

Chapter 8

Plant biosecurity RD&E





Identifying fruit fly from large samples collected in male fruit fly lure traps from north Queensland. Image courtesy of Queensland Department of Agriculture and Fisheries

Plant biosecurity research, development and extension

An understanding of the biology of plant pests, the hosts that are susceptible to them, their effects on production, and methods of control are fundamental to an effective plant biosecurity system.

Plant biosecurity research, development and extension (RD&E) develops this understanding and how to apply it to situations to minimise negative impacts from plant pests.

Industry and government often combine resources to invest in plant biosecurity RD&E. The research on pests and how to manage them is undertaken by research institutions across Australia, including CSIRO, the Cooperative Research Centre for Honey Bee Products, the Australian Government, state and territory agencies as well as universities, plant industries, PHA, botanic gardens and private organisations.

The science underpinning Australia's plant biosecurity system takes many forms. It covers the topics of pest management, crop improvement, risk analysis, data management, surveillance, diagnostics, protecting the natural environment, and the basic biology of pests and crops. It involves the full range of crops grown in Australia as well as pollinators.

The pests investigated include bacteria, fungi, nematodes and viruses, along with the diseases they cause, and also weeds, insects and other invertebrates, such as mites.

The data for 2019 provides an overview of plant, weed and pollinator biosecurity RD&E in Australia, with a summary of where it was carried out, the size, the topic, pest and crop types.⁴¹ Surveillance programs that include some research or extension activities are also included, as are some training and awareness programs.

41. Every year, the methods used to collect data for this chapter improve incrementally. While every effort is made to secure accurate data for inclusion in Table 59 on page 232, we acknowledge that it is not complete.

National Plant Biosecurity RD&E Strategy

The National Plant Biosecurity RD&E Strategy provides an overarching framework to guide and strengthen cross-sectoral biosecurity RD&E for Australia's plant industries and those dependent on them.

The strategy's objective is to enable the effective management of economic, environmental and social risks posed by established pests as well as those that may enter, emerge, establish or spread within Australia.

Developed in 2013 by PHA in collaboration with stakeholders around Australia, the strategy sits under the National Primary Industries RD&E Framework. The framework is overseen by the Agriculture Senior Officials' Committee (AGSOC) Research and Innovation Committee whose goal is to implement cross-jurisdictional cooperative and coordinated approaches to matters of national interest such as plant biosecurity research.

The National Plant Biosecurity RD&E Strategy Implementation Committee, which reports to the AGSOC Research and Innovation Committee, is chaired and supported by PHA to drive implementation of the strategy.

The implementation committee includes representatives from the Australian Government, state governments, PHA, the Council of Rural Research and Development Corporations, Hort Innovation, Grains Research and Development Corporation, Wine Australia, CSIRO and the Plant Biosecurity Research Initiative.

The committee is funded by Hort Innovation (lead coordinator role across the RDCs), the Victorian Department of Jobs, Precincts and Regions (on behalf of the state and territory governments), Cotton Research and Development Corporation, Dairy Australia, Grains Research and Development Corporation, Sugar Research Australia, AgriFutures Australia, Wine Australia and Forest and Wood Products Australia.

Australian Government agencies and statutory authorities

The Australian Government currently contributes to a variety of plant biosecurity related RD&E activities. This occurs predominantly through the Department of Agriculture but also through the Department of Industry, Innovation and Science, the Department of Education, the Department of the Environment and Energy, and the Department of Foreign Affairs and Trade.

AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURAL RESEARCH

aciarc.gov.au

The Australian Centre for International Agricultural Research (ACIAR) works to achieve more productive and sustainable agricultural systems for the joint benefit of developing countries and Australia through international agricultural research partnerships. The research focuses on fields where Australia has special research competence and develops enduring research collaborations as a trusted science partner.

ACIAR's biosecurity projects adopt various approaches and are spread across several program areas, including horticulture, agricultural systems, crop improvement and management and forestry. This research provides a unique opportunity to learn about the biology and management of exotic pests and diseases, preparing for potential exotic incursions, and to develop and share best practice in biosecurity management. Working to build capacity in biosecurity science in our neighbouring countries also contributes to earlier knowledge of the spread of pests and diseases and contributes to Australia's preparedness for incursions and pre-border security.



Dr Richard Markham (right) and Stewart Lindsay (left) inspect the Queensland Department of Agriculture and Fisheries banana collection in South Johnstone, Queensland, part of ACIAR project on the integrated management of Fusarium wilt of bananas in the Philippines and Australia. Image courtesy of ACIAR

AUSTRALIAN RESEARCH COUNCIL

arc.gov.au

The Australian Research Council (ARC) is a Commonwealth entity and advises the Australian Government on research matters, administers the National Competitive Grants Program, a significant component of Australia's investment in research and development, and has responsibility for Excellence in Research for Australia (ERA).

The ARC's purpose is to grow knowledge and innovation for the benefit of the Australian community through funding the highest quality research, assessing the quality, engagement and impact of research and providing advice on research matters.

In seeking to achieve its purpose, the ARC supports the highest-quality fundamental and applied research and research training through national competition across all disciplines. Clinical and other medical research is primarily supported by the National Health and Medical Research Council. In addition, the ARC encourages partnerships between researchers and industry, government, community organisations and the international community.

The outcomes of ARC-funded research deliver cultural, economic, social and environmental benefits to all Australians.

The ARC is the primary source of advice to the government on investment in the national research effort. The ARC:

- supports the highest quality research and research training through national competition in all fields of science, social sciences and the humanities
- brokers partnerships between researchers and industry, government, community organisations and the international community.



One of the purposes of the PIC@PEC facility is to develop in-house R&D capability to conduct applied trials. Image courtesy of Department of Agriculture

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

csiro.au/research

As Australia's national science agency, CSIRO is solving the greatest challenges through innovative science and technology. CSIRO delivers impact nationally and globally through collaboration with industry, governments and communities. CSIRO feeds into the plant biosecurity system via its Health and Biosecurity and Agriculture and Food business units, together with its National Research Collections.

CSIRO's Health and Biosecurity business unit delivers research-based solutions to manage the impacts of invasive pests, weeds and diseases. It also assesses the risks they pose, prioritises the pathways of entry and provides new technologies for surveillance and early response through sensor networks and autonomous platforms. The Agriculture and Food business unit takes an integrated gene-to-plate approach to improving crop quality and yield.

CSIRO is the custodian of a number of plant and plant pest specimen collections that contribute to national and international biological knowledge that underpin a significant part of the country's taxonomic, genetic, agricultural and ecological research. They include the Australian Tree Seed Centre, Australian National Insect Collection and Australian National Herbarium, amongst others.

PLANT INNOVATION CENTRE @ POST-ENTRY QUARANTINE (PIC@PEQ)

The Plant Innovation Centre was launched at the Mickleham Post-Entry Quarantine facility near Melbourne's Tullamarine Airport in November 2017. The purpose of the facility, known as PIC@PEQ, is to:

- develop in-house R&D capability to conduct applied trials that address operational issues with a focus on implementing into service delivery
- further engage with the scientific research community
- develop closer collaborative links with the education sector.

Outcomes will improve the capacity to address current and anticipated plant biosecurity risks, ensuring the nation has a modern and effective plant biosecurity system in place to secure Australia's border.

The centre's research team consists of a small group of departmental scientists who collaborate with external scientists and other biosecurity stakeholders to deliver on the agreed projects.





David Trohdal, Research and Development Agronomist, NSW DPI. Image courtesy of Rice Extension

RESEARCH AND DEVELOPMENT CORPORATIONS

Research and development corporations (RDCs) bring together industry and researchers to establish the strategic directions for RD&E and to fund projects that provide industries with the innovation and productivity tools needed to compete in global markets.

RDCs provide funding and support to research providers including state governments, universities, CSIRO, industry associations and research organisations in the private sector.

In 2019, the Department of Agriculture released a discussion paper to modernise and improve the RDC system. An advisory panel will make recommendations in the first half of 2020 to the Department of Agriculture for implementation. Fifteen rural RDCs cover most Australian agricultural industries, with seven focusing on plant production.

RDCs of relevance to Australia's plant industries are described in this section. They include a mixture of industry owned companies and statutory corporations. The industry owned RDCs have statutory funding agreements with the Australian Government that lay out the general principles that must be observed when investing levy funds, as well as reporting obligations to levy payers and the Australian Government.

AGRIFUTURES AUSTRALIA

agrifutures.com.au

AgriFutures Australia invests in research, leadership, innovation and learning to support industries that do not have their own research and development corporation, new and emerging industries, and the issues that affect the whole of agriculture. Primarily funded by the Australian Government, the vision of the organisation is to grow the long-term prosperity of Australian rural industries.

AgriFutures Australia invests in biosecurity RD&E activities, including:

- incursion risk analysis
- biosecurity planning
- pest management
- weed management
- resistance breeding
- adoption of knowledge.

COTTON RESEARCH AND DEVELOPMENT CORPORATION

crdc.com.au

The Cotton Research and Development Corporation (CRDC) is a partnership between the Australian Government and cotton growers that invests in world-leading RD&E to benefit Australia's cotton industry and the wider community. A key driving force behind the cotton industry's continued success is investment in innovation and transformative technologies to deliver impact.

CRDC invests across five strategic areas, as outlined in the Strategic RD&E Plan 2018–23. Protecting Australian cotton from endemic and exotic biotic threats is a key focus area under the goal of increasing the productivity and profitability of cotton farms. CRDC supports RD&E that contributes to:

- investigating and monitoring the economic, environmental and social impacts of biotic threats
- investigating and delivering new and improved tools, systems and strategies for the surveillance, prevention and sustainable and responsible management of biotic threats
- working collaboratively with growers and consultants to deliver industry-led biosecurity preparedness activities and address identified knowledge gaps.

FOREST AND WOOD PRODUCTS AUSTRALIA

fwpa.com.au

Forest and Wood Products Australia (FWPA) is an industry service company that provides a nationally integrated strategy to increase demand for forest and wood products and reduce the impediments to their supply. FWPA is committed to helping industry grow through targeted RD&E investments, generic promotion and other services as requested by members.

These services include direct and collaborative investment in RD&E to provide innovative solutions for the industry and promotion of the industry's products, services and values. FWPA provides services to the industry that are designed to increase the sustainability and international competitiveness of wood products. FWPA is funded by private companies and government agencies within the Australian wood products sector, except for pulp and paper manufacturers.

GRAINS RESEARCH AND DEVELOPMENT CORPORATION

grdc.com.au

The GRDC is a corporate Commonwealth entity established to plan and invest in RD&E for the Australian grains industry to create enduring profitability for Australian grain growers. Activities drive the discovery, development and delivery of innovation to the benefit of grain growers, the grains industry value chain and the wider community.

GRDC's primary source of income is through a levy on grain growers, which is matched by the Australian Government. The research portfolio covers 25 leviable crops, spanning temperate and tropical cereals, oilseeds and pulses, which are worth over \$13 billion a year in farm production.

The GRDC investment objective 'Optimise input costs' in addition to an overarching core biosecurity framework are identified as part of the GRDC's five year RD&E plan.

The following key investment targets are related to crop protection and biosecurity:

- develop and implement management options to minimise the cost of effectively and sustainably managing vertebrate and invertebrate pests, weeds and diseases
- maintain and/or improve the price of Australian grain through differentiation based on functionality, food safety and traceability, sustainability of production, reduced downgrading, new and/or enhanced grain classification processes, and optimal management of biosecurity issues
- reduce the gap between actual and potential grain yield through more informed and timely decision-making on planting time, crop or variety choice, weed management, pest and disease control, and crop nutrition.



Launched at the Hart Field Day in South Australia in September 2019, the \$21 million RD&E partnership iMapPESTS Sentinel is a mobile surveillance unit designed to sample air for fungal spores and insects. Image courtesy of iMapPESTS

HORT INNOVATION

horticulture.com.au

Hort Innovation is a not-for-profit, grower-owned RDC for Australia's \$13.2 billion horticultural industry. Hort Innovation invests around \$110 million into research and development (R&D) and marketing programs annually to benefit the industry and the wider community. It exists to drive a prosperous and healthy Australia, by providing the best knowledge and solutions to create a world-class horticulture sector. Key functions include:

- providing leadership to and promoting the development of the Australian horticulture sector
- increasing the productivity, farm gate profitability and global competitiveness of horticultural industries by investing grower levies and Australian Government contributions in RD&E
- marketing funds, programs and services
- providing information, services and products related to project outcomes
- promoting the interests of horticultural industries overseas, including the export of Australian horticultural products.

SUGAR RESEARCH AUSTRALIA

sugarresearch.com.au

Sugar Research Australia (SRA) invests in and manages a portfolio of research, development and adoption projects that drive the productivity, profitability and sustainability of its levy payers and the Australian sugarcane industry.

In its role as the industry services body, SRA receives the statutory levies paid by growers and milling businesses, and matching funds from the Australian Government. SRA's team of in-house researchers conducts research in the areas of plant breeding, trait development, biosecurity, plant health and farming systems.

The SRA Breeding Program and SRA Biosecurity Program collaborate to breed disease and pest-resistant crop varieties and support quarantine and disease-free seed cane programs. Cooperating with government departments to prevent entry of these pests and to prepare for possible incursions is also a high priority.

WINE AUSTRALIA

wineaustralia.com

Wine Australia supports a competitive wine sector by investing in RD&E, marketing, disseminating knowledge, encouraging adoption and protecting the reputation of Australian wine. Wine Australia's revenue comes from levies on the annual wine grape harvest with contributions matched by the Australian Government. Wine Australia collaborates with key stakeholders to coordinate and direct investments to best address the RD&E priorities of the wine industry.

THE PLANT BIOSECURITY RESEARCH INITIATIVE

pbri.com.au

The Plant Biosecurity Research Initiative (PBRI) supports cross-sectoral investment for plant biosecurity RD&E, delivering vital projects and attracting further co-investment. The PBRI partners that work collaboratively with industry, state and federal biosecurity stakeholders include;

- Australia's seven plant research and development corporations:
 - AgriFutures Australia
 - Cotton Research and Development Corporation
 - Forest and Wood Products Australia
 - Grains Research and Development Corporation
 - Hort Innovation
 - Sugar Research Australia
 - Wine Australia
- Plant Health Australia
- Department of Agriculture
- Council of Rural Research and Development Corporations

In 2018–19, the plant RDCs collectively invested \$135.4 million into biosecurity RD&E. A coordinated approach ensures that this effort is aligned to broader national goals and delivered efficiently, avoiding duplication of effort.

