The National Plant Biosecurity **Status Report**

2017

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Image courtesy of John McDonald, Nursery and Garden Industry Australia

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Image courtesy of the Australian Table Grape Association

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Foreword

Australia maintains its freedom from many serious plant pests by devoting considerable resources to plant biosecurity. It's a status that, while often taken for granted, benefits all Australians. Our unique ecosystems, vigorous plant production industries, high standard of social amenity and rural way of life are sustained by the system.

The National Plant Biosecurity Status Report documents the pest species that pose a significant threat to our nation and charts the efforts of the government, industry, research and community partners in maintaining and strengthening the plant biosecurity system.

This year, the content of the report has been rearranged to better reflect the multiple contributions that stakeholders make to maintain the integrity of the system – the plant biosecurity partnership. Activities are set out in accordance with the system's three layers of protection: pre-border, at the border and post-border.

Setting the content out in this way emphasises the role of everyday Australians as they go about their daily activities. Each of us has a role to play in keeping unwanted pests from spreading to and within Australia and it is hoped that the new format will assist in raising understanding of shared responsibility.

The final chapter of the book collates and analyses the 700 scientific projects being carried out at multiple institutions around the country. It is included in a chapter of its own since scientific knowledge underpins all layers of biosecurity in Australia. Each project sheds light on some aspect of plant or bee biosecurity that will inform better management of pests and crop production. The data is more robust this year, due to the use of an improved data collection technique.

Throughout the book the reader will find feature articles, which make apparent the significance of all of this activity. Examples of how the system works in specific circumstances brings the system to life.

This 2017 edition has been developed from some 90 contributions from plant biosecurity stakeholders. PHA is grateful for the cooperation that allows its publication.

I commend this highly valuable resource to you.

Steve McCutcheon
Chairman
Plant Health Australia

Overview

The importance of plant biosecurity

Without biosecurity efforts, plant pests such as insects, fungi, bacteria and viruses will spread to suitable host plants in new areas, countries and, aided by the movement of people and goods, to new continents.

The damage from new pests varies from species to species, but it can be significant. In addition to changing natural ecosystems and disrupting the built environment, it is estimated that every year between 20 and 40 per cent of crops are lost to plant pests and weeds globally[1]. The losses to food, fibre and foliage production are vast and will worsen without measures to curtail further spread.

Australia is fortunate to be free from many serious plant pests that exist overseas, due to our geographic isolation and more than a century of effective quarantine measures. Our enviable plant health 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. It allows higher yields for farmers, with less pesticide use, resulting in lower production costs and greater acceptance of our produce around the world.

The definition of a pest used in this report (except in Chapter 5) covers insects, mites, snails, nematodes, pathogens (diseases) and weeds that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. Exotic pests are those not currently present in Australia. Established or regionalised pests are those currently present within Australia.

To maintain this favourable situation, Australia places a high priority on plant biosecurity, a necessity in this age of increased global trade and travel.

Given the enormous number of potential pest incursions by exotic species, Plant Health Australia (PHA) has made assessments of pest threats industry by industry to develop a list of high priority pests that warrant special biosecurity efforts. Each of the 370 species on the list would thrive in Australian conditions, with the potential to cause ongoing damage to native flora and plant production systems.

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 to prevent the spread of weeds and pests include peak industry bodies and their growers, state government agencies, local councils, grower groups, transporters, research organisations, international and domestic travellers, gardeners and anyone who visits a farm including utility providers such as electricity and water service staff.

Almost half of Australia's total land area is used for agriculture. In 2015–16, around 371 million hectares was farmed by 85,681 crop and livestock businesses, all of whom depend on plant production to some extent. Of all the states and territories, Queensland has the highest proportion of agricultural land[2].

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, mangoes 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. Thirty nine crop industries, from grains to passionfruit, are featured in the next chapter.

Plant production makes a significant contribution to the Australian economy with an increasing amount of produce, particularly grains, cotton and higher value premium horticultural crops, being exported overseas.

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, 2017, 7121.0 - Agricultural Commodities, Australia, 2015-16

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

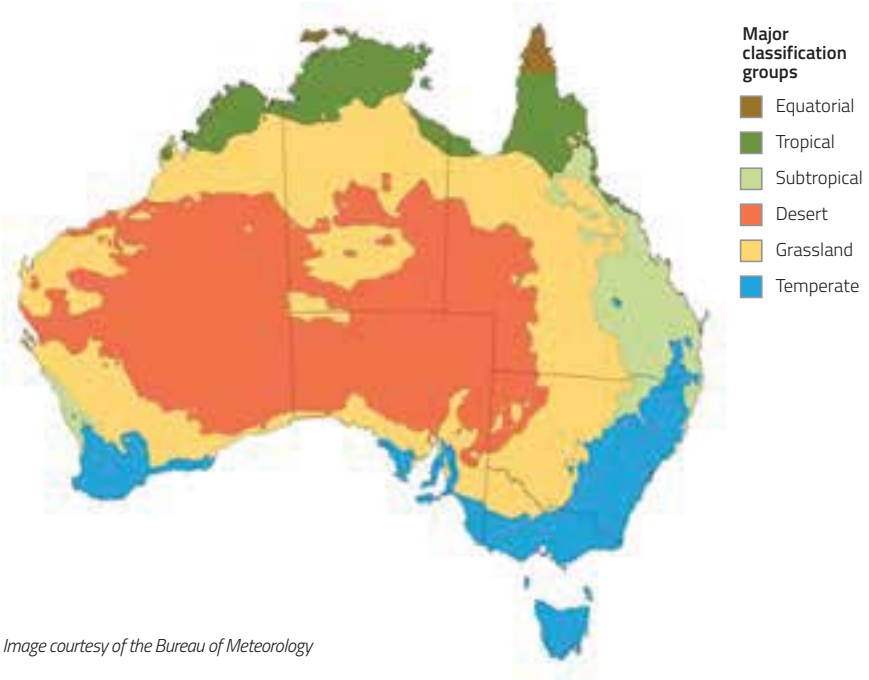
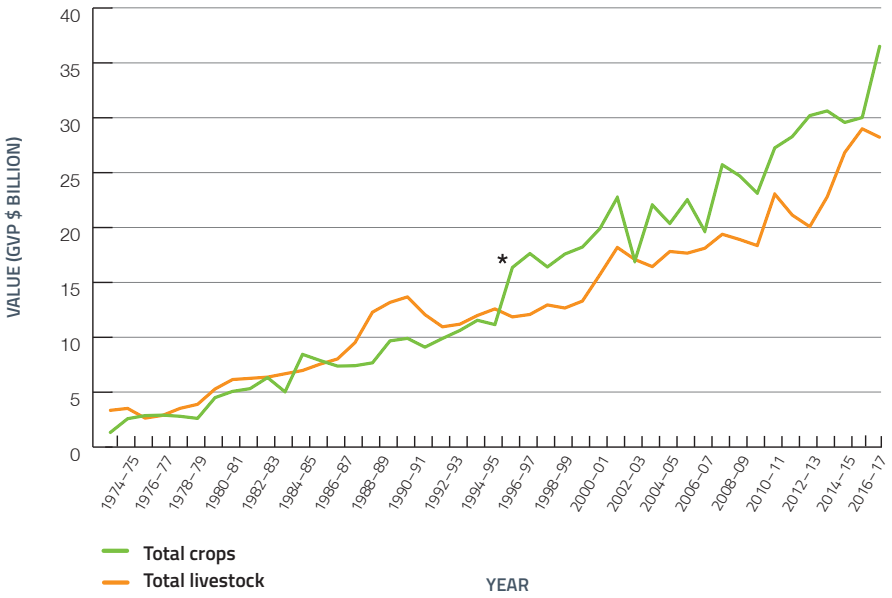


Image courtesy of the Bureau of Meteorology

Figure 2. Gross value of plant and animal production industries in Australia, 1972–2017*



** Includes forestry from 1995–96*

Produce destined for overseas markets must meet the standards set for market access, which often includes evidence that production areas are free from certain pests. Production and trade could be jeopardised by an incursion of a new pest that makes its way into our fields, orchards and plantations.

According to the Australian Bureau of Agricultural and Resource Economics in 2016–17, plant production industries had a gross value of $36.5 billion (see Figure 2)[3]. This is higher than the value of livestock production industries, a situation that has existed for a decade.

Our unique ecosystems need protection from invasive exotic plant pests, some of which could change the face of the landscape, disrupt ecosystems and threaten native species. There is much to protect. Australia has huge biodiversity including many native plants and animals that occur nowhere else on Earth. Parklands and other public amenities too are threatened by the introduction of particular exotic plant pests.

It takes a great amount of effort to keep exotic pests out. With a total coastline stretching almost 60,000 km, Australia's borders can only be 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).

3. Agricultural commodities: March quarter 2018 - Statistics - data tables 13A and 13B. Australian Bureau of Agricultural and Resource Economics, Canberra. Accessed online 31 May 2018 Agriculture.gov.au/abares/research-topics/agricultural-commodities/report

About this book

The National Plant Biosecurity Status Report 2017 describes the major activities that make up Australia's extensive plant biosecurity system and identifies the main stakeholder groups with greatest responsibility for each.

Chapter 1 provides an overview of the layers of Australia's plant biosecurity system and the roles and responsibilities of key organisations as well as agreed frameworks that guide and govern the system including biosecurity legislation and policy statements. It provides details of the government departments and agencies with key responsibilities.

Chapter 2 describes Australia's plant industries, including their value and where the produce is grown. Peak plant industry bodies for each industry are identified, and key pests and risk mitigation measures are identified.

Chapters 3 and 4 explain the complex web of activities that make up the biosecurity system, structured around the layers of protection: pre-border and at the border.

Chapter 5 explains the system for responding to incursions of new plant pests.

Chapter 6 features pest management within Australia including managing established pests and containing regionalised pests with domestic quarantine measures, on-farm biosecurity, the general biosecurity duty of everyday Australians, as well as weeds.

Chapter 7 describes the diagnostic and surveillance systems. Together, these function to provide an early warning system of any new exotic plant pest incursion or breech of containment of regionalised pests as well as to facilitate market access.

Australian plant biosecurity research, development and extension (RD&E) is covered in Chapter 8, with information on the hundreds of research projects undertaken in 2017, aimed at providing a better understanding of plant pests and how to deal with them.

Chapter 1

The plant biosecurity system protecting Australia

Australia's plant biosecurity system is made up of three layers of protection: pre-border activities, those at the border and post-border measures within Australia, plus whole of system assets (see Figure 3).

While some activities defy easy categorisation into these layers, some generalisations can be made. Pre-border activities are dealings with overseas countries to prevent pests from reaching Australia.

Border restrictions aim to intercept pests arriving through movements of people and goods from overseas.

Post-border initiatives aim to control risks within Australia, including surveillance to quickly detect any new exotic pest incursions, regional and interstate movement restrictions, farm biosecurity, taking responsibility for risks under an individual's control, and eradication efforts in response to the detection of emergency plant pests within Australia.

Figure 3. Key components of Australia's plant biosecurity system

The plant biosecurity partnership

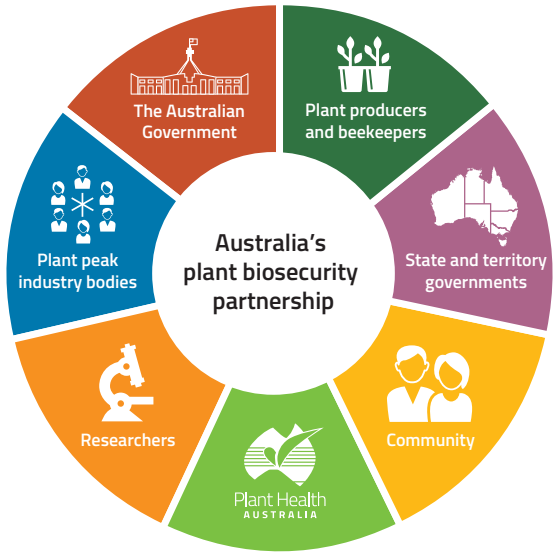
The enormous challenge of protecting Australia from plant pests can only be achieved by stakeholders operating in a coordinated fashion, referred to as the plant biosecurity partnership.

Previous reviews of Australia's biosecurity arrangements by Nairn (1996)[4] and Beale (2008)[5] have emphasised the complex nature of biosecurity, the consequent challenges in building a sustainable support structure, and the need for all stakeholders – national, state, industry and others – to work together to achieve better biosecurity outcomes.

The principle of biosecurity partnerships was established in recognition that, in addition to plant producers and governments, the wider Australian community benefits from good biosecurity. Benefits include improved productivity, product quality, market access, trade, profitability, sustainability and environmental preservation.

Each of the seven key plant biosecurity partners has a role to play in protecting Australia from plant pests (see Figure 4). The roles and responsibilities, legislation and frameworks are described in the following sections.

Figure 4. Key players in the plant biosecurity partnership that protects Australia from plant pests



4. Nairn ME, Allen PG, Inglis AR and Tanner C (1996). Australian quarantine: A shared responsibility
5. Beale R, Fairbrother J, Inglis A and Trebeck D (2008). One biosecurity : A working partnership

ACT Government biosecurity officers setting up exotic fruit fly traps. Image courtesy of Suzie Breitkopf

Roles of governments

THE AUSTRALIAN GOVERNMENT

Under national legislation, the Australian Government has responsibility for the bulk of biosecurity activities pre-border and at the border. This includes screening and compliance at the multiple entry points that make up the nation's border, international phytosanitary (plant health) obligations, carrying out risk analysis for proposed imports, and post-entry plant quarantine.

As well as regulating imports, the Australian Government's biosecurity activities also play a key role in exports of Australian produce. This is because overseas markets can reject imported produce from countries if it is grown in areas known to have particular pests.

The Australian Government assists in market access negotiation by working with states and territories and plant industry peak bodies to collect and analyse plant health surveillance data, to provide our trading partners with evidence of our freedom from pest and disease.

The Australian Government also undertakes negotiations to determine any treatments that may be required, or any other conditions to be met in sending Australia's plant products overseas.

In addition to bilateral and multilateral trade negotiations Australia also plays a leadership role in developing and implementing international agreements that aim to prevent the spread of plant pests, known as phytosanitary agreements.

Under the *Agricultural Competitiveness White Paper, Stronger Farmers, Stronger Economy*[6], the Australian Government is also investing $200 million into improving biosecurity surveillance and analysis, to better target critical biosecurity risks and improve market access for Australian producers.

Department of Agriculture and Water Resources

Most of the responsibilities of the Australian Government are delivered through the agriculture portfolio, in collaboration with other agencies described in the following pages.

Following several reviews over recent decades, the Australian Government Department of Agriculture and Water Resources takes a future focused approach to maintain a strong and resilient biosecurity system that will protect Australia from new biosecurity challenges, whatever they may be.

6. Commonwealth of Australia (2015). Agricultural Competitiveness White Paper, Canberra

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 system layers (pre-border, at the border and post-border).
- Good regulation, including effective legislation and reduced regulatory burden.
- Better processes, including modernisation of service delivery 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-through effects to the nation's economy.

The core priorities of the Department of Agriculture and Water Resources 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 and diseases.
- Support Australia's reputation as a competitive exporter of agricultural goods and products.

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

- Working to remove barriers to international trade.
- Progressing and resolving market access priorities and 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.

This work is supported and enhanced by a network of agricultural counsellors located in Belgium, China, Dubai, Europe, France, India, Indonesia, Italy, Malaysia, Japan, Korea, the Middle East, Thailand, Saudi Arabia, Vietnam and the United States. Through its overseas network, the department pursues international market access opportunities.

Strengthening plant biosecurity surveillance and analysis

AGRICULTURAL COMPETITIVENESS WHITE PAPER

Through investment under the Agricultural Competitiveness White Paper, the Australian Government is building the capability and effectiveness of the Australian plant biosecurity system.

One focus is stronger surveillance to prevent the arrival and establishment of exotic pests and disease, and improve the timeliness and accuracy of surveillance data collected for market access negotiations.

A $200 million package of biosecurity measures aims to improve biosecurity surveillance and analysis to better target critical biosecurity risks, including in Northern Australia, to protect agricultural industries, environment and the community from the impact of exotic pests and diseases.

The investment is being used to strengthen biosecurity surveillance, build community based engagement, and improve scientific and analytical capability.

The Department of Agriculture and Water Resources is responsible for implementing this component of the White Paper and are doing so through:

- Additional pre-border surveys to provide early warning of risks to Australia, enabling adjustments to risk management measures and national preparedness activities.
- Additional national and departmental surveillance, including support for industry surveillance strategies. This is helping to detect pests of concern as early as possible to better support containment or eradication, and to provide evidence to our trading partners of pest freedom.
- Updated import conditions to ensure that our risk management measures are fit for purpose and stay up to date.
- Additional import risk assessments to ensure safe trade, improve relations with trading partners and facilitate export market access negotiations. This includes the adoption of improved risk assessment processes and policies.
- Improved analytics capability to give insights into emerging biosecurity risks.
- A new process for identifying and managing changes in biosecurity risk to ensure that high impact changes are assessed and mitigation actions tracked to completion.
- Export market access assisted through the development of standardised treatment packages, domestic and offshore capability building and the use of surveillance data to demonstrate area freedom during market access negotiations.

For more information visit **agriculture.gov.au/whitepaperbiosecurity.**

Department of Foreign Affairs and Trade

The Department of Foreign Affairs and Trade (DFAT) helps 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 the Environment and Energy

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

The department is also responsible under the *Environment Protection and Biodiversity Conservation Act 1999* for assessing the environmental impact associated with proposals to import live plants and animals (the approvals of which are not inconsistent 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 Home Affairs

The Department of Home Affairs, formed in 2017, 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.

The Inspector-General of Biosecurity

Australia's biosecurity system relies on various government programs, in cooperation with industry, to ensure the safe international movement of people and goods.

Dr Helen Scott-Orr is the inaugural Inspector-General of Biosecurity, appointed in July 2016. Image courtesy of the Department of Agriculture and Water Resources

The Inspector-General of Biosecurity (IGB) was established to enhance the integrity of Australia's biosecurity systems through independent evaluation of the performance of these programs across the whole system: pre-border, at the border and post-border.

The position is independent from the Department of Agriculture and Water Resources and its Minister, though they will consider particular review requests.

The Inspector-General may review the performance of functions and exercise of powers by the Director of Biosecurity and make recommendations for improvement to the overall system.

A review program is published annually, set in consultation with the Minister for Agriculture and Water Resources and the Director of Biosecurity. Processes that underpin Biosecurity Import Risk Assessments are subject to review by this office. In 2017, the Inspector-General analysed pest and disease incursions, barrier breaches and high-risk interceptions in Australia over the past 10 years.

Other Australian 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, and the Australian Pesticides and Veterinary Medicines Authority (APVMA).

The Australian Trade and Investment 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.

For a list of other Australian Government organisations that support plant biosecurity research and development see Chapter 8.

STATE AND TERRITORY GOVERNMENTS

While the Australian Government has responsibilities for the majority of pre-border and border biosecurity activities, state and territory governments are responsible for the delivery of plant biosecurity operations and the supporting legislation within their borders.

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, most of which involve the community.

Broadly, these are activities concerned with not spreading existing plant pests further within Australia, including any newly detected exotic pests.

State and territory government responsibilities include:

- Managing domestic imports and exports into and out of their jurisdiction, primarily to prevent the spread of regionalised pests around Australia. There are two components to this:
  - Domestic quarantine services for the clearance of passengers, cargo, mail, plants and plant products moving interstate.
  - Export and market access support for producers who want to sell their produce across state boundaries. This includes including plant health certification services, surveys and inspections to support area freedom and the accreditation and auditing of export compliance arrangements.
- Providing quarantine services, involving activities to prepare for, and respond to, any plant pest incursions in their jurisdiction, including communicating with communities.
- Maintaining normal commitments and deliver responsibilities under the Emergency Plant Pest Response Deed, which is activated upon detection of a suspected Emergency Plant Pest in their jurisdiction. Responsibilities include setting up and enforcing quarantine zones, informing the public and treating pests and plants. The lead agency also carries out surveillance to find out how far pests have spread, and at the end of the response, to confirm that eradication has been achieved.
- Undertaking pest surveillance in their jurisdiction, in partnership with industry and community volunteers. There are 155 surveillance programs carried out by state and territory governments, requiring significant resourcing. Pest surveillance is crucial for the early detection of new pests, discovering the extent of pest spread (delimiting), and providing evidence of area freedom to facilitate market access.
- Providing state and territory diagnostic services to identify plant pests (both endemic and exotic) found in their jurisdiction, or to assist another jurisdiction. This includes reference collections for comparison of species.
- Developing and maintaining information systems to support routine and emergency plant biosecurity management.
- Sending out public information to raise awareness of biosecurity threats and calls to action.
- Carrying out science based risk analyses to identify pest threats and inform plant biosecurity policy and operations.
- Funding and providing research, development and extension to support the continued improvement of pest management and protection capabilities.
- Developing and administering plant biosecurity policies and legislation, and work on national committees to ensure that these are in line with other governments around Australia.

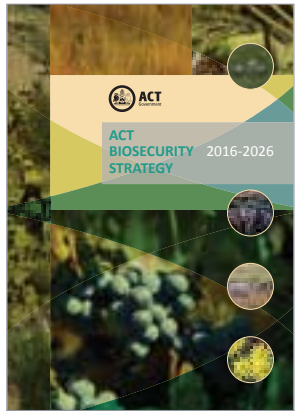
State and territory governments coordinate their activities through the Intergovernmental Agreement on Biosecurity (page 30), the Plant Health Committee and subcommittees (page 28), through Plant Health Australia (page 26) and through the Emergency Plant Pest Response Deed (page 142).

Australian Capital Territory

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

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

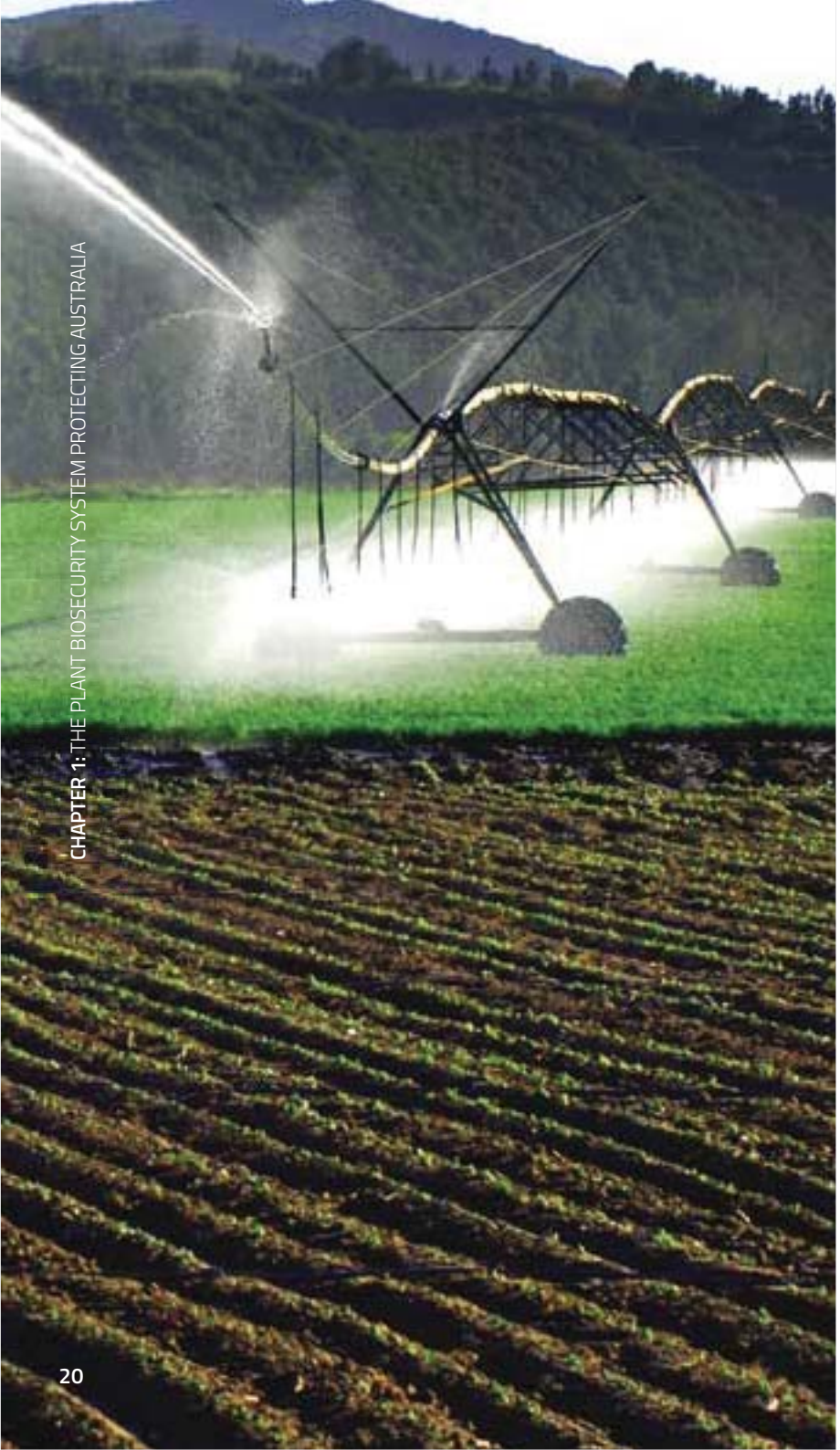
Plant biosecurity activities in the ACT are underpinned by the *Plant Diseases Act 2002*, the *Pest Plants and Animals Act 2005*. Although the ACT does not have many plant production industries, the government is represented on national committees during plant pest emergency responses and participates in the development of associated national frameworks and strategies when it has expertise to contribute. It has particular expertise in forestry, urban tree management and national parks.



In 2017, the ACT Biosecurity Strategy 2016–26 was released, identifying the goals, objectives and supporting actions for addressing biosecurity across the Territory. Since the ACT is surrounded by NSW, the Strategy's goals and outcomes are closely aligned with those of NSW.

International flights to Canberra Airport began in 2016, prompting regular surveillance around the airport to check for exotic pests including exotic fruit flies and Asian gypsy moth.

During 2017 the ACT declared parts of the state of Western Australia be an area subject to an importation restriction to prevent the introduction of tomato potato psyllid (*Bactericera cockerelli*) and the bacterium *Candidatus* Liberibacter solanacearum into the ACT.



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 plant 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.

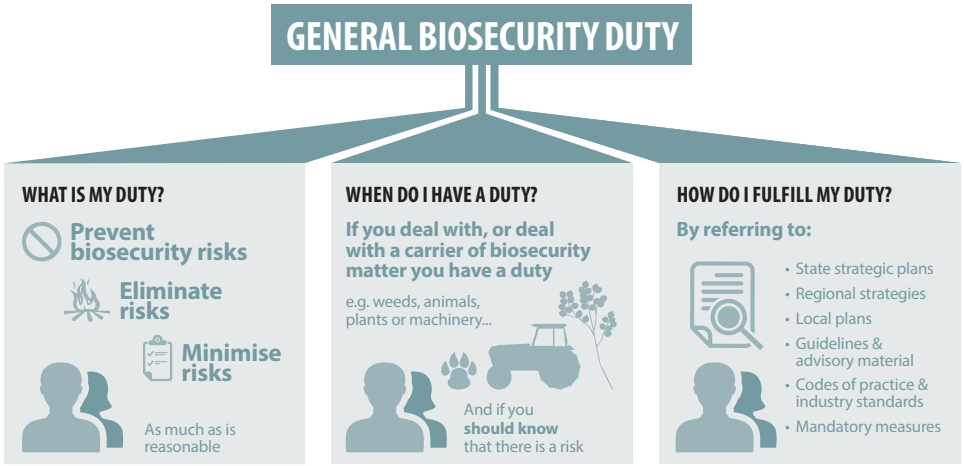
Within NSW DPI, the Plant Biosecurity and Product Integrity unit develops plant pest policy directions and has oversight of operational responses to Emergency Plant Pests.

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.

Significant changes to NSW biosecurity legislation occurred in 2017 with the commencement of the *Biosecurity Act 2015*, the *Biosecurity Regulation 2017* and other supporting legislation. Fourteen previous Acts have now been wholly or partially repealed with the commencement of the *Biosecurity Act 2015*. The NSW Government's plant biosecurity activities administered by NSW DPI are now wholly underpinned by the *Biosecurity Act 2015* and the *Biosecurity Regulation 2017*.



The NSW Biosecurity Act 2015 incorporates a general biosecurity duty

Northern Territory

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

Plant biosecurity in the Northern Territory (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 NT agricultural sector provides over $606 million to the Australian economy each year. Horticultural industries contribute over one third of this value, in annual production of iconic Territory produce such as mangoes and melons. Other markets offer growth opportunities.

To protect this, the environment and social amenity, the Plant Biosecurity Branch undertakes the following services:

- 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.

Recently, the NT has been providing front line services to eradicate or manage pests including banana freckle, browsing ant, cucumber green mottle mosaic virus, Asian honey bee and Queensland fruit fly.

The NT has also been undertaking surveillance and eradication of Queensland fruit fly and taking part in the National Browsing Ant Eradication Program.

NT banana freckle eradication on track

In 2013, a strain of the fungal pest banana freckle (*Phyllosticta cavendishii*) was detected on Cavendish variety bananas in the NT. This strain of banana freckle is present in other countries and is known to severely limit commercial banana production.

With scientific advice about the status, epidemiology and impact of the pest, the National Management Group convened under the Emergency Plant Pest Response Deed deemed that eradication of banana freckle was technically and economically feasible. In October 2014, nationally cost-shared response plan was agreed and the NT department officers began the huge task of locating and removing banana plants in the area.

Now in 2017, the National Banana Freckle Eradication Program is approaching the final phase – Assessment of Proof of Freedom. For NT DPIR, this has involved two more rounds of inspections of more than 300 properties that were previously infected with banana freckle, or close to infected areas, to provide confidence that the pest is eradicated from the NT.

Quarantine zones and movement restrictions have been relaxed, so that banana plants can once again be cultivated and moved freely throughout the Territory. Permits are still required to move banana plants or fruit into and out of the Territory.

The eradication of banana freckle is significant for the sustainability of the national banana industry, and for the potential expansion of the Australian banana industry in the NT.

Maurice Thompson with sentinel banana plants prior to distribution. Image courtesy of Bill Whitington

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, regulatory arrangements for importers and specific measures to effectively respond to and eradicate any fruit flies detected.

Additionally, the South Australian government has, in partnership with Hort Innovation and the SITplus consortium, constructed and commissioned the National Sterile Insect Technology (SIT) Facility in Port Augusta, which has the ability to produce 50 million sterile Queensland fruit flies per week.

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. The Plant Biosecurity and Diagnostics Branch of the Division supports and maintains Tasmania's biosecurity system as a leader in the development of plant biosecurity policy, and delivery of plant health diagnostic and associated service areas. It does this through the delivery of work programs across three areas: plant biosecurity policy and administration, plant health diagnostics (entomology), and plant health diagnostics (plant pathology).

The branch also provides diagnostic and control advice for plant pests and diseases in primary industry, horticulture and biosecurity situations. The state-wide laboratory services supply a range of tests for plant pests and pathogens, utilising microbiological, molecular, ELISA, and electron microscopy techniques on a wide range of plants and seeds for private industry, government research bodies and certification schemes.

The unit maintains and develops Tasmania's capability to effectively respond to and recover from plant biosecurity emergencies, compiles and maintains official pest records to assist market access and trade, and also leads the implementation of plant biosecurity risk analysis activities consistent with the Import Risk Analysis Framework.

A draft *Biosecurity Bill 2017* has been developed and will be considered by the Tasmanian Parliament in 2018. The single new *Biosecurity Act* will promote good regulatory practices through an efficient and effective legislative framework. The framework will support a strong biosecurity system in Tasmania that facilitates trade and protects business, the environment and the community.

Victoria

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

The Biosecurity and Agriculture Services Branch, within DEDJTR, delivers biosecurity and product integrity programs across the agriculture, horticulture, forest and amenity plant sectors. Activities undertaken are guided by the Victorian Biosecurity Strategy which aims 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 is responsible for the development, review and monitoring of policies, protocols and procedures in accordance with national and international obligations.

The Biosecurity Operations Division delivers operational functions from metropolitan and regional centres according to technical standards and protocols which are underpinned by the *Plant Biosecurity Act 2010* and implemented by *Plant Biosecurity Regulations 2016*. 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 including development and review of biosecurity plans for industries, as well as technical expert representation on national committees and working groups.

The research team, and its associated Crop Health Services diagnostic business, supports biosecurity by conducting relevant research and providing diagnosis in the areas of entomology, mycology, nematology, virology and bacteriology. Specialist diagnostic services and expertise is also provided to interstate jurisdictions as required, to support national responses to new pests.

Western Australia

Lead agency: Department of Primary Industries and Regional Development (DPIRD)
dpird.wa.gov.au

In 2017, the Department of Agriculture and Food, Western Australia amalgamated into the new Department of Primary Industries and Regional Development (DPIRD). DPIRD is the lead agency responsible for plant biosecurity in WA, with development and implementation of plant biosecurity policies, programs and procedures delivered under the Sustainability and Biosecurity organisational pillar. This pillar includes our biosecurity, resource management, operations and compliance functions. It is largely regulatory and market access focussed, helping WA to maintain its enviable reputation as a producer of safe, sustainable and biosecure agricultural and aquatic products.

Plant biosecurity in WA is mainly managed under the *Biosecurity and Agriculture Management Act 2007*, designed to prevent pests and diseases from entering the state and manage those that are found here. The Act provides for a modern biosecurity system to control the entry, establishment, spread and impact of harmful organisms (pests and diseases), 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.

Port of Pilbara Western Australia. Image courtesy of Ports Australia

State apiary and biosecurity officers work with volunteer beekeepers to inspect sentinel hives for exotic bee pests at high risk ports throughout Australia. Image courtesy of Jenny Shanks, Plant Heath Australia

Roles played by other partners

Plant industry peak bodies represent growers of particular types of crops, such as grain growers or stone fruit orchardists, as well as beekeepers. These organisations form a network of industry stakeholders with key roles to play in ensuring that their industry is protected from plant pests and that their growers understand the threats and how to mitigate them. Peak industry bodies are funded by memberships from growers, and many have primary industry levies in place to provide funding for particular biosecurity initiatives to protect that industry.

Details of Australia's plant industry peak bodies, their value, major pest threats and biosecurity initiatives are in Chapter 2.

Plant producers and beekeepers have a responsibility to protect their own enterprises, and those of others in their region, from new pests and weeds by using farm biosecurity measures. On-farm biosecurity measures are covered in Chapter 6.

Researchers are the research funders and scientists who ensure that scientific research – research development and extension (RD&E) – provides answers to pest problems that Australian producers face. These activities are carried out by government and industry researchers, often through cooperative funding organisations like Hort Innovation and the Plant Biosecurity Cooperative Research Centre. Research includes methods of identifying pests (diagnostics), effective management techniques and work to breed resistant crop varieties. Plant biosecurity research is covered in Chapter 8.

Community is a broad category, including everyday Australians who must reduce risks within their control. Local governments, landholders, travellers returning from overseas, tourists, home gardeners and anyone moving goods around the country or visiting rural areas have particular responsibilities.

Primarily, community members have post-border biosecurity responsibilities, although people returning from overseas and those importing goods from overseas must abide by international border restrictions to prevent incursions of exotic pests. The roles of community in preserving the integrity of Australia's plant biosecurity status is explained in Chapter 6.

The plant biosecurity partnership in action – Protecting honey bees and pollination

The National Bee Pest Surveillance Program is an early warning system to detect new incursions of exotic bee pests and pest bees. It is only made possible by partners working together.

The program involves a range of surveillance methods conducted at locations considered high risk for the entry of bee pests and pest bees throughout Australia.

The main aim is to detect any threat soon after arrival. Threats include any pest bees or bees arriving from overseas that might carry a pest or disease that would spread to Australia's honey bees.

Early detection greatly increases the possibility of eradicating an incursion, and limits the scale and cost of an eradication program.

The benefits of honey bees are far greater than the honey they produce, given the pollination services that honey bees provide. Many crops including canola, nuts, fruit and vegetables benefit from or even rely on honey bee pollination.

Given the value of honey bees to crop growers, PHA brought together stakeholders with an interest in protecting Australia's honey bees to fund and implement the National Bee Pest Surveillance Program.

PHA coordinates the program at the national level. State and territory governments provide staff at ports to undertake the surveillance and report findings to a central database. Funding is provided by the Australian Honey Bee Industry Council, Grain Producers Australia, the Australian Government, as well as horticultural industries via Hort Innovation. Volunteer beekeepers play a valuable role by making checks of sentinel hives every two months.

Australia remains free of many serious pests and diseases that affect honey bees overseas.

For more on the National Bee Pest Surveillance Program see page 190.

THE ROLE OF PLANT HEALTH AUSTRALIA

Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, funded by member subscriptions from all Australian governments and most of the plant industry peak bodies, PHA independently advocates on behalf of the national plant biosecurity system to benefit plant industries and the environment.

Since plant biosecurity can only be effective if everyone plays a role, a key strategic goal for PHA is to bring together the main stakeholders in the plant biosecurity system, to agree and implement actions to maintain and improve the integrity and performance of the system.

As the national coordinator of the government-industry partnership for plant biosecurity in Australia PHA works to:

- Enhance the commitment of governments and industries to work together.
- Enhance the operation and integrity of Australia's plant pest emergency response arrangements.
- Assist national management of biosecurity risks.
- Monitor performance and promoting continual improvement of Australia's plant biosecurity system.
- Determine future needs of Australia's plant biosecurity system.
- Facilitate 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.

Members of Plant Health Australia

All Australian Governments and most major plant-based agricultural industries are members of PHA, bringing the total number to 60 at the end of December 2017. Table 1 gives a full list of industry, government and associate members. The honey bee industry is a member of PHA because of the benefits that pollination brings to crop yield.

Being a member enables parties to stay up to date on plant biosecurity issues and to work together on strengthening all aspects of the system. Membership 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.

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.

The number of plant biosecurity partnerships are increasing over time, and the model is proving highly successful. One example of a biosecurity partnership facilitated by PHA is the National Bee Pest Surveillance Program, described on page 25.

PHA provides 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, facilitate improved national coordination and collaboration, and target member efforts and investment to best effect. The National Plant Biosecurity Strategy, biosecurity plans for industries and the series of annual status reports are examples of this work.

PHA facilitates and manages 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 Emergency Plant Pest Response Deed (EPPRD), and its operational guide PLANTPLAN, which sets out the agreed approach that government and industry stakeholders will take whenever an Emergency Plant Pest (a new exotic pest of significance) is found or suspected.

At the end of 2017, there were 47 signatories to the EPPRD and seven eradication responses were underway. In addition to ensuring that a response is carried out and cost-shared in accordance with the EPPRD, PHA runs a process to continually improve its provisions. Twice a year, PHA convenes meetings of signatories to the agreement to discuss and agree modifications to the agreement to take account of new information and procedural improvements that are identified through post-incident reviews.

In addition, PHA assists signatories to meet their preparedness and prevention obligations that are stipulated under the EPPRD. As part of this, PHA provides a range of services including contingency planning, surveillance and diagnostic systems support, response training and simulation exercises, all of which boost preparedness.

PHA works with members to mitigate 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.

PHA maintains the Pest Information Document Database

Biosecurity plans, biosecurity manuals for producers and awareness raising extension services are examples of activities that PHA undertakes with and on behalf of members.

PHA also works to ensure that the system is supported with assets such as information systems, diagnostic expertise, targeted research, development and extension activities, and surveillance protocols and provides information on exotic pests including the Pest Information Document Database. This online information resource holds publicly available fact sheets and other kinds of information on serious exotic pests, which is frequently used by PHA members.

Additional activities to mitigate risk

PHA's main activities are funded from annual subscriptions paid by members, allocated as detailed in each edition of PHA's Annual Operational Plan.

In addition, PHA is also commissioned to undertake many risk mitigation projects by individual members, groups of members in partnership and non-members. Often these non-subscription funded projects boost biosecurity for particular industries. Examples of non-subscription funded projects include industry funded biosecurity outreach officers, Emergency Plant Pest response simulations, and biosecurity manuals to inform growers.

For more information on PHA and its role in plant biosecurity see the PHA website **planthealthaustralia.com.au**.

Table 1. Plant Health Australia's members

Industry members	
Almond Board of Australia Inc	Avocados Australia Ltd
Apple and Pear Australia Ltd	CANEGROWERS
Australian Banana Growers' Council Inc	Canned Fruit Industry Council of Australia
Australian Blueberry Growers' Association Inc	Cherry Growers of Australia Inc
Australian Forest Products Association Limited	Chestnuts Australia Inc
Australian Ginger Industry Association Inc	Citrus Australia Ltd
Australian Honey Bee Industry Council Inc	Cotton Australia Ltd
Australian Lychee Growers' Association Inc	Dried Fruits Australia Inc
Australian Macadamia Society Ltd	Grain Producers Australia Limited
Australian Mango Industry Association Ltd	GROWCOM
Australian Melon Association Inc	Hazelnut Growers of Australia Inc
Australian Olive Association Ltd	Nursery and Garden Industry Australia Ltd
Australian Processing Tomato Research Council Inc	Onions Australia
Australian Sweetpotato Growers Inc	Passionfruit Australia Incorporated
Australian Table Grape Association Inc	Pistachio Growers' Association Incorporated
Australian Tea Tree Industry Association Ltd	Raspberries and Blackberries Australia Inc
Australian Truffle Growers' Association Inc	Ricegrowers' Association of Australia Inc
Australian Vigerons	Strawberries Australia Inc
Australian Walnut Industry Association	Summerfruit Australia Limited
AUSVEG Limited	
Government members	
Australian Capital Territory Government	South Australian Government
Commonwealth of Australia	Tasmanian Government
New South Wales Government	Victorian Government
Northern Territory Government	Western Australian Government
Queensland Government	
Associate members	
AgNova Technologies	Northern Territory Farmers Association Inc
Cotton Research and Development Corporation	Plant Biosecurity CRC Ltd
CSIRO	Sugar Research Australia
Grains Research and Development Corporation	Victorian Farmers Federation
Horticulture Innovation Australia Ltd	Vinehealth Australia
Lawn Solutions Australia	Wine Australia (Australian Grape and Wine Authority)

National committees provide coordination

While state and territory governments have responsibility for implementing many biosecurity activities within their borders, a level of coordination is required between the jurisdictions and with the Australian Government.

National committees provide a formal mechanism for developing and coordinating key plant biosecurity policy and procedures that are nationally consistent. As such, Australia's plant biosecurity committee structure plays a major role in facilitating partnerships between governments.

Figure 5 shows the structure of Australian biosecurity committees that are tasked with national coordination of plant biosecurity.

PHA has observer status at National Biosecurity Committee, and is a member of Plant Health Committee 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 National Biosecurity Committee.

NATIONAL BIOSECURITY COMMITTEE

The National Biosecurity Committee (NBC) 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, and consistency across and between Australian governments. The NBC has reporting responsibilities 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 and Energy (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.

In 2017, as a result of the IGAB review (see page 30), the NBC decided to extend the scope of the Invasive Plants and Animals Committee (IPAC) to include the environment. As a result IPAC (see Figure 5) will become the Environmental and Invasives Committee.

PLANT HEALTH COMMITTEE

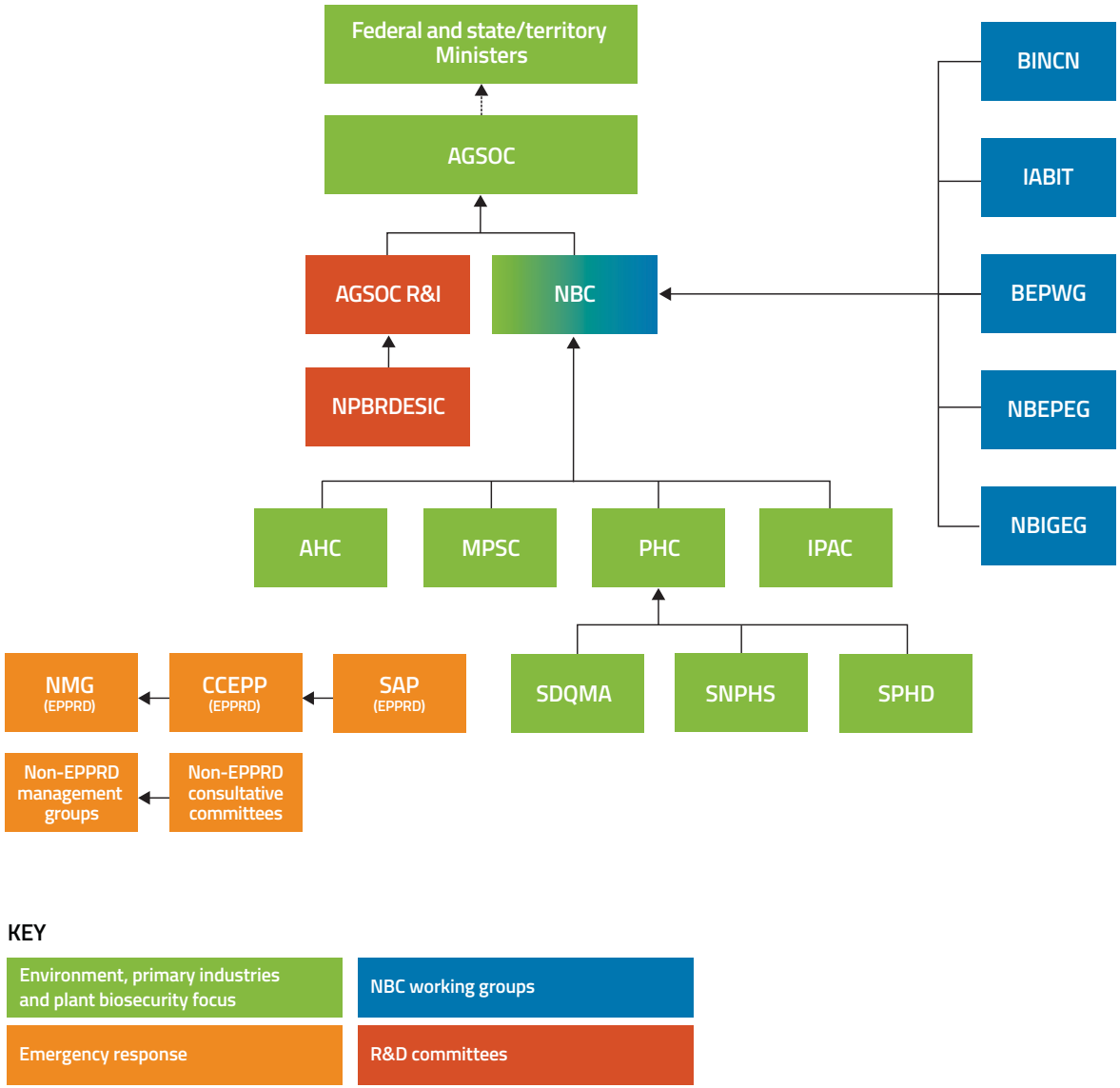
Plant Health Committee (PHC) is the peak government plant biosecurity policy forum. Its role is to maintain or improve plant health in Australia in support of the economy, environment and community. PHC provides strategic policy, technical and regulatory advice, and national leadership on plant biosecurity 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, Subcommittee on National Plant Health Surveillance and Subcommittee on Domestic Quarantine and Market Access, 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 attend PHC meetings with observer status.

In 2017, PHC continued implementation of the National Plant Biosecurity Strategy, 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.

Figure 5. National biosecurity committees and working groups with plant focus



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

Plant biosecurity frameworks and legislation

Australia's plant biosecurity system is supported by a suite of strategies, agreements, review reports, policies and legislation, developed over many years. These not only provide the current structure, but provide a vision of how the plant biosecurity system should operate into the future.

INTERGOVERNMENTAL AGREEMENT ON BIOSECURITY

For governments Australia's partnership approach to biosecurity is cemented by the Intergovernmental Agreement on Biosecurity (IGAB), which came into effect in January 2012.

The IGAB was developed under the Council of Australian Governments to strengthen the working partnership between the Australian Government and state and territory governments. It defines roles and responsibilities and outlines priority areas for collaboration and improvements to the national biosecurity system. It ensures that all governments are working together in harmony on biosecurity issues.

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 2016, the IGAB was reviewed by an independent panel and in July 2017, the final IGAB report Priorities for Australia's biosecurity system was presented to the Agriculture Ministers' Forum.

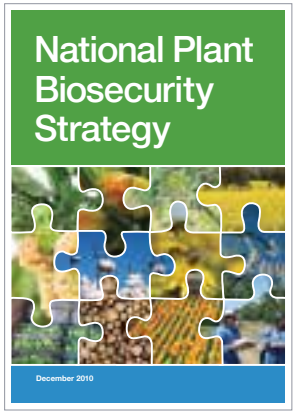
The report recognises the significant achievements of the IGAB including the strong and healthy working relationships it fosters between governments, and the development of sound national policy principles and frameworks for an effective and well-regarded system.

It also highlights a number of challenges for the system including a growing global population, increasing international trade and travel, loss of biodiversity, and ever-expanding urbanisation.

The report makes 42 recommendations aimed at strengthening Australia's biosecurity system over the next five to 10 years.

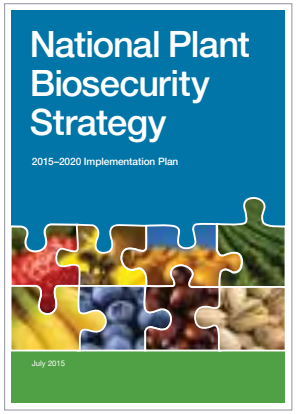
Agriculture ministers have agreed to develop a national, intergovernmental response to the findings and recommendations of the report through the National Biosecurity Committee.

THE NATIONAL PLANT BIOSECURITY STRATEGY



The National Plant Biosecurity Strategy (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, aligning them with the IGAB to ensure consistency.

The national strategy was finalised in December 2010 (prior to IGAB) 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 industry and governments, responsibility for guiding the implementation process is shared among organisations and committees, based on their expertise.



Toward the end of 2014, halfway through its lifespan, PHA reviewed the strategy and assessed progress against each of the recommended activities and alignment with IGAB. An implementation plan that lists 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.

Implementation of government responsibilities is overseen by the Plant Health Committee (PHC), with specific input from the Subcommittee on Plant Health Diagnostics and the Subcommittee on National Plant Health Surveillance on implementing the diagnostic and surveillance aspects, respectively. The Subcommittee on Domestic Quarantine and Market Access works to ensure consistency of biosecurity requirements across states and internationally.

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

The National Plant Biosecurity Strategy 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 2017 is listed in Table 2.

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 *NSW Biosecurity Act 2015* was assented to in September 2015 and came into effect during 2017. The new legislation aligns with *Queensland's Biosecurity Act 2014* in introducing into law the principle that everyone has a responsibility for mitigating biosecurity risks under their control, known as the general biosecurity obligation or duty. Other state and territory governments have indicated that they will also formalise this responsibility in legislation in future.

Table 2. Plant biosecurity related legislation across Australia

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	▪ *Biosecurity Act 2015* ▪ *Biosecurity Regulation 2017* ▪ *Biosecurity Order (Permitted Activities) 2017* and other supporting legislation such as Control Orders
NT	Department of Primary Industries and Resources	▪ *Plant Health Act 2008* ▪ *Plant Health Regulations 2011*
Queensland	Department of Agriculture and Fisheries	▪ *Biosecurity Act 2014* ▪ *Biosecurity Regulation 2016*
SA	Primary Industries and Regions	▪ *Plant Health Act 2009* ▪ *Plant Health Regulations 2009*
Tasmania	Department of Primary Industries, Parks, Water and Environment	▪ *Plant Quarantine Act 1997* ▪ *Weed Management Act 1999*
Victoria	Department of Economic Development, Jobs, Transport and Resources	▪ *Plant Biosecurity Act 2010* ▪ *Plant Biosecurity Regulations 2016*
WA	Department of Primary Industries and Regional Development	▪ *Biosecurity and Agricultural Management Act 2007*

Chapter 2

Australia's plant production industries

Plant industry peak bodies

Australia's farmers have peak representative bodies that act on their behalf on a range of activities of collective importance, including biosecurity. Most plant industry peak bodies represent producers of one crop, such as strawberries, or a group of similar crops such as vegetables.

In addition to broadacre farmers and horticulture producers, industry peak bodies represent truffle growers, foresters and beekeepers (due to the importance of honey bees as pollinators for many crops), and the majority of these peak bodies are members of PHA.

Industry bodies consider biosecurity to be a matter of importance, since it underpins the sustainability of their industry. New plant pests can make production more expensive due to increased use of pesticides, greater labour costs or additional procedures. Pests can lower yields, reduce quality or cause damage to stored produce. In some cases, these factors mean it is no longer viable to grow a particular crop in a region. In addition, pests can mean loss of access to markets so that some growers have fewer market options to sell their crops.

As a result of these potential biosecurity threats to sustainability, Australia's peak industry bodies are proactive about biosecurity risk mitigation. Most have joined PHA to be a part of the plant biosecurity partnership, which ensures that they are kept up to date on biosecurity and can contribute to strengthening the plant biosecurity system.

In addition to taking part in PHA and Emergency Plant Pest Response Deed (EPPRD) activities, plant industry peak bodies also:

- Work with government departments to negotiate international market access.
- Contribute to scientific advisory panels when Emergency Plant Pest responses need information to make decisions.
- Take part in government consultation events such as Biosecurity Roundtables.
- Communicate with growers about the need for on-farm biosecurity and other biosecurity risk mitigation activities.
- Work with government departments on pest surveillance activities.
- Develop information on exotic pests, often in collaboration with the relevant state or territory department of agriculture or PHA.

BIOSECURITY PLANNING FOR INDUSTRIES

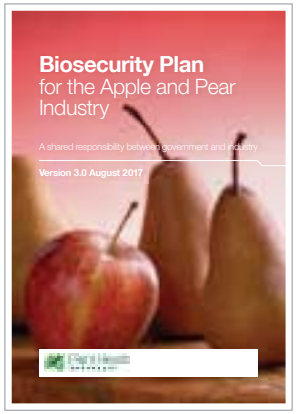
One of the first steps in reducing risk for an industry is to arrange the development of a biosecurity plan for the crops that they produce. As part of biosecurity planning a risk assessment is made which then guides many of the biosecurity activities undertaken by industry and government. The process of funding biosecurity plans is a complex arrangement between industry bodies, their relevant Research and Development Corporation and the Australian Government.

Each of PHA's plant industry members (39 at the end of 2017) undergoes biosecurity planning which results in a list of High Priority Pests (those assessed to pose the greatest risk). There are two industries, tea tree and sweetpotato, with this process still in progress. For all other industries who are members of PHA, High Priority Pests have been agreed and are listed in the following pages.

The biosecurity planning process is at the heart of the plant biosecurity partnership since each risk assessment is carried out by government and industry experts, PHA and researchers. Each expert group seeks information from both Australian and international sources to perform their pest threat evaluation.

Having identified the pests that pose the greatest threat to the industry, the next step is to develop and agree on effective biosecurity measures to protect against them. Agreed risk mitigation methods might include:

- Developing contingency plans that will assist in responding to particular plant pests, should they make it to Australia.
- Developing diagnostic protocols so that pests can be identified quickly.
- Promoting on-farm biosecurity measures among growers.
- Developing surveillance plans so that exotic pest incursions are detected early.
- Funding and carrying out pre-emptive plant breeding programs to develop more resistant crop varieties.
- Gaining pre-emptive permit registration for pesticides that would be needed to manage pests.



The plan is endorsed by the peak industry body and by all Australian governments through Plant Health Committee. This means that the key stakeholders in the plant biosecurity system are agreed on the priorities and risk mitigation efforts to protect an industry. This is emphasised on the cover of each PHA biosecurity plan by the inclusion of the sub-title *A shared responsibility between government and industry.* See Table 3 for a list of biosecurity plans prepared by PHA.

Beginning in 2017 a panel of government and industry experts is now appointed for individual plans to assess the progression of activities. This ensures that by the end of a plan (usually five years) activities have been achieved, providing a significant boost in protection from pest threats.

Growers have an important role to play in supporting Australia's biosecurity system. 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 6.

REPRESENTING GROWERS IN AN EMERGENCY PLANT PEST RESPONSE

The majority (33 of 39 industry members) of PHA's plant industry members are also signatories to the EPPRD, which has the potential to provide reimbursement of costs for growers in the event of an Emergency Plant Pest incursion.

In order to join the agreement, plant industry bodies have to set up a funding mechanism with the agreement of their growers, usually an Emergency Plant Pest Response Levy, which ensures that the industry can pay their share of an agreed Cost Shared eradication response for a pest that affects their crops.

Establishing levies under the terms of the Australian Government Levy Principles and Guidelines can be a time-consuming process for industry peak bodies, although recent changes to the process have lessened the consultation requirements.

Levies or other funding mechanisms at regional, state or national levels are increasingly being used to fund specific plant biosecurity activities that benefit the industry, such as research and development, industry outreach programs and preparedness initiatives such as developing contingency plans on particular high risk pests to speed the development of a Response Plan in the event of an incursion. More information on Emergency Plant Pest responses is in Chapter 5.

Table 3. Current biosecurity plans covering Australia's plant industries

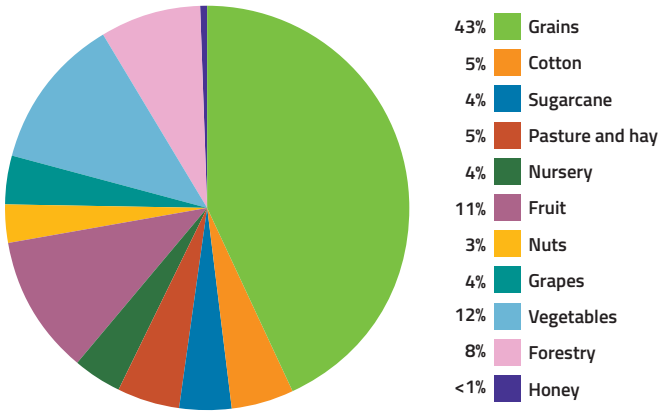
Industry plans	
Apple and Pear BP (Version 3.0)	Olive BP (Version 2.0)
Avocado IBP (Version 2.01)	Onion IBP (Version 2.0)
Banana IBP (Version 2.0)	Papaya IBP (Version 1.0)
Blueberry BP (Version 1.0)	Passionfruit IBP (Version 1.0)
Cherry IBP (Version 2.01)	Pineapple BP (Version 2.0)
Citrus BP (Version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

Plant production in Australia

Agriculture contributes significantly to the nation's economy, with crops worth more than livestock production. In 2016–17 plant production industries were valued at over $36 billion (see Figure 2).

Figure 6 shows the contribution of each of the main plant production industries including honey and beeswax to total plant gross value of production in 2015–16 (the latest year for which this breakdown is available)[7].

Figure 6. Comparative value of Australia's plant production industries, based on gross value of production, 2015–16



PLANT INDUSTRY PROFILES

The following pages profile PHA plant industry members, their value, and where crops are produced across the states and territories. Each profile also provides the industry's key exotic pest threats, and the biosecurity 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. Note that data used in the graphs are up to 2015–16, the latest available year.

Farm-gate values are sourced from approved statistical authorities such as Australian Bureau of Statistics (ABS) and Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

7. ABS 7503 data series, ABARES Agricultural Commodities: March quarter 2018

ALMONDS

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

In 2015–16, almond production was valued at $699 million (LVP). There are several almond varieties grown in Australia. The most popular include the Nonpareil, Carmel and Price which are sold in a range of forms, including in-shell, raw kernel, and as roasted and blanched products.

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

The Australian almond industry is concentrated along the Murray Valley in Victoria, SA and NSW with an orchard recently commencing production in WA. In total, almond trees cover 40,000 hectares.

The industry is undergoing an expansion phase, and when current plantings are mature in 2025 production is expected to reach nearly 130,000 tonnes. More planting is planned.

The almond industry is covered by version 3.0 of the nut industry biosecurity plan and the Orchard Biosecurity Manual for the Almond Industry Version 1.0.

Figure 7. Annual value of almond production, 2007–16

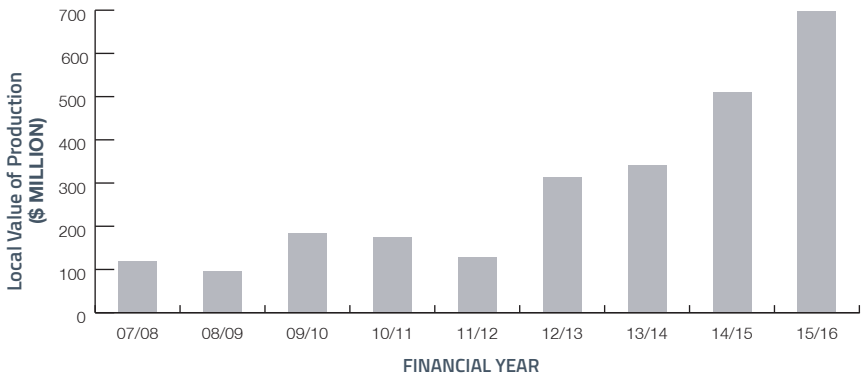


Figure 8. Distribution of almond production by state and territory, 2015–16 (based on LVP)

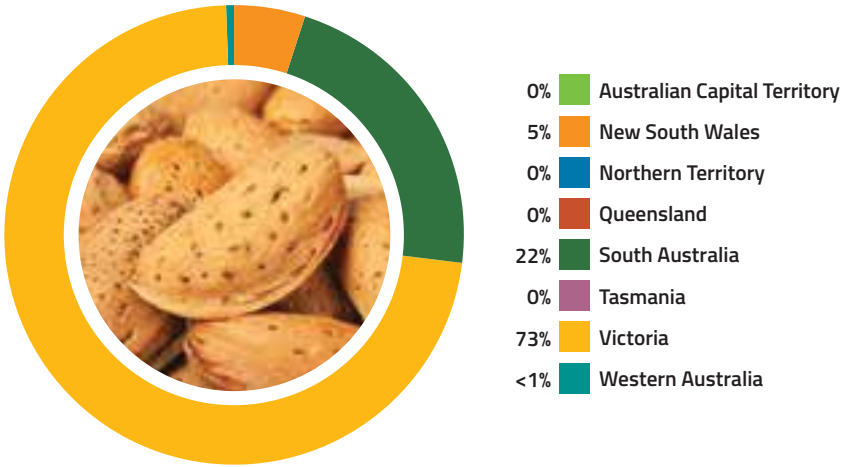


Table 4. High Priority Pests of the almond industry

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
Trogoderma granarium	Khapra beetle
Tropilaelaps clareae	Tropilaelaps mite
Tripilaelaps 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

Adult green stink bug. Image courtesy of Daren Mueller, Iowa State University, Bugwood.org

Tropilaelaps mite, dorsal view. Image courtesy of Food and Environment Research Agency (Fera), Crown Copyright

APPLES AND PEARS

Represented by Apple and Pear Australia
apal.org.au

In 2015–16, apple and pear production was valued at $537 million (LVP). The total planted area for apples is 9,375 hectares and 3,175 hectares for pears.

There are approximately 550 commercial apple and/or pear grower businesses in Australia. All states produce apples, although Victoria is the largest producer of apples and pears. In Victoria, over 45 per cent of Australia's apples and 90 per cent of pears are produced.

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 apples produced are Pink Lady™, Gala, Fuji and Granny Smith. A number of newer club apple varieties such as Jazz™, Kanzi™ and Bravo™ have been increasing in production recently.

Packham and Williams are the main pear varieties. Most production is consumed domestically with less than five per cent exported to the premium markets of the United Kingdom and Europe and the markets of south east Asia.

The apple and pear industry is covered by version 3.0 of the apple and pear biosecurity plan and the Orchard Biosecurity Manual for the Apple and Pear Industry Version 2.0.

Figure 9. Annual value of apple and pear production, 2007–16

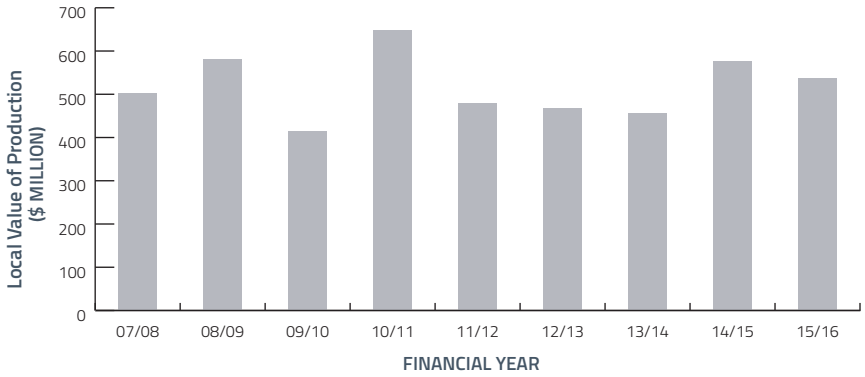


Figure 10. Distribution of apple and pear production by state and territory, 2015–16 (based on LVP)

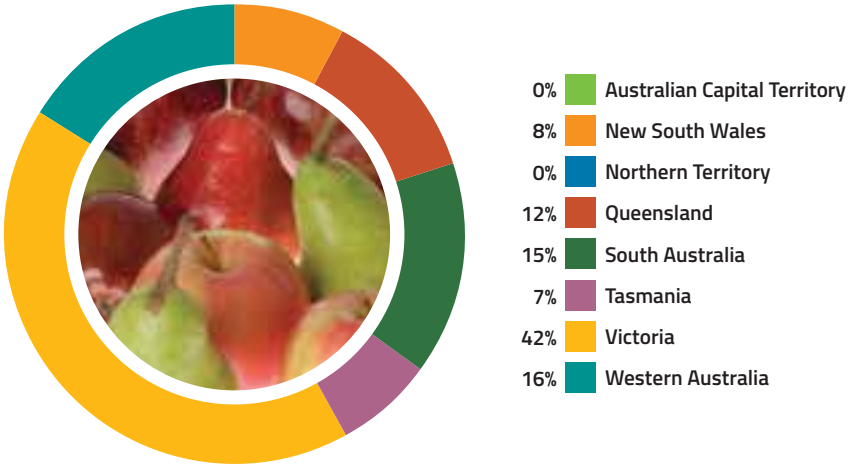


Table 5. High Priority Pests of the apple and pear industry

Scientific name	Common name
Bactrocera dorsalis	Oriental fruit fly
Carposina sasakii	Peach fruit moth, small peach fruit borer
Cydia inopinata (syn. *Grapholita inopinata*)	Manchurian fruit moth
Dasineura mali	Apple leaf curling midge
Drosophila suzukii (syn. *Leucophenga suzukii*)	Spotted wing drosophila
Dysaphis plantaginea	Rosy apple aphid
Erwinia amylovora	Fire blight
Halyomorpha halys (syn. *Halyomorpha mista*)	Brown marmorated stink bug
Lymantria dispar	Gypsy moth (Asian and European strains)
Lymantria mathura	Rosy gypsy moth, pink gypsy moth
Lymantria monacha	Nun moth
Monilinia fructigena	Brown rot
Monilinia mali	Monilinia leaf blight, blossom wilt
Monilinia polystroma	Asiatic brown rot
Neonectria ditissima (syn. *Neonectria galligena*)	European canker, nectria canker, crotch canker, eye rot
Rhagoletis pomonella	Apple maggot
Tropilaelaps clareae	Tropilaelaps mite
Tropilaelaps mercedesae	Tropilaelaps mite
Varroa destructor	Varroa mite

Adult apple maggot flies are similar to other small fly species, with the exception of the zigzag pattern on the wings and white dot on back. Image courtesy of Joseph Berger, Bugwood.org

Fruit surface dimpling and internal larval feeding tracks in apple maggot infested apples. Image courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org

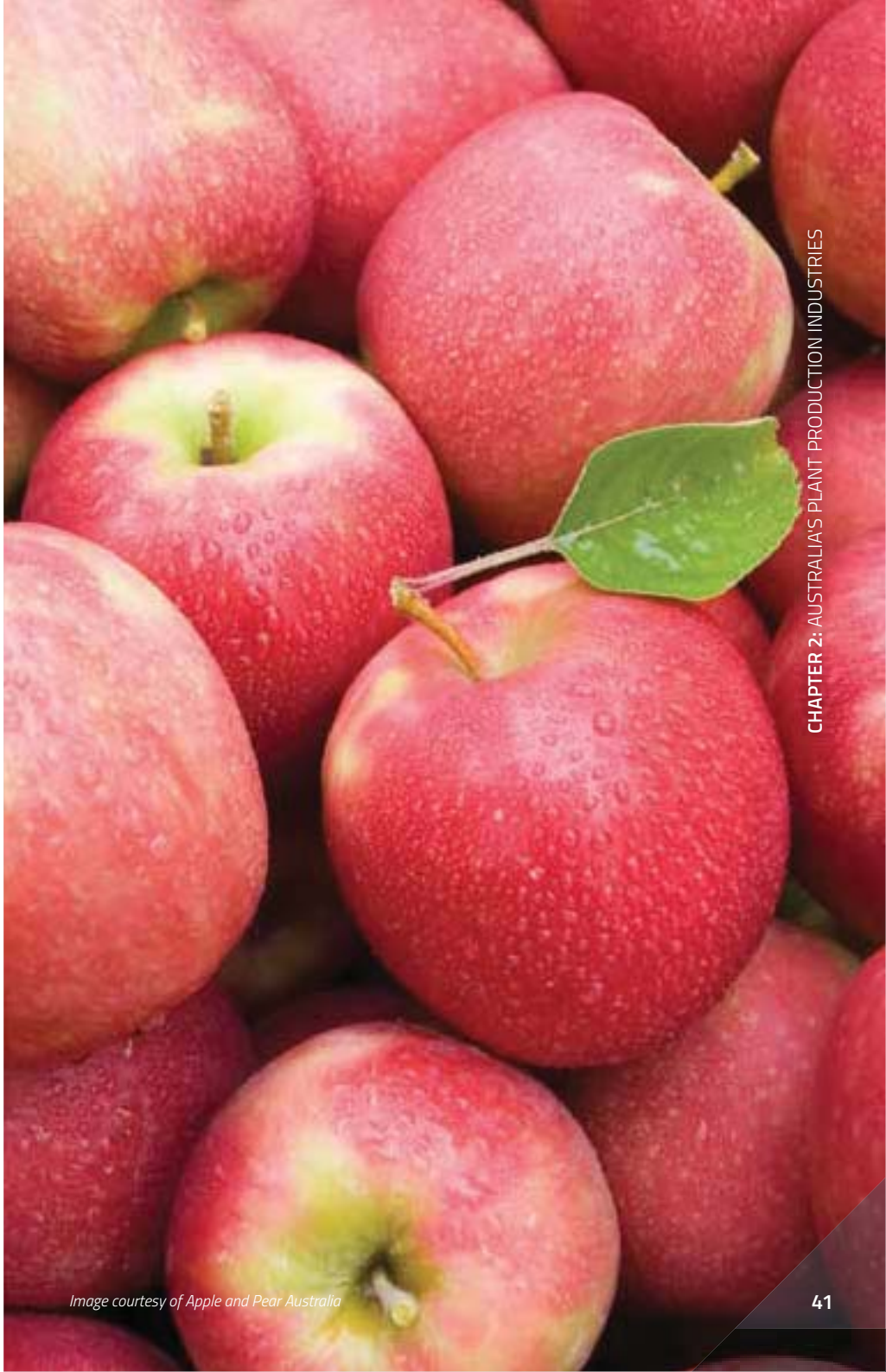


Image courtesy of Apple and Pear Australia

AVOCADOS

Represented by Avocados Australia
avocado.org.au

In 2015–16, avocado production was valued at $281 million (LVP). The Hass variety is the predominant avocado produced in Australia, accounting for approximately 87 per cent of production, with Shepard accounting for about 10 per cent. A number of other varieties such as Reed, Sharwil, Gwen, Wurtz and Fuerte make up the balance. Exports were only just over three per cent of production in 2016–17, mostly shipped to Singapore and Malaysia.

Australians' love of avocados has grown steadily each year since the 1990s. Consumption in 2016–17 reached just over 3.5kg per person, up from 3.2kg the previous year.

Queensland dominates Australia's avocado production, followed by WA, NSW, SA and Victoria, with a small amount of production in Tasmania. This geographic diversity in growing regions ensures domestic access to Australian avocados year-round. Imported New Zealand fruit supplements supply during spring and summer.

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 11. Annual value of avocado production, 2007–16

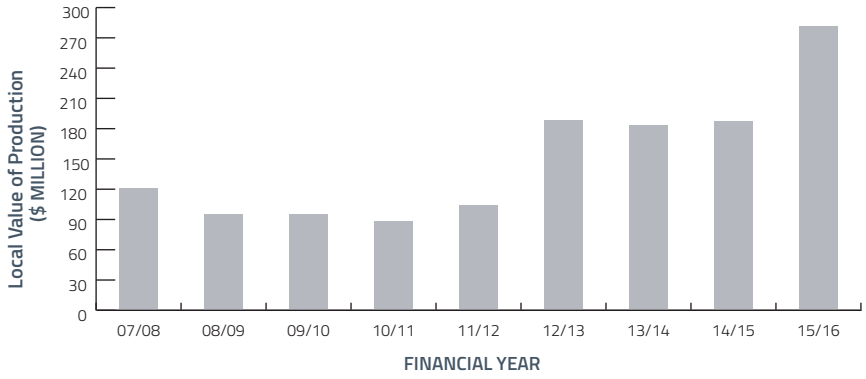


Figure 12. Distribution of avocado production by state and territory, 2015–16 (based on LVP)

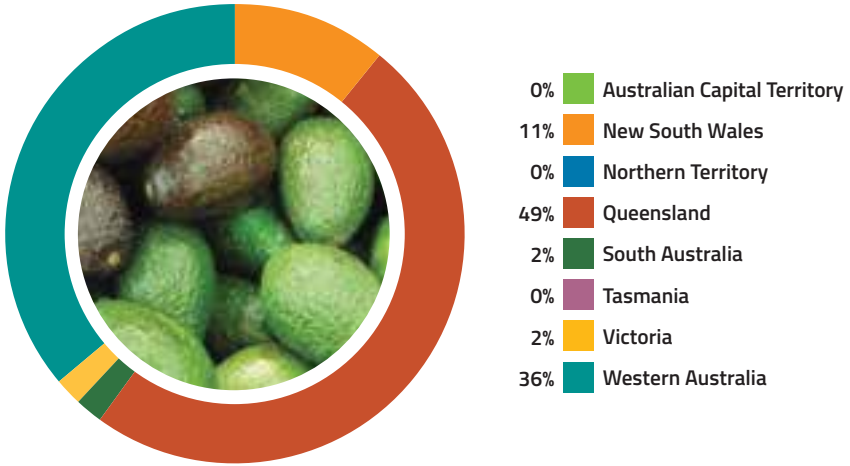


Image courtesy of Avocados Australia

Table 6. 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

* This species has been synonymised with *Bactrocera dorsalis*

Lateral view of Fijian fruit fly. Image courtesy of Ken Walker Museum Victoria, PaDIL

Avocado seed moth larva feeding in young branch. Image courtesy of Mark Hoddle, University of California

BANANAS

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

In 2015–16, banana production was valued at $364 million. There are currently about 13,000 hectares of bananas grown in Australia, 94 per cent of which are located in north Queensland around Tully, Innisfail and the Kennedy areas and also from Ingham to Hopevale and the Atherton Tablelands.

Bananas are grown all year round with the two main varieties being Cavendish and Lady Finger. The Cavendish variety accounts for 95 per cent of production. The vast majority of the Australian banana crop is supplied to the domestic market while a small number of growers are creating export markets to Asia.

There are currently three major biosecurity threats challenging the banana industry:

- Banana freckle in the NT
- Panama disease tropical race 4 (TR4) in north Queensland
- Banana bunchy top virus in northern NSW and south east Queensland.

The National Banana Freckle Eradication Program (carried out under the Emergency Plant Pest Response Deed) is expected to achieve successful eradication of banana freckle from the NT in 2018. Australia will then prepare a submission declaring national proof of freedom. Interstate movement and access restrictions remain in place.

Panama disease tropical race 4 was first detected on a north Queensland property in March 2015. While significant effort was directed to contain the disease, by the end of 2017 it had been confirmed on two properties.

The first infected farm was purchased by the Australian Banana Growers' Council (ABGC) in October 2016 using an industry levy as well as contributions from the Australian governments. After purchase, all banana plants (hosts) were destroyed and the farm ceased all operations. The farm with the second detection continues to produce and pack fruit under strict biosecurity conditions but well away from the destroyed infection sites. Biosecurity Queensland continues to conduct surveillance on all commercial banana farms in north Queensland.

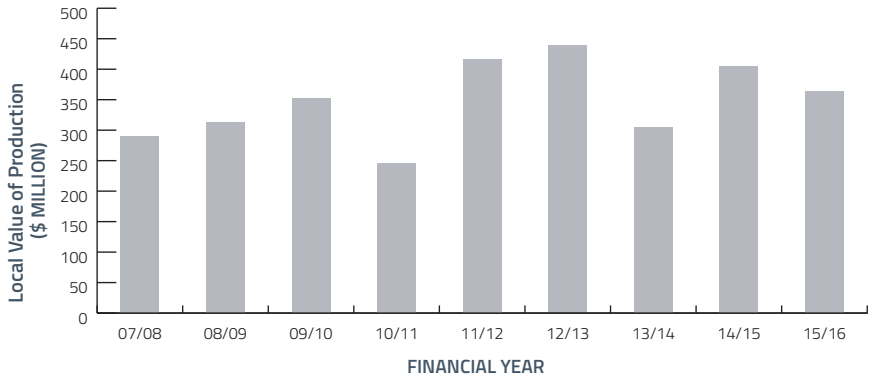
A control program for banana bunchy top virus has been operating in NSW since 2009. The aim is to contain the virus to a limited area and eradicate it from all commercial banana plantations.

An officer is employed by the ABGC to undertake inspections for the presence of yellow sigatoka in the north Queensland commercial production area. Yellow sigatoka is an endemic leaf disease that spreads easily if not controlled and reduces the production of fruit.

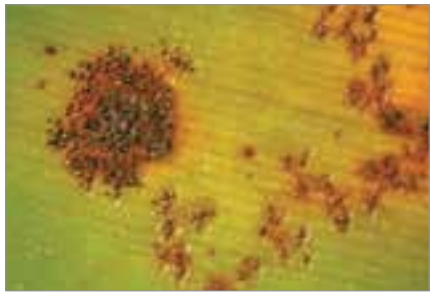
The ABGC also employs two staff members who have a combined responsibility for biosecurity related research and development as well as strategy development and implementation.

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.

Figure 13. Annual value of banana production, 2007–16

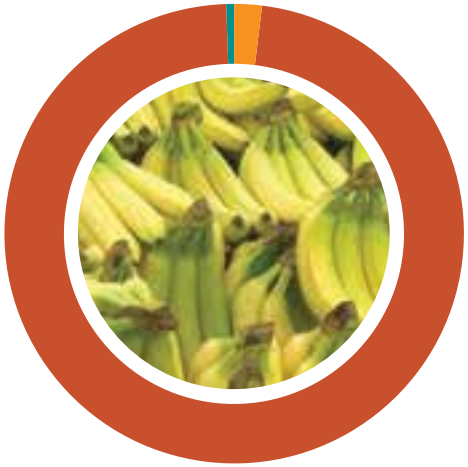


Bunchy top virus affected leaves are more upright with pale yellow margins. Leaf margins may also be more wavy than normal. Image courtesy of Jeff Daniells



Leaf affected by banana freckle. Image courtesy of Kathy Grice

Figure 14. Distribution of banana production by state and territory, 2015–16 (based on LVP)



0%	Australian Capital Territory
2%	New South Wales
0%	Northern Territory
98%	Queensland
0%	South Australia
0%	Tasmania
0%	Victoria
<1%	Western Australia

Table 7. 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

BLUEBERRIES

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

In 2015–16, blueberry production was valued at $146 million (LVP). The industry is rapidly expanding with farmers on average producing 11,500 tonnes of blueberries per annum.

Around 250 growers produce blueberries over 1,300 hectares in all states of Australia, except NT. The major production area of the Australian blueberry industry is on the NSW north coast. NSW produced over 80 per cent of the Australian crop in 2015. Other regions have increased plantings to take advantage of late and early season fruit, with the aim of having Australian blueberries available all year round.

The crop is grown in Tumbarumba in southern NSW; the Atherton Tablelands, Bundaberg and Mundubbera in Queensland; the Tamar Valley, Meander Valley, Bernie, Devonport 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 five per cent exported to markets including Hong Kong, Singapore and Thailand.

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

Table 8. 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 15. Annual value of blueberry production, 2011–16

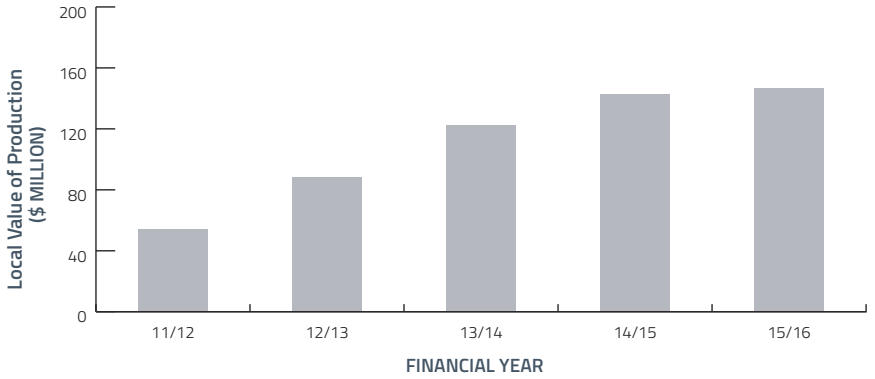
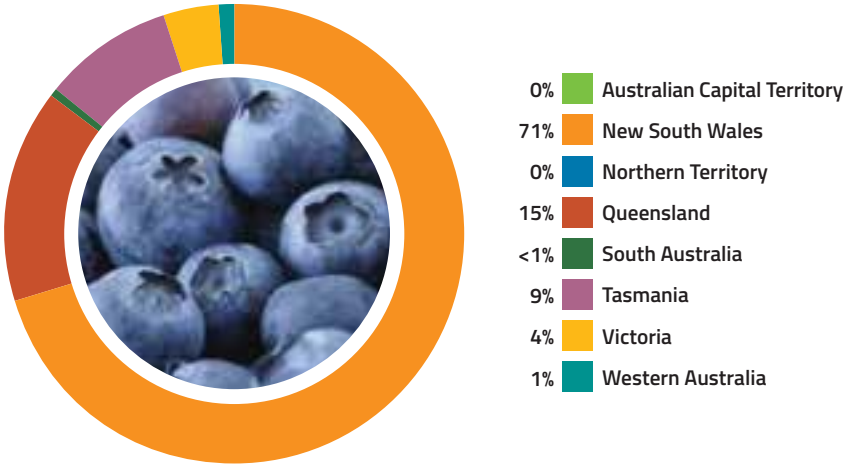


Figure 16. Distribution of blueberry production by state and territory, 2015–16 (based on LVP)



CANNED FRUITS

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

In 2015–16, production of canned fruit was valued at $20 million (LVP), $1 million less than the 2014–15 production year. Fruit production for canning is carried out from December to May and volumes of between 100,000 and 120,000 tonnes are processed annually.

The industry represents more than 170 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) at Shepparton.

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.

Figure 17. Annual value of canned fruit production, 2007–16

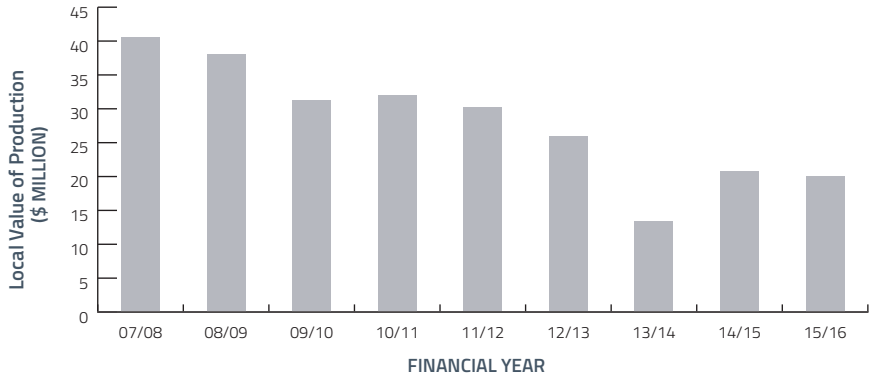
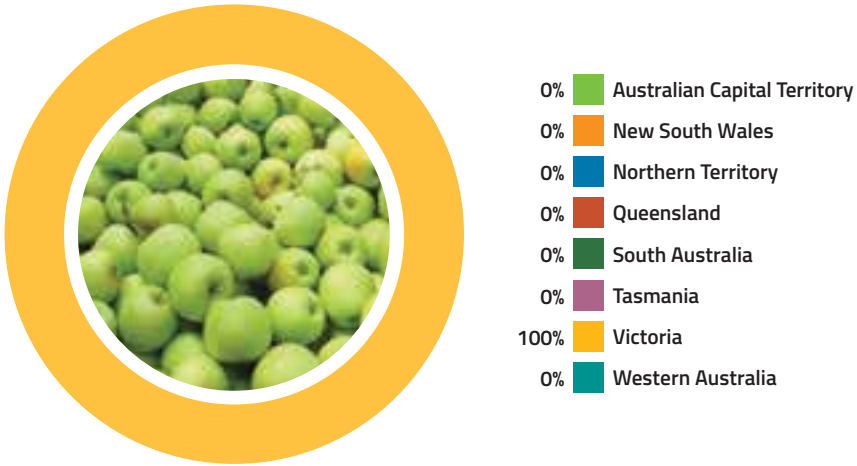
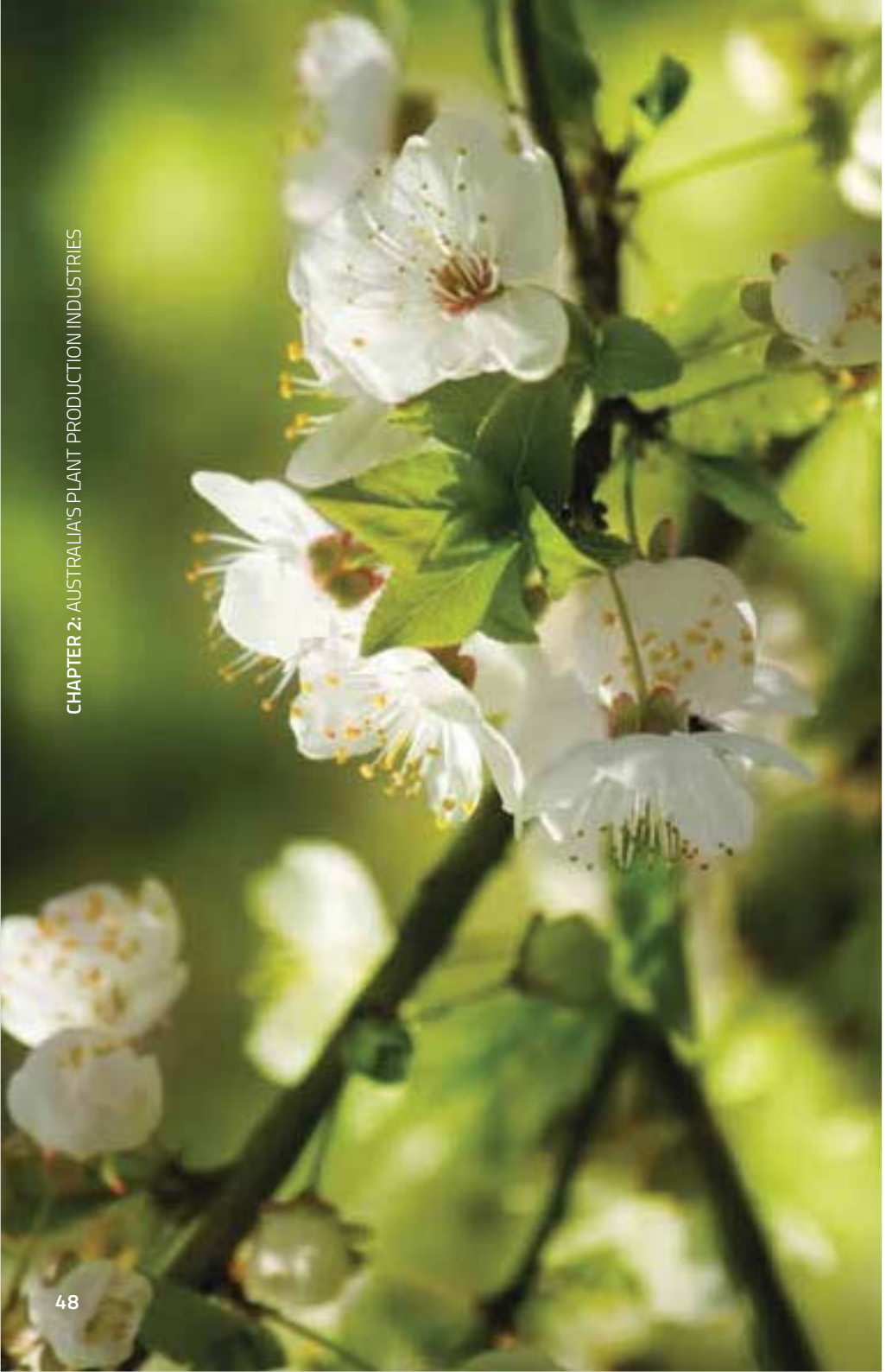


Figure 18. Distribution of canned fruit production by state and territory, 2015–16 (based on LVP)





CHERRIES

Represented by Cherry Growers Australia
cherrygrowers.org.au

In 2015–16, production of cherries was valued at $158 million (LVP). The cherry industry comprises 485 cherry enterprises farming 2,845 hectares and producing more than 18,500 tonnes of fruit.

Australia produces some of the world's finest cherries. Growing international demand is driving expansion, with new investment within the Australian cherry industry from both local and overseas stakeholders.

Currently, 70 per cent of produce is for domestic consumption, with $76 million of Australian cherries exported in 2015–16 to more than 30 overseas markets.

Across Australia, cherry growing regions span a variety of climatic zones, with over 30 cherry varieties under production. Cherry growing enterprises vary from smaller boutique orchards in WA and Queensland to larger suppliers in NSW, Victoria and Tasmania who export across the globe.

National expansion is underpinned by ongoing research and strong biosecurity principles, established through the cherry industry's Biosecurity Management Programme, and supported by PHA's cherry biosecurity plan version 2.01 and Orchard Biosecurity Manual for the Cherry Industry Version 1.0.

Figure 19. Annual value of cherry production, 2007–16

Figure 20. Distribution of cherry production by state and territory, 2015–16 (based on LVP)

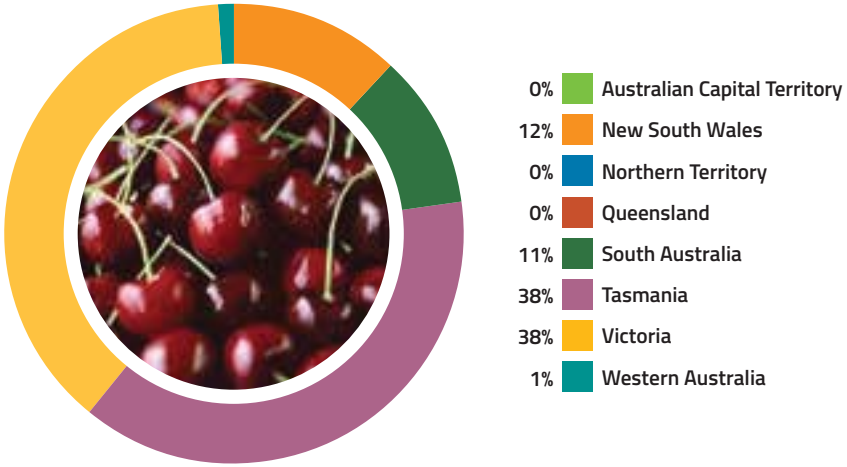


Image courtesy of Charlotte Brunt

Table 9. High Priority Pests of the cherry industry

Scientific name	Common name
Candidatus Phytoplasma prunorum*	European stone fruit yellows
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
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
Planotortrix 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

* Previously called European stone fruit yellows phytoplasma

Adult plum curculio weevils are brown/grey. Image courtesy of Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org

Adult apple maggot. Image courtesy of Joseph Berger, Bugwood.org

CHESTNUTS

Represented by Chestnuts Australia
chestnutsaustralia.com.au

In 2015–16, chestnut production of 1,350 tonnes was valued at $6 million (LVP). Around 1,300 hectares are planted with 250,000 chestnut trees. It is estimated that with more trees planted, production will rise to approximately $12.5 million by 2020.

The main varieties grown are Red Spanish, Purton's Pride and De Coppi Marone. 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.

Chestnuts are grown mainly in the southern states of Australia, primarily in Victoria.

Throughout 2017 Chestnuts Australia continued to participate in the Emergency Plant Pest response for chestnut blight, including sitting on the chestnut blight decision making committees, the Consultative Committee on Emergency Plant Pests (CCEPP) and the National Management Group (NMG).

In addition, Chestnuts Australia has participated on other relevant and appropriate NMG and CCEPP activities and exotic incursions.

Australia is free from major exotic insect pests such as the chestnut gall wasp and chestnut weevil.

Chestnuts Australia includes biosecurity as an integral part of its activities. Biosecurity is considered in the Australian Chestnut Industry Five Year Strategic Plan – 2015 to 2020 and is covered by the risk analysis documented in the nut industry biosecurity plan. The industry has regular representation at PHA meetings and the Australian Government's Biosecurity Roundtables.

A Hort Innovation project is keeping the industry up to date with the latest news, R&D outputs and other information, including on biosecurity, through a variety of channels.

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

Table 10. High Priority Pests of the chestnut industry

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

Figure 21. Annual value of chestnut production, 2009–16

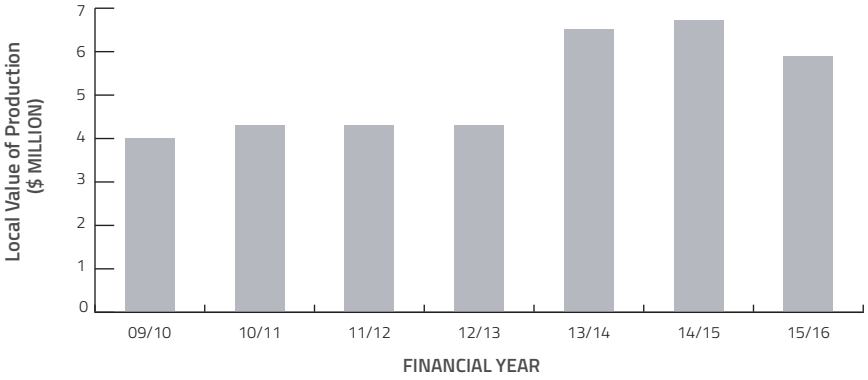
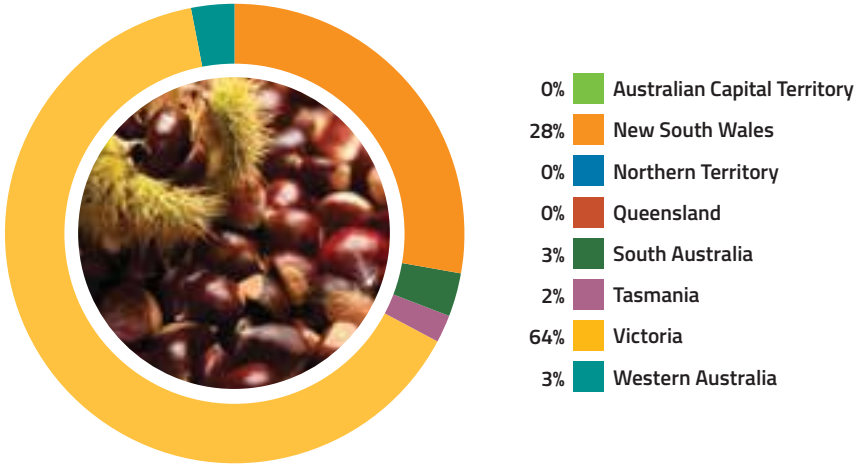


Figure 22. Distribution of chestnut production by state and territory, 2015–16 (based on LVP)



CITRUS

Represented by Citrus Australia
citrusaustralia.com.au

In 2015–16, the citrus industry was valued at $568 million (LVP). It is Australia's largest fresh fruit exporting industry by volume, with citrus exports (oranges, mandarins, lemons, limes and grapefruit) totalling 260,209 tonnes worth $427 million in 2017. Total production of citrus was estimated to be 750,000 tonnes, produced from about 26,000 hectares of citrus plantings nationally.

Major export markets include China, Japan, Hong Kong, Malaysia, Indonesia, United Arab Emirates, Singapore, the United States and Thailand.

Citrus fruits are grown commercially throughout the Australian mainland excluding the ACT. Major growing areas include the Riverina in NSW; Central Burnett and Emerald in Queensland; Riverland in SA; and the Murray Valley in Victoria/NSW. Production also occurs in WA and there are a small number of plantings in the NT.

The Citrus Biosecurity Project, boosting the preparedness of the citrus industry for serious exotic pests, concluded in 2017. The outreach program was funded by Hort Innovation and jointly managed by PHA and Citrus Australia. A new project has commenced with a focus on coordinated surveillance for 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 23. Distribution of citrus production by state and territory, 2015–16 (based on LVP)

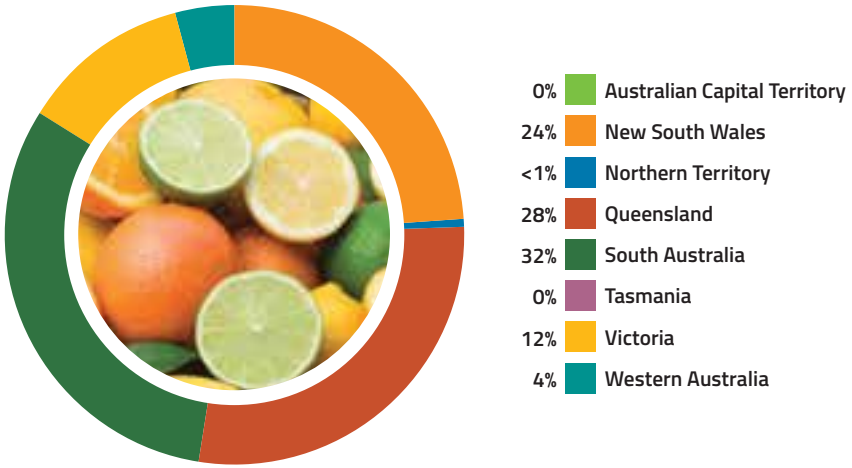


Figure 24. Annual value of citrus production, 2007–16

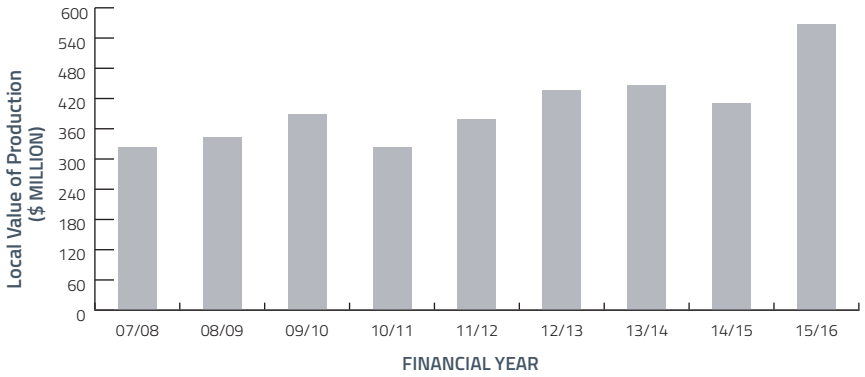


Table 11. High Priority Pests of the citrus industry

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
cottonaustralia.com.au

In 2015–16, cotton production was valued at $1.3 billion (LVP).

Australian cotton yields are high by international standards, at nearly three times the world average. Although a relatively small producer on the world scale, Australia sustainably produces high quality, low contaminant cottons that attract a premium on the world market. Almost the entire Australian cotton crop is exported, with the majority sold to China and the remainder mainly to spinning mills in other parts of Asia.

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 Murray Valley Area in Victoria, and Menindee Lakes in 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 in Victoria. Cotton is predominantly grown as an annual irrigated summer crop, with rain-grown cotton representing 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 25. Distribution of cotton production by state and territory, 2015–16 (based on LVP)

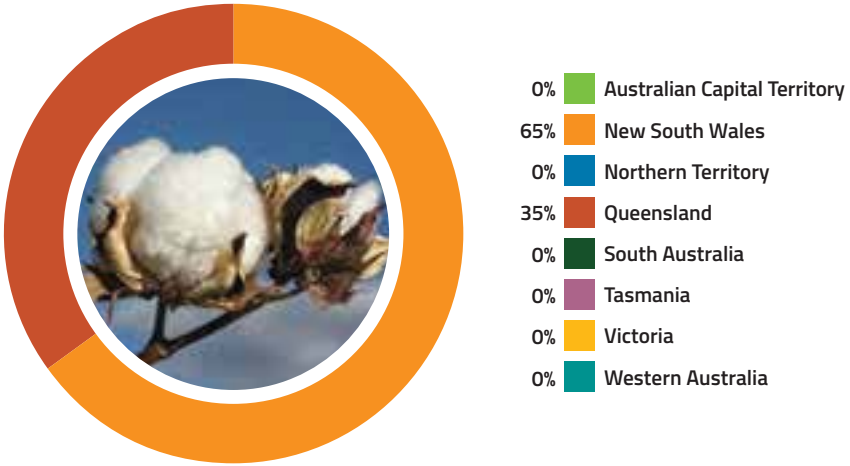


Figure 26. Annual value of cotton production, 2007–16

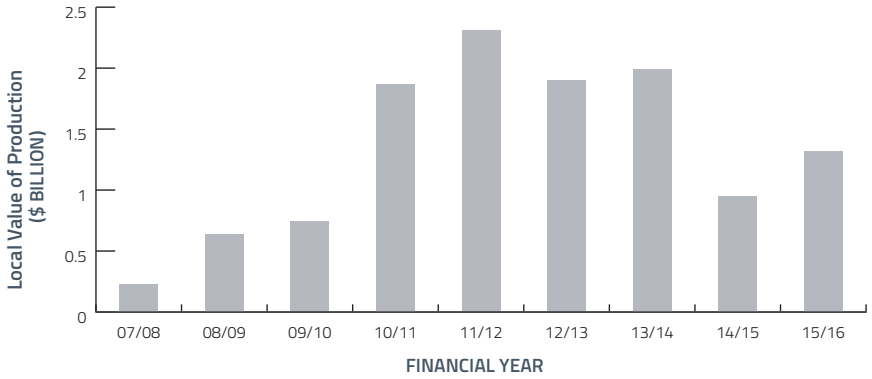


Image courtesy of Cotton Australia

Table 12. 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 bug
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)	No common name

Image courtesy of Cotton Australia

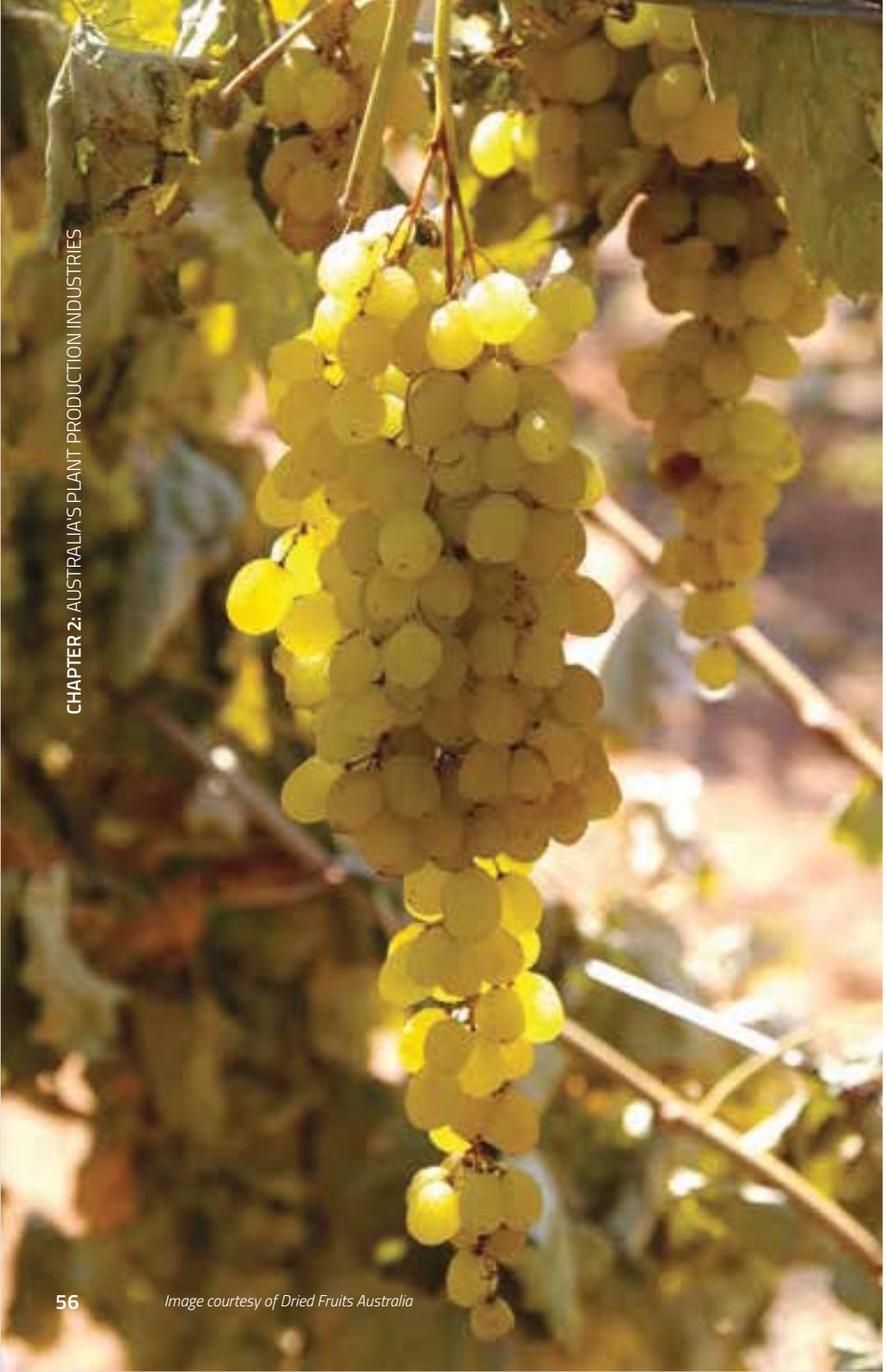


Image courtesy of Dried Fruits Australia

DRIED FRUITS (GRAPES)

Represented by Dried Fruits Australia
driedfruitsaustralia.org.au

In 2015–16, dried grape production (sultana types, currants and raisins) had a value of $41 million (LVP).

The 2018 crop is expected to be 20,000 tonnes. The main export markets for dried vine fruits are found in Europe with new market opportunities increasing across Asia. Total exports have averaged around 2,500 to 3,000 tonnes over the past few years.

In Australia, grapes for the dried fruit industry are predominantly grown in the Sunraysia region which spans north western Victoria and south western NSW around the Murray River, and also 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, and through the email newsletter Currant News.

The viticulture biosecurity manual has been distributed to dried fruit growers through the major industry processors. 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 vine fruits 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 27. Distribution of dried grape production by state and territory, 2015–16 (based on LVP)

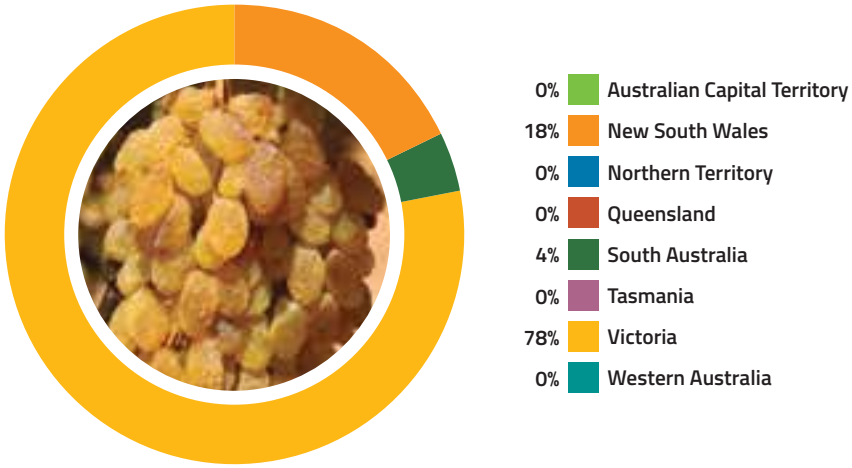


Figure 28. Annual value of dried grape production, 2007–16

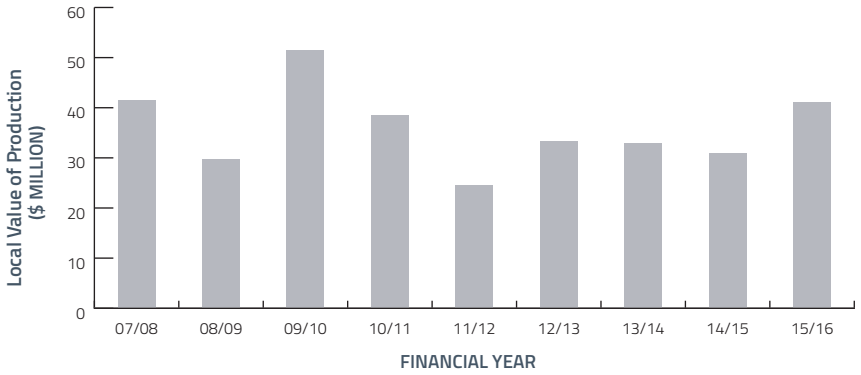


Image courtesy of Dried Fruits Australia

Table 13. High Priority Pests of the dried 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 winged 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*

Adult male spotted winged drosophila flies show distinct spots on the ends of their wings, which give the species their name. Image courtesy of John Davis

European grapevine moth webbing around mature fruit. Image courtesy of Monica Cooper, University of California

FORESTRY

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

In 2015–16, plantation forestry production was valued at $1.9 billion (LVP). The forest, wood and paper products sector is Australia's eighth largest manufacturing industry.

Australia is the seventh most forested country in the world. Of the 125 million hectares of forest in Australia, there are 2 million hectares of plantation forestry and 36.6 million hectares of native forest that are both available and suitable for commercial wood production.

Plantation species are split almost evenly between softwood plantations and hardwood plantations.

Softwood plantations are predominately long rotation (from 28 to 40 years) and produce logs for a range of products including structural timber for housing, appearance grade sawn timber, wood-based panels, engineered wood products, paper and paperboard. The majority of softwood grown in Australia is *Pinus radiata*, which is the dominant species in SA, NSW, Victoria and Tasmania. *P. elliottii* and *P. caribaea* are grown in Queensland and northern NSW, and *P. pinaster* is grown 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.

Hardwood plantations include short rotation eucalypt species (eight to 12 years) grown for woodchips to be made into tissue, paper and paperboard products, and around 10 per cent are long rotation species, producing logs for a range of products including appearance grade sawn timber and structural timber for housing.

There are also some small plantings of *Acacia mangium*, African mahogany and sandalwood grown in the NT and northern WA.

Of the 36.6 million hectares of native forest both available and suitable for commercial wood production, 7.5 million hectares was multiple-use public forests. The remainder is in leasehold and private forests. Multiple-use native forests are managed by state government departments or agencies in NSW, Queensland, Victoria, WA and Tasmania and are defined as crown land managed for a range of values including wood harvesting, water supply, conservation, recreation and environmental protection.

The 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.

Figure 29. Annual value of plantation forest production, 2007–16

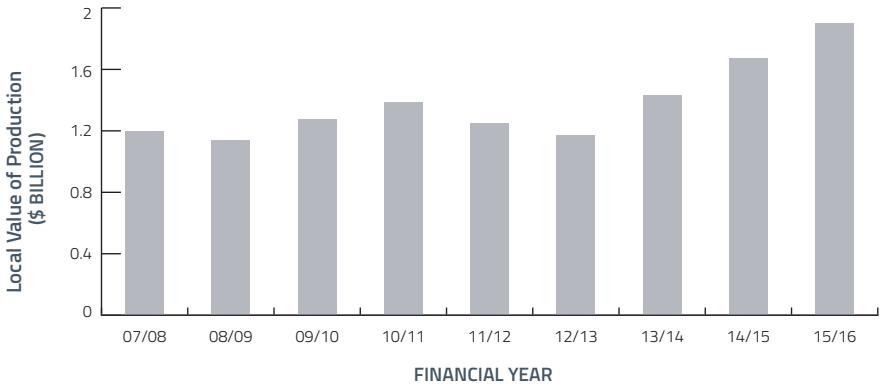


Figure 30. Distribution of plantation forest production by state and territory, 2015–16 (based on LVP)

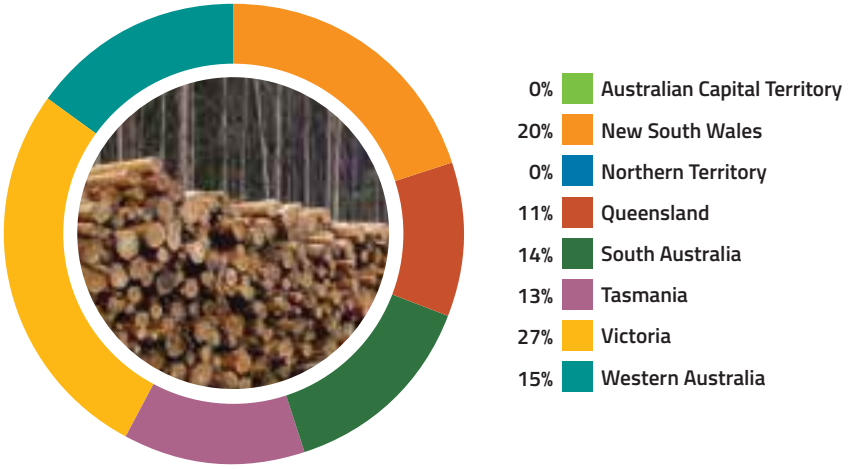


Table 14. High Priority Pests of the plantation forest industry

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 beetle
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 larvae. Image courtesy of Scott Tunnock, USDA Forest Service, Bugwood.org

Bark removed from sudden oak death affected tree showing mottled areas of necrotic inner-bark. Image courtesy of Joseph O'Brien, USDA Forest Service, United States

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 of AFPA 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.

The key functions of the 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 Australian 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.

Image courtesy of the Australian Forestry Products Association

GINGER

Represented by the Australian Ginger Industry Association
australianginger.org.au

In 2015–16, ginger production was valued at $31 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 Jumbo (Canton). Approximately 60 per cent of ginger produced in Australia is sold as fresh ginger with the remaining 40 per cent processed. The value of sales of semi-processed and processed ginger products in the domestic market is over $60 million while exports are 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 31. Distribution of ginger production by state and territory, 2015–16 (based on LVP)

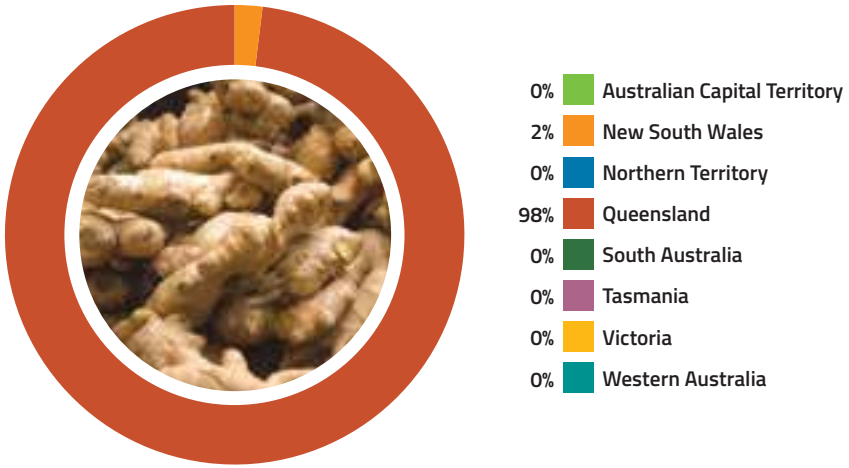


Figure 32. Annual value of ginger production, 2010–16

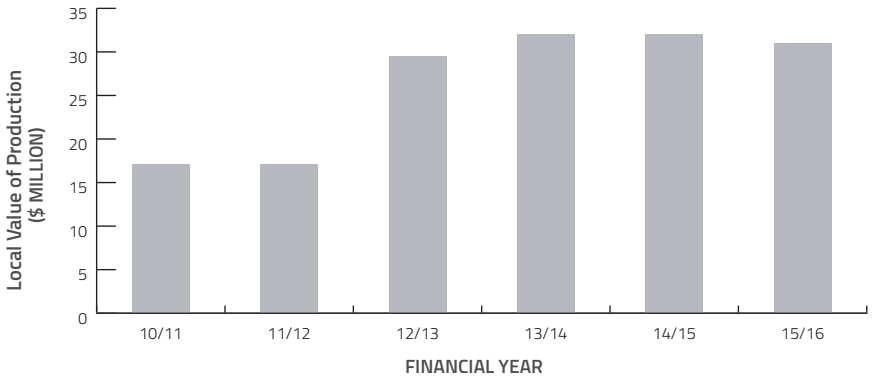


Table 15. High Priority Pests of the ginger industry

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

Ginger showing signs of damage from burrowing nematode. Image courtesy of Michael McClure, University of Arizona, Bugwood.org

GRAINS

Represented by Grain Producers Australia
grainproducers.com.au

In 2015–16, grain production (wheat, barley, canola, sorghum, oats, and lupins) was valued at $11.6 billion (LVP). The grains industry contributed 28 per cent of the total gross revenue from agriculture in that year, making it Australia's largest plant industry.

Wheat is the largest crop, accounting for more than half of total grains production. Australia also produces barley, canola and many varieties of pulse as well as summer crops. The majority of Australia's grain is produced in the wheat belt, which stretches 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, India, Indonesia, Iraq, Korea, Iran and Vietnam.

Since 2007 Grain Producers Australia has funded a biosecurity outreach program to raise awareness and improve practices on-farm and boost preparedness for management of any biosecurity threats. See the next page for more on the Grains Farm Biosecurity Program.

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.

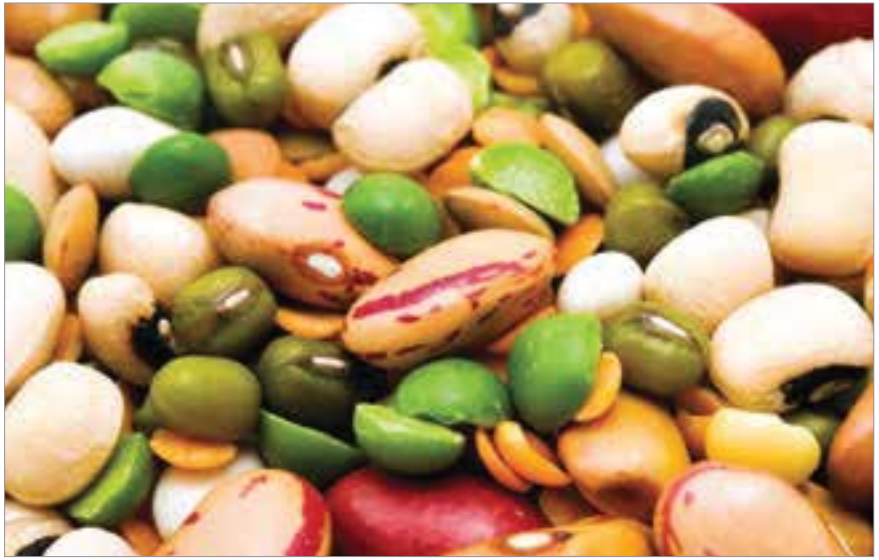


Figure 33. Annual value of grains production, 2007–16

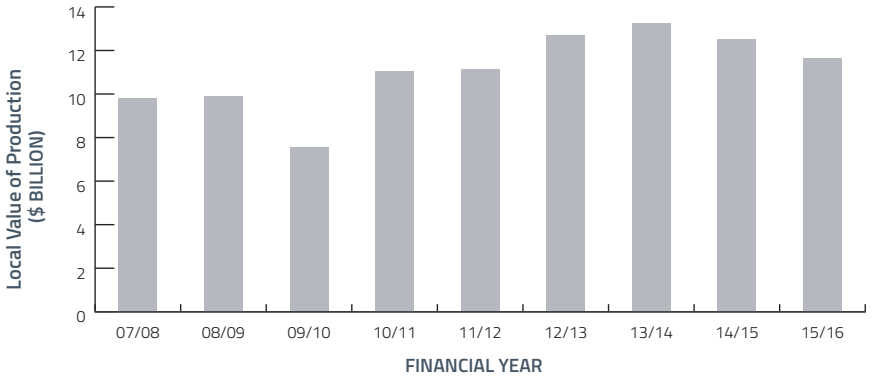
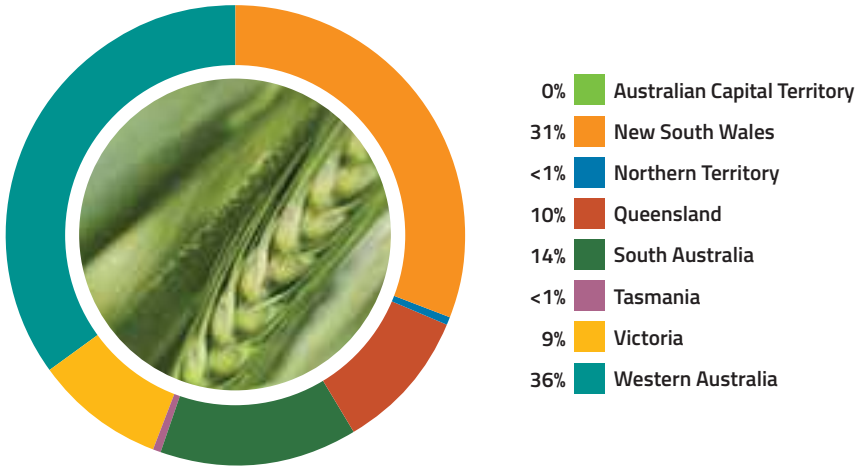


Figure 34. Distribution of grains production by state and territory, 2015–16 (based on LVP)



A decade of Grains Farm Biosecurity

This year marks 10 years of the Grains Farm Biosecurity Program, the outreach program run as a partnership between state governments and the grains industry, which is coordinated by PHA.

The program is funded by growers through levies collected by Grain Producers Australia in partnership with the governments of grain-growing states. PHA has administered and coordinated the program since its inception.

The biosecurity frontline personnel are the state Grains Biosecurity Officers (GBOs) in NSW, Queensland, SA, Victoria and WA. Each officer is responsible for raising awareness of biosecurity among grain growers and others along the supply chain in their region, and for helping the industry with emergency responses and pest incursions.

Some of the faces have changed over the years but, collectively, GBOs have attended more than a thousand events and handed out many thousands of farm biosecurity signs, pest fact sheets, manuals and other information and tools to producers.

Officers have delivered hundreds of training sessions in towns all over the country to raise awareness of the importance of biosecurity and provide growers with information on how to protect their properties. They have written articles for Ground Cover magazine and other publications, and worked with individual growers to develop farm biosecurity plans to help manage the risks from diseases, pests and weeds.

The biosecurity officers are also part of the continuous effort to keep grain markets open. Officers recruit volunteers who check for exotic pests in their paddocks, silos and field trials. 'Nil' findings from active surveillance are amalgamated to confirm to overseas markets that Australia is free from particular exotic pests.

This program was the first to deliver outreach services in an industry and government partnership model.

Table 16. 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

Leaf infected with Russian wheat aphid. Image courtesy of Michael Nash

Leaf sheaths showing signs of barley stripe rust infection. Image courtesy of PaDIL

HAZELNUTS

Represented by Hazelnut Growers of Australia
hazelnuts.org.au

In 2015–16, hazelnut production of approximately 220 tonnes, was valued at $1.2 million (LVP). The industry is however, expanding, with major on-farm investment from a northern hemisphere confectionary manufacturer giving renewed confidence to Australian growers. Approximately 2,200 hectares are planted with 1.1 million trees. The industry estimates that by 2021 hazelnut production will be 2,550 tonnes with a value of $22.5 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 Narrandera, and north east Victoria around Myrtleford. They are also grown in central and eastern Victoria and increasingly in northern Tasmania.

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.

In 2017, Hazelnut Growers of Australia was involved in a number of exotic incursion responses affecting the hazelnut industry, including detections of brown marmorated stink bug in cargo.

Australia is free from eastern filbert blight, a serious disease affecting the industry in the United States, and most other exotic hazelnut pests and diseases.

Biosecurity is considered in the Australian Hazelnut Industry Five Year Strategic Plan – 2015 to 2020 and the industry peak body is represented at PHA meetings and government Biosecurity Roundtables.

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

Table 17. 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 35. Annual value of hazelnut production, 2010–16

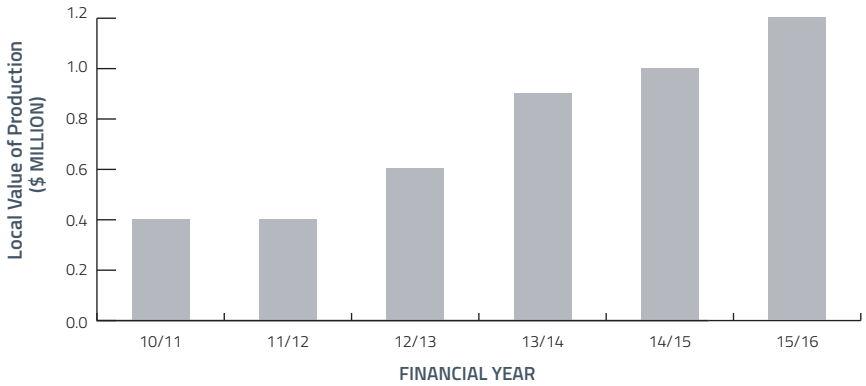
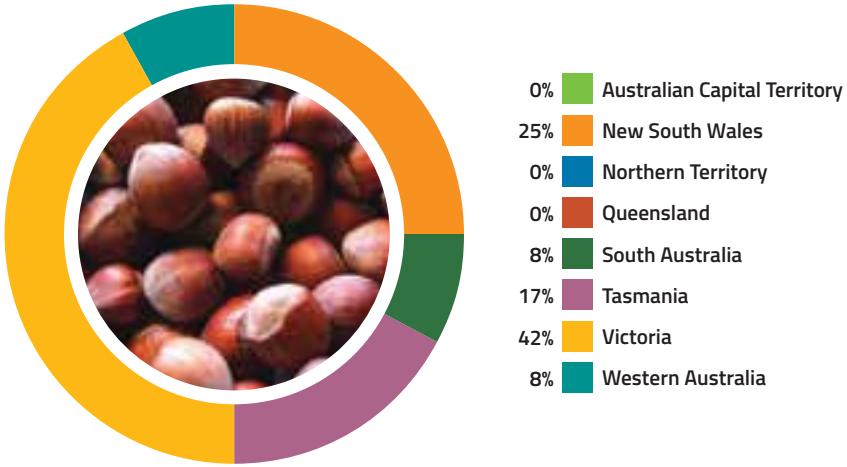


Figure 36. Distribution of hazelnut production by state and territory, 2015–16 (based on LVP)



HONEY BEES

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

In 2015–16, honey and beeswax production was valued at $99 million (LVP). Around 20,800 beekeepers are currently registered, operating around 647,000 hives. Apiaries range in size from one hive to several thousand.

The industry has products other than honey. Australia exports live bees to some countries and our beeswax commands a premium price overseas. Trade relies on the healthy status of Australia's bees, with beeswax valued highly because it lacks residue from pesticides used overseas to treat Varroa mites.

Australia's bees are further valued for the pollination services that they provide to many plant industries, estimated to be worth $4–6 billion per year, and this is the reason the industry is a member of PHA.

The Australian Honey Bee Industry Council (AHBIC) works in partnership with other industries and governments to protect the health of bees with a number of biosecurity initiatives.

The Council contributes to the National Bee Pest Surveillance Program which operates at ports around Australia to provide an early detection mechanism for any exotic pests of bees and pest bees. This government and industry partnership is featured on page 25.

AHBIC worked with PHA and state and territory governments develop the Australian Honey Bee Industry Biosecurity Code of Practice to protect Australia's honey bees, which was endorsed by the honey bee industry in 2016. The aim of the Code of Practice is to improve the management of established pests and diseases, as well as increase preparedness and surveillance for exotic pest threats.

In addition, the National Bee Biosecurity Program, a partnership arrangement involving Bee Biosecurity Officers in each state is nearing full establishment, with officers appointed in all states except Queensland.

AHBIC is currently a part of a national eradication program for *Varroa jacobsoni* in Townsville in north Queensland. The eradication phase has now concluded and in March 2017 the program entered a three year proof of freedom stage.

The honey bee industry is covered by version 1.0 of the honey bee biosecurity plan, which is due for review in 2018, and the Biosecurity Manual for Beekeepers Version 1.1.

Figure 37. Annual value of honey and beeswax production, 2007–16

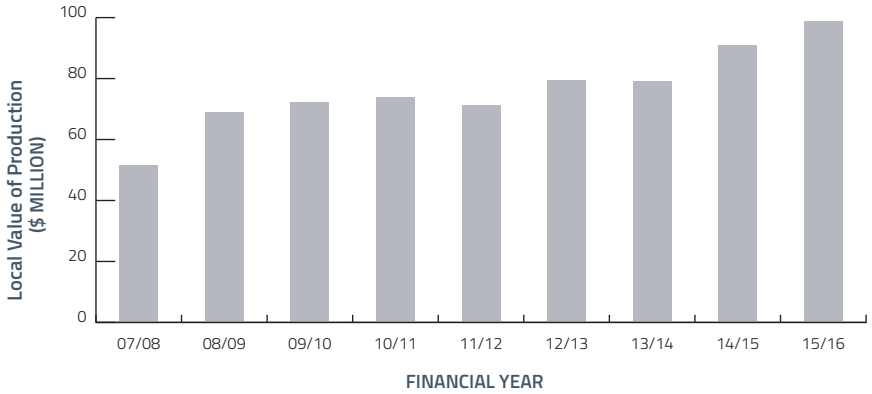


Figure 38. Distribution of honey and beeswax production by state and territory, 2015–16 (based on LVP)

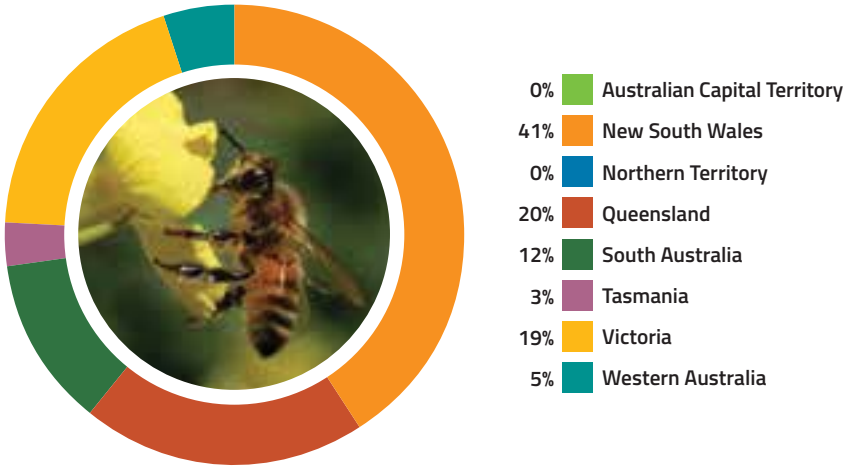


Table 18. High Priority Pests of the honey bee industry

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	Varrora mite
Vespa spp. (exotic species)	Hornets

Asian honey bee feeding at a sugar station. Image courtesy of Arthur Giblin

Africanised honey bee swarm in a tree. Image courtesy of William H Kern, University of Florida

Tropilaelaps mites on European honey bees and a deformed bee. Image courtesy of Denis Anderson, CSIRO

Size comparison of varroa mite and tropilaelaps mite, dorsal view. Image courtesy of Food and Environment Research Agency (Fera), Crown Copyright

Image courtesy of Jenny Shanks, Plant Health Australia

LYCHEES

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

In 2015–16, lychee production was valued at $28 million (LVP). Current annual production ranges from 2,250 to 3,500 tonnes, depending on climatic and seasonal conditions.

Lychees are produced as a single annual crop with production significantly dependent on rainfall at the right time and cold winters to induce flowering. The harvest period is late October (north Queensland) to March (northern NSW) which provides the world's longest production period.

Australian lychees have a reputation for being fresh and sweet, however retailers must store and display produce carefully to preserve the quality.

While official export trade data is not available specifically for lychees, the industry estimates that 12 to 20 per cent of annual production is exported. In 2015–16, 17 per cent of production was exported at a value of $5.5 million.

Exports are increasing and, with recently approved markets available to growers and a successful trial of shipments to the United States, there is the potential for further growth.

Most world production of lychees is counter-seasonal to Australia. The main competition for Australian lychees in the southern hemisphere is from South Africa and emerging supplies from some South American countries.

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

Table 19. 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 39. Annual value of lychee production, 2009–16

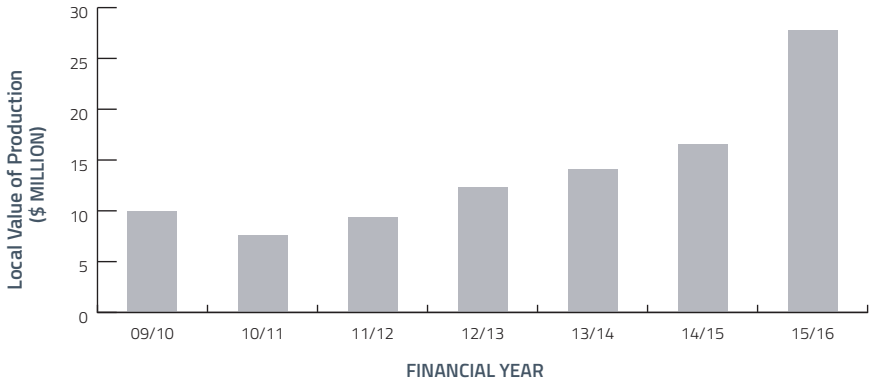
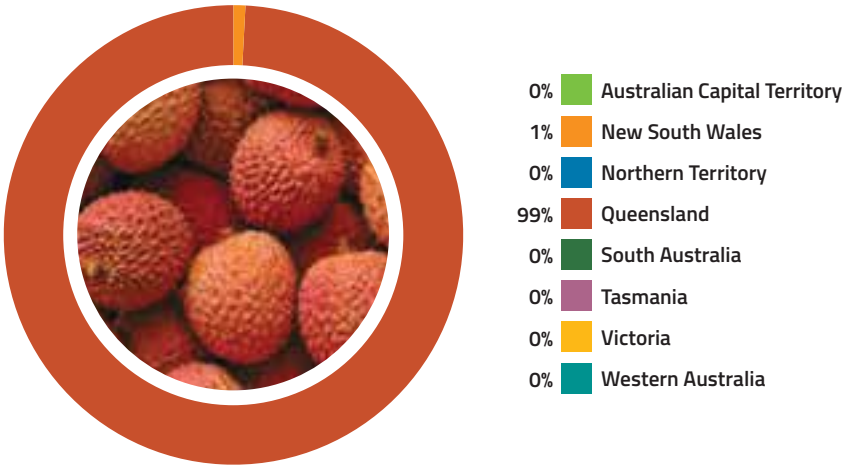


Figure 40. Distribution of lychee production by state and territory, 2015–16 (based on LVP)



MACADAMIAS

Represented by the Australian Macadamia Society
australian-macadamias.org

In 2015–16, macadamia production was valued at $198 million (LVP) and in 2017 the value of production was $272 million. Annual production from approximately 700 growers on 22,000 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 varieties with the remainder being Australian. 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 now the largest growing region in Australia.

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 3.0 of the nut industry biosecurity plan.

Table 20. 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
Tripilaelaps 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 41. Annual value of macadamia production, 2007–16

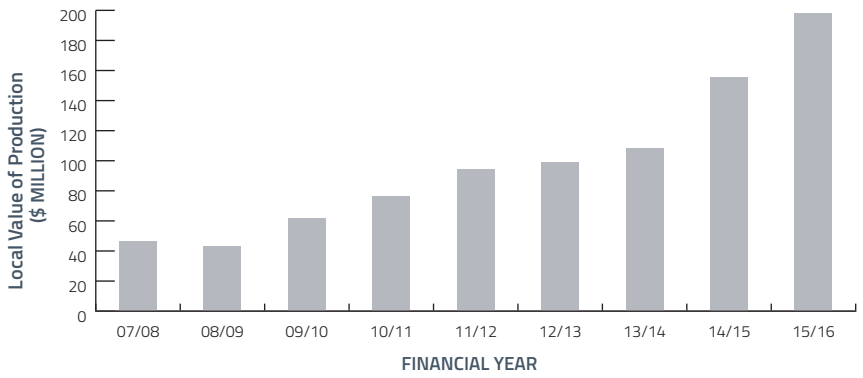
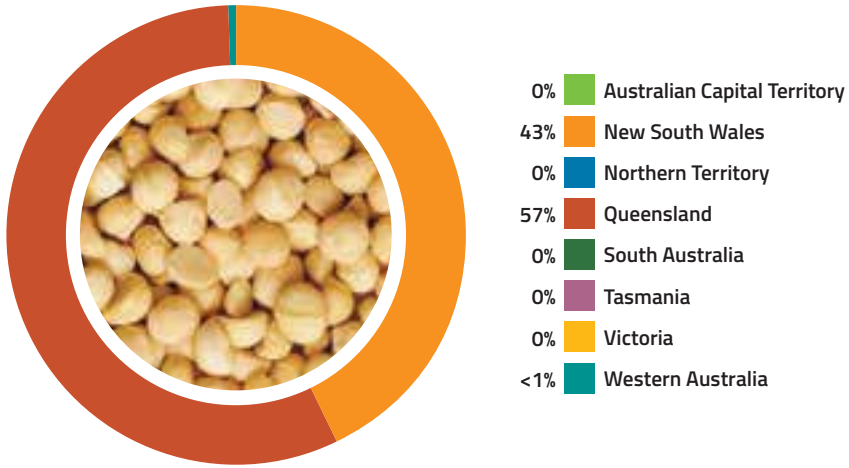


Figure 42. Distribution of macadamia production by state and territory, 2015–16 (based on LVP)



MANGOES

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

In 2015–16, mango production was valued at $104 million (LVP). The average production volume over the last three years has been 65,000 tonnes.

Around 83 per cent of fruit is consumed fresh, 11 per cent is exported and the remainder processed.

In Australia, nine varieties of mango are in commercial production. The most abundant variety, Kensington Pride, accounts for over 50 per cent of Australian production. Other varieties include B74 (Calypso), Honey Gold, and R2E2, green eating varieties such as Keow Savoey and Nam Doc Mai, as well as late season varieties such as Brooks, Keitts, Palmers, Kents and Pearls. B74 and R2E2 are popular in export markets. There are other varieties produced in smaller volumes.

The industry supplies the Australian market with production occurring from August to March each year. In Australia, the majority of mangoes are grown in Queensland, followed by 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.

Figure 43. Distribution of mango production by state and territory, 2015–16 (based on LVP)

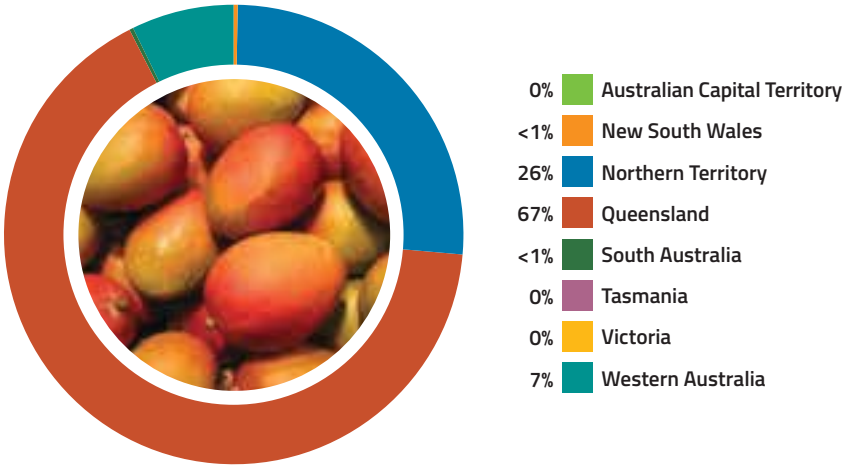


Figure 44. Annual value of mango production, 2007–16

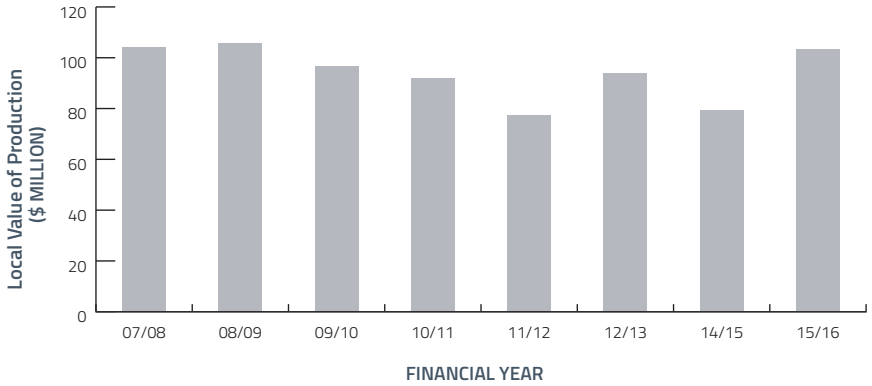


Table 21. High Priority Pests of the mango industry

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*

MELONS

Represented by the Australian Melon Association
melonsaustralia.org.au

In 2015–16, melon production was valued at $176 million (LVP). Fresh seedless watermelons, rockmelon, honeydew and Piel de Sapo melons are the major products and are produced all year round. The main form of value-adding is cut and wrapped fruit, fruit salad products and juices.

The Australian melon industry consists of approximately 250 growers producing around 231,000 tonnes of melons annually, with the majority of production occurring in Queensland, NT, WA and NSW.

Melons are grown for domestic consumption as well as international export ($32 million) to New Zealand, United Arab Emirates, Malaysia, Hong Kong and Singapore.

The Australian melon industry commenced research and development and biosecurity levies in January 2016. The R&D levy is managed through Hort Innovation and the biosecurity levy through PHA.

The melon industry is working with growers on biosecurity measures to address seed-borne diseases, on-farm biosecurity and surveillance. A biosecurity project that will improve preparedness for, and management of, biosecurity risks in the melon industry at the farm gate and industry level commenced in late 2017.

Melons are covered by version 1.0 of the biosecurity plan for the melon industry.

Figure 45. Distribution of melon production by state and territory, 2015–16 (based on LVP)

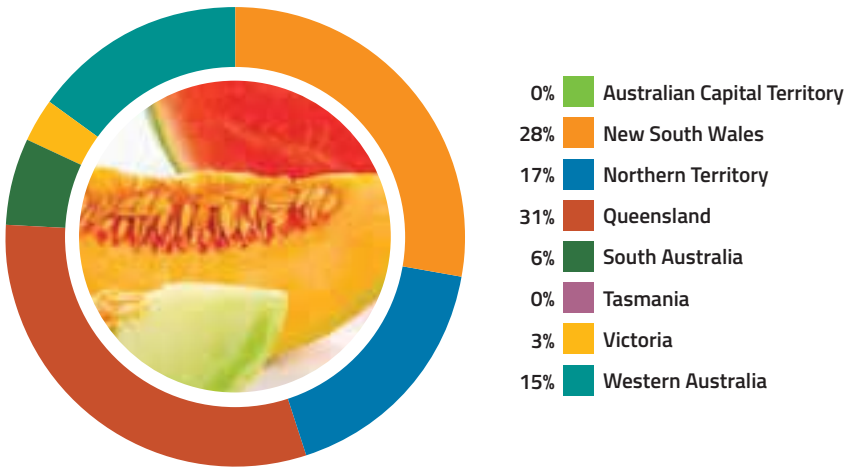


Figure 46. Annual value of melon production 2010–16

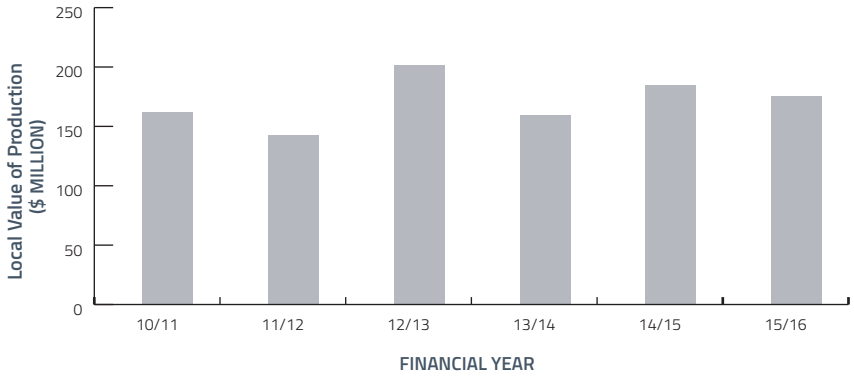


Table 22. High Priority Pests of the melon industry

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 leafminer, 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

OLIVES

Represented by the Australian Olive Association
australianolives.com.au

In 2015–16, olive production was valued at $120 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 a levy to fund research, development and extension projects.

The industry suffered losses during the global financial crisis which saw a number of groves change hands. Since then a number of new growers have purchased olive orchards and joined 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 of market share, followed by Italy (14%) China and New Zealand (13%). Another 33 markets accounted for the remaining 21 per cent.

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

Table 23. 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)

Figure 47. Annual value of olive production, 2007–16

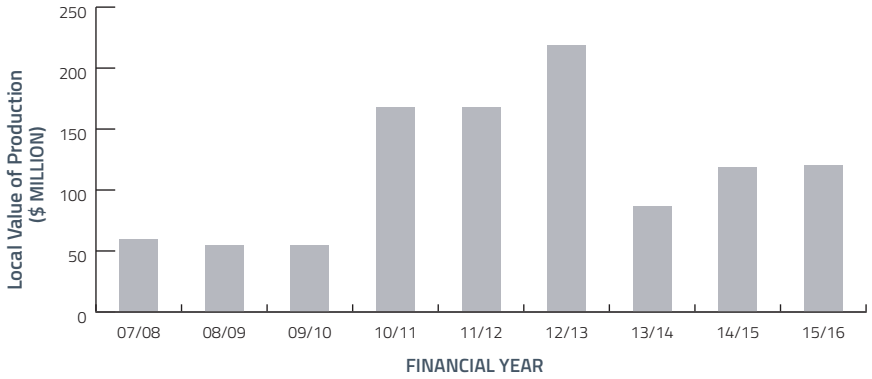
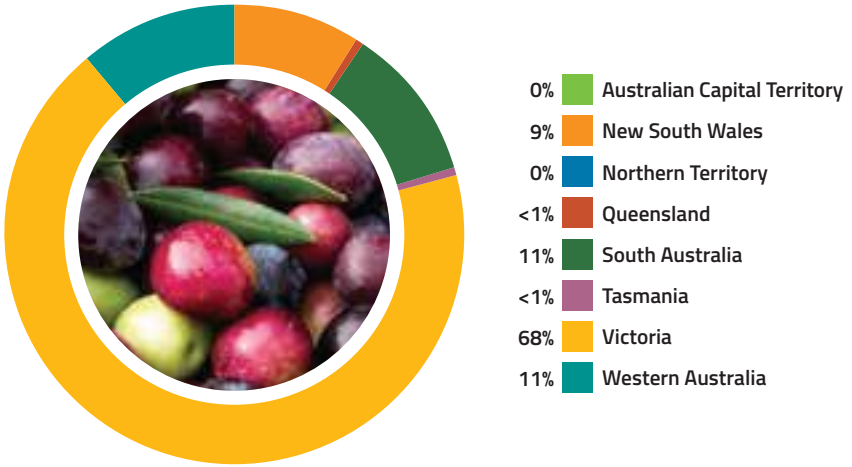


Figure 48. Distribution of olive production by state and territory, 2015–16 (based on LVP)



ONIONS

Represented by Onions Australia
onionsaustralia.org.au

In 2015–16, onion production was valued at $184 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 during February (short day types) in Queensland and finishes in September (long day types) in the southern states. 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. A biosecurity manual for growers is being produced and is due for launch in 2018.

Figure 49. Annual value of onion production, 2007–16

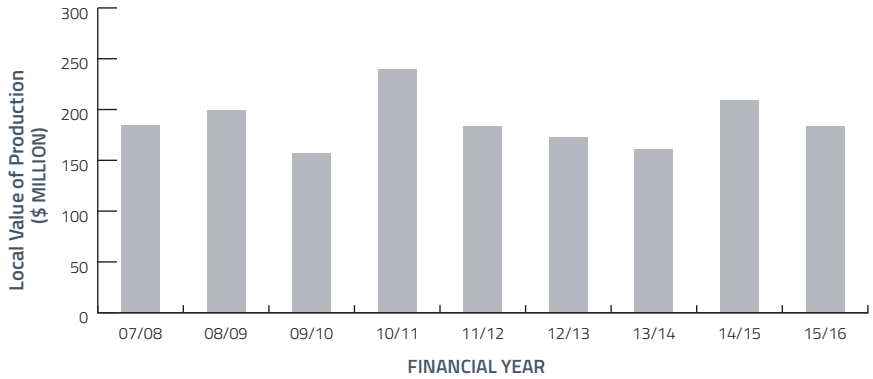
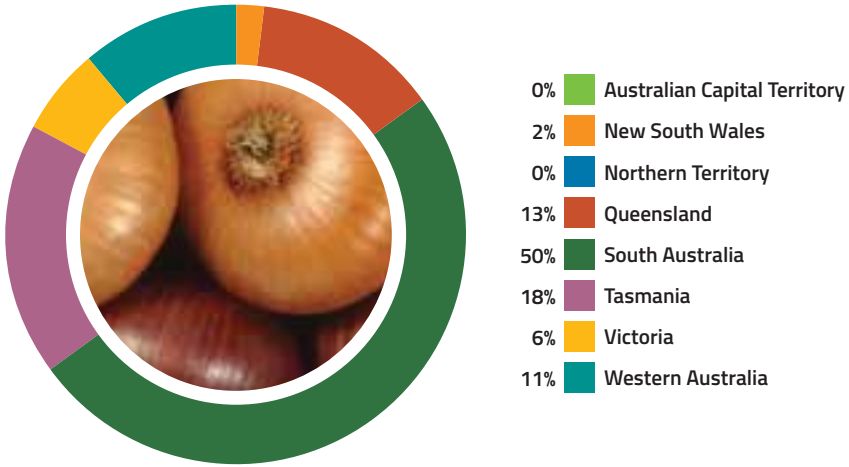


Table 24. High Priority Pests of the onion industry

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 bul 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/biotypes)	Onion thrip
Xanthomonas axonopodis pv. *allii*	Xanthomonas leaf blight

Figure 50. Distribution of onion production by state and territory, 2015–16 (based on LVP)



PASSIONFRUIT

Represented by Passionfruit Australia
passionfruitaustralia.org.au

In 2015–16, passionfruit production was valued at $16 million (LVP) with 196 tonnes produced. There are currently around 300 hectares of passionfruit under cultivation in Australia with about 400,000 passionfruit vines.

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 minimal amounts of passionfruit exported, however the industry currently has two projects underway developing an export plan and identifying prospective export markets.

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

Figure 51. Distribution of passionfruit production by state and territory, 2015–16 (based on LVP)

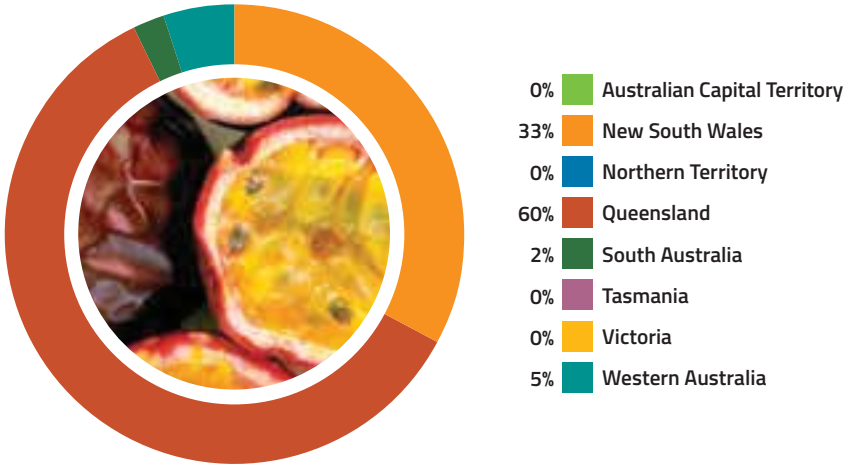


Figure 52. Annual value of passionfruit production, 2007–16

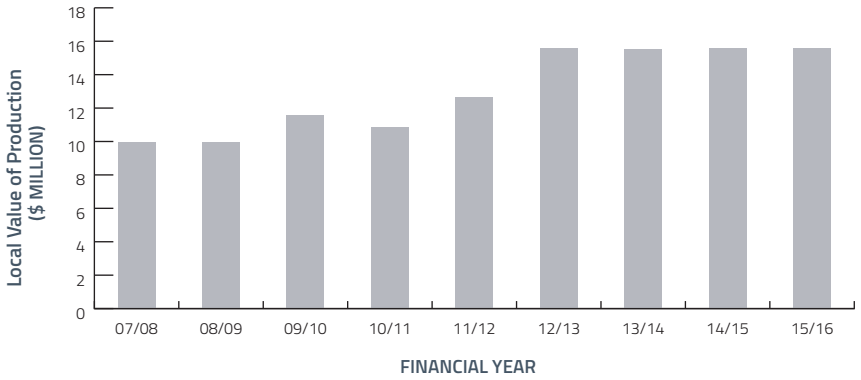


Table 25. High Priority Pests of the passionfruit industry

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*

The female Oriental fruit fly has a serrated-tip ovipositor for penetrating the skin of fruit. Image courtesy of Scott Bauer

Melon fruit fly. Image courtesy of Merle Shepard, Gerald R. Carner, and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org

PINEAPPLES

Represented by GROWCOM
growcom.com.au

In 2015–16, pineapple production was valued at $39 million (LVP), a decrease on the year before. The industry estimates that around 47,500 tonnes of fresh fruit and 28,000 tonnes of processed fruit were marketed.

There are approximately 80 commercial pineapple enterprises, all but one based in Queensland. Key growing districts are in Wamuran, Elimbah, Glasshouse Mountains, Beerwah, Yandina, Mary Valley, Maryborough, Hervey Bay, Childers, Bundaberg, Cawarral, Yeppoon and northern Queensland, with one 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 2.0 of the pineapple biosecurity plan.

Table 26. 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 53. Annual value of pineapple production, 2007–16

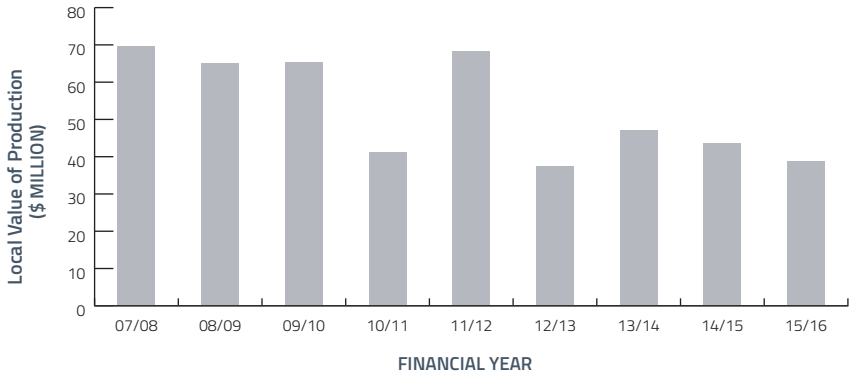
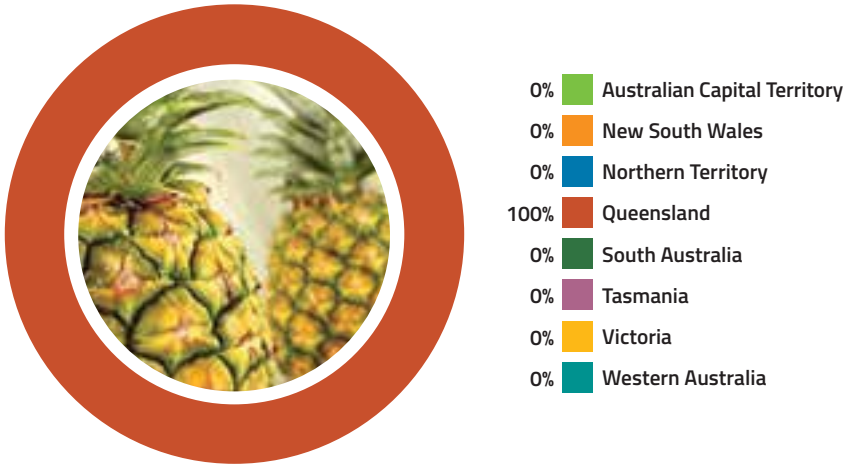


Figure 54. Distribution of pineapple production by state and territory, 2015–16 (based on LVP)



PISTACHIOS

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

In 2015–16, pistachio production was valued at $25 million (LVP). The industry estimates that in 2017, 1,200 hectares were under cultivation with 1,600 tonnes of pistachio nuts produced from the productive orchards.

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 2017 with 100 hectares per annum to be planted in the next three years (2018 to 2020). There are five large pistachio orchards and another five orchards of 10 to 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 five tonnes of pistachios (dry) per annum from one to five hectares.

Australian pistachio production currently meets only 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.

In 2017 Pistachio Growers' Association participated in Emergency Plant Pest activities, including as an affected party in the eradication response for khapra beetle. Australia is free from major exotic pistachio pests and diseases. Biosecurity is a priority for the industry, with aspects of embedded in the Australian Pistachio Industry Five Year Strategic Plan – 2015 to 2020, and in two Hort Innovation research projects PS16000 and PS16002. The industry is represented at PHA meetings and government Biosecurity Roundtables.

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

Table 27. 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 55. Annual value of pistachio production, 2008–16

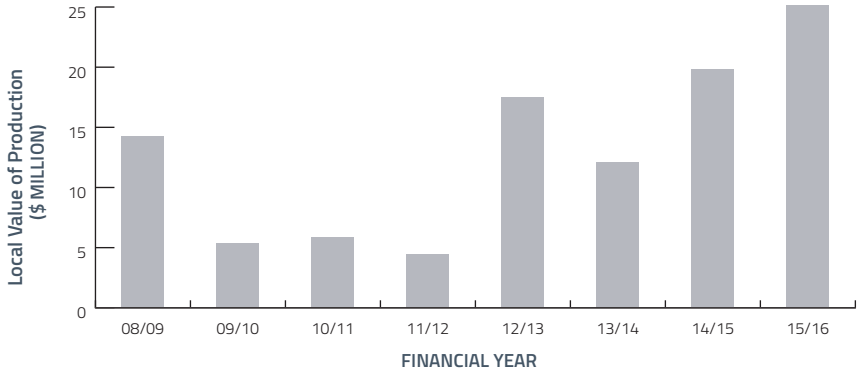
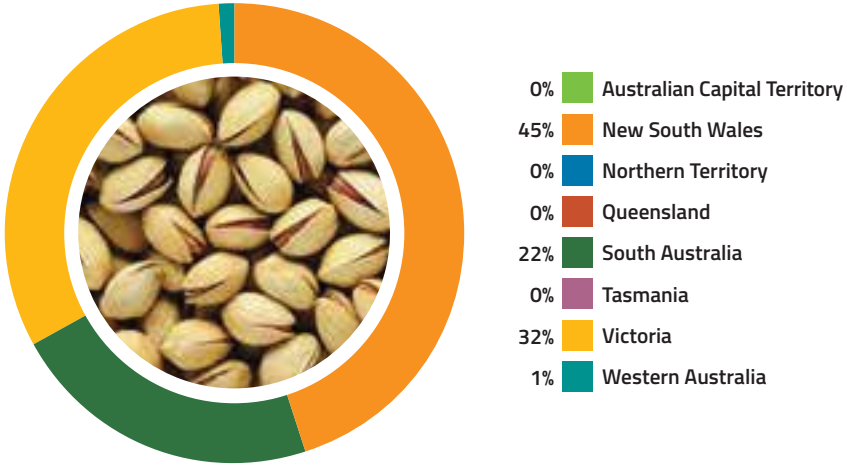


Figure 56. Distribution of pistachio production by state and territory, 2015–16 (based on LVP)



PROCESSING TOMATOES

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

In 2015–16, 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.

Around 184,680 tonnes of tomatoes were delivered for processing during the 2016–17 season. This is a drop of about 90,166 tonnes (one third) on the previous year. While 2,180 hectares was planted, rain and high mould counts meant 112 hectares of produce was not harvested.

Australia consumes around 535,690 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.

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

Figure 57. Annual value of processing tomato production, 2007–16

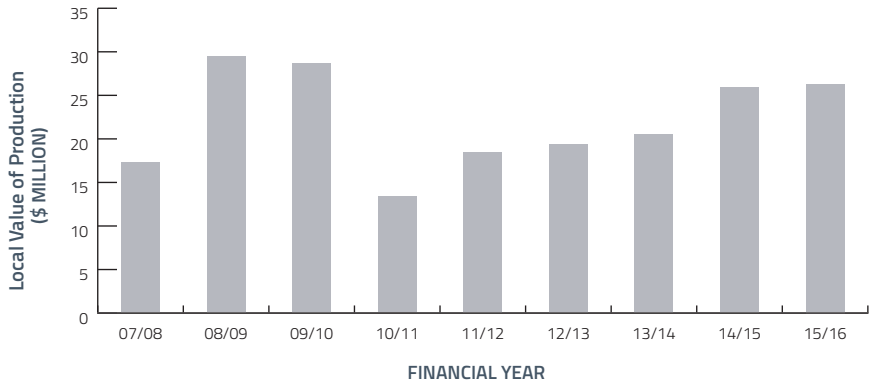
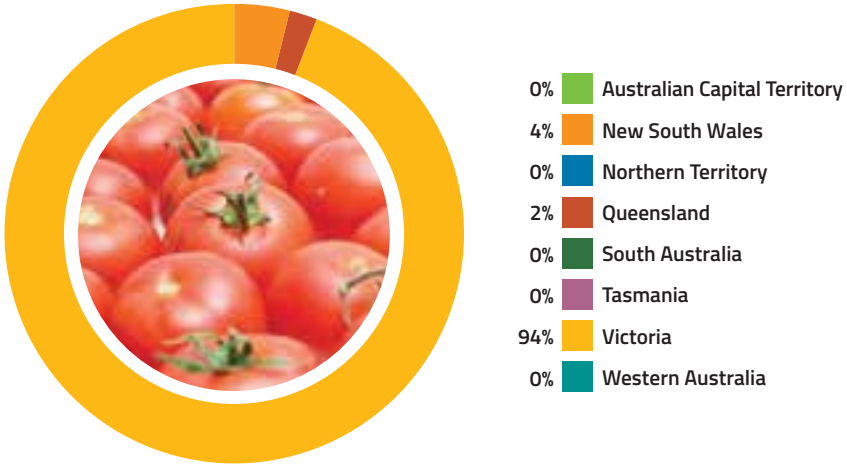


Figure 58. Distribution of processing tomato production by state and territory, 2015–16 (based on LVP)



PRODUCTION NURSERIES

Represented by the Nursery & Garden Industry Australia
ngia.com.au

In 2015–16, nursery production (propagation stock, vegetable and forestry seedlings, bedding plants, indoor plants, fruit and landscape trees and shrubs) was valued at $657 million (LVP). The nursery industry operates in all states and territories, being one of the largest and most diverse plant industries in Australia.

Nursery & Garden Industry Australia (NGIA) supplies to ornamental retail, landscape, re-vegetation, rehabilitation and production horticulture sectors including tree crops (e.g. fruit, vines, tea tree), vegetables, forestry and cut flowers with a combined annual production value of more than $15 billion. 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 is the one-stop shop for industry biosecurity information for growers. It holds pest fact sheets, management plans, videos and the eLearning portal.

NGIA continues to work in partnership with state and territory governments in the roll out of BioSecure HACCP with legal recognition achieved in Queensland, NSW, Victoria, Tasmania, SA and WA by the end of 2017, allowing certified producers to self-certify consignments of nursery stock for interstate market access.

The industry has invested over $5 million in biosecurity focused projects to develop plant biosecurity resources and upskill industry members:

- The National Nursery Industry Biosecurity Program (2015–2020) (Themes: on-farm biosecurity, biosecurity preparedness, biosecurity awareness and pesticide minor use).
- The national plant health project Building the Resilience and On-Farm Biosecurity Capacity of the Australian Production Nursery Industry (2015–2020).

Since 2016 several extension videos covering site surveillance, intake inspection and crop monitoring have been developed by NGIA and PHA. Others are scheduled for development.

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 3.0 of the biosecurity plan for the nursery industry and the Biosecurity Manual for the Nursery Production Industry Version 1.0.

Figure 59. Annual value of production nurseries, 2007–16

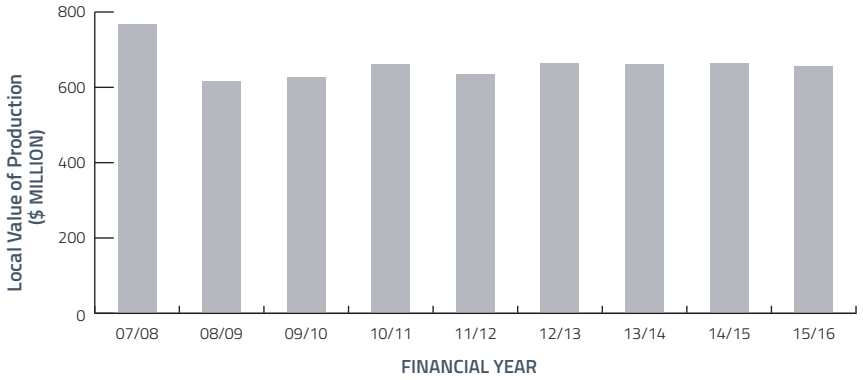


Figure 60. Distribution of production nurseries by state and territory, 2015–16 (based on LVP)

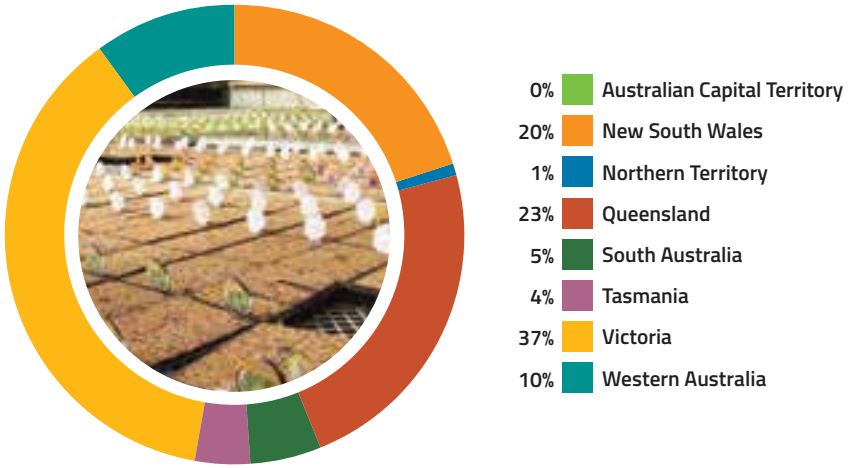


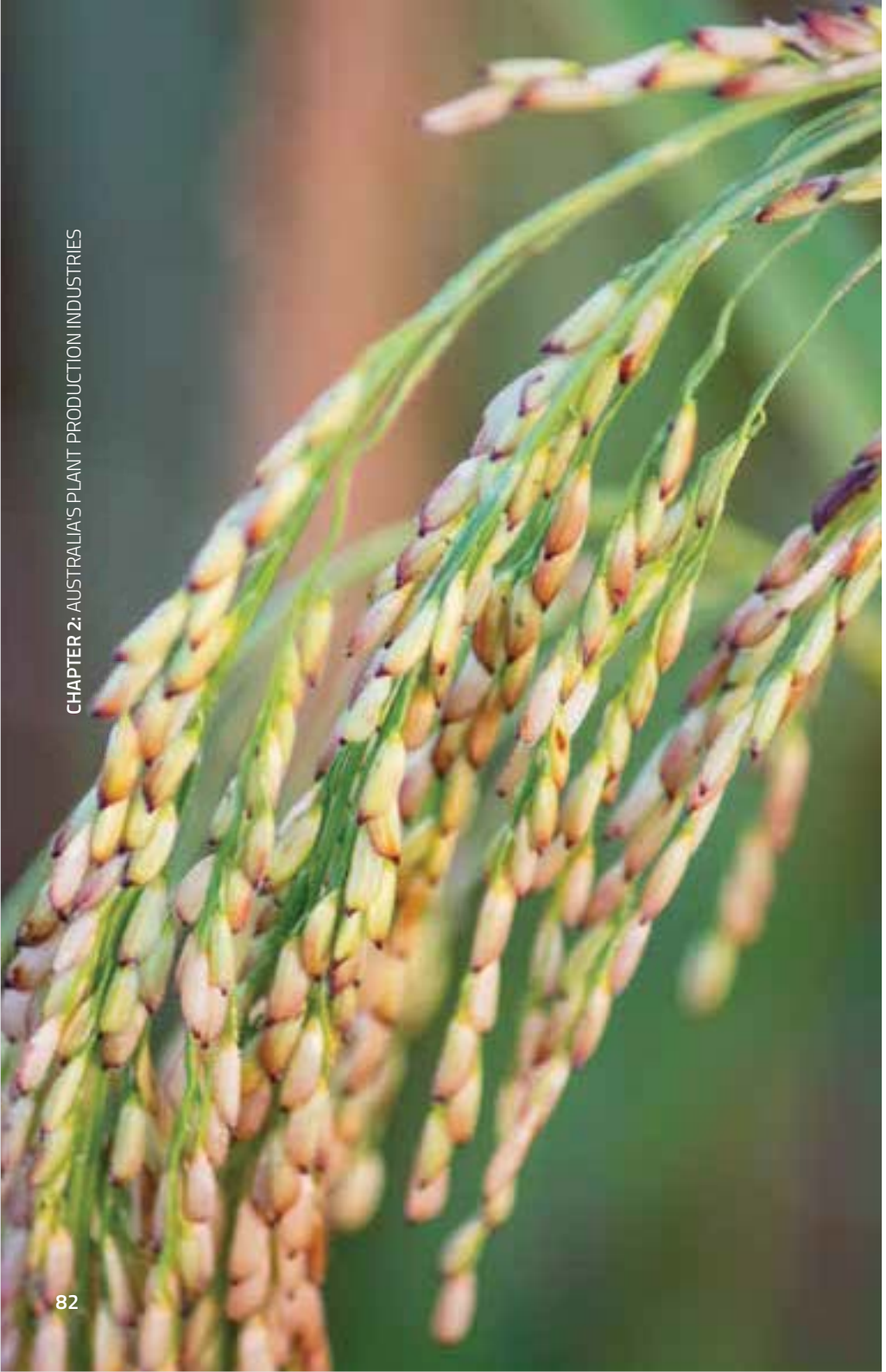
Table 29. High Priority Pests of the production nursery industry

Scientific name	Common name
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
Lissachatina fulica	Giant African snail
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

Huanglongbing psyllids. Image courtesy of A. Beattie, University of Western Sydney

Adult glassy winged sharpshooter. Image courtesy of Ken Walker, Museum Victoria

Image courtesy of Rod Turner, Plant Health Australia



RICE

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

In 2015–16, rice production was valued at $107 million.

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

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

The rice industry is conducting research into suitable varieties and management techniques to allow production in north Queensland. Strict biosecurity measures have been put in place to ensure that any pests 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 the Ricegrowers' Association of Australia

Figure 61. Annual value of rice production, 2007–16

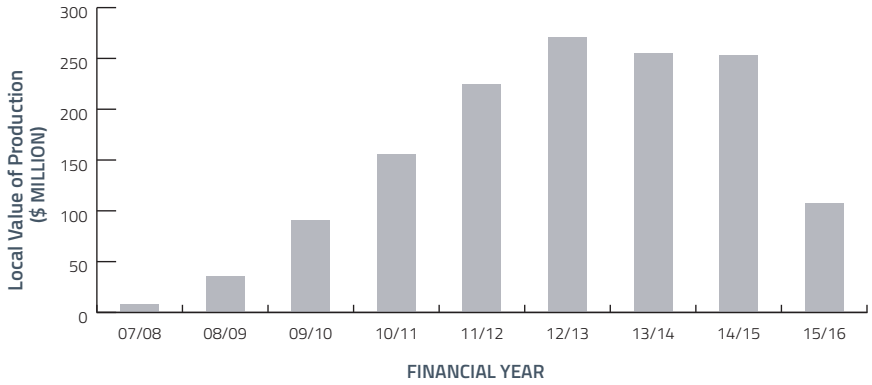


Figure 62. Distribution of rice production by state and territory, 2015–16 (based on LVP)

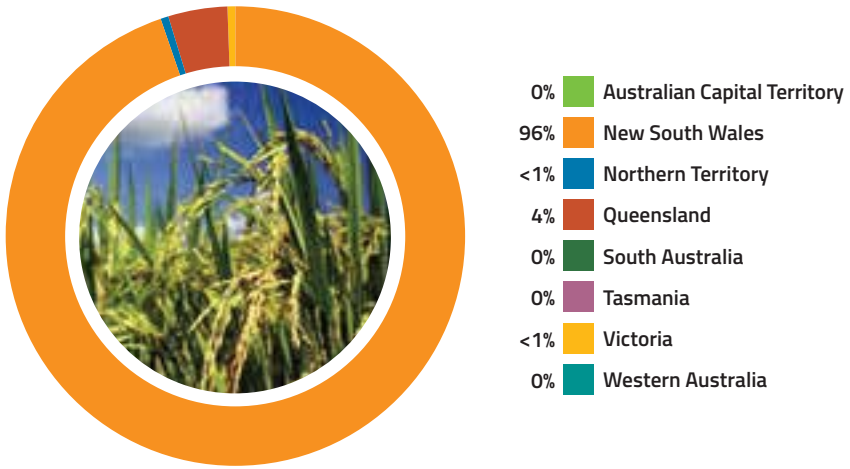


Table 30. High Priority Pests of the rice industry

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 rungro 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

Image courtesy of the Ricegrowers' Association of Australia

RUBUS

Represented by Raspberries and Blackberries Australia (RABA)

In 2015–16, the rubus industry was valued at $116 million (LVP).

Raspberry, blackberry and hybrid brambles (including silvanberries, boysenberries, loganberries, youngberries and marionberries) are collectively referred to as rubus or cane berries. There are currently over 700 hectares of land under cultivation with rubus varieties, much of it under protected cropping (rain shelters). New plantings continue, with the industry expanding in response to 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 brambleberries produced in Australia are consumed locally with little 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 consulting with growers on a proposal to establish a PHA Levy to fund membership and an EPPR Levy (set at zero).

Figure 63. Distribution of rubus berry production by state and territory, 2015–16 (based on LVP)

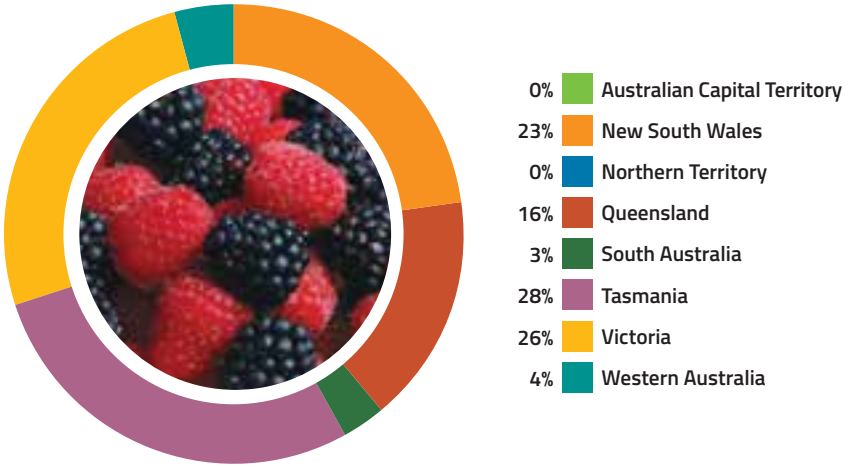


Figure 64. Annual value of rubus berry production, 2009–16

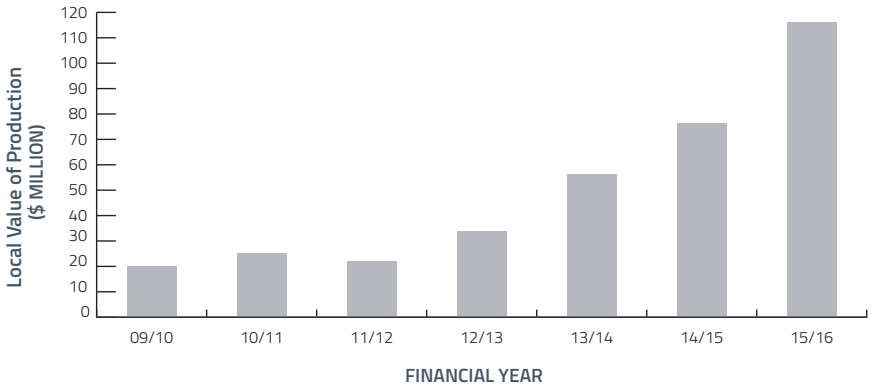


Table 31. High Priority Pests of the rubus industry

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 marmorated 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
summerfruit.com.au

In 2015–16, stone fruit production (fresh apricots, nectarines, peaches and plums) was valued at $176 million (LVP). Nectarines and peaches comprised two thirds of national stone fruit production, followed by plums and apricots.

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.

Market access to mainland China for nectarines (in May 2016) and apricots, peaches and plums (in November 2017) has allowed an expansion of exports. During the 2016–17 export season 13,964 tonnes were exported, with 5,886 tonnes going to China and Hong Kong. Other major markets were United Arab Emirates, Saudi Arabia, Singapore and Malaysia.

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 65. Distribution of stone fruit production by state and territory, 2015–16 (based on LVP)

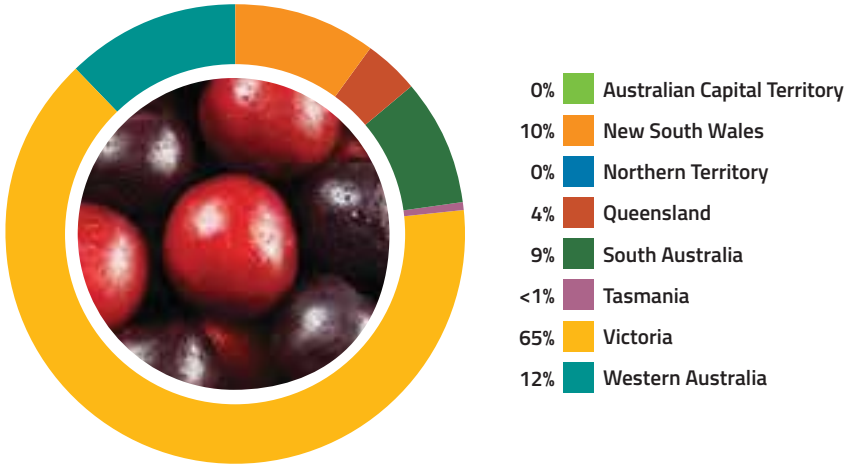


Figure 66. Annual value of stone fruit production, 2007–16

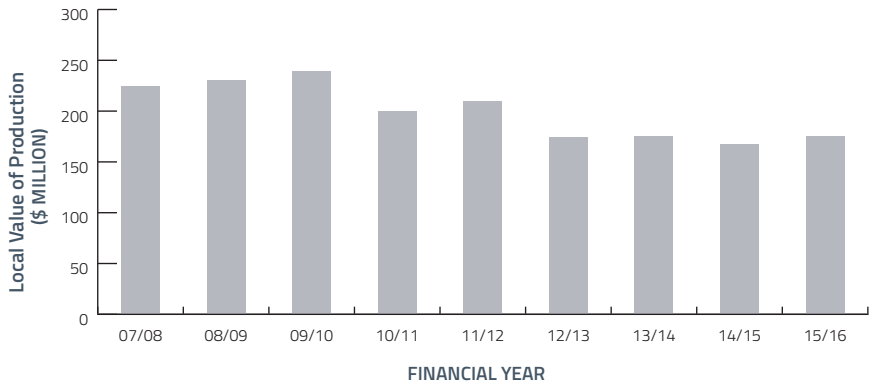


Table 32. High Priority Pests of the stone fruit industry

Scientific name	Common name
Bactrocera cucurbitae	Melon fruit fly
Bactrocera dorsalis	Oriental fruit fly
*Bactrocera papayae**	Papaya fruit fly
Candidatus Phytoplasma prunorum#	European stone fruit yellows
Conotrachelus nenuphar	Plum curculio
Cryptophlebia leucotreta	False codling moth
Cydia funebrana	Plum fruit moth
Drosophila suzukii	Spotted wing drosophila
Homalodisca vitripennis	Glassy winged sharpshooter
Monilinia fructigena	Brown rot
Monilinia 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*
# Previously called European stone fruit yellows phytoplasma

STRAWBERRIES

Represented by Strawberries Australia
strawberriesaustralia.com.au

In 2015–16, strawberry production was valued at $269 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 in Australia throughout the year. Florida varieties are grown in subtropical locations from May to October and California varieties are grown in temperate climate areas from October to June.

Industry investment in new Australian varieties continues, with gradual introduction of the new types which are being developed from the best varieties in Europe and the United States. In 2016, approximately one third of strawberries grown were Australian varieties.

The industry is primarily focused on the domestic market with around five per cent of produce exported. The increase in production over recent years is due primarily to rising per capita consumption, driven by higher planting numbers, improved Australian varieties and better cool chain management.

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

Table 33. 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 67. Annual value of strawberry production, 2007–16

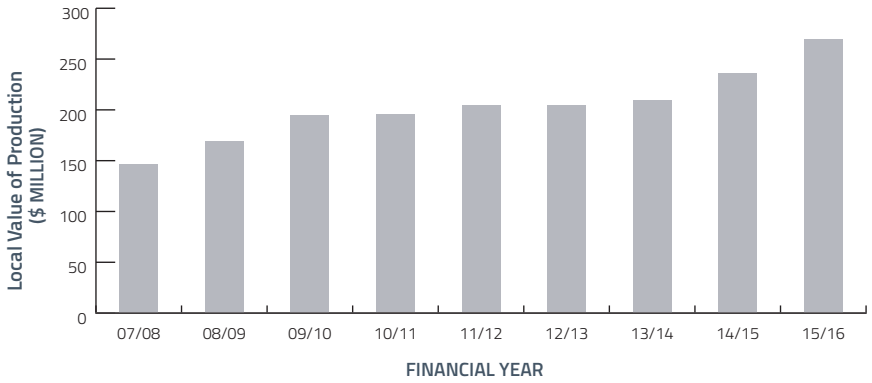
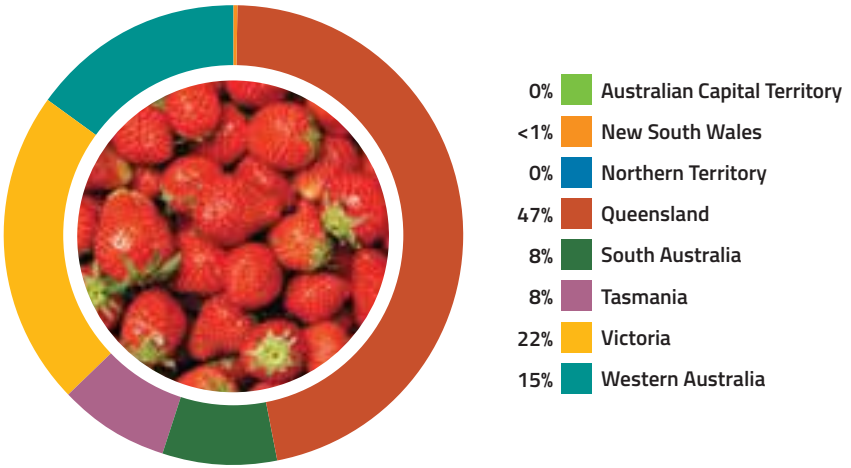


Figure 68. Distribution of strawberry production by state and territory, 2015–16 (based on LVP)



SUGARCANE

Represented by CANEGROWERS
canegrowers.com.au

In 2015–16, sugarcane production was valued at $1.25 billion. 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.

In 2016, the Australian sugarcane industry delivered a crop of 36,507,438 tonnes producing 4,791,222 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.

Image courtesy of Bernard Milford, Halcyon Photography

Figure 69. Annual value of sugarcane production, 2007–16

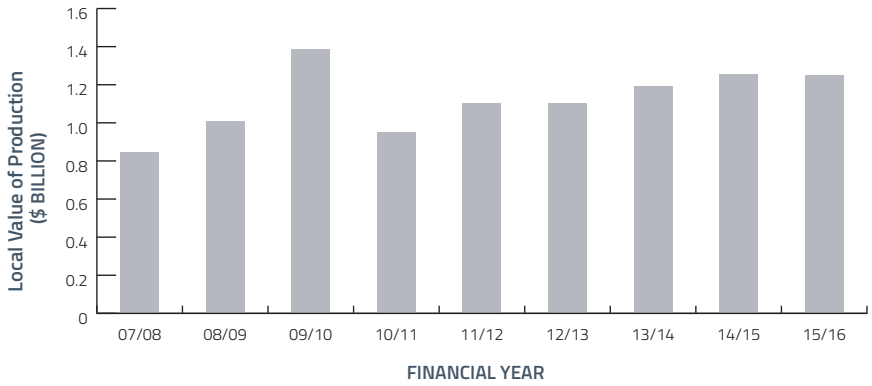


Figure 70. Distribution of sugarcane production by state and territory, 2015–16 (based on LVP)

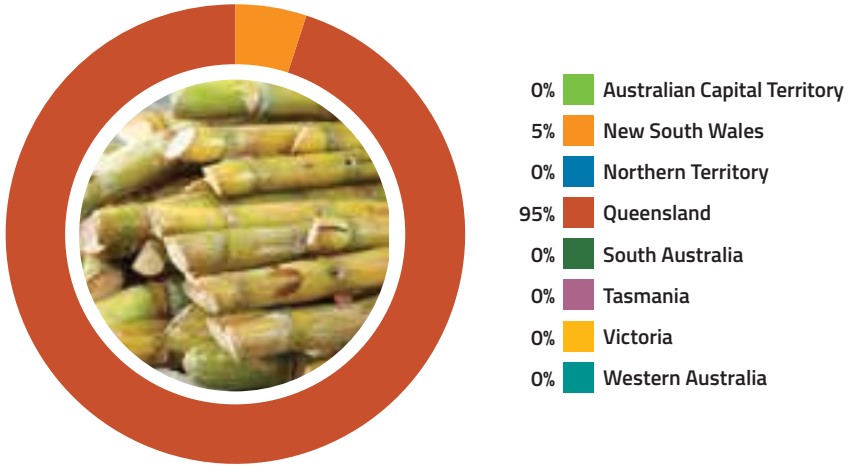


Table 34. High Priority Pests of the sugarcane industry

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 (with 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
Suspected 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

SWEETPOTATOES

Represented by Australian Sweetpotato Growers
aspg.com.au

In 2015–16, sweetpotato production was valued at $80 million (LVP). Sweetpotatoes 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 production area is around Cudgen in northern NSW. Sweetpotatoes are also grown in Mareeba, Atherton and Rockhampton in Queensland; Murwillumbah in NSW; and Perth, Carnarvon and Kununurra in WA.

Four types of sweetpotato are grown in Australia, categorised by skin and flesh colour. The gold variety (rose-gold skin, gold flesh) dominates the Australian sweetpotato 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 sweetpotato production is consumed domestically with under one per cent exported.

Commercial growers purchase pathogen-tested planting material every year, a measure that has almost doubled marketable yield per hectare. The pathogen testing scheme is reinforced by industry supported research into virus (and other disease) diagnostics and management, as well as enhancing effective distribution and multiplication of clean planting material.

The sweetpotato industry became a signatory to the Emergency Plant Pest Response Deed in late 2017 and has started to develop a national biosecurity plan.

Image courtesy of Hort Innovation

Figure 71. Annual value of sweetpotato production, 2011–16

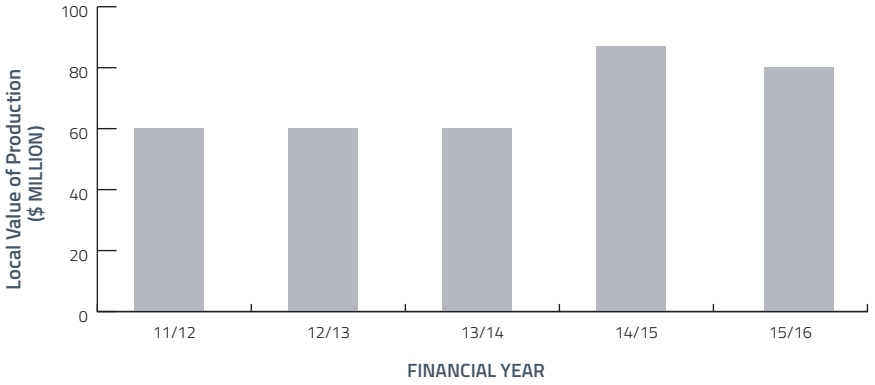


Figure 72. Distribution of sweetpotato production by state and territory, 2015–16 (based on LVP)

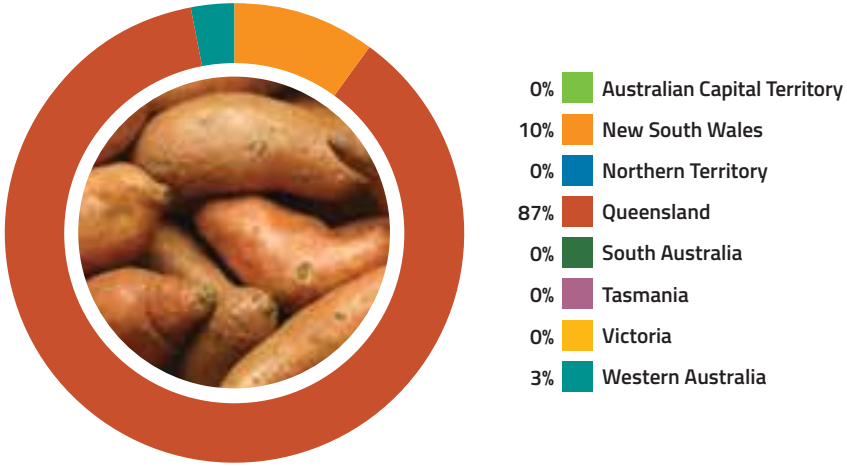


TABLE GRAPES

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

In 2015–16, Australia produced a total of 178,000 tonnes of table grapes, valued at $431 million. This made 2015–16 the best year for the industry for volume and value of production in 12 years.

Green, red and blue-black varieties of table grapes are produced by approximately 1,000 growers in the major growing regions of Sunraysia and the Murray Valley in Victoria; the Riverland in SA; Swan Valley, Carnarvon and Geraldton regions of WA; the south east of Queensland; and Ti Tree in the NT.

By the end of the 2016–17 season, Australian table grape exports totalled 106,841 tonnes, valued at $373 million. This result was just lower than the previous season due to poor weather and a late season, which reduced opportunities for export.

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.

Figure 73. Annual value of table grape production, 2007–16

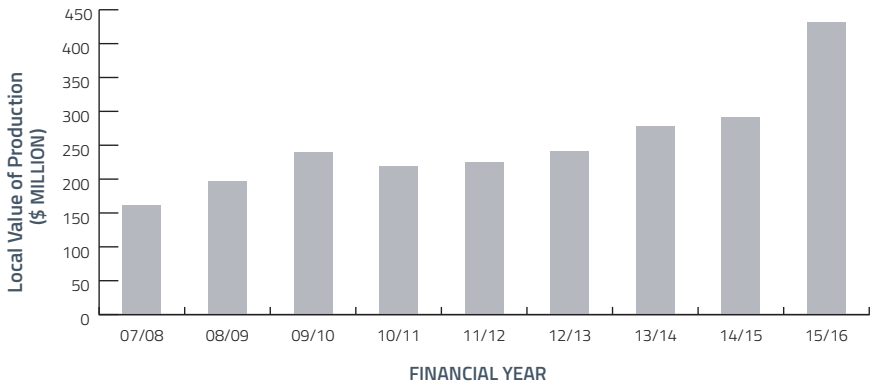
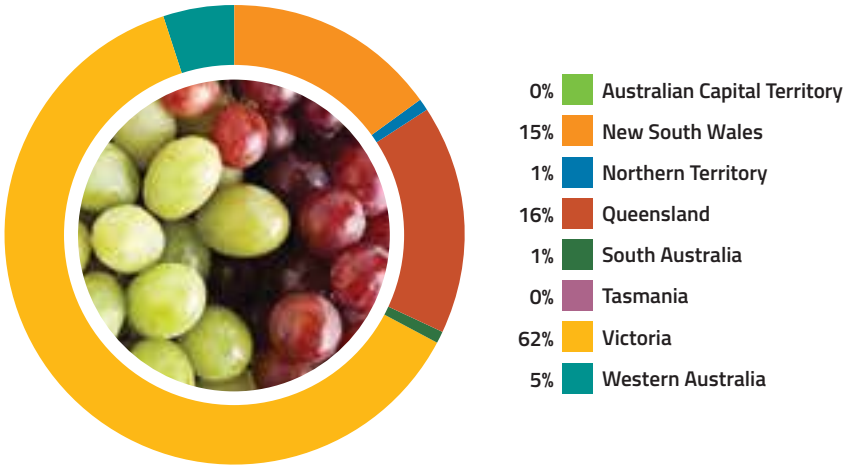


Table 35. High Priority Pests of the table grape industry

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
Grapvine 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 disesase

* This species has been synonymised with *Bactrocera dorsalis*

Figure 74. Distribution of table grape production by state and territory, 2015–16 (based on LVP)



TEA TREE

Represented by the Australian Tea Tree Industry Association
teatree.org.au

In 2016–17, tea tree production was valued at $38 million (LVP). In 2016, there were about 120 tea tree growers in Australia and about 4,000 hectares under plantation production.

The main product of the Australian tea tree industry is tea tree oil, which is steam distilled from *Melaleuca alternifolia*, an iconic Australian native plant species. Nearly all Australian tea tree oil production is sourced from plantations. Most plantations (three quarters) are located in the coastal region of northern NSW with 10 per cent located in the Atherton Tablelands of Queensland.

Industry growth has stabilised, with average annual production of 750 tonnes of oil. The vast majority (90%) is exported through an established supply chain to over 70 countries, particularly North America and Europe.

Tea tree oil is exported as bulk oil which is used to make value-added products including healthcare, cosmetic, pharmaceutical, veterinary and aromatherapy products.

Domestic consumption is estimated to be around 95,000 kg per annum with much of this also destined for the export market as value-added cosmetic and therapeutic goods such as soap, shampoo, burn dressings as well as tea tree oil.

The tea tree industry has partnered with AgriFutures Australia on industry RD&E since 1998. The industry established an Emergency Plant Pest Response Levy which commenced in July 2017. In 2017, the Australian Tea Tree Industry Association became a member of PHA.

Image courtesy of the Australian Tea Tree Industry Association

Figure 75. Annual value of tea tree production, 2015–16

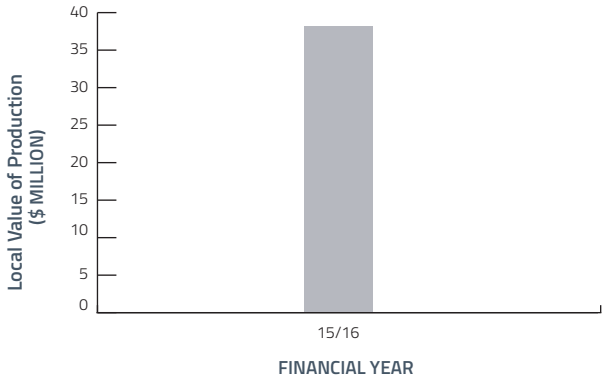
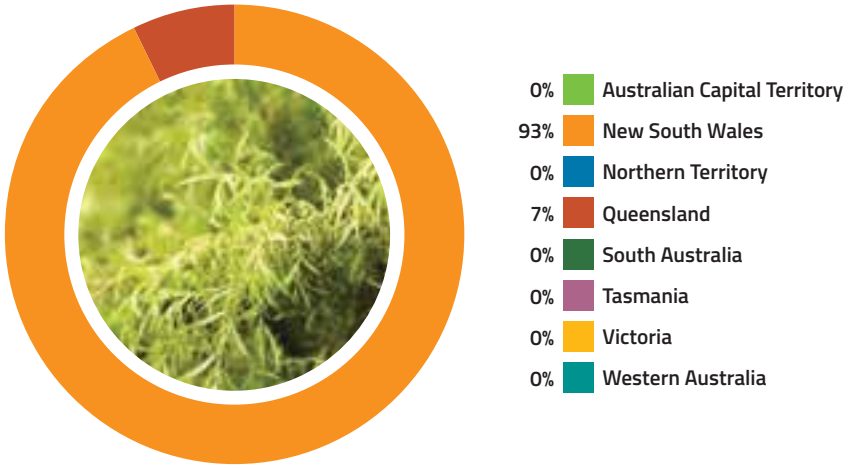


Figure 76. Distribution of tea tree production by state and territory, 2015–16 (based on LVP)



TRUFFLES

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

In 2015–16, truffle production was estimated to be 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 has become the fourth largest producer of the Périgord black truffle (*Tuber melanosporum*) in the world. The major production area for Australian truffles is the Manjimup region of WA, which accounts for around 80 per cent of the harvest. There is increasing 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 overseas markets, particularly in the northern hemisphere, where our produce is available when local product is 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 introduced accidentally) has been eliminated. More recently several white truffle species have been found including *T. maculatum*, *T. puberulum*, *T. dryophilum* and *T. borchii*.

Version 1.0 of the truffle industry biosecurity plan was published in 2016.

Table 36. 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

Figure 77. Annual value of truffle production, 2012–16

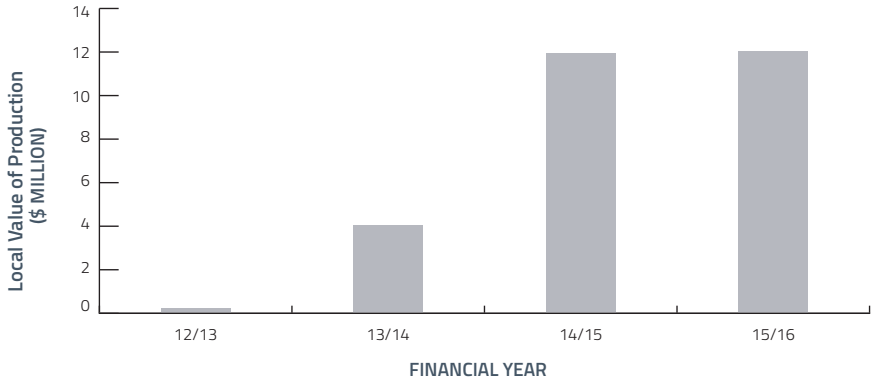
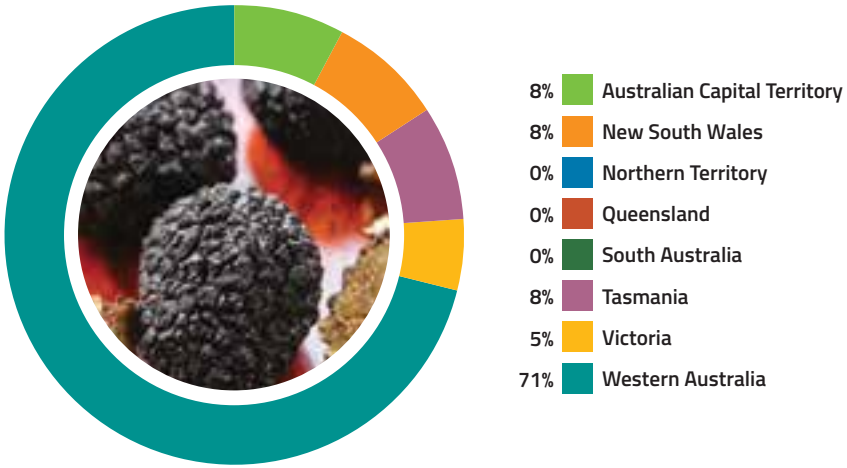


Figure 78. Distribution of truffle production by state and territory, 2015–16 (based on LVP)



VEGETABLES (INCLUDING POTATOES)

Represented by AUSVEG
ausveg.com.au

In 2015–16, vegetable and potato production was valued at $2.1 billion. 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. A vegetable industry Biosecurity Advisor, and two full-time Biosecurity Officers allow the industry to participate in a range of biosecurity initiatives.

During 2017, the Vegetable and Potato Biosecurity Officers visited growing regions across Australia and held a series of biosecurity awareness seminars. Farm biosecurity planning resources have been reviewed and updated to reflect industry needs. The Officers are also working with PHA to develop a potato Owner Reimbursement Cost Framework and a potato grower biosecurity manual.

Other biosecurity initiatives include participation in technical meetings with the Department of Agriculture and Water Resources as well as engagement with other government departments, committees, bodies and PHA. AUSVEG provided advice in the update of the potato and vegetable industry biosecurity plans.

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.

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

Figure 79. Annual value of vegetable production, 2007–16

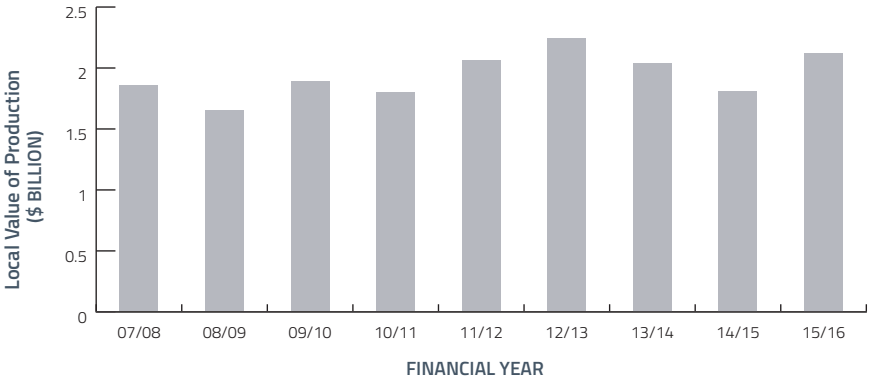


Figure 80. Distribution of vegetable production by state and territory, 2015–16 (based on LVP)

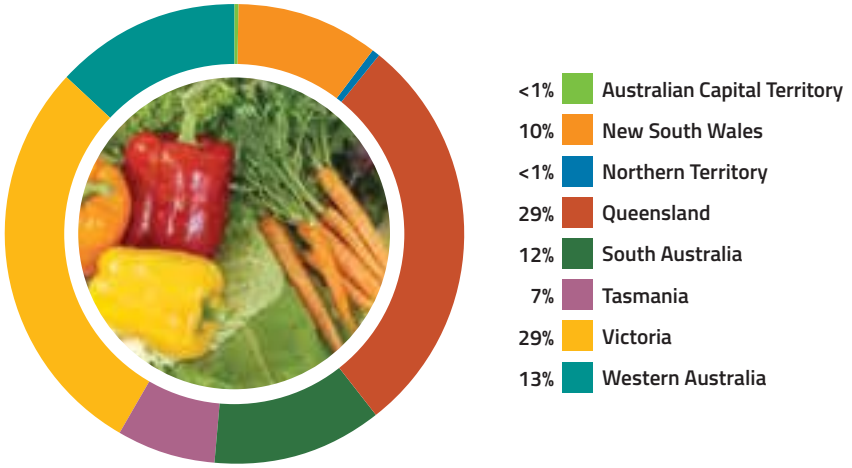


Table 37. High Priority Pests of the vegetable industry

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

Potato cyst nematode. Image courtesy of Florida Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Service

Serpentine mines on an onion leaf caused by the feeding larvae. Image courtesy of Merle Shepard, Gerald R. Carner, and P.A.C Ooi, Bugwood.org

First hand exposure to the vegetable supply chain

In 2017, AUSVEG and the Department of Agriculture and Water Resources arranged a two-day Victorian vegetable industry study tour for the department's biosecurity scientists.

The group was taken by AUSVEG Biosecurity Officers to vegetable farms, vegetable seedling nurseries, and the Melbourne fresh produce wholesale market in order to gain a 360 degree view of the vegetable industry supply chain.

The group agreed that the excursion gave them a deeper understanding of how the vegetable industry operates.

In addition to this event, the relationship between AUSVEG and the department has been strengthened this year with the appointment of a Biosecurity Liaison Officer for the vegetable industry within the department. As part of this association, Biosecurity Officers visited Tullamarine airport's arrivals terminal to learn about procedures implemented by the department for biosecurity risk assessment and profiling.

Australian Government scientists benefited from two days of vegetable industry visits. Image courtesy of AUSVEG

WALNUTS

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

In 2015–16, the walnut industry was valued at $33 million (LVP). In-shell production of 13,000 tonnes was produced from 3,600 hectares. The industry is predicted to expand to 17,000 tonnes (4,300 hectares) by 2021 as current growers expand their orchards and new growers enter the industry.

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, the Murray Irrigation area near Kerang and Swan Hill in Victoria; the Riverina near Griffith in NSW; and Manjimup in WA.

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

Australia is free from major walnut exotic pests and diseases and the Australian Walnut Industry Association prioritises biosecurity to maintain its status. Biosecurity is included in the Australian Walnut Industry Five Year Strategic Plan – 2015 to 2020 and it is part of the Industry Development Officer's role. The industry website has a biosecurity section to raise awareness of biosecurity among growers, and a representative attends PHA meetings and Australian Government Biosecurity Roundtables.

Throughout 2017 the Australia Walnut Industry Association participated in Emergency Plant Pest Response Deed processes, including the eradication response for khapra beetle. The association is funding projects to establish an Emergency Plant Pest Response Levy and an Owner Reimbursement Cost Framework for the walnut industry.

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

Table 38. 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

Figure 81. Distribution of walnut production by state and territory, 2015–16 (based on LVP)

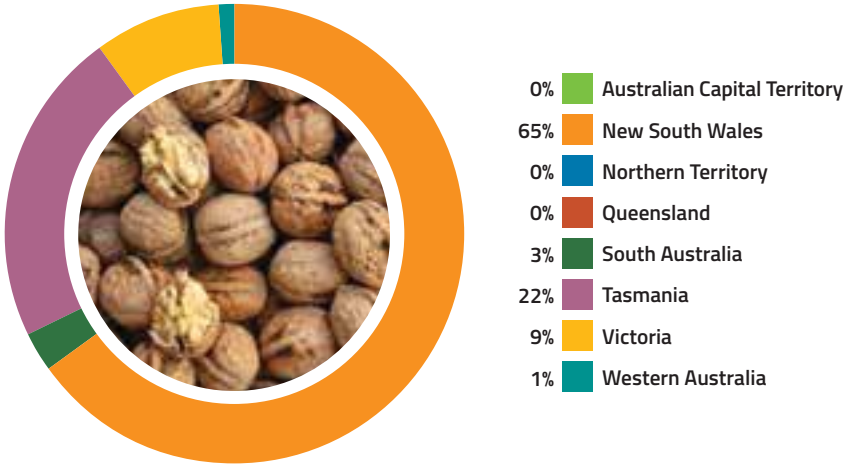
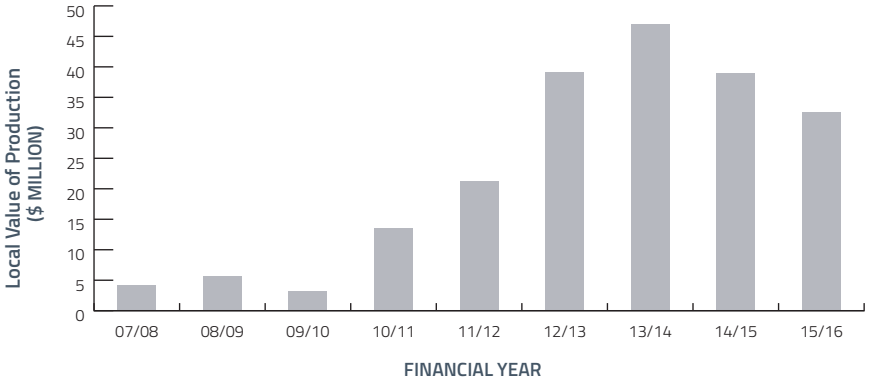


Figure 82. Annual value of walnut production, 2007–16



WINE GRAPES

Represented by Australian Vignerons
australianvignerons.com.au

In 2015–16, the Australian wine industry was valued at $880 million (LVP).

The wine industry has a significant footprint in Australia, comprising 5,100 winegrowers over a vineyard area of 132,390 hectares. Grapes are made into wine at 2,300 wineries, and generated export sales of $2.56 billion in 2017, and gross sales of $5 billion. It is estimated that the wine industry contributes over $40 billion to the Australian economy, and directly employs over 68,000 people.

The most-grown wine grape varieties are Shiraz (26%), Chardonnay (20%) and Cabernet Sauvignon (14%). 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 although production has been steady, around two to three per cent of vines have been removed from production each year since the 2007–08 season. Recent positive market signals have seen vineyards being replanted to different varieties and clones in an effort to supply the changing demands.

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.

Figure 83. Distribution of wine grape production by state and territory, 2015–16 (based on LVP)

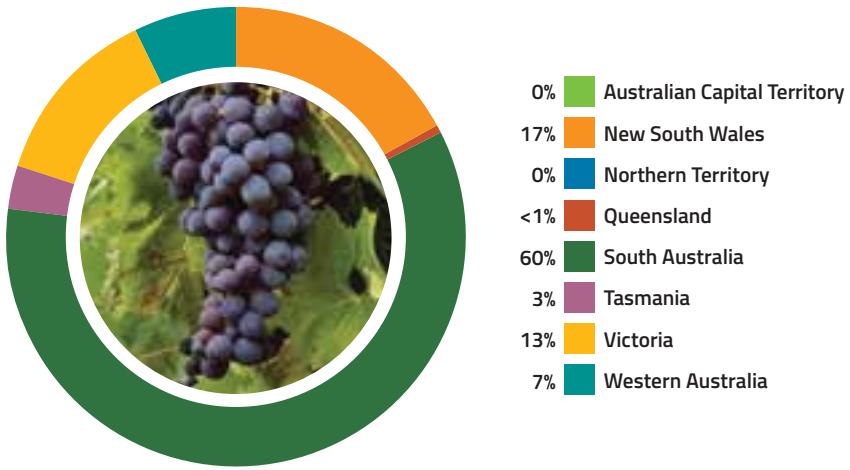


Figure 84. Annual value of wine grape production, 2007–16

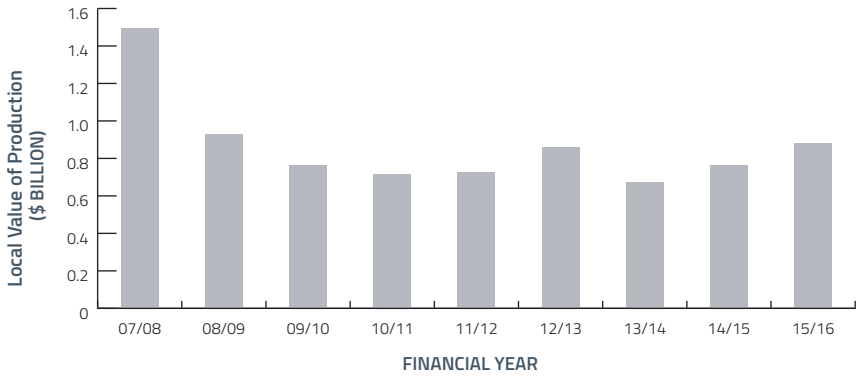


Table 39. High Priority Pests of the wine grape industry

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 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*

Chapter 3

Pre-border biosecurity

International trade is important to Australia in a global economy. Australia gains significant economic benefits as a net exporter of agricultural products, with around two-thirds of national agricultural production exported to overseas markets. The amount of exported product varies between industries, with some producing only for local markets while others, such as the grains and cotton industries, exporting the majority of the produce grown.

Australia also benefits from importing a range of goods and produce from overseas. Imports provide access to a wide range of products, technology and services that enable economic growth in multiple sectors. While Australians consume mostly local products, some food is imported, commonly produce that is out of season in the Southern Hemisphere.

This movement of plant produce around the world poses biosecurity risks to the importing countries. In an effort to mitigate risk, the Australian Government performs a number of activities collectively known as pre-border biosecurity.

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 still allowing the movement of people and goods into Australia. They provide assurance to the community and producers about the biosecurity status of commodities imported into Australia.

The Australian Government's efforts to support exports is covered later in this chapter.

Pre-border activities to mitigate the risks of imports

Pre-border activities include:

- Conducting risk assessments to consider the level of biosecurity risk that may be associated with imports and imposing relevant risk management measures.
- Conducting pre-border verifications, inspections and audits on imports.
- Conducting pest and disease surveillance in neighbouring countries.
- Collaborating with international partners on multilateral or bilateral plant health issues and the development of standards.
- Building regional capacity through collaborative activities.
- Gathering intelligence to determine and address potential biosecurity risks.
- Negotiating market access for Australian exports.

Image courtesy of Apple and Pear Australia

OBLIGATIONS UNDER INTERNATIONAL TRADE AGREEMENTS

Trade is covered by international agreements, known as phytosanitary agreements, that aim to prevent the spread of plant pests.

As an active trading nation, Australia has entered into a number of multilateral and bilateral trade agreements that influence its plant biosecurity system. Biosecurity risks are managed in keeping with Australia's legislative framework for biosecurity and international obligations.

On a multilateral level, Australia's rights and obligations in relation to plant biosecurity are set out under World Trade Organization 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 World Trade Organization 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.

Members can 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 (plant health) measures.

THE INTERNATIONAL PLANT PROTECTION CONVENTION

The International Plant Protection Convention (IPPC) was established to protect the world's plant resources from the spread of serious pests by international trade, including diseases and invasive species. 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), set 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:

- Commission on Phytosanitary Measures, the governing body that oversees implementation of the IPPC. Australia is the current chair of the Commission.
- IPPC Strategic Planning Group, which determines strategic priorities for IPPC activities.
- IPPC Standards Committee and associated working groups responsible for the development of ISPMs.
- 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**.

Australia's membership of these IPPC bodies provides an important avenue for the Department of Agriculture and Water Resources to raise and address plant health matters in regard to international trade. The department consults with peak industry groups and state and territory governments to determine Australia's position on items for the IPPC agenda.

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 Organisation (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.

Through its Standards Committee, 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.

Australia is involved in the following APPPC committees and regional working groups:

- Chair and member of the APPPC Standards Committee.
- Chair of the APPPC ePhyto Working Group.

Australia is also involved in leading a number of APPPC initiatives to enhance plant health and biosecurity capacity within the Asia Pacific including:

- A series of APPPC workshops over six years (2016–22) on surveillance management, methodologies and analysis.
- A workshop to be held in 2018 on irradiation as a phytosanitary measure.
- A workshop to be held in 2019 on risk categorisation and mitigation for semi-processed products under ISPM 32.

These opportunities allow Australia to enhance its plant health engagement with the 28 member countries of the APPPC. This strengthens regional plant health and biosecurity capacity and implementation of international plant health standards.

CANBERRA AGREEMENT

Australia is also a member of a second Regional Plant Protection Body, 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 Pacific Plant Protection Organisation 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 Pacific Plant Protection Organisation Executive Committee.

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 2000* and any subordinate legislation.

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 2015*. 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.

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 40 (on the next page) details policy advice finalised by December 2017, as well as draft policy advice that is currently in progress.

Review of import conditions database

AGRICULTURAL COMPETITIVENESS WHITE PAPER

A review of existing import conditions is underway, with funding from the Agricultural Competitiveness White Paper, to ensure that consistent risk management options and measures have been included in policies in the Australian Government's Biosecurity Import Conditions database, BICON.

The system, available on the Department of Agriculture and Water Resources website, contains the Australian import conditions for more than 20,000 plant, animal, mineral and human commodities.

About a third of the commodities in the BICON database have been reviewed, and already a number of pathways have been identified that require further intervention to ensure risks are addressed pre-border, including for cut flowers, asparagus and leafy vegetables.

Also with White Paper funding, the department is assessing import conditions for vegetable seeds from the following families in light of known and emerging risks: Apiaceae (carrot), Cucurbitaceae (including cucumber and melons), Brassicaceae (including cabbage and broccoli) and Solanaceae (tomato, capsicum).

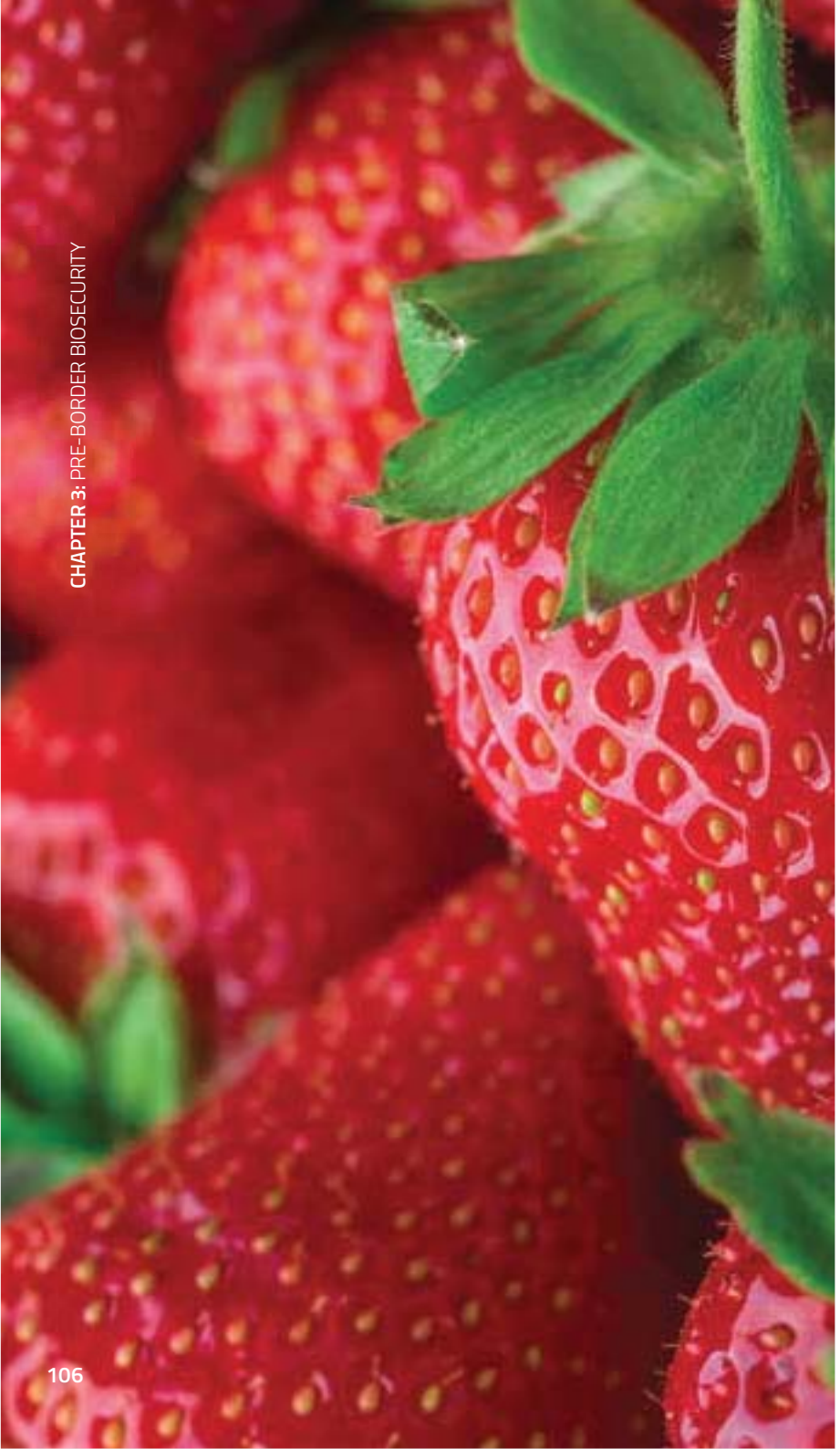
See Chapter 4 for more on BICON.

Table 40. Australian Government import policy advice, final and in draft

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
Candidatus Liberibacter solanacearum (apiaceous crops, including carrot and celery)	All countries	2017
Capsicum	Korea	2009
Cherries (into Western Australia)	New Zealand	2003
Citrus	Egypt	2002
Citrus (revision)	Israel	2003
Cucumber green mottle mosaic virus pest risk analysis (host cucurbit seeds)	All countries	2017
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
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 (revisions)	India	2011
Mangoes	Pakistan	2011

Table 40. Australian Government import policy advice, final and in draft (continued)

Policy	Country (from)	Year released
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
Nectarines	China	2016
Olive (plants from approved sources)	Generic	2003
Oranges (sweet)	Italy	2005
Papaya	Fiji	2002
Peaches, plums and apricots (extention to nectarine IRA)	China	2017
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
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
Potato propagative material (*Solanum tuberosum*)	All countries	2013
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
Thrips and Orthotospoviruses	All countries	2017
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 spp. propagative material	All countries	2016
Draft policy advice (in progress)		
Apiaceous crop seeds (review of import conditions)	All countries	2017
Apples	USA	2009 (stop the clock provisions have been activated on this policy)
Cucurbitaceous crop seeds (review of import conditions)	All countries	2017
Dates	Middle East, North Africa	2016
Dragon fruit	Indonesia	2017
Fresh strawberries	Japan	2017
Fresh decrowned pineapple (*Ananas comosus*)	Taiwan	2017
Fresh breadfruit	Fiji, Samoa, Tonga	2017
Pest risk analysis for brown marmorated stink bug (*Halyomorpha halys*)	All countries	2017
Potatoes for processing	New Zealand	2012
Tahitian limes	Cook Islands, Niue, Samoa, Tonga, Vanuatu	2016



THE BIOSECURITY RISK ANALYSIS PROCESS

Risk analyses conducted by the Department of Agriculture and Water Resources are consistent with Australia's international biosecurity obligations to establish a balance between our international trade obligations and risks posed by goods.

Conducting a Biosecurity Import Risk Analysis

A Biosecurity Import Risk Analysis, under the *Biosecurity Act 2015* may be conducted where relevant risk management measures have not been established, or where they exist for a similar good and pest or disease combination, but the likelihood or consequences of entry, establishment or spread of pests or diseases could differ significantly from those previously assessed.

Regulated risk analyses conducted before 16 June 2016 were completed under the *Quarantine Act 1908* and were called an Import Risk Analysis.

The department is responsible for conducting each Biosecurity Import Risk Analysis (BIRA) as well as other risk analyses but the process can involve other stakeholders. Some covered in the BIRA guidelines, include:

- Departmental officers with expertise in science and regulation, pests and diseases, commercial processes or other relevant disciplines.
- A Scientific Advisory Group, comprising external scientific and economic experts.
- A BIRA Liaison Officer, acting as the first point of contact for stakeholders during a BIRA.
- Other external experts, other government agencies and domestic and international stakeholders.

Improving industry liaison on import risk analysis

AGRICULTURAL COMPETITIVENESS WHITE PAPER

With White Paper funding, the Department of Agriculture and Water Resources has appointed a dedicated plant stakeholder engagement team. These officers work with stakeholders from the beginning of the risk analysis process to ensure they are kept well informed of the process and technical issues.

Two risk analyses published in 2017 – for dragon fruit from Vietnam and strawberries from Korea – were done trialling this new approach, with a Biosecurity Liaison Officer working successfully with industry and other stakeholders for the import risk analysis for the strawberry case.

Conducting a non-regulated risk analysis

A non-regulated risk analysis is a review of existing biosecurity measures that can be conducted when there is a change in biosecurity risk, and when there are technological advancements or process improvements that removes or minimises the biosecurity risk associated with a particular commodity.

These reviews are often driven by industry requests and usually result in more treatment options that importers can undertake to meet biosecurity requirements.

Non-regulated risk analyses are undertaken through an administrative process to meet Australia's international rights and obligations.

The department uses a similar technical methodology to conduct a scientific review of existing policy as it does to conduct BIRAs. As with BIRAs, specific adjustments and modifications to methods are explained in the individual reports.

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. 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.

Analysing pest groups improves risk assessment efficiency

In 2017, the Department of Agriculture and Water Resources completed the first pest risk analysis for a group of pests, as part of an improved pest risk analysis process to improve effectiveness and consistency.

The group pest risk analysis considers the biosecurity risk posed by groups of pests across numerous import pathways. It applies the significant body of available scientific knowledge, including pest interception data and previous pest analyses, to provide an overarching analysis of the risks posed by the group.

The first group pest risk analysis considers the biosecurity risk posed by plant-feeding thrips insects (from the insect order Thysanoptera) that are, or are likely to be, associated with fresh fruit, vegetables, cut flowers and foliage imported into Australia as commercial consignments.

The emerging risks posed by all members of the virus genus *Orthotospovirus* (formerly *Tospovirus*) that are transmitted by some thrips was also assessed. The resulting policy supports the review of import conditions for asparagus and will aid other market access requests.

The International Plant Protection Convention (IPPC) defines pest risk analysis as "the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it".

International Standard for Phytosanitary Measures (ISPM) 2: Framework for Pest Risk Analysis states that "Specific organisms may … be analysed individually, or in groups where individual species share common biological characteristics".

This is the basis for the group pest risk analysis, in which organisms are grouped if they share common biological characteristics – and as a result also have similar likelihoods of entry, establishment, spread and comparable consequences – thus posing a similar level of biosecurity risk.

Each group risk analysis is a building block that can be used to review existing trade pathways and can also be applied to prospective pathways for which a specific pest risk analysis is required. If the trade-dependent factors relating to the likelihood of entry on specific pathways have been verified, the group analysis can be applied.

This is the first group pest risk analysis to be finalised, with others to follow.

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. See also High Priority Pests and National Priority Pests in Chapter 4.

Building biosecurity capacity in the Solomon Islands

The Department of Agriculture and Water Resources is working with Biosecurity Solomon Islands to deliver the Solomon Islands Biosecurity Development Program.

Phase one of the program ran from 2013 to 2016 and focused on developing middle management for Biosecurity Solomon Islands. Activities enhanced key operational, organisational, institutional, scientific and trade related functions.

Beginning in 2017 phase two of the program focuses on strengthening biosecurity for the coffee, cocoa and coconut industries. The program, running until 2019, aims to contribute to international efforts to combat damage to the country's palm species by the exotic coconut rhinoceros beetle.

Funding for the program is provided by the Department of Foreign Affairs and Trade.

Regional allies join us to fight Australia's top plant pests

AGRICULTURAL COMPETITIVENESS WHITE PAPER

Australia has long placed an importance on working with our nearest neighbours to better manage the risk of exotic biosecurity pests and diseases.

With funding from the Agricultural Competitiveness White Paper the Department of Agriculture and Water Resources is collaborating with biosecurity agencies in Papua New Guinea (PNG) and Timor-Leste to establish an 'early warning' mechanism for exotic plant pests and diseases.

Surveillance in these countries aims to detect the Australian Government's 'top 40' National Priority Plant Pests as well others that pose a risk to crops in nearby northern Australia.

Through White Paper funding, biosecurity specialists from the department's Northern Australia Quarantine Strategy (NAQS) and PNG's National Agriculture Quarantine and Inspection Authority (NAQIA) have carried out the first major plant health surveys in more than 17 years. Plant pest checks have been carried out in 'treaty' villages in coastal PNG, which are close to the Torres Strait Islands at the north eastern tip of Australia.

'Treaty' villages are covered by the Torres Strait Treaty, which regulates the movement of people, plants, animals and cargo. The treaty allows Torres Strait Islanders and coastal peoples from PNG to move freely for traditional activities, without the need for visas or passports.

These surveys have found no new evidence of exotic pests or diseases, providing reassurance to both PNG and Australia.

Plant health surveys have also been undertaken in Timor-Leste, again with no findings of major new pests or disease reported.

Importantly the surveys supported community engagement and improved knowledge of biosecurity amongst the governments and people of PNG and Timor-Leste, with capacity building critical to the success of managing biosecurity risks.

White Paper funding also allowed plant scientists from PNG and Timor-Leste to come to Australia in 2017 for training and collaboration with their NAQS counterparts, as well as industry, state government and research stakeholders.

Plant health surveys and community engagement work will also be undertaken in Australia's Indian Ocean Territories of Christmas and Cocos (Keeling) Islands through White Paper funding.

Lynne Jones (NAQS, Australia) and Marilyn Apa (NAQIA, PNG) join forces to detect plant pests. Image courtesy of the Department of Agriculture and Water Resources

Ensuring Australian exports meet required standards

Many Australian plant industries export a proportion of the food and fibre that they produce. A few, notably grains and cotton, export almost everything that is grown. Just as imports are subject to restrictions to protect plant health, exports must also meet conditions, including evidence of pest freedom in the area where the produce was grown. Export trade is therefore heavily reliant on plant biosecurity.

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, to meet the 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 41. 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.

Table 41. 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 Control (Plants and Plant Products – Norfolk Island) Order 2016
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
Primary Industries (Customs) Charges Act 1999
Primary Industries (Customs) Charges Regulations 2000
Export Inspection Charges Collection Act 1985
Export Inspection (Establishment Registration Charges) Act 1985
Export Inspection (Quantity Charge) Act 1985
Export Inspection (Service Charge) Act 1985

Meeting biosecurity conditions of importing countries

To assist Australia's 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 other relevant export information and documentation. Information in MICoR Plants is a guide only and exporters are advised to also check with the importing country 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.

With funding from the Agricultural Competitiveness White Paper the Department of Agriculture and Water Resources is also working to standardise instructional material across the export certification system. This includes packages for cold treatment, fumigation, irradiation and vapour heat treatment and processes to manage and audit accredited properties.

Negotiating market access

There is a high level of investment by the Department of Agriculture and Water Resources to negotiate protocols and build export systems that increase the value of plant exports.

Australia negotiates technical market access with its trading partners for the benefit of Australia's producers. These activities are done in close consultation with industry stakeholders, while taking into consideration the required phytosanitary requirements.

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 to ensure Australia can continue to export its plant products.

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 42 details market access achievements since 2000, including access to new markets, improving opportunities in existing markets and preserving existing market access.

Table 42. Market access achievements for pollinator and 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	Olives, rooted cuttings	2003
USA	Tomatoes, greenhouse	2003
Brazil	Lychees, nursery stock	2004
China	Mangoes	2004
Morocco	Olives, 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	Cotton seed, 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

Table 42. Market access achievements for pollinator and plant product exports from Australia since 2000 (continued)

Country	Commodity	Year achieved
Market access gained and restored		
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
Vietnam	Cherries	2017
Chile	Vegetable seeds, sowing	2017
Myanmar	Plants and plant products	2017
Solomon Islands	Queen bees	2017
Saudi Arabia	Honey	2017
Iran	Lentils	2017
Iran	Logs without bark and sawn timber	2017

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

Table 42. Market access achievements for pollinator and plant product exports from Australia since 2000 (continued)

Country	Commodity	Year achieved
Improvements in market access		
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	Table grapes – 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
Bangladesh	Lentils	2017
Pakistan	Chickpeas	2017
Iran	Wheat	2017
Iran	Chickpeas	2017

Table 42. Market access achievements for pollinator and 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
Myanmar	Plants and plant products	2017
New Zealand	Fruit fly host commodities	2017

PLANT PEST SURVEILLANCE SUPPORTS MARKET ACCESS

Governments and industries make systematic checks for exotic pests within our borders in order to have evidence that Australia does not have certain exotic pests, particularly those that could preclude market access for exporters. Nil findings are recorded and collated to provide evidence of absence of a pest from the country, state or region. These activities are part of Australia's plant pest surveillance system.

In recent years Australia's trading partners and international organisations have asked for more robust and quantitative evidence of Australia's plant health status to both justify import requirements and defend export certification. It is no longer sufficient to state a pest is 'not known to occur', or rest on the assurance of Australia being historically free of a particular pest. Consequently, surveillance is vitally important to market access.

Australia's ability to collect and analyse surveillance data is being improved through the Agricultural Competitiveness White Paper. Better access to more surveillance data will provide our trading partners with confidence in claims of pest absence and area freedom. This will make things easier for exporters, minimising delays and allowing producers to get a better price for their quality produce overseas.

Australia's plant pest surveillance programs are detailed in Chapter 7.

National Minimum Dataset Specifications for surveillance

An important step in building an improved national plant health surveillance system was taken in 2017, with the National Biosecurity Committee (NBC) endorsing national minimum dataset specifications (NMDS) for national sharing of surveillance data.

Agreement on the new standards enhances Australia's ability to collate, share, analyse and report national surveillance data on plant pests, including fruit fly. Reporting on the likely presence or absence of pests at a particular location and time is crucial to supporting market access negotiations.

To comply with NMDS, each record has its own unique identifier code, with comprehensive data captured on the location and type of surveillance activity, as well as the name and jurisdiction of the organisation entering the data.

The use of real time data tools such as AUSPest*Check*, and the introduction of the NMDS, will ensure that Australia continues to be amongst a handful of countries able to fully comply with the International Standards for Phytosanitary Measures on recording and reporting of plant health surveillance information.

AUSPest*Check* to provide a real-time picture of Australia's plant health status

AGRICULTURAL COMPETITIVENESS WHITE PAPER

The Australian Government funds a National Plant Health Surveillance Program for exotic pests of agriculture that is carried out by state agencies at points of entry and other high risk sites.

With funding from the White Paper, PHA is piloting the use of the national data tool AUSPest*Check* to improve the collection and collation of data from that program.

AUSPest*Check*, developed by PHA, can provide a real-time picture of pest numbers and spread, as well as information collected from surveillance activities in agricultural and environmental settings.

The trial will see the collection and analysis of data for the National Plant Health Surveillance Program move from a task involving manual 'number crunching' to one that is fully automated, allowing more rapid sharing of accurate plant pest data by industry, state and territory governments and the Australian Government.

As well as the benefits for market access, improved real-time data would also support a faster detection, eradication or containment response should one of the Australian Government's 'top 40' exotic and unwanted plant pests or diseases enter the country.

This is particularly important as the level of biosecurity risk continues to increase with rising volumes of passengers and cargo entering Australia.

Chapter 4

Border biosecurity

The Department of Agriculture and Water Resources has primary responsibility for international border biosecurity activities, to restrict the import of items that pose a risk to Australia.

Restrictions at the border

Live animals and plants, packaging, plant material, animal products and certain food from overseas could introduce some of the world's most damaging pests and diseases into Australia. This could devastate our valuable agriculture and tourism industries and unique environment.

With increasing levels of international travel and trade, the detection of threats at the border remains an important element of the biosecurity system.

The Department of Agriculture and Water Resources employs officers at the border to 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 for biosecurity risks as they arrive at airports, seaports and mail centres. Officers operate in conjunction with the Department of Home Affairs, which polices people movements and intercepts illegal goods, such as drugs and weapons.

Australia has strict laws relating to the importation of certain goods, including goods brought back from overseas by travellers, to reduce the chance of an exotic pest incursion.

All goods need to be declared whether they are being brought back from overseas or arriving in the mail. The Department of Agriculture and Water Resources uses sophisticated risk assessment and intelligence tools to assess biosecurity risk and respond appropriately.

Screening passengers

In an effort to intercept risk material from being brought in from overseas, when travelling to Australia, passengers are provided with an Incoming Passenger Card by the crew on the aircraft or cruise vessel.

Image courtesy of the Department of Home Affairs

The Incoming Passenger Card is a legal document and must be completed correctly. Passengers must declare if they are carrying certain food, plant material or animal products.

Declared goods can be taken to the clearance point where they will be assessed by a Biosecurity Officer.

Alternatively, goods such as food, plant material or animal items can be voluntarily disposed of in bins located in the terminal.

Biosecurity Officers will assess the level of biosecurity risk associated with the declared goods. Passengers may be required to provide information or documents to assist in determining the risk. Biosecurity Officers also refer to the department's import conditions database, BICON.

Some products may require treatment such as fumigation or irradiation to make them safe. Other goods may not be allowed into the country if the risk is too great.

Biosecurity officers can also inspect baggage when passengers do not declare any goods. If arriving passengers are found to have made a false declaration on the Incoming Passenger Card, they can be penalised under the *Biosecurity Act 2015*.

Screening mail

When goods arrive at the Australian border they are assessed for biosecurity risk and a decision is made on whether they can be imported.

When sending mail to Australia, the contents of any packages must be accurately declared on a postal declaration. Biosecurity officers assess the risk based on the declaration and use detector dogs and x–ray machines to check packages.

Some goods may require treatment (at the importer's expense) before they are permitted into Australia. Goods that are not permitted into Australia will be forfeited to the Australian Government and destroyed. If any attempt has been made to conceal goods, the importer may be subject to an investigation and possible criminal prosecution.

ACTIVITIES TO DEAL WITH RISKS POSED BY CARGO IMPORTS

The Australian Government works with the cargo and shipping industries to prevent pests and diseases being imported with cargo. Biosecurity restrictions on imported goods can be complex. People who wish to import goods are advised to check whether the goods will be allowed to enter. Sometimes the treatments will be more costly and time consuming than the goods are worth.

First time or infrequent importers are encouraged to use the services of a licensed customs broker to facilitate the process.

BICON, the Australian Government's Biosecurity Import Conditions database, holds information on requirements for foreign plant, animal, mineral and human commodities. People wishing to bring in goods can check the conditions of entry on the Department of Agriculture and Water Resources website.

The information available on BICON is the same information that biosecurity officers use when inspecting goods arriving in Australia. Import conditions within BICON are regularly reviewed, so importers need to check the conditions each time they travel or send goods. More information on import risk assessment is in Chapter 3.

Detector dogs

Department of Agriculture and Water Resources detector dogs have played a key role in helping to protect Australia from exotic pests and diseases since 1992. They are used in conjunction with a number of other biosecurity strategies and detection technologies.

Detector Dog Program Operations has approximately 40 dogs operating in international airports, seaports, mail centres and courier depots throughout Australia. Most detector dogs are Labradors, a breed of dog with ideal characteristics for the job. They have an extraordinary sense of smell, are co-operative and gentle with people and possess extreme hunt, food and retrieve drives.

Detector dogs are trained to find items that could bring pests or diseases into Australia such as certain food, plant material and animal products. They have a working life of about six to eight years, and on average, find between 3,000 and 3,500 biosecurity risk items during their working life.

There are two types of detector dogs:

- Passive response detector dogs are trained to sit in the presence of target odours. They are rewarded with food or praise from their handler when they find biosecurity risk material. Passive response detector dogs generally work among the public at international passenger terminals.
- Multi-purpose detector dogs are trained to deliver the appropriate response in the environment in which they are operating. At an international passenger terminal, they will sit beside a passenger or piece of baggage. When scanning objects in mail facilities and private depots they will dig at the source of target odour.

Unusual interceptions at the border

In 2017, around 12 million mail items and four million passengers were screened, and one million cargo consignments were assessed.

Some 3,500 infringement notices were issued for items posing a risk to Australian biosecurity, including plants and seeds, whole fresh fish, dried lizards, frogs and spiders.

Biosecurity officers at the Sydney Mail Centre uncovered a snail when they came across 13 live *Helix pomatia* snails in packages sent from the Ukraine.

The snails, commonly known as Roman snails, were most likely intended for the food industry – where they and their progeny would be eaten by gourmet diners. But had they gotten loose, snails like these can breed rapidly and in great numbers, and an established population could cause huge damage to Australia's agricultural industries and precious environment.

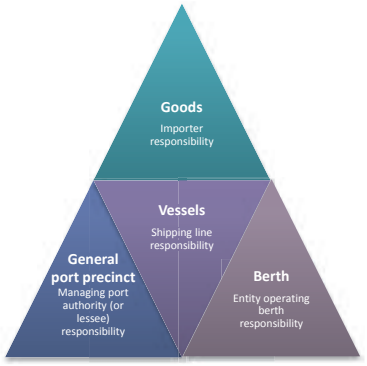
Another recent interception was a parcel containing seeds and fertiliser posted from France. The items had been collected at the famous Chelsea Flower Show in Britain. One of the seed packets was permitted entry but three others and a sample of fertiliser were destroyed.

Pests and diseases associated with imported seeds pose a high risk to Australian agriculture, flora and fauna.

Snails may seem like slow movers, but they can breed rapidly and in great numbers. Images courtesy of Pest and Diseases Image Library, Bugwood.org

First point of entry biosecurity

Figure 85. Entity responsibility for biosecurity risks, first points of entry (ports)



Biosecurity at ports and other first points of entry is shared between stakeholders. Image courtesy of the Department of Agriculture and Water Resources

First point of entry (FPoE) refers to sea ports and airports that accept arrivals from overseas. FPoE operators and staff are in a unique position to notice biosecurity risks and respond to them. The Australian Government works with FPoE authorities, operators and workers to reduce biosecurity risks.

Operators and authorities are required to have facilities, arrangements and systems in place to manage the risk of pests and diseases entering, spreading and establishing. The requirements for FPoE authorities and operators are listed in the First Point of Entry Biosecurity Standards for both landing places and ports. For example, seaports must keep wharves free of vegetation and manage weeds so that they do not flower or spread.

Rubbish, such as old tyres and packaging, must not be left lying around the wharf area as it can create pools of water and attract pests. Baits are put out in the area for rodents and feral animals and FPoE authorities and operators must manage pools of water that might harbour mosquitos, and if necessary, treat any water to prevent breeding of vectors of pests and diseases.

The Australian Government has set up the See. Secure. Report. Hotline (1800 798 636) for FPoE workers to report any biosecurity risks they find during day-to-day operations.

Staff are required to report any hitchhiker pests found on or in vessels and containers or non-containerised cargo. Any unwanted goods from a vessel or cargo consignment – whether packaging, weeds, soil, straw, food scraps, contaminated or spilled goods – are considered waste goods subject to biosecurity control. Staff are required to dispose of waste goods in biosecurity bins, rather than ordinary garbage bins.

Timber dunnage (loose wood, matting, or similar material that is used to keep a cargo in position in a ship's hold) and packaging can carry a variety of borers, beetles, ants and termites. Workers at FPoE are asked to report any evidence of the presence of a timber pest such as frass or sawdust piles under dunnage or imported timber, and tracks or holes in the timber that are signs that exotic timber pests are present.

The special responsibilities of FPoE authorities, operators and staff are an example of the biosecurity responsibilities of everyday Australians (see Figure 85).

NATIONAL BORDER SURVEILLANCE PROGRAM

The National Border Surveillance Program commenced in late 2016 and operates under the policy direction of the Compliance Division within the Department of Agriculture and Water Resources. National border surveillance teams are located in all major Australian mainland ports (see Figure 86).

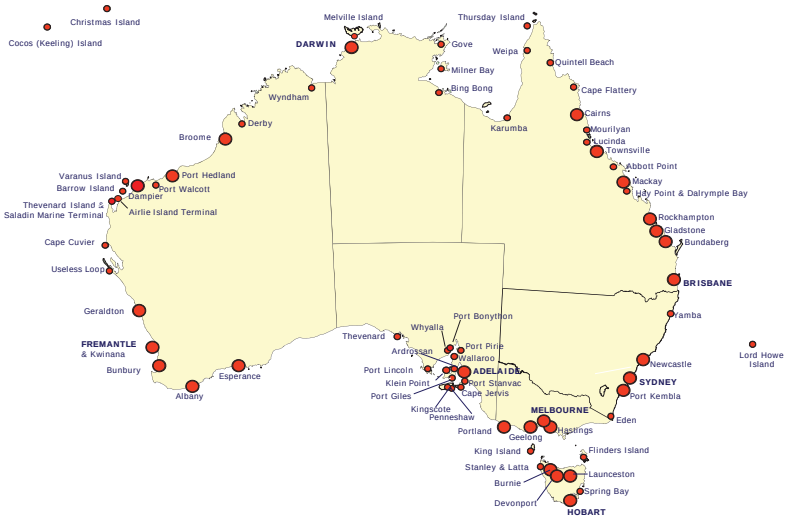
The teams' scope of work includes plant health surveillance at all Australian first points of entry (seaports and airports), premises of businesses handling imported goods of biosecurity interest or biosecurity risk material (so-called Approved Arrangements), and areas associated with or surrounding these.

The primary focus of the border surveillance program is the early detection of pest organisms – that may have escaped from conveyances, containers, goods or passengers at the border – before they have the chance to spread to production areas.

Teams also work to check that no incursions have occurred when an exotic pest is detected at the border and to search for pests in emergency responses.

Data from the teams is also used to inform biosecurity policy areas for the review of import conditions and requirements for Approved Arrangements.

Figure 86. Ports of Australia



Stakeholders implement biosecurity activities at ports all around Australia's coast. Image courtesy of Ports Australia

The success of surveillance activities is due to the co-operation and good will of people in Northern Australia. Image courtesy of Vivien Attwood

Protecting our northern coastline – Northern Australia Quarantine Strategy

The unique biosecurity threats in Australia's north – stretching from Cairns in Queensland to Broome in WA and including the Torres Strait – have been managed by the Department of Agriculture and Water Resources through its Northern Australia Quarantine Strategy (NAQS) since 1989.

The northern coastline is vast and sparsely populated. It faces biosecurity risks from countries in close proximity to Australia including Indonesia, Timor-Leste and Papua New Guinea. These countries have many pests, plant diseases and weeds not present in Australia, which could be spread by human activities as well as natural pathways.

NAQS delivers integrated activities to reduce risk through three main components: surveillance, location and cooperation.

Officers carry out surveillance for exotic pests, diseases and weeds, on horticultural plants as well as native and alternative cultivated hosts. Pest checks are made for nationally agreed target species as well as those identified as High Priority Pests during biosecurity planning for industries. In addition, reports of damage symptoms on host plants are investigated. Increasingly, surveillance is conducted in partnership with industry and other government partners.

Each year NAQS notifies relevant authorities of four or five pests that are either new records or new distributions. This intelligence improves national and local incursion responses and aids in determining plant pest status across the north.

In the Torres Strait, department officers manage risks associated with the southwards movement of people, vessels, aircraft and goods through the Strait to mainland Australia. This includes traditional visitors from Papua New Guinea under the Torres Strait Treaty – up to 30,000 movements.

Officers regulate plant risks associated with movements of goods and conveyances through the islands. Regulated pathways are from the Torres Strait Protected Zone to the Permanent Biosecurity Monitoring Zone, and from either zone to mainland Australia, as shown in Figure 87.

Figure 87. Biosecurity risk pathways regulated by NAQS

Image courtesy of the Department of Agriculture and Water Resources

Most importantly, the success of surveillance and regulatory activities is due to the cooperation and good will of people in northern Australia. The strategy invests heavily in community engagement including the well-known campaign 'Top Watch' to create strong community support. As a result, biosecurity awareness is high and local communities engage with the strategy. They comply with requirements in the Torres Strait, report unusual pests and diseases and provide access to land and country for surveillance.

EXOTIC FRUIT FLY SURVEILLANCE AND ERADICATION

Exotic fruit fly species are one of the highest risks for Australia's horticultural industry with some, including Oriental and New Guinea fruit fly, present in Papua New Guinea. As part of the Torres Strait Fruit Fly Containment Strategy, NAQS works with industry, the Queensland Government and communities to conduct surveys and monitor traps.

Incursions are often detected in November and December in permanent traps on the northern islands of the Torres Strait. These known seasonal incursions are eradicated each year by the Department of Agriculture and Water Resources and the Queensland Government, under the auspices of the Emergency Plant Pest Response Deed. That means that potentially affected industry Parties pay a share of the cost of keeping these pests out of Australia. See Chapter 5 for more on the Emergency Plant Pest Response Deed.

A NAQS ranger checks a trap for exotic fruit flies. Image courtesy of the Department of Agriculture and Water Resources

Latest app technology for rangers

Seventy ranger groups that work across Australia's 10,000 kilometres of northern coastline now have the Ranger App on mobile devices to record checks for plant pests.

The Ranger App allows rangers to store surveillance data even when they're offline. The data they enter is submitted to a database when internet connectivity is restored.

The new system makes biosecurity data collection much more efficient.

NAQS rangers use a new app for plant pest data collection. Image courtesy of the Department of Agriculture and Water Resources

International experts gather to protect against Xylella

In May 2017, experts from across the globe gathered in Brisbane to share knowledge and strengthen Australia's defences against the nation's most unwanted exotic plant pest. The International Symposium on *Xylella fastidiosa* was attended by more than 100 delegates who heard from experts from all over the world.

Representatives from the United States, France, Italy and Taiwan shared their first-hand experience of the disease and its sap sucking insect vectors, with the audience who were from government, industry and research agencies in Australia, along with New Zealand, Japan, Myanmar, Tuvalu, Tonga, Timor-Leste, French Polynesia and Sri Lanka.

A key message arising from the symposium was that every Australian has a role to play in protecting plant industries and the environment from Xylella.

Presentations from the symposium are available on the Department of Agriculture and Water Resources website at **agriculture.gov.au/pests-diseases-weeds/plant/xylella/international-symposium-xylella-fastidiosa**.

Local and international delegates gather at Australia's first international Xylella fastidiosa symposium in May 2017. Image courtesy of the Department of Agriculture and Water Resources

Post-entry plant quarantine

Imported live plant material can introduce foreign plant pests and diseases, but it can be advantageous at times for growers to import new varieties, to help maintain the competitiveness and productivity of Australian agribusiness. As a result, live plants can be imported but are subject to conditions and risk assessment processes set by the Department of Agriculture and Water Resources. This includes new plant material spending time in post-entry quarantine facilities, allowing for growth and disease screening and testing to eliminate any disease concerns.

Live plant material is defined as all live plants or plant material, other than seeds, that is imported for the purposes of growth or propagation. Import conditions vary, depending on the genus and species of the plant and the form of the imported plant material.

Plant importers begin the process by checking import conditions using the Australian Government import database, BICON, and, if the species is allowed into Australia, apply for an import permit. The national plant protection organisation of the country of export will need to inspect the plants and issue a phytosanitary certificate prior to export. New species that have not previously been imported will be subject to a weed risk assessment, after which the department may choose to develop import conditions for the new species. Plant material classified by departmental officers as high risk will be taken directly to the government post entry quarantine facility at Mickleham in Victoria. Other nursery stock and restricted seeds can be grown and screened for pests at an approved facility (see Table 43).

The amount of time the plants spend in a post-entry quarantine facility depends on the biosecurity risks they pose and the specific testing required. Once all required testing and screening procedures have taken place and the plants are deemed to be free of any biosecurity concern, the department will release the goods to the importer, who covers all associated costs for services.

