials in the local area which aim to demonstrate new technologies. Andrew was previously in private industry as a Farm Superintendent managing a horticultural farm in the MIA (300 ha grapes and 600 ha cucurbits). He also worked for six years as the NSW DPI District Horticulturist based

at Griffith focusing on citrus. Andrew obtained his Bachelor of Horticultural Science Degree from the University of Western Sydney.

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Kevin Dodds, Development Officer Temperate Fruits, Tumut



Kevin Dodds engages with temperate-fruit industries and research providers to facilitate research and development activities that sustain and grow the pome fruit, stone fruit and cherry industries of NSW. Kevin joined NSW DPI in 1990 having completed his degree in horticulture at the University of Western Sydney. His association with the temperate fruit industries spans 25 years and he has worked in research, extension and retail environments. Kevin's professional interests and skills are in working with the temperate fruit, particularly focusing on apple production and IPM, and effectively working with producers and producer groups to solve problems. He is excited by opportunities to add value in horticulture, such as ciders and perrys that add diversity and resilience to farm businesses. His recent achievements

include producing the 'Orchard Plant Protection Guide' since 2011, facilitating the Apple and Pear Australia Ltd Future Orchards Program since 2010, and more recently undertaking the Front Line Advisor role for Batlow and Orange on that program. Kevin also convenes the National Cider Industry Conference.

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Darren Fahey, Development Officer Viticulture, Wagga Wagga

Darren Fahey's brief is to develop information for viticulture production across 14 major wine-growing regions and liaise with industry groups to build NSW viticulture profitability and grow market share. This includes a role in overseeing the delivery of the NSW Viticulture Skills Development Program for the NSW wine industry and the NSW component of Australian Grape & Wine Authority funded Regional Program. His recent achievements include his work as the NSW Market & Development Officer for the recycled organics industry for five years, contributing technical information to the industry and end users, compiling fact sheets and case studies whilst delivering workshops and presentations. Darren actively developed markets for compost and mulch use across a range of industries. His professional interests include quantifying the benefits of recycled organics in agriculture, improving grape-quality measures, investigating new wine grape varieties and building capacity of NSW wine grape growers. Darren holds a Bachelor of Horticultural Science (Viticulture) from the University of Western Sydney.



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Steven Falivene, Development Officer Citrus, Dareton

Steven Falivene began working for NSW DPI in 1989 and his brief is to develop the citrus industry through the provision of information and training packages. Steven holds a Bachelor of Science Degree (Agriculture) from Sydney University and his professional interests and skills are in conducting on-farm trials that address industry issues, developing training packages, and producing both print and digital materials that are available on the web (NSW DPI website and YouTube). His recent achievements include working with industry to develop training and information packages to increase Asian exports of citrus such as the 'Asian Export Crop Monitors Training Package'.



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Jonathan Lidbetter, Development Officer Protected Cropping, Ourimbah

Jonathan Lidbetter has over 20 years experience with NSW DPI and has worked with industry across a range of commodities from native cut flowers, to nursery crops and green tea. He was seconded to forest ecology to work on emergency management of a major biosecurity incursion—myrtle rust. His overall experience is largely centred on propagation from seed, cuttings and grafting to tissue culture. Jonathan has also worked on new crop development where he focused on crop performance and manipulation, nutrition, disease tolerance and management, as well as flower and seed biology. His current focus is grower adoption of new and appropriate technologies to deal with current challenges, and he has recently completed a tour of leading North American facilities to study relevant technologies. Jonathan has a B.Sc. (Agriculture) (Hons) from the University of Sydney and a M.Sc. (Hons) from Macquarie University. He is currently working on the economics of grafting cucumbers for *Fusarium* resistance.



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Matthew Weinert, Development Officer Bananas, Wollongbar

Matthew Weinert's brief is to reinvigorate the NSW banana industry by working with growers and developing training materials and techniques for pest and disease management. His professional interests include developing banana nutrition recommendations delivered through fact sheets and workshops, developing alternative pest management options, testing and developing banana weevil borer management systems using an existing pheromone, completing a baseline survey of the NSW banana industry, and mapping the NSW banana supply chain. Mathew's recent achievements include co-authoring the 'Avocado problem solver field guide' and developing training videos for picking and packing mangoes and avocados. Matthew started with NSW DPI in 2104 and previously worked with CSIRO, QDPI, QDAF, AQIS and the University of Queensland. He

holds a B.Sc. from the University of Queensland and has over 20 years experience in research, extension and development in horticulture and plant pathology. Matthew has also worked on a wide range of tropical and subtropical horticultural crops in Australia and overseas including mangoes, avocados and citrus.

