Biosecurity Plan
for the Vegetable Industry

A shared responsibility between government and industry

Version 3.1 December 2019

Plant Health AUSTRALIA

Hort Innovation
Strategic levy investment

VEGETABLE FUND

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Disclaimer:

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AUSVEG

NSW GOVERNMENT Department of Primary Industries

Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Government of South Australia
Primary Industries and Regions SA

State Government Victoria
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Australian Government
Department of Agriculture and Water Resources

ACT GOVERNMENT

Queensland Government

Northern Territory Government

Hort Innovation
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Endorsement

The *Biosecurity Plan for the Vegetable Industry* (Version 3.0) was formally endorsed by the vegetable industry (through AUSVEG) in October 2017, and all state and territory governments (through the Plant Health Committee) in March 2018. The Australian Government endorses the document without prejudice for the purposes of industry's planning needs and meeting the Department's obligations under Clause 13 of the EPPRD. In providing this endorsement the Department notes page 98 of the Plan which states: "This Document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the IRA conducted by the Department of Agriculture and Water Resources which focus only on specific regulated import pathways."

Reporting suspect pests

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881). Early reporting enhances the chance of effective control and eradication.

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List of acronyms

ACPPO	Australian Chief Plant Protection Office
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
BICON	Australian Biosecurity Import Conditions Database
BIG	Biosecurity Implementation Group
BP	Biosecurity Plan
BOLT	Biosecurity On-Line Training
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	State Chief Plant Health Manager
DAF Qld	Department of Agriculture and Fisheries, Queensland
DPI NSW	Department of Primary Industries, New South Wales
DEDJTR	Department of Economic Development, Jobs, Transport and Resources, Victoria
DPIR NT	Department of Primary Industry and Resources, Northern Territory
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
DPIRD	Department of Primary Industries and Regional Development, WA
EPP	Emergency Plant Pest
EPPO	European and Mediterranean Plant Protection Organization
EPPRD	Emergency Plant Pest Response Deed
FAO	Food and Agriculture Organization of the United Nations
HACCP	Hazard Analysis Critical Control Point
HPP	High Priority Pest
ICA	Interstate Certification Assurance
IGAB	Intergovernmental Agreement on Biosecurity
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis
ISPM	International Standards for Phytosanitary Measures
MICoR	Manual of Importing Country Requirements
NAQS	Northern Australian Quarantine Strategy
NDP	National Diagnostic Protocol
NGIA	Nursery and Garden Industry Australia
NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network

NPBRDE IC	National Plant Biosecurity Research, Development and Extension Strategy. Implementation Committee
NPBS	National Plant Biosecurity Strategy
NSW	New South Wales
NT	Northern Territory
ORC	Owner Reimbursement Costs
PaDIL	Pest and Disease Image Library
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
QA	Quality Assurance
QLD	Queensland
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute
SDQMA	Sub-Committee for Domestic Quarantine and Market Access
SNPHS	Sub-Committee for Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostic
SPS	Sanitary and Phytosanitary
TEG	Technical Expert Group
TST	Threat Summary Table
Vic	Victoria
WA	Western Australia
WA DPIRD	Western Australia Department of Primary Industries and Regional Development
WTO	World Trade Organization

Definitions

The definition of a plant pest used in this document are insects, mites, snails, nematodes or pathogens (diseases) 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. Endemic pests are those established within Australia.

EXECUTIVE SUMMARY

Executive Summary

To ensure its future viability and sustainability, it is important that the Australian vegetable industry, represented by AUSVEG as the peak industry body, minimises the risks posed by exotic pests and responds effectively to plant pest threats. This plan is a framework to coordinate biosecurity activities and investment for Australia's vegetable industry. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the vegetable industry. It identifies and prioritises exotic plant pests (not currently present in Australia) and established pests of biosecurity concern, and focus on future biosecurity challenges.

The Biosecurity Plan for the Vegetable Industry was developed in consultation with the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), which consisted of plant health and biosecurity experts and industry representatives. These groups were coordinated by Plant Health Australia (PHA) and included representatives from AUSVEG, relevant state and territory agriculture agencies and PHA.

The development of Threat Summary Tables (TSTs), constituting a list of more than 760 exotic plant pests and the potential biosecurity threat that they represent to the Australian vegetable industry was key to the industry biosecurity planning process. Currently the TSTs include pest of Apiaceae (carrots, celery, parsley, parsnips), Fabaceae (peas, beans), Asteraceae (lettuce), Brassicaceae (cabbage, radishes, broccoli, cauliflower), Cucurbitaceae (cucumber, zucchini, luffa, pumpkins), Amaranthaceae (beetroot, silver beet), Peaceae (sweet corn), Solanaceae (eggplant, capsicum, chilli) and Alliaceae (leeks, spring onion and shallot). Should other vegetable commodities be included in the future this list will expand. Each pest on the list was given an overall risk rating based on four criteria; entry, establishment, spread potential, and economic impact. In this biosecurity plan, established pests of biosecurity significance for the vegetable industry were also identified (Table 3) as good biosecurity practice is beneficial for the ongoing management and surveillance for these pests.

The Biosecurity Plan for the Vegetable Industry also details current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the vegetable industry (Table 6). This enables identification of gaps and prioritises specific actions, as listed in the Biosecurity Implementation Table (Table 5). The development of this table will increase the vegetable industry's biosecurity preparedness and response capability by outlining specific areas of action which could be undertaken through a government and industry partnership.

This biosecurity plan is principally designed for decision makers. It provides the vegetable industry and government with a mechanism to identify exotic plant pests as well as to address the strengths and weaknesses in relation to the vegetable industry's current biosecurity position. It is envisaged that annual reviews of this BP will be undertaken with another formal review conducted in 5 years.

The biosecurity plan is a document outlining the commitment to the partnership between the vegetable industry and government to improve biosecurity for the vegetable industry and is supported by the industry biosecurity statement (Page 85).

SIGNIFICANT BIOSECURITY THREATS

Document overview

Biosecurity for the Australian vegetable industry focuses on five key areas to identify the components to be implemented through the life of the biosecurity plan 2017-2022. These five areas are outlined in the sections below.

High priority exotic pests, established pests and weeds of biosecurity significance

A key outcome of this biosecurity plan is the identification of the exotic high priority pests, established pests and weeds of biosecurity significance for the Australian vegetable industry (Page 10). This section includes:

- the High Priority Pests (HPPs), are the most significant exotic threats affecting the vegetable industry as identified through a prioritisation process.
- the established pests of biosecurity significance, which have been identified in consultation with industry
- the established weeds of biosecurity significance, as identified by industry and government.

The exotic HPP list, established pests and weeds of biosecurity significance will allow industry and government to better prioritise preparedness activities and will assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, development of surveillance programs, diagnostic protocols as well as development of pest-specific mitigation activity.

Implementing biosecurity for the Australian Vegetable industry 2017-2022

This section (Page 43) includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPPs of the vegetable industry. The Biosecurity Implementation Group (BIG), comprised of both industry and government representatives, developed the implementation plan that sets out shared biosecurity goals and objectives over the next five years. It is intended that the biosecurity implementation plan is revisited by the Biosecurity Reference Panel regularly over the next five years to maintain its relevance.

Threat identification and pest risk assessments

Guidelines are provided for the identification and ranking of biosecurity threats through a process of qualitative risk assessment. The primary goal is to coordinate identification of exotic pest threats that could impact productivity, or marketability. This plan strengthens risk assessment work already being done both interstate and overseas. All exotic vegetable biosecurity threats considered in the biosecurity plan are detailed in threat summary tables (TST; Appendix 2). From the prioritisation process undertaken in the TST, pests with an overall high rating were identified as a HPP (Table 1) Established pests and weeds of biosecurity significance are also listed.

Risk mitigation and preparedness

This section provides a summary of activities to mitigate the impact of pest threats on the Australian vegetable industry, along with a set of guidelines for managing risk at all operational levels. Many pre-emptive practices can be adopted by plant industries and government agencies to reduce risks. The major themes covered include:

- Barrier quarantine
- Surveillance
- Training
- Awareness
- Farm biosecurity
- Reporting of suspect pests

A summary of pest-specific information and preparedness documents, such as fact sheets, contingency plans and diagnostic protocols are also described to outline activities industry has undertaken to prepare for an exotic pest incursion. Information for industry on how to align preparedness activities with R,D&E, such as researching IPM strategies, resistance breeding and chemical control is also provided.

Response management

This section provides a summary of the processes in place to respond to emergency plant pest (EPP)[1] incursions that would affect the Australian vegetable industry. Areas covered in this section include the Emergency Plant Pest Response Deed (EPPRD), PLANTPLAN (outlines the generic approach to response management under the EPPRD), categorisation of

[1] Refer to the PHA website for details **http://www.planthealthaustralia.com.au/biosecurity/emergency-plant-pests/**

pests under the EPPRD and industry specific response procedures and industry communication.

Pests and Weeds of Biosecurity Significance Overview

A key component of this biosecurity plan is to identify the exotic and established pests and weeds of biosecurity significance to the Australian vegetable industry. This section provides information on the High Priority Pest list, the established pests of biosecurity significance and the established weeds of biosecurity significance to the vegetable industry. These pest lists, provide the Australian vegetable industry, governments and other stakeholders with the information needed to prioritise resources for biosecurity risk management.

Vegetable industry high priority exotic pests

Table 1 provides an overview of the top ranked threats to the vegetable industry for invertebrates, and pathogens and nematodes respectively. Further details on each pest along with the basis for the likelihood ratings are provided in the threat summary tables (Appendix 2). Assessments may change given more detailed research, and the priority list will be formally reviewed along with the Biosecurity Plan on an annual basis through the biosecurity reference panel. An explanation of the method used for calculating the overall risk can be found on the PHA website[2]. The effect of a pest on the overall vegetable industry is shown in Table 2.

Table 1. *Vegetable industry high priority pest threat list*

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
INVERTEBRATES								
ACARI (Mites e.g. spider and gall mites)								
Bulb mite (*Rhizoglyphus setosus*)	Alliaceae	Leek	Bulb and roots	HIGH	HIGH	HIGH	HIGH	HIGH
COLEOPTERA (Beetles and weevils)								
Red pumpkin beetle (*Aulacophora foveicollis*)	Cucurbitaceae	Pumpkin and other cucurbits	Whole plant	MEDIUM	HIGH	HIGH	HIGH	HIGH
DIPTERA (Flies and midges)								
Allium leafminer (*Phytomyza gymnostoma)*	Alliaceae	Leek and other *Allium* spp.	Stalks and bulbs	HIGH	MEDIUM	HIGH	HIGH	HIGH

[2] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**
[3] Note: Where there are multiple commodities affected only the economic impact and overall risk for the most affected commodity are shown in the table.

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
American leafminer, Serpentine vegetable leafminer, Vegetable leafminer (*Liriomyza sativae*[4])	Alliaceae, Fabaceae, Solanaceae, Cucurbitaceae, Asteraceae, Apiaceae	Wide host range including *Allium* spp., bean, pea, eggplant, pumpkin, cucumber, beets, lettuce, celery	Leaves	HIGH	HIGH	MEDIUM	HIGH	HIGH
American serpentine leafminer (*Liriomyza trifolii*[5])	Alliaceae, Cucurbitaceae, Fabaceae, Solanaceae	Wide host range over 400 species of plants in 28 families. The main host families and species include: Cucurbitaceae, Fabaceae and Solanaceae, Alliaceae	Leaves	HIGH	HIGH	MEDIUM	HIGH	HIGH
Bean seed fly, Bean seed maggot (*Delia florilega*)	Alliaceae, Brassicaceae, Fabaceae, Poaceae	Cabbage, cauliflower, bean, corn and leek	Whole plant, above ground	HIGH	MEDIUM	HIGH	HIGH	HIGH
Carambola fruit fly (*Bactrocera carambolae*)	Solanaceae	Wide host range including capsicum	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
Carrot rust fly (*Psila rosae*)	Apiaceae, Brassicaceae	Carrot, cauliflower, celery, parsnip, parsley, other Apiaceae	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH
Fijian fruit fly (*Bactrocera passiflorae*)	Solanaceae	Eggplant	Fruit	MEDIUM	HIGH	HIGH	HIGH	HIGH
Lesser bulb fly (*Eumerus strigatus*)	Alliaceae, Apiaceae, Brassicaceae	*Allium* spp., parsnip and cabbage	Bulb, below ground part of plant	HIGH	HIGH	HIGH	HIGH	HIGH

[4] Note: Detected in Queensland but a quarantine area has been established in the far northern biosecurity zone to restrict the spread of the pest.
[5] *Liriomyza trifolii* is only a HPP for the Fabaceae and Solanaceae families and has a medium overall risk for the Alliaceae and Cucurbitaceae families.

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
Melon fruit fly (*Bactrocera cucurbitae*)	Cucurbitaceae	Zucchini, pumpkin and cucumber	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
New Guinea fruit fly (*Bactrocera trivialis*)	Solanaceae	Chilli	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
Onion fly (*Delia antiqua*)	Alliaceae	Shallot and leek	Stalk	HIGH	MEDIUM	HIGH	HIGH	HIGH
Oriental fruit fly (*Bactrocera dorsalis*)	Fabaceae, Solanaceae, Cucurbitaceae	Wide host range including over 300 species of commercial crops and wild hosts. Common families include Fabaceae, Solanaceae, Cucurbitaceae	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
Pea leafminer, Potato leafminer, Serpentine leafminer (*Liriomyza huidobrensis*)	Amaranthaceae, Alliaceae and Asteraceae	Wide host range including beet, leeks and lettuce	Leaves	HIGH	HIGH	MEDIUM	HIGH	HIGH
Summer cabbage fly (*Delia floralis*)	Brassicaceae and Alliaceae	Cabbage, radish and leek	Whole plant	HIGH	MEDIUM	HIGH	HIGH	HIGH
Tomato leaf miner (*Liriomyza bryoniae*[6])	Solanaceae, Cucurbiataceae, Asteraceae, Fabaceae	Wide range of hosts including bean, peas, cabbage, lettuce and eggplants	Leaves	HIGH	HIGH	MEDIUM	HIGH	HIGH
GASTROPODA (Slugs and snails)								
Giant African land snail (*Lissachatina fulica* (Syn. *Achatina fulica*))	Fabaceae	Wide range of crops affected including pea	Whole plant, above ground	HIGH	HIGH	MEDIUM	HIGH	HIGH

[6] *Liriomyza bryoniae* is only a HPP for the Asteraceae, Fabaceae and Solanaceae families and has a medium overall risk for the Cucurbitaceae family.