Table 43. Australia post-entry plant quarantine facilities

Location	Australian Government facilities	State government facilities approved for high-risk plant material	Scientific (S) and private (P) facilities approved for high-risk plant material	Private facilities approved for medium-risk plant material
ACT			1 (S), 1 (P)	1
NSW		1	2 (P)	13
Queensland		2	2 (P)	11
SA		1	1 (S)	19
Tasmania			1 (P)	10
Victoria	1	3		51
WA		1	2 (P)	14
NT				

Targeting the highest risk exotic plant pests

Identifying exotic threats and the ways in which they might make it into Australia can significantly increase the chance of containing and successfully eradicating them should they arrive.

Prioritising pests allows biosecurity activities, including surveillance, pathway analysis, and border screening and inspection, to target the most serious risks.

BIOSECURITY PLANNING TO DETERMINE HIGH PRIORITY PESTS

High Priority Pests are those assessed to pose the greatest threat to a particular plant industry or environmental species during biosecurity planning. High Priority Pests are exotic pests that could have a significant impact on production or trade should they establish in Australia, as well as some serious pests that are in Australia but confined to particular regions.

Biosecurity planning is a requirement for signatories to the Emergency Plant Pest Response Deed and biosecurity plans are generally developed by PHA, with funding secured by a Research and Development Corporation or by a plant industry peak body. The plans developed by PHA are listed in Table 44.

Planning is a key risk mitigation strategy that gives an industry the best chance of future viability and sustainability. A biosecurity plan consists of two main parts: a risk assessment of exotic pests and an implementation table outlining risk mitigation activities that industry and government can undertake to improve biosecurity preparedness.

To identify and prioritise exotic plant pests, experts from industry and government are brought together to form a Technical Expert Group for that crop. Pest risk assessment 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 for an industry are deemed to be High Priority Pests.

It is important to note that pest risk assessments differ from the Biosecurity Import Risk Analysis processes undertaken by the Department of Agriculture and Water Resources. Pest risk assessments consider all potential pathways including unregulated ways into the country. Biosecurity Import Risk Analysis is conducted for an individual import application under a specific circumstance, which might involve specified treatments or certification prior to import.

Once the High Priority Pests for an industry or crop have been identified, experts are gathered to form a Biosecurity Implementation Group, who develop and agree to risk mitigation measures for each pest, and general activities to improve biosecurity preparedness.

Biosecurity plans developed by PHA undergo formal reviews every four to five years to ensure they remain up-to-date, taking into consideration new research, incursions overseas and changes to potential pathways. New biosecurity plans also have an annual mini review by Biosecurity Reference Panels to help drive implementation of preparedness activities. For more on biosecurity planning, see Chapter 2.

At the end of this chapter (page 130), Table 46 lists all 370 high priority pests that have been identified from the 32 biosecurity plans developed by PHA, along with those listed in *schedule 13* of the *EPPRD*, which are known as pre-categorised pests. In Chapter 2, the High Priority Pests of each industry are listed.

Table 44. Current biosecurity plans covering Australia's plant industries

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

NATIONAL PRIORITY PLANT PESTS

In November 2016, a list of Australia's least wanted plant pests and diseases was released by the Department of Agriculture and Water Resources. The pests are listed in Table 45.

The list was derived from a comparative analysis of exotic pests considering:

- The possible ways they could enter Australia.
- The likelihood of them entering.
- 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, these highly damaging exotic species are kept out by ongoing biosecurity measures. Over 300 types of fruit and vegetables would be at risk from these fruit flies.

For more information on National Priority Plant Pests go to **agriculture.gov.au/pests-diseases-weeds/plant/national-priority-plant-pests-2016.**

Table 45. Australia's National Priority Plant Pests

National priority plant pests
Xylella fastidiosa
Khapra beetle
Exotic fruit flies
Karnal bunt
Huanglongbing or citrus greening
Gypsy moth
Tramp ants
Internal and external mites of bees
Giant African snail
Brown marmorated stink bug
Zebra chip
Ug 99 wheat stem rust
Russian wheat aphid (holocyclic form)
Citrus canker
Guava (Eucalyptus) rust
Phytopthora blight
Exotic bees
Panama Tropical race 4
Potato cyst nematode
Leaf miners
Fire blight
Hessian fly/barley stem gall midge
Texas root rot
Wheat stem sawfly
Golden apple snail
Barley stripe rust
Cereal cyst nematode

National priority plant pests
Sharka
Drywood termite
Subterranean termite
Citrus longhorn beetle
Red ring disease/pine wood nematode
Fusarium wilt
Sugarcane stalk borer
Black sigatoka
Potato late blight
Sunn pest
Western/tarnished plant bug
Exotic sawyer beetles
Burning moth
European canker
Dutch elm disease

Least wanted number three: melon fly (Zeugodacus cucurbitae). Image courtesy of Central Science Laboratory, Harpenden, British Crown, Bugwood.org

OTHER PLANT PESTS OF CONCERN

The Department of Agriculture and Water Resources also identifies the following list of other serious plant pests that may have a significant impact on growers, industries, Australia's environment and way of life.

- Citrus fruit borers (*Citripestis sagittiferella* and *Prays endocarpa*)
  Hosts – Rutaceae, particularly citrus
- Exotic diseases of coconuts (phytoplasmas)
  Hosts – coconut
- Mango pulp weevil (*Sternochaetus frigidus*)
  Hosts – mango
- Pine pitch canker (*Fusarium circinatum*)
  Hosts – Douglas fir, pines
- Sugarcane stem borers (*Chilo, Sesamia* and *Scirpophaga* spp.)
  Hosts – sugarcane
- Lesser auger beetle (*Heterobostrychus aequalis*)
  Hosts – timber in service, range of horticultural and tree crops, amenity plantings.

Targeting the least wanted pests through improved plant health surveillance

AGRICULTURAL COMPETITIVENESS WHITE PAPER

Through the Agricultural Competitiveness White Paper, the Department of Agriculture and Water Resources is working with Plant Health Australia, state and territory governments, industry and environmental groups, as well as the R&D sector, to strengthen surveillance for the national priority pests, from working with our near neighbours to conduct surveys and build biosecurity capacity to targeted industry surveillance strategies.

White Paper funding is also strengthening national surveillance activities for fruit flies and providing enhancements to the National Bee Pest Surveillance Program. For more information see Chapter 7.

A national priority pest – Airborne phytophthora, the plant destroyer

Phytophthora ramorum causes sudden oak death. Image courtesy of Joseph O'Brien, USDA Forest Service, Bugwood.org

Name: *Phytophthora ramorum*

Life form: Oomycete (fungus-like microorganism)

Origin: Asia

Distribution: North America and Europe

Symptoms: Leaf spots, stem cankers which often ooze smelly dark red sap, and dieback of the foliage which often results in the death of the tree.

Spread pathways: Spores in air and water, as well as on clothes and shoes, equipment, or animals plus plant trade and green waste.

At risk: Plantation forestry, nut industries, production nurseries, urban trees, native ecosystems.

Phytophthora species are pests of a wide range of trees, shrubs and herbaceous plants. Derived from Greek, the word phytophthora means 'plant destroyer'.

Phytophthora ramorum is best known for causing sudden oak death which is causing devastation in nurseries and woodland ecosystems throughout Europe and North America.

Sudden oak death is known to affect over 130 tree and shrub species and has killed millions of trees worldwide. Where the disease is established, some plant production industries, particularly the nursery industry, have been badly damaged.

The pest is highly invasive. Its rapid lifecycle, ability to spread by spores through wind and rain, and to survive harsh climatic conditions means it can spread and reproduce rapidly in new environments.

Testing suggests that iconic Australian native plants including species of *Eucalyptus*, *Leptospermum* and *Melaleuca* would be highly susceptible, making it a pest of particular concern to Australia.

In addition to damaging nut, forestry and nursery industries, *Phytophthora ramorum* would forever change the face of the Australian bush.

Table 46. High priority pest 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)	Truffle, Nut, EPPRD
Anthonomus bisignatus	Strawberry bud weevil	EPPRD
Anthonomus grandis	Cotton boll weevil	Cotton, EPPRD
Aphis gossypii (exotic strains)	Cotton aphid	Cotton, Production nurseries
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 (MAT1-1 is endemic, MAT 1-2 is exotic)	Ascochyta blight	Grains
Aspidiella hartii	Yam scale (rhizome scale)	Ginger
Avocado sunblotch viroid (asymptomatic strains)	Avocado sunblotch	Avocado
Avocado sunblotch viroid (symptomatic strains)	Avocado sunblotch	Avocado
Bactericera cockerelli	Tomato potato psyllid	Tomato, Potato, EPPRD
Bactrocera carambolae	Carambola fruit fly	Avocado, Tomato, Citrus, Mango, Papaya, Passionfruit, Viticulture
Bactrocera dorsalis	Oriental fruit fly	Apple and Pear, Avocado, Tomato, Citrus, Lychee, Papaya, Passionfruit, Summerfruit, Viticulture, EPPRD
Bactrocera facialis	Tropical fruit fly	Avocado, Tomato, Passionfruit
Bactrocera invadens (syn. *B. dorsalis*)	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 (syn. *B. dorsalis*)	Papaya fruit fly	Avocado, Citrus, Mango, Papaya, Passionfruit, Summerfruit, Viticulture, EPPRD
Bactrocera passiflorae	Fijian fruit fly	Avocado, Papaya, Passionfruit
Bactrocera philippinensis (syn. *B. dorsalis*)	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 (biotypes other than B and AN)	Silverleaf whitefly	Cotton, Melon, Production nurseries
Bemisia tabaci (Types 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	Tomato, Cotton, Melon, Production nurseries
Blood disease bacterium	Blood disease	Banana, EPPRD

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
Botrytis squamosa	Leaf blight	Onion
Burkholderia caryophylli (syn. *Pseudomonas caryophylli*)	Bacterial wilt of carnation	Cutflower
Bursaphelenchus spp. including *B. xylophilus*	Pinewood nematode species complex	Forestry
Cacoecimorpha pronubana	Carnation tortrix	Cutflower
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, Production nurseries, EPPRD
Candidatus Liberibacter solanacearum (syn. *Candidatus* Liberibacter psyllaurous)	Zebra chip	Tomato, Potato, EPPRD
Candidatus Phytoplasma pruni (syn. X disease phytoplasma)	Peach X disease	Cherry, Summerfruit, EPPRD
Candidatus Phytoplasma solani	Bois noir	Viticulture
Carposina sasakii	Peach fruit moth, small peach fruit borer	Apple and Pear
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 (syn. *Ceutorhynchus obstrictus*)	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	Forestry
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	Cherry, Summerfruit, EPPRD
Conotrachelus perseae	Small seed weevil	Avocado
Coptotermes formosanus	Formosan subterranean termite	Forestry

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
Coptotermes gestroi	Asian subterranean termite	Forestry
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
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
Cydia inopinata (syn. *Grapholita inopinata*)	Manchurian fruit moth	Apple and Pear
Cylindrocopturus adspersus	Sunflower stem weevil	Grains
Daktulosphaira vitifoliae (biotype B)	Grape phylloxera type B	EPPRD
Daktulosphaira vitifoliae (exotic strains)	Grapevine phylloxera	Viticulture
Dasineura mali	Apple leaf curling midge	Apple and Pear
Deanolis sublimbalis (syn. *Noorda albizonalis*)	Red banded mango caterpillar (red banded borer)	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	Forestry
Dendroctonus valens	Red turpentine beetle	Forestry
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, Production nurseries, 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, Summerfruit
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	Production nurseries
Eldana saccharina	African sugarcane stalkborer	Sugarcane
Elytroteinus subtruncatus	Fijian ginger weevil	Ginger
Endocronartium harknessii	Western gall rust	Forestry
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

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
Candidatus Phytoplasma prunorum	European stone fruit yellows	Cherry, Summerfruit, EPPRD
Eurygaster integriceps	Sunn pest	Grains
Euschistus conspersus	Consperse stink bug	Rubus
Frankliniella bispinosa	Florida flower thrips	Citrus
Frankliniella intonsa	Flower thrips	Tomato, Cutflower
Frankliniella tritici	Eastern flower thrips	Cutflower
Fusarium circinatum	Pitch canker	Forestry
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
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 spp. (*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
Halyomorpha halys	Brown-marmorated stink bug	Apple and Pear, Truffle, Cotton, Nut, Rubus
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
Homalodisca vitripennis (syn. *Homalodisca coagulata*)	Glassy winged sharpshooter	Cherry, Citrus, Production nurseries, Summerfruit, Viticulture
Homoeosoma electellum	Sunflower moth	Grains
Hoplostoma fuligineus	Large hive beetle	Honey bee
Hyalesthes obsoletus	Cixiidae planthopper	Viticulture
Hylesia nigricans	Burning moth	Forestry
Hypothenemus obscurus	Tropical nut borer	Nut

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
Ips typographus	Spruce bark beetle	Forestry
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	Production nurseries
Liriomyza bryoniae	Tomato leaf miner	Tomato, Melon, Vegetable
Liriomyza congesta	Pea leafminer	Cutflower
Liriomyza huidobrensis	Serpentine leaf miner	Tomato, Cutflower, Melon, Production nurseries, Vegetable
Liriomyza sativae	Vegetable leaf miner, American leaf miner	Tomato, Melon, Onion, Vegetable, EPPRD
Liriomyza trifolii	American serpentine leaf miner	Tomato, Cutflower, Melon, Vegetable
Lissachatina fulica (syn. *Achatina fulica*)	Giant African snail	Tomato, Production nurseries
Lissorhoptrus oryzophilus	Rice water weevil	Rice, EPPRD
Lobesia botrana	European grapevine moth	Viticulture
Lygus hesperus	Western plant bug	Cotton, Strawberry, EPPRD
Lygus lineolaris	Tarnished plant bug	Cotton, Production nurseries, Strawberry
Lymantria dispar	Asian gypsy moth	Apple and Pear, Production nurseries, Nut, Forestry
Lymantria mathura	Rosy gypsy moth, pink gypsy moth	Apple and Pear
Lymantria monacha	Nun moth	Apple and Pear, Truffle, Forestry
Magnaporthe grisea	Rice blast	Grains, Rice, EPPRD
Mayetiola destructor	Hessian fly	Grains, EPPRD
Mayetiola hordei	Barley stem gall midge	Grains
Monilinia fructigena	Brown rot	Apple and Pear, Blueberry, Cherry, Summerfruit, EPPRD
Monilinia mali	Monilinia leaf blight, blossom wilt	Apple and Pear
Monilinia polystroma	Asiatic brown rot	Apple and Pear, Summerfruit
Monilinia vaccinii-corymbosi	Mummy berry, cotton ball disease	Blueberry
Monochamus spp. including *M. alternatus*, *M. galloprovinicialis*, *M. titillator*, *M. scutellatus*	Longhorn beetles	Forestry
Monosporascus cannonballus	Monosporascus root rot	Melon
Mungbean yellow mosaic virus (Begomovirus)	Mungbean yellow mosaic virus	Grains
Mycosphaerella eumusae	Eumusae leaf spot	Banana
Nemorimyza maculosa	Chrysanthemum leaf miner	Cutflower
Neonectria ditissima (syn. *Nectria galligena* and *Neonectria galligena*)	European canker	Apple and Pear, EPPRD
Nysius huttoni	Wheat bug	Grains
Oligonychus ilicis	Southern red mite	Production nurseries
Oligonychus perseae	Persea mite	Avocado
Ophiostoma novo-ulmi (syn. *Ceratocystis ulmi*)	Dutch elm disease	EPPRD
Orgyia thyellina	White spotted tussock moth	Forestry
Pandemis cerasana	Cherry brown tortrix	Cherry
Pantoea stewartii	Stewarts 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

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
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
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	Forestry
Phytophthora ramorum	Sudden oak death	Avocado, Truffle, Blueberry, Cutflower, Production nurseries, Nut, Forestry, 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	Production nurseries, 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, Production nurseries
Pseudotheraptus wayi	Coconut bug	Lychee
Psila rosae	Carrot rust fly	Vegetable
Puccinia asparagi	Asparagus rust	EPPRD
Puccinia graminis f. sp. *tritici* (exotic pathogenic races e.g. Ug99)	Stem rust of wheat	Grains

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
Puccinia psidii sensu lato (exotic variants)	Guava rust/Eucalyptus rust	Cutflower, Production nurseries, Forestry, 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) (syn. *Pseudomonas solanacearum*)	Bacterial wilt	Ginger
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
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, Waika virus	Rice
Riptortus dentipes	Pod sucking bug	Grains
Roesleria subterranea	Grape root rot	EPPRD
Schizaphis graminum	Greenbug	Grains
Scirpophaga excerptalis	Top shoot borer	Sugarcane
Scirtothrips perseae	Avocado thrips	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	Forestry
Teratosphaeria zuluensis	Coniothyrium Eucalyptus canker	Forestry
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	Forestry

Table 46. High priority pest threats (continued)

Scientific name	Common name	High priority pest of
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	Apple and Pear, Honey bee, Nut
Tropilaelaps mercedesae	Tropilaelaps mite	Apple and Pear, Honey bee, Nut
Tuta absoluta	South American tomato moth, tomato leafminer	Tomato
Unknown	Ramu stunt disease	Sugarcane, EPPRD
Unknown (suspected phytoplasma)	Longan and lychee witches' broom disease	Lychee
Uredo rangelii	Myrtle rust	EPPRD
Urocerus gigas	Giant wood wasp	Forestry
Varroa destructor	Varroa mite	Apple and Pear, 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
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
Xanthomonas campestris (avocado strain)	Bacterial canker	Avocado
Xanthomonas citri subsp. *citri* (syn. *X. axonopodis* pv. *citri*)	Citrus canker	Citrus, EPPRD
Xanthomonas citri subsp. *malvacearum* (syn. *X. axonopodis* pv. *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, phony peach	Blueberry, Cherry, Citrus, Production nurseries, Nut, Summerfruit, Viticulture, EPPRD
Xylella fastidiosa subsp. *fastidiosa*	Pierce's disease, blueberry leaf scorch, olive leaf scorch	Olive, EPPRD
Xylella fastidiosa subsp. *pauca*	Pierce's disease, blueberry leaf scorch, olive quick decline	Olive, EPPRD
Xylosandrus compactus	Black twig borer	Mango
Zea mosaic virus (Potyvirus)	Zea mosaic virus	Grains
Zeugodacus curcubitae (syn. *Bactrocera cucurbitae*)	Melon fruit fly	Avocado, Tomato, Melon, Papaya, Passionfruit, Summerfruit, Vegetable

Leaf symptoms of Pierce's disease. Image courtesy of Christine Horlock, Department of Agriculture and Fisheries Queensland

An adult female Varroa mite feeds on a developing bee. Image courtesy of Scott Bauer, USDA Agricultural Research Service, Bugwood.org

Chapter 5

Post-border biosecurity – Eradicating new plant pests

While Australia's border biosecurity is second to none, exotic pests still enter Australia. They might arrive with imported goods or the packaging it is sent in, with illegally imported goods, in luggage or via natural pathways such as wind and water currents. In some cases, an existing plant pathogen will evolve to become a pest of a new species.

Since pests can make it into the country despite all the precautions in place, Australia has established a unique and highly effective post-border biosecurity system to provide additional protection against exotic pests.

The next few chapters cover different aspects of post-border activities that together are aimed at limiting the impact of any detected pest or disease.

Image courtesy of the Northern Territory Department of Primary Industry and Resources

Responding when new plant pests are found

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 post-border biosecurity mechanisms in place to rapidly and effectively respond to plant pests to minimise any negative impacts.

Reports of new plant pests and diseases are referred to state departments of agriculture in the first instance. An Exotic Plant Pest Hotline has been set up for such reports. The national number,1800 084 881, is directed to the state agency, and all calls are confidential and treated seriously.

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

1800 084 881

A report to the Exotic Plant Pest Hotline triggers investigations by the state agency to identify the pests or the unusual plant symptoms. Diagnosticians in state and territory agencies are tasked with determining if the suspicious pest is indeed exotic. Information on Australia's diagnostic system is in Chapter 7.

In cases where a new pest that warrants further action is identified, state and territory agencies will take immediate steps as stipulated under Australia's pest response arrangements.

If a new pest is considered to primarily impact the environment or social amenity, and where the response is for the public good, the National Environmental Biosecurity Response Agreement (NEBRA) will be activated. NEBRA was signed by the Australian Government and state and territory governments in January 2012.

In 2017 an independent review was undertaken of the implementation and effectiveness of the NEBRA agreement in the five years since its commencement. The final report has been provided to the National Biosecurity Committee which will consider its findings and recommendations in conjunction with the relevant Intergovernmental Agreement on Biosecurity Review recommendations.

Serious exotic pests that would affect agricultural industries are dealt with under the provisions of the Emergency Plant Pest Response Deed, and the majority of this chapter focuses on those arrangements.

Exotic production weeds are also responded to, although at this time there is no formal national response agreement in place.

Emergency responses are coordinated from a state biosecurity operations centre

Image courtesy of NAQS

The Emergency Plant Pest Response Deed

The Emergency Plant Pest Response Deed (EPPRD) is a formal, legally binding agreement between PHA, the Australian Government, all state and territory governments, and, at the end of 2017, 33 plant industry peak bodies.

PHA is the custodian of the EPPRD, bestowing on the company the dual roles of ensuring that responses are carried out in accordance with the provisions of the agreement and of progressively improving the provisions to meet the needs of Signatories.

In this chapter, terms defined under the EPPRD are identified through capitalisation. For the full list of definitions, refer to clause 1 of the EPPRD available at **planthealthaustralia.com.au/epprd**.

This chapter, which is focused on the implementation of the EPPRD, 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, Bees or Fungi provided that it is discrete, identifiable and genetically stable, but excludes Genetically Modified Organisms.*

In order for a new detection to be considered under the EPPRD, the species detected must first meet the definition of a Plant Pest. Note that the EPPRD definition of a Plant Pest does not include weeds.

DEFINITION OF AN EMERGENCY PLANT PEST

For a pest to be covered by the EPPRD, it must be an Emergency Plant Pest (EPP) as defined in the agreement. Some pests have already been accepted as EPP, through the process of categorisation, and these appear in *schedule 13 of the EPPRD*.

Otherwise, a Plant Pest is an EPP if it meets one of the following 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.

The honey bee industry is also covered by the EPPRD, since a Plant Pest affecting honey bees would also affect plant industries that benefit from pollination. In 2017, edible fungi were also added to the EPPRD so that Plant Pests that are injurious to edible fungi (for example truffles) can be considered under the agreement.

EPPRD ERADICATION RESPONSES

The EPPRD is designed to ensure a rapid and effective response to the detection of an EPP, and to provide certainty on the governance, decision making 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.

Decision making committees that drive eradication responses

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 to 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.

The National Management Group (NMG) is responsible for making the key decisions on a response under the EPPRD. The group is formed when an EPP is detected and consists of representatives from PHA, the Australian Government, all state and territory governments and Industry Parties identified as Affected by the EPP.

The NMG is responsible for approving a Response Plan, including the budget, if it is agreed that eradication of the EPP is technically feasible and cost beneficial. The NMG is advised on technical matters by the Consultative Committee on Emergency Plant Pests (CCEPP).

The CCEPP is a technical committee that makes recommendations to the NMG on a response under the EPPRD. As with the NMG, the CCEPP is formed when an EPP, or a suspected EPP, is detected.

The CCEPP 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 Industry Party identified as Affected by the EPP.

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.

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, stand down and transition to management), 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.

PLANTPLAN is supported by several documents providing detail on specific topics to make access to information easier in training and emergency response situations. In 2017 Parties endorsed a number of new and revised supporting documents, all of which are available at **planthealthaustralia.com.au/plantplan**.

CATEGORISATION OF PESTS

Investment in a response plan by government and Industry Parties is guided by the category of the EPP. Each category is based on the public versus private benefit of eradication of the EPP and falls into one of four categories, as shown in Table 47.

Assessments are made by a Categorisation Group comprising 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.

Relevant Parties must agree unanimously to the category recommended by the Categorisation Group in order for it to be formally recognised.

Giant pine scale was reported for the first time in Australia in late 2014. It was found in pine trees in Melbourne and in Adelaide, sparking an eradication response under the EPPRD. Image courtesy of the Department of Economic Development, Jobs, Transport and Resources

Table 47. Emergency Plant Pest 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.

TRANSITION TO MANAGEMENT

In some cases, EPPs are not able to be eradicated. In 2016 a Transition to Management (T2M) Phase was incorporated into the EPPRD and PLANTPLAN following approval by all EPPRD Parties.

T2M may only be initiated under certain circumstances and its aim is to provide a formalised structure for transitioning a response from the eradication of an EPP under the EPPRD to management of the EPP outside of the EPPRD processes.

The objectives and activities undertaken during a T2M phase depend on the biology of the pest and the circumstances relating to the stage of the response, and are considered on a case by case basis. Activities might include development of control options, improving knowledge of the pest, negotiating new trading protocols, and communication, engagement and training.

Prior to the inclusion of a T2M phase in the EPPRD, once a decision that an EPP was not eradicable had been made, the processes of the EPPRD ceased. This left no clear path for decision making and cost sharing of any further programs that may be in the national interest.

Parties agreed that the T2M phase in the EPPRD would only apply in a situation where an eradication program fails. That is where a Response Plan has been agreed and implemented and subsequently NMG has determined that it is no longer feasible to eradicate the EPP.

Transition to management for giant pine scale

Transition to Management arrangements under the Emergency Plant Pest Response Deed were used for the first time in 2017 for the exotic forestry pest, giant pine scale (*Marchalina hellenica*).

Giant pine scale was reported for the first time in Australia in late 2014. It was found in pine trees in Melbourne and in Adelaide, sparking an eradication response under the EPPRD.

In Victoria, infested trees were treated with an insecticide, but the chemical injection treatments were not completely effective. Eventually, surveillance revealed that more than 4,300 trees were infested in the south east suburbs of Melbourne.

While the Consultative Committee on Emergency Plant Pests considered alternative eradication options in Victoria the group eventually concluded that giant pine scale could not be eradicated. The decision was based on the following factors:

- Chemical controls were ineffective.
- The only other control option was to remove all infested trees, an action not likely to be publicly acceptable.
- Low confidence that the pest is detectable at very low densities.
- High cost of achieving full eradication of the pest.

As a result, the NMG for giant pine scale – comprising all Australian Government, all state and territory governments, Affected Industry Parties and Plant Health Australia – agreed that the pest was not technically feasible to eradicate from Victoria. In May 2017, the group agreed to a Response Plan incorporating Transition to Management, to prepare the industry and the community for ongoing management of the pest and minimise future impacts.

The amended National Giant Pine Scale Response Plan includes a 12 month T2M program which is being implemented by the governments of Victoria and SA. This allows for ongoing management of the pest to minimise future impacts.

The current arrangements in place in Victoria have restricted giant pine scale to urban areas and, to date, there have been no reports of infestation in soft wood plantations. SA has advised that they have no infected trees at this time and surveillance will continue towards attaining proof of freedom for the state.

The Australian Government, all state and territory governments, and the Australian Forest Products Association are contributing to the cost of the response under the EPPRD.

Image courtesy of Rod Turner, Plant Health Australia

Responses to Emergency Plant Pest incursions in 2017

Seven Cost Shared responses to EPPs were ongoing or initiated in 2017. These responses, and descriptions of past actions and key activities in 2017, are provided in Table 48. A number of new and ongoing responses that have not progressed to a Cost Shared Response Plan in 2017, and for which significant activity occurred in 2017 are also included in Table 48.

In addition to the Cost Shared responses, a number of pests were detected that did not proceed to a Response Plan. Some have been assessed as requiring no further action, while others are still under investigation and further actions may still be taken. These pest detections are listed in Table 49 (page 149).

For more information on the EPPRD and emergency response provisions go to **planthealthaustralia.com.au/plantplan**.

EVALUATING ACTIVITIES UNDER THE EPPRD

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 learnt from evaluations are effectively shared across the biosecurity sectors.

Table 48. Responses to plant pests under EPPRD arrangements

Scientific name	Common name	Crops affected	Region	Past action	Current (2017) 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 the National Management Group (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 in response to sporadic fruit fly detections.
Bactrocera trivialis	New Guinea fruit fly				
Zeugodacus cucurbitae	Melon fly				
Bactericera cockerelli	Tomato potato psyllid	Tomatoes, vegetables, production nurseries	WA	New incursion in 2017	Detected in Perth in February 2017. Treatment and surveillance activities undertaken. NMG endorsed a Response Plan for eradication however subsequently agreed that it was not feasible to eradicate tomato potato psyllid. A Response Plan incorporating Transition to Management was approved by the NMG. The plan is aimed at managing ongoing risks and impacts of the psyllid and providing proof of freedom from the pathogen it can vector, *Candidatus* Liberibacter solanacearum haplotypes A and B, which have not been detected in Australia to date.
Candidatus Liberibacter solanacearum haplotypes D and E	Vegetative disorder, yellows decline	Vegetables, production nurseries	NSW	New incursion in 2017	Haplotypes D and E detected in parsley seed imported from overseas. Tracing of imported seed undertaken by state and territory governments. To date, the bacterium has only been detected in unsown imported seeds and not within any of the host crops being grown in Australia.
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. Single detection in July 2016. Diseased tree and surrounding host trees destroyed. Tracing and surveillance activities undertaken with no further detections. Response Plan under revision and surveillance ongoing.	Revised Response Plan endorsed by the NMG in May 2017. Seven infected trees subsequently detected in late 2017. All infected trees were destroyed. Containment measures remain in place and surveillance activities ongoing. The Response Plan is under review. A Scientific Advisory Panel convened to consider technical information on spore dispersal and latency of the pathogen.
Fusarium mangiferae	Mango malformation disease (MMD)	Mangoes, production nurseries	Qld, NT	The CCEPP considered the technical advice of the Scientific Advisory Panel and prepared recommendations on each individual *Fusarium* species for consideration by the NMG.	*F. sterilihyphosum* sensu lato was initially reported in association with MMD. The species was subsequently reidentified to be the newly described species, *F. parvisorum*. CCEPP recommendations on the EPP status and technical feasibility of eradication of *F. proliferatum*, *F. pseudocircinatum* and *F. parvisorum* were provided to the NMG for consideration. The CCEPP agreed that three unrelated Incidents of *F. mangiferae* should be considered separately, consistent with the EPPRD. The CCEPP agreed to recommend to the NMG that the Incident of *F. mangiferae* in Qld and one incident of *F. mangiferae* in NT have been eradicated. A third unrelated Incident of *F. mangiferae* in the NT remains under consideration by the CCEPP, with further targeted surveillance to be undertaken in order to inform a decision on technical feasibility of eradication.
F. proliferatum					
F. pseudocircinatum					
F. sterilihyphosum sensu lato (rediagnosed as *F. parvisorum*)					

Table 48. Responses to plant pests under EPPRD arrangements (continued)

Scientific name	Common name	Crops affected	Region	Past action	Current (2017) situation and status
Halyomorpha halys	Brown marmorated stink bug	Various fruits and vegetables, hazelnuts, cotton, grains, production nurseries	NSW	New incursion in 2017	Detected in imported cargo. Treatment, surveillance and trapping activities undertaken, and tracing and surveillance ongoing. A Response Plan has been prepared by the CCEPP for consideration by the NMG.
Liriomyza sativae	Vegetable leafminer	Tomatoes, vegetables, cotton, legumes, onions, production nurseries	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. This recommendation was agreed by the NMG. Detected in the Cape York Peninsula in May 2015 and considered by the CCEPP. Surveillance activities ongoing.	The NMG endorsed the CCEPP recommendation that *L. sativae* is not technically feasible to eradicate from Qld's Far Northern Biosecurity Zone.
Marchalina hellenica	Giant pine scale	Pine trees, production nurseries	SA, Vic	Detected in Vic and SA 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 *M. hellenica*. A revised Response Plan incorporating Transition to Management is being prepared for consideration by the CCEPP and NMG.	Updated Response Plan incorporating Transition to Management endorsed by the NMG. The plan is aimed at preparing industry and the community with ongoing management of the pest and minimising future impacts.
Phyllosticta cavendishii	Banana freckle	Bananas, production nurseries	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.	Surveillance activities are continuing to provide proof of freedom from banana freckle and the program remains on track to achieve eradication in 2018.
Trogoderma granarium	Khapra beetle	Almonds, ginger, vegetables, walnuts, cotton, dried fruit, grains, pistachios and rice	SA	Detected on imported goods in SA. 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 activities are continuing.	Surveillance activities are ongoing with no further detections.
Varroa jacobsoni	Varroa mite	Honey and various pollination-reliant crops	Qld	Detected on Asian honey bee (*Apis cerana*) in Qld in June 2016. Response Plan endorsed by the NMG in September 2016 and eradication activities undertaken. Surveillance activities ongoing.	There have been no further detections of Asian honey bee or *V. jacobsoni*. Surveillance activities to provide proof of freedom from *V. jacobsoni* are ongoing.

Table 49. Pest detections notified under the EPPRD in 2017*

Scientific name	Common name	State
New detections		
Collophora rubra	No common name	Vic
Dickeya dianthicola	Black leg of potato	WA
Eriophyes cf. *exilis*	Eriophyoid mite	Tas
Kilifia acuminata	Acuminate scale	Qld
Lasiodiplodia citricola	Dieback	SA
Liothula omnivora	Common bag moth	NSW
Papaya meleira virus	Papaya sticky disease	Qld
Peronospora belbahrii	Downy mildew of basil	Qld
Plicothrips apicalis	No common name	Ashmore Reef, external territory
Puccinia striiformis f. sp. *tritici* pathotype 64 E64 A	Wheat stripe rust	Vic
Thecaphora sp. on *Oxalis* spp.	Smut fungus	Vic
Trionymus sp. on *Tasmannia lanceolata*	Root mealybug	Tas
Ustilago sporoboli-indici	Smut of Sporobolus grasses	Qld
Wahlgreniella nervata	Strawberry tree aphid	WA
Extensions of geographic or host range		
Acanthococcus coccineus	Cactus spine scale	Vic
Aphelenchoides ritzemabosi	Chrysanthemum foliar nematode	Vic
Aphis spiraecola	Spirea aphid	Qld
Arthrocladiella mougeotii	Powdery mildew	Qld
Austropuccinia psidii	Myrtle rust	Norfolk Island, external territory
Botryotinia porri	Botrytis rot	Tas
Bursaphelenchus aff. *vallesianus / sexdentati*	Pine nematode	Qld
Coccotrypes dactyliperda	Palm seed borer	Norfolk Island, external territory
Corynespora cassiicola	Corynespora leaf spot	Qld
Corythucha ciliata	Sycamore lace bug	WA
Cucumber green mottle mosaic virus	Cucumber green mottle mosaic virus	Qld, SA
Diatrypella vulgaris	Dieback	Vic
Diuraphis noxia	Russian wheat aphid	NSW, Tas
Dothiorella sarmentorum	Dieback	Vic
Fusarium oxysporum on coriander	Fusarium wilt	Qld
Hop latent viroid	Hop latent viroid	NSW
Hop stunt viroid	Hop stunt viroid	NSW
Neofusicoccum australe	Dieback	NSW
Neofusicoccum luteum	Dieback	Vic
Oulema rufotincta	Crabgrass leaf beetle	SA
Phenacoccus solenopsis	Cotton mealybug	NSW
Pseudomonas viridiflava	No common name	Vic
Sclerotinia sclerotiorum	Stem rot	WA
Shivaphis celti	Asian woolly hackberry aphid	WA
Sweetpotato leaf curl virus	Sweetpotato leaf curl virus	NT
Tetranychus evansi	Tomato red sider mite	Qld
Tilletia nigrifaciens	Leaf smut	Vic

* These pests may be new detections, extensions of geographic range or new host records. Pests reported in 2017 that have progressed to a Response Plan are identified in Table 48. Some pests not listed in this table are still under investigation. If further action is implemented these pests may be reported in future publications.

Maintaining the capacity to respond to incursions

For an EPP 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.

Training on 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 formal educational qualifications.

Signatories also undertake simulation exercises, where responders are put through their paces for a simulated scenario, on a regular basis. This provides both practice in EPP responses and improved preparedness by identifying any aspects of the system that need improvement.

Evaluation of incursions and of simulated response exercises are also critical for effective EPP responses and the ongoing relevance and integrity of response systems in Australia. Regular evaluation activities are undertaken by all stakeholders, including PHA.

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 and industries may request crop-specific workshops to improve grower practices.

ENSURING TRAINING IN BIOSECURITY EMERGENCY PREPAREDNESS IS EFFECTIVE

The 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 trainers. 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.*

EDUCATIONAL QUALIFICATIONS IN BIOSECURITY EMERGENCY RESPONSE

Three biosecurity emergency response 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.

Achieving these qualifications puts 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. Training is delivered through a combination of face-to-face sessions and simulation exercises. 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.

Biosecurity Online Training

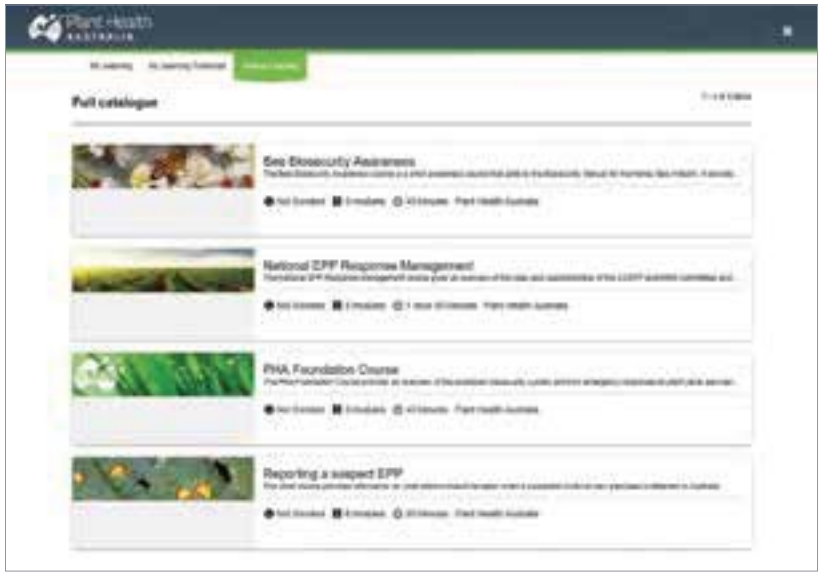
The e-learning platform BOLT (Biosecurity Online Training), managed by PHA, supports the National EPP Training Program.

Current courses available on BOLT are:

- **PHA Foundation Course** – provides a summary of the Australian biosecurity system and how emergency responses to plant pests are managed under the EPPRD.
- **National EPP Response Management** – introduces the purpose of the CCEPP and the NMG, the roles and responsibilities of and their members, and the decision making process in an incident.
- **Reporting a Suspect Emergency Plant Pest** – provides information on when and how to report an exotic plant pest.

- **Bee Biosecurity Awareness** – a short awareness course that adds to the Biosecurity Manual for the Honey Bee Industry. It provides an introduction to biosecurity best practice, hive inspections, surveillance, moving hives and how to report a suspect EPP.
- **Biosecurity for Beekeepers** – provides advice on keeping honey bees healthy using industry best practice. This course supports the Australian Honey Bee Industry Code of Practice.

BOLT courses are open to all plant biosecurity stakeholders and can be accessed through **planthealthaustralia.com.au/bolt**.



University qualifications

At several universities across Australia online training extends to postgraduate studies. Participating universities are Charles Darwin University, La Trobe University, Murdoch University, the University of Queensland and the University of Adelaide.

Postgraduate 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.

Image courtesy of the Department of Agriculture and Water Resources

Managing biosecurity incidents

Across all sectors biosecurity incidents are managed in accordance with the Biosecurity Incident Management System (BIMS).

BIMS is an 'all hazards' approach, which:

- Co-exists with and complements current, sector specific and jurisdictional response arrangements.
- Is contextualised to a biosecurity environment.
- Can be applied to all biosecurity incidents, irrespective of sector or scale of response.
- Provides a guide for personnel working within operations centres established at national, state, territory, local and field levels.

Importantly, BIMS is consistent with contemporary incident management systems employed by other emergency response agencies across Australia and in other countries, including Australasian Inter Services Incident Management System, Australia Emergency Coordination System and the New Zealand Critical Incident Management System.

In a biosecurity incident, responses are conducted by teams, and Figure 88 shows one example of the team structure. A range of positions and functions may be needed, depending on the level of the incident.

Since the system is consistent with other emergency response systems, response capacity can be boosted more easily in the event of a large or long term response. With roles consistent across the systems, people who have been involved in one response can be more readily co-opted into another.

THE NATIONAL BIOSECURITY RESPONSE TEAM

The National Biosecurity Response Team (NBRT) is a group of trained and experienced personnel that can be deployed to a jurisdiction to boost capacity temporarily to assist in a response to a biosecurity incident. Deployment might be in response to an animal, plant, aquatic or environmental biosecurity incident.

Members are government officers with knowledge, experience and training in emergency management, incident management or more specifically, responding to biosecurity incidents. They may be deployed in a State Coordination Centre or Local Control Centre to perform functions including incident management, liaison, public information, planning, operations and logistics.

The NBRT has two cohorts of members: a cohort of experienced functional response personnel and a cohort of highly experienced mentors.

Animal Health Australia manages the NBRT outside of any biosecurity response activities. During a biosecurity response, members are deployed by the Australian Government Department of Agriculture and Water Resources. Members of the team participate in relevant professional development opportunities and maintain their skills in exercises and responses.

COMMUNICATION IN AN EMERGENCY PLANT PEST RESPONSE

During an EPP response, the relevant state government takes the lead in ensuring that the public and any stakeholders are kept informed about activities. Given the multiple Parties involved, messaging is based on nationally agreed talking points, which are determined by the Consultative Committee on Emergency Plant Pests that oversees the response.

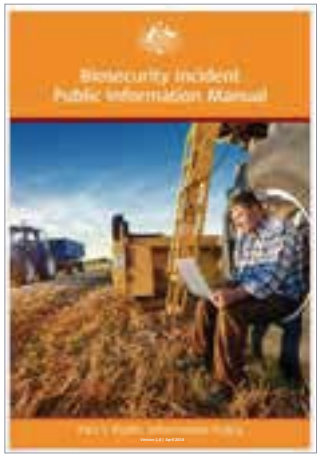
Talking points are circulated through members of the Biosecurity Incident National Communication Network (NCN), which consists of communication managers from the Australian Government, state and territory agencies, and biosecurity organisations including PHA and Animal Health Australia.

This allows input from these agencies and relevant plant industry peak bodies. Agreed talking points are circulated, allowing consistent messaging nationally.

The NCN also advances preparedness and prevention awareness activities for issues that warrant a national approach to communication.

THE BIOSECURITY INCIDENT PUBLIC INFORMATION MANUAL

Effective communication is vital in responding to a biosecurity incident. Keeping the public informed improves the effectiveness of actions taken to assist with operations as well as perceptions of effectiveness.

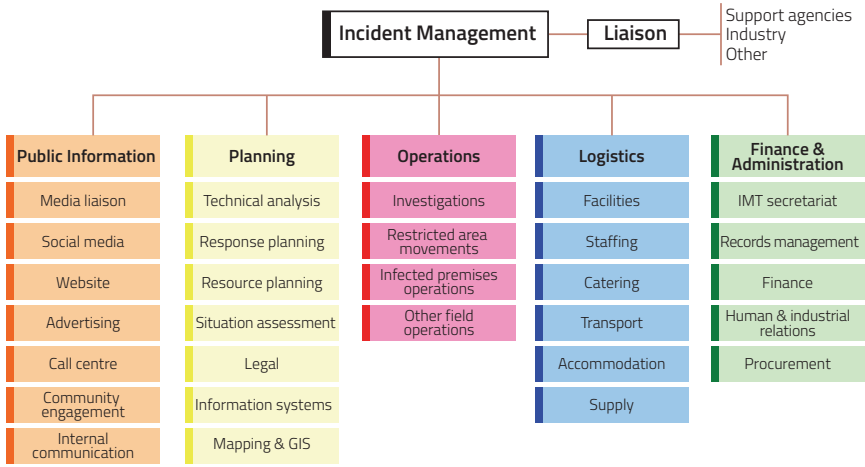


During a response, agricultural agencies and affected industries all refer to the Biosecurity Incident Public Information Manual (BIPIM), developed by the NCN. Manual content is in line with the Public Information function set out in the Biosecurity Incident Management System. Use of the manual ensures that anyone performing a function in public information knows the role they are to play.

Setting out roles in this way allows a temporary boost in capacity when needed in a lengthy or large biosecurity incident. National consistency allows communication experts from other jurisdictions to slot into a response to assist during large or lengthy responses.

The BIPIM is available from the Animal Health Australia website **animalhealthaustralia.com.au**.

Figure 88. Incident management team structure for biosecurity incursion responses



A range of positions and functions in the response team may need to be established, depending on the level of the incident. Image courtesy of the Department of Agriculture and Water Resources


VISITORS
PLEASE RESPECT
FARM BIOSECURITY
Please contact the manager before ente
enter property without prior approv
roadways and laneways.

Chapter 6

Post-border biosecurity – Controlling pests and weeds

While many resources are invested in keeping new pests out of Australia, existing pests and weeds require biosecurity measures to prevent further spread. This chapter describes biosecurity measures that apply to pests found only in certain parts of Australia, pests that are established and must be managed, and weeds.

There is a national system that coordinates domestic quarantine – restrictions to prevent spread within Australia – but post-border control of pests and weeds is one part of the biosecurity system where the Australian community has a major role to play.

Most farmers are aware that they have responsibility for controlling pests and weeds on their property and the use of on-farm biosecurity practices is on the rise. However there is more that producers can do to prevent biosecurity incursions on their properties. This chapter details the communication initiatives to encourage on-farm biosecurity risk mitigation undertaken by PHA and Animal Health Australia, government and industries.

The chapter finishes with an overview of Australia's weed biosecurity system.

Domestic quarantine

Newly established and regionalised plant pests can be spread easily from one part of Australia to another through the movement of plants, plant products, people, soil and equipment.

To address this risk, domestic quarantine restrictions imposed on the movement of high risk items apply in each state and territory. Restrictions operate under state and territory legislation, to complement and support the national quarantine legislation that governs the import and export of goods to and from Australia.

THE SUBCOMMITTEE ON DOMESTIC QUARANTINE AND MARKET ACCESS

Coordination of domestic quarantine between the state and territory governments happens through the Subcommittee on Domestic Quarantine and Market Access (SDQMA). This committee consists of senior plant health regulators from state and territory governments, representatives from the Australian Government Department of Agriculture and Water Resources, and an independant chair and observer from PHA.

The objective of the committee is to develop, review and maintain domestic quarantine standards and conditions that allow movement of produce around the country while avoiding the risk of spreading regionalised plant pests. 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.

PHA also set up the website **interstatequarantine.org.au** which provides information on domestic quarantine restrictions for travellers and producers.

Official control of quarantine plant pests protects overseas trade

In 2017, a Plant Quarantine Pest and Official Control National Policy was developed to help contain and control new plant pests and diseases, while allowing the Australian Government to continue to regulate imports to prevent pest entry. The policy also facilitates exports, so growers can continue sending their products to overseas markets. Chief Plant Health Managers across Australia have agreed to implement the policy.

On occasions, an exotic plant pest or disease may enter Australia that cannot be eradicated. In these circumstances, responsibility for managing the pest or disease rests with industry and the government of the state or territory in which it occurs.

When 'official control' is applied, the state or territory government has put in place measures that aim to contain and control the pest or disease. These mandatory activities include:

- Containment or suppression activities (mostly involving destruction, disposal and decontamination).
- Surveillance in the area where the pest or disease could establish.
- Movement restrictions so the pest or disease does not spread to an area that is not affected.

Official control can be applied at a regional or national level. If it is applied nationally, it must be consistent across all states and territories.

When an exotic pest or disease enters and is officially confirmed in Australia, the Department of Agriculture and Water Resources has an obligation to notify the International Plant Protection Convention. When other countries become aware of the presence of the pest or disease in Australia, it can trigger trade bans or restrictions on our exports, as well as requests for Australia to review its current import conditions.

If Australia can provide trading partners with evidence that the pest or disease is under official control, the department can continue to justify regulating international imports to prevent exotic pest entry.

Official control may also underpin negotiations for export with concerned trading partners to accept plants or products that have been produced in areas of Australia that are not affected by the pest or disease and/or are treated to IPPC standards to manage the biosecurity risk.

If an established pest is not under official control, the department cannot justify continuing to prevent the pest's entry by regulating imported goods and conveyances.

While there are numerous benefits in implementing official control, there are also costs associated with containment, surveillance and movement restrictions. State and territory governments, in consultation with peak industry bodies, must determine whether official control is cost-beneficial or whether other management options are more appropriate.

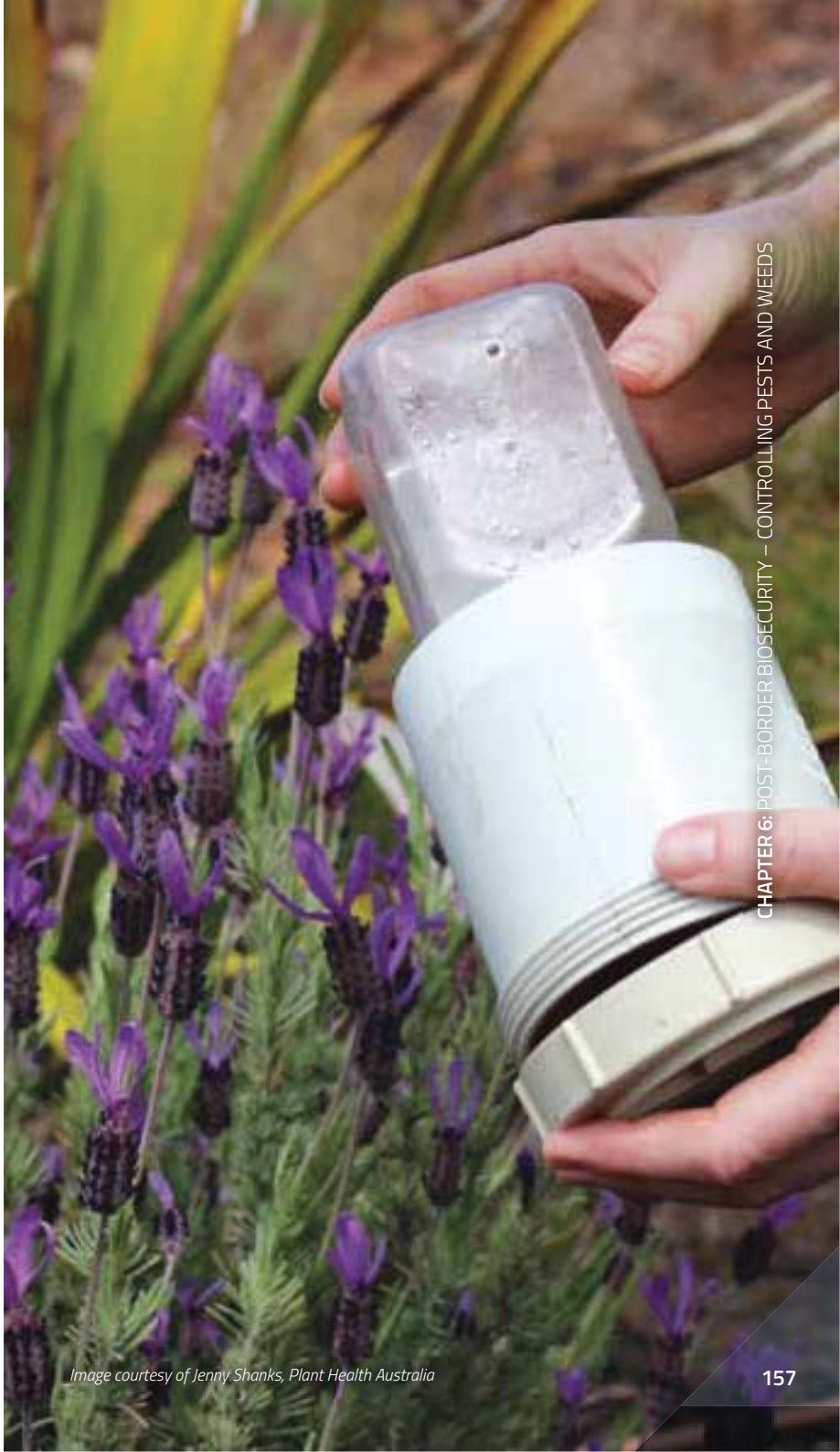
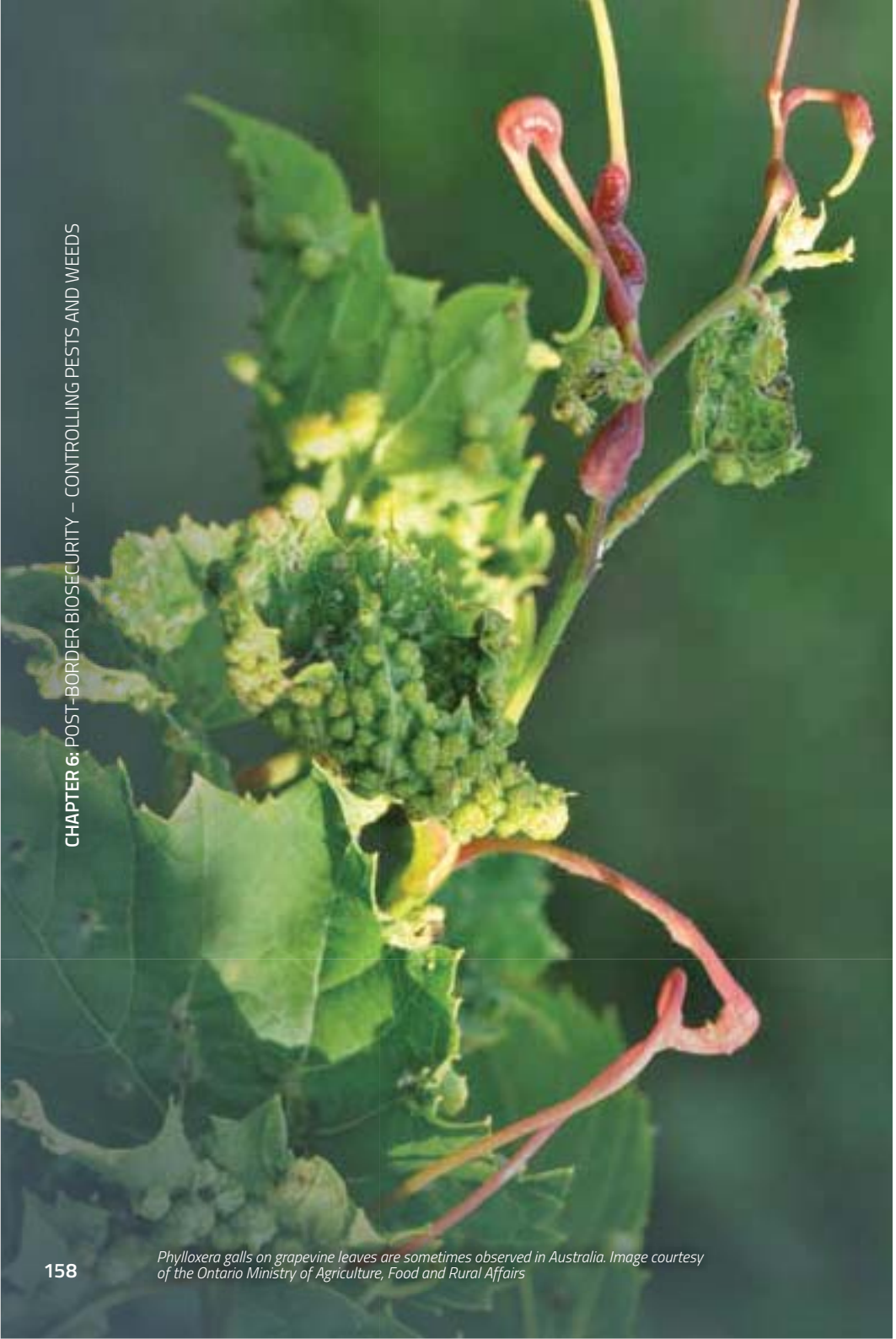


Image courtesy of Jenny Shanks, Plant Health Australia



Phylloxera galls on grapevine leaves are sometimes observed in Australia. Image courtesy of the Ontario Ministry of Agriculture, Food and Rural Affairs

AUSTRALIA'S REGIONALISED PESTS

When new exotic pests that have the potential to damage the environment or agriculture are detected, eradication is the ideal goal. In some cases, however, a new pest cannot be eradicated. Wherever possible, domestic quarantine measures are implemented to contain the pest, minimising negative impacts.

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.

In addition to introduced pests, some regionalised pests are native to parts of Australia, notably the Queensland fruit fly which is found on the east coast but not in SA, Tasmania or WA.

Table 50 lists the 73 regionalised pests recognised by formal legislation and their current area of distribution within Australia. These are the pests that domestic quarantine measures aim to contain.

Table 50. 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 Queensland Fruit Fly Control Zone on the Victorian border as defined in *Biosecurity (Queensland Fruit Fly) Control Order 2017* under the *Biosecurity Act 2015*
Banana bunchy top virus (Babuvirus)	Banana bunchy top virus	Present within the Banana Bunchy Top Virus Control Zone on the far north coast as defined in the *Biosecurity (Banana Bunchy Top Virus) Control Order 2017* under the *Biosecurity Act 2015*
Daktulosphaira vitifoliae	Grapevine phylloxera	Present within the Grapevine Phylloxera Infested Areas, comprising the Sydney and the Albury-Corowa regions as defined in the *Biosecurity Regulation 2017* under the *Biosecurity Act 2015*
Panonychus citri	Citrus red mite	Present within the Citrus Red Mite Biosecurity Zone, comprising the Cumberland and Northumberland counties as defined in the *Biosecurity Regulation 2017* under the *Biosecurity Act 2015*
Ralstonia solanacearum	Bacterial wilt of potatoes	Endemic in NSW excluding the Seed Protected Area, comprising specific areas within the Central Tablelands and Northern Tablelands as defined in the *Biosecurity Regulation 2017* under the *Biosecurity Act 2015*
Spongospora subterranea	Powdery scab of potatoes	Endemic in NSW excluding the Seed Protected Area, comprising specific areas within the Central Tablelands and Northern Tablelands as defined in the *Biosecurity Regulation 2017* under the *Biosecurity Act 2015*

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
Bemisia 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, PMWaV-3)	No common name	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
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
Chilo terrenellus (Pagenstecher)	Sugarcane stem borer	Detected on a number of occasions in sugarcane on two of the three Torres Strait islands closest to PNG (Saibai and Dauan)
Cucumber green mottle mosaic virus	Cucumber green mottle mosaic virus	Confined to three quarantined properties in central and south east Queensland
Cryptotermes brevis	West Indian drywood termite	Greater Brisbane, Wide Bay-Burnett, 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 disease virus	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 Races 1, 2 and subtropical race 4 are no longer in regulation, although the General Biosecurity Obligation (GBO) applies **Race 4 (tropical)** detected in 2015 and 2017 on two separate properties. A containment program remains in place

Table 50. Australia's regionalised pests (continued)

Scientific name	Common name	Area of regionalisation
Idioscopus clypealis	Mango leaf hopper	Cape York Peninsula and Mareeba area, south to Atherton, and along the coast from Wangetti to Gordonvale. Managed under the General Biosecurity Obligation
Idioscopus nitidulus	Mango leaf hopper	Cape York Peninsula. Managed under the GBO
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, Gold Coast and Moreton Bay (Regional) 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
Victoria		
Bactrocera tryoni	Queensland fruit fly	Permanent fruit fly zones (refer to specific gazetted orders)
Cornu apertus (syn. *Cantareus apertus*)	Green snail	Management of green snail linked and infested lands (refer to specific gazetted orders)
Cryphonectria parasitica	Chestnut blight	Management of chestnut blight and infected land
Daktulosphaira vitifoliae	Grapevine phylloxera	Phylloxera Infested Zone and Phylloxera Free Zone (refer to specific gazetted orders)
Globodera rostochiensis	Potato cyst nematode	Management of potato cyst nematode linked and infested lands, and Plant Protection District (refer to specific gazetted 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
Cornu apertus (syn. *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

Table 50. Australia's regionalised pests (continued)

Scientific name	Common name	Area of regionalisation
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
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
Trogoderma variabile	Warehouse beetle	WA. Regulations or controls for movement and control in specified areas

A national plan for managing the regionalised pest phylloxera

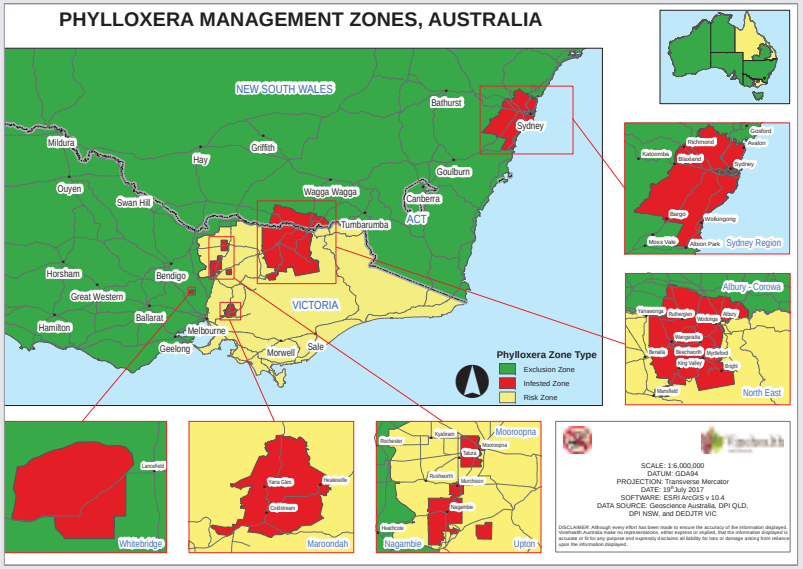
AGRICULTURAL COMPETITIVENESS WHITE PAPER

Grape phylloxera (*Daktulsphaira vitifoliae*) is one of the most serious grapevine pests in Australia. The tiny insect pest destroys grapevines and ornamental vines by feeding on their roots.

Phylloxera is currently confined to parts of Victoria and NSW but commercial vine plantings in Australia are predominantly own-rooted *Vitis vinifera*, and highly susceptible to phylloxera. Once vines are infested, they die within six years.

Preventing spread to phylloxera free areas is a high priority. In 2017, Australian Vignernons worked on a national management plan for phylloxera, with funding from the Agricultural Competitiveness White Paper. The Department of Agriculture and Water Resources, state and territory governments and industry groups all contributed to the plan.

The new plan will provide consistency in how biosecurity arrangements for this grapevine pest are managed across the country. National arrangements developed under the plan will help protect growers by improving measures to contain the pest to its current locations, and to help detect and quickly respond to any potential incursions.



The grapevine pest phylloxera is confined to specific parts of Victoria and NSW by movement restrictions. Image courtesy of Vinehealth Australia

Restrictions for domestic travellers

Anyone travelling within Australia or moving house across regional or state borders is bound by restrictions set by SDQMA in conjunction with state and territory governments on what they can and cannot carry.

Rules apply to high risk material including plants and plant products, fruit and vegetables, honey and beekeeping equipment, soil, agricultural machinery and recreational equipment.

Travellers can check before they travel at **interstatequarantine.org.au**, and in the booklet Australian Interstate Quarantine: A Traveller's Guide.

There are interstate quarantine bins at domestic airports, ferry terminals and state and quarantine zone borders. Traveller's must dispose of any restricted products at those points.

Rules change as new pest incursions occur, so travellers are advised to check on the Australian Interstate Quarantine website for the latest information.

Travellers must comply with restrictions on what they can take when moving around Australia

Restrictions for interstate export

Interstate certification is the system that governs 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.

Consignments of produce that originate from a controlled region can be shipped into a region that does not have the pest of concern, if the produce is certified to have been treated in such a way that it no longer poses a biosecurity risk. It might be growing or packing produce in a particular way, such as under cover, or being fumigated after harvest.

Produce from regions that have Queensland fruit fly are commonly subject to interstate certification requirements. For example, a traveller cannot take a tray of mangoes from Queensland (where the fly is endemic) back to SA (which is Queensland fruit fly free), due to the risk of transporting fruit fly larvae with the fruit. A mango producer in Queensland can, however, ship their produce to SA if they have certification that shows that the fruit has been subjected to appropriate treatment to ensure the produce is fruit fly free.

There are two types of certificates that may be issued to certify that produce meets transport requirements:

- 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 Australian Interstate Quarantine website holds the Schedule of National ICA Documents, a complete list of Interstate Certification Assurance (ICA) documents.

PREVENTING THE SPREAD OF FRUIT FLIES – A SIGNIFICANT TARGET FOR DOMESTIC QUARANTINE

Fruit flies are amongst the world's most damaging pests affecting horticultural production. Alongside increased production costs and potential reduction in marketable yields, the presence of fruit flies can result in the loss of domestic and international markets, or a requirement for stringent post-harvest treatments.

Home gardeners are also affected. The presence of even a small number of fruit flies can potentially destroy an entire backyard crop if they are not managed. The ability of fruit flies to move independently means that fruit flies in an urban area can easily spread to local commercial growers.

There are two pest species of fruit flies in parts of Australia (see page 163). Many domestic quarantine restrictions are in place to prevent the pests from spreading into fruit fly free areas.

The National Fruit Fly Council

Given the widespread ramifications of the two pest species of fruit flies, it is in everyone's interest to tackle fruit fly management collectively. In 2008, PHA developed the National Fruit Fly Strategy (NFFS), a collaborative approach to managing pest species. 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 national strategy could generate benefits of between $29 and $38 million per year.

The National Fruit Fly Council was established to oversee and monitor implementation of the NFFS, continuing the work begun by the National Fruit Fly Strategy Advisory Committee which performed this role from May 2014 to September 2015.

The Council includes representatives from governments, industry and research funding agencies. It has an independent chair and is supported by a National Manager and a secretariat from PHA.

The Council aims to help 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'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 opportunities to ensure that innovative solutions and technically justifiable approaches are available to meet the requirements of the three areas above.

Regular meetings of the Council provide an important opportunity to identify priority areas for action and to coordinate activities between government agencies, industry and research funders.

The Council has focused on increasing awareness of the pest species of fruit flies and of the Council itself.

The website **preventfruitfly.com.au**, developed by PHA in 2016, provides information for backyard growers and commercial producers. It is supported by an e-newsletter and Twitter to keep stakeholders informed.

While Australia has two pest species of fruit flies, we are fortunate to be free of some of the most damaging species that occur overseas. Some of these – like the Oriental fruit fly, Natal fruit fly, melon fly and peach fruit fly – would cause considerable damage to crop production in Australia should they establish here.

Australia has an extensive system of surveillance and an ongoing response in the Torres Strait to ensure we remain free of these devastating pests.

Pest species of fruit fly

While there are over 250 species that belong to the family Tephritidae, in Australia just two fruit fly species pose a significant problem for producers and home gardeners alike.

The first of these, the Queensland fruit fly, occurs in the NT, Queensland, NSW and Victoria and is an Australian native species. The other, Mediterranean fruit fly, is an introduced species that is confined to parts of Western Australia.

While these are different species, similar methods and strategies are used for control.

Fruit flies attack and damage most kinds of soft skinned fruits and some harder skinned commodities. Crops such as summerfruit, citrus, apples, pears, loquats, berries, grapes, olives, persimmons, tomatoes, capsicum, eggplant, and mangoes can all be attacked.

For gardeners, ruined fruit is disappointing, but for producers it can be devastating. All Australians have a role to play in preventing fruit fly.

Queensland fruit fly (Qfly) *Bactrocera tryoni*

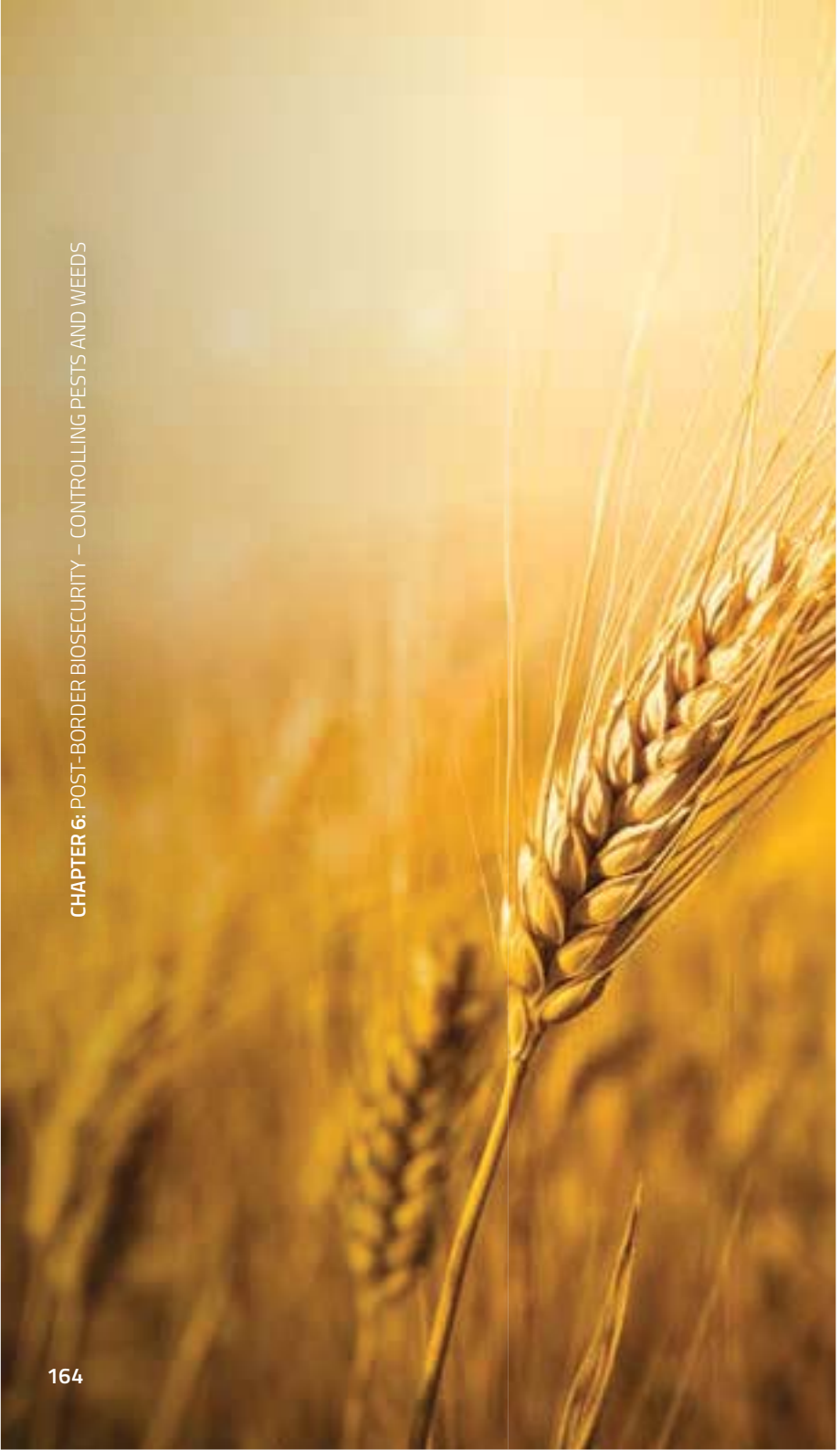
Queensland fruit fly. Image courtesy of Bugwood.org

- Larvae (maggots) are about 5–10mm long and creamy-white in colour.
- A fruit fly that is native to north-eastern Australia.
- It occurs in parts of Queensland, NSW, Victoria and the NT. Incursions occasionally occur in the ACT but only in warmer months.
- The pest affects many different plants including horticultural crops.
- Most active from September to May but can also be active in warmer periods during winter months.

Mediterranean fruit fly (Medfly) *Ceratitis capitata*

Mediterranean fruit fly. Image courtesy of Bugwood.org

- Adult flies are about 3–5mm long, with a light brown body and mottled wings.
- Larvae (maggots) grow to about 8mm long and are white in colour.
- The fly is an introduced species confined to WA by domestic quarantine.
- It can infest a wide variety of fruits and vegetables.
- It does most damage from October to May.



The biosecurity obligations of all Australians

Abiding by international and domestic border restrictions is one role that all Australians must play in maintaining Australia's biosecurity status. In addition, everyone has an obligation to do what they can to avoid spreading plant pests and weeds, to keep a lookout for anything unusual and report unfamiliar pests. In two states, NSW and Queensland, governments have included these obligations in legislation.

The introduction of a general biosecurity obligation or duty makes explicit the role that everyday Australians have a role to play in biosecurity. A biosecurity risk exists when dealing with any pest, disease or contaminant. This includes moving an animal, plant, turf, soil, machinery and equipment that could carry a pest, disease or contaminant.

People in the two eastern states are now required by law 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. 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.

Australians are not expected to know about all biosecurity risks but are expected to know about those associated with their day-to-day work and hobbies. For example:

- Those who live or work 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 to and out of the zone, and any other precautions required.
- Residential gardeners are 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.
- Farmers are 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.
- Land owners are expected to stay informed about and appropriately manage the weeds and pest animals (such as wild dogs) that could be on their property.
- Transporters of agricultural produce are expected to check whether the transportation of goods could spread diseases or pests and, if so, to manage the risks appropriately.

To learn more about the new laws, go to the Queensland and NSW government websites.

CONTROLLING PESTS THROUGH AREA WIDE MANAGEMENT

Area wide management is an approach to pest management that operates in a geographic area. It is an approach that can be applied to many pests but is currently a widespread technique for managing pest species of fruit flies. Area wide management often requires cooperation from Australian communities to be effective.

Recent years have seen the southward spread of Queensland fruit fly into southern NSW and northern Victoria. Areas previously free from this pest or experiencing only very low numbers are now having to manage the pest. Given the deregistration of several agricultural chemicals previously used for fruit fly control in some regions, area wide management is a necessary management strategy.

As a result, regional groups are taking a proactive approach to managing fruit flies in local areas. Area wide management can involve a range of techniques such as trapping, protein baiting, orchard hygiene (particularly picking up fallen fruit), sterile insect release, cover spraying and scouting.

Area wide management is only effective if all stakeholders take steps to reduce fly populations. This includes efforts by residents of urban areas and regional towns who need to reduce fruit flies in their gardens.

THE NEED TO RAISE AWARENESS IN THE GENERAL COMMUNITY

The implementation of a general biosecurity duty in state government legislation has prompted a need for greater awareness of biosecurity among the general community. In 2017, NSW Department of Primary Industries released the findings from a study that sought to benchmark the level of awareness and understanding of biosecurity across NSW.

The study showed that around three quarters of the general community are not clear on what the word biosecurity means. In addition, respondents predominantly see biosecurity as the responsibility of governments, followed by primary producers and related industry groups. Only around half of general community respondents realise individuals have some level of responsibility for biosecurity.

Overall, the study concluded that the broader implications and ramifications of biosecurity are not well understood in the general community.

Communication strategies implemented by governments, particularly in Queensland and NSW, aim to make the general community aware of their obligations.

How everyday Australians can reduce biosecurity risks – Grain transporters

While most grain growers realise that spilled grain on-farm is a biosecurity risk, truck drivers who deliver grain also have a role to play in preventing grain pests.

Dumped grain, as well as grain spilt around farm sheds, bins and bags can attract and build up populations of grain storage pests that fly or hitch-hike in from surrounding areas. Common pests include the lesser grain borer, flat grain beetle, rust-red flour beetle and warehouse moth.

These insects can easily make it into nearby grain stores requiring time and money to disinfest. And it's not just a risk for established pests. Should an exotic pest make it through Australian border controls, grain spills can harbour and build up its population too.

Grain left to germinate will grow, disrupting local ecosystems and becoming an unmonitored host for a range of insects, fungi and other pests that affect crops. These can then invade local farms and threaten yields.

Deliberate roadside spilling is against the Grain Transport Code of Practice established by Grain Trade Australia. According to the Code, after a delivery there should be no residual grain left in the trailer that then needs to be dumped prior to picking up a new delivery.

The Code of Practice stipulates the cleaning regime required after carrying particular products. After loads of untreated bulk grain, trucks should be blown out, swept or washed. Loads of grain infested with pests need to be washed with high-pressure water and then sanitised or steamed.

Left over grain must be disposed of safely, which means it should be burned, buried or bagged and reused, perhaps as livestock feed if it is uncontaminated.

Image courtesy of Jim Moran, Grains Farm Biosecurity Program

The role of local government

As the community's closest tier of government, local government is a key stakeholder in biosecurity management.

Local government's involvement in biosecurity varies from state to state and even from region to region, but generally includes:

- Management of pest species on land owned by local governments.
- On-going support for local community groups in the area of natural resource management including the management of post-border invasive species.
- Developing and enforcing pest management local laws under the *Local Government Act 1995*.
- Providing tools, management plans, staff support and training on post-border biosecurity issues.
- Delivering environmental education programs and other information relating to biosecurity to the community.
- Regional collaboration between local governments to deal with regional biosecurity issues.
- Providing field trial sites for biological control of certain weeds.
- Assisting in emergency responses, since local governments have local knowledge and expertise.

Image courtesy of the Northern Territory Department of Primary Industry and Resources

On-farm biosecurity

On-farm biosecurity is a set of measures producers can use to protect a property from the entry and spread of pests, diseases and weeds. On-farm risk mitigation establishes another layer of protection for a farm, allowing producers to mitigate new pest problems as well as boosting biosecurity for their region, their industry and supporting market access for produce.

On-farm biosecurity measures work most effectively when integrated into everyday activities. Often measures are procedural, such as changing vehicles between zones on a property, providing gumboots for visits to production areas, disinfecting pruning shears and ensuring that farm inputs are clean and disease free.

Increasingly, growers are appreciating the benefits of on-farm biosecurity (see also page 171). The rate of uptake of on-farm biosecurity risk mitigation varies between and within industries, and better participation is the remit of a number of programs, described below.

THE FARM BIOSECURITY PROGRAM

Recognising the increasing number of mixed farming enterprises in Australia, PHA and Animal Health Australia (AHA) work together in a joint communication and awareness program, 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 and tools, including biosecurity manuals, templates for record keeping, farm biosecurity gate signs to download or order, industry specific information, videos outlining best practice, a personal profile builder, a biosecurity planner and a planning app.

Resources produced by Farm Biosecurity are structured around the six biosecurity essentials:

- farm inputs
- people, vehicles and equipment
- production practices
- feral animals and weeds
- farm outputs
- train, plan and record.

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 MANUALS FOR PRODUCERS

In 2017, PHA developed a biosecurity manual for sugarcane producers

PHA, in partnership with plant production industries and governments, has released 19 crop-specific biosecurity manuals. Manuals are listed in Table 51.

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. Each booklet also raises awareness of the High Priority Pests of that industry, increasing the likelihood of detecting an incursion early enough to eradicate or contain it, should it make it through border controls.

The information from biosecurity manuals is also provided in industry sections of the Farm Biosecurity website and complete manuals are available for download.

Table 51. Biosecurity manuals for producers

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

Manual	Version
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

Australian Biosecurity Award for the Farm Biosecurity Program

The Farm Biosecurity Program, Australia's only national on-farm biosecurity awareness program, was recognised by winning the Australian Government's prestigious government biosecurity award on 7 March 2017.

This award celebrates not only a significant biosecurity initiative but highlights the strong collaborative partnership between Animal Health Australia (AHA) and Plant Health Australia (PHA).

The annual Australian Biosecurity Awards recognises organisations and individuals who have made notable and outstanding contributions to protect the health of Australia's plants and animals. The award acknowledged the eight-year partnership between AHA and PHA that has generated multiple innovative and useful resources to improve on-farm biosecurity uptake by Australian producers.

Producers play a key role in protecting Australian plant and livestock industries from pests and diseases by implementing sound biosecurity measures on-farm. All producers are encouraged to secure their farm and secure their future.

The award recognised eight years of cooperation to encourage on-farm biosecurity. (L-R) PHA Chairman, Darral Ashton; Deputy Secretary for the Department of Agriculture Water and Resources, Lyn O'Connell; PHA Executive Director and CEO, Greg Fraser; AHA Communications Coordinator, Harley McNamara; PHA Communications Officer, Sharon Abrahams; Assistant Minister for Agriculture and Water Resources, Senator Anne Ruston; AHA CEO, Kathleen Plowman; AHA Biosecurity and Product Integrity Services Executive Manager, Duncan Rowland; PHA National Manager Horticultural Cropping, Alison Saunders; AHA Chairman, Peter Milne

MANAGING PESTS ON-FARM

Australian farmers manage pests with a variety of methods tailored to the type of pest, the crop and geographical conditions. Most growers use an integrated pest management approach, which means that producers combine chemical, cultural, mechanical and biological controls in a flexible way that can change over time.

Chemical control

For many pests, pesticides are the fastest and easiest option for control and most growers use at least some type of chemical to maintain productive agriculture. Chemical use is however strictly regulated in Australia and use can also be costly. As a result, growers tend to use a threshold approach when deciding whether to use chemical control options. They might only spray when pest numbers become high enough to inflict considerable damage to crops.

A recent report[8] 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. Table 52 illustrates the amount and type of agricultural chemicals used for controlling plant pests in Australia. This total expenditure on pesticides for plants represents over seven per cent of the gross value of production for all crops in Australia[9].

Table 52. Sales of plant chemicals in Australia, 2016 versus 2017[10]

Product type	No. of products	Value of product sales ($ million)	No. of products	Value of product sales ($ million)
	2016		2017	
Herbicide	3,301	1,716.80	3,363	1,683.42
Insecticide	1,445	337.47	1,482	484.44
Fungicide	939	254.05	967	343.40
Mixed function pesticide	149	32.34	148	39.26
Miticide	131	18.99	131	36.07
Molluscicide	54	11.83	54	16.01
Nematicide	18	4.18	15	2.04
Total	**6,037**	**2,375.66**	**6,160**	**2,604.62**

8. CropLife Australia, 2018. Economic activity attributable to crop protection products. Deloitte Access Economics Pty Ltd
9. ABARES, 2018. Agricultural Commodities March quarter 2018
10. APVMA Gazette No. 6 March 2018

All agricultural chemicals sold or used in Australia must be registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA). National registration through APVMA 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. In the event of an exotic pest incursion, the required chemicals might not be immediately available.

Minor use permits and emergency permits can be issued by the APVMA. Approximately 80 per cent of minor use permit applications are submitted for approval because no other options are currently available in Australia to manage a particular pest.

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 tillage methods and changing soil pH levels, irrigation practices and fallow periods, which 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 using 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, parasitoids and pathogens, also known as beneficials.

Biological control has been highly successful in many instances, with a number of pest problems permanently solved by importation and successful establishment of biological control agents. Successes tend to be confined to particular ecosystems or pest situations, and when they are effective, can provide long-term and even permanent results.

Awareness of the need to use biosecurity measures on-farm is on the rise. Image courtesy of Joanne Lee, Plant Health Australia

IMPROVING UPTAKE OF FARM BIOSECURITY MEASURES

Plant industries are becoming increasingly involved in biosecurity communication and engagement. Biosecurity outreach and engagement programs are funded by PHA member industries to improve the management of, and preparedness for, biosecurity risks at the farm level. Biosecurity officers associated with the programs are often funded by grower levies and so tend to work with producers of a particular crop or group of crops.

Some state governments have additional outreach programs with officers who work with groups of producers and others along the supply chain to strengthen the state's biosecurity system. For example the NSW Local Land Services brings together agricultural production advice including biosecurity, natural research management and emergency management for farmers, landholders and the community.

The joint PHA–AHA Farm Biosecurity Program also provides support to extension and biosecurity officers, in the development of crop or pest specific information for growers.

Grains Farm Biosecurity Program

The Grains Farm Biosecurity Program is funded by growers via Grain Producers Australia (GPA), in partnership with the governments of five grain-producing states. Grains Biosecurity Officers are responsible for raising awareness of biosecurity management practices among grain growers and others along the supply chain. The officers engage growers at field days and conferences, giving presentations and demonstrations and running training sessions on biosecurity management practices that growers can use to protect their farms.

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. The Grains Farm Biosecurity Program is managed by PHA.

National Bee Biosecurity Program

The National Bee Biosecurity Program is funded by the Australian Honey Bee Industry Council, with support from the state governments, and underpins the Australian Honey Bee Industry Biosecurity Code of Practice. The aim of the Code 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 National Bee Biosecurity Program is managed by PHA. It aims to help beekeepers to manage pests that are already in Australia, and to prepare for incursions by exotic pests, through training and education. If there is an exotic pest incursion, the biosecurity officers will be on hand to provide expert support to industry, and to help design and implement response measures. Once fully staffed, the program will operate in every state.

Citrus biosecurity project

Citrus Australia and Hort Innovation funded the Citrus Biosecurity Project into 2017 to improve biosecurity planning, preparedness and awareness. A Citrus Biosecurity Manager worked 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 program saw the development of the First Detectors Network, a group of trained growers who monitor their crops regularly for any sign of exotic pests. The Citrus Biosecurity Manager also teamed up with officers from the NSW Government to carry out 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, where citrus plants and related species such as Murraya are sold.

Vegetable and potato biosecurity project

The Vegetable and Potato Biosecurity Program is an extension and engagement program funded by AUSVEG through grower levies to enhance biosecurity management practices of producers and others along the supply chain in that industry.

It has a major focus on supporting increased awareness and adoption of farm biosecurity in vegetable and potato production zones and has also served as an increasingly important platform for driving strategically important biosecurity initiatives in these industries.

Two dedicated Biosecurity Officers develop biosecurity extension and training material, write articles on biosecurity themes for industry magazines, engage with producers at field days, and liaise with growers during pest incursions. In 2017 the officers worked in the Greater Western Sydney area to tailor awareness material for growers speaking languages other than English.

Throughout 2017, the Biosecurity officers have taken part in a variety of forums, biosecurity meetings and working groups. Their involvement has also precipitated a number of initiatives with industry and researchers to extend surveillance capabilities and improve general surveillance reporting outcomes.

Producer survey shows rising biosecurity awareness

In 2017, a survey of 1,200 plant and animal producers showed that the level of understanding of biosecurity amongst Australian producers is increasing, with more producers controlling weeds and managing pests and diseases of crops and livestock.

In the latest survey carried out by the Farm Biosecurity Program, 56 per cent of all producers surveyed said that 'controlling diseases, pests and weeds' related to biosecurity, without any prompting. This is an improvement over the past two surveys for the program, which found that only 37 per cent knew this in 2010 and 47 per cent in 2013.

Other key findings include:

- Producers reported undertaking a broad range of activities to protect crops or livestock from diseases, pests and weeds.
- Activities generally were related to controlling current problems, rather than preventing new pests, diseases and weeds from entering and becoming established.
- At 30 per cent, controlling weeds was the most reported practice, with controlling livestock or cropping pests and diseases the next most reported.
- When prompted about biosecurity practices undertaken in the last two years, answers indicated an overall increase since 2010 for record keeping, monitoring stored products, inspecting on purchase, restricting access to properties, cleaning machinery and equipment coming onto farms and controlling visitor movement.
- Producers reporting using many sources of information on animal or crop protection, tending to fall along producer lines – vets for livestock producers (39%) and agronomists for plant and grain producers (34% and 58% respectively). Industry bodies (26%) and rural press (25%) were the most important sources overall.
- A total of 40 per cent of respondents said they had heard of the Farm Biosecurity Program, up from 36 percent in 2013 and 28 per cent in 2010 (28%). Awareness was similar across producer types.

This important data will inform future program strategies.

Australia's weed biosecurity system

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. A weed is a plant that requires some form of action to reduce its negative effects on the economy, the environment and human health or amenity.

Weeds displace native species, contribute to land degradation and reduce productivity in addition to the considerable costs of control.

It has been estimated that the total economic cost of weeds in Australia is over $4 billion annually[11]. An estimated 2,300 species currently impact the natural environment nationally, and a further 1,000 species have a direct impact on plant production.

There are far more potential weed species that have not yet entered the country or become established in Australia. In addition, many weeds display a 'lag phase' in which impacts do not become apparent, potentially for decades. As such, many future problem weeds may already be here.

Australia's weed biosecurity system aims to:

- prevent entry of high-risk plant species
- eradicate or contain those in the early stages of invasion
- mitigate the impacts of established weeds.

As with plant pest biosecurity, responsibility for weeds is shared between all levels of government, industry and the community. Legislation across the country sets out the various roles of governments in managing weeds across Australia (see Figure 89).

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.

At the local level, weed surveillance is undertaken by most local councils, which report new weed incursions in their areas. Weed management is a component of on-farm biosecurity activities. Producers of both crops and livestock manage weeds on individual properties to reduce their impacts and play an integral part in the weed detection and reporting network.

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.

11. Sinden JA et al, 2004, 'The economic impact of weeds in Australia: Report to the CRC for Australian Weed Management, Technical Series No. 8, Adelaide

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 comprises members from the Australian Government and all state and territory governments, plus observers from CSIRO, PHA and the New Zealand Government.

IPAC oversees the administration of the Australian Weeds Strategy, 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 strategy is reviewed every 10 years to ensure it remains relevant to Australia's needs. It has recently been revised to produce the Australian Weeds Strategy 2017–27.

The strategy provides information on where improvements can be made at the national level that will result in benefits across Australia. It draws attention to areas that require national collaboration and will drive the development of consistent and coordinated national approaches by providing clarity around priorities, roles and responsibilities.

The new strategy is available at **agriculture.gov.au/SiteCollectionDocuments/pests-diseases-weeds/consultation/aws-final.pdf**

PREVENTING THE ENTRY OF NEW WEEDS

A large percentage of weed species (at least 50 per cent and possibly up to 70 per cent) were originally imported for use as garden ornamentals. However, many of these species were imported a long time ago and modern improvements to biosecurity arrangements have significantly reduced this risk.

The Department of Agriculture and Water Resources develops and implements quarantine policies for plant imports and for the past decade plant imports have been subject to a Weed Risk Assessment. A Permitted Seeds List has also been developed, so that all species not currently in Australia or on the Permitted Seeds List are subject to a risk assessment prior to importation. Australia's Weed Risk Assessment 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), which involves surveillance activities in Australia's north and neighbouring countries.

Figure 89. Australia's weed management system

The Australian Weeds Strategy is part of a complex weed management system. Source: Australian Weeds Strategy 2017 to 2027, Department of Agriculture and Water Resources, Canberra

ERADICATION AND CONTAINMENT OF NEWLY ESTABLISHED WEEDS

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 Australian, state and territory governments manage and coordinate nationally cost-shared invasive weed eradication programs through the Consultative Committee on Exotic Plant Incursions (CCEPI).

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 2013–18, integrates the Natural Heritage Trust, the National Landcare Program, the Environment Stewardship Program and the Working on Country Indigenous ranger programs.

Eradication of red witchweed

In July 2013 red witchweed (*Striga asiatica*) was detected in sugarcane on six properties in Queensland. Reaching agreement on a national approach to the eradication response was complex, since weeds are not covered under the existing industry and government response agreements, and both plant and livestock industries were considered likely to be affected. Nonetheless, 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 endorsed a 10-year response plan of up to $5.8 million to eradicate red witchweed. The eradication response is led by the Queensland Government and is being funded by the Cattle Council of Australia, Meat and Livestock Australia, Grain Producers Australia and CANEGROWERS.

Red witchweed is being eradicated in Queensland. Image courtesy of the Department of Agriculture and Fisheries Queensland

MANAGING ESTABLISHED WEEDS

Combating weeds 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 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.

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 common 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.

Weeds of National Significance

Thirty two Weeds of National Significance (WoNS, see Table 53) 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 and government agencies report to this Committee on progress against any remaining actions under the strategic plans.

AGRICULTURAL COMPETITIVENESS WHITE PAPER

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.

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 2017 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 spread 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.

Miconia calvescens. Image courtesy of The Nature Conservancy, The Nature Conservancy, Bugwood.org

Mikania micrantha. Image courtesy of Andrew Derksen, USDA-APHIS, Bugwood.org

Table 53. Weeds of National Significance

Common name	Scientific name
African boxthorn	*Lycium ferocissimum*
Alligator weed	*Alternanthera philoxeroides*
Asparagus weeds	*Asparagus aethiopicus, A. africanus, A. asparagoides* (Western Cape form), *A. declinatus, A. plumosus* and *A. scandens*. Excludes *A. officinalis* and *A. racemosis*
Athel pine	*Tamarix aphylla*
Bellyache bush	*Jatropha gossypiifolia*
Bitou bush, boneseed	*Chrysanthemoides monilifera*
Blackberry	*Rubus fruticosus aggregate*
Bridal creeper	*Asparagus asparagoides*
Brooms, scotch, Montpellier, flaxleaf	*Cytisus scoparius, Genista monspessulana, G. linifolia*
Cabomba	*Cabomba caroliniana*
Cat's claw creeper	*Dolichandra unguis-cati*
Chilean needle grass	*Nassella neesiana*
Gamba grass	*Andropogon gayunus*
Gorse	*Ulex europaeus*
Fireweed	*Senecio madagas cariensis*
Hymenachne	*Hymenachne amplexicaulis*
Lantana	*Lantana camara*
Madeira vine	*Anredera cordifolia*
Mesquite	*Prosopis* spp.
Mimosa	*Mimosa pigra*
Opuntioid cacti	*Opuntia* spp. (except *O. ficus-indica*), *Cylindropuntia* spp., *Austrocylindropuntia* spp.
Parkinsonia	*Parkinsonia acuteata*
Parthenium weed	*Parthenium hysterophorus*
Pond apple	*Annona glabra*
Prickly acacia	*Acacia nilotica subsp. indica*
Rubber vine	*Cryptostegia grandiflora*
Sagittaria	*Sagittaria platyphylla*
Salvinia	*Salvinia molesta*
Serrated tussock	*Nassella trichotama*
Silverleaf nightshade	*Solanum elaeagnifolium*
Water hyacinth	*Eichhornia crassipes*
Willows	*Salix* spp., except *S. babvlonica, S. x calendendron* and *S. x reichardtii*

Chapter 7

Post-border biosecurity – Plant pest surveillance and diagnostics

Plant pest surveillance and diagnostics are intertwined activities. Surveillance is a system of making and recording checks for plant pests. Diagnostics is the ability to precisely identify a plant pest, including species that are not known to be present in Australia.

Surveillance is mostly carried out by state governments, but the Australian Government, peak industry bodies, environmental agencies, growers and the Australian community is also involved.

Diagnostic services, which rely on scientific expertise, are primarily provided by governments, universities and research organisations, with coordination through a national committee and PHA.

In 2017, strengthening surveillance capacity and collaboration was a key focus for investment through the Agricultural Competitiveness White Paper, providing benefits for the agricultural industries, the community and the environment. Key projects are noted throughout this chapter.

Plant pest surveillance

Plant pest surveillance data is highly valuable because it underpins many aspects of the biosecurity system.

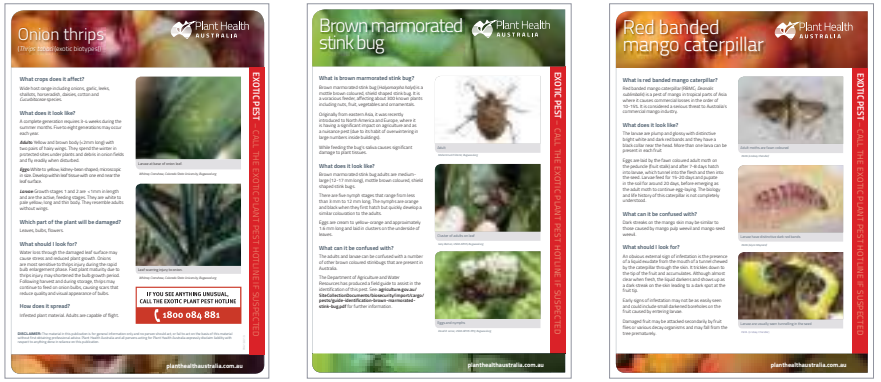
Chapter 3 discussed the importance of surveillance for market access, where nil findings of particular pests are collated to provide evidence of absence to countries that want assurances that they will not be importing new pests with Australian produce.

There are other important functions that surveillance supports in plant biosecurity.

- **Early detection of exotic pests.** Checks are regularly made in high risk areas for pests that Australia doesn't have in an effort to detect new pest incursions before they become widely established. Early detection increases the chance of successful eradication or containment responses.
- **Delimiting the spread of pests.** 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.
- **Improving pest management.** Surveillance improves management decisions by providing information on population levels.
- **Identifying high risk pathways and high risk areas** to focus future surveillance efforts.

Targeted surveillance is where checks are made for particular pests. Most is undertaken by state and territory governments (some funded by the Australian Government) but some industries undertake targeted surveillance for pests of concern.

General surveillance programs raise awareness about pests with growers and the wider community, and rely on people to look for and report anything unusual that they find during their day-to-day activities. PHA encourages growers to be on the lookout for serious exotic pests, by including pictures of pests and symptoms in each grower biosecurity manual. Fact sheets on exotic pests are also available from the PHA website.



PHA factsheets on exotic pests encourage growers to be on the lookout for new pest incursions

MEASURES TO ENCOURAGE EARLY REPORTING

Along with pest surveillance, prompt reporting is vital to minimise the long term impact of exotic pests and weeds. Many plant pests and weeds can spread rapidly, which greatly increases the challenge of containing or eradicating them. Response Plans under the Emergency Plant Pest Response Deed (EPPRD) are only agreed and implemented if it is feasible and cost-effective to eradicate a pest. Clearly, the sooner a new pest is detected the better.

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

1800 084 881

To encourage the reporting of findings made by general surveillance activities, 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.

A separate Department of Agriculture and Water Resources reporting hotline has been established for port workers and importers, who are urged to report anything unusual to the See. Secure. Report. Hotline (1800 798 636).

Under the terms of the EPPRD, reporting of unusual pests is mandatory. To encourage early reporting, owner reimbursement costs can be payable to commercial growers for losses incurred during a response to a new pest incursion. This could include destruction of crops, enforced fallow periods and additional chemical treatments. It only applies to industries signed up to the agreement.

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 specific strategies that promote domestic and international market access.

SNPHS comprises representatives from the Australian Government, state and territory governments, PHA, the Plant Biosecurity Cooperative Research Centre 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.

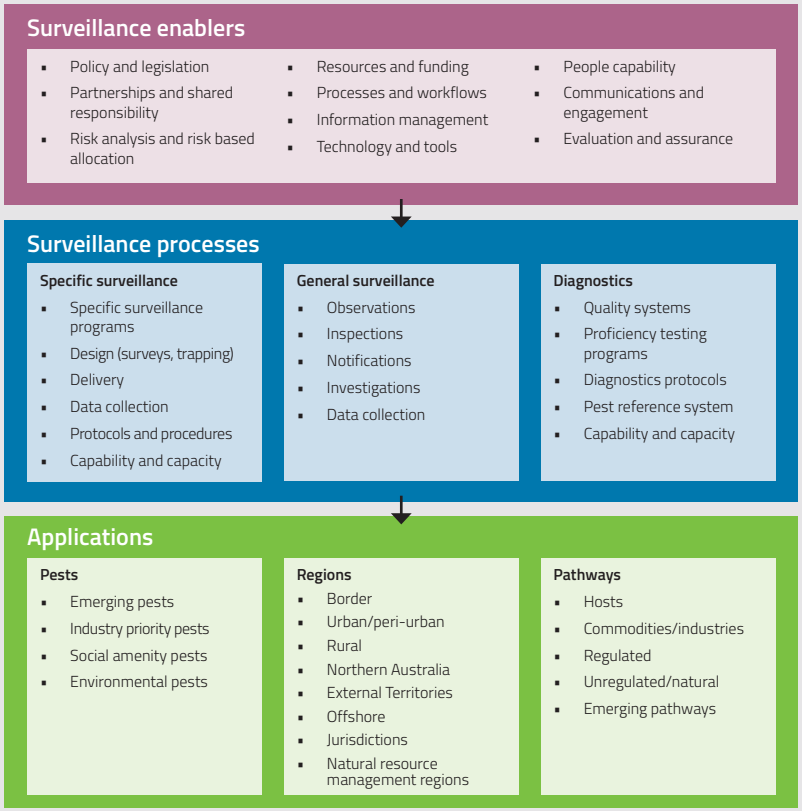
National Plant Biosecurity Surveillance System Framework

AGRICULTURAL COMPETITIVENESS WHITE PAPER

Through the Agricultural Competitiveness White Paper, the Department of Agriculture and Water Resources is working with peak industry bodies, state and territory governments, PHA and community and environmental stakeholders to build an effective and sustainable national plant health surveillance system.

The framework for the development of the system has been established through extensive consultation, with refinements made by the department's Plant Health Surveillance Consultative Committee and other national stakeholders. The framework describes surveillance objectives, processes and enablers, and depicts how these are applied to pests, pathways and regions.

Further work will be undertaken in 2018–19, with a new national plant health surveillance system to be a lasting legacy of the White Paper investment in improving biosecurity surveillance and analysis.



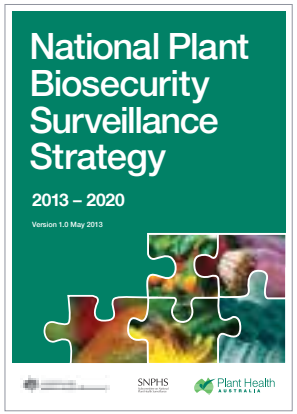
Australia's new national surveillance system framework was developed in 2017

PLANT HEALTH SURVEILLANCE CONSULTATIVE COMMITTEE

Established in 2016, the national Plant Health Surveillance Consultative Committee (PHSCC) is a group that helps to guide the investment in improving biosecurity surveillance and analysis through the Agricultural Competitiveness White Paper. This includes work to develop and implement a new National Plant Biosecurity Surveillance System Framework.

The PHSCC includes members from the Department of Agriculture and Water Resources, Plant Health Committee, Grains Research and Development Corporation, Centre of Excellence for Biosecurity Risk Analysis, Hort Innovation, AUSVEG, Summerfruit Australia, Growcom, National Resource Management Regions Australia and PHA.

THE NATIONAL PLANT BIOSECURITY SURVEILLANCE STRATEGY



Recognising both the importance of plant health surveillance, and the challenges of maintaining an effective plant health surveillance system, the National Plant Biosecurity Surveillance Strategy (NPBSS) 2013–20 was developed as a sub-strategy of the National Plant Biosecurity Strategy.

Through the Australian Government's Agricultural Competitiveness White Paper, funding is being provided to review and progress key actions of the NPBSS by investing in projects which will help realise an enhanced, sustainable future national plant health surveillance system.

TARGETED SURVEILLANCE PROGRAMS IN 2017

A huge amount of resourcing goes into surveillance activities across Australia. During 2017, Australian governments carried out 155 plant pest surveillance programs, which are detailed by jurisdiction in Table 54.

The following figures show the same surveillance data by target host (Figure 90) and target pest type (Figure 91).

Figure 90. Surveillance programs by target host

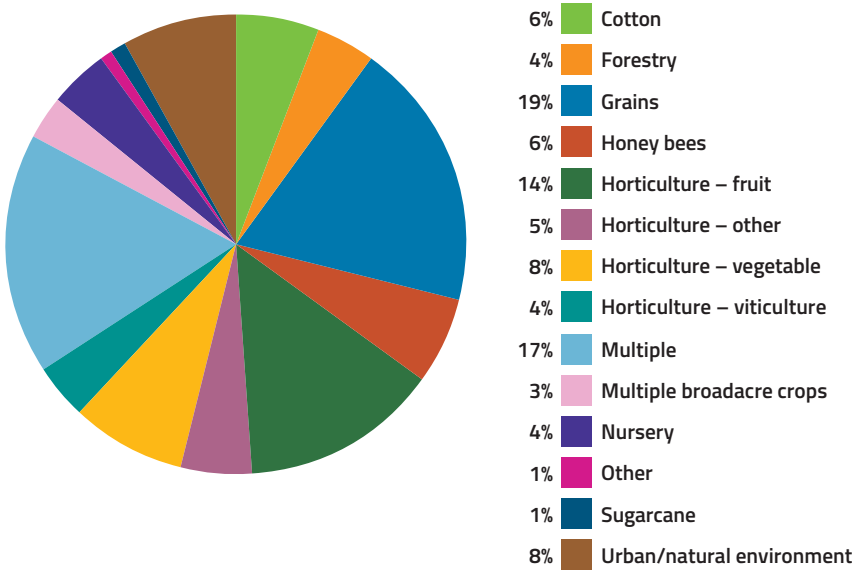
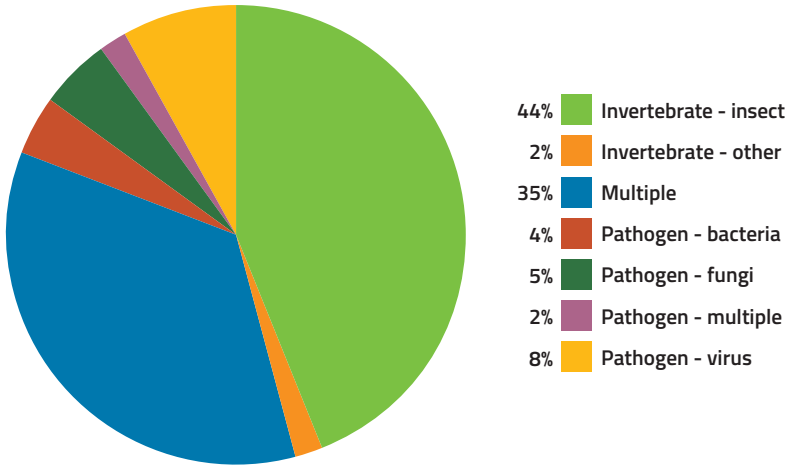


Figure 91. Surveillance programs by target pest type



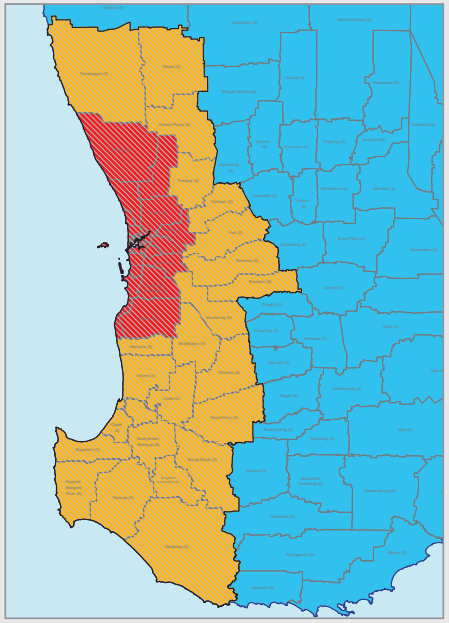
Surveillance for tomato potato psyllid

In February 2017, a new pest, the tomato potato psyllid (*Bactericera cockerelli*) was detected in WA. After this first detection, the WA Department of Primary Industries and Regional Development began surveillance to establish how far the new pest had spread.

Surveillance activities under a nationally approved Response Plan soon revealed that the pest was widespread around the Perth metropolitan area. The Tomato Potato Psyllid National Management Group agreed later in 2017 that eradication of the pest from WA was not feasible.

To limit the impact on growers and improve the capacity of the horticulture sector to manage tomato potato psyllid a Transition to Management plan has been developed. Activities under the plan include supporting surveillance, market access activities, research and enterprise management planning.

Overseas, the psyllid has been associated with the spread of a serious disease of potatoes known as zebra chip. So far, the organism that causes zebra chip, *Candidatus* Liberibacter solanacearum, has not been found in Australia. Surveillance is being done to confirm its absence and has included significant support from the WA community.



Surveillance showed where the tomato potato psyllid was found around Perth in WA. Image courtesy of the Department of Primary Industries and Regional Development

In 2017, growers of potato, tomato, eggplant, capsicum, chilli, tamarillo and sweetpotato plants were asked to check their plants for the tomato potato psyllid, even if they only keep a few plants in their backyard. A large number of traps have been installed and monitored to trap the psyllids and test for the zebra chip bacterium.

New domestic quarantine rules now apply to movement of risk plants and plant material produced in WA, and new rules for interstate certification apply to WA growers.

Surveillance for the new pest is ongoing. The Tasmanian Institute of Agriculture, funded by Hort Innovation, is coordinating a national surveillance program, including the placement of many traps in eastern Australia, for early detection in case the pest should spread.

Table 54. Australia's plant biosecurity surveillance programs

Surveillance program name	Target hosts	Target pests
Australian Government		
National Australia Quarantine Strategy pest and disease surveys	Multiple surveillance programs of tropical horticultural and agricultural species	157 high priority exotic pests
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
Northern Australia Quarantine Strategy exotic fruit fly trapping	Horticultural crops	Exotic fruit flies
Within New South Wales		
Aphids	Field crops, horticulture	Multiple species
Asian gypsy moth	Various tree hosts around ports	Asian gypsy moth (*Lymantria* spp.)
Brown marmorated stink bug	Multiple tree and crop hosts	Brown marmorated stink bug (*Halyomorpha halys*)
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 crops (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* spp.
Grains Farm Biosecurity Program	In-crop and stored grains	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*)
Grape vine pinot gris virus	Grape vines	Grape vine pinot gris virus (Trichovirus)
Lettuce seed crop surveillance	Lettuce	Lettuce mosaic virus (Potyvirus)
Lupin anthracnose	Lupins	Lupin anthracnose (*Colletotrichum gloeosporioides*)
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
National Plant Health Surveillance Program	Citrus in the Sydney basin	Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*), huanglongbing (*Candidatus* Liberibacter asiaticus), citrus canker (*Xanthomonas axonopodis* pv. *citri*)
National Plant Health Surveillance Program	Multiple plant and weed hosts in the Sydney basin	Glassy winged sharpshooter (*Homalodisca vitripennis*), Pierce's disease (*Xylella fastidiosa*), fire blight (*Erwinia amylovora*), brown marmorated stink bug (*Halyomorpha halys*), exotic mites (including *Brevipalpus* spp., *Aceria granati*), exotic leaf miners (*Liriomyza* spp.)

* This species has been synonymised with *Bactrocera dorsalis*

Table 54. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
National Plant Health Surveillance Program	Port environments	Red imported fire ant (*Solenopsis invicta*), electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*)
Onion seed crop surveillance	Onions	Varies but may include *Burkholderia gladioli* pv. *alliicola*, *Erwinia chrysanthemi*, *Alternaria porri*, *Pyrenochaeta terrestris*, *Urocystis cepulae*, *Ceratitis* spp. *Helix aspersa*, *Liriomyza trifolii*, *Naupactus leucoloma*, *Aphelenchoides fragariae*, *Ditylenchus destructor*, *D. dipsaci*, *Longidorus* spp., *Meloidogyne goeldi*, *Paratrichodorus* spp., *Pratylenchus filipjev*
Phylloxera surveillance	Grape vines	Grapevine phylloxera (*Daktulosphaira vitifoliae*)
Tomato potato psyllid	Solanaceae	Tomato potato psyllid (*Bactericera cockerelli*)
Within the Northern Territory		
Area Freedom Surveillance Program	Horticultural crops	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	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, *Aethina tumida*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
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*), 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*)

Table 54. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
National Plant Health Surveillance Program	Nursery stock	Red imported fire ant (*Solenopsis invicta*), electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*)
National Banana Freckle Eradication Program	*Musa* spp.	Banana freckle (*Phyllostica cavendishii*)
National Browsing Ant Eradication Program	Nursery stock	Browsing ant (*Lepisiota frauenfeldi*)
National Plant Health Surveillance Program – Port of Entry Program	Horticultural crops	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	Horticultural crops	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 Queensland		
Area freedom surveys	Multiple	A range of pests e.g. papaya ringspot virus, banana bunchytop virus
Banana pest surveillance	Banana	A range of banana pests
Bulk handlers	Stored grains	Khapra beetle (*Trogoderma granarium*), Karnal bunt (*Tilletia indica*)
Cape York Peninsula surveys	Multiple	A range of pests
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 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
Exotic Fruit Fly in the Torres Strait Program	Multiple	Exotic fruit fly including *Bactrocera* and *Zeugodacus* spp.
Grains Farm Biosecurity Program	Summer grain crops	*Striga* spp. (especially *Striga asiatica*, red witchweed), sorghum downy mildew (*Peronosclerospora sorghi*), downy mildew of millet (*Sclerospora graminicola*), sorghum mosaic virus, *Orobanche* spp., phoma blight (*Phoma* spp.), stem nematode (*Ditylenchus dipsaci*), sunflower downy mildew (*Plasmopara halstedii*)
Grains Farm Biosecurity Program	Winter grain crops	Russian wheat aphid (*Diuraphis noxia*), barley stripe rust (*Puccinia striiformis* f. sp. *hordei*), khapra beetle (*Trogoderma granarium*), Karnal bunt (*Tilletia indica*)
Grow Help Australia diagnostic service project	Fruit, vegetable and ornamental hosts	All pests and pathogens that can affect horticultural crops, national parks, gardens, hobby growers and home gardeners. Commonly encountered pathogens include *Phytophthora* spp., *Fusarium* spp., *Colletotrichum* spp., *Alternaria* spp., *Rhizoctonia* spp., *Pythium* spp., *Ralstonia* spp., *Erwinia* spp. and viruses
Incident response surveys	Multiple	A number of targeted surveys are conducted each year in response to plant pest incidents managed under the Emergency Plant Pest Response Deed

Table 54. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
National Electric Ant Eradication Program	Amenity and environment	Electric ant (*Wasmannia auropunctata*)
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	Multiple	A range of exotic timber and forest pests, including sugarcane longhorn beetle (*Dorysthenes buqueti*), Asian and citrus longhorn beetle (*Anoplophora* spp.), lychee longicorn beetle (*Aristobia testudo*), lateral-banded mango longhorn beetle (*Batocera rubus*), sawyer beetles (*Monochamus* spp.), drywood longicorn beetle (*Stromatium barbatum*), ambrosia beetles, bark beetles (*Ips* spp.), pine beetles bark beetles (*Dendroctonus* spp.), wood wasps (Siricid wasps e.g. *Uroceris gigas*). Exotic fruit flies (*Bactrocera*, *Zeugodacus* and *Ceratitis* spp.), gypsy moths (*Lymantria* spp.), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*)
National Red Imported Fire Ant Eradication Program	Amenity and environment	Red imported fire ant (*Solenopsis invicta*)
National Varroa Mite Eradication Program	European and Asian honey bees	*Varroa jacobsoni*
Panama TR4 Program	Banana	Panama disease (*Fusarium oxysporum* f. sp. *cubense*)
Plant Pest Diagnostic Service – broadacre cropping	Broadacre field crops	All pathogens that can affect broadacre crops (cotton, grains, pastures)
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		
Giant pine scale	Pinaceae	Giant pine scale (*Marchalina hellenica*)
Grains Farm Biosecurity Program	In-crop and stored grains	Various, including barley stripe rust (*Puccinia striiformis* f. sp. *hordei*), khapra beetle (*Trogoderma granarium*), Karnal bunt (*Tilletia indica*), Russian wheat aphid (*Diuraphis noxia*), Sunn pest (*Eurygaster integriceps*), wheat stem rust (*Puccinia graminis* f. sp. *tritici*), wheat stem sawfly (*Cephus cinctus*)
Mediterranean fruit fly	Horticultural crops	Mediterranean fruit fly (*Ceratitus capitata*)
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
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	Oleaceae	Olive quick decline (*Xylella fastidiosa*)

Table 54. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
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*), yellow crazy ant (*Anoplolepis gracilipes*), Argentine ant (*Linepithema humile*), browsing ant (*Lepisiota frauenfeldi*), tawny (raspberry) crazy ant (*Nylanderia fulva*), 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
Tomato potato psyllid	Solanaceae	Tomato potato psyllid (*Bactericera cockerelli*)
Cucumber green mottled mosaic virus	Cucurbitaceae	Cucumber green mottle mosaic virus
Dickeya dianthicola	Solanaceae	*Dickeya dianthicola*
Grape vine pinot gris virus	*Vitus vinifera*	Grape vine pinot gris virus
Grape phylloxera	*Vitus vinifera*	*Daktulosphaira vitifoliae*
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*)
Devonport (Stoney Rise) light trapping	Multiple	Numerous flying pests and beneficials
Fruit fly trapping surveillance	Host fruit trees, fruit and vegetables	*Bactrocera tryoni*, *Ceratitis capitata*, *B. dorsalis* and other exotic fruit flies
Multiple Pest Surveillance Program 2016–17 – Russian wheat aphid	Wheat and barley crops	Russian wheat aphid (*Diuraphis noxia*)
Multiple Pest Surveillance Program 2016–17 and 2017–18 – fire blight	Commercial orchards	Fire blight (*Erwinia amylovora*)
Multiple Pest Surveillance Program 2016–17 – khapra beetle	Stored grains, grain processors and animal feed outlets	Khapra beetle (*T. granarium*)
Multiple Pest Surveillance Program 2016–17 – red imported fire ant (and other exotic ants)	Ports of entry	Red imported fire ant (*Solenopsis invicta*)
Multiple Pest Surveillance Program 2016–17 and 2017–18 – gypsy moth trapping	Multiple, including forest and amenity trees	Gypsy moth (including *Lymantria dispar asiatica*, *L. dispar dispar*, *L. dispar japonica*, *L. umbrosa*, *L. albescens*, *L. postalba*, *L. xylina*, *L. monacha*, *L. pulverea*, *L. minomonis*, *L. concolor*, *L. dissoluta*, *L. sinica*, *L. marginata*, *L. atameles*, *L. fumida*
Multiple Pest Surveillance Program 2017–18 – Pierce's disease	Nurseries, urban pathways	Pierce's disease (*Xylella fastidiosa*)
Multiple Pest Surveillance Program 2017–18 – glassy winged sharpshooter	Nurseries, urban pathways	Glassy winged sharpshooter (*Homalodisca vitripennis*)
Multiple Pest Surveillance Program 2017–18 – exotic leaf miners	Urban pathways, community gardens, commercial potato crops	*Liriomyza bryoniae*, *L. cicerina*, *L. huidobrensis*, *L. sativae*, *L. trifolii*
Multiple Pest Surveillance Program 2017–18 – sharka	Commercial orchards	Sharka (plum pox virus)
Multiple Pest Surveillance Program 2017–18 – spotted wing drosphila	Urban pathways	Spotted wing drosphila (*Drosophila suzukii*)

Table 54. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Aethina tumida*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
Tomato potato psyllid	Commercial potato and tomato crops, community gardens, urban pathways	Tomato potato psyllid (*Bactericera cockerelli*)
Silverleaf white fly surveillance	Nursery stock	Silver leaf white fly (*Bemisia tabaci*)
Warehouse beetle trapping surveillance	Stored grains, grain processors and animal feed outlets	Warehouse beetle (*Trogoderma variable*)
Within Victoria		
Grains Farm Biosecurity Program	In-crop and stored grains	Various, including barley stripe rust (*Puccinia striiformis* f. sp. *hordei*), khapra beetle (*Trogoderma granarium*), Karnal bunt (*Tilletia indica*), Russian wheat aphid (*Diuraphis noxia*), Sunn pest (*Eurygaster integriceps*), wheat stem rust (*Puccinia graminis* f. sp. *tritici*), wheat stem sawfly (*Cephus cinctus*)
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
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)
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*)
Within 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*)
Brown marmorated stink bug	General surveillance, all hosts, urban areas	*Halyomorpha halys*
Candidatus Liberibacter solanacearum	Tomato, potato, capsicum, chilli and eggplant crops	Tomato potato pysllid (*Bactericera cockerelii*)
Codling moth surveillance	Pome fruit	Codling moth (*Cydia pomonella*)
Crop Variety Trials	Grain crops	Grain pests

Table 54. Australia's plant biosecurity surveillance programs (continued)

Surveillance program name	Target hosts	Target pests
Cucumber green mottle mosaic virus (as an incident)	Cucurbits and host weeds	Cucumber green mottle mosaic virus
European wasp surveillance	Urban areas and horticultural crops	European wasp (*Vespula germanica*)
Grains Farm Biosecurity Program	In-crop and stored grains	Various, including barley stripe rust (*Puccinia striiformis* f. sp. *hordei*), khapra beetle (*Trogoderma granarium*), Karnal bunt (*Tilletia indica*), Russian wheat aphid (*Diuraphis noxia*), Sunn pest (*Eurygaster integriceps*), wheat stem rust (*Puccinia graminis* f. sp. *tritici*), wheat stem sawfly (*Cephus cinctus*)
Medfly Area Freedom (ORIA)	Many horticultural hosts	Mediterranean fruit fly (*Ceratitis capitata*)
Multiple pest surveillance	Pome and citrus crops	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
MyPestGuide e-surveillance	All hosts, general surveillance	All plant pests
National Bee Pest Surveillance Program	European honey bee	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, *Aethina tumida*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris*, *Vespa velutina* and new exotic swarms of *A. mellifera*
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	Horticultural hosts	Various *Bactrocera* and *Ceratitis* spp.
Queensland fruit fly surveillance	Many horticultural hosts	Queensland fruit fly (*Bactrocera tryoni*)
Sentinel stored products merchants	Stored grain products	Khapra beetle (*Trogoderma granarium*)

Strengthening fruit fly surveillance

Through the Agricultural Competitiveness White Paper funds are being invested to strengthen the National Exotic Fruit Fly Surveillance Program, which operates at many entry points into Australia to stop exotic species entering and becoming established.

This complements work undertaken by NAQS in northern Australia under the Torres Strait Fruit Fly Containment Strategy, and Australia's international surveillance activities.

A vision for the future – smart traps for fruit flies

Also with funding from the Agricultural Competitiveness White Paper, Hort Innovation is trialling the use of automated or 'smart' traps to improve surveillance for Mediterranean fruit fly and Queensland fruit fly.

Sensors indicating when a fly has entered the trap will trigger alerts, saving growers and biosecurity officers precious time, in particular by providing faster access to information to help prevent or respond to fruit fly outbreaks.

More rapid access to accurate information on fruit fly status will also help to support market access requirements for horticultural products.

INDUSTRY SURVEILLANCE STRATEGIES AND PROGRAMS

While growers routinely monitor crops to support production practices and manage established pests and diseases, the Department of Agriculture and Water Resources is working with PHA as well as peak industry bodies, environmental, community and research stakeholders to develop and implement targeted surveillance strategies.

A national surveillance strategy for Australia's temperate fruit industries is being scoped as part of this work. A research project is underway in the production nursery industry to review crop monitoring and surveillance methodologies to help producers to monitor for key pests. Examples of other significant surveillance initiatives include the vegetable, grains and cotton industries, through a combination of general and targeted surveillance. Citrus and forestry industry strategies were developed in 2017, and are described in the following pages.

INTERNATIONAL PLANT SENTINEL NETWORK

Plant species maintained outside of their natural ranges (e.g. as in botanic gardens and arboreta) offer a unique opportunity to understand and predict potential threats to a country's plant health by acting as standing sentinels in foreign lands. These plants can be monitored for damage by pests and diseases that are not currently in their country of origin. This information can then be used to provide an early warning system.

Sentinel plants can also provide valuable information which can help:

- Increase understanding about 'known' pests and diseases (e.g. dispersal mechanisms, origin)
- Identify new pest–host associations (e.g. suggest which species of plant may be particularly susceptible or resistant to a particular pest)
- Identify potential biocontrols.

The Melbourne Royal Botanic Gardens and the Royal Botanic Gardens Sydney are the two Australian members of the sentinel network. For more information go to **plantsentinel.org**.

Department of Agriculture and Water Resources Enterprise Surveillance System (ESS)

In October 2017 the Australian Chief Plant Protection Office released the first version of the Enterprise Surveillance System (ESS), which allows Department of Agriculture and Water Resource officers to capture data at the source using mobile devices, rather than manually recording information and then re-entering it into spreadsheets or databases.

This provides field validation and improved data quality, as well as saving time. The ESS will become the central repository for data for departmental biosecurity surveillance programs.

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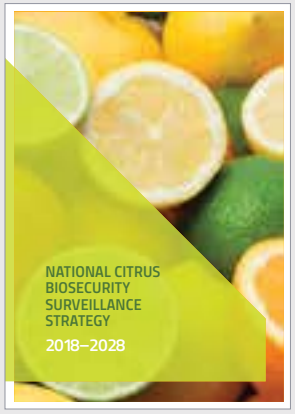
National Citrus Biosecurity Surveillance Strategy

The National Citrus Biosecurity Surveillance Strategy 2018–28 was developed by PHA in consultation with Citrus Australia and the Department of Agriculture and Water Resources in 2017. Funding for the development of the strategy and an associated Implementation Plan was provided through the Agricultural Competitiveness White Paper.

The strategy provides a framework for national coordination and implementation of surveillance activities carried out by government and industry to better target national priority pests that could severely disrupt production and trade. This includes the bacterial disease huanglongbing and the Asian citrus psyllid, citrus canker, and Australia's number one unwanted plant pest, *Xylella fastidiosa*. Fruit flies are also targeted under the strategy.

Should an exotic pest enter Australia, early detection of incursions will help to limit their spread and minimise the costs of eradication. Improved surveillance will also help to provide ongoing evidence to demonstrate area freedom from pests, to support new market access requests and the maintenance of existing markets.



The strategy is aligned with the National Plant Biosecurity Strategy and National Plant Biosecurity Surveillance Strategy, as described in Chapter 1. It will support the broader Citrus Biosecurity Program being developed by Citrus Australia and PHA through funding provided by the Department of Agriculture and Water Resources and Hort Innovation.

Implementation of the strategy will be carried out through the establishment of a National Citrus Biosecurity Surveillance Program. The program will be overseen by a National Citrus Biosecurity Surveillance Group, with a National Citrus Biosecurity Surveillance Coordinator working directly with growers.

National Forest Biosecurity Surveillance Strategy

The National Forest Biosecurity Surveillance Strategy 2018–23 was prepared by PHA in 2017, in consultation with industry, government and the R&D sector.

Funding for the development of the strategy and associated Implementation Plan was provided through the Agricultural Competitiveness White Paper.

Increased trade, climate change and the movement of people and commodities are all increasing the risk of an exotic forest pest incursion, with the strategy outlining activities and priorities to improve the management and coordination of exotic forest pest surveillance activities in Australia.

Many of Australia's national priority plant pests pose a significant threat to forests, including *Xylella fastidiosa*, gypsy moth (which could 'hitch-hike' into Australia on cargo ships) and pinewood wilt nematode.

These unwanted and exotic pests could cause significant environmental, economic and social harm if they were to enter Australia and establish in urban, native or commercial plantation forests.

Should exotic forest pests enter Australia early detection of incursions will help to limit their spread and minimise the costs of eradication, while improved surveillance will also help to provide ongoing evidence to demonstrate area freedom from pests, to support access to established and emerging export markets.

The National Forest Biosecurity Surveillance Strategy 2018–28 is aligned with the National Plant Biosecurity Strategy and National Plant Biosecurity Surveillance Strategy, as described in Chapter 1.

Implementation of the strategy will be carried out through the establishment of a National Forest Biosecurity Surveillance Program. The program will be overseen by a National Forest Biosecurity Surveillance Group, with a National Forest Biosecurity Surveillance Coordinator working directly with industry, state governments, environmental groups and other forest industry stakeholders.

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 exotic pest bees (such as Asian honey bees) and bee pests (such as Varroa mites). The program also provides technical, evidence-based information to support Australia's pest free status claims during export negotiations and assists exporters to meet export certification requirements.

The Enhanced National Bee Pest Surveillance Program 2016–21 is funded by the $2.5 million Hort Frontiers Pollination Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation. This consists of contributions from nine pollinator-dependent industry research and development levies, with co-investment from the Australian Honey Bee Industry Council ($500,000), Grain Producers Australia ($100,000), and contributions from the Department of Agriculture and Water Resources.

The Enhanced NBPSP came into effect December 2016, building on existing activities and incorporating new methodologies. The program uses a variety of activities to detect 14 exotic bee pests and pest bees, and two regionalised, but significant, bee pests.

Multiple surveillance methods

As part of the program, sentinel hives (hives of European honey bees of a known health status) are maintained at high risk locations around Australia. These are routinely inspected for bee pests such as mites. During 2017, sentinel hives positioned at 33 sea and air ports were inspected 880 times for external exotic bee pests.

Honey bees found around port environments may be swarms from local populations but could also be newly arrived swarms from overseas. For this reason, swarms that have taken up homes in strategically placed empty catchboxes or found on structures at ports are captured, identified and inspected for all exotic bee pests. In 2017, 49 bee swarms were captured. Of these, 28 were Asian honey bee swarms captured in Cairns where a current isolated population exists. The remaining 21 swarms were captured from various port locations and identified as European honey bees, all of which were free of exotic internal and external mites.

Floral sweep netting is carried out near ports to provide early detection of exotic pest bees including red dwarf honey bee (*Apis florea*), the giant honey bee (*A. dorsata*), exotic and established strains of Asian honey bee (*A. cerana*) and bumble bees (*Bombus terrestris*), as well as European honey bee (*A. mellifera*). Using nets to collect and identify foraging bees allows officers to locate any exotic bee swarms.

There has been an increase in the number of port locations and the frequency of floral sweep netting activities that take place via PHA subcontracting activities with state and territory governments. A total of 121 floral sweep surveys took place in 2017, with more planned for 2018.

Also in 2017, CSIRO undertook the first round of testing for exotic honey bee viruses at the 33 ports in the program. All were found to be free from exotic honey bee viruses such as deformed wing virus.

The NBPSP is an excellent example of a strong industry–government biosecurity partnership in action between the industries that rely on pollination, all state and territory governments, Northern Australian Quarantine Strategy Team and the Australian Government, as well as port staff and beekeepers.

Image courtesy of Jenny Shanks, Plant Health Australia

AGRICULTURAL COMPETITIVENESS WHITE PAPER

Strengthening bee surveillance

The Australian Government is strengthening the National Bee Pest Surveillance Program through the Agricultural Competitiveness White Paper. Better virus diagnostics and surveillance are now included in the program, as well as an increase in surveillance for Asian honey bees, and an improvement in catchboxes in remote locations or areas of high risk. The first ever trial of traps for Asian hornets at key Australian ports has been designed and will begin in 2018.

As well as guarding against Varroa mite and other unwanted exotic bee pests, this work will help Australia to provide evidence of the health of our bee population to trading partners.

Image courtesy of Jenny Shanks, Plant Health Australia

Diagnostics – identifying plant pests

Accurate diagnosis of plant pests fundamentally underpins all aspects of the plant biosecurity system. It is essential that diagnostic services can quickly and accurately identify both established and exotic species. The differences between species can be very minor, making identification a matter of close examination, expertise, morphological comparison to reference species and DNA sequence analysis.

The cause of plant diseases can be difficult to pin down. There can be many different causes for a given symptom, not all of them related to insects or diseases. The health of a plant may be affected by soil structure and nutrients, weather conditions, amount of light, other environmental and cultural conditions, as well as the activities of animals and people.

In the event of an incursion, diagnostic expertise is required to identify an initial sample, to help determine how widespread the incursion is (a critical factor in determining whether a pest is eradicable), and eventually to provide the evidence necessary to claim that the pest has been eradicated.

Diagnostic capacity also supports many of the everyday management practices that are integral to 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, which allow access to both domestic and international markets.

DIAGNOSTIC SERVICES IN AUSTRALIA

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, CSIRO and universities.

Australia's diagnostic facilities and their services are detailed in Table 55.

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.

Table 55. Australia's diagnostic services, their capabilities, accreditations and collections

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		Insect, nematode, mite, other arthropod (e.g. spider, centipede), earthworm and other invertebrate 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		
CSIRO Tropical Ecosystems Research Centre, Darwin	CSIRO	Ant identification for general public and biosecurity purposes		Tropical Ecosystems Research Centre ant collection
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		

Table 55. Australia's diagnostic services, their capabilities, accreditations and collections (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
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)		
Northern Territory				
Entomology Laboratory, Berrimah	NT DPIR	Insects and mites, molecular biology		The Northern Territory Economic Insect Reference Collection and insect DNA collection
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 and botany including microscopy and molecular capacity.		Plant pathology: herbarium specimens, desiccated virus and virus-like disease collections and nucleic acids from Australia and northern neighbouring countries. 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
Plant Pathology Laboratory, Berrimah	NT DPIR	Plant pathology, virology, bacteriology, PCR, mycology and diagnostics		Northern Territory Plant Pathology Herbarium and plant pathogen nucleic acids collection
Queensland				
Bowen Research Station, Bowen	QDAF	Entomology		
Biosecurity Queensland Control Centre, Moggill	QDAF	Fire ants		Fire ant reference collection
Brisbane Airport, Brisbane	DAWR	Temperate and tropical plant pests. Plant pathology including microscopy and molecular techniques. Entomology including microscopy and limited molecular capacity.	DAWR accredited quarantine containment 5.2/7.2	Insect collections
Cairns Research Station, Cairns	QDAF	Plant pest and disease triage		
Centre for Tropical Agriculture, Mareeba	QDAF	Entomology, plant pathology, molecular and bacteriology		Entomology

Table 55. Australia's diagnostic services, their capabilities, accreditations and collections (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	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
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.
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
South Johnstone Research Station, South Johnstone	QDAF	Nematology, entomology and plant pathology		
Sugar Research Australia, Indooroopilly, Woodford, Mackay, Tully	Sugar Research Australia	Sugarcane pests and diseases		
Toowoomba Research Station, Toowoomba	QDAF	Field crop pests and diseases, molecular, entomology, virology, nematology and mycology		
University of Southern Queensland, Toowoomba	University of Southern Queensland	Plant pathology and nematology		
South Australia				
SARDI, Adelaide	SARDI	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		

Table 55. Australia's diagnostic services, their capabilities, accreditations and collections (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
Tasmania				
Peracto, Devonport	Peracto	Plant pathology and nematology	Laboratory DAWR containment approved	
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
Sustainable Timber Tasmania Laboratory, Derwent Park, Hobart	Sustainable Timber Tasmania	Limited pathology diagnostics, particularly focusing on testing for *Phythophthora cinnamomi*. Entomology, specialising in beetles for internal projects		
Tasmanian Museum and Art Gallery, Hobart	Tasmanian Museum and Art Gallery	Entomology, specialising in beetles and moths, and insect identification for the general public		Tasmanian forest insect collection, herbarium including weeds and fungi
University of Tasmania Cradle Coast Campus, Burnie	University of Tasmania and Tasmanian Institute of Agriculture	Plant pathology (mycology including molecular)		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	Insect reference collection
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	DAWR	General plant pathology including mycology, bacteriology, botany, virology (traditional and modern) and nematology		

Table 55. Australia's diagnostic services, their capabilities, accreditations and collections (continued)

Laboratory and location	Organisation	Diagnostic capability	Accreditation	Collections
Royal Botanic Gardens, Victoria	Royal Botanic Gardens, Victoria	Mycology and weeds		
Rutherglen Research Centre, Rutherglen	DEDJTR	Entomology		
Tatura Research Centre, Tatura	DEDJTR	Entomology		
Western Australia				
Department of Environmental Biology, Perth	Curtin University of Technology	Mycology		
DPIRD Diagnostic Plant Laboratories, South Perth	DPIRD	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
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

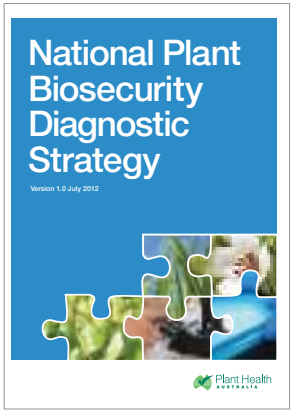
NATIONAL COORDINATION OF PLANT BIOSECURITY DIAGNOSTICS

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 pest 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 92).
- Coordinating and fostering the National Plant Biosecurity Diagnostic Network.
- Coordinating national capability building through a professional development framework.
- Driving the development and uptake of accreditation and quality management systems for diagnostic laboratories.
- Improving the surge capacity of diagnostic services to support plant pest responses.

To set the national policy and direction for plant biosecurity diagnostics in Australia a National Plant Biosecurity Diagnostic Strategy was developed in 2012. The strategy contains four main recommendations to ensure that the diagnostic system can meet Australia's needs:



- Develop a nationally integrated plant biosecurity diagnostic network that underpins Australia's plant biosecurity system.
- Implement and maintain appropriate quality management systems in diagnostic laboratories.
- Develop and maintain diagnostic capability and capacity for all HPPs.
- Establish a national plant biosecurity information management framework to optimise data sharing.

The partners in the plant biosecurity system are working to meet these recommendations.

The National Plant Biosecurity Diagnostic Network boosts capacity

The formation in 2011 of the National Plant Biosecurity Diagnostic Network (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, the Plant Biosecurity CRC, PHA, universities and the New Zealand Ministry for Primary Industries.

Members of the diagnostic network include:

- entomologists
- general plant pathologists
- virologists
- bacteriologists
- molecular biologists
- mycologists
- nematologists
- botanists
- relevant policy makers.

NPBDN activities are coordinated and driven by SPHD through a Network Implementation Working Group.

The network 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, and to 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.

NPBDN is supported by a website **plantbiosecuritydiagnostics.net.au** which contains resources, contact details of members, news, events and a selection of tools to assist in pest identification.

A skills-based workshop on mounting slides contributed to identifying the distinctive features which define nematode genera was run in conjunction with the Annual Diagnosticians' Workshop in 2017. Image courtesy of Sue Pederick, SARDI

Ms Mereia Fong Lomavatu at the Ecoscience laboratories, Brisbane, working on mango disease identification. Image courtesy of Steven Underhill

NATIONAL DIAGNOSTIC PROTOCOLS

National Diagnostic Protocols are documents that contain detailed information about a specific plant pest or related group of pests, to allow accurate diagnosis. They comply with ISPM 27, Diagnostic Protocols for Regulated Pests, and include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification.

These National Diagnostic Protocols provide the basis for:

- 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.

Each protocol has been nationally endorsed by SPHD for use in the event of an incursion, providing consistency when comparing diagnostic results between laboratories. Protocols are developed according to SPHD Reference Standards, which include the processes of peer review, verification and endorsement as shown in Figure 92. These Reference Standards cover:

- Reference Standard 1: Glossary of Terms (Version 3).
- Reference Standard 2: Development of Diagnostic Protocols – Procedures for Authors (Version 5).
- Reference Standard 3: Guidelines for the Approval Process of National Diagnostic Protocols (Version 5).
- Reference Standard 4: Guidelines for Verification and Peer Review Reports (Version 3).

A list of National Diagnostic Protocols, both under development and endorsed, are listed in Table 56. 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.

Figure 92. National Diagnostic Protocol endorsement process

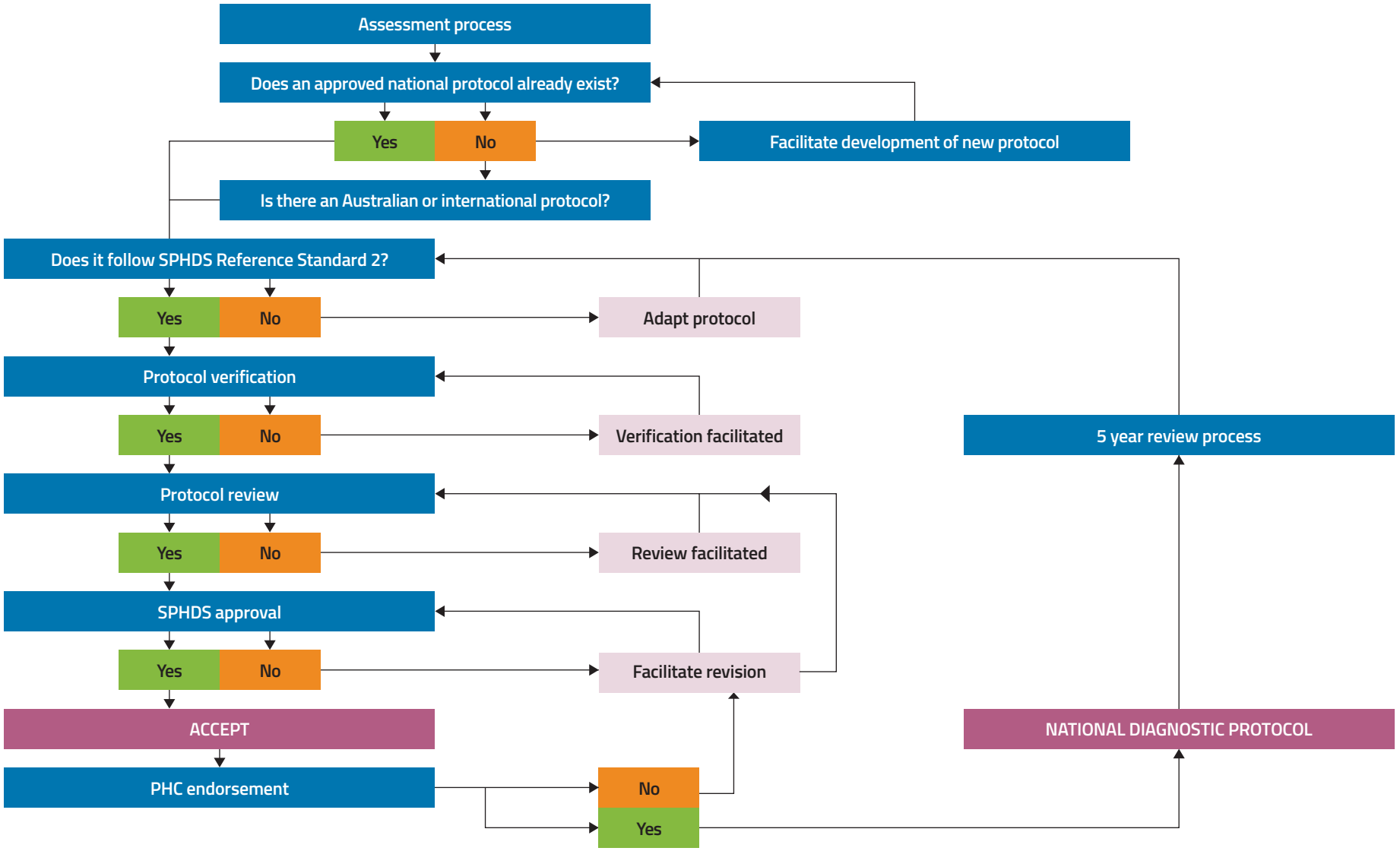


Table 56. National Diagnostic Protocols

Scientific name	Common name
Endorsed protocols	
Adoxophyes orana	Summer fruit tortrix
Bactericera cockerelli	Potato tomato psyllid
Candidatus Liberibacter asiaticus	Huanglongbing, citrus greening
Candidatus Liberibacter prunorum	European stone fruit yellows
Candidatus Liberibacter pruni	X disease
Candidatus Liberibacter solanacearum	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
Fusarium oxysporum f. sp. *ciceris*	Fusarium wilt of chickpea
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	Grape vine leaf rust
Phoma tracheiphila	Mal secco
Phyllosticta ampelicida	Grape black rot
Phytophthora ramorum	Sudden oak death
Phytoptus avellanae	Hazelnut big bud mite
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
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

Zebra chip of tomato. Note the interveinal chlorosis. Image courtesy of J.E. Munyananeza, USDA-ARS, Konnowac Pass (USA)

Adult avocado thrip. Image courtesy of Jack Kelly Clark, UC Statewide IPM Program

Table 56. National Diagnostic Protocols (continued)

Scientific name	Common name
Draft protocols	
Agrilus planipennis	Emerald ash borer
Anastrepha spp., *Bactrocera* spp., *Ceratitis* spp., *Dacus* spp., *Dirioxa* spp. and *Rhagoletis* spp.	Fruit flies (exotic and endemic species of priority to Australia)
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
Candidatus Phytoplasma solani	Bois noir
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
Cotton leaf roll dwarf virus	Cotton leaf roll dwarf virus
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
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 soil-borne 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 weaver
Pantoea stewartii subsp. *stewartii*	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

Table 56. National Diagnostic Protocols (continued)

Scientific name	Common name
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
Planococcus ficus	Vine mealybug
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 spp.	Sugarcane white leaf
Scirpophaga excerptalis	Top borer, top shoot borer
Scirpophaga nivella	White rice borer
Scirtothrips aurantii	South African citrus thrip
Scolytines spp.	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 citri subsp. *malvacearum*	Hypervirulent bacterial blight of cotton
Xanthomonas fragariae	Angular leaf spot
Xanthomonas vasicola pv. *musacearum*	Banana bacterial wilt
Xylophilus ampelina	Bacterial blight

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

Sugarcane woolly aphid. Image courtesy of Sugar Research Australia

Initial external symptoms of Panama disease include yellowing leaf margins on older leaves. Image courtesy of Jeff Daniells

Adult rice weevil feeding on corn. Image courtesy of Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org

Spider mites. Image courtesy of David Cappaert, Michigan State University, Bugwood.org

HANDBOOK FOR THE IDENTIFICATION OF FRUIT FLIES

The accurate identification of fruit flies is a key component of Australia's biosecurity system that underpins the domestic movement of fruit and vegetables, maintains international market access for Australian producers and protects Australia's borders from exotic pest incursions.

In 2015–16 the Department of Agriculture and Water Resources in conjunction with the Plant Biosecurity CRC commissioned PHA to facilitate a major revision of the Australian Handbook for the Identification of Fruit Flies Version 2.1.

The volume was developed in consultation with, and input from, fruit fly entomologists, scientists, academics and diagnosticians from Australia and overseas, including government departments of agriculture or primary industries and research institutions.

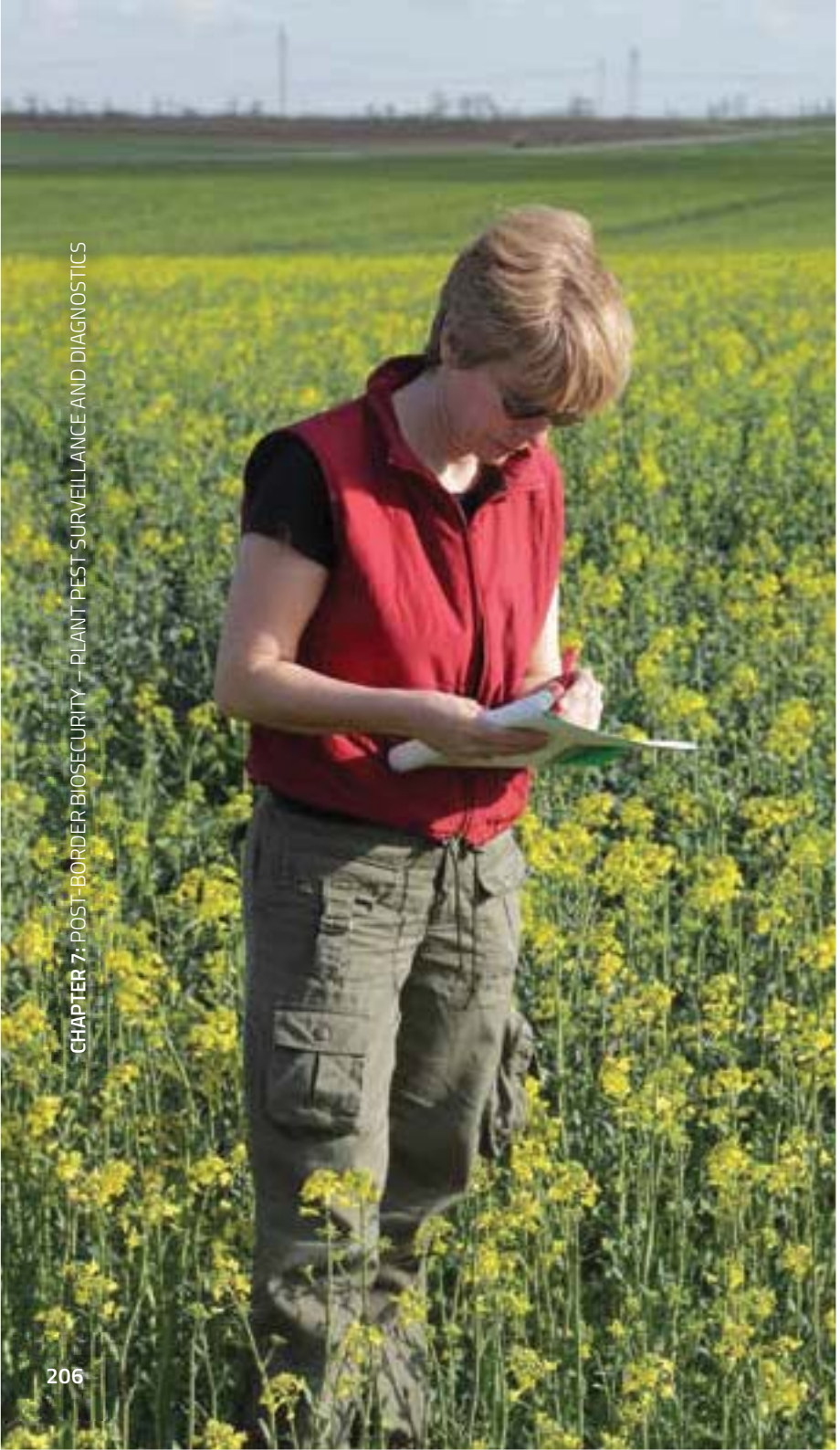
The handbook integrates all the techniques currently used in Australia for the identification of 70 species of (primarily exotic) fruit flies using both taxonomy and molecular biology techniques. The handbook has been compiled by diagnosticians as a working document for diagnosticians.

Work is well underway on a third revision of the handbook which is due for release in early 2018.

Carambola fruit fly. Image courtesy of Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org

Adult Mediterranean fruity fly resting on leaf. Image courtesy of Scott Bauer, USDA Agricultural Research Service, Bugwood.org

Queensland fruit fly. Image courtesy of G.T. O'Loughlin, Bugwood.org



Contingency planning

In addition to protocols for identifying particular pests, contingency planning is a pre-emptive preparedness initiative that improves readiness for a particular exotic pest threat. Contingency plans are developed by industries and governments.

Before any incursion occurs, experts are brought together to collate information on a particular pest or pest group, its biology and available control measures. Each contingency plan provides guidelines and options for steps to be undertaken and considered when developing a Response Plan to this pest.

Table 57 provides a listing of over 121 contingency plans that have been developed to date. These plans make a considerable contribution to Australia's preparedness for serious exotic plant pest threats. Contingency plans are available on PHA's website, in the Pest Information Document Database.


Contingency Plan for Brown Marmorated Stink Bug *(Halyomorpha halys)*

Prepared by Plant Health Australia

May 2017

In 2017, a contingency plan for brown marmorated stink bug was developed by PHA

Image courtesy of Gary Bernon, USDA APHIS, Bugwood.org

Table 57. Contingency plans

Scientific name	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	PHA	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	Tomato potato psyllid	2017–18	PIRSA	State
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	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	2013	QDAF, NGIA	National – production nurseries
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 57. Contingency plans (continued)

Scientific name	Common name	Year	Location of document	Scope
Ceutorhynchus assimilis and *Dasineura brassicae*	Cabbage seedpod weevil and Brassica pod midge	2011	PHA	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
Cucumber green mottle mosaic virus	CGMMV	2015	QDAF	State – containment by melon, vegetable and nursery industries
Conopomorpha cramerella	Cocoa pod borer	2012–14	QDAF	State
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 (and its impact on honey bees)	Fire blight	2004	DPIPWE	State – honey bee industry
Erwinia amylovora	Fire blight	2007	Hort Innovation, PHA	National – apple and pear industry
Erwinia papayae	Bacterial crown rot	2011	PHA	National – papaya industry
Eumetopina flavipes	Island sugarcane planthopper	2009	SRA	National – sugarcane industry

Table 57. Contingency plans (continued)

Scientific name	Common name	Year	Location of document	Scope
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
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	DPIRD, 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	2011	QDAF	State
Hypothenemus hampei	Coffee berry borer	2012–13	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 (syn. *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	NSW DPI	National

Table 57. Contingency plans (continued)

Scientific name	Common name	Year	Location of document	Scope
Lymantria dispar dispar	Gypsy moth (Asian and European strains)	2009	PHA	National – production nurseries
Magnaporthe grisea	Rice blast	2005	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	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
Psila rosae	Carrot rust fly	2009	DPIRD, Hort Innovation	National – vegetable industry
Puccinia graminis f. sp. *tritici* (pathotype Ug99)	Stem rust of wheat	2009	PHA	National – grains industry
Puccinia psidii	Myrtle rust	2015	DPIRD	State
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

Table 57. Contingency plans (continued)

Scientific name	Common name	Year	Location of document	Scope
Sitobion avenae	Wheat aphid	2009	PHA	National – grains industry
Sitona spp. complex, especially *S. lineatus*	Pea leaf weevils	2005	DPIRD, PHA	National – grains industry
Solenopsis invicta	Red imported fire ant	2013	QDAF, NBC	National
Solenopsis invicta	Red imported fire ant	2013	QDAF, TACC	State
Striga asiatica	Red witchweed		QDAF	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	PHA	National – grains industry
Tilletia indica	Karnal bunt	2005	PHA	National – grains industry
Tilletia indica	Karnal bunt	2006	NSW DPI	National – grains industry
Tilletia indica	Karnal bunt	2013–14 draft	PIRSA	State
Trogoderma granarium	Khapra beetle	2005	PHA	National – grains industry
Tropilaelaps clareae and *T. mercedesae*	Tropilaelaps mites	2012	PHA	National – honey bee industry
Austropuccinia psidii (syn. *Uredo rangelii*)	Myrtle rust	2012–13	DEDJTR	State
Austropuccinia psidii (syn. *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 draft	DEDJTR	National – production nurseries
Varroa destructor and *V. jacobsoni*	Varroa mites	2015	DEDJTR	National – honey bee industry
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, 2016	DEDJTR, PHA, QDAF, NGIA	National – viticulture and production nurseries

Specimen draws (Lepidoptera) in the Australian National Insect Collection (ANIC)

National reference collections

Biological collections are an essential part of the plant biosecurity system, providing a reference for the identification of a plant pest. They also serve other purposes such as biodiversity or scientific research, but in plant biosecurity, collections are a vital support for effective diagnostics.

Reference collections contain:

- **Exotic pest specimens** – necessary for identification since these pests are not present in Australia.
- **Common native relatives and lookalikes of exotic pests** – essential for accurate diagnosis of the pests, and to develop effective diagnostic methods.
- **Type specimens** – definitive scientific records of any species, and essential for taxonomic research and diagnostics.
- **Historical material and records** – including vouchers and evidence of surveillance or distribution.

Diagnosticians use collections to inform biosecurity and to support exports. Proof of area freedom requires vouchering of specimens and records under international standards including ISPM 8, a service that is provided by Australia's collections.

COLLECTIONS WITHIN PLANT HEALTH DIAGNOSTICS

Collections are one part of the national plant health diagnostic system and must operate within the broader plant health diagnostic system. There are four components, each of which is necessary for the whole diagnostic system:

- **Collections** – consisting of specimens and other material used for reference, vouchering, teaching, providing genetic material, producing images, recording variation and anchoring names to attributes of organisms (using the concept of type specimens).
- **Human capability** – being a store of undocumented experience and expertise.
- **Information** – contained in images, diagnostic protocols, gene sequences and systematic publications, on-line keys and other taxonomic resources.
- **Interactions and linkages** – between the other three components necessary for the whole system to work together.

To deliver the best performance, all of these components need to be coordinated and integrated. Interactions and linkages are critical for the other components to work together.

During 2017, SPHD developed the National Plant Pest Reference Collections Strategy to ensure that biological collections can continue to support Australia's trade and biosecurity. The strategy is due for release early in 2018.

Online systems supporting plant biosecurity

Digital resources are of increasing importance to plant biosecurity, providing fast upload, analysis and access of information. Many online systems are used by stakeholders in the biosecurity system with major ones described here.

THE BIOSECURITY PORTAL

The Biosecurity Portal, developed by PHA in 2014, brings together a suite of online biosecurity information and can be found at **biosecurityportal.org.au**. At the end of December 2017, 28 web sites and shared work spaces can be accessed from the Portal, making it a key information source for biosecurity stakeholders.

Sites fall into four categories:

- Tools and databases such as the National Plant Surveillance Reporting Tool.
- Knowledge bases and data libraries such as the Fruit Fly Body of Knowledge and the Emergency Management Knowledge Base.
- Shared spaces for committees and working groups such as the National Fruit Fly Strategy Advisory Committee and the National Biosecurity Information Governance Expert Group.
- Awareness and information resources such as the Farm Biosecurity website and BeeAware.

THE AUSTRALIAN PLANT PEST DATABASE

The Australian Plant Pest Database (APPD) is a key reference system for plant pests. The APPD contains information on validated specimen records of pests and diseases of plants with significance to agriculture, forestry, pasture or the environment.

Currently APPD draws information from 18 databases throughout Australia. This database is interrogated in every plant pest incursion that is detected in Australia to assist with identification. APPD is housed within the Atlas of Living Australia (ALA). ALA also has information relevant to plant biosecurity as it is a collaborative, national database aggregating biodiversity data from multiple data sources. ALA can be accessed at **ala.org.au**.

AUSPEST*CHECK*

AUSPest*Check* is a system developed by PHA for hosting surveillance data on the presence or absence of exotic and established pests around Australia. This system collates surveillance data from multiple sources and in different formats. Maps are generated in real time, providing digital representations of pest status around the country, including during plant pest incursions. During 2017, AUSPest*Check* has provided proof of concept for coordinating surveillance data online. Over 2.5 million records of surveillance checks were included in the database by the end of 2017.

All the information is integrated to allow seamless mapping and searching for information about types of pests. Standardised data can be uploaded manually using preformatted spreadsheets, or automatically uploaded from pre-existing databases or systems via a programming interface.

OTHER RESOURCES

Databases of agreed import policies (BICON) and export conditions (MICoR) are maintained by the Department of Agriculture and Water Resources, as described in Chapters 3 and 4.

PHA has the Pest Information Document Database on its website. This database holds factsheets, contingency plans, diagnostic protocols and other information specific to Australia's high priority exotic pests to support stakeholders in the biosecurity system.

Mobile devices such as smart phones and tablets are supplementing online systems, improving accessibility to the tools and integration into biosecurity operations.

Everyday Australians can use smart phone apps to contribute to biosecurity. Examples are FarmBiosecurity, which helps a user to create a biosecurity plan for their property, and MyPestGuide Reporter which sends images of plant pests or symptoms directly to the WA government diagnostics service for identification.

Chapter 8

Plant biosecurity RD&E

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

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

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

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

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

The data for 2017 provides an overview of all plant, weed and pollinator RD&E in Australia, with a summary of where it was carried out, the size, the topic, pest and crop types*. Surveillance programs that include some research or extension activities are also included, as are some training and awareness programs.

* Every year, the methods used to collect data for this chapter improve incrementally. While every effort is made to secure accurate data for inclusion in this table, we acknowledge that it is not complete.

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.

There was no overarching framework coordinating research nationally until PHA devised the National Plant Biosecurity RD&E Strategy in 2013 in collaboration with stakeholders around Australia. It was developed 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 established pests as well as those that may enter, emerge, establish or spread within Australia, by strengthening biosecurity RD&E for Australia's plant industries and those dependent on them.

Since 2014, an Implementation Committee comprising 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, PBCRC and the Plant Biosecurity Research Initiative.

The National Plant Biosecurity RD&E Strategy Implementation Committee is chaired by PHA and receives administrative support from PHA to drive the agenda and to host workshops focusing on particular biosecurity issues. It reports to the AGSOC Research and Innovation Committee.

It is funded by Hort Innovation, the Victorian 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 Research Australia, AgriFutures, Wine Australia and Forest and Wood Products Australia.

In 2017, the committee held a workshop at AgriBio in Melbourne. The workshop was attended by governments, industry and RDCs and covered the policy implications of plant pest diagnostics and RD&E. More workshops will be held in 2018.

Image courtesy of the Plant Biosecurity CRC

Australian Government agencies and statutory authorities

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

AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURAL RESEARCH

aciar.gov.au

The Australian Centre for International Agricultural Research (ACIAR) was established to help address agricultural problems in developing countries, and to commission collaborative research-for-development, 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, regional monitoring and management and the reduction of poverty, thereby enhancing regional security.

ACIAR's biosecurity projects adopt various approaches and are spread across several program areas, including horticulture, agricultural systems, crop improvement and management and forestry.

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

The Centre for Fruit Fly Biosecurity Innovation

fruitflyittc.edu.au

The Centre for Fruit Fly Biosecurity Innovation co-ordinates research and research training cross three universities, Macquarie University, Queensland University of Technology, and Western Sydney University, and four Partner Organisations: New Zealand Institute for Plant & Food Research, CSIRO, NSW Department of Primary Industries, Queensland Department of Agriculture and Fisheries, and Ecogrow Environmental Ltd.

With a focus on research training, the Centre for Fruit Fly Biosecurity Innovation supports research fellows and PhD students, who are distributed across and move freely between participating organisations.

Research activities of the Centre are supported by a grant of $3.7 m from the Australian Research Council's Industrial Transformation Training Centre program, with supplementary support from NSW Trade and Investment's Research Attraction and Acceleration Program.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

csiro.au

The Commonwealth Scientific and Industrial Research Organisation (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.

PLANT INNOVATION CENTRE

In November 2017, a new Plant Innovation Centre was launched at the Mickleham Post-Entry Quarantine facility near Melbourne's Tullamarine Airport.

The purpose of the new facility, known as PIC@PEQ, is to develop innovations that improve Australia's capacity to address current and anticipated plant biosecurity risks, ensuring the nation has modern, effective plant biosecurity systems in place to combat any incursion.

The centre's research team consists of a steering board, which will determine priority operational projects based on operational challenges, and departmental scientists, who will collaborate with various external scientists and other biosecurity stakeholders to deliver on the agreed projects.

State and territory governments

Most of Australia's state and territory departments of agriculture have dedicated RD&E divisions that undertake research, including aspects of plant biosecurity that are a priority for that jurisdiction. These organisations carry out a significant proportion of Australia's agricultural RD&E. A smaller proportion of projects are undertaken by botanic gardens in some states. Research projects are done to meet state and territory government needs, as well as projects commissioned by commercial clients.

Doctor Sarah Collins, nematologist, in a sterile working environment in the Plant Pathology Laboratory in South Perth. Image courtesy of the Department of Primary Industries and Regional Development

Seed analysts conducting tests. Image courtesy of the Department of Primary Industries and Regional Development

Image courtesy of the Plant Biosecurity CRC

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.

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 and social analysis, modelling and agricultural engineering.

PBCRC is a collaborative venture with 27 government, industry and research participants from: the Department of Agriculture and Water Resources; the Bio-Protection Research Centre New Zealand; CAB International; CBH Group; Charles Darwin University; CSIRO; the Department of Primary Industries and Regional Development, 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.

A key strength of the PBCRC is the involvement of the above participants who are, in many cases, end-users of the research. This ensures maximum benefit and impact in the delivery of project outputs, development of new products and services and capture of intellectual property. Visit **pbcrc.com.au** for more information on where and how the research has benefited national and international biosecurity objectives.

PBCRC concludes in July 2018 after a six-year term. It followed on from the Cooperative Research Centre for National Plant Biosecurity, which began operating in November 2005.

Image courtesy of Damian Herde, Plant Biosecurity CRC

Detecting phosphine resistant insects

The Plant Biosecurity Cooperative Research Centre with Kansas State University undertook research to find out which insects in Australia are becoming resistant to phosphine, a pesticide used extensively in grain silos. Phosphine resistance is a critical issue for the grains industry and represents a major threat to lucrative export markets.

The research has delivered a range of improvements for the grains industry including the development of a world-first molecular test and a re-structuring of the national insect resistance survey based on new diagnostic tools. This places Australia as world leaders in understanding the genetic basis of resistance. Additionally, a 'quick-test' developed by the team provides same-day advice to industry enabling a rapid response and eradication of pests with a high level of resistance.

The recommendations from this research form the basis of major pest and resistance management strategies across Australia, including the nationally agreed 'Phosphine Resistance Management Strategy'.

Due to the strategy the frequency of strong resistance to phosphine in key pests in Australian grain is, by global standards very low at 10 per cent, a level necessary for Australia to remain globally competitive. This success supports Australia's efforts to maintain a nil tolerance for live insect exports, the highest standard in the world.

Discussions with key end-users (GRDC and bulk handlers) with regards to a formal agreement are ongoing with the potential to transition the resistance monitoring to a self-sustaining model beyond the life of the CRC.

PBCRC research is helping the grains industry to monitor for and manage insect resistance in grain storages. Image courtesy of the Department of Agriculture and Fisheries Queensland

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 2017, 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.

AGRIFUTURES AUSTRALIA

agrifutures.com.au

The vision of AgriFutures Australia is to grow the long-term prosperity of Australian agriculture through research and development, knowledge and understanding that fosters innovative, adaptive and valuable rural industries.

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

- Incursion risk analysis.
- Biosecurity planning.
- Pest management.
- Weed management.
- Resistance breeding.
- Adoption of knowledge.

COTTON RESEARCH AND DEVELOPMENT CORPORATION

crdc.com.au

The Cotton Research and Development Corporation (CRDC) is a partnership between the Australian Government and the Australian cotton industry. CRDC's role is to invest in RD&E on behalf of cotton growers and the government, with the outcomes boosting the productivity and profitability of the Australian cotton industry. RD&E, and its resulting innovations, are a key driving force behind the cotton industry's continued success.

In 2016–17, the CRDC invested $24.1 million into 350 RD&E projects in collaboration with 122 research partners, across five key program areas: farmers, industry, customers, people and performance. Biosecurity is a key focus of the CRDC's investment under the industry program, with a key goal being a cotton industry capable of managing its biosecurity responsibilities. CRDC supports RD&E that contributes to improved biosecurity surveillance, preparedness and awareness throughout the cotton industry.

FOREST AND WOOD PRODUCTS AUSTRALIA

fwpa.com.au

Forest and Wood Products Australia (FWPA) is an industry service company that provides a nationally integrated strategy to increase demand for forest and wood products and reduce the impediments to their supply. 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 Grains Research and Development Corporation (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.

The 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.

HORTICULTURE INNOVATION AUSTRALIA

horticulture.com.au

Horticulture Innovation Australia (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.

SUGAR RESEARCH AUSTRALIA

sugarresearch.com.au

Sugar Research Australia (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.

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.

THE PLANT BIOSECURITY RESEARCH INITIATIVE

pbri.com.au

The Plant Biosecurity Research Initiative (PBRI) is a partnership between the nation's seven plant RDCs, working collaboratively with the Department of Agriculture and Water Resources, industry, state and federal biosecurity stakeholders and PHA. It was established in 2017 to minimise the damaging consequences of established and exotic pests, diseases and weeds that affect Australia's plant industries, community and the environment.

In 2015–16, the plant RDCs collectively invested $62.9 million into biosecurity research, development and extension. A coordinated approach ensures that this effort is aligned to broader national goals and delivered with increased efficiency, avoiding duplication of effort .

The aim of the initiative is to support cross-sectoral RD&E, deliver vital projects and attract further co-investment. Cross-sectoral collaborative RD&E refers to activities that are relevant to two or more RDCs, which may include research on pests that affect a broad range of plants and platform technologies or areas of research that are applicable to multiple industries.

The Plant Biosecurity Research Initiative was established for three years, with a mid-term review and option to renew. Research is developed to contract by a single lead RDC with co-investment from others.

Six key focus areas have been agreed for the initiative, taking into consideration:

- Seven RDC priorities and strategies
- National Biosecurity Committee priorities
- RD&E priorities from a 2016 AGSOC Research and Innovation (R&I) Forum
- The National Plant Biosecurity Strategy and the National Plant Biosecurity RD&E Strategy
- The Department of Agriculture and Water Resources Plant Biosecurity priorities
- The 2017 Intergovernmental Agreement on Biosecurity review and the Australian Academy of Science Decadal Plan for Australian Agricultural Sciences 2017–26.

The six key focus areas are:

- Preparedness
- Diagnostics
- Surveillance
- Sustainable management of pests, diseases and weeds
- Capability building
- Industry resilience.

More information, including freely available reports arising from the majority of PBRI projects can be found at **pbri.com.au**.

University and private research institutes

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

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

CENTRE OF EXCELLENCE FOR BIOSECURITY RISK ANALYSIS

cebra.unimelb.edu.au

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

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

The key point of difference between CEBRA and other academically focused research providers is the close engagement with stakeholders from conception through implementation to review. CEBRA researchers have learned that the traditional arm's length server–client relationship leads to shallow and sometimes impractical outcomes. CEBRA's outcomes are almost always in the public domain, and freely available.

CEBRA engages in international collaborative research with organisations in New Zealand and the United States, and has international linkages with other nations, including Canada and the United Kingdom. CEBRA has collaborated with a wide range of state and national organisations, including the NSW Department of Primary Industries; the Victorian Department of Economic Development, Jobs, Transport and Resources; the Office of Transport Security; the Clean Energy Regulator; Energy Safe Victoria; Chevron; the Department of Home Affairs; the Department of Primary Industries and Regions, South Australia; the Northern Territory Department of Primary Industry and Resources; the West Australian Department of Primary Industries and Regional Development; AgResearch New Zealand; Plant and Food Research New Zealand; the Cawthron Institute; and Scion.

CEBRA was created in 2013 by deeds between the Australian Government Department of Agriculture and Water Resources, New Zealand's Ministry for Primary Industries and the University of Melbourne. The CEBRA deeds will expire in 2021. CEBRA's predecessor was ACERA, the Australian Centre of Excellence for Risk Analysis, which ran from 2006–13.

Plant biosecurity RD&E projects in 2017

In 2017, a substantial amount of RD&E that benefits plant biosecurity occurred across Australia.

PHA was able to access data from additional research organisations this year. This chapter contains details of over 700 projects, more than in previous years.

Figures 93–97 present the research projects by pest type, research type, project value, biosecurity area and affected crop type to give some indication of how research budgets are spent in Australia.

Research projects covered the spectrum of crops and pest types relevant to Australian plant production industries and the natural environment. The highest proportion of projects were categorised as pest management.

Table 58 gives a complete listing of plant biosecurity related research projects that were active during 2017.

Figure 94. RD&E projects by research type or location

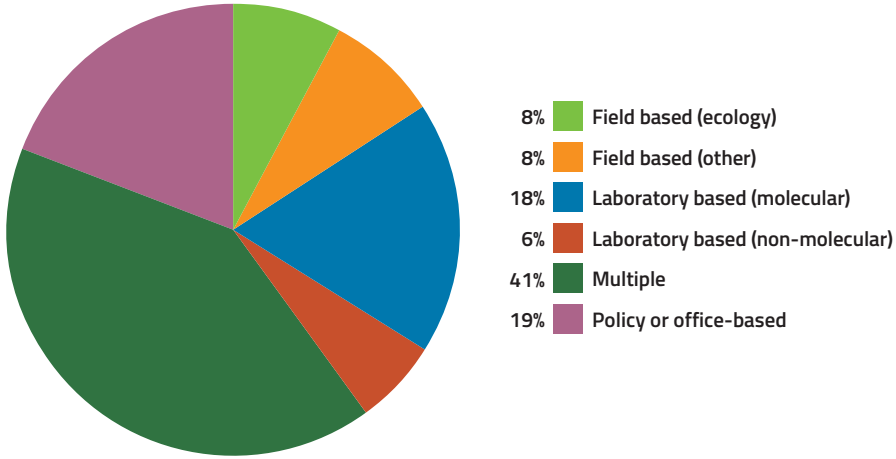


Figure 93. RD&E projects by pest type

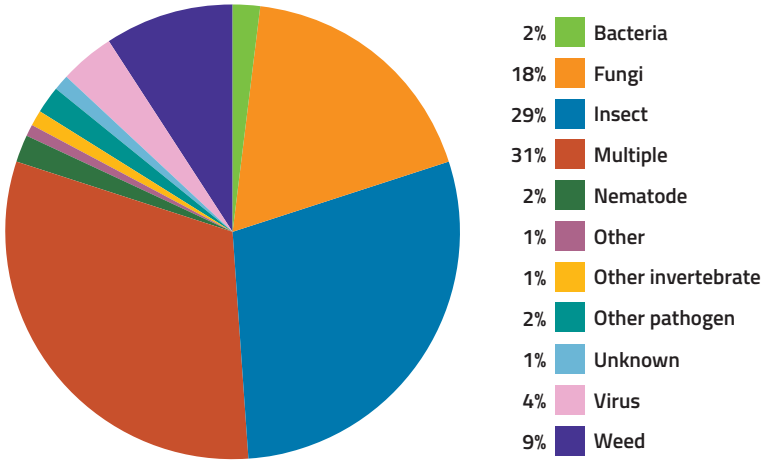


Figure 95. RD&E projects by project value

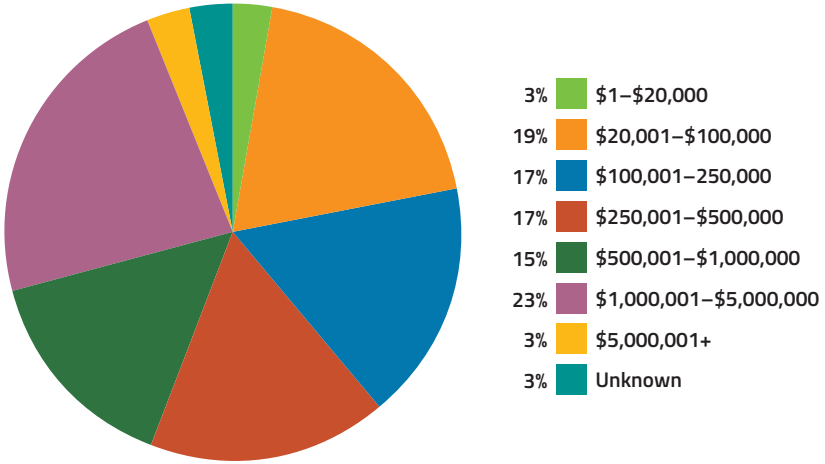


Figure 96. RD&E projects by biosecurity areas

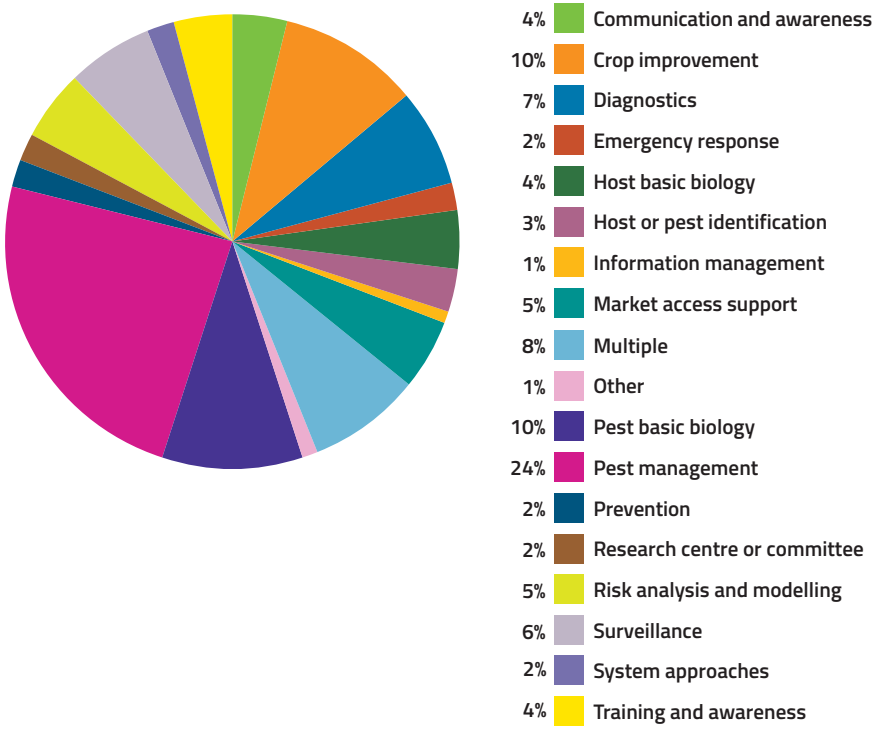


Figure 97. RD&E projects by crop type

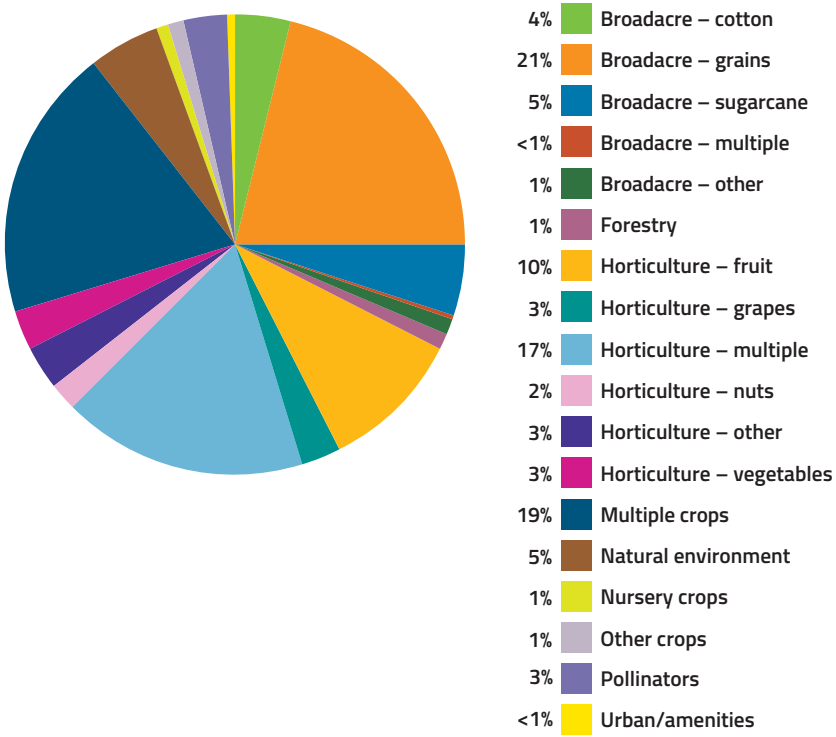


Table 58. Plant biosecurity RD&E projects

Project title	Organisation undertaking the research	Funding source
Broadacre – cotton		
Application of molecular tools to monitoring for resistance alleles in Helicoverpa	CSIRO	CRDC, Monsanto
Biology of *Amarathus hybridus*, *A. mitchelli* and *A. powelii* (PhD)	University of Queensland	CRDC
Biosecurity training scenario	PHA	CRDC
Crop protection development specialist	QDAF	CRDC, QDAF
Developing the weed control threshold (PhD)	NSW DPI	CRDC, NSW DPI
Electrophysiological and molecular identification of novel biopesticides (PhD)	Western Sydney University	CRDC
Enhancing integrated pest management in cotton systems	CSIRO	CRDC, CSIRO
Establishing southern cotton – integrated pest management	NSW DPI	CRDC, NSW DPI
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
Improving the management of cotton diseases in Australian cotton farming systems	QDAF	CRDC, Wine Australia, QDAF
Innovative solutions to cotton diseases	NSW DPI	CRDC, NSW DPI
Management of mirids, stinkbugs and Solenopsis mealybug	QDAF	CRDC, QDAF
Managing *Bt* resistance and induced tolerance in Bollgard III using refuge crops	CSIRO	CRDC
Managing Verticillium risk for cotton	NSW DPI	Wine Australia, CRDC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Mirid and mealybug management best practice	QDAF	CRDC, QDAF
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 biosecurity/disease extension and central Queensland regional extension	QDAF	CRDC, QDAF
National cotton extension development and delivery – stewardship of biotechnologies	CRDC	CRDC
Novel approaches to silverleaf whitefly	University of Queensland	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
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
Understanding the ecology of reniform nematodes in cotton	QDAF	CRDC, QDAF
Verticillium wilt assessments using drones	WA Aerial Mapping	CRDC
Viruses, vectors and endosymbionts – exploring interactions for control	University of Queensland	CRDC, Greenwich University (England), University of Queensland
Broadacre – grains		
Accelerating the utilisation and deployment of durable adult plant resistance to leaf rust in barley	University of Sydney	GRDC
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	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 (USA), University of Cukuorva (Turkey)	GRDC
Australian Cereal Rust Control Program – towards 2019 and a century of monitoring cereal rust pathogens in Australia	University of Sydney	GRDC
Australian Cereal Rust Control Program 3 – durable genes	University of Sydney	GRDC
Australian Cereal Rust Control Program 3 – molecular genetics	CSIRO	GRDC
Australian Cereal Rust Control Program 3 – national breeding support	University of Sydney	GRDC
Australian Cereal Rust Control Program 3 – rust surveillance	University of Sydney	GRDC
Australian herbicide resistance initiative – phase 5	University of Western Australia, QDAF	GRDC
Australian wheat and barley molecular marker program	DEDJTR	Univerity of Adelaide, GRDC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Broadacre – grains (continued)		
Australian wheat and barley molecular marker program – genetic analysis	University of Adelaide	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
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, DEDJTR
Characterising structural variation in the canola genome	University of Western Australia	ARC
Chemical residues of stored grain	Murdoch University	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
Control of chickpea pathogens	Flinders University	Flinders University
CSIRO snail biocontrol revisited – phase 2	CSIRO	GRDC
Delivering a collaborative monitoring program with industry to manage and facilitate trade	NSW DPI, QDAF, WA DPIRD	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, Chinese Academy of Grain, Cytec Industries (USA)
Developing new diagnostic tools for *Trogoderma* spp. by using solid phase micro extraction, gas chromatography, mass spectrometry and visible near infrared hyperspectral imaging (PhD)	Murdoch University	Government of Iraq
Developing tools for in-field surveillance of pathogens	SARDI	PBCRC
Developing whole genome sequence resources for fungal pathogens of lupin	University of Western Australia	Curtin University
Development and implementation of biosensors for botrytis grey mould causal species affecting temperate legumes	Griffith University	NSW DPI, GRDC
Development of gene deployment strategies – using evolutionary principles to optimise the deployment of genetic resistance in crops	CSIRO	GRDC
Development of genetic tools for Australian barley crops against leaf rust	University of Sydney	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
Diagnostic services for pulse germplasm enhancement and breeding program	DEDJTR	GRDC, DEDJTR
Disease screening 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
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	WA DPIRD	GRDC
Emerging foliar diseases of canola	University of Western Australia	GRDC
Enhancing resistance to wheat stripe rust disease	Australian National University	ARC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Establishing the international mungbean improvement network	Asian Vegetable Research and Development Centre, QDAF	ACIAR
Evaluating chlorine dioxide (PhD)	Kansas State University (USA)	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
Extension and engagement	Curtin University	GRDC
Fungal pathogenomics and bioinformatics	Curtin University	GRDC
Fungicide resistance group	Curtin University	GRDC
Fungicide resistance management strategy and communications	Curtin University	GRDC
Fungus and rust red flour beetles – identifying the fungal volatiles attractive to *Tribolium castaneum* (PhD)	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 rotational crops have on nematode numbers in the soil	University of Adelaide, University of Southern Queensland	GRDC
Germplasm enhancement for yellow spot resistance	DEDJTR	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Broadacre – grains (continued)		
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 e-surveillance project	WA DPIRD	Royalties for Regions, WA DPIRD
Grain storage extension	QDAF	GRDC
Grain weeds advisory committee	Rural Directions Pty Ltd	GRDC
Grains farm biosecurity program	PHA	Grain Producers Australia
Harnessing wheat plant microbiome for drought tolerance and improved productivity in Australian and Indian environments	Flinders University	Department of Industry, Innovation and Science (Australia–India Strategic Research Fund)
Harvest weed seed control for the southern region	Southern Farming Systems	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
Identification of sources of resistance to wheat blast and their deployment in wheat varieties adapted to Bangladesh	CIMMYT	ACIAR
Impacts of host resistance on disease-induced yield loss	DEDJTR	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
Improved diagnostic methods for khapra beetle	WA DPIRD, Murdoch University	WA DPIRD
Improved farming systems	Curtin University	GRDC
Improved fungicide use for cereal rust control	Foundation for Arable Research (NZ)	GRDC
Improved resistance to oat pathogens and abiotic stress management	SARDI	GRDC
Improve genetic solutions management of yellow spot in wheat	WA DPIRD, University of Southern Queensland	GRDC
Improving grower surveillance management, epidemiology knowledge and tools to manage crop disease	University of Southern Queensland, GRDC, QDAF	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 on 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
Insect tolerant chickpea for Bangladesh	CSIRO	ACIAR
Integrated genetic solutions to crown rot in wheat	University of Sydney, QDAF, CSIRO, University of Southern Queensland	GRDC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Investigation of new control options for phosphine resistant pests of stored grain	University of Queensland, QDAF, DEDJTR	PBCRC, University of Queensland, QDAF, DEDJTR
Linking crop protection, weeds and native vegetation management – on the ground, natural resource management action to benefit grain growers	CSIRO	GRDC
Maintaining a barley pre-breeding capability in Queensland	QDAF	GRDC
Managing crop disease – improving chickpea pathogen resistance	NSW DPI	GRDC
Managing crop disease – 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
Mitigating the effects of wheat blast in Bangladesh and beyond	CIMMYT	ACIAR
National barley foliar pathogen variety improvement program	QDAF, Australian National University, SARDI, DEDJTR, WA DPIRD, NSW DPI, University of Adelaide, University of Southern Queensland, University of Tasmania	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
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, DEJTER, WA DPIRD	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
National improved molecular diagnostics for disease management	GRDC, SARDI, WA DPIRD, NSW DPI, DEDJTR, University of Southern Queensland	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
National nematode epidemiology and management program	GRDC, DEDJTR, NSW DPI, SARDI, WA DPIRD, University of Southern Queensland	GRDC, DEDJTR
National pathogen management modelling and delivery of decision support	GRDC, WA DPIRD, Marcroft Grains Pathology Pty Ltd, NSW DPI, SARDI, DEDJTR, University of Southern Queensland, QDAF	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
National variety trials – disease screening	DEDJTR	GRDC
National variety trials – service agreement	GRDC, University of Southern Queensland, QDAF	GRDC
Net blotch of barley	Curtin University	GRDC
Network analysis of post-border pest spread (PhD)	Lincoln University (NZ)	PBCRC
New discriminatory diagnostic protocols for exotic khapra beetle (*Trogoderma granarium*) to aid early detection and future-proof market access	WA DPIRD	Royalties for Regions
New knowledge to improve the timing of pest management decisions in grain crops	CSIRO	GRDC
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

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Broadacre – grains (continued)		
New tools for field grains surveillance and diagnostics of high priority exotic pests	SARDI, QDAF, DEDJTR	GRDC, PBCRC
New uses for existing chemistry	Southern Farming Systems	GRDC
New Zealand rust pathotype survey	NSW DPI	PBCRC
Non-chemical method for stored grain (PhD)	Murdoch University	PBCRC
Non-chemical technologies to protect grain (PhD)	Kansas State University (USA)	PBCRC
Northern NSW integrated disease management	NSW DPI	GRDC
Northern pulse and grains integrated pest management	QDAF	GRDC
Pathways to registration – minor use	AKC Consulting Pty Ltd	GRDC
Phosphine distribution modelling (PhD)	Kansas State University (USA), WA DPIRD	PBCRC
Phosphine resistance	Murdoch University	WA DPIRD
Powdery mildew of barley	Curtin University	GRDC
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 Centre 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
Protein trafficking pathways in fungal rust pathogens of plants	Australian National University	ARC
Pulse breeding Australian faba bean breeding	University of Adelaide, SARDI, University of Sydney, NSW DPI	GRDC
Pulse pathology and genetics	Curtin University	GRDC
Rapid detection and diagnosis of plant pathogens	Australian National University	Hermon Slade Foundation
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
Russian wheat aphid incursion	DEDJTR	SARDI, GRDC
Sclerotinia stem rot of canola	Curtin University	GRDC
Septoria nodorum blotch of wheat	Curtin University	GRDC
Smart-trap design and deployment strategies (PhD)	Kansas State University (USA)	PBCRC
Smart use of fertilisers to minimise and manage the risk of pest infestations in growing canola	University of Western Australia	GRDC
Surveillance of herbicide resistant weeds in Australian grain cropping	Charles Sturt University, University of Western Australia	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
Triple rust resistance 1	CSIRO	GRDC
Triple rust resistance 2	CSIRO	2Blades Foundation (USA)
Two new phytotoxins in *Septoria nodorum* blotch – biosynthesis and functions	University of Western Australia	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

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Virus threats – new tools and germplasm for Australian pulse and oil seeds breeding programs	DEDJTR	GRDC, WA DPIRD, NSW DPI, SARDI, QDAF, University of Western Australia, DEDJTR
Weed surveillance	QDAF	GRDC
White grain disorder in wheat	SARDI	GRDC
Yellow spot of wheat	Curtin University	GRDC
Yield loss response curves for host resistance to leaf, crown and root diseases in wheat and barley	WA DPIRD, QDAF	GRDC
Zea mays model and *Phytophthora cinnamomi*	Deakin University	Australian Government

Image courtesy of Barry Large, Grain Producers Australia

Project title	Organisation undertaking the research	Funding source
Broadacre – sugarcane		
Advancing yield, disease resistance and ratooning by exploiting new sources of genetic variability from wild relatives of sugarcane	SRA	SRA, QDAF
A novel polyphasic framework to resolve the yellow canopy syndrome paradox	Western Sydney University	SRA, QDAF
Bioprospecting for beneficial endophytes of sugarcane	AgResearch Ltd (NZ)	SRA
Delivering solutions for chlorotic streak disease	SRA	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
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, diagnostics, training and technical advice – Tully	SRA	SRA
General pathology, diagnostics, training and technical advice – Woodford	SRA	SRA
General pest management – central Queensland	SRA	SRA
General pest management – north Queensland	SRA	SRA
General pest management – south Queensland	SRA	SRA
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with existing product	SRA	SRA, QDAF

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Broadacre – sugarcane (continued)		
Improving sugarcane pest management through cross industry deployment of smart sensors, diagnostics and forecasting	SRA	SRA, DAWR
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
Keeping our chemicals in their place – in the field	James Cook University	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
Mesostigmatid mites as predators of nematodes in sugarcane soils – ecology, food preferences and biocontrol potential (PhD)	University of the Sunshine Coast	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
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 industry 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 Paupa New Guinea biosecurity threats	SRA	SRA, QDAF, Ramu–AI
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 leaf sheath biopsy PCR diagnostics 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
Broadacre – multiple		
Benchmarking and managing soil herbicide residues for improved crop production – developing antigen for Clorpyralid	Monash University	GRDC
Validating the use of Bacillus for biocontrol	University of Southern Queensland, New Edge Microbials	New Edge Microbials, Department of Industry, Innovation and Science
Broadacre – other		
Herbicide resistance in rice	Charles Sturt University	AgriFutures Australia
Hydrophobin proteins on the fungal frontline	University of Sydney	ARC
Improved subterranean clover seed production from multiple disease resistance	University of Western Australia	AgriFutures Australia
Knowledge transfer and uptake of new practices for pest management in irrigated rice	Charles Darwin University	PBCRC
Potential exotic virus threats to lucerne seed production in Australia	University of Queensland	AgriFutures Australia, University of Queensland
Rice pest and disease biosecurity II	NSW DPI	AgriFutures Australia, NSW DPI

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Forestry		
A model system for the discovery and development of biocontrol agents against forest pests	University of the Sunshine Coast	FWPA, DAWR, University of the Sunshine Coast, NSW DPI, Forestry Tasmania
Asian gypsy moth – national surveillance program	QDAF	QDAF
Biological control of galling pests of eucalypt plantations in the Mekong region	University of the Sunshine Coast, QDAF	ACIAR
Dispersal modelling of invasive forestry pest species	DEDJTR	DEDJTR
Ethanedinitrile – a potential replacement for the fumigant methyl bromide for eradication of pests in *Pinus radiata* export logs	Stakeholders in Methyl Bromide Reduction Incorporated (NZ)	PBCRC
Evaluating the costs and benefits of managing new and existing biosecurity threats to Australia's plantation industry	University of the Sunshine Coast	FWPA, University of the Sunshine Coast, NSW DPI, Forestry Tasmania
Management strategies for Acacia plantation diseases in Indonesia and Vietnam	University of Tasmania, University of the Sunshine Coast, NSW DPI, VAFS, Gadjah Mada University (Indonesia), Forest Research and Development Agency (Indonesian government)	ACIAR
National Forest Biosecurity Surveillance Strategy	Forest Health and Biosecurity Subcommittee, PHA	DAWR (Agricultural Competitiveness White Paper)
National Forestry Biosecurity Surveillance Program	PHA	DAWR (Agricultural Competitiveness White Paper)

Project title	Organisation undertaking the research	Funding source
Horticulture – fruit		
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	Hort Innovation
Alternative quarantine treatment for bananas infested with coffee bean weevil	QDAF	Hort Innovation
An inventory of *Colletotrichum* species infecting tropical and subtropical fruit crops in Australia based on molecular phylogenetics	QDAF	DEE (Australian Biological Resources Study)
Auscitrus horticultural project	NSW DPI	Collaborative Research
Australian lychee industry communication program	Australian Lychee Growers Association	Hort Innovation
Avocado industry biosecurity capacity building	University of Queensland	Hort Innovation
Banana blood disease	NT DPIR	Modern Diagnostic
Banana strategic industry development	Australian Banana Growers' Council	Hort Innovation
Biological control of yellow scale insect *Aonidiella orientalis* (Newstead)	Murdoch University	Government of Iraq
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
Cherry export readiness and market access	Cherry Growers Australia	Hort Innovation
Coordination of banana industry R&D – Panama TR4	Australian Banana Growers' Council	Hort Innovation
Data packages to support market access for additional citrus varieties to Japan	SARDI	Hort Innovation

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – fruit (continued)		
Detection and prevention of scab disease in Asian and European pears (PhD)	La Trobe University	PBCRC, La Trobe University
Developing US market access based on irradiation and methyl bromide	NSW DPI	Hort Innovation
Development of effective and sustainable disease management for blueberry production in Australia	NSW DPI	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
Enhancing Australia's capability and capacity to diagnose *Fusarium oxysporum* f. sp. *cubense* tropical race 4	NSW DPI	PBCRC
Exploring alternatives for managing Phytophthora root rot in avocado	University of Queensland	Hort Innovation
Facing Fusarium – better banana biosecurity	QDAF	Hort Innovation
Feasibility of biocontrol of European blackberry with the sawfly	DEDJTR, CSIRO	Australian Government, Meat and Livestock Australia, DEDJTR
Fusarium wilt of watermelon in Australia – biology and management	Royal Botanic Garden Sydney, University of Sydney, NT DPIR, NSW DPI	Royal Botanic Garden Sydney, Hort Innovation
Fusarium wilt tropical race 4 – biosecurity and sustainable solutions	QDAF	Hort Innovation
Fusarium wilt tropical race 4 research program – 1	QDAF	Hort Innovation
Fusarium wilt tropical race 4 research program – 2	University of Queensland	QDAF, Hort Innovation
Host-pathogen interactions in the Venturia–Pyrus pathosystem	La Trobe University	PFRNZ
Implementation of recommendations from the avocado industry nursery voluntary accreditation scheme review	Nursery and Garden Industry Australia	Hort Innovation
Improved management of charcoal rot strawberry	QDAF	Hort Innovation
Improved plant protection for the banana industry	QDAF	Hort Innovation
Improvement of banana for small holder farmers in the Great Lakes region of Africa	University of Queensland	International Institute for Tropical Agriculture (Nigeria)
Improving avocado orchard productivity through disease management	Murdoch University	Hort Innovation
Improving avocado orchard productivity through disease management	University of Queensland	Hort Innovation
Improving biosecurity preparedness of the Australian citrus industry	PHA, Citrus Australia	Hort Innovation
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 management of yellow sigatoka	Australian Banana Growers' Council	Hort Innovation
Integrated pest management of redberry mite, *Acalitus essigi*, on blackberries	University of Tasmania	Hort Innovation
Investigating tree mortality during early field establishment	University of Queensland	Hort Innovation
Joint Florida and Australia citrus black spot initiative	University of Queensland	Hort Innovation
Maximum residue limit risk analyses and risk management options for major citrus export markets	AKC Consulting Pty Ltd	Hort Innovation
Melon industry biosecurity	Dianne Fullelove & Associates Pty Ltd	PHA

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Mid-term review of banana bunchy top program	Murdoch University	Hort Innovation
Monitoring mangoes through the supply chain to the United States	NT DPIR	Hort Innovation
Multi-scale monitoring tools for managing Australian tree crops – industry meets innovation	QDAF	University of Queensland, University of Central Queensland, University of New England, University of Sydney, Avocados Australia, Simpson Farms, Australian Mango Industry Association, Australian Macadamia Society, QDAF, AGTRIX Ltd, 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 – Queensland	Barry Sullivan	Hort Innovation
National citrus biosecurity surveillance program	PHA, Citrus Australia	DAWR (Agricultural Competitiveness White Paper)
National passionfruit breeding program	Southern Cross University	Hort Innovation
Panama disease – longitudinal analysis of community wellbeing	CSIRO	CSIRO
Pest status and management of six spotted mite, *Eotetranychus sexmaculatus*, in WA avocado orchards	Western Australian Agriculture Authority	Hort Innovation
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, Citrus Australia	Hort Innovation
Protecting Australian citrus germplasm through improved diagnostic tools	NSW DPI	Hort Innovation
Protecting Australia's citrus genetic material	Auscitrus, NSW DPI	Hort Innovation
Review host status of cherries for codling moth	Applied Horticultural Research Pty Ltd	Hort Innovation
Review of the national biosecurity plan for the banana industry	PHA	Hort Innovation
Review of the national biosecurity plan for the cherry industry and development of a biosecurity manual for cherry producers	PHA	Hort Innovation
Strengthening the banana industry diagnostic capacity	University of Queensland	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	Australia Pacific Science Foundation
The cause and management of crown rot of banana	QDAF	Hort Innovation
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
Treatment for mites on lychee fruit after irradiation for improved market access	QDAF	Hort Innovation
United States market access project continuation	Australian Lychee Growers Association	Hort Innovation

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – grapes		
Adaptive area-wide management of Queensland fruit fly using SIT – guidelines for efficient and effective pest suppression and stakeholder adoption	CSIRO, DEDJTR	Hort Innovation, RDCs, CSIRO, DAWR (Rural Research and Development for Profit)
A generic approach to improving spray coverage	University of Queensland	Wine Australia
Biosecurity management activties for the wine grape industry	Australian Wine Research Institute	Australian Vignerons
Cold disinfestation verification trials for table grape access to Japan	WA DPIRD	Hort Innovation
Coonawarra rootstock trial	Vinehealth Australia, Treasury Wine Estates, Coonawarra Vignerons	Vinehealth Australia, Treasury Wine Estates, Coonawarra Vignerons
Desktop review to inform a national approach to grape phylloxera managment	Australian Vignerons, Retallack Viticulture	DAWR
Developing a threat-specific contingency plan for the exotic pest angular leaf scorch	SARDI, Cornell University (USA)	Wine Australia
Evaluating and demonstrating new resistant varieties for warm irrigated regions	CSIRO	Wine Australia
Grapes e–surveillance project	WA DPIRD	Royalties for Regions, WA DPIRD
Identification and marker-assisted selection of genes for reducing the susceptibility of new wine grape cultivars to fungal pathogens	CSIRO	Wine Australia
Integrated management of established grapevine phylloxera	DEDJTR	Wine Australia
New rootstocks for Australian conditions	CSIRO	Wine Australia
Phylloxera rootstock screening	DEDJTR	CSIRO
Project boundary rider	Vinehealth Australia	Vinehealth Australia, PIRSA
Responsible visitation campaign	Vinehealth Australia	PIRSA, South Australian Wine Industry Association, Winemakers Federation of Australia, Vinehealth
Risks and management of exotic and endemic Phylloxera	DEDJTR	Wine Australia, DEDJTR
Sampling strategies for sensitive, accurate and cost effective detections of Phylloxera for quantifying area freedom status	Vinehealth Australia, SARDI, University of Adelaide, PIRSA, DEDJTR, NSW DPI, PFRNZ, Rho Environmetrics	PBCRC, Wine Australia, Vinehealth Australia, SARDI
Scoping study – development of a biosecurity IT platform for the wine industry	Vinehealth Australia	Vinehealth Australia
Spore trapping technologies for botrytis and powdery mildew DNA testing	SARDI, Australian Wine Research Institute	Wine Australia
Surveillance of South Australia for Phylloxera	Vinehealth Australia	Vinehealth Australia
Towards elite mildew resistant selections suitable for industry use	CSIRO	Wine Australia
Understanding factors leading to sooty mould	Australian Wine Research Institute	Wine Australia
Understanding fungicide resistance in powdery and downy mildew	SARDI	Wine Australia
Understanding the basis of agrochemical resistance in biotrophic grapevine pathogens	Australian Wine Research Institute	Wine Australia

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – multiple crops		
Alternaria on tomato	University of Queensland	University of Queensland
A multi-faceted approach to soil-borne disease management	Applied Horticultural Research Pty Ltd	Hort Innovation
An integrated pest, disease and weed management program for the Australian apple and pear industry	University of Tasmania, DEDJTR	Hort Innovation, DEDJTR, WA DPIRD, University of Tasmania, NSW DPI, QDAF
A novel regulator of growth signalling in Drosophila	Monash University	ARC
A strategic approach to weed management for the Australian vegetable Industry	University of New England	Hort Innovation
Biochemistry of ejaculate-mediated sexual inhibition in Queensland fruit flies (PhD)	Macquarie University	Hort Innovation
Biology, behaviour and population structure of *Fopius arisanus*	NSW DPI	Charles Sturt University
Blends versus pure chemicals – understanding the mechanisms of host fruit location by Queensland fruit fly (Masters)	Queensland University of Technology	PBCRC
Chemical relationships between Queensland fruit flies and their natural enemies (PhD)	Macquarie University	ARC
Cold storage of Queensland fruit fly for mass-rearing programs (PhD)	Macquarie University	Hort Innovation
Combining sterile insect technique in Queensland fruit fly integrated pest managemnt programs (PhD)	Macquarie University	Hort Innovation
Comparisons of new sexing strains of Queensland fruit fly	Macquarie University	International Atomic Energy Agency Cooperative Research Program
Continuation of pilot systems to validate pest free place of production for Queensland fruit fly in the Yarra Valley	DEDJTR	Hort Innovation
Creating a novel lure and kill device for Queensland fruit fly	Queensland University of Technology, QDAF, DEDJTR	PBCRC, DEDJTR
Crop hygiene – hort indexing	DEDJTR	Fee for Services
Decision intelligence determining pest natal origin	NSW DPI, Lincoln University (Bio-Protection Research Centre, NZ), Queensland University of Technology, SARDI, WA DPIRD	PBCRC, PFRNZ
Design and evaluation of targeted biosecurity surveillance systems	University of Western Australia, University of Adelaide, DEDJTR, WA DPIRD, Vinehealth Australia, PFRNZ	PBCRC
Developing an emergency response and longterm management strategy for *Cassava mosaic virus* in Cambodia and Vietnam	International Center for Tropical Agriculture (Colombia)	ACIAR
Development and production optimisation of a male-only selecting, temperature sensitive lethal strain of Queensland fruit fly	University of Adelaide	SARDI
Development of plant biosecurity surveillance protocols for the citrus and mango industries in northern Australia	PHA	DAWR
Diet medicated RNAi sterile insect technology	CSIRO	Hort Innovation
Dynamics of the Queensland fruit fly microbiome under mass-rearing (PhD)	Macquarie University	Hort Innovation
Efficacy of combined female lures for Mediterranean and Queensland fruit fly trapping	DEDJTR	DEDJTR
Essential market access data packages	QDAF	Hort Innovation
Establishment of systems to validate pest free place of productions 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

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – multiple crops (continued)		
Evaluating volatiles from the infected insects as indicators for diagnostic insect health (PhD)	Murdoch University	Government of Iraq
Evaluation of fumigation and cold treatment for fruit fly on post harvest citrus	Murdoch University	Government of Korea (quarantine department)
Evaluation of mating, dispersion and migration between different treated fruit flies by using stable isotope technology (PhD)	Murdoch University	Government of Iraq
Evaluation of natural product extracts for control of vegetable pests (PhD)	Murdoch University	Government of Iraq
Genetic consequences of domestication in the Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Genomic tools to improve molecular diagnostics and control of fruit fly pests	DEDJTR, La Trobe University	DEDJTR
Gut bacteria-mediated physiology in Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Heritability of stress tolerance in Queensland fruit fly (PhD)	Macquarie University	Hort Innovation
Identification and taxonomy of economic crop diseases and their management using biological approaches	University of Queensland	Government of Korea (rural development administration)
Implementing brown sugar flotation for assuring freedom in fruit fly	Applied Horticultural Research Pty Ltd	Hort Innovation
Improved detection and identification of xanthomonads affecting vegetable crops (PhD)	La Trobe University, DEDJTR	PBCRC
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, PFRNZ, NSW DPI, QDAF
Improved soil-borne disease diagnostic capacity for the Australian vegetable industry	SARDI	Hort Innovation
Increasing yield and quality in tropical horticulture with better pollination, fruit retention and nutrient distribution	University of the Sunshine Coast	Hort Innovation
Industrial transformation training centre – Centre for Fruit Fly Biosecurity Innovation	Macquarie University, Western Sydney University, Queensland University of Technology	ARC
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
Integrated crop management to enhance vegetable profitability and food security	NSW DPI, QDAF	ACIAR
Integrated pest and disease management – productivity, irrigation pests and soils II	DEDJTR	Hort Innovation, DEDJTR
International acceptance of Australian solanaceous and cucurbit seed tests	DEDJTR	PBCRC
Investigation into deployment, dispersal and transformation of fruit fly lures (PhD)	Macquarie University	Hort Innovation
Irradiation doses for mites and thrips on fresh produce	NSW DPI	New Zealand Ministry for Primary Industries
LAMP assay for the detection of fruit flies	DEDJTR	DEDJTR
Male-only sterile Queensland fruit fly, SITplus	SARDI	Hort Innovation
Management and detection of bacterial leaf spot in capsicum and chilli crops	QDAF	Hort Innovation
Mating frequency of Queensland fruit fly – a potential constraint on sterile insect technique (PhD)	Macquarie University	Hort Innovation

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Maximum residue limit risk analyses for major export markets of the pome fruit industry	AKC Consulting Pty Ltd	Hort Innovation
Mediterranean fruit fly eradication from Carnarvon using area wide management and sterile insect technique	WA DPIRD	Hort Innovation, Royalties for Regions
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
Methyl bromide disinfection of Queensland fruit fly	NSW DPI	Hort Innovation
Molecular basis of response to sub-lethal stresses	Murdoch University	PBCRC
Molecular basis of sexual performance in Queensland fruit fly (PhD)	Macquarie University	ARC
Molecular characterisation of specimens in the Victorian Plant Pathogen Herbarium to support market access into Asian markets – powdery mildews	DEDJTR, La Trobe University	DEDJTR
Mypolonga fruit fly monitoring – market access program	RDA Murraylands & Riverland Inc	Hort Innovation
National biosecurity plan for the summerfruit industry	PHA	Hort Innovation
National centre for post-harvest disinfestation research on Mediterranean fruit fly	Murdoch University	AgriFutures Australia, Hort Innovation, Kalang Consultancy Services Pty Ltd, QDAF, WA DPIRD
National Fruit Fly Council	PHA	Hort Innovation
National fruit fly RD&E plan	PBCRC	PBCRC
National Mediterranean fruit fly R&D centre	Murdoch University	Hort Innovation
National tomato potato psyllid program coordinator	AUSVEG	Hort Innovation
New and improved fruit fly lures for border security and management	Macquarie University	Hort Innovation
New end-point treatment solutions to control fruit fly	QDAF, NSW DPI	Hort Innovation
New end-point treatment solutions to control fruit fly 1	NSW DPI	Hort Innovation
New end-point treatment solutions to control fruit fly 2	QDAF	Hort Innovation
New in-field treatment solutions to control fruit fly 1	QDAF	Hort Innovation
New in-field treatment solutions to control fruit fly 2	Applied Horticultural Research Pty Ltd	Hort Innovation
Next generation national fruit fly diagnostics and handbook	Queensland University of Technology, QDAF, WA DPIRD, PHA	PBCRC
Non-host status and detection methods for Queensland fruit flies	DEDJTR	DEDJTR
Nutritional immunology of Queensland fruit flies (PhD)	Macquarie University	Hort Innovation
Olfactory relationship between fruit flies and associated bacteria (PhD)	Macquarie University	ARC
Olfactory switch as a mechanisms of Queensland fruit fly sexual inhibition	Macquarie University	Australian Government Department of Education and Training
Perceptions towards biosecurity threats across Vietnamese farming communities in Australia (PhD)	Charles Darwin University	PBCRC
Pheromones as potential fruit fly lures (PhD)	Macquarie University	ARC
Piloting new techniques to control and eradicate Mediterranean fruit fly	WA DPIRD	Royalties for Regions, WA DPIRD
Pilot testing efficacy of post-harvest disinfestation treatments	DEDJTR	DEDJTR
Plant biosecurity diagnostic and surveillance web-based bioinformatics toolkit	Murdoch University	PBCRC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – multiple crops (continued)		
Plant pest surveillance project	DEDJTR	Hort Innovation
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 (PhD)	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
Psyllid microflora – implications for Liberibacter disease surveillance and pest control (PhD)	La Trobe University, DEDJTR	PBCRC
Quality control procedures for Queensland fruit fly mass rearing (PhD)	Macquarie University	Hort Innovation
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
Review of national biosecurity plans for avocados and mangoes	PHA	Hort Innovation
Review of principles and current practices in determination of quarantine exclusion zones	DEDJTR	PBCRC, DEDJTR
Review of the biosecurity plan for the apple and pear industry	PHA	Hort Innovation
Review of the biosecurity plan for the vegetable industry	PHA	Hort Innovation
Risk evaluation and improvements to diagnostics of south eastern Australian fruit flies	DEDJTR	DEDJTR
Scoping for the requirements of a national surveillance strategy for temperate fruit industries	PHA	DAWR (Agricultural Competitiveness White Paper)
Scoping report into the potential biosecurity risks associated with powdery mildews on citrus and mango in northern Australia	University of Southern Queensland	DAWR
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
Strengthened biosecurity for the vegetable industry – phase 2	AUSVEG	Hort Innovation
Suppressing repression of plant defence through viral micro RNA	University of Queensland	University of Queensland (UniQuest)

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
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
The diversity of Ilarviruses infecting Australian Prunus species (PhD)	DEDJTR	Hort Innovation, DEDJTR, La Trobe University
The phenology of fruit fly in subtropical Australia	Queensland University of Technology	Queensland University of Technology
The science underpinning ISPM 37	Queensland University of Technology	Queensland University of Technology
Tomato potato psyllid and Liberibacter ecology	PFRNZ	PBCRC
Training in the development and application of biological control technologies for insect pests and fungal diseases in tropical tree plantations	University of Tasmania	Crawford Fund Limited
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
Horticulture – nuts		
An integrated disease management program for the Australian almond industry	DEDJTR	Hort Innovation
An integrated pest management program for the Australian almond industry	DEDJTR	Hort Innovation
Biological husk spot research	Biocontrol Australia	Hort Innovation
Biology, species, and genetic diversity of macadamia lace bugs (*Ulonemia* spp.)	University of New South Wales	Australian Macadamia Society, Hort Innovation
Communication and adoption program for the Australian chestnut industry	Chestnuts Australia	Hort Innovation, Chestnuts Australia
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	Hort Innovation, Chestnuts Australia
Macadamia integrated disease management	University of Queensland	Hort Innovation
Pathogens and other factors contributing to dark staining on pistachio shells	Ag Etc Pty Ltd	Hort Innovation
Technology transfer to pistachio growers utilising regional grower groups	Pistachio Growers' Association	Hort Innovation, Pistachio Growers' Association
Understanding and managing insects on pistachio orchards	Ag Dynamics Pty Ltd	Hort Innovation

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – other		
An integrated pest and disease management extension program for the olive industry	University of Western Sydney	Hort Innovation
A trial of Vapormate® fumigant for the disinfestation of Australian wildflowers	Cedar Hill Flowers	DAWR
Biology, epidemiology and management of Elsinoe leaf spot in tea tree	NSW DPI	AgriFutures Australia, NSW DPI, Australian Tea Tree Industry Association
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
Determining pathogenicity and methyl bromide control of ginger nematodes	QDAF	AgriFutures Australia
Development of a biosecurity plan for the Australian coffee industry	PHA	AgriFutures Australia
Development of a biosecurity plan for the tea tree Industry	PHA	Australian Tea Tree Industry Association
Development of a pilot mushroom farm disease monitoring scheme	Australian Mushroom Growers' Association	Hort Innovation
Development of a risk management system for systemic downy mildew of poppy	University of Tasmania	ARC
Effective management of summer root rot of parsley	NSW DPI	Hort Innovation
Epidemiology, impact and management of myrtle rust in lemon myrtle plantations (PhD)	University of Queensland	PBCRC
Fusarium oxysporum on ginger	University of Queensland	AgriFutures Australia, QDAF
Improved management strategies for cocoa in Papua New Guinea	University of Sydney	ACIAR
Improved tissue culture production of ginger clean planting material	QDAF	AgriFutures Australia, QDAF
Pest and disease management and research services	University of Tasmania	Hort Innovation
Pests and diseases of truffles and their tree hosts in Australia	WA DPIRD	AgriFutures Australia, Australian Truffle Growers' Association, WA DPIRD, Truffle Producers Western Australia, Australian National University, Truffle and Wine Co.
RD&E for the truffle industry	Australian Truffle Growers' Association	AgriFutures Australia, Australian Truffle Growers' Association
Technical support, extension and minor use development for the ginger industry	Australian Ginger Industry Association	AgriFutures Australia

Image courtesy of the Australian Ginger Industry Association

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Horticulture – vegetables		
Characterisation of a Carlavirus of French bean	QDAF	Hort Innovation
Cucumber green mottle mosaic virus – next generation sequencing	NT DPIR	Subcommittee for Plant Health Diagnostics
Detection and management of bacterial diseases in Australian Allium crops	QDAF	Hort Innovation
Developing improved crop protection options in support of intensification of sweetpotato production in Papua New Guinea	Charles Sturt University, University of Southern Queensland	ACIAR
Development of an onion white root rot forecasting model for Tasmania	University of Tasmania	Hort Innovation
Diagnostic capability to detect *Candidatus* Liberibacter solanacearum	DEDJTR, PFRNZ	Hort Innovation
Disinfestation of tomatoes against Mediterranean fruit fly for interstate market access	WA DPIRD	Hort Innovation
Extension of the Predicta Pt potato diagnostic service	SARDI	Hort Innovation
Fungus resistant crop development	Australian National University	ARC
Improved certification for certified seed potatoes	DEDJTR	DEDJTR
Improved knowledge of factors contributing to carrot rot	Peracto Pty Ltd	Hort Innovation
Improved management of pumpkin brown etch	Applied Horticultural Research Pty Ltd	Hort Innovation
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 sweetpotato industry	Australian Sweetpotato Growers, QDAF	Hort Innovation
Managing soil-borne diseases of onions	SARDI	Hort Innovation
Minor use permits for the onion industry	Hort Innovation	Onions Australia
Novel approaches for root knot nematodes control	Central Queensland University, QDAF, Henderson RDE, Australian Sweetpotato Growers	QDAF, Australian Sweetpotato Growers
Plant viral messenger RNA project – nexgen plants (Syngenta)	University of Queensland	University of Queensland (UniQuest)
Potato virus resistance discovery project	University of Queensland	University of Queensland (UniQuest)
Resolving the critical disease threat to the Western Australian cucurbit industry	WA DPIRD	Royalties for Regions
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
Supporting commercial sweetpotato production and marketing in the Papua New Guinea highlands	Central Queensland University, QDAF, Australian National University, Enterprises, Fresh Produce Development Agency (PNG), National Agricultural Research Institute (PNG), Henderson RDE, Australian Sweetpotato Growers	ACIAR

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Multiple crops		
Access to industry priority uses of agvet chemicals	AgAware Consulting Pty Ltd	AgriFutures Australia, DAWR
Advancing collaborative knowledge systems for plant biosecurity surveillance	CSIRO, Charles Darwin University	PBCRC
Agriculture weed surveillance in the south west to protect industry profitability	WA DPIRD	Royalties for Regions, WA DPIRD
Air inversion modelling to manage spray drift	MicroMeteorology Research and Educational Services	GRDC
Anthracnose diseases (taxonomy)	DEDJTR	University of Melbourne
Anticipating, combating and exploiting the evolution of pesticide resistance in Australian agricultural pests and disease vectors	Australian National University	ARC
Area freedom	PHA	DAWR
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
Assessing the progress against the national plant biosecurity surveillance strategy	PBCRC	DAWR
Australia–Africa plant biosecurity partnership	PBCRC	PBCRC, ACIAR
Australian psyllids – implications for conservation and biosecurity	University of Adelaide	DEE (Australian Biological Resources Study)
Biocontrol feasibility for giant pine scale	DEDJTR	DEDJTR
Biological control of silverleaf nightshade	DEDJTR	DAWR (Rural Research and Development for Profit), AgriFutures Australia, PIRSA, GRDC
Biopesticide use and insect resistance in Australian agriculture	University of Adelaide	ARC
Biosecurity planning	PHA	DAWR (Stronger Biosecurity and Quarantine Initiative)
Biosecurity risk management in Torres Strait and the northern peninsula area	QDAF	DAWR (Stronger Biosecurity and Quarantine Initiative)
Biotic mortality factors of Australian fruit fly across different regions	Western Sydney University	ARC
Black spot of field peas and native legumes in Australia	University of Adelaide, Royal Botanic Garden Sydney	University of Adelaide, Royal Botanic Garden Sydney
Centre for Biopesticides and Semiochemicals – novel insecticides and synergists from endemic and exotic flora	Western Sydney University	CRDC
Characterisation of soil microbial interactions for increased efficacy of herbicides using novel fertiliser management practices	University of Western Australia	ARC
Collaborative planning and shared decision making amongst stakeholders	QDAF	PBCRC
Commercial development and evaluation of a machine vision-based weed spot sprayer	University of Southern Queensland	CRDC, University of Southern Queensland, SRA, Hort Innovation
Compliance based inspection scheme – continuous sampling plan sensitivity analysis	University of Melbourne (CEBRA), University of New England	DAWR
Conventional insecticide resistance in Helicoverpa	NSW DPI	CRDC, NSW DPI
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
Decision making for eradication and quarantine zones	Queensland University of Technology, QDAF, NSW DPI	PBCRC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Defensible resource allocation for plant health surveillance	University of Melbourne (CEBRA)	DAWR
Delivery of an integrated internet based bioinformatics toolkit for plant biosecurity diagnosis and surveillance of viruses and viroids	Murdoch University	PBCRC, Murdoch University, PFRNZ
Deployment of validated, genome-informed bacterial diagnostics	NSW DPI	PBCRC
Determining the value of surveillance in biosecurity risk management	Deloitte Access Economics	DAWR (Agricultural Competitiveness White Paper)
Develop diagnostic keys to genera of Australian Cerambycidae and subfamily Prioninae	CSIRO	DAWR (Agricultural Competitiveness White Paper)
Developing an alternative herbicide management strategy to replace photosystem II herbicides in the Wet Tropics area	SRA, James Cook University	SRA, QDAF
Developing models for the spread and management of national priority plant pests	University of Melbourne (CEBRA)	DAWR
Developing scientifically robust risk maps for priority plant pests	University of Melbourne (CEBRA)	DAWR
Development of a generic sample size tool for the importation of small seed lots into New Zealand	University of Melbourne (CEBRA)	New Zealand Ministry for Primary Industries
Development of a remote pest identification system in Indonesia	PBCRC	PBCRC, RedClaw
Development of effective insect surveillance plans utilising economic portfolio theory	Murdoch University	Murdoch University, Chevron (USA)
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
Diagnosis of water samples for Phytophthora species	DEDJTR	DEDJTR
Discovering the pathways and mechanisms underlying bioinsecticide control of the global migratory pest, diamondback moth, *Plutella xylostella*	University of Adelaide	ARC
DITA regulation – West Indian drywood termite	QDAF	QDAF
Down to earth defence – unlocking soil-derived defences for plant protection	Western Sydney University	ARC
Ecological impact of myrtle rust, *Puccinia psidii*, in native and managed ecosystems (PhD)	NSW DPI, Macquarie University	NSW DP&E, PBCRC, DEE
Embedding GERDA (global eradication and response database) into the biosecurity landscape – phase 2, 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	Innovative research universities (IRU) – Malaysian university research network
Emerging weeds – seed bank biology of emerging weeds	University of Adelaide	GRDC
Enabling improved plant biosecurity practices in Cambodia, Laos and Thailand	PBCRC, RedClaw	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, DPIPWE	PBCRC, DEDJTR, DAWR, PHA
Establishment of the Australia–Indonesia bilateral plant biosecurity initiative	PBCRC	PBCRC, Crawford Fund
Evaluation of stressed weeds with herbicide, adjuvant and biostimulant blends	Monash University	Axieo Operations Pty Ltd
Evolution of multiple herbicide resistance is widespread in *Lolium rigidum* in Australia	University of Western Australia	ARC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Multiple crops (continued)		
Evolution of viral diversity and virus ecology in the management of resistance to biopesticides (PhD)	Queensland University of Technology	CRDC
Evolutionary aerial robotics	CSIRO	CSIRO
From individuals to mass organisation – aggregation, synchronisation and collective movement in locusts	University of Adelaide	ARC
Gene identification and functional characterisation for metabolism based herbicide resistance in *Lolium rigidum*	University of Western Australia	Bayer Crop Science
Genes of biosecurity importance	CSIRO	CSIRO
Historical pest genomes inform debate about how rapid evolution proceeds	Australian National University	ARC
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 2,4-D herbicide resistance in the economically important weed wild radish, *Raphanus raphanistru*	University of Western Australia	ARC, Nufarm Australia
Implementation of a multi target surveillance system	Murdoch University	Chevron (USA)
Improved management options for cucumber green mottle mosaic virus	NT DPIR	Hort Innovation
Improving the efficacy of pseudomonad biocontrol bacteria	Macquarie University	ARC
Industry liason officer	PHA	DAWR
Interactions of entomopathogens and Australian fruit fly	Western Sydney University	ARC
Invasion pathway analysis for Australia – insects	Monash University	Invasive Species Council
Invasive grass LAMP platform	NSW DPI	DAWR
iSCOUT – sentinel surveillance systems for agriculture	Eight service providers (one for each subproject) – PHA, AUSVEG, SRA, University of Queensland (via CRDC), SARDI, DEDJTR, CSIRO and WA DPIRD	Hort Innovation, PHA, SRA, GRDC, Agrifutures Australia, Wine Australia, FWPA, CRDC, SARDI, DEDJTR, CSIRO, PFRNZ, Rothamsted Research (England), Burkard Manufacturing Company (England), Nursery and Garden Industry Australia, DAWR (Rural Research and Development for Profit) and WA DPIRD
Making Green Guard® greener – enhancing the efficacy of a biopesticide	University of Sydney, University of Adelaide	ARC
Manipulation of regulatory microRNAs to supress insecticide resistance in the diamondback moth	University of Queensland	Hort Innovation
Mechanically transmitted DNA virus control of Botrytis	PFRNZ	PBCRC
Molecular mechanism of action of plant immune receptors	University of Queensland	ARC
Myrtle rust genetics	University of Sydney	
National diagnostic capability assessment	CSIRO	DAWR (Stronger Biosecurity and Quarantine Initiative)
National plant biosecurity RD&E strategy implementation committee	CSIRO, Council of Rural RDCs, DAWR, DEDJTR, GRDC, Hort Innovation, NSW DPI, PBCRC, PBRI, PHA, QDAF, WA DPIRD, Wine Australia	Hort Innovation, DEDJTR, CRDC, Dairy Australia, GRDC, Meat and Livestock Australia, Wine Australia, SRA, AgriFutures Australia, FWPA, PHA, state governments
National surveillance program for tramp ants	PBCRC	DAWR (Agricultural Competitiveness White Paper)

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
National weed biological control project	DEDJTR	DEE, 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
Natural dispersal subproject – metabarcoding of trapped insects	DEDJTR	PBCRC, Hort Innovation
New tools for insect surveillance and eradication	PFRNZ	PBCRC
New Zealand psyllids (PhD)	Lincoln University (NZ), University of Adelaide	PBCRC
Novel community engagement in plant biosecurity	NSW DPI	PBCRC
Novel insecticides and synergists from endemic and exotic flora (PhD)	Western Sydney University	CRDC
National Plant Health Surveillance Program – AUSPest*Check* trial	PHA	DAWR
Odorant recognition in insect olfactory system to control insect behaviour	Murdoch University	ARC
Optimising surveillance protocols using unmanned aerial systems	Kansas State University (USA), QDAF, DEDJTR	PBCRC, Kansas State University (USA), Queensland University of Technology, DEDJTR, QDAF
Pantry Blitz – surveillance and reporting of pantry pests via citizen science	WA DPIRD	QDAF, WA DPIRD
Pathways and risk assessment framework for high impact species	CSIRO, QDAF, PFRNZ, WA DPIRD, Lincoln University	PBCRC
Pest and Disease Image Library (PaDIL)	PBCRC	PBCRC
Pestpoint	PBCRC	PBCRC
Physical management options for herbicide resistant weeds – targeted tillage	University of Western Australia, University of Sydney	University of Sydney
Phytophthora cinnamomi and native vegetation	Deakin University	DEE, Parks Victoria

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Multiple crops (continued)		
Plant and associated microbiome responses to indoleamines and potential applications in agriculture	La Trobe Univeristy	La Trobe University
Plant Biosecurity Research Initiative	Projects led by individual RDCs	Hort Innovation, CRDC, GRDC, Wine Australia, SRA, Agrifutures Australia, FWPA
Plant biosecurity surveillance symposium	PBCRC	DAWR
Planthoppers in Cixiidae	NSW DPI	DEE (Australian Biological Resources Study)
Quantifying evidence of a plant pest's absence	University of Melbourne (CEBRA)	DAWR
RD&E program for control, eradication and preparedness for vegetable leafminer	AUSVEG, CESAR, NAQS, University of Melbourne, PHA	Hort Innovation
Real-time plant discrimination and weed detection platform	Edith Cowan University	ARC
Reduced herbicide usage through application technology	Edith Cowan University	GRDC
Reducing the impact of Nosema and viruses by improving honeybee nutrition	CSIRO	AgriFutures Australia
Reliable identification of downy mildews	University of Queensland	DAWR (Agricultural Competitiveness White Paper)
Research to inform yellow crazy ant management in the Wet Tropics	James Cook University	Wet Tropics Management Authority
Revision of bristle fly genus Rutilia	CSIRO	DEE (Australian Biological Resources Study)
Risk assessment and evaluation for plant pest disease pathways in northern Australia	QDAF	DAWR
Risk-mapping import pathways for risk-return opportunities	University of Melbourne (CEBRA)	DAWR
Risks associated with the spread of myrtle rust spores, through the movement of bees and beehives in New Zealand	PFRNZ	New Zealand Ministry of Primary Industries, PFRNZ
Semiochemical management for occasional pests of cotton and grains	University of New England	CRDC
Social attitudes and understanding of plant health surveillance	Instinct and Reason	DAWR (Agricultural Competitiveness White Paper)
Streamlining plant pest contingency plans	DEDJTR	DAWR (Stronger Biosecurity and Quarantine Initiative)
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
Surveillance of tomato potato psyllid in the eastern states and South Australia	University of Tasmania	Hort Innovation
Systematics, biodiversity and host associations of Australian psyllids – implications for conservation and biosecurity	University of Adelaide	University of Adelaide
Targeting metabolic resistance to the new herbicide pyroxasulfone in the global grass weed *Lolium rigidum*	University of Western Australia	Bayer Crop Science
Testing an iterative approach to selecting successful biological control agents	University of Queensland	CSIRO
Testing incentive-based drivers for importer compliance	University of Melbourne (CEBRA), University of New England	DAWR
The effects of damage and repair of fungal DNA on animal and plant diseases	University of Melbourne	ARC
The more the merrier – investigating copy number variation in Brassicas	University of Western Australia	ARC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
The role of reproductive parasites in the biology of invasive pest thrips (PhD)	Western Sydney University	Western Sydney University
Time to prime – using silicon to activate grass resistance under higher CO_2	Western Sydney University	ARC
Tomato potato psyllid transition to management research project	WA DPIRD	Costs shared under the EPPRD
TraitCapture – genomic modelling for plant phenomics under environmental stress	Australian National University	ARC
Treatment of stressed weeds with herbicide, adjuvant and oxidative hydrothermal dissolution liquor blends	Monash University	Greenpower Energy Limited
Weed biocontrol	DEDJTR	Goulburn Murray Water, Murrumbidgee Irrigation, Coleambally Irrigation Cooperative, Goulburn Broken CMA, Wyong Shire, OEH NPWS, Central Murray Council, NQ Dry Tropics, Murray Local Land Services, Murrumbidgee Landcare, PIRSA, GRDC
What are the roles of disturbance and biotic resistance in the establishment of *Solenopsis geminata*?	James Cook University	Ecological Society of Australia
Wind spread of plant viral pathogens into northern Australia (PhD)	University of Western Australia, WA DPIRD, CSIRO	PBCRC
With the benefit of hindsight – a bioeconomic analysis of past pest incursions	University of Western Australia	PBCRC
Yellow crazy ant biology and novel control methodologies	James Cook University	Kuranda Envirocare Inc
Yellow crazy ant eradication in and next to the Wet Tropics World Heritage Area	James Cook University	Wet Tropics Management Authority

Project title	Organisation undertaking the research	Funding source
Natural environment		
A lucid key to the genera of Australian psyllids and lerp insects	University of Adelaide	University of Adelaide
Application of advanced molecular tools for identification of non indigenous invertebrates	Murdoch University	Chevron (USA)
A predictive framework for invaded communities	Monash University	ARC
Biocontrol solutions for sustainable management of weed impacts to agriculture	CSIRO, DEDJTR, NSW DPI, QDAF	GRDC, CSIRO, DEDJTR, NSW DPI, QDAF, PIRSA, Seqwater, Shire of Ravensthorpe, NSW Weed Biocontrol Taskforce, North West Local Land Services, NSW DP&E, Bundaberg Regional Council, Gladstone Regional Council, HQPlantations, Goulburn–Murray Water Corporation, Murrumbidgee Irrigation Ltd, Coleambally Irrigation Cooperative, Goulburn Broken Catchment Management Authority, Murray Local Land Services, USDA Agricultural Research Service, Australian Biological Control Laboratory, Wyong Shire Council, NSW National Parks Service, Central Murray County Council, Murrumbidgee Landcare Inc, NQ Dry Tropics

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Natural environment (continued)		
Biological control of Sagittaria (Phase 2)	DEDJTR	Goulburn Murray Water Corporation, Goulburn Broken catchment management authority, Coleambally Irrigation Cooperative, Murrumbidgee Irrigiation, Murray Irrigation
Biological control of Tradescantia	DEDJTR, CSIRO	DEE
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 biosecurity plan for Acacia species	PHA	DAWR
Development of a protocol to enable in-transit fumigation with ethyl formate	Murdoch University	Chevron (USA)
Development of Davren™ technology for control of red imported fire ant	Murdoch University, QDAF	PBCRC
Development of surveillance and a pre-border data management system	Murdoch University	Chevron (USA)
Eradication of inkweed, a new priority weed incursion on King Island	King Island Natural Resource Management Group	National Landcare Program
Evaluating the deployment of autonomous vehicles for weed eradication	Murdoch University	Chevron (USA)
Fungus trials to control Parkinsonia weeds along the De Grey River in the Pilbara Region	De Grey Land Conservation District Committee	National Landcare Program
Habitat enhancement to support the endangered coastal emu	National Landcare Program	National Landcare Program
Improving and developing tools to manage Parkinsonia and mesquite in the Pilbara Region	Pilbara Mesquite Management Committee	DAWR
Info gap theory as a tool to assist biosecurity decision making	Murdoch University	Murdoch University, Chevron (USA)
Integrating emerging Parkinsonia biocontrol technologies on the Barkly Lakes	Australian Agricultural Company Ltd	[Northern] Territory Natural Resource Management
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
Maximising the net benefits of Barrow Island biosecurity	University of Melbourne (CEBRA)	PBCRC, Chevron (USA)
Mixed models to analyse pre-border and border surveillance to assist with decision making	Murdoch University	Murdoch University, Chevron (USA)
Multi-scale seed dispersal models for improved regional weed management	Monash University	ARC
National review and proposed action plan for myrtle rust	PBCRC	PBCRC, DEE
Psyllid resistant Leucaena to market	University of Queensland	Meat and Livestock Australia
Promoting conservation and future regeneration of Wollemi pine through manipulation of microbial communities (PhD)	Western Sydney University	DET (Research Training Program)
Phosphonate bark painting of Wollemi pine	Royal Botanic Garden Sydney, NSW DP&E	NSW DP&E, Royal Botanic Garden Sydney
Plant ecophysiology, prospecting for weed control using a native parasitic plant – from laboratory to field implementation	University of Adelaide	ARC, SA Water, Forestry SA, Department for Environment and Water SA, PIRSA, Nature Foundation SA, Lirabenda Endowment Fund, Adelaide and Mount Lofty Ranges and South Australian Murray Darling Basin Natural Resources Management Boards

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Rehabilitation of corridors to connect significant areas of remnant vegetation	Wellstead Community Resource Centre	National Landcare Program
Resolving the reproductive mode of the invasive yellow crazy ant, *Anoplolepis gracilipes*	James Cook University	Skyrail Rainforest Foundation
Role of mycorrhizae in invasion	University of Wollongong	University of Wollongong
Susceptibility of Australian alpine species to *Phytophthora cinnamomi*	Royal Botanic Garden Sydney, NSW DP&E	NSW DP&E, Royal Botanic Garden Sydney
To determine the mechanism for dieback in the invasive tree *Parkinsonia aculeata* (PhD)	Western Sydney University	DET (Research Training Program)
Understanding the mechanisms underpinning range expansion in exotic plant species	Macquarie University	Macquarie University
Understanding the drivers of aquatic weed success	Macquarie University	Macquarie University
Weed control for soil handling practices associated with native ecosystem rehabilitation	Charles Darwin University	NT DPIR
Nursery crops		
A review of diagnostic technologies to benefit the Australian nursery industry	DEDJTR	Hort Innovation, DEDJTR
Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry	QDAF	Hort Innovation
Integrated disease management in pyrethrum	University of Tasmania	Hort Innovation
National nursery industry biosecurity program	Nursery and Garden Industry Australia	Hort Innovation
Nursery production visual training resources	EHR Consultants	PHA

Image courtesy of Rod Turner, Plant Health Australia

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
Other crops		
AgWhite – aquatic weed control tools for maintaining water flow in irrigation channels	DEDJTR	DAWR, United Phosphorus Ltd, Goulburn–Murray Water, Murrumbidgee Irrigation, Ord Irrigation, Coleambally Irrigation Cooperative, Sun Water Ltd
Best practice management of Sagittaria	DEDJTR	DAWR (Rural Research and Development for Profit), AgriFutures Australia, Goulburn Murray Water Corporation, Goulburn Broken CMA, Coleambally Irrigation Cooperative, Murrumbidgee Irrigiation
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
Generation of efficacy and crop safety data with various pesticides in carobs	WA DPIRD	AgriFutures Australia
Solutions and understanding African whitefly (PhD)	CSIRO	DET (Research Training Program)
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

Project title	Organisation undertaking the research	Funding source
Pollinators		
Asexual reproduction and social parasitism in honey bee invaders	University of Sydney	ARC
Assessing pathogen risks to honeybees and native bees in NSW (PhD)	Western Sydney University	Western Sydney University
A world without bees – simulating important agricultural insect pollinators	Monash University	ARC
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
Enhanced national bee pest surveillance program	PHA	Hort Innovation, Australian Honey Bee Industry Council, Grain Producers Australia, DAWR
Enhancing bee research with collections specimen data	CSIRO	Bush Blitz
External attractant trap for small hive beetle	QDAF	AgriFutures Australia, QDAF, Queensland Beekeepers' Association, Wheen Bee Foundation
Healthy bee populations for horticultural pollination services	Western Sydney University	Hort Innovation
Improving biosecurity resources and better understanding bee health in Australia	PHA	AgriFutures Australia
Improving honey bee diagnostics in Australia	CSIRO	DAWR
National bee biosecurity program	PHA	Australian Honey Bee Industry Council
National bee pest surveillance program enhancements	PHA	DAWR
Quantifying the role of wild insect pollinator biodiversity in the provision of pollination ecosystem services	University of New England	Ian Potter Foundation
Quantifying the use of pesticides on Nosema	University of Western Australia	ARC

Table 58. Plant biosecurity RD&E projects (continued)

Project title	Organisation undertaking the research	Funding source
RNA viruses of native bees	University of Adelaide	Holsworth Foundation
Securing pollination for more productive agriculture – guidelines for effective pollinator management and stakeholder adoption	University of New England, University of Sydney, University of Adelaide, Australian National University, AgriFutures	DAWR (Rural Research and Development for Profit), Hort Innovation, University of Sydney, University of Adelaide, University of New England, Adelaide and Mount Lofty Ranges Natural Resources Management Board, Almond Board of Australia, Apple and Pear Growers Association (SA), Australian Mango Industry Association, Australian Melon Association, Australian National University, Costa Group, Department of Environment Water and Natural Resources SA, Greening Australia, Lucerne Australia, Native Vegetation Council, Natural Resources Northern and Yorke, O'Connor NRM, PIRSA, Rasberries and Blackberries Australia, South Australian Apiarist Association, Terrestrial Ecosystems Research Network Eco-informatics, Trees For Life
Selection and development of Australian hygienic honey bee lines	Bee Scientifics	AgriFutures Australia, Wheen Bee Foundation, Bee Scientifics
Stingless bees as effective managed pollinators for Australian horticulture	University of Western Sydney	Hort Innovation
Strengthening and enabling effective pollination for Australia	PFRNZ, PHA	Hort Innovation, PFRNZ
Systematics and biology of braconid wasps	University of Adelaide	DEE (Australian Biological Resources Study)
The mechanisms underlying crop pollinator effectiveness in agro-ecosystems	University of New England	ARC
Varroa mite host switch	Australian National University	ARC
Urban, amenities		
A risk-return prioritisation tool for global trade inspections	CSIRO	PBCRC
Improved disinfestation protocols for the Torres Strait – Qantas airways	Qantas, DAWR	Qantas, DAWR
Improving biodiversity through restoration of habitat at Westgate Park using community volunteers	Friends of Westgate Park	National Landcare Program

Image courtesy of Trevor Monson, Australian Pollination Services

Appendices

Organisation contact details

Organisation	For more information
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Almond Board of Australia	**australianalmonds.com.au** +61 8 8584 7053
Apple and Pear Australia	**apal.org.au** +61 3 9329 3511
Atlas of Living Australia	**ala.org.au** +61 2 6218 3431
Australasian Plant Pathology Society	**appsnet.org** +61 7 4632 0467
Australian Banana Growers' Council	**abgc.org.au** +61 7 3278 4786
Australian Blueberry Growers' Association	**abga.com.au** +61 422 234 124
Australian Entomological Society	**austentsoc.org.au** +61 3 9895 4462
Australian Forest Products Association	**ausfpa.com.au** +61 2 6285 3833
Australian Government – Australian Centre for International Agricultural Research	**aciar.gov.au** +61 2 6217 0500
Australian Government – Australian Pesticides and Veterinary Medicines Authority	**apvma.gov.au** +61 2 6210 4701
Australian Government – Australian Research Council	**arc.gov.au** +61 2 6287 6600
Australian Government – Department of Agriculture and Water Resources	**agriculture.gov.au** +61 1800 900 090
Australian Government – Department of Agriculture and Water Resources, Australian Bureau of Agricultural and Resource Economics and Sciences	**agriculture.gov.au/abares** +61 1800 900 090
Australian Government – Department of Agriculture and Water Resources, Northern Australia Quarantine Strategy	**agriculture.gov.au/biosecurity/australia/naqs** +61 1800 900 090

Organisation	For more information
Australian Government – Department of Agriculture and Water Resources, Trade and Market Access Division	**agriculture.gov.au/market-access-trade** +61 1800 900 090
Australian Government – Department of Environment and Energy	**environment.gov.au** +61 1800 803 772
Australian Government – Department of Foreign Affairs and Trade	**dfat.gov.au** +61 2 6261 1111
Australian Ginger Industry Association	**australianginger.org.au**
Australian Honey Bee Industry Council	**honeybee.org.au** +61 7 5467 2265
Australian Lychee Growers' Association	**australianlychee.com.au** +61 417 639 927
Australian Macadamia Society	australian-macadamias.org +61 1800 262 426
Australian Mango Industry Association	**industry.mangoes.net.au** +61 7 3278 3755
Australian Melon Association	**melonsaustralia.org.au** +61 413 101 646
Australian National University	**anu.edu.au** +61 2 6125 5111
Australian Olive Association	**australianolives.com.au** +61 478 606 145
Australian Processing Tomato Research Council	**aptrc.asn.au**
Australian Society for Microbiology	**theasm.org.au** +61 1300 656 423
Australian Society of Agronomy	**agronomyaustralia.org**
Australian Sweetpotato Growers	**aspg.com.au**
Australian Table Grape Association	**australiangrapes.com.au** +61 3 5021 5718
Australian Tea Tree Industry Association	**teatree.org.au** +61 2 4017 1336
Australian Truffle Growers' Association	**trufflegrowers.com.au**

Organisation	For more information
Australian Walnut Industry Association	**walnut.net.au**
Australian Vignerons	**australianvignerons.com.au** +61 8 8133 4400
AUSVEG	**ausveg.com.au** +61 3 9882 0277
Avocados Australia	**avocado.org.au** +61 7 3846 6566
CANEGROWERS	**canegrowers.com.au** +61 7 3864 6444
Canned Fruits Industry Council of Australia	**fgv.com.au**
Central Queensland University	**cqu.edu.au** +61 7 4930 9777
Charles Darwin University	**cdu.edu.au** +61 8 8946 7766
Charles Sturt University	**csu.edu.au** +61 1800 334 733
Cherry Growers of Australia	**cherrygrowers.org.au** +61 3 6231 1229
Chestnuts Australia	**chestnutsaustralia.com.au**
Citrus Australia	**citrusaustralia.com.au** +61 3 5023 6333
Commonwealth Scientific and Industrial Research Organisation	**csiro.au** +61 1300 363 400
Cotton Australia	**cottonaustralia.com.au** +61 2 9669 5222
Cotton Research and Development Corporation	**crdc.com.au** +61 2 6792 4088
Council of Australasian Weed Societies	**caws.org.au**
Deakin University	**deakin.edu.au** +61 3 9244 6100
Department of Primary Industries and Regional Development, Western Australia	**dpird.wa.gov.au** +61 8 9368 3333
Department of Agriculture and Fisheries, Queensland	**daf.qld.gov.au** +61 13 25 23

Organisation	For more information
Department of Economic Development, Jobs, Transport and Resources, Victoria	**economicdevelopment.vic.gov.au** +61 13 61 86
Department of Primary Industry and Resources, Northern Territory	**dpir.nt.gov.au** +61 8 8999 2006
Department of Primary Industries and Regions, South Australia	**pir.sa.gov.au** +61 8 8226 0995
Department of Primary Industries, New South Wales	**dpi.nsw.gov.au** +61 1800 808 095
Department of Primary Industries, Parks, Water and Environment, Tasmania	**dpipwe.tas.gov.au** +61 1300 368 550
Dried Fruits Australia	**driedfruitsaustralia.org.au** +61 3 5023 5174
Edith Cowan University	**ecu.edu.au** +61 13 43 28
Flinders University	**flinders.edu.au** +61 8 8201 3911
Forest and Wood Products Australia	**fwpa.com.au** +61 3 9927 3200
Forestry Corporation of NSW	**forestrycorporation.com.au** +61 1300 655 687
Grain Producers Australia	**grainproducers.com.au** +61 2 6273 3000
Grains Research and Development Corporation	**grdc.com.au** +61 2 6166 4500
Griffith University	**griffith.edu.au** +61 7 3735 7111
Growcom	**growcom.com.au** +61 7 3620 3844
Hazelnut Growers of Australia	**hazelnuts.org.au** +61 2 6379 1616
Horticulture Innovation Australia	**horticulture.com.au** +61 2 8295 2300
International Plant Protection Convention	**ippc.int**
James Cook University	**jcu.edu.au** +61 7 4781 4111

Organisation contact details

Organisation	For more information
La Trobe University	**latrobe.edu.au** +61 1300 528 762
Macquarie University	**mq.edu.au** +61 2 9850 7111
Monash University	**monash.edu** +61 3 9902 6000
Murdoch University	**murdoch.edu.au** +61 8 9360 6000
Nursery and Garden Industry Australia	**ngia.com.au** +61 2 8861 5100
Onions Australia	**onionsaustralia.org.au** +61 8 8725 8862
Passionfruit Australia	**passionfruitaustralia.org.au** +61 7 5438 7662
Pistachio Growers' Association	**pgai.com.au** +61 428 922 576
Plant Biosecurity Cooperative Research Centre	**pbcrc.com.au** +61 2 6201 2882
Plant Breeding Institute, University of Sydney	**sydney.edu.au/agriculture/plant_breeding_institute/index.shtml**
Plant Health Australia	**planthealthaustralia.com.au** +61 2 6215 7700
Queensland University of Technology	**qut.edu.au** +61 7 3138 2000
Raspberries and Blackberries Australia	No details available
Ricegrowers' Association of Australia	**rga.org.au** +61 2 6953 0433
Strawberries Australia	**strawberriesaustralia.com.au** +61 428 375 711
Sugar Research Australia	**sugarresearch.com.au** +61 7 3331 3333
Summerfruit Australia	**summerfruit.com.au** +61 2 6041 6641
Transport Canberra and City Services, Australian Capital Territory	**tccs.act.gov.au** +61 13 22 81

Organisation	For more information
University of Adelaide	**adelaide.edu.au** +61 8 8313 4455
University of Canberra	**canberra.edu.au** +61 2 6201 5111
University of Melbourne	**unimelb.edu.au** +61 13 63 52
University of New England	**une.edu.au** +61 2 6773 3333
University of New South Wales	**unsw.edu.au** +61 2 9385 1000
University of Queensland	**uq.edu.au** +61 7 3365 1111
University of Sydney	**sydney.edu.au** +61 2 9351 2222
University of Tasmania	**utas.edu.au** +61 1300 363 864
University of Western Australia	**uwa.edu.au** +61 8 6488 6000
University of Western Sydney	**westernsydney.edu.au** +61 2 9852 5222
University of Wollongong	**uow.edu.au** +61 2 4221 3555
Weeds of National Significance	**environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html** +61 1800 803 772
Wine Australia	**wineaustralia.com** +61 8 8228 2000

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 insects, mites, snails, nematodes, pathogens (diseases) and weeds that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna.
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.

Term	Definition
PLANTPLAN	The national contingency planning framework for the management of plant pest emergencies in Australia.
Plant production industries	All plant industries in the agricultural, horticultural and forestry sectors.
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 Emergency Plant Pest 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.

Acronyms

Acronym	Full name
ABARES	Australian Bureau of Agriculture and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ABGC	Australian Banana Growers' Council
ACIAR	Australian Centre for International Agricultural Research
ACT	Australian Capital Territory
AFPA	Australian Forest Products Association
AGSOC	Agriculture Senior Officials' Committee
AGSOC R&I	Agriculture Senior Officials' Committee Research & Innovation Committee
AHA	Animal Health Australia
AHC	Animal Health Committee
AHBIC	Australian Honey Bee Industry Council
ALA	Atlas of Living Australia
ALOP	Appropriate Level of Protection
APEC	Asia-Pacific Economic Cooperation
APPPC	Asia and Pacific Plant Protection Commission
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
ASEAN	Association of Southeast Asian Nations
BEPWG	Biosecurity Emergency Preparedness Working Group
BICON	Biosecurity Import Conditions
BIMS	Biosecurity Incident Management System
BINCN	Biosecurity Incident National Communication Network
BIPIM	Biosecurity Incident Public Information Manual
BIRA	Biosecurity Import Risk Analysis
BOLT	Biosecurity On-line Training
CCEPI	Consultative Committee on Exotic Plant Incursions
CCEPP	Consultative Committee on Emergency Plant Pests
CEBRA	Centre of Excellence for Biosecurity Risk Analysis, University of Melbourne
CIMMYT	International Maize and Wheat Improvement Center
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora

Acronym	Full name
CRC	Cooperative Research Centre
CRDC	Cotton Research and Development Corporation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPIRD	Department of Primary Industries and Regional Development, Western Australia
DAWR	Australian Government Department of Agriculture and Water Resources
DEDJTR	Victorian Department of Economic Development, Jobs Transport and Resources
DEE	Australian Government Department of the Environment and Energy
DFAT	Australian Government Department of Foreign Affairs and Trade
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
EPBC	Environment Protection and Biodiversity Conservation
EPP	Emergency Plant Pest
EPPRD	Emergency Plant Pest Response Deed
EPSD	Environment Planning and Sustainable Development Directorate
ESS	Enterprise Surveillance System
EXDOC	Export Documentation System
FAO	Food and Agriculture Organization
FHaB	Forest Health and Biosecurity
FPoE	First Point of Entry
FWPA	Forest and Wood Products Australia
GBO	Grains Biosecurity Officer
GPA	Grain Producers Australia
GRDC	Grains Research and Development Corporation
HACCP	Hazard Analysis Critical Control Point
Hort Innovation	Horticulture Innovation Australia Limited
HPP	High Priority Pest
IABIT	Intergovernmental Agreement on Biosecurity Implementation Taskforce
ICA	Interstate Certification Assurance
IGAB	Intergovernmental Agreement on Biosecurity
IGB	Inspector-General of Biosecurity
IPAC	Invasive Plants and Animals Committee

Acronym	Full name
IPPC	International Plant Protection Convention
IRA	Import Risk Analyses
ISPM	International Standards for Phytosanitary Measures
LVP	Local Value of Production
MICoR	Manual of Importing Country Requirements
MPSC	Marine Pest Sectoral Committee
NAQS	Northern Australia Quarantine Strategy
NAQIA	National Agriculture Quarantine and Inspection Authority
NBC	National Biosecurity Committee
NBEPEG	National Biosecurity Emergency Preparedness Expert Group
NBIGEG	National Biosecurity Information Governance Expert Group
NBPSP	National Bee Pest Surveillance Program
NBRT	National Biosecurity Response Team
NCN	National Communication Network
NDP	National Diagnostic Protocol
NEBRA	National Environmental Biosecurity Response Agreement
NFFS	National Fruit Fly Strategy
NGIA	Nursery and Garden Industry Australia
NMDS	National Minimum Dataset Specifications
NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network
NPBRDESIC	National Plant Biosecurity Research, Development & Extension Strategy Implementation Committee
NPBS	National Plant Biosecurity Strategy
NSW	New South Wales
NSW DPI	Department of Primary Industries, New South Wales
NSW DP&E	Department of Planning and Environment, New South Wales
NT	Northern Territory
NT DPIR	Department of Primary Industries and Resources, Northern Territory
PBCRC	Plant Biosecurity Cooperative Research Centre
PFRNZ	Plant and Food Research, New Zealand
PHA	Plant Health Australia
PHC	Plant Health Committee

Acronym	Full name
PIRSA	Department of Primary Industries and Regions, South Australia
PNG	Papua New Guinea
PPPO	Pacific Plant Protection Organisation
QDAF	Department of Agriculture and Fisheries, Queensland
R&D	Research and Development
RD&E	Research Development & Extension
RDC	Research and Development Corporation
RPPO	Regional Plant Protection Organisation
RSPM	Regional Standards for Phytosanitary Measures
SA	South Australia
SAP	Scientific Advisory Panel
SARDI	South Australian Research and Development institute
SDQMA	Subcommittee on Domestic Quarantine and Market Access
SIT	Sterile Insect Technology
SNPHS	Subcommittee on National Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics
SPS	Sanitary and Phytosanitary
SRA	Sugar Research Australia
TCCS	Transport Canberra and City Services
T2M	Transition to Management
WA	Western Australia
WoNS	Weeds of National Significance

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