The National Plant Biosecurity **Status Report**

2016

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Image courtesy of Helen Carpenter

Image courtesy of Jeff Reynolds

Foreword

With increasing globalisation, biosecurity has never been more important for Australia. Our island nation has a vast coastline with over 70 ports, eight major international airports and in 2016, travellers crossed Australia's external borders 37.7 million times. Since every movement of goods and people poses the risk of importing a new pest, the challenge of protecting Australia's unique natural environment and way of life from new pest threats is enormous.

Many serious plant pests exist elsewhere in the world that are not present in Australia, a status that confers a range of benefits on us all. It is the plant biosecurity system that works to maintain this enviable status, a sophisticated system underpinned by cooperation between all the major stakeholders. Only by working together are we able to protect Australia's plant industries and ecosystems. This valuable reference document reveals the workings of the plant biosecurity system that together protect Australia's unique natural environment and dozens of plant production industries.

The report details the efforts both in Australia and overseas to protect our international borders from exotic pest incursions, as well as post-border efforts within Australia. Post-border biosecurity works to prevent existing pests and weeds from spreading between states and territories, as well as from region to region and farm to farm.

The best-known example of post-border biosecurity is the coordinated measures that prevent the spread of Queensland fruit fly, a pest native to the north of Australia, from attacking horticultural crops across the country. In addition to avoiding damage to crops by this destructive pest, areas known to be free from Qfly are able to sell their produce more freely, preserving export markets that contribute a significant amount to Australia's economy.

Given the fundamental importance of plant biosecurity to our nation, Plant Health Australia collates information from numerous stakeholders to develop the National Plant Biosecurity Status Report each year. This 2016 edition, the ninth in the series, was compiled from over 60 contributions provided by organisations that play a role in protecting Australia. PHA thanks all of the contributors, without whom this report would not be possible.

The report describes the roles that governments play in the system, as well as the efforts of plant industries and individual farmers, our research institutions, community groups, indigenous communities particularly in the tropical north, and every day Australians. It lists the preparedness activities that have been undertaken to identify and protect against particular pest threats, and the RD&E that's happening in our universities and government facilities to assist us with the challenges we face.

The book is written in an accessible style to provide a comprehensive resource for a wide readership. I commend it to you.

Darral Ashton
Chairman
Plant Health Australia

Overview

Due to Australia's geographic isolation and more than a century of effective quarantine measures, Australia is fortunate to be free from many serious plant pests that negatively impact crops overseas. To maintain this favourable situation, Australia places a high priority on plant biosecurity.

From assessments of the pest threats to each industry, Plant Health Australia (PHA) has identified 380 high priority pests that Australia needs to guard against.

Australia's enviable plant pest status confers significant benefits to us all. Not only does it protect our unique natural environment, but it also supports our rural way of life and the economy. The lack of serious pests allows higher yields for farmers, with less pesticide use. This results in cheaper produce and acceptance of our produce around the world.

The definition of a **pest** used in this report (except in Chapter 4) covers insects, mites, snails, nematodes, pathogens (diseases) and weeds that are injurious to plants, plant products or bees. **Exotic** pests are those not currently present in Australia. **Established** or **endemic** pests are those currently present within Australia.

The importance of plant biosecurity

Plant pests are a significant problem worldwide. It is estimated that every year between 20 and 40 per cent of crops are lost to plant pests and weeds globally[1] in addition to the damage done to the environment and social amenity.

While the activities of the Australian Government, such as restrictions on what comes in at international arrival points, are often the most visible aspects of the plant biosecurity system, in fact, all Australians have a role to play in keeping Australia free from new pests. Other key stakeholders with important roles in preventing the spread of weeds and pests include peak industry bodies and their growers, state government agencies, utility providers, local councils, grower groups, transporters, research organisations, international and domestic travellers, gardeners and anyone who visits a farm.

Almost half of Australia's total land area is used for agriculture, some 385 million hectares[2]. Of all the states and territories, Queensland has the highest proportion of agricultural land, with 79 per cent of the state used for agricultural production, followed by NSW with 72 per cent.

Due to wide climate variability across Australia (see Figure 1), producers grow a variety of crop species, each of which has a set of pests that pose a threat to production. Bananas, sugarcane, pineapples and ginger are grown in the tropical and sub-tropical north, while pome and stone fruits, grapes, nuts, onions and potatoes can be cultivated in more southern temperate zones. Vast areas with grassland climate are suited to broadacre production of grains, pulses, cotton, forestry, and pasture for livestock production, and vegetables are grown in many areas. There are 38 crop industries featured later in this chapter.

Most crops grown in Australia are for use domestically, but produce is increasingly being exported overseas, particularly grains, cotton and higher value premium produce. Produce for overseas markets must meet the standards set for market access, which often includes evidence that production areas are free from certain pests.

Together, plant production industries make a significant contribution to the Australian economy, with a gross value of $30 billion in 2015–16 (see Figure 2). This is slightly more than the value of livestock production industries.

Production and trade could be jeopardised by an incursion of a new pest that makes its way into our fields, orchards and plantations.

1 Savary, S, Ficke, A, Aubertot, J-N and Hollier, C (2012). Crop losses due to diseases and their implications for global food production losses and food security. Food Security, 4(4): 519-537

2 Australian Bureau of Statistics, 7121.0 – Agricultural Commodities, Australia, 2014–15

Figure 1. Australia's climate zones allow production of many crops

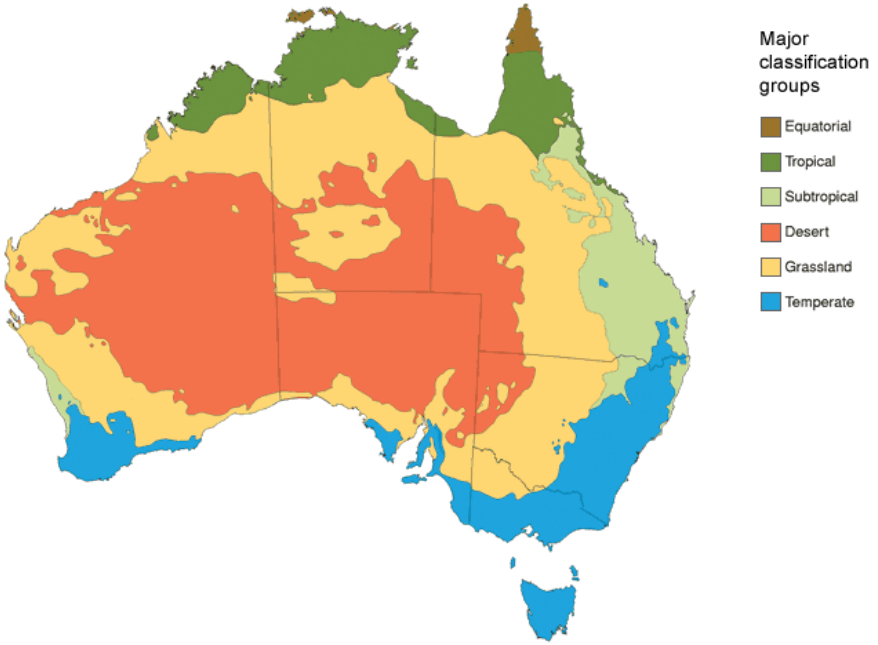
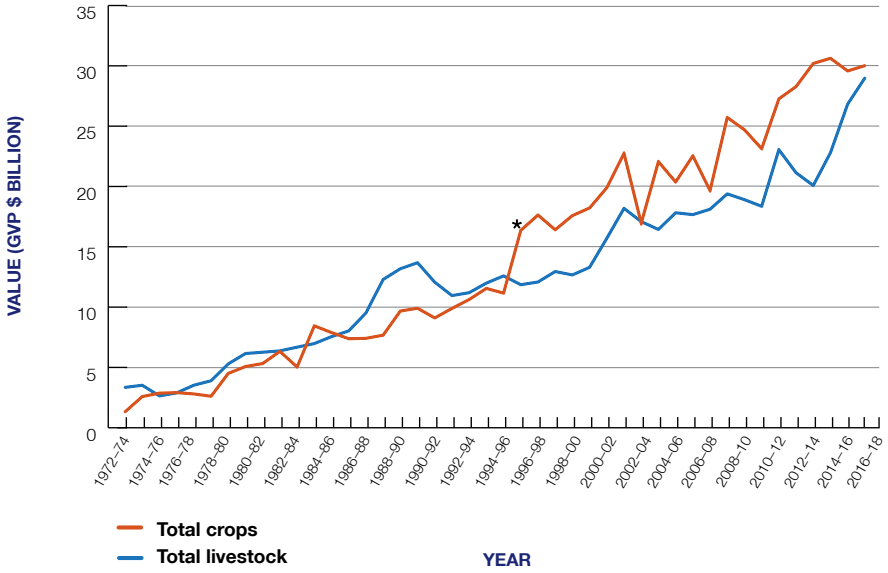


Figure 2. Value of plant and animal production industries in Australia, 1972–2016*



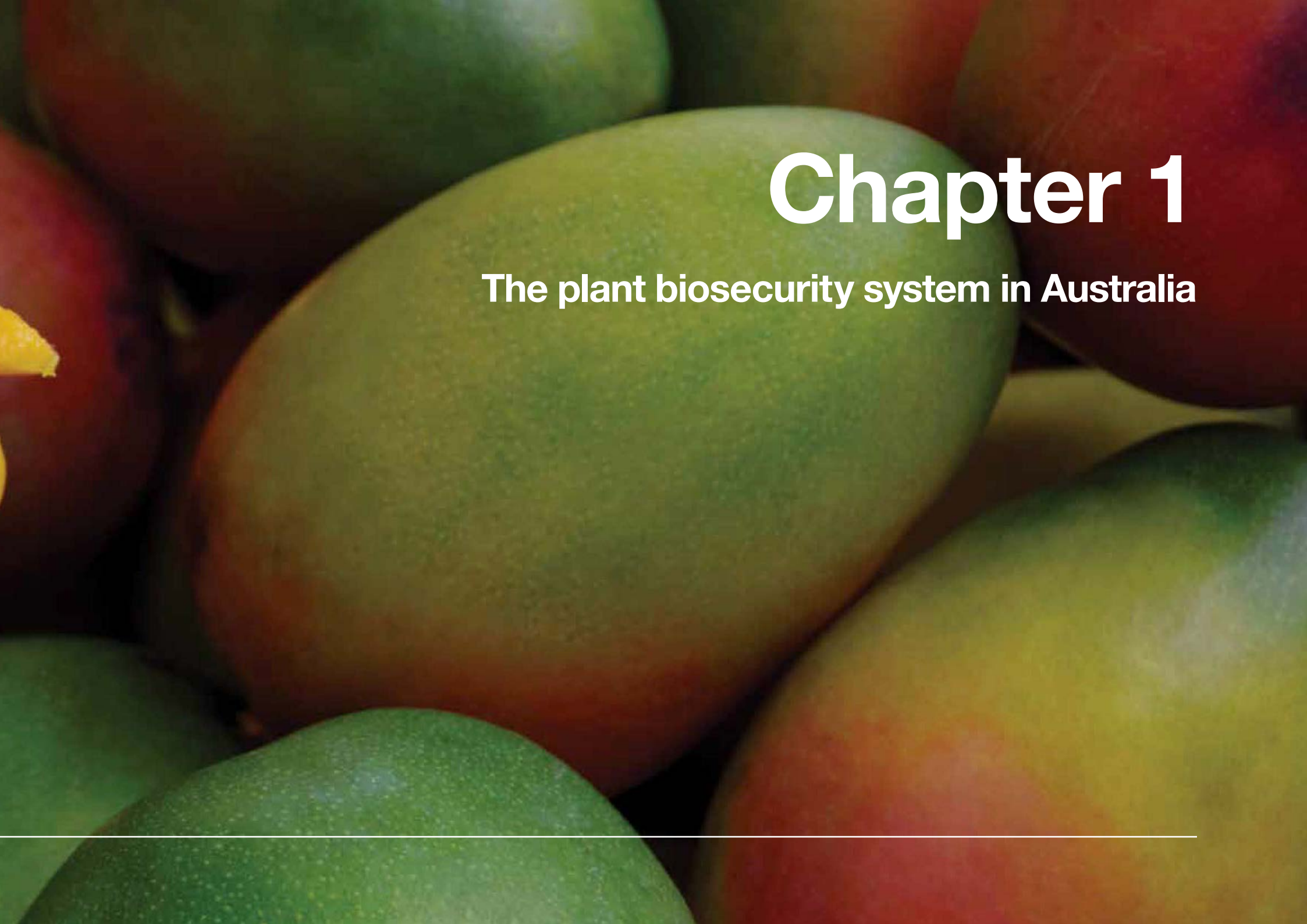
* Includes forestry from 1995–96
Source: ABS 7503 data series, ABARES Agricultural Commodities Vol 5, no. 1 March quarter 2017

Our unique ecosystems also need protection from invasive exotic plant pests, some of which could change the face of the landscape, upset ecosystem food chains and threaten native species. There is much to protect. Australia has a high level of species richness including many native plants and animals that occur nowhere else on Earth. Parklands and other public amenity plantings could also be threatened by the introduction of particular exotic plant pests.

It takes a great amount of effort to keep exotic pests out. Escalating amounts of international trade and the rising amount of movement by people around the globe, together with natural means of entry such as wind and water currents, present enormous challenges.

With a total coastline stretching almost 60,000 km, Australia's borders are protected from plant pests by a collaborative partnership, and by coordinated activities that occur pre-border (overseas), at the border and within Australia (post-border). The plant biosecurity partnership includes plant industries and their growers, the Australian Government, state and territory governments, local governments, researchers, PHA and the wider community including home gardeners.

Chapter 1 provides an overview of the different roles and responsibilities of the key organisations and coordinating committees within Australia's plant biosecurity system, including details about the many plant industries that are members of PHA.



Chapter 1

The plant biosecurity system in Australia

1.1 Plant biosecurity policy and legislation

Australia's plant biosecurity system involves efforts along the whole biosecurity continuum—pre-border, at the border and post-border—not simply restrictions at international entry points. Risk mitigation activities pre-border prevent pests reaching Australia, border restrictions aim to intercept pests, and post-border initiatives focus on regional and interstate restrictions, preparedness and emergency responses within Australia. These activities across the continuum are carried out by a range of stakeholders including a cooperative government-industry partnership.

The framework for managing the cooperative partnership that underpins Australia's effective plant biosecurity system consists of a suite of strategies, policies and legislation. These not only provide the current structure, but provide a vision of how the plant biosecurity system should operate into the future.

Australia's biosecurity system has been reviewed several times. The resulting recommendations have seen the Australian Government Department of Agriculture and Water Resources recognise that a future focused approach is vital to maintain a strong and resilient biosecurity system that will protect Australia from new biosecurity challenges, whatever they may be.

Key themes underpinning continuous improvement to Australia's biosecurity system include:

- Targeting what matters most, including risk-based decision making and managing biosecurity risk across the continuum (pre-border, at the border and post-border).
- Good regulation, including effective legislation and reduced regulatory burden.
- Better processes, including service delivery modernisation and streamlined systems.
- Sharing the responsibility, including maintaining productive relationships with all levels of government, primary industries and the wider Australian public.
- Maintaining a capable workforce.

The benefits of the modern biosecurity system are realised by industry, government and the community, with positive flow-on effects to the economy more generally.

Benefits include streamlined business processes, productivity improvements and reduced regulatory burden in a seamless and lower cost business environment. The system is characterised by evidence and risk-based decision making, the use of intelligence, a single point of regulatory contact and robust partnerships.

INTERGOVERNMENTAL AGREEMENT ON BIOSECURITY

Within government, Australia's partnership approach to biosecurity is underpinned by the Intergovernmental Agreement on Biosecurity (IGAB), which came into effect in January 2012. The IGAB was developed under the Council of Australian Governments and signed by ministers. The IGAB strengthens the working partnership between the Australian Government and state and territory governments by defining the roles and responsibilities of governments, and outlining priority areas for collaboration and improving the national biosecurity system.

Under the IGAB, key aspects of Australia's biosecurity system are becoming better coordinated. Areas addressed include mechanisms to allow emergency response information to be shared between governments, an improved model for managing nationally significant established pests, measures to improve the transparency and rigour of national decision making and investment and a national biosecurity research, development and extension strategy. A public information and stakeholder engagement framework with standardised tools for all jurisdictions has also been developed.

In March 2016 an independent review commenced to ensure our nation's biosecurity system remained current, efficient and flexible with a draft report released in December 2016. A final report is expected in July 2017 that will consider and provide recommendations on seven terms of reference.

NATIONAL PLANT BIOSECURITY STRATEGY

As responsibility for biosecurity management is shared, the agreement also provides opportunities for industries, natural resource managers and the community to work together to achieve some of the reforms outlined in the IGAB. PHA has been an active contributor to this process, and has aligned the National Plant Biosecurity Strategy (NPBS). The NPBS outlines a set of aims and activities to strengthen Australia's plant biosecurity system by 2020. PHA developed the strategy by drawing together the views of stakeholders across Australia.

The NPBS was finalised in December 2010 with endorsement from PHA members, and in 2011 the process of implementing the recommendations began. With the benefits of many of the recommendations cutting across both industries and governments, responsibility for guiding the implementation process is shared among organisations and committees, based on their expertise.

Towards the end of 2014, halfway through its lifespan, PHA reviewed the NPBS and assessed progress against each of the recommended activities. An implementation plan listing the remaining tasks to be completed was published in 2015. All plant biosecurity stakeholders have a role to play in achieving the vision set out for 2020.

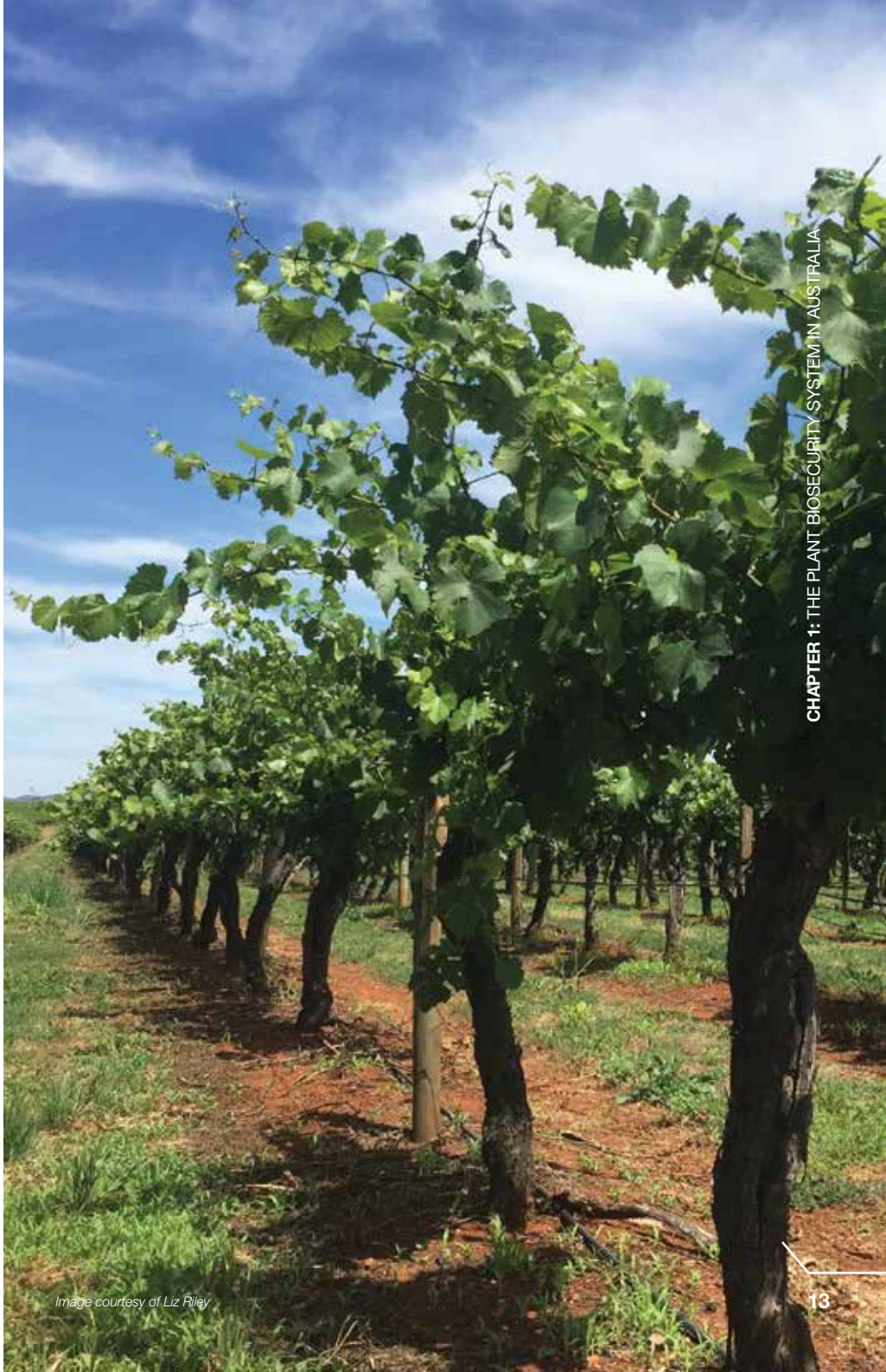


Image courtesy of Liz Riley

The government aspects of implementation are overseen by the Plant Health Committee (PHC) (see Figure 3 on page 17), with specific input from the Subcommittee on Plant Health Diagnostics (SPHD) and the Subcommittee on National Plant Health Surveillance (SNPHS) on implementing the diagnostic and surveillance aspects, respectively. The Subcommittee on Domestic Quarantine and Market Access (SDQMA) works to ensure consistency of biosecurity requirements across states.

Plant industries, PHA and research and development corporations are contributing to NPBS implementation through biosecurity preparedness activities such as developing contingency plans and prioritising threats through the industry biosecurity planning process.

The NPBS continues to provide the focus and strategic direction for national plant biosecurity activities and, through its implementation, will strengthen the plant biosecurity system.

BIOSECURITY LEGISLATION

Australia's biosecurity system operates under Commonwealth, state and territory legislation administered and managed by the respective government agricultural and environmental agencies. Legislation current at 31 December 2016 is listed in Table 1.

Legislation covers a range of activities involving the international movement of people and goods into Australia, movement of goods within the country and the export of agricultural commodities. There are also laws covering related aspects such as the collection of primary industry levies to cover the costs of biosecurity activities, reporting of suspicious pests and biosecurity incident responses.

The *Commonwealth Biosecurity Act 2015* and *Biosecurity (Consequential Amendments and Transitional Provisions) Act 2015* were enacted on 16 June 2016.

The *NSW Biosecurity Act 2015* was assented to in September 2015 and is expected to come into effect in 2017. Queensland also has new legislation, the *Biosecurity Act 2014*, which came into effect 1 July 2016. The legislation in both states brings into law the principle that everyone has a responsibility for mitigating biosecurity risks under their control: that is, a general biosecurity obligation.

Table 1. Plant biosecurity related legislation

Jurisdiction	Administering authority	Legislation
Commonwealth	Department of Agriculture and Water Resources	*Biosecurity Act 2015* *Biosecurity (Consequential Amendments and Transitional Provisions) Act 2015*
Commonwealth	Department of the Environment and Energy	*Environment Protection and Biodiversity Conservation Act 1999* *Environment Protection and Biodiversity Conservation Regulations 2000*
ACT	Environment Planning and Sustainable Development Directorate	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*
NSW	Department of Primary Industries	*Plant Diseases Act 1924* *Plant Diseases Regulation 2008* *Noxious Weeds Act 1993* *Noxious Weeds Regulation 2008* *Apiaries Act 1985* *Stock Diseases Act 1923* *Animal Diseases and Animal Pests (Emergency Outbreaks) Act 1992* *NSW Biosecurity Act 2015**
NT	Department of Primary Industries and Resources	*Plant Health Act 2008* *Plant Health Regulations 2011*
QLD	Department of Agriculture and Fisheries	*Plant Protection Act 1989* *Plant Protection Regulation 2002* *Biosecurity Act 2014*
SA	Primary Industries and Regions	*Plant Health Act 2009* *Plant Health Regulations 2010*
TAS	Department of Primary Industries, Parks, Water and Environment	*Plant Quarantine Act 1997* *Weed Management Act 1999*
VIC	Department of Economic Development, Jobs, Transport and Resources	*Plant Biosecurity Act 2010* *Plant Biosecurity Regulations 2012*
WA	Department of Agriculture and Food	*Biosecurity and Agricultural Management Act 2007*

** Not yet enacted*

1.2 National committees

National committees provide a mechanism for developing and coordinating key plant biosecurity policy and procedures across jurisdictions. As a representative or observer at meetings, PHA is able to provide a link back to other members, particularly peak industry bodies, and other organisations with a stake in biosecurity. Figure 3 shows the structure of Australian plant related committees that are tasked with national coordination. PHA has observer status at National Biosecurity Committee (NBC), and is a member of Plant Health Committee (PHC) and the three PHC subcommittees, as well as the majority of emergency response committees.

The Agriculture Senior Officials Committee (AGSOC) is responsible for primary industry policy issues. AGSOC comprises the heads of primary industry government departments from the Australian Government, Australian states and territories and the New Zealand government. AGSOC is supported by the NBC.

NATIONAL BIOSECURITY COMMITTEE

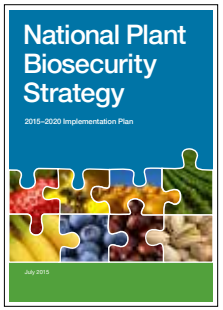
The National Biosecurity Committee is responsible for managing a national, strategic approach to biosecurity issues relating to plant and animal pests and diseases, marine pests and aquatics, and the impact of these on agriculture production, the environment, community wellbeing and social amenity. A core objective of the committee is to promote cooperation, coordination, consistency and synergies across and between Australian governments. The NBC reports to ministers responsible for biosecurity through relevant Chief Executive Officers.

The Secretary of the Department of Agriculture and Water Resources chairs the NBC as a member of the AGSOC. The Australian Government is also represented by the Department of Agriculture and Water Resources' Deputy Secretary responsible for biosecurity, and a Deputy Secretary from the Department of the Environment (or delegate). PHA and Animal Health Australia are observers.

Remaining members are senior representatives from primary industry or environment departments for each state and territory. Jurisdictions may have up to two representatives.

PLANT HEALTH COMMITTEE

The Plant Health Committee (PHC) is the peak government plant biosecurity policy forum. Its role is to maintain or improve plant health in Australia in support of the economy, environment and community. PHC provides strategic policy, technical and regulatory advice, and national leadership on plant biosecurity matters. It has responsibility for overseeing the implementation of the government aspects of the National Plant Biosecurity Strategy (NPBS) and the Intergovernmental Agreement on Biosecurity (IGAB) with respect to plant health. The Committee reports to the National Biosecurity Committee (NBC).

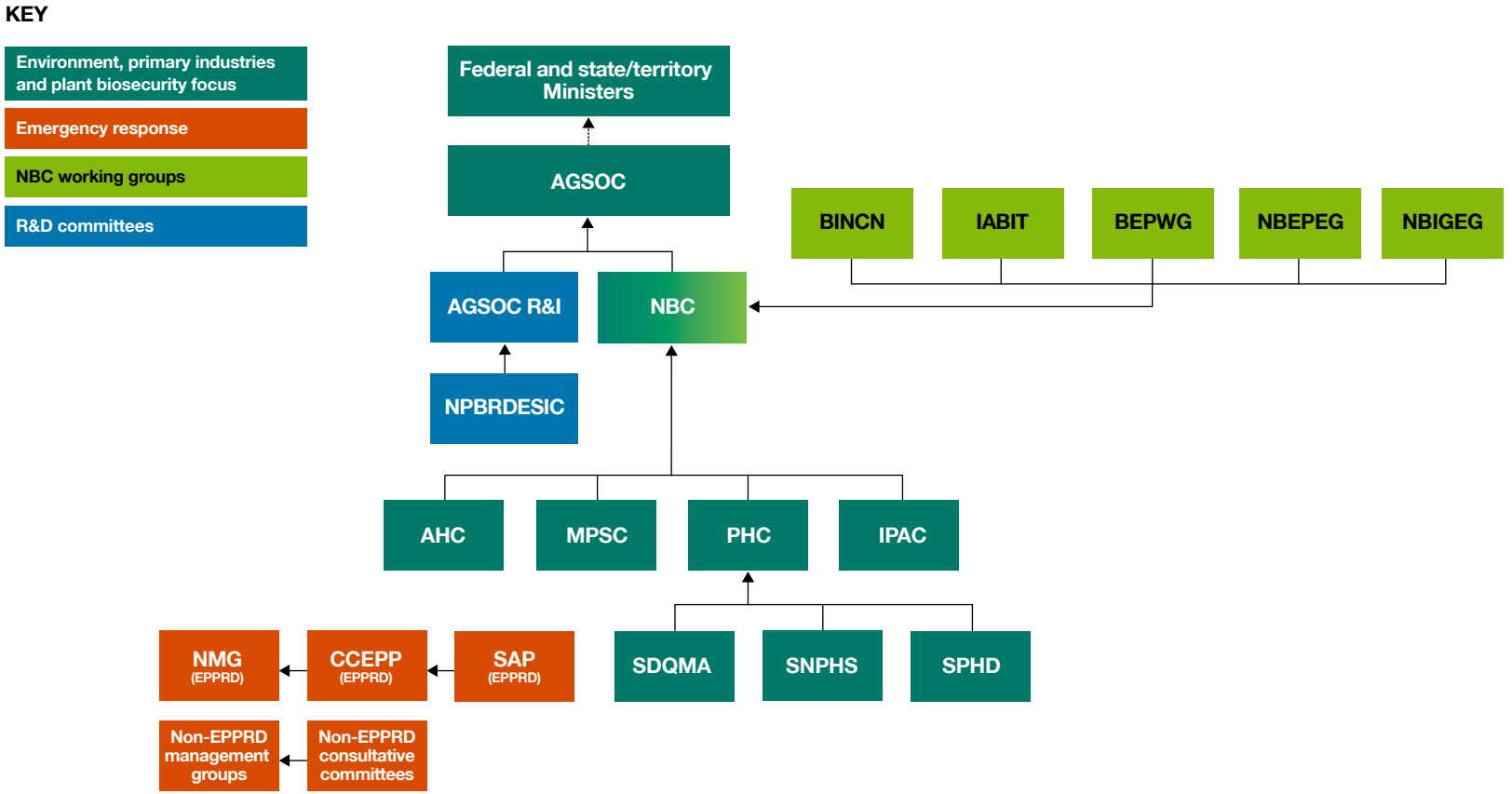


Through its subcommittees, currently the Subcommittee on Plant Health Diagnostics (SPHD), Subcommittee on National Plant Health Surveillance (SNPHS) and Subcommittee on Domestic Quarantine and Market Access (SDQMA), PHC also facilitates a consistent national approach to legislative outcomes and standards within the plant biosecurity sector. PHC's membership comprises representatives from the Australian, state and territory governments. PHA and subcommittee chairs have observer status and attend PHC meetings.

In 2016 PHC continued implementation of the NPBS, using the document as one of the main guiding principles when determining work area priorities. PHC also continued to progress various lines of work to support and maintain trade and market access, both domestically and internationally.

Further information on PHC can be found at **agriculture.gov.au/plant/health/committees/phc**

Figure 3. National biosecurity committees and the associated working groups



Abbreviations	
AGSOC	Agriculture Senior Officials Committee
AGSOC R&I	Agriculture Senior Officials Committee Research & Innovation Committee
AHC	Animal Health Committee
BEPWG	Biosecurity Emergency Preparedness Working Group
BINCN	Biosecurity Incident National Communication Network
CCEPP	Consultative Committee on Emergency Plant Pests
EPPRD	Emergency Plant Pest Response Deed

Abbreviations	
IABIT	Intergovernmental Agreement on Biosecurity Implementation Taskforce
IPAC	Invasive Plants and Animals Committee
MPSC	Marine Pest Sectoral Committee
NBEPEG	National Biosecurity Emergency Preparedness Expert Group
NBIGEG	National Biosecurity Information Governance Expert Group
NBC	National Biosecurity Committee
NMG	National Management Group

Abbreviations	
NPBRDESIC	National Plant Biosecurity Research, Development & Extension Strategy Implementation Committee
PHC	Plant Health Committee
SAP	Scientific Advisory Panel
SDQMA	Subcommittee on Domestic Quarantine and Market Access
SNPHS	Subcommittee on National Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics

Prune Harvest. Image courtesy of Ann Furner

1.3 Australian Government plant health services

Australian Government plant biosecurity responsibilities are delivered principally through the Agriculture portfolio, in collaboration with other agencies described below.

DEPARTMENT OF AGRICULTURE AND WATER RESOURCES

Australia's approach to managing the risk of incursions by exotic pests is multi-layered, involving complementary measures applied along the biosecurity continuum: pre-border, at the border and post-border. The Department of Agriculture and Water Resources' core priorities in managing biosecurity are to:

- Effectively identify risks and direct resources to the areas of greatest return from a risk management perspective.
- Partner with other governments, industry, clients and stakeholders to manage Australia's biosecurity.
- Deliver biosecurity services to support access to overseas markets and protect the economy and the environment from the impacts of unwanted pests.
- Support Australia's reputation as a competitive exporter of agricultural goods and products.

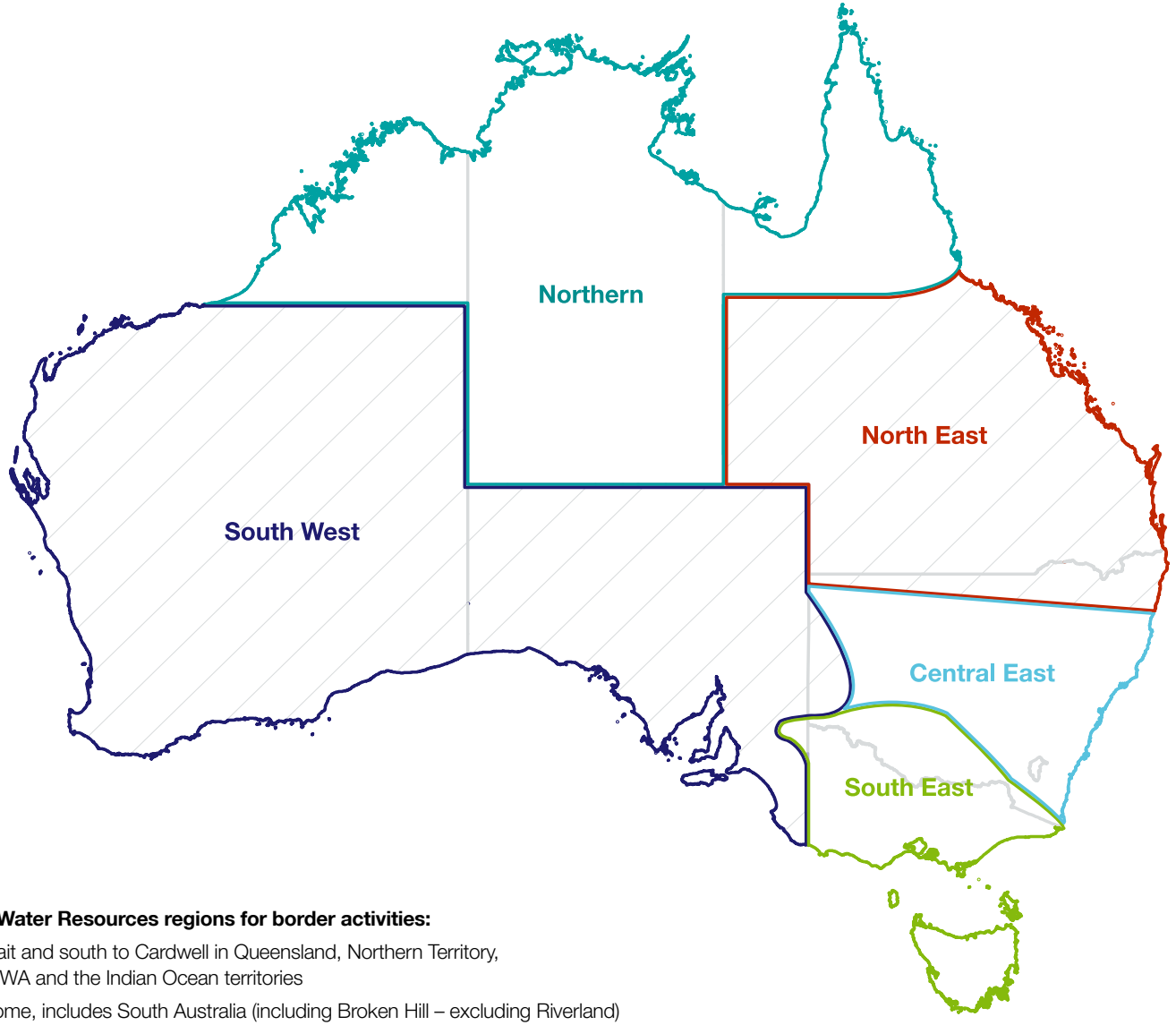
The Department of Agriculture and Water Resources also pursues international market access for Australia's produce and access to the Australian market for our trading partners through bilateral, regional and multilateral engagement. Priority is given to:

- Working to remove impediments to international trade.
- Progressing and resolving market access issues for portfolio industries.
- Facilitating targeted technical assistance and agricultural cooperation in support of portfolio interests.
- Assisting the development of international standards for portfolio products and industries.

The market access work of the Department of Agriculture and Water Resources is supported and enhanced by a network of agricultural counsellors located in China, Europe, India, Indonesia, Japan, Korea, the Middle East, Thailand and the United States. Through its overseas network, the department pursues international market access in important and emerging markets for Australian portfolio industries. The overseas network works with government partners and industry to remove distortions to international trade, and to progress and resolve market access issues. The network facilitates targeted technical assistance and agricultural cooperation in support of portfolio interests, and influences the development of international standards.

See Chapter 3 for more on the Australian Government's activities pre-border, at the border and post-border.

Figure 4. Regional boundaries for Department of Agriculture and Water Resources border biosecurity operations



Department of Agriculture and Water Resources regions for border activities:

Northern	Includes Torres Strait and south to Cardwell in Queensland, Northern Territory, west to Broome in WA and the Indian Ocean territories
South West	From south of Broome, includes South Australia (including Broken Hill – excluding Riverland)
South East	Includes Tasmania, Riverland and extends north to Riverina and east coast NSW to Eden
Central East	Includes NSW with the exception of Eden and areas south, Riverina and far north coast
North East	Extends from Cardwell in Queensland to far north coast NSW, south to Grafton

DEPARTMENT OF FOREIGN AFFAIRS AND TRADE

The purpose of the Department of Foreign Affairs and Trade (DFAT) is to help make Australia stronger, safer and more prosperous by promoting and protecting our interests internationally and contributing to global stability and economic growth. The department provides foreign, trade and development policy advice to the government and works with other government agencies to coordinate Australia's global, regional and bilateral interests.

DEPARTMENT OF ENVIRONMENT AND ENERGY

The Department of the Environment and Energy is responsible for contributing to the development of national policies on pests and invasive plants that cause harm to the environment.

The Department of the Environment and Energy is also responsible under the *Environment Protection and Biodiversity Conservation Act 1999* for assessing the environmental impact associated with proposals to import live species (except plants, the approvals of which are done in accordance with the *Biosecurity ACT 2015*) and ensuring that Australia complies with its obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It also provides advice to the Department of Agriculture and Water Resources on environmental issues in relation to risk assessments.

DEPARTMENT OF IMMIGRATION AND BORDER PROTECTION

The Department of Immigration and Border Protection manages the security and integrity of Australia's borders. It works closely with other government and international agencies, in particular the Australian Federal Police, the Department of Agriculture and Water Resources and the Department of Defence, to regulate and control the movement of goods and people across the Australian border.

DEPARTMENT OF INDUSTRY, INNOVATION AND SCIENCE

The vision for the Department of Industry, Innovation and Science is to enable growth and productivity for globally competitive industries. One of the four key objectives of the department is to support science and commercialisation through policy, various funding programs and multi-layered initiatives aimed at securing Australia's industry innovation and competitiveness.

OTHER GOVERNMENT ORGANISATIONS

Within the Department of Agriculture and Water Resources, the Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES) provides current scientific and economic advice to decision makers to support the plant biosecurity system. Other Australian Government agencies that contribute to maintaining Australia's plant biosecurity system include the CSIRO, the Office of the Gene Technology Regulator (OGTR), and the Australian Pesticides and Veterinary Medicines Authority (APVMA).

The Australian Trade Commission, Austrade, is the Australian Government's trade, investment and education promotion agency. Austrade's role is to advance Australia's international trade, investment and education interests by providing information, advice and services.

The Australian Centre for International Agricultural Research (ACIAR) is a statutory authority that operates as part of the Australian Government's development cooperation programs. ACIAR encourages Australia's agricultural scientists to use their skills for the benefit of developing countries and Australia.

1.4 State and territory plant biosecurity services

Under the Australian Constitution, state and territory governments are responsible for the delivery of plant biosecurity operations and the supporting legislation within their borders. While each state and territory has a different approach to the role, primarily due to the varied climatic conditions and legislative frameworks across the country, jurisdictions each provide a number of core services. These include:

- Management of state and territory imports and exports:
  - State quarantine services for the clearance of passengers, cargo, mail, plants and plant products moving interstate.
  - Export and market access support, including plant health certification services, the accreditation and auditing of export compliance arrangements, and surveys and inspections to support area freedom.
- Emergency response services, involving activities to prepare for, and respond to, a plant pest incursion.
- Delivery of responsibilities under the Emergency Plant Pest Response Deed (EPPRD) (Chapter 4).
- Core services to support biosecurity:
  - Surveillance and monitoring for early detection of pests, maintaining area freedom and delimiting the extent of pests, in partnership with industry surveillance.
  - Diagnostic services to identify plant pests (both endemic and exotic) found in a broad range of crops.
  - The development and maintenance of information systems to support routine and emergency plant biosecurity management.
  - Communication programs to raise awareness of biosecurity.
- Science based risk analysis to identify pest threats and inform plant biosecurity policy and operations.
- Research, development and extension (RD&E) to support the continued improvement of pest management and protection capabilities.
- Development and administration of plant biosecurity policies and legislation.

State and territory governments work with the Australian Government in a manner set out in the Intergovernmental Agreement on Biosecurity (Section 1.2). The National Biosecurity Committee is responsible for managing a national approach to all biosecurity issues. Each state and territory has developed a biosecurity strategy, with WA, NT and ACT all releasing updates in 2016.

Preventing pests from hitchhiking around Australia

Just as there are restrictions on what can be brought into Australia from overseas, there are also rules on what can and can't be moved within the country, to prevent plant pests hitchhiking from one place to another.

Working closely with the Quarantine Domestic program, PHA developed a new website to improve awareness of interstate quarantine rules in 2016.

The Australian Interstate Quarantine website now features an interactive map that shows what can and cannot be carried on a particular trip across interstate borders and regional quarantine zones.

The rules apply to holiday travellers, people moving house, beekeepers shifting hives to provide pollination services, contractors taking machinery from one area to another, and any other movements involving plants, animals, soil, machinery and recreational equipment.

Farmers selling produce interstate or out of regions are also subject to restrictions. A second part of the website holds Interstate Certification Assurance documents – agreed procedures that produce must go through before it is transported to another state or another zone within a state. The procedures ensure that farmers are not sending pests with their goods for sale.

The Australian Interstate Quarantine website is **interstatequarantine.org.au**. A quick check of the rules before travelling or transporting goods can help avoid any on-the-spot fines that may apply.

AUSTRALIAN CAPITAL TERRITORY

Lead agency: Environment Planning and Sustainable Development Directorate (EPSD)
environment.act.gov.au

The ACT Government manages plant biosecurity through the EPSD Directorate, together with Transport Canberra and City Services (TCCS). EPSD is responsible for the policy development and shares operational implementation with TCCS.

Although the ACT does not have many plant production industries, the government is represented on national committees during plant pest emergency responses and participates in the development of associated national frameworks and strategies when it has the expertise to contribute.

Plant biosecurity activities in the ACT are underpinned by the *Plant Diseases Act 2002*, the *Pest Plants and Animals Act 2005*

During 2016 international flights to Canberra International Airport began. As a result, the ACT has begun surveillance around the airport to check for any introduced exotic fruit flies, Asian gypsy moth and pine beetle.

NEW SOUTH WALES

Lead agency: Department of Primary Industries (NSW DPI)
dpi.nsw.gov.au

NSW DPI is the principal agency responsible for plant biosecurity in the state, ensuring that policies, management and procedures are in place to minimise the impact of existing, invasive and emergency pests. NSW DPI maintains rapid response mechanisms for pest incursions in order to protect trade and market access, agricultural resources, regional economies and the environment.

The NSW Biosecurity Strategy 2013–21 defines how NSW DPI, in partnership with other government agencies, industry and the public, manages biosecurity risks to NSW.

Within NSW DPI, the Plant Biosecurity and Product Integrity unit develops plant pest policy directions and has oversight of operational responses to Emergency Plant Pests. The group provides advice to, and participates actively in, national decision making forums for plant pests of national significance and interstate market access for NSW plants and plant products.

Diagnosis and surveillance activities are supported by the Plant Health Diagnostic Service at Elizabeth Macarthur Agricultural Institute, the Biosecurity Collections unit at Orange Agricultural Institute, the state-wide network of compliance officers and the emergency management First Response Team.

Close collaboration is established with entomology and plant pathology researchers and with the state-wide Local Land Services network.

Current legislation underpinning the NSW Government's plant biosecurity activities administered by NSW DPI are the *Plant Diseases Act 1924* No. 38 and the *Plant Diseases Regulation 2008*. In 2017 the *NSW Plant Diseases Act 1924* will be rescinded and powers to respond to plant pests and diseases will be provided by the *NSW Biosecurity Act 2015* which was passed by the NSW parliament in September 2015.

NORTHERN TERRITORY

Lead agency: NT Department of Primary Industry and Resources (NT DPIR)
dpir.nt.gov.au

Plant biosecurity in the NT is managed by the Plant Biosecurity Branch, within NT DPIR's Biosecurity and Animal Welfare Division. The Plant Biosecurity Branch is responsible for the development and implementation of plant biosecurity policies, programs and procedures aimed at maintaining NT's freedom from plant pests that could adversely impact on trade, market access, public health and the environment.

The objectives of the Plant Biosecurity Branch include:

- Maintaining and improving the plant health status of the plant and plant product industries of NT.
- Minimising the risk of exotic pests entering NT through compliance and surveillance.
- Facilitating interstate trade of plant and plant products through certification, inspection and the Interstate Certification Assurance program.
- Conducting active and passive pest surveillance to support market access nationally and within NT.
- Conducting active surveillance for the early detection of a range of Emergency Plant Pests.
- Preparing for effective emergency response mechanisms in the event of an Emergency Plant Pest incursion.
- Developing, implementing and reviewing NT's plant health policy and legislation.

The Plant Biosecurity Program is underpinned by the *Plant Health Act 2008* and the *Plant Health Regulations 2011*. The Act and Regulations aim to minimise the risk of plant pests entering and establishing in the NT through movement and importation controls on plants and plant products. They also provide the powers to ensure appropriate action can be taken for the control of pests if an incursion were to occur.

QUEENSLAND

Lead agency: Queensland Department of Agriculture and Fisheries (QDAF)
daf.qld.gov.au

Within QDAF, Biosecurity Queensland is responsible for: developing policies, standards, delivery systems and services to reduce the risk of introduction of exotic plant pests; minimising the impacts of new plant pest incursions on Queensland's plant industries, environment and communities; and preserving and expanding market access for Queensland's plant based industries. The Plant Biosecurity and Product Integrity program within Biosecurity Queensland has responsibility for plant biosecurity, diagnostics and the implementation of programs for the detection, control and prevention of certain plant pests.

Agri-Science Queensland, a division of QDAF, undertakes research, development and extension on a wide range of plant pests in the cropping, horticultural and forestry industries. The group provides additional diagnostic capability, undertakes surveillance and develops integrated management packages to limit the impacts of pests within farming systems.

Currently, plant biosecurity management in Queensland is underpinned by the *Biosecurity Act 2014* and *Biosecurity Regulation 2016* which are focused on preventing, controlling and removing pest infestations of plants. This legislation is also complemented by a number of other acts, including the *Chemical Usage (Agricultural and Veterinary) Control Act 1988* and the *Agricultural and Veterinary Chemicals (Queensland) Act 1994*.

The *Biosecurity Act 2014* commenced on 1 July 2016. It ensures a consistent, modern, risk-based and less prescriptive approach to biosecurity in Queensland.

SOUTH AUSTRALIA

Lead agency: Department of Primary Industries and Regions SA (PIRSA)
pir.sa.gov.au

Biosecurity SA, a division within PIRSA, is responsible for the development and implementation of plant biosecurity policies, programs and procedures aimed at maintaining SA's freedom from pests that could adversely impact trade, market access, public health, food safety, the rural economy and the environment.

Given SA's freedom from fruit flies of economic significance, PIRSA has a strong focus on operations aimed at preventing their entry and establishment. These activities include a dedicated state wide fruit fly trapping grid, static quarantine stations and random roadblocks, targeted awareness and education campaigns, and specific measures to effectively respond to and eradicate any fruit flies detected.

The South Australian Research and Development Institute (SARDI) is the state government's principal research institute and provides Biosecurity SA with plant diagnostic, pathology and entomology advice. SARDI also undertakes targeted research and development to reduce losses from plant diseases across cereal, pulse, pasture, viticulture and horticulture industries. This includes delivery of plant health diagnostic services to growers, consultants, state and national plant biosecurity authorities. The group collaborates closely with breeding companies, pre-breeding programs and the private sector to develop disease resistant plant varieties.

Plant biosecurity programs in SA are underpinned by the *Plant Health Act 2009* and *Plant Health Regulations 2009*. In addition, the *Plant Quarantine Standard SA* has been established under the Act to identify the relevant conditions of entry for fruit, vegetables, plants, plant products, machinery or equipment of biosecurity concern.

TASMANIA

Lead agency: Department of Primary Industries, Parks, Water and Environment (DPIPWE)
dpipwe.tas.gov.au

The DPIPWE Biosecurity Tasmania Division manages biosecurity policy and programs for plant pests. Branches within this division are responsible for the development and implementation of policies on barrier control, surveillance and monitoring, risk analysis, Emergency Plant Pest (EPP) response and incursion management and plant biosecurity communications.

Central to biosecurity emergency preparedness in Tasmania is the Biosecurity Emergency Preparedness Program. This program features an all-hazard approach and all Biosecurity Emergency Response Team (BERT) members receive the same training regardless of whether they are from animal, plant, fisheries or natural resource areas. At present BERT consists of over 100 registered volunteers. The Tasmanian Government's Biosecurity Policy and the Tasmanian Biosecurity Strategy 2013–17 provide the state framework for all government biosecurity actions and decision making processes, including EPP responses.

Plant biosecurity in Tasmania is underpinned by the *Plant Quarantine Act 1997*. When needed, this is complemented by the *Emergency Service Act 1976.* This legislation has been shown to provide an appropriate range of specific and general legislative functions and powers to deal with prevention, monitoring, control and eradication of plant pests. In addition, the various Tasmanian Government agency responsibilities are detailed in the Tasmanian Emergency Management Plan, which includes details of biosecurity emergency response arrangements.

VICTORIA

Lead agency: Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR)
ecodev.vic.gov.au

Agriculture Victoria, within DEDJTR, delivers biosecurity programs across the agriculture, horticulture, forest and amenity plant sectors. Activities undertaken within these programs aim to minimise the impact of Emergency Plant Pest incidents on the environment and production systems and maintain access to local and overseas markets.

The Chief Plant Health Officer Unit within the Biosecurity Branch is responsible for the development, review and monitoring of policies, protocols and procedures in accordance with national and international obligations. The Agriculture Service Biosecurity Operations Division delivers operational functions from a number of regional centres according to technical standards and protocols which are underpinned by the *Plant Biosecurity Act 2010*. Opportunities are provided under the legislation for producers and marketers to adopt quality assurance arrangements which are subject to regular audit and improvements.

Scientific and diagnostic support is provided by Agriculture Victoria Research. Staff provide expert technical advice to assist with incursion responses, market access programs and other biosecurity initiatives (e.g. development and review of industry biosecurity plans) as well as technical expert representation on national committees and working groups. This team and its associated Crop Health Services diagnostic business supports biosecurity by conducting relevant research and providing diagnoses in the areas of entomology, mycology, nematology, virology and bacteriology. Specialist diagnostic services and expertise has also been provided to interstate jurisdictions to support national incursion responses.

WESTERN AUSTRALIA

Lead agency: Department of Agriculture and Food WA (DAFWA)
agric.wa.gov.au

Maintaining market access and the productive capacity of the agriculture and food sectors are the key drivers for DAFWA investment in biosecurity services. This contributes to market competitiveness, profitability and sustainability in WA. Biosecurity services are delivered through a network of dedicated and skilled staff throughout the state. A new objective is to review the current state of Western Australian grains and horticulture industries' biosecurity and market access risk management, and provide policy and action plan to build and maintain Biosecurity and Market Access Preparedness (BIOMAP) for the industry supply chain – a state of readiness to manage biosecurity and market access risks.

Plant biosecurity in WA is governed mainly by the *Biosecurity and Agriculture Management Act 2007*. This Act establishes a modern biosecurity regulatory system to control the entry, establishment, spread and impact of pests, control the use of agricultural and veterinary chemicals, establish standards to ensure the safety and quality of agricultural products and raise funds for biosecurity related purposes.

New SA sterile insect facility to tackle fruit fly

Each year, damage to produce caused by Queensland fruit fly (Qfly, *Bactrocera tryoni*) is estimated to cost the Australian horticultural industry $300 million. As part of the national efforts to combat this pest, a $3.8 million National Sterile Insect Technology Facility was officially opened in Port Augusta, SA in November 2016.

The sterile insect technique (SIT) sees the large scale release of sterilised male insects that flood an area and compete with wild pest populations. When mated, the wild females produce non-viable eggs, reducing the size of the next generation. Over time, and combined with other control measures, this can lead to the localised eradication of the pest.

The initiative has huge potential for controlling fruit fly. When fully operational, the new facility will produce 50 million sterile male flies a week that can be used to assist producers of a range of fruit and vegetable crops to combat Qfly damage.

SIT is one method of control that will be used alongside a suite of measures such as on-farm hygiene, mass trapping, bait sprays. Combined with postharvest treatments and cool storage, this will assist growers produce high quality produce and access premium markets.

The new facility is funded as part of the National SITplus Consortium investment of $50 million over five years, with R&D focused on developing the flies, area wide management and release strategies, and smart technology.

SITPlus is an industry and government partnership involving Hort Innovation, PIRSA, SARDI, DEDJTR, CSIRO, Plant and Food Research Australia, NSW Department of Primary Industries and Macquarie University.

National Sterile Insect Technology Facility, Port Augusta

National Sterile Insect Technology Facility, Port Augusta

1.5 Private sector plant biosecurity services

In addition to the activities performed by the Australian and state and territory governments and industry bodies, the private sector makes a large contribution to the plant biosecurity system.

PRIVATE CONSULTANTS AND COMMERCIAL AGRONOMISTS

Private consultants and advisers provide a wide range of professional services to plant production industries and their growers in Australia. Across a range of crop types, and in most key production areas, consultants provide extensive plant biosecurity extension advice.

In addition to private consultants, commercial agronomists work across a wide range of Australian plant production industries, providing local services through the major distribution chains. They are backed by national technical networks which provide a comprehensive suite of services to agricultural industries. This group of professional agriculturalists supply a variety of free and consultative services across the spectrum of crops grown in Australia, including specialty services for plant biosecurity issues.

Aerial spraying is undertaken during the main flowering period of bitou bush in Autumn and Winter. Image courtesy of News of the Area, Medowie and Myall Coast

PROFESSIONAL ASSOCIATIONS

A number of Australian societies and associations whose membership includes scientific professionals are linked with plant biosecurity. These organisations contribute to the development of Australia's plant biosecurity system through a range of activities including:

- Peer reviews and publication of research findings.
- Provision of pest, disease and weed notes.
- Scientific reviews.
- Convening forums to share plant biosecurity research.
- Independent comment and input into the development and implementation of plant biosecurity policy and the development of international phytosanitary standards.
- Encouraging professionalism amongst plant scientists and technicians.

Key associations include the Australasian Plant Pathology Society, the Australian Society for Microbiology, the Australian Entomological Society, the Australian Society of Agronomy, the Council of Australian Weed Societies and Ag Institute Australia.

AUSTRALIAN AERIAL AGRICULTURE OPERATORS

Aerial agriculture has played an important role in Australian agriculture for over half a decade. Some 300 agricultural aircraft are used to efficiently apply fertilisers, seed and, importantly for biosecurity, pesticides to a range of crops.

Aerial application allows registered farm chemicals to be used particularly when the height of the crop limits access from the ground, when a pest has to be managed within a short window of opportunity or when weather or soil conditions prevent wheeled access to a crop.

Agricultural aircraft pilots are highly trained and enable growers to have access to a range of professional specialised application services.

1.6 Plant Health Australia

PHA is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, PHA services the needs of its members and independently advocates on behalf of the national plant biosecurity system to benefit plant industries and the environment.

PHA achieves this by:

- Enhancing the commitment of governments and industries to work together.
- Enhancing the operation and integrity of Australia's plant pest emergency response arrangements.
- Assisting national management of biosecurity risks.
- Monitoring performance and promoting continual improvement of Australia's plant biosecurity system.
- Determining future needs of Australia's plant biosecurity system.
- Facilitating improved national investment in plant biosecurity.

PHA's efforts help to:

- Minimise plant pest impacts.
- Enhance Australia's plant health status.
- Assist trade both domestically and internationally.
- Safeguard the livelihood of producers.
- Support the sustainability and profitability of plant industries and the communities that rely upon them.
- Preserve environmental health and amenity.

All Australian governments and most major plant-based agricultural industries are members of PHA, bringing the total number to 58. Table 2 gives a full list of industry, government and associate members. The honey bee industry are members with PHA because of the benefits that pollination brings to crop yield.

Being a member enables parties to work together on biosecurity issues. It also gives members the option of being a signatory to the Emergency Plant Pest Response Deed (EPPRD), providing significant benefits for all parties in the event of an Emergency Plant Pest incursion.

Table 2. Plant Health Australia's members at end December 2016

Industry members
Almond Board of Australia Inc
Apple and Pear Australia Ltd
Australian Banana Growers' Council Inc
Australian Blueberry Growers' Association Inc
Australian Forest Products Association Limited
Australian Ginger Industry Association Inc
Australian Honey Bee Industry Council Inc
Australian Lychee Growers' Association Inc
Australian Macadamia Society Ltd
Australian Mango Industry Association Ltd
Australian Melon Association Inc
Australian Olive Association Ltd
Australian Processing Tomato Research Council Inc
Australian Sweet Potato Growers Inc
Australian Table Grape Association Inc
Australian Truffle Growers' Association Inc
Australian Vigerons
Australian Walnut Industry Association
AUSVEG Limited
Avocados Australia Ltd
CANEGROWERS
Canned Fruit Industry Council of Australia
Cherry Growers of Australia Inc
Chestnuts Australia Inc
Citrus Australia Ltd
Cotton Australia Ltd
Dried Fruits Australia Inc
Grain Producers Australia Limited
GROWCOM
Hazelnut Growers of Australia Inc
Nursery and Garden Industry Australia Ltd
Onions Australia
Passionfruit Australia Incorporated
Pistachio Growers' Association Incorporated
Raspberries and Blackberries Australia Inc
Ricegrowers' Association of Australia Inc
Strawberries Australia Inc
Summerfruit Australia Limited

Government members
Australian Capital Territory Government
Commonwealth of Australia
New South Wales Government
Northern Territory Government
Queensland Government
South Australian Government
Tasmanian Government
Victorian Government
Western Australian Government

Associate members
AgNova Technologies
Australian Grape and Wine Authority (Wine Australia)
Cotton Research and Development Corporation
CSIRO
Grains Research and Development Corporation
Horticulture Innovation Australia Ltd
Lawn Solutions Australia
Northern Territory Farmers Association Inc
Plant Biosecurity CRC Ltd
Sugar Research Australia
Victorian Farmers Federation
Vinehealth Australia

FACILITATING PARTNERSHIPS

Plant biosecurity in Australia operates as a partnership between governments and industries that together are responsible for maintaining the integrity and performance of the plant biosecurity system. The principle of biosecurity partnerships was established in recognition that, in addition to plant producers, the wider Australian community benefits from good biosecurity. Benefits include improved productivity, product quality, market access, trade, profitability, sustainability and environmental preservation.

Fostering, strengthening and expanding the government-industry partnership is a primary role for PHA. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed upon, issues identified and solutions to problems found. PHA's autonomy fosters an impartial approach to servicing member needs, allowing the company to put the interests of the plant biosecurity system first, as well as supporting a long-term view.

PROVIDING STRATEGIC PERSPECTIVE

PHA's independence and expertise enable the company to take a lead in monitoring the performance of the national biosecurity system and determining its future needs. In close consultation with stakeholders, PHA formulates the strategies, plans and reports that contribute to government and industry policy development, facilitates improved national coordination and collaboration, and targets member efforts and investment to best effect. The National Plant Biosecurity Strategy (Section 1.1) and this status report are examples of this work.

FACILITATING EMERGENCY RESPONSES TO EXOTIC PLANT PESTS

Another central role for PHA is the establishment of funding and management arrangements for effective responses to Emergency Plant Pest incursions. PHA undertakes this role through its custodianship and administration of the EPPRD and PLANTPLAN, the agreed operational response plan for suspected exotic pests of significance (Chapter 4).

PHA convenes regular meetings of signatories to the EPPRD to facilitate modifications to the agreement to take account of new information and procedural improvements that are identified through post-incident reviews. To assist members to meet their obligations as signatories to the EPPRD and improve their emergency response preparedness, PHA provides a range of services including contingency planning, surveillance and diagnostic systems support, response training and simulation exercises.

MITIGATING RISKS POSED BY PESTS

Beyond its contribution to response arrangements, PHA supports the national plant biosecurity system by coordinating and assisting efforts to reduce the risks posed by Emergency Plant Pests. This is achieved in large part by supporting industries and governments to develop strategies and plans that improve biosecurity standards as well as providing assistance with implementation of agreed risk mitigation measures. Biosecurity plans, biosecurity manuals for producers and awareness raising extension services are examples of activities that PHA undertakes with and on behalf of members.

FUNDING

PHA's main activities are funded from annual subscriptions paid by members, as detailed in PHA's Annual Operational Plan. A range of separately funded projects are also undertaken for individual members or groups of members. Non-subscription funded projects boost biosecurity for particular industries. Examples include biosecurity officers who work with growers, government and industry partnership initiatives for honey bee health, and the development of manuals and plans for non-members. The exposure of PHA staff to a wide range of biosecurity related projects with a national view adds not only to their personal experience but to the capacity of the biosecurity system as a whole.

Bee Biosecurity Officer Jess Hartland and the State Quarantine Response Team carrying sticky mats for hive surveillance. Image courtesy of Rachael Holmes

1.7 Australia's plant production industries

INDUSTRY REPRESENTATIVE BODIES AND GROWERS

Many of Australia's farmers have peak representative bodies that act on behalf of their members on a range of activities including biosecurity.

Industry groups may provide funding at regional, state or national levels for specific plant biosecurity activities, such as research and development, management initiatives and emergency responses. Industries can also set biosecurity priorities that deliver outcomes specific to their needs.

They provide a voice for growers at meetings and conferences and on committees that determine the direction of plant biosecurity in Australia including any Emergency Plant Pest responses. Furthermore, industry groups negotiate and work with government departments on biosecurity issues including international market access and pest surveillance activities. Personnel from industries that are signatories to the Emergency Plant Pest Response Deed also represent their growers during any Emergency Plant Pest response involving their industry.

Raising awareness among growers about the importance of biosecurity, the key pests they need to protect against and how to implement biosecurity on-farm and along the supply chain is another responsibility of industry representative bodies.

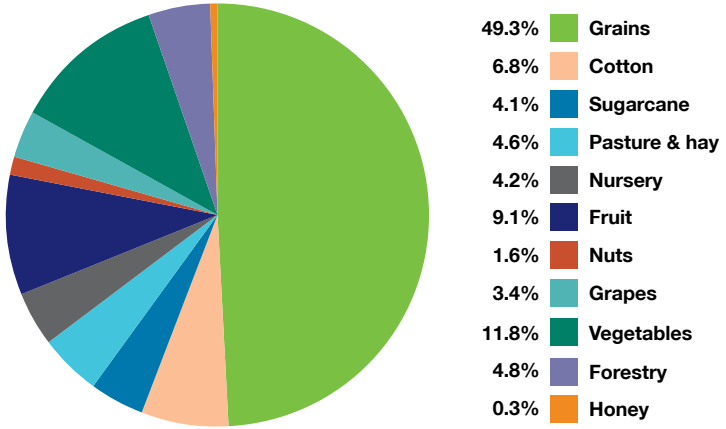
Growers themselves have an important role to play in supporting Australia's biosecurity on-farm. Each producer needs to implement good biosecurity practices to protect their crops, their livelihood, the region and, in turn, their industry from both endemic and exotic pests. See On-farm biosecurity in Chapter 3.

CROP PRODUCTION SUMMARY

Australian agriculture is an integral part the nation's economy, with crops generating more than half of the total value in recent years. In 2015–16 plant production industries contributed over $30 billion to annual agricultural production.

Figure 5 shows the contribution of each of the main plant production industries including honey and beeswax to total plant gross value of production in 2014–15 (the latest year for which this breakdown is available)[3].

Figure 5. Comparative value of Australia's plant production industries, based on gross value of production, 2014–15



3 ABS 7503 data series, ABARES Agricultural Commodities Vol 5, no. 1 March quarter 2017

INDUSTRY PROFILES

The following pages profile PHA plant industry members and show where crops are produced across the states and territories. Each profile also provides the industry's key exotic pest threats, and the preparedness initiatives that they have in place.

Graphs show trends over recent years in local value of production (LVP), which is the value of agricultural commodities at the farm gate. Data used in the graphs are up to 2014–15, the latest available year. Farm gate values are from the Australian Bureau of Statistics (ABS), Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) or from appropriate peak industry bodies.

ALMONDS

Represented by the Almond Board of Australia Inc.
australianalmonds.com.au

In 2014–15, almond production was valued at $510 million (LVP). There are several almond varieties grown in Australia. The most popular include the Australian Nonpareil, Australian Carmel and Australian Price which are sold in a range of blanched forms, in-kernel and in-shell.

About three-quarters of Australian almonds are exported, going to 50 countries, with Europe the largest market and India the most valuable export country.

The Australian almond industry is concentrated in Victoria, SA and NSW with almost 30,000 hectares of cultivated almond trees.

The industry is undergoing enormous expansion, and production now far exceeds domestic demand. From 12,000 tonnes in 2005, production is expected to reach 84,000 tonnes in 2017.

The almond industry is covered by version 2.0 of the nut biosecurity plan and the Orchard Biosecurity Manual for the Almond Industry Version 1.0.

Table 3. High Priority Pests of the almond industry

Scientific name	Common name
Amyelois transitella	Navel orangeworm
Chinavia hilaris (syn. *Acrosternum hilare, Pentatoma hilaris, Chinavia hilarae, Nezara hilaris*)	Green stink bug, pistachio bug
Leptoglossus clypealis	Leaf footed bug
Leptoglossus occidentalis	Western conifer seed bug
Leptoglossus zonatus	Western leaf footed bug
Trogoderma granarium	Khapra beetle
Tropilaelaps clareae	Tropilaelaps mite
Tropilaelaps mercedesae	Tropilaelaps mite
Varroa destructor	Varroa mite
Verticillium dahliae (exotic defoliating strains)	Verticillium wilt
Xylella fastidiosa (including: *X. fastidiosa* subsp. *fastidiosa*; *X. fastidiosa* subsp. *multiplex*; *X. fastidiosa* subsp. *piercei*) (with vector)	Almond leaf scorch, pecan bacterial leaf scorch

Figure 6. Annual value of almond production, 2007–15

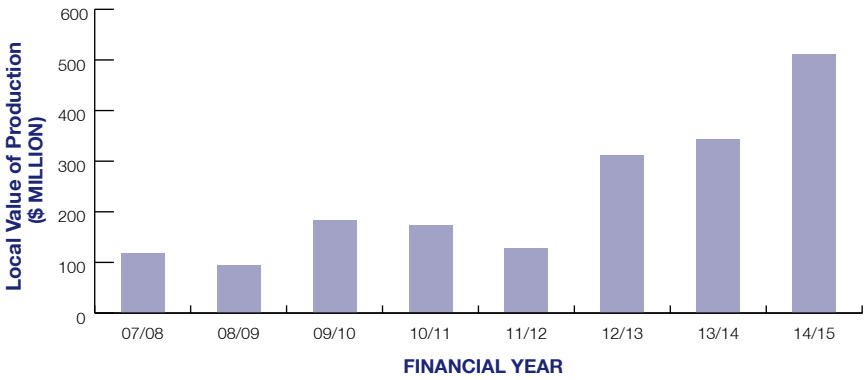
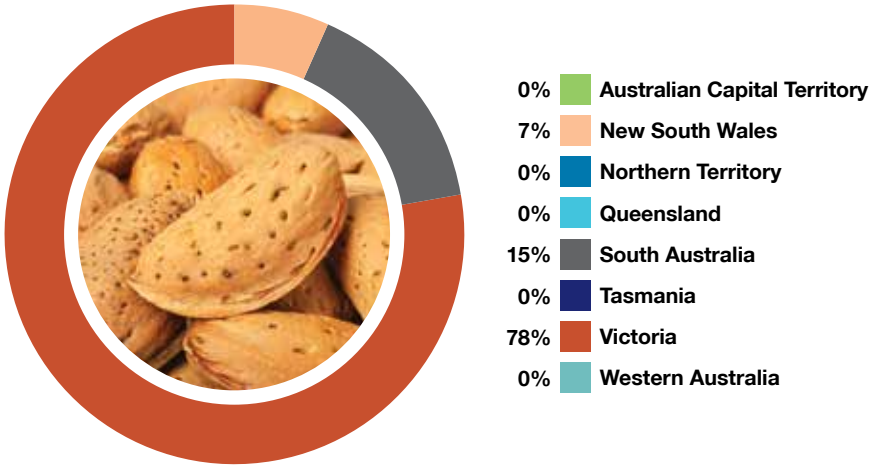


Figure 7. Distribution of almond production by state and territory, 2014–15 (based on LVP)



APPLES AND PEARS

Represented by Apple and Pear Australia Ltd
apal.org.au

In 2014–15, apple and pear production was valued at $578 million (LVP). In 2017 it was estimated that the total planted area for apples was 9,430 hectares and 3,180 hectares for pears.

There are approximately 560 commercial apple and/or pear growers in Australia. All states produce apples, although Victoria is the largest pear producer, with almost 90 per cent of the nation's pears grown there.

The major production areas include the Goulburn Valley, Gippsland, Yarra Valley and the Mornington Peninsula in Victoria; Stanthorpe in Queensland; Batlow and Orange in NSW; the Huon Valley and Tamar Valley in Tasmania; the Adelaide Hills in SA; and Donnybrook, Manjimup and the Perth Hills in WA.

The main apple varieties produced are Pink Lady, Gala, Red Delicious, Fuji and Granny Smith. Packham and Williams are the main pear varieties. Most production is consumed domestically and less than five per cent is exported to the premium markets of the United Kingdom and Europe and the markets of south east Asia. However, exports are slowly starting to increase.

The apple and pear industry is covered by version 2.01 of the apple and pear biosecurity plan and the Orchard Biosecurity Manual for the Apple and Pear Industry Version 2.0.

Table 4. High Priority Pests of the apple and pear industry

Scientific name	Common name
Bactrocera dorsalis	Oriental fruit fly
Conotrachelus nenuphar	Plum curculio
Drosophila suzukii	Spotted wing drosophila
Dysaphis plantaginea	Rosy apple aphid
Erwinia amylovora	Fire blight
Gymnosporangium juniperi-virginianae	Cedar apple rust
Lymantria dispar	Asian gypsy moth
Monilinia fructigena	Brown rot
Neonectria galligena	European canker
Rhagoletis pomonella	Apple maggot

Figure 8. Annual value of apple and pear production, 2007–15

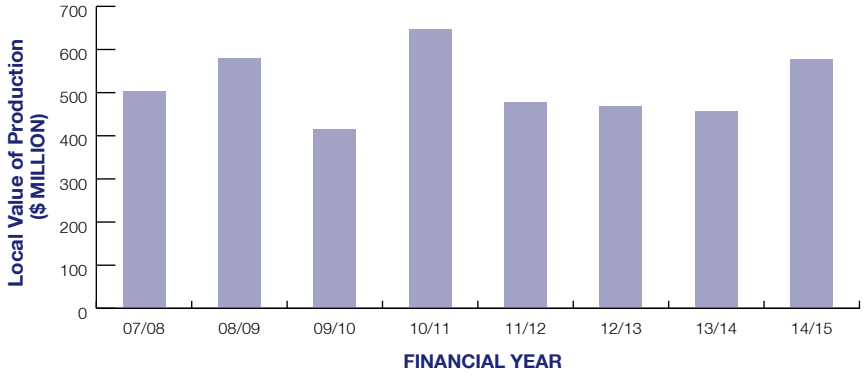


Figure 9. Distribution of apple and pear production by state and territory, 2014–15 (based on LVP)

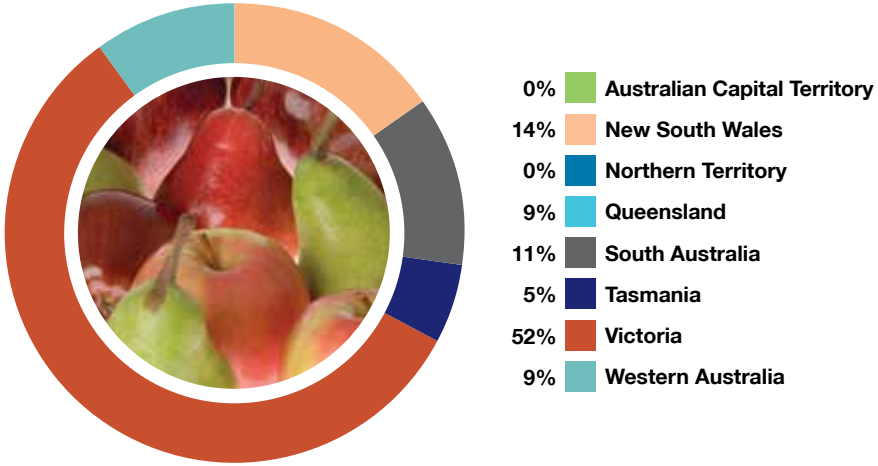


Image courtesy of Avocados Australia

AVOCADOS

Represented by Avocados Australia Ltd
avocado.org.au

In 2014–15, avocado production was valued at $188 million (LVP). The Hass variety is the predominant avocado produced in Australia, accounting for approximately 80 per cent of production, with Shepard accounting for about 15 per cent. A number of other varieties such as Reed, Wurtz, Sharwil and Fuerte make up the balance. Exports are mostly shipped to Singapore and Malaysia.

Queensland dominates Australia's avocado production, followed by WA, NSW, SA and Victoria.

The avocado industry is covered by the avocado biosecurity plan version 2.01 and the Orchard Biosecurity Manual for the Avocado Industry Version 1.0.

Figure 10. Distribution of avocado production by state and territory, 2014–15 (based on LVP)

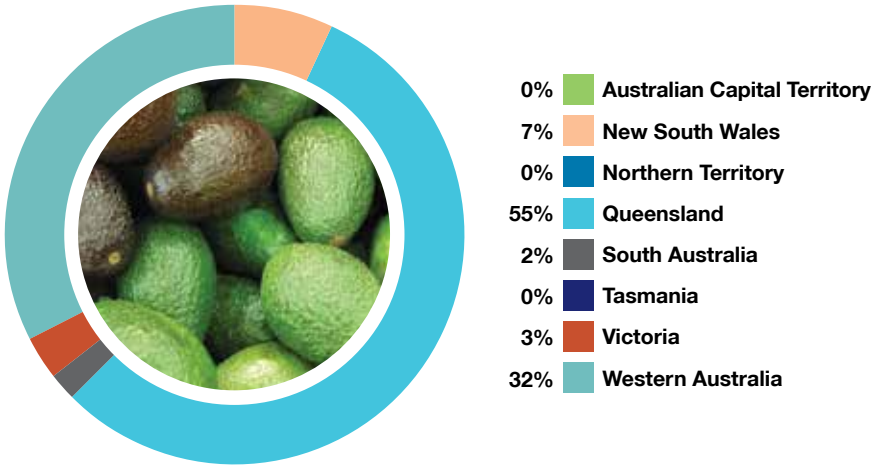


Figure 11. Annual value of avocado production, 2007–15

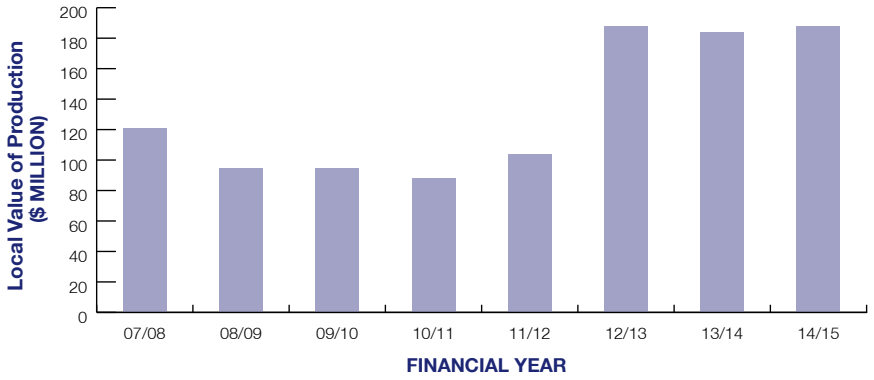


Image courtesy of Avocados Australia

Table 5. High Priority Pests of the avocado industry

Scientific name	Common name
Avocado sunblotch viroid	Avocado sunblotch (asymptomatic and symptomatic strains)
Bactrocera carambolae	Carambola fruit fly
Bactrocera cucurbitae	Melon fly
Bactrocera dorsalis	Oriental fruit fly
Bactrocera facialis	Tropical fruit fly
Bactrocera kandiensis	Fruit fly
Bactrocera kirki	Fruit fly
Bactrocera melanotus	Fruit fly
Bactrocera papayae	Papaya fruit fly
Bactrocera passiflorae	Fijian fruit fly
Bactrocera philippinensis	Philippine fruit fly
Bactrocera xanthodes	Pacific fruit fly
Conotrachelus aguacatae (Barber)	Small avocado seed weevil
Conotrachelus perseae	Small seed weevil
Erwinia herbicola	Avocado blast complex
Heilipus lauri (Boheman)	Large seed weevil
Oligonychus persea (Tuttle, Baker and Abbatiello)	Persea mite
Pseudomonas syringae	Avocado blast complex
Pseudomonas syringae pv. *syringae* (van Hall)	Bacterial canker complex
Scirtothrips perseae (Nakahara)	Thrips
Stenoma catenifer (Walsingham)	Stenomid (avocado) moth

BANANAS

Represented by the Australian Banana Growers' Council Inc.
abgc.org.au

In 2014–15, banana production was valued at $405 million (LVP). There are currently about 13,100 hectares of bananas grown in Australia. Around 97 per cent of bananas are grown in Queensland, from Ingham to Hopevale (including the Tablelands).

Bananas are grown all year round with the two main varieties being Cavendish and Lady Finger. The Cavendish variety accounts for the vast majority of production. The Australian banana industry supplies only the domestic market.

The Australian banana industry is currently involved in two major biosecurity responses – one for banana freckle in the NT and the other for Panama disease tropical race 4 (TR4) in north Queensland. The final phase of the banana freckle response (Phase 4 – Assessment of Proof of Freedom) is scheduled to conclude in July 2019. Significant effort continues to be directed to the containment of TR4 in north Queensland. To date, the disease has only been confirmed on a single property in Tully. The affected property has been purchased by the Australian Banana Growers' Council on behalf of banana growers and all farming has ceased. Surveillance on all commercial banana farms in north Queensland continues.

There is also a major banana bunchy top virus containment project running in northern NSW and south east Queensland. Additionally, an officer is employed to undertake inspections for the presence of yellow sigatoka in the north Queensland commercial production area.

The banana industry is covered by version 2.0 of the banana industry biosecurity plan and the Farm Biosecurity Manual for the Banana Industry Version 1.0. A review of the biosecurity plan is expected to commence in 2017.

Image courtesy of the Australian Banana Growers Council

Figure 12. Annual value of banana production, 2007–15

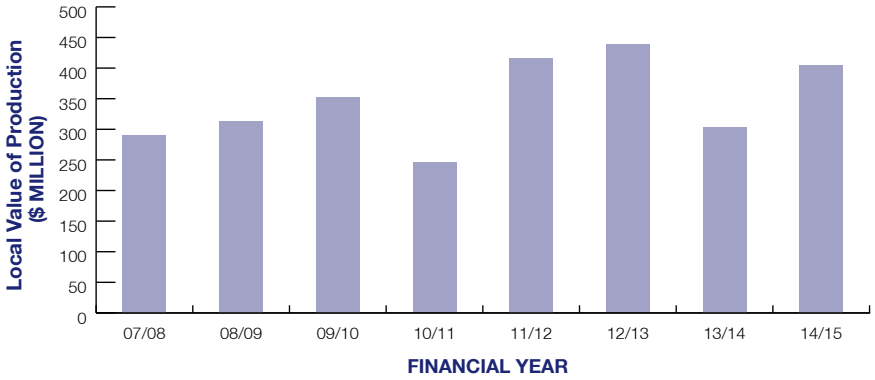


Figure 13. Distribution of banana production by state and territory, 2014–15 (based on LVP)

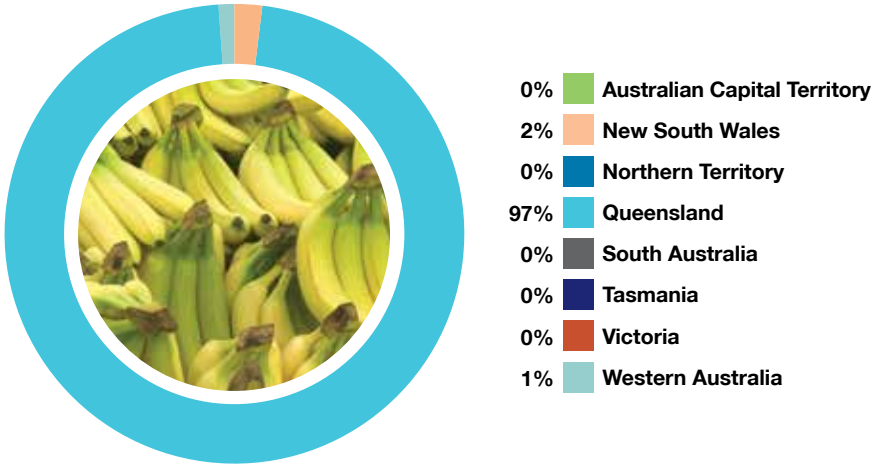


Table 6. High Priority Pests of the banana industry

Scientific name	Common name
Abaca bunchy top virus (Babuvirus)	Abaca bunchy top virus
Banana bract mosaic virus (Potyvirus)	Banana bract mosaic disease
Banana bunchy top virus (Nanovirus)	Banana bunchy top disease
Blood disease bacterium	Blood disease
Erionata thrax	Banana skipper butterfly
Fusarium oxysporum f. sp. *cubense*	Panama disease tropical race 4
Guignardia musae	Banana freckle
Mycosphaerella eumusae	Eumusae leaf spot
Mycosphaerella fijiensis	Black sigatoka
Ralstonia solanacearum race 2	Moko
Teranychus piercei	Banana spider mite

Banana freckle (Cavendish strain). Image courtesy of Kathy Grice

Panama diseased stem

Banana bunchy top disease. Affected leaves are more upright with pale yellow margins and may be more wavy than normal. Image courtesy of Jeff Daniells

Blood disease bacterium. Image courtesy of Jeff Daniells

BLUEBERRIES

Represented by Australian Blueberry Growers' Association
abga.com.au

In 2014–15, blueberry production was valued at $142 million (LVP). The industry is rapidly expanding with farmers on average producing 4,500 tonnes of blueberries per annum.

The major production area of the Australian blueberry industry is on the NSW north coast. This area produces approximately 80 per cent of Australia's blueberries. The crop is grown in Tumbarumba in southern NSW; the Atherton Tablelands, Bundaberg and Mundubbera in Queensland; the Tamar Valley, Meander Valley, Bernie, Devenport and the Huon Valley in Tasmania; the Grampians, Silvan and Strathbogie in Victoria; Margaret River and Geraldton in WA; and the Mount Lofty ranges in SA.

There are three varieties of blueberries grown in Australia: northern highbush, southern highbush and rabbiteye. Northern highbush are grown in the cooler climate areas such as Victoria, Tasmania and the southern highlands of NSW whereas southern highbush and rabbiteye varieties are grown in NSW and Queensland. The majority of blueberry production is consumed domestically, with less than 5 per cent exported to markets such as Hong Kong, Singapore and Russia.

The blueberry industry is covered by the blueberry biosecurity plan version 1.0.

Table 7. High Priority Pests of the blueberry industry

Scientific name	Common name
Croesia curvalana	Blueberry leaftier
Drosophila suzukii	Spotted wing drosophila
Ericaphis fimbriata (with blueberry scorch Carlavirus)	Blueberry aphid
Homalodisca vitripennis (with *Xylella fastidiosa*)	Glassy winged sharpshooter
Monilinia fructigena	Brown rot
Monilinia vaccinii-corymbosi	Mummy berry disease
Phytophthora ramorum	Sudden oak death
Xylella fastidiosa	Blueberry leaf scorch, Pierce's disease of grapevine

Figure 14. Annual value of blueberry production, 2011–15

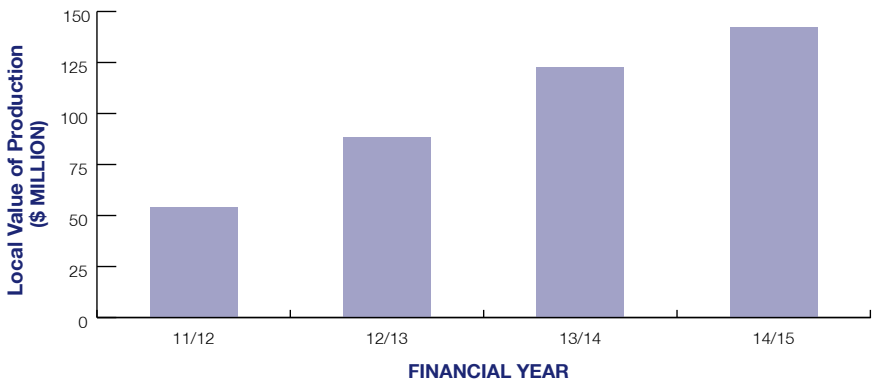
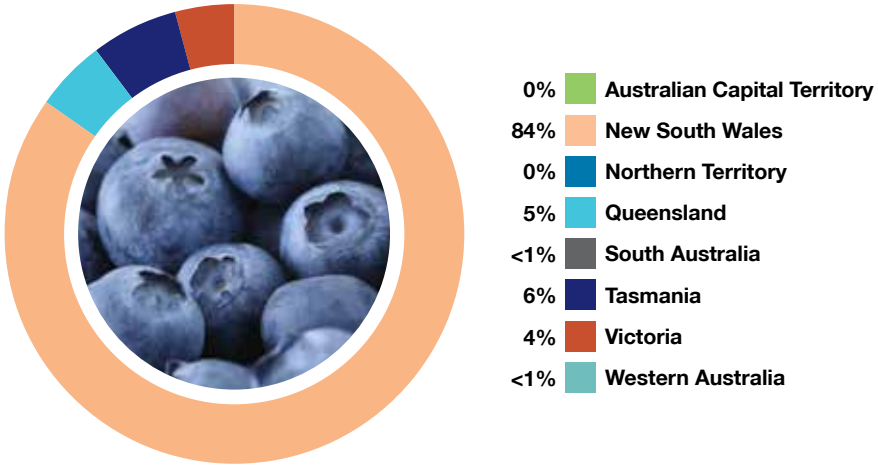


Figure 15. Distribution of blueberry production by state and territory, 2014–15 (based on LVP)



CANNED FRUITS

Represented by the Canned Fruits Industry Council of Australia
fgv.com.au

In 2014–15, production of canned fruit was valued at $21 million (LVP), an increase of $8 million from the 2013–14 production year. Fruit production for canning is carried out from December to May and volumes of between 80,000 and 100,000 tonnes are processed annually.

The industry represents more than 300 fruit growing, packing and exporting businesses.

The canned fruits industry is primarily based in the Goulburn–Murray Valleys region of Victoria, processing Australian apples, pears and stone fruit (peaches, apricots and plums).

The canned fruit industry does not have a specific biosecurity plan or manual, but is covered by plans and manuals for the pome fruit (apple and pear) and stone fruit (summerfruit) industries.

Image courtesy of Canned Fruits Industry Council of Australia

Figure 16. Annual value of canned fruit production, 2007–15

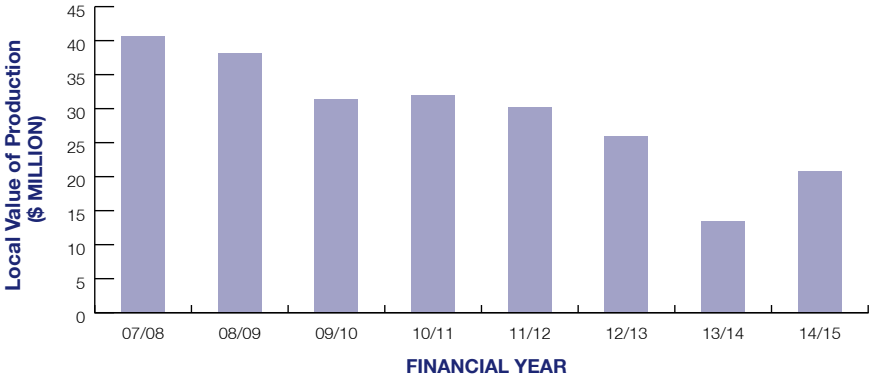
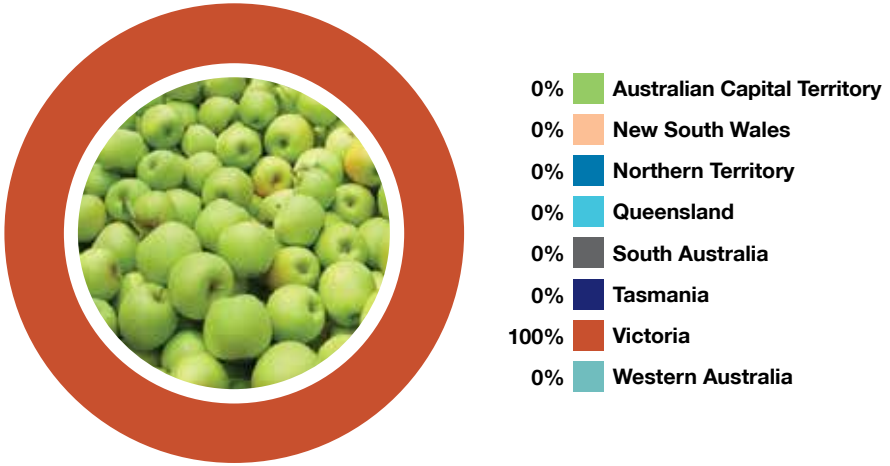
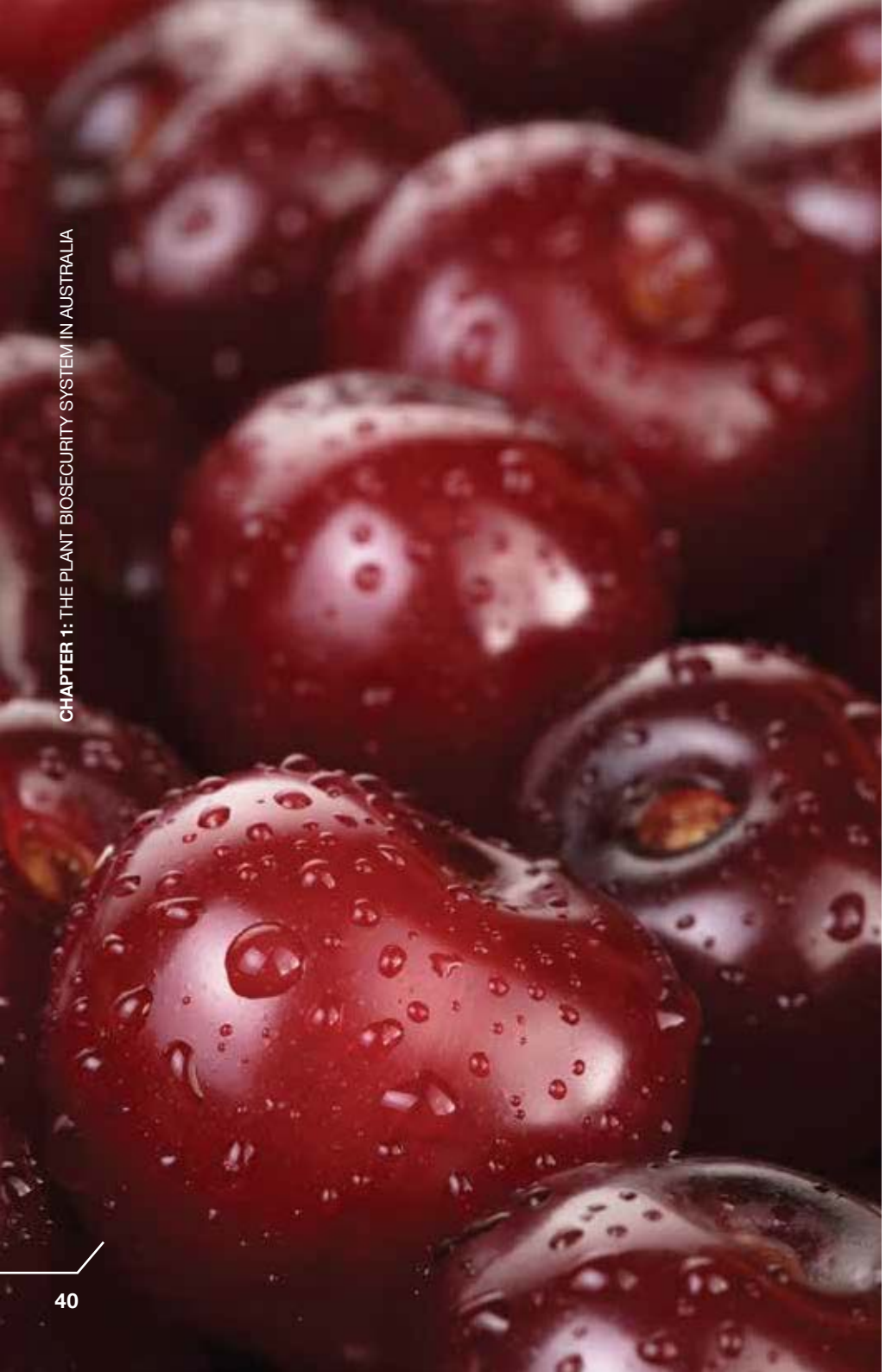


Figure 17. Distribution of canned fruit production by state and territory, 2014–15 (based on LVP)





CHERRIES

Represented by Cherry Growers of Australia Inc.
cherrygrowers.org.au

In 2014–15, cherry production was valued at $134 million (LVP). The main varieties grown are Lapin, Sweetheart, Sweet Georgia, Merchant, Stella, Bing, Van, Simone, Regina, Samba and Stacarto.

The Australian cherry industry has smaller boutique enterprises in WA and QLD and larger suppliers in NSW, Victoria and Tasmania, representing over 485 growers.

About 10,000 tonnes of cherries are consumed domestically and another 6,000 tonnes exported at a value of $73 million. Exports are currently shipped to 30 countries, with the top six destinations being Hong Kong, China, Taiwan, Singapore, Korea and the Middle East.

The Australian cherry industry is covered by version 2.01 of the cherry biosecurity plan and the Orchard Biosecurity Manual for the Cherry Industry Version 1.0.

Figure 18. Distribution of cherry production by state and territory, 2014–15 (based on LVP)

Figure 19. Annual value of cherry production, 2007–15

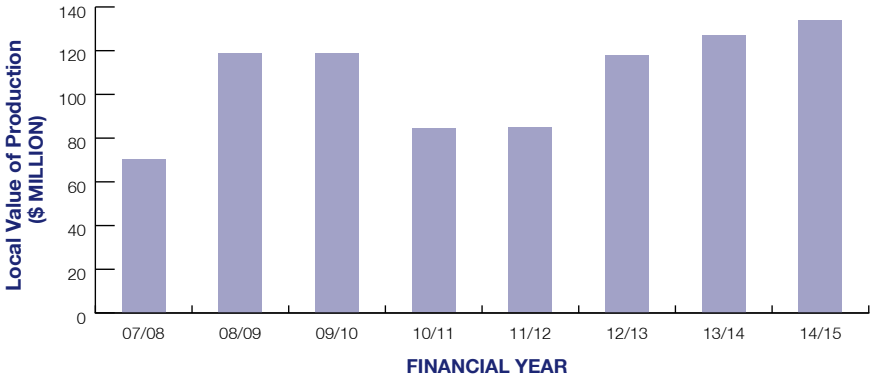


Image courtesy of Ingrid Roth

Table 8. High Priority Pests of the cherry industry

Scientific name	Common name
Cherry leaf roll virus (Nepovirus) (exotic strains)	Blackline
Choristoneura rosaceana	Oblique banded leaf roller
Conotrachelus nenuphar	Plum curculio
Ctenopseustis obliquana	Brown headed leaf roller
Drosophila suzukii	Spotted wing drosophila
European stone fruit yellows phytoplasma	European stone fruit yellows
Little cherry virus 1 (unassigned)	Little cherry virus 1
Little cherry virus 2 (Ampelovirus)	Little cherry virus 2
Monilinia fructigena	Brown rot
Neonectria ditissima	European canker
Pandemis cerasana	Cherry brown tortrix
Phymatotrichum omnivorum	Texas root rot
Planotoritx octo	Green headed leaf roller
Plum pox virus (Potyvirus)	Plum pox virus
Podosphaera clandestina var. *clandestina* (exotic strains)	Powdery mildew of cherry
Rhagoletis fausta	Black cherry fruit fly
Rhagoletis indifferens	Western cherry fruit fly
Rhagoletis pomonella	Apple maggot
X disease phytoplasma	Peach X disease
Xylella fastidiosa	Pierce's disease

Plum curculio. Image courtesy of E. Levine, The Ohio State University, bugwood.org.

European canker. Image courtesy Abrahami.

CHESTNUTS

Represented by Chestnuts Australia Inc
chestnutsaustralia.com.au

In 2016, chestnut production was valued at $7 million (LVP). In 2016 there were around 1,300 hectares containing about 200,000 chestnut trees. It is estimated that with more trees planted, production will rise to approximately $9.8 million by 2020.

The main varieties grown are Red Spanish, Purton's Pride and De CoppiMarone. Chestnuts flower during November and December and are harvested from March through to May.

The industry is primarily focused on the domestic market with approximately two per cent exported, mainly to Asian markets.

The Australian chestnut industry operates principally in the southern states of Australia, primarily in Victoria.

Throughout 2016 Chestnuts Australia Inc has participated in a number of exotic incursion responses relevant to the chestnut industry including a chestnut blight eradication program and a response to a new surface mould that was isolated through a recent chemical residue/efficacy project. Australia is free from insect pests such as the chestnut gall wasp and chestnut weevil.

Aspects of biosecurity are well embedded in the Australian Chestnut Industry Five Year Strategic Plan – 2015 to 2020. The chestnut industry is covered by version 2.0 of the nut biosecurity plan that was reviewed in 2016.

Figure 20. Distribution of chestnut production by state and territory, 2014–15 (based on LVP)

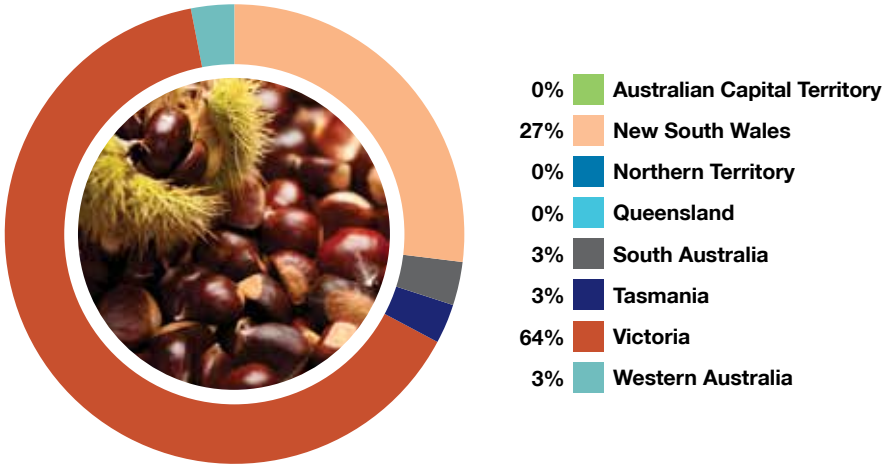


Figure 21. Annual value of chestnut production, 2009–15

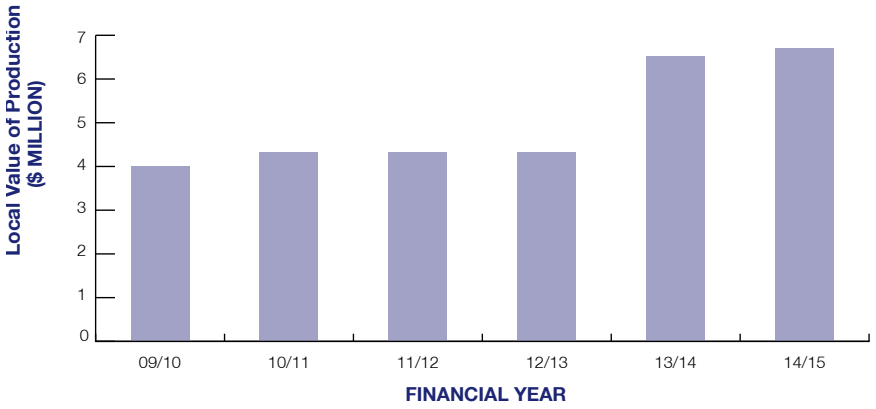
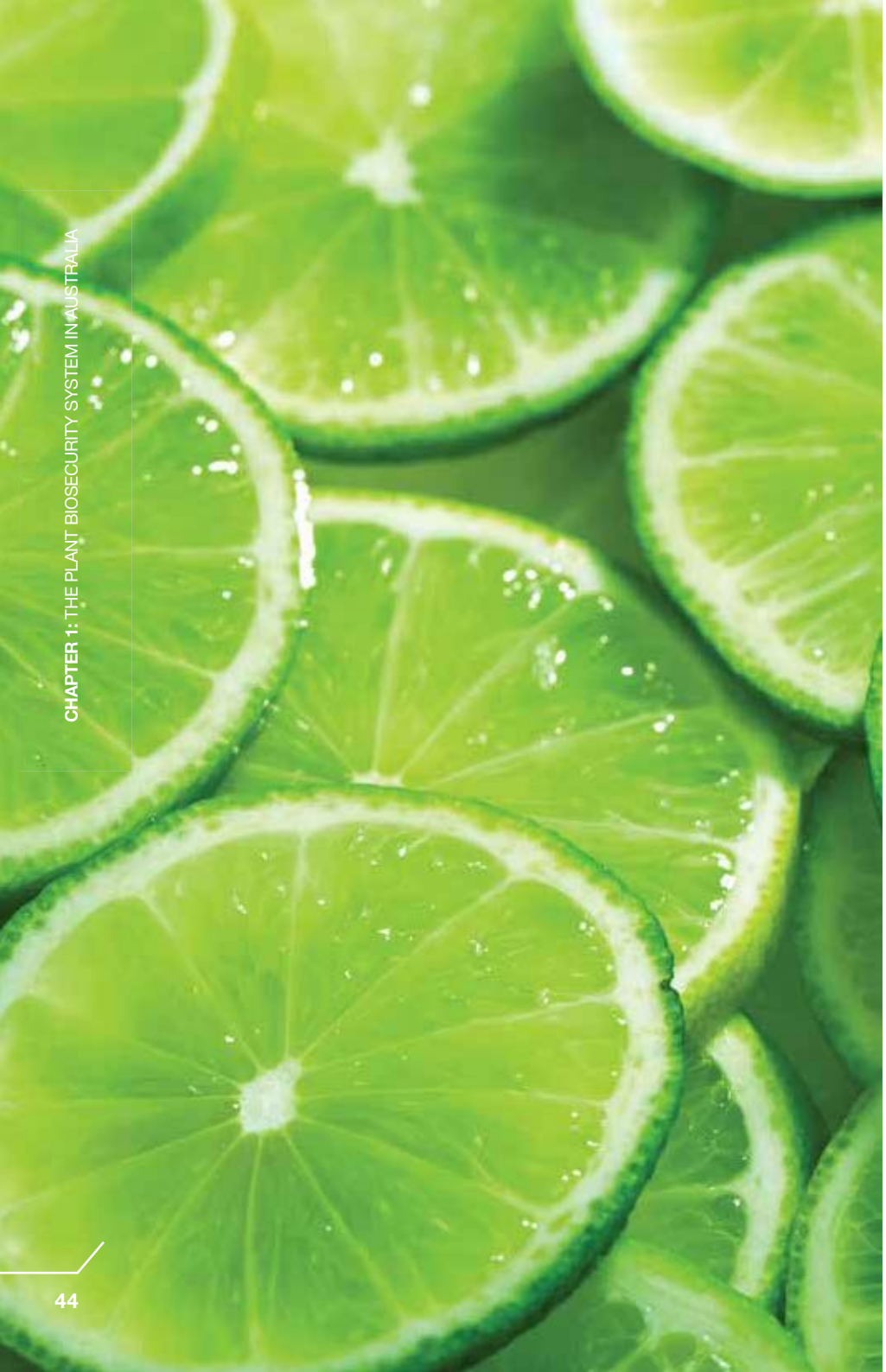


Table 9. High Priority Pests of the chestnut industry

Scientific name	Common name
Dryocosmus kuriphilus	Oriental chestnut gall wasp
Lymantria dispar	Gypsy moth (Asian and European strains)
Cryphonectria parasitica	Chestnut blight
Verticillium dahliae (exotic defoliating strains)	Verticillium wilt
Phytophthora ramorum	Sudden oak death

Adult wasp. Image courtesy of Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org

Male (left) and female (right) Asian gypsy moths. Image courtesy of John H. Ghent, USDA Forest Service, Bugwood.org



CITRUS

Represented by Citrus Australia Ltd
citrusaustralia.com.au

In 2014–15, citrus production (oranges, mandarins, lemons, limes and grapefruit) was valued at $411 million (LVP). In 2016, production of citrus was estimated to be 660,000 tonnes. Currently, there are about 26,000 hectares of citrus plantings nationally.

Citrus is the largest fresh fruit exporting industry in Australia by volume, with major export markets including China, Japan, Hong Kong, Malaysia, Indonesia, United Arab Emirates, Singapore, the United States and Thailand.

Citrus fruits are grown commercially throughout Australia, except for Tasmania and the ACT. Major growing areas include the Riverina (NSW), Central Burnett and Emerald (Queensland), Riverland (SA) and Murray Valley (Victoria/NSW). Production also occurs in WA and there are a small number of plantings in NT.

The Citrus Biosecurity Project, which is funded by Hort Innovation and jointly managed by PHA and Citrus Australia, continued through 2016, boosting the preparedness of the citrus industry for serious exotic pests.

The citrus industry is covered by version 3.0 of the citrus biosecurity plan and the Biosecurity Manual for Citrus Producers Version 2.0.

Figure 22. Distribution of citrus production by state and territory, 2014–15 (based on LVP)

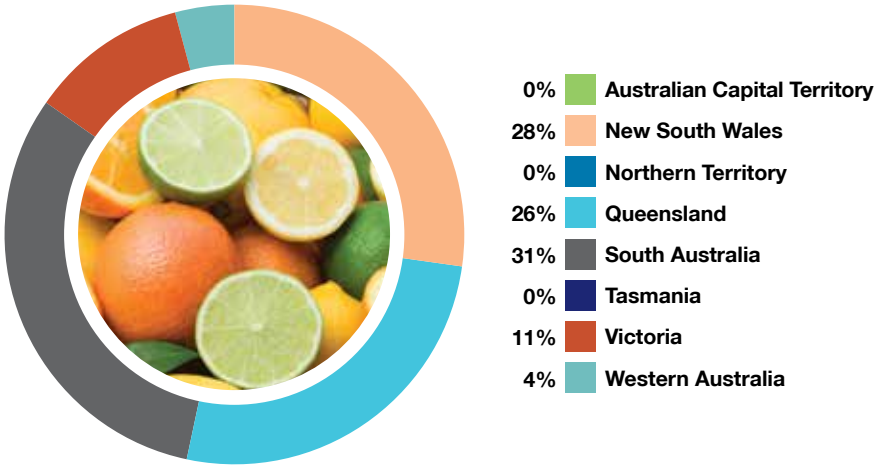


Figure 23. Annual value of citrus production, 2007–15

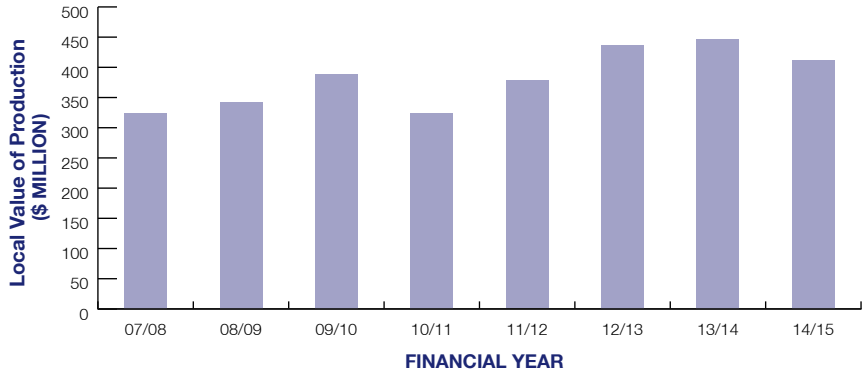


Image courtesy of Citrus Australia

Table 10. High Priority Pests of the citrus industry

Scientific name	Common name
Anastrepha ludens	Mexican fruit fly
Bactrocera carambolae	Carambola fruit fly
Bactrocera dorsalis	Oriental fruit fly
*Bactrocera invadens**	Fruit fly
Bactrocera kandiensis	Fruit fly
Bactrocera occipitalis	Fruit fly
*Bactrocera papayae**	Papaya fruit fly
*Bactrocera philippinensis**	Philippine fruit fly
Bactrocera trivialis	New Guinea fruit fly
Caliothrips fasciatus	Bean thrips
Candidatus Liberibacter africanus	Huanglongbing, citrus greening (African strain)
Candidatus Liberibacter americanus	Huanglongbing, citrus greening (American strain)
Candidatus Liberibacter asiaticus	Huanglongbing, citrus greening (Asiatic strain)
Citripestis sagittiferella	Citrus fruit borer
Citrus leprosis virus (Cilevirus)	Citrus leprosis
Citrus tristeza virus (Closterovirus) (exotic strains)	Mandarin stem-pitting, citrus tristeza
Diaphorina citri	Asiatic or Asian citrus psyllid
Frankliniella bispinosa	Florida flower thrips
Homalodisca vitripennis	Glassy winged sharpshooter
Spiroplasma citri	Citrus stubborn disease
Trioza erytreae	African citrus psyllid
Xanthomonas citri subsp. *citri*	Citrus canker
Xylella fastidiosa subsp. *pauca*	Citrus variegated chlorosis

* This species has been synonymised with *Bactrocera dorsalis*

COTTON

Represented by Cotton Australia Ltd
cottonaustralia.com.au

In 2014–15, cotton production was valued at $950 million (LVP).

Australian cotton yields are high by international standards, nearly three times the world average. Almost the entire Australian cotton crop is exported, with two-thirds sold to China and the remainder mainly to spinning mills in other parts of Asia. Australia is the fourth largest cotton exporter in the world, behind the United States, India and Brazil.

Cotton is grown in most of the major inland river valleys of eastern Australia, in a belt stretching from central Queensland in the north, to the Murrumbidgee Irrigation Area and Menindee Lakes in southern and western NSW. Approximately 60 per cent of the national crop is grown in NSW, with the remainder grown in Queensland and a small number of fields over the Victoria border. Cotton is generally grown as an annual irrigated summer crop in fertile alluvial floodplain soils but, in an average season, rain grown cotton represents approximately 20 per cent of the total planted area.

The cotton industry is covered by version 3.0 of the biosecurity plan for the cotton industry and the Farm Biosecurity Manual for the Cotton Industry Version 1.1.

Figure 24. Distribution of cotton production by state and territory, 2014–15 (based on LVP)

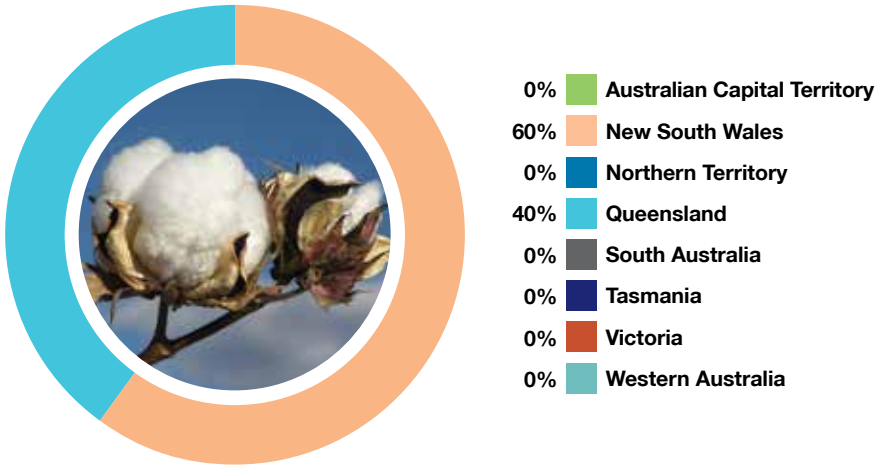
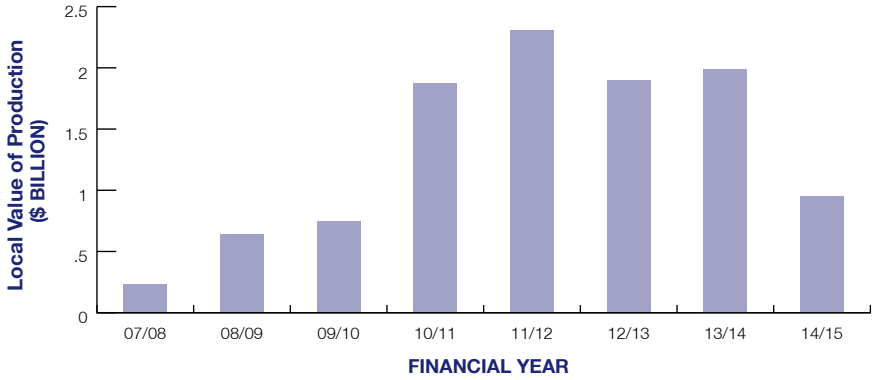


Figure 25. Annual value of cotton production, 2007–15



Cotton seed. Image courtesy of Heather Parkes

Table 11. High Priority Pests of the cotton industry

Scientific name	Common name
Anthonomus grandis	Boll weevil
Aphis gossypi (exotic strains)	Cotton aphid (exotic strains)
Bemisia tabaci (biotypes other than B and AN)	Silverleaf whitefly (exotic biotypes)
Cotton leaf curl virus complex (Begomovirus)	Cotton leaf curl virus, cotton leaf crumple virus, cotton leaf curl Gezira virus, cotton leaf curl Alabad virus, cotton leaf curl Burewala virus, cotton leaf curl Kokhran virus, cotton leaf curl Multan virus, cotton leaf curl Rajasthan virus, cotton leaf curl Shahdadpur virus
Cotton leafroll dwarf virus (Polerovirus)	Cotton blue disease
Dysdercus spp. (including *D. honestus, D. marus, D. suturellus* (American species))	Cotton stainer, red bugs
Fusarium oxysporum f. sp. *vasinfectum* (exotic races)	*Fusarium wilt* (exotic races)
Halyomorpha halys	Brown marmorated stink bug
Helicoverpa armigera (carrying Bt resistance alleles)	Cotton bollworm, African boll worm
Lygus hesperus	Western plant bug
Lygus lineolaris	Tarnished plant bug
Phymatotrichopsis omnivora (syn. *Phymatotrichum omnivorum*)	Texas root rot, Phymatotrichum root rot, cotton root rot
Thaumatotibia leucotreta (syn. *Cryptophlebia leucotreta*)	False codling moth
Verticillium dahliae (defoliating strain)	*Verticillium wilt* (defoliating strain)
Xanthomonas citri subsp. *malvacearum* (syn. *X. axonopodis* pv. *malvacearum; X. campestris* pv. *malvacearum)* (exotic/ hypervirulent races)	

Image courtesy of Julie Reardon

DRIED FRUITS

Represented by Dried Fruits Australia Inc.
driedfruitsaustralia.org.au

In 2014–15, dried grape production (sultana types, currants and raisins) increased to about 18,000 tonnes and was valued at $31 million (LVP).

The main export markets for dried fruit are found in Europe (Germany, Italy, France and United Kingdom). Total exports have averaged around 2,500 tonnes over the past few years.

In Australia, grapes are grown for the dried fruit industry in the Sunraysia region which spans north western Victoria and south western NSW around the Murray River, and to a lesser extent, in the SA Riverland.

The dried fruit industry regularly distributes biosecurity information and guidelines from PHA to its members via a quarterly publication, The Vine. The viticulture biosecurity manual has been distributed to dried fruit growers through the major industry processors, Sunbeam Foods and Australian Premium Dried Fruits. The industry also undertakes EPPRD training in order to understand the roles and responsibilities of their officers in the event of a pest incursion.

The dried fruit industry is covered by version 3.0 of the biosecurity plan for viticulture and the Biosecurity Manual for the Viticulture Industry Version 1.0

Figure 26. Distribution of dried fruit production by state and territory, 2014–15 (based on LVP)

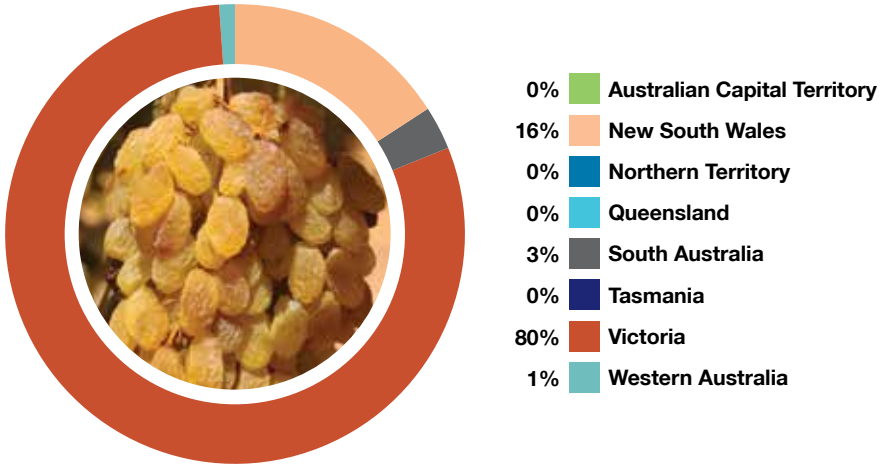


Figure 27. Annual value of dried fruit production, 2007–15

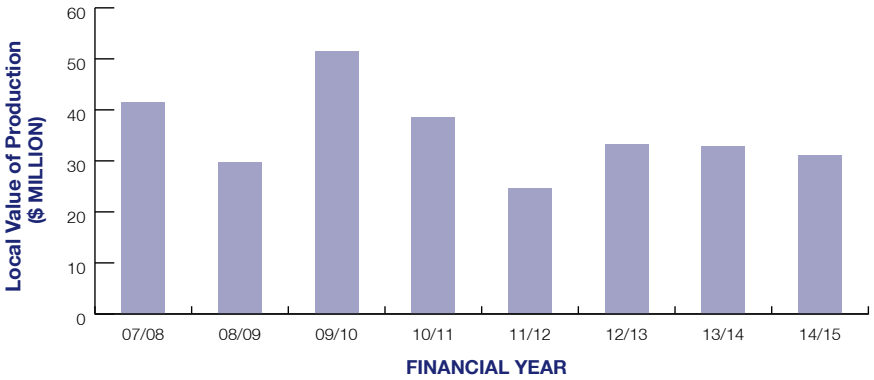


Table 12. High Priority Pests of the dried fruit industry

Scientific name	Common name
Bactrocera carambolae	Carambola fruit fly
Bactrocera dorsalis	Oriental fruit fly
*Bactrocera papayae**	Papaya fruit fly
Candidatus Phytoplasma solani	Bois noir
Daktulosphaira vitifoliae (exotic strains)	Grapevine phylloxera
Drosophila suzukii	Spotted wing drosophila
Grapevine flavescence doree phytoplasma	Flavescence doree
Guignardia bidwellii	Black rot
Homalodisca vitripennis	Glassy winged sharpshooter
Hyalesthes obsoletus	Cixiidae planthopper
Lobesia botrana	European grapevine moth
Planococcus ficus	Vine mealybug
Polychrosis viteana	American berry moth
Pseudococcus maritimus	Grape mealybug
Xylella fastidiosa	Pierce's disease

* This species has been synonymised with *Bactrocera dorsalis*

GINGER

Represented by Australian Ginger Industry Association
australianginger.org.au

In 2014–15, ginger production was valued at $32 million (LVP). Land under ginger cultivation is approximately 280 hectares, which produces around 8,400 tonnes of fresh ginger available year round.

The most popular ginger variety grown in Australia is the Jumbo (Canton). Approximately 60 per cent of ginger produced in Australia is sold as fresh ginger and the remaining 40 per cent is processed. The value of sales of semi-processed and processed ginger products in the domestic market is over $60 million while exports is currently valued at $40 million.

The Australian ginger industry is based predominantly in south east Queensland within the Sunshine Coast and Wide Bay regions, with a small amount of production in far north Queensland and northern NSW.

The ginger industry is covered by version 1.0 of the biosecurity plan for the ginger industry.

Figure 28. Distribution of ginger production by state and territory, 2014–15 (based on LVP)

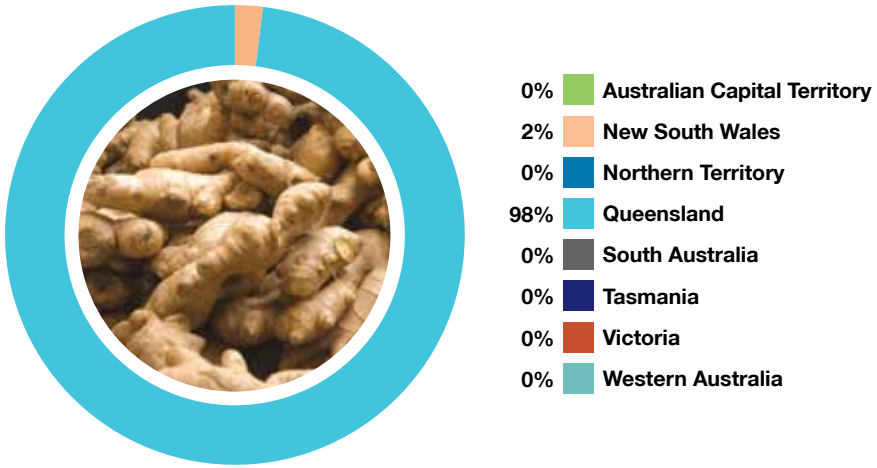


Figure 29. Annual value of ginger production, 2010–15

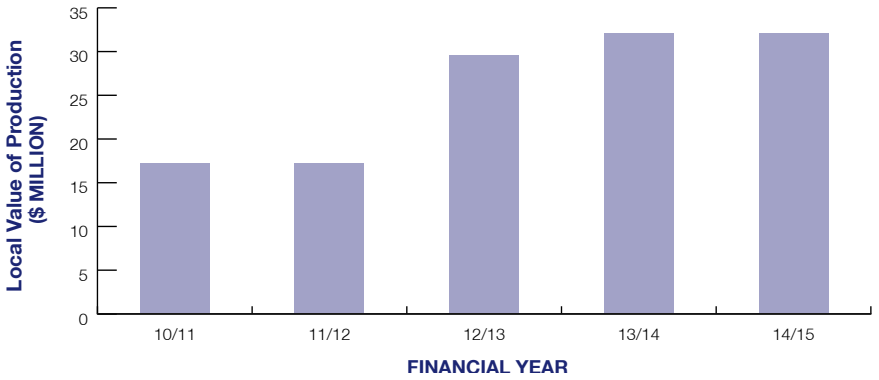
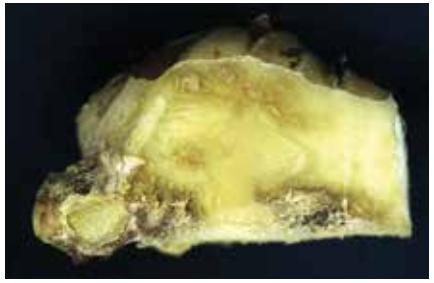


Table 13. High Priority Pests of the ginger industry

Scientific name	Common name
Aspidiella hartii	Yam scale
Elytroteinus subtruncatus	Fijian ginger weevil
Radopholus similis (exotic strains)	Burrowing nematode
Ralstonia solanacearum race 4 (exotic strains)	Bacterial wilt

Ralstonia solanacearum. Image courtesy of Bruce Mathews, University of Hawaii at Hilo College of Agriculture, Forestry & Natural Resource Management.



Burrowing nematode. Image courtesy of bugwood.org.

GRAINS

Represented by Grain Producers Australia Ltd
grainproducers.com.au

In 2014–15, grain production (wheat, barley, canola, sorghum, oats, and lupins) was valued at $12.5 billion (LVP). The grains industry is Australia's largest plant industry with wheat, the largest crop, accounting for more than half of total production. Australia also produces barley, canola and many vareties of pulse as well as summer crops. The majority of Australia's grain is produced in what is known as the wheat belt, from central Queensland through NSW, Victoria, Tasmania, SA and southern WA.

A large percentage of the grain produced in Australia is exported, with major markets in Asia and the Middle East including China, Indonesia, Iraq, Korea, Iran and Vietnam.

The grains industry invests in a biosecurity outreach program to raise awareness and improve practices on-farm and to ensure preparedness for management of any biosecurity threats. Grain Producers Australia funds the Grains Farm Biosecurity Program which includes the deployment of five Grains Biosecurity Officers embedded in state departments in NSW, Queensland, SA, Victoria and WA.

The grains industry is covered by version 3.0 of the biosecurity plan for grains, the Biosecurity Manual for Grain Producers Version 4.0, and the Farm Biosecurity Manual for the Organic Grains Industry Version 1.0.

Image courtesy of Barry Large

Figure 30. Annual value of grains production, 2007–15

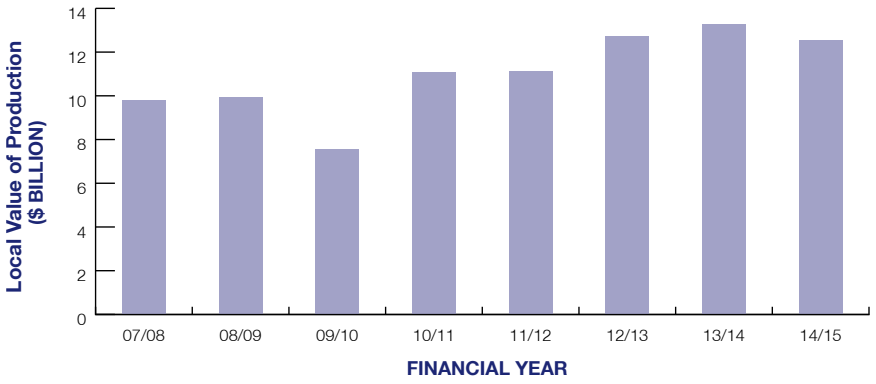
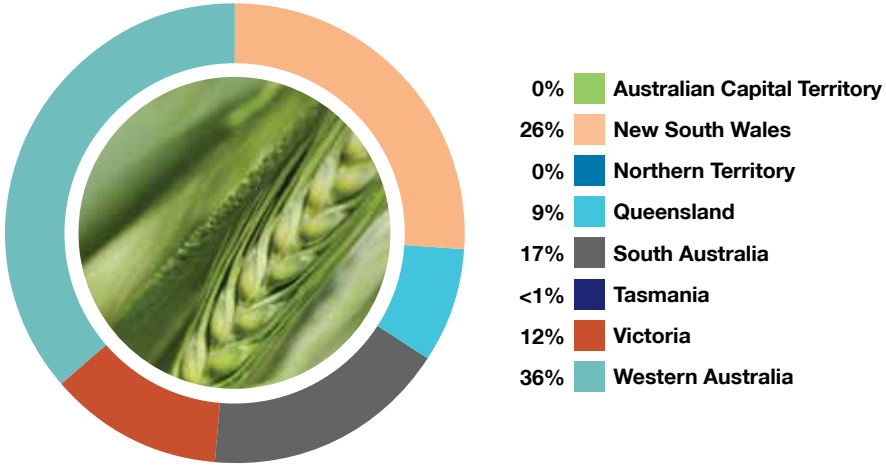


Figure 31. Distribution of grains production by state and territory, 2014–15 (based on LVP)



Russian wheat aphid spread tracked by AUSPest*Check*

PHA's AUSPest*Check* app was used successfully to track the spread of Russian wheat aphid during 2016, following the first detection of the new grains pest in SA in May.

AUSPest*Check* is a system that amalgamates and maps the outcome of surveillance activity across Australia, using mobile devices in the field and a secure cloud computing environment.

In pre-emptive risk assessment for the grains industry, Russian wheat aphid had been identified as a high priority pest due to reports from overseas of the pest causing large crop losses.

Because of the threat posed by the pest, PHA established the Russian Wheat Aphid National Technical Group to inform management of the new pest as soon as it was determined that the pest was not able to be eradicated.

AUSPest*Check* mapping was very valuable. For the first time, maps showing the spread of the aphid and areas still pest free were generated in real time as checks for the pest were made across southern Australia.

A priority for the Russian Wheat Aphid National Technical Group was to communicate public information about the extent of the pest incursion. AUSPest*Check* maps were an ideal way to let growers know if their properties were at risk.

The National Technical Group was established as part of the National Management Plan, to provide information on short term control options and longer term research and development requirements.

AUSPest*Check* was developed with an Australian Government National Landcare Programme Innovation Grant. More crop and pest types are expected to be added to the system in time.

PHA's AUSPestCheck system mapped the distribution of the new pest in real time

Table 14. High Priority Pests of the grains industry

Scientific name	Common name
Ascochyta rabiei (*MAT1-1* mating type is endemic. *MAT 1-2* is exotic)	Ascochyta blight
Barley mild mosaic virus (Baymovirus)	Barley mild mosaic virus
Bean common mosaic virus (Potyvirus)	Bean common mosaic virus, peanut stripe strain
Cephus cinctus	Wheat stem sawfly
Cephus pygmeus	European wheat stem sawfly
Ceutorhynchus assimilis	Cabbage seed weevil
Ceutorhynchus napi	Rape stem weevil
Ceutorhynchus pallidactylus	Cabbage seed weevil
Chickpea chlorotic dwarf virus (Mastrevirus)	Chickpea chlorotic dwarf
Chickpea chlorotic stunt virus (Polerovirus)	Chickpea chlorotic stunt virus
Chilo orichalcociliellus	Coastal stalk borer
Colletotrichum truncatum (lentil affecting strain)	Lentil anthracnose
Cylindrocopturus adspersus	Sunflower stem weevil
Diabrotica barberi	Northern corn rootworm
Diabrotica undecimpunctata	Southern corn rootworm, spotted cucumber beetle
Diabrotica virgifera	Western corn rootworm
Diaporthe helianthi	Stem canker
Diuraphis noxia	Russian wheat aphid
Eurygaster integriceps	Sunn pest
Fusarium oxysporum f. sp. *ciceris*	Fusarium wilt of chickpea, chickpea wilt
Fusarium oxysporum f. sp. *glycines*	Fusarium wilt of soybean
Fusarium oxysporum f. sp. *lupini*	Fusarium wilt
Fusarium virguliforme	Sudden death syndrome
Groundnut bud necrosis virus (Tospovirus)	Groundnut bud necrosis virus
Groundnut ringspot virus (Tospovirus)	Groundnut ringspot virus
Harpophora maydis	Late wilt, slow wilt
Heterodera ciceri	Chickpea cyst nematode
Heterodera filipjevi	Cereal cyst nematode
Heterodera glycines	Soybean cyst nematode
Heterodera latipons	Mediterranean cereal cyst nematode
Heterodera sorghi	Sorghum cyst nematode
Homoesoma electellum	Sunflower moth
Magnaporthe grisea	Wheat blast
Mayetiola destructor	Hessian fly
Mayetiola hordei	Barley stem gall midge
Mungbean yellow mosaic virus	Legume yellow mosaic viruses
Nysius huttoni	Wheat bug
Pantoea stewartii	Stewart's disease, bacterial wilt
Peanut clump virus (Pecluvirus)	Peanut clump virus, Indian peanut clump virus
Peronosclerospora philippinensis	Philippine downy mildew of maize
Peronosclerospora sorghi	Sorghum downy mildew
Plasmopara halstedii	Downy mildew
Prostephanus truncatus	Larger grain borer
Puccinia graminis f. sp. *tritici*	Wheat stem rust
Puccinia striiformis f. sp. *hordei*	Barley stripe rust
Rhizoctonia solani f. sp. *sasakii*	Banded leaf and sheath spot
Riptortus dentipes	Pod sucking bug
Schizaphis graminum	Greenbug, wheat aphid, spring green aphid
Soil-borne wheat mosaic virus (Furovirus)	Soil-borne wheat mosaic
Thaumatotibia leucotreta	False codling moth
Tilletia indica	Karnal bunt
Trogoderma granarium	Khapra beetle
Zea mosaic virus (Potyvirus)	Zea mosaic virus

Puccinia graminis f. sp. *tritici, pathotype Ug99. Reddish brown, powdery, oblong spore-producing pustules characteristic of wheat stem rust. Image courtesy of Department of Agriculture and Water Resources*

Puccinia striiformis f. sp. *hordei. Barley stripe rust symptoms can present on all leaves in an area of a crop. Image courtesy of Flavio Capettini*

HAZELNUTS

Represented by Hazelnut Growers of Australia Inc.
hazelnuts.org.au

In 2014–15, hazelnut production was valued at $1 million (LVP). The industry is however, expanding, with approximately 200 hectares planted, consisting of around 100,000 trees. The industry estimates hazelnut production in 2020 will be 300 tonnes with a value of $2.1 million.

Hazelnuts are grown in the temperate areas of south eastern Australia. The main production regions are the Central Tablelands of NSW around Orange, and north-east Victoria around Myrtleford. They are also grown in central and eastern Victoria and increasingly in northern Tasmania. There are small levels of production in SA and WA.

Australia has recently seen a major on-farm investment in hazelnuts from a northern hemisphere confectionary manufacturer which confirms that the opportunities for Australian hazelnuts are large, giving renewed confidence to Australian growers.

Australia imports 2,500 tonnes of hazelnut product annually, primarily from Turkey. Imported produce is mainly in kernel form for use by mass market confectioners.

Throughout 2016 the Hazelnut Growers of Australia Inc has been involved in a number of exotic incursions relevant to the hazelnut industry, including a new hazelnut mite. Australia is free from Eastern filbert blight, a serious disease affecting the industry in the USA.

Aspects of biosecurity are well embedded in the Australian Hazelnut Industry Five Year Strategic Plan – 2016 to 2021.

The hazelnut industry is covered by version 2.0 of the nut industry biosecurity plan, which was reviewed in 2016.

Table 15. High Priority Pests of the hazelnut industry

Scientific name	Common name
Anisogramma anomala	Eastern filbert blight
Chinavia hilaris (syn. *Acrosternum hilare, Pentatoma hilaris, Chinavia hilarae; Nezara hilaris*)	Green stink bug, pistachio bug
Halyomorpha halys	Brown marmorated stink bug
Lymantria dispar	Gypsy moth (Asian and European strains)

Figure 32. Annual value of hazelnut production, 2010–15

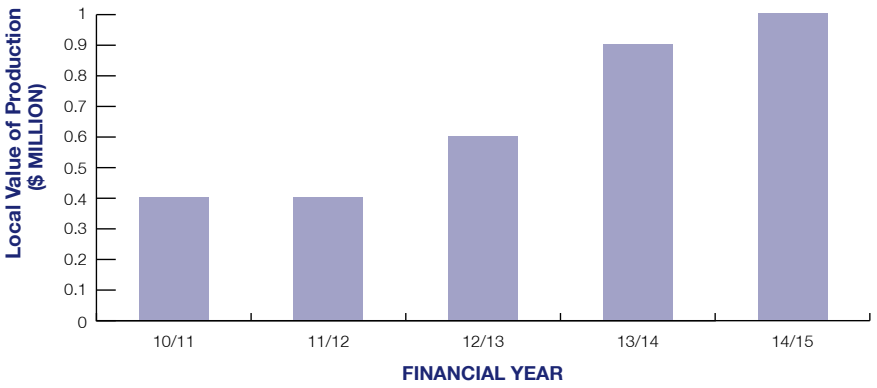
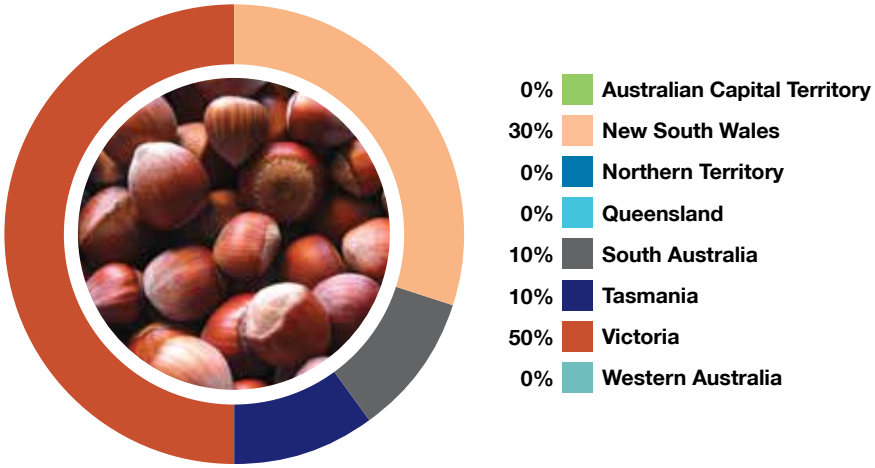


Figure 33. Distribution of hazelnut production by state and territory, 2014–15 (based on LVP)



HONEY BEES

Represented by Australian Honey Bee Industry Council Inc.
honeybee.org.au

In 2014–15, honey production was valued at $91 million (LVP). Around 13,000 beekeepers are currently registered, operating around 448,000 hives. Apiaries range in size from between one and several thousand hives.

In addition to honey, there is some trade in live bees but this has declined in recent years due to market closures including the United States which Australia is endeavouring to re-open. There are other smaller markets in which work is being done to gain access.

The honey bee industry is a member of PHA due to the benefits that honey bees provide to pollination dependent plant industries, estimated to be worth $4–6 billion per year. Emergency pest responses relating to honey bees are now covered under the EPPRD.

The National Bee Pest Surveillance Program (NBPSP) continues to operate at ports around Australia to boost preparedness for exotic pests of bees and pest bees. In 2016 the program was reviewed and is set to be expanded to include more ports.

A National Bee Biosecurity Program and the Australian Honey Bee Industry Biosecurity Code of Practice for beekeepers have been agreed by industry. The appointment of Bee Biosecurity Officers (BBO) in each state is progressing.

The honey bee industry is covered by version 1.0 of the honey bee biosecurity plan and the Biosecurity Manual for Beekeepers Version 1.1.

National Bee Pest Surveillance PROGRAM

NATIONAL BEE BIOSECURITY PROGRAM

Figure 34. Annual value of honey and beeswax production, 2007–15

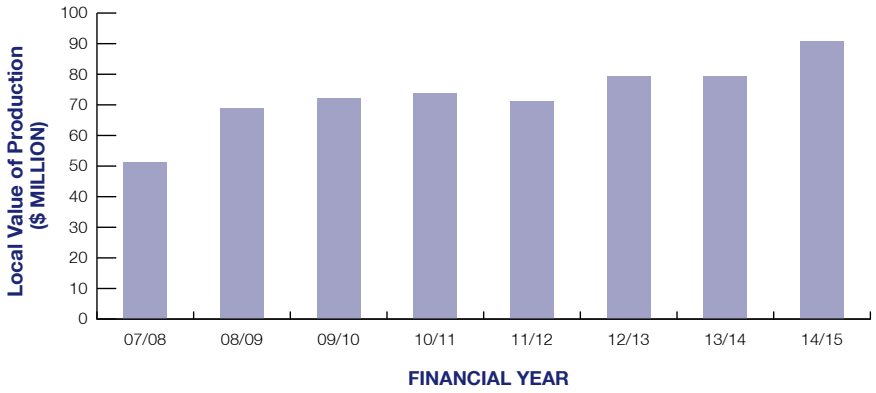


Figure 35. Distribution of honey and beeswax production by state and territory, 2014–15 (based on LVP)

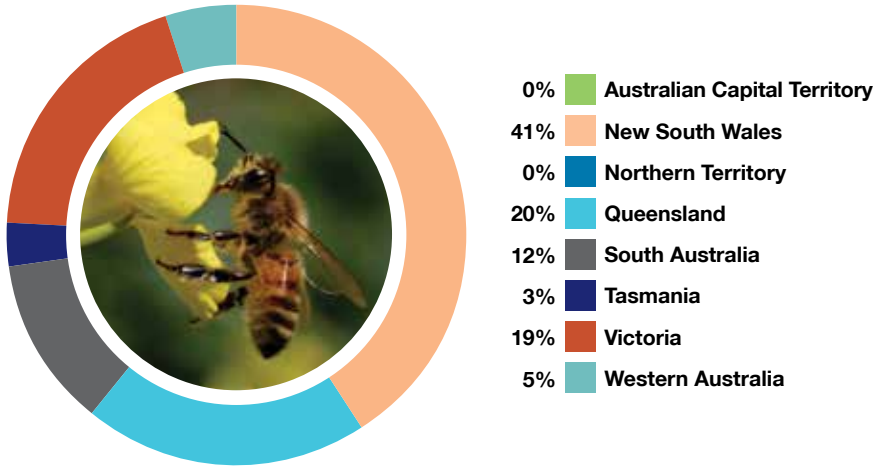


Table 16. High Priority Pests of the honey bee industry

Scientific name	Common name
Acarapis woodi	Tracheal mite
Apis cerana (exotic strains, genotypes and sub-species)	Asian honey bee
Apis mellifera capensis	Cape honey bee
Apis mellifera scutellata	African honey bee
Apis mellifera scutellata (hybrid)	Africanised honey bee
Deformed wing virus (Iflavirus)	Deformed wing virus
Hoplostoma fuligineus	Large hive beetle
Slow paralysis virus (Iflavirus)	Slow paralysis virus
Tropilaelaps clareae	Tropilaelaps mite
Tropilaelaps mercedesae	Tropilaelaps mite
Varroa destructor	Varroa mite
Varroa jacobsoni	Varroa mite
Vespa spp. (exotic species)	Hornets

LYCHEES

Represented by Australian Lychee Growers' Association
australianlychee.com.au

In 2014–15, lychee production was valued at $16 million (LVP). Current annual production ranges from 2,250 to 3,500 tonnes, depending on climatic and seasonal conditions.

Australian lychees are available to consumers on the domestic and export markets for a 6-month period from October to March. This gives Australia a significant advantage over other suppliers on world markets, as no other country can offer such a long line of supply of fresh lychee during the northern hemisphere winter.

While the majority of lychees are grown for domestic consumption, export demand is increasing. Small niche markets are also being developed by producers using Australian lychee for a range of other value added products. Australian lychees were exported to the United States during the 2016 season as part of a 3-year pilot program that is expected to fully open the market for future lychee export.

In 2016 the governments of Queensland and Taiwan signed a Memorandum of Understanding allowing the import into Australia of several hundred marcotts of six new TaiNung Taiwan lychee varieties. After a 12-month post-entry quarantine period, the plants will be trial grown on selected orchards. If successful, the new varieties will then be available to other interested lychee growers.

The lychee industry is covered by version 1.0 of the lychee biosecurity plan.

Table 17. High Priority Pests of the lychee industry

Scientific name	Common name
Aristobia testudo	Lychee longicorn beetle
Bactrocera dorsalis	Oriental fruit fly
Conopomorpha sinensis	Lychee fruit borer
Paradasynus longirostris	Hong Kong stink bug
Peronophythora litchii	Brown blight
Pseudotheraptus wayi	Coconut bug
Unknown (suspected phytoplasma)	Longan and lychee witches' broom disease

Figure 36. Annual value of lychee production, 2009–15

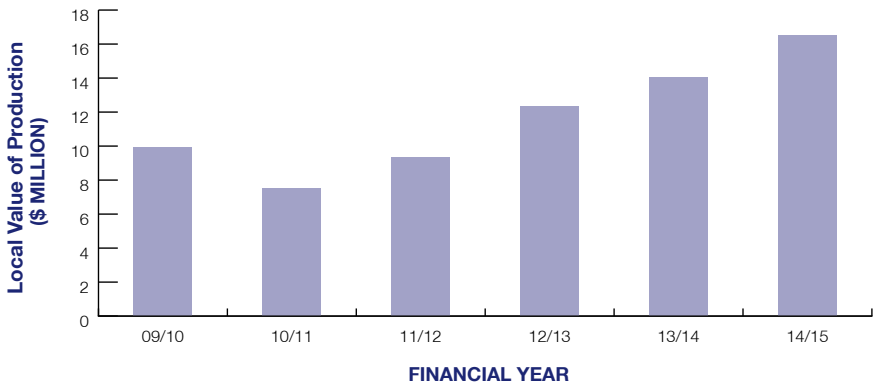
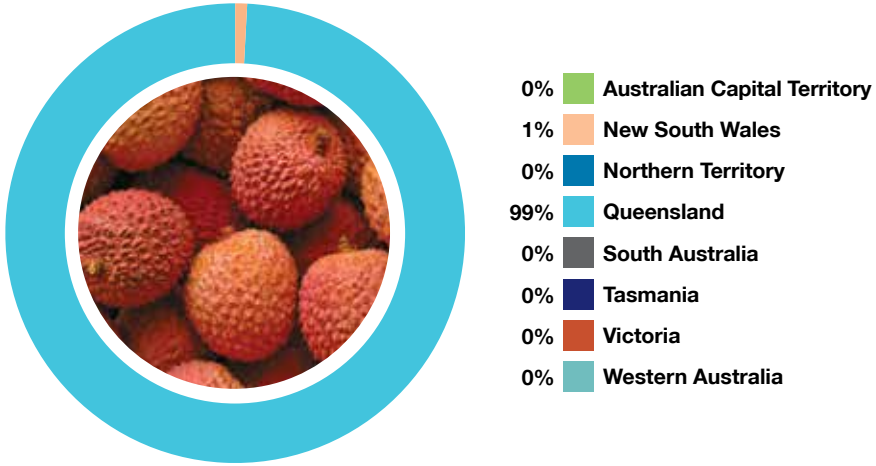


Figure 37. Distribution of lychee production by state and territory, 2014–15 (based on LVP)



MACADAMIAS

Represented by the Australian Macadamia Society Ltd
australian-macadamias.org

In 2014–15, macadamia production was valued at $156 million (LVP). Annual production from 20,000 hectares is approximately 50,000 tonnes in-shell or 15,000 tonnes of kernel.

The majority of plantings are varieties of *Macadamia integrifolia*. Of these about 80 per cent are Hawaiian selections with the remainder being Australian varieties. New Australian bred varieties are likely to be released in the next few years. Harvest commences in March and runs through to August.

Australian macadamia production stretches from Coffs Harbour on the NSW north coast to Mackay on the north Queensland coast. The majority of macadamia plantings are in northern NSW, Bundaberg and south east Queensland. The northern rivers region of NSW and Bundaberg each comprise about 40 per cent of production. Bundaberg has the fastest growth in production and is likely to become the largest growing region in the next year or so.

Approximately 70 per cent of the crop is exported, principally to Europe, the United States, Japan and other Asian countries as kernels and to China as nut-in-shell. Australia is currently the world's largest producer of macadamia kernels. South Africa and Kenya are the other major producers.

In order to encourage biosecurity awareness within the industry, approximately 70 per cent of orchards employ professional pest scouts and the Australian Macadamia Society convenes an annual pest scout forum where pest pressures for the previous season are reviewed and any new pest and disease sightings reported.

The macadamia industry is covered by version 2.0 of the nut biosecurity plan.

Table 18. High Priority Pests of the macadamia industry

Scientific name	Common name
Hypothenemus obscurus	Tropical nut borer
Phytophthora ramorum	Sudden oak death
Tropilaelaps clareae	Tropilaelaps mite
Tropilaelaps mercedesae	Tropilaelaps mite
Varroa destructor	Varroa mite
Xylella fastidiosa (including *X. fastidiosa* subsp. *fastidiosa, X. fastidiosa* subsp. *multiplex, X. fastidiosa* subsp. *piercei)* (with vector)	Almond leaf scorch, pecan bacterial leaf scorch

Figure 38. Annual value of macadamia production, 2007–15

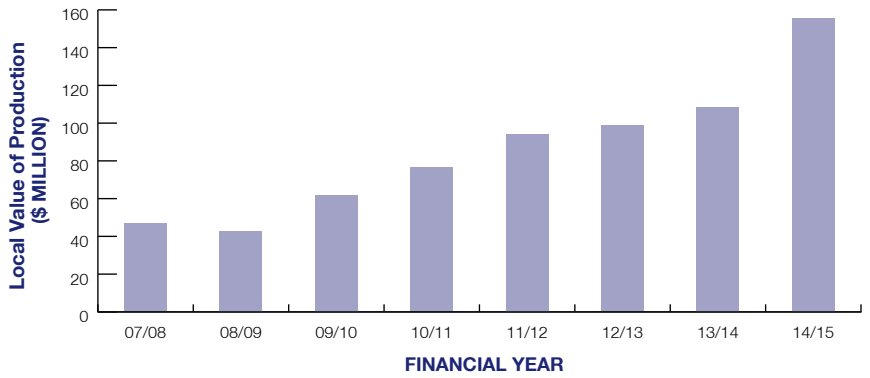
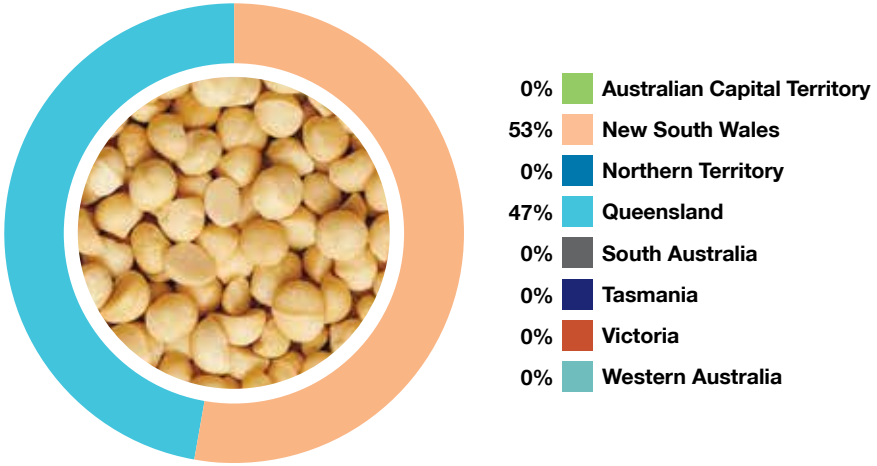


Figure 39. Distribution of macadamia production by state and territory, 2014–15 (based on LVP)



MANGOES

Represented by the Australian Mango Industry Association Ltd
industry.mangoes.net.au

In 2014–15, mango production was valued at $66 million (LVP). Over the last five years the average production volume has been 53,500 tonnes. Around 85 per cent of fruit produced is consumed fresh with the remainder processed. The proportion processed is influenced by crop production and the fresh market price.

The most abundant variety, Kensington Pride, accounts for approximately 65 per cent of Australian production. Other varieties include B74 (Calypso), Brooks, Honey Gold, Keitt, Palmer, Pearl and R2E2, as well as green eating varieties Keo Savoy and Nam Doc Mai. Other varieties are produced in smaller volumes.

The industry supplies the Australian market, with production occurring from September to March each year. In Australia, the majority of mangoes (92 per cent of the nation's crop) are grown in Queensland and the NT, with smaller but significant production in regions throughout WA.

The mango industry is covered by version 2.1 of the biosecurity plan for the mango industry and the Orchard Biosecurity Manual for the Mango Industry Version 1.0.

Table 19. High Priority Pests of the mango industry

Scientific name	Common name
Bactrocera carambolae	Carambola fruit fly
*Bactrocera papayae**	Papaya fruit fly
Ceratocystis fimbriata sensu lato	Mango sudden decline syndrome
Ceratocystis manginecans	Mango sudden decline syndrome
Ceratocystis omanensis	Mango sudden decline syndrome
Deanolis sublimbalis	Red banded mango caterpillar
Fusarium mangiferae	Mango malformation
Fusarium mexicanum	Mango malformation
Fusarium poliferatum	Mango malformation
Fusarium sterilihyphosum	Mango malformation
Parasa lepida	Blue striped nettle grub
Procontarinia spp. (exotic species)	Mango gall midge
Sternochetus frigidus	Mango pulp weevil
Xylosandrus compactus	Black twig borer

* This species has been synonymised with *Bactrocera dorsalis*

Figure 40. Annual value of mango production, 2007–15

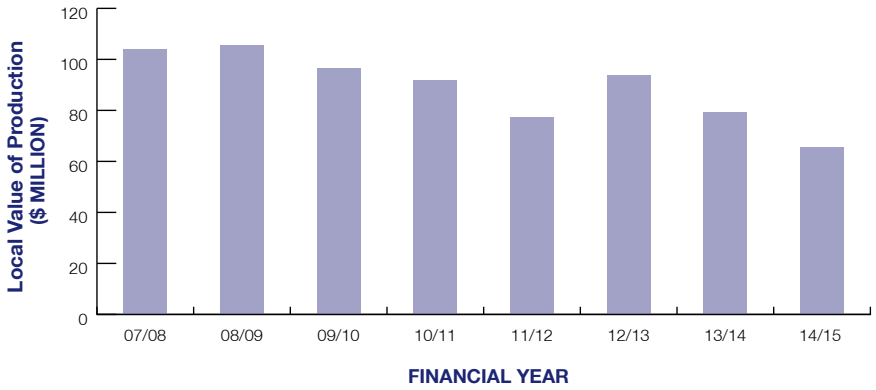
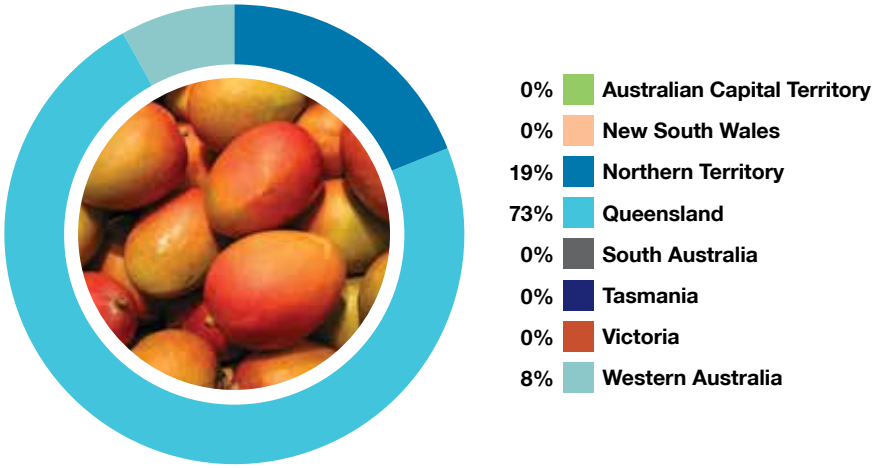


Figure 41. Distribution of mango production by state and territory, 2014–15 (based on LVP)



MELONS

Represented by the Australian Melon Association Inc
melonsaustralia.org.au

In 2014–15, melon production was valued at $185 million (LVP). Fresh seedless watermelons, rockmelons and honeydew melons are the major products. They are produced all year round. The main form of value-adding is cut and wrapped fruit. Some melons are used in fresh cut fruit salad mixes and juice products.

The Australian melon industry consists of approximately 300 growers producing, on average, 200,000 tonnes of melons annually across an area of around 7,000 hectares, with the majority of production occurring in Queensland, NT, WA and NSW.

Melons are grown for domestic consumption as well as international export with 85 per cent of all exported products going to New Zealand, United Arab Emirates and Singapore. About one quarter of the produce is watermelons.

The melon industry is working with growers on biosecurity measures to address seed borne diseases, on-farm biosecurity and surveillance. Melons are covered by version 1.0 of the biosecurity plan for the melon industry.

Table 20. High Priority Pests of the melon industry

Scientific name	Common name
Bactrocera cucurbitae	Melon fruit fly
*Bactrocera invadens**	Fruit fly
Bactrocera latifrons	Solanum fruit fly
Liriomyza bryoniae	Tomato leafminer
Liriomyza huidobrensis	Pea or serpentine leafminer
Liriomyza sativae	Vegetable leafminer
Liriomyza trifolii	American serpentine leafminer
Bemisia tabaci (exotic strains and biotypes)	Silverleaf whitefly
Fusarium oxysporum f. sp. *melonis* (exotic races), *F. oxysporum* f. sp. *niveum* (exotic races), *F. oxysporum* f. sp. *radicis-cucumerinum*	Fusarium root and stem rot of melons
Monosporascus cannonballus	Monosporascus root rot
Erwinia tracheiphila	Cucurbit bacterial wilt

* This species has been synonymised with *Bactrocera dorsalis*

Figure 42. Annual value of melon production 2010–15

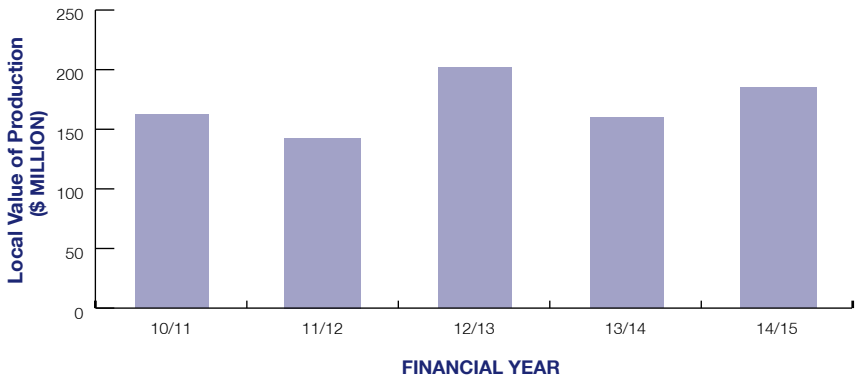


Figure 43. Distribution of melon production by state and territory, 2014–15 (based on LVP)

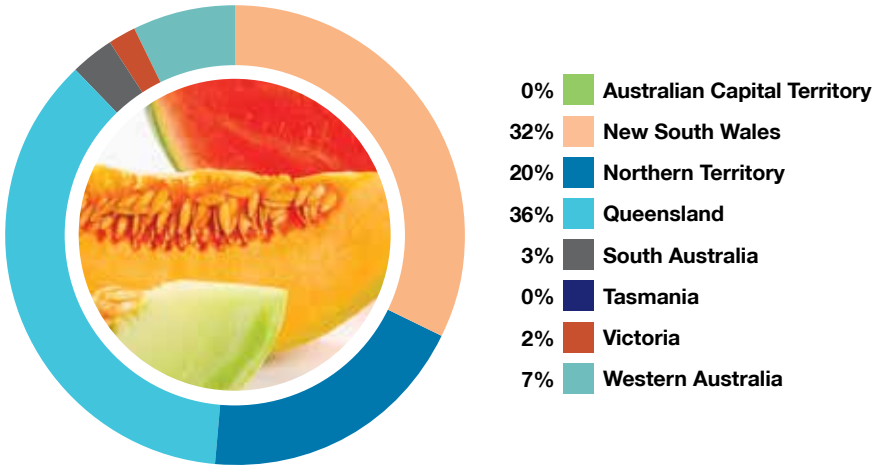


Image courtesy of Nursery and Garden Industry Australia

NURSERY

Represented by the Nursery & Garden Industry Australia Ltd (NGIA)
ngia.com.au

In 2014–15, nursery production (propagation stock, vegetable and forestry seedlings, bedding plants, indoor plants, fruit and landscape trees and shrubs) was valued at $664 million (LVP). The nursery industry operates in all states and territories, being one of the largest and most diverse plant industries in Australia.

The industry estimates an annual gross production value of approximately $2.5 billion (production nurseries only) in 2016 across the entire supply chain. NGIA supplies to ornamental retail, landscape, re-vegetation, rehabilitation and production horticulture sectors including tree crops (e.g. fruit, forestry, tea tree), vegetables, forestry and cut flowers. The industry has a limited export focus of approximately $18 million annually; however there is ample opportunity for international export growth.

In 2016 NGIA developed the Nursery Production Farm Management System website **nurseryproductionfms.com.au** which will be the one-stop shop for industry biosecurity for growers including access to pest fact sheets, management plans, videos, BioSecure HACCP and a training portal.

The national plant health project Building the Resilience and On-Farm Biosecurity Capacity of the Australian Production Nursery Industry (2015–2020) will continue to develop plant biosecurity resources and to upskill industry members and expand knowledge. Extension videos covering topics such as site surveillance, intake inspection and crop monitoring have been developed since 2013, with NGIA and PHA working together in 2016 to produce six to eight new biosecurity videos annually through to 2019.

The industry continues to build the online electronic plant pest identification resource Pest ID Tool **pestid.com.au** which combines information and images on endemic and key exotic plant pests that impact on production or trade.

The nursery industry is covered by version 3 of the biosecurity plan for the nursery industry and the Biosecurity Manual for the Nursery Production Industry Version 1.

Figure 44. Distribution of production nurseries by state and territory, 2014–15 (based on LVP)

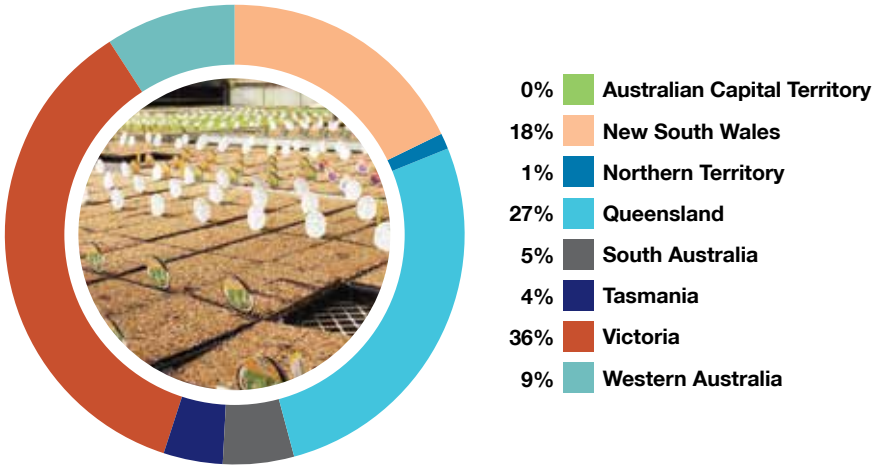


Figure 45. Annual value of nursery production, 2007–15

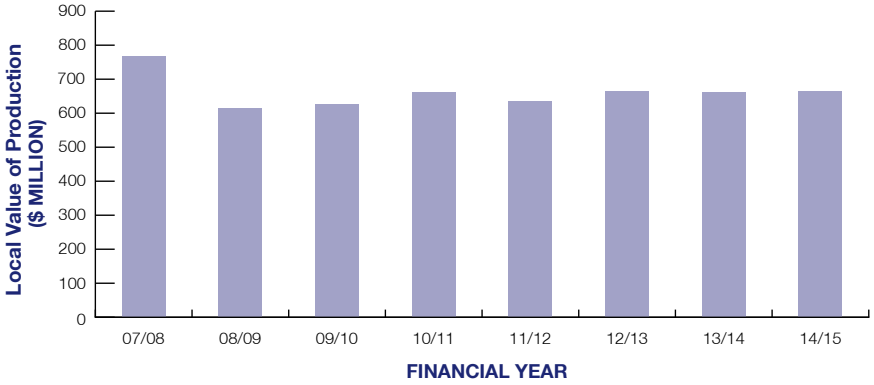


Table 21. High Priority Pests of the nursery industry

Scientific name	Common name
Achatina fulica	Giant African snail
Aphis gossypii (exotic strains)	Cotton aphid
Bemisia tabaci (exotic strains)	Silverleaf whitefly
Candidatus Liberibacter asiaticus	Huanglongbing (Asiatic strain)
Diaphorina citri	Asian citrus psyllid
Echinothrips americanus	Poinsettia thrip
Homalodisca vitripennis	Glassy winged sharpshooter
Lettuce infectious yellows virus (Crinivirus)	Lettuce infectious yellows virus
Liriomyza huidobrensis	Serpentine leaf miner
Lygus lineolaris	Tarnished plant bug
Lymantria dispar	Asian gypsy moth
Oligonychus ilicis	Southern red mite
Phytophthora ramorum	Sudden oak death
Pomacea canaliculata	Golden apple snail
Pseudomonas syringae pv. *syringae* (exotic races)	Bacterial canker
Puccinia psidii sensu lato (exotic variants)	Guava rust, Eucalyptus rust
Xylella fastidiosa	Pierce's disease

OLIVES

Represented by the Australian Olive Association Ltd
australianolives.com.au

In 2014–15, olive production was valued at $119 million (LVP). The Australian olive industry began in earnest in 1990 with the majority of large groves planted between 1996 and 2004. The olive industry is regarded as mainstream agriculture and remains an important employer in regional Australia. In 2013 the industry began collecting an RD&E levy.

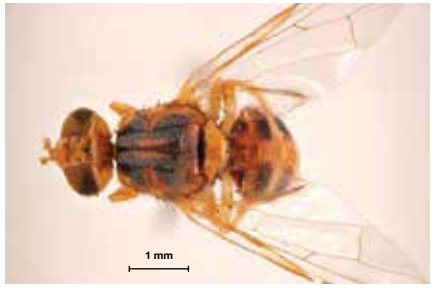
The industry suffered losses during the global financial crisis which saw a number of groves change hands. Since then the Australian Olive Association has noticed a number of new, younger people purchasing olive orchards and joining the Association bringing renewed enthusiasm and vision. Victoria is the largest producer, followed by WA, SA and NSW.

The industry estimates that in 2015–16 the Australian olive industry exported 5,047 tonnes of olive products, 11 per cent more than the previous year, worth $30.75 million. Olive oil accounted for 95 per cent of the exports of olive products, with table olives accounting for the rest. There were no measurable fresh olive exports. Spain was the leading export destination with 39 per cent market share, followed by Italy (14%) China and New Zealand (13%). Another 33 markets accounted for the remaining 21 percent.

The olive industry is covered by version 2.0 of the biosecurity plan for the olive industry.

Table 22. High Priority Pests of the olive industry

Scientific name	Common name
Bactrocera oleae	Olive fly
Prays oleae	Olive moth, olive kernel borer
Xylella fastidiosa subsp. *multiplex* (with vectors)	Leaf scorch
Xylella fastidiosa subsp. *pauca* (with vectors)	Olive quick decline
Verticillium dahliae (exotic defoliating strain)	Verticillium wilt (defoliating strains)



Olive fly. Image courtesy of PaDIL, bugwood.org.

Olive fly. Image courtesy of Lorraine Graney, Bartlett Tree Experts, bugwood.org.

Figure 46. Annual value of olive production, 2007–15

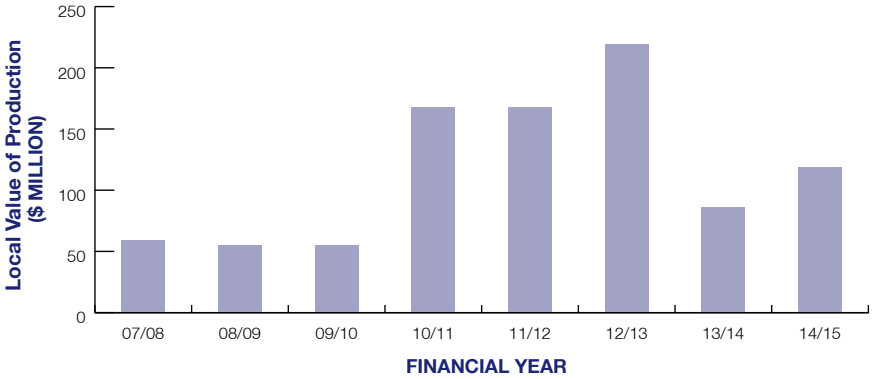
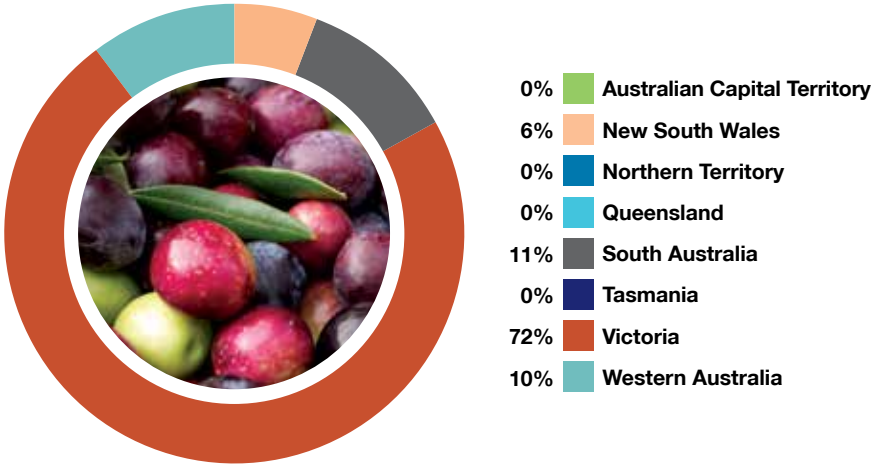


Figure 47. Distribution of olive production by state and territory, 2014–15 (based on LVP)



ONIONS

Represented by Onions Australia
onionsaustralia.org.au

In 2014–15, onion production was valued at $209 million (LVP).

The main growing areas for onion production include the Lockyer Valley, St George and Darling Downs in Queensland; Murrumbidgee Irrigation Area in NSW; Adelaide Plains, Riverland and south eastern SA; Manjimup and Pemberton in WA; Werribee and Cranbourne in Victoria; and the north western to northern midlands of Tasmania.

Sowing of onions starts in Queensland during February (short day types) and finishes in the southern states in August (long day types). Harvest starts in Queensland during September and finishes during April in the southern states.

The onion industry is covered by version 2.0 of the onion biosecurity plan.

Table 23. High Priority Pests of the onion industry

Scientific name	Common name
Botrytis squamosa	Leaf blight
Cladosporium allii	Leaf spot
Delia antiqua	Onion fly
Delia florilega	Bean fly
Eumerus amoenus	Onion bulb fly
Eumerus strigatus	Lesser bulb fly
Liriomyza sativae	Vegetable leaf miner
Phytomyza gymnostoma	Allium leaf miner
Puccinia spp. (exotic species)	Rust
Rhizoglyphus callae	Bulb mite
Rhizoglyphus setosus	Bulb mite
Thrips tabaci (exotic strains and biotypes)	Onion thrip
Xanthomonas axonopodis pv. *allii*	*Xanthomonas* leaf blight

Figure 48. Annual value of onion production, 2007–15

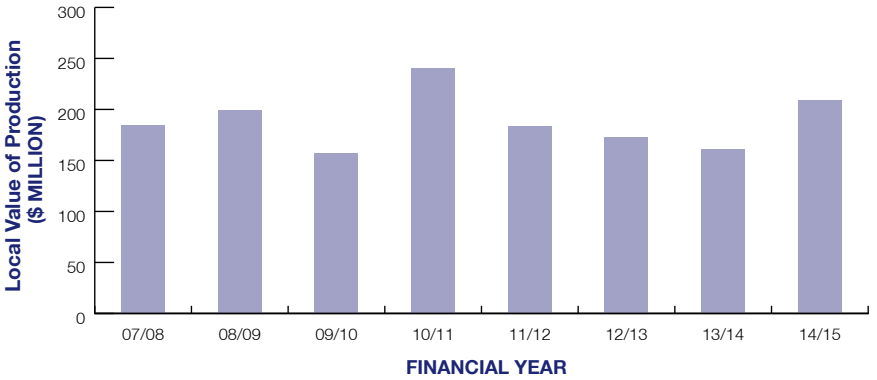
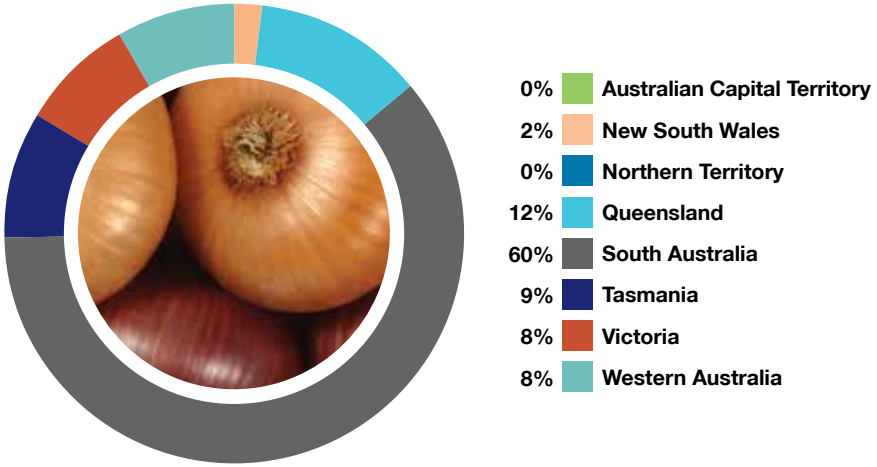


Figure 49. Distribution of onion production by state and territory, 2014–15 (based on LVP)



PASSIONFRUIT

Represented by Passionfruit Australia Inc.
passionfruitaustralia.org.au

In 2014–15, passionfruit production was valued at $16 million (LVP). There are currently 300 hectares of passionfruit under cultivation in Australia with about 400,000 passionfruit vines yielding approximately 4,600 tonnes of fruit.

About two thirds of the Australian passionfruit crop is grown in Queensland and around one third in NSW.

Passionfruit is grown year round but main supply times to market are December through to September. The main purple passionfruit varieties grown in Australia are Misty Gem and Sweetheart, and the major Panama passionfruit varieties are Pandora and McGuffie's Red.

At present, there are only small amounts of passionfruit exported, however the industry is looking to progress an application for export to New Zealand.

The passionfruit industry is covered by version 1.0 of the passionfruit biosecurity plan.

Figure 50. Distribution of passionfruit production by state and territory, 2014–15 (based on LVP)

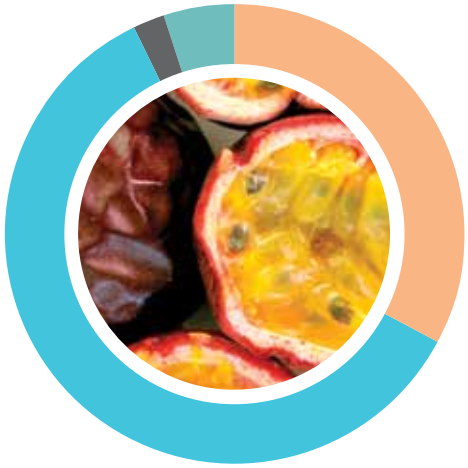


Figure 51. Annual value of passionfruit production, 2007–15

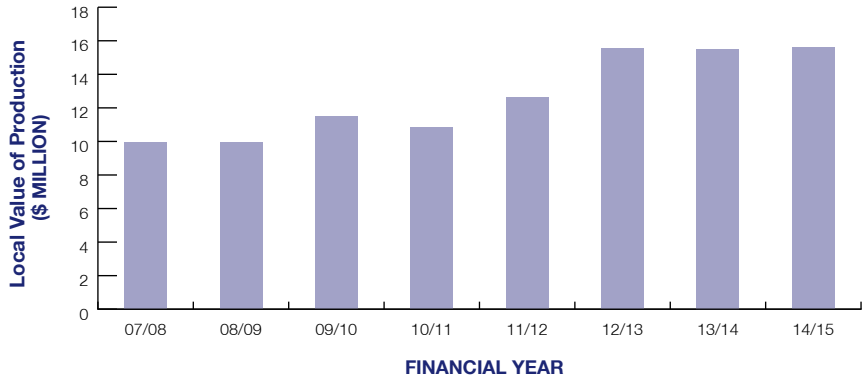


Table 24. High Priority Pests of the passionfruit industry

Scientific name	Common name
Bactrocera carambolae	Carambola fruit fly
Bactrocera cucurbitae	Melon fruit fly
Bactrocera dorsalis	Oriental fruit fly
Bactrocera facialis	Tropical fruit fly
Bactrocera kandiensis	Fruit fly
Bactrocera kirki	Fijian fruit fly
Bactrocera melanotus	Fruit fly
*Bactrocera papayae**	Papaya fruit fly
Bactrocera passiflorae	Fijian fruit fly
*Bactrocera philippinensis**	Philippine fruit fly
Bactrocera psidii	South Sea guava fruit fly
Bactrocera xanthodes	Pacific fruit fly
East Asian passiflora virus (Potyvirus)	East Asian passiflora virus
Passiflora chlorosis virus (Potyvirus)	Passiflora chlorosis virus
Passionfruit crinkle virus (Potyvirus)	Passionfruit crinkle virus
Passionfruit ringspot virus (Potyvirus)	Passionfruit ringspot virus
Passionfruit severe leaf distortion virus (Begomovirus)	Passionfruit severe leaf distortion virus
Passionfruit Sri Lankan mottle virus (Potyvirus)	Passionfruit Sri Lankan mottle potyvirus
Passionfruit vein clearing virus (Rhabdovirus)	Passionfruit vein clearing rhabdovirus
Passionfruit yellow mosaic virus (Tymovirus)	Passionfruit yellow mosaic virus
Xanthomonas axonopodis pv. *passiflorae*	Bacterial blight

* This species has been synonymised with *Bactrocera dorsalis*

Xanthomonas axonopodis pv. *passiflorae*. *(A) Typical necrotic lesion (B) Pale spots on fruit occur in high severity disease conditions. Image courtesy of Bernardo de Almeida Halfeld-Vieira and Kátia de Lima Nechet*

Adult papaya fruit fly (Bactrocera papayae). Image courtesy of Jeffrey W. Lotz, Florida Department of Agriculture and Consumer Services, Bugwood.org

PINEAPPLES

Represented by GROWCOM
growcom.com.au

In 2014–15, pineapple production was valued at $44 million (LVP), a decrease on the year before. The industry estimates that in 2015 approximately 47,000 tonnes of fresh fruit and 20,200 tonnes of processed fruit were marketed.

There are approximately 80 commercial pineapple enterprises, all based in Queensland, with key growing districts in Wamuran, Elimbah, Glasshouse Mountains, Beerwah, Yandina, Mary Valley, Maryborough, Hervey Bay, Childers, Bundaberg, Cawarral, Yeppoon and northern Queensland and one additional commercial farm located just outside Darwin, NT.

Australia contributes less than one per cent of the world's fresh pineapple production but supplies almost the entire domestic market. Four primary packing houses pack and market more than 70 per cent of fresh pineapples. The primary pineapple processor, Heinz Golden Circle Ltd, produces canned pineapple and juice.

Approximately 45 per cent of pineapple varieties grown are Smooth Cayenne and Queen (rough leaf). The remaining 55 per cent of plantings are new hybrid varieties that appeal more to the fresh market and this proportion is expected to increase.

The pineapple industry is covered by version 1.0 of the pineapple biosecurity plan.

Table 25. High Priority Pests of the pineapple industry

Scientific name	Common name
Cotinis mutabilis	Fig beetle
Dickeya spp. (pineapple infecting strains) (syn. *Erwinia chrysanthemi*)	Bacterial fruit collapse, bacterial heart rot
Dysmicoccus neobrevipes	Grey pineapple mealybug, annona mealybug
Fusarium ananatum and *F. guttiforme* (syn. *Fusarium subglutinans* subsp. *ananas*)	Fusariosis, Fusarium stem rot, pineapple eye rot, fruitlet core rot
Strymon megarus (as a vector of Fusariosis)	Pineapple fruit borer
Thaumatotibia leucotreta (syn. *Cryptophlebia leucotreta)*	False codling moth

Figure 52. Annual value of pineapple production, 2007–15

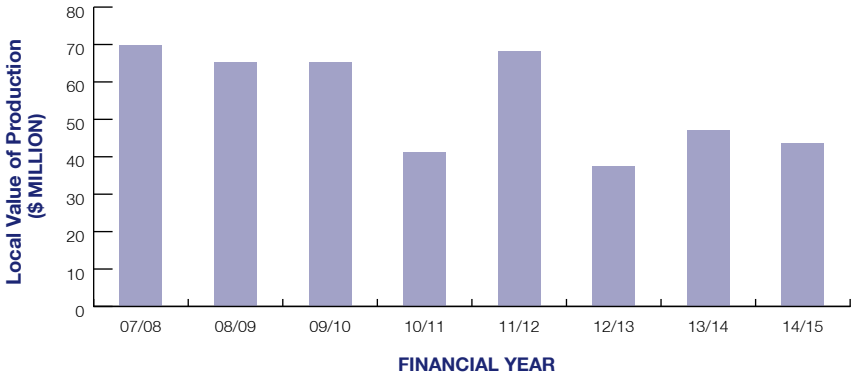
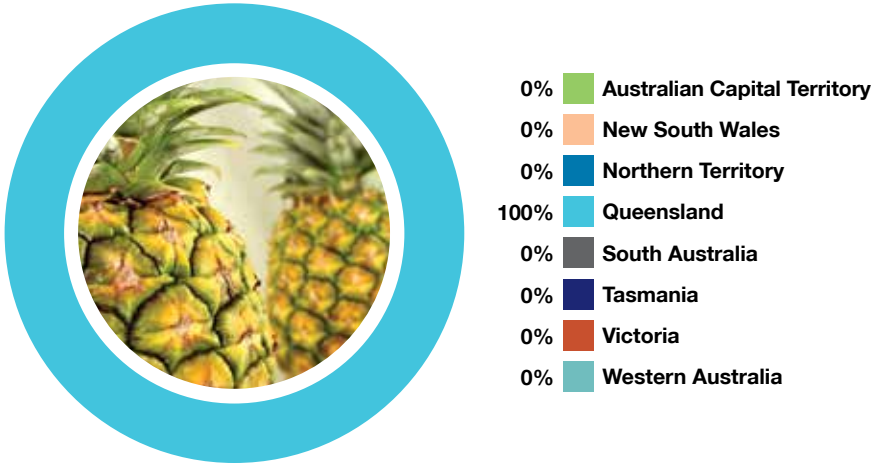


Figure 53. Distribution of pineapple production by state and territory, 2014–15 (based on LVP)



PISTACHIOS

Represented by Pistachio Growers' Association Inc.
pgai.com.au

In 2014–15, pistachio production was valued at $20 million (LVP). The industry estimates that in 2016, 1,060 hectares were under cultivation with 1,950 tonnes of pistachio nuts produced. This represented not only the best 'off-crop' but also the best crop ever produced by the Australian Pistachio Industry.

The major production areas are along the Murray River Valley between Swan Hill in Victoria and Waikerie in SA. Further plantings are in central west Victoria and Pinnaroo, SA, with small plantings in WA. It is estimated that 100 hectares were planted in 2016 with 100 hectares per annum to be planted in the next three years (2017 to 2019).

There are five large pistachio orchards and another five orchards of 10–15 hectares, which is the acknowledged size required to make a living solely from pistachio nut production. Around 20 mixed fruit growers each produce less than 5 tonnes of pistachios (dry) per annum from one to five hectares.

Australian pistachio production currently only meets 50 per cent of domestic consumption, with the remainder imported from other major producers including Iran and the United States. The domestic production of pistachio is expected to increase to 2,000 tonnes (rolling average of two seasons) by 2020.

Aspects of biosecurity are well embedded in the Australian Pistachio Industry Five Year Strategic Plan 2015 to 2020. The pistachio industry is covered by version 2.0 of the nut industry biosecurity plan.

Table 26. High Priority Pest of the pistachio industry

Scientific name	Common name
Amyelois transitella	Navel orange worm
Chinavia hilaris (syn. *Acrosternum hilare, Pentatoma hilaris, Chinavia hilarae, Nezara hilaris*)	Green stink bug, Pistachio bug
Leptoglossus clypealis	Leaf footed bug
Leptoglossus occidentalis	Western conifer seed bug
Leptoglossus zonatus	Western leaf footed bug
Lymantria dispar	Gypsy moth (Asian and European strains)
Trogoderma granarium	Khapra beetle
Verticillium dahliae (exotic defoliating strains)	Verticillium wilt

Figure 54. Annual value of pistachio production, 2008–15

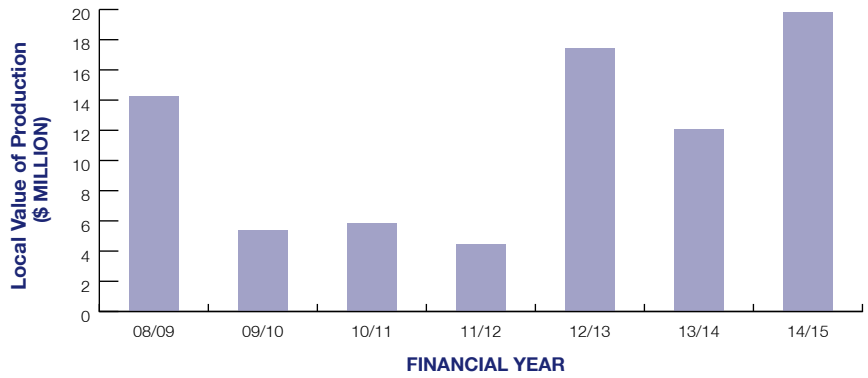


Figure 55. Distribution of pistachio production by state and territory, 2014–15 (based on LVP)

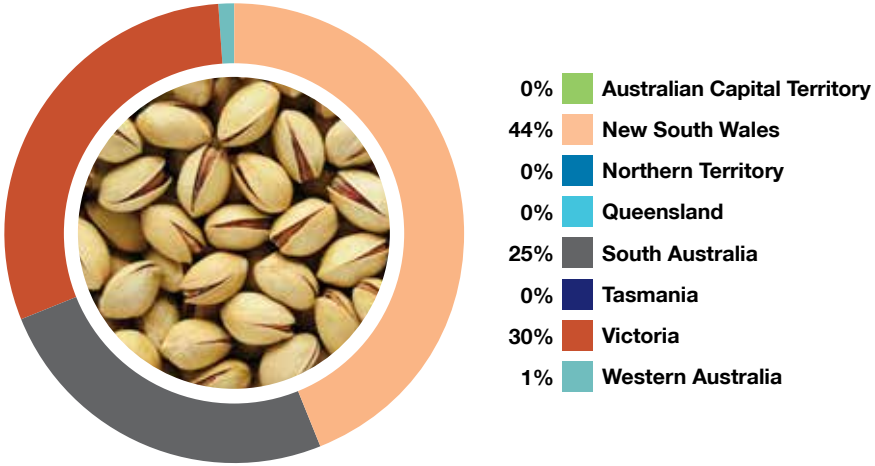


Image courtesy of Sara Bray

PLANTATION FORESTRY

Represented by the Australian Forest Products Association Ltd
ausfpa.com.au

In 2014–15, plantation forestry production was valued at $1.7 billion (LVP). The forest, wood and paper products sector is Australia's eighth largest manufacturing industry.

In 2015–16, 24.5 million cubic metres of logs were harvested from plantation estates for processing in Australia for international export. Plantations provide around 83 per cent of the log resources. Plantings are split almost evenly between softwood and hardwood.

The softwood plantation estate of over one million hectares is dominated by exotic species of pine: *Pinus radiata* in southern states, *P. elliottii* and *P. caribaea* in Queensland and northern NSW, and *P. pinaster* in WA. There is also a notable area (around 50,000 hectares) of native hoop pine (*Araucaria cunninghamii*) in the south east of Queensland and northern NSW. Softwood plantations are predominately long rotation and produce saw, peeler and pulp logs for a range of products including sawn timber, wood-based panels, engineered wood products, paper and paperboard.

The hardwood plantation estate of just under one million hectares is predominantly species of eucalypts grown for pulp and export woodchips. Around 10 per cent of hardwood is grown for saw logs to supplement the native forest sawlog supply. There are also some small plantings of *Acacia mangium*, African mahogany and sandalwood grown in the NT and northern WA.

Plantations are grown mainly in the medium rainfall zones (greater than 700 mm but less than 1,200 mm) along the east coast and south west corner of mainland Australia, as well as in Tasmania and NT.

The plantation forestry industry is covered by version 2.0 of the plantation forest biosecurity plan and the Biosecurity Manual for the Plantation Timber Industry version 1.0.

Image courtesy of HV Plantations

Figure 56. Annual value of plantation forest production, 2007–15

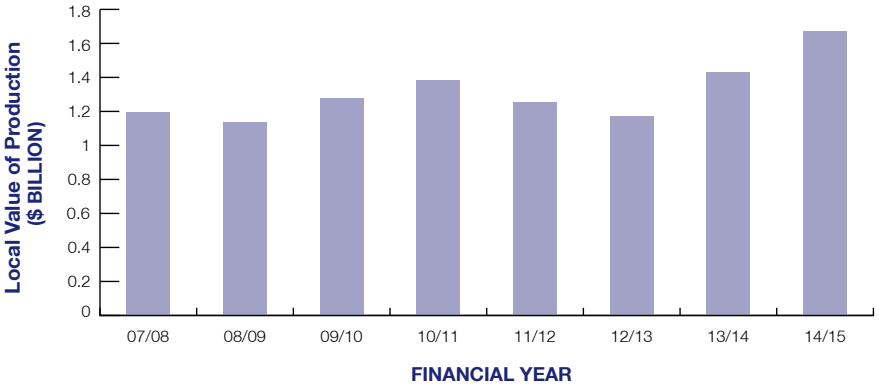


Figure 57. Distribution of plantation forest production by state and territory, 2014–15 (based on LVP)

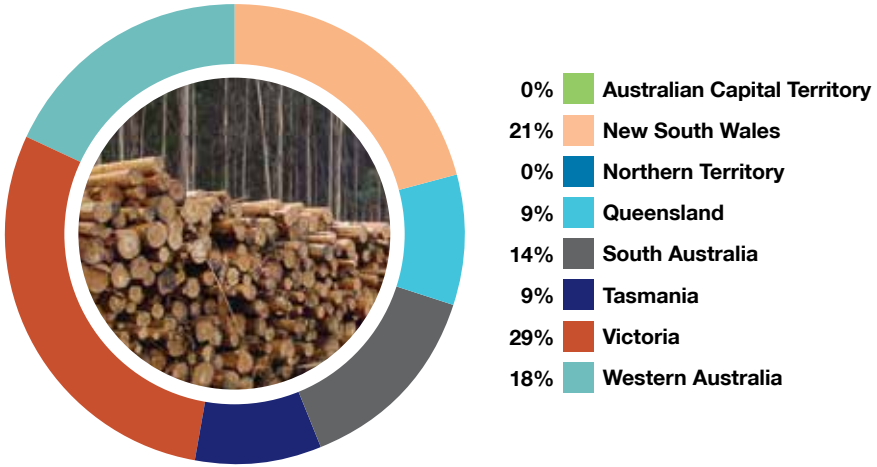


Table 27. High Priority Pests of the plantation forest industry

Scientific name	Common name
Bursaphelenchus spp. including *B. xylophilus*	Pinewood nematode species complex
Chrysopothe austroafricana	Eucalyptus canker disease
Coptotermes formosanus	Formosan subterranean termite
Coptotermes gestroi	Asian subterranean termite
Dendroctonus ponderosae	Mountain pine beetle
Dendroctonus valens	Red turpentine beetle
Endocronartium harknessii	Western gall rust
Fusarium circinatum	Pitch canker
Hylesia nigricans	Burning moth
Ips typographus	Spruce bark beetle
Lymantria dispar	Asian gypsy moth
Lymantria monacha	Nun moth
Monchamus spp. including *M. alternatus, M. galloprovinicialis, M. titillator, M. scutellatus*	Longhorn beetles
Orgyia thyellina	White spotted tussock moth
Phytophthora pinifolia	Dano foliar del Pino
Phytophthora ramorum	Sudden oak death
Puccinia psidii sensu lato (exotic variants)	Guava rust, Eucalyptus rust
Teratosphaeria gauchensis	Coniothyrium, Eucalyptus canker
Teratosphaeria zuluensis	Coniothyrium, Eucalyptus canker
Tomicus piniperda	Pine shoot beetle
Urocerus gigas	Giant wood wasp

Mountain pine beetle. Image courtesy of G. D. Amman, United States Department of Agriculture Forest Service

Red turpentine beetle larvae. Image courtesy of Ladd Livingston, Idaho Department of Lands

PROCESSING TOMATOES

Represented by the Australian Processing Tomato Research Council Inc.
aptrc.asn.au

In 2014–15, processing tomato production was valued at $26 million (LVP). The main varieties grown in Australia are dominated by Heinz cultivars and 99 per cent of the production area is irrigated using sub-surface drip lines.

An area totalling around 2,780 hectares was planted by processing tomato growers during the 2015–16 season. A total of 86 hectares were not harvested for a range of reasons, including a poor plant stand, delayed harvest and over-contracted fruit. Approximately 274,848 tonnes of tomatoes were delivered for processing during the 2015–16 season. This is drop of about 4 per cent or 12,000 tonnes on last year.

Australia consumes around 562,000 tonnes of processed tomatoes, with the majority of imports coming from Italy and China.

The processing tomatoes industry is covered by version 1.0 of the biosecurity plan for the tomato industry, published in 2016.

Figure 58. Distribution of processing tomato production by state and territory, 2014–15 (based on LVP)

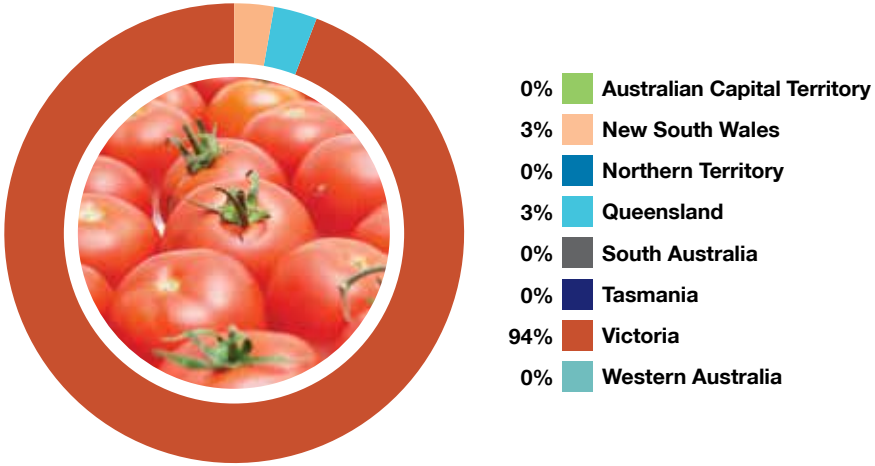


Figure 59. Annual value of processing tomato production, 2007–15

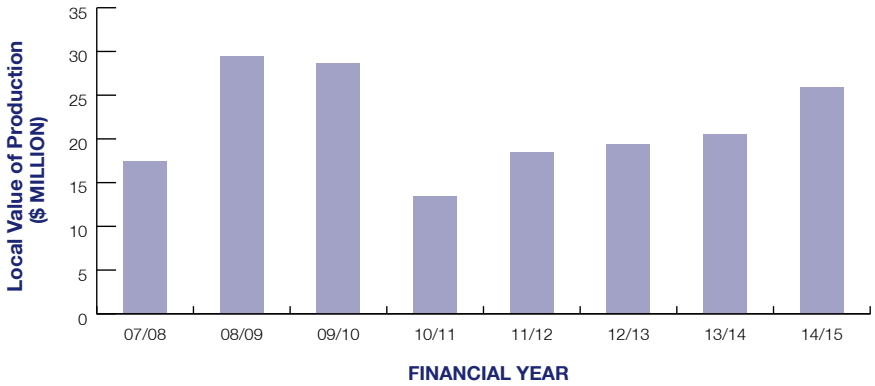


Table 28. High Priority Pests of the processing tomato industry

Scientific name	Common name
Achatina fulica	Giant African land snail
Bactericera cockerelli (syn. *Paratrioza cockerelli*)	Tomato potato psyllid
Candidatus Liberibacter solanacearum (with known vector)	Zebra chip
Frankliniella intonsa	Flower thrips
Liriomyza bryoniae	Tomato leaf miner
Liriomyza huidobrensis	Pea leafminer, serpentine leafminer
Liriomyza sativae	Vegetable leaf miner, American leaf miner
Liriomyza trifolii	American serpentine leaf miner
Tuta absoluta	South American tomato moth or tomato leafminer

RICE

Represented by the Ricegrowers' Association of Australia Inc.
rga.org.au

In 2014–15, rice production was valued at $253 million (LVP).

The Australian rice industry is predominantly located in the temperate climatic region of the Riverina in southern NSW. A very small area of rice is also grown in northern NSW and rice growing is emerging as an industry in north Queensland. In the Riverina, the major varieties grown are temperate Japonica varieties planted in October and harvested from March to May of the following year.

The vast majority of Australia's rice is exported to international destinations in Asia, the Middle East, and many nations in the Pacific. Market analysis indicates that there is demand across all market segments, both domestic and international, for 950,000 tonnes of paddy production annually.

Following the acquisition of a rice seed company in north Queensland by Ricegrowers' Limited (SunRice), rice is being grown there in increasing tonnages. While still limited, commercial production continues to increase as varieties bred specifically for that environment and local management techniques are introduced to the cropping system.

Strict biosecurity measures have been put in place to ensure that any rice plant pests which may be endemic in northern Australia are not spread south to the major rice growing area in NSW.

The rice industry is covered by version 3.0 of the rice biosecurity plan.

Image courtesy of Ricegrowers' Association of Australia

Figure 60. Annual value of rice production, 2007–15

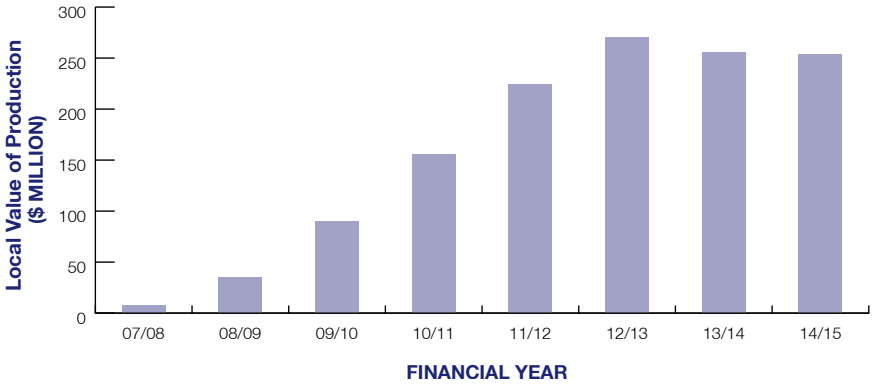


Figure 61. Distribution of rice production by state and territory, 2014–15 (based on LVP)

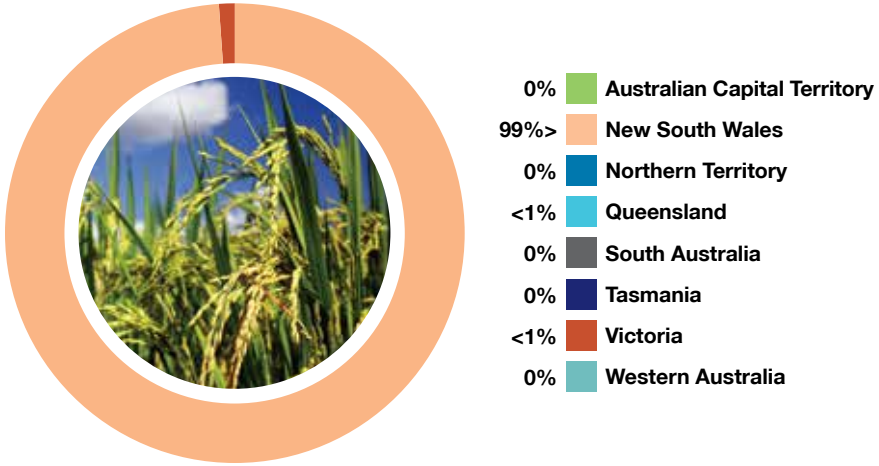


Table 29. High Priority Pests of the rice industry

Scientific name	Common name
Lissorhoptrus oryzophilus	Rice water weevil
Magnaporthe grisea	Rice blast
Pomacea cancliculata	Golden apple snail
Rice grassy stunt virus (Tenuivirus)	Rice grassy stunt virus
Rice ragged stunt virus (Oryzavirus)	Ragged stunt virus
Rice tungro bacilliform virus (unassigned)	Rice tungro bacilliform virus
Rice tungro spherical virus (Waikavirus)	Rice tungro spherical virus, Waikavirus
Tilletia barclayana	Kernel smut of rice
Tilletia indica	Karnal bunt
Trogoderma granarium	Khapra beetle

RUBUS

Represented by Raspberries and Blackberries Australia Inc. (RABA)

In 2014–15, the rubus industry was valued at $76 million (LVP).

Raspberry, blackberry and hybrid brambles (for example, silvanberries, boysenberries, loganberries, youngberries and marionberries) are collectively referred to as rubus or cane berries. There are currently over 550 hectares of land under cultivation with rubus varieties, much of it under protected cropping (rain shelters). New plantings continue to see the industry expand in response to increasing consumer demand. Production is also developing in new areas such as north of Perth, WA.

Peak production is early summer to autumn. Year round supply is possible with production in subtropical areas such as south east Queensland and the mid-north coast of NSW where harvest occurs late autumn to spring. The increased use of protected cropping and hydroponic systems also extends the harvest season and productivity. Most of the raspberries, blackberries and bramble berries produced in Australia are consumed locally with little to no export of fresh fruit. Berries that are exported are sent to non-protocol markets such as Singapore and Hong Kong.

The rubus industry is covered by version 1.0 of the biosecurity plan for the rubus industry. RABA signed the EPPRD agreement in June 2015 and is in the process of developing the consultation to introduce an EPPR levy (at zero) and a PHA levy to fund membership.

Figure 62. Distribution of rubus production by state and territory, 2014–15 (at the farm gate)

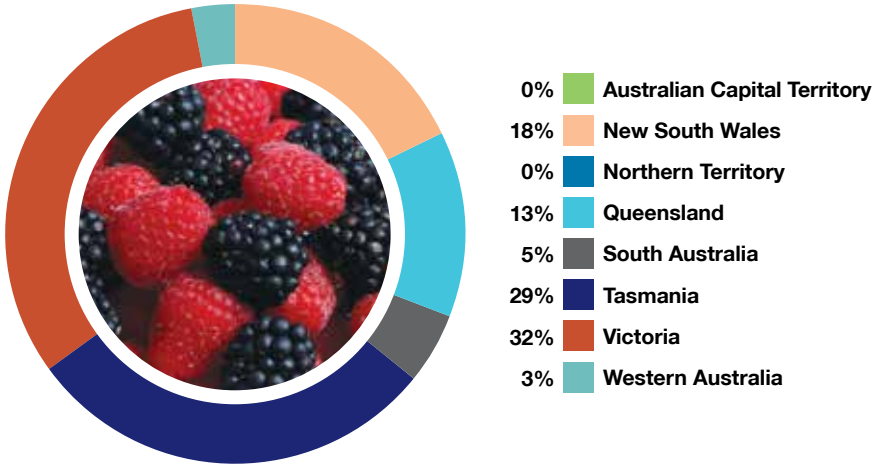


Figure 63. Annual value of rubus production, 2009–15

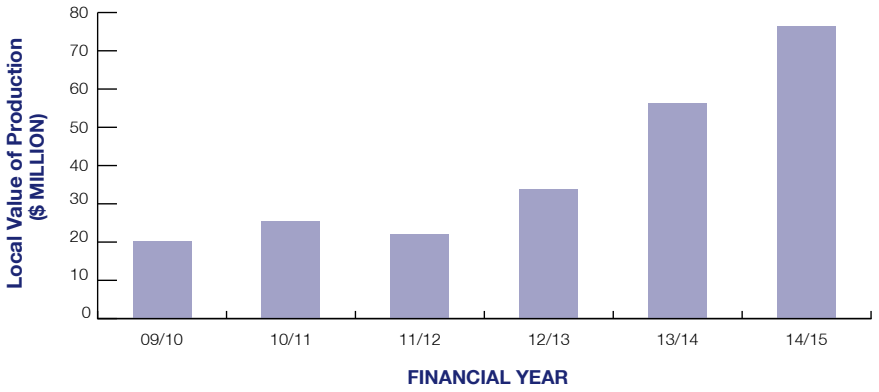


Table 30. High Priority Pests of the rubus industry

Scientific name	Common name
Arthurimyces peckianus	Orange rust (long-cycled)
Cercosporella rubi	Rosette
Drosophila suzukii	Spotted wing drosophila
Euschistus conspersus	Consperse stinkbug
Halyomorpha halys	Brown mamorated stink bug, yellow-brown stink bug
Heterocrossa rubophaga	Raspberry bud moth
Penniseta hylaeiformis	Raspberry clearwing moth
Penniseta marginata	Raspberry crown borer
Popillia japonica	Japanese beetle

STONE FRUIT

Represented by Summerfruit Australia Ltd
summerfruit.com.au

In 2014–15 stonefruit production (fresh apricots, nectarines, peaches and plums) was valued at $167 million (LVP). Nectarines and peaches comprised two-thirds of national stone fruit production, followed by plums and apricots.

In May 2016, access was granted for nectarines to mainland China. Market access negotiations are underway between the governments of China and Australia for export of peaches, plums and apricots. Around 14,340 tonnes worth $49 million of stone fruit was exported in 2015–16, an increase of 14 per cent.

Production is mainly located in subtropical and temperate Australia where the industry is a major rural and regional employer. Victoria produces around 50 per cent of Australia's stone fruit (in the order of 120,000 tonnes nationally) with the remaining production spread between NSW, Queensland, SA, WA and Tasmania.

The stone fruit industry is covered by version 1.0 of the biosecurity plan for the summerfruit industry and the Orchard Biosecurity Manual for the Summerfruit Industry Version 1.0.

Figure 64. Distribution of stone fruit production by state and territory, 2014–15 (based on LVP)

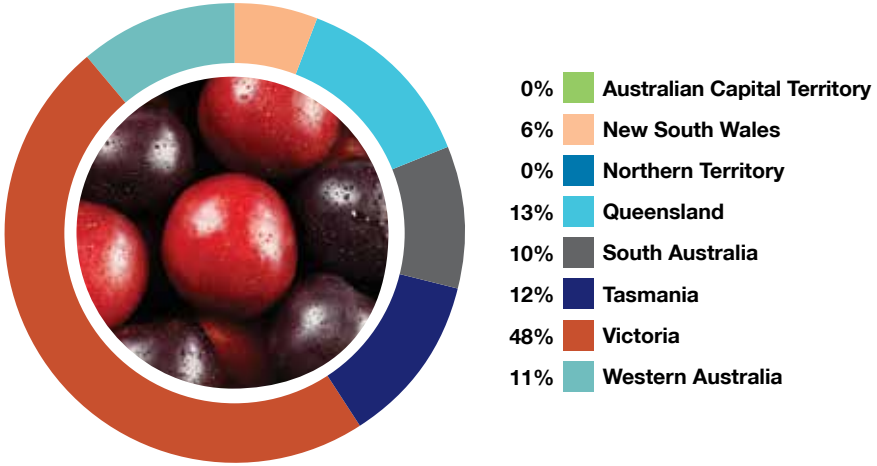


Figure 65. Annual value of stone fruit production, 2007–15

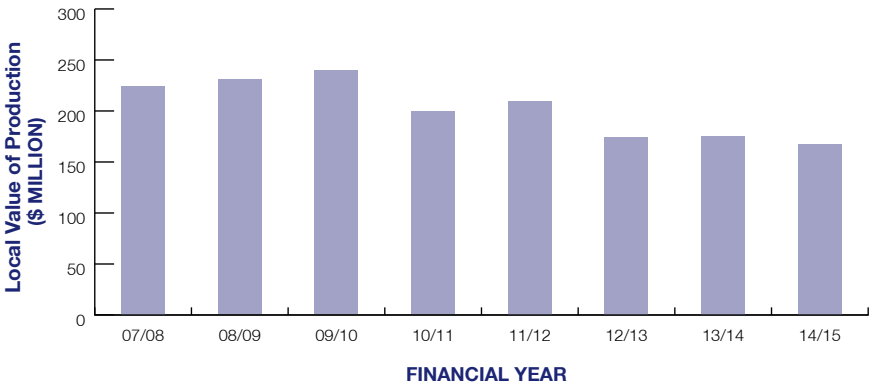


Table 31. High Priority Pests of the stone fruit industry

Scientific name	Common name
Bactrocera cucurbitae	Melon fruit fly
Bactrocera dorsalis	Oriental fruit fly
*Bactrocera papayae**	Papaya fruit fly
Conotrachelus nenuphar	Plum curculio
Cryptophlebia leucotreta	False codling moth
Cydia funebrana	Plum fruit moth
Drosophila suzukii	Spotted wing drosophila
European stone fruit yellows phytoplasma	European stone fruit yellows
Homalodisca vitripennis	Glassy winged sharpshooter
Monilinia fructigena	Brown rot
Monilia polystroma	Asiatic brown rot
Peach rosette mosaic virus (Nepovirus)	Peach rosette mosaic virus
Plum pox virus (Potyvirus)	Plum pox virus
Popillia japonica	Japanese beetle
X disease phytoplasma	Peach X disease
Xylella fastidiosa	Pierce's disease

* This species has been synonymised with *Bactrocera dorsalis*

STRAWBERRIES

Represented by Strawberries Australia Inc.
strawberriesaustralia.com.au

In 2014–15, strawberry production was valued at $236 million (LVP).

Strawberries are grown in all states of Australia by an estimated 500 growers concentrated in the Sunshine Coast area of Queensland, the Yarra Valley and the Mornington Peninsula in Victoria, Wannaroo and Albany in WA, the Adelaide Hills in SA and Launceston in Tasmania.

Strawberries are grown throughout the year with Florida varieties grown in subtropical locations (May–October) and Californian varieties grown in temperate climate areas (October–June). The industry is investing in the breeding of Australian varieties and these are gradually entering the market.

The industry is primarily focused on the domestic market with around five per cent exported. The increase in production over recent years is due primarily to rising per capita consumption, driven by higher planting numbers, improved Australian varieties that have been developed using the best varieties from Europe and the United States, and better cool chain management.

The strawberry industry is covered by version 2.0 of the biosecurity plan for the strawberry industry.

Table 32. High Priority Pests of the strawberry industry

Scientific name	Common name
Lygus hesperus	Western plant bug
Lygus lineolaris	Tarnished plant bug
Phytophthora fragariae var. *fragariae*	Red steele root rot
Raspberry ringspot virus (Nepovirus)	Raspberry ringspot virus
Strawberry latent ringspot virus (Sadwavirus)	Strawberry latent ringspot virus
Tomato black ring virus (Nepovirus)	Tomato black ring virus
Tomato ringspot virus (Nepovirus)	Tomato ringspot virus
Xanthomonas fragariae	Strawberry angular leaf spot

Figure 66. Annual value of strawberry production, 2007–15

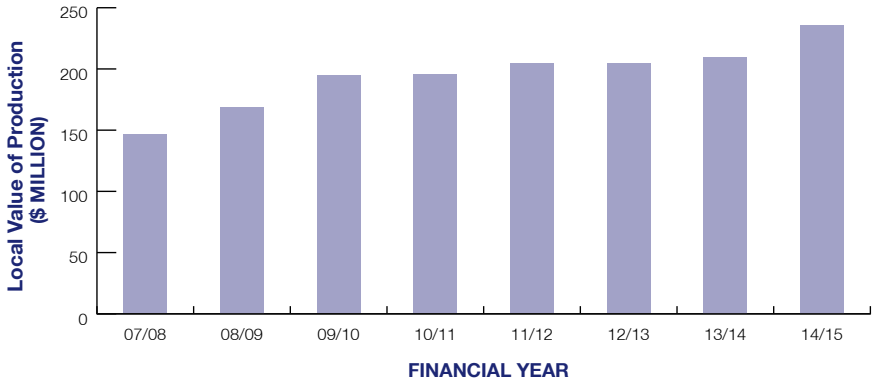
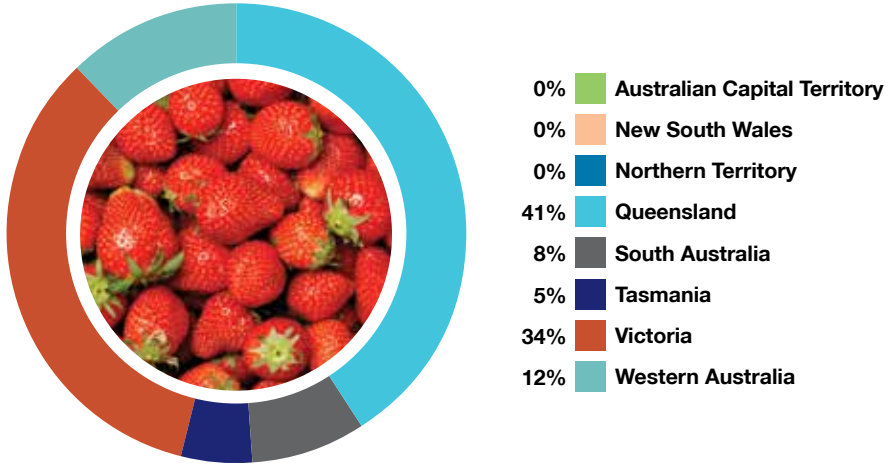


Figure 67. Distribution of strawberry production by state and territory, 2014–15 (based on LVP)



SUGARCANE

Represented by CANEGROWERS
canegrowers.com.au

In 2014–15, sugarcane production was valued at $1.3 billion (LVP). The Australian cane industry produces 30–35 million tonnes of cane per year, which when processed equates to around 4–4.5 million tonnes of sugar.

Australia's sugarcane is grown in high rainfall and irrigated areas along coastal plains and river valleys on 2,100 km of Australia's eastern coastline between Mossman in far north Queensland and Grafton in NSW. Queensland accounts for about 95 per cent of Australia's raw sugar production.

Australia is the world's third largest exporter of raw sugar, with approximately 80 per cent of production sold to international markets. Major export customers include east Asia, China, Indonesia, Japan, Korea, Malaysia, Taiwan, the United States and New Zealand.

The sugarcane industry is covered by version 2.01 of the sugarcane biosecurity plan and version 1.0 of the Biosecurity Manual for Sugarcane Producers, developed in 2016.

Harvesting at sundown. Image courtesy of Canegrowers.

Figure 68. Annual value of sugarcane production, 2007–15

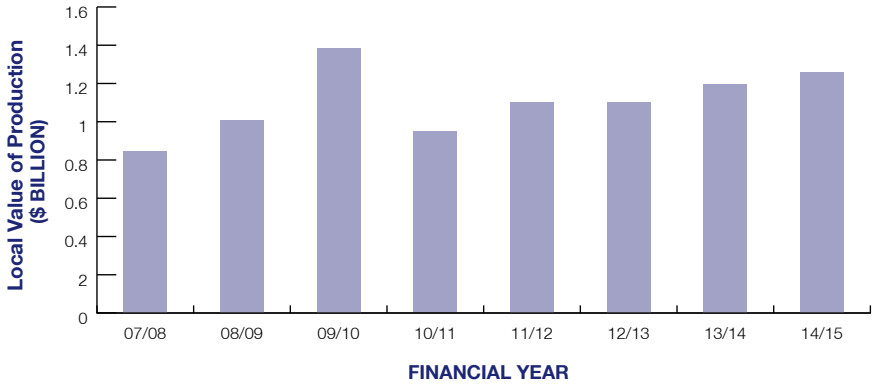


Figure 69. Distribution of sugarcane production by state and territory, 2014–15 (based on LVP)

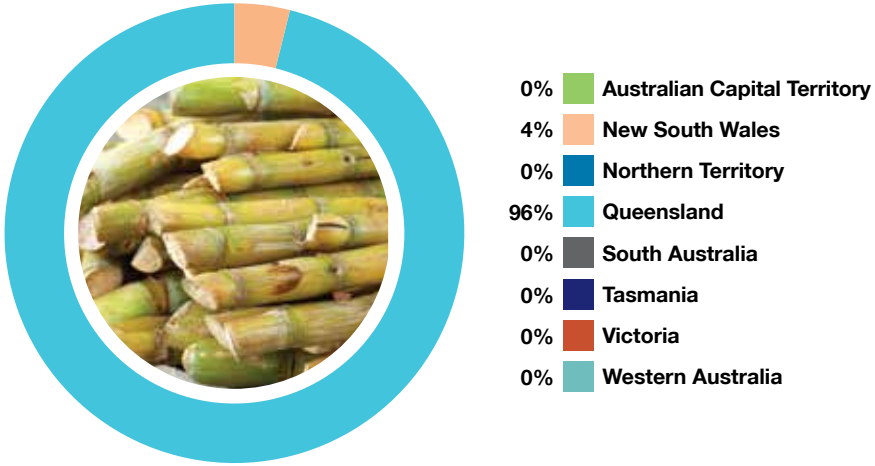


Table 33. High Priority Pests of the sugarcane industry

Scientific name	Common name
Aleurolobus barodensis	Sugarcane whitefly
Ceratovacuna lanigera	Sugarcane woolly aphid
Chilo auricilius	Sugarcane internode borer
Chilo infuscatellus	Yellow top borer of sugarcane
Chilo sacchariphagus	Sugarcane internode borer
Chilo terrenellus	Dark headed rice borer
Chilo tumidicostalis	Spotted sugarcane stem borer
Eldana saccharina	African sugarcane stalkborer
Eumetopina flavipes	Sugarcane leafhopper (as a vector of ramu stunt disease)
Grassy shoot phytoplasma	Grassy shoot (unknown vector)
Perkinsiella vastatrix	Sugarcane planthopper (as a vector of Fiji leaf gall disease)
Perkinsiella vitiensis	Sugarcane planthopper (as a vector of Fiji leaf gall disease)
Peronosclerospora philippinensis	Downy mildew
Peronosclerospora sacchari	Downy mildew
Polyocha depressella	Root borer
Pyrilla perpusilla	Sugarcane pyrilla
Scirpophaga excerptalis	Top borer
Sesamia grisescens	Pink stalk borer
Stagonospora sacchari	Leaf scorch
Sugarcane streak mosaic virus (Potyvirus)	Sugarcane streak mosaic virus
Suspect virus (Tenuivirus)	Ramu stunt (with vector)
White leaf phytoplasma	White leaf (with vector *Matsumuratettix hiroglyphicus*)
Xanthomonas albilineans (exotic strains – serological groups 2 or 3)	Leaf scald

Sugarcane planthopper (Perkinsiella vastatrix). Image courtesy of the National History Museum, London.

Sugarcane top borer (Scirpophaga excerptalis). Image courtesy of Sugar Research Australia.

Sugarcane woolly aphid (Ceratovacuna lanigera). Image courtesy of Sugar Research Australia.

Adult sugarcane pyrillia (Pyrilla perpusilla). Image courtesy of Bugwood.org.

Sugarcane streak mosaic virus (Potyvirus). Image courtesy of Sugarcane Research Australia.

Leaf scald (Xanthomonas albilineans). Image courtesy of CANEGROWERS.

SWEET POTATOES

Represented by Australian Sweetpotato Growers Inc.
aspg.com.au

In 2014–15, sweet potato production was valued at $87 million (LVP). Sweet potatoes are available all year round in Australia with total production of around 100,000 tonnes. There are around 90 commercial producers with farm sizes ranging from 10 to 200 hectares, with most in the 15–80 hectare range.

Queensland is the biggest producer with over 87 per cent of production, centred mainly in Bundaberg. The second major producing area is around Cudgen in northern NSW. Sweet potatoes are also grown in Mareeba, Atherton and Rockhampton (Queensland), Murwillumbah (NSW), Perth, Carnarvon and Kununurra (WA).

Australians grow four types of sweet potatoes, categorised by skin and flesh colour. The gold variety (rose-gold skin, gold flesh) dominates the Australian sweet potato industry with over 90 per cent of production. Red category (red skin, white flesh) makes up around eight per cent, with purple (white skin, purple flesh) and white category (white skin, white flesh) making up the remainder. The majority of sweet potato production is consumed domestically with less than one percent exported.

Commercial growers purchase pathogen-tested planting material every year, which has almost doubled marketable yield per hectare.

Image courtesy of Australian Sweetpotato Growers Inc

Figure 70. Annual value of sweet potato production, 2011–15

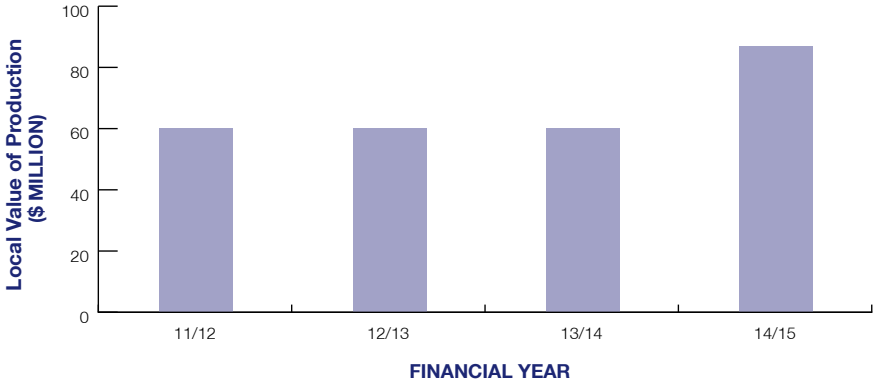


Figure 71. Distribution of sweet potato production by state and territory, 2014–15 (based on LVP)

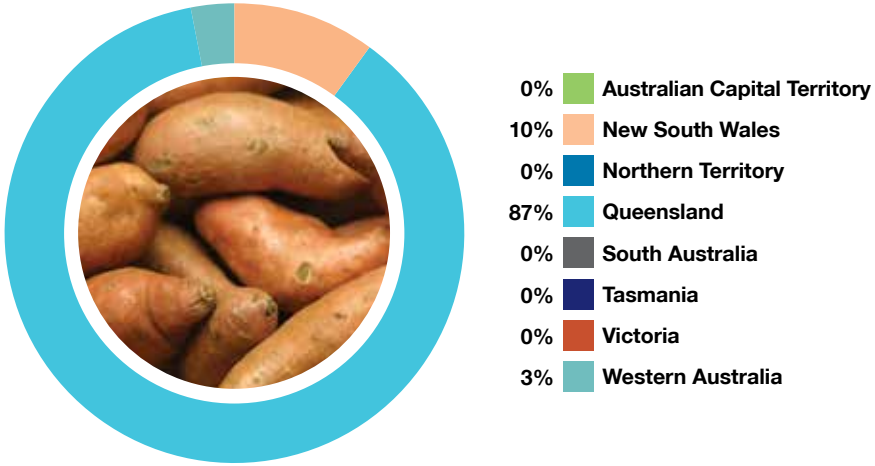


TABLE GRAPES

Represented by Australian Table Grape Association Inc.
australiangrapes.com.au

In 2014–15, table grape production was valued at $293 million (LVP). Green, red and blue-black varieties of table grapes are produced by 900 growers in the major growing regions of Sunraysia and the Murray Valley in Victoria, the Riverland in SA and in south east Queensland.

The Australian table grape industry was valued at approximately $300 million (LVP) in 2015–16. Exports of Australian table grapes now equal table grape production consumed domestically.

The table grape industry is covered by version 3.0 of the viticulture industry biosecurity plan and the Biosecurity Manual for the Viticulture Industry Version 1.0.

Table 34. High Priority Pests of the table grape industry

Scientific name	Common name
Bactrocera carambolae	Carambola fruit fly
Bactrocera dorsalis	Oriental fruit fly
*Bactrocera papayae**	Papaya fruit fly
Candidatus Phytoplasma solani	Bois noir
Daktulosphaira vitifoliae (exotic strains)	Grapevine phylloxera
Drosophila suzukii	Spotted wing drosophila
Grapevine flavescence dorée phytoplasma	Flavescence dorée
Guignardia bidwellii	Black rot
Homalodisca vitripennis	Glassy winged sharpshooter
Hyalesthes obsoletus	Cixiidae planthopper
Lobesia botrana	European grapevine moth
Planococcus ficus	Vine mealybug
Polychrosis viteana	American berry moth
Pseudococcus maritimus	Grape mealybug
Xylella fastidiosa	Pierce's disease

* This species has been synonymised with *Bactrocera dorsalis*

Figure 72. Annual value of table grape production, 2007–15

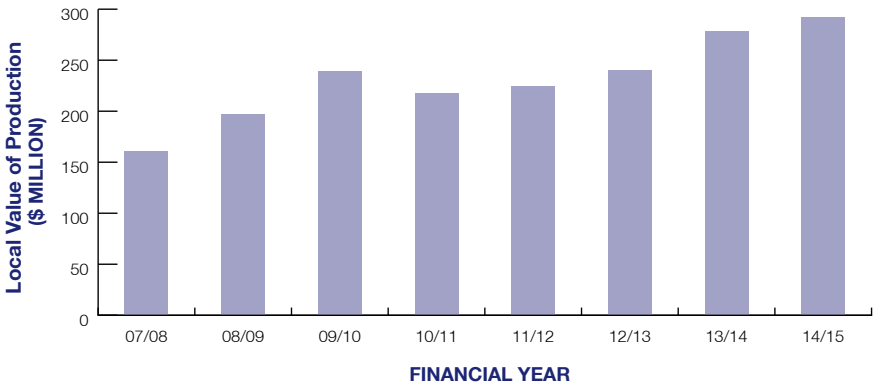
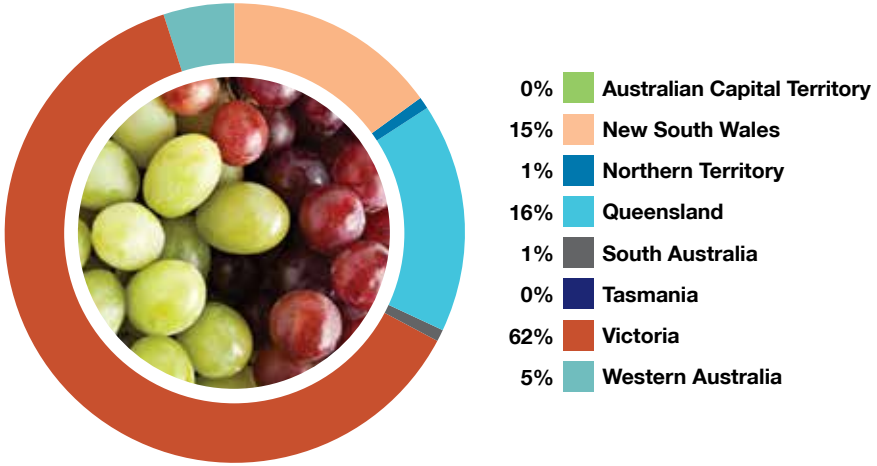


Figure 73. Distribution of table grape production by state and territory, 2014–15 (based on LVP)



TRUFFLES

Represented by the Australian Truffle Growers' Association
trufflegrowers.com.au

In 2014–15, truffle production was valued at $12 million (LVP). There are some 250 owners of truffle orchards, or truffières, around the country, of which around half have harvested truffles. The Australian Truffle Growers' Association has 120 members across the truffle growing states.

Since the first truffle was harvested in 1999, Australia now ranks number four in the world for the production of the Périgord black truffle (*Tuber melanosporum*). The major production area for Australian truffles is the Manjimup region of WA that accounts for around three quarters of the harvest, but there is also some production in Tasmania, ACT, NSW and Victoria.

The majority of the harvest is exported to 30 different countries, but mainly to Europe, the United States and Asia. Australian *T. melanosporum* are recognised for their excellent quality and are highly sought after in the northern hemisphere since our production occurs out of season.

There are another four species of black truffle with limited production in Australia; namely *T. brumale*, *T. aestivum*, *T. uncinatum* and *T. indicum* although it is believed that *T. indicum*, an undesirable species accidentally introduced, has been eliminated. More recently several white truffle species have been found including *T. maculatum*, *T. puberulum*, *T. dryophilum* and *T. borchii*.

The first edition of the biosecurity plan for the truffle industry was published in 2016.

Figure 74. Distribution of truffle production by state and territory, 2014–15 (based on LVP)

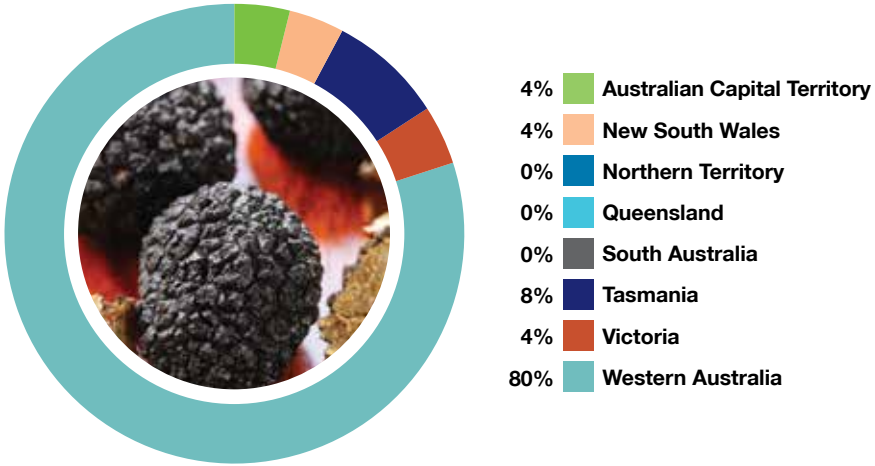


Figure 75. Annual value of truffle production, 2012–15

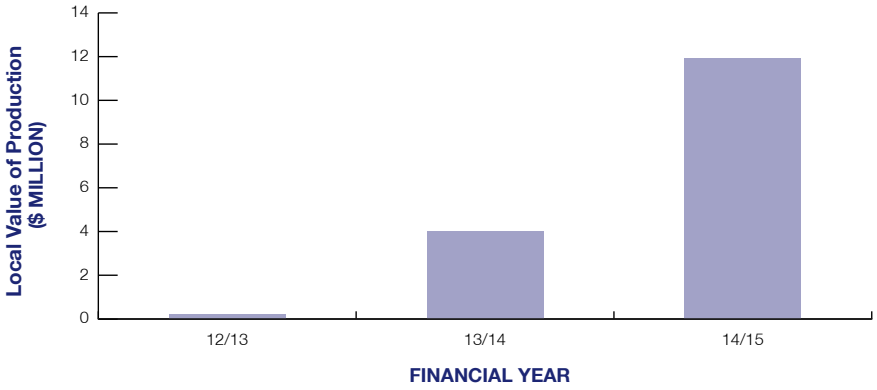


Table 35. High Priority Pests of the truffle industry

Scientific name	Common name
Halyomorpha halys	Brown marmorated stink bug
Lymantria monacha	Nun moth
Anisogramma anomala	Eastern filbert blight
Phytophthora ramorum	Sudden oak death
Pseudomonas avellanae (syn. *P. syringae* pv. *avellanae*)	Bacterial canker
Pucciniastrum coryli	Hazelnut rust

Eastern filbert blight (Anisogramma anomala). Image courtesy of Bruce Watt, University of Maine, Bugwood.org

Brown marmorated stink bug (Halyomorpha halys). Image courtesy of Steven Valley, Oregon Department of Agriculture, Bugwood.org

VEGETABLES (INCLUDING POTATOES)

Represented by AUSVEG Ltd
ausveg.com.au

In 2014–15, vegetable and potato production was valued at $1.8 billion (LVP). Major crops include potatoes, carrots and lettuce.

Australia's diverse climate and soils accommodate vegetable cultivation in all states and territories, ensuring a constant supply of fresh vegetables. Australian vegetable growers provide the majority of fresh vegetables consumed in Australia and an increasing amount of fresh vegetables consumed overseas.

The Australian vegetable industry is committed to building its capacity to respond to potential biosecurity threats and is engaging with multiple relevant government departments, committees and bodies. This includes participation in technical meetings with the Department of Agriculture and Water Resources and PHA, the appointment of a vegetable industry Biosecurity Advisor and two dedicated Biosecurity Officers.

During 2016, the Vegetable and Potato Biosecurity Officer held a series of biosecurity awareness seminars across Australia and visited a number of growing regions in order to discuss best practice on-farm biosecurity. Raising biosecurity awareness among growers, and especially farm visitors, is a key goal of the program.

The Australian vegetable industry is covered by version 2.0 of the vegetable biosecurity plan, the Farm Biosecurity Manual for the Northern Adelaide Plains Vegetable Growers Version 1.0 and the Biosecurity Induction Manual for Bundaberg Horticultural Farms Version 1.0.

Figure 76. Annual value of vegetable production, 2007–15

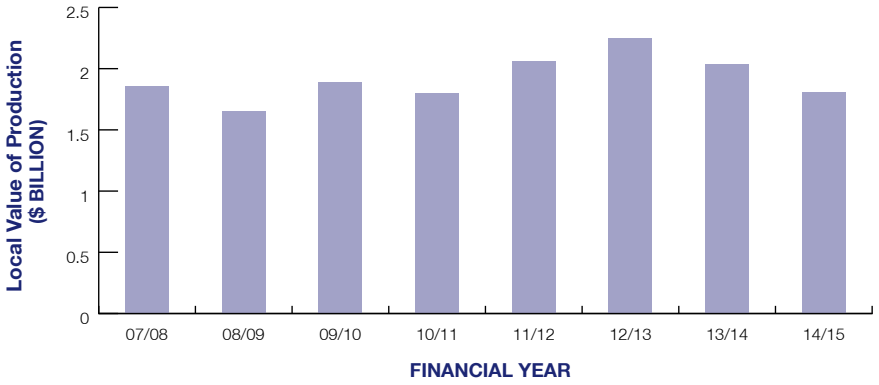


Figure 77. Distribution of vegetable production by state and territory, 2014–15 (based on LVP)

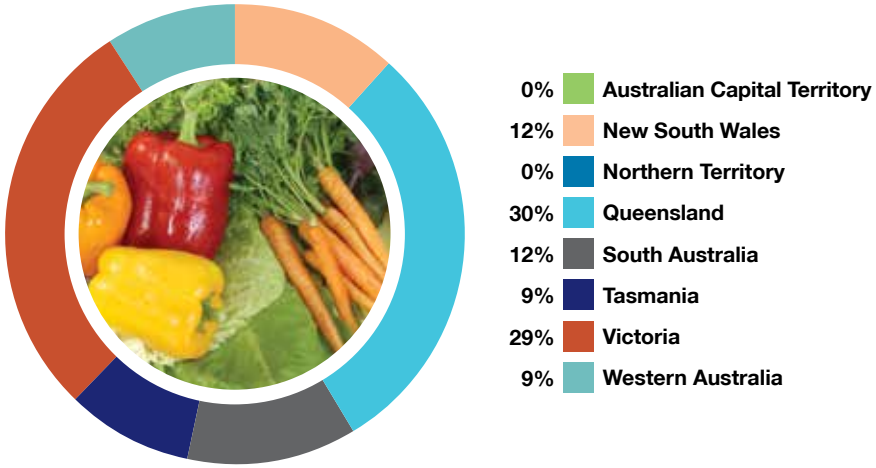


Table 36. High Priority Pests of the vegetable industry

Scientific name	Common name
Bactricera cockerelli	Tomato potato psyllid
Bactrocera cucurbitae	Melon fruit fly
Candidatus Liberibacter solanacearum	Zebra chip
Globodera pallida (pathotypes PA1, PA2)	Potato cyst nematode (white or pale)
Globodera rostochiensis (exotic strains)	Potato cyst nematode (golden)
Groundnut bud necrosis virus (Tospovirus)	Bud necrosis disease
Heterodera carotae	Carrot cyst nematode
Liriomyza bryoniae	Tomato leaf miner
Liriomyza huidobrensis	Serpentine leaf miner
Liriomyza sativae	Vegetable leaf miner
Liriomyza trifolii	American serpentine leaf miner
Phytophthora infestans (A2 mating type and exotic strains of A1 mating type)	Late blight
Potato spindle tuber viroid (Pospiviroidae)	Potato spindle tuber viroid
Potato virus Y (Potyvirus) (exotic strains)	Potato virus Y
Psila rosae	Carrot rust fly
Ralstonia solanacearum race 3 (exotic strains)	Bacterial wilt
Watermelon bud necrosis virus (Tospovirus)	Watermelon bud necrosis
Watermelon silver mottle virus (Tospovirus)	Watermelon silver mottle

Nymphs, adults and cast skins of tomato potato psyllid. Image courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org

Tubers infected with potato spindle tuber viroid (left) are typically smaller than healthy tubers (right). Image courtesy of Plant Protection Service Archive, Bugwood.org

WALNUTS

Represented by the Australian Walnut Industry Association
walnut.net.au

The Australian walnut industry operates in most states of Australia. Major walnut production areas in Australia are on the east coast of Tasmania, the Goulburn Valley near Shepparton and the Murray Irrigation area near Kerang and Swan Hill in Victoria and in the Riverina near Griffith in NSW.

Nearly 3,600 hectares of mature and developing trees were under cultivation in 2016. This number is expected to rise to more than 4,300 hectares by 2021 as current growers expand their orchards, and as new growers enter the industry in current and new regions.

Local production of in-shell walnuts can satisfy all domestic consumption. About 70 per cent of Australia's walnut production is exported with greatest demand for in-shell walnuts in China, Turkey and Italy.

Throughout 2016 the Australian Walnut Industry Association Inc has participated in a number of exotic outbreaks relevant to the walnut industry.

Aspects of biosecurity are well embedded in the Australian Walnut Industry Five Year Strategic Plan 2016 to 2021. The walnut industry is covered by version 2.0 of the nut industry biosecurity plan that was endorsed in 2016.

Figure 78. Distribution of walnut production by state and territory, 2014–15 (based on LVP)

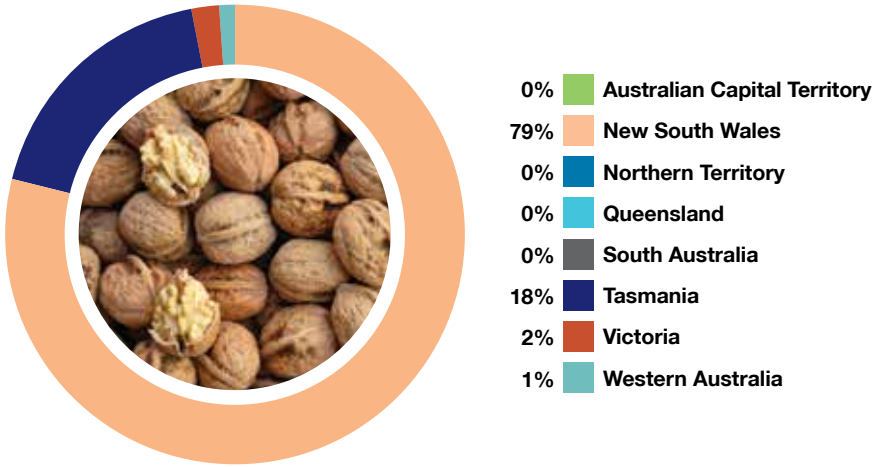


Figure 79. Annual value of walnut production, 2007–15

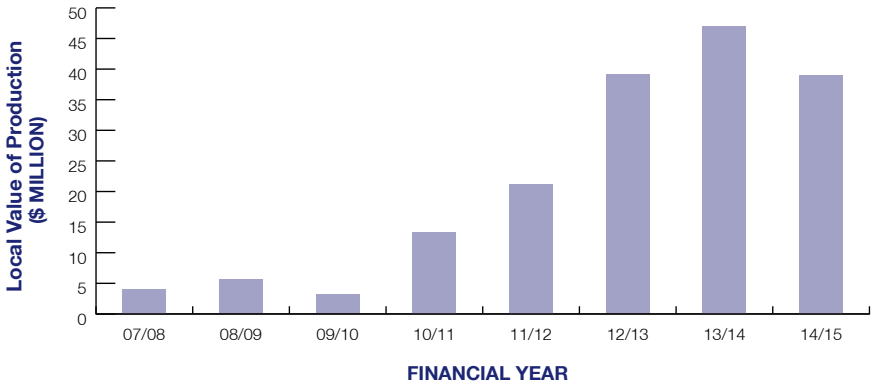


Table 37. High Priority Pests of the walnut industry

Scientific name	Common name
Amyelois transitella	Navel orange worm
Halyomorpha halys	Brown marmorated stink bug
Lymantria dispar	Gypsy moth (Asian and European strains)
Trogoderma granarium	Khapra beetle
Verticillium dahliae (exotic defoliating strains)	Verticillium wilt

WINE GRAPES

Represented by Australian Vignerons
australianvignerons.com.au

In 2014–15, wine grape production was valued at $765 million (LVP). The wine industry has a significant footprint in Australia, comprising 5,100 winegrowers over a vineyard area of 132,393 hectares, made into wine at 2,300 wineries, and generating gross sales of $5 billion. Wine grape production was 1.81 million tonnes in 2016, about the same as the previous year. It is estimated that the wine industry contributes over $40 billion to the Australian economy, and directly employs over 68,000 people.

In 2016, the most grown wine grape varieties were Shiraz (23%), Chardonnay (22%) and Cabernet Sauvignon (13%). The major varieties by colour are Shiraz, Cabernet Sauvignon and Merlot for reds and Chardonnay, Sauvignon Blanc and Semillon for whites.

Australian Vignerons estimates that there has been a net removal of vines of 2–3 per cent each year since the 2007–08 season, although production has been steady.

The wine grape industry is covered by version 3.0 of the viticulture biosecurity plan and the Biosecurity Manual for the Viticulture Industry Version 1.0.

Table 38. High Priority Pests of the wine grape industry

Scientific name	Common name
Bactrocera carambolae	Carambola fruit fly
Bactrocera dorsalis	Oriental fruit fly
*Bactrocera papayae**	Papaya fruit fly
Candidatus Phytoplasma solani	Bois noir
Daktulosphaira vitifoliae (exotic strains)	Grapevine phylloxera
Drosophila suzukii	Spotted wing drosophila
Grapevine flavescence dorée phytoplasma	Flavescence dorée
Guignardia bidwellii	Black rot
Homalodisca vitripennis	Glassy winged sharpshooter
Hyalesthes obsoletus	Cixiidae planthopper
Lobesia botrana	European grapevine moth
Planococcus ficus	Vine mealybug
Polychrosis viteana	American berry moth
Pseudococcus maritimus	Grape mealybug
Xylella fastidiosa	Pierce's disease

* This species has been synonymised with *Bactrocera dorsalis*

Figure 80. Annual value of wine grape production, 2007–15

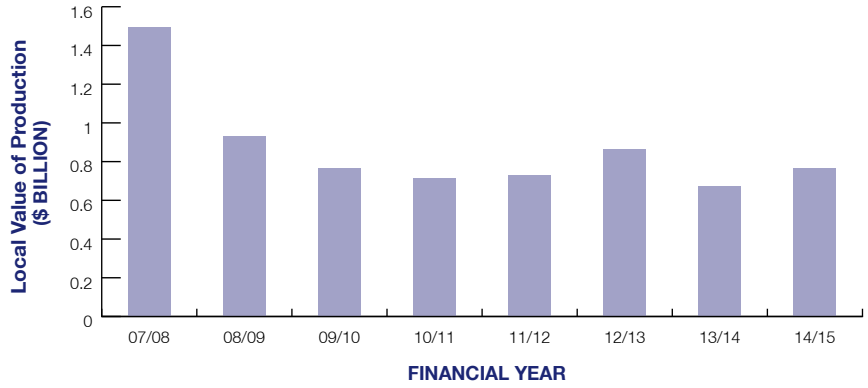
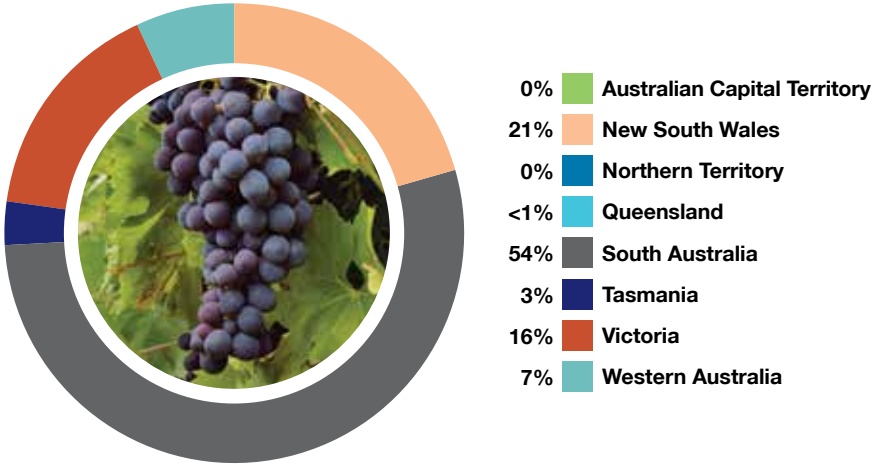


Figure 81. Distribution of wine grape production by state and territory, 2014–15 (based on LVP)



Chapter 2

Threats to Australia's plant production systems and environment

This chapter covers the pests and weeds that pose the greatest threat to plant production and the Australian environment.

The first step in preventing incursions of exotic plant pests is to identify those that pose the greatest threat. PHA has assessed exotic pests for each industry to develop a list of around 380 high priority pests.

Each one represents a high risk to one or more crops, or to honey bees, with a severe economic impact if it should establish in Australia.

In addition to exotic pests, some pests have made it to Australia but are confined to regions or states. The key regionalised pests listed here are targeted by domestic quarantine measures to prevent further spread.

Other pests have been detected in Australia but are currently subject to an eradication response under the Emergency Plant Pest Response Deed.

The chapter ends with a description of the management of weeds in Australia, which also pose a considerable threat and are subject to ongoing control.

Russian wheat aphid colony. Note leaf rolling and streaks along the leaf. Image courtesy of M.A. Nash

2.1 High Priority Pests

To ensure the future viability and sustainability of Australian agriculture industries and to protect the environment, one must first identify threats. For Australia's plant producers and beekeepers, this includes exotic pests that could have a significant impact on production or trade, should they establish in Australia, as well as pests that are in Australia but confined to particular regions.

To identify and prioritise exotic plant pests of quarantine concern, PHA coordinates pest risk assessments as part of the biosecurity planning process for an industry. Experts from industry and government are brought together to form an Industry Biosecurity Group, who work together to agree on the level of risk that each pest poses to Australia. The process takes into account the pest's likelihood of entry, establishment and spread, as well as the economic impact if it established in Australia. The assessment includes all entry pathways including legal, illegal, accidental or through natural causes.

At the end of this process the exotic pests that pose the greatest risk with the largest potential economic impact are deemed to be High Priority Pests (HPPs). It is important to note that pest risk assessments are general assessments of overseas pest risks, which differ from the Import Risk Analysis processes conducted for individual import applications under specific circumstances (see Section 3.1 International Trade).

Once the HPPs for an industry or crop have been identified, the Industry Biosecurity Group develops and agrees risk mitigation measures for each. Agreed measures also form part of the biosecurity plan.

Measures to mitigate the risk posed by a particular HPP might include surveillance protocols to check for the presence of the pest, the development of diagnostic protocols to ensure the pest can be identified accurately and rapidly should it make it to Australia. Contingency plans that outline the approach to dealing with such a pest should an incursion occur are also developed. Public awareness programs, pre-emptive breeding or other research might also be included.

Biosecurity plans developed by PHA undergo formal reviews on a regular basis to ensure they remain up-to-date, taking into consideration new research and changes to potential pathways.

Table 39 lists all 378 HPPs that have been identified from the 32 biosecurity plans developed by PHA (see Section 3.4, Table 47) in conjunction with industries and governments, along with those listed in Schedule 13 of the EPPRD, which are pre-categorised pests.

Whilst this list predominantly contains exotic pests, it does contain some species that are already present in Australia. These regionalised pests are usually controlled through active management or containment programs, yet are still of significant quarantine concern nationally.

How pollination will change if *Varroa destructor* mite establishes in Australian hives

Currently Australia has a high concentration of feral honey bee colonies – unmanaged hives in the wild – and these helpful insects pollinate many crops. But overseas experience has shown that should there be an incursion of the honey bee parasite *Varroa destructor* in Australia, this invader would kill off unmanaged colonies, with the loss of valuable pollination services.

Since *Varroa destructor* mites are found in the rest of the world, including New Zealand and our northern neighbours, Australia has to be prepared.

That's why PHA has been working on a suite of honey bee biosecurity projects. Some are efforts to prevent an incursion, while others aim to assist our industries, including plant producers, to prepare for the changes that *Varroa destructor* is likely to bring.

In 2016, PHA developed a series of videos to explain the threat posed by Varroa destructor to our honey bees, how beekeepers can best protect their apiaries from pests, and the likely implications for plant producers. There are 12 videos in all, which specifically focus on the situation in Australia.

Keeping hives healthy would become even more important if *Varroa destructor* was to establish here. So PHA has worked with beekeepers and governments to develop the Australian Honey Bee Industry Biosecurity Code of Practice to provide a framework for best-practice beekeeping.

The video production was funded by a partnership between the Australian Government, state and territory governments, the Australian Honey Bee Industry Council, Wheen Bee Foundation, Capilano, Syngenta, Bayer, Plant and Food Research NZ and plant production industries through Hort Innovation and the Rural Industries Research and Development Corporation.

Beekeepers and producers of crops that benefit from honey bee pollination are encouraged to view the videos and become familiar with the Code of Practice, both of which are available at **beeaware.org.au**.

Table 39. High Priority Pests threats

Scientific name	Common name	High Priority Pest of
Abaca bunchy top virus (Babuvirus)	Abaca bunchy top virus	Banana
Acarapis woodi	Tracheal mite	Honey bee
Acleris comariana	Strawberry tortrix	EPPRD*
Adoxophyes orana	Summer fruit tortrix	EPPRD
Aleurolobus barodensis	Sugarcane whitefly	Sugarcane, EPPRD
Amyelois transitella	Navel orangeworm	Nut, EPPRD
Anastrepha ludens	Mexican fruit fly	Citrus
Anisogramma anomala	Eastern filbert blight, hazelnut blight	Nut, Truffle, EPPRD
Anthonomus bisignatus	Strawberry bud weevil	EPPRD
Anthonomus grandis	Cotton boll weevil	Cotton, EPPRD
Aphis gossypii (exotic strains)	Cotton aphid	Cotton, Nursery and Garden
Apiosporina morbosa	Black knot	EPPRD
Apis cerana (exotic strains, genotypes and sub-species)	Asian honey bee	Honey bee
Apis mellifera capensis	Cape honey bee	Honey bee
Apis mellifera scutellata	African honey bee	Honey bee
Apis mellifera scutellata (hybrid)	Africanised honey bee	Honey bee
Aristobia testudo	Lychee longicorn beetle	Lychee
Arthuriomyces peckianus	Orange rust (long-cycled)	Rubus
Ascochyta rabiei (*MAT 1-2*)	Ascochyta blight	Grains
Aspidiella hartii	Yam scale	Ginger
Avocado sunblotch viroid (asymptomatic strains)	Avocado sunblotch	Avocado
Avocado sunblotch viroid (symptomatic strains)	Avocado sunblotch	Avocado
Bactericera cockerelli	Tomato potato psyllid	Potato, Tomato, EPPRD
Bactrocera carambolae	Carambola fruit fly	Avocado, Citrus, Mango, Papaya, Passionfruit, Tomato, Viticulture
Bactrocera dorsalis	Oriental fruit fly	Apple and Pear, Avocado, Citrus, Lychee, Papaya, Passionfruit, Summerfruit, Tomato, Viticulture, EPPRD
Bactrocera facialis	Tropical fruit fly	Avocado, Passionfruit, Tomato
Bactrocera invadens+	Fruit fly	Citrus, Melon
Bactrocera kandiensis	Fruit fly	Avocado, Citrus, Passionfruit
Bactrocera kirki	Fijian fruit fly	Avocado, Passionfruit
Bactrocera latifrons	Solanum fruit fly	Melon
Bactrocera melanotus	Fruit fly	Avocado, Passionfruit
Bactrocera occipitalis	Fruit fly	Citrus
Bactrocera oleae	Olive fly	Olive
Bactrocera papayae+	Papaya fruit fly	Avocado, Citrus, Mango, Papaya, Passionfruit, Summerfruit, Viticulture, EPPRD
Bactrocera passiflorae	Fijian fruit fly	Avocado, Papaya, Passionfruit
Bactrocera philippinensis+	Philippine fruit fly	Avocado, Citrus, Papaya, Passionfruit, EPPRD
Bactrocera psidii	South Sea guava fruit fly	Passionfruit
Bactrocera trivialis	New Guinea fruit fly	Citrus
Bactrocera xanthodes	Pacific fruit fly	Avocado, Passionfruit
Banana bract mosaic virus (Potyvirus)	Banana bract mosaic disease	Banana, EPPRD
Banana bunchy top virus (Nanovirus)	Banana bunchy top disease	Banana
Barley mild mosaic virus (Bymovirus)	Barley mild mosaic virus	Grains
Bean common mosaic virus (Potyvirus), peanut stripe strain	Bean common mosaic virus	Grains
Bemisia tabaci (Asia 1, China 1, China 2, Asia II (1-8), Italy, Sub-Saharan Africa (1-4), Uganda, New World, Mediterranean, Middle East-Asia Minor 2, Indian Ocean)	Silverleaf whitefly	Cotton, Melon, Nursery and Garden, Tomato
Blood disease bacterium (*Ralstonia solanacearum* species complex)	Blood disease	Banana, EPPRD
Botrytis squamosa	Leaf blight	Onion
Burkholderia caryophylli (syn. *Pseudomonas caryophylli*)	Bacterial wilt of carnation	Cutflower
Bursaphelenchus spp. including *B. xylophilus*	Pinewood nematode species complex	Plantation forest
Cacoecimorpha pronubana	Carnation tortrix	Cutflower

* Defined as a categorised High Priority Pest in the EPPRD, independent of biosecurity planning processes

\+ This species has been synonymised with *Bactrocera dorsalis*

Table 39. High Priority Pests threats (continued)

Scientific name	Common name	High Priority Pest of
Caliothrips fasciatus	Bean thrips	Citrus
Candidatus Liberibacter africanus	Huanglongbing (African strain)	Citrus
Candidatus Liberibacter americanus	Huanglongbing (American strain)	Citrus
Candidatus Liberibacter asiaticus	Huanglongbing (Asiatic strain)	Citrus, Nursery and Garden, EPPRD
Candidatus Liberibacter psyllaurous	*Candidatus* Liberibacter psyllaurous	EPPRD
Candidatus Liberibacter solanacearum	Zebra chip	Potato, Tomato, EPPRD
Candidatus Phytoplasma mali (Apple proliferation phytoplasma)	Apple proliferation	Apple and Pear
Candidatus Phytoplasma pruni (syn. X disease phytoplasma)	Peach X disease	Cherry, Summerfruit, EPPRD
Candidatus Phytoplasma prunorum (syn. European stone fruit yellows phytoplasma)	European stone fruit yellows	Cherry, Summerfruit, EPPRD
Candidatus Phytoplasma solani	Bois noir	Viticulture
Cephus cinctus	Wheat stem sawfly	Grains
Cephus pygmeus	European wheat stem sawfly	Grains
Ceratocystis fimbriata sensu lato	Mango sudden decline syndrome	Mango
Ceratocystis manginecans	Mango sudden decline syndrome	Mango
Ceratocystis omanensis	Mango sudden decline syndrome	Mango
Ceratovacuna lanigera	Sugarcane woolly aphid	Sugarcane
Cercosporella rubi	Rosette	Rubus
Ceutorhynchus assimilis	Cabbage seedpod weevil	Grains
Ceutorhynchus napi	Rape stem weevil	Grains
Ceutorhynchus pallidactylus	Cabbage stem weevil	Grains
Cherry leaf roll virus (Nepovirus) (exotic strains)	Blackline	Cherry, Rubus, EPPRD
Chickpea chlorotic dwarf virus (Mastrevirus)	Chickpea chlorotic dwarf virus	Grains
Chickpea chlorotic stunt virus (Polerovirus)	Chickpea chlorotic stunt virus	Grains
Chilo auricilius	Sugarcane internode borer	Sugarcane
Chilo infuscatellus	Yellow top borer of sugarcane	Sugarcane
Chilo orichalcociliellus	Coastal stem borer	Grains
Chilo partellus	Spotted stem borer	Grains
Chilo sacchariphagus	Sugarcane internode borer	Sugarcane
Chilo terrenellus	Sugarcane stem borer	Sugarcane
Chilo tumidicostalis	Spotted sugarcane stem borer	Sugarcane
Chinavia hilaris (syn. *Chinavia hilare*)	Green stink bug	Nut
Choristoneura rosaceana	Oblique banded leaf roller	Cherry
Chromatomyia horticola	Pea leafminer	Cutflower
Chrysoporthe austroafricana	Eucalyptus canker disease	Plantation forest
Ciborinia camelliae	Camellia petal blight	EPPRD
Citripestis sagittiferella	Citrus fruit borer	Citrus
Citrus leprosis virus (unassigned)	Citrus leprosis disease	Citrus
Citrus tristeza virus (Closterovirus) (mandarin stem-pitting strain)	Mandarin stem-pitting	Citrus
Cladosporium allii	Leaf spot	Onion
Clavibacter michiganensis subsp. *sepedonicus*	Bacterial ring rot	EPPRD
Colletotrichum truncatum (lentil strain)	Lentil anthracnose	Grains
Conopomorpha sinensis	Lychee fruit borer	Lychee
Conotrachelus aguacatae	Small avocado seed weevil	Avocado
Conotrachelus nenuphar	Plum curculio	Apple and Pear, Cherry, Summerfruit, EPPRD
Conotrachelus perseae	Small seed weevil	Avocado
Coptotermes formosanus	Formosan subterranean termite	Plantation forest
Coptotermes gestroi	Asian subterranean termite	Plantation forest
Cotinis mutabilis	Fig beetle	Pineapple
Cotton leaf curl virus (Begomovirus)	Cotton leaf curl disease	Cotton, EPPRD
Cotton leafroll dwarf virus (Polerovirus)	Cotton blue disease	Cotton

Table 39. High Priority Pests threats (continued)

Scientific name	Common name	High Priority Pest of
Croesia curvalana	Blueberry leaftier	Blueberry
Cryphonectria parasitica	Chestnut blight	Nut, EPPRD*
Cryptosporella umbrina	Brown rose canker	Cutflower
Ctenopseustis obliquana	Brown headed leaf roller	Cherry
Cydia funebrana	Plum fruit moth	Summerfruit
Cylindrocopturus adspersus	Sunflower stem weevil	Grains
Daktulosphaira vitifoliae (biotype B)	Grape phylloxera type B	EPPRD
Daktulosphaira vitifoliae (exotic strains)	Grapevine phylloxera	Viticulture
Deanolis sublimbalis	Red banded mango caterpillar	Mango, EPPRD
Deformed wing virus (Iflavirus)	Deformed wing virus	Honey bee
Delia antiqua	Onion fly	Onion
Delia florilega	Bean fly	Onion
Dendroctonus ponderosae	Mountain pine beetle	Plantation forest
Dendroctonus valens	Red turpentine beetle	Plantation forest
Diabrotica barberi	Northern corn root worm	Grains
Diabrotica undecimpunctata	Southern corn root worm	Grains
Diabrotica virgifera	Western corn root worm	Grains
Diaphorina citri	Asian citrus psyllid	Citrus, Nursery and Garden, EPPRD
Diaporthe helianthi	Sunflower stem canker	Grains
Dickeya dianthicola (syn. *Erwinia chrysanthemi* pv. *dianthicola*)	Slow wilt	Cutflower
Dickeya spp. (pineapple infecting strains) (syn. *Erwinia chrysanthemi*)	Bacterial fruit collapse, bacterial heart rot	Pineapple
Diuraphis noxia	Russian wheat aphid	Grains, EPPRD
Drosophila suzukii	Spotted wing drosophila	Apple and Pear, Blueberry, Cherry, Rubus, Summerfruit, Viticulture
Dryocosmus kuriphilus	Oriental chestnut gall wasp	Nut
Dysaphis plantaginea	Rosy apple aphid	Apple and Pear
Dysdercus spp. (including *D. honestus, D. maurus, D. suturellus* (American species))	Cotton stainer	Cotton
Dysmicoccus neobrevipes	Grey pineapple mealybug	Pineapple
East Asian passiflora virus (Potyvirus)	East Asian passiflora virus	Passionfruit
Echinothrips americanus	Poinsettia thrips	Nursery and Garden
Eldana saccharina	African sugarcane stalkborer	Sugarcane
Elytroteinus subtruncatus	Fijian ginger weevil	Ginger
Endocronartium harknessii	Western gall rust	Plantation forest
Epichoristodes acerbella	South African carnation tortrix, South African carnation miner	Cutflower
Ericaphis fimbriata (with Blueberry scorch Carlavirus)	Blueberry aphid	Blueberry
Erionota thrax	Banana skipper butterfly	Banana, EPPRD
Erwinia amylovora	Fire blight	Apple and Pear, EPPRD
Erwinia herbicola (exotic strains)	Avocado blast	Avocado
Erwinia herbicola pv. *gypsophilae*	Bacterial gall	Cutflower
Erwinia papayae	Bacterial crown rot	Papaya
Erwinia spp.	Mushy canker	Papaya
Erwinia tracheiphila	Cucurbit bacterial wilt	Melon
Eumerus amoenus	Onion bulb fly	Onion
Eumerus strigatus	Lesser bulb fly	Onion
Eumetopina flavipes	Sugarcane leafhopper (vector of ramu stunt disease)	Sugarcane
Eurygaster integriceps	Sunn pest	Grains
Euschistus conspersus	Consperse stink bug	Rubus
Frankliniella bispinosa	Florida flower thrips	Citrus
Frankliniella intonsa	Flower thrips	Cutflower, Tomato
Frankliniella tritici	Eastern flower thrips	Cutflower
Fusarium circinatum	Pitch canker	Plantation forest
Fusarium mangiferae	Mango malformation	Mango, EPPRD
Fusarium mexicanum	Mango malformation	Mango
Fusarium oxysporum f. sp. *chrysanthemi*	Fusarium wilt of chrysanthemum	Cutflower
Fusarium oxysporum f. sp. *ciceris*	Fusarium wilt of chickpea	Grains

* Defined as a categorised High Priority Pest in the EPPRD, independent of biosecurity planning processes

Table 39. High Priority Pests threats (continued)

Scientific name	Common name	High Priority Pest of
Fusarium oxysporum f. sp. *cubense*	Panama disease tropical race 4	Banana, EPPRD
Fusarium oxysporum f. sp. *glycines*	Fusarium wilt of soybean	Grains
Fusarium oxysporum f. sp. *lupini*	Fusarium wilt of lupin	Grains
Fusarium oxysporum f. sp. *vasinfectum* (exotic races)	Fusarium wilt	Cotton
Fusarium oxysporum f.sp. *melonis* (exotic races)	Fusarium root and stem rot of melons	Melon
Fusarium oxysporum f.sp. *niveum* (exotic races)	Fusarium root and stem rot of melons	Melon
Fusarium oxysporum f.sp. *radicis-cucumerinum*	Fusarium root and stem rot of melons	Melon
Fusarium proliferatum	Mango malformation	Mango
Fusarium sp. (*F. ananatum* and *F. guttiforme* syn. *F. subglutinans* f.sp. *ananas)*	Fusariosis, Fusarium stem rot, pineapple eye rot, fruitlet core rot	Pineapple
Fusarium sterilihyphosum	Mango malformation	Mango
Fusarium virguliforme	Sudden death syndrome	Grains
Fusicladium effusum (syn. *Cladosporium caryigenum)*	Pecan scab	Nut
Globodera pallida (pathotypes PA1, PA2)	Potato cyst nematode (white or pale)	Potato
Globodera rostochiensis (exotic strains)	Potato cyst nematode (golden)	Potato, EPPRD
Grapevine flavescence dorée phytoplasma	Flavescence dorée	Viticulture
Grassy shoot phytoplasma	Grassy shoot	Sugarcane
Groundnut bud necrosis virus (Tospovirus)	Bud necrosis disease	Grains, Vegetable
Groundnut ringspot virus (Tospovirus)	Groundnut ringspot virus	Grains
Guignardia bidwellii	Black rot	Viticulture, EPPRD
Guignardia musae	Banana freckle	Banana, EPPRD
Gymnoconia nitens	Orange rust (short-cycled)	Rubus
Gymnosporangium juniperi-virginianae	Cedar apple rust	Apple and Pear
Halyomorpha halys	Brown marmorated stink bug	Cotton, Nut, Rubus, Truffle
Haplothrips chinensis	Chinese thrips	Cutflower
Harpophora maydis	Late wilt	Grains
Heilipus lauri	Large seed weevil	Avocado
Helicoverpa armigera (carrying *Bt* resistance alleles)	Cotton bollworm	Cotton
Heterocrossa rubophaga	Raspberry bud moth	Rubus
Heterodera carotae	Carrot cyst nematode	Vegetable
Heterodera ciceri	Chickpea cyst nematode	Grains
Heterodera filipjevi	Cereal cyst nematode	Grains
Heterodera glycines	Soybean cyst nematode	Grains
Heterodera latipons	Mediterranean cereal cyst nematode	Grains
Heterodera sorghi	Sorghum cyst nematode	Grains
High plains virus (unassigned)	High plains virus	EPPRD
Homalodisca vitripennis (syn. *Homalodisca coagulata*)	Glassy winged sharpshooter	Cherry, Citrus, Nursery and Garden, Summerfruit, Viticulture
Homoeosoma electellum	Sunflower moth	Grains
Hoplostoma fuligineus	Large hive beetle	Honey bee
Hyalesthes obsoletus	Cixiidae planthopper	Viticulture
Hylesia nigricans	Burning moth	Plantation forest
Hypothenemus obscurus	Tropical nut borer	Nut
Ips typographus	Spruce bark beetle	Plantation forest
Leptinotarsa decemlineata	Colorado potato beetle	EPPRD
Leptoglossus clypealis	Leaf footed bug	Nut
Leptoglossus occidentalis	Western conifer seed bug	Nut
Leptoglossus zonatus	Western leaf footed bug	Nut
Lettuce infectious yellows virus (Crinivirus)	Lettuce infectious yellows virus	Nursery and Garden
Liriomyza bryoniae	Tomato leaf miner	Melon, Tomato, Vegetable
Liriomyza congesta	Pea leafminer	Cutflower
Liriomyza huidobrensis	Serpentine leaf miner	Cutflower, Melon, Nursery and Garden, Tomato, Vegetable
Liriomyza sativae	Vegetable leaf miner, American leaf miner	Melon, Onion, Tomato, Vegetable, EPPRD
Liriomyza trifolii	American serpentine leaf miner	Cutflower, Melon, Tomato, Vegetable
Lissachatina fulica (syn. *Achatina fulica*)	Giant African snail	Nursery and Garden, Tomato

Table 39. High Priority Pests threats (continued)

Scientific name	Common name	High Priority Pest of
Lissorhoptrus oryzophilus	Rice water weevil	Rice, EPPRD*
Little cherry virus 1 (unassigned)	Little cherry virus 1	Cherry
Little cherry virus 2 (Ampelovirus)	Little cherry virus 2	Cherry
Lobesia botrana	European grapevine moth	Viticulture
Longan and lychee witches' broom (suspected phytoplasma)	Longan and lychee witches' broom disease	Lychee
Lygus hesperus	Western plant bug	Cotton, Strawberry, EPPRD
Lygus lineolaris	Tarnished plant bug	Cotton, Nursery and Garden, Strawberry
Lymantria dispar	Asian gypsy moth	Apple and Pear, Nursery and Garden, Nut, Plantation forest
Lymantria monacha	Nun moth	Plantation forest, Truffle
Magnaporthe grisea	Rice blast	Grains, Rice, EPPRD
Marchalina hellenica	Giant pine scale	EPPRD
Mayetiola destructor	Hessian fly	Grains, EPPRD
Mayetiola hordei	Barley stem gall midge	Grains
Monilia polystroma	Asiatic brown rot	Summerfruit
Monilinia fructigena	Brown rot	Blueberry, Cherry, Summerfruit, EPPRD
Monilinia vaccinii-corymbosi	Mummy berry, cotton ball disease	Blueberry
Monochamus spp. including *M. alternatus, M. galloprovinicialis, M. titillator, M. scutellatus*	Longhorn beetles	Plantation forest
Monosporascus cannonballus	Monosporascus root rot	Melon
Mungbean yellow mosaic virus (Begomovirus)	Mungbean yellow mosaic virus	Grains
Mycosphaerella eumusae	Eumusae leaf spot	Banana
Mythimna unipuncta	Armyworm	EPPRD
Nemorimyza maculosa	Chrysanthemum leaf miner	Cutflower
Neonectria ditissima	European canker	Apple and Pear, Cherry, EPPRD
Noorda albizonalis	Red banded borer	EPPRD
Numonia pirivorella	Pear fruit moth	EPPRD
Nysius huttoni	Wheat bug	Grains

* Defined as a categorised High Priority Pest in the EPPRD, independent of biosecurity planning processes

Scientific name	Common name	High Priority Pest of
Oligonychus ilicis	Southern red mite	Nursery and Garden
Oligonychus perseae	Persea mite	Avocado
Ophiostoma novo-umi (syn. *Ceratocystis ulmi*)	Dutch elm disease	EPPRD
Orgyia thyellina	White spotted tussock moth	Plantation forest
Otiorhynchus rugosostriatus	Rough strawberry weevil	EPPRD
Pandemis cerasana	Cherry brown tortrix	Cherry
Pantoea stewartii	Stewart's wilt of maize	Grains
Paracoccus marginatus	Papaya mealy bug	Papaya
Paradasynus longirostris	Hong Kong stink bug	Lychee
Parasa lepida	Blue striped nettle grub	Mango
Passiflora chlorosis virus (Potyvirus)	Passiflora chlorosis virus	Passionfruit
Passionfruit crinkle virus (Potyvirus)	Passionfruit crinkle virus	Passionfruit
Passionfruit ringspot virus (Potyvirus)	Passionfruit ringspot virus	Passionfruit
Passionfruit severe leaf distortion virus (Begomovirus)	Passionfruit severe leaf distortion virus	Passionfruit
Passionfruit Sri Lankan mottle virus (Potyvirus)	Passionfruit Sri Lankan mottle potyvirus	Passionfruit
Passionfruit vein clearing virus (Rhabdovirus)	Passionfruit vein clearing rhabdovirus	Passionfruit
Passionfruit yellow mosaic virus (Tymovirus)	Passionfruit yellow mosaic virus	Passionfruit
Peach rosette mosaic virus (Nepovirus)	Peach rosette mosaic virus	Summerfruit
Peanut clump virus (Pecluvirus)	Peanut clump virus	Grains
Pennisetia hylaeiformis	Raspberry crown borer	Rubus
Pennisetia marginata	Raspberry crown borer	Rubus
Peridroma saucia	Variegated cutworm	EPPRD
Perkinsiella vastatrix	Sugarcane plant hopper	Sugarcane
Perkinsiella vitiensis	Sugarcane plant hopper	Sugarcane
Peronophythora litchii	Brown blight	Lychee
Peronosclerospora philippinensis	Philippine downy mildew of maize	Grains, Sugarcane
Peronosclerospora sacchari	Sugarcane downy mildew	Sugarcane, EPPRD
Peronosclerospora sorghi	Downy mildew of sorghum	Grains

Table 39. High Priority Pests threats (continued)

Scientific name	Common name	High Priority Pest of
Phakopsora euvitis	Grapevine leaf rust	EPPRD
Phialophora cinerescens	Phialophora wilt	Cutflower
Phoma tracheiphila	Mal secco	EPPRD
Phymatotrichopsis omnivora (syn. *Phymatotrichum omnivorum, Ozonium texanum*)	Texas root rot	Cherry, Cotton, EPPRD
Phytomyza gymnostoma	Allium leaf miner	Onion
Phytophthora fragariae var. *fragariae*	Red steele root rot	Strawberry, EPPRD
Phytophthora infestans (A2 mating type and exotic strains of A1 mating type)	Late blight	Potato
Phytophthora kernoviae	Phytophthora blight	Avocado
Phytophthora mengei	Trunk canker	Avocado
Phytophthora pinifolia	Dano foliar del Pino	Plantation forest
Phytophthora ramorum	Sudden oak death	Avocado, Blueberry, Cutflower, Nursery and Garden, Nut, Plantation forest, Truffle, EPPRD
Planococcus ficus	Vine mealybug	Viticulture
Planotortrix octo	Green headed leaf roller	Cherry
Plasmopara halstedii	Downy mildew of sunflower	Grains
Plum pox virus (Potyvirus)	Plum pox virus	Cherry, Summerfruit, EPPRD
Podosphaera clandestina var. *clandestina* (exotic strains)	Powdery mildew of cherry	Cherry
Polychrosis viteana	American berry moth	Viticulture
Polyocha depressella	Root borer	Sugarcane
Pomacea canaliculata	Golden apple snail	Nursery and Garden, Rice, EPPRD
Popillia japonica	Japanese beetle	Rubus, Summerfruit
Potato spindle tuber viroid (Pospiviroidae)	Potato spindle tuber viroid	Potato, EPPRD
Potato virus Y (Potyvirus) (exotic strains)	Potato virus Y	Potato
Prays oleae	Olive moth	Olive
Procontarinia spp. (exotic species)	Mango gall midges	Mango
Prostephanus truncatus	Larger grain borer	Grains
Pseudocercospora fijiensis (syn. *Mycosphaerella fijiensis*)	Black sigatoka	Banana, EPPRD
Pseudococcus maritimus	Grape mealybug	Viticulture
Pseudomonas avellanae (syn. *P. syringae* pv. *avellanae*)	Bacterial canker	Truffle
Pseudomonas syringae pv. *syringae* (exotic races)	Bacterial canker	Avocado, Nursery and Garden
Pseudotheraptus wayi	Coconut bug	Lychee
Psila rosae	Carrot rust fly	Vegetable
Puccinia asparagi	Asparagus rust	EPPRD
Puccinia graminis f. sp. *tritici* (exotic pathogenic races eg Ug99)	Stem rust of wheat	Grains
Puccinia psidii sensu lato (exotic variants)	Guava rust, Eucalyptus rust	Cutflower, Nursery and Garden, Plantation forest, EPPRD
Puccinia spp. (exotic species affecting *Allium* spp.)	Rust	Onion
Puccinia striiformis f. sp. *hordei*	Barley stripe rust	Grains
Pucciniastrum coryli	Hazelnut rust	Truffle
Pyrilla perpusilla	Sugarcane pyrilla	Sugarcane
Radopholus similis (exotic strains)	Burrowing nematode	Ginger
Raffaelea lauricola	Laurel wilt	Avocado
Ralstonia solanacearum race 2	Moko	Banana, EPPRD
Ralstonia solanacearum race 3 (exotic strains)	Bacterial wilt	Potato
Ralstonia solanacearum race 4 (exotic strains)	Bacterial wilt	Ginger
Ramu stunt (unknown organism)	Ramu stunt disease	Sugarcane, EPPRD
Raspberry ringspot virus (Nepovirus)	Raspberry ringspot virus	Rubus, Strawberry
Rhagoletis fausta	Black cherry fruit fly	Cherry
Rhagoletis indifferens	Western cherry fruit fly	Cherry
Rhagoletis pomonella	Apple maggot	Apple and Pear, Cherry
Rhizoctonia solani f. sp. *sasaki* (AG 1)	Banded leaf and sheath spot	Grains
Rhizoglyphus callae	Bulb mite	Onion
Rhizoglyphus setosus	Bulb mite	Cutflower, Onion
Rhodococcus fascians	Leafy gall	Cutflower

Table 39. High Priority Pests threats (continued)

Scientific name	Common name	High Priority Pest of
Rice grassy stunt virus (Tenuivirus)	Rice grassy stunt virus	Rice
Rice ragged stunt virus (Oryzavirus)	Ragged stunt virus	Rice
Rice tungro bacilliform virus (unassigned)	Rice tungro bacilliform virus	Rice
Rice tungro spherical virus (Waikavirus)	Rice tungro spherical virus, Waikavirus	Rice
Riptortus dentipes	Pod sucking bug	Grains
Roesleria subterranea	Grape root rot	EPPRD*
Schizaphis graminum	Greenbug	Grains
Scirpophaga excerptalis	Top shoot borer	Sugarcane
Scirtothrips aurantii	South African citrus thrip	EPPRD
Scirtothrips perseae	Avocado thrip	Avocado
Sesamia grisescens	Stem borer	Sugarcane, EPPRD
Slow paralysis virus (Iflavirus)	Slow paralysis virus	Honey bee
Soil-borne wheat mosaic virus (Furovirus)	Soil-borne wheat mosaic virus	Grains
Sphaceloma perseae	Avocado scab	Avocado
Spiroplasma citri	Stubborn	Citrus
Spodoptera eridania	Southern armyworm	Cutflower
Spodoptera frugiperda	Fall armyworm	Cutflower
Spodoptera littoralis	Cotton leafworm	Cutflower
Stagonospora sacchari	Leaf scorch	Sugarcane, EPPRD
Stenoma catenifer	Avocado seed moth	Avocado
Sternochetus frigidus	Mango pulp weevil	Mango, EPPRD
Strawberry latent ringspot virus (Sadwavirus)	Strawberry latent ringspot virus	Rubus, Strawberry
Strymon megarus (as a vector of Fusariosis)	Pineapple fruit borer	Pineapple
Sugarcane streak mosaic virus (Poacevirus)	Sugarcane streak mosaic	Sugarcane, EPPRD
Teratosphaeria gauchensis	Coniothyrium Eucalyptus canker	Plantation forest
Teratosphaeria zuluensis	Coniothyrium Eucalyptus canker	Plantation forest
Tetranychus piercei	Banana spider mite	Banana, EPPRD
Thaumatotibia leucotreta (syn. *Cryptophlebia leucotreta*)	False codling moth	Cotton, Grains, Pineapple, Summerfruit, EPPRD
Thrips tabaci (exotic strains and biotypes)	Onion thrips	Onion
Tilletia barclayana	Kernel smut of rice	EPPRD
Tilletia indica	Karnal bunt	Grains, EPPRD
Tomato black ring virus (Nepovirus)	Tomato black ring virus	Strawberry
Tomato ringspot virus (Nepovirus)	Tomato ringspot virus	Rubus, Strawberry
Tomicus piniperda	Pine shoot beetle	Plantation forest
Toxotrypana curvicauda	Papaya fly	Papaya
Tribolium castaneum (phosphine resistant)	Rust red flour beetle	EPPRD
Trioza erytreae	African citrus psyllid	Citrus
Trogoderma granarium	Khapra beetle	Grains, Nut, Rice, EPPRD
Tropilaelaps clareae	Tropilaelaps mite	Honey bee, Nut
Tropilaelaps mercedesae	Tropilaelaps mite	Honey bee, Nut
Tuta absoluta	South American tomato moth, tomato leafminer	Tomato
Uredo rangelii	Myrtle rust	EPPRD
Urocerus gigas	Giant wood wasp	Plantation forest
Varroa destructor	Varroa mite	Honey bee, Nut
Varroa jacobsoni	Varroa mite	Honey bee
Verticillium dahliae (defoliating strain)	Verticillium wilt	Cotton, Nut, Olive, EPPRD
Vespa spp. (exotic species)	Hornets	Honey bee
Watermelon bud necrosis virus (Tospovirus)	Watermelon bud necrosis	Vegetable
Watermelon silver mottle virus (Tospovirus)	Watermelon silver mottle	Vegetable
Wheat spindle streak mosaic virus (Bymovirus)	Wheat spindle streak mosaic virus	EPPRD
White leaf phytoplasma	White leaf	Sugarcane, EPPRD
X disease phytoplasma (MLO)	Peach X disease	EPPRD
Xanthomonas albilineans (exotic strains-serological groups 2 or 3)	Leaf scald	Sugarcane
Xanthomonas axonopodis pv. *allii*	Xanthomonas leaf blight	Onion
Xanthomonas axonopodis pv. *passiflorae*	Bacterial blight	Passionfruit

* Defined as a categorised High Priority Pest in the EPPRD, independent of biosecurity planning processes

Scientific name	Common name	High Priority Pest of
Xanthomonas axonopodis pv. *malvacearum*	Bacterial blight, angular leaf spot	EPPRD
Xanthomonas campestris (avocado strain)	Bacterial canker	Avocado
Xanthomonas citri subsp. *citri*	Citrus canker	Citrus, EPPRD
Xanthomonas citri subsp. *malvacearum*	Bacterial blight, angular leaf spot	Cotton, EPPRD
Xanthomonas fragariae	Strawberry angular leaf spot	Strawberry, EPPRD
Xylella fastidiosa (subspecies not specified)	Pierce's disease, blueberry leaf scorch, olive leaf scorch, olive quick decline	Blueberry, Cherry, Citrus, Nursery and Garden, Nut, Summerfruit, Viticulture, EPPRD
Xylella fastidiosa subsp. *fastidiosa*	Pierce's disease, blueberry leaf scorch, olive leaf scorch	Olive
Xylella fastidiosa subsp. *pauca*	Pierce's disease, blueberry leaf scorch, olive quick decline	Olive
Xylosandrus compactus	Black twig borer	Mango, EPPRD
Zea mosaic virus (Potyvirus)	Zea mosaic virus	Grains
Zeugodacus curcubitae (syn. *Bactrocera cucurbitae*)	Melon fruit fly	Avocado, Melon, Papaya, Passionfruit, Summerfruit, Tomato, Vegetable

Surveillance for Panama TR4 disease. Image courtesy of Biosecurity Queensland, QDAF

Xylella preparedness and prevention workshop

Xylella fastidiosa is an exotic bacterial plant pathogen that causes significant environmental and economic damage overseas. Although it is not present in Australia it is a plant pest of major concern to Australia's plant production industries and environment.

So far, over 200 commercial and ornamental plants are known to be susceptible to Xylella (pronounced Zy-lella), and it spreads easily since any insects that feed on xylem fluid from plants are thought to act as vectors for the disease.

Symptoms vary according to the host plants but in general, as the bacterium blocks the transport of water and soluble nutrients, affected plants show drying, scorching, wilting of the foliage, eventually followed by plant death. Depending on the host plant, the disease is known as: Pierce's disease, California vine disease, Anaheim disease (in grapevine), alfalfa dwarf disease (in lucerne), phony disease (in peach), leaf scald (in plum), quick decline (in olive), leaf scorch (in coffee, almond, blueberry, olive, oleander, elm, oak, plane, mulberry, maple) and variegated chlorosis (in citrus).

To improve protection from this pest, in June 2016 PHA hosted the National Xylella Preparedness Workshop in Melbourne, funded by the Australian Government Department of Agriculture and Water Resources.

Forty-two people attended the workshop, representing 12 industries, state and territory governments, R&D funding providers, the Ministry of Primary Industries NZ and the Australian Government.

Participants received a briefing on the impacts of Xylella in Europe, in particular the death of olive trees in parts of Italy.

Leaf scorch is a common symptom of Xylella infection. Image courtesy of Theodor D. Leininger, USDA Forest Service, Bugwood.org

They then assessed the types of prevention and preparedness activities that would minimise the impact of a potential Xylella incursion in Australia. Key areas identified were heightened industry and government awareness, improved diagnostics, and building on our capacity to detect and report the presence of Xylella in Australia.

Adult sugarcane weevil borer. Image courtesy of Sugar Research Australia

2.2 Australia's regionalised pests

When new exotic pests with the potential to cause serious economic impact on plant production industries are detected, eradication is the ideal goal. While Australia has had great success in eradicating exotic pests, in some cases eradication is not possible.

Following the establishment of these pests, measures can still be taken to minimise negative impacts, primarily through containment. Regionalised pests can be contained at a local, regional or state level, depending on current distribution and the ability to implement cost beneficial measures for containment.

State and territory government legislation underpins containment activities which are carried out by the jurisdictions in cooperation with other states, territories and relevant industries as appropriate. Domestic quarantine restrictions are key in preventing the spread of pests nationally. Table 40 lists the 81 regionalised pests recognised by formal legislation and their current area of distribution within Australia.

Asian honey bee swarm on a tree. Image courtesy of Queensland Department of Agriculture and Fisheries

Table 40. Australia's regionalised pests

Scientific name	Common name	Area of regionalisation
New South Wales		
Bactrocera tryoni	Queensland fruit fly	Endemic within all of NSW excluding the NSW portion of the Greater Sunraysia Pest Free Area as defined in Order O-458 of the NSW *Plant Diseases Act 1924* No. 38
Banana bunchy top virus (Babuvirus)	Banana bunchy top virus	Far north coast – regulated via Order OR121 under the NSW *Plant Diseases Act 1924* No. 38
Daktulosphaira vitifoliae	Grapevine phylloxera	Present within the NSW Phylloxera Infested Zone, comprising the Sydney and the Albury-Corowa regions as defined in Proclamation P176 of the NSW *Plant Diseases Act 1924* No. 38
Fusarium oxysporum f. sp. *cubense* (race 1 and subtropical race 4)	Panama disease endemic strains	Far north coast – regulated via Order OR121 under the NSW *Plant Diseases Act 1924* No. 38
Panonychus citri	Citrus red mite	The Citrus Quarantine Area of Cumberland and Northumberland Counties as outlined in Plant Diseases (Citrus Red Mite) Notification 2016 under the NSW *Plant Diseases Act 1924* No. 38
Potato viruses belonging to the Potyviridae family (including *Potato virus Y*) and the Luteoviridae family (including *Potato leaf roll virus*)		Endemic in NSW excluding the NSW Seed Protected Areas as defined in Order O-443 of the NSW *Plant Diseases Act 1924* No. 38
Ralstonia solanacearum	Bacterial wilt of potatoes	Endemic in NSW excluding the NSW Seed Protected Areas as defined in Order O-443 of the NSW *Plant Diseases Act 1924* No. 38
Spongospora subterranea	Powdery scab of potatoes	Endemic in NSW excluding the NSW Seed Protected Areas as defined in Order O-443 of the NSW *Plant Diseases Act 1924* No. 38

Scientific name	Common name	Area of regionalisation
Northern Territory		
Aleuroides dispersus	Spiraling whitefly	Darwin, Palmerston, Darwin rural area, Katherine
Bactrocera tryoni	Queensland fruit fly	Darwin, Palmerston, Darwin rural area, Katherine, Tennant Creek, Alice Springs
Bermisia tabaci	Silver leaf whitefly	Darwin, Palmerston, Darwin rural area, Katherine
Brontispa longissima	Palm leaf beetle	Darwin, Palmerston, Darwin rural area
Citripestis eutrapera	Mango fruit borer	Darwin, Darwin rural area, Katherine
Cryptosporiopsis citri	Cryptosporiopsis leaf spot	Darwin, Darwin rural area, Batchelor, Daly River, Litchfield region
Cucumber green mottle mosaic virus	Cucumber green mottle mosaic virus	Darwin rural area, Katherine, Alice Springs (Ti Tree)
Dickeya spp.	Dickeya	Darwin rural area
Fusarium mangiferae	Mango malformation disease	Darwin, Darwin rural area, Adelaide River
Fusarium oxysporum f. sp. *cubense* (tropical race 4)	Panama disease	Darwin rural area
Fusarium oxysporum f. sp. *niveum*	Fusarium wilt of watermelon	Darwin, Darwin rural area, Katherine
Idioscopus clypealis	Mango leaf hopper	Tiwi Islands, Darwin rural
Idioscopus nitidulus	Mango leaf hopper	Darwin, Palmerston, Darwin rural area, Adelaide River, Pine Creek, Katherine
Lepisiota frauenfeldi	Browsing ant	Darwin
Monomorium dichroum	Monomorium dichroum	Darwin
Parlatoria blanchardi	Date palm scale	Alice Springs
Phakopsora cherimoliae	Phakopsora rust	Darwin rural area
Pineapple mealy bug wilt associated virus (PMWaV-1)		One property only (Darwin Correctional Facility Shoal Bay)
Pseudocercospora purpurea	Cercospora spot	Darwin rural area
Selenothrips rubrocinctus	Red-banded thrips	Darwin, Palmerston, Darwin rural area, Adelaide River, Pine Creek, Katherine
Sternochetus mangiferae	Mango seed weevil	Darwin, Palmerston, Darwin rural area, Batchelor, Adelaide River
Tetranycus gloveri	Glovers mite	Darwin rural area
Thrips palmi	Melon thrips	Darwin rural area
Uredo morifolia	Mulberry rust	Dundee Downs, Palmerston, Noonamah, Darwin rural area

Table 40. Australia's regionalised pests (continued)

Scientific name	Common name	Area of regionalisation
Queensland		
Aleurodicus dispersus	Spiraling whitefly	Torres Strait Islands, Cape York Peninsula, Mareeba, Charters Towers, coastal towns south to Bundaberg
Anoplolepis gracilipes	Yellow crazy ant	Populations dotted in various locations spanning Cairns to the Gold Coast
Apis cerana, Java genotype	Asian honey bee	Surrounding Cairns region, north to Bonnie Doon (near Mossman), west of Atherton and Mareeba and south to Mena Creek
Banana bunchy top virus (Babuvirus)	Bunchy top	Noosa south to the NSW border
Cryptotermes brevis	West Indian drywood termite	Greater Brisbane, Wide Bay, Rockhampton, Bowen, Townsville
Deanolis sublimbalis	Red banded mango caterpillar	Far northern Cape York Peninsula
Eumetopina flavipes Muir	Island sugarcane planthopper	Torres Strait island archipelago and the northern peninsula area of Cape York
Fiji disease virus	Fiji leaf gall	Sugarcane biosecurity zones 4, 5 and 6
Fusarium oxysporum f. sp. *Cubense* (race 1, race 2, subtropical race 4 and tropical race 4)	Panama disease	**Race 1** endemic throughout banana growing regions **Race 2** south Johnstone and Cairns **Race 4** (subtropical) south east Queensland as far north as Rosedale **Race 4** (tropical) detected in 2015 on a single property in the Tully Valley, far north Queensland. A containment program has been established.
Idioscopus clypealis	Mango leafhopper	Cape York Peninsula and Mareeba area, south to Atherton, and along the coast from Wangetti to Gordonvale
Idioscopus nitidulus	Mango leafhopper	Cape York Peninsula
Liriomyza sativae	Vegetable leafminer	Northern peninsula area of Cape York Peninsula
Mycosphaerella fijiensis	Black sigatoka	Some northern and eastern Torres Strait Islands
Papaya ringspot virus (Potyvirus)	Papaya ringspot virus	South east Queensland as far north as Bundaberg area
Planococcus lilacinus	Coffee mealybug	Boigu Island, Torres Strait Islands
Procontarinia spp.	Mango leaf gall midge	Torres Strait and northern tip of Cape York Peninsula
Pseudococcus cryptus	Cryptic mealybug	Islands in the Torres Strait and isolated places in North Queensland, including Cairns, not widely distributed
Pseudococcus jackbeardsleyi	Jack beardsley mealybug	Torres Strait Islands and the Cape York Peninsula
Pseudocercospora purpurea	Cercospora leaf spot	Mareeba Shire Council and Tablelands Regional Council
Solenopsis invicta	Red imported fire ant	South east Queensland including parts of Brisbane, Ipswich, Lockyer, Redland, Logan, Somerset, Scenic Rim and Gold Coast councils. The Brisbane Airport is a separate response as it is a new incursion not genetically related to the one in the south east.
Striga asiatica	Red witchweed	Contained to a small number of properties in the Mackay region
Sugarcane mosaic virus (strain A) (Potyvirus)	Sugarcane mosaic virus	Sugarcane biosecurity zones 4, 5 and 6
Sugarcane striate mosaic-associated virus (Carlavirus)	Sugarcane striate mosaic virus	Sugarcane biosecurity zone 2 and 6
Tetranychus piercei	Spider mite	Weipa, Cape York Peninsula
Thrips palmi	Melon thrips	South east Queensland as far north as Bundaberg area. North Queensland coastal areas from Ayr to Mossman and Atherton Tablelands
Wasmannia auropunctata	Electric ant	Far north Queensland, Cairns hinterland and Bingle Bay
South Australia		
Urocystis cepulae	Onion smut	Annual surveys of Allium crops. Quarantine measures are applied in two remaining quarantine zones.

Table 40. Australia's regionalised pests (continued)

Scientific name	Common name	Area of regionalisation
Victoria		
Bactrocera tryoni	Queensland fruit fly	Permanent fruit fly zones (refer to specific orders)
Cantareus apertus	Green snail	Management of green snail linked and infested lands (refer to specific orders)
Daktulosphaira vitifoliae	Grapevine phylloxera	Phylloxera Infested Zone and Phylloxera Free Zone (refer to specific orders)
Globodera rostochiensis	Potato cyst nematode	Management of PCN linked and infested lands, and Plant Protection District (refer to specific orders)
Western Australia		
Achroia grisella	Lesser wax moth	WA. Regulations or controls for movement and control in specified areas
Aethina tumida	Small hive beetle	Kimberley. Host material restricted from movement to rest of state
Bemisia tabaci (B biotype)	Silverleaf whitefly	Perth and Carnarvon. Host material restricted from movement to Kununurra
Brontispa longissima	Palm leaf beetle	Broome. Host material restricted from movement to rest of state
Cantareus apertus	Green snail	WA. Regulations or controls for movement and control in specified areas
Ceratitis capitata	Mediterranean fruit fly	WA. Absent from east Kimberley region. Regulations or controls for movement and control in specified areas
Chortoicetes terminifera	Australian plague locust	WA. Regulations for control in specified areas
Cosmopolites sordidus	Banana weevil borer	Kununurra. Host material restricted from movement to rest of state
Cryptolestes ferrugineus	Flat grain beetle	WA. Regulations or controls for movement and control in specified areas
Cryptolestes pusillus	Flat grain beetle	WA. Regulations or controls for movement and control in specified areas
Ephestia elutella	Tobacco moth	WA. Regulations or controls for insecticide resistant strains
Ephestia kuehniella	Mediterranean flour moth	WA. Regulations or controls for insecticide resistant strains
Fusarium oxysporum f. sp. *cubense* (race 1)	Panama disease	Carnarvon. Host material restricted from movement to rest of the state
Galleria mellonella	Larger wax moth	WA. Regulations or controls for movement and control in specified areas
Hylotrupes bajulus	European house borer	WA. Regulations or controls for movement and control in specified areas
Oryzaephilus surinamensis	Sawtooth grain beetle	WA. Regulations or controls for insecticide resistant strains
Pentalonia nigronervosa	Banana aphid	Carnarvon. Host material restricted from movement to rest of the state
Plodia interpunctella	Indian meal moth	WA. Regulations or controls for insecticide resistant strains
Potato spindle tuber viroid	Potato spindle tuber viroid (PSTVd)	Carnarvon
Pythium tracheiphilum	Lettuce blight	Gingin and Perth metropolitan area
Rhyzopertha dominica	Lesser grain borer	WA. Regulations or controls for insecticide resistant strains
Sitophilus granarius	Granary weevil	WA. Regulations or controls for insecticide resistant strains
Sitophilus oryzae	Rice weevil	WA. Regulations or controls for insecticide resistant strains
Sitotroga cerealella	Angoumois grain moth	WA. Regulations or controls for insecticide resistant strains
Thrips palmi	Melon thrips	Kimberley (low pest prevalence area)
Tribolium castaneum	Rust red flour	WA. Regulations or controls for insecticide resistant strains
Tribolium confusum	Confused flour beetle	WA. Regulations or controls for insecticide resistant strains
Trogderma variabile	Warehouse beetle	WA. Regulations or controls for movement and control in specified areas

2.3 Responses to Emergency Plant Pests

With increasing global trade, travel and tourism, and the potential for pests to enter via natural routes, serious exotic pest incursions are inevitable. Australia has a formal legal agreement between government and industry for dealing with Emergency Plant Pests (EPPs) and for sharing the costs of responses to eradicate them. This agreement, the Emergency Plant Pest Response Deed (EPPRD), is detailed in Section 4.2.

Table 41 identifies the status of responses to EPPs as at 31 December 2016. In addition, there were a number of new pests detected in Australia in 2016 for which no further action was required, or which are currently under investigation (Table 42).

COST SHARED EMERGENCY RESPONSES IN 2016

Six Cost Shared responses to Emergency Plant Pest incursions were underway in 2016.

Giant pine scale (*Marchalina hellenica*) was under eradication in urban areas of South Australia and Victoria following its detection in October 2014, with the costs being shared by the Australian Government, state and territory governments and two industry bodies: Australian Forest Products Association and Nursery and Garden Industry Australia (NGIA). In October 2016, the National Management Group (NMG) agreed that it is not technically feasible to eradicate giant pine scale. A Transition to Management approach is being prepared for consideration by the NMG. To date, there have been no detections in commercial pine plantations.

Banana freckle (*Phyllosticta cavendishii*) eradication on Cavendish bananas in the NT continued in 2016 and the response is on track to achieve eradication. Affected Parties for this response include the Australian Government, state and territory governments, Australian Banana Growers Council and NGIA. Following the conclusion of the host free period, the sentinel planting phase (reintroducing clean banana material into the NT) commenced in May 2016.

Exotic fruit flies in the Torres Strait are dealt with under an annual program of surveillance and eradication that has been agreed by the NMG for the period 1 July 2015 to 30 June 2018. The Response Plan covers activities for Oriental fruit fly, New Guinea fruit fly and melon fly, with the costs being shared between the Australian Government, state and territory governments and 12 Affected Industry Parties.

Chestnut blight in Victoria has been under a Cost Shared eradication program since November 2010 and freedom from the disease was due to be declared in June 2016. Following a single detection on a Victorian property in July 2016, operational activities have been extended. Affected Parties for this response include the Australian Government, state and territory governments and Chestnuts Australia.

Varroa jacobsoni was detected on its natural host, the Asian honey bee in Queensland in June 2016. This species of Varroa mite does not normally reproduce on European honey bee (EHB), and has not been detected on EHB in Australia. The NMG endorsed a Response Plan for *V. jacobsoni* in September 2016, with the costs of the response being shared between the Australian Government, state and territory governments, the Australian Honey Bee Industry Council and 13 pollination-reliant Industry Parties.

Khapra beetle was detected on imported goods in South Australia in April 2016 and a Cost Shared response agreed by the NMG in May 2016. Beetles and larvae were destroyed, premises fumigated and tracing and surveillance activities undertaken. There have been no further detections and surveillance activities are ongoing. Affected Parties for the response include the Australian Government, state and territory governments, Almond Board of Australia, Australian Ginger Industry Association, AUSVEG, Australian Walnut Industry Association, Cotton Australia, Dried Fruits Australia, Grain Producers Australia, Pistachio Growers' Association and Ricegrowers' Association of Australia.

Oriental fruit fly

Table 41. Emergency responses to plant pests under EPPRD arrangements

Scientific name	Common name	Crops affected	Region	Past action	Current (2016) situation and status
Bactrocera dorsalis	Oriental fruit fly	Various fruits and vegetables	Torres Strait	Exotic fruit flies are sporadically detected in the Torres Strait and eradicated to protect mainland Australia. In November 2015 NMG endorsed the Exotic Fruit Flies in the Torres Strait Response Plan for the period July 2015 to June 2018. Surveillance and eradication activities will occur on an annual basis.	Surveillance and eradication activities in the Torres Strait are ongoing.
Bactrocera trivialis	New Guinea fruit fly				
Zeugodacus cucurbitae	Melon fly				
Cryphonectria parasitica	Chestnut blight	Chestnuts	Vic	First detected in September 2010. NMG endorsed a Response Plan in November 2010 and eradication activities were undertaken. Further detection in June 2014. Revised Response Plan endorsed by NMG August 2014. All infected trees were destroyed. Eradication program in Proof of Freedom Phase, with ongoing surveillance undertaken to confirm that the EPP had been eradicated.	Single detection in July 2016. Diseased tree and surrounding host trees destroyed. Tracing and surveillance activities undertaken with no further detections. Response Plan is being revised and surveillance is ongoing.
Fusarium mangiferae	Mango malformation disease (MMD)	Mangoes, nursery and garden	Qld	The CCEPP considered the technical feasibility of eradication for Fusarium species causing MMD in Australia. A Scientific Advisory Panel was convened to address technical questions related to Fusarium species causing MMD in Australia. Recommendations prepared for consideration by the CCEPP.	The CCEPP is considering the advice of the Scientific Advisory Panel and preparing recommendations on each Fusarium species for consideration by the NMG.
F. proliferatum					
F. pseudocircinatum					
F. sterilihyphosum sensu lato					
Liriomyza sativae	Vegetable leafminer	Tomatoes, vegetables, cotton, legumes, onions, nursery and garden	Torres Strait, Qld	First detected in the Torres Strait in 2008 and additionally in May 2014. In August 2014 the CCEPP determined that it was not technically feasible to eradicate from the Torres Strait. Detected in the Cape York Peninsula in May 2015 and considered by the CCEPP. Surveillance activities undertaken.	The CCEPP is preparing recommendations for consideration by the NMG.
Marchalina hellenica	Giant pine scale	Pine trees, nursery and garden	SA, Vic	Detected in Victoria and South Australia in October 2014. Tracing and surveillance undertaken. Response Plan endorsed by NMG in March 2015. Eradication activities and surveillance undertaken.	In October 2016 NMG supported the CCEPP recommendation that it is not technically feasible to eradicate. A revised Response Plan incorporating a Transition to Management Phase is being prepared for consideration by the CCEPP and NMG.
Phyllosticta cavendishii	Banana freckle	Bananas, nursery and garden	NT	Detected in July 2013. NMG endorsed a Response Plan in October 2013 and eradication activities were undertaken. Destruction of host material continued and host free period commenced May 2015.	Sentinel planting phase commenced May 2016 with the controlled reintroduction of banana plants and ongoing surveillance activities.
Trogoderma granarium	Khapra beetle	Almonds, ginger, vegetables, walnuts, cotton, dried fruit, grains, pistachios and rice	SA	New incursion in 2016	Detected on imported goods in South Australia. Response Plan endorsed by the NMG in May 2016 and eradication, tracing and surveillance activities undertaken. There have been no further detections and precautionary surveillance acitvities are continuing.
Varroa jacobsoni	Varroa mite	Honey and various pollination-reliant crops	Qld	New incursion in 2016	Detected on Asian honey bee (*Apis cerana*) in Queensland in June 2016. Response Plan endorsed by the NMG in September 2016 and eradication activities undertaken. Surveillance activities are ongoing.
Xanthomonas fragariae	Strawberry angular leaf spot	Strawberries	Qld	Detected in May 2010. Infected plants were destroyed and delimiting surveys undertaken. CCEPP considered eradication report and recommended to NMG that *X. fragariae* has been eradicated.	In July 2016 the NMG endorsed the CCEPP recommendation that *X. fragariae* has been eradicated.

Table 42. Pest detections notified under the EPPRD that did not result in a formal cost-shared emergency response*

Scientific name	Common name	Region	State
Acrospeira mirabillis	Shell moulds	Buckland	Vic
Agonoscelis rutila	Horehound bug	Stratham, Perth	WA
American plum line pattern virus	American plum line pattern virus	Mildura and Croydon Vic, Brisbane Qld	Vic, Qld
Anoplophora glabripennis	Asian longhorn beetle	Perth	WA
Aphis forbesi	Strawberry root aphid	Perth	WA
Apricot vein clearing associated virus	Apricot vein clearing associated virus	Hobart	Tas
Astrothrips tumiceps	Oriental waisted thrips	Kununurra	WA
Atrichonotus sordidus	Flores weevil	Devonport, Hillwood	Tas
Bipolaris yamadae		Yandaran	Qld
Botryosphaeria stevensii	Botryosphaeria canker	Ballarat	Vic
Bursaphelenchus vallesianus	Pine nematode	Eastlakes	NSW
Cowpea mild mottle virus group (Carlavirus)	Cowpea mild mottle virus	Fassifern, Gatton	Qld
Citrus bark cracking viroid	Citrus bark cracking viroid	Binna Burra, Sunraysia	NSW
Citrus viroid VII	Citrus viroid VII	Dareton	NSW
Colletotrichum alienum		Cressy	Tas
Colletotrichum brevisporum		Gregory River, Johnstone	Qld
Colletotrichum cairnsense	Chilli anthracnose	Cairns	Qld
Colletotrichum ocimi		Brisbane	Qld
Colletotrichum queenslandicum		Brisbane	Qld
Colletotrichum siamense		Bundaberg	Qld
Colletotrichum simmondsii		Cairns	Qld
Contarinia spp.	Alstroemeria gall midge fly	Forreston SA, Cabarlah Qld	SA, Qld
Corynespora smithii		Kiewa Valley	Vic
Crypsiptya coclesalis	Bamboo moth, bamboo leaf roller	Mullumbimby	NSW
Cryptolestes cornutus	Flat bark beetle	Torres Strait	Qld
Cucumber green mottle mosaic virus	Cucumber green mottle mosaic virus	Geraldton	WA
Diaporthe australafricana	Phomopsis canker	Nannup	WA
Dichromothrips phalaenopsidis	Orchid thrips	Beachmere	Qld
Dickeya zeae		Various locations	Qld, NT
Diuraphis noxia	Russian wheat aphid	Various locations	SA, Vic, NSW, Tas
Embellisia allii	Skin blotch, bulb canker of garlic	Preston, Spring Bay	Tas
Fusarium avenaceum		Ballarat	Vic
Fusarium denticulatum		Rockhampton	Qld
Fusarium fujikuroi (syn. *Gibberella fujikuroi*)		Childers, Dimbulah, Warwick	Qld
Fusarium oxysporum	Fusarium rot of pyrethrum	Ballarat	Vic
Fusarium oxysporum	Fusarium wilt of prince of orange	Ningi	Qld
Grapevine pinot gris virus	Grapevine pinot gris virus	Mildura NSW, Angaston SA	NSW, SA
Ilyonectria radicicola		Camberwell	Vic
Lasiodiplodia brasiliensis	Grape dieback	Emerald	Qld
Lasiodiplodia iraniensis	Grape dieback, Botryosphaeria dieback	Emerald	Qld
Macrophomina phaseolina	Charcoal rot	Littlehampton	SA
Magnaporthiopsis agrostidis			NSW
Megoura crassicauda	Vetch aphid	Beecroft	NSW
Melampsoridium betulinum	Birch rust	Various locations	NSW, Tas

Scientific name	Common name	Region	State
Neofusicoccum parvum	Dieback and canker disease	Eurobin	Vic
Neopestalotiopsis rosae		Wamuran	Qld
Pantoea ananatis	Leaf spot disease of maize	Bairnsdale	Vic
Papilio demoleus malayanus	Lime butterfly, lime swallowtail	Dauan Island, Torres Strait	Qld
Paraconiothyrium brasiliense		Yarraman	Qld
Parlatoria blanchardii	Parlatoria date scale	Gurra Gurra Lakes region	SA
Paropsides calypso	Blackburn	Geelong	Vic
Pepper vein yellows virus	Pepper vein yellows virus	East Kimberley	WA
Phenacoccus solani	Solanum mealybug	Murchison	Vic
Phenacoccus solenopsis	Cotton mealybug	Murchison	Vic
Phoma bellidis		Kiewa Valley	Vic
Phytophthora boodjera		Tincurrin	WA
Phytophthora crassamura		Stokes Inlet National Park	WA
Phytophthora palmivora		El Arish	Qld
Phytophthora pseudocryptogea		Fitzgerald River National Park	WA
Potato spindle tuber viroid	Potato spindle tuber viroid	Carisbrook	Vic
Pseudoplagiostoma sp. *nov.*		Yarraman	Qld
Puccinia hemerocallidis	Daylily rust	Melbourne	Vic
Puccinia lagenophorae		Gapsted	Vic
Puccinia psidii sensu stricto	Eucalyptus rust, guava rust	Lord Howe Island	NSW
Pythium helicoides		Caboolture	Qld
Quadrastichus erythrinae	Erythrina gall wasp	Torres Strait	Qld
Ralstonia solanacearum Phylotype I	Bacterial wilt		Qld
Ramularia collo-cygni	Ramularia leaf spot	Hagley	Tas
Rhombacus sp. *nov.*		Kingaroy	Qld
Sclerotium cepivorum	White rot of allium	Bentley	WA
Stagonosporopsis citrulli	Gummy stem blight	Mareeba	Qld
Sweet potato leaf curl virus	Sweet potato leaf curl virus	Ord River Irrigation Area	WA
Tetranycopsis horridus	Hazelnut mite	Mitta Mitta Vic, Orange NSW	Vic, NSW
Thekopsora minima	Blueberry rust	Sulphur Creek	Tas
Thelonectria veuillotiana		Camberwell	Vic
Trichoferus campestris	Chinese longhorned beetle	Brisbane	Qld
Xanthomonas gardneri	Bacterial leaf spot	Stanthorpe Qld, Tenterfield NSW	Qld, NSW
Xanthomonas perforans	Bacterial leaf spot	Bowen, Bundaberg and Brisbane Qld, Turramurra NSW	Qld, NSW
Xylosandrus crassiusculus	Granulate ambrosia beetle	Beerburrum State Forest	Qld

* Some pests listed in this table are still under investigation and an emergency response may be undertaken. These pests may be new detections, extensions of geographic range or new host records.

Giant sensitive plant (Mimosa diplotricha). Image courtesy of Challiyan, Wikimedia Commons

2.4 Managing weed threats in Australia

The scope of Australia's biosecurity system covers more than just invertebrates and pathogens, with a range of activities also in place to address the threats posed by weeds. Weeds are among the most serious threats to Australia's natural environment and plant production industries. They displace native species, contribute to land degradation and reduce productivity. These impacts are in addition to the costs associated with control. The total economic cost of weeds in Australia has been estimated at over $4 billion annually[4]. An estimated 2,300 species currently impact the natural environment nationally, and a further 1,000 species have a direct impact on plant production. However, there are far more potential weed species that have not yet entered the country or become established in Australia.

Australia's weed biosecurity system aims to prevent entry of high-risk plant species, eradicate or contain those in the early stages of invasion, and mitigate the impacts of established weeds. Managing and responding to weed threats involves all levels of government, industry and the community. Legislation across the country sets out the various roles of governments in managing weeds across Australia.

WEEDS OF NATIONAL SIGNIFICANCE

Thirty two Weeds of National Significance (WoNS) have been agreed by Australian federal, state and territory governments based on assessments of their invasiveness, potential for spread and environmental, social and economic impacts. Consideration was also given to their ability to be successfully managed. A list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

Weeds designated to be of national significance are those that require coordination among all levels of government, as well as organisations and individuals with weed management responsibilities. A national focus on WoNS continues through the work of the Invasive Plants and Animals Committee (see Figure 2) and government agencies report to this Committee on progress against any remaining actions under the strategic plans.

Bellyache bush, cotton-leaf physic nut (Jatropha gossypifolia), Berrimah, NT. Image courtesy of C.G. Wilson

Immature pods of the mimosa shrub (Mimosa pigra). Image courtesy of C.G. Wilson

4 Australian Government Weeds in Australia (2016) Impact of Weeds. Available from **environment.gov.au/biodiversity/invasive/weeds/weeds/why/impact.html**

WEED PREVENTION

The Department of Agriculture and Water Resources develops and implements quarantine policies for plant imports. Over the past decade, plant import policies have been tightened considerably with the implementation of Weed Risk Assessments (WRAs) for proposed new imports and the development of the Permitted Seeds List. This means that all species not currently in Australia or on the Permitted Seeds list are subject to a mandatory WRA prior to importation. Australia's WRA system has been adapted for use in other parts around the world. Weeds are also an integral part of the Northern Australia Quarantine Strategy (NAQS) surveillance activities in Australia's north and neighbouring countries.

Within Australia, state and territory government departments of primary industries and environment, along with Natural Resource Management authorities, have responsibility for weed biosecurity, policy and management. This is an important part of Australia's biosecurity system, ensuring appropriate post-border risk management, prevention of spread between regions and jurisdictions, and alignment of management and control with regional and national needs and priorities.

At the local level, weed surveillance is undertaken by most local councils, which report new weed incursions in their areas. Plant production industries and their growers manage weeds on individual properties to reduce the impact on plant production, and play an integral part in the weed detection and reporting network. Weed management is a component of on-farm biosecurity activities. Community based weed spotter programs are active in many states and local areas. Volunteers in these groups report new weed detections in their areas, and are generally supported in their activities by government agencies.

ERADICATION AND CONTAINMENT

Early detection and eradication or containment of newly established weeds provides the best opportunity to avoid the costs and impacts associated with established weeds. The Australian, state and territory governments manage and coordinate nationally cost-shared invasive weed eradication programs through the Consultative Committee on Exotic Plant Incursions (CCEPI). Eradication and containment of weeds is only possible if weed incursions are detected early, and a response is mounted before the weeds have a chance to spread too far.

The Established Pest Animals and Weeds Measure is a $50 million investment as part of the Australian Government's 2015 Agricultural Competitiveness White Paper. This is a four-year investment to improve the tools, technologies, information and skills needed by farmers and communities to tackle weeds and pest animals.

The Caring for our Country program coordinates national surveillance, containment and eradication of weed incursions that threaten production or the environment, or impact on trade or communities. Phase two of this program, from July 2013–2018, integrates the Natural Heritage Trust, the National Landcare Programme, the Environment Stewardship Program and the Working on Country Indigenous ranger programs.

National Four Tropical Weeds Eradication Program

The National Four Tropical Weeds Eradication Program targets weed species native to tropical America that are in north Queensland. The program is managed by Biosecurity Queensland and is cost-shared by the Australian, Queensland, NSW, NT and WA governments.

In 2016 the program targeted eradication of:

- Limnocharis (*Limnocharis flava*)
- Miconia (*Miconia calvescens*, *M. nervosa*, *M. racemosa*)
- Mikania vine (*Mikania micrantha*).

Limnocharis, miconia and mikania vine are all considered serious weeds in other countries, while *Miconia nervosa* and *M. racemosa* have exhibited invasive characteristics in north Queensland.

The combined impacts of these weeds on agriculture and the environment in tropical and subtropical areas of Australia would be significant if allowed to expand unchecked. The national eradication program involves targeted weed surveys and weed control, extensive community engagement to identify infested areas and research components. Regular reviews are undertaken to track the progress of the program towards eradication milestones and targets.

Red Witchweed Response Plan

In July 2013 red witchweed was detected in sugarcane on six properties in Queensland. Reaching agreement on a national approach to the eradication response has been complex. The weed is not covered under the existing industry and government response agreements which prescribe matters such as decision making and cost-sharing arrangements. The response to red witchweed has been undertaken according to the principles and arrangements set out in the national eradication agreements.

In April 2016 the Agriculture Ministers' Forum (AGMIN) comprising of Australian primary industry ministers, endorsed a ten year response plan of up to $5.8 million to eradicate red witchweed. The eradication response is led by the Queensland Government. Affected industry parties include the Cattle Council of Australia, Meat and Livestock Australia, Grain Producers Australia and CANEGROWERS.

WEED MANAGEMENT

Combating weeds at the farm level is an integral part of most farming systems. Problem weeds and their management differ greatly among industries and regions, but most production systems use a mixture of chemical and non-chemical control methods. Some plant production industry peak bodies produce integrated weed management (IWM) manuals, and the larger industry organisations conduct weed surveillance and research.

In Australian broadacre plant production industries, weeds are most commonly managed through competition with other plants, herbicide sprays, tillage, slashing, grazing, burning, or a combination of these measures through IWM. In horticultural production systems, weed control focuses on mechanical cultivation and herbicide applications. No-till production systems, which use herbicides to control weeds, are now commonly implemented in Australia.

Local councils are responsible for weed management on land that they own, control or manage, and some jurisdictions also conduct weed inspections on private land. Local community groups support the activities of industry and governments in weed management. Formal organisations such as Landcare Australia, Conservation Volunteers and Greening Australia, together with smaller informal groups organise volunteers to restore and maintain local bushland.

Weed biological control

Following prevention, biological control, commonly called 'biocontrol', represents one of the most effective and cost efficient strategies for weed management. Australia has been a leader in the development of effective, risk-assessed biocontrol programs.

Salvation Jane or Patterson's curse (*Echium plantagineum*) is an excellent case study of the benefits of biocontrol to Australia's economy, environment and community. The weed displaces productive pasture and is cumulatively toxic to livestock. At its peak, it was Australia's worst broadleaf temperate pasture weed, covering more than 10 million hectares and costing nearly $40 million a year in lost production.

Following development of an ongoing biocontrol program, Salvation Jane densities and biomass have dropped by around 80 to 90 per cent. An economic assessment for this control program has shown that for a research and development investment of $23.1 million, the net present value benefits are on target to be $1.2 billion by 2050, representing a return on investment of 52:1[5].

Since the late 1980s six agents have been released to control the weed. The crown weevil (*Mogulones larvatus*) has proven to be the most effective, often killing the weed outright, and on a large scale, at a number of sites in NSW, Victoria and South Australia.

Australia currently has research programs aiming to develop biocontrol agents for a number of other established weeds, including silverleaf nightshade and African boxthorn.

COORDINATION OF WEED MANAGEMENT

The Invasive Plants and Animals Committee (IPAC) provides an inter-governmental mechanism for identifying and resolving weed issues at a national level. It is a cross-jurisdictional committee with members from the Australian Government and all state and territory governments. Observers on the committee include representatives from CSIRO, PHA and the New Zealand Government.

The IPAC oversees the administration of the Australian Weeds Strategy (AWS), which is the overarching policy for weed management in Australia. It outlines goals and actions required to keep Australia's economic, environmental and social assets secure from the impacts of weeds. The AWS is reviewed every 10 years to ensure it remains relevant to Australia's needs. A public consultation process on the draft revised Australian Weeds Strategy 2017–27 closed in October 2016.

Parthenium weed, bitter weed, false ragweed (Parthenium hysterophorus) seedling. Image courtesy of C.G. Wilson

5 Australian Weeds Strategy 2017–27

Eradicating orange hawkweed from the highlands

Hawkweeds (*Hieracium* species) have the potential to be serious weeds in temperate areas of south eastern Australia, including the Australian Alps and Tasmanian grasslands. In addition to being a major threat to biodiversity, if left unchecked hawkweeds could cause losses of over $48 million a year to the Australian grazing industry alone.

Currently, naturalised populations are only known to occur in a few locations in the high country of Victoria and NSW including in Kosciusko National Park, where it was first detected in 2003.

Orange hawkweed (*Hieracium aurantiacum*) is a species of daisy that originates from northern and central Europe. This species has established as a weed in many countries, including the United States, Canada, Japan and New Zealand. In these countries, this weed is threatening biodiversity and reducing productivity of agricultural lands.

It poses a serious threat to the Australian Alps and surrounding environments, including farmland, outcompeting native and pastoral plants. In Kosciusko National Park over 200 volunteers have been assisting the NSW National Parks and Wildlife Service to eradicate the weed. Because orange hawkweed is so small, detector dogs have been used as they can sniff out even tiny fragments of plant.

Although previously sold as ornamental plants, sale of hawkweeds is now prohibited under state and territory legislation.

Volunteers and detector dogs are helping to locate and eradicate orange hawkweed from Kosciusko National Park. Image courtesy of NSW DPI

Boneseed (Chrysanthemoides monilifera subsp. *monilifera) Image courtesy of C.G. Wilson*

Image courtesy of Ports Australia

Chapter 3

Maintaining Australia's plant biosecurity status

This chapter describes the three layers of protection that make up Australia's plant biosecurity system: pre-border activities, those at the border and post-border measures within Australia.

The Australian Government has responsibility for border activities as well as for international obligations, import risk analysis, market access negotiations, post-entry plant quarantine and national legislation.

Within our borders, the plant biosecurity system is made up of coordinated activities carried out by governments, industries and everyday Australians.

Under the Australian Constitution, individual state and territory governments are responsible for plant biosecurity matters within their boundaries. This includes exotic plant pest surveillance, domestic quarantine, research and development, preparedness initiatives, and emergency response activities such as establishing quarantine zones and informing the public.

State and territory governments coordinate their activities through the Plant Health Committee and subcommittees, as described in Chapter 1 and through the Emergency Plant Pest Response Deed (Chapter 4).

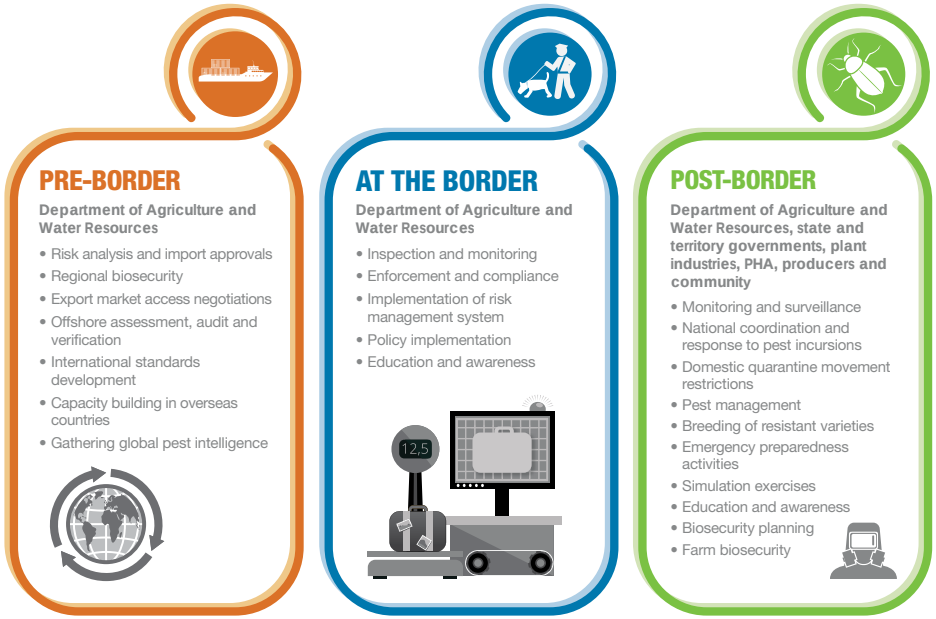
Increasingly, governments are also working in partnerships with industry and community to mitigate risk in initiatives such as the National Bee Pest Surveillance Program and the Farm Biosecurity Program, which are facilitated by PHA.

3.1 Biosecurity and international trade

Australia's enviable plant biosecurity status is due to coordinated activities that occur pre-border (overseas), at the border, and post border (within Australia) (Figure 82). Responsible parties may include the Australian government, state and territory governments, local governments, researchers, PHA and the wider community (e.g. home gardeners).

Australia gains significant economic benefits as a net exporter of agricultural products, with around two-thirds of national agricultural production exported to overseas markets. Australia also benefits from importing a range of goods from overseas. Imports provide access to a wide range of products, technology and services that enable economic growth in multiple sectors. The movement of plant produce around the world is covered by international agreements that function to prevent the spread of plant pests, known as phytosanitary agreements.

Figure 82. Key components of Australia's plant biosecurity system



PARTICIPATING IN INTERNATIONAL PLANT PEST AGREEMENTS

As an active trading nation, Australia has entered into a number of multilateral and bilateral trade agreements that influence its plant biosecurity system. On a multilateral level, Australia's rights and obligations in relation to plant biosecurity are set out under World Trade Organization (WTO) agreements, particularly the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), although others, such as the General Agreement on Tariffs and Trade 1994, may apply in certain circumstances.

The SPS Agreement provides WTO member countries with the right to use sanitary and phytosanitary measures to protect human, animal and plant life or health. The agreement also imposes obligations, including that sanitary and phytosanitary measures cannot be used to inhibit trade where there is no danger to human, animal or plant health.

The WTO allows members to specify the level of protection that they consider fitting to protect human, animal and plant life or health within their territory (this is known as the appropriate level of protection or acceptable level of risk) provided it is science-based, is applied consistently and considers the objective of minimising negative trade effects. Australia's appropriate level of protection (ALOP) is defined in section 5 of the *Biosecurity Act 2015* as providing "a high level of sanitary and phytosanitary protection aimed at reducing biosecurity risk to a very low level, but not to zero."

All Australian state and territory governments have agreed to this statement as the basis for the national biosecurity system. Consistent with these requirements, Australia's policy is to reduce biosecurity risk to this ALOP by using science-based risk assessments.

Australia has a number of bilateral free trade agreements with other countries, each of which deals with biosecurity issues in a slightly different way. However, all agreements are consistent with the SPS Agreement and Australia does not negotiate on specific biosecurity measures within its free trade agreements.

There are also multilateral agreements on plant protection, to which Australia is a party, that outline the responsibilities and obligations to members. These agreements also set standards to help harmonise phytosanitary measures.

Port Authority of NSW. Image courtesy of Ports Australia

The International Plant Protection Convention

The International Plant Protection Convention (IPPC) is an international agreement that protects the world's plant resources from the spread of serious pests, including diseases and invasive species, in international trade. The IPPC is an Article XIV statutory body of the Food and Agriculture Organization (FAO) of the United Nations, from which it receives program funding, sourced from FAO assessed contributions and donations and supplemented by voluntary contributions of contracting parties.

The IPPC is recognised by the SPS Agreement as the body responsible for the establishment of phytosanitary standards relating to plants and plant products in international trade, as well as to anything that can act as a vector for the spread of plant pests.

These standards, known as International Standards for Phytosanitary Measures (ISPMs), provide specific requirements for the management of biosecurity issues, such as the development of pest risk analyses or guidelines for surveillance. Importantly, these standards are a means by which governments can harmonise their phytosanitary regulations. The standards not only reduce the number of pests moved through international trade, but also help facilitate safe trade. Australia, through the Department of Agriculture and Water Resources, coordinates and provides input into four governance bodies:

1. Commission on Phytosanitary Measures, the governing body that oversees implementation of the IPPC
2. IPPC Strategic Planning Group, which determines strategic priorities for IPPC activities
3. IPPC Standards Committee and associated working groups responsible for the development of ISPMs.
4. IPPC Implementation and Capacity Development Committee responsible for facilitating implementation of the convention and its standards and recommendations.

Australia has contributed a number of technical resources to help other contracting parties better manage phytosanitary risks, including guidance on managing risks posed by sea containers and establishing and maintaining pest free areas. Australia has also taken a lead role in the development and implementation of the electronic generation and transmission of phytosanitary certification through the IPPC ePhyto program. Reporting and exchange of information, including pest status of parties, is available on the International Phytosanitary Portal at **ippc.int**.

The Plant Protection Agreement for the Asia and Pacific Region

The Plant Protection Agreement is an intergovernmental treaty administered by the Asia and Pacific Plant Protection Commission (APPPC), a Regional Plant Protection Body (RPPO) recognised under the IPPC. The APPPC covers phytosanitary issues relating to the movement of pests in trade, pesticide use and regulation, and integrated pest management. Following the acceptance of amendments to the funding mechanism for the APPPC, Australia and 24 other member countries make an annual mandatory contribution to the organisation to support the work program.

The APPPC develops Regional Standards for Phytosanitary Measures (RSPMs) that deal with specific regional issues, support the region's trade and may form the basis of an international standard. Australia is an active participant in the APPPC assisting with the development of standards and their implementation in the region. The APPPC implements relevant RSPMs, for example on training requirements for plant quarantine inspectors and irradiation as a phytosanitary treatment.

During its 2013 biennial meeting, the APPPC adopted two new RSPMs: Approval of Irradiation Facilities and Approval of Fumigation Facilities, the development of which had been led by Australia. Officers from the Department of Agriculture and Water Resources facilitated an Australian-funded pilot workshop, which focused on the implementation of RSPMs through a systems approach, based on International Standards for Phytosanitary Measures (ISPM) 14.

A follow up activity led by Australia was delivered in 2015. At its biennial meeting in 2015, the APPPC adopted several Australian-led initiatives supporting regional harmonisation, the development of a RSPM on hot water immersion treatment for fruit flies on mangoes, and a six-year surveillance work plan and associated workshops to assist with the implementation of ISPM 6 Guidelines for Surveillance.

Canberra Agreement

Australia is also a member of a second RPPO, the Pacific Plant Protection Organisation (PPPO), which is an auxiliary body established under the then South Pacific Commission of the Canberra Agreement. The PPPO provides advice and support to its members on phytosanitary measures to facilitate international trade whilst protecting the plant health status of parties. The Pacific region covers Pacific island countries and United States and French territories, together with Australia and New Zealand.

During 2016, the PPPO hosted an IPPC regional workshop to consider draft ISPMs and other IPPC activities funded under the Department of Foreign Affairs and Trade's Pacific Horticultural and Agricultural Market Access initiative. Australia currently holds the Vice-Chair position on the PPPO Executive Committee.

Port of Newcastle. Image courtesy of Ports Australia

REGULATING IMPORTS TO MANAGE RISK

Since imported plant products could bring exotic pests into the country, the importation of plants and plant products into Australia is strictly regulated. The Australian Government has responsibility for regulation under the *Biosecurity Act 2015*, the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, and where relevant, the *Gene Technology Act 1989* and any subordinate legislation (for further detail see Section 1.1).

Import conditions are imposed to ensure that goods entering the country do not introduce new pests and diseases to Australia. Import conditions are determined on a case-by-case basis, depending on the pest risks associated with the product, the location of production and the shipping arrangements. The Department of Agriculture and Water Resources verifies that imported goods meet these conditions and compliant goods are allowed entry.

Some imported goods require an import permit and these are issued under the *Biosecurity Act 2016*. Other goods may be allowed entry without a permit subject to standard conditions that are included in the *Biosecurity (Prohibited and Conditionally Non-prohibited Goods) Determination 2016*. Permits may also be required under the *EPBC Act 1999* for imports of internationally endangered species designated by CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and live specimens.

Import conditions are published in the Biosecurity Import Conditions system (BICON). The system can be found on the Department of Agriculture and Water Resources website and contains the Australian import conditions for more than 20,000 plant, animal, mineral and human commodities.

In establishing import conditions, Australia must be confident that the required risk management measures are properly implemented and can be maintained. Pre-border site visits or audits may be required.

Import risk assessment is an important part of Australia's biosecurity protection. Assessments are conducted by technical and scientific experts and can take several forms, such as import risk analyses (IRAs), pest risk assessments and policy reviews. IRAs have a timeframe for completion which is regulated by legislation and the process includes mandated public consultation periods and a formal appeal process.

Assessments are conducted in accordance with Australia's rights and obligations under the SPS Agreement and following the guidance of relevant international standards including ISPM 2 (Framework for Pest Risk Analysis) and ISPM 11 (Pest Risk Analysis for Quarantine Pests) of the IPPC.

Table 43 details policy advice finalised by December 2016, as well as draft policy advice that is currently in progress. Refer to Section 3.2 for further information on pre-border activities.

Table 43. Department of Agriculture and Water Resources finalised and draft import policy advice

Policy	Country (from)	Year released
Finalised policy advice		
Apple and pear (budwood)	Generic	2002
Apples	New Zealand	2007
Apples	China	2010
Apples	New Zealand (review)	2011
Apples (Fuji)	Japan	1998
Avocado (revision)	New Zealand	2007
Baeodromus eupatorii for the biological control of the weed *Ageratina adenophora*	Source country	2014
Bananas	Philippines	2009
Candidatus Liberibacter psyllaurous (capsicum, nursery stock, potato tubers, tamarillo fruit, tomato)	New Zealand, USA	2009
Candidatus Liberibacter spp. and their vectors associated with Rutaceae	All countries	2011
Capsicum	Korea	2009
Cherries (into Western Australia)	New Zealand	2003
Citrus	Egypt	2002
Citrus (revision)	Israel	2003
Dactylopius tomentosus (fulgida) for the biological control of coral cactus *Cylindropuntia fulgida* var. *mamillata*	All countries	2015
Dragon fruit	Vietnam	2017
Drosophila suzukii (spotted wing drosophila)	All countries	2013
Durian	Thailand	1999
Durian (supplement)	Thailand	2000
Eueupithecia cisplatensis for the biological control of Parkinsonia, *Parkinsonia aculeata*	Source country	2012
Eueupithecia sp. 2 for the biological control of the weed *Parkinsonia aculeata*	Source country	2014
Fresh ginger	Fiji	2015
Ginger	Fiji	2013
Grains	Various	2006, 2007, 2008
Grapes (table)	India	2016
Grapes (table)	USA	2002
Grapes (table)	Chile	2005
Grapes (table)	Korea	2011
Grapes (table)	China	2011
Grapes (table)	Japan	2014
Grapes (table, revisions)	USA	2003, 2006

Policy	Country (from)	Year released
Grapes (table)	Sonora, Mexico	2016
Grapes (table, into Western Australia)	USA	2016
Grapevine propagative materials	All countries	2013
Hazelnut	Chile	2011
Hops propagative materials	All countries	2010
Island cabbage	Cook Islands, Fiji, Samoa, Tonga, Vanuatu	2013
Lentil (seed and human consumption)	All countries	2002
Lettuce (reinstatement)	New Zealand	2007
Lilium spp.	Taiwan	2013
Limes (Tahitian)	New Caledonia	2006
Lychee	Taiwan, Vietnam	2013
Lychee and longan	China, Thailand	2004
Maize (bulk)	USA	2003
Mandarin (Unshu)	Japan	2009
Mangoes	Philippines	1999
Mangoes	Taiwan	2006
Mangoes	India	2008
Mangoes	Philippines (additional areas)	2010
Mangoes	India (revised conditions)	2011
Mangoes	Pakistan	2011
Mangoes	Indonesia, Thailand, Vietnam	2015
Mangosteen	Thailand	2004
Mangosteen	Indonesia	2012
Mastrus ridens for the biological control of codling moth, *Cydia pomonella*	Source country	2013
Medium Risk Nursery Stock review (internal)	All countries	2014
Nectarines	China	2016
Olive (plants from approved sources)	Generic	2003
Oranges (sweet)	Italy	2005
Papaya	Fiji	2002
Pears	Korea	1999
Pears	China	2005
Pears (Asian)	China	2003
Pears (Ya)	China	1998
Permitted seeds	All countries	2006
Persimmon	Israel, Japan, Korea	2004
Phalaenopsis orchids (nursery stock)	Taiwan	2010

Policy	Country (from)	Year released
Phytophthora spp. host propagative material	All countries	2015
Pineapple	Philippines, Solomon Islands, Sri Lanka, Thailand	2002
Pineapple (de-crowned)	Malaysia	2012
Pineapple (modification)	Philippines, Solomon Islands, Sri Lanka, Thailand	2003
Plectonycha correntina for the biological control of Madeira vine	Source country	2010
Pome fruit testing	China, Japan, Korea	2003
Poppy straw for processing	Turkey, Hungary, Portugal	2016
Pseudomonas syringae pv. *actindae*	New Zealand	2011
Salacca	Indonesia	2014
Seed contaminants (review of tolerances)	All countries	2000
Stone fruit	USA	2010
Stone fruit (into Western Australia)	New Zealand	2006
Strawberries	Korea	2017
Sweet corn (seed)	USA	2003
Tachardiaephagus somervillei for the biological control of yellow lac scale	All countries	2015
Taro corms (fresh)	Generic	2011
Tomato (truss)	Netherlands	2003
Tomato (truss, review)	New Zealand	2002
Tortricid moth, *Cydia succedana*, for the biological control of gorse, *Ulex europaeus*	Source country	2014
Wood packaging	Generic	2006
Zantedeschia propagative material	All countries	2016
Draft policy advice (in progress)		
Apples	USA	2009 (stop the clock provisions have been activated on this policy)
Candidatus Liberibacter solanacearum	All countries	2015
Citrus spp. nursery stock	All countries	2014
Dates	Middle East, North Africa	2016
Cucumber green mottle mosaic virus pest risk analysis	All countries	2016
Fruit Fly Pest Free Areas	China	2009
Potatoes for processing	New Zealand	2012
Prunus spp. propagative material	All countries	2014
Thrips and Tospoviruses	All countries	2016
Tahitian limes	Cook Islands, Niue, Samoa, Tonga, Vanuatu	2016

ENSURING AUSTRALIAN EXPORTS MEET REQUIRED STANDARDS

Many Australian plant industries export a proportion of the food and fibre that they produce. Just as imports are subject to restrictions to protect plant health, exports must also meet conditions.

The *Export Control Act 1982* and its subordinate legislation provides the legal framework by which Australian producers can export their products. Exporters must meet the requirements of the Act and any quarantine requirements of the importing country.

The Department of Agriculture and Water Resources provides phytosanitary export inspection, verification, and certification services for plants and plant products in accordance with importing country requirements and Australia's international obligations. The department also negotiates technical market access for Australian export produce, and has responsibility for the Australian Wood Packaging Certification Scheme which enables Australia to provide ISPM 15 compliant wood packaging material for export.

The *Export Control (Plant and Plant Products) Orders 2011* provide criteria for the export of fresh fruits, fresh vegetables, dried fruits, prescribed grain, and plants or plant products for which a phytosanitary certificate, or any other official certificate, is required by an importing country authority.

More specific export legislation is listed in Table 44. Strong linkages are maintained with exporters through industry consultative committees (the Grain and Plant Products Export Industry Consultative Committee and Horticulture Export Industry Consultative Committee) which are instrumental in developing effective and efficient operational responses to government policy and legislation.

To assist exporters, the Manual of Importing Country Requirements (MICoR) provides information on export conditions required to export plants and plant products from Australia. This includes details on requirements for import permits, phytosanitary certificates, additional declarations and treatments, and any other relevant export information and documentation. Information in MICoR Plants is intended as a guide only and exporters are responsible to check the importing country's requirements before exporting.

For plant industries, the Export Documentation (EXDOC) system supports the preparation of export documentation for primary produce prescribed under the *Export Control Act 1982* and associated legislation. The system provides certification for grain and horticulture exports, as well as for animal products. EXDOC accepts details of proposed exports from exporters. This is linked to endorsements and results in inspections as required, and where applicable, an export permit and phytosanitary certificate is issued.

Technical market access negotiations between Australia and its trading partners, in close consultation with industry stakeholders, facilitate access to markets for Australian producers by addressing phytosanitary issues. Changes in pest status, the emergence of new or improved treatment technologies, and reviews by trading partners of their import conditions mean that negotiations surrounding market improvement and market maintenance are increasingly the focus of technical market access activities which ensure Australia can continue to export its plant products.

There is a high level of departmental investment in negotiating protocols and building export systems to increase the value of plant exports. Table 45 details market access achievements since 2000, including access to new markets, improving opportunities in existing markets and maintenance of existing market access. When prioritising activities, the department consults with industry to ensure its processes select market pathways with the highest likelihood of technical and commercial success, with a strong focus on evidence-based analyses.

For dried bulk commodities, the Grains Industry Market Access Forum provides a conduit between government and industry to ensure market access decisions are informed and prioritised in line with overall industry benefit.

For the horticulture industry, advice to the Department of Agriculture and Water Resources on the industry's priorities for new or improved market access requests is provided through Hort Innovation's Trade Assessment Panel.

Table 44. Australia's export legislation, administered by the Department of Agriculture and Water Resources

Legislation
Export Control Act 1982
Export Control (orders) Regulations 1982
Export Control (Plants and Plant Products) Order 2011
Export Control (Prescribed Goods—General) Order 2005
Export Control (Hardwood Wood Chips) Regulations 1996
Export Control (Organic Produce Certification) Orders
Export Control (Regional Forest Agreements) Regulations
Export Control (Unprocessed Wood) Regulations
Export Charges (Collection) Act 2015
Export Charges (Imposition—Customs) Act 2015
Export Charges (Imposition—Excise) Act 2015
Export Charges (Imposition—General) Act 2015
Export Control (Fees) Order 2015
Export Charges (Collection) Regulation 2015
Export Charges (Imposition—Customs) Regulation 2015
Export Charges (Imposition—General) Regulation 2015

Table 45. Market access achievements for plant product exports from Australia since 2000

Country	Commodity	Year achieved
Market access gained and restored		
South Korea	Oranges	2000
South Korea	Lemons	2000
New Zealand	Multiple products (from Goulburn Valley) – pest free area	2003
Peru	Olive, rooted cuttings	2003
USA	Tomatoes, greenhouse	2003
Brazil	Lychees, nursery stock	2004
China	Mangoes	2004
Morocco	Olive, rooted cuttings	2004
New Zealand	Mangoes, irradiated	2004
China	Citrus	2005
Japan	Cherries (from Tasmania)	2005
South Africa	Seed potatoes, microtubers	2005
South Korea	Mangoes	2005
South Korea	Citrus (unspecified)	2005
Japan	Apples	2006
New Zealand	Bananas – resumption of trade	2006
New Zealand	Papaya	2006
Thailand	Seed potatoes (from Victoria and WA)	2006
Thailand	Potatoes, brushed ware	2006
South Korea	Multiple products	2007
South Korea	Mangoes	2007
New Zealand	Lychees	2008
South Korea	Lupins	2008
United States	Cherries (mainland)	2008
India	Peanuts, processed	2009
Japan	Citrus (from Sunraysia) – seasonal freedom	2009
China	Table grapes	2010
European Union	Citrus	2010
India	Kiwifruit	2010
Japan	Citrus (grapefruit)	2010
South Korea	Cherries (from Tasmania)	2010
Taiwan	Cherries – access reinstated for non pest free areas	2010
Saudi Arabia	Lentils	2011
Bolivia	Sunflower seed, sowing	2012
Chile	Grapevine, nursery stock	2012
Egypt	Honey	2012
India	Pearl millet seed, sowing	2012
Indonesia	Table grapes, summerfruits and cherries	2012
Peru	Wax flower, rooted cuttings	2012
Peru	Paulownia, rooted cuttings	2012
Peru	Sorghum seed, sowing	2012
Peru	Chia seed, sowing	2012
Taiwan	Carrots	2012
Taiwan	Whole lupins, processing	2012
USA	Cottonseed, stock feed	2012
Uruguay	Hemp seeds, sowing	2012
China	Cherries – access after initiating a protocol and meeting Chinese requirements	2013
China	Canola – re-opening of trade after resolving quarantine issues preventing exports since 2009	2013
Ecuador	Macadamia nuts – access gained for macadamia nuts in shell for consumption	2013
Ecuador	Barley – for consumption following a technical submission in 2008	2013
Malaysia	Creeping signal grass, sowing	2013
Peru	Teak seed, sowing	2013
Phillipines	Bana grass cuttings	2013
USA	Apples	2013
China	Grape seed	2014
Japan	Table grapes	2014
South Korea	Table grapes	2014
Thailand	Cherries	2014
Thailand	Summerfruit (apricots, plums, nectarines and peaches)	2014
USA	Mangoes and lychees	2015
India	Blueberries	2015
Vietnam	Table grapes – market access restored following suspension for all Australian fruit	2015
Vietnam	Citrus – market access restored following import suspensions for Australian fruit	2015
Saudi Arabia	Lentils – market access restored	2015
Mexico	Onion seed, sowing	2015
French Polynesia	Honey and other apiculture products	2016
China	Nectarines	2016
Japan	Melon (*Cucumus melo*)	2016
Japan	Watermelons	2016
Fiji	Honey bees (live queens)	2016

Table 45. Market access achievements for plant product exports from Australia since 2000 (continued)

Country	Commodity	Year achieved
Improvements in market access		
New Zealand	Zucchini – removal of Queensland fruit fly from the pest list	2005
Thailand	Citrus – 2–3 degree cold disinfestation	2005
Malaysia	Mangoes – new phytosanitary requirements	2006
New Zealand	Tomatoes – improved conditions	2006
South Korea	Carrots – freedom from nematode	2006
South Korea	Citrus – 3 degree cold disinfestation	2006
Taiwan	Multiple products (from Tasmania) – reinstatement of Queensland fruit fly area freedom	2006
Japan	Citrus – 2–3 degree cold disinfestation	2007
India	Oats	2008
India	Mangoes, irradiated	2008
Indonesia	Table grapes – in-transit cold disinfestation	2008
Indonesia	Citrus – in-transit cold disinfestation	2008
Japan	Cherries (from Tasmania) – revised protocol	2008
Japan	Mangoes – reduced inspection rate	2008
Taiwan	Multiple products – 2–3 degree cold disinfestation	2008
United Arab Emirates	Multiple products – removal of Standard Operating Policy and Procedure requirement	2008
China	Citrus – revised protocol	2009
China	Mangoes – revised protocol	2009
China	Apples (from Tasmania) – improved conditions	2010
Japan	Grapefruit	2010
South Korea	Citrus	2010
USA	Cherries (from mainland) – stand alone cold treatment	2010
India	Macadamia nuts	2011
Indonesia	Table grapes – in-transit cold disinfestation from non pest free areas	2011
Indonesia	Citrus – in-transit cold disinfestation from non pest free areas	2011
USA	Citrus – 3 degree cold disinfestation	2011
India	Citrus (unspecified) – more favourable temperatures and flexible conditions	2012
India	Citrus (unspecified) – 3 degree in-transit cold treatment	2012
New Zealand	Citrus (unspecified) – in-transit cold treatment	2012
New Zealand	Pears – in-transit cold treatment	2012
New Zealand	Table grapes – in-transit cold treatment	2012
New Zealand	Avocado – in-transit cold treatment	2012
United States	Apples	2012
China	Canola	2013
Hong Kong	Plants and plant products	2013
Indonesia	Soybeans – removal of a five per cent tariff	2013
Iran	Grain and seed	2013
Kenya	Wheat	2013
Libya	Grain and seed	2013
Phillipines	Fruit – revised protocol including favourable cold treatment conditions	2013
Qatar	Hay	2013
South Korea	All products – FTA negotiations concluded in December 2013	2013
Taiwan	Apples	2013
Thailand	Citrus – some import limitations removed by Thailand	2013
Thailand	Grain and seed	2014
China	Wheat and barley – access improved with new protocol	2015
Thailand	Citrus – more varieties approved for export from non pest free area districts	2015
Thailand	Tablegrapes – new temperature for cold treatment	2015
Thailand	Cherries – new temperature for cold treatment	2015
Thailand	Persimmons – irradiation for fruit fly control	2015
Korea	Cherries – improved inspection rates	2015
Japan	Walnuts	2016
Korea	Blood oranges and other sweet orange varieties	2016
Japan	Pumpkins	2016
USA	Mango	2016
USA	Lychees	2016
Colombia	Kangaroo paw nursery stock	2016

Table 45. Market access achievements for plant product exports from Australia since 2000 (continued)

Country	Commodity	Year achieved
Maintained in market access		
Malaysia	Cut and dried flowers	2004
South Korea	Potatoes	2004
Thailand	Citrus	2004
Various	Citrus	2004
Indonesia	Multiple products	2006
Canada	Summerfruit	2007
China	Citrus (unspecified)	2007
India	Grain	2007
Mauritius	Citrus	2007
Mauritius	Potatoes	2008
Thailand	Multiple products	2009
New Zealand	Mangoes	2010
New Zealand	Papaya	2010
New Zealand	Lychees	2010
Taiwan	Summerfruit (peach and nectarine)	2011
Thailand	Multiple products	2011
Thailand	Table grapes	2011
Thailand	Citrus	2011
Vietnam	Multiple products	2011
China	Table grapes	2014
India	Pome fruit	2012
Indonesia	Multiple products	2012
South Korea	Barley (malting), processing	2012
Taiwan	Summerfruit (plums)	2012
Vietnam	Multiple products	2012
Thailand	Apples	2013
Thailand	Pears	2013
Thailand	Avocado	2013
Thailand	Kiwifruit	2013
Thailand	Strawberries	2013
Thailand	Persimmon	2013
All markets	All products – implementation of a new security paper for export health certificates	2013
Taiwan	Apples – revised improved export protocol	2013
USA	Cottonseed, for stock feed – reinstated methyl bromide fumigation and new tolerance levels	2013
Indonesia	Wheat – access maintained for grain for consumption	2015
Vietnam	Seed, sowing	2015
Vietnam	Grains, consumption	2015
Vietnam	Nuts, consumption	2015
Vietnam	Plant based stockfeed	2015
India	Wheat flour	2016
Korea	Mangoes	2016

Tasmanian port. Image courtesy of Ports Australia

Australia elected Chair of the Commission on Phytosanitary Measures

Australia's expertise in biosecurity, plant health and setting standards was recognised in 2016 with its election to the position of Chair of the International Plant Protection Convention (IPPC) Commission on Phytosanitary Measures in 2016.

The new Chair is Lois Ransom from the Australian Government Department of Agriculture and Water Resources.

The IPPC is governed by the Commission which meets each year in Rome, Italy, to promote cooperation on plant protection around the world. The aim of the group is to enable global objectives of food security, trade facilitation and environmental protection.

In particular, the Commission:

- Reviews the state of plant protection around the world.
- Identifies action to control the spread of pests into new areas.
- Develops and adopts international standards.
- Establishes rules and procedures for resolving disputes.
- Adopts guidelines for the recognition of regional plant protection organisations.
- Cooperates with international organisations on matters covered by the Convention.

The international standards agreed by the Commission apply to plants, plant products, storage places, packaging, conveyances, containers, soil and any other organism, object or material capable of harbouring or spreading plant pests.

The Commission on Phytosanitary Measures is chaired by Australia's Lois Ransom. Image courtesy of IPPC

3.2 Pre-border activities

The Department of Agriculture and Water Resources has primary responsibility for pre-border biosecurity activities. These are focused on minimising the likelihood of exotic pests and diseases reaching our border, while enabling the movement of people and goods across the border. They provide assurance to the community and producers about the biosecurity status of commodities imported into Australia.

Pre-border activities include:

- Conducting risk assessments to consider the level of biosecurity risk that may be associated with imports and identifying risk management measures.
- Conducting pre-border verifications, inspections and audits.
- Conducting pre-border surveillance in near neighbouring countries.
- Collaborating with international partners on plant health issues and standards.
- Building regional capacity through collaborative activities.
- Gathering intelligence to determine and assess potential biosecurity risks.
- Assessing risks associated with imports.

Biosecurity risks are managed in keeping with Australia's legislative framework for biosecurity and international obligations, particularly the SPS Agreement. See Section 3.1 for further information on the role of risk assessments in assessing biosecurity risks associated with imports.

VERIFICATIONS, INSPECTIONS AND AUDITS

A range of verifications, inspections and audits are undertaken offshore to manage risks prior to import into Australia (to ensure that exporting countries can meet Australia's biosecurity requirements), provide export systems for safe trade and prevent the arrival of non-compliant consignments at the border.

Regular verifications and audits are undertaken to ensure compliance of specified plant material with prescribed risk management procedures. Controls also extend to production areas and stock feed processing facilities to ensure compliance with Australia's import permit requirements.

The Australian Government works with national plant protection organisations in exporting countries to increase confidence in their systems' ability to effectively manage biosecurity risks pre-border. This reduces the pressure on mitigating risks at the border and provides opportunities to reduce post-border intervention.

PARTICIPATING IN INTERNATIONAL PLANT HEALTH SYSTEMS

Australia engages in international activities to gather national and international plant pest information. The information is made available to regional plant health practitioners through a variety of sources including published records, surveillance data, insect and herbarium collections and networks. Intelligence assessments of High Priority Pests informs pre-border risk management and early detection of any pests that may enter and establish in Australia.

Australia also participates in setting standards for both international and regional bodies (refer to Section 3.1). This cooperative approach boosts Australia's ability to actively monitor pests pre-border, limit their spread, and reduce their impact on the agricultural systems of regional neighbours and trading partners. Significant effort is also invested in gaining intelligence and promoting Australia's interests in the evolution of trade regulations, codes and standards.

BUILDING CAPACITY IN THE ASIA-PACIFIC REGION

Activities to build capacity are delivered for Asia-Pacific countries that are close to Australia and for important and emerging trading partners. Commonly, these activities are coordinated through regional bodies, such as the Association of Southeast Asian Nations (ASEAN) or the Asia-Pacific Economic Cooperation (APEC) group of countries. Activities are often delivered with the assistance of funding from the Department of Foreign Affairs and Trade.

Capacity building activities yield a better understanding of the plant pest risks in the region, improve regional biosecurity, build diagnostic networks and capabilities, and foster links among plant health and biosecurity agencies and experts. These programs also help Australia to meet its formal international obligations to assist developing countries. Increasingly, capacity building activities promote approaches to managing phytosanitary risk that safeguard existing trade or create opportunities for expanding markets.

ANTICIPATING EXOTIC PLANT PEST THREATS

A range of sophisticated technologies and approaches including research, shared international resources and intelligence are used to anticipate exotic plant pest threats and to help prevent their introduction and spread. Work is undertaken with domestic and international partners to inform responses to emerging risks and to risks associated with deliberate and inadvertent non-compliance.

Information and intelligence is shared between partners through legislative requirements, memoranda of understanding and agreements with international bodies. The intelligence is used to develop cargo profiles and campaigns, and to support identification and management of non-compliance, enabling resources to be targeted at the areas of greatest risk.

Image courtesy of Apple and Pear Australia Ltd

Imported lychee plants were found to contain red coffee borer during post-entry quarantine. Image courtesy of Department of Agriculture and Water Resources

3.3 Activities at the border

The Department of Agriculture and Water Resources has primary responsibility for border biosecurity activities. With increasing levels of international travel and trade, the detection of threats at the border remains an important element of the biosecurity system.

Biosecurity activities at the border focus on:

- Screening and inspecting international vessels, passengers, cargo, mail, animals, plants and plant products arriving in Australia.
- Managing the high biosecurity risks of live plants and animals through containment, observation and treatment at quarantine facilities.
- Identifying and evaluating the specific biosecurity risks facing northern Australia through the Northern Australia Quarantine Strategy (NAQS).
- Raising awareness of Australia's biosecurity requirements among travellers, importers and industry operators.

Activities at the border are risk-based, informed by evidence and subject to review and continual improvement.

SCREENING AND INSPECTION

The Department of Agriculture and Water Resources employs more than 3,900 officers, many of whom contribute to the inspection of international vessels and passengers, cargo and mail as they arrive at ports of entry.

Surveillance and inspection activities are performed at international airports, seaports, mail facilities and container depots to screen and inspect incoming goods and people. A range of techniques are used including risk profiling, detector dogs and x-ray machines.

Audits are also undertaken on businesses that import goods to ensure compliance with biosecurity requirements. All plants or plant parts, fruits, seeds, cuttings, bulbs and wood or bamboo items are examined and treated as required. Low and medium risk plants can be imported and screened for exotic pests in privately operated quarantine approved facilities, whereas high risk plants are sent to either Australian or state government post-entry quarantine facilities.

PROTECTING OUR NORTHERN COASTLINE – NORTHERN AUSTRALIA QUARANTINE STRATEGY

Since 1989, NAQS has been meeting the unique biosecurity challenges facing Australia's north, stretching from Cairns to Broome and including the Torres Strait (Figure 83). The northern coastline is vast and sparsely populated, and commercial plantings are few and far between, making surveillance a challenge.

The primary biosecurity risk is the proximity of neighbouring countries to the Australian mainland. Indonesia, Timor-Leste and Papua New Guinea have many insect pests, plant diseases and weeds not present in Australia. These pests and diseases have the potential to arrive through human activities or natural means.

NAQS designs and conducts surveillance for pest and disease incursions to facilitate eradication before they spread or become established further south. In addition, NAQS collects information about the absence of significant pests and diseases which contributes to market access and broader biosecurity strategies. Increasingly, surveillance is conducted in partnership with industry and other government partners.

NAQS delivers on its objectives through a program that involves:

- Scientific teams in Darwin and Cairns delivering plant health surveys and monitoring across northern Australia.
- Public awareness activities to encourage local people and communities to report unusual pests and diseases.
- Delivery of pest and disease surveys and capacity building activities in Papua New Guinea, Indonesia, Timor-Leste and the Solomon Islands.

In 2016, plant scientists from NAQS conducted targeted surveillance for 155 exotic pests and diseases on most horticultural hosts and a range of native and cultivated alternate hosts across northern Australia. In addition to targeted activity, damage symptoms are regularly investigated. As part of the Torres Strait Fruit Fly Containment Strategy, NAQS maintained a set of permanent traps in the Torres Strait and Northern Peninsular Area of Cape York to target three exotic fruit fly species: Oriental fruit fly, melon fly and New Guinea fruit fly.

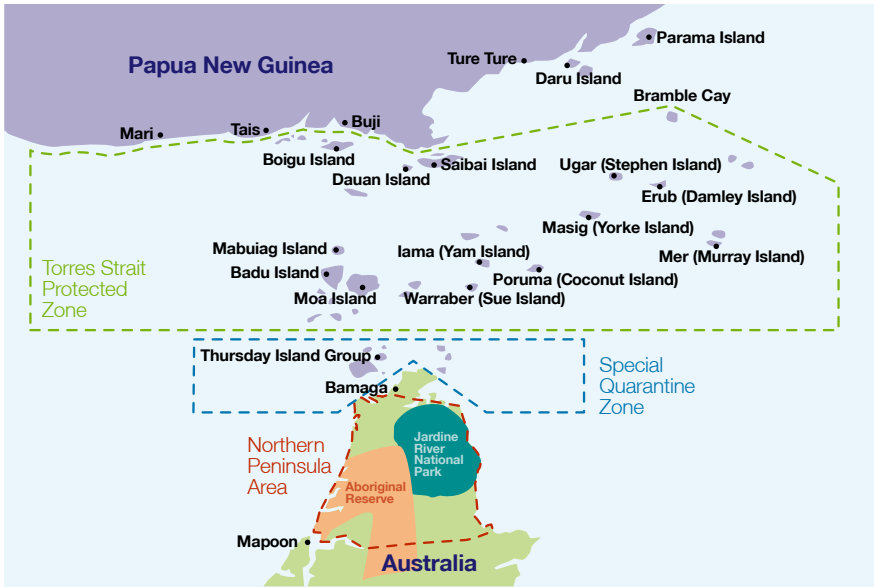
Regulation of the movement of goods and conveyances between Torres Strait Biosecurity Zones and mainland Australia

As discussed above, NAQS also regulates the biosecurity aspects of the southwards movement of people, vessels, aircraft and goods through the Torres Strait to mainland Australia. The key to success has been the cooperation and good will of Torres Strait communities.

Officers at strategic locations, including the inhabited islands of Torres Strait, regulate plant risks associated with movements of goods and conveyances through the islands (from the Torres Strait Protected Zone to the Permanent Biosecurity Monitoring Zones and from either zone to mainland Australia as seen in Figure 84).

Figure 83. NAQS surveillance area (shown in dark green)

Figure 84. Quarantine zones in the Torres Strait (shown in red, blue and green)



3.4 Post-border activities

Despite all the precautions in place, exotic pests may still enter Australia. This might be as a result of some imported goods containing a pest, illegal imports in parcels or luggage, or via natural pathways such as wind and water currents.

Recognising the need for a range of post-border measures aimed at limiting the impact of any detected pest or disease, Australia has established a unique and highly effective post-border biosecurity system to provide additional protection against exotic pests. Post-border activities range from planning and preparedness through to everyday pest management operations.

Identifying exotic threats and being prepared for their arrival significantly increases the chance of containing and successfully eradicating them should they arrive. Preparedness activities include agreed and implemented biosecurity plans for plant industries, pre-emptive breeding of resistant species and other targeted research and development, measures to raise awareness of plant pest risks among growers and internationally recognised surveillance systems capable of early detection and demonstrating area freedom.

When an Emergency Plant Pest is detected in Australia, formal emergency response arrangements are activated to ensure timely decisions and actions, providing the best chance of eradicating the new pest (see Chapter 4). For signatories to the Emergency Plant Pest Response Deed and the National Environmental Biosecurity Response Agreement, there are formal arrangements to share the cost of responding to an incursion between the Australian Government, state and territory governments and relevant industry partners.

In addition to responses to exotic plant pest incursions, there are numerous activities to minimise the impact of pests already endemic in Australia. Some pests are contained to specific regions of Australia, so domestic arrangements are in place to allow trade to both domestic and international markets without spreading these pests. The Australian Government, state and territory governments and industry all contribute to the management of endemic pests and preparing for potential exotic pest incursions.

POST-ENTRY PLANT QUARANTINE

All imported plant nursery stock and high risk seeds are subject to pest risk management to prevent the entry of pests. Australia maintains a post-entry plant quarantine program that enables high and medium risk nursery stock and restricted seeds to be grown and screened for pests at an approved facility (Table 46). Material is released from quarantine once it has been verified free from specific pests.

Table 46. Australian post-entry plant quarantine facilities, 2016

Location	Australian Government facilities	State government facilities approved for growing **high-risk** plant material	Scientific (S) and privately (P) operated facilities approved for growing **high-risk** plant material	Privately operated facilities approved for growing **medium-risk** plant material	Scientific research facilities approved for holding high and medium risk plant material for research purposes – **no material released from quarantine**
ACT			1 (S)		1
NSW		1	1 (S), 1 (P)	8	
Queensland		2	1 (S), 2 (P)	8	2
SA		1	2 (S)		1
Tasmania		1	1 (S)	1	
Victoria	1	3	4 (S), 2 (P)	13	4
WA		1	2 (P)	5	1
NT					

Plants found during quarantine search. Image courtesy of Department of Agriculture and Water Resources

Australian Government border inspections and unusual interceptions

Staff from the Department of Agriculture and Water Resources were hard at work this year enforcing quarantine restrictions at international entry points around Australia.

Border biosecurity officers screened 12 million mail items and four million passengers during the 2015–16 financial year, as well as assessing a million cargo consignments.

The Department's activities resulted in 3,500 infringement notices and the seizure of a range of items that posed a risk to Australian biosecurity. Items included plants and seeds, insects, whole fresh fish, dried lizards, frogs and spiders.

Notable finds this year included:

- A mail parcel containing more than 3,000 live convergent ladybeetles (*Hippodamia convergens*) sent on a plane from the United States.
- Two mail consignments from Korea that had over a dozen cacti and succulents (roots and all) concealed in packets of fries.
- The discovery of an exotic pest called red coffee borer – that affects grapes, citrus, apple, coffee, avocado, walnut and cotton – inside a batch of 300 lychee plants from Taiwan during post-entry quarantine assessment.

Live plants and other organic material can contain high-risk pathogens and nematodes and are subject to stringent import restrictions including a period in post-entry quarantine. Sellers might not be aware of these Australian restrictions so buyers have to beware.

Plants concealed in packets of fries to get around border controls. Images courtesy of Department of Agriculture and Water Resources

A package containing live convergent ladybeetles and plant material to feed them was intercepted at Melbourne airport

Export hay inspection, Riverina NSW. Image courtesy of Heather Parkes

DOMESTIC QUARANTINE

Newly established and regionalised pests (Section 2.2 Australia's regionalised pests) can be easily spread from one part of Australia to another through the movement of plants, plant products, people, soil or equipment. Restrictions on the movement of high risk items apply in each state and territory to reduce this risk. Domestic quarantine restrictions operate under state and territory legislation (Table 1, Section 1.1) to complement and support the national quarantine legislation that governs the import and export of goods to and from Australia.

Restrictions apply to domestic travellers as well as to interstate movement of goods. There are lists for travellers detailing what they can and cannot carry across state and regional borders available at the interactive site **interstatequarantine.org.au** developed by PHA in 2016. The website provides information for travellers on disposing of produce, interstate quarantine and quarantine zones. Producers can also use the site to gain more information on certification, committees, news, major pests, moving plant goods and quarantine regulators. The Exotic Plant Pest Hotline (1800 084 881) is available to direct any further Australian interstate quarantine queries.

Interstate certification

Interstate certification is used to govern the movement of plant products under the quarantine regulations in each state and territory. This certification scheme provides a harmonised approach for interstate movement of plant products and provides evidence that the quarantine regulations of the importing state or territory have been met. In many instances this may require specific treatments such as growing produce in a particular way (e.g. under cover), or undergoing disinfestation treatments after harvest (e.g. fumigation).

There are two types of certificates that may be issued:

- **Plant Health Certificate** – which is issued by a government officer from the state or territory of origin.
- **Plant Health Assurance Certificate** – which is supplied by an approved business under an Interstate Certification Assurance scheme arrangement. To issue these certificates, a business must meet specific requirements and undergo regular audits by the state or territory government accreditation authority.

The Subcommittee on Domestic Quarantine and Market Access

The Subcommittee on Domestic Quarantine and Market Access (SDQMA) reports to the Plant Health Committee (Section 1.3 National Committees) and consists of senior regulators from the Australian Government and state and territory governments. The objective of the committee is to develop, review and maintain domestic quarantine standards and conditions that allow export of produce around the country while avoiding the risk of spreading regionalised plant pests.

SDQMA's oversight of a wide range of quarantine conditions means it has an important role in developing domestic market access conditions for plants and plant products in Australia. For example, produce from fruit fly affected regions can be moved to non-affected regions for sale, once it has met certain conditions such as in-field and post-harvest treatments.

SDQMA is tasked with ensuring that conditions are:

- Technically justified, to minimise regulatory burdens on industry.
- Coordinated and harmonised across the country and regions to the extent possible.
- Consistent with Australia's international obligations under the World Trade Organization's Agreement of the Application of Sanitary and Phytosanitary Measures.

SDQMA works closely with state and national plant quarantine agencies and industries to develop and implement new treatment arrangements which not only provide for domestic trade, but also present a potential pathway to support international market access.

PRE-EMPTIVE BIOSECURITY PLANNING

Biosecurity planning provides a mechanism for plant production industries, in collaboration with governments and other relevant stakeholders, to identify and prioritise plant pests and diseases that could have a significant impact on their crops.

In addition to identifying the greatest threats to a particular industry or crop, biosecurity plans provide an agreed framework for individual industries and other biosecurity stakeholders including governments, to focus biosecurity risk mitigation activity. Biosecurity plans thereby enhance the ability to prevent, prepare for and effectively respond to pest incursions. The pre-emptive planning process ensures that industries are better placed to maintain domestic and international trade, negotiate access to new overseas markets, and reduce the social and economic costs of pest incursions to growers and the wider community.

Over time, the biosecurity system in Australia has matured, and the biosecurity planning process, including the review and monitoring of biosecurity plans, has improved to strengthen the identification and implementation of biosecurity activities and the mechanism for development of partnerships between industry and government.

The new model for developing industry biosecurity plans includes:

- Changing the term Industry Biosecurity Plans to Biosecurity Plans (BPs), to better reflect the partnership approach between industry and government in biosecurity planning and implementation.
- Developing Biosecurity Implementation Tables in each BP to identify and describe biosecurity preparedness activities relevant to the Intergovernmental Agreement on Biosecurity and the National Plant Biosecurity Strategy, the parties responsible for delivery, and the expected due date for completion.
- Establishing an oversighting group termed a Biosecurity Reference Panel that annually monitors the progress of biosecurity preparedness activities.

As of December 2016, 32 biosecurity plans have been developed by PHA, covering 38 of Australia's major plant industries (Table 47). Further information on biosecurity planning can be found on the PHA website.

Table 47. Current industry biosecurity plans covering Australia's plant industries

Current biosecurity plans
Apple and Pear IBP (Version 2.01)
Avocado IBP (Version 2.01)
Banana IBP (Version 2.0)
Blueberry BP (Version 1.0)
Cherry IBP (Version 2.01)
Citrus BP (Version 3.0)
Cotton BP (Version 3.0)
Cut Flower BP (Version 1.0)
Ginger IBP (Version 1.0)
Grains BP (Version 3.0)
Honey Bee IBP (Version 1.0)
Lychee BP (Version 1.0)
Mango IBP (Version 2.1)
Melon IBP (Version 1.0)
Nursery (Version 3.0)
Nuts BP (Version 3.0)
Olive BP (Version 2.0)
Onion IBP (Version 2.0)
Papaya IBP (Version 1.0)
Passionfruit IBP (Version 1.0)
Pineapple BP (Version 2.0)
Plantation Forest IBP (Version 2.0)
Potato IBP (Version 2.0)
Rice IBP (Version 3.0)
Rubus IBP (Version 1.0)
Strawberry IBP (Version 2.0)
Sugarcane IBP (Version 3.0)
Summerfruit IBP (Version 1.0)
Tomato BP (Version 1.0)
Truffle BP (Version 1.0)
Vegetable IBP (Version 2.0)
Viticulture IBP (Version 3.0)

MANAGING ECONOMICALLY SIGNIFICANT SPECIES OF FRUIT FLIES

Fruit flies are a nationally troublesome group of pests. They affect a range of horticultural commodities and the potential Affected Industry Parties are spread across all Australian states and territories. The presence of certain species of fruit flies in a growing area can have potentially large economic impacts for producers through increased production costs, loss of domestic and international markets, or a requirement for post-harvest treatments. Fruit flies are also a problem for non-commercial producers due to damage to fruit, crop losses and the costs of control.

Given the widespread ramifications of these pests, it is in everyone's interest to tackle fruit fly management collectively. The National Fruit Fly Strategy (NFFS) developed in 2008 detailed the importance of a collaborative approach and a subsequent cost-benefit analysis undertaken in 2012 by the Australian Bureau of Agricultural and Resource Economics and Sciences estimated that, if fully implemented, the NFFS could generate benefits of between $29 and $38 million per year.

The National Fruit Fly Council has been established to oversee and monitor implementation of the NFFS and continues the work begun by the National Fruit Fly Strategy Advisory Committee who performed this role from May 2014 to September 2015. The Council was established to drive the delivery of a national system that prevents fruit flies being a constraint to sustainable production or a barrier to trade and market access. The Council includes representatives from governments, industry and research funding agencies. It has an independent Chair and is supported by a National Manager and an independent secretariat from PHA.

The Council's focus areas are:

- Fruit fly management systems for the prevention, detection, eradication and management of fruit flies.
- Market access, including activities that assist in securing entry conditions for horticultural produce into markets.
- Legislation and regulation discussions to ensure that regulation and legislative controls for managing fruit flies are harmonised across Australia and in line with international standards.
- Research and development (R&D) opportunities to ensure that Australian R&D provides technically justifiable approaches and innovative solutions to meet the requirements of the three areas above.

During its first year of operation, the Council has focused on increasing fruit fly awareness and the availability of information on fruit fly management and information on the Council, including establishing a public webpage **preventfruitfly.com.au**, developing a communications strategy, creating a Twitter account and preparing regular e-newsletters to communicate fruit fly news to interested parties.

Fruit fly research at the Elizabeth Macarthur Agricultural Institute

PEST MANAGEMENT

The agricultural plant production industries of Australia manage pests through a variety of methods that are tailored to crop types, target pests and geographical conditions. Most growers regularly employ a mixture of methods as part of their integrated pest management (IPM) program.

IPM combines chemical, cultural, mechanical and biological control methods with the needs of a particular crop to develop a multi-faceted approach to controlling the most economically threatening pests. IPM is an approach, not a defined method, and is usually unique to each grower. The strength of employing an IPM approach to managing pests is that it targets individual pests specifically and is highly adaptable to change when new and improved methods of pest management are created.

Chemical control

For many pests, chemical control is considered the fastest and easiest option available, though it is strictly regulated and can be costly. Chemicals are often necessary for pest incursion management and they underpin on-farm biosecurity with most growers using at least some type of chemical to maintain productive agriculture.

A recent report estimated that up to 68 per cent ($17.6 billion) of Australia's total value of crop production is attributable to the use of crop protection products[6]. Table 48 illustrates the amount and type of agricultural chemicals used for controlling plant pests in Australia. This total expenditure on pesticides for plants represents over six per cent of the gross value of production for all crops in Australia[7].

Table 48. Sales of plant chemicals in Australia, 2015 versus 2016

Product type	No. of products	Value of product sales ($ million)	No. of products	Value of product sales ($ million)
	2015		2016	
Herbicide	3119	1,545.49	3301	1,716.80
Insecticide	1,514	332.45	1445	337.47
Fungicide	959	206.61	939	254.05
Mixed function pesticide	219	71.74	149	32.34
Miticide	128	20.86	131	18.99
Molluscicide	53	15.57	54	11.83
Nematicide	18	3.90	18	4.18
Total	**6,010**	**2,196.62**	**6037**	**2,375.66**

Source: APVMA Gazette No. 6, 22 March 2016

All agricultural chemicals sold or used in Australia must be registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA). A national registration system ensures that all agricultural chemical products, when used as directed on the product label, will be effective and have no harmful or unintended effects on people, animals, crops, the environment or international trade. The use of chemicals is regulated by state and territory governments.

Although many pesticide products are formulated and packaged in Australia, almost all the active constituent chemicals are manufactured overseas, with many chemicals not registered in Australia. This means that Australian growers and other land managers often do not have access to chemicals needed to manage exotic pests.

Minor use permits and emergency permits can be issued by the APVMA. Approximately 83 per cent of minor use permit applications are submitted to the APVMA because no other options are currently available in Australia to manage a particular pest. Contingency plans on how to deal with an exotic pest, and Response Plans setting out how an incursion is dealt with, usually depend on the timely availability of appropriate chemicals, and permits often need to be obtained quickly by quarantine authorities when Emergency Plant Pest incursions occur.

Cultural and mechanical control

Cultural and mechanical control refers to the practice of modifying the growing environment of production crops to reduce the prevalence of unwanted pests. Examples include changing soil pH levels, irrigation practices, tillage methods, temperatures and fallow periods to make the environment less favourable for the survival, growth and reproduction of pest species. These practices can provide significant relief from some pests when used effectively.

Biological control

Biological control is a method of controlling pests through the use of natural enemies, biologically based products such as pheromones, resistant plant varieties and techniques such as insect sterilisation. Natural enemies of pests are known as biological control agents and include predators, herbivores, parasitoids and pathogens.

Biological control has been highly successful in many instances, with a number of pest problems permanently resolved by importation and successful establishment of biological control agents. These successes have been limited largely to certain types of ecosystems or pest situations, such as introduced pests in perennial ecosystems. However, biological control can provide long-term and even permanent results and poses no risk to human health.

6 CropLife Australia, 2015. Economic activity attributable to crop protection products. Deloitte Access Economics Pty Ltd

7 ABARES, 2013. Agricultural commodity statistics 2013. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra

On-farm biosecurity planning app

In November 2016, the Farm Biosecurity Program launched a smartphone app to allow crop and livestock producers to create their own personalised biosecurity plan.

Available for both Apple and Android devices, the free FarmBiosecurity app was developed to assist producers to make a plan to protect their business from pests, diseases and weeds.

The app is framed around the six biosecurity essentials featured in the Farm Biosecurity Action Planner that was launched by the program late in 2014.

Creating a biosecurity plan on the app is easy. Producers use their smartphone to simply select the actions that apply to them or type in actions that need to be made. Selections then become a to-do list that can be shared with others or emailed to a computer to print out.

The app works even if there is no internet access, and users can create as many plans as they like, which is helpful for those who have multiple properties or production areas.

Photos can also be attached as reminders for later actions or to let others know what activities need to be done.

The FarmBiosecurity app is available from the App Store or from Google Play.

Making a plan to safeguard a property from new pests has never been easier

PRE-EMPTIVE BREEDING

Many Australian industries prepare for a potential exotic pest incursion through pre-emptive breeding of crops to incorporate or improve pest tolerance or resistance characteristics that can reduce the impacts of target pest species. In the absence of a pest, pre-emptive breeding programs rely on pre-border testing of new Australian varieties or use resistance gene markers or other traits that allow for the selection of resistance.

In the event of an incursion, pre-emptive breeding allows the development of crop varieties that are more resistant to pest damage, reducing negative impacts on production. Programs in Australia include the Australian Cereal Rust Control Program and the identification of new wine grape cultivars for resistance to fungal pathogens.

SURVEILLANCE FOR EXOTIC SPECIES

Post-border surveillance activities for exotic plant pests are carried out by governments, industries and the wider community to provide information for:

- **Early detection:** surveillance designed to detect new pest incursions before they become widely established, increasing the chance of successful eradication or containment responses.
- **Market access:** surveillance to demonstrate the absence (i.e. evidence of absence) of a pest from the country, state or region, to support access to international and domestic markets.
- **Delimiting surveys:** following a pest incursion, delimiting surveys provide information on the distribution and spread of pests for use in response management activities or to confirm the successful eradication of the pest.
- **Improved pest management:** management of established pests requires regular inspections to determine population levels to improve management decisions.
- **Identification of high risk pathways and high risk areas:** to focus future surveillance efforts.

Australia uses a mix of targeted and general surveillance programs. General surveillance programs raise awareness about specific pests with growers and the wider community, and rely on these stakeholders to look for and report the pests during their day-to-day activities. To ensure that all detections of new pests through general surveillance are reported, all states and territories run the Exotic Plant Pest Hotline (1800 084 881). Calls to the hotline are directed to the relevant state or territory agriculture department.

Most post-border targeted surveillance is undertaken by state and territory governments. Several national programs are also supported by the Australian Government, and some industries undertake targeted surveillance for pests of concern.

Subcommittee on National Plant Health Surveillance

The Plant Health Committee (PHC) established the Subcommittee on National Plant Health Surveillance (SNPHS) to provide expert policy and technical advice on national plant health surveillance issues and ensure the continued effective operation of the surveillance system. SNPHS has responsibility for supervising the implementation of the National Plant Biosecurity Surveillance Strategy and facilitates the development and implementation of national plant biosecurity surveillance strategies that promote both domestic and international market access.

SNPHS comprises representatives from the Australian Government, state and territory governments, PHA, the Plant Biosecurity Cooperative Research Centre (PBCRC) and the CSIRO. Observers to the group include representatives from the Subcommittee on Plant Health Diagnostics (SPHD) and forestry experts. SNPHS and SPHD also collaborate through joint working groups on common topics, as required.

Diagnostician viewing fungal specimens. Image courtesy of Sue Pederick, SARDI

IF YOU SEE ANYTHING UNUSUAL, CALL THE EXOTIC PLANT PEST HOTLINE

1800 084 881

Targeted surveillance programs in 2016

During 2016, Australian governments carried out 139 surveillance programs, detailed in Table 49. The figures below show surveillance by target host (Figure 85) and target pest type (Figure 86).

Figure 85. Surveillance programs by target host

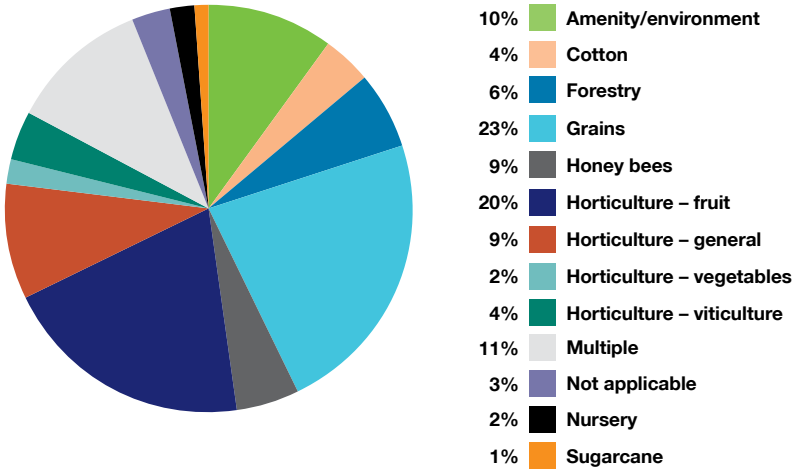
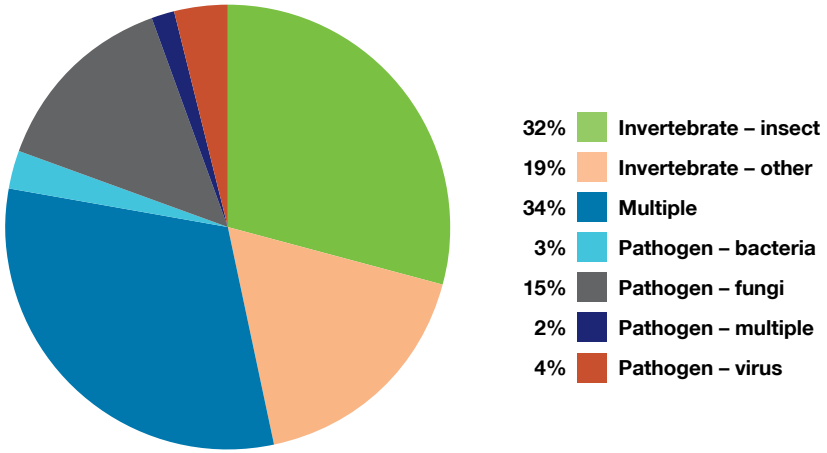


Figure 86. Surveillance programs by target pest type



New laws make biosecurity everyone's responsibility

Beginning in 2016, Australia's state and territory governments are bringing in new biosecurity legislation that formally makes everyone responsible for managing biosecurity risks.

Queensland is the first jurisdiction to write a general biosecurity obligation into law with the *Biosecurity Act 2014*, which came into force in early 2016. NSW is next, with the *Biosecurity Act 2015* imposing a general biosecurity duty.

The biosecurity strategies of the other states and territories indicate that they will follow suit.

Under the Queensland legislation, individuals and organisations whose activities pose a biosecurity risk will have greater legal responsibility for managing them. Queenslanders need to take all reasonable and practical steps to prevent or minimise the risk of causing a biosecurity event and limit the consequences of such an event.

Legislation in states and territories makes it everyone's obligation to prevent the spread of pests and diseases

A biosecurity event is caused by a pest, disease or contaminant that is, or is likely to become, a significant problem for human health, social amenity, the economy or the environment.

While Australians are not expected to know about all biosecurity risks, we are expected to know about those associated with our work and hobbies. For example:

- Land owners will be expected to stay informed about and appropriately manage the weeds and pest animals (such as wild dogs) that could be on their property.
- Residential gardeners will be expected to know the basics about reducing the risks of spreading a pest or disease, and the problem pests in their local area. They will not be expected to know about all of the biosecurity risks to plants.
- People living or working in a biosecurity zone (for example a builder or developer in a fire ant biosecurity zone), are expected to know what can and cannot move in and out of the zone, and any other precautions required.
- Growers and owners of livestock will be expected to stay informed about and appropriately manage the pests and diseases that could affect or be carried by their crops and livestock, as well as weeds and pest animals that could be on their property.
- Transporters of agricultural produce will be expected to check whether the transportation of goods could spread diseases or pests and, if so, to manage the risks appropriately.

The legislation also includes industry initiatives such as compliance agreements and industry accreditation schemes, to make use of industry knowledge about best practice risk management for their circumstances.

Information specific to NSW and Queensland is available on government websites.

Table 49. Australia's plant biosecurity surveillance programs

Surveillance program name	Target hosts	Target pests
Australian Government		
National Australia Quarantine Survey pest and disease surveys	Multiple surveillance programs of tropical horticultural and agricultural species	157 high priority exotic pests
Northern Australia Quarantine Survey exotic fruit fly trapping	Horticulture	Exotic fruit flies (*Bactrocera* spp.)
Within New South Wales		
Aphids	Field crops, horticulture	Multiple species
Asian gypsy moth	Various tree hosts around ports	Asian gypsy moth, *Lymantria* spp.
Candidatus Liberibacter solanacearum	Solanaceae	Zebra chip, *Candidatus* Liberibacter solanacearum
Central Coast Citrus	Citrus	Asian citrus psyllid (*Diaphorina citri*), Huanglongbing (*Candidatus* Liberibacter asiaticus) citrus canker, citrus red mite (*Panonychus citri*)
Diseases of Cotton	Cotton	Exotic strains of bacterial blight (*Xanthomonas campestris*), cotton blue disease (Luteovirus), cotton leaf curl virus (Begomovirus), Texas root rot (*Phymatotrichum omnivorum*), exotic strains of Verticillium wilt (*Verticillium dahliae*), exotic strains of Fusarium wilt (*Fusarium oxysporum* f. sp. *vasinfectum*)
Exotic fruit flies – Ports	Various production and ornamental plants	Multiple – *Bactrocera cucurbitae, B. tau, B. carambolae, B. dorsalis, B. albistrigata, B. umbrosa, B. trivialis, B. facialis, B. kirki, B. melanotus, B. passiflorae*, B. xanthodes, B. psidii, B. zonata, Ceratitis capitata*
Exotic fruit flies – Riverina	Various horticultural (citrus, stone fruit)	Mediterranean fruit fly (*Ceratitis capitata*), papaya fruit fly (*Bactrocera papayae**), various cue lure attracted exotic fruit flies
Exotic Longhorn Beetle Trapping	Various hosts around ports	Asian longhorn beetle (*Anoplophora glabripennis*), Japanese pine sawyer beetle (*Monochamus alternatus*), brown mulberry longhorn beetle (*Apriona germari*)
Forestry Corporation of NSW Forest Health Surveillance	General forests	Various exotic and endemic high priority pests
Forestry High Risk Surveillance Program	Pine forests	Various exotic and endemic high priority pests of Pinus species
Grains Farm Biosecurity Surveillance Program	Wheat, barley, canola, lupin	Russian wheat aphid (*Diuraphis noxia*), barley stripe rust (*Puccinia striiformis* f. sp. *hordei*), Karnal bunt (*Tilletia indica*), khapra beetle (*Trogoderma granarium*), cabbage seedpod weevil (*Ceutorhynchus obstrictus*), Hessian fly (*Mayetiola destructor*), lupin anthracnose (*Colletotrichum gloeosporioides*)
Hazelnut mite	Hazelnuts	Hazelnut mite, *Tetranycopsis horridus*
Lupin anthracnose	Lupins	Lupin anthracnose, *Colletotrichum gloeosporioides*
National Bee Pest Surveillance Program	European honey bees	Asian honey bee (*Apis mellifera)*, giant honey bee (*A. dorsata*), red dwarf honey bee (*A. florea*), tracheal mite (*Acarapis woodi*), Tropilaelaps mites (*Tropilaelaps mercedesae, T. clareae*), Varroa mites (*Varroa destructor, V. jacobsoni*)
Onion seed crop surveillance	Onions	Varies but may include *Burkholderia gladioli* pv. *alliicola, Erwinia chrysanthemi, Alternaria porri, Pyrenochaeta trrestris, Urocystis cepulae, Ceratitis* spp. *Helix aspersa, Liriomyza trifolii, Naupactus leucoloma, Aphelenchoides fragariae, Ditylenchus destructor, D. dipsaci, Longidorus, Meloidogyne goeldi, Paratrichodorus, Pratylenchus filipjev*
Phylloxera surveillance	Grapevines	Grapevine phylloxera, *Daktulosphaira vitifoliae*
Pine nematode	Multiple pine species	Pine nematode, *Bursaphelenchus vallesianus*
Russian wheat aphid	Wheat, barley	Russian wheat aphid, *Diuraphis noxia*
Tramp ants	Urban plants, horticulture	Tramp ants, *Solenopsis* spp.

* This species has been synonymised with *Bactrocera dorsalis*

Table 49. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
Within the Northern Territory		
Area Freedom Surveillance Program	Horticulture	Queensland fruit fly (*Bactrocera tryoni*)
Bulk handlers	Stored grains	Khapra beetle (*Trogoderma granarium*), Karnal bunt (*Tilletia indica*)
Endemic and exotic cotton virus surveys	Cotton	*Cotton bunchy top virus*, *cotton leafroll dwarf virus* (Polerovirus), *cotton leaf curl virus* (Begomovirus) and all other exotic viruses
Endemic and exotic diseases of cotton	Cotton	Exotic strains of bacterial blight (*Xanthomonas campestris*), blue disease (suspected Luteovirus), cotton leaf curl virus (Begomovirus), Texas root rot (*Phymatotrichum omnivorum*), exotic strains of Verticillium wilt (*Verticillium dahliae*), exotic strains Fusarium wilt (*Fusarium oxysporum* f. sp. *vasinfectum*). Endemic cotton diseases, including *Fusarium* spp. and *Verticillium* spp.
Endemic and exotic grains virus surveys	Grains	Various viruses, especially aphid transmitted Polerovirus complex
Major Industry Monitoring and Surveillance	Mango	Mango malformation (*Fusarium mangiferae*), mango pulp weevil (*Sternochetus frigidus*), mango seed weevil (*Sternochetus mangiferae*), mango gall midges (*Procontarinia* spp.) and red banded mango caterpillar (*Deanolis sublimbalis*)
Monochamus Surveillance Program	*Pinus* spp.	Japanese pine sawyer beetle (*Monochamus alternatus*)
National Bee Pest Surveillance Program		Asian honey bee *(Apis cerana*)
National Phosphine Resistance Monitoring Program	Grains	Lesser grain borer (*Rhyzopertha dominica*), rice weevil (*Sitophilus oryzae*), rust-red flour beetle (*Tribolium castaneum*), rusty grain beetle (*Cryptolestes ferrugineus*), sawtoothed grain beetle (*Oryzaephilus surinamensis*)
National Plant Health Surveillance Program	Solanaceae	*Bactericera cockerelli*, *Candidatus* Liberibacter solanacearum
National Plant Health Surveillance Program	Multiple	Glassy winged sharpshooter (*Homalodisca vitripennis*)
National Plant Health Surveillance Program	Multiple	Pierce's disease (*Xylella fastidiosa*)
National Plant Health Surveillance Program	Citrus	Citrus canker (*Xanthomonas axonopodis* pv. *citri*), citrus Huanglongbing (*Candidatus* Liberibacter spp.) and Asiatic citrus psyllid (*Diaphorina citri*)
National Plant Health Surveillance Program	*Musa* spp.	Banana black sigatoka (*Mycosphaerella fijiensis*)
National Plant Health Surveillance Program	Solanaceae	Potato leafminer, pea leafminer, serpentine leafminer (*Liriomyza huidobrensis*)
National Plant Health Surveillance Program	Solanaceae, Asteraceae	American leafminer (*Liriomyza trifolii*)
National Plant Health Surveillance Program	Solanaceae, Cucurbitaceae, Fabaceae	Vegetable leafminer (*Liriomyza sativae*)
National Plant Health Surveillance Program	Multiple	Giant African snail (*Achatina fulica*)
National Plant Health Surveillance Program	*Myrtaceae* spp., *Callistemon* spp., *Melaleuca* spp., *Eucalyptus* spp.	Guava, eucalyptus or myrtle rust (*Puccinia psidii*)
National Plant Health Surveillance Program	Nursery stock	Red imported fire ant (*Solenopsis invicta*), electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*)
National Plant Health Surveillance Program/ National Banana Freckle Eradication Program	*Musa* spp.	Banana freckle (*Phyllostica cavendishii*)
National Plant Health Surveillance Program/ National Browsing Ant Eradication Program	Nursery stock	Browsing ant (*Lepisiota frauenfeldi*)

Table 49. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
National Plant Health Surveillance Program/ Port of Entry Program	Horticulture	Exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)
Plant Pest Diagnostic Service (broadacre cropping)	Broadacre field crops	All pathogens that can affect broadacre crops (cotton, grains, pastures)
Regional Fruit Fly Monitoring and Surveillance	Horticulture	Exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)
Silverleaf whitefly resistance monitoring	Cotton	Silverleaf whitefly (*Bemisia tabaci* B-type)
Sucking pest management in cotton	Cotton	Solenopsis mealybug (*Phenacoccus solenopsis*)
Sugar industry surveys, seed cane inspections, variety trials and general pest surveys	Sugarcane	Ratoon stunting disease (*Leifsonia xyli* subsp. *xyli*), leaf scald (*Xanthomonas albilineans*), sugarcane mosaic virus (Potyvirus), Fiji leaf gall (*Fiji disease virus* (Fijivirus)), sugarcane smut (*Sporisorium scitamineum*), sugarcane rust (*Puccinia melanocephala, P. kuehnii*), yellow spot (*Mycovellosiella koepkei*), exotic pests and diseases
West Indian drywood termite surveys	Timber structures	West Indian drywood termite (*Cryptotermes brevis*)
		Within South Australia
European house borer	*Pinus* spp.	European house borer (*Hylotrupes bajulus* pv. *Linnaeus*)
Giant pine scale	Pinaceae	Giant pine scale (*Marchalina hellenica*)
Mediterranean fruit fly	Horticultural crops	Mediterranean fruit fly (*Ceratitus capitata*)
Myrtle rust	Myrtaceae	Myrtle rust (*Puccinia psidii*)
National Bee Pest Surveillance Program	European honey bees in managed hives, catchboxes	Asian honey bee (*Apis cerana*), giant honey bee (*A. dorsata*), red dwarf honey bee (*A. florea*), bumblebees (*Bombus* spp.), Varroa mites (*Varroa destructor* and *V. jacobsoni*), Tropilaelaps mites (*Tropilaelaps clareae* and *T. mercedesae*) and tracheal mite (*Acarapis woodi*)
National Plant Health Surveillance Program	Rutaceae	Huanglongbing (*Candidatus* Liberibacter asiaticus), citrus canker (*Xanthomonas axonopodis* pv. *citri*), citrus variegated chlorosis (*Xylella fastidiosa*)
National Plant Health Surveillance Program	Rutaceae	Glassy winged sharpshooter (*Homalodisca vitripennis*), African citrus psyllid (*Trioza erytreae*), Asian citrus psyllid (*Diaphorina citri*)
National Plant Health Surveillance Program	*Vitus vinifera*	Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*)
National Plant Health Surveillance Program	Sampling	Red imported fire ant (*Solenopsis invicta*), tropical fire ant (*Solenopsis geminata*), electric ant (*Wasmannia auropunctata*), African big-headed ant (*Pheidole megacephala*), yellow crazy ant (*Anoplolepis gracilipes*), Argentine ant (*Linepithema humile*), browsing ant (*Lepisiota frauenfeldi*), khapra beetle (*Trogoderma granarium*)
Onion smut	*Allium* spp.	Onion smut (*Urocystis cepulae*)
Ports of Entry Trapping Program	*Eucalyptus* spp., ornamental trees	Exotic gypsy moths (*Lymantria* spp.)
Ports of Entry Trapping Program	Fruit fly host	Fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)
Potato spindle tuber viroid	Solanaceae	*Potato spindle tuber viroid*
Queensland fruit fly	Horticultural crops	Queensland fruit fly (*Bactrocera tryoni*)
Tomato yellow curl leaf virus	Solanaceae	*Tomato yellow curl leaf virus*

Table 49. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
Within Tasmania		
Bee Surveillance – American Foulbrood	European honey bees	American foulbrood (*Paenibacillus* spp.)
Blueberry Rust Surveillance	Commercial blueberry crops	Blueberry rust (*Thekopsora minima*)
Codling Moth Trapping Surveillance	Apples, cherries	Codling moth (*Cydia pomonella*)
Fruit Fly Trapping Surveillance	Fruit trees, fruit and vegetables	*Bactrocera tryoni, Ceratitis capitata, Bactrocera dorsalis* and other exotic fruit flies
Hazelnut Mite Surveillance	Hazelnut plantations	Hazelnut mite (*Tetranychus horridus*)
Multiple Pest Surveillance Program – Allium Pest Surveillance	Mature onion bulbs (commercial) and garlic plants	*Delia antiqua, Eumerus amoenus, E. strigatus, Rhizoglyphus callae, R. setosus, Botrytis squamosa, Puccinia* spp.
Multiple Pest Surveillance Program – Brown Marmorated Stink Bug Surveillance	Imported consignments at high risk points of entry	Brown marmorated stink bug (*Halyomorpha halys*)
Multiple Pest Surveillance Program – Glassy Winged Sharpshooter Surveillance	Grapevines	Glassy winged sharpshooter (*Homalodisca vitripennis*)
Multiple Pest Surveillance Program – Gypsy Moth Trapping Surveillance	Multiple, including forest and amenity trees	Gypsy moth (including *Lymantria dispar asiatica, L. dispar dispar* and *L. dispar japonica*), moths including (*L. umbrosa, L. albescens, L. postalba, L. xylina, L. monacha, L. pulverea, L. minomonis, L. concolor, L. dissoluta, L. sinica, L. marginata, L. atameles* and *L. fumida*)
Multiple Pest Surveillance Program – Pierce's Disease Surveillance	Grapevines	Pierce's disease (*Xylella fastidiosa)*
Myrtle Rust Surveillance	Lophomyrtus and other susceptible Myrtaceae nursery plant hosts, targeted native forest, Myrtaceae tree species	Myrtle rust, eucalyptus rust (*Puccinia psidii* sensu lato (exotic variants))
National Bee Pest Surveillance Program	European honey bees	Asian honey bee (*Apis cerana*), giant honey bee (*Apis dorsata*), red dwarf honey bee (*Apis florea*), Varroa mites (*Varroa destructor* and *V. jacobsoni*), Tropilaelaps mites (*Tropilaelaps clareae* and *T. mercedesae*), tracheal mite (*Acarapis woodi*), small hive beetle (*Aethina tumida*)
Russian Wheat Aphid Surveillance	Wheat and barley crops	Russian wheat aphid (*Diuraphis noxia*)
Silverleaf White Fly Surveillance	Nursery stock	Silver leaf white fly (*Bemisia tabaci*)
Warehouse and Khapra Beetle Trapping Surveillance	Stored grains, grain processors and animal feed outlets	Warehouse beetle (*Trogoderma variable*), khapra beetle (*T. granarium*)
Western Flower Thrips Surveillance	Crops and weeds surrounding commercial strawberry tunnels	Western flower thrips (*Frankliniella occidentalis*)
Within Victoria		
National Bee Pest Surveillance Program	European honey bees	Asian honey bee (*Apis cerana*), red dwarf honey bee (*A. florea*), giant honey bee (*A. dorsata*) and Varroa mite (*Varroa destructor*)
National Plant Health Surveillance Project	Fruit and vegetable crops	Fruit flies (*Bactrocera* spp.)
National Plant Health Surveillance Project	Grapes	Pierces's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*)
National Plant Health Surveillance Project	Citrus	Citrus canker (*Xanthomonas axonopodis* pv. *citri*), African citrus psyllid (*Trioza erytreae*), Asian citrus psyllid (*Diaphorina citri)* and Huanglongbing (*Candidatus* Liberibacter asiaticus)

Table 49. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
National Plant Health Surveillance Project	Plants and weed hosts around Melbourne ports	Japanese sawyer beetle (*Monocamus alternatus*), wood wasp (*Urocerus fantoma*), black spruce longhorn beetle (*Tetropium castaneum*), brown spruce longhorn beetle (*Tetropium fuscum*), Asian gypsy moth (*Lymantria dispar*) and other *Lymantria* spp., pine wilt nematode (*Bursaphelenchus* spp.)
National Plant Health Surveillance Project	Plants and weed hosts around Victorian ports	Exotic fruit flies, various *Bactrocera* and *Ceratitis* spp.
Nationally cost shared eradication program	*Pinus* spp.	Giant pine scale (*Marchelina hellenica*)
Nationally cost shared eradication program	Chestnut and oak trees	Chestnut blight (*Cryphonectria parasitica*)
Victorian funded containment program	Pasture and fruit trees	Giant green snail (*Cantareus apertus*)
Western Australia		
Agrisearch	Grain crops	Grain pests
AgWest grain testing laboratory	Grain crops	Grain pests
Asian Longhorn Beetle Response	Maple (Acer), horse chestnut (Aesculus), birch (Betula), plane tree (Platanus), poplar (Populus), willow (Salix), elm (Ulmus)	Asian longhorn beetle (*Anoplophora glabripennis*)
Biosecurity Blitz	General surveillance, all hosts	All plant pests
Browsing ant surveillance	Environmental, urban areas	Browsing ant (*Lepisiota frauenfeldi*)
Codling Moth Surveillance	Pome fruit	Codling moth (*Cydia pomonella*)
Crop Variety Trials	Grain crops	Grain pests
Cucumber green mottle mosaic virus	Cucurbits and host weeds	*Cucumber green mottle mosaic virus*
European wasp surveillance	Urban areas and horticultural crops	European wasp (*Vespula germanica*)
Grain insect diagnostics	Grain crops	Grain pests
Grain insect ecology studies	Grain crops	Grain pests
Grains agronomy	Grain crops	Grain pests
Grains cereal physiology	Grain crops	Grain pests
Grains crop protection – PestFax	Grain crops	Grain pests
Grains legume genetic	Grain crops	Grain pests
Grains soils management	Grain crops	Grain pests
Kalyx agriculture	Grain crops	Grain pests
Khapra beetle surveillance	Stored grain products	Khapra beetle (*Trogoderma granarium*)
Medfly Area Freedom	Many horticultural hosts	Mediterranean fruit fly (*Ceratitis capitata*)
Multiple Pest Surveillance	Pome, citrus	Fire blight (*Erwinia amylovora*), Huanglongbing (*Candidatus* Liberibacter asiaticus), citrus canker (*Xanthomonas axonopodis* pv. *citri*), citrus longicorn beetle (*Anoplophora chinensis*), red imported fire ants (*Solenopsis invicta*), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*)
MyCrop e-surveillance	Broadacre crops, general surveillance	All plant pests

Table 49. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
MyPestGuide e-surveillance	All hosts, general surveillance	All plant pests
National Bee Pest Surveillance Program	European honey bees	Asian honey bee (*Apis mellifera*), giant honey bee (*A. dorsata*), red dwarf honey bee (*A. florea*), tracheal mite (*Acarapis woodi*), Tropilaelaps mites (*Tropilaelaps mercedesae*, *T. clareae*), Varroa mites (*Varroa destructor, V. jacobsoni*)
National grain insect resistance monitoring	Grain crops	Grain pests
National Variety Trials	Grain crops	Grain pests
Pantry Blitz	Stored grain products	Khapra beetle (*Trogoderma granarium*)
PestFax e-surveillance	Broadacre crops, general surveillance	All plant pests
Port of Entry Asian Gypsy Moth Trapping	More than 600 forest, orchard, ornamental and native species	Asian gypsy moth (*Lymantria dispar*)
Port of Entry Fruit Fly Trapping	Many horticultural hosts	Various *Bactrocera* and *Ceratitis* spp.
Qfly Surveillance	Many horticultural hosts	Queensland fruit fly (*Bactrocera tryoni*)
Sentinel Stored Products Merchants	Stored grain products	Khapra beetle (*Trogoderma granarium*)

Floral sweep netting aims to capture foraging exotic bees

Catchbox at Sydney seaport, part of the National Bee Pest Surveillance Program

Table 50. Number of samples undertaken in the National Bee Pest Surveillance Program by state and pest, 2016

State or territory	Total number of adult honey bees inspected for tracheal mites	Total number of floral sweep netting events to target pest bees	Total number of catchbox inspections	Total number of pest bee swarms collected	Total number of small hive beetle traps inspected
Queensland	750	28	15	18	N/A
New South Wales	1080	2	0	0	N/A
ACT	–	–	–	–	–
Victoria	1800	25	136	1	N/A
Tasmania	360	0	0	1	40
Northern Territory	360	6	0	0	36
South Australia	600	29	29	2	N/A
Western Australia	210	2	0	2	48
TOTAL	**5160**	**92**	**180**	**24**	**124**

National Bee Pest Surveillance Program

PHA has been coordinating surveillance activities at ports nationwide as part of the National Bee Pest Surveillance Program (NBPSP) since 2012. The NBPSP is an early warning system to detect new incursions of pest bees and exotic bee pests. It targets key pests such as Varroa mites and Asian honey bees.

The NBPSP is made possible by a strong partnership between the industries that rely on pollination by honey bees (represented by Hort Innovation), the Australian Honey Bee Industry Council, state and territory governments, Northern Australian Quarantine Strategy Team, the Australian Government Department of Agriculture and Water Resources, as well as port staff and beekeepers.

The NBPSP incorporates a number of activities including regular checks of sentinel hives of European honey bee located near ports for any signs of exotic pests, inspections of catch boxes and bee swarms for exotic pests and pest bee species, and floral sweep netting to capture potential foraging exotic bees (Table 50).

In 2016, a statistical review of the NBPSP was carried out, which led to a redesign of the surveillance program nationwide. The new enhanced NBPSP came into effect from December 2016 and will run until December 2021. As well as building on current activities, it also includes several new initiatives supported through increased cost-sharing between the honey bee industry, Hort Innovation, research and development agencies, state and territory governments and the Australian Government.

National Bee Pest Surveillance PROGRAM

The Australian Honey Bee Industry Biosecurity Code of Practice

The honey bee industry, represented by the Australian Honey Bee Industry Council (AHBIC) and PHA have developed the Australian Honey Bee Industry Biosecurity Code of Practice to protect Australia's honey bees. This Code of Practice was nationally endorsed by the honey bee industry in July 2016.

The aim of the Code of Practice is to improve the management of established pests and diseases, as well as increase the preparedness and surveillance for exotic pest threats to the honey bee industry. The Code will underpin the National Bee Biosecurity Program, which will see the employment of Bee Biosecurity Officers in each state. Currently, there is an officer employed in Victoria, while contracts have been signed and recruitment is underway in SA and NSW.

Surveillance activities use acaricides in sentinel hives for early exotic mite detection. Image courtesy of NOD Global

Top 40 exotic pests targeted

In November 2016, a list of Australia's top 40 least wanted plant pests and diseases was released by the Department of Agriculture and Water Resources. Prioritising exotic pest threats allows the partners of the plant biosecurity system to focus their risk mitigation efforts effectively.

The list was devised from a comparative analysis of exotic pests considering:

- the likelihood of them entering Australia
- the possible ways they could enter Australia
- their ability to become established and spread
- the consequences for businesses, human health and the environment if they do.

The bacterial disease *Xylella fastidiosa* topped the list. The pest has a huge host range, with hundreds of native, commercial and ornamental plant species at risk so it could devastate horticultural crops, native flora and gardens. There is no treatment and no documented example of it ever being eradicated once it has become established. It could enter Australia with imported plant propagation material or with infected insects that can hitch a ride on anything that is imported.

The pest assessed as second worst is khapra beetle, a pest of stored grain. An incursion of khapra beetle would have a major impact on Australia's largest crop industry, grains, including threatening market access for our exports.

The beetle is small but tough: larvae are able to survive dormant for up to two years with very little to feed on. It can arrive in cargo, machinery, food or mail items, or be brought in by travellers in personal effects. Once here, it could spread easily through the movement of seed, straw, stored grain, cargo or machinery.

Khapra beetle larvae and adults were found in SA in 2016, but were detected quickly and confined to a number of warehouses in Adelaide and Kangaroo Island. The premises were fumigated to destroy the pest.

Exotic fruit flies, the world's most destructive horticultural pests, round out the top three. While Australia already has some fruit fly species, we are free from some of the more damaging ones. Exotic species such as melon fly can be blown in by monsoon winds or arrive on imported fruit or plant material. Once here, the flies could spread quickly through the movement of infested products. Over 300 types of fruit and vegetables would be at risk from these species.

You can see the complete list of 40 national priority pests on the Department of Agriculture and Water Resources website **agriculture.gov.au/pests-diseases-weeds/plant**.

The Australian Government's least wanted pest list allows all partners to focus resources. Image courtesy of the Department of Agriculture and Water Resources

DIAGNOSTICS – ACCURATE IDENTIFICATION OF PLANT PESTS

The accurate diagnosis of plant pests and diseases fundamentally underpins all aspects of the plant biosecurity system. It is essential that diagnostic services can quickly and accurately identify both endemic and exotic plant pests and diseases.

Australia relies on its diagnostic experts to detect and respond to new pests in an appropriate and timely manner. In the event of an incursion, diagnostic expertise is required to identify an initial detection, assess the magnitude of the incursion (which is a critical factor in determining whether a pest is eradicable), and to allow subsequent surveillance programs. Diagnostics also provide the evidence necessary to claim that the pest has been eradicated.

Diagnostic capacity also supports many of the everyday management practices involved in the production and trade of plant products. Pest management programs, including the selection and application of farm chemicals, rely on the accurate identification of pests. Rapid identification also supports quarantine processes, such as maintaining Pest Free Areas, allowing access to markets both domestically and internationally.

These critical diagnostic services are distributed across every state and territory in Australia and are available throughout most major agricultural and horticultural production areas. Services are delivered by a range of agencies, including state and territory governments, the Australian Government, commercial and private diagnostic laboratories, museums, the CSIRO and universities (Table 51).

Services are provided on an ad hoc, commercial or nationally coordinated basis, as required. Diagnostic operations are often performed as part of collaborative research activities that focus on specific pests of concern.

Subcommittee on Plant Health Diagnostics

The Subcommittee on Plant Health Diagnostics (SPHD) was established in December 2004 by the Plant Health Committee to sustain and improve the quality and reliability of plant diagnostics in Australia. Key roles and responsibilities of SPHD include:

- Reviewing and developing diagnostic policies, protocols and standards.
- Reviewing and developing strategies to address national capability and capacity issues.
- Endorsing National Diagnostic Protocols (NDPs) (see Figure 87).
- Coordinating and fostering the National Plant Biosecurity Diagnostic Network (NPBDN).
- Coordinating national capability building through a professional development framework.
- Driving development and uptake of accreditation and quality management systems for diagnostic laboratories.

Figure 87. National Diagnostic Protocol endorsement process

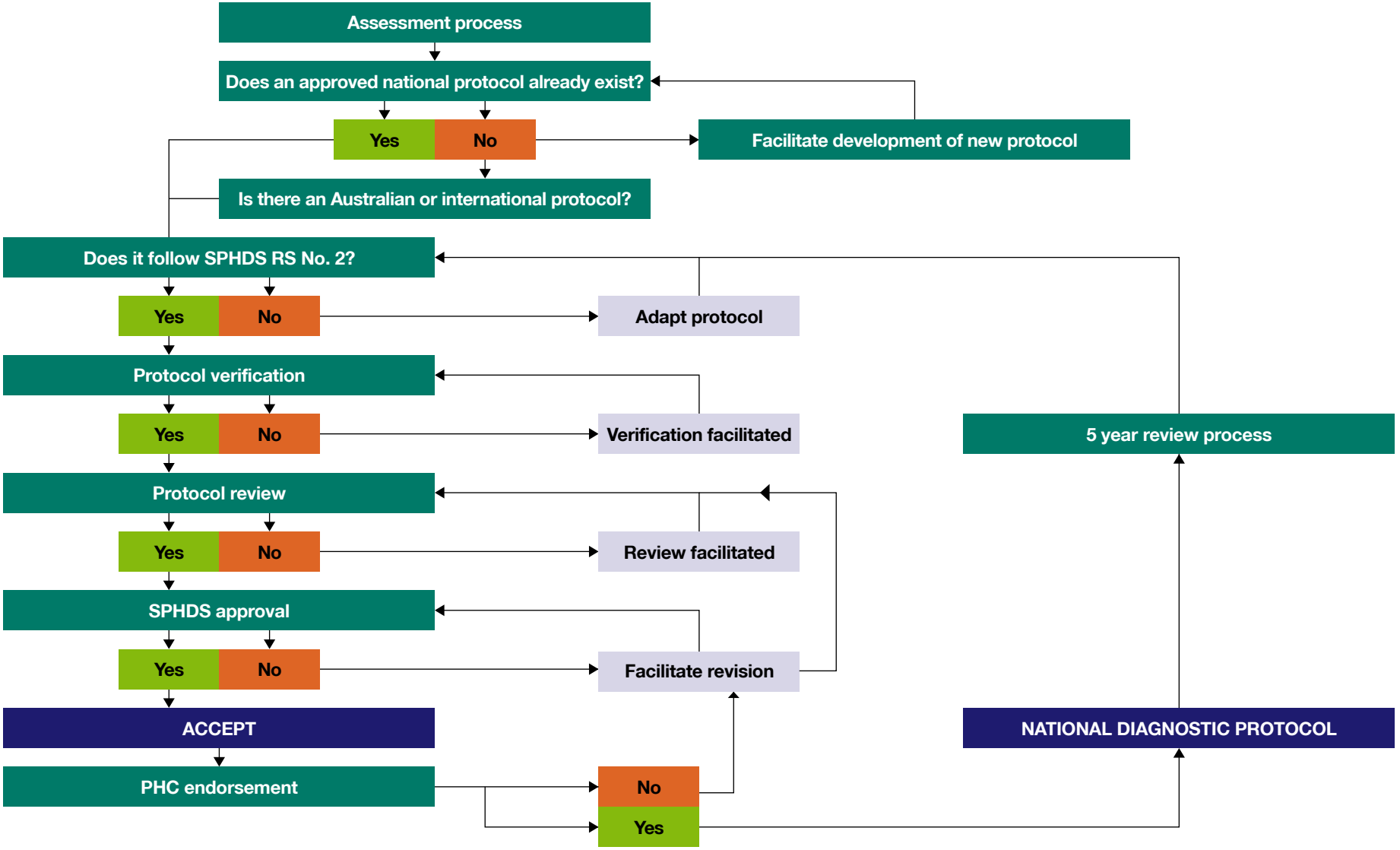


Table 51. Australia's diagnostic services, their capabilities and accreditations

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
Australian Capital Territory				
Black Mountain Laboratories, Canberra	CSIRO Health and Biosecurity	Bee pathogens		
Black Mountain Laboratories, Canberra	CSIRO Health and Biosecurity	Fungal identification		
Black Mountain Laboratories, Canberra	National Research Collections Australia, CSIRO (Australian National Herbarium)	Fungal identification		Herbarium and fungi collections
Black Mountain Laboratories, Canberra	National Research Collections Australia, CSIRO (Australian National Insect Collection)	Insect, nematode and mite identification		Herbarium and fungi collections
New South Wales				
Agricultural Scientific Collections Unit, Orange Agricultural Institute, Orange	NSW DPI	Invertebrates and pathogens, specialist insect and mite identification (mycology and entomology)	NATA accreditation (ISO/IEC 17025:2005)	Fungal, bacterial and arthropods
Australian Cotton Research Institute, Narrabri	NSW DPI, CSIRO	Cotton pathology (e.g. mycology, virology and bacteriology)	ISO9001	
Australian Museum, Sydney	Australian Museum	Entomology		Entomology
CSIRO Cotton Research Unit, Narrabri	CSIRO	Entomology		
Elizabeth Macarthur Agricultural Institute, Menangle	NSW DPI	Invertebrates and pathogens (virology, bacteriology and mycology)	NATA accreditation (ISO/IEC 17025:2005)	
Forest Health Management Laboratory, West Pennant Hills	NSW DPI	Internal routine diagnostics		
Grafton Agricultural Research and Advisory Station, Grafton	NSW DPI	Insect pests		
Macleay Museum, Sydney	University of Sydney	Entomology		Entomology
Operational Science, Crewe Place, Rosebery	DAWR	Pest and disease identification, collection and rearing of immature stages of arthropods. Pathology investigation to determine causal agent	DAWR accredited quarantine containment 5.2/7.2	Entomology
Royal Botanic Garden, Sydney	NSW Office of Environment and Heritage	Plant pathogens, using both classical and molecular methods		
Tamworth Agricultural Institute, Tamworth	NSW DPI	Invertebrates and pathogens (entomology, plant pathology and broadacre crops)		
The Cereal Rust Laboratory, Cobbitty	NSW DPI, University of Sydney	Rust pathology		
Wagga Wagga Agricultural Institute, Wagga Wagga	Charles Sturt University, NSW DPI	Plant pathology, nematode identification and molecular biology		
Yanco Agricultural Institute, Yanco	NSW DPI	Invertebrates and pathogens (vegetables and rice pathology)		
CSIRO Tropical Ecosystems Research Centre, Darwin	CSIRO	Ant identification for general public and biosecurity purposes		Tropical Ecosystems Research Centre ant collection

Table 51. Australia's diagnostic services, their capabilities and accreditations (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
Northern Territory				
Entomology Laboratory, Berrimah	NT DPIR	Insects and mites		The Northern Territory Economic Insect Reference Collection
Plant Pathology Laboratory, Berrimah	NT DPIR	Plant pathology, virology, bacteriology, PCR, mycology and diagnostics		Darwin Northern Australian Plant Pathology Herbarium
Herbarium, Flora and Fauna Division, Palmerston	NT Department of Environment and Natural Resources	Plant identification for general public and commercial purposes	Registration for exchange (export and import) of scientific specimens	Native plant collection of the Northern Territory
Museum and Art Galleries of the Northern Territory	Museum and Art Galleries of the Northern Territory	Insect identification for general public and commercial purposes. A gastropod collection that has been assisting DAWR quarantine inspectors with intercepted samples.	Registration for exchange (export and import) of scientific specimens	Insects with a focus on native species. Gastropoda with a number of border collections
Northern Australia Quarantine Strategy Regional Laboratory, Darwin	DAWR	Tropical plant pests. Plant pathology including microscopy, serology and molecular assays (conventional and real time PCR) for selected organisms. Entomology including microscopy and limited molecular capacity. Botany including microscopy.		Plant pathology: herbarium specimens and desiccated virus and virus-like disease collections. Entomology: Northern Territory Quarantine Insect Collection which comprises: general entomology insect pests; WA, NT and Timor Leste Tephritidae; and WA, NT and overseas Culicoides biting midges
Queensland				
Bowen Research Station, Bowen	QDAF	Entomology		
Biosecurity Queensland Control Centre, Moggill	QDAF	Fire ants		Fire ant reference collection
Cairns Research Station, Cairns	QDAF	Plant pest and disease triage		
Centre for Tropical Agriculture, Mareeba	QDAF	Entomology, plant pathology, molecular and bacteriology		Entomology
Eagle Farm, Brisbane	DAWR	Temperate and tropical plant pests. Plant pathology including microscopy and molecular techniques (conventional PCR). Entomology including microscopy and limited molecular capacity.	DAWR accredited quarantine containment 5.2/7.2	Limited plant pathogen and insect collections
Ecosciences Precinct, Dutton Park	QDAF	Entomology, plant pathology, virology, bacteriology, mycology, nematology, molecular biology and exotic fruit fly screening	DAWR Approved Arrangement for Class 5.2 & 5.3. Biosecurity containment level 2 (BC2) and 3 (BC3).	Plant pathology and entomology

Table 51. Australia's diagnostic services, their capabilities and accreditations (continued)

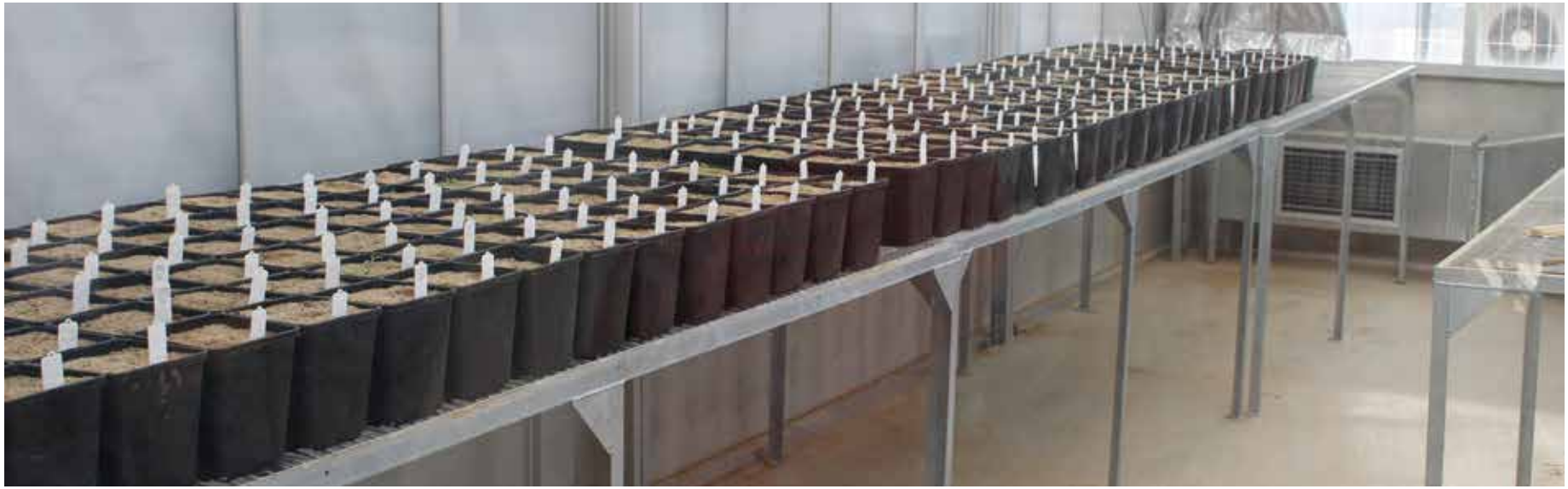
Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
Gatton Research Station, Gatton	QDAF	Vegetable pests and diseases		
Maroochy Research Station, Nambour	QDAF	Plant pathology		
Northern Australia Quarantine Strategy Regional Laboratory, Cairns	DAWR	Tropical plant pests. Plant pathology including microscopy, serology and molecular assays (conventional and real time PCR) for selected organisms. Entomology including microscopy and limited molecular capacity. Botany including microscopy.		Plant pathology: herbarium specimens and desiccated virus and virus-like disease collections. Entomology: extensive insect collections including overseas specimens and a large fruit fly collection.
University of Southern Queensland, Toowoomba	University of Southern Queensland	Plant pathology and nematology		
QAAFI, St Lucia, Dutton Park, Warwick, Nambour	Queensland Alliance for Agriculture and Food Innovation, University of Queensland	Plant pathology and virology		
Queensland Museum, South Brisbane, Brisbane	Queensland Museum	Acaralogy and entomology		Acaralogy and entomology
Sugar Research Australia, Indooroopilly, Woodford, Mackay, Tully	Sugar Research Australia	Sugarcane pests and diseases		
South Johnstone Research Station, South Johnstone	QDAF	Nematology, entomology and plant pathology		
Toowoomba Research Station, Toowoomba	QDAF	Field crop pests and diseases, molecular, entomology, virology, nematology and mycology		
South Australia				
SARDI, Adelaide	South Australian Research and Development Institute	Molecular diagnostics, plant pathology (mycology, nematology, virology, taxonomy), entomology and surveillance	Molecular Diagnostics Laboratory is NATA accredited under Biologicals. NATA accredited for potato virus testing. DAWR accredited containment facilities for insects and plants.	Entomology collection, Adelaide University
School of Agriculture, Food and Wine, Waite Institute, Adelaide	University of Adelaide	Nematology and viticulture virology		
School of Earth and Environmental Sciences, Adelaide	University of Adelaide	Entomology		
South Australian Museum, Adelaide	SA Department of Premier and Cabinet	Entomology		
Tasmania				
Forestry Tasmania, Hobart	Forestry Tasmania	Limited diagnostics in pathology, main focus is on testing for *Phytophthora cinnamomi*		Tasmanian forest insect collection
Peracto, Devonport	Peracto	Plant pathology	Laboratory DAWR containment approved	

Table 51. Australia's diagnostic services, their capabilities and accreditations (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
Plant Health Laboratories, New Town (satellite entomology laboratories at Devonport and Launceston)	DPIPWE	Entomology, plant pathology (virology, mycology and bacteriology), TASAG ELISA testing services (virology)	Laboratories DAWR containment approved, TASAG laboratories have NATA accreditation (ISO/IEC 17025:2005)	Insect reference collection
Queen Victoria Museum and Art Gallery, Launceston	Queen Victoria Museum and Art Gallery	Insect identification for the general public		Invertebrate reference collection covering most groups including insects
Seed Analysis Laboratory, Mt Pleasant	DPIPWE	Feed grain quarantine assessments for declared species	ISTA accredited	Prohibited and quarantinable species seed reference collection
Tasmanian Museum and Art Gallery, Hobart	Tasmanian Museum and Art Gallery	Entomology, specialising in beetles and moths, and insect identification for the general public		Small insect reference collection, herbarium including weeds and fungi
University of Tasmania Cradle Coast Campus, Burnie	University of Tasmania and Tasmanian Institute of Agriculture	Plant pathology and nematology		Limited collection of fungal pathogens
University of Tasmania Sandy Bay Campus, Hobart	University of Tasmania and Tasmanian Institute of Agriculture	Entomology, forest pathology and molecular laboratory	Laboratory DAWR containment approved	
Victoria				
AgriBio, Bundoora	DEDJTR, La Trobe University	Entomology, mycology, virology, nematology, bacteriology, general plant pathology, fungal and insect taxonomy, high throughput molecular diagnostics and weeds	DAWR approved AS/NSZ 9001:2000/QA certification. Laboratory is NATA accredited under Biologicals. NATA accredited for potato virus testing, potato cyst nematode identification, fruit fly and Phylloxera identification	Fungal, bacterial, nematode, invertebrates and limited virus collection
Forest Health Laboratory, Heidelberg	University of Melbourne	Forest pathology and entomology		
Horsham Research Centre, Horsham	DEDJTR	General plant pathology and virology (grains focus)		
Irymple Research Centre, Irymple	DEDJTR	General plant pathology and entomology		
Operational Science Laboratory, Tullamarine Airport	DEDJTR	Entomology and plant pathology	DAWR accredited quarantine containment 5.2/7.2	Entomology collection
Plant Post Entry Quarantine facility, Mickleham	DEDJTR	General plant pathology including mycology, bacteriology, botany, virology (traditional and modern) and nematology		
Royal Botanic Gardens Melbourne	Royal Botanic Gardens Melbourne	Mycology and weeds		
Rutherglen Research Centre, Rutherglen	DEDJTR	Entomology		
Tatura Research Centre, Tatura	DEDJTR	Entomology		

Table 51. Australia's diagnostic services, their capabilities and accreditations (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
		Western Australia		
DAFWA Diagnostic Plant Laboratories, South Perth	DAFWA	Commercial diagnostic laboratory for plant pathogen identification, entomology, nematology, virology, bacteriology, mycology, seeds and limited number of bee pathogens	Seed lab is ISTA and QC2 accredited. Plant quarantine laboratory is QC2 accredited	Western Australian plant pathogen and invertebrate collections
Department of Environmental Biology, Perth	Curtin University of Technology	Mycology		
Northern Australia Quarantine Strategy, Broome	DAWR	Identification of quarantine intercept samples, mostly exotic pests		Small reference collection, mostly exotic invertebrates
Operational Science, DAWR, Perth International Airport	DAWR	Identification of quarantine intercept samples, mostly exotic pests including arthropods, fungi, bacteria and viruses	DAWR accredited quarantine containment 5.2/7.2	Small reference collection, mostly exotic invertebrates with a limited collection of seed and cultures
Phytophthora Laboratory, Murdoch	Murdoch University	Commercial and research Phytophthora diagnostic laboratory		
Western Australian State Agricultural Biotechnology Centre	Murdoch University	Commercial and research molecular biology laboratory for plant pathogen identification		
Western Australian Museum, Kewdale	Western Australian Museum	Insect identification for general public		Largest invertebrate collection in Western Australia



National coordination of plant biosecurity diagnostics

To strengthen connections between stakeholders in plant pest diagnostics, a National Plant Biosecurity Diagnostic Strategy and a national network of diagnosticians were developed in 2011 and 2012 respectively.

The formation of the NPBDN was driven by SPHD to build diagnostic capacity for Australasia. Network members are from a range of organisations involved in the delivery of plant pest diagnostics, including, but not limited to, state and territory governments, the Australian Government, CSIRO, PBCRC, PHA, universities and the New Zealand Ministry for Primary Industries.

Members include entomologists, general plant pathologists, virologists, phytoplasmologists, bacteriologists, molecular biologists, mycologists, nematologists, botanists and weed scientists.

The NPBDN improves capacity by facilitating communication between experts and sharing of diagnostic resources, as well as offering professional development activities. Each year the Annual Diagnosticians' Workshop brings members of the network together to share ideas and knowledge, as well as identify future activities.

An integrated, national network has numerous benefits, including more efficient delivery of services, preventing any duplication of effort or identifying and addressing any gaps, and providing surge capacity during incursions.

More information on the NPBDN can be found at **plantbiosecuritydiagnostics.net.au**.

Attendees at the SPHD May meeting

National Diagnostic Protocols

National Diagnostic Protocols (NDPs) are documents that contain detailed information about a specific plant pest or related group of pests, relevant to its diagnosis. Such information is crucial for the management of established and exotic pests, including:

- General surveillance for pest status.
- Testing of material for compliance with certification procedures.
- Surveillance as part of an official control or eradication program.
- Pest diagnostic operations associated with phytosanitary certification.
- Routine diagnosis of pests found in imported consignments.
- Detection of a pest in an area where it is not known to occur.

NDPs are diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM 27 Diagnostic Protocols for Regulated Pests. They have been nationally endorsed for use in the event of an incursion, providing transparency when comparing diagnostic results between laboratories. NDPs include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification.

Australia has a coherent and effective system for the development of NDPs for plant pests through SPHD. NDPs are developed according to SPHD Reference Standards 1–4 which include the processes of peer review, verification and endorsement by PHC as shown in Figure 87. NDPs, both under development and endorsed, are listed in Table 52.

Current SPHD Reference Standards include:

- Glossary of Terms (Version 3).
- Development of Diagnostic Protocols – Procedures for Authors (Version 5).
- Guidelines for the Approval Process of National Diagnostic Protocols (Version 5).
- Guidelines for Verification and Peer Review Reports (Version 3).

In some cases, a lucid key has been developed for pest identification. A lucid key is an interactive diagnostic tool based on observable characteristics, rather than a protocol using a pre-defined tree.

Image courtesy of Sue Pederick

Table 52. National Diagnostic Protocols

Scientific name	Common name
Draft protocols	
Agrilus planipennis	Emerald ash borer
Banana bract mosaic virus (Potyvirus)	Banana bract mosaic disease
Blood disease bacterium	Blood disease
Broad bean mottle virus	Broad bean mottle virus
Broad bean stain (Comovirus)	Broad bean stain virus
Broad bean true mosaic (Comovirus)	Broad bean true mosaic virus
Burkholderia glumae	Panicle blight, bacterial grain rot of rice
Bursaphelenchus spp. including *B. xylophilus*	Pine wilt nematode, pinewood nematode species complex
Ceratovacuna lanigera	Sugarcane woolly aphid
Chilo auricilius	Sugarcane internode borer
Chilo infuscatellus	Sugarcane yellow top borer
Chilo partellus	Spotted stalk borer
Chilo polychrysus	Stem borer
Chilo sacchariphagus	Spotted borer
Chilo terrenellus	Sugarcane stem borer
Cicadulina mbila	South African maize leafhopper
Citripestis eautraphera	Mango fruit borer
Citripestis sagittiferella	Citrus fruit borer
Clavibacter michiganensis subsp. *nebraskensis*	Goss's bacterial wilt, blight of corn
Colletotrichum lentis	Lentil anthracnose
Coryphodema tristis	South African cossid moth
Cotton leaf curl virus (Begomovirus)	Cotton leaf curl disease
Daktulosphaira vitifolii	Grape phylloxera, type B
Deanolis sublimbalis	Red banded mango caterpillar adult
Dendroctonus frontalis	Mountain pine beetle
Dendroctonus ponderosae	Southern pine beetle
Diaphorina citri	Citrus psyllid
Drosophila suzukii	Spotted wing drosophila
Dysaphis plantaginea	Rosy apple aphid
Erionota thrax	Banana skipper butterfly

Endorsed – the standard has been assessed by the Subcommittee on Plant Health Diagnostics (SPHD) and endorsed by the Plant Health Committee as a National Diagnostic Protocol

Draft – the standard has not yet been assessed and verified by SPHD

Lucid key – only a lucid key exists for this species

Table 52. National Diagnostic Protocols (continued)

Scientific name	Common name
Erwinia amylovora	Fireblight
Exotic aphids	Exotic aphids
Flavescence dorée phytoplasma	Flavescence dorée
Furoviruses and Bymoviruses (wheat mosaic, cereal mosaic, Chinese mosaic virus, wheat spindle streak and wheat yellow mosaic virus)	Wheat soilborne viruses
Fusarium circinatum	Pine pitch canker
Fusarium oxysporum f. sp. *cubense* tropical race 4	Panama disease
Gibberella fujikuroi	Bakanae
Globodera pallida	Potato cyst nematode
Globodera rostochiensis	Potato cyst nematode
Hyalesthes obsoletus	Cixxidae planthopper
Liriomyza cicerina	Chickpea leafminer
Liriomyza huidobrensis	Serpentine leafminer
Lissorhoptrus oryzophilus	Rice water weevil
Lobesia botrana	Grape berry moth
Lymantria dispar	Asian gypsy moth, gypsy moth complex
Maize dwarf mosaic virus (Potyvirus)	Maize dwarf mosaic virus
Mayetiola destructor	Hessian fly
Mycosphaerella eumusae	Eumusae leaf spot
Mycosphaerella fijiensis	Black sigatoka
Orthaga euadrusalis	Mango leaf webber
Pantoea stewartii subsp. *steartii*	Stewart's wilt of maize
Pea early browning virus (Tobravirus)	Pea early browning virus
Pea enation mosaic virus (Enamovirus)	Pea enation mosaic virus
Pepino mosaic virus (Potexvirus)	Pepino mosaic virus
Peronosclerospora sacchari	Sugarcane downy mildew
Phomopsis helianthi (teleomorph *Diaporthe helianthi*)	Sunflower stem canker
Phymatotrichum omnivorum	Texas root rot
Phytophthora infestans A2 mating type	Potato late blight
Pomacea canaliculata	Golden apple snail
Potyvirus (general)	Potyvirus
Pseudomonas maritimus	Grape mealybug
Pseudomonas syringae pv. *papulans*	Blister spot of apples
Puccinia psidii sensu lato (exotic strain)	Guava rust, Eucalyptus rust
Raffaelea lauricola	Laurel wilt (and beetle vector)
Ralstonia solanacearum	Bacterial brown rot of potatoes
Ralstonia solanacearum race 2	Moko and bugtok
Red clover vein mosaic virus (Carlavirus)	Red clover vein mosaic virus
Saccarum	Sugarcane white leaf
Scirpophaga excerptalis	Top borer, top shoot borer
Scirpophaga nivella	White rice borer
Scirtothrips aurantii	South African citrus thrip
Scolytines	Bark beetles
Semiaphis dauci	Carrot aphid
Sesamia grisescens	Stem borer
Sitobion avenae	Wheat aphid
Stagonospora sacchari	Leaf scorch
Sternochetus frigidus	Mango pulp weevil
Termites	Termites
Tetranychus desertorum	Prickly pear spider mite
Tetranychus lombardinii	Crimson spider mite
Tetranychus pacificus	Pacific spider mite
Tetranychus piercei	Spider mites
Tetranychus turkestani	Strawberry spider mite
Tilletia controversa	Dwarf bunt of wheat
Tilletia horrida (nee *barclayana*)	Kernel smut of rice
Trioza erytreae	African citrus psyllid
Unknown	Ramu stunt
Verticillium dahliae	Verticillium wilt (defoliating strain)
Wheat spindle streak mosaic virus (Bymovirus)	Wheat spindle streak mosaic virus
Xanthomonas campestris pv. *musacearum*	Bacterial wilt
Xanthomonas citri subsp. *malvacearum*	Hypervirulent bacterial blight of cotton

Table 52. National Diagnostic Protocols (continued)

Scientific name	Common name
Draft protocols (continued)	
Xanthomonas fragariae	Angular leaf spot
Xanthomonas vasicola pv. *musacearum*	Banana bacterial wilt
Xylophilus ampelina	Bacterial blight
Anastrepha spp., *Bactrocera* spp., *Ceratitis* spp., *Dacus* spp., *Dirioxa* spp. and *Rhagoletis* spp.	Fruit flies (exotic and endemic species of priority to Australia)
Endorsed protocols	
Adoxophyes orana	Summer fruit tortrix
Bactericera cockerelli	Potato tomato psyllid
Candidatus Liberobacter asiaticus	Huanglongbing, citrus greening
Candidatus Liberobacter psyllaurous	Zebra chip
Ceratosystus ulmi	Dutch elm disease
Cherry leaf roll virus (Nepovirus)	Blackline
Clavibacter michiganensis subsp. *sepedonicus*	Bacterial ring rot of potato
Cryphonectria parasitica	Chestnut blight
Dendroctonus valens	Red turpentine beetle
Diuraphis noxia	Russian wheat aphid
Echinothrips americanus	Poinsettia thrips
Endocronartium harknessii	Pine gall rust
European stone fruit yellows phytoplasma	European stone fruit yellows
Fusarium oxysporum f. sp. *ciceris*	Fusarium wilt of chickpea
Guignadia bidwellii	Black rot
Homalodisca vitripennis	Glassy winged sharpshooter
Leptinotarsa decemlineata	Colorado potato beetle
Liriomyza trifolii	American serpentine leafminer
Magnaporthe grisea	Rice blast
Monilinia fructigena	Brown rot
Neonectria ditissima	European canker
Phakopsora euvitis	Grapevine leaf rust
Phoma tracheiphila	Mal secco
Phytophthora ramorum	Sudden oak death
Plum pox virus (Potyvirus)	Plum pox virus
Potato mop top virus (Pomovirus)	Potato mop top virus
Potato spindle tuber viroid (Pospiviridae)	Potato spindle tuber viroid
Protopulvinaria pyriformis	Pyriform scale
Puccinia striiformis f. sp. *hordei*	Barley stripe rust
Pulvinaria iceryi (Signoret)	Pulvinaria scale
Roesleria subterranea	Grape root rot
Scirtothrips perseae	Avocado thrips
Synchytrium endobioticum	Potato wart
Tilletia indica	Karnal bunt
Uromyces vicia-fabae (lentil strain)	Lentil rust
X disease phytoplasma	Peach X disease
Xanthomonas citri subsp. *citri*	Citrus canker
Xylella fastidiosa	Pierce's disease
Protocols as Lucid keys	
Anastrepha spp., *Bactrocera* spp., *Ceratitis* spp., *Dacus* spp., *Dirioxa* spp. and *Rhagoletis* spp.*	Fruit flies (exotic and endemic species of priority to Australia)
Bemisia tabaci	Silverleaf whitefly
Liriomyza bryoniae	Tomato leaf miner
Liriomyza sativae	American leafminer
Tetranychidae spp.	Spider mites

Endorsed – the standard has been assessed by the Subcommittee on Plant Health Diagnostics (SPHD) and endorsed by the Plant Health Committee as a National Diagnostic Protocol

Draft – the standard has not yet been assessed and verified by SPHD

Lucid key – only a lucid key exists for this species

* see also Australian Handbook for the Identification of Fruit Flies

FOREST HEALTH AND BIOSECURITY SUBCOMMITTEE

At a meeting in March 2015, the Australian Forests Products Association (AFPA) Resources Chamber agreed to establish the AFPA Subcommittee, to replace the Subcommittee on National Forest Health, which was disbanded earlier in the year.

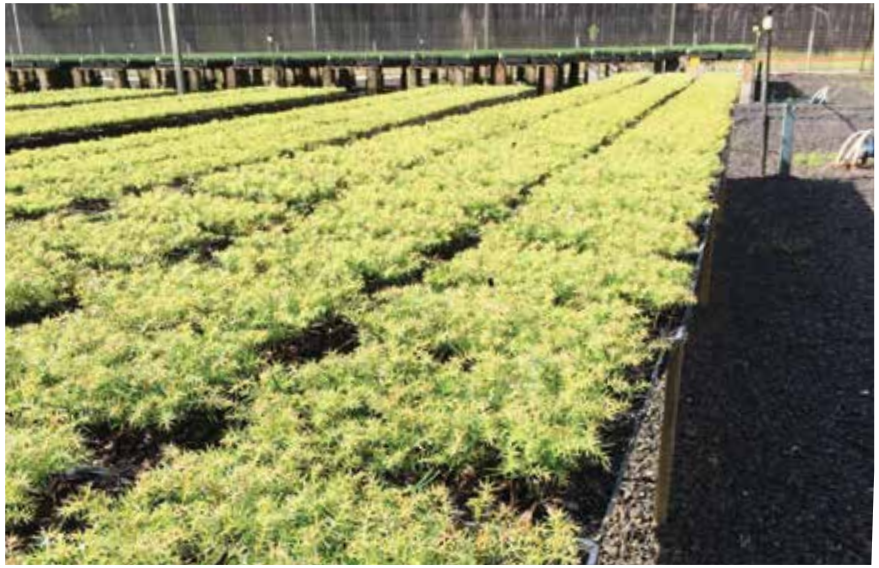
The Forest Health and Biosecurity (FHaB) Subcommittee includes both industry representatives responsible for managing forest health within their organisations and forest health technical experts.

Also included are representatives from Plant Health Committee, PHA and the New Zealand Forest Researchers Scion.

Key functions of FHaB Subcommittee include:

- Discussing and raising awareness of forest health and biosecurity issues within the AFPA membership and the broader forest industry.
- Providing expert advice to inform federal and state government policy on forest health and biosecurity issues.
- Supporting AFPA as the industry representative for PHA and as signatory to the EPPRD.
- Offering technical advice to AFPA members during an emergency response to an EPP.
- Providing forestry representatives on the SNPHS and SPHD committees.

The FHaB Subcommittee has been actively engaged in the development of a National Forest Biosecurity Surveillance Strategy which has built on the framework for National Biosecurity Surveillance of Exotic Forest Pests.



Seedlings. Image courtesy of Sara Bray, HQ Plantations

Image courtesy of Sara Bray, HQ Plantations

ON-FARM BIOSECURITY

Farm biosecurity is a set of measures designed to protect a property from the entry and spread of pests, diseases and weeds. The actions of producers on-farm are important in maintaining Australia's plant biosecurity status. So that it actually gets done amid the rest of the jobs that need doing on farm, biosecurity needs to become second nature and integrated into everyday activities. Increasingly, growers are seeing the benefits of on-farm biosecurity and its role in preventing the spread of pest and disease causing organisms, and in maintaining access to markets.

Biosecurity manuals for producers

PHA, in partnership with plant production industries and governments, has released a number of crop-specific biosecurity manuals (Table 53). These booklets are designed for growers and consultants, explaining effective measures that can be incorporated into day-to-day operations to improve biosecurity and help protect farms from both new and established pests. The information from biosecurity manuals is provided in industry sections of the Farm Biosecurity website and complete manuals are available for download.

The Farm Biosecurity Program

Recognising the increasing number of mixed farming enterprises in Australia, PHA has partnered with Animal Health Australia (AHA) in a joint communication and awareness campaign, Farm Biosecurity, which provides biosecurity advice for both crop and livestock producers.

The program aims to help producers identify and reduce the risks to their enterprises posed by diseases, pests and weeds. The program website **farmbiosecurity.com.au** provides an array of information, including biosecurity manuals, templates for records, gate signs for sale, industry specific information, videos, a personal profile builder and a biosecurity planner.

Resources produced by Farm Biosecurity are structured around the six biosecurity essentials. By considering how these principles apply to their properties, producers can go a long way towards protecting their farms and their future from the impact of new or established diseases, pests and weeds.

BIOSECURITY OFFICERS ON THE GROUND

Industry biosecurity programs have been developed to improve the management of, and preparedness for, biosecurity risks at the farm level. These programs are managed by PHA and funded by industry and relevant state governments.

State governments have similar programs, for example the NSW Local Land Services bring together agricultural production advice, biosecurity, natural research management and emergency management advice to farmers, landholders and the community.

Grains Farm Biosecurity Program

The Grains Farm Biosecurity Program is funded by growers via Grain Producers Australia, in partnership with the governments of five grain-producing states. Grains Biosecurity Officers are responsible for raising awareness of biosecurity among grain growers and others along the supply chain. The officers attend field days, training sessions and conferences, giving talks and presentations on biosecurity.

Since it began in 2007, thousands of farm biosecurity signs have been distributed to grain growers, improving on-farm biosecurity as well as raising awareness in grain growing regions. Media articles are distributed year-round to raise awareness of seasonal biosecurity risks for grain growers. Biosecurity officers also undertake surveillance for exotic pests of grains and assisted in the incursion response following the detection of the exotic pest Russian wheat aphid in May 2016.

Citrus biosecurity project

A citrus biosecurity project, funded by Citrus Australia and Hort Innovation, includes a number of risk mitigation activities to improve biosecurity planning, preparedness and awareness. A citrus biosecurity manager works with government and industry to improve surveillance for exotic pests and raise awareness of pest threats among citrus growers and others along the supply chain.

The First Detectors Network is a group of trained growers who monitor their crops regularly for any sign of exotic pests. In 2016 the citrus biosecurity manager teamed up with officers from the NSW Government who assisted with surveillance of backyard citrus plants in Sydney and in peri-urban Gosford. Staff from the Northern Australia Quarantine Strategy also facilitated searches in orchards in the Ord River Region of WA, and retail nurseries including Bunnings and Masters, where citrus plants and related species such as Murraya are sold, were checked.

Vegetable and potato biosecurity project

The Vegetable and Potato Biosecurity Program is an outreach program funded by AUSVEG through grower levies to enhance biosecurity practices of producers and others along the supply chain in that industry.

Two dedicated biosecurity officers develop biosecurity awareness material, write articles on a biosecurity theme for industry magazines, meet with producers to improve awareness at field days, and liaise with growers during pest incursions. In 2016 the officers worked in the Greater Western Sydney area to tailor awareness material for growers speaking languages other than English.

PLANT BIOSECURITY COMMUNICATION

The Australian Government is primarily responsible for messages about national border protection, international requirements and pre-border initiatives, while state and territory governments disseminate information about biosecurity in their regions.

Information for producers and others along the supply chain is generally communicated by industry bodies and the Farm Biosecurity program, with governments playing a supporting role. Plant industries also work to mitigate risks through heightened awareness about plant pests and improving the practices of their producers. They use a variety of communication tools including industry magazines and, increasingly, biosecurity officers on the ground.

PHA aggregates biosecurity news and raises awareness of the importance of plant biosecurity through the website **phau.com.au,** social media and the e-newsletter Tendrils **planthealthaustralia.com.au/subscribe**.

During a plant pest emergency, the Affected state government is responsible for ensuring that the public and any stakeholders are kept informed about the response. The messaging is based on nationally agreed talking points, which are determined by the Consultative Committee on Emergency Plant Pests (CCEPP) that oversees the response – usually representatives of government and industry parties to the EPPRD (see Chapter 4).

Biosecurity Incident National Communication Network

The National Communication Network (NCN) consists of communication managers from the Australian Government, state and territory agencies, and biosecurity organisations including PHA and AHA.

During responses to pest and disease outbreaks, the NCN develops and circulates key messages arising from CCEPP meetings, allowing consistent messaging nationally. The NCN also advances preparedness and prevention awareness activities in areas where a national approach is warranted.

Information technology supporting plant biosecurity

Information technology is of increasing importance to the plant biosecurity sector. The speed at which information can be uploaded and analysed promises greater efficiency in many areas, from production management through to diagnosing plant pests. Mobile devices such as smart phones and tablets are supplementing IT systems, improving accessibility to the tools and integration into biosecurity operations.

The Australian Plant Pest Database (APPD) and the Atlas of Living Australia (ALA) are key reference systems for plant pests. The APPD is used in every plant pest incursion that is detected in Australia.

Remote microscopy links diagnosticians around the country to assist with pest identification.

The Biosecurity Portal, developed by PHA in 2014, brings together a suite of online biosecurity information for ease of access at **biosecurityportal.org.au**.

Apps including FarmBiosecurity and MyPestGuide Reporter make it easier for everyday Australians to participate in improving biosecurity.

AUSPest*Check* is a new system developed by PHA for hosting surveillance data on the presence or absence of exotic and established pests around Australia. Maps are generated in real time, providing digital representations of pest status around the country, including during plant pest incursions.

Table 53. Current PHA biosecurity manuals for producers of various industries

Manual	Version
Biosecurity Induction Manual for Bundaberg Horticultural Farms	1.0
Biosecurity Manual for Beekeepers	1.1
Biosecurity Manual for Citrus Producers	2.0
Biosecurity Manual for Grain Producers	4.0
Biosecurity Manual for the Nursery Production Industry	1.0
Biosecurity Manual for the Papaya Industry	1.0
Biosecurity Manual for the Plantation Timber Industry	1.0
Biosecurity Manual for Sugarcane Producers	1.0
Biosecurity Manual for the Viticulture Industry	1.0
Farm Biosecurity Manual for the Banana Industry	1.0
Farm Biosecurity Manual for the Cotton Industry	1.0
Farm Biosecurity Manual for the Northern Adelaide Plains Vegetable Growers	1.0
Farm Biosecurity Manual for the Organic Grains Industry	1.0
Orchard Biosecurity Manual for the Almond Industry	1.0
Orchard Biosecurity Manual for the Apple and Pear Industry	2.0
Orchard Biosecurity Manual for the Avocado Industry	1.0
Orchard Biosecurity Manual for the Cherry Industry	1.0
Orchard Biosecurity Manual for the Mango Industry	1.0
Orchard Biosecurity Manual for the Summerfruit Industry	1.0

Image courtesy of QDAF

Chapter 4

Responding to plant pest incursions

Even with a highly effective biosecurity system, including strong border controls, there is still a risk that new plant pests will enter the country. Passenger arrivals and imports are increasing with time and, together with natural entry pathways such as wind and water currents, the risk of exotic pest incursions is ever present.

As a result, Australia has mechanisms in place to rapidly and effectively respond to plant pests to minimise any negative impacts.

The Emergency Plant Pest Response Deed is the legally binding agreement between governments and industries that sets out how Emergency Plant Pests are dealt with when detected in Australia. The agreement ensures that any new detection is dealt with swiftly, providing the best chance of containing and eradicating the pest.

This chapter uses the EPPRD definition of a **Plant Pest**: *any species, biotype or strain of invertebrate pest or pathogen injurious to Plant Health, Unprocessed Plant Products or Bees, provided that it is discrete, identifiable and genetically stable but excludes Genetically Modified Organisms*. The EPPRD definition of a Plant Pest does not include weeds.

Defined terms under the EPPRD are used throughout this chapter, identified through capitalisation. For the full list of definitions, refer to clause 1 of the EPPRD available at **planthealthaustralia.com.au/epprd**.

4.1 The Emergency Plant Pest Response Deed

The EPPRD is a formal, legally binding agreement between PHA, the Australian Government, all state and territory governments, and 33 plant industry peak bodies. The EPPRD, of which PHA is the custodian, covers the management and funding of eradication responses to Emergency Plant Pests (EPP).

For a pest to be covered by the EPPRD, it must be an EPP, with categorised EPPs listed in schedule 13 of the EPPRD. If there is an Incident of an uncategorised Plant Pest the response action may commence if it is reasonably believed to meet one of the following EPP criteria:

- A known exotic Plant Pest that could have an adverse economic impact regionally and nationally if established in Australia.
- A variant form of an established Plant Pest which can be distinguished by appropriate investigative methods, and could have an adverse economic impact regionally and nationally if established in Australia.
- A serious Plant Pest of unknown or uncertain origin which may be an entirely new Plant Pest.
- A Plant Pest restricted to a defined area of Australia through the use of regulatory measures, that is not native to Australia or under a national instrument of management, and has been detected outside the defined area and is likely to have an adverse economic impact such that an emergency response is required to prevent an incident of regional and national importance.

A Plant Pest is not formally designated to be an EPP until the Categorisation Group makes the determination that it meets one of the above criteria and this is approved by Relevant Parties. Honey bees and their pests also fall under the EPPRD, since a pest affecting the honey bee industry would also affect plant industries that benefit from pollination.

The EPPRD is designed to ensure a rapid and effective response to the detection of an EPP, and to provide certainty on the management and funding of that response. It specifies Parties' roles in the decision making and operational processes of the EPP response and how government and Industry Parties will share the costs, based on an assessment of the relative public and private benefits of eradication.

The terms of the EPPRD ensure that no single Party is exclusively responsible for making decisions on responses to EPPs. Instead, formal committees are assembled to agree actions. These committees are made up of representatives from government and Industry Parties that are likely to be Affected by the EPP. Only EPPRD signatories can take an active part in these decision-making groups.

NATIONAL MANAGEMENT GROUP

The National Management Group (NMG) is responsible for making the key decisions in a response to an EPP incursion under the EPPRD. The group is formed in response to the detection of an EPP and consists of representatives from PHA, the Australian Government, all state and territory governments and Industry Parties Affected by the EPP.

The NMG is responsible for approving a Response Plan, including the budget, if it is agreed that eradication is technically feasible and cost beneficial. The NMG is advised on technical matters by the Consultative Committee on Emergency Plant Pests (CCEPP).

CONSULTATIVE COMMITTEE ON EMERGENCY PLANT PESTS

The Consultative Committee on Emergency Plant Pests (CCEPP) is a technical committee that makes recommendations to the NMG on responses to EPP incursions. As with the NMG, the CCEPP is formed when an EPP is detected or suspected to be present. The committee is comprised of the Australian Chief Plant Protection Officer, all state and territory Chief Plant Health Managers, and nominated representatives from the Australian Government, PHA and each Affected Industry Party.

The CCEPP is responsible for assessing the grounds for eradication and for providing the technical advice needed for the NMG to make decisions. A Scientific Advisory Panel may be convened by the CCEPP as required to provide advice on specific technical matters.

CATEGORISATION GROUP

The Categorisation Group is assembled to determine a category for the purposes of applying the provisions of the EPPRD, including the proportion of costs that each Affected Party will pay. Each category is based on the public versus private benefit of eradication of the EPP and assigns the Cost Sharing split that will be borne by Affected Parties. The four Cost Sharing categories are shown in Table 54. Relevant Parties must agree unanimously to the category recommended by the Categorisation Group in order for it to be formally recognised.

Each Categorisation Group comprises nominated representatives from the Affected Industry Parties, relevant technical experts nominated by government and Industry Parties, an economic expert and an independent Chair from PHA.

Table 54. EPP categories and the associated Affected Party Cost Sharing splits

Category 1
The eradication of Category 1 EPPs would have very high public benefits and would be 100 per cent government funded. These are EPPs which, if not eradicated, would: • cause major environmental damage to natural ecosystems; and/or • potentially affect human health or cause a major nuisance to humans; and/or • cause significant damage to amenity flora; and • have relatively little impact on commercial Crops. This category also covers situations where the EPP has a wide range of hosts, including native flora, and there is considerable uncertainty as to the relative impacts on Crops. In short, it is almost impossible to properly determine which Cropping Sectors benefit from eradication and to what extent, and in any case the incursion primarily affects native flora and/or amenity plants, and/or is a major nuisance, if not a health risk to humans.
Category 2
The eradication of Category 2 EPPs would have high public benefits and so would be funded 80 per cent by governments and 20 per cent by Affected Industry Parties. These are EPPs, which if not eradicated, would: • cause significant public losses either directly through serious loss of amenity, and/or environmental values and/or effects on households; or indirectly through very severe economic impacts on regions and the national economy, through large trade losses with flow on effects through the economy; and • impose major costs on the Affected Cropping Sectors such that the Cropping Sectors would benefit significantly from eradication.
Category 3
The eradication of Category 3 EPPs would have moderate public benefits and would be funded 50 per cent by governments and 50 per cent by Affected Industry Parties. These are EPPs, which if not eradicated, would: • primarily harm the Affected Cropping Sectors, but there would also be some significant public costs as well (that is, moderate public benefits from eradication). The EPP could adversely affect public amenities, households or the environment, and/or could have significant, though moderate trade implications and/or national and regional economic implications.
Category 4
The eradication of Category 4 EPPs would mainly, if not wholly, have private benefits and would be funded 20 per cent by governments and 80 per cent by Affected Industry Parties. These are EPPs, which if not eradicated, would: • have little or no public cost implications and little or no impacts on natural ecosystems. The Affected Cropping Sectors would be adversely affected primarily through additional costs of production, extra control costs, or nuisance costs; and • generally there would be no significant trade issues that would affect national and regional economies.

Exercise Haryana improves readiness for an exotic pest of grains

Beginning in late 2015, PHA facilitated a series of activities under the banner of Exercise Haryana to improve Australia's readiness for a serious exotic pest of the grains industry.

Karnal bunt, caused by the fungus *Tilletia indica*, is a serious pest elsewhere in the world. Should it make it to Australia, it would reduce the quality of Australian grain and threaten access to export markets.

PHA and partners took part in the activities to rehearse for such an event, in order to make any real eradication response faster and more effective.

Exercise Haryana was funded by Grain Producers Australia, with all activities based on a simulated incursion of Karnal bunt in the wheat supply chain.

In total, nine functional and discussion activities were delivered across five states. The main areas of operation tested were interstate movement conditions, surveillance planning, diagnostic processes, the ability to trace back grain to production areas and effective public information.

In all, 20 organisations took part in Haryana. Government response agencies, the grains industry and the grains supply chain were the key players, but intensive animal industries were also involved. The chicken meat, egg, pork and stockfeed industries took part to consider the effects that a Karnal bunt response, including a grains standstill, might have on their operations.

In addition to a considerable boost in understanding the effects of a significant exotic pest response in Australia, Haryana activities produced 25 recommendations which can be found on the PHA website **planthealthaustralia.com.au/simulation-exercises**.

Surveillance officers entering sample collection data during Exercise Haryana

4.2 PLANTPLAN

PLANTPLAN is the agreed technical response plan used by governments and industries in responding to a Plant Pest Incident in accordance with the EPPRD. PLANTPLAN underpins the EPPRD as part of schedule 5 and is endorsed by all EPPRD signatories.

It provides nationally consistent guidelines for response procedures under the EPPRD, outlining the phases of an incursion (investigation and alert, operational and stand down), as well as the key roles and responsibilities of industry and government Parties during each of these phases. It incorporates best practice in EPP responses and is further updated each year to incorporate the findings of Incident debriefs and simulation exercises. PHA manages the continued development of PLANTPLAN on behalf of EPPRD Parties.

In 2016 a Transition to Management Phase was incorporated into the EPPRD and PLANTPLAN following approval by all EPPRD Parties. This Phase may be initiated under certain circumstances and its aim is the undertaking of activities for transitioning the management of an EPP from seeking to achieve eradication under the Emergency Response Phase to management of the EPP outside of the EPPRD.

PLANTPLAN is supported by several documents providing detail on specific topics to make access to information easier in training and emergency response situations. In 2016 Parties endorsed a number of new and revised supporting documents, all of which are available online at **planthealthaustralia.com.au/plantplan**.

CONTINGENCY PLANNING

Contingency planning is a pre-emptive preparedness initiative that assesses the risks posed by particular exotic pest threats. Before any incursion occurs, experts are brought together to collate information about a designated pest or pest group and to devise the best strategies for surveillance, control and destruction. In the event of an incursion the information contained in a contingency plan allows an effective Response Plan to be developed quickly.

Table 55 provides a listing of contingency plans for over 110 plant pests and pest groups that have been developed by industries and governments in Australia. These plans make a considerable contribution to Australia's preparedness for serious plant pest risks.

Table 55. Contingency plans

Pest scientific name	Pest common name	Year	Location of document	Scope
Acarapis woodi	Tracheal mite	2012	PHA	National – honey bee industry
Agromyza ambigua, A. megalopsis, Cerodontha denticornis, Chromatomyia fuscula and C. nigra	Cereal leaf miners	2009	PHA	National – grains industry
Agrotis segetum	Turnip moth	2011	DAWR	National – grains industry
Alternaria humicola	Leaf spot of field pea	2009	PHA	National – grains industry
Alternaria triticina	Leaf blight of wheat	2009	PHA	National – grains industry
Anoplophora chinensis	Citrus longicorn beetle	2009	PHA	National – production nurseries
Aphis fabae, Haplothrips tritici and *Schizaphis graminum*	Exotic sap-sucking pests	2015	PHA	National – grains industry
Atherigona soccata	Sorghum shoot fly	2008	PHA	National – grains industry
Bactericera cockerelli and *Candidatus* Liberibacter solanacearum	Zebra chip complex	2011	Hort Innovation, PHA	National – vegetable and potato industries
Bactrocera papayae, B. tryoni* and *Ceratitis capitata*	Papaya fruit fly, Queensland fruit fly and Mediterranean fruit fly	Updated bi-annually	PIRSA	State
Bactrocera tryoni and *Ceratitis capitata*	Queensland fruit fly and Mediterranean fruit fly	2013	DPIPWE	State
Bactrocera tryoni, *Ceratitis capitata* and exotic fruit fly species	Fruit flies	Updated bi-annually	PIRSA	State
Barley stripe mosaic virus (Hordeivirus)	Barley stripe mosaic virus	2009	PHA	National – grains industry
Beet pseudo-yellows virus (Closterovirus), *Diodia vein chlorosis virus* (Crinivirus), *Lettuce infectious yellows* virus (Crinivirus) and *Tomato yellow leaf curl virus* (Begomovirus)	Whitefly transmitted viruses	2011	PHA	National – production nurseries
Bipolaris spicifera (now *Curvularia spicifera*)	Leaf blotch of cereals	2009	PHA	National – grains industry
Braula coeca	Braula fly	2012	PHA	National – honey bee industry
Burkholderia glumae	Panicle blight	2008	PHA	National – rice industry
Candidatus Liberibacter africanus, *Ca.* L. americanus, *Ca* L. asiaticus, *Diaphorina citri* and *Trioza erytreae*	Huanglongbing and vectors	2013	QDAF, NGIA	National – production nurseries
Candidatus Liberibacter africanus, *Ca.* L. americanus, *Ca*. L. asiaticus, *Diaphorina citri* and *Trioza erytreae*	Huanglongbing and vectors	2009	Hort Innovation	National – citrus and nursery industries (under review)
Candidatus Liberibacter africanus, *Ca.* L. americanus, *Ca.* L. asiaticus, *Diaphorina citri* and *Trioza erytreae*	Huanglongbing and vectors	2015	Hort Innovation, PHA	National – citrus and nursery industries
Cantareus apertus	Green snail	2012–13	DEDJTR	State
Cephus cinctus and *Thaumatotibia leucotreta*	Wheat stem sawfly and false codling moth	2015	PHA	National – grains industry
Cephus pygmeus	European wheat stem sawfly	2008	PHA	National – grains industry
Ceratocystis ulmi	Dutch elm disease	2001	DEDJTR	State

* This species has been synonymised with *Bactrocera dorsalis*

Table 55. Contingency plans (continued)

Pest scientific name	Pest common name	Year	Location of document	Scope
Ceutorhynchus assimilis and *Dasineura brassicae*	Cabbage seedpod weevil and Brassica pod midge	2011	DAWR	National – grains industry
Chilo partellus	Spotted stem borers	2009	PHA	National – grains industry
Chilo spp.	Sugarcane stem borer	2008	SRA	National – sugarcane industry
Chortoicetes terminifera	Plague locust	2010	PIRSA	State
Chromatomyia horticola, Liriomyza bryoniae, L. cicerina, L. huidobrensis, L. sativae and *L. trifolii*	Agromyzid leaf miners	2008	PHA	National – grains industry
Chrysanthemum stem necrosis virus (Tospovirus), *Impatiens necrotic ringspot virus* (Tospovirus), *Pelargonium flower break virus* (Carmovirus) and *Tomato spotted wilt virus* (Tospovirus)	Thrips-transmitted viruses	2011	PHA	National – production nurseries
Colletotrichum truncatum (lentil strain)	Lentil anthracnose	2008	PHA	National – grains industry
Cryphonectria parasitica	Chestnut blight	2010	DEDJTR	State – chestnut industry
Daktulosphaira vitifolii	Grape phylloxera	Updated bi-annually	PIRSA	State – viticulture industry
Deanolis sublimbalis	Red-banded mango caterpillar	2008	PHA	State
Diatraea spp.	Sugarcane borer	2008	SRA	National – sugarcane industry
Diuraphis noxia	Russian wheat aphid	2012	PHA	National – grains industry
Dorysthenes buqueti	Sugarcane longhorn stemborer	2009	SRA	National – sugarcane industry
Echinothrips americanus	Poinsettia thrips	2010	PHA	National – production nuseries
Eldana saccharina	African sugarcane moth borer	2008	SRA	National – sugarcane industry
Eoreuma loftini	Mexican rice borer	2008	SRA	National – sugarcane industry
Erwinia amylovora	Fire blight	2002	DEDJTR	State
Erwinia amylovora	Fire blight	2007	Hort Innovation, PHA	National – apple and pear industry
Erwinia amylovora (and its impact on honey bees)	Fire blight	2004	DPIPWE	State – honey bee industry
Erwinia papayae	Bacterial crown rot	2011	PHA	National – papaya industry
Eumetopina flavipes	Island sugarcane planthopper	2009	SRA	National – sugarcane industry
Eurogaster integriceps	Sunn pest	2008	PHA	National – grains industry
Fulmekiola serrata	Oriental sugarcane thrips	2009	SRA	National – sugarcane industry
Fusarium oxysporum f. sp. *ciceris, F. oxysporum* f. sp. *lentis* and *F. oxysporum* f. sp. *lupini*	Fusarium wilt of chickpea, lentil and lupin	2009	PHA	National – grains industry
Fusarium oxysporum f. sp. *conglutinans*	Fusarium wilt of canola	2007	PHA	National – grains industry
Gibberella fujikuroi	Bakanae	2005	NSW DPI	National – rice industry
Gibberella fujikuroi	Bakanae	2008	PHA	National – rice industry
Globodera pallida	Potato cyst nematode	2001	DPIPWE	State
Globodera rostochiensis	Potato cyst nematode	2002	DEDJTR	National

Table 55. Contingency plans (continued)

Pest scientific name	Pest common name	Year	Location of document	Scope
Halyomorpha halys	Brown marmorated stink bug	2016	PHA	Not specific to particular industry
Harpophora maydis and *Plasmopara halstedii*	Exotic soil borne pathogens of grains	2013	PHA	National – grains industry
Helicoverpa zea	Corn earworm	2009	PHA	National – grains industry
Heterodera avenae, H. latipons and *H. filipjevi*	Cereal cyst nematodes	2012	PHA	National – grains industry
Heterodera carotae	Carrot cyst nematode	2008	DAFWA, Hort Innovation	National – vegetable industry
Heterodera ciceri, H. glycines and *H. zeae*	Exotic nematodes of grains	2013	PHA	National – grains industry
Homalodisca vitripennis	Glassy winged sharpshooter	2009	PHA	National – production nurseries
Hylotrupes bajulus	European house borer	2006	DAFWA	State
Hylotrupes bajulus	European house borer	2011	QDAF	State
Liriomyza bryoniae, L. huidobrensis, L. sativa, L. trifolii and *Chromatomyia horticola*	Agromyzid leaf miners	2008	QDAF, Hort Innovation	National
Liriomyza huidobrensis	Serpentine leaf miner	2009	PHA	National – production nurseries
Lissachatina fulica (Achatina fulica)	Giant African land snail	2015	NGIA	National – ornamentals, vegetables, legumes
Lissorhoptrus oryzophilus	Rice water weevil	2005	NSW DPI	National – rice industry
Lissorhoptrus oryzophilus	Rice water weevil	2008	PHA	National – rice industry
Lygus lineolaris	Tarnished plant bug	2011	PHA	National – production nurseries
Lymantria dispar	Asian gypsy moth, gypsy moth complex	2002	DAWR, NSW DPI	National
Lymantria dispar dispar	Gypsy moth (Asian and European strains)	2009	PHA	National – production nurseries
Magnaporthe grisea	Rice blast	2005	DAFWA, NSW DPI	National – rice industry
Magnaporthe grisea	Rice blast	2008	PHA	National – rice industry
Maize dwarf mosaic virus (Potyvirus)	Maize dwarf mosaic virus	2011	PHA	National – grains industry
Mayetiola destructor	Hessian fly	2005	DAFWA, PHA	National – grains industry
Mayetiola hordei	Barley stem gall midge	2008	PHA	National – grains industry
Meromyza americana and *M. saltatrix*	Wheat stem maggots	2009	PHA	National – grains industry
Nysius huttoni	Wheat bug	2008	PHA	National – grains industry
Paracoccus marginatus	Papaya mealy bug	2011	PHA	National – papaya industry
Peronosclerospora philippinensis and *P. sorghi*	Downy mildew of maize and sorghum	2009	PHA	National – grains industry
Phakopsora euvitis	Grapevine leaf rust	2006	QDAF	National
Phyllophaga spp.	May beetle	2008	PHA	National – grains industry
Phytophthora ramorum	Sudden oak death	2010	PHA	National – production nurseries
Plum pox virus (Potyvirus) and *Tobacco etch virus* (Potyvirus)	Aphid-transmitted viruses	2011	PHA	National – production nurseries
Pomacea canaliculata	Golden apple snail	2008	PHA	National – rice industry
Potato spindle tuber viroid	Potato spindle tuber viroid (PSTVd)	2012–13	DEDJTR	State – eradication plan

Table 55. Contingency plans (continued)

Pest scientific name	Pest common name	Year	Location of document	Scope
Psila rosae	Carrot rust fly	2009	DAFWA, Hort Innovation	National – vegetable industry
Puccinia graminis f. sp. *tritici* (pathotype Ug99)	Stem rust of wheat	2009	PHA	National – grains industry
Puccinia psidii sensu lato	Eucalyptus rust	2009	PHA	National – production nurseries
Puccinia striiformis f. sp. *hordei*	Barley stripe rust	2010	NSW DPI, PHA	National – grains industry
Pyrenophora teres f. sp. *teres*	Net form of net blotch	2009	PHA	National – grains industry
Red clover vein mosaic virus (Carlavirus)	Red clover vein mosaic virus	2008	PHA	National – grains industry
Scirpophaga spp.	Top borers	2008	SRA	National – sugarcane industry
Sesamia spp.	Sugarcane and maize borers	2008	SRA	National – sugarcane industry
Sitobion avenae	Wheat aphid	2009	PHA	National – grains industry
Sitona spp. complex, especially *S. lineatus*	Pea leaf weevils	2005	DAFWA, PHA	National – grains industry
Solenopsis invicta	Red imported fire ant	2013	QDAF, NBC	National
Solenopsis invicta	Red imported fire ant	2013	QDAF, TACC	State
Thekopsora minima	Blueberry rust	2014	DEDJTR	State
Tilletia barclayana	Kernel smut of rice	2008	PHA	National – rice industry
Tilletia contraversa	Dwarf bunt of wheat	2007	DAFWA, PHA	National – grains industry
Tilletia indica	Karnal bunt	2006	DAFWA, NSW DPI	National – grains industry
Tilletia indica	Karnal bunt	2013–14 draft	PIRSA	State
Tilletia indica	Karnal bunt	2005	PHA	National – grains industry
Trogoderma granarium	Khapra beetle	2005	DAFWA, PHA	National – grains industry
Tropilaelaps clareae and *T. mercedesae*	Tropilaelaps mites	2012	PHA	National – honey bee industry
Uredo rangelii	Myrtle rust	2012–13	DEDJTR	State
Uredo rangelii	Myrtle rust	2015	PIRSA	State
Uromyces pisi and *U. viciae-fabae*	Field pea and lentil rust	2009	PHA	National – grains industry
Ustilago scitaminea	Sugarcane smut	1997	SRA	National – sugarcane industry
Various	Tramp ant	2015	DEDJTR	National – production nurseries
Varroa destructor and *V. jacobsoni*	Varroa mites	2015	DEDJTR	National – honey bee industry
Venturia inaequalis	Apple scab fungus	1992	DAFWA	State
Verticillium longisporum	Verticillium wilt of canola	2011	PHA	National – grains industry
Wasmannia auropunctata	Electric ant	2013	QDAF, TACC	State
Xanthomonas citri subsp. *citri*	Citrus canker	2006	QDAF	State – citrus industry
Xanthomonas translucens pv. *translucens* and *X. translucens* pv. *undulosa*	Bacterial leaf streak	2011	PHA	National – grains industry
Xylella fastidiosa	Pierce's disease	2002, 2011	DEDJTR, PHA	National – viticulture and production nurseries

TRAINING AND EVALUATION

For an Emergency Plant Pest response to work effectively there must be enough people who understand their role ahead of time. Trained personnel are required at all levels of a response, including representatives from both industry and government, and from members of the national decision making committees through to the surveillance officers carrying out field activities.

Delivery of this specialist training in emergency responses is provided by PHA, the Australian Government, state and territory governments and peak plant industry bodies. Training is offered in a variety of forms, from short presentations and e-learning courses, through to complete qualifications.

In addition to emergency response training, a range of skills-based training is offered to members of the plant biosecurity system. For example, plant pest diagnostic training is available to members of the National Plant Biosecurity Diagnostic Network to address any identified gaps in skills or capacity.

Also critical for effective emergency plant pest responses and the ongoing relevance and integrity of response systems in Australia, is regular evaluation of both simulated responses and incursions. Evaluation activities are undertaken by all stakeholders, including PHA.

Biosecurity Emergency Training Working Group

The National Biosecurity Emergency Preparedness Training Specialist Task Group (TSTG) is a skills-based working group that guides training to enhance Australia's biosecurity emergency preparedness, response and initial recovery arrangements. In its national capacity, the TSTG identifies risks, gaps and duplication in biosecurity emergency training, and provides advice and support to those undertaking delivery. The TSTG also ensures that biosecurity emergency training is consistent with contemporary emergency management practices.

The TSTG reports to the National Biosecurity Emergency Preparedness Expert Group (NBEPEG) and supports delivery of schedule 7 of the Intergovernmental Agreement on Biosecurity.

Biosecurity emergency response qualifications

Three qualifications have been developed and nationally endorsed as part of the Public Safety Training Package. These align with the emergency response role training delivered by jurisdictions, allowing people to achieve formal qualifications based on their work experience and training.

These qualifications put biosecurity response personnel on the same footing as those in other emergency response areas, such as police and firefighters. The system ensures that biosecurity emergency response training across the country meets the desired standard. Qualifications available are:

- PUA33112 – Certificate III in Public Safety (Biosecurity Response Operations)
- PUA42912 – Certificate IV in Public Safety (Biosecurity Response Leadership)
- PUA52412 – Diploma of Public Safety (Biosecurity Response Management).

National EPP Training Program

PHA conducts the National EPP Training Program on behalf of its members, delivering training to industry and government representatives, growers and other biosecurity stakeholders. The aim is to highlight the key elements of the EPPRD and PLANTPLAN, ensuring that members can fulfil their roles and obligations as EPPRD Parties.

The National EPP Training Program is delivered through a combination of face-to-face sessions and simulation exercises, which are supported by the e-learning platform BOLT (Biosecurity On-Line Training). Access to BOLT is open to all plant biosecurity stakeholders and can be accessed through **planthealthaustralia.com.au/bolt**.

Plant Biosecurity Program

Online training extends to postgraduate studies at several universities across Australia including Charles Darwin University, La Trobe University, Murdoch University, the University of Queensland and the University of Adelaide. Students can undertake a Graduate Certificate of Biosecurity, Graduate Diploma of Biosecurity, Masters of Biosecurity or Masters of Food Security.

Students can also complete a Bachelor of Biosecurity Science on campus at Box Hill Institute, Lilydale.

Evaluation activities

To maintain the ongoing relevance and integrity of the EPPRD, PHA and signatories to the EPPRD undertake continual evaluation of its performance, including specific response debriefs. The Evaluation and Lessons Management Specialist Task Group is a skills-based working group that ensures best practice is applied to all processes and systems nationally, and that lessons learn from evaluations are effectively shared across the biosecurity sectors.

Chapter 5

Research, development and extension

Industry and government combine resources to allow a significant investment in Australian plant biosecurity research, development and extension (RD&E). The term extension refers to communicating research and development outcomes, allowing uptake of the newly developed knowledge, process or product.

The research on pests and how to manage them is undertaken by research institutions across Australia including CSIRO, Research and Development Corporations, Cooperative Research Centres, the Australian Government, state and territory agencies as well as universities, plant industries, PHA and private organisations.

The science takes many forms. It covers the topics of pest management, crop improvement, surveillance, diagnostics, and the basic biology of pests and crops. It involves the full range of crops grown in Australia as well as honey bees. The pests investigated include insects, bacteria, fungi, viral diseases, weeds and other invertebrates. Some projects are conducted in the field, some in laboratories, and others including policy research or risk modelling is computer based.

The data in this chapter provide an overview of all plant and bee biosecurity RD&E in Australia during 2016.

Dr Sarah Collins, nematologist, in a sterile working environment in the Plant Pathology Laboratory. Image courtesy of Western Australian Agricultural Authority, DAFWA

5.1 National Plant Biosecurity RD&E Strategy

Plant biosecurity RD&E is conducted by dozens of research organisations across Australia, including universities, governments, botanic gardens, museums, plant industries, PHA and other private organisations.

Until recently, there has been no overarching framework coordinating the research that is done. PHA devised the National Plant Biosecurity RD&E Strategy in 2013 in collaboration with stakeholders around Australia, under the National Primary Industries RD&E Framework. The strategy was developed to guide plant biosecurity research to increase efficiency and effectiveness and enhance collaboration. It was developed along with other sector specific and cross sector strategies being implemented by the Agriculture Senior Officials' Committee (AGSOC).

The objective of the strategy is to enable effective management of economic, environmental and social risks posed by pests that may enter, emerge, establish or spread within Australia, by strengthening biosecurity research, development and extension for Australia's plant industries and those dependent on them.

Since 2014, an Implementation Committee comprised of a broad group of stakeholders has been bringing the strategy to life. The Committee includes representatives from the Australian Government, state governments, PHA, Hort Innovation, and the following research organisations: Council of Rural Research and Development Corporations, GRDC, CSIRO and PBCRC.

The Committee is chaired by PHA, and receives administrative support from PHA to drive the agenda and to host workshops focusing on particular biosecurity issues. The committee reports to the AGSOC Research and Innovation Committe and is funded by Horticulture Innovation, the Victoria Department of Economic Development, Jobs, Transport and Resources, Cotton Research and Development Corporation, Dairy Australia, Grains Research and Development Corporation, Meat and Livestock Australia, Sugar Researach Australia, Rural Industries Research and Development Corporation, Wine Australia and Forest and Wood Products Australia.

A forestry scientist lifts seedling out of an experiment tray. Image courtesy of CSIRO

Image courtesy of CSIRO

5.2 Australian Government RD&E

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

AUSTRALIAN GOVERNMENT AGENCIES AND STATUTORY AUTHORITIES

Australian Centre for International Agricultural Research
aciar.gov.au

The Australian Centre for International Agricultural Research (ACIAR) was established to help identify agricultural problems in developing countries, and to commission collaborative RD&E, focusing on fields where Australia has special research competence. Its mission is to achieve more productive and sustainable agricultural systems for the joint benefit of developing countries and Australia through international agricultural research partnerships.

ACIAR's biosecurity projects are spread across several program areas, including crop protection, horticulture, agricultural systems, economics and management, crop improvement and management, forestry, agricultural development, support for market driven adaptive research, soil management and crop nutrition.

Australian Research Council
arc.gov.au

The Australian Research Council (ARC) is an independent agency within the Australian Government's Education and Training portfolio. The ARC administers the National Competitive Grants Program and Excellence in Research for Australia, and provides advice to the Minister on research matters. The ARC plays a leading role in supporting and developing Australian research to benefit Australia across the full range of research disciplines with outcomes in the commercial, cultural, economic, environmental, health and societal fields.

Commonwealth Scientific and Industrial Research Organisation
csiro.au

The CSIRO is Australia's preeminent scientific organisation and plays a crucial role in the Australian innovation system. It is one of the largest and most diverse research organisations in the world ranked in the top one per cent in 15 of 22 research fields, with over 5,000 experts holding more than 1,800 patents. CSIRO creates value for customers through innovation that delivers positive impacts for Australia. 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 successes include:

- Developing solutions to reduce the impact of invasive pests and diseases in plants.
- Delivering counter measures to detect, control and mitigate biosecurity threats.
- Designing integrated strategies to manage invasive pests in agriculture.
- Developing knowledge and tools around rigorous risk analysis protocols.
- Delivering biological control for many exotic weeds that are found in production landscapes and the wider environment.

COOPERATIVE RESEARCH CENTRES

CRCs are formed through a collaboration of businesses, the community, government organisations and researchers. Essential participants within a CRC must include at least one Australian end user (from either the private, public or community sector) and one Australian higher education institution (or a research institution affiliated with a university). The CRC program is an Australian Government funded initiative.

The Plant Biosecurity Cooperative Research Centre (PBCRC) is the key plant biosecurity CRC.

Plant Biosecurity CRC

pbcrc.com.au

The PBCRC undertakes research to develop and deploy scientific knowledge, tools, resources and capacity to safeguard Australia, its plant industries and regional communities from the economic, environmental and social consequences of damaging invasive plant pests and diseases.

PBCRC's objectives are achieved through its four research programs – Early Warning, Effective Detection and Response, Safeguarding Trade and Secure Future – with education and delivery embedded throughout the programs.

Areas of expertise within PBCRC include plant biosecurity risk, pest pathway analysis, incursion impact management, insect resistance, plant health policy, economic analysis, modelling and agricultural engineering.

PBCRC is a collaborative venture with 27 government, industry and research participants from: the Department of Agiculture and Water Resources; the Bio-Protection Research Centre New Zealand; CAB International; CBH Group; Charles Darwin University; CSIRO; the Department of Agriculture and Food, Western Australia; the Department of Economic Development, Jobs, Transport and Resources, Victoria; GrainCorp Operations Limited; the Grains Research and Development Corporation; Hort Innovation; Kansas State University; La Trobe University; Murdoch University; Museum Victoria; the NSW Department of Primary Industries; the Pacific Institute for Sustainable Development, Indonesia; Vinehealth Australia; Plant and Food Research New Zealand; PHA; the Queensland Department of Agriculture and Fisheries; the Queensland University of Technology; the South Australian Research and Development Institute; the University of Adelaide; the University of Queensland; the University of Western Australia; and Viterra Ltd.

PBCRC engages in international collaborative research with organisations in China, Timor-Leste, Indonesia, Laos, Malaysia, New Zealand, Thailand, United Kingdom, the United States and Vietnam, and has international linkages with east African nations including Burundi, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Uganda, Tanzania, Zambia and Zimbabwe. PBCRC commenced its six-year term on 1 July 2012, following on from the Cooperative Research Centre for National Plant Biosecurity, which began operating in November 2005.

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. In 2016, 15 rural RDCs covered most Australian agricultural industries, with seven focusing on plant production.

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

RDCs of particular 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.

Cotton Research and Development Corporation

crdc.com.au

The Cotton Research and Development Corporation (CRDC) was established in 1990 and is a partnership between the Australian Government and the Australian cotton industry. CRDC's purpose is to invest in RD&E projects that support the performance of the cotton industry, helping to increase both productivity and profitability.

The cotton industry has always placed great emphasis on the value of its RD&E and the results speak for themselves. Over the past 10 years alone, RD&E has helped cotton growers reduce their pesticide use by 87 per cent, and increase their water use efficiency by 40 per cent. Thanks to RD&E, Australian cotton growers are now growing more cotton on less land and with less impact upon the environment. Biosecurity is a key focus of CRDC's investment.

Forest and Wood Products Australia

fwpa.com.au

Forest and Wood Products Australia (FWPA) is an industry service company that provides a national integrated strategy to increase demand for forest and wood products and reduce the impediments to their supply. Owned by industry, 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 forest and wood products. FWPA is funded by private companies and government agencies within the Australian forest and 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. The GRDC's aim is to create enduring profit for Australian grain growers. GRDC's activities drive the discovery, development and delivery of world class 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 (up to a specified limit) by the Australian Government.

GRDC's 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 scheme 'Protecting Your Crop' is identified as part of the GRDC's five year RD&E plan. This five year plan targets genetic, cultural management and pesticide options for root and foliar crop diseases; increased farmer awareness and adoption of invertebrate and weed integrated management practices; and biosecurity and stewardship of genetic and pesticide technologies.

Wine Australia
wineaustralia.com/research

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.

Horticulture Innovation Australia (Hort Innovation)
horticulture.com.au

Hort Innovation is a not-for-profit, grower-owned RDC for Australia's $9.5 billion horticulture industry. It invests more than $100 million in research, development and marketing programs annually.

Hort Innovation's 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 the 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.

Rural Industries Research and Development Corporation
rirdc.gov.au

The purpose of the Rural Industries Research and Development Corporation is to increase, through research and development, knowledge and understanding that foster innovative, adaptive and valuable rural industries.

The Corporation invests in biosecurity research, development and extension activities, including:

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

Sugar Research Australia
sugarresearch.com.au

SRA was launched in August 2013 bringing together the assets of BSES Limited and the Sugar RDC. SRA invests in and manages a portfolio of RD&E 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 is entitled to receive the statutory levies paid by growers and milling businesses, and matching funds from the Australian Government. SRA's own team of in-house researchers conducts research in the areas of plant breeding, trait development, biosecurity 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.

5.3 State and territory government RD&E

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 botanic gardens in some states. As well as research projects done to meet state and territory government needs, projects are often commissioned by commercial clients.

Alison Mackie looking at an apple infected with brown rot (Monilinia fructicola), which is exotic to Australia. Image courtesy of Western Australian Agricultural Authority, DAFWA

5.4 University and private research institution RD&E

Many universities across Australia provide biosecurity research and education services for the community, often in partnership with other organisations. Research is funded by governments, industry, and by 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.

Shining a LAMP on bacteria in the field

While new molecular technologies are a significant step forward for diagnosing plant disease, in the event of plant pest incursion, speed of identification is vital. A faster diagnosis can mean the difference between eradication of a disease or its establishment.

To help biosecurity officers in just such an event, Plant Biosecurity CRC researchers have developed user-friendly protocols to detect a number of bacterial plant pests in the field using LAMP technology (loop-mediated isothermal amplification).

LAMP uses constant temperature and pathogen-specific primers to amplify the genetic data in a sample collected in the field, creating specific DNA patterns that can be used to rapidly identify a plant pest.

LAMP is robust and sensitive, takes about 30 minutes, and is easily done with portable equipment on a folding table or even a tailgate.

The practicality of the system was demonstrated at the 2016 PBCRC Science Exchange when researchers on the LAMP project took many delegates through the in-field test for *Pseudomonas syringae* on field peas. Most tests were completed during lunch breaks and showed a high degree of accuracy.

The benefits of smart surveillance tools that can be used in the field are significant. Decisions can be made at the site of discovery within an hour, rather than submitting all samples to a central laboratory for more conventional diagnosis.

Instead of a laboratory, LAMP allows samples to be tested for particular bacterial infections in the back of a car. Image courtesy of Plant Biosecurity CRC

5.5 Plant biosecurity RD&E in 2016

In 2016, a substantial amount of RD&E that benefits plant biosecurity occurred across Australia. A wider range of research organisations contributed to this edition of the National Plant Biosecurity Status Report, increasing the number of projects presented here over previous years. And with projects containing larger budgets, this category was expanded to reflect this change. Research organisations and funders have reported more than 650 projects that directly support the development and enhancement of the national plant biosecurity system.

Table 55 gives a complete listing of plant biosecurity related research projects that were active during 2016. RD&E projects are presented by affected crop type, pest type, biosecurity area, research type and project size in Figures 88-92.

Research projects covered the spectrum of crops and pest types relevant to Australian plant production industries and the natural environment, with a similar distribution to the RD&E projects captured in the 2015 edition of this report. The highest proportion of projects were categorised as pest management.

Figure 88. RD&E projects by crop type

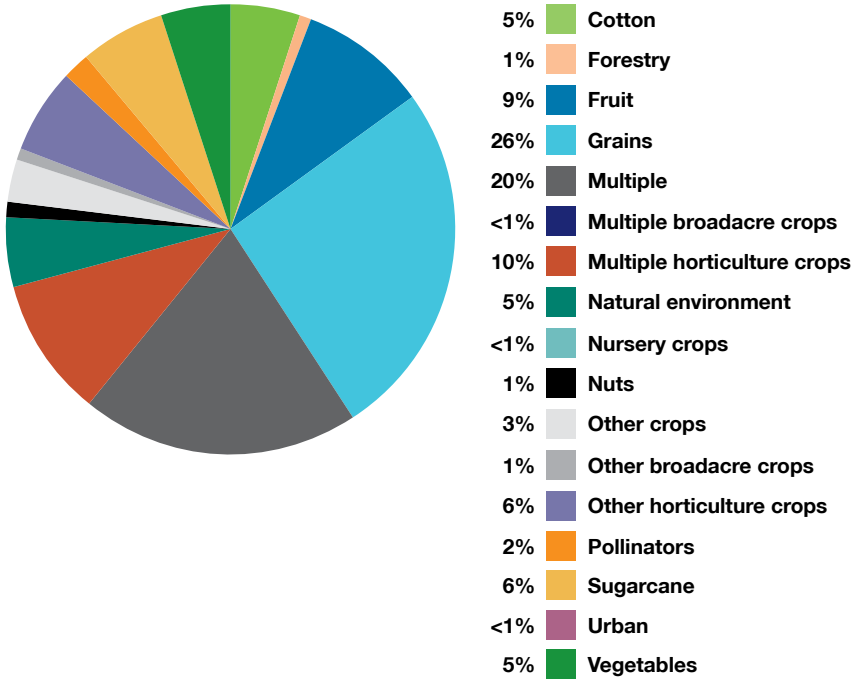


Figure 89. RD&E projects by pest type

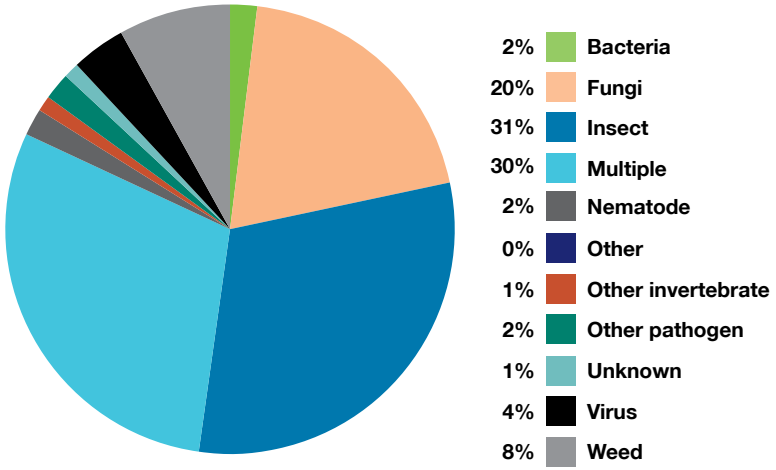


Figure 90. RD&E projects by biosecurity area

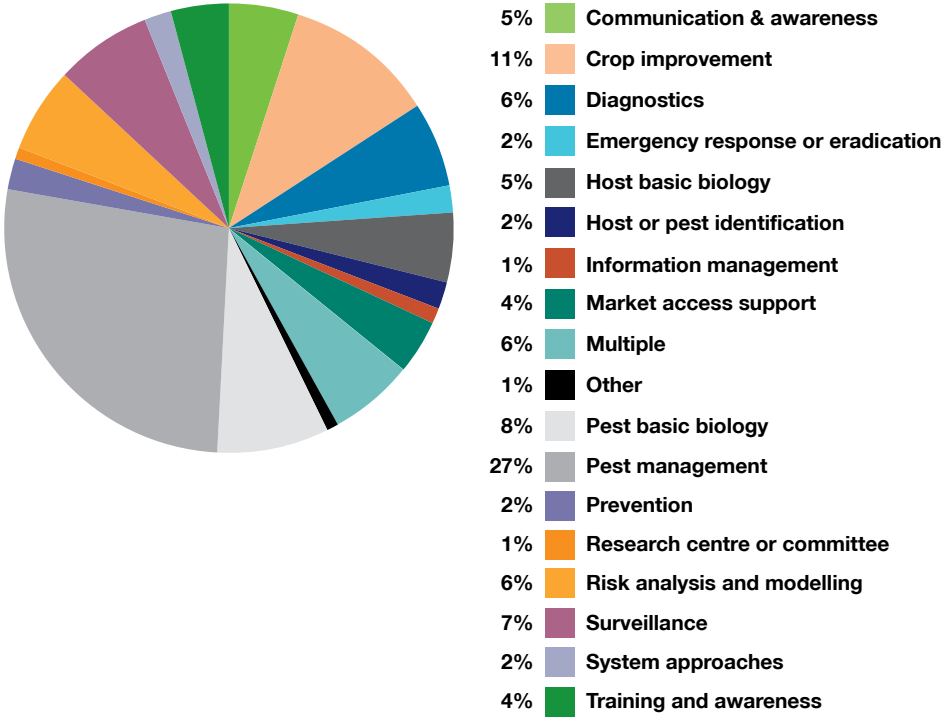


Figure 91. RD&E projects by research type or location

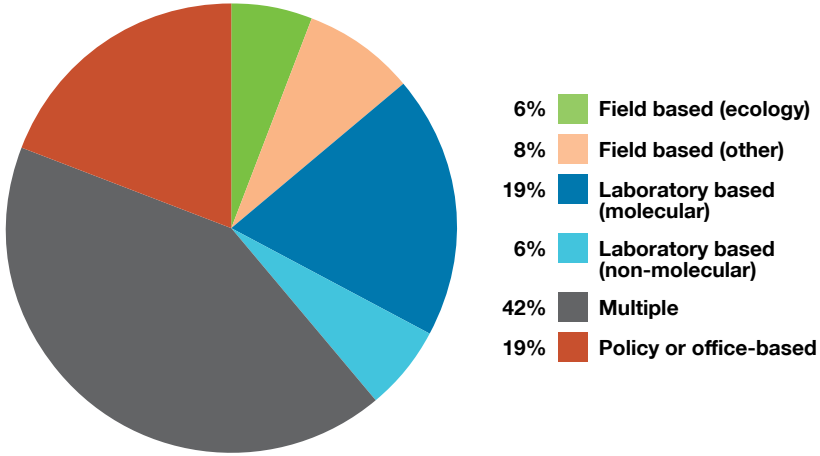
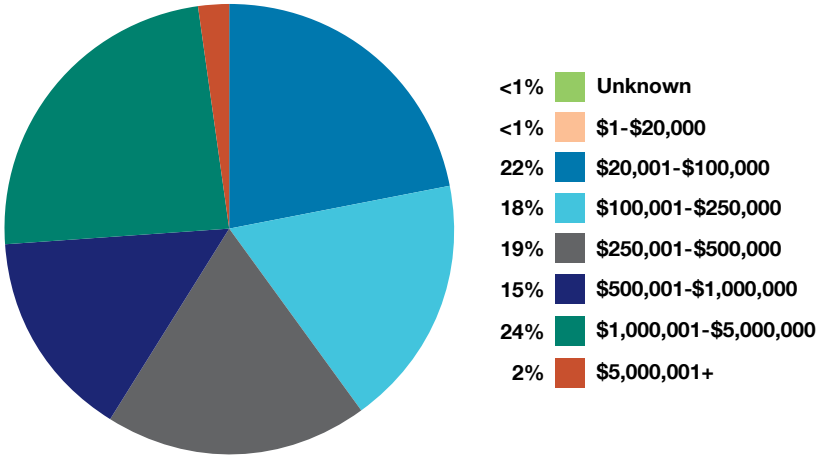


Figure 92. RD&E projects by project size



RESEARCH, DEVELOPMENT AND EXTENSION PROJECTS

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Broadacre – Cotton		
Australian cotton production and best practice web documentaries	QDAF	CRDC
Conventional insecticide resistance in Helicoverpa	NSW DPI	CRDC, NSW DPI
Crop Protection Development Specialist	QDAF	CRDC, QDAF
Developing the weed control threshold (PhD)	NSW DPI	CRDC, NSW DPI
Development of eco-friendly alternatives for crop pest management	University of Queensland	ARC
Disease of cotton XI	NSW DPI	CRDC
Economic risk assessment of resistance management strategies for *Bt* cotton	CSIRO	CRDC
Enhancing integrated pest management in cotton systems	CSIRO	CRDC, CSIRO
Establishing southern cotton – integrated pest management	NSW DPI	CRDC, NSW DPI
Evolution of viral diversity and virus ecology in the management of resistance to biopesticides (PhD)	Queensland University of Technology	CRDC
Fusarium wilt management in cotton	QDAF	CRDC, QDAF
Hard to control weeds in northern farming systems – understanding key processes to improve control methods	NSW DPI	CRDC, NSW DPI
Helicoverpa punctigera in inland Australia – what has changed?	University of New England	CRDC, University of New England
Host plant relationships of green mirids – is alternative control possible? (PhD)	University of Queensland	CRDC
Identification of beneficials attacking silverleaf whitefly and green vegetable bug	CSIRO	CRDC, CSIRO
Investigating the risk of mycotoxin contamination in Australian cotton production systems	NSW DPI	CRDC
Management of mirids, stinkbugs and Solenopsis mealybug	QDAF	CRDC, QDAF
Management options enhancing beneficial microbial functions in cotton soils	CSIRO	CRDC, CSIRO
Managing *Bt* resistance and induced tolerance in Bollgard III using refuge crops	CSIRO	CRDC
Managing *Bt* resistance, *Helicoverpa punctigera* movements and cotton planting windows	CSIRO	CRDC, CSIRO
Microbial tools for advancing the management of soil and seedling health in cotton production systems (PhD)	University of New England	CRDC
Molecular genetic methods to detect neonicotinoid resistance in cotton aphid	NSW DPI	CRDC
Molecular vegetative compatibility grouping	NSW DPI	CRDC
Monitoring to manage resistance to *Bt* toxins	CSIRO	CRDC, CSIRO
Multiple host use and gene-flow in green vegetable bug relative to cotton crop (PhD)	University of Queensland	CRDC
National cotton extension development and delivery – stewardship of biotechnologies	CRDC	CRDC
Professor of soil biology	University of New England	CRDC
Regional weed management workshops for growers and advisors	Independent Consultant Australia Network	CRDC
Silverleaf whitefly resistance monitoring	QDAF	CRDC, QDAF
Surveillance and monitoring for endemic and exotic virus diseases of cotton	QDAF	CRDC, QDAF
Surveillance for exotic cotton viruses – multiple targets in and nearby Australia	QDAF	CRDC
Sustainable resistance management of mites, aphids and mirids in Australian cotton	NSW DPI	CRDC
The sustainable chemical control and resistance management of aphids, mites and mirids in Australian cotton	NSW DPI	CRDC
Viruses, vectors and endosymbionts – exploring interactions for control whitefly transmitted cotton viruses	University of Queensland, QDAF	CRDC
Broadacre – Grains		
Accelerating the utilisation and deployment of durable adult plant resistance to leaf rust in barley	University of Sydney	GRDC
ACRCP3 durable genes	University of Sydney	GRDC
ACRCP3 molecular genetics	CSIRO	GRDC
ACRCP3 national breeding support	University of Sydney	GRDC
ACRCP3 rust surveillance	University of Sydney	GRDC

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Advancement of new stem genes for stem and leaf rust resistance from uncultivated relatives of wheat	University of Adelaide	GRDC
An integrated approach to manage pests and resistance to phosphine in stored grain	QDAF, NSW DPI, GrainCorp	PBCRC
Aphid and insecticide resistance management in oil seed and pulse crops	CESAR Consulting Pty Ltd	GRDC
Ascochyta blight of pulses – integrating development of novel selection methods, mining germplasm for resistance and pathogen surveillance	Curtin University, Griffith University	GRDC
Assessing collections of wild chickpea relatives for resistance to root-lesion nematodes	University of Southern Queensland, CSIRO, University of California Davis, University of Cukuorva (Turkey)	GRDC
Assessing the biology impacts of wheat-infecting *Botryosphaeria* spp.	Australian National University	GRDC
Australian cereal rust control program – towards 2019 and a century of monitoring cereal rust pathogens in Australia	University of Sydney	GRDC
Australian herbicide resistance initiative – phase 5	University of Western Australia, QDAF	GRDC
Australian wheat and barley molecular marker program – genetic analysis	University of Adelaide	GRDC
Barley germplasm progression	QDAF	GRDC
Barley rust genetics	University of Sydney	AusAID
Beneficial microbes program 2 – progressing new microbial products for Australian grain production to commercialisation	Flinders University	GRDC
Biological control of snails	CSIRO	GRDC
Cell wall structure and dynamics in emerging fungal pathogens of crops	University of Adelaide	ARC
Cereal and pulse cultivar resistance ratings for the southern region	DEDJTR	GRDC
Characterising structural variation in the canola genome	University of Western Australia	ARC
Characterisation of a major quantitative trait locus on wheat chromosome 3BL responsible for Fusarium crown rot resistance	University of Western Australia	ARC
Characterisation of effector proteins from necrotrophic fungal wheat pathogens	Australian National University	GRDC
Chemical residues of stored grain	Murdoch University	PBCRC
Combining monitoring and incursion surveillance for grains	NSW DPI	PBCRC
Combining monitoring and incursion surveillance for grains	NSW DPI	PBCRC
Comparison of biological and physiological behaviour of phosphine resistant and susceptible strains of two species of stored product insects (PhD)	Murdoch University	Government of Iraq
Components of immunity to *Stagnospora nodurum* in wheat (PhD)	Australian National University	GRDC
Delivering a collaborative monitoring program with industry to manage and facilitate trade	NSW DPI, QDAF, DAFWA	PBCRC
Delivery and adoption of nitrogen/low oxygen and nitrogen plus phosphine technology for the management of grain storage pests and grain quality	Murdoch University	PBCRC
Deployment of a synthetic amorphous silica product for the control of grain storage pests	PBCRC	PBCRC
Developing new diagnostic tools for *Trogoderma* spp. by using solid phase micro extraction, gas chromatography/mass spec and visible near infrared hyperspectral (PhD)	Murdoch University	Government of Iraq
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	GRDC
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	GRDC

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Broadacre – Grains (continued)		
Diagnostic services for pulse germplasm enhancement and breeding programs	DEDJTR	GRDC, DEDJTR
Disease screening service (fee for service)	DEDJTR	Fee for services
DNA marker development and their use in monitoring and eradication of phosphine resistance in stored grain pests (PhD)	University of Queensland	PBCRC
Ecology of Sitophilus and Cryptolestes species	QDAF	PBCRC
Effective control of *barley yellow dwarf virus* in wheat	University of Tasmania	GRDC
Effective genetic control of *Septoria tritici* blotch	NSW DPI	GRDC
Effective genetic control of *Stagonospora nodorum* blotch	DAFWA	GRDC
Emerging foliar diseases of canola	University of Western Australia	GRDC
Ensuring food security – harnessing science to protect our grain harvest from insect threats	University of Queensland	Department of Industry, Innovation and Science, Australia–India Strategic Research Funding
Evaluating chlorine dioxide (PhD)	Kansas State University	PBCRC
Evaluation of chlorine dioxide and ozone to control stored product insects	Kansas State University	PBCRC
Expanding the Brassica germplasm base through collaboration with China and India	University of Melbourne	GRDC
Extending biosecurity preparedness and surveillance strategies and developing a chemical supply framework for pest incursions	PHA	GRDC, PBCRC
Field trials of attract-and-kill for diamondback moth	University of New England	GRDC
Fungicide control of Rhizoctonia	SARDI	GRDC
Fungicide insensitivity in rusts	NSW DPI	Collaborative research
Fungicide resistance management strategy and communications	Curtin University	GRDC
Fungus and rust red flour beetles – identifying the fungal volatiles attractive to *Tribolium castaneum*	University of Queensland	PBCRC
Future national invertebrate pest initative forums – towards more sustainable pest management practices	CSIRO	GRDC
Genetic control of nematode species affecting major crops – germplasm enhancement for nematode control in cereals and pulses	University of Southern Queensland, GRDC	GRDC
Genetic control of nematode species affecting major crops grown within the Australian farming system and quantification of the effects of rotational crops have on nematode numbers in the soil	University of Adelaide, University of Southern Queensland	GRDC
Germplasm enhancement for yellow spot resistance in wheat	DEDJTR	GRDC, DAFWA, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
Get tough, get toxic and get a bodyguard – using silicon to augment direct and indirect anti-herbivore defences in cereals	Western Sydney University	Western Sydney University, Australian Steel Mill Services
Grain crop disease management in Victoria	DEDJTR	GRDC, DEDJTR
Grain economic analyses for biosecurity	University of Western Australia	PBCRC
Grain e-surveillance project	DAFWA	Royalties for Regions, DAFWA
Grains farm biosecurity officer program	PHA	Grain Producers Australia Ltd
Grain industry delivery sites	PBCRC, QDAF	PBCRC
Grain storage extension	QDAF	GRDC
Grains surveillance strategy and chemical supply	PHA	PBCRC
Grain weeds advisory committee	Rural Directions Pty Ltd	GRDC
Grains surveillance and diagnostic tools	SARDI	PBCRC
Harvest weed seed control for the southern region	Southern Farming Systems	GRDC
Herbicide tolerance screening in the northen region – phase IV	QDAF	GRDC
How do effector proteins from necrotrophic fungi cause disease in plants?	Australian National University	ARC
Identification and utilisation of novel sources of resistance to crown rot and the root lesion nematodes in adapted spring and durum wheat	CIMMYT	GRDC

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Identifying DAWR-intercepted Cryptolestes and an 'unknown' Cryptolestes in New South Wales and Queensland stored grain	CSIRO	PBCRC
Impact of seeding time and *Pratylenchus neglectus* on Rhizoctonia fungicide yield responses	SARDI	South Australia Grain Industry Trust
Impacts of host resistance on disease-induced yield loss for selected foliar and root diseases (including nematodes) in wheat and barley crops	DEDJTR	GRDC, DAFWA, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
Improve genetic solutions management yellow spot in wheat	DAFWA, University of Southern Queensland	GRDC
Improved diagnostic methods for Khapra beetle	DAFWA, Murdoch University	DAFWA
Improved fungicide use for cereal rust control	Foundation for Arable Research	GRDC
Improved herbicide efficacy and longevity in southern no-till farming systems	University of Adelaide	GRDC
Improved management of snails and slugs	SARDI	GRDC
Improved resistance to oat pathogens and abiotic stress management	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	QDAF, University of Southern Queensland	GRDC
Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in South Australia	SARDI	GRDC
Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in southern NSW	NSW DPI	GRDC
Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in Victoria	DEDJTR	GRDC
Improving integrated weed management practice in the northern region	University Of Queensland	GRDC
Improving integrated weed management practice of emerging weeds in the southern and western regions.	University of Adelaide	GRDC
Improving on-farm grain storage management through technical training	QDAF	GRDC
Improving weed management in pulse crops through herbicide tolerance – part A	SARDI	GRDC
Improving weed management in pulse crops through herbicide tolerance – part B	SARDI	GRDC
Increasing skills in cereal rust pathology and genetics in the developing world	University of Sydney	Bill and Melinda Gates Foundation
Inducing suppression of Fusarium crown rot complexes	CSIRO	GRDC
Integrated genetic solutions to crown rot in wheat	University of Sydney, QDAF, CSIRO, University of Southern Queensland	GRDC
Integrated strategy to manage phosphine resistance	QDAF	PBCRC
Integrated weed management extension in the northern region	Independent Consultant Australia Network	GRDC
Investigating the role of gamma-aminobuturic acid in pathogenicity of fungal wheat diseases	Australian National University	GRDC
Investigating the utility of industry generated data for surveillance	DEDJTR	DAWR
Investigation of new control options for phosphine resistant pests of stored grain	University of Queensland, QDAF, DEDJTR	PBCRC
Karnal bunt preparedness project and emergency response simulation exercise	PHA	Grain Producers Australia Ltd
Linking crop protection, weeds and native vegetation management – on the ground NRM action to benefit grain growers	CSIRO	GRDC
Maintaining a barley pre-breeding capability in Queensland	QDAF	GRDC
Management of insecticide resistance in red legged earth mite and screening new MoA chemistry	University of Melbourne	GRDC
Management of spray drift through inversion risk awareness	DAFWA	GRDC

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Broadacre – Grains (continued)		
Managing crop disease – improving chickpea pathogen resistance	NSW DPI	GRDC
Managing crop diseases – improving crown rot resistance in durum	University of Southern Queensland, NSW DPI, SARDI	GRDC
Managing on-farm biosecurity risk through pre-emptive breeding – the case of rust in field pea and lentil	Curtin University	GRDC
Mechanisms, evolution and inheritance of resistance	University of Adelaide	GRDC
Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa	University of Sydney	ACIAR
Model of action of food grade silica dust to kill stored grain insect pests	Murdoch University	PBCRC
Molecular markers for broadening the genetic base of stem rust resistance genes effective against strain Ug99	University of Sydney	ACIAR
Molecular markers for pulse breeding programs	DEDJTR	GRDC
More than defence – primary roles for cyanogenic glucosides	Monash University	ARC
National barley foliar pathogen variety initiative program	QDAF, Australian National University, SARDI, DEDJTR, 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 chickpea pathology program (*Ascochyta rabiei*)	Griffith University	GRDC
National coordination of invertebrate pest research and insecticide resistance management	University of Melbourne	GRDC
National crown rot epidemiology and management program	NSW DPI, University of Southern Queensland, SARDI, DEDJTR, DAFWA	GRDC, DAFWA, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
National improved molecular diagnostics for disease management	GRDC, SARDI, DAFWA, NSW DPI, DEDJTR, University of Southern Queensland	GRDC
National monitoring program for resistance to chemicals in stored grain pests	QDAF, NSW DPI, DAFWA, Kansas State University, GrainCorp, PHA	PBCRC
National nematode epidemiology and management program	GRDC, DEDJTR, NSW DPI, SARDI, DAFWA, University of Southern Queensland	GRDC, DEDJTR
National pathogen management modelling and delivery of decision support	GRDC, DAFWA, Marcroft Grains Pathology Pty Ltd, NSW DPI, SARDI, DEDJTR, University of Southern Queensland, QDAF	GRDC
National variety trials service agreement	GRDC, University of Southern Queensland	GRDC
Network analysis of post-border pest spread (PhD)	Lincoln University	PBCRC
New fungicide technologies for crown rot management	SARDI	GRDC
New knowledge to improve the timing of pest management decisions in grain crops	CSIRO	GRDC
New strategies for disease resistance to wheat stripe rust	NSW DPI	Collaborative research
New technology for stored grain pest management – phase 2	Queensland University of Technology	GRDC
New tools and germplasm for Australian pulse and oilseeds breeding programs to respond to changing virus threats	QDAF, NSW DPI	GRDC
New tools for field grains surveillance and diagnostics of high priority pests	SARDI, QDAF, DEDJTR	GRDC, PBCRC
New uses for existing chemistry	Southern Farming Systems	GRDC

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Nitrogen and low oxygen technology for management of phosphine resistant insects	Murdoch University	PBCRC
Non-chemical method for stored grain (PhD)	Murdoch University	PBCRC
Non-chemical technologies to protect grain (PhD)	Kansas State University	PBCRC
Northern NSW integrated disease management	NSW DPI	GRDC
Northern pulse and grains integrated pest management	QDAF	GRDC
New Zealand rust pathotype survey	NSW DPI	PBCRC
Options for improved insecticide and fungicide use and canopy penetration in cereals and canola	University of Western Australia	GRDC
PestFax map II national	DAFWA	GRDC
Phosphine distribution modelling (PhD)	Kansas State University, DAFWA	PBCRC
Pre-emptive APVMA emergency permit development for grains industry	PHA	GRDC
Pre-emptive chickpea pre-breeding for biotic stresses and germplasm enhancement for abiotic stresses	International Center for Agricultural Research in the Dry Areas	GRDC
Proof of concept for approaches designed at increasing disease resistance to fungal pathogens of canola	University of Melbourne	GRDC
Protecting stored grains against pests	PBCRC	ACIAR
Pulse breeding Australia faba bean breeding	University of Adelaide, SARDI, University of Sydney, NSW DPI	GRDC
Pulse germplasm enhancement program – resistance to biotic stresses	DEDJTR	GRDC
Rapid introgression of crown rot resistance into hexaploid wheat	University of Queensland	GRDC
Reducing agrochemical dependence through directional sowing techniques in Kaniva	Kaniva District Landcare	National Landcare Programme
Reforming an integrated Australasian cereal rust surveillance system	NSW DPI	PBCRC
Registration of minor use chemicals for the grain industry	AKC Consulting Pty Ltd	GRDC
Reverse genetics for the development of wheat cultivars with improved resistance to necrotrophic pathogens	CSIRO	GRDC
Smart-trap design and deployment strategies (PhD)	Kansas State University	PBCRC
Smart-use of fertilisers to minimise and manage the risk of pest infestations in growing canola	University of Western Australia	GRDC
Strategies to provide resistance to the economically important fungal pathogen *Rhizoctonia solani*	CSIRO	GRDC
Surveillance of herbicide resistant weeds in Australian grain cropping	Charles Sturt University	GRDC
Sustainable wheat and maize production in Afghanistan	CIMMYT	ACIAR, DFAT
The evolution of stripe rust virulence	Australian National University	ARC
The facilitation of category 25 submissions in the Australian grain industry	PHA	GRDC
The role of weedy hosts in disease incidence and emergence in barley	QDAF	GRDC
Towards genome methylation based crop improvement	University of Queensland	ARC
Understanding disease resistance mechanisms across the Brassicaceae	University of Queensland	ARC
Understanding the mechanisms of dust-induced insect death and biological effect (PhD)	Murdoch University	PBCRC
Use of ProFume gas fumigant in Australian grain storages	QDAF	Dow AgroSciences
Virus threats – new tools and germplasm for Australian pulse and oil seeds breeding programs	DEDJTR	GRDC, DAFWA, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
Weed surveillance	QDAF	GRDC
White grain disorder in wheat	SARDI	GRDC
Yield loss response curves for host resistance to leaf, crown and root diseases in wheat and barley	DAFWA, QDAF	GRDC
Zea mays model and *Phytophthora cinnamomi*	Deakin University	Australian Government

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Broadacre – Sugarcane		
A novel polyphasic framework to resolve the yellow canopy syndrome paradox	Western Sydney University	SRA, QDAF
Advancing yield, disease resistance and ratooning by exploiting new sources of genetic variability from wild relatives of sugarcane	SRA	SRA, QDAF
Bio-prospecting for beneficial endophytes of sugarcane	AgResearch Ltd	SRA
Delivery of remote sensing technology to combat canegrubs in Queensland cane fields	SRA	SRA, QDAF
Developing cytogenetic and molecular tools to improve selection for soil-borne pathogen resistance in wild hybrids	SRA	SRA, QDAF
Development of controlled-release formulations of imidacloprid for canegrub control	SRA	SRA, Nufarm
Diagnostic laboratory for ratoon stunting disease	SRA	SRA
Exploiting soil microbe associations with sugar cane roots for resistance to canegrubs (PhD)	Western Sydney University	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 Qld	SRA	SRA
General pest management – north Qld	SRA	SRA
General pest management – south Qld	SRA	SRA
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with existing product	SRA	SRA, QDAF
Innovative approaches to identifying the cause of chlorotic streak and new management strategies	SRA	SRA, QDAF
Integrated disease management of sugarcane streak mosaic in Indonesia	SRA	ACIAR
International and domestic quarantine for sugarcane germplasm	SRA	SRA
Investigation of biotic causes of yellow canopy syndrome	University of Queensland	SRA
Leaf sucrose – the link to diseases, physiological disorders such as yellow canopy syndrome and sugarcane productivity	SRA	SRA, QDAF
Management of sugarcane soldier flies	SRA	SRA
Managing threats from exotic borers through accurate identification	SRA	SRA
Mass production of the Adelina disease to better manage greyback canegrubs	SRA	SRA
Molecular assay of major soil-borne pathogens for better exploitation of commercial varieties	SRA	SRA
New approaches to identify and integrate Pachymetra resistance genes from Erianthus into SRA breeding program	SRA	SRA
New germplasm to develop more productive varieties with enhanced resistance to nematodes, Pachymetra root rot and smut	SRA, CSIRO	SRA, QDAF, CSIRO
Pachymetra awareness project for Condong mill area	NSW CANEGROWERS	SRA
Rapid detection of ratoon stunting disease	CSIRO	SRA, QDAF
Regenerating a soil food web capable of improving soil health and reducing losses from soil-borne pests and pathogens of sugarcane	Biological Crop Protection Pty Ltd	SRA
Review of the sugarcane biosecurity plan and development of a biosecurity manual	PHA	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
Securing Australia from Papua New Guinea biosecurity threats	SRA	SRA, QDAF, Ramu-AI
SmutBuster – accelerated breeding of smut resistant sugarcane varieties	SRA	SRA
Soil diagnostic assay laboratory – nematodes and Pachymetra root rot	SRA	SRA
Solving the yellow canopy syndrome	SRA	SRA, QDAF
Strategies to manage soil-borne fungi and mitigate sugarcane yield decline	CSIRO	SRA
Validation of LSB-PCR diagnostic for ratoon stunting disease and characterisation of non-Lxx strains of Leifsonia associated with sugarcane	University of Southern Queensland, SRA, University of the Sunshine Coast	SRA

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Broadacre crops – Other		
Hydrophobin proteins on the fungal frontline	University of Sydney	ARC
Improved subterranean clover seed production from multiple disease resistance	University of Western Australia	RIRDC
Improving pest and disease biosecurity in the Australian rice industry	NSW DPI	RIRDC
Knowledge transfer and uptake of new practices for pest management in irrigated rice	Charles Darwin University	PBCRC
Molecular basis of rust infection and host plant resistance	Australian National University	ARC
Potential exotic virus threats to lucerne seed production in Australia	University of Queensland	RIRDC
Rice pathogens (PhD top-up)	University of Queensland	PBCRC
Rice pest and disease biosecurity II	NSW DPI	RIRDC
The co-evolution of wild rice and its pathogens, especially *Pyricularia* spp. (PhD)	University of Queensland	PBCRC
Broadacre crops – Multiple		
Application technology – reducing risk and improving efficacy when applying agricultural chemicals for farmers and horticulturalists	Northern Territory Farmers Association Incorporated	National Landcare Programme
The more the merrier – investigating copy number variation in Brassicas	University of Western Australia	ARC
Forestry		
Asian gypsy moth – national surveillance program	QDAF	QDAF
Ethanedinitrile – a potential replacement for the fumigant methyl bromide for eradication of pests in *Pinus radiata* export logs	Stakeholders in Methyl Bromide Reduction Incorporated	PBCRC
Evaluating the costs and benefits of managing new and existing biosecurity threats to Australia's plantation industry	University of the Sunshine Coast	Forest and Wood Products Australia, University of the Sunshine Coast, NSW DPI, Forestry Tasmania
Genome-wide determination of *Puccinia psidii* sensu lato rust resistance in eucalypts	University of Melbourne	ARC

Project title	Organisation undertaking the research	Funding source/ body
Horticulture – Fruit		
A generic approach to improving spray coverage	University of Queensland	Wine Australia
Adapting integrated crop management technologies to commercial citrus enterprises in Bhutan and Australia	NSW DPI	ACIAR
Agrichemical residue monitoring program for Australian citrus exports – stage 2	Citrus Australia Limited	Hort Innovation
An analysis of fruitspotting in bug activity in avocado crops from fruit-set to harvest	University of Queensland	Hort Innovation
An inventory of Colletotrichum species infecting tropical and subtropical fruit crops in Australia based on molecular phylogenetics	QDAF	Department of Environment and Energy
Banana plant protection program	University of Queensland, QDAF	Hort Innovation
Banana plant protection program (subprogram 1 – resistant varieties)	NT DPIR	Hort Innovation, QDAF
Better understanding epidemiology of Panama disease of banana	QDAF	QDAF, Hort Innovation
Biological control of yellow scale insect *Aonidiella orientalis* (Newstead) (PhD)	Murdoch University	Government of Iraq
Biosecurity TR4 extension services	Australian Banana Growers' Council	DAWR
Breeding tools for enhanced fruit quality for the Australian papaya industry	Griffith University	Hort Innovation
Building a resilient mango industry in Cambodia and Australia through improved production and supply chain practices	NSW DPI	ACIAR
Continuation of pilot systems to validate pest free place of production for Queensland fruit fly in the Yarra Valley	DEDJTR	Hort Innovation
Data packages to support market access for additional citrus varieties to Japan	SARDI	Hort Innovation
Desk audit of the fruit fly body of knowledge – identifying the gaps and strengths of past fruit fly research	NSW DPI	PBCRC
Detection and prevention of scab disease in Asian and European pears (PhD)	La Trobe University	PBCRC, La Trobe University

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Horticulture – Fruit (continued)		
Developing virus molecular diagnostics for post entry quarantine and certification of strawberry runners	DEDJTR	Hort Innovation
Diagnosis and control of *Botrytis cinerea* on postharvest blueberry fruit (PhD)	Murdoch University	Government of Iraq
Disinfestation of blueberries against Mediterranean fruit fly for market access to Japan	Kalang Consultancy Services Pty Limited, Murdoch University	Hort Innovation
Effect of pre-harvest fungicides on post-harvest decay in papaya	QDAF	Hort Innovation
Enhancing Australia's capability and capacity to diagnose *Fusarium oxysporum* f. sp. *cubense* tropical race 4	NSW DPI	PBCRC
Evaluating options for further development of mango value chains in Java and Bali	QDAF	ACIAR
Evaluation of citrus varieties	NSW DPI	Collaborative research
Exploring alternatives for managing Phytophthora root rot in avocado	University of Queensland	Hort Innovation
Fusarium oxysporum f.sp. *cubense* on banana	University of Queensland	Hort Innovation, Australian Banana Growers' Council, PBCRC, University of Queensland
Fusarium wilt tropical race 4 – biosecurity and sustainable solutions	QDAF	Hort Innovation
Fusarium wilt tropical race 4 research program	University of Queensland	QDAF, Hort Innovation
Host-pathogen interactions in the Venturia-Pyrus pathosystem	La Trobe University	PFRNZ
Integrated crop management strategies for papaya in the Phillipines and Australia	QDAF	ACIAR
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 pest and disease management – PIPs II	DEDJTR	Hort Innovation, DEDJTR
Joint Florida and Australia citrus black spot initiative	University of Queensland	Hort Innovation
Low dose methyl bromide against fruit flies to improve market access for summerfruit	QDAF	Hort Innovation
Mechanically transmitted DNA virus control of Botrytis	PFRNZ	PBCRC
Mid-term review of banana bunchy top program	Murdoch University	Hort Innovation
Maximum residue limits risk analyses and risk management options for major citrus export markets	AKC Consulting Pty Ltd	Hort Innovation
Maximum residue limits risk analyses for major export markets of the pome fruit industry	AKC Consulting Pty Ltd	Hort Innovation
Multi-scale monitoring tools for managing Australian tree crops – industry meets innovation	QDAF	Hort Innovation
National banana bunchy top virus program – phase 3, NSW	The Trustee for The Lagom Trading Trust	Hort Innovation
National banana bunchy top virus program – phase 3, QLD	Barry Sullivan	Hort Innovation
National banana freckle eradication program	NT DPIR	Australian Government
National citrus biosecurity surveillance strategy	PHA, Citrus Australia	DAWR
National citrus postharvest science program	SARDI	Hort Innovation
New fruit fly systems for mangoes and market access	NT DPIR	Hort Innovation
Panama disease – longitudinal analysis of community wellbeing	CSIRO	CSIRO
Pineapple model and *Phytophthora cinnamomi*	Deakin University	Deakin University
Precise recognition for automated harvesting and grading of strawberries	Griffith University	ARC
Protecting Australia's citrus industry from biosecurity threats	PHA	Hort Innovation, Citrus Australia Ltd

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Protecting Australian citrus germplasm through improved diagnostic tools	NSW DPI	Hort Innovation
Protecting Australia's citrus genetic material	NSW DPI	Collaborative research
Review of the biosecurity plan for the apple and pear industry	PHA	Hort Innovation
Scoping herbicide impacts on banana production and soil health	QDAF	Hort Innovation
Testing the potential of incompatible insect technique for a haplodiploid insect species, Kelly's citrus thrips, a significant citrus pest originating from Australia and invasive in New Zealand	Western Sydney University	
The influence of soil physicochemical conditions on growth and infectivity of the banana disease-causing fungus *Fusarium oxysporum* f. sp. *cubense*	James Cook University	Hort Innovation, QDAF
The leaf litter cycle of citrus black spot and improvements to current management practices	University of Queensland	University of Florida
Treatment for mites on lychee fruit after irradiation for improved market access	QDAF	Hort Innovation
Horticulture – Nuts		
Biology, species, and genetic diversity of macadamia lace bugs (Heteroptera, Tingidae, *Ulonemia* spp.)	University of New South Wales	Australian Macadamia Society, Hort Innovation
Communication and adoption program for the Australian chestnut industry	Chestnuts Australia Inc	Hort Innovation, Chestnuts Australia Inc
Control of Carpophilus beetle in almonds using attract-and-kill system	DEDJTR	Hort Innovation, DEDJTR
Disease management in the macadamia industry	University of Queensland	Hort Innovation
Generation of residue and efficacy data for pesticide minor-use permit applications in chestnuts in 2016	Chestnuts Australia Inc	Hort Innovation, Chestnuts Australia Inc
Technology transfer to pistachio growers utilising regional grower groups	Pistachio Growers' Association Inc	Hort Innovation, Pistachio Growers' Association Inc
Horticulture – Vegetables		
Alternaria on tomato	University of Queensland	University of Queensland
Classification of the onion rust complex and development of rapid diagnostic assays	University of Queensland	Hort Innovation
Detection and management of bacterial diseases in Australian Allium crops	QDAF	Hort Innovation
Developing improved crop protection options in support of intensification of sweet potato production in Papua New Guinea	Charles Sturt University, University of Southern Queensland	ACIAR
Development of an onion white root rot forecasting model for Tasmania	University of Tasmania	Hort Innovation
Disinfestation of tomatoes against Mediterranean fruit fly for interstate market access	DAFWA	Hort Innovation
Evaluate volatiles from the infected insects as indicators for diagnostic insect health (PhD)	Murdoch University	Government of Iraq
Evaluation of natural product extracts for control of vegetable pests (PhD)	Murdoch University	Government of Iraq
Fusarium oxysporum on ginger	University of Queensland	RIRDC, QDAF
Identification and taxonomy of economic crop diseases and their management using biological approaches	University of Queensland	Rural Development Administration (Republic of Korea)
Improved detection and identification of xanthomonads affecting vegetable crops (PhD)	La Trobe University	PBCRC
Improved production from well managed native grassland management in the mid north of South Australia	Mid North Grasslands Working Group	National Landcare Programme
Improving productivity of fruiting solanaceous crops through area wide management of insect vectored viruses in Bowen	QDAF	Hort Innovation, Bowen Gumlu Growers' Association
Innovating new virus diagnostics and planting bed management in the Australian sweet potato industry	Australian Sweetpotato Growers' Association, QDAF	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

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Horticulture – Vegetables (continued)		
Integrated crop management to enhance vegetable profitability and food security	NSW DPI, QDAF	ACIAR
International acceptance of Australian solanaceous and cucurbit seed tests	PBCRC	PBCRC
Management and detection of bacterial leaf spot in capsicum and chilli crops	QDAF	Hort Innovation
Managing soil-borne diseases of onions	SARDI	Hort Innovation
Minor use permits for the onion industry	Hort Innovation	Onions Australia
New end-point treatment solutions to control fruit fly	QDAF, NSW DPI	Hort Innovation
New end-point treatment solutions to control fruit fly I	NSW DPI	Hort Innovation
New end-point treatment solutions to control fruit fly II	QDAF	Hort Innovation
Perceptions towards biosecurity threats across Vietnamese farming communities in Australia (PhD)	Charles Darwin University	PBCRC
Plant viral messenger RNA project – nexgen plants (Syngenta)	University of Queensland	UniQuest
Potato virus resistance discovery project	University of Queensland	UniQuest
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
Spongospora infection of potato roots – ecology epidemiology and control	University Of Tasmania	Hort Innovation
Suppressing repression of plant defence through viral micro RNA	University of Queensland	UniQuest
Sustainable productivity improvements in Allium and solanaceous vegetable crops in Indonesia and sub-tropical Australia	QDAF	ACIAR
Tomato potato psyllid and Liberibacter ecology	PFRNZ	PBCRC
Vegetable and potato biosecurity officer program	PHA	AUSVEG
Viruses of national importance to the vegetable industry	QDAF	Hort Innovation

Project title	Organisation undertaking the research	Funding source/ body
Horticulture – Other		
A trial of Vapormate® fumigant for the disinfestation of Australian wildflowers	Cedar Hill Flowers	DAWR
Adaptive area-wide management of Queensland fruit fly using SIT – guidelines for efficient and effective pest suppression and stakeholder adoption	CSIRO	Hort Innovation, RDCs, CSIRO, DAWR
Biology and control of the systemic form of poppy downy mildew	University of Tasmania	DPIPWE, poppy industry
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
Cold disinfestation verification trials for table grape access to Japan	DAFWA	Hort Innovation
Coonawarra rootstock trial	Vinehealth Australia, Treasury Wine Estates, Coonawarra Vignerons	Vinehealth Australia, Treasury Wine Estates, Coonawarra Vignerons
Determining pathogenicity and methyl bromide control of ginger nematodes	QDAF	RIRDC
Developing a threat-specific contingency plan for the exotic pest angular leaf scorch	SARDI, Cornell University USA	Wine Australia
Development of a risk management system for systemic downy mildew of poppy	University of Tasmania	ARC
Diet medicated RNAi sterile insect technology	CSIRO	Hort Innovation
Disease and pest testing technology	SARDI	SA Government
Effect of sulphur dioxide and cold on survival of insects during storage of table grapes	Agriculture Victoria Services Pty Ltd	Hort Innovation
Effective management of summer root rot of parsley	NSW DPI	Hort Innovation
Elsinoe leaf spot of tea tree	NSW DPI	RIRDC
Epidemiology, impact and management of myrtle rust in lemon myrtle plantations (PhD)	University of Queensland	PBCRC
Evaluating and demonstrating new resistant varieties for warm irrigated regions	CSIRO	Wine Australia
Genetic transformation of grapevine to test significant abiotic stress and pest resistance genes	CSIRO	Wine Australia

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Grapes e-surveillance project	DAFWA	Royalties for Regions, DAFWA
Identification and marker-assisted selection of genes for reducing the susceptibility of new winegrape cultivars to fungal pathogens	CSIRO	Wine Australia
Improved management strategies for cocoa in Papua New Guinea	University of Sydney	ACIAR
Improved tissue culture production of ginger clean planting material	QDAF	RIRDC
Improving soil health to suppress soilborne diseases of ginger	QDAF	RIRDC
Improving the sustainability of cocoa production in eastern Indonesia through integrated pest, disease and soil management in an effective extension and policy environment	La Trobe University	ACIAR, La Trobe University
New rootstocks for Australian conditions	CSIRO	Australian Grape and Wine Authority
Objective measures for powdery mildew	University of Adelaide	Australian Grape and Wine Authority
On farm DNA surveillance for grape growers	Vinehealth Australia	PBCRC
Pests and diseases of truffles and their tree hosts in Australia	Australian National University	RIRDC
Practical management of grapevine trunk diseases	SARDI	Australian Grape and Wine Authority
Project boundary rider	Vinehealth Australia	Vinehealth Australia, PIRSA
Requirements for the establishment and maintenance of Phylloxera exclusion zones	Retallack Viticulture	DAWR
Risks and management of exotic and endemic Phylloxera	DEDJTR	Australian Grape and Wine Authority
Sampling strategies for Phylloxera area freedom	Vinehealth Australia, SARDI	PBCRC
Sampling strategies for sensitive, accurate and cost effective detections of Phylloxera for quantifying area freedom status	Vinehealth Australia	Wine Australia, PBCRC
Scoping study – development of a biosecurity IT platform for the wine industry	Vinehealth Australia	Vinehealth Australia
Surveillance of South Australia for Phylloxera	Vinehealth Australia	Vinehealth Australia
Sustaining vineyards through practical management of grapevine trunk diseases	SARDI	New Zealand Winegrowers
Technical support, extension and minor use development for the ginger industry	Australian Ginger Industry Association	RIRDC
Towards elite mildew resistant selections suitable for industry use	CSIRO	Wine Australia
Understanding fungicide resistance in powdery and downy mildew	SARDI	Wine Australia
Horticulture – Multiple		
Blends versus pure chemicals – understanding the mechanisms of host fruit location by Queensland fruit fly (Masters)	Queensland University of Technology	PBCRC
Building resilience in NT horticultural row crops through integrated pest management	Northern Territory Farmers Association Incorporated	National Landcare Programme
Cold storage of Queensland fruit fly for mass-rearing programs (PhD)	Macquarie University	Hort Innovation
Comparative investigation of Bactrocera fruit fly pheromones	Macquarie University	Hort Innovation
Comparisons of new sexing strains of Queensland fruit fly	Macquarie University	International Atomic Energy Agency Co-operative Research Program
Compliance and risk based sampling for horticulture exports	University of Melbourne	University of Melbourne, DAWR
Creating a novel lure and kill device for Queensland fruit fly	Queensland University of Technology, QDAF	PBCRC
Decision intelligence determining pest natal origin	NSW DPI, Bio-Protection Research Centre New Zealand	PBCRC

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Horticulture – Multiple (continued)		
Dynamics of the Queensland fruit fly microbiome under mass-rearing (PhD)	Macquarie University	Hort Innovation
Engaging communities in biosecurity strategies (PhD)	University of Western Australia	PBCRC
Essential market access data packages	QDAF	Hort Innovation
Establishment of areas of low pest prevalence of Mediterranean fruit fly for market access	DAFWA	Hort Innovation
Establishment of systems to 'validate pest free place of production' for Queensland fruit fly in the Yarra Valley	DEDJTR	Hort Innovation
Establishment of the Queensland fruit fly SITplus facility in southern Australia	SARDI	Hort Innovation
Evaluation of mating, dispersion and migration between different treated fruit flies by using stable isotope technology (PhD)	Murdoch University	Government of Iraq
Fruit fly management incorporating SPLAT technology	NSW DPI	Hort Innovation
Genetic consequences of domestication in the Queensland fruit fly	Macquarie University	Hort Innovation
Improved larval diets for mass rearing of Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Improved post-harvest market access treatment for horticultural commodities	PFRNZ, QDAF, NSW DPI	PBCRC
Improving efficacy of MAT to enhance area-wide management of Queensland fruit fly	Macquarie University	Hort Innovation
Improving environmental health by encouraging entomovectoring in horticultural crops to reduce spray drift and fungicide use	University of Adelaide	DAWR
Industrial transformation training centre – 'Centre for fruit fly biosecurity innovation'	Macquarie University	ARC
Investigation into deployment, dispersal and transformation of fruit fly lures (PhD)	Macquarie University	Hort Innovation
Irradiation for mites and thrips	NSW DPI	NZ MPI
Larval diets for high-productivity mass-rearing of Queensland fruit fly for sterile insect technique	Macquarie University	Hort Innovation
Male only sterile Queensland fruit fly, SITplus	SARDI	Hort Innovation
Mediterranean fruit fly eradication from Carnarvon using area-wide management and sterile insect technique	DAFWA	Hort Innovation
Mediterranean fruit fly, *Ceratitis capitata*, responses to lethal stressors (PhD)	Murdoch University	Government of Iraq
Methoprene and dietary yeast as pre-release supplements for Queensland fruit fly sterile insect technique (PhD)	Macquarie University	Hort Innovation
Molecular basis of response to sub-lethal stresses	Murdoch University	PBCRC
Mypolonga fruit fly monitoring – market access program	RDA Murraylands and Riverland Inc	Hort Innovation
National centre for post-harvest disinfestation research on Mediterranean fruit fly	Murdoch University	RIRDC, Hort Innovation
National Fruit Fly Council	PHA	Hort Innovation
National fruit fly research, development and extension plan	PBCRC	PBCRC
National fruit fly strategy implementation advisory group	PHA	Hort Innovation
New and improved fruit fly lures for border security and management	Macquarie University	Hort Innovation
New in-field treatment solutions to control fruit fly	Macquarie University	Hort Innovation
New in-field treatment solutions to control fruit fly I	QDAF	Hort Innovation
New in-field treatment solutions to control fruit fly II	Applied Horticultural Research Pty Ltd	Hort Innovation
Next generation national fruit fly diagnostics and handbook (version 3)	PHA, Queensland University of Technology, QDAF, DAFWA	PBCRC
Nutritional immunology of Queensland fruit flies	Macquarie University	Hort Innovation
Olfactory switch as a mechanisms of Queensland fruit fly sexual inhibition	Macquarie University	Macquarie University
Pheromone component of a multi-target approach to fruitspotting bug management	NSW DPI, QDAF	Hort Innovation
Pheromones as potential fruit fly lures (PhD)	Macquarie University	Macquarie University

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Piloting new techniques to control and eradicate Mediterranean fruit fly	DAFWA	Royalties for Regions, DAFWA
Plant biosecurity diagnostic and surveillance web-based bioinformatics toolkit	Murdoch University	PBCRC
Potential impacts of climate change on habitat suitability for the Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Predator-prey interactions in Queensland fruit flies	Macquarie University	Hort Innovation
Preparedness for exotic fruit flies	PHA	DAWR
Probiotic diets to increase Queensland fruit fly male performance as part of the sterile insect technique (PhD)	Western Sydney University, NSW DPI	PBCRC
Probiotics for enhancing fruit fly sterile insect technique	NSW DPI, Western Sydney University	PBCRC
Queensland fruit fly behaviour (PhD)	Macquarie University	Hort Innovation
Raspberry ketone as a pre-release supplement for Queensland fruit fly sterile insect technology (PhD)	Macquarie University	Hort Innovation
Research and development of integrated crop management for mango production in the southern Philippines and Australia	QDAF	ACIAR
Semiochemical-mediated enhancement of sterile male Queensland fruit fly	NSW DPI	Universities
SITplus – area-wide integrated pest management using the sterile insect technique to control the Queensland fruit fly	NSW DPI	Hort Innovation
SITplus – developing and optimising production of a male-only, temperature-sensitive-lethal, strain of Queensland fruit fly	SARDI	Hort Innovation
SITplus – dietary sterilisation of male Queensland fruit fly	CSIRO	Hort Innovation
SITplus – improved population management system for Queensland fruit fly	PFRNZ	Hort Innovation
SITplus – larval diets for high-productivity mass-rearing of Queensland fruit fly	Macquarie University	Hort Innovation
SITplus – Port Augusta Queensland fruit fly sterile insect technique factory pilot operation	PIRSA	Hort Innovation
SITplus – raising Queensland fruit fly sterile insect technology to world standard	Macquarie University	Hort Innovation
Social and institutional aspects of grower participation in area-wide fruit fly management programs in Australian horticultural industries (PhD)	Charles Darwin University	PBCRC
SPLAT cuelure based management of Queensland fruit fly	SARDI	Hort Innovation
Surveillance and management of horticultural crop diseases	NSW DPI	Applied Horticultural Technology Ltd
Synthesis and analysis of zingerone analogues as fruit fly attractants (PhD)	Macquarie University	Hort Innovation
Multiple crops		
A scientific trial to measure the in-paddock and economic benefits of biofumigation on soil health, and on disease pest and weed levels on a range of annual crops under Tasmanian conditions	University of Tasmania	DPIPWE
Advancing collaborative knowledge systems for plant biosecurity surveillance	CSIRO, Charles Darwin University	PBCRC
Agriculture weed surveillance in the south west to protect industry profitability	DAFWA	Royalties for regions, DAFWA
Air inversion modelling to manage spray drift	Micrometeorlogical Research and Educational Services	GRDC
Anticipating, combating and exploiting the evolution of pesticide resistance in Australian agricultural pests and disease vectors	Australian National University	ARC
Arabidopsis and *Plasmodiophora brassicae*	Deakin University	DEDJTR
Assessing the progress against the National Plant Biosecurity Surveillance Strategy	PBCRC	DAWR
Autonomous fruit fly traps	CSIRO	CSIRO
Big data analytics for biosecurity	CSIRO	CSIRO
Biopesticide use and insect resistance in Australian agriculture	University of Adelaide	ARC
Biosecurity planning	PHA	DAWR

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Multiple crops (continued)		
Biosecurity risk management in Torres Strait and the Northern Peninsula Area	QDAF	SBPI
Biotic mortality factors of Australian fruit fly across different regions	Western Sydney University	ARC
Candidatus Liberibacter solanacearum on Norfolk Island	QDAF	PBCRC
Centre for fruit fly biosecurity innovation	Macquarie University, Western Sydney University	ARC
Citizen science to surveillance	CSIRO	PBCRC
Collaborative planning and shared decision making amongst stakeholders	QDAF	PBCRC
Co-management of the greater Sunraysia pest free area for market access	DEDJTR	Hort Innovation
Commercial development and evaluation of a machine vision-based weed spot sprayer	University of Southern Queensland	CRDC, University of Southern Queensland, SRA, Hort Innovation
Comparative toxicology of a fumigant and gasotransmitters – testing a new model of fumigant toxicity in *Caenorhabditis elegans*	University of Queensland	ARC
Critical analyses of existing surveillance strategies in horticulture industries in Australia based on natural dispersion pathways	DEDJTR	PBCRC
CSIRO innovative technologies project – remote sensing for presence or absence	CSIRO	DAWR
Curtailing exotic fungal spore incursions into Australia (PhD)	University of Western Australia	PBCRC
Deciphering the role of microRNAs during pathogen attack – new concepts for disease resistance in plants	University of Queensland	ARC
Decision making for eradication and quarantine zones	Queensland University of Technology, QDAF, NSW DPI	PBCRC
Delivery of an integrated internet-based bioinformatics toolkit for plant biosecurity diagnosis and surveillance of viruses and viroids	Murdoch University	PBCRC
Deployment of validated genome-informed bacterial diagnostics	NSW DPI	PBCRC
Design and evaluation of targeted biosecurity surveillance systems	University of Western Australia, University of Adelaide	PBCRC
Determining the relative sensitivity and contribution of criteria in prioritising plant pests along the biosecurity continuum	Centre of Excellence for Biosecurity Risk Analysis	University of Melbourne, DAWR
Determining the value of surveillance in biosecurity risk management	Deloitte Access Economics	DAWR
Develop diagnostic keys to genera of Australian Cerambycidae and subfamily Prioninae	CSIRO	DAWR
Developing a response strategy for exotic stink bugs	PHA	DAWR
Developing an alternative herbicide management strategy to replace photosystem II herbicides in the Wet Tropics area	SRA, James Cook University	SRA, QDAF
Development of a remote pest identification system in Indonesia	PBCRC	PBCRC
Development of new tools and strategies for integrated pest management (biopesticides and semiochemicals)	NSW DPI	CRDC, NSW DPI
Diagnosis of emerging pathogens	NSW DPI	Private industry
Diagnostic development – Cerambycidae and Lamiinae	CSIRO	DAWR
Discovering the pathways and mechanisms underlying bio-insecticide control of the global migratory pest diamondback moth, *Plutella xylostella*	University of Adelaide	ARC
DNA barcoding Echium weed	NSW DPI	ARC
Do informal networks represent a biosecurity risk? (PhD)	Murdoch University	PBCRC
Ecological impact of myrtle rust (*Puccinia psidii*) in native and managed ecosystems (PhD)	NSW DPI, Macquarie University	PBCRC, Department of Environment and Energy
Embedding GERDA into the biosecurity landscape – uptake and legacy	PFRNZ	PBCRC
Emerging viruses in agriculture – development of a network for biosecurity and biosurveillance to support food security	La Trobe University, DEDJTR	IRU–Malaysian University Research Network

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Emerging weeds (seed-bank biology of emerging weeds)	University of Adelaide	GRDC
Enabling improved plant biosecurity practices in Cambodia, Laos and Thailand	PBCRC	ACIAR
Engagement in resilience in indigenous communities	PFRNZ	PBCRC
Enhanced surveillance strategies in horticultural industries based on knowledge of natural dispersal pathways – phase 2	DEDJTR	PBCRC, DAWR, DEDJTR, PHA
Enhancing capacity to identify and respond to high priority exotic pests	PHA	DAWR
Evolution of multiple herbicide resistance is widespread in *Lolium rigidum* in Australia	University of Western Australia	ARC
Evolutionary aerial robotics	CSIRO	CSIRO
Extending biosecurity preparedness and surveillance strategies and developing a chemical supply framework for pest incursions	PHA	PBCRC
Extending chemical usefulness 'spray application technologies project'	PHA	GRDC
'Farming the lower blackwood' field day	Lower Blackwood Catchment Land Conservation District Committee	National Landcare Programme
Front line field plant pest diagnostic service for horticultural and broadacre cropping industries	QDAF	QDAF
Future climates northern tablelands biosecurity	CSIRO	NSW DPI
Genes of biosecurity importance	CSIRO	CSIRO
Global threat to agriculture from invasion	CSIRO	CSIRO
Grand challenge designing aphid	CSIRO	University of Melbourne
Horticulture funding for the PBCRC	PBCRC	Hort Innovation
Identification of immune receptor and signalling proteins from plants	Australian National University	ARC
Identification of the molecular targets on filamentous fungi that lead to specific recognition and killing by an antifungal plant defensin	La Trobe University	ARC
Identifying the biochemical and molecular bases of 2,4D herbicide resistance in the economically important weed *Raphanus raphanistrum* (wild radish)	University of Western Australia	ARC
Implementation of a multi target surveillance system	Murdoch University	Chevron
Import clearance performance management	Centre of Excellence for Biosecurity Risk Analysis	University of Melbourne, DAWR
Improved management options for cucumber green mottle mosaic virus	NT DPIR	Hort Innovation
Innovative solutions to controlling agricultural weeds	South Gippsland Landcare Network	National Landcare Programme
Intelligence gathering and analysis	CEBRA	University of Melbourne, DAWR
Intelligence tools for regulated goods traded via e-commerce	CEBRA	University of Melbourne, DAWR
Intelligent image retrieval from distorted and partial queries for rapid mobile identification of pests threatening food and the environment	Griffith University	ARC
Interactions of entomopathogens and Australian fruit fly	Western Sydney University	ARC
Knowledge systems for surveillance	CSIRO	PBCRC
Making Green Guard® greener – enhancing the efficacy of a biopesticide	University of Sydney	ARC
Manipulation of regulatory microRNAs to supress insecticide resistance in the diamondback moth	University of Queensland	Hort Innovation
Market-based incentives for biosecurity compliance	Centre of Excellence for Biosecurity Risk Analysis	University of Melbourne, DAWR
Model imaging collaboration with Australian National University	PBCRC	PBCRC
Molecular mechanism of action of plant immune receptors	University of Queensland	ARC
Myrtle rust genetics	University of Sydney	

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Multiple (continued)		
Nanoassembling agrochemicals – a new paradigm in delivery for enviro-friendly crop treatment	Monash University	ARC
National browsing ant eradication program	NT DPIR	Australian Government
National diagnostic capability assessment	CSIRO	SBQI
National plant biosecurity RD&E strategy implementation committee	PHA, DAWR, QDAF, DAFWA, DEDJTR, NT DPIR, DPIPWE, PIRSA, NSW DPI, PBCRC, CSIRO, GRDC, Wine Australia, Hort Innovation, Council of Rural RDCs	Hort Innovation, DEDJTR, CRDC, Dairy Australia, GRDC, MLA, Wine Australia, SRA, RIRDC, FWPA
National surveillance system for weeds and plant pests – virtual coordination centre (AUSPest*Check*)	PHA	DAWR
National weed biological control project	DEDJTR	Australian Government Department of the Environment and Energy, Meat and Livestock Australia, DEDJTR, NSW DPI, CSIRO, QDAF
National working party on pesticide applications	PHA	CropLife Australia, GRDC, Hort Innovation, Wine Australia, CRDC, SRA
New approaches for diagnosing bacterial pathovars	Kansas State University	PBCRC, DEDJTR
New tools for insect surveillance and eradication	PFRNZ	PBCRC
New Zealand psyllids (PhD)	Lincoln University, University of Adelaide	PBCRC
Novel community engagement in plant biosecurity	NSW DPI	PBCRC
Novel insecticide resistance in green peach aphid	CSIRO	Hort Innovation, GRDC
Novel insecticides and synergists from endemic and exotic flora	Western Sydney University	CRDC, Western Sydney University
Novel insecticides and synergists from endemic and exotic flora (PhD)	Western Sydney University	CRDC
Optimising surveillance protocols using unmanned aerial systems	Kansas State University, QDAF	PBCRC
Pantry Blitz, surveillance and reporting of pantry pests via citizen science	DAFWA	QDAF, DAFWA
Pathway analysis of the risk of introduction of exotic tramp ants to inform surveillance and mitigate risks	CSIRO	DAWR
Pathways and risk assessment framework for high impact species (PRAFHIS)	CSIRO, QDAF, PFRNZ, DAFWA, Lincoln University	PBCRC
PBCRC rating system for myrtle rust	NSW DPI	PBCRC
Peptide toxins from animal venoms specifically targeting voltage-gated sodium channels as novel analgesics and pesticides	Australian National University	National Health and Medical Research Council
Pest and Disease Image Library	PBCRC	PBCRC
Pestpoint	PBCRC	PBCRC
Phytophthora cinnamomi and native vegetation	Deakin University	Australian Government Department of the Environment and Energy, Parks Victoria
Plant and associated microbiome responses to indoleamines and potential applications in agriculture	La Trobe University	La Trobe University
Plant biosecurity surveillance symposium	PBCRC	DAWR
Provision of plant biosecurity capacity development services for the sub-Saharan Africa	PBCRC	ACIAR
Pseudomonas biocontrol to protect Australia crops	Macquarie University	ARC
Psyllid microflora – implications for Liberibacter disease surveillance and pest control (PhD)	La Trobe University	PBCRC
Real-time plant discrimination and weed detection platform	Edith Cowan University	ARC
Reduced herbicide usage through application technology	Edith Cowan University	GRDC
Reliable identification of downy mildews	University of Queensland	DAWR

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Remote sensing for biosecurity surveillance	CSIRO	CSIRO
Risk assessment for the large African hive beetle	University of Sydney	RIRDC
Risk maps for optimising biosecurity surveillance	Centre of Excellence for Biosecurity Risk Analysis	University of Melbourne, DAWR, NZ MPI
Roadmaps to support technology driven innovation in biosecurity operations	CSIRO	DAWR
Semiochemical management for occasional pests of cotton and grains	Universtity of New England	CRDC
Social attitudes and understanding of plant health surveillance	Instinct and Reason	DAWR
Streamlining plant pest contingency plans	DEDJTR	SBPI
Strengthening integrated crop management research in the Pacific islands in support of sustainable intensification of high-value crop production	University of Queensland	ACIAR
Structural basis of host-pathogen interactions	La Trobe University	ARC
Systematics, biodiversity and host associations of Australian psyllids – implications for conservation and biosecurity	University of Adelaide	University of Adelaide
The effects of damage and repair of fungal DNA on animal and plant diseases	University of Melbourne	ARC
The role of reproductive parasites in the biology of invasive pest thrips (PhD)	Western Sydney University	Western Sydney University
TraitCapture – genomic modelling for plant phenomics under environmental stress	Australian National University	ARC
Tramp ants – national approach to surveillance and management of risk	PBCRC	DAWR
Transport risk pathways for emerging invasive species	University of Adelaide	ARC
Understanding the biochemical and molecular mechanisms of glyphosate and glufosinate resistance in *Elausine indica*	University of Western Australia	ARC
Unique epigenetic states in plant stem cell niches for safeguarding genome integrity	University of Western Australia	ARC
Use of citizen science surveillance	CSIRO	PBCRC
What makes some genotypes invasive?	CSIRO	CSIRO
Wind spread of plant viral pathogens into northern Australia (PhD)	University of Western Australia, DAFWA, CSIRO	PBCRC
With the benefit of hindsight – a bioeconomic analysis of past pest incursions	University of Western Australia	PBCRC
Yellow crazy ant eradication in and next to the Wet Tropics World Heritage Area	James Cook University	Wet Tropics Management Authority
Natural environment		
A lucid key to the genera of Australian psyllids and lerp insects	University of Adelaide	Department of Environment and Energy
A predictive framework for invaded communities	Monash University	ARC
Application of advanced molecular tools for identification of non indigenous invertebrates	Murdoch University	Chevron
Assessing pollination services of honey bees in native ecosystems and threats posed by parasites	James Cook University	ARC
Biocontrol solutions for sustainable management of weed impacts to agriculture	CSIRO, DEDJTR, NSW DPI, QDAF	Australian Government and >20 partners
Biological control of wandering Tradescantia – phase 2	CSIRO	Department of Environment and Energy
Box gum woodland, upper Maranoa catchment – managing woody regrowth and the impacts of buffel grass	Mitchell and District Landcare Association Incorporated	National Landcare Programme
Changes in the ecology and control of introduced non-native plants following pest herbivore eradication in the sub-Antarctic (*Stellaria media*)	University of New England	Australian Antarctic Division
Development of a bioherbicide for control of prickly acacia	University of Queensland, BioHerbicides Australia	Meat and Livestock Australia, BioHerbicides Australia
Development of a protocol to enable in-transit fumigation with ethyl formate	Murdoch University	Chevron
Development of Davren™ technology for control of red imported fire ant	Murdoch University, QDAF	PBCRC

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Natural environment (continued)		
Development of surveillance and pre-border data management system	Murdoch University	Chevron
Distribution of *Euphorbia paralias*	University of Wollongong	University of Wollongong
Ecology and control methods – managing the invasive weed *Poa annua* in the Australian sub-Antarctic	University of New England	Australian Antarctic Division
Effectiveness of biocontrol agents for bitou bush	University of Wollongong	University of Wollongong
Effects of elevated atmospheric CO_2 on insect herbivory and its regulation in a *Eucalyptus tereticornis* woodland	Western Sydney University	Australian Postgraduate Award
Empowering farmers to identify and control buffel grass to protect production values in native pastures of the southern Flinders Ranges	Greening Australia Limited	National Landcare Programme
Eradication of *Phytophthora cinnamomi* from infested haul roads and rehabilitated bauxite mine sites in the *Eucalyptus marginata* forest	Murdoch University	ARC
Evolution and function of terpenes in Eucalyptus	Australian National University	ARC
Factors regulating population dynamics of eucalypt psyllids in Australia (PhD)	Western Sydney University	Australian Postgraduate Award
Genetic characteristics of buffel grass (*Cenchrus ciliaris*) using next generation sequencing to support eradication strategies	University of Queensland	PBCRC
Improved awareness and best practices to deal with fodder weeds across droughted Queensland	AgForce Queensland Industrial Union of Employers	National Landcare Programme
Invasion and impact – predicting the causes and consequences of plant invasions	University of Canberra	ARC
Linking flow, nutrients, seagrass and fish – an integrated approach to estuary management	Monash University	ARC
Managing myrtle rust and its impact in Australia	QDAF, NSW DPI	PBCRC
Morphological and molecular variation in Gynaikothrips on fig trees in Australia, and generic revisions of Lissothrips and Strepterothrips	QDAF	ABRS
Multi-scale seed dispersal models for improved regional weed management	Monash University	ARC
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 and South Australian Murray Darling Basin Natural Resources Management Boards
Promoting conservation and future regeneration of Wollemi pine through manipulation of microbial communities (PhD)	Western Sydney University	Australian Postgraduate Award
Psyllid resistant Leucaena to market	University of Queensland	Meat and Livestock Australia
Role of mycorrhizae in invasion	University of Wollongong	University of Wollongong
Sagittaria – phase 2	DEDJTR	Goulburn Murray Water Corporation, Goulburn Broken CMA, Coleambally Irrigation Cooperative, Murrumbidgee Irrigiation, Murray Irrigation
To determine the mechanism for dieback in the invasive tree *Parkinsonia aculeata*	Western Sydney University	Australian Postgraduate Award
Understanding the drivers of aquatic weed success	Macquarie University	Macquarie University
Understanding the mechanisms underpinning range expansion in exotic plant species	Macquarie University	Macquarie University
Weed control for soil handling practices associated with native ecosystem rehabilitation	Charles Darwin University	NT DPIR

Table 56. Plant biosecurity research projects (continued)

Project title	Organisation undertaking the research	Funding source/ body
Nursery crops		
Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry	QDAF	Hort Innovation
National nursery industry biosecurity program	NGIA	Hort Innovation
Understanding the evolution of fungicide resistance for durable control of fungal pathogens in pyrethrum	University Of Tasmania	ARC
Other crops		
A risk-return prioritisation tool for global trade inspections	CSIRO	PBCRC
A test for Africanisation in imported honey bee semen	University of Sydney	RIRDC
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
Development of a biosecurity plan for the Australian coffee Industry	PHA	RIRDC
Development of a biosecurity plan for the Australian truffle industry	PHA	RIRDC
Development of a pilot mushroom farm disease monitoring scheme	Australian Mushroom Growers' Association Ltd	Hort Innovation
Get tough, get toxic or get a bodyguard – how root herbivores shape grass defences	Western Sydney University	ARC
Review and development of the olive industry biosecurity plan	PHA	Hort Innovation
Improved disinfestation protocols for the Torres Strait – QANTAS airways	QANTAS, DAWR	QANTAS, DAWR
Solutions and understanding African whitefly	CSIRO	Australian Government Department of Education and Training
Systematic gene silencing and relevance to plant biology	University of Queensland	ARC
Transcriptome analysis of Phytophthora-plant interactions – characterisation of plant inhibitor proteins targeting Phytophthora extracellular effectors	Australian National University	ARC
Pollinators		
Assessing pathogen risks to honey bees and native bees in NSW (PhD)	Western Sydney University	Western Sydney University
Bee health and resources	PHA	RIRDC, AHBIC
Developing the use of sensors to model bee colony dynamics and to monitor bee health productivity and performance	Macquarie University, USDA Agricultural Research Service	USDA Agricultural Research Service
Development of educational videos for Australian beekeepers and growers of pollinator-reliant crops on honey bee biosecurity	PHA, PFRNZ	DAWR, Hort Innovation, RIRDC, Wheen Bee Foundation, Capilano, Syngenta, Bayer, AHBIC
Enhanced national bee pest surveillance program	PHA	Hort Innovation
External attractant trap for small hive beetle	QDAF	RIRDC
Healthy bee populations for horticultural pollination services	Western Sydney University	Hort Innovation
Improving honey bee diagnostics in Australia	CSIRO	DAWR
National bee biosecurity program	PHA	RIRDC
National bee pest surveillance program	PHA	RIRDC
National bee pest surveillance program	PHA	Hort Innovation
Reducing impact of Nosema and viruses by improving honey bee nutrition	CSIRO	RIRDC
Review of the biosecurity manual for beekeepers	PHA	Beekeepers Association of the ACT, Wheen Bee Foundation, Amateur Beekeepers Association of NSW, AHBIC and the Victorian Apiary Industry Advisory Committee, via DEDJTR
RNA viruses of native bees	University of Adelaide	Holsworth Foundation

Table 56. Plant biosecurity research projects

Project title	Organisation undertaking the research	Funding source/ body
Pollinators (continued)		
Securing pollination for more productive agriculture – guidelines for effective management and stakeholder adoption	University of New England, University of Sydney, University of Adelaide	RIRDC
Selection and development of Australian hygienic honey bee lines	Bee Scientific	RIRDC
Strengthening and enabling effective pollination for Australia	PHA, PFRNZ	Hort Innovation
Training and surveillance for Tropilaelaps mites in Papua New Guinea	CSIRO	ACIAR
Varroa mite host switch	Australian National University	ARC
Urban		
Prevention and control program for west Indian drywood termite under the *Biosecurity Act* 2014	QDAF	QDAF

Setting directions for plant biosecurity research

To make the most of research dollars, research, development and extension (RD&E) needs to be strategic, collaborative and well planned.

In July 2016, a two-day forum brought together plant industries, regulators, policy makers and research leaders to link the needs of plant industries and governments with national science and research priorities.

Around 90 people gathered at AgriBio in Melbourne. They heard from some high profile figures in plant biosecurity, who provided expert views on the current RD&E requirements of Australia's plant biosecurity system.

Presentations were followed by workshops during which participants contributed expertise on problems and solutions in plant biosecurity so that research priorities could be aligned with the areas of greatest need.

The National Plant Biosecurity RD&E Strategy Implementation Committee sponsored the meeting. Committee Chair, Greg Fraser, who is also Executive Director and CEO of PHA, said that the forum was a resounding success.

The forum identified areas where cross-sectoral research could benefit multiple industries which will help to maximise the benefits from investments in future research.

In addition, some specific areas of activity to improve research outcomes were identified. These included establishing diagnostic expert groups for key pests, real time surveillance for high priority pests and development of preparedness plans for Xylella and other high priority pests that can affect multiple crops.

The Plant Biosecurity Priorities Forum was arranged to link plant industries and governments with science

Dr Anna Smyth collecting fungal mycelium. Image courtesy of Biosecurity Queensland, QDAF

Image courtesy of Jeff Reynolds

Appendices

Organisation contact details

Organisation	For more information
Almond Board of Australia	**www.australianalmonds.com.au** +61 8 8584 7053
Apple and Pear Australia Ltd	**www.apal.org.au** +61 3 9329 3511
Atlas of Living Australia	**www.ala.org.au** +61 2 6246 4061
Australasian Plant Pathology Society	**www.appsnet.org** +61 7 4632 0467
Australian Banana Growers' Council	**www.abgc.org.au** +61 7 3278 4786
Australian Blueberry Growers' Association	**www.abga.com.au** +61 422 234 124
Australian Entomological Society	**www.austentsoc.org.au** +61 3 9895 4462
Australian Forest Products Association	**www.ausfpa.com.au** +61 2 6285 3833
Australian Government – Australian Centre for International Agricultural Research	**www.aciar.gov.au** +61 2 6217 0500
Australian Government – Australian Pesticides and Veterinary Medicines Authority	**www.apvma.gov.au** +61 2 6210 4701
Australian Government – Australian Research Council	**www.arc.gov.au** +61 2 6287 6600
Australian Government – Department of Agriculture and Water Resources	**www.agriculture.gov.au** +61 2 6272 3933
Australian Government – Department of Agriculture and Water Resources, Australian Bureau of Agricultural and Resource Economics and Sciences	**www.agriculture.gov.au/abares** +61 2 6272 3933
Australian Government – Department of Agriculture and Water Resources, Northern Australia Quarantine Strategy	**www.agriculture.gov.au/biosecurity/australia/naqs** +61 1800 900 090
Australian Government Department of Agriculture and Water Resources, Trade and Market Access Division	**www.agriculture.gov.au/market-access-trade** +61 1800 900 090
Australian Government – Department of Environment and Energy	**www.environment.gov.au** + 61 2 6274 1111

Organisation	For more information
Australian Government – Department of Foreign Affairs and Trade	**www.dfat.gov.au** +61 2 6261 1111
Australian Ginger Industry Association	**www.australianginger.org.au** +61 429 996 161
Australian Honey Bee Industry Council	**www.honeybee.org.au** +61 7 5467 2265
Australian Lychee Growers' Association	**www.australianlychee.com.au** +61 417 639 927
Australian Macadamia Society	**www.australian-macadamias.org** +61 1800 262 426
Australian Mango Industry Association	**www.industry.mangoes.net.au** +61 7 3278 3755
Australian Melon Association Inc.	**www.melonsaustralia.org.au** +61 413 101 646
Australian National University Research Services	**www.services.anu.edu.au/business-units/research-services-division** + 61 2 6125 9569
Australian Olive Association	**www.australianolives.com.au** +61 8 8573 6545
Australian Processing Tomato Research Council Inc.	**www.aptrc.asn.au** +61 3 5825 4633
Australian Society for Microbiology	**www.theasm.org.au** +61 1300 656 423
Australian Society of Agronomy	**www.agronomyaustralia.org**
Australian Sweetpotato Growers Inc.	**www.aspg.com.au**
Australian Table Grape Association	**www.australiangrapes.com.au** +61 3 5021 5718
Australian Truffle Growers' Association	**www.trufflegrowers.com.au** +61 402 351 025
Australian Walnut Industry Association	**www.walnut.net.au** +61 418 664 672
Australian Vignerons	**www.australianvignerons.com.au** +61 8 8133 4400
AUSVEG	**www.ausveg.com.au** +61 3 9882 0277

Organisation	For more information
Avocados Australia	**www.avocado.org.au** +61 7 3846 6566
CANEGROWERS	**www.canegrowers.com.au** +61 7 3864 6444
Canned Fruits Industry Council of Australia	**www.fgv.com.au**
Central Queensland University	**www.cqu.edu.au** +61 7 4930 9777
Charles Darwin University	**www.cdu.edu.au** +61 8 8946 7766
Charles Sturt University	**www.csu.edu.au** +61 1800 334 733
Cherry Growers of Australia	**www.cherrygrowers.org.au** +61 3 6231 1229
Chestnuts Australia	**www.chestnutsaustralia.com.au** +61 3 5751 1466
Citrus Australia	**www.citrusaustralia.com.au** +61 3 5023 6333
Commonwealth Scientific and Industrial Research Organisation	**www.csiro.au** +61 1300 363 400
Cotton Australia	**www.cottonaustralia.com.au** +61 2 9669 5222
Cotton Research and Development Corporation	**www.crdc.com.au** +61 2 6792 4088
Council of Australasian Weed Societies Inc.	**www.caws.org.au** +61 8 9821 3246
Deakin University	**www.deakin.edu.au** +61 3 5227 2673
Department of Agriculture and Food, Western Australia	**www.agric.wa.gov.au** +61 8 9368 3333
Department of Agriculture and Fisheries, Queensland	**www.daf.qld.gov.au** +61 13 25 23
Department of Economic Development, Jobs, Transport and Resources, Victoria	**www.economicdevelopment.vic.gov.au** +61 136 186
Department of Primary Industry and Resources, Northern Territory	**www.dpif.nt.gov.au** +61 8 8999 206

Organisation	For more information
Department of Primary Industries and Regions, South Australia	**www.pir.sa.gov.au** +61 8 8226 0995
Department of Primary Industries, New South Wales	**www.dpi.nsw.gov.au** +61 1800 808 095
Department of Primary Industries, Parks, Water and Environment, Tasmania	**www.dpipwe.tas.gov.au** +61 1300 368 550
Dried Fruits Australia	**www.driedfruitsaustralia.org.au** +61 3 5023 5174
Edith Cowan University	**www.ecu.edu.au** +61 134 328
Flinders University	**www.flinders.edu.au** +61 8 8201 3911
Forest and Wood Products Australia	**www.fwpa.com.au** +61 3 9927 3200
Grain Producers Australia	**www.grainproducers.com.au** +61 2 6273 3000
Grains Research and Development Corporation	**www.grdc.com.au** +61 2 6166 4500
Griffith University	**www.griffith.edu.au** +61 7 3735 7111
Growcom	**www.growcom.com.au** +61 7 3620 3844
Hazelnut Growers of Australia	**www.hazelnuts.org.au** +61 2 6379 1616
Horticulture Australia	**www.horticulture.com.au** +61 2 8295 2300
International Plant Protection Convention	**www.ippc.int**
James Cook University	**www.jcu.edu.au** +61 7 4781 4111
La Trobe University	**www.latrobe.edu.au** +61 1300 528 7623
Macquarie University	**www.mq.edu.au** +61 2 9850 7111
Monash University	**www.monash.edu** +61 3 9902 6000

Organisation contact details

Organisation	For more information
Murdoch University	**www.murdoch.edu.au** +61 8 9360 6000
New South Wales State Forests	**www.forestrycorporation.com.au** +61 1300 655 687
Nursery and Garden Industry Australia	**www.ngia.com.au** +61 2 8861 5100
Onions Australia	**www.onionsaustralia.org.au** +61 8 8725 8862
Passionfruit Australia	**www.passionfruitaustralia.org.au** +61 439 596 174
Pistachio Growers' Association	**www.pgai.com.au** +61 428 922 576
Plant Biosecurity Cooperative Research Centre Ltd	**www.pbcrc.com.au** +61 2 6201 2882
Plant Breeding Institute, University of Sydney	**www.sydney.edu.au/agriculture/plant_breeding_institute/index.shtml** +61 2 9351 8800
Plant Health Australia	**www.planthealthaustralia.com.au** +61 2 6215 7700
Queensland University of Technology	**www.qut.edu.au** +61 7 3138 2000
Raspberries and Blackberries Australia	No details available
Ricegrowers' Association of Australia	**www.rga.org.au** +61 2 6953 0433
Rural Industries Research and Development Corporation	**www.rirdc.gov.au** +61 2 6271 4100
Strawberries Australia	**www.strawberriesaustralia.com.au** +61 4 1291 7538
Sugar Research Australia	**www.sugarresearch.com.au** +61 7 3331 3333
Summerfruit Australia	**www.summerfruit.com.au** +61 2 6041 6641
Tasmanian Institute of Agriculture	**www.utas.edu.au/tia** +61 3 6226 6368
Transport Canberra and City Services, Australian Capital Territory	**www.tccs.act.gov.au** +61 13 22 81

Organisation	For more information
University of Adelaide	**www.adelaide.edu.au** +61 8 8313 4455
University of Canberra	**www.canberra.edu.au** +61 2 6201 5111
University of Melbourne	**www.unimelb.edu.au** +61 3 13 6352
University of New England	**www.une.edu.au** +61 2 6773 3333
University of New South Wales	**www.unsw.edu.au** +61 2 9385 1000
University of Queensland	**www.uq.edu.au** +61 7 3365 1111
University of Sydney	**www.sydney.edu.au** +61 1800 793 864
University of Tasmania	**www.utas.edu.au** +61 3 6226 2999
University of Western Australia	**www.uwa.edu.au** +61 8 6488 6000
University of Western Sydney	**www.westernsydney.edu.au** +61 2 9852 5222
University of Wollongong	**www.uow.edu.au** +61 2 4221 3555
Weeds of National Significance	**www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html** +61 3 6274 1111
Wine Australia	**www.wineaustralia.com** +61 8 8228 2000
Wine Australia Research and Development Corporation	**www.research.wineaustralia.com** +61 8 8228 2000

Image courtesy of D. Barbour

Glossary

Term	Definition
Appropriate Level of Protection	The level of protection deemed appropriate by a country establishing a sanitary or phytosanitary measure to protect human, animal and plant life or health within its territory.
Area freedom	Absence of a specific pest in a specified location.
Biosecurity	The protection of the economy, environment and human health from the negative impacts associated with entry, establishment or spread of exotic pests.
Biosecurity activities	Activities undertaken to manage biosecurity risks.
Biosecurity continuum	The range of biosecurity activities and arrangements that are undertaken in pre-border, border and post-border locations.
Border	In relation to the biosecurity continuum: airports, seaports and land borders that represent the potential point of entry for a pest into Australia.
Commonwealth	The Commonwealth of Australia, including its external territories.
Contingency plans	Management plans that outline pest specific information for use in the event of an emergency response.
Diagnostic protocols	Protocols that describe the procedures and methods for the identification of a pest to a defined level.
Diagnostics	Processes and standards associated with the accurate identification of a pest.
Disinfestation	Post-harvest management measures focused on eliminating the presence of pests within plants and plant products.
Domestic quarantine	Activities designed to prevent the movement and spread of pests within Australia.
Emergency Plant Pest	A pest that is included in Schedule 13 of the Emergency Plant Pest Response Deed or which is determined by the Categorisation Group to meet one or more of the EPP criteria listed in Clause 1 of the EPPRD.
Emergency Plant Pest Response Deed	A pre-agreed cost sharing and response framework for dealing with an incursion of an Emergency Plant Pest.

Term	Definition
Emergency response	The actions undertaken to eradicate an exotic pest after its detection.
Established pests	Non-endemic pests that have established in Australia.
Exotic pests	Pests not currently present in Australia.
High Priority Pest	A pest that has been identified to have the greatest potential economic impact to a particular plant industry and is listed in an Industry Biosecurity Plan or in Schedule 13 of the EPPRD.
International Standard for Phytosanitary Measures	An international standard adopted by the Commission on Phytosanitary Measures, established under the International Plant Protection Convention.
National Diagnostic Protocols	Diagnostic protocols for the official taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic protocols for regulated pests. National Diagnostic Protocols include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification.
Pre-border	Measures to address risks that are undertaken before goods arrive at the border.
Post-border	Measures to address risks that are undertaken inside Australia's border.
Pest	Any insect, mite, snail, nematode, pathogen (disease) and weed that is injurious to a plant or plant product.
Pest Free Area	An area in which a pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained.
Phytosanitary measure	Any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests.
Plant biosecurity	The protection of plants or plant products from pests that may impact on production or market access.
Plant production industries	All plant industries in the agricultural, horticultural and forestry sectors.
PLANTPLAN	The national contingency planning framework for the management of plant pest emergencies in Australia.

Term	Definition
Quarantine	The system of measures that are used to minimise risks associated with the entry or exit of pests.
RD&E	Research aimed at developing solutions for particular problems and communication (extension) to users.
Regionalised pests	Pests contained within a geographic region due to specific quarantine and/or management arrangements.
Response Plan	An integrated plan for undertaking a response to an EPP incident.
Risk analysis	The process of evaluating scientific and economic evidence to determine the risk posed by a pest to Australia's environment, plant production industries and economy.
Surveillance	Processes which collect and record data on pest occurrence or absence by survey, monitoring or other procedures.
Weeds of National Significance	Weeds considered to currently pose serious threats at a national level.

Image courtesy of Ann Furner

Acronyms

Acronym	Full name
ABARES	Australian Bureau of Agriculture and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ACIAR	Australian Centre for International Agricultural Research
ACT	Australian Capital Territory
AGSOC	Agriculture Senior Officials Committee
AHA	Animal Health Australia
AHC	Animal Health Committee
ALA	Atlas of Living Australia
APPD	Australian Plant Pest Database
APVMA	Australian Pesticides and Veterinary Medicines Authority
ARC	Australian Research Council
AusAID	The Australian Agency for International Development, Department of Foreign Affairs and Trade
AHBIC	Australian Honey Bee Industry Council
BEPWG	Biosecurity Emergency Preapredness Working Group
BERT	Biosecurity Emergency Response Team
BETWG	Biosecurity and Emergency Training Working Group
BIMS	Biosecurity Incident National Communication Network
BOLT	Biosecurity Online Training
BRCNZ	Bio-Protection Research Centre New Zealand
CCEPI	Consultative Committee on Exotic Plant Incursions
CCEPP	Consultative Committee on Emergency Plant Pests
CIMMYT	International Maize and Wheat Improvement Center
CRC	Cooperative Research Centre
CRDC	Cotton Research and Development Corporation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFWA	Department of Agriculture and Food, Western Australia
DAWR	Australian Government Department of Agriculture and Water Resources
DEDJTR	Department of Economic Development, Jobs Transport and Resources, Victoria
DEE	Australian Government Department of Environment and Energy
DEWNR SA	Department of Environment, Water and Natural Resources, South Australia

Acronym	Full name
DFAT	Australian Government Department of Foreign Affairs and Trade
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
EPP	Emergency Plant Pest
EPPRD	Emergency Plant Pest Response Deed
EPSD	Environment, Planning and Sustainable Directorate
FAO	Food and Agriculture Organisation
FWPA	Forest and Wood Products Australia
GRDC	Grains Research and Development Corporation
Hort Innovation	Horticulture Innovation Australia Limited
HPP	High Priority Pest
ICON	Import Conditions Database
IGAB WGs	Inter-Governmental Agreement on Biosecurity Implementation Working Groups
IPPC	International Plant Protection Convention
ISPMs	International Standards for Phytosanitary Measures
LVP	Local value of production
MICoR	Manual of Importing Country Requirements
NAQS	Northern Australia Quarantine Strategy
NBC	National Biosecurity Committee
NBPSP	National Bee Pest Surveillance Program
NDP	National Diagnostic Protocol
NEBRA	National Environmental Biosecurity Response Agreement
NFFS	National Fruit Fly Strategy
NGIA	Nursery and Garden Industry Australia
NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network
NPBDS	National Plant Biosecurity Diagnostic Strategy
NPBS	National Plant Biosecurity Strategy
NPSRT	National Plant Surveillance Reporting Tool
NSW	New South Wales
NSW DPI	Department of Primary Industries, New South Wales

Acronym	Full name
NT	Northern Territory
NT DPIR	Department of Primary Industries and Resources, Northern Territory
NZMPI	New Zealand Ministry for Primary Industries
OGTR	Office of the Gene Technology Regulator
PBCRC	Plant Biosecurity Cooperative Research Centre
PFRNZ	Plant and Food Resesarch, New Zealand
PHA	Plant Health Australia
PHC	Plant Health Committee
PIRSA	Department of Primary Industries and Regions, South Australia
QDAF	Department of Agriculture and Fisheries, Queensland
R,D&E	Research, Development and Extension
RDC	Research and Development Corporation
RIRDC	Rural Industries Research and Development Corporation
SA	South Australia
SAP	Scientific Advisory Panel
SARDI	South Australian Research and Development Institute
SBQI	Stronger Biosecurity and Quarantine Initiative
SDQMA	Subcommittee on Domestic Quarantine and Market Access
SNPHS	Subcommittee on National Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics
SPS	Sanitary and Phytosanitary
SRA	Sugar Research Australia
TACC	Tramp Ant Consultative Committee
TIA	Tasmanian Institute of Agriculture
WA	Western Australia
WTO	World Trade Organisation

Image courtesy of the Australian Macadamia Society

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Note: f = figure, t = table

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