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Phillip Wilk, Development Officer Blueberries, Wollongbar

Phillip Wilk's role within NSW DPI is to guide the industry through areas such as managing and identifying research and development needs, assisting market access through provision of technical advice, and conference organisation. His professional interests and skills are in identifying intensive fruit production opportunities and requirements. Phillip graduated with a B.Sc. Ag. (Horticulture) from the University of New England and he has a Dip. Ed. Phillip has well developed skills in extension and in taking a complex system and breaking it down into manageable parts to ensure our recommendations provide better returns for the grower's product. His recent achievements include the identification of key projects for the blueberry industry including disease management and industry demographics. He is also involved in the establishment of the Blueberry Industry Council. Phillip joined NSW DPI in 1998 at Alstonville where he worked on stone

fruit, citrus, avocado, macadamia, vegetables, blueberries, and new and emerging industries.

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Melinda Simpson, Development Officer Blueberries, Wollongbar

Melinda Simpson works part time as a Blueberry Development Officer with Phillip Wilk at Wollongbar. Melinda is enrolled in a post-graduate degree at the University of Queensland in Agricultural Science majoring in horticulture and has been growing bananas with her father for over seven years. The family business 'Uralba Valley Bananas' supplies to Coles, IGA, Nursing Homes and other small stores in the Northern Rivers area. Melinda is qualified as a nutritionist and dietitian and has a particular interest in the nutritional benefits of having fresh produce readily available to the general public. She has an interest in dragon fruit (Pitaya) in the sub-tropical area and is establishing a trial block on her family property.

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Our Facilities

Wollongbar Agricultural Institute



The Wollongbar Primary Industries Institute is a major research centre for NSW Department of Primary Industries located on the NSW Far North Coast. It is situated between the towns of Lismore and Wollongbar.

The Institute supports profitable and sustainable agriculture, fishery and plantation forestry industries and rural communities through research and compliance. Internationally recognised scientists at the Institute collaborate with a range of industry, government and other organisations to conduct cutting edge research

covering a range of disciplines including soils, horticulture, forestry, food safety and animal health. Other professional officers at the Institute work closely with local government, other State agencies and the community across a range of resource management themes such as aquatic ecosystems, water, land use planning, development and climate. Research and other professional staff at the Institute are supported by internal services such as ICT, information, media, biometrics and administration services.

The Institute is well placed to support primary industries with approximately 100 expert staff, state-of-the-art laboratory facilities and more than 500 ha of prime agricultural land used for research and production activities (283 ha of agricultural land on the Alstonville Plateau as well as 191 ha of land on the coastal floodplain).

Central Coast Primary Industries Centre, Ourimbah



The Central Coast Primary Industries Centre (CCPIC) is the Department's Centre of Excellence for research in Market Access and Greenhouse Horticulture. The CCPIC is located on the Ourimbah Campus of the University of Newcastle, between the towns of Gosford and Wyong.

The modern and recently completed complex has extensive facilities for research in physiology, microbiology and pathology; and includes disinfestation laboratories, insect colonies, cool and controlled atmosphere rooms, and fully controlled greenhouses.

The Centre benefits from a close working relationship with the University, which includes the use of their food science and sensory evaluation facilities. Several staff at the CCPIC have adjunct faculty appointments with the University and supervise postgraduate students who conduct part or most of their research work at the Centre.

Three specialist research groups operate from this site. The Market Access Group supported by some of the best market-access facilities in Australia and with a proven track record, develops, tests and implements innovative, cost-effective, and practical market-access protocols to support NSW horticulture. The Postharvest Research Group has considerable expertise and experience in applied R&D projects in postharvest management of horticultural crops along the supply chain. The Protected Cropping Group conducts research and education programs into production systems with the aim to increase profitability and productivity and assist growers to attain world's best-practice in producing high quality and high value fresh produce in sustainable systems.

Orange Agricultural Institute



Orange Agricultural Institute (OAI) is dedicated to developing profitable, practical, and scientifically sustainable agricultural systems, particularly within the Central West and Lachlan catchments. Located on the outskirts of Orange, its environment and soil are typical of the surrounding horticultural area producing pome, stone fruit and in recent times, temperate nuts.

The institute supports 5 ha of irrigated orchards of approximately 5000 trees which form part of a broader 188 ha property. Apple plantings have dwarfing rootstocks showcasing intensification strategies for efficient apple production. The main areas of research emphasise orchard management. An established collections block of commercial and heritage varieties hold apple, European pear, cider apple, apple rootstock, quince, cherry and Nashi pear varieties which are available to industry.

Pome fruit variety evaluation is conducted in conjunction with the Australian Pome Fruit Improvement Program on newly established trees at the Institute, forming part of a long-term commitment to variety evaluation on a national level. Assessments include new local varieties and varieties from breeding programs around the world and apple rootstocks as they become available.

Smaller institute plantings consist of 500 trees of modern cherry varieties like Kordia, Lapins and other cherry varieties from Australian breeding programs. Recent collaborative work with cherries into cherry rots has included both institute and district plantings. A Hazelnut Variety Evaluation Program containing leading and recently imported varieties has been established in collaboration with commercial interests to assess regional performance, linking this to a broader NSW DPI program to assess potential production areas. A number of the orchard blocks, by nature of their design, are conducive to chemical registration work and Integrated Pest Management investigations.

Australian Oils Research Laboratory, Wagga Wagga



The Australian Oils Research Laboratory (AORL) conducts important tests and screening reports on established and emerging varieties of olive and canola oil to ensure that Australian products are of a constantly high quality.

The laboratory boasts the latest technology including seed-cleaning facilities, a cold store for olives, an oil extraction room as well as facilities for seed grinding, oil extraction and oil testing. The laboratory allows NSW DPI to provide a commercial testing service of edible oil products for the industry and individuals as well as superior facilities to undertake research across a range of projects.

Through research, the AORL aims to improve methods for authenticating the quality of olive products for producers, retailers and consumers. Staff work closely with oilseed and olive producers, marketers and exporters, and provide screening services for improved quality traits in major Australian canola-breeding programs.

The AORL has International Olive Council accreditation for laboratory analysis and its olive oil sensory panel. It was also the recipient of the 2013 Australian Olive Association Service to Industry Award. The Laboratory contains a range of equipment to allow analysis by different chromatographic and spectrophotometric methods, and to extract oil and measure oil characteristics.

National Wine Grape Industry Centre, Wagga Wagga



The National Wine and Grape Industry Centre (NWGIC) at Wagga Wagga is a collaboration between NSW DPI, CSU and the NSW Wine Industry Association. It is committed to its role as a principal source of scientific knowledge of grapevine physiology and ecology as they relate to wine quality, consumer-preferred wine styles, and wine in society. NWGIC includes seven key NSW DPI scientists and technicians with expertise in plant physiology, plant pathology, viticulture, wine science and industry capacity building.

NWGIC provides national leadership through its integration of viticulture research with training, and applies its expertise and facilities to related fields in the food and beverage industry.

NWGIC has an experimental winery along with an experimental vineyard and a close association with the nearby CSU commercial winery and vineyard. All NWGIC scientific activities are conducted with the ISO 9001 accredited Quality Management System and the experimental winery is a member of the Inter-Winery Analysis group. Aside from its relationship with NSW WIA, NWGIC works closely with a range of large, medium and small wine companies and grape growers.

Yanco Agricultural Institute



The Institute is situated in the centre of the Murrumbidgee Irrigation Area, mid-way between Wagga Wagga and Griffith. The environment is hot and dry in summer, and cool and damp in winter. The Murrumbidgee Rural Studies Centre and NSW DPI regulatory officers are co-located with horticulture research and development officers at the Institute.

The Institute has extensive plantings of citrus (operated by NSW DPI researchers at Dareton), rice, and cereals. There are 5 ha available on light sandy soils for vegetable production, and recent crops include

rockmelons, onions, carrots, French beans, and garlic. Soil tillage, seeding, irrigation, crop management, harvesting and grading equipment for field crop plantings are available.

The Institute also has laboratory space for dirty and clean postharvest handling, equipment for quality assessment (titratable acidity, soluble solids, colour, firmness and digital linear measurements), driers, and two commercial-sized cold storage rooms. A Scholander pressure chamber is available for plant water stress measurement, and laboratories are available for insect rearing, entomology research, plant disease diagnosis, and a glasshouse production unit. The rice research group operate an analytical laboratory with HPLC and associated rice quality equipment.

The Murrumbidgee Rural Studies Centre is located on the Institute. It offers training and certification for OH&S, (including SMARTtrain) and agricultural skills (machinery handling). All horticulture research staff hold AQF4 SMARTtrain accreditation in chemical application and risk management.

Dareton Primary Industries Institute



The Dareton Primary Industries Institute is located in the Coomealla irrigation district three kilometres west of the Dareton township and 10 km east of Wentworth. The land for the Institute was acquired in 1948 and the first citrus trees planted in 1955. The predominant role for the Institute has been citrus research and development, and currently there are 24 ha of citrus grown for research and commercial purposes on the site. The total area of the Institute is 243 ha of which approximately 80 ha are suitable for horticultural production.

NSW DPI has lease arrangements with three leading industry organisations to provide land and support for the production of high quality propagation material to the Australian citrus and grape industries. Auscitrus is the high health status budwood and seed supply scheme for Australia and has 5 ha of source trees on the Institute. A more recent addition has been the Victorian and Murray Valley Vine Industry Association (VAMVVIA) and the Australian Vine Improvement Association (AVIA) who jointly have 20 ha of grapevines established on the Institute.

The current staff is comprised of two citrus research officers, a citrus development officer, an irrigation development officer, five support personnel, two fisheries compliance officers and a veterinary officer.

The research and development emphasis is in citrus variety and rootstock evaluation, production improvement, climate modelling, and the development and delivery of training courses and packages for industry. Dareton is the main citrus research and development facility in Australia and has established links with major citrus producing countries as well as hosting international visitors and scientists from California, Spain, Israel, Chile and South Africa in recent years. The close relationship with the national citrus organisation, Citrus Australia Ltd (CAL), complements and helps to direct future activities at the Institute.

Our Projects



Program 1: Germplasm improvement

1. **Highly improved tea tree varieties (December 2014–June 2017). Co-investor: RIRDC. DPI lead: Gary Baker**

This is the sixth project in a breeding program (1993–2017) that has released genetically improved seed to industry since 1997. The program has progressively increased oil yield from 150 kg/ha at the start of breeding to 270 kg/ha. The current project has the potential for significant profit gains through releases from the new seedling (SSO3) and clonal (CSO3) seed orchards, together with even greater gains expected from the release of elite clones.

2. **Evaluating new citrus varieties (scions) (June 2013–May 2017). Co-investor: HIA. DPI lead: Graeme Sanderson**

This project is a continuation of co-investment by NSW DPI and HIA under the National Citrus Improvement program, a program initiated in 2004. The program undertakes the independent evaluation of more than 40 citrus varieties including new variety introductions to Australia. Evaluation agreements have been developed with two new variety managers to undertake independent assessment of their varieties under local conditions.

3. **Pome fruit rootstocks and variety evaluation (June 2011–ongoing). Co-investor: APFIP and APAL. DPI lead: Lester Snare**

NSW DPI forms part of an Australia wide monitoring group supporting the Australian Pome Fruit Improvement Program. New pome varieties are assessed on behalf of the Australian Apple Industry at Orange and other sites around Australia. Observations are compiled, entered on a common data base and released by APFIP to industry. It is intended in the future to expand this project to include pome fruit rootstocks.

4. **Evaluation and commercialisation of citrus rootstocks (June 2014–November 2017). Co-investor: HIA. DPI lead: Tahir Khurshid**

New rootstocks derived from earlier co-funded projects and from collaborators overseas will be trialled under Australian conditions. New suggested rootstocks will be tested at growers' properties in NSW and around Australia under different soil and climatic conditions. The Rootstock Evaluation Program also includes experiments on dwarfing material from overseas.



Program 2: Farming systems

5. **Pre-harvest practices that will increase the shelf-life and freshness of vegetables (April 2015–December 2015). Co-investor: HIA. DPI lead: Roberto Marques**

The project will review existing information on pre-harvest practices which maximise quality of vegetables. A comprehensive literature review will be conducted to compile the existing knowledge on pre-harvest factors (including environmental, genetic and agronomic practices) that can impact on vegetable quality including shelf-life, freshness, nutritional value, and health benefits (e.g. bioactive compounds). The information will be communicated to industry in a grower- and consumer-friendly format. Information gaps will be identified for potential future investment in R&D aimed at increasing the opportunities for growers to add value to their produce and drive demand for high quality Australian vegetables.

Our Projects

6. Developing agronomic practices to improve the quality of southern highbush blueberries as an evergreen system (September 2014–September 2017). Co-investor: HIA. DPI lead: Sophie Parks

This project will investigate the use of foliar nutrient sprays, reflective matting and thinning techniques in blueberries to improve light quality, reduce leaf abscission and enhance fruit quality on-farm. Consumer preferences for blueberries will be evaluated in a small survey. By improving quality through this project, the level of poor quality fruit on the market (20%) will be reduced.

7. Improving yield prediction for the wine industry (July 2014–June 2017). Co-investor: AGWA. DPI lead: Greg Dunn

The demand for improved crop forecasting for wine grapes has intensified because inaccurate predictions have negative impacts throughout the value chain, for example, in timing harvests, pricing, tank allocation and the development of marketing strategies for domestic and export markets. The best practice systems currently used miscalculate by approximately 15%. This project will apply appropriate image-sensing technology to substantially improve block level forecasts, aiming to meet the 'winemaker' goal of +/-5%.

8. Hazelnuts—opportunities for long term development RIRDC (June 2012–April 2017). Co-investor: Agri Australis and RIRDC. DPI lead: Lester Snare

This project will assist the hazelnut industry in Australia to achieve commercial sustainability. Currently the industry is valued at \$0.5 million annually, with mostly small family orchards growing varieties not well suited to larger processors. The project builds on the recent successful importation of commercial numbers of hazelnut plants by commercial interests to rapidly expand and propagate that material. This will provide an alternative long-term market for all producers.

9. Macadamia selective limb removal trial (January 2014–December 2018). Collaborative agreement with QLD DAFF. DPI lead: Trevor Olesen

The work will assess the yield penalty involved in using selective limb removal to control tree height in macadamia for two varieties, '246' and '816'.

10. Citrus in Bhutan and Australia (April 2012–March 2017). Co-investor: ACIAR. DPI lead: Graeme Sanderson

The focus of project activities in Bhutan is securing germplasm, improving nursery and production practices and the knowledge of key citrus pests and diseases. The main focus of the Australian component is to strengthen the Australian citrus variety and rootstock evaluation program, assess potential new rootstock for mandarins, and improve field- and laboratory-based diagnostics and strategies for major exotic pests and diseases. The project will provide Bhutan with a clean and healthy source of citrus germplasm, and ensure both countries improve citrus productivity through management practices, more targeted nutrition and irrigation application, and implementing control methods for key pests and diseases.

11. The enhancement of citrus value chain production in Pakistan and Australia through improved orchard management practices (April 2011–September 2015). Co-investor: ACIAR. DPI lead: Tahir Khurshid

Citrus is a major fruit crop of Pakistan. The yield and fruit quality of citrus, and thus the potential farm income for growers, could be increased with the adoption of improved horticultural management techniques. This project aims to improve mandarin and orange productivity in Pakistan and Australia by increasing the range of varieties available to industry, improving orchard management techniques and capacity building. This project is focused on training growers in Pakistan and Australia. Training will also be provided to trainers and scientists.

Our Projects



Program 3: Plant protection

12. A multi-targeted approach to fruit spotting bug management (March 2011– April 2016). Co-investor: HIA. DPI lead: Ruth Huwer

Fruit spotting bug (FSB) is a major native pest, causing significant damage to more than 25 different subtropical and tropical tree fruit and nut crops and some vine fruits across Australia. Crop losses of more than 50% have been attributed to FSB, amounting to tens of millions of dollars annually across all industries. This project will investigate more selective and effective chemical control options as alternatives to broad-spectrum insecticides. These include IPM compatible insecticides, new chemistries, and the development of monitoring traps and potential new biological control options. Case studies will demonstrate these improved control strategies on a regional basis through Area Wide Management.

13. Understanding pest ecology—blueberry girdling moth (September 2011–December 2016). Co-investor: HIA. DPI lead: Ruth Huwer

A native moth species has begun girdling blueberry plants in northern NSW but its basic biology and ecology are virtually unknown. This study seeks to investigate the biology and ecology of the girdling moth. The first step is to develop a rearing method and establish a laboratory rearing technique. Management strategies will include screening of insecticides that are compatible with biological control and biological control.

14. Managing green stink bugs in raspberries (September 2012–December 2015). Co-investor: HIA. DPI lead: Ruth Huwer

The green stink bug (GSB) and other closely related bugs have become a pest in raspberries grown under tunnels in Northern NSW. This study investigates a low pesticide management strategy including the potential for biological control and the screening of insecticides that are compatible with biological control.

15. Improving vegetable industry profitability through IPM (Australia & Philippines) (March 2013–June 2017.) Co-investor: ACIAR. DPI lead: Sandra McDougall

This project seeks to build research capacity, vegetable farmer incomes and consumer health through development and adoption of integrated crop management practices for vegetables in both Australia and the Philippines. NSW DPI leads the crop protection component on integrated pest management, diagnosis of a disease in cucurbits, and evaluation of the efficacy of sanitisers to reduce food safety risks.

16. Vineyard disease management with biological products (July 2014–June 2015). Co-investor: AGWA. DPI lead: Darren Fahey

This project will evaluate new biological control methods for vine diseases in the Riverina. These include formulated products containing naturally occurring microbes to control powdery mildew, *Botrytis cinerea* and potential sour rot organisms, compost tea and worm juice nutrient formulations.

17. Effect of under-vine cover-crops on grapevine yield, wine quality and soil health (July 2014–August 2017). Co-investors: AGWA and Adelaide University. DPI lead: Melanie Weckert

As it is estimated that up to 12 million dollars are spent annually in the purchase and application of herbicides for under-vine weed control in Australian vineyards. This project aims to reduce costs by introducing early senescing, self-perpetuating plant species under-vine to ultimately negate the need for herbicides, and to also investigate the effects of resultant changes in the rhizosphere microbial ecology and soil structure, biology and chemistry on yield and quality. Agricultural Economist, Dr Tom Nordblom, will evaluate the cost effectiveness of different options.

Our Projects

- 18. Brassica biofumigation of *Ilyonectria* (cause of grapevine black-foot disease and young vine decline) on the roots of Riverina grapevines (July 2013–July 2015). Co-investor: AGWA. DPI lead: Melanie Weckert**

Young vine decline in the Riverina is caused by sequential infection by Botryosphaeriaceae fungi from rootstock cuttings and *Ilyonectria* (grapevine black-foot disease) fungi originating from grapevine propagation nursery soil. *Ilyonectria* inoculum builds up in vineyard soil with repeated planting. This research program is investigating the suppression of this grapevine disease by isothiocyanates produced from brassica crops and seed meals.

- 19. Evaluating and demonstrating new disease-resistant varieties for warm irrigated regions (July 2014–June 2017). Co-investors: AGWA. DPI lead: Bruno Holzapfel**

An assessment of the new varieties for resistance against fungal attacks and how they can handle abiotic stress such as heat events and drought, particularly in the warmer grape growing regions.



Program 4: Supply chain and market access

- 20. Sustained development of the PNG sweet potato value chains (June 2012–July 2015). Co-investor: ACIAR. DPI lead: Shane Hetherington**

This project aims to support development of a sweet potato value chain in PNG and Australia using an integrated and participatory approach. Postharvest losses from the farm are very high in PNG as a result of poor postharvest handling, inadequate storage and transport infrastructure and lack of value-chain coordination. The Australian component of this project will focus on increasing our understanding of the New South Wales sweet potato industry value chains.

- 21. Developing integrated, whole-of-production-chain approaches to managing flavour and alcohol in wine production (January 2014–January 2017). Co-investors: ARC. DPI lead: Suzy Rogiers**

This project will focus on one of the major problems facing the Australian grape and wine industry, that of high sugar accumulation during ripening resulting in highly alcoholic wines. High alcohol makes it more difficult to achieve flavour and aroma balance. This project will develop profitable grape growing and winemaking to achieve the desired balance of taste, mouth feel, aroma/flavour, colour and alcoholic strength.

- 22. Improving industry capacity to manage yield and wine quality relationship through understanding the influence of vine carbon balance and berry composition (January 2013–June 2016). Co-investors: AGWA. DPI lead: Bruno Holzapfel**

Vine balance is central to the production of wine grapes but is largely defined by empirical relationships and is difficult for growers to translate into practice. This project will provide a mechanistic understanding of vine carbon balance effects on berry composition and wine quality, assisting growers to manage berry sugars, acids, colour and tannins through manipulating the canopy/yield/fruit composition relationship. We will use field trials, molecular techniques and targeted manipulation of carbohydrate supply to investigate the relationship between berry tannin, anthocyanin and sugar accumulation. This will enable canopy and crop management techniques to be used more effectively to manage wine quality and use markers as tools to assist in decision making.

- 23. Innovative postharvest technology to support market access (July 2014–June 2017). Co-investors: ARC. DPI lead: John Golding**

The ARC Food & Beverage Supply Chain Optimisation Industrial Transformation Training Centre is hosted by the University of Newcastle and aims to grow Australia's food industry and increase Australia's food exports. The training centre will support the development of new and innovative postharvest treatments to improve horticultural market access and reduce waste in the supply chain.

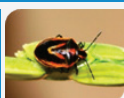
Our Projects

24. Reducing energy costs in the horticulture supply chain (July 2013–June 2016). Co-investors: ARC. DPI lead: John Golding

This project aims to reduce postharvest energy costs through atmosphere control of fruit and vegetables during storage and transport. This project is within the ARC Advanced Technologies for Food Manufacture Industrial Transformation Training Centre which is led by the University of New South Wales.

25. Improved postharvest market access treatments for horticultural commodities (July 2014–June 2016). Co-investors: Plant Biosecurity CRC. DPI lead: John Golding

This project will improve the market access of horticultural produce by assessing and developing new postharvest disinfestation protocols that are effective, economic, 'soft' (low toxicity or non-chemical if possible) and safe to use.



Program 5: Development and delivery

26. 'Orchard Plant Protection Guide' (July 1996–June 2015) (Iterative). Co-investors: various commercial enterprises. DPI lead: Kevin Dodds

The 'Orchard Plant Protection Guide' provides growers with up-to-date chemical registration information, spray application and research information that allows them to make better business decisions in the orchard.

27. 'Grapevine Management Guide' (March 2013–October 2018). Co-investors: various commercial enterprises. DPI lead: Darren Fahey

The 'Grapevine Management Guide' provides growers with up-to-date chemical registration information, spray application data and research information that allows them to make better business decisions in the Vineyards. This guide is accepted by the industry as one of its main information sources for technical information and features a broad range of technical subjects in a readily understandable format.

28. Regional development program for Riverina wine and grape growers (July 2014–June 2015) (Iterative). Co-investors: AGWA. DPI lead: Darren Fahey

This project contains a blend of applied research and industry communications. This includes mulching trials, spray trials and development of management strategies.

29. Riverina fruit fly coordinator (November 2012–October 2015). Co-investor: HIA. DPI lead: Myles Parker

The aim of this program is to get commitment from all stakeholders to get maximum control of fruit fly in the Riverina. The main aims of the project are to coordinate a well-timed grower driven bait spray program applied area wide by all growers. A communication strategy will be developed, where the message of fruit fly control is unified and embedded in grower and householder culture.

30. Future orchards—Batlow (July 2006–June 2016). Co-investors: AgFirst and APAL. DPI lead: Kevin Dodds

This project aims to lower orchard production costs per kilogram of fruit, increase the percentage of premium fruit harvested, and bring Australian orchardists up to international competitiveness in the domestic and export markets. The project is led by AgFirst, and managed by Apple and Pear Australia Ltd. Future Orchards 2012 aims to have apple and pear growers understand and move to more intensive practises to ensure an internationally competitive industry in Australia within 10 years. The project will monitor designated blocks with different tree densities, and hold orchard walks.

Our Projects

31. Optimal management of pre-harvest rot in sweet cherry (October 2013–September 2016). Co-investor: HIA. DPI lead: Kevin Dodds

The project will conduct field investigations and a survey to identify key pathogens in Australian sweet cherry growing regions and undertake a laboratory evaluation of the infection pathways of the main pathogens including *Monilinia fructicola*, *Monilinia laxa* and *Botrytis cinerea*. Information will provide a basis for future research on optimal fungicide use and other management tools. Control methods at the field will be investigated, and findings published.

32. Blueberry industry development (October 2014–June 2017). Co-investor: HIA. DPI lead: Phil Wilk

This project aims to improve adoption of sustainable production systems and implementation of best management practices, develop a strong industry association, continue with promotional campaigns to increase berry consumption, and improve retail sale quality of blueberries. This will be achieved using a combination of the ABGA website, industry journal, information days and seminars. The Industry Development Officer provides information to members to improve on farm berry quality, maintain permits for registered chemicals, and identify gaps where registrations or emergency permits are required. A Blueberry Orchard Guide for Australian blueberry growers will be produced.

33. Integrated advanced fertigation and irrigation for citrus (December 2007–December 2015). Co-investor: HIA. DPI lead: Steven Falivene

This project will evaluate the use of 'Open Hydroponics' (OH) in the citrus industry. OH is a system where trees are grown in soil, but nutrient needs are managed similarly to hydroponics and trees are irrigated throughout the day. There are anecdotal reports of superior yields attributed to OH but little objective scientific data are available. This project will conduct a replicated extension trial to compare citrus OH with conventional practice in young citrus and fill an industry-wide knowledge gap.

34. Cambodia Australia mango project (September 2013–April 2017). Co-investor: ACIAR. DPI lead: Mark Hickey

This is a consolidated program looking to optimise management options to manipulate the mango harvest window. Objectives for Cambodia are to develop and evaluate crop management strategies and sustainable practices for the integrated management of pests and diseases, identify and prioritise the key supply chain constraints, and design and implement a pathway to adoption. This presents opportunities for the Australian mango industry by providing intelligence on reliable techniques to advance or delay fruit maturity, spreading the harvest period, improving harvest and packaging efficiencies and profitability, and ensuring the development of a successful export industry. This project also links to the Fruit Spotting Bug Project.

35. National banana industry extension project (July 2013–June 2016). Co-investor: HIA. DPI lead: Matthew Weinert

The Australian banana industry consists of several hundred producers spread across three main production regions, with NSW producing about 7% of the Australia's total. Growers have identified soil health and the control of parasitic nematodes as priorities but approaches designed in Queensland need to be modified for the NSW production system. This project will also implement a coordinated information development and dissemination program that ensures a focused and systematic approach to delivering the information and results from industry-funded R&D and other sources.

36. Stonefruit industry communications (February 2013–February 2016). Co-investor: HIA. DPI lead: Kevin Dodds

The overall aim of the project is to improve communications in the stone fruit industry through its peak industry body Summerfruit Australia. This will be achieved by a continuation of an industry journal, maintenance of an industry website, a bi-monthly information sheet to be sent electronically and an industry database.

Our Projects

37. Banana industry development officer (July 2014–June 2017). Co-investors: HIA, Banana Industry Committee, Coffs Harbour Banana Growers Association. DPI lead: Myles Parker

This project aims to re-invigorate the NSW banana industry through industry and NSW DPI co-investment in a Banana Industry Development Officer position. The appointee will work with industry and assist in focusing the development of Lady Fingers and Lady Finger types. Other components will be identifying regions for potential growth of the industry in NSW, evaluating varieties resistant to Panama disease, improving the packout rate of first grade bananas, and promoting opportunities for improved marketing.