Plant Biosecurity Research Initiative Symposium

The inaugural Plant Biosecurity Research Symposium held in Brisbane in August 2019 was an opportunity to share plant biosecurity RD&E in Australia and New Zealand. The symposium, attended by 220 delegates, showcased research on pests, diseases and weeds affecting plant production systems and surrounding environments

The focus was on research funded by the member organisations of Plant Biosecurity Research Initiative and Better Border Biosecurity (B3) New Zealand.

Themes included:

- Preparedness: Biosecurity threats and the risk to business – what have we learnt and are we prepared?
- Diagnostics: Identifying biosecurity threats
- Surveillance: Monitoring for early detection and area freedom
- Sustainable pest, disease and weed management
- Trans-Tasman biosecurity – collaboration and opportunities
- Capability building: Future expertise in biosecurity across sectors – are we prepared?
- Industry resilience: Coping with future shocks – business continuity
- Cross-sectorial RD&E priorities.

The presentations by growers and industry representatives were a highlight of the symposium, describing the lessons learnt during biosecurity incursions, what the impacts are and how to better prepare using the best available knowledge.



International speaker at the symposium Dr Baldissera Giovani from Euphresco and Dr Jo Luck, Program Director, Plant Biosecurity Research Initiative. Image courtesy of Tony Steeper

State and territory governments

Most of Australia's state and territory departments of agriculture have dedicated RD&E divisions that undertake research, including aspects of plant biosecurity that are a priority for that jurisdiction. These organisations carry out a significant proportion of Australia's agricultural RD&E.

A smaller proportion of projects are undertaken by researchers in other departments in some states. Research projects are funded by the state, territory and Australian Governments, and some are commissioned by commercial clients.



Stereo microscope set up for examining bee sticky mats for pest mites by the diagnostic entomologists of Agriculture Victoria based at AgriBio, Centre For AgriBioscience. Image courtesy of Agriculture Victoria

University and private research institutes

Many universities across Australia provide biosecurity research and education services for the community, often in partnership with other organisations. Research is funded by governments, industries and domestic or international sources, often in partnership arrangements.

Private research institutions commonly collaborate with universities to provide research facilities and services in specific subject areas. They contribute specialist knowledge and research skills in areas of significance to the Australian community and plant production industries.

COLLABORATIVE RESEARCH ARRANGEMENTS

Some state and territory governments have formed partnerships with universities. These partnerships allow for the sharing of facilities, staff and equipment (such as next generation sequencers) and encourage the specialist agricultural training of students. Collaborative research arrangements also ensure that state and territory government plant biosecurity priorities are funded and supported by researchers. It also provides a larger pool of expertise for the government agencies to work with.

AgriBio – a partnership between the Victorian Department of Jobs, Precincts and Regions and La Trobe University.

Queensland Alliance for Agriculture and Food Innovation – a partnership between the Queensland Department of Agriculture and Fisheries and the University of Queensland.

Tasmanian Institute of Agriculture – a partnership between the Tasmanian Department of Primary Industries, Parks, Water and Environment and the University of Tasmania.

Waite Research Institute – a partnership between the South Australian Research and Development Institute and the University of Adelaide.

Graham Centre for Agriculture Innovation – a partnership between NSW Department of Primary Industries and Charles Sturt University.

A partnership also exists between the Northern Territory Department of Primary Industry and Resources and Charles Darwin University.

CENTRE FOR CROP AND DISEASE MANAGEMENT

ccdm.com.au

The Centre for Crop and Disease Management (CCDM) focuses on reducing the economic impact of disease in the Australian grains industry. Established in 2014 the centre is co-supported by Curtin University and the GRDC. In 2019 CCDM rolled out its new strategic direction that will guide its research efforts and focus through until mid-2022.

The new direction includes three key research themes:

- fungicide resistance management and disease impacts
- cereal diseases
- canola and pulse diseases.

Five Foundation Projects will also support CCDM's research outputs:

- bioinformatics
- physiological impacts of disease
- genomic analysis of co-infection
- communication and engagement
- improving the return on investments in crop protection.

2019 also saw the centre grow to more than 75 researchers and professional support staff who, through laboratory-based research, field work and the development of integrated farm management strategies, work to deliver real impact and in-field solutions for Australian growers.



Barley researcher Elzette Wentzel planting net blotch field trials. Image courtesy of Carole Kerr, Centre for Crop and Disease Management

CENTRE FOR FRUIT FLY BIOSECURITY INNOVATION

fruitflyittc.edu.au

The Centre for Fruit Fly Biosecurity Innovation is an ARC funded Industrial Transformation Training Centre dedicated to providing the Australian horticulture industries new, sustainable and environmentally friendly tools to control fruit fly pests. The centre coordinates research and research training across three universities and four partner organisations.

With a focus on research training, the Centre for Fruit Fly Biosecurity Innovation supports research fellows and PhD students, who are distributed across and move freely between participating organisations. Research activities are supported by a grant of \$3.7m from the ARC's Industrial Transformation Training Centre program, with supplementary support from NSW Trade and Investment's Research Attraction and Acceleration Program.

CENTRE OF EXCELLENCE FOR BIOSECURITY RISK ANALYSIS

cebra.unimelb.edu.au

The Centre of Excellence for Biosecurity Risk Analysis (CEBRA) is a group of quantitative scientists housed in the School of Biosciences at the University of Melbourne. CEBRA focuses on improving the management of biosecurity risk, working closely with Australia and New Zealand's peak biosecurity regulatory bodies.

CEBRA's remit covers animal, plant and environmental biosecurity, as well as protecting social amenity, and its scientific output spans the biosecurity continuum. Areas of expertise include pest pathway analysis, incursion impact assessment, mathematical and statistical modelling, and agricultural economics.

CEBRA collaborates with organisations in New Zealand and the United States, and has international linkages with other nations including Canada, South Africa and the United Kingdom. CEBRA collaborates with a wide range of state and national agencies.

CEBRA was created in 2013 by deeds between the Australian Government Department of Agriculture and Water Resources (now known as Department of Agriculture), New Zealand's Ministry for Primary Industries and the University of Melbourne, which will expire in 2021.

AUSTRALIAN PLANT BIOSECURITY SCIENCE FOUNDATION

apbsf.org.au

The Australian Plant Biosecurity Science Foundation was established to follow the Plant Biosecurity Cooperative Research Centre (PBCRC), which finished operations in June 2018, and is supported by unspent funds from PBCRC.

The Foundation supports plant biosecurity RD&E and capacity building, particularly where there is a need for investment in environmental, capacity building, international linkages, non-levy payer, cross-sectoral and strategic plant biosecurity research. It also invests in commercial IP developed by and inherited from the PBCRC. It is hoped in the long term that a return is realised from this IP and the Foundation will manage and invest those funds in plant biosecurity science.

COOPERATIVE RESEARCH CENTRE FOR HONEY BEE PRODUCTS

crchoneybeeproducts.com

The Cooperative Research Centre (CRC) for Honey Bee Products was established in November 2017 to bring together industry and research expertise from across Australia for five years. The research work is trans-disciplinary across four programs, driving innovation within the industry to meet export demands.

The CRC aims to help resolve problems that limit the value and expansion of the Australian honey bee products industry. The four focus areas are honey bee hive sites, honey bee products, honey bee health and honey bee chain of custody. The CRC has 25 industry and community partners and is presently running 30 projects.



Plant biosecurity RD&E projects in 2019

In 2019, a substantial amount of RD&E that benefits plant biosecurity occurred across Australia. PHA received data from over 90 organisations who were asked to provide information relevant to plant or pollinator (e.g. honey bee) biosecurity RD&E projects which they either funded or in which they were involved.

Research projects covered the spectrum of crops and pest types relevant to Australian plant production industries and the natural environment. Figures 94–98 present the research projects by pest type, research type, project value, biosecurity area and affected crop type to give some indication of how research budgets are spent in Australia.

Table 59 on page 232 lists 681 plant biosecurity related research projects undertaken during 2019. Fifty of these projects are categorised as extension activities, highlighting the extensive work being performed in the area of communication, training and awareness. Although projects have simply been listed by project title in the table, other information (e.g. an abstract) was sourced to help categorise the research.

Figure 94. RD&E projects by pest type

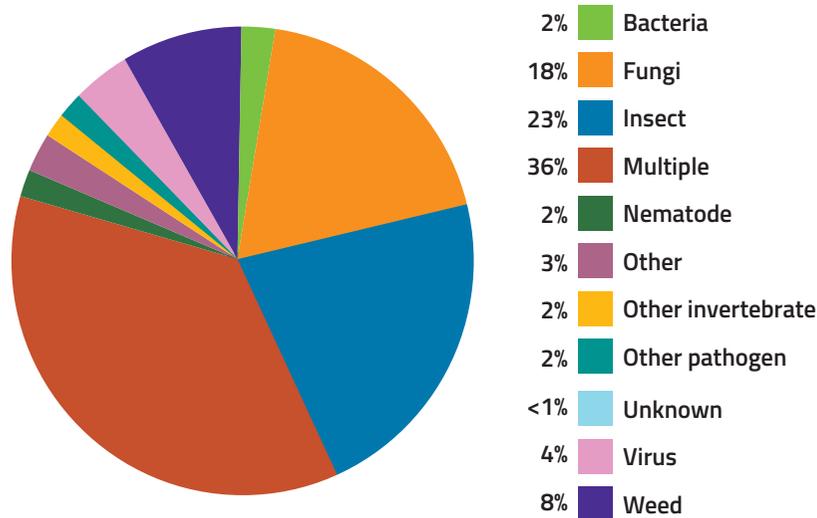


Figure 95. RD&E projects by research type or location

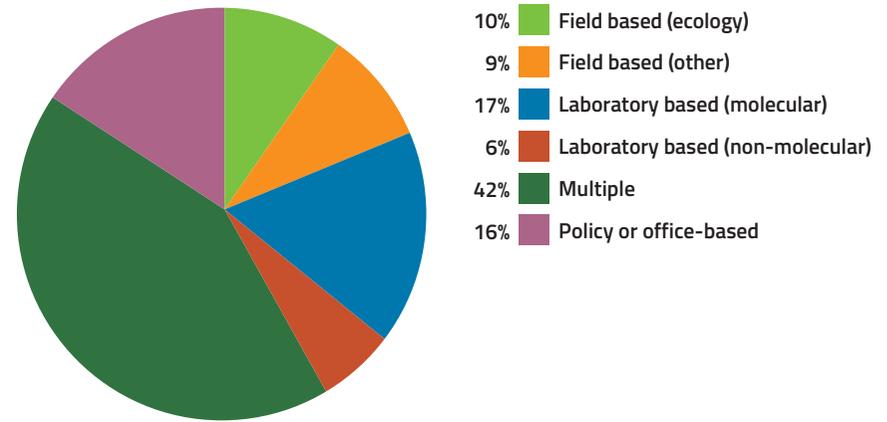


Figure 96. RD&E projects by project value

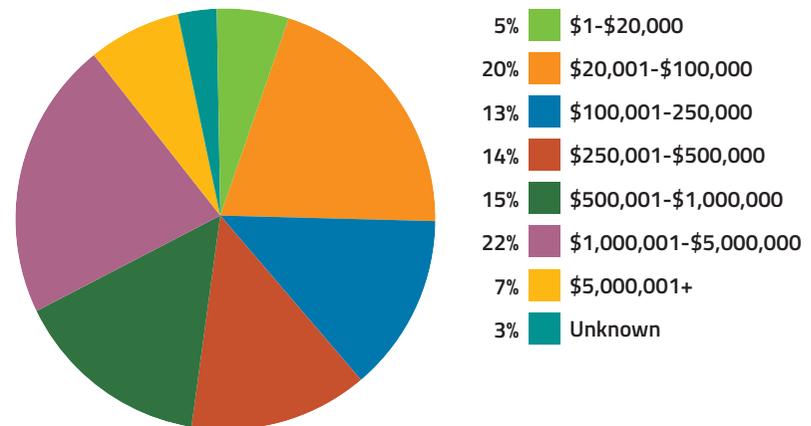


Figure 97. RD&E projects by biosecurity areas

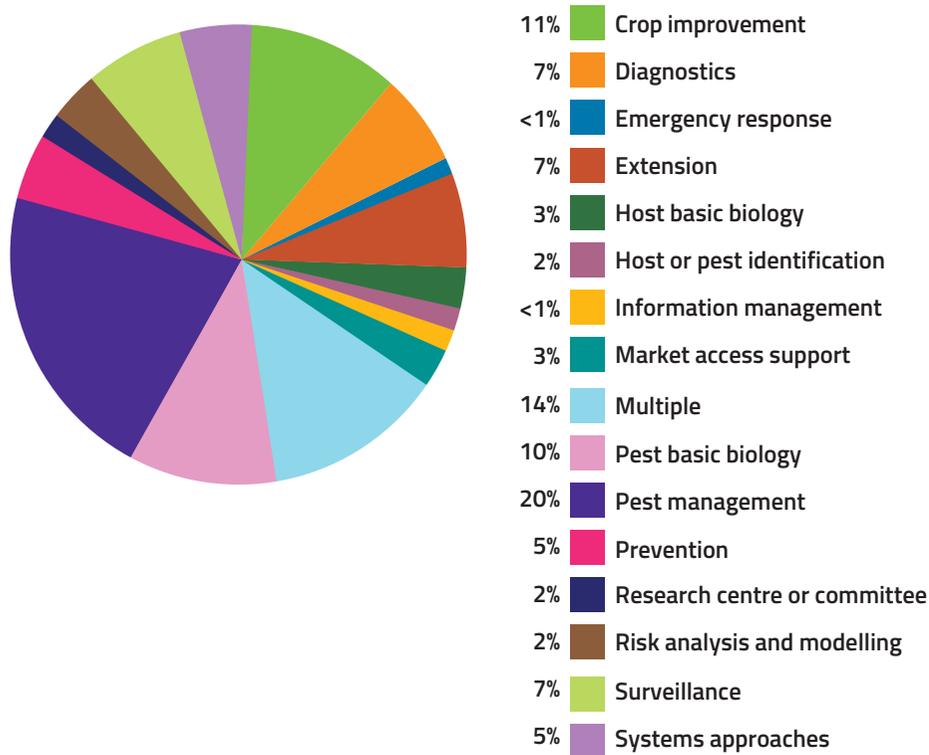
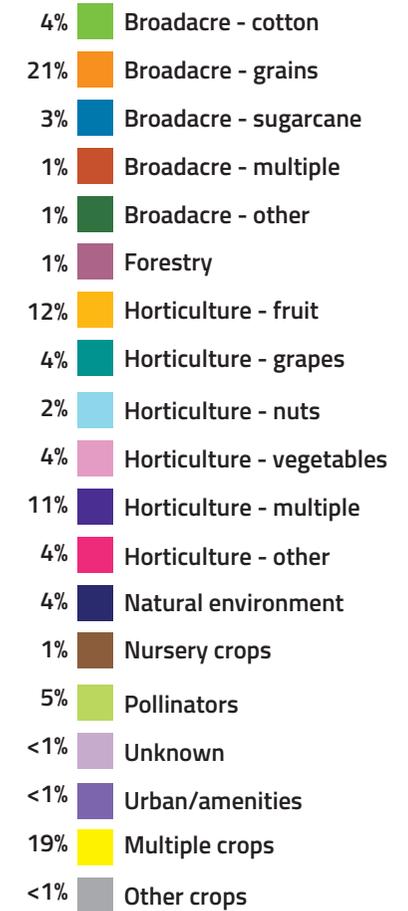


Figure 98. RD&E projects by crop type*



*The definition for 'crop type' are generally based on the Hort Innovation, Agrifutures Australia and GRDC crop groupings.