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
Giant African snail (*Achatina achatina*)	Brassicaceae, Asteraceae	Not host specific. Feeds on a range of plants including cabbage and lettuce	Whole plant, above ground	HIGH	HIGH	MEDIUM	HIGH	HIGH
HEMIPTERA (Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)								
Bean aphid (*Aphis fabae*)	Solanaceae, Fabaceae, Amaranthaceae, Cucurbitaceae, Brassicaceae, Apiaceae	Very broad host range with over hosts including cabbage, cauliflower, radish, celery, capsicum, eggplant, cucumber, beets, broad beans, bean, peas, cucurbits and chilli	Leaves	HIGH	HIGH	HIGH	HIGH	HIGH
Brown marmorated stink bug (*Halyomorpha halys* (Syn. *Halyomorpha mista*))	Poaceae, Cucurbitaceae, Solanaceae, Fabaceae, Asteraceae, Apiaceae, Amaranthaceae	Very wide host range including sweet corn, cucumber, capsicum, carrot, beans, beets, eggplant, lettuce, pea and beans	Whole plant, above ground	HIGH	HIGH	HIGH	HIGH	HIGH
Silverleaf whitefly (*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))	Broad host range across vegetables	Broad host range (over 600 plant species) across vegetables	Leaves and stems	MEDIUM-HIGH	LOW-HIGH	HIGH	HIGH	MEDIUM-HIGH
Western tarnished plant bug (*Lygus hesperus*)	Amaranthaceae, Apiaceae	Wide host range including sugar beet, bean and carrot	Whole plant, above ground	MEDIUM	HIGH	HIGH	HIGH	HIGH

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
LEPIDOPTERA (Butterflies and moths)								
Cabbage looper (*Trichoplusia ni*)	Apiaceae, Brassicaceae, Asteraceae, Amaranthaceae, Cucurbitaceae	Over 160 hosts including beet, broccoli, cabbage, cauliflower, radish, celery, cucumber, lettuce, parsnip, pea, capsicum, navy bean and pumpkin	Leaves	MEDIUM	HIGH	HIGH	HIGH	HIGH
Fall armyworm (*Spodoptera frugiperda*)	Amaranthaceae, Fabaceae, Solanaceae, Brassicaceae, Cucurbitaceae, Poaceae	Wide host range with a preference for Poaceae. It can also infect the following families; Malvaceae, Lilliaceae, Amaranthaceae, Fabaceae, Solanaceae, Chenopodiaceae, Brassicaceae, Cyperaceae, Juglandaceae, Asteraceae, Cucurbitaceae, Rutaceae, Euphorbiaceae, Convolvulaceae, Cyperaceae, Caryophyllaceae, Polygonaceae, Rosaceae, Iridaceae, Musaceae, Geraniaceae, Platanaceae, Apocynaceae, Portulacaceae, Violaceae, Vitaceae, Zingiberaceae	Whole plant, above ground	HIGH	HIGH	HIGH	HIGH	HIGH
False codling moth (*Thaumatotibia leucotreta* (Syn. *Cryptophlebia leucotreta*))	Solanaceae	Wide host range including capsicum and maize	Fruit	MEDIUM	HIGH	HIGH	HIGH	HIGH
South American tomato moth, tomato leafminer (*Tuta absoluta*)	Solanaceae	Eggplant and other solanaceous plants	Whole plant	MEDIUM	HIGH	HIGH	HIGH	HIGH
PATHOGENS AND NEMATODES								
BACTERIA (including phytoplasmas)								

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
CLsO (*Candidatus Liberibacter solanacearum*[7])	Apiaceae	Carrot and celery	Whole plant	HIGH	HIGH	HIGH	EXTREME	EXTREME
FUNGI								
Puccinia agrophila	Solanaceae	Eggplant	Leaves	HIGH	LOW-MEDIUM	HIGH	HIGH	MEDIUM-HIGH
Anthracnose (*Colletotrichum higginsianum*)	Brassicaceae	Brassicas	Leaves	MEDIUM	HIGH	HIGH	HIGH	HIGH
Banded Leaf and sheath spot/ blight (*Rhizoctonia solani* f. sp. *sasakii* (AG1) (teleomorph: *Corticium sasakii* (Syn. *Thanatephorus cucumeris*)))	Poaceae	Corn	Whole plant, above ground	HIGH	MEDIUM	HIGH	HIGH	HIGH
Late blight (exotic strains) (*Phytophthora infestans* (A2 mating type))	Solanaceae	*Solanum* spp.	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH
Late wilt, slow wilt (*Harpophora maydis* (Syn. *Cephalosporium maydis, Acremonium maydis*))	Poaceae	Corn	Whole plant, above ground	HIGH	HIGH	HIGH	HIGH	HIGH
Leaf spot (*Alternaria humicola*)	Fabaceae	Pea	Whole plant, above ground	HIGH	HIGH	MEDIUM	HIGH	HIGH

[7] Haplotype A and B affect Solanaceae (e.g. potatos) and is vectored by *Trioza apicalis*. Haplotype C affect Apiaceae (carrots and celery) and is vectored by *Bactericera cockerelli*

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
Lentil anthracnose or soybean anthracnose (*Colletotrichum lentis* (lentil affecting strain))	Fabaceae	Broad bean	Whole plant, above ground	MEDIUM	HIGH	HIGH	HIGH	HIGH
Lettuce rust (*Puccinia opizii*)	Asteraceae	Lettuce	Leaves	HIGH	MEDIUM	HIGH	HIGH	HIGH
Rust - Apiaceae (*Uromyces lineolatus*)	Apiaceae	Carrot, parsnip and other Apiaceae species	Leaves	HIGH	MEDIUM	HIGH	HIGH	HIGH
Rusts – Alliaceae (*Puccinia spp.* (exotic species))	Alliaceae	Allium spp.	Leaves	HIGH	MEDIUM	HIGH	HIGH	HIGH
Rust of Celery (*Puccinia apii)*	Apiaceae	Celery	Leaves	HIGH	MEDIUM	HIGH	HIGH	HIGH
Rust of Dill (*Puccinia nitida)*	Apiaceae	Parsley, dill, corriander	Leaves	HIGH	MEDIUM	HIGH	HIGH	HIGH
NEMATODES								
Barley root knot nematode (*Meloidogyne naasi*)	Amaranthaceae	Sugar beet	Roots	MEDIUM	HIGH	HIGH	HIGH	HIGH
Carrot cyst nematode (*Heterodera carotae*)	Apiaceae	Carrot	Roots	MEDIUM	HIGH	HIGH	HIGH	HIGH
Chickpea cyst nematode (*Heterodera cicero*)	Fabaceae	Pea	Roots	MEDIUM	HIGH	HIGH	HIGH	HIGH
Root knot nematode (*Meloidogyne enterolobii (Syn. Meloidogyne mayaguensis))*	Solanaceae, Brassicaceae, Cucurbitaceae, Asteraceae, Apiaceae, Fabaceae	Capsicum, eggplant, cabbage, cucumber lettuce, carrot and bean	Roots	MEDIUM	HIGH	HIGH	HIGH	HIGH
VIRUSES AND VIROIDS								

Common name (scientific name)	Vegetable R&D levied family affected	Vegetable R&D levied commodity affected	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk[3]
Groundnut bud necrosis virus (*Groundnut bud necrosis virus (Tospovirus)*[8])	Fabaceae, Cucurbitaceae	Cucumber, pumpkin, pea and bean	Leaves	MEDIUM	HIGH	HIGH	HIGH	HIGH
PSTVd *(Potato spindle tuber viroid (Pospiviroid)* (exotic strains))	Solanaceae	Potato, tomato, capsicum	Whole plant, above ground	HIGH	HIGH	HIGH	HIGH	HIGH
ToBRFV (*Tomato brown rugose fruit virus)*	Solanaceae	Tomato, capsicum	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH
ToMMV *(Tomato mottle mosaic virus (Tobamovirus))*	Solanaceae	Tomato, capsicum	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH
Watermelon bud necrosis virus (*Watermelon bud necrosis virus (Tospovirus)*)	Cucurbitaceae	Luffa	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH

As the vegetable industry covers multiple commodities Table 2 lists the effect of the high priority pest on the vegetable industry as a whole. For example, a pest that affects three commodities will have a greater effect on the industry than a pest that only affects one crop. Using the production value for each crop, as calculated by the Horticulture Innovation Australia Limited (2017a)[9] a value of $1,643.4 million was calculated to be the total production value of crops covered in the Biosecurity Plan for the Vegetable Industry[10]. The production of each crop was then divided by 1,643.4 to provide the proportion of levied vegetable impacted by a pest/disease [e.g. (cabbage production value + bean production value)/1,643.4]. No production data for the 2014/15 year was available for radishes or the luffa industry.

[8] Groundnut bud virus (Tospovirus) is only a HPP for the Fabaceae family and has an unknown overall risk for the Cucurbitaceae family.
[9] Available online at **http://horticulture.com.au/wp-content/uploads/2016/10/Australian-Horticulture-Statistics-Handbook-Vegetables.pdf**
[10] For crops covered in the Biosecurity Plan for the Vegetable Industry refer to Appendix 1, Profile of the Australian Vegetable Industry

***Table 2**. Proportion of total levied vegetable industry impacted by vegetable high priority pests*[11]

Common name	Scientific name	Vegetable R&D levied commodity affected	Proportion of total levied vegetable industry impacted by pest/disease	Overall risk (for AUSVEG levied commodities within the family)								
				Apiaceae	Fabaceae	Asteraceae	Brassicaceae	Cucurbitaceae	Amaranthacea	Poaceae	Solanaceae	Alliaceae
INVERTEBRATES												
Allium leafminer	*Phytomyza gymnostoma*	Leek and other *Allium* spp.	2.28%									H
American leafminer, Vegetable leafminer	*Liriomyza sativae*	Wide host range including: *Allium* spp., bean, pea, eggplant, pumpkin, cucumber, beets, lettuce, celery	53.52%		H	H		H	H	H	H	H
American serpentine leafminer	*Liriomyza trifolii*	Wide host range over 400 species of plants in 28 families. The main host families and species include: Cucurbitaceae, Fabaceae and Solanaceae, Alliaceae	92.36%		H			M			H	M
Bean aphid	*Aphis fabae*	Very broad host range with over hosts including: cabbage, cauliflower, radish, celery, capsicum, eggplant, cucumber, beets, broad beans, bean, peas, cucurbits and chilli	41.65%		H		H	H	H		H	
Bean seed fly	*Delia florilega*	Cabbage, cauliflower, bean, corn and leek	14.31%		H		H			H		H
Brown marmorated stink bug	*Halyomorpha halys (Syn. Halyomorpha mista)*	Very wide host range including: sweet corn, cucumber, capsicum, carrot, beans, beets, eggplant, lettuce, pea and beans	73.59%		H	H		H	H	H	H	

[11] In the overall risk; H stands for high, M stands for medium, M-H stands for medium-high, E stands for extreme, U stands for unknown

Common name	Scientific name	Vegetable R&D levied commodity affected	Proportion of total levied vegetable industry impacted by pest/disease	Overall risk (for AUSVEG levied commodities within the family)								
				Apiaceae	Fabaceae	Asteraceae	Brassicaceae	Cucurbitaceae	Amaranthacea	Poaceae	Solanaceae	Alliaceae
Bulb mite	*Rhizoglyphus setosus*	Leek	0.97%									H
Cabbage looper	*Trichoplusia ni*	Over 160 hosts including: beet, broccoli, cabbage, cauliflower, radish, celery, cucumber, lettuce, parsnip, pea, capsicum, navy bean and pumpkin	76.03%		H	H	H	H	H		H	
Carambola fruit fly	*Bactrocera carambolae*	Wide host range including capsicum	8.80%								H	
Carrot rust fly	*Psila rosae*	Carrot, cauliflower, celery, parsnip, parsley, other Apiaceae	18.38%	H								
Fall armyworm	*Spodoptera frugiperda*	Wide host range with a preference for Poaceae. It can also infect the following families; Malvaceae, Lilliaceae, Amaranthaceae, Fabaceae, Solanaceae, Chenopodiaceae, Brassicaceae, Cyperaceae, Juglandaceae, Asteraceae, Cucurbitaceae, Rutaceae, Euphorbiaceae, Convolvulaceae, Cyperaceae, Caryophyllaceae, Polygonaceae, Rosaceae, Iridaceae, Musaceae, Geraniaceae, Platanaceae, Apocynaceae, Portulacaceae, Violaceae, Vitaceae, Zingiberaceae	55.15%		H		H	H	H	H	H	
False codling moth	*Thaumatotibia leucotreta (Syn. Cryptophlebia leucotreta)*	Wide host range including capsicum and maize	12.63%							H	H	
Fijian fruit fly	*Bactrocera passiflorae*	Eggplant	1.06%								H	
Giant African land snail	*Lissachatina fulica*	Wide range of crops affected including pea	2.56%		H							

Common name	Scientific name	Vegetable R&D levied commodity affected	Proportion of total levied vegetable industry impacted by pest/disease	Overall risk (for AUSVEG levied commodities within the family)								
				Apiaceae	Fabaceae	Asteraceae	Brassicaceae	Cucurbitaceae	Amaranthacea	Poaceae	Solanaceae	Alliaceae
Giant African snail	*Achatina achatina*	Not host specific. Feeds on a range of plants including: cabbage and lettuce	29.20%			H	H					
Lesser bulb fly	*Eumerus strigatus*	Allium spp., parsnip and cabbage	4.30%	H			H					H
Melon fruit fly	*Bactrocera cucurbitae*	Zucchini, pumpkin and cucumber	15.84%					H				
New Guinea fruit fly	*Bactrocera trivialis*	Chilli	0.52%								H	
Onion fly	*Delia antiqua*	Shallot and leek	2.28%									H
Oriental fruit fly	*Bactrocera dorsalis*	Wide host range including over 300 species of commercial crops and wild hosts. Common families include Fabaceae, Solanaceae, Cucurbitaceae	33.30%		H			H			H	
Pea leafminer	*Liriomyza huidobrensis*	Wide host range including: beet, leeks and lettuce	28.73%			H			H			H
Red pumpkin beetle	*Aulacophora foveicollis*	Pumpkin and other cucurbits	15.84%					H				
Silverleaf whitefly	*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) [1]*	Broad host range (over 600 plant species) across vegetables	100.00%		M-H	M-H	M-H				M-H	

Common name	Scientific name	Vegetable R&D levied commodity affected	Proportion of total levied vegetable industry impacted by pest/disease	Overall risk (for AUSVEG levied commodities within the family)								
				Apiaceae	Fabaceae	Asteraceae	Brassicaceae	Cucurbitaceae	Amaranthacea	Poaceae	Solanaceae	Alliaceae
South American tomato moth	*Tuta absoluta*	Eggplant and other solanaceous plants	10.39%								H	
Tomato leaf miner	*Liriomyza bryoniae*	Wide range of hosts including: bean, peas, cabbage, lettuce and eggplants	40.58%		H	H		M			H	
Turnip maggot	*Delia floralis*	Cabbage, radish and leek	18.76%				H					H
Western plant bug	*Lygus hesperus*	Wide host range including: sugar beet, bean and carrot	16.69%	H	H				H			
PATHOGENS AND NEMATODES												
Anthracnose	*Colletotrichum higginsianum*	Brassicas	16.48%				H					
Banded leaf and sheath spot	*Rhizoctonia solani f. sp. sasakii (AG1)*[14] *(teleomorph : Corticium sasakii (Syn. Thanatephorus cucumeris))*	Corn	3.83%							H		
Barley root knot nematode	*Meloidogyne naasi*	Sugar beet	0.59%						H			
Carrot cyst nematode	*Heterodera carotae*	Carrot	11.59%	H								
Groundnut bud necrosis virus	*Groundnut bud necrosis virus (Tospovirus)*	Cucumber, pumpkin, pea and bean	19.66%		H			U				

Common name	Scientific name	Vegetable R&D levied commodity affected	Proportion of total levied vegetable industry impacted by pest/disease	Overall risk (for AUSVEG levied commodities within the family)								
				Apiaceae	Fabaceae	Asteraceae	Brassicaceae	Cucurbitaceae	Amaranthacea	Poaceae	Solanaceae	Alliaceae
Late blight (exotic strains)	*Phytophthora infestans (A2 mating type)*	Solanum spp.	10.39%								H	
Late wilt	*Harpophora maydis (Syn. Cephalosporium maydis, Acremonium maydis)*	Corn	3.83%							H		
Leaf spot	*Alternaria humicola*	Pea	2.56%		H							
Lentil anthracnose	*Colletotrichum lentis* (lentil affecting strain)	Broad bean	4.52%		H							
Lettuce rust	*Puccinia opizii*	Lettuce	27.17%			H						
Potato spindle tuber viroid (exotic strains)	*Potato spindle tuber viroid* (Pospiviroid) (exotic strains)	Potato, tomato, capsicum	8.80%								H	
Root knot nematode	*Meloidogyne enterolobii (Syn. Meloidogyne mayaguensis)*	Capsicum, eggplant, cabbage, cucumber lettuce, carrot and bean	64.12%	H	H	H	H	H			H	
Rust	*Uromyces lineolatus*	Carrot, parsnip and other Apiaceae species	15.40%	H								
Rust of celery	*Puccinia apii*	Celery	2.76%	H								
Rust of dill	*Puccinia nitida*	Parsley, dill, coriander	0.50%	H								

Common name	Scientific name	Vegetable R&D levied commodity affected	Proportion of total levied vegetable industry impacted by pest/disease	Overall risk (for AUSVEG levied commodities within the family)								
				Apiaceae	Fabaceae	Asteraceae	Brassicaceae	Cucurbitaceae	Amaranthacea	Poaceae	Solanaceae	Alliaceae
Rusts	*Puccinia spp.* (exotic species)	Allium spp.	2.28%									H
Tomato brown rugose fruit virus	*Tomato brown rugose fruit virus*	Tomato, capsicum	8.80%								H	
Tomato mottle mosaic virus	*Tomato mottle mosaic virus* (Tobamovirus)	Tomato, capsicum	8.80%								H	
Watermelon bud necrosis virus	*Watermelon bud necrosis virus (*Tospovirus*)*	Luffa	Unknown					H				
Zebra chip	*Candidatus* Liberibacter solanacearum	Carrot and celery	14.34%	E							E	
	Puccinia agrophila	Eggplant	1.06%								M-H	

Established pests of biosecurity significance

Introduction

This section identifies established pests of biosecurity significance for the vegetable industry in Australia. By identifying and prioritising established pests which vegetable producers already have to manage, mechanisms can be put in place to better align industry and government resources and provide a stronger base for biosecurity risk management for the vegetable industry.

Identification of established pests of significance will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, surveillance coordinators, diagnosticians and development of pest-specific mitigation activity.