Table 59. Plant biosecurity RD&E projects

Project title	Organisation undertaking the research	Funding source or body
Broadacre – cotton		
Application of molecular tools to monitor for resistance alleles in <i>Helicoverpa</i>	CSIRO	CRDC, Monsanto (USA)
Assessing the potential of a new monitoring tool (Zappa trap) for managing sucking pests on cotton	NSW DPI	CRDC, NSW DPI
Biological based products for improved cotton production	Western Sydney University	CRDC
Biology of <i>Amarathus hybridus</i> , <i>A. mitchellii</i> and <i>A. powelii</i> (PhD)	University of Queensland	CRDC
Characteristics of disease suppressive cotton farming systems and soils	QDAF, NSW DPI, CSIRO	CRDC, QDAF, NSW DPI, CSIRO
Detecting cotton pests and pathogens using environmental DNA from irrigation water	University of Queensland	DA
Evaluation of relative damage caused by two-spotted mite, bean spider mite and strawberry mite in cotton	NSW DPI	CRDC, NSW DPI
Identifying sensors for better integrated pest management in cotton	Univeristy of Southern Queensland	CRDC, University of Southern Queensland, QDAF
Improved management of silverleaf whitefly on cotton farms	QDAF	CRDC, QDAF
Improving the management of cotton diseases in Australian cotton farming systems	QDAF	CRDC, Wine Australia, QDAF
Innovative solutions to cotton diseases	NSW DPI	CRDC, NSW DPI
Integrated pest management technical lead and pest management for high yield research	QDAF	CRDC, QDAF
Integrated pest management to support management of emerging cotton pests 1	NSW DPI	CRDC, NSW DPI
Integrated pest management to support management of emerging cotton pests 2	CSIRO	CRDC, CSIRO

Project title	Organisation undertaking the research	Funding source or body
Broadacre – cotton (continued)		
Large scale biosecurity scenario to support cotton industry preparedness	PHA	CRDC, PHA, NSW DPI, QDAF
Managing Verticillium risk for cotton	NSW DPI	Wine Australia, CRDC
Mirid and mealybug management best practice	QDAF	CRDC, QDAF
Monitoring to manage resistance to Bt toxins	CSIRO	CRDC, CSIRO
National biosecurity or disease extension and central Queensland regional extension	QDAF	CRDC, QDAF
Ready to use soil test to manage black root rot risks	Microbiology Laboratories Australia	CRDC
Science leadership for cotton development in northern Australia	CSIRO	CRDC, Ord River District Co-operative Ltd, QDAF, CSIRO
Silverleaf whitefly resistance monitoring	QDAF	CRDC, QDAF
Surveillance and monitoring for endemic and exotic virus diseases of cotton	QDAF	CRDC, QDAF
Sustainable resistance management of mites, aphids and mirids in Australian cotton	NSW DPI	CRDC
Sustainable silverleaf whitefly resistance management through improved insect resistance monitoring	QDAF	CRDC, QDAF
The sustainable chemical control and resistance management of aphids, mites and mirids in Australian cotton	NSW DPI	CRDC
Transformation of <i>Verticillium dahliae</i> , causal agent of Verticillium wilt of cotton	NSW DPI	CRDC, NSW DPI
Understanding the ecology of reniform nematodes in cotton	QDAF	CRDC, QDAF

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains		
A 'focus farms' study to optimise weed resistance management practices in WA	University of Western Australia	GRDC
A model for predicting chickpea Ascochyta blight risk	University of Southern Queensland, WAAA	GRDC
A simple and innovative test for real-time detection of resistance in weeds	University of Western Australia	GRDC
Accelerating the utilisation and deployment of durable adult plant resistance to leaf rust in barley	University of Sydney, University of Queensland	GRDC
Actinobacterial endophytes for increased chickpea yield	Flinders University	Flinders University
Actinobacterial endophytes for increased lentil yield	Flinders University	Flinders University
An integrative approach towards sustainable management of sorghum stalk rot in the GRDC northern region	University of Southern Queensland	GRDC
Aphid and insecticide resistance management in oil seed and pulse crops	cesar	GRDC
Ascochyta blight of field pea	Curtin University (CCDM)	GRDC
Ascochyta blight of pulses – integrating development of novel selection methods, mining germplasm for resistance and pathogen surveillance	Curtin University, Griffith University	GRDC
Ascochyta blight of pulses with a focus on chickpea	Curtin University (CCDM)	GRDC
Ascochyta blight of pulses with a focus on lentils	Curtin University (CCDM), SARDI	GRDC
Assessing collections of wild chickpea relatives for resistance to root-lesion nematodes	University of Southern Queensland, CSIRO, University of California, Davis (USA), University of Cukurova (Turkey)	GRDC

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Australian cereal rust control program – continued monitoring of cereal rust pathogens in Australia	University of Sydney	GRDC
Australian cereal rust control program – delivering genetic tools and knowledge required to breed wheat and barley with resistance to leaf rust, stripe rust and stem rust 1	CSIRO	GRDC
Australian cereal rust control program – delivering genetic tools and knowledge required to breed wheat and barley with resistance to leaf rust, stripe rust and stem rust 2	University of Sydney	GRDC
Australian cereal rust control program – wheat and barley breeding support	University of Sydney	GRDC
Australian Fungicide Resistance Extension Network – fungicide resistance management targeted at regional level	Curtin University (CCDM)	GRDC
Australian wheat and barley molecular marker program – genetic analysis	University of Adelaide	GRDC
Bioinformatics foundation project	Curtin University (CCDM)	GRDC
Biology and management of snails and slugs in grain crops	SARDI	GRDC
Cell wall structure and dynamics in emerging fungal pathogens of crops	University of Adelaide	ARC
Centre for Crop Disease Management	Curtin University (CCDM)	GRDC
Cereal and pulse cultivar resistance ratings for the southern region	DJPR	GRDC, DJPR
Cereals and rust diseases – molecular interactions for plant defence and food security	University of Sydney	ARC
Chaff lining in the Geraldton port zone – a new, cost effective harvest weed seed control tool	Planfarm Pty Ltd	GRDC
Characterising structural variation in the canola genome	University of Western Australia	ARC

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Communications and engagement foundation project	Curtin University (CCDM)	GRDC
Conduct integrative taxonomic revision of Australian <i>Trogoderma</i> species	CSIRO	DA
Control of snails and slugs – new products for snail and slug control – biological control of slugs using ciliate protozoa	University of Melbourne	GRDC
Cultivar crown rot tolerance trials	Crown Analytical Services Pty Ltd	GRDC
Cultural management for weed control and maintenance of crop yield	University of Western Australia	GRDC
Delivery of improved invertebrate pest management in the northern grains region	QDAF	GRDC
Developing new diagnostic tools for <i>Trogoderma</i> species by using solid phase micro extraction, gas chromatography/mass spectrometry and visible near infrared hyperspectral (PhD)	Murdoch University	Government of Iraq
Development and implementation of biosensors for <i>Botrytis</i> grey mould causal species affecting temperate legumes	Griffith University	NSW DPI, GRDC
Development of gene deployment strategies – using evolutionary principles to optimise the deployment of genetic resistance in crops	CSIRO	GRDC
Development of genetic tools for Australian barley crops against leaf rust	University of Sydney, CSIRO	GRDC
Development of local strategies to enable the integrated and profitable management of annual ryegrass seed banks in high rainfall zone farming systems of the southern region	University of Adelaide	GRDC

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Development of rapid phenotyping and genotyping tools for selection of key agronomic and quality traits in the Australian peanut breeding program	University of Southern Queensland, Peanut Company of Australia	Peanut Company of Australia
Development of tools to accelerate nematode resistance gene deployment	University of Adelaide, University of Southern Queensland, SARDI	GRDC
Diagnostic services for pulse germplasm enhancement and breeding programs	DJPR	GRDC, DJPR
Disease epidemiology and management tools	DJPR, WAAA, NSW DPI, SARDI, University of Southern Queensland, University of Western Australia, Curtin University (CCDM)	GRDC, DJPR, WAAA, NSW DPI, SARDI, University of Southern Queensland, University of Western Australia, Curtin University (CCDM)
Disease epidemiology and management tools for Australian grain growers	WAAA, NSW DPI, SARDI, DJPR, University of Southern Queensland, University of Western Australia, Curtin University (CCDM)	GRDC
Disease screening service (fee for service)	DJPR	Fee for Service
Durable resistance to barley powdery mildew	Curtin University (CCDM)	GRDC
Durum crown rot benchmarking for improved grower access to durum varieties with greater crown rot resistance	University of Southern Queensland	GRDC
Effective control of barley yellow dwarf virus in wheat	University of Tasmania	GRDC
Effective genetic control of <i>Septoria tritici</i> blotch	NSW DPI	GRDC
Effective genetic control of <i>Stagonospora nodorum</i> blotch	WA DPIRD	GRDC
Emerging foliar diseases of canola	University of Western Australia	GRDC
Engineering rust resistance	CSIRO	Two Blades Foundation (USA)
Enhancing resistance to wheat stripe rust disease	Australian National University	ARC

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Establishing the international mungbean improvement network	Asian Vegetable Research and Development Centre, QDAF	ACIAR
Extension and engagement	Curtin University (CCDM)	GRDC
Fungicide resistance detection and underlying mechanisms	Curtin University (CCDM)	GRDC
Genetic control of nematode species affecting major crops – germplasm enhancement for nematode control in cereals and pulses	University of Southern Queensland, GRDC	GRDC
Genetically improving wheat's ability to out-compete weeds	CSIRO	GRDC
Genetics of wild germplasm, gene-pool expansion and integrated ASSD approach to enhance adaptive potential in chickpea	Curtin University (CCDM)	GRDC
Genetics solutions to Sclerotinia stem rot of canola and pulses	Curtin University (CCDM)	GRDC
Grain crop disease management in Victoria	DJPR	GRDC, DJPR
Grain weeds advisory committee	Rural Directions Pty Ltd	GRDC
Grains farm biosecurity program	PHA	GPA
GRDC Communities – field crop diseases	DJPR	GRDC
Herbicide options for the management of emerging summer grass weeds in winter cereals	Northern Grower Alliance Incorporated	GRDC
Identification and utilisation of novel sources of resistance to crown rot and the root lesion nematodes in adapted spring and durum wheat	International Maize and Wheat Improvement Center (CIMMYT; Mexico)	GRDC
Identification of sources of resistance to wheat blast and their deployment in wheat varieties adapted to Bangladesh	International Wheat and Maize Improvement Centre	ACIAR
Identification, surveillance and advisory platform for management of grains pests	cesar	GRDC
Impacts of host resistance on disease-induced yield loss	DJPR	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DJPR

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Improved approaches for rapid <i>de novo</i> fungicide resistance and disease diagnostics	Curtin University (CCDM)	GRDC
Improved disease management in South Australian field crops through surveillance, diagnostics and epidemiology knowledge	SARDI	GRDC
Improved farming systems	Curtin University	GRDC
Improved genetic solutions for management of yellow spot in wheat	WA DPIRD, University of Southern Queensland, Curtin University (CCDM), WAAA, University of Adelaide, DJPR	GRDC
Improving disease management through improved agronomic practices	SARDI	GRDC
Improving grower surveillance management, epidemiology knowledge and tools to manage crop disease	University of Southern Queensland, GRDC	GRDC
Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease	WA DPIRD	GRDC
Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease – national chickpea pathology program	Griffith University, University of Melbourne, NSW DPI, DJPR	GRDC
Improving management of Phytophthora root rot of chickpea	Western Sydney University	NSW DPI
Improving monitoring and management of Etiella in lentils	SARDI	SA Grain Industry Trust
Incidence and severity of disease in cereal and pulses	DJPR	GRDC, DJPR
Insect tolerant chickpea for Bangladesh	CSIRO	ACIAR
Integrated disease management tools to manage summer crop diseases in the GRDC northern region	University of Southern Queensland (lead), QDAF	GRDC
Integrated genetic solutions to crown rot in wheat	University of Sydney, University of Southern Queensland, CSIRO, QDAF	GRDC

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Integrated weed management of herbicide resistant annual ryegrass at Lake Bolac	Southern Farming Systems	GRDC
Integrated disease management strategies for cereal and pulse growers	DJPR	GRDC, DJPR
Investigating snail rollers to clean small conical snails out of barley and canola	Stirlings to Coast Farmers	GRDC
Low weed seed bank persistence under sustained integrated weed management	University of Western Australia	GRDC
Maintaining a barley pre-breeding capability in Queensland	QDAF, University of Queensland	GRDC, QDAF
Management of barley diseases under threat of fungicide resistance	Curtin University (CCDM)	GRDC
Managing Botrytis diseases in intensive pulse cropping systems	SARDI	GRDC
Managing early season canola establishment pests in NSW – development of technical content	cesar	GRDC
Managing early season canola pests in NSW – establishment and co-ordination of grower and advisor groups	FarmLink Research Ltd	GRDC
Managing on-farm biosecurity risk in wheat through pre-emptive breeding	NSW DPI	GRDC
Mechanisms of antifungal resistance in blackleg disease of canola	University of Melbourne	ARC
Mechanisms, evolution and inheritance of resistance	University of Adelaide	GRDC
Mitigating disease constraints to improve productivity and sustainability	University of Western Australia	ACIAR
Mitigating the effects of stripe rust on wheat production in south Asia and eastern Africa	University of Sydney	ACIAR

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Mitigating the effects of wheat blast in Bangladesh and beyond	International Wheat and Maize Improvement Centre	ACIAR
Modelling framework for optimising deployment of fungicides for management of resistance	Curtin University (CCDM)	GRDC
National barley foliar pathogen variety improvement program	QDAF, DJPR, Australian National University, SARDI, WAAA, NSW DPI, University of Adelaide, University of Southern Queensland, University of Tasmania	GRDC, QDAF, DJPR, Australian National University, SARDI, WAAA, NSW DPI, University of Adelaide, University of Southern Queensland, University of Tasmania
National barley foliar pathogen variety improvement program – extension	University of Queensland	QDAF
National barley foliar pathogen variety initiative program	QDAF, Australian National University, SARDI, DJPR, DAFWA, NSW DPI, University of Adelaide, University of Southern Queensland, University of Tasmania	GRDC
National Brassica germplasm improvement program – phase II	NSW DPI	GRDC
National canola pathology program	University of Melbourne, Marcroft Grains Pathology, NSW DPI, SARDI, WA DPIRD, CSIRO	GRDC
National crown rot epidemiology and management program	NSW DPI, DJPR, QDAF, University of Southern Queensland, SARDI, WAAA, DAFWA	GRDC, DAFWA, NSW DPI, SARDI, QDAF, University of Western Australia, DJTR
National hay agronomy project	WAAA, DJPR	AgriFutures Australia
National mungbean improvement program	QDAF	GRDC, QDAF
National nematode epidemiology and management program	DJPR, SARDI, NSW DPI, QDAF, WAAA	GRDC, DJPR, SARDI, NSW DPI, QDAF, WAAA
National variety trials – pathology	University of Southern Queensland	GRDC
National variety trials disease screening	DJPR	GRDC

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
New capability to survey pulse and cereal crops for root pathogens	SARDI	GRDC, SA Grain Industry Trust
New knowledge to improve the timing of pest management decisions in grain crops	CSIRO	GRDC
New uses for existing chemistry	University of Queensland	GRDC
Novel suppression and resistance management of invertebrate grain pests	University of Melbourne	GRDC
NVT pathology of cultivar disease resistance ratings	DJPR	GRDC
Pathology support for the Queensland mungbean improvement program	University of Queensland	QDAF
Pathways to registration – minor use	AKC Consulting Pty Ltd	GRDC
Phosphine resistance	Murdoch University	WA DPIRD
Podborer resistant cowpea with two different Bt genes	CSIRO with collaborators in Nigeria, Burkina Faso and Ghana	African Agricultural Technology Foundation
Protection of stored grains against insect pests	Davren Global Pty Ltd	ACIAR
Protein trafficking pathways in fungal rust pathogens of plants	Australian National University	ARC
Pulse breeding Australia – faba bean breeding	University of Adelaide, SARDI, University of Sydney, NSW DPI	GRDC
Pulse pathology and genetics	Curtin University	GRDC
PulseBio 4 – biosecure pulse seeds	DJPR	GRDC
Push notifications to enable proactive management of pests, weeds and diseases	DJPR	GRDC
Rapid detection and diagnosis of plant pathogens	Australian National University	Hermon Slade Foundation
Regional risk assessment and thresholds for Russian wheat aphid	SARDI, cesar	GRDC
Resistance to barley net blotches	Curtin University (CCDM)	GRDC
Sclerotinia stem rot of canola	Curtin University	GRDC
<i>Septoria nodorum</i> blotch of wheat	Curtin University (CCDM)	GRDC



Professor John Thompson and Roslyn Reen inspecting chickpea plants as part of the GRDC funded project assessing collections of wild chickpea relatives for resistance to root-lesion nematodes. Image courtesy of David Martinelli, University of Southern Queensland

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Snail biocontrol revisited – phase II	CSIRO	GRDC
Snails, slugs and slaters in WA – case studies of growers in WA's southern coastal region	Stirlings to Coast Farmers	GRDC
Soil-borne diseases interaction in Australian farming systems	DJPR, NSW DPI, CSIRO, SARDI, University of Southern Queensland, WA DPIRD, WAAA	GRDC, DJPR, NSW DPI, CSIRO, SARDI, University of Southern Queensland, WA DPIRD
Sorghum midge testing scheme	QDAF	GRDC
Statistics for the Australian grains industry western node	Curtin University	GRDC
Surveillance of herbicide resistant weeds in Australian grain cropping	Charles Sturt University, University of Western Australia	GRDC
Survey of the summer and autumn Brassica refuges for diamondback moth in the Western region to predict early season risk of infestation	WA DPIRD	GRDC
Survey of vertebrate and invertebrate pests and beneficials harbouring in harvest weed-seed control systems	WA DPIRD	GRDC
Surveys and associated diagnostics of the incidence and severity of diseases of cereal and pulses within the Northern Region	QDAF	GRDC, QDAF
The functional characterisation of a novel immune response in plants	Australian National University	ARC
Two new phytotoxins in <i>Septoria nodorum</i> blotch – biosynthesis and functions	University of Western Australia	ARC
Understanding or evaluating the effectiveness of fungicides to manage Septoria and leaf rust	Foundation for Arable Research	GRDC
Virus threats – new tools and germplasm for Australian pulse and oilseeds breeding programs to respond to changing virus threats	NSW DPI, QDAF, University of Queensland, DJPR, WA DPIRD	GRDC, NSW DPI
Virus threats for pulse and oil seeds breeding	NSW DPI, DJPR, University of Queensland, QDAF, WAAA	GRDC, NSW DPI, DJPR, University of Queensland, QDAF, WAAA

Project title	Organisation undertaking the research	Funding source or body
Broadacre – grains (continued)		
Weed surveillance	QDAF	GRDC
Yellow spot of wheat	Curtin University (CCDM)	GRDC
Yield loss response curves for host resistance to leaf, crown and root diseases in wheat and barley	WA DPIRD, QDAF, NSW DPI, DJPR	GRDC
Broadacre – sugarcane		
Bio-prospecting for beneficial endophytes of sugarcane	AgResearch Ltd	SRA
Delivering solutions for chlorotic streak disease	SRA	SRA
Development of commercial molecular biological assays for improved sugarcane soil health and productivity	SRA	SRA
Development of new ratoon stunting disease diagnostics	SRA	SRA
Diagnostic laboratory for ratoon stunting disease	SRA	SRA
General pathology diagnostic, training and technical advice – Tully	SRA	SRA
General pathology diagnostic, training and technical advice – Woodford	SRA	SRA
General pest management – central Queensland	SRA	SRA
General pest management – north Queensland	SRA	SRA
General pest management – south Queensland	SRA	SRA
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with existing product	SRA	SRA, QDAF
Improving sugarcane pest management through cross industry deployment of smart sensors, diagnostics and forecasting	SRA	SRA, DA, Hort Innovation
Integrated disease management of sugarcane streak mosaic in Indonesia	SRA	ACIAR

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Broadacre – sugarcane (continued)		
Integrated solution for on-farm pathogen detection for sugarcane diseases	SRA, Griffith University	SRA
International and domestic quarantine for sugarcane germplasm	SRA	SRA
Investigation of biotic causes of yellow canopy syndrome	University of Queensland	SRA
Keeping our chemicals in their place – in the field	James Cook University, SRA	SRA
Moth borers – how are we going to manage them when they arrive?	SRA	SRA
New approaches to identify and integrate <i>Pachymetra</i> resistance genes from <i>Erianthus</i> into SRA breeding program	SRA	SRA
Screening clones for disease resistance for the SRA breeding program – Tully	SRA	SRA
Screening clones for disease resistance for the SRA breeding program – Woodford	SRA	SRA
Soil diagnostic assay laboratory – nematodes and <i>Pachymetra</i> root rot	SRA	SRA
Using leaf sheath biopsy metagenomics for determining if novel bacterial strains are associated with yellow canopy syndrome	University of Queensland	SRA
Broadacre – multiple		
Conventional insecticide resistance in <i>Helicoverpa</i>	NSW DPI	CRDC, NSW DPI
Down to earth defence – unlocking soil-derived defences for plant protection	Western Sydney University	ARC
Sustainable insect management through improved insect resistance monitoring	NSW DPI	CRDC, NSW DPI, GRDC
Time to prime – using silicon to activate grass resistance under higher CO ₂	Western Sydney University	ARC

Project title	Organisation undertaking the research	Funding source or body
Broadacre – other		
Ensuring lucerne seed production in the absence of bees	University of Western Australia	AgriFutures Australia
Impacts of the pasture legume phase on the seedbank, establishment, and growth of barnyard grass (<i>Echinochloa crus-galli</i>) in drill-sown rice	Charles Sturt University	AgriFutures Australia
Lucerne seed wasp management	NSW DPI	AgriFutures Australia
Northern Rice Australia – developing rice growing packages for tropical north Australia	University of Southern Queensland	AgriFutures Australia
Potential exotic virus threats to lucerne seed production in Australia	University of Queensland	AgriFutures Australia, University of Queensland
Rice – weed management in Australia	Agropraisals Pty Ltd	AgriFutures Australia
Rice pest and disease biosecurity II	NSW DPI	AgriFutures Australia, NSW DPI



Sharon Zuiddam learning sweep netting techniques for *Cephus cinctus* (wheat stem sawfly) in Montana grasslands, USA, June 2019. Image courtesy of Sharon Zuiddam, WA Department of Primary Industries and Regional Development

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Forestry		
A model system for the discovery and development of biocontrol agents against forest pests	University of the Sunshine Coast	FWPA, DA, University of the Sunshine Coast, NSW DPI, Forestry Tasmania
Biological control of galling insect pests of eucalypt plantations in the Mekong region	University of the Sunshine Coast	ACIAR
Forestry aerial spray review for coastal regions	University of Queensland	Hancock Queensland Plantations
Giant pine scale biology and ecology (PhD)	La Trobe University	FWPA & Australian Forest and Products Association (16 companies)
Giant pine scale chemical control	HVPlantations	FWPA & Australian Forest and Products Association (16 companies)
Management strategies for Acacia plantation diseases in Indonesia and Vietnam	University of Tasmania, University of the Sunshine Coast, NSW DPI, Vietnamese Academy of Forest Sciences (Vietnam), Gadjah Mada University (Indonesia), Forest Research and Development Agency (Indonesia)	ACIAR
Maximising productivity of Eucalyptus and Acacia plantations for growers in Indonesia and Vietnam	CSIRO	ACIAR
National forestry biosecurity surveillance program	PHA	DA (Agricultural Competitiveness White Paper)
Plantation forests biosecurity plan review	University of the Sunshine Coast, PHA	FWPA
The Industry Plantation Management Group – applied research and extension	WA Plantation Resources	WA Plantation Resources

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit		
Agrichemical residue monitoring program for Australian citrus exports – stage 2	Citrus Australia	Hort Innovation
Alternative quarantine treatment for bananas infested with coffee bean weevil	QDAF	Hort Innovation
An integrated management response to the spread of Fusarium wilt of banana in south-east Asia	QDAF	ACIAR
An integrated pest, disease and weed management program for the Australian apple and pear industry	DJPR, University of Tasmania	Hort Innovation, DJPR, WA DPIRD, University of Tasmania, NSW DPI, QDAF
Auscitrus horticultural project	NSW DPI	Collaborative Research
Australian lychee industry communication program	Australian Lychee Growers' Association	Hort Innovation
Australian mango industry biosecurity project	Australian Mango Industry Association	PHA
Avocado industry biosecurity capacity building	University of Queensland	Hort Innovation
Avocado sunblotch viroid survey	University of Queensland	Hort Innovation
Banana bunchy top virus mitigation – community management in Nigeria, and screening wild banana progenitors for resistance	University of Queensland	Bill & Melinda Gates Foundation
Banana industry R&D coordination	Australian Banana Growers' Council	Hort Innovation
Bee surveillance for avocado sunblotch viroid	CSIRO	University of Queensland
Cherry export readiness and market access	Cherry Growers Australia	Hort Innovation

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit (continued)		
Citrus agrichemical and export maximum residue limit program	Citrus Australia	Hort Innovation
Citrus canker research	NT DPIR	National citrus canker eradication program
Citrus pest and disease prevention committee	Citrus Australia	Citrus Australia
Clean seed program for the papaya industry	QDAF, Griffith University	Hort Innovation
Conditional non-host systems protocol for fruit fly in mangoes	QDAF	Hort Innovation
Developing diagnostic protocols for Ralstonia on bananas	University of Queensland	SARDI (SPHD)
Developing IPM-compatible controls for spotted wing drosophila (<i>Drosophila suzukii</i>)	IPM Technologies	Hort Innovation
Development of area-wide management approaches for fruit flies in mango for Indonesia, Philippines, Australia and the Asia-Pacific region	QDAF	ACIAR
Development of IPM compatible methods for controlling <i>Drosophila suzukii</i> in berry crops	IPM technologies	Hort Innovation
Development of molecular markers for Fusarium wilt resistance in banana	University of Queensland	Hort Innovation
Diagnosis and control of <i>Botrytis cinerea</i> on post-harvest blueberry fruit (PhD)	Murdoch University	Government of Iraq
Employment of a national citrus surveillance coordinator	Citrus Australia	PHA (DA)
Evaluation of <i>Beauveria bassiana</i> for rust thrips control in Australian bananas	James Cook University	Department of Industry, Innovation and Science

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit (continued)		
Exploring IPM-compatible methods for spotted wing drosophila in berry crops	cesar	Hort Innovation
Farm survey 2020 – charcoal rot incidence in the Victoria strawberry industry	Victoria Strawberry Industry Certification Authority	Victorian Strawberry Industry Development Committee
Field triage capability and capacity for citrus pests	PHA	DA
First detector network – USA huanglongbing and citrus canker	Citrus Australia	Hort Innovation
Fusarium wilt tropical race 4 research program 1	QDAF	Hort Innovation
Fusarium wilt tropical race 4 research program 2	University of Queensland	Hort Innovation
Fusarium wilt tropical race 4 research program 3	NT DPIR	Hort Innovation
Generation of data for pesticide applications in horticulture crops 1	Peracto Pty Ltd	Hort Innovation
Generation of data for pesticide applications in horticulture crops 2	Peracto Pty Ltd	Hort Innovation
Huanglongbing tolerant rootstock evaluation	NSW DPI	NSW DPI
Implementation of recommendations from the avocado industry nursery voluntary accreditation scheme review	GIA	Hort Innovation
Implementing precision agriculture solutions in Australian avocado production systems	University of New England	Hort Innovation
Improved management of charcoal rot of strawberry	QDAF	Hort Innovation
Improved plant protection for the banana industry	QDAF, NT DPIR	Hort Innovation

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit (continued)		
Improving avocado orchard productivity through disease management 1	Murdoch University	Hort Innovation
Improving avocado orchard productivity through disease management 2	University of Queensland	Hort Innovation
Improving biosecurity preparedness of the Australian citrus industry	PHA, Citrus Australia	Hort Innovation
Improving pest and disease surveillance in the Australian mango industry	PHA	DA
Industry led surveillance pilot	Citrus Australia	Citrus Australia
Integrated disease management strategies for the productive, profitable and sustainable production of high quality papaya fruit in the southern Philippines and Australia	QDAF	ACIAR
Integrated management of Fusarium wilt of bananas in the Philippines and Australia	QDAF	ACIAR
Integrated management of yellow Sigatoka	Australian Banana Growers' Council	Hort Innovation
Integrated pest management of redberry mite (<i>Acalitus essigi</i>) on blackberries	University of Tasmania	Hort Innovation
International industry analysis for diphenylamine decontamination, alternative treatments and review of current best practice	University of Melbourne	Hort Innovation
Investigation into citrus blossom bug in avocados	QDAF	Hort Innovation
Investigation into citrus blossom bugs in avocados	QDAF, University of Queensland	Hort Innovation
Low-dose methyl bromide fumigation of plums	QDAF	Hort Innovation

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit (continued)		
Lychee pest and disease field guide	Australian Lychee Growers' Association	Hort Innovation
Management of banana pests and diseases in north Queensland	Australian Banana Growers' Council	Hort Innovation
Melon industry biosecurity	Dianne Fullelove & Associates Pty Ltd	Melon PHA levy
Mite and insect disinfestation of lychee fruit using high pressure water sprays	Australian Lychee Growers' Association, QDAF	Hort Innovation, DA
Monitoring mangoes through the supply chain to the US	NT DPIR	Hort Innovation
National banana bunchy top virus program – phase III	Australian Banana Growers' Council	Hort Innovation
National banana bunchy top virus program – phase IV	Australian Banana Growers' Council	Hort Innovation
National citrus biosecurity surveillance program	PHA, Citrus Australia	DA (Agricultural Competitiveness White Paper)
National masterclasses to improve biosecurity for control of soil-borne diseases on strawberry farms	Victorian Strawberry Industry Development Committee	APBSF
National papaya breeding program, including PRSV-P resistance breeding	Griffith University	Hort Innovation
National passionfruit breeding program	Southern Cross University	Hort Innovation
Odour detection dog and development of a volatile profile for citrus canker	NT DPIR	DA
Opportunities and strategies to improve biosecurity, market access and trade for selected mango markets	Griffith University	ACIAR

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit (continued)		
Pilot sterile codling moth releases for the apple industry	University of Tasmania (Tasmanian Institute of Agriculture)	Hort Innovation, Fruit Growers Tasmania
Pineapple integrated crop protection program	QDAF, Growcom, Agri Supply Global	Hort Innovation
Protecting Australia's citrus genetic material	NSW DPI, Australian Citrus Propagation Association Incorporation	Auscitrus, Hort Innovation, NSW DPI
Remote sensing for biosecurity surveillance in urban and peri-urban environments	University of New England	Horticulture Innovation (Rural Research and Development for Profit)
Reversing the impact of banana blood disease in Indonesia	University of Queensland	APBSF
Review and extension of avocado arthropod pests and their management	IPM Technologies	Hort Innovation
Review of national biosecurity plans for avocados and mangoes	PHA	Hort Innovation
Review of the biosecurity plan for the berry industry	PHA	Hort Innovation
Review of the existing lychee industry biosecurity plan	Australian Lychee Growers' Association	Hort Innovation
Review of the national biosecurity plan for the banana industry	PHA	Hort Innovation
Review of the national biosecurity plan for the cherry industry and development of a biosecurity manual for cherry producers	PHA	Hort Innovation
Scoping strategic research to safeguard the banana industry in China, Philippines, Laos, Indonesia and Australia	Australian Banana Growers' Council	ACIAR
Strengthening the banana industry diagnostic capacity	University of Queensland	Hort Innovation



Dr Simon Lawson in a Lao Eucalyptus plantation, part of an ACIAR project on the biological control of galling insect pests of eucalypt plantations in the Mekong region. Image courtesy of ACIAR

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – fruit (continued)		
The influence of soil physicochemical conditions on growth and infectivity of the banana disease-causing fungus <i>Fusarium oxysporum</i> f. sp. <i>cubense</i>	James Cook University	Hort Innovation, QDAF
Topical application of BioClay-delivered dsRNS for management of pineapple and avocado diseases	University of Queensland	QDAF
Understanding and managing the role of honey bees in cucumber green mottle mosaic virus epidemiology	NT DPIR	Hort Innovation
Use of biofumigants for management of charcoal rot and weeds: step by step video	Victoria Strawberry Industry Certification Authority	Victorian Strawberry Industry Development Committee
Variety evaluation and tree certification devices for the apple and pear industry	Apple and Pear Australia Limited	Hort Innovation
Horticulture – grapes		
A comprehensive review of grapevine pinot gris virus	Vinehealth Australia	Wine Australia
Area wide integrated pest management support for Queensland fruit fly in table grapes	Australian Table Grape Association	Hort Innovation
Building capacity in area wide integrated pest management for Queensland fruit fly in table grapes	SunRise 21 Inc	Hort Innovation
Characterisation of the microbiome associated with grapevines and evaluation of endophytic microorganisms as biological control agents of grapevine trunk disease pathogens (PhD)	Charles Sturt University	Wine Australia, Charles Sturt University
Coonawarra rootstock trial	Vinehealth Australia, Treasury Wine Estates, Coonawarra Vignerons	Vinehealth Australia, Treasury Wine Estates, Coonawarra Vignerons
Determining thresholds for bunch rot tolerance in wine and detection of unwanted fungal aromas	Charles Sturt University	Wine Australia

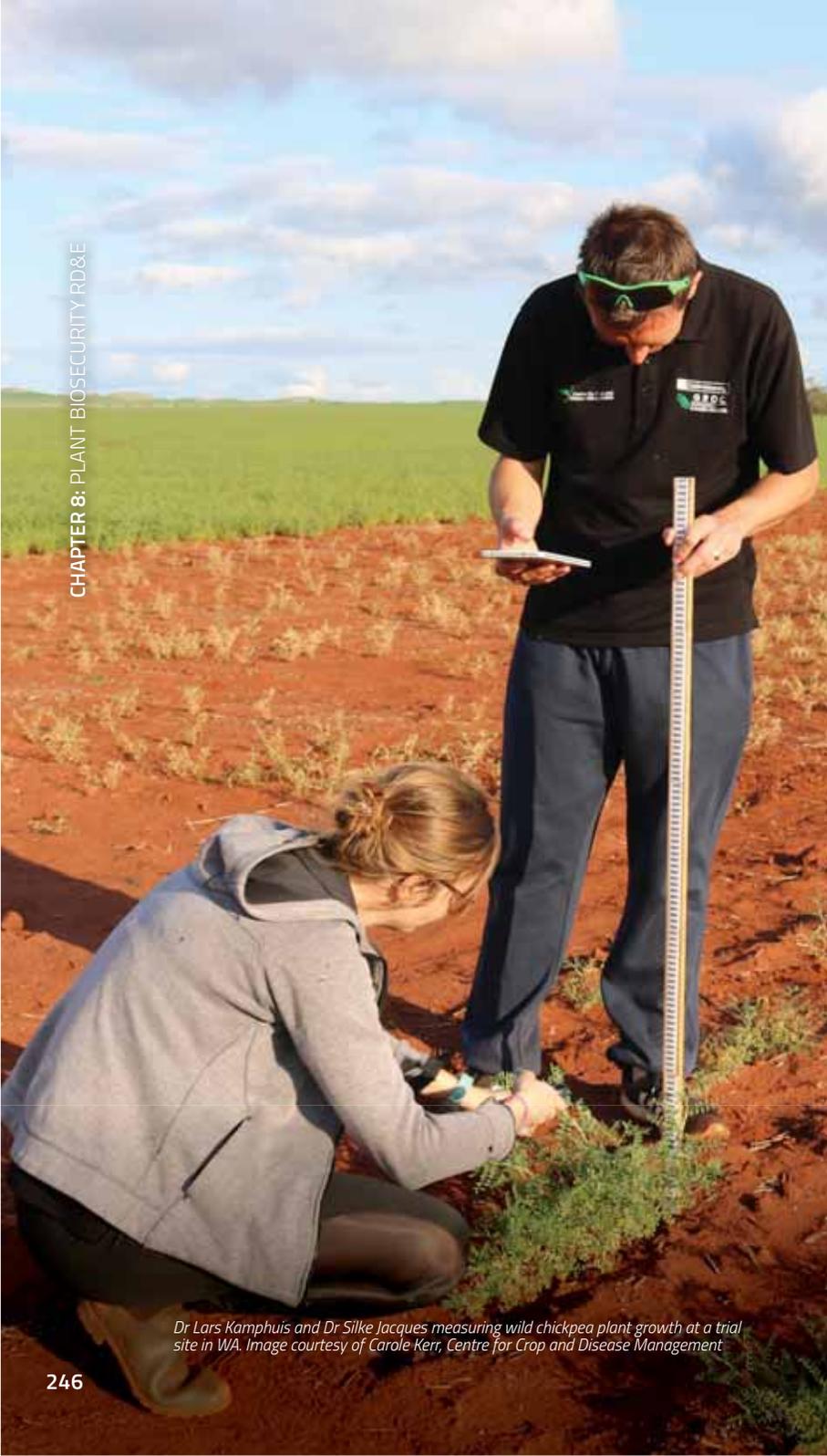
Project title	Organisation undertaking the research	Funding source or body
Horticulture – grapes (continued)		
Do viral infection(s) in the Gingin clone of chardonnay influence vine phenotype, performance and consequent wine quality?	WA DPIRD	Wine Australia
Enabling technologies and genetic resources	CSIRO	Wine Australia
Entomopathogenic fungi as potential biocontrol agents of grape phylloxera (PhD)	Charles Sturt University	Wine Australia, Charles Sturt University
Field trials with new scion-rootstock combinations and evaluation of new technology for improved water efficiency and reduced costs	CSIRO	Wine Australia
Fungicide resistance monitoring in viticulture	Curtin University	Wine Australia
Grapevine pinot gris virus information extension program	Vinehealth Australia	Wine Australia
Grapevine trunk disease management for vineyard longevity in diverse climates in Australia	SARDI	Wine Australia
Integrated management of established grapevine phylloxera	DJPR	Wine Australia
Isolation and characterisation of phytotoxins produced by the Botryosphaeriaceae and their role in grapevine trunk diseases (PhD)	Charles Sturt University	Wine Australia
Managing fungicide resistance in Australian viticulture	SARDI	Wine Australia
New technologies for dynamic canopy and disease management	CSIRO	Wine Australia
Phylloxera LAMP	DJPR	DJPR
Regional evaluation of new germplasm – pathway to adoption	CSIRO	Wine Australia
Review of the biosecurity plan and manual for the viticulture industry	PHA	Wine Australia, Hort Innovation
Rootstock genetics and improvement – new improved rootstocks with durable resistance to root knot nematodes and phylloxera	CSIRO	Wine Australia

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – grapes (continued)		
Scion genetics and improvement – development of new disease-resistant varieties in grapevines	CSIRO	Wine Australia
Spore trapping technologies for Botrytis and powdery mildew DNA testing	SARDI, Australian Wine Research Institute	Wine Australia
Strategic policy approach for phylloxera management in Australia	PHA	DJPR
Surveillance of South Australia for phylloxera	Vinehealth Australia	Vinehealth Australia
The molecular diversity of viruses infecting Australian grapevines (PhD)	Adelaide University, DJPR	Wine Australia
Understanding the basis of agrochemical resistance in biotrophic grapevine pathogens	Australian Wine Research Institute	Wine Australia
Horticulture – nuts		
An integrated disease management program for the Australian almond industry	DJPR	Hort Innovation
An integrated pest management program for the Australian almond industry	DJPR	Hort Innovation
Biology, species, and genetic diversity of macadamia lace bugs (Heteroptera: Tingidae) <i>Ulonemia</i> spp.	University of New South Wales	Australian Macadamia Society, Hort Innovation
Chestnut industry communications program	Chestnuts Australia	Hort Innovation
Communication and adoption program for the Australian chestnut industry	Chestnuts Australia	Hort Innovation, Chestnuts Australia
Integrated pest management in macadamia	NSW DPI	Hort Innovation
Investigating the infection process of <i>Rhizopus stolonifer</i> and symptom development in the almond disease, hull rot	DJPR	DJPR
Macadamia integrated disease management	University of Queensland	Hort Innovation



Dr Nicole Thompson is based at SRA's Woodford research station, which plays a vital role in biosecurity research activity for the Australian sugarcane industry. Image courtesy of Sugar Research Australia



Dr Lars Kamphuis and Dr Silke Jacques measuring wild chickpea plant growth at a trial site in WA. Image courtesy of Carole Kerr, Centre for Crop and Disease Management

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – nuts (continued)		
Mid-term review of macadamia integrated pest management program	DJPR	Hort Innovation
New technologies for improved insect management for the almond industry	DJPR	DJPR
Pathogens and other factors contributing to dark staining on pistachio shells	AgXtra Pty Ltd	Hort Innovation
Understanding and managing insect pests of pistachios	Ag Dynamics Pty Ltd	Hort Innovation
Horticulture – vegetable		
A genomic approach to understanding the diversity and biology of phytoplasmas threatening vegetable production in Australia	DJPR	DJPR
A strategic approach to weed management for the Australian vegetable industry	University of New England	Hort Innovation
Alternaria on tomato	University of Queensland	University of Queensland
Area wide management of vegetable diseases – virus and bacteria	QDAF (lead), University of Tasmania, NSW DPI, NT DPIR, DJTR, WA DPIRD	Hort Innovation, QDAF, DJPR, WA DPIRD, University of Tasmania
Characterisation of a Carlavirus of french bean	QDAF	Hort Innovation
Developing improved crop protection options in support of intensification of sweetpotato production in Papua New Guinea	Charles Sturt University, University of Southern Queensland	ACIAR, University of Southern Queensland, Charles Sturt University, PNG–Unitech, Central Queensland University, Fresh Produce Development Agency (PNG), National Agricultural Research Institute (PNG)

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – vegetable (continued)		
Developing the national potato biosecurity surveillance strategy	PHA	DA
Elucidating the epidemiology of bacterial crown and fruit rot, an unusual <i>Pseudomonas</i> disease of zucchini	DJPR	DJPR
Exploring <i>Spongospora</i> suppressive soils in potato production	NZ PFR	Hort Innovation
Extension of the PreDicta Pt potato diagnostic service	SARDI	Hort Innovation
Fungus resistant crop development	Australian National University	ARC
Improved management of pumpkin brown etch	Applied Horticultural Research Pty Ltd	Hort Innovation
Integrated crop management strategies for root and tuber crops – strengthening national and regional capacities in Papua New Guinea, Fiji, Samoa, Solomon Islands and Tonga	University of Queensland	ACIAR, University of Queensland, Secretariat of the Pacific Community, PNG-NARI, the governments of Fiji, Solomon Islands, Tonga and Samoa
Integrated pest management of nematodes in sweetpotatoes	QDAF	Hort Innovation, QDAF, Australian Sweetpotato Growers, Central Queensland University, University of Southern Queensland
Mechanisms and manipulation of resistance to powdery scab in potato roots	University of Tasmania	Hort Innovation
Minor use permits for the onion industry	Hort Innovation	Onions Australia
National diagnostic protocols – nematology	DJPR	SARDI (SPHD)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – vegetable (continued)		
Novel approaches for root knot nematode control	Central Queensland University, QDAF, Henderson RDE, Australian Sweetpotato Growers	QDAF, Australian Sweetpotato Growers
Potato virus resistance to support potato production in Indonesia	DJPR	La Trobe University Scholarship
Program approach for pest and disease potato industry investments	RMCG Consultancy	Hort Innovation
Review of the biosecurity plan for the sweetpotato industry	PHA	Hort Innovation
Review of the biosecurity plan for the vegetable industry	PHA	Hort Innovation
Review of the national biosecurity plan for the onion industry and development of a biosecurity manual for onion producers	PHA	Hort Innovation
Review of the national biosecurity plan for the potato industry and development of a biosecurity manual for potato producers	PHA	Hort Innovation
Supporting commercial sweetpotato production and marketing in the Papua New Guinea highlands	Central Queensland University, QDAF, Australian National University, Enterprises, Fresh Produce Development Agency (PNG), National Agricultural Research Institute (PNG), Henderson RDE, Australian Sweetpotato Growers	ACIAR
Testing of carrot seed for <i>Candidatus Liberibacter solanacearum</i>	DJPR	DA, DJPR
Vegetable and potato biosecurity officer program	AUSVEG	AUSVEG
Horticulture – multiple crops		
Area wide fruit fly management in Sunraysia	Alison Macgregor	Hort Innovation
Assessment of alternative approaches to establishing measures for assurance about regulatory compliance of consignments of seeds imported for purposes of sowing	CEBRA	DA

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – multiple crops (continued)		
Benefits and risks of raspberry ketone supplements for Queensland fruit fly, and selection lines as an alternative approach to reduced cue lure responsiveness	Macquarie University	International Atomic Energy Agency Co-operative Research Program (Austria)
Biochemistry of ejaculate mediated sexual inhibition in Queensland fruit flies (PhD)	Macquarie University	Hort Innovation
Biogeographic histories and evolutionary relationships among Australian Dacini fruit flies (Diptera: Tephritidae) (Honours)	Queensland University of Technology	DEE
Biotic mortality factors of Australian fruit fly across different regions (PhD)	Western Sydney University	ARC
Chemical relationships between Queensland fruit flies and their natural enemies (PhD)	Macquarie University	ARC
Combining SIT in Queensland fruit fly IPM programs (PhD)	Macquarie University	Hort Innovation
Comparisons of new sexing strains of Queensland fruit fly	Macquarie University	International Atomic Energy Agency Co-operative Research Program (Austria)
Contribution RnD4P project – improving plant pest management	Hort Innovation	AgriFutures Australia
Crop hygiene – hort indexing	DJPR	Fee for Services
Detection and prediction of herbicide residues for the protection of crop plantations	Monash University	Yitpi Foundation
Develop new molecular methods for comprehensive and rapid fruit fly diagnosis	SARDI	DA
Dynamics of the Queensland fruit fly microbiome under mass-rearing (PhD)	Macquarie University	Hort Innovation

Project title	Organisation undertaking the research	Funding source or body
Horticulture – multiple crops (continued)		
Entomology – use of genomic tools to improve molecular diagnostics and surveillance of Queensland fruit fly	DJPR	DJPR
Essential market access data packages	QDAF	Hort Innovation
Evaluation of fumigation and cold treatment for fruit fly on post-harvest citrus	Murdoch University	Korean Quarantine Department
Factors influencing efficacy of <i>Trichoderma harzianum</i> and its interaction with <i>Botrytis cinerea</i> to improve biological control in horticultural crops	University of Tasmania	BioAust, Hort Innovation
Fruit fly lures from microbial odours (PhD)	Macquarie University	ARC
Fungal taxonomy – use of genomic tools to differentiate important fungal pathogens of Victorian horticultural produce destined for Asian markets	DJPR	La Trobe University Scholarship
Gamma irradiation of garlic, ginger and vegetable seed	DA	DA
Generation of data for pesticide application in horticulture 1	Eurofins	DA
Generation of data for pesticide application in horticulture 2	Peracto Pty Ltd	DA
Genetic consequences of domestication in the Queensland fruit fly (PhD)	Macquarie University	Hort Innovation

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – multiple crops (continued)		
Genetics of fruit fly thermal tolerance and pupal colour	Macquarie University	Hort Innovation
Genomic tools to improve molecular diagnostics and control of fruit fly pests (PhD)	DJPR, La Trobe University	DJPR
Gut bacteria-mediated physiology in Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Heritability of stress tolerance in Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Implementation of RapidAIM – real-time monitoring for the presence and location of fruit fly	CSIRO	Hort Innovation
Implementing brown sugar flotation for assuring freedom in fruit fly	Applied Horticultural Research Pty Ltd	Hort Innovation
Improving preparedness of the Australian horticultural sector to the threat potentially posed by <i>Xylella fastidiosa</i> (a severe biosecurity risk)	NSW DPI, DJPR, WA DPIRD, QDAF, NZ MPI	Hort Innovation
Improving the biosecurity preparedness of Australian horticulture for the exotic spotted wing drosophila (<i>Drosophila suzukii</i>)	PHA	Hort Innovation
Industrial transformation training centre – Centre for Fruit Fly Biosecurity Innovation	Macquarie University, Western Sydney University, Queensland University of Technology	ARC
Integrated pest and disease management – PIPs II	DJPR	Hort Innovation, DJPR
Interactions of entomopathogens and Australian fruit fly	Western Sydney University	ARC
Investigate the use of smart traps in fruit fly surveillance	Hort Innovation	DA
LAMP post harvest fruit fly detection in floatation trials	DJPR	DJPR
Mating frequency of Queensland fruit fly – a potential constraint on SIT (PhD)	Macquarie University	Hort Innovation
Methoprene and dietary yeast as pre-release supplements for Queensland fruit fly SIT (PhD)	Macquarie University	Hort Innovation
Methyl bromide disinfection of Queensland fruit fly	NSW DPI	Hort Innovation

Project title	Organisation undertaking the research	Funding source or body
Horticulture – multiple crops (continued)		
Microbial gut symbionts and domestication	NSW DPI, Macquarie University, Western Sydney University	Macquarie University
Models for border inspection for pelleted seeds – how much assurance?	CEBRA	Ministry for Primary Industries (New Zealand)
Molecular basis of sexual performance in Queensland fruit fly (PhD)	Macquarie University	ARC
Multi-scale monitoring tools for managing Australian tree crops – phase II	University of New England, Central Queensland University, many others	Horticulture Innovation, Rural R&D for profit
National biosecurity plan for the summerfruit industry	PHA	Hort Innovation
National centre for post-harvest disinfestation research on Mediterranean fruit fly	Murdoch University (Australian Mediterranean Fruit Fly R&D Centre)	AgriFutures Australia, Hort Innovation, Kalang Consultancy Services Pty Ltd, QDAF, WA DPIRD
National diagnostic protocols – <i>Xylella</i> vectors	DJPR, WA DPIRD	SARDI (SPHD)
National tomato potato psyllid and zebra chip surveillance	WA DPIRD, DJPR, SARDI	Hort Innovation, DJPR, SARDI
National tomato potato psyllid program coordinator	AUSVEG	Hort Innovation
New integrated pest management tools for insect pests of biosecurity significance	DJPR	DJPR
Nutritional immunology of Queensland fruit flies (PhD)	Macquarie University	Hort Innovation
Olfactory relationship between fruit flies and associated bacteria (PhD)	Macquarie University	ARC
Optimising the Fruition® trap for improved control of pest fruit flies in eastern Australia	Griffith University	AgNova Technologies Pty Ltd
Pheromones as potential fruit fly lures (PhD)	Macquarie University	ARC
Plant pest surveillance project	DJPR, University of Queensland	Hort Innovation
Planthoppers in Cixiidae	NSW DPI	DEE
Post factory pilot of SITplus fly production	Macquarie University	Hort Innovation

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – multiple crops (continued)		
Post-factory pilot of SITPlus fly production	Macquarie University, DJPR, SARDI, NSW DPI, PFRA	Hort Innovation, Macquarie University, DJPR, SARDI, NSW DPI, PFRA
Potential impacts of climate change on habitat suitability for the Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Potential of gene drives to eliminate incursions of <i>Drasophila suzukii</i>	University of Melbourne	ARC
Predator-prey interactions in Queensland fruit flies (PhD)	Macquarie University	Hort Innovation
Psyllid microflora – implications for Liberibacter disease surveillance and pest control	DJPR	La Trobe University Scholarship
Quality control procedures for Queensland fruit fly mass-rearing (PhD)	Macquarie University	Hort Innovation
Queensland fruit fly behaviour (PhD)	Macquarie University	Hort Innovation
Sampling for <i>Candidatus Liberibacter solanacearum</i>	SARDI	Hort Innovation
Semiochemical-mediated enhancement of sterile male Queensland fruit fly	NSW DPI	Universities
Sex selection genes from fruit fly species for use in SITplus	Macquarie University	Hort Innovation
SITplus – developing and optimising production of a male-only, temperature-sensitive-lethal, Queensland fruit fly strain	SARDI	Hort Innovation
SITplus – dietary sterilisation of male Queensland fruit fly	CSIRO	Hort Innovation
SITplus – Port Augusta Queensland fruit fly sterile insect technique factory pilot operation 1	PIRSA	Hort Innovation
SITplus – Port Augusta Queensland fruit fly sterile insect technique factory pilot operation 2	PIRSA, Western Sydney University	Hort Innovation, Western Sydney University

Project title	Organisation undertaking the research	Funding source or body
Horticulture – multiple crops (continued)		
SITplus – raising Queensland fruit fly SIT to world standard	Macquarie University	Hort Innovation
SITplus production facility – proof of concept	Western Sydney University	Hort Innovation
Synthesis and analysis of zingerone analogues as fruit fly attractants (PhD)	Macquarie University	Hort Innovation
The evolution of generalism – why so many polyphagous fruit flies?	Queensland University of Technology	ARC
The phenology of fruit fly in subtropical Australia	Queensland University of Technology	Queensland University of Technology
The science underpinning ISPM 37	Queensland University of Technology	Queensland University of Technology
Wolbachia endosymbionts – novel strain dynamics in Australian <i>Drosophila</i>	University of Melbourne	ARC
Horticulture – other		
Alternative herbicide treatments to devitalise cut flowers	DA	DA
An integrated pest and disease management extension program for the olive industry	Western Sydney University	Hort Innovation
Australian tea tree industry leadership structural development initiative	PHA	DA
Basic research on the cocoa pod borer in Papua New Guinea to permit effective pest management	NSW DPI	ACIAR
Bogia coconut syndrome in Papua New Guinea and related phytoplasma syndromes – developing biological knowledge and a risk management strategy	Charles Sturt University, University of Southern Queensland	ACIAR
Developing tools to screen native pepper for resistance to dieback and tolerance to drought (PhD)	University of Tasmania	Diemen Pepper

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Horticulture – other (continued)		
Development of a biosecurity plan for the tea tree Industry	PHA	Australia Tea Tree Industry Association
Development of a risk management system for systemic downy mildew of poppy	University of Tasmania	ARC, DPIPW, Poppy Growers Tasmania, SunPharm Aus, Tasmanian Alkaloids, USDA
Disease diagnostics for small cocoa farmers in west Africa	University of Queensland	University of Queensland (Office of the Deputy Vice-Chancellor)
Entomopathogens for management of key pests of tea tree	NSW DPI	AgriFutures Australia, NSW DPI
<i>Fusarium oxysporum</i> on ginger	University of Queensland	AgriFutures Australia, QDAF
Ginger ninja – automating disease detection in seed ginger stock	Queensland University of Technology	AgriFutures Australia
Identification and management of nematodes in coffee (PhD)	University of Sydney	DFAT (Australia Awards)
Improved capacity for integrated disease management of couch smut (<i>Ustilago cynodontis</i>) in turf	University of Queensland	Hort Innovation
Improving ginger to future proof the industry against pests and diseases	University of the Sunshine Coast	AgriFutures Australia
Integrated pest management of phytophagous mites on turfgrass	IPM Technologies	Hort Innovation
Minor use permit renewals	Peracto Pty Ltd	Hort Innovation
Pest and disease management and research services for the mushroom industry	University of Tasmania	Hort Innovation
Pests and diseases of truffles and their tree hosts in Australia	WA DPIRD	AgriFutures Australia, Australian Truffle Growers' Association, WA DPIRD, Truffle Producers Western Australia, Australian National University, Truffle and Wine Co.

Project title	Organisation undertaking the research	Funding source or body
Horticulture – other (continued)		
Protecting the coffee industry from coffee berry borer in Papua New Guinea and Australia	QDAF	ACIAR
Review of the biosecurity plan for the ginger industry	PHA	AgriFutures Australia
Safeguarding and deploying coconut diversity for improving livelihoods in the Pacific Islands	Pacific Community (SPC)	ACIAR
Scoping study of sustainable weed management in tea tree oil plantations	University of New England	AgriFutures Australia
Site-specific weed control for ginger cropping systems	University of Sydney	AgriFutures Australia
Natural environment		
Application of remote sensing for surveillance of high risk invasive plants	DJPR	DJPR
Aquatic weed ecology (PhD)	Macquarie University	Macquarie University, Sydney Water
Colonisation by alien microbiota – identifying key ecological processes	Western Sydney University	ARC
Developing an environmental risk mitigation plan for mangroves and associated communities	PHA	DA
Developing an environmental risk mitigation plan for Australian Acacia species	PHA	DA
Egeria containment in irrigation channels	DJPR	Goulburn Murray Rural Water Corporation, DJPR
Enhancing community capacity to assess the impacts of myrtle rust on rainforest Myrtaceae in ecologically and culturally significant lowland subtropical rainforests associated with World Heritage Gondwana Rainforest ecosystems	NSW DPI	APBSF

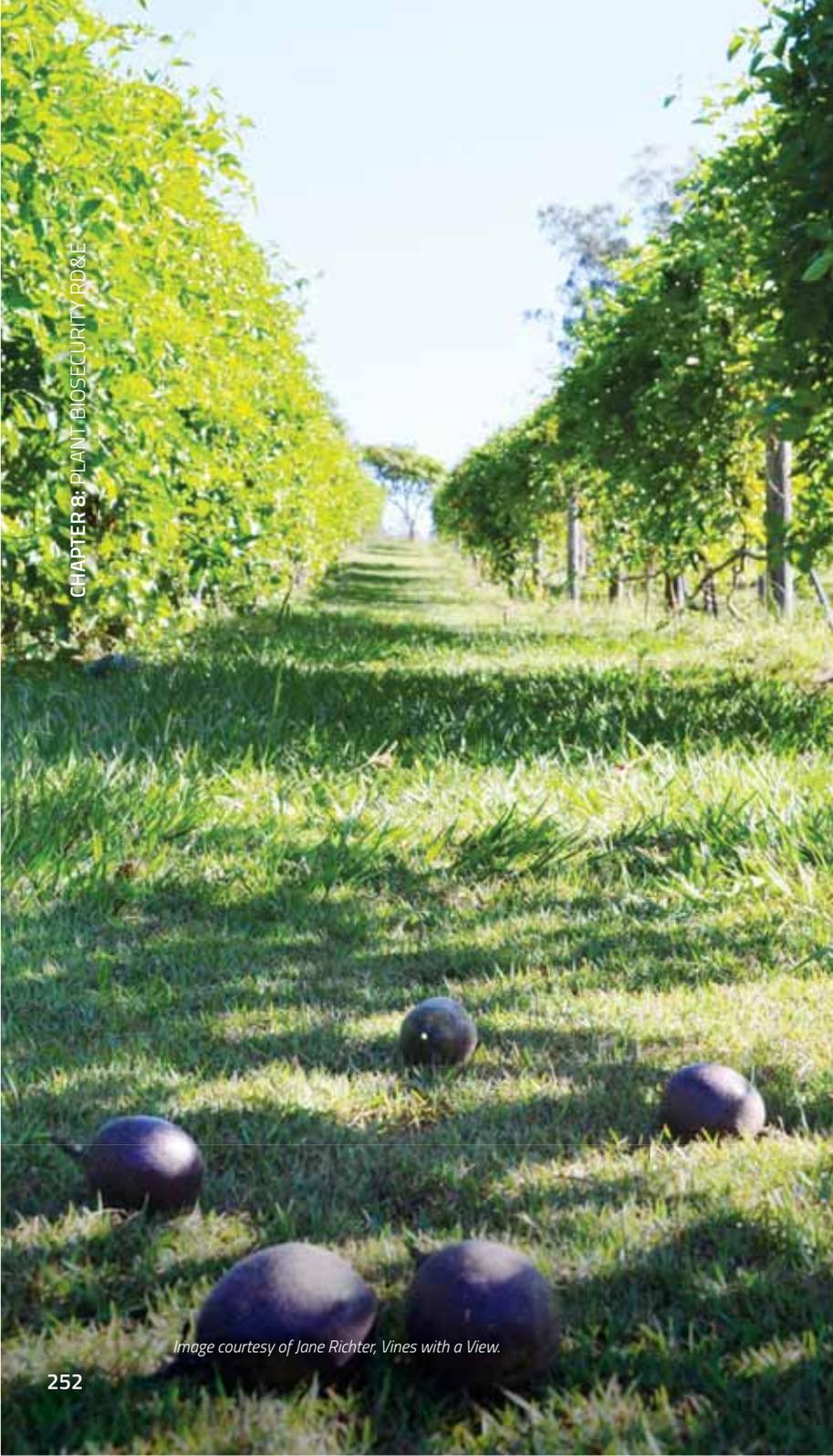


Image courtesy of Jane Richter, *Vines with a View*.

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Natural environment (continued)		
Eradication of inkweed, a new priority weed incursion on King Island	King Island Natural Resource Management Group	National Landcare Program
Evaluating progress of detector dogs for hawkweed eradication	Monash University	Parks Victoria
Evaluating the deployment of autonomous vehicles for weed eradication	Murdoch University	Chevron (USA)
Evolution of chemical warfare in plants	Monash University	ARC
Expanding environmental biosecurity capacity to protect our unique ecosystems	QDAF	APBSF
Expanding indigenous communities biosecurity surveillance and monitoring capacity to care for country and to protect country from pests and diseases	Charles Darwin University	APBSF
Impact of draw-down on Egeria in Lake Mulwala	DJPR	Goulburn Murray Rural Water Corporation, DJPR
Information gap theory as a tool to assist in biosecurity decision making (PhD)	Murdoch University	Murdoch University, Chevron (USA)
Mixed models to analyse pre-border and border surveillance to assist with decision making (PhD)	Murdoch University	Murdoch University, Chevron (USA)
Optimising plant populations for ecological restoration and resilience	University of New South Wales	ARC
Phosphonate bark painting of Wollemi pine	Royal Botanic Gardens Domain Trust, NSW Office of Environment and Heritage	NSW Department of Planning and Environment, Royal Botanic Garden Sydney
Plant ecophysiology – prospecting for weed control using a native parasitic plant, from laboratory to field implementation	University of Adelaide	ARC, SA Water, Forestry SA, DEWNR SA, PIRSA, Nature Foundation SA, Lirabenda Endowment Fund, Adelaide and Mount Lofty Ranges, South Australian Murray Darling Basin Natural Resources Management Boards

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Natural environment (continued)		
Plant epidemiology – host susceptibility to myrtle rust	Queensland University of Technology	APBSF
Plant invasions as a driver tri-trophic community structures in dry forest ecosystems	Monash University	Ecological Society of Australia
Research and access potential pests and pathogens that could significantly impact biodiversity in NSW	Macquarie University, University of Melbourne	Macquarie University, NSW Office of Environment and Heritage
Sea spurge genomics in Australia	CSIRO	Australian National University
Weed control for soil handling practices associated with native ecosystem rehabilitation	Charles Darwin University	NT DPIR
WeedFutures	Macquarie University	Macquarie University, NSW Office of Environment and Heritage
Nursery crops		
Building plant health surveillance capacity in Australia's nursery production industry project	GIA	DA
Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry	QDAF	Hort Innovation
Improving pest management for the nursery industry	GIA	Hort Innovation
Integrated disease management in pyrethrum	University of Tasmania	Hort Innovation
National nursery industry biosecurity program	GIA	Hort Innovation
Northern Australia biosecurity training program	GIA	NT DPIR
Greenlife Industry Australia biosecurity engagement measures	GIA	DA
Nursery production visual training resources	EHR Consultants	PHA

Project title	Organisation undertaking the research	Funding source or body
Pollinators		
A world without bees – simulating important agricultural insect pollinators	Monash University	ARC
Assessing pathogen risks to honey bees and native bees in NSW (PhD)	Western Sydney University	Western Sydney University
Be(e) friendly venomous spiders – novel biopesticides from arachnid venoms	University of Queensland	ARC
Bee pollination projects	Western Sydney University	Syngenta Australia Ltd
Context dependent flower choice in honey bees	University of Sydney	ARC
Development and establishment of a honey bee virus diagnostic surveillance network within the national bee pest surveillance program	CSIRO	PHA (DA)
Development and implementation of a portal solution for the national bee surveillance program	Soda Strategic	PHA (DA)
Development and implementation of protocols to enable importation of improved honey bee genetics to Australia	CSIRO	Hort Innovation
Development of target plant lists and floral maps for specific high-risk ports in the national bee pest surveillance program	State and territory departments of agriculture as part of the National Bee Pest Surveillance Program contracts	PHA (DA)
Enhancing and safeguarding pollination services for almond production in Australia	Western Sydney University	Olam International Pty Ltd
Healthy bee populations for horticultural pollination services	Western Sydney University	Hort Innovation
Honey bee disease diagnostics	University of Western Australia	CRC for Honey Bee Products
Honey bee nutrition – early detection of malnutrition and colony collapse	University of Western Australia	CRC for Honey Bee Products
Improving biosecurity resources and better understanding bee health in Australia	PHA	AgriFutures Australia
Improving the health of hives used in pollination	University of Adelaide	AgriFutures Australia

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Pollinators (continued)		
Increasing participation of honey bee industries in the Pacific	CSIRO	Southern Cross University
Investigating factors that influence chalkbrood outbreaks in Australia	CSIRO	AgriFutures Australia
Managing flies for crop pollination	WAAA, Western Sydney University, University of New England	Hort Innovation
Molecular marker identification for disease resistance and implementation into a bee breeding program	University of Western Australia	CRC for Honey Bee Products
National bee biosecurity program	PHA	AHBIC
National bee pest surveillance program	PHA	Hort Innovation, AHBIC, Grain Producers Australia, DA
National bee pest surveillance program enhancements	PHA	DA
Native pollinators in the Riverina Local Land Services region	University of New England	Australian Melon Association Inc
Pollination harmony	University of Western Australia	CRC for Honey Bee Products
Probiotic development for bees – analysing gut bacteria in healthy bees	University of Canberra	AgriFutures Australia
Progressing implementation of genetic selection in Australian honey bees	University of New England	AgriFutures Australia
Quantifying the role of wild insect pollinator biodiversity in the provision of pollination ecosystem services	University of New England	Ian Potter Foundation
Rapid evolution via genetic novelty in an invasive social insect	University of Sydney	ARC
Refinement, development and deployment of remote catchboxes as part of the overarching national bee pest surveillance program	University of Southern Queensland	PHA (DA)
Remote bee hive health communication using low power, long range communication technology	University of Western Australia	CRC for Honey Bee Products

Project title	Organisation undertaking the research	Funding source or body
Pollinators (continued)		
Securing pollination for productive agriculture: guidelines for effective pollinator management and stakeholder adoption	AgriFutures Australia	DA (Rural R&D for Profit), Hort Innovation, University of Sydney, University of Adelaide, University of New England, Australian National University, SA DPIRD, SA Department of Environment, Water and Natural Resources, O'Connor NRM, Native Vegetation Council, Trees for Life, CSIRO, Lucerne Australia, South Australia Apiarist Association, Apple and Pear Growers Association of South Australia, Costa Group, Australian Melon Association, Australian Mango Industry Association, Terrestrial Ecosystems Research Network, Greening Australia, Almond Board of Australia, Adelaide and Mount Lofty Ranges Natural Resources Management Board, Natural Resource Northern and Yorke, Raspberries and Blackberries Australia
Stingless bees as effective managed pollinators for Australian horticulture	Western Sydney University	Hort Innovation
Strengthening and enabling effective pollination for Australia	NZ PFR	Hort Innovation
Systematics and host associations of the Australian gasteruption wasps	Flinders University	DEE

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Pollinators (continued)		
The mechanisms underlying crop pollinator effectiveness in agro-ecosystems	University of New England	ARC
The storage of beneficial and plant pathogenic fungi in honey bee hives and its influence on honey bee health and longevity	University of Adelaide	University of Adelaide
Varroa mite host switch	Australian National University	ARC
Unknown crop		
Biodiversity, systematics and taxonomy of Australian microgastrine parasitoid wasps (Honours)	University of Adelaide	DEE
Hermitage Research Facility – Pest Invaders competition and workshops 2019	QDAF	APBSF
Hermitage Research Facility – schools ‘plant health’ science competition 2020	QDAF	APBSF
Sexual conflict and evolutionary dynamics of insecticide resistance genes	University of Melbourne	ARC
Systematics of Australian microgastrine wasps (Hymenoptera: Braconidae) – a key group of caterpillar parasitoids (PhD)	University of Adelaide	University of Adelaide
Taxonomy, phylogeny and host associations in Labeninae parasitoids from south-east Australia (Hymenoptera: Ichneumonidae) (Honours)	University of Adelaide	DEE
Urban and amenity		
Establishing a program of plant pest surveillance in Australian botanic gardens and arboreta	PHA	DA
Strengthening the weakest link in peri-urban Mediterranean fruit fly suppression	University of Western Australia, WA DPIRD, Peel Harvey Biosecurity Group	APBSF



Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple		
2020 International Year of Plant Health	Hort Innovation	All plant RDCs, PBRI, PHA
AgVet access grants 2018	AgAware Consulting Pty Ltd	AgriFutures Australia
AgVet minor use access grants – trial management	Agaware Consulting Pty Ltd	AgriFutures Australia
ARC research hub for driving farming productivity and disease prevention	Monash University	ARC
ARC research hub for sustainable crop protection	University of Queensland	ARC, Nufarm Limited, CRDC, GRDC, HI, QDAF, NSW DPI, Wine Australia, Australian Wine Research Institute, AUSVEG, Griffith University, Curtin University, La Trobe University, University of Tasmania, University of California, Riverside
AUSPestCheck™ trial	PHA	DA
Australian herbicide resistance initiative – phase V	University of Western Australia	GRDC
Australian psyllids – implications for conservation and biosecurity	University of Adelaide	DEE
Best practice glyphosate use for Esperance port zone growers	AGRONOMO	GRDC

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Biocontrol solutions for sustainable management of weed impacts to agriculture	Meridian Agriculture, CSIRO, NSW DPI, QDAF, DJPR, Hot Tin Roof Communications (extention)	DA (Rural R&D for Profit), AgriFutures Australia, GRDC, CSIRO, DJPR, NSW DPI, QDAF, PIRSA, Seqwater, Shire of Ravensthorpe, NSW Weed Biocontrol Taskforce, North-West Local Land Services, NSW DP&E, Bundaberg Regional Council, Gladstone Regional Council, HQPlantations, Goulburn–Murray Water Corporation, Murrumbidgee Irrigation Ltd, Coleambally Irrigation Cooperative, Goulburn Broken Catchment Management Authority, Murray Local Land Services, USDA Agricultural Research Service (USA), Australian Biological Control Laboratory, Wyong Shire Council, NSW National Parks Service, Central Murray County Council, Murrumbidgee Landcare Inc, NQ Dry Tropics
Biological control of giant pine scale in Australia	DJPR, CABI, Hellenic Agriculture Org. Demeter	FWPA, DJPR, ADK Softwoods, The Trust Company ANZOF Sub 1, Hancock Vic Plantations Pty Ltd, Forestry SA, Norske Skog, Forestry Corporation of NSW, ACT Parks Conservation and Lands, Green Triangle Forest Operating Sub Trust, HQ Plantations Pty Ltd, OneFortyOne Plantations, Hume Forests, Green Triangle Forest Products, Forest Products Commission

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Biological control of silverleaf nightshade	DJPR	DA (Rural Research and Development for Profit), AgriFutures Australia, PIRSA, GRDC
Biosecurity planning workshop – Australia and Indonesia	Lovett Associates	APBSF
Black spot of field peas and native legumes in Australia	University of Adelaide, Royal Botanic Gardens and Domain Trust, SARDI	University of Adelaide, Royal Botanic Gardens and Domain Trust
Boosting biosecurity awareness and action in the freight and logistics industry	NSW DPI	APBSF
Boosting diagnostic capacity for plant production industries	WA DPIRD, NSW DPI, QDAF, DJPR, BioProtection Research NZ, cesar, CSIRO, DPIPWE, DPIR NT, NZ PFR, PHA, SARDI, AUSVEG, SRA	GRDC (Rural R&D for Profit), CRDC, WA DPIRD, NSW DPI, QDAF, DJPR, BioProtection Lincoln, cesar, CSIRO, DPIPWE, NT DPIR, NZ PFR, PHA, SARDI
Brown marmorated stink bug trapping and surveillance	DJPR	DJPR
Clay nanoparticle-facilitated RNAi for non-transgenic modification of crops	University of Queensland	ARC
Commercial development and evaluation of a machine vision-based weed spot sprayer	University of Southern Queensland	CRDC, University of Southern Queensland, SRA, Hort Innovation
Compliance based inspection scheme – continuous sampling plan sensitivity analysis	CEBRA, University of New England	DA
Demonstrating and validating the implementation of integrated weed management strategies to control barley grass in the low rainfall zone farming systems	University of Adelaide	GRDC

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Developing a national systems approach for meeting AM17001 biosecurity requirements to access key Asian markets	CSIRO	Hort Innovation
Developing models for the spread and management of national priority plant pests	University of Melbourne (CEBRA)	DA
Developing molecular fingerprinting of myrtle rust disease to facilitate strategies in monitoring and control	Western Sydney University	APBSF
Developing scientifically robust risk maps for priority plant pests	University of Melbourne (CEBRA)	DA
Development of biodegradable controlled release pesticides	University of Queensland	UniQuest Pty Ltd
Development of effective insect surveillance plans utilising economic portfolio theory (PhD)	Murdoch University	Murdoch University, Chevron (USA)
Development of proof of freedom guidelines	CEBRA	DA
Development of smart surveillance tools	DJPR	DJPR
Discovering the pathways and mechanisms underlying bio-insecticide control of the global migratory pest diamondback moth, <i>Plutella xylostella</i>	University of Adelaide	ARC
Disease resistance genes from skeleton weed	CSIRO	Australian National University
Driving food safety culture and integrity across value chains	DJPR	DJPR
Early and effective summer weed control – a workshop series for the WA grainbelt	AGRONOMO	GRDC
Ecological impacts of myrtle rust (PhD)	Macquarie University	CRC (Plant Biosecurity), NSW DPI

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Efficacy of a biocontrol agent against plant pathogenic fungi	Monash University	Nutrifield Pty Ltd
Elucidating trifluralin resistance in Australian major weed <i>Lolium rigidum</i>	University of Western Australia	ARC, NuFarm Australia
Engineering better sprays for leaf coating – from drop impact to retention	University of New South Wales	ARC
Enhancing NSW biosecurity food safety risk management system	University of Melbourne	NSW DPI
Estimating worldwide brown marmorated stink bug risk of establishment	University of Melbourne (CEBRA)	DA
Evaluation of insecticidal spider peptides	University of Queensland	UniQuest Pty Ltd
Farm biosecurity project	PHA, AHA	PHA, AHA
Field surveillance capability	DJPR	DA
Forging an effective fight against Phytophthora in NSW	Royal Botanic Gardens Domain Trust, NSW Office of Environment and Heritage	Royal Botanic Gardens Domain Trust, NSW Office of Environment and Heritage
General surveillance	CSIRO	DA
Harvest weed seed control for the southern region	Southern Farming Systems	GRDC
Identify new trojan female mutations in vinegar flies to support screening of clover root weevil	Monash University	New Zealand Ministry of Business, Innovation and Employment
iMapPESTS – sentinel surveillance for agriculture	Eight service providers (one for each subproject) – PHA, AUSVEG, SRA, University of Queensland (via CRDC), SARDI (Burkard Scientific Limited [UK], Rothamsted Research Limited [UK]), DJPR, CSIRO, WA DPIRD	Hort Innovation, PHA, SRA, GRDC, AgriFutures Australia, Wine Australia, FWPA, CRDC, SARDI, DJPR, CSIRO, NZ PFR, Rothamsted Research (UK), Burkard Manufacturing Company (UK), GIA, DA (Rural Research and Development for Profit), WA DPIRD

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Implementation of a multi-target surveillance system	Murdoch University	Chevron (USA)
Improve biosecurity capabilities for demonstrating pest area freedom	PHA	DA
Improved management options for cucumber green mottle mosaic virus	NT DPIR	Hort Innovation
Improving access to new germplasm using next generation sequencing	DJPR, Queensland University of Technology	Hort Innovation, DJPR, Queensland University of Technology
Improving AusPestCheck™ data quality and transfer	PHA	DA
Improving biosecurity implementation of biosecurity planning	PHA	DA
Improving diagnostics and biosecurity for graft-transmissible diseases in citrus	NSW DPI, Queensland Alliance for Agriculture and Food Innovation, University of Queensland, WA DPIRD, Auscitrus	Hort Innovation
Improving plant biosecurity in the Pacific Islands	Kalang Consulting, Magee Consultancy, Pacific NPPOs, Pacific Horticultural and Agricultural Market Access, Pacific Agribusiness Research for Development Initiative, Crawford Fund, Biosecurity and Agrisystems Protection Consultants	ACIAR, DA
Improving weed management in high break crop intensity farming systems	SARDI	GRDC
Innovative BioClay platform for fire ant eradication	University of Queensland	QDAF
Innovative crop weed control for northern region cropping systems	University of Sydney	GRDC
Innovative plant pathogen surveillance using metabarcoding and next generation sequencing on spore trap contents	DJPR	La Trobe University Scholarship
Innovative technologies project – remote sensing for presence or absence	CSIRO	DA

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Insecticide resistance management in red-legged earth mite and chemical sensitivities	University of Melbourne	GRDC
Interstate trade reform – Interstate Certification Assurance scheme	PHA	DA, state and territory governments
Invasion pathway analysis for Australia – insects	Monash University	Invasive Species Council
Invasive grass LAMP platform	NSW DPI	DA
Locally important weeds	WA DPIRD	GRDC
Lucid identification keys for Australian endemic and exotic genera	DJPR	DA, DJPR
Making Green Guard® greener – enhancing the efficacy of a biopesticide	University of Sydney, University of Adelaide	ARC
Managing weeds in the GRDC northern grains region – coordination of workshop material and establishment and monitoring of regional focus paddocks	Local Land Services	GRDC
Manipulating plant root exudation for soil-borne disease control	University of Tasmania	ARC
Molecular characterisation of specimens in the Victorian plant pathogen herbarium to support market access into Asian markets – powdery mildews (PhD)	DJPR, La Trobe University	DJPR
Molecular Diagnostic Centre – national disease surveillance	SARDI	GRDC
Monitoring diamondback moth for forecasting and adaptive management of outbreak and insecticide resistance risk	SARDI	GRDC
Myrtle rust masterclass – community awareness	Box Hill Institute (TAFE)	APBSF
National Diagnostic Protocols – entomology	DJPR	SARDI (SPHD)
National Diagnostic Protocols – microbiology	DJPR	SARDI (SPHD)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
National plant biosecurity RD&E strategy implementation committee	PHA	Hort Innovation, DJPR, CRDC, Dairy Australia, GRDC, Meat and Livestock Australia, Wine Australia, SRA, AgriFutures Australia, FWPA, PHA, state governments
National priority plant pests – true host list and risk pathways	QDAF	DA
National tree genomics program – genotype prediction toolbox	Western Sydney University	Hort Innovation
National working party on pesticide applications	PHA	CropLife Australia, GRDC, Wine Australia, CRDC, SRA, AAAA
New Gene Sequencing – PEQ plant virus and viroids	Queensland University of Technology	DA
New horizons with BioClay – protecting crops from aphids and whiteflies	University of Queensland	Queensland Department of Science Information Technology and Innovation
Novel tropical vegetable and cotton virus protection	University of Queensland	Hort Innovation
Online plant health surveillance training and awareness resources	PHA	DA
Ornamental and Asian vegetable plants as entry pathways for viruses	University of Queensland	APBSF
Pest and Disease Image Library	PHA	DA
Phylogenomic classification of rust fungi in Australia	University of Queensland	Australian Government Department of Sustainability, Environment, Water, Population and Communities
Pilot workshops – why weeds grow where they do and how to control them	Planfarm Pty Ltd	GRDC
Plant Biosecurity Research Initiative	Projects led by individual RDCs	Hort Innovation, CRDC, GRDC, Wine Australia, SRA, AgriFutures Australia, FWPA

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Plant health – a major challenge to achieving sustainable 'green' agriculture in Myanmar	CABI (Malaysia)	ACIAR
Plant industry liaison officer for northern Australia	PHA	DA
Portable, in-field pathogen detection	DJPR	DJPR
Post doctoral fellowship – maximising crops and minimising weeds with smart phase farming	University of Western Australia	GRDC
Prevention and control of West Indian drywood termite	QDAF	QDAF
Protecting Australia's food future – shared responsibility for biosecurity	University of Tasmania	ARC
Provision of a revised economic allocation theory model – Barrow Island biosecurity	University of Melbourne	Murdoch University, Chevron (USA)
Pursuing sensitive limits of biochemical geographic discrimination as generic tool for high-risk plant pests	Queensland University of Technology	APBSF
Putting new herbicide targets on the table	University of Western Australia	ARC
Rapid diagnostics for major biosecurity threats	SARDI, Macquarie University	DA
RD&E program for control, eradication and preparedness for vegetable leafminer	AUSVEG, cesar, NAQS, University of Melbourne, PHA	Hort Innovation
Real-time phylogenetics for food-borne outbreak surveillance	University of Technology Sydney	ARC
Re-evaluating management of established pests including the European wasp, <i>Vespa germanica</i> , using biocontrol agents	University of Melbourne (CEBRA)	DA

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Reference collections strategy implementation	Agriculture Victoria	PHA (DA)
Regional master classes in plant biosecurity (Indonesia)	Lovett Associates	APBSF
Research to inform yellow crazy ant management in the wet tropics	James Cook University	Wet Tropics Management Authority
Resolution of disease epidemiology and detection of genetic and genotypic diversity in Australian populations of myrtle rust	University of Queensland (Queensland Alliance for Agriculture and Food Innovation)	APBSF
Resolve the taxonomy of native Australian longhorn beetles	CSIRO	DA
Responding to emerging pest and disease threats to horticulture in the Pacific Islands	University of Queensland	ACIAR
Review and development of national strategies to support implementation of the National Plant Biosecurity Strategy	PHA	DA (Agricultural Competitiveness White Paper)
Revision of bristle fly genus <i>Rutilla</i>	CSIRO	DEE
RNA vaccines for next generation crop protection against fungal pathogens	University of Queensland	Queensland Government Department of Innovation, Tourism Industry Development
Seed bank biology of emerging weeds	University of Adelaide	GRDC
Single model irregular region retrieval for rapid plant disease detection	Griffith University	ARC
Smart surveillance tools	DJPR	DA (Agricultural Competitiveness White Paper)
Structure based investigations into new modes of action for herbicides	University of Western Australia	ARC

Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Summer weed survey of WA cropping districts	AGRONOMO	GRDC
Surge capacity simulation model	SPHD (Surge Capacity Working Group)	PHA (SPHD)
Sustainable productivity improvements in Allium and solanaceous vegetable crops in Indonesia and sub-tropical Australia	QDAF	ACIAR
Systematics of the chalcid wasp genus <i>Psyllaephagus</i> (Hymenoptera: Encyrtidae), parasitoids of lerp insects	University of Adelaide	University of Adelaide
Systematics, biodiversity and host associations of Australian psyllids – implications for conservation and biosecurity	University of Adelaide	University of Adelaide
Tackling pests using game theory to support cooperative management	University of Queensland	ARC
Testing an iterative approach to selecting successful biological control agents	University of Queensland	CSIRO
Testing incentive-based drivers for importer compliance	CEBRA, University of New England	DA
The role of reproductive parasites in the biology of invasive pest thrips (PhD)	Western Sydney University	Western Sydney University
Towards herbicide cocktails with a new mode of action to avert resistance	La Trobe University	ARC
Uncovering how rust fungi cause devastating plant diseases	Australian National University	ARC





Table 59. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source or body
Multiple (continued)		
Upskilling Tasmanian growers and advisors to manage annual ryegrass through exposure to external knowledge and peer-to-peer learning	Southern Farming Systems	GRDC
Using mobile apps to identify pests and diseases	DA	DA
Virtual fencing for better crop integrated weed management	CSIRO	GRDC
Weed biocontrol	DJPR	Goulburn Murray Water, Murrumbidgee Irrigation, Coleambally Irrigation, Goulburn Broken CMA, Wyong Shire, NSW Office of Environment and Heritage, Central Murray Council, NQ Dry Tropics, Murray Local Land Services, Murrumbidgee Landcare, PIRSA, GRDC
When are earwigs pests and when are they beneficial?	CSIRO	GRDC
When is hybridisation helpful or harmful to invaders?	Monash University	ARC
Xylella coordinator	Wine Australia	Wine Australia, Hort Innovation, Plant Biosecurity Research Initiative
Other crops		
Developing a foundation for the long-term management of basal stem rot of oil palm in Papua New Guinea and Solomon Islands	University of Queensland	ACIAR