Threat identification

Information on established pests of the vegetable industry described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

Prioritising pest threats

Although established pests listed in this plan (Table 3) had to meet the criteria listed below for establishment, spread and economic impact, these pests did not undergo a formal pest risk assessment. These pests were considered in an effort to prioritise investment.

Spread: The natural spread of the pest to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage. There may be state or territory specific regulations in place to prevent the pest spreading.

Establishment: The pest has the potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environment conditions that prevail in Australia. Based upon its current distribution in Australia, and known conditions of survival, it is likely to survive in Australia in the majority of regions where the host is grown.

Economic Impact: There are severe impacts on production including host mortality and/or significant impacts on either crop quality or storage losses, and/or severe impacts on market access.

Table 3. Established pests of biosecurity significance

Common name	Scientific name	Host(s)	Affected plant part	Additional comments	Factsheets	Distribution within Australia	State movement controls
INVERTEBRATE							
Silverleaf white fly	*Bemisia tabaci* (endemic types)	Highly polyphagous including Asteraceae, Balsaminaceae, Brassicaceae, Chenopodiaceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Malvaceae, Piperaceae, Solanaceae	Leaves and stems	*B. tabaci* is a vector of over 60 plant viruses in the genera Geminivirus, Closterovirus, Nepovirus, Carlavirus, Potyvirus and a rod-shaped DNA virus (Markham et al., 1994). There are 24 different types. Currently types Australia/Indonesia, Australia and Middle East/Asia Minor 1 are found in Australia (De Barro et al., 2011).	**www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/312805/Silverleaf-whitefly-in-vegetables.pdf** **https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/pests-field-crops/silverleaf-whitefly**	ACT, QLD, SA, VIC, WA	Restrictions on the entry of nursery stock, cut flowers and foliage, and leafy vegetables **into** the Kimberley region.
Tomato/ potato psyllid	*Bactericera cockerelli*	Capsicums, eggplants, peppers & other solanaceous crops	Whole plant, above ground	An insect that is capable of spreading bacterium that lives in the phloem or conducting tissue of plants and causes serious disease in tomatoes, potatoes and carrots. The tomato-potato psyllid is native to North America and can cause a syndrome on plants known as psyllid yellows in the absence of CLsO. Psyllid yellows can cause a significant reduction in tomato yield and quality.	**www.planthealthaustralia.com.au/wp-content/uploads/2017/04/Zebra-chip-tomato-potato-psyllid-FS.pdf**	WA	Various movement restrictions apply on Solanaceae and Convolvulaceae plants entering QLD, NSW, SA and VIC. Movement controls also exist within WA.
Bean pod borer	*Maruca vitrata* (Syn. *M. testulalis*)	Fabaceae including pigeon pea, legumes, soybean, beans, lima bean, kudzu, cowpea	Pods	Larvae consume the seeds within pods, sometimes totally. Entry holes in the pods allow water to enter which can stain the uneaten seeds.	**www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/bean-podborer**	NSW, QLD, NT	

Common name	Scientific name	Host(s)	Affected plant part	Additional comments	Factsheets	Distribution within Australia	State movement controls
Beanfly	*Ophiomyia phaseoli*	Fabaceae including pigeon pea, legumes, soybean, lucerne, lima bean, common bean, pea, adzuki bean, mung bean, cowpea	Roots and stems, can cause dwarfing of whole plant	Larvae tunnel into vascular tissue, causing wilting and reduced plant strength. Newly emerging crops are at greater risk but later crops are sometimes attacked.	**https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/pests-field-crops/bean-fly**	ACT, QLD, WA and restricted distribution within NSW	
Cluster caterpillar	*Spodoptera litura*	Highly polyphagous including potato, tomato, eggplant, onion, cauliflower, cabbage, citrus, chilli, coffee, soybean, cut flowers, apple, lucerne, tobacco, peppers, cocoa, grapevine, maize	Leaves	Can be severe leaf defoliators if conditions are favourable to them, with studies reporting 20-100% damage to potato crops depending on water availability.		ACT, NT and restricted distribution within NSW, QLD, and WA	
Diamondback moth	*Plutella xylostella*	Brassicas including cabbage, cauliflower, brussels sprouts, kohlrabi, broccoli, Chinese cabbage, turnip, lettuce, mustard	Above ground plant parts	Attacks 136, 000 hectares of major *Brassica* vegetable crops in Australia per year. Throughout the world it is considered to be the main insect pest of cruciferous vegetables.	**http://pir.sa.gov.au/__data/assets/pdf_file/0004/272992/Diamondback_Moth.pdf**	ACT, NSW, QLD, SA, TAS, VIC, WA	
Potato tuber moth	*Phthorimaea operculella*	Potato, tomato, eggplant, capsicum, tobacco	Leaves, roots, stems	A significant pest both pre- and post-harvest		ACT, NSW, QLD, SA, TAS, VIC and restricted distribution within WA	

Common name	Scientific name	Host(s)	Affected plant part	Additional comments	Factsheets	Distribution within Australia	State movement controls
Red legged Earth Mite	*Halotydeus destructor*	Highly polyphagous including asparagus, beetroot, capsicum, cucurbits, sweet pea, lupin, lucerne, tobacco, beans, radish, tomato, potato, wheat, faba bean	Above ground plant parts	Mite feeding causes seedling mortality which can lead to reduced yields. Production losses can be severe in southern Australia.		VIC, NSW, SA, WA	
Red shouldered leaf beetle	*Monolepta australis*	Avocado, carambola, cotton, corn, Eucalyptus, grasses, legumes, lychee, macadamia, mango	Leaves, roots	Form swarms which invade orchards and can cause serious damage within 2-3 hours. However it is only the swarming beetles which cause damage; individuals or small groups are not likely to cause damage.	**https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable/insect-pests/red-shouldered-leaf-beetle**	ACT, NSW, QLD	
Western flower thrips	*Frankliniella occidentalis*	Highly polyphagous including Asteraceae, Alliaceae, Solanaceae, Cucurbitaceae, Chenopodiaceae, Fabaceae, Moraceaea, Roseaceae, Malvaceae, Liliaceae, Orchidaceae, Vitaceae, Rutaceae, Brassicaceae, Ericaceae, Poaceae, Balsaminaceae	Above ground parts		**www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/thrips-overview/western-flower-thrips** **www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Western-flower-thrips-FS.pdf** **https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/349791/Western-flower-thrips-Frankliniella-occidentalis.pdf**	Widespread	

Common name	Scientific name	Host(s)	Affected plant part	Additional comments	Factsheets	Distribution within Australia	State movement controls
Green snail	*Cornu apertus* (syn. *Cantareus apetus, Helix aperta)*	Highly polyphagous including leafy vegetables, cereal crops, pasture grasses and native plants.	Leaves	Green snail is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*, landholders are required to report and control the pest on their properties.	**www.agric.wa.gov.au/plant-biosecurity/green-snail-declared-pest**	WA	A WA declared pest that must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia.
Red imported fire ant	*Solenopsis invicta*	Omnivore eating soybean, eggplant, corn, honeydew, invertebrates and vertebrates	Whole plant	The impact on vegetables is low however the social implications is high on workers as bites from fire ants are very painful.	**http://invasives.org.au/wp-content/uploads/2015/01/fs-red-imported-fire-ants.pdf**	Restricted distribution within QLD	QLD has a fire ant pest biosecurity zone **https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/pests/movement-controls/maps**

Common name	Scientific name	Host(s)	Affected plant part	Additional comments	Factsheets	Distribution within Australia	State movement controls
Stable fly	*Stomoxys calcitrans*	Humans, pets, agriculture, livestock	Crop residue	Stable fly breeds in vegetable residue after crops are harvested. It is closely associated with human activity and can be a serious pest of livestock around animal enclosures, stables, feedlots and paddocks or pastures. All vegetable growers in WA (except for beans, capsicums, cucumbers, parsley, potatoes, tomatoes and spinach) need to abide by the Regulation and Management Plan as part of the Biosecurity and Agricultural Management Act.	**www.toodyay.wa.gov.au/files/sharedassets/public/planning/health/stable-flies-fact-sheet.pdf**	Restricted distribution in WA, TAS, SA and VIC	
Melon thrips	*Thrips palmi*	Wide range including beans, capsicum, cucumbers, eggplant, melons, pumpkin, squash and zucchini. Weed hosts include plants from the Cucurbitaceae and Solanaceae families.	Whole plant	There are no quarantine restrictions for movement of melon thrips hosts within Queensland. However, South Australia, Western Australia and the Northern Territory restrict the introduction of host crops and plants from within a 100 km radius of a detection of the pest.	**https://www.daf.qld.gov.au/business-priorities/biosecurity/plant/health-pests-diseases/a-z-list-of-emergency-plant-pests-and-diseases/melon-thrips** **www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Melon-thrips-FS.pdf** **https://dpir.nt.gov.au/__data/assets/pdf_file/0020/233606/753.pdf**	ACT and QLD	Melon thrips north Queensland restricted area and Melon thrips south east Queensland restricted area. Restrictions apply to fruit and vegetables when travelling south from Darwin to prevent the spread of the pest melon thrips. Uncertified cut flowers, foliage and leafy vegetables are **not allowed out of** the Ord River Irrigation Area (Kununurra) unless certified. This is to reduce the risk of spreading melon thrips.

Common name	Scientific name	Host(s)	Affected plant part	Additional comments	Factsheets	Distribution within Australia	State movement controls
PATHOGENS AND NEMATODES							
Angular mosaic of beans	*Cowpea mild mottle virus* (Carlavirus)	Wide range including soyabeans, peanuts, lima bean, bean, tomato, faba bean, cowpea, asparagus bean, groundnut	Whole plant	First detected of the virus in Queensland in 2016 in Fabaceae species. May be transmitted by manual inoculation or whitefly (*Bemisia tabaci)*		Queensland	
Cucumber Green Mottle Mosaic Virus (CGMMV)	*Cucumber green mottle mosaic virus* (Tobamovirus)	Watermelon, melon, cucumber, pumpkin, gourd, tobacco, apricot	Whole plant	Reduces fruit yield and quality. Spreads efficiently by plant-to-plant contact transmission and via seed. Different CGMMV strains differ in the symptoms they cause		NT, Qld, WA	
Potato spindle tuber viroid (PSTVd)	*Potato spindle tuber Pospiviroid*	The primary natural host of PSTVd is potato, but the viroid also affects tomato and other Solanaceae plants	Whole plant	Mild strains show no or minor symptoms but severe strains induce leaves to curl downwards and become spindly with a rough surface and darker colour. The tubers become small, spindly and elongated and may have growth cracks	**www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Potato-spindle-tuber-viroid-FS.pdf**	WA, QLD and under eradication in South Australia. Successfully eradicated from Victoria and New South Wales	Legislation is consistent between NSW, Victoria and South Australia. Potato propagative material (including seed potatoes) will be restricted entry unless produced under a certification scheme that meets the National Standard for Certification of Seed Potatoes or grown in an area free from PSTVd

Established weeds of biosecurity significance

Introduction

This section identifies established weeds of biosecurity significance for the vegetable industry. By identifying and prioritising weeds which vegetable producers already have to manage, or may have to deal with in the future, mechanisms can be put in place to better align industry and government resources and provide a strong base for biosecurity risk management for the vegetable industry.

Although weeds were not formally included in the EPPRD at the time that this biosecurity plan was released, exotic weeds may be responded to in a similar way to exotic plant pests in the future. Therefore, it is critical that the vegetable industry start reviewing the threat of weeds to their production system.

Identification of weeds of significance will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and botanists, and development of specific incursion response plans if an incursion of the weed occurs, or if the weed spreads further in production regions of Australia.

Threat identification

Information on weeds of the vegetable industry described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

Prioritising weed threats

Although established weeds listed in this plan (Table 4) had to meet the criteria listed below for establishment, spread and economic impact, these pests did not undergo a formal pest risk assessment. These weeds were considered in an effort to prioritise investment.

Spread: The natural spread of the weed to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage. There may be state or territory specific regulations in place to prevent the pest spreading.

Establishment: The weed has the potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environment conditions that prevail in Australia. Based upon its current distribution in Australia, and known conditions of survival, it is likely to survive in Australia in the majority of regions where the host is grown.

Economic Impact: There are severe impacts on production including host mortality and/or significant impacts on either crop quality or storage losses, and/or severe impacts on market access.

Table 4. Established weeds of biosecurity significance

Common name	Scientific Name	Crop affected	Distribution in Australia	Plant part affected	Comments	State movement controls
Blackberry	***Rubus* spp.**	Generalist	Across southern Australia including southern QLD, NSW, VIC, parts of SA, WA and TAS	Whole plant	Highly invasive. Forms impenetrable thickets and mounds that alienate productive land. Thickets contain dry material and thus are a fire hazard. Livestock and other large animals may be trapped in the thickets.	Movement controls described in the Blackberry control manual. **http://weeds.ala.org.au/WoNS/blackberry/docs/blackberry-control-manual-intro.pdf**
Branched broomrape	***Orobanche ramosa***	Potato, tomato, eggplant, onion, celery, cucurbits, lettuce, Fabaceae	South Australia	Leaves, roots	Parasitic plant that can cause wilting, yellowing and necrosis of foliage and reduced root system	NSW state prohibited weed.
Fireweed	***Senecio madagascariensis***	Generalist	South-eastern coast of Australia (QLD, NSW, VIC)	Whole plant	Highly invasive and quickly establishes anywhere where ground has been cultivated or disturbed or where groundcover competition is reduced. Toxic to livestock	ACT notifiable and prohibited weed. **www.legislation.act.gov.au/ni/2014-333/current/pdf/2014-333.pdf**
Lantana	***Lantana camara***	Pineapple, tea, coffee, cotton, rice, sugarcane, Poaceae, pastures	Present in all states and territories as an ornamental plant, is a weed in NSW, QLD, NT, WA and SA	Whole plant	Highly invasive and quickly establishes anywhere where ground has been cultivated or disturbed or where groundcover competition is reduced. Toxic to livestock	Sale and movement of prohibited in SA. **http://pir.sa.gov.au/__data/assets/pdf_file/0020/137351/common_lantana_policy.pdf**
Mexican poppy	***Argemone mexicana***	Potato, sorghum, wheat, maize, coffee, cotton, lucerne, beans	Nationwide	Whole plant	Can inhibit germination and seedling growth of vegetables. Toxic to livestock.	WA prohibited pest. **www.agric.wa.gov.au/organisms/77657**
Nut grass	***Cyperus rotundus***	Occurs in all crops grown within its range	Nationwide	Whole plant	Highly invasive. Can grow in all soil types and survive high temperatures. Transported in contaminated soil. Is tolerant to many herbicides.	

Common name	Scientific Name	Crop affected	Distribution in Australia	Plant part affected	Comments	State movement controls
Parthenium	***Parthenium hysterophorus***	Potato, tomato, eggplant, okra, onion, citrus, coffee, pumpkin, cotton, sunflower, mango, beans, sugarcane wheat, maize	NT, QLD, NSW	Whole plant	Releases allelopathic chemicals into soil that inhibit germination and growth of crops.	
Saffron thistle	***Carthamus lanatus***	Can grow in any cultivated land, but mainly affects cereal and grain crops	VIC, NSW, SA, WA	Whole plant	Competes with crops for moisture, light and nutrients, can cause up to 70% yield reduction in grain crops	
Serrated tussock	***Nassella trichotoma***	Grasses, pastures	NSW, VIC, TAS	Whole plant	Outcompetes grasses and pasture plants and greatly reduces production capacity due to its low grazing value	**Regionally prohibited** in the Mallee, Wimmera, North Central, Glenelg Hopkins, Goulburn Broken, North East, and East Gippsland Catchments. **Regionally controlled** in the Corangamite, West Gippsland, Port Phillip and Western Port Catchments. **http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/weeds/a-z-of-weeds/serrated-tussock**
Datura stramonium	***Thornapple***	Potato, tomato, beetroot, soyabean, cotton, barley, cassava, lucerne, beans, pea, sugarcane, wheat, grapevine, maize	Nationwide	Whole plant	Can compete with crops season-long, resulting in decreased yields. Is an alternate host for many important pests and pathogens of Solanaceous crops, including potato moth (*Phthorimaea operculella*). It is highly toxic to humans and livestock.	WA declared pest under official management. **www.agric.wa.gov.au/organisms/91959** Lord Howe Island regionally controlled weed. **http://weeds.dpi.nsw.gov.au/Weeds/Details/296**
Cyperus esculentus	***Yellow Nutsedge***	Occurs in all crops grown within its range	QLD, NSW, VIC, SA, TAS	Tubers, roots, whole plant	Produces tubers that can compete with and damage tuber/root crops	

Implementing biosecurity for the Australian Vegetable industry 2017-2022

Following the prioritisation and gap analysis through the Biosecurity Implementation Group (BIG) biosecurity planning process, both industry and government have developed an implementation plan that sets out shared biosecurity goals and objectives. This section contains a Biosecurity Implementation Table which should act as a guide for biosecurity activities for the vegetable industry and the government for 2017-2022. It is intended that the plan is monitored using annual review by the Biosecurity Reference Panel.

Biosecurity Implementation Table

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[12] and the National Plant Biosecurity Strategy (NPBS)[13] by providing a clear line of sight between the development of this Biosecurity Plan and broader plant health policy and legislation.

This table aims to provide the focus and strategic direction for plant biosecurity activities relating to the vegetable industry over the next five years (i.e. the life of this Biosecurity Plan). The table provides specific recommendations on potential biosecurity activities identified by both industry and government to improve biosecurity preparedness for pest threats.

This table has been developed in recognition that biosecurity is a shared responsibility between the vegetable industry and governments, and for this reason, the Biosecurity Implementation Table has been produced to help coordinate actions and resources in the biosecurity system, with the view of creating an effective and productive biosecurity partnership. Activities may require additional funding to be sourced prior to commencement. By implementing the specific actions listed in the Biosecurity Implementation Table, it will not only strengthen the vegetable biosecurity system, but also the broader plant biosecurity system. Future versions of this table will contain information on the progress made by governments and industry on the Biosecurity Implementation Table (Table 5).

[12] For more information visit **www.agriculture.gov.au/animal-plant-health/pihc/intergovernmental-agreement-on-biosecurity**
[13] For more information visit **www.planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/**

Table 5. The Biosecurity Implementation Table for the Australian Vegetable Industries (2017-2022)

Strategy: Capacity and Capability

Aligns with Strategy 4 of NPBS, Schedule 6 of IGAB

	Details	Responsible party	Involved Parties	Due date	Current activities
a	Establish a biosecurity reference panel to help coordinate industry's future biosecurity activities, develop key biosecurity messages/materials and to review the implementation plan annually.	PHA	Vegetable industry, Hort Innovation, State and Territory Government, Commonwealth Government, PHA	2017 and then annually	Biosecurity reference panel will run as part of the Hort Innovation funded vegetable biosecurity plan update
b	Ensure that reference panel priorities feed through to the relevant funding body (e.g. RDC) or committee (e.g. fruit fly council, NPBRDE IC, SPHD, SNPHS).	PHA	Reference panel, Commonwealth Government, Hort Innovation, relevant committees, PHA	Annually	Undertaken where appropriate.
c	Develop biosecurity content/capability industry training program for vegetable growers. An example training program would be a biosecurity workshop that would go through the steps to develop your own farm biosecurity plan integrated with a quality assurance scheme. This would be run by field extension officers. - Consider a nation-wide train the trainer biosecurity module for VegNET extension officers in the vegetable area - Provide training for growers in online biosecurity planning	Vegetable industry	Vegetable industry, PHA	Ongoing	AUSVEG Activities: A farm biosecurity planning and train the trainer scheme is currently being developed as a part of the Vegetable and Potato Biosecurity Program. Update of the biosecurity component in EnviroVeg has commenced. EnviroVeg is currently undergoing alignment with Freshcare ENV3. Vegetable Industry Activities: VegNET Coordinators around Australia are organising biosecurity workshops with more frequency.

Details	Responsible party	Involved Parties	Due date	Current activities
h) State departments review their capability for an incursion across all components of a response. Implement action if appropriate.	State and Territory Government	State and Territory Government	Ongoing	Every state has a review following every incursion but this may be done internally or externally.
i) Ensure industry have sufficient research capacity in biosecurity (including succession planning).	Vegetable industry, State and Territory Government	Vegetable industry, CSIRO, PBRI, Hort Innovation, State and Territory Government, Commonwealth Government	Ongoing	Vegetable Industry Activities: The Plant Biosecurity Research Initiative has been championed by Hort Innovation and the Rural Research and Development for Profit project “improving plant pest management through cross industry deployment of smart sensor, diagnostics and forecasting” will support development of biosecurity research capacity.
j) Consider the potential for a cost benefit analysis of implementing a vegetable industry biosecurity certification system similar to BioSecure HACCP.	Vegetable industry	Vegetable industry, Hort Innovation, State and Territory Government, Commonwealth Government	2020	Vegetable Industry Activities: Hort Innovation funded an options paper – investigating on Farm HACCP Programs for Managing Plant Pests of Biosecurity Concern and are currently considering the potential for further work following on from the recommendations of this paper.

Strategy: Plant Biosecurity Education and Awareness

Aligns with Strategy 7 of NPBS, Schedule 6 of IGAB

Details	Responsible Party	Involved Parties	Due Date	Current Activities
a) Promote, disseminate and demonstrate biosecurity to industry through industry forums, newsletters, road shows, field days, social media, networks and/or workshops (hardcopy and online): - On-farm Biosecurity Planning - Reporting anything unusual - Use of high health propagation material - Best biosecurity practice such as hygiene principles - Develop a shed poster (by commodity) on exotic and established pests to be on the lookout for to encourage monitoring and reporting if found. - Raise industry-wide awareness of the EPPRD and owner reimbursement cost (ORC) frameworks. - A targeted approach to raising awareness of biosecurity is required to ensure risks are mitigated throughout the supply chain (growers, contractors, agronomists, processors etc.). Delivered through the vegetable and potato biosecurity program.	AUSVEG	AUSVEG, State and Territory Governments, PHA	Ongoing	AUSVEG Activities: Vegetable and Potato biosecurity officers and the Vegetable Industry Communications program routinely disseminate biosecurity awareness material and information on ORCs and the EPPRD and include information on reporting, biosecurity BMPs, and the EPPRD in each biosecurity workshop with industry.

Details	Responsible Party	Involved Parties	Due Date	Current Activities
b) Raise awareness of the economic case for good biosecurity practice (e.g. what would be the cost of a specific incursion at a regional level and across the supply chain).	Vegetable industry	Vegetable industry, Hort Innovation, Commonwealth Government, PHA	Ongoing	Cowpea mottle mosaic virus had some costs associated with good biosecurity practice done by QDAF which has been shared with AUSVeg to promote to the vegetable industry to demonstrate the economic case for good biosecurity practice.
c) Raise understanding of risk pathways (i.e. areas of vulnerability for the industry e.g. seed/seedlings, an open domestic industry that shares equipment, planting materials, contractors and the distribution of waste post-processing).	Vegetable industry	Vegetable industry, Commonwealth Government, PHA	Ongoing	AUSVEG Activities: Vegetable and Potato biosecurity officers raise an understanding of risk pathways. AUSVEG represents the industry on the Imported Seed Regulation Taskforce. Department of Agriculture continuously do Import Risk Analyses which report risk pathways.
d) Review and develop the vegetable biosecurity manual and distribute to growers through awareness activities (e.g. a ute guide, hard copy and an electronic format).	Vegetable industry, PHA	Vegetable industry, Hort Innovation, PHA	Ongoing	AUSVEG Activities: Biosecurity officers have developed an industry specific Action Planner.

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
e)	Prioritise, review and develop detailed fact sheets on the following High Priority Pests and publish them on the AUSVEG and PHA websites and distribute to growers through the biosecurity officer program: **Invertebrates** *Delia florilega (*bean seed fly), *Rhizoglyphus setosus (*bulb mite), **Pathogens** *Colletotrichum higginsianum (anthracnose), Colletotrichum lentis* (lentil affecting strain – lentil anthracnose), *Heterodera ciceri* (Chickpea cyst nematode), *Rhizoctonia solani f.sp. sasakii* (banded leaf and sheath spot), *Meloidogyne naasi* (barley root knot nematode), *Puccinia opizii (*lettuce rust), *Puccinia spp*. (exotic species) (Alliaceae rust), *Uromyces lineolatus (*Apiaceae rust)	Vegetable industry, PHA	Vegetable industry, Hort Innovation, PHA	Ongoing	
f)	Develop a virus factsheet providing growers with a decision tree to shortlist potential causes and contacts for further diagnosis.	Vegetable industry, PHA	Vegetable industry, Selected researchers, PHA	Ongoing	Hort Innovation: funded area wide management for vegetables is investigating pest management as a group in a geographic area. This project is delivering basic disease identification knowledge to vegetable industry consultants, agronomists and other industry representatives like seed companies and resellers. It will be delivered nationally over 2020

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
g)	Prepare biosecurity awareness materials and training in languages other than English (for owners, backpackers and casual staff).	Vegetable industry	Vegetable industry, State and Territory Governments	Ongoing	AUSVEG Activities: The Vegetable and Potato biosecurity officer program routinely has biosecurity information sheets, gate signs and planning resources translated into languages other than English e.g. Vietnamese. In 2018 there was a number of factsheets translated into Mandarin, Arabic and Hindi by NSW LLS.
h)	Identify industry biosecurity training and extension needs, recommend priorities.	PHA	Biosecurity Reference Panel, PHA	Annually	PHA provided this information at the implementation meeting and will review it annually at the biosecurity reference panel meetings
i)	Raise awareness of the BeeAware website: **beeaware.org.au** and subscribe to the BeeAware newsletter.	Vegetable industry	Vegetable industry	Ongoing	
j)	Raise awareness of the Australian Honey Bee Industry Biosecurity Code of Practice for growers who utilise managed hives for pollination as a lever for requiring high health (biosecure) hives (growers to request certificate of compliance from beekeepers) **honeybee.org.au/wp-content/uploads/2016/07/Australian-Honey-Bee-Industry-Code-of-Practice-July-2016.pdf**	Vegetable industry	Vegetable industry	Ongoing	

Strategy: Preparedness and Response

Aligns with Strategy 3 of NPBS, Schedule 7 of IGAB

Details	Responsible party	Involved Parties	Due date	Current Activities
a) Engage with regulators and regulatory experts (e.g. SDQMA) in determining domestic market aspects in an incursion of a HPP. Consider the opportunity for multi-species contingency plans e.g. Tospoviruses.	Vegetable Industry, State and Territory Governments	Vegetable Industry, SDQMA, Hort Innovation, State and Territory Governments	Ongoing	Hort Innovation has funded a leafminer, spotted wing drosophila and an area wide management project all which are delivering contingency plans.
b) Prioritise then develop an industry specific contingency plan for the following High Priority Pests **Invertebrates** *Trichoplusia ni* (Cabbage looper), *Psila rosae* (Carrot rust fly), *Aulacophora foveicollis* (Red pumpkin beetle), *Delia floralis* (Summer cabbage fly), Thaumatotibia leucotreta (false codling moth) **Pathogens** *Puccinia agrophila*, *Colletotrichum higginsianum* (Anthracnose), *Heterodera carotae* (Carrot cyst nematode), *Puccinia opizii* (Lettuce rust), *Uromyces lineolatus* (Apiaceae rust), Tospoviruses	Vegetable industry	Vegetable industry, Hort Innovation, PHA	Ongoing	

	Details	Responsible party	Involved Parties	Due date	Current Activities
c)	Prioritise then develop/update a cross sectoral contingency plan for the following High Priority Pests **Invertebrates** *Lissachatina fulica* (Giant African land snail) - Multiple Industries, *Delia florilega* (Bean seed fly) -Onions, *Rhizoglyphus setosus* (Bulb mite) - Onions, *Bactrocera carambolae* (Carambola fruit fly), *B. passiflorae* (Fijian fruit fly), *B. cucurbitae* (Melon fruit fly), *B. trivialis* (New Guinea fruit fly), *B. dorsalis* (Oriental fruit fly) - Multiple Industries, *Bemisia tabaci* (Silverleaf whitefly) -Cotton, Nursery and Garden, Melons, *Eumerus strigatus* (Lesser bulb fly) -Onions, *Lygus hesperus* (Western plant bug) - Strawberry, Cotton **Pathogens** *Phytophthora infestans* (A2 mating type) (Late blight) -Potato, *Puccinia spp.* (exotic species) (Alliaceae rust) -Onions, *Meloidogyne enterolobii* (Root knot nematode) -Potato, Onion, *Meloidogyne naasi* (Barley root knot nematode) -Grains	Vegetable industry	Vegetable industry, Relevant Industries, relevant RDCs, relevant State and Territory Governments, Commonwealth Government, PHA	Ongoing	
f)	To investigate the development of leafminer emergency permits with the APVMA for high priority pests of the Australian vegetable industry. If required identify trial work required to acquire a permit.	Vegetable industry, Hort Innovation, State and Territory Governments	Vegetable Industry, Hort Innovation, APVMA, State and Territory Governments, PHA	2019	Vegetable Industry Activities: 6 chemical insecticide permits for the control of Vegetable leafminer applied for through a Hort Innovation funded project in 2018.

	Details	Responsible party	Involved Parties	Due date	Current Activities
g)	Promote clean planting material and communicate the benefits to growers e.g. - Working with nursery to promote clean seedlings and planting material and linking with the auditable scheme BioSecure *HACCP* - Ensure clean seed for planting (e.g. virus screening).	AUSVEG, NGIA, State and Territory Governments	AUSVEG, NGIA, State and Territory Government, PHA	Ongoing	AUSVEG Activities: The Vegetable and Potato biosecurity officer program has distributed information on biosecure HACCP to industry and routinely makes reference to this scheme at workshops.
i)	Undertake preparedness activities including chemical control, contingency planning, surveillance strategy and diagnostic protocols for *Liriomyza spp.* (leafminer).	AUSVEG	AUSVEG, State and Territory Government, Hort Innovation, PHA	2020	AUSVEG Activities: AUSVEG and four other project partners have funding from the vegetable and nurseries industry levies to conduct research, development and extension on *Liriomyza sativae*, in preparation for its spread from the north. Project funding granted to cover other exotic leafminer species.

	Details	Responsible party	Involved Parties	Due date	Current Activities
j)	Undertake preparedness and response activities for *Candidatus* Liberibacter solanacearum (CLso).	AUSVEG	AUSVEG, Biosecurity Reference Panel, Hort Innovation, State and Territory Government, Researchers	Ongoing	AUSVEG Activities: AUSVEG has employed a TPP Coordinator who has been working since October 2017. The Coordinator acts as a central contact point and knowledge broker for TPP preparedness activities. Vegetable Industry Activities: Hort Innovation has funded several other projects relating to surveillance, diagnostics and extension to prepare for TPP.A proposal is with Hort Innovation to fund a CLso specific business continuity plan. National surveillance program for TPP.
k)	Engage with preparedness and response activities developed for bee pests such as Varroa e.g. simulation activities and National Bee Pest Surveillance and remain up to date with the latest RD&E about optimal pollination and alternative pollinators.	Vegetable industry, State and Territory Governments	Vegetable industry, Relevant industries, Hort Innovation, State and Territory Governments, Commonwealth Government, PHA	Ongoing	AUSVEG has supplied a CCEPP and NMG representative during the Varroa incursion. The Vegetable Industry is contributing to the Varroa eradication.
l)	Ensure the vegetable industry member databases remain current to facilitate distribution of critical information in the event of an emergency response (to be held confidentially by AUSVEG).	AUSVEG	AUSVEG	Ongoing	AUSVEG: Ongoing maintenance of databases occurs along with communication material distributed to members of these databases. AUSVeg have undertaken a review of the database and implemented changes.

	Details	Responsible party	Involved Parties	Due date	Current Activities
m)	Consider categorisation of these High Priority Pests in the Emergency Plant Pest Response Deed: **Invertebrates** Phytomyza gymnostoma (Allium leafminer*),* *Liriomyza trifolii* (American serpentine leafminer), *Aphis fabae (*Bean aphid), *Delia florilega* (Bean seed fly), *Halyomorpha halys* (Brown marmorated stink bug), *Rhizoglyphus setosus* (Bulb mite), *Trichoplusia ni* (Cabbage looper), *Spodoptera frugiperda* (Fall armyworm) *Bactrocera carambolae* (Carambola fruit fly), *Psila rosae* (Carrot rust fly), *Bactrocera passiflorae* (Fijian fruit fly), *Lissachatina fulica* (Giant African land snail), *Eumerus strigatus* (Lesser bulb fly), *Bactrocera cucurbitae* (Melon fruit fly), *Bactrocera trivialis* (New Guinea fruit fly), *Delia antiqua* (Onion fly), *Liriomyza huidobrensis* (Pea/Serpentine leafminer), *Liriomyza bryoniae* (Tomato leaf miner), *Aulacophora foveicollis* (Red pumpkin beetle), *Bemisia tabaci* (Silverleaf whitefly), *Tuta absoluta* (South American tomato moth), *Delia floralis* (Summer cabbage fly)	AUSVEG, State and Territory Government, Commonwealth Government	AUSVEG, other affected industry, State and Territory Government, Commonwealth Government, PHA	Ongoing	Brown Marmorated Stink Bug is currently under review for categorisation

	Details	Responsible party	Involved Parties	Due date	Current Activities
n)	Consider categorisation of these High Priority Pests in the Emergency Plant Pest Response Deed: **Pathogens** *Puccinia agrophila*, *Colletotrichum higginsianum* (Anthracnose), *Rhizoctonia solani f.sp. sasakii* (Banded leaf and sheath spot), *Meloidogyne naasi* (Barley root knot nematode), *Heterodera carotae* (Carrot cyst nematode), *Heterodera ciceri* (Chickpea cyst nematode), Groundnut bud necrosis virus, *Phytophthora infestans* (A2 mating type) (Late blight), *Harpophora maydis* (Late wilt), *Alternaria humicola* (Leaf spot), *Colletotrichum lentis* (Lentil anthracnose), *Puccinia opizii* (Lettuce rust), *Meloidogyne enterolobii* (Root knot nematode), *Puccinia spp*. (exotic species) (Alliaceae rust), *Puccinia apii* (Rust of Celery), *Puccinia nitida* (Rust of Dill), *Uromyces lineolatus* (Apiaceae rust), Tomato brown rugose fruit virus, Tomato mottle mosaic virus, Watermelon bud necrosis virus	AUSVEG, State and Territory Government, Commonwealth Government	AUSVEG, other affected industry, State and Territory Government, Commonwealth Government, PHA	Ongoing	

Strategy: Surveillance

Aligns with Strategy 2 of NPBS, Schedule 4 of IGAB

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
a)	To consider the development of a framework for prioritising implementation activities with respect to surveillance (giving consideration to closest neighbour, market analysis, probability and proportion of industry impacted).	Biosecurity Reference Panel	Biosecurity Reference Panel	Ongoing	Plant RDCs, AUSVEG, NGIA, and several other project partners have launched a RRD4P project has been developed for the national plant pest surveillance system. AUSVEG, through vegetable industry funds, has developed an export strategy for the next 5 years.
b)	Raising industry awareness of HPPs, exotic and established pests to ensure better monitoring across the industry and an understanding of the importance of monitoring records regardless of whether a pest is found or not.	Vegetable industry, State and Territory Governments	Vegetable industry, State and Territory Governments, PHA, PBRI	2017 - 2022	Plant RDCs and several other project partners have launched a RRD4P project that will enable development of a national plant pest surveillance system. AUSVEG activities: The Vegetable and Potato Biosecurity Program actively raises awareness of exotic pests throughout industry communications and engagement channels.

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
c)	Understand what surveillance is taking place for HPPs (exotic and established) and develop a surveillance strategy (in a workshop) that links industry and government efforts and ensures industry HPPs are adequately considered.	Vegetable industry, State and Territory Governments	Vegetable industry, State and Territory Governments, Commonwealth Government (SNPHS), PHA	Ongoing	Plant RDCs and several other project partners have launched a RRD4P project that will enable development of a national plant pest surveillance system.
d)	Work with the Subcommittee on National Plant Health Surveillance (SNPHS) to recommend surveillance for industry's HPPs. The biosecurity reference panel to engage annually with SNPHS regarding surveillance priorities.	PHA	Biosecurity Reference Panel, Commonwealth Government (SNPHS), PHA	Annually	Plant RDCs and several other project partners have launched a RRD4P project that will enable development of a national plant pest surveillance system. AUSVEG Activities: AUSVEG has supplied a representative to sit on the National Plant Health Surveillance Consultative Committee
e)	Facilitate and capture data from industry initiated surveillance activities.	Vegetable industry, Hort Innovation, State and Territory Governments	Vegetable industry, Hort Innovation, State and Territory Governments, PHA	Ongoing	Plant RDCs and several other project partners have launched a RRD4P project that will enable development of a national plant pest surveillance system.

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
f)	Facilitate and engage with the iMapsPESTS Sentinel Surveillance initiative.	AUSVEG	AUSVEG, other plant based industries, RDCs, Commonwealth Government (Rural R&D for Profit), State and Territory Government, PHA	2017 - 2022	AUSVEG is a service provider of the surveillance hub initiative and collecting data. The vegetable industry is a partial funder of the initiative. Being complemented by a RR&D4P diagnostics project.
g)	Consider adoption of a surveillance tool to capture industry surveillance data that can be nationally collated (e.g. an existing or new app).	Vegetable industry	Vegetable industry, Hort Innovation, PHA	Ongoing	Plant RDCs and several other project partners have launched a RRD4P project that will enable development of a national plant pest surveillance system. MyPestGuide reporter app is currently available for use.
h)	The industry to continue to fund the National Bee Pest Surveillance Program, which is designed to detect new incursions of exotic bee pests and pest bees.	Vegetable industry	Vegetable industry, Relevant industries, Hort Innovation, State and Territory Government, Commonwealth Government, PHA	2017 - 2021	

Strategy: Diagnostics

Aligns with Strategy 5 of NPBS, Schedule 4 of IGAB

Details	Responsible Party	Involved Parties	Due Date	Current Activities
b) Prioritise, review, develop and submit final National Diagnostic Protocols for High Priority Pests to SPHD for endorsement: **Invertebrates** *Phytomyza gymnostoma* (Allium leafminer), *Liriomyza sativae* (American leafminer), *Aphis fabae* (Bean aphid), *Delia florilega* (Bean seed fly), *Halyomorpha halys* (Brown marmorated stink bug), *Rhizoglyphus setosus* (Bulb mite), *Trichoplusia ni* (Cabbage looper), *Spodoptera frugiperda* (Fall armyworm), *Psila rosae* (Carrot rust fly), *Thaumatotibia leucotreta* (False codling moth), *Lissachatina fulica* (Giant African land snail), *Eumerus strigatus* (Lesser bulb fly), *Delia antiqua* (Onion fly), *Aulacophora foveicollis* (Red pumpkin beetle), *Bemisia tabaci* (Silverleaf whitefly), *Tuta absoluta* (South American tomato moth), *Delia floralis* (Summer cabbage fly), *Liriomyza bryoniae* (Tomato leaf miner), *Lygus hesperus* (Western plant bug)	Commonwealth Government (SPHD)	Vegetable industry, other affect industries, RDCs, Commonwealth Government (SPHD), PHA	Ongoing	

Details	Responsible Party	Involved Parties	Due Date	Current Activities
c) Prioritise, review, develop and submit final National Diagnostic Protocols for High Priority Pests to SPHD for endorsement: **Pathogens** *Puccinia agrophila*, *Colletotrichum higginsianum* (Anthracnose), *Rhizoctonia solani* f.sp. *sasakii* (Banded leaf and sheath spot), *Meloidogyne naasi* (Barley root knot nematode), *Heterodera carotae* (Carrot cyst nematode), *Heterodera ciceri* (Chickpea cyst nematode), *Groundnut bud necrosis virus, Harpophora maydis* (Late wilt), *Alternaria humicola* (Leaf spot), *Colletotrichum lentis* (Lentil anthracnose), *Puccinia opizii* (Lettuce rust), *Meloidogyne enterolobii* (Root knot nematode), *Puccinia* spp. (exotic species) (Alliaceae rust), *Uromyces lineolatus* (Apiaceae rust), *Puccinia apii* (Rust of Celery), *Puccinia nitida* (Rust of Dill), *Tomato brown rugose fruit virus, Tomato mottle mosaic virus,* *Watermelon bud necrosis virus*	Commonwealth Government (SPHD)	Vegetable industry, other affect industries, RDCs, Commonwealth Government (SPHD), PHA	Ongoing	
d) To raise diagnostic priorities with SPHD on an annual basis where priorities change.	Biosecurity reference panel, State and Territory Governments	Biosecurity reference panel, State and Territory Governments, Commonwealth government (SPHD)	Annually	

Details	Responsible Party	Involved Parties	Due Date	Current Activities
e) Consider opportunities to develop in field diagnostics, molecular diagnostics, alternative diagnostics and/or cross-sectoral industry pest diagnostics.	Biosecurity reference panel, State and Territory Governments	Biosecurity reference panel, Hort Innovation, State and Territory Governments, Commonwealth government (SPHD)	Ongoing	Quite a few initiatives being funded by Hort Innovation, PB CRC and private agricultural companies, such as ADAMA. Vegetable industry activities: AgVic is developing in field diagnostics for LAMP. The RR&D4P project covers some diagnostic development. Diagnostic workshops to upskill those involved in the vegetable industry are being run through the VG16086 Hort Innovation funded project.
f) Ensure diagnostic capacity can meet rapid response and monitoring needs (bearing in mind the need for positive controls, reference samples, availability of collections and both capability and experience in a minimum of two laboratories in Australia).	Commonwealth Government (SPHD)	Vegetable industry, State and Territory Government, Commonwealth government (SPHD)	2017	Waiting on release of a diagnostic capacity report that was commissioned by DAWR.

Strategy: Established Pests and Weeds

Aligns with Strategy 6 of NPBS, Schedule 5 of IGAB

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
b)	Raise industry awareness of pests and weeds of biosecurity significance, and demonstrate how best biosecurity practice has direct relevance to day to day operations for pests already within Australia as well as exotic pests.	Vegetable industry	Vegetable industry, PHA	Ongoing	AUSVEG activities: The Vegetable and Potato Biosecurity Program actively raises awareness of exotic pests throughout industry communications and engagement channels.
c)	Prioritise efforts in relation to the containment and management of established pests and weeds.	Biosecurity Reference Panel	Biosecurity Reference Panel, Hort Innovation	Ongoing	AUSVEG activities: The Vegetable and Potato Biosecurity Program raises awareness of weeds
d)	Undertake targeted surveillance for established pests of market concern for the vegetable industry (noting existing markets (Japan, Singapore, United Arab Emirates, New Zealand, Malaysia and Kuwait) and potential markets (China, South Korea, Japan, Taiwan and Indonesia).	Vegetable industry, State and Territory Governments	Vegetable industry, State and Territory Governments	2019	Vegetable Industry Activities: Hort Innovation has funded several other projects relating to surveillance, diagnostics and extension to prepare for TPP.

Strategy: Biosecurity Research, Development and Extension (RD&E)

Aligns with Strategy 8 of NPBS, Schedule 8 of IGAB

Details	Responsible Party	Involved Parties	Due Date	Current Activities
a) Prioritise biosecurity RD&E annually to feed into Hort Innovation plant biosecurity RD&E priorities.	PHA	Biosecurity Reference Panel	Annually	
b) Consider collaborative opportunities to maximise R&D investment in biosecurity.	Biosecurity Reference Panel	Biosecurity Reference Panel, RDCs, NPBRDES IC, FF advisory council, PBRI	Ongoing	The Plant Biosecurity Research Initiative
c) Keep informed about trapping options for brown marmorated stinkbug.	Commonwealth Government	Vegetable Industry, Biosecurity Reference Panel, Affected industries, RDCs, Commonwealth Government	Ongoing	AgVic preparedness team are putting guidelines in place.
d) Support and monitor fruit fly RD&E initiatives either underway or planned (e.g. SITplus initiative and area wide management, Qfly and Medfly disinfestation, investigating support for more flexible trade especially with Asia, and more challenging quarantine requirements) that are relevant to the Vegetable Industry.	Vegetable industry	Vegetable Industry, Hort Innovation Fruit Fly Fund, State and Territory Governments	Ongoing	
e) Invest in alternate pollinator/optimal pollination R&D as a preparedness initiative for bee pests.	Vegetable industry	Vegetable industry, other pollinator reliant industries, P&F NZ, Hort Innovation Pollination Fund, PHA	Year 2017-2020	This aligns with the Hort Frontiers Pollination Fund.

Strategy: Legislative and Regulatory Issues of Importance

Aligns with Strategy 1 of NPBS

	Details	Responsible Party	Involved Parties	Due Date	Current Activities
a)	Raise awareness that everyone has a responsibility to practice good biosecurity under The Biosecurity Act 2015. Some states may have quite specific legislative approaches whilst others have a more general approach, e.g. The General Biosecurity Obligation (in QLD), General Biosecurity Duty (NSW).	Vegetable industry, State and Territory Government	Vegetable industry, State and Territory Government, Commonwealth Government, PHA	Ongoing	AUSVEG activities: The Vegetable and Potato Biosecurity Program actively raises awareness of legal responsibilities pertaining to biosecurity best practice.
b)	States to inform industry and in turn industry to raise awareness with growers on each states legislative requirements in relation to pest reporting and management of neglected farms.	State and Territory Governments, Vegetable industry	Vegetable industry, State and Territory Governments, PHA	2020	AUSVEG activities: An article is being written for the AUSVEG magazines and emails (e-bulletins) on state biosecurity acts.
c)	Consider the constraints and benefits of Property Identification Codes (PICs) for the vegetable industry.	Vegetable industry, State and Territory Governments	Vegetable industry, other plant based industries, State and Territory Governments, Commonwealth Government, PHA	2017-2021	PHA activities: PHA are in discussions with CPHMs and will ask annually what their legislation is and if the state is proposing to amend their legislation to consider PICs.

Australian Vegetable industry - biosecurity preparedness

This document represents the third industry biosecurity planning process undertaken for the Australian industry.

The following table (Table 6) has been populated with the high priority pests of the vegetable industry. The aim of this table is to document the current preparedness documents and activities which are available and are currently being undertaken. This will allow industry, governments and RD&E agencies to better prepare for these high priority pests and align future activities as listed in the Biosecurity Implementation Table (Table 5).

Table 6. Documents and activities currently available for high priority pests of the Vegetable Industry[14] [15]

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Bulb mite (*Rhizoglyphus setosus*)	Alliaceae	**Onion, Cut Flower**		Yes- Qld				
Red pumpkin beetle (*Aulacophora foveicollis*)	Cucurbitaceae	Melon			**www.pacificdisaster.net/pdnadmin/data/original/MAL_SLB_Aulacophora_ExtFsheet40.pdf**			
Allium leafminer (*Phytomyza gymnostoma)*	Alliaceae	**Onion**		Yes- Australian Government				

[14] Copies of these documents are available from **www.planthealthaustralia.com.au/pidd**
[15] Information presented has been taken from the National Plant Health Status Report 2016 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostic Standards, the Subcommittee on National Plant Health Surveillance or other stakeholders
[16] This column only includes vegetable commodities which contribute to the R&D levy. For a complete list of the commodities which contribute to this levy see Appendix 1.
[17] This column includes other industries that have this pest in their biosecurity plan and affected governments
[18] Copies of these documents are available from **planthealthaustralia.com.au/pidd**
[19] For further information please refer to Schedule 13 of the EPPRD. Available from: **www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/**
[20] The National Priority Plant Pest List was developed by the Department of Agriculture and Water Resources. Available from: **www.agriculture.gov.au/pests-diseases-weeds/plant**

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
American leafminer, Serpentine vegetable leafminer, Vegetable leafminer (*Liriomyza sativae*[21])	Alliaceae, Fabaceae, Solanaceae, Cucurbitaceae, Asteraceae, Apiaceae	**Onion, Melon, Tomato**, Nursery and Garden, Cotton, Grains, Potato		Yes- Australian Government, QLD NT, Tas	**www.planthealthaustralia.com.au/wp-content/uploads/2015/08/Vegetable-leaf-miner-FS-Vegetables.pdf** **www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Exotic-leaf-miners-FS-Vegetable.pdf** **https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/exotic-leaf-miners**	Yes – Grains industry	3	
American serpentine leafminer (*Liriomyza trifolii*[22])	Alliaceae, Cucurbitaceae, Fabaceae, Solanaceae	**Cut Flower, Melon, Tomato,** Grains, Cotton, Nursery and Garden, Onion	Yes– NDP 27	Yes- Australian Government, NT, Tas, Vic	**www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Exotic-leaf-miners-FS-Vegetable.pdf** **https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/exotic-leaf-miners**	Yes – Grains industry		

[21] Note: Detected in Queensland but a quarantine area has been established in the far northern biosecurity zone to restrict the spread of the pest.
[22] *Liriomyza trifolii* is only a HPP for the Fabaceae and Solanaceae families and has a medium overall risk for the Alliaceae and Cucurbitaceae families.

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Bean seed fly, Bean seed maggot (*Delia florilega*)	Alliaceae, Brassicaceae, Fabaceae, Poaceae	**Onion,** Nursery and Garden, Tomato						
Carambola fruit fly (*Bactrocera carambolae*)	Solanaceae	**Avocado, Tomato, Mango, Papaya, Passionfruit, Citrus, Viticulture**, Tropicals, Banana	Australian Handbook for the Identification of Fruit Flies	Yes- NAQS, SA, WA, NSW, NT				
Carrot rust fly (*Psila rosae*)	Apiaceae, Brassicaceae	Nursery and Garden			**www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Carrot-rust-fly-FS.pdf**			

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Fijian fruit fly (*Bactrocera passiflorae*)	Solanaceae	**Avocado, Papaya, Passionfruit,** Citrus, Tropicals	Australian Handbook for the Identification of Fruit Flies	Yes- NAQS, Tas, WA, NSW, NT, QLD, Vic	**www.planthealthaustralia.com.au/wp-content/uploads/2013/09/Fijian-fruit-fly-FS.pdf**			
Lesser bulb fly (*Eumerus strigatus*)	Alliaceae, Apiaceae, Brassicaceae	**Onion,** Cutflower			**www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Lesser-bulb-fly-FS.pdf**			
Melon fruit fly (*Bactrocera cucurbitae*)	Cucurbitaceae	Avocado, Cherry, Citrus, Mango, Melon, Lychee, Papaya, Passionfruit, Summerfruit, Tropicals		Yes- NAQS, Tas, SA, WA, Vic, NSW, NT, Qld, Vic	**www.planthealthaustralia.com.au/wp-content/uploads/2013/09/Melon-fruit-fly-FS.pdf**			

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
New Guinea fruit fly (*Bactrocera trivialis*)	Solanaceae	**Citrus,** Tropicals	Australian Handbook for the Identification of Fruit Flies	Yes- NAQS, Tas, SA, WA, Vic, NSW, NT, Qld, Vic	**www.planthealthaustralia.com.au/wp-content/uploads/2013/03/New-Guinea-fruit-fly-FS.pdf** https://www.daf.qld.gov.au/business-priorities/biosecurity/plant/health-pests-diseases/a-z-list-of-emergency-plant-pests-and-diseases/new-guinea-fruit-fly			
Onion fly (*Delia antiqua*)	Alliaceae	**Onion,** Nursery and Garden			**www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Onion-fly-FS.pdf**			

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Oriental fruit fly (*Bactrocera dorsalis*)	Fabaceae, Solanaceae, Cucurbitaceae	**Apple and Pear, Avocado, Tomato, Citrus, Lychee, Papaya, Passionfruit, Summerfruit, Viticulture,** Banana, Cherry, Mango, Tropicals	Australian Handbook for the Identification of Fruit Flies	Yes- NAQS, Tas, SA, WA, NSW, NT, Qld, Vic	**www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Oriental-fruit-fly-FS.pdf** **www.planthealthaustralia.com.au/wp-content/uploads/2015/01/Exotic-fruit-flies-FS.pdf**		2	
Pea leafminer, Potato leafminer, Serpentine leafminer (*Liriomyza huidobrensis*)	Amaranthaceae, Alliaceae, Asteraceae	**Nursery and Garden, Cut Flower, Melon, Tomato,** Grains, Potato	Draft available	Yes- Australian Government, NT, Tas	**www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Exotic-leaf-miners-FS-Vegetable.pdf** https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/exotic-leaf-miners	Yes – Grains industry and Nursery and Garden industry		
Summer cabbage fly (*Delia floralis*)	Brassicaceae, Alliaceae	Grains, Onion			**www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=28167**			

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Tomato leaf miner (*Liriomyza bryoniae*[23])	Solanaceae, Cucurbiataceae, Asteraceae, Fabaceae	**Melon, Tomato,** Cutflower, Grains, Nursery and Garden		Yes- general surveillance, Australian Government, Tas	**www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Exotic-leaf-miners-FS-Vegetable.pdf** https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/exotic-leaf-miners	Yes – Grains industry		
Giant African land snail (*Lissachatina fulica (syn. Achatina fulica)*)	Wide range of crops affected including Fabaceae	**Tomato, Nursery and Garden,** Banana, Grains, Papaya		Yes – Australian Government, NT				
Giant Ghana African snail (*Achatina achatina*)	Wide host range including Brassicaceae, Asteraceae	Grains, Tomato						

[23] *Liriomyza bryoniae* is only a HPP for the Asteraceae, Fabaceae and Solanaceae families and has a medium overall risk for the Cucurbitaceae family.

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Black bean aphid (*Aphis fabae*)	Solanaceae, Fabaceae, Amaranthaceae, Cucurbitaceae, Brassicaceae, Apiaceae	Cotton, Grains, Nursery and Garden, Potato, Tomato, Viticulture				Yes – Nursery and Garden		
Brown marmorated stink bug (*Halyomorpha halys* (Syn. *Halyomorpha mista)*)	Poaceae, Cucurbitaceae, Solanaceae, Fabaceae, Asteraceae, Apiaceae, Amaranthaceae	**Apple and Pear, Truffle, Cotton, Nut, Rubus**, Blueberry, Cherry, Cotton, Cutflower, Grains, Strawberry, Summerfruit, Tomato, Viticulture		Yes– Australian Government, SA, Tas, Vic, WA, NSW,	**www.planthealthaustralia.com.au/wp-content/uploads/2016/04/Brown-Marmorated-Stink-Bug-FS.pdf** **www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/import/cargo/pests/guide-identification-brown-marmorated-stink-bug.pdf**	Yes – Commonwealth Government	In progress	

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Silverleaf whitefly (*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))	Wide host range across vegetables & ornamentals including chrysanthemum and poinsettia.	**Tomato, Cotton, Melon, Nursery and Garden**, Citrus		Yes- NSW, Tas, Qld	**www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/whitefly-overview/silverleaf-whitefly-biotype-b-and-native**			
Western tarnished plant bug (*Lygus hesperus*)	Amaranthaceae, Apiaceae	**Strawberry, Cotton,** Apple and Pear, Grains, Nursery and Garden, Onion, Tomato			**www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Tarnished-and-Western-plant-bugs-FS.pdf**		4	

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Cabbage looper (*Trichoplusia ni*)	Apiaceae, Brassicaceae, Asteraceae, Amaranthaceae, Cucurbitaceae	Cotton, Cutflower, Grains, Melon, Onion, Strawberry, Tomato			**http://idtools.org/id/citrus/pests/factsheet.php?name=Cabbage%20looper** **http://idtools.org/id/leps/lepintercept/pdfs/ni.pdf**			
Fall armyworm (*Spodoptera frugiperda*)	Amaranthaceae, Fabaceae, Solanaceae, Brassicaceae, Cucurbitaceae, Poaceae	**Cotton, Cutflower,** Banana, Ginger, Grains, Onion, Potato, rice, Strawberry, Sweetpotato, Tomato			https://apps.lucidcentral.org/ppp/pdf/mini/fall_armyworm_401.pdf			

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
False codling moth (*Thaumatotibia leucotreta (Syn. Cryptophlebia leucotreta)*)	Wide host range including Solanaceae	**Cherry, Citrus, Cotton, Grains, Pineapple, Summerfruit,** Avocado, Nursery and Garden, Nut, Lychee, Olive, Tomato			**www.planthealthaustralia.com.au/wp-content/uploads/2013/03/False-codling-moth-FS.pdf**	Yes- Grains industry	2	

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
CLsO (*Candidatus* Liberibacter solanacearum[24])	Apiaceae, Solanaceae	**Tomato, Potato**	Yes- NDP 18	Yes[25] - WA, NT. Though every state is doing surveillance for CLsO through TPP surveillance	**www.planthealthaustralia.com.au/wp-content/uploads/2017/04/Zebra-chip-tomato-potato-psyllid-FS.pdf** https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/candidatus-liberibacter-solanacearum https://www.agric.wa.gov.au/plant-biosecurity/candidatus-liberibacter-solanacearum-pest-data-sheet	Yes- Potato industry		
Puccinia agrophila	Solanaceae	No other affected parties			**https://nt.ars-grin.gov/taxadescriptions/factsheets/index.cfm?thisapp=Pucciniaagrophila**			

[24] Haplotype A and B affect Solanaceae (e.g. potatoes) and is vectored by *Trioza apicalis*. Haplotype C affect Apiaceae (carrots and celery) and is vectored by *Bactericera cockerelli*

[25] Following on from the Tomato Potato Psyllid detection in WA the statement below was given concerning Zebra chip surveillance; "Additional surveillance will also take place to provide confidence to industry that the bacterium, which is associated with Zebra chip disease in potatoes, is not present in Australia" (National Talking Points, 27 April 2017).

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Anthracnose (*Colletotrichum higginsianum*)	Brassicaceae	No other affected parties		Yes – general surveillance, QLD				
Banded Leaf and sheath spot/ blight (*Rhizoctonia solani* f. sp. *sasakii* (AG1) (teleomorph *: Corticium sasakii* (Syn. *Thanatephorus cucumeris*))	Poaceae	**Grains**		Yes – general surveillance, QLD				

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Late blight (exotic strains) (*Phytophthora infestans* (A2 mating type, exotic A1 mating type strains))	Solanaceae	**Potato,** Nursery and Garden, Tomato	Draft available	Yes – general surveillance, widespread excluding NT	**http://www.planthealthaustralia.com.au/wp-content/uploads/2018/07/Late-blight-FS.pdf**			
Late wilt, slow wilt (*Harpophora maydis* (Syn. *Cephalosporium maydis, Acremonium maydis*))	Poaceae	**Grains,** Cotton				Yes – Grains industry		
Leaf spot (*Alternaria humicola*)	Fabaceae	Grains		Yes – general surveillance, QLD		Yes – Grains industry (leaf spot of field peas)		

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Lentil anthracnose or soybean anthracnose (*Colletotrichum lentis* (lentil affecting strain))	Fabaceae	No other affected parties		Yes – Vic, NSW, general surveillance, Qld		Yes – Grains industry		
Lettuce rust (*Puccinia opizii*)	Asteraceae	No other affected parties						
Rust (*Uromyces lineolatus*)	Apiaceae	No other affected parties						
Rusts (*Puccinia* spp. (exotic species))	Alliaceae	**Onion**		Yes – species specific surveillance, WA, NSW, Qld, SA, Vic,				
Rust of Celery (*Puccinia apii)*	Apiaceae							

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Rust of Dill (*Puccinia nitida*)	Apiaceae							
Barley root knot nematode (*Meloidogyne naasi*)	Amaranthaceae	Grains						
Carrot cyst nematode (*Heterodera carotae*)	Apiaceae	Nursery and Garden, Olive			**www.appsnet.org/Publications/potm/pdf/Apr08.pdf**			
Chickpea cyst nematode (*Heterodera ciceri*)	Fabaceae	**Grains,** Cutflower				Yes – Grains industry		

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Root knot nematode (*Meloidogyne enterolobii (Syn. Meloidogyne mayaguensis)*)	Solanaceae, Brassicaceae, Cucurbitaceae, Asteraceae, Apiaceae, Fabaceae	Tomato			**www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=33248**			
Groundnut bud necrosis virus (*Groundnut bud necrosis virus (Tospovirus)*[26])	Fabaceae, Cucurbitaceae	**Grains**	In progress	National – passive surveillance	In progress	In progress		

[26] Groundnut bud virus (Tospovirus) is only a HPP for the Fabaceae family and has an unknown overall risk for the Cucurbitaceae family.

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
PSTVd (*Potato spindle tuber viroid (Pospiviroid) (exotic strains)*)	Solanaceae	**Potato,** Nursery and Garden	Yes – NDP 7	Yes – species specific surveillance, SA	www.planthealthaustralia.com.au/wp-content/uploads/2015/08/Potato-spindle-tuber-viroid-FS.pdf www.agric.wa.gov.au/potatoes/potato-spindle-tuber-viroid pir.sa.gov.au/__data/assets/pdf_file/0010/296164/Potato_Spindle_Tuber_Viroid_Fact_Sheet_-_June_2019.pdf	Yes	3	
Tomato brown rugose fruit virus (ToBRFV) *Tomato brown rugose fruit virus (Tobamovirus)*	Solanaceae				WWW.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/tomato-brown			

Common name (scientific name)	Vegetable family affected[16]	Affected parties (key parties in bold)[17]	National diagnostic protocol[18]	Surveillance programs	Fact sheets	Contingency plan	EPPRD category[19]	National Priority Plant Pest[20]
Tomato mottle mosaic virus (ToMMV) *Tomato mottle mosaic virus (Tobamovirus)*	Solanaceae							
Watermelon bud necrosis virus (*Watermelon bud necrosis virus (Tospovirus)*)	Cucurbitaceae	Melon	In progress	National – passive surveillance	In progress	In progress		

AUSVEG Ltd. industry biosecurity statement

All EPPRD Parties are required under clause 13 of the EPPRD to produce a Biosecurity statement, the purpose of which is to provide acknowledgement of and commitment to risk mitigation measures and preparedness activities related to plant biosecurity. The Biosecurity statement will inform all Parties of activities being undertaken by the Industry Party to meet this commitment. Parties are required to report to PHA each year any material changes to the content of, or the Party's commitment to, the Party's Biosecurity statement. Biosecurity statements are included in schedule 15 of the EPPRD, which can be found on the PHA website at
www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/

NATIONAL BIOSECURITY SYSTEM

What is biosecurity and why is it important?

Plant biosecurity is a set of measures which protect the economy, environment and community from the negative impacts of plant pests. A fully functional and effective biosecurity system is a vital part of the future profitability, productivity and sustainability of Australia's plant production industries and is necessary to preserve the Australian environment and way of life.

Plant pests are insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. For agricultural systems, if exotic pests enter Australia they can reduce crop yields, affect trade and market access, significantly increase costs to production and in the worst-case scenario, bring about the complete failure of a production system. Historical examples present us with an important reminder of the serious impact that exotic plant pests can have on agricultural production.

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic plant pest threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industries. However, there will always be some risk of an exotic pest entering Australia, whether through natural dispersal (such as wind) or assisted dispersal as a result of increases in international tourism, imports and exports, mail and changes to transport procedures (e.g. refrigeration and containerisation of produce).

The plant biosecurity system in Australia

Australia has a unique and internationally recognised biosecurity system to protect our plant production industries and the natural environment against new pests. The system is underpinned by a cooperative partnership between plant industries and all levels of government.

The framework for managing the cooperative partnership for delivering an effective plant biosecurity system is built on a range of strategies, policies and legislation, such as the

Intergovernmental Agreement on Biosecurity[27] and the National Plant Biosecurity Strategy[28]. These not only provide details about the current structure, but provide a vision of how the future plant biosecurity system should operate.

Australia's biosecurity system has been subject to several reviews in recent times, with the recommendations recognising that a future-focused approach is vital for maintaining a strong and resilient biosecurity system that will protect Australia from new challenges. As a result, there is a continuous improvement from industry and governments to Australia's plant biosecurity system, with the key themes including:

- Targeting what matters most, including risk based decision making and managing biosecurity risks across the biosecurity continuum (pre-border, border and post-border).
- Good regulation, including reducing regulatory burden and having effective legislation in place.
- Better processes, including service delivery modernisation with electronic, 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.

Through these themes, a focus on the biosecurity continuum better supports consistent service delivery offshore, at the border, and onshore, and provides an effective biosecurity risk management underpinned by sound evidence and technical justification.

The benefits of the modern biosecurity system are realised by industry, government and the community, with positive flow on effects to the economy more generally. This is through streamlined business processes, productivity improvements and reduced regulatory burden in a seamless and lower cost business environment, by emphasising risk based decision making and robust partnerships.

Vegetable Peak Industry Body

AUSVEG is the peak industry body for the vegetable and potato industry. They are a signatory to the EPPRD and are the key industry contact point if a suspect emergency plant pest affecting the vegetable industry is detected. For further information about AUSVEG in relation to response procedures following the identification of a suspect exotic pest refer to page 146.

[27] For more information visit **www.agriculture.gov.au/animal-plant-health/pihc/intergovernmental-agreement-on-biosecurity**
[28] For more information visit **www.planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/**

For a background on the vegetable industry, including more detail on the crops covered in this vegetable biosecurity plan, refer to page 149.

Plant Health Australia

Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia.

PHA is a not-for-profit, subscription-funded public company based in Canberra. PHA's main activities are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 39 plant industry organisations are all members of PHA and each meet one third of the total annual membership subscription. This tripartisan funding model ensures the independence of the company.

The company was formed to address priority plant health issues, and to work with all its members to develop an internationally outstanding plant health management system that enhances Australia's plant health status and the sustainability and profitability of plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. PHA's independence and impartiality allow the company to put the interests of the plant biosecurity system first and support a longer-term perspective.

For more information about PHA visit **www.planthealthaustralia.com.au**

The Biosecurity Plan

The Biosecurity Plan for the Vegetable Industry was developed in consultation with the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), which consisted of plant health and biosecurity experts and industry representatives. These groups were coordinated by Plant Health Australia (PHA) and included representatives from AUSVEG, relevant state and territory agriculture agencies and PHA.

The biosecurity plan not only details exotic pest threats of the Australian vegetable industry but also contains information on the current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the vegetable industry.

This plan is a framework to coordinate biosecurity activities and investment for Australia's vegetable industry and to address the strengths and weaknesses in relation to industry's

current biosecurity position. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the vegetable industry.

Biosecurity planning

Biosecurity planning provides a mechanism for the vegetable industry, government and other relevant stakeholders to actively determine pests of highest priority, analyse the risks they pose and put in place practices and procedures that would rapidly detect an incursion, minimise the impact if a pest incursion occurs and/or reduce the chance of pests becoming established. Effective industry biosecurity planning relies on all stakeholders, including government agencies, industry, and the public (Figure 1).

Ensuring the vegetable industry has the capacity to minimise the risks posed by pests, and to respond effectively to any pest threats is a vital step for the future sustainability and viability of the industry. Through this pre-emptive planning process, the industry will be better placed to maintain domestic and international trade, and reduce the social and economic costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian vegetable industry is free from specific pests and has systems in place to control and manage biosecurity risks, which assists the negotiation of access to new overseas markets.

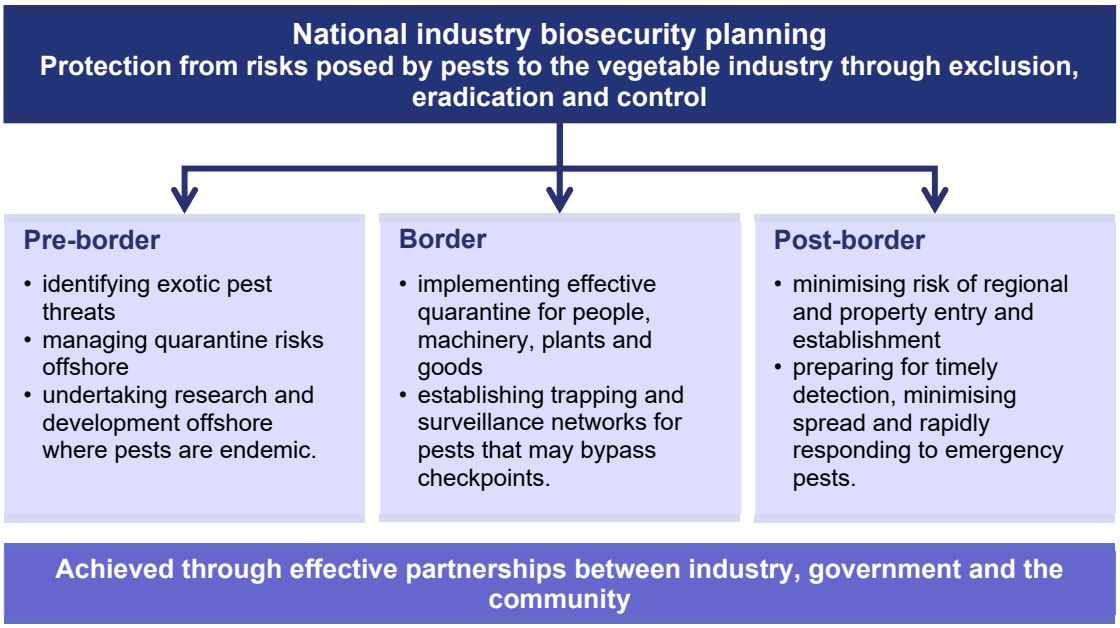

Figure 1. *Industry biosecurity: a shared responsibility*

Biosecurity Plan development

With the assistance of AUSVEG, a Technical Expert Group (TEG) and a Biosecurity Implementation Group (BIG) were formed to work on the review the Biosecurity Plan for the Vegetable Industry (BP). These groups were coordinated by Plant Health Australia (PHA) and included representatives from AUSVEG, relevant state and territory agriculture agencies and PHA (Table 7 and Table 8).

Key roles of the technical expert group for the vegetable BP included:

- identifying and documenting key threats to the vegetable industry
- confirming an agreed high priority pest (HPP) list

Key roles of the biosecurity implementation group for the vegetable BP included:

- documenting pest-specific fact sheets, contingency plans, diagnostic protocols and surveillance programs for HPPs
- documenting the roles and responsibilities of stakeholder groups.
- developing a biosecurity implementation table for future biosecurity related work to be conducted over the life of this biosecurity plan

Table 7. *Members of the technical expert group and/or biosecurity implementation group*

Name	Organisation	Area of expertise	Member of Technical Expert Group	Member of Biosecurity Implementation Group
Toni Chapman	NSW DPI	Bacteriology	✓	✓
Kevin Clayton-Greene	AUSVEG	Industry		✓
Fiona Constable	ECODEV-VIC	Virologist	✓	✓
Will Cuddy	NSW DPI	Pathologist	✓	
James Dickson	GroLink Nursery	Nursery, Industry		✓
Maureen Dobra	Loose Leaf Lettuce Company	Grower, Industry		✓
John Duff	DAF – QLD	Entomologist	✓	
Kyla Finlay	ECODEV – VIC	Entomologist / Wind dispersal	✓	
Callum Fletcher	AUSVEG	Industry	✓	✓
Peter Gillespie	NSW DPI	Entomologist	✓	
Barbara Hall	SARDI	Pathologist	✓	
Lionel Hill	TAS DPI	Entomologist	✓	
Dean Harapas	ECODEV – VIC	Pathologist	✓	
Mike Hodda	CSIRO	Nematology	✓	✓
Michael Holmes	Plant Health Australia	Biosecurity	✓	✓
Jo Lee	Plant Health Australia	Biosecurity	✓	✓

Name	Organisation	Area of expertise	Member of Technical Expert Group	Member of Biosecurity Implementation Group
Jessica Lye	AUSVEG	Industry	✓	✓
Liz Minchinton	ECODEV – VIC	Pathologist	✓	
Natalie O'Donnell	Plant Health Australia	Biosecurity	✓	
Denis Persley	DAF-QLD	Virologist	✓	✓
Heidi Radcliff	Rhebanvale	Grower, Industry		✓
Michael Radcliff	Rhebanvale	Grower, Industry		✓
Alison Saunders	Plant Health Australia	Biosecurity	✓	✓
Jenny Shanks	Plant Health Australia	Biosecurity	✓	

Table 8: *Scientists and others who contributed information for review of the biosecurity plan*[29]

Name	Organisation	Area of expertise
Rohan Burgess	Plant Health Australia	Biosecurity
Victoria Ludowici	Plant Health Australia	Biosecurity
John Thomas	DAF-QLD	Virologist
Isabel Valenzuela-Gonzalez	ECODEV-VIC	Entomologist/Wind dispersal

Review processes

With the support of the relevant vegetable industry bodies and PHA this plan should be reviewed on a 5 year basis. The review process will ensure:

- Threat Summary Tables are updated to reflect current knowledge
- pest risk assessments are current
- changes to biosecurity processes and legislation is documented
- contact details and the reference to available resources is accurate

In addition to the formal review process above, the document should be reviewed/revisited annually by a Biosecurity Reference Panel comprised of industry, government and PHA to ensure currency and relevance and to monitor progress with implementation. As an example, the industry biosecurity priorities identified within the plan could feed directly into industry R&D priority setting activities on an annual basis.

Opportunities to make out of session changes to the biosecurity plan, including the addition/subtraction of high priority pests or changes to legislation are currently being

[29] These people did not attend the technical expert group or biosecurity implementation group meetings but were approached for assistance during the biosecurity plan review process.

investigated. Such changes would need to include consultation and agreement of industry and government. This flexibility will facilitate the plan's currency and relevance.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

This section identifies high risk exotic pest threats to the vegetable industry, and presents a framework for assessing the potential economic, social and environmental impacts associated with each threat. This part of the biosecurity plan uses a nationally consistent and coordinated approach to threat identification and risk assessment to provide a strong base for future risk management in the vegetable industry.

By identifying key threats a pre-emptive approach may be taken to risk management. Under this approach, mechanisms can be put into place to increase our response effectiveness if pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA's government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions, and assists in the response to EPP incursions, particularly those identified as key threats.

Identification of high risk exotic pests will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and diagnosticians, and development of pest-specific incursion response plans.

Established pests and weeds of biosecurity significance have also been listed in this plan. It is well understood that good biosecurity practice is beneficial for the ongoing management of established pests and weeds, as well as for surveillance and early detection of exotic pests. Established pests cause ongoing hardships for growers and these pests have been listed with the support of industry and government in recognition that they need a strategic, consistent, scientific and risk-based approach to better manage these pests for the vegetable industry.

Exotic pests of the vegetable industry

Threat identification

Information on exotic pest threats to the vegetable industry described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

At this time, only invertebrate pests (insects, mites, molluscs and nematodes) and pathogens (disease causing organisms) have been identified, for risk assessment as these are what are responded to under national agreed arrangements, under the EPPRD. If exotic weeds were to be included in the EPPRD then this would be revisited through future reviews of the plan.

Pest risk assessments

The assessment process used in this BP was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2 and 11 [Food and Agriculture Organization of the United Nations (FAO), 2004; 2007]. A summary of the pest risk analysis protocol followed in this BP is shown in Table 9, and the complete protocol used for pest risk analysis in this BP can be found on the PHA website[30].

While there are similarities in the ranking system used in this document and the Import Risk Analysis (IRA) process followed by the Department of Agriculture and Water Resources (DAWR), there are differences in the underlying methodology and scope of consideration that may result in different outcomes between the two assessment systems. This includes different guidance to assignment of qualitative probabilities when compared with DAWR's IRA process.

Modifications of the DAWR (Department of Agriculture Fisheries and Forestry, 2011) protocol have been made to suit the analysis required in the BP development process, including, but not limited to:

[30] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

- **Entry potential:** The determination of entry potential in this BP takes into account multiple possible pathways for the legal importation of plant material as well as illegal pathways, contamination and the possibility of introduction through natural means such as wind. Therefore, the scope is wider than that used by the DAWR in their IRA process, which only considers legal importation of plants or plant commodities.
- **Potential economic impact** of pest establishment in this document only takes into account the impacts on the vegetable industry. The DAWR IRA process has a wider scope, including the effects to all of Australia's plant industries, trade, the environment and public health.
- **Risk potentials and impacts:** The number of categories used in this BP for describing the entry, establishment, spread, and potential economic impact (see 'Description of terms used in pest risk tables', page 98) differs in comparison to that used in the DAWR Resources IRA process.

Table 9. *Summary of pest risk assessment process used in BPs*

Step 1	Clearly identify the pest	• Generally, pest defined to species level • Alternatively, a group (e.g. family, genus level) can be used • Sub-species level (e.g. race, pathovar, etc.) may be required
Step 2	Assess entry, establishment and spread likelihoods	• Assessment based on current system and factors • Negligible, low, medium, high or unknown ratings
Step 3	Assess likely consequences	• Primarily based on likely economic impact to industry based on current factors • Negligible, low, medium, high, extreme or unknown ratings
Step 4	Derive overall risk	• Entry, establishment and spread likelihoods are combined to generate a likelihood score • Likelihood score combined with the likely economic impact to generate an overall risk score
Step 5	Review the risk	• Risk ratings should be reviewed with the BP

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and treatment of these risks. Risk assessment involves consideration of the sources of risk, their consequences, and the likelihood that those consequences may occur. Factors that affect the consequences and likelihood may be identified and addressed via risk mitigation strategies.

Risk assessment may be undertaken to various degrees of refinement, depending on the risk information and data available. Assessment may be qualitative, semi-quantitative, quantitative, or a combination of these. The complexity and cost of assessment increase with the production of more quantitative data. It is often more practical to first obtain a general indication of the level of risk through qualitative risk assessment, and if necessary, undertake

more specific quantitative assessment later [Australian Standard/New Zealand Standard (AS/NZS) ISO 31000, 2009].

Ranking pest threats

Key questions required for ranking the importance of pests include the following:

- What are the probabilities of entry into Australia, establishment and spread, for each pest?
- What are the likely impacts of the pest on cost of production, overall productivity and market access?
- How difficult is each pest to identify and control and/or eradicate?

The TSTs (more information in Appendix 2) present a list of potential plant pest threats to the vegetable industry and provide summarised information on entry, establishment and spread potential, the economic consequences of establishment and eradication potential (where available). The most serious threats from the TSTs were identified through a process of qualitative risk assessment[31] and are listed in the HPP list (Table 1).

This document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the IRA conducted by the Department of Agriculture and Water Resources which focus only on specific regulated import pathways.

When a pest that threatens multiple industries is assessed, the entry, establishment and spread potentials take into account all known factors across all host industries. This accurately reflects the ability of a pest to enter, establish and spread across Australia and ultimately results in different industries, and their BPs, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (i.e. for the vegetable industry only in this BP), and therefore this rating may differ between BPs.

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 1 and elsewhere in the document.

[31] An explanation of the risk assessment method used can be found on the PHA website (**www.planthealthaustralia.com.au/biosecurity/risk-mitigation**)

Entry potential

Negligible	The probability of entry is extremely low given the combination of all known factors including the geographic distribution of the pest, quarantine practices applied, probability of pest survival in transit and pathways for pest entry and distribution to a suitable host.
Low	The probability of entry is low, but clearly possible given the expected combination of factors described above.
Medium	Pest entry is likely given the combination of factors described above.
High	Pest entry is very likely and potentially frequent given the combination of factors described above.
Unknown	The pest entry potential is unknown or very little of value is known.

Establishment potential

Negligible	The pest has limited potential to survive and become established within Australia given the combination of all known factors.
Low	The pest has the potential to survive and become established in approximately one-third or less of the range of hosts. The pest could have a low probability of contact with susceptible hosts.
Medium	The pest has the potential to survive and become established in between approximately one-third and two-thirds of the range of hosts.
High	The pest has potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environmental conditions that prevail in Australia. Based upon its current world distribution, and known conditions of survival, it is likely to survive in Australia wherever major hosts are grown.
Unknown	The establishment potential of the pest is unknown or very little of value is known.

Spread potential

Negligible	The pest has very limited potential for spread in Australia given the combination of dispersal mechanisms, availability of hosts, vector presence, industry practices and geographic and climatic barriers.
Low	The pest has the potential for natural or assisted spread to susceptible hosts within Australia yet is hindered by a number of the above factors
Medium	The pest has an increased likelihood of spread due to the above factors
High	The natural spread of the pest to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage
Unknown	The spread potential is unknown or very little of value is known.

Economic impact

Negligible	There are very minor, often undetectable, impacts on production with insignificant changes to host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Very low	There are minor, yet measurable, impacts on production including either host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Low	There are measurable impacts to production including either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or minimal impacts on market access.
Medium	There are significant impacts on production with either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or moderate impacts on market access.
High	There are severe impacts on production including host mortality and significant impacts on either crop quality or storage losses, and/or severe impacts on market access.
Extreme	There is extreme impact on standing crop at all stages of maturity, with high host mortality or unmanageable impacts to crop production and quality, and /or extreme, long term, impacts on market access.
Unknown	The economic potential of the pest is unknown or very little of value is known.

References

AS/NZS ISO 31000:2009 Risk management - Principles and guidelines. Standards Australia, Sydney, and Standards New Zealand, Wellington.

DAFF (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

FAO (2004) Pest risk analysis for quarantine pests including analysis or environmental risks and living modified organisms. International Standards for Phytosanitary Measures No. 11. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

FAO (2007) Framework for pest risk analysis. International Standards for Phytosanitary Measures No. 2. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

RISK MITIGATION AND PREPAREDNESS

Introduction

There are a number of strategies that can be adopted to help protect and minimise the risks of emergency plant pests under International Plant Protection Convention (IPPC) standards (**www.ippc.int/standards**) and Commonwealth and State/Territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the vegetable industry (Figure 2). Such risk mitigation and preparedness practise are the responsibility of governments, industry and the community.

A number of key risk mitigation areas are outlined in this guide, along with summaries of the roles and responsibilities of the Australian Government, state/territory governments, and vegetable industry members. This section is to be used as a guide outlining possible activities that may be adopted by industry and growers to mitigate the risk and prepare for an incursion response. Each grower will need to evaluate the efficacy of each activity for their situation.

Figure 2. *Examples of biosecurity risk mitigation activities*

Barrier quarantine

Barrier quarantine refers to the biosecurity measures implemented at all levels of the vegetable industry including national, state, regional, and farm levels.

National level – importation restrictions

The Department of Agriculture and Water Resources (DAWR) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAWR achieves this through:

- establishment of scientifically-based quarantine policies
- provision of effective technical advice and export certification services
- negotiations with key trading partners
- participation in multilateral forums and international sanitary and phytosanitary (SPS) standard-setting organisations
- collaboration with portfolio industries and exporters.

DAWR is responsible for developing biosecurity (SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DAWR undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAWR also consults with industry and the community, conducting research and developing policy and procedures to protect Australia's animal and plant health status and natural environment. In addition, DAWR assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants. Further information can be found at **www.agriculture.gov.au**.

The administrative authority for national quarantine is vested in DAWR under the *Biosecurity Act 2015*. Quarantine policies are developed on the basis of an IRA process. This process is outlined in the IRA Handbook 2011 (Department of Agriculture, Fisheries and Forestry, 2011). DAWR maintains barrier quarantine services at all international ports and in the Torres Strait region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, is the responsibility of DAWR.

The schedule 5 “Permitted Seeds” list from the *Quarantine Proclamation 1998* is maintained on the Import Conditions (BICON) database at **www.agriculture.gov.au/import/online-services/bicon**

BICON contains the current Australian import conditions for more than 20,000 foreign plants, animal, mineral and human products and is the first point of access to information about Australian import requirements for a range of commodities. It can be used to determine if a commodity intended for import to Australia requires a quarantine import permit and/or treatment or if there are any other quarantine prerequisites. There are currently a number of cases for vegetables listed on BICON (see Table 10). For export conditions see the Manual of Importing Country Requirements (MICoR) database at **www.agriculture.gov.au/micor/plants**.

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact DAWR on (02) 6272 3933 or 1800 020 504, or visit the website at **www.agriculture.gov.au/biosecurity/import**.

The World Trade Organization (WTO) SPS Agreement facilitates international trade while providing a framework to protect the human, animal and plant health of WTO members. SPS measures put in place must minimise negative effects on trade while meeting an importing country’s appropriate level of protection. For plant products, these measures are delivered through the IPPC standard setting organisations and collaboration with portfolio industries and exporters. For more information on the IPPC visit **www.ippc.int**.

Table 10. *Product types for which import conditions are listed in BICON (as at June 2017)*[32]

Crop	Product type
Apiaceae	
Carrots	Pet food, supplements and ingredients of plant origin
	Stock feed, supplements and ingredients of plant origin
	Candidatus Liberibacter solanacearum hosts for use as nursery stock
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Fresh root vegetables for human consumption
	Preserved fruit and vegetables for human consumption
	Daucus carota seed for sowing
Celery	Raw seed
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Frozen fruit, vegetables and herbs for human consumption
	Candidatus Liberibacter solanacearum hosts as seed for sowing
	Fresh leafy vegetables for human consumption
	Candidatus Liberibacter solanacearum hosts for use as nursery stock
	Fresh *Brassica* spp. for human consumption
	Fresh root vegetables for human consumption
Parsley	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Frozen fruit, vegetables and herbs for human consumption
	Candidatus Liberibacter solanacearum hosts as seed for sowing
	Fresh leafy vegetables for human consumption
	Candidatus Liberibacter solanacearum hosts for use as nursery stock
Parsnips	Fresh root vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Candidatus Liberibacter solanacearum hosts as seed for sowing
	Candidatus Liberibacter solanacearum hosts for use as nursery stock
Fabaceae	
Peas	Whole dried peas for human consumption
	Fresh snow or sugar snap peas for human consumption
	Birdseed
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Roasted seeds for human consumption
	Pea seed for sowing
	Split legumes for human consumption

[32] Please note, this is a summary only. Conditions change overtime and BICON (**www.agriculture.gov.au/import/bicon**), or the Department of Agriculture and Water Resources will need to be consulted to confirm the specific conditions that apply to a given situation.

Crop	Product type
	Restricted legume seed for sowing
Beans	*Phaseolus* spp. seed for sowing
	Bean seed for human consumption
Asteraceae	
Lettuce	Medium risk plants for use as nursery stock
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Dried seaweed for human consumption
	Fresh leafy vegetables for human consumption
Brassicaceae	
Cabbage	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Brassica spp. seed for sowing
	Frozen fruit, vegetables and herbs for human consumption
	Brassica oleracea for use as nursery stock
	Fresh leafy vegetables for human consumption
	Fresh *Brassica* spp. for human consumption
	Preserved fruit and vegetables for human consumption
Radishes	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Frozen fruit, vegetables and herbs for human consumption
	Fresh root vegetables for human consumption
	Horseradish for human consumption
Broccoli	Frozen fruit, vegetables and herbs for human consumption
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Brassica spp. seed for sowing
	Brassica oleracea for use as nursery stock
Cauliflower	*Brassica oleracea* for use as nursery stock
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Brassica spp. seed for sowing
	Frozen fruit, vegetables and herbs for human consumption
	Fresh *Brassica* spp. for human consumption
	Brassica oleracea for use as nursery stock
Cucurbitaceae	
Cucumber	Cucurbit seed for sowing requiring testing for plant viruses
	Cucurbits as nursery stock requiring testing
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Preserved fruit and vegetables for human consumption
	Cnidarians, echinoderms and tunicates
	Fresh marrow, squash or zucchini for human consumption
	Pet food
Zucchini	Fresh marrow, squash or zucchini for human consumption

Crop	Product type
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Cucurbit seed for sowing requiring testing for plant viruses
	Pet food, supplements and ingredients of plant origin
	Stock feed, supplements and ingredients of plant origin
Luffa	Plant fibre products and handicrafts
	Frozen fruit, vegetables and herbs for human consumption
	Fresh marrow, squash or zucchini for human consumption
Pumpkin	Fresh pumpkin for human consumption
	Fruit and vegetable juices and oils
	Raw seed
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Roasted seeds for human consumption
	Telfairia occidentalis seed for sowing
	Cucurbit seed for sowing requiring testing for plant viruses
Amaranthaceae	
Beetroot	Dried vegetables for human consumption
	Fresh root vegetables for human consumption
Silverbeet	Fresh leafy vegetables for human consumption
Poaceae	
Sweet corn	Fresh corn for human consumption
	Freeze-dried vegetables for human consumption
Solanaceae	
Eggplant	Frozen fruit, vegetables and herbs for human consumption
	Dried herbs (including leaves, spices, roots, crushed nut shells)
	Solanaceous produce for human consumption
Capsicum	Fresh capsicum, chillies and peppers for human consumption
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Capsicum spp. (requiring testing) seed for sowing
	Powdered herbs for human consumption
	Solanaceous produce for human consumption
Chilli	Fresh capsicum, chillies and peppers for human consumption
	Dried vegetables for human consumption
	Frozen fruit, vegetables and herbs for human consumption
	Powdered herbs for human consumption
	Food, food products and beverages
	Preserved fruit and vegetables for human consumption

Crop	Product type
	Solanaceous produce for human consumption
Alliaceae	
Leeks	*Allium porrum* for use as nursery stock
	Dried vegetables for human consumption
	Fresh Allium
	Allium spp. seed for sowing
	Frozen fruit, vegetables and herbs for human consumption
Spring Onion	Frozen fruit, vegetables and herbs for human consumption
Shallot	*Allium* spp. seed for sowing
	Dried vegetables for human consumption
	Fresh Allium

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread vegetable pests is of high importance. Each state/territory has quarantine legislation in place to control the importation of vegetable material interstate and intrastate, and to manage agreed pests if an incursion occurs (refer to Table 11). Further regulations have been put in place in response to specific pest threats and these are regularly reviewed and updated by state/territory authorities and the Sub-Committee for Domestic Quarantine and Market Access (SDQMA).

Moving plant material between states/territories generally requires permits from the appropriate authority, depending on the plant species and which territory/state the material is being transferred to/from. Moving plant material intrastate may also require a permit from the appropriate authority. Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of vegetables can be obtained by contacting your local state or territory agriculture department directly (see Table 11), or through the SDQMA website **www.domesticquarantine.org.au** which lists relevant contacts in each state/territory as well as Interstate Certification Assurance (ICA) documents relating to each state/territory.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state/territory has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Further information can be obtained by contacting your local state/territory Department of Agriculture and Water Resources (Table 11).

Table 11. *Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers*

State	Administering authority	Legislation	Links to quarantine manual[33]	Phone
ACT	Environment ACT **www.environment.act.gov.au**	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*	See NSW conditions	13 22 81
NSW	Department of Primary Industries **www.dpi.nsw.gov.au**	*Plant Diseases Act 1924* *Plant Diseases Regulation 2008* *Noxious Weeds Act 1993* *Noxious Weeds Regulation 2008*	**www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases**	02 6391 3384
NT	Department of Primary Industry and Fisheries **https://dpir.nt.gov.au/**	*Plant Health Act 2008* *Plant Health Regulations 2011*	**https://nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/plants-and-quarantine**	08 8999 2118
QLD	Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland **www.daf.qld.gov.au/biosecurity**	*Biosecurity Act 2014* *Biosecurity Regulation 2016*	**www.daf.qld.gov.au/plants/moving-plants-and-plant-products**	132 523[34] 07 3404 6999[35]
SA	Primary Industries and Regions SA **www.pir.sa.gov.au**	*Plant Health Act 2009* *Plant Health Regulations 2010*	**www.pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia**	08 8207 7820
TAS	Department of Primary Industries, Parks, Water and Environment **www.dpipwe.tas.gov.au**	*Plant Quarantine Act 1997* *Weed Management Act 1999*	**http://dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manual**	1300 368 550
VIC	Department of Economic Development, Jobs, Transport and Resources **www.economicdevelopment.vic.gov.au/**	*Plant Biosecurity Act 2010* *Plant Biosecurity Regulations 2012*	**www.agriculture.vic.gov.au/psb**	136 186
WA	Department of Primary Industries and Regional Development **www.agric.wa.gov.au/**	*Biosecurity and Agricultural Management Act 2007*		08 9334 1800

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from NSW DPI Regulatory Services by phone 02 6391 3384 or by visiting the NSW Department of Primary Industries website **www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases**.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory (NT) is vested in the Department of Primary Industry and Resources (DPIR) under the *Plant Health Act 2008* and *Plant Health Regulations 2011*. The Act enables notifiable pests to be gazetted, quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. Plant import requirements for particular pests, plants or plant related materials are identified in the Regulations. Further information on NT import requirements and treatments can be obtained by contacting NT Quarantine on (08) 8999 5511 or email **quarantine@nt.gov.au.**

For more information refer to the DPIR website (**https://dpir.nt.gov.au/**).

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Queensland, as well as maps of pest quarantine areas, may be obtained from the Biosecurity Queensland part of the DAF Queensland website (**www.daf.qld.gov.au/plants/moving-plants-and-plant-products**).

Further details can be obtained from the DAF Queensland Customer Service Centre (13 25 23 within Queensland, or phone 07 3404 6999 or fax 07 3404 6900 interstate).

South Australia

Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material in South Australia (SA) may be obtained from Biosecurity SA - Plant Health by phone (08) 8207 7820 or fax (08) 8207 7844. Further information can be found at **www.pir.sa.gov.au/biosecurity/plant_health**.

Primary Industries and Regions South Australia (PIRSA) have strict regulations and requirements regarding the entry of plant material (fruit, vegetables, flowers, plants, soil and seeds) into the State.

For further information on import conditions consult the Plant Quarantine Standard (**www.pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia**).

Tasmania

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Tasmania may be obtained from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) Biosecurity website (**www.dpipwe.tas.gov.au/biosecurity**) or by phoning 1300 368 550.

General and specific import conditions apply to the importation of plant material into Tasmania to prevent the introduction of pests and diseases into the State. Plants and plant products must not be imported into Tasmania unless State import requirements are met and a Notice of Intention to import has been provided to a Biosecurity Tasmania inspector not less than 24 hours prior to the importation.

For further information on import conditions consult the Plant Quarantine Manual (**http://dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manualhttp://dpipwe.tas.gov.au/biosecurity/plant-biosecurity/plant-biosecurity-manual**).

Victoria

The movement into Victoria of plants and plant products may be subject to a prohibition, or to one or more conditions which may include chemical treatments. These prohibitions and conditions are described on the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) website (see link in Table 11). Some items may need to be presented to a DEDJTR inspector or an accredited business, for checking of details such as correct certification, labelling or treatment.

Further information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material into or within Victoria may be obtained from DEDJTR on the web at **www.agriculture.vic.gov.au/psb** or by phone 136 186.

Western Australia

The lead agency for agricultural biosecurity in Western Australia is the Department of Primary Industries and Regional Development (WA DPIRD). Western Australia is naturally free from a large number of pests and diseases that are present in many other parts of the world. WA's geographical isolation in conjunction with a robust plant biosecurity system including border and intrastate regulations, industry and public awareness campaigns and surveillance programs maintains this status.

There are general and specific legislative requirements which underpin Western Australian plant biosecurity. Amongst other things the legislation regulates movement of potential carriers (such as plant material, honey, machinery, seeds etc.) into and within the state.

General conditions include (but are not limited to the following):

- The requirement for all potential carriers to be presented to an inspector for inspection upon arrival in WA
- Soil is prohibited entry and imported goods, including containers, must be free from soil
- Freedom from pests and diseases of quarantine concern to WA

In addition to the general requirements, specific requirements are also in place for movement into and within the state.

For further information on requirements contact Quarantine WA on (08) 9334 1800 or fax (08) 9334 1880.

Farm level – exclusion activities

A significant risk of spreading pests onto farms arises when propagation material, people, machinery and equipment move from property to property and from region to region. It is the responsibility of the industry and the owner/manager of each property to ensure these risks are minimised.

It is in the interests of industry to encourage and monitor the management of risk at the farm level, as this will reduce the probability of an incursion and increase the probability of early detection. This should in turn reduce the likelihood of a costly incident response, thereby reducing costs to industry, government and the community.

One major way this can be achieved is through management of industry biosecurity at the farm level using exclusion practices. Further detail on potential strategies is included in the Farm Biosecurity section (page 124). The vegetable industry is already a strong supporter of farm biosecurity with its ‘Come clean. Go clean’ message; but should continue to further extend this message of promoting good farm hygiene in a wide range of ways.

Surveillance

Surveys enhance prospects for early detection, minimise costs of eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia’s states, territories and regions.

The SPS Agreement gives WTO members the right to impose SPS measures to protect human, animal and plant life health provided such measures do not serve as technical barriers to trade. In other words, for countries (such as Australia) that have signed the SPS Agreement, imports of food, including fresh fruit and vegetables, can only be restricted on proper, science-based quarantine grounds. Where quarantine conditions are imposed, these will be the least trade restrictive measures available that meet Australia's appropriate level of quarantine protection. The Agreement also stipulates that claims of area freedom must be supported by appropriate information, including evidence from surveillance and monitoring activities. This is termed "evidence of absence" data and is used to provide support that we have actively looked for pests and not found them.

ISPM 6 (**www.ippc.int/sites/default/files/documents/20140528/spec_61_revispm6_2014-05-28_201405281352--150.18%20KB.pdf**) provides international guidelines for structured pest surveys. Structured pest survey planning and implementation depends on the risk involved, the resources available, and the requirements of trading partners (particularly when Australia wishes to access overseas markets). The intensity and timing of surveys also depend on the spread characteristics of the pest and the costs of eradication.

Early detection of an exotic incursion can significantly increase the likelihood of a successful eradication campaign, and reduce the associated costs. Effective surveillance plays a critical role in working toward this goal. Surveillance can be either targeted toward specific pests, or general in nature. General non-targeted surveillance is based on recognising normal versus suspect plant material. Targeted surveillance is important for establishing whether particular pests are present in each state or region, and if so, where these occur.

Industry personnel can provide very effective early detection of new or unusual symptoms through their normal management practices (i.e. 'passive surveillance'), provided individuals are aware of what to look for and of reporting procedures. Consultants and crop scouts can provide valuable information as they are regularly in the field, and hence can observe any unusual pest activity or symptoms on plants.

National surveillance programs

The Department of Agriculture and Water Resources (DAWR) maintains barrier quarantine services at all international ports and in the Torres Strait region. DAWR also surveys the northern coast of Australia, offshore islands and neighbouring countries for exotic pests that may have reached the country through other channels (e.g. illegal vessel landings in remote areas, bird migrations, wind currents) as part of the Northern Australia Quarantine Strategy (NAQS). NAQS surveillance programs relevant to the vegetable industry are listed in Table 12.

State surveillance programs

State level surveillance depends on the participation of all stakeholder groups, particularly state/territory agriculture departments, industry representative groups, agri-business and growers.

The state/territory agriculture department can provide:

- planning and auditing surveillance systems
- coordination of surveillance activities between industry and interstate groups
- diagnostic services
- field diagnosticians for special field surveillance
- surveillance on non-commercial sites
- liaison services with industry members
- communication, training and extension strategies with industry
- biosecurity training
- reporting services to all interested parties (Department of Agriculture and Water Resources, national bodies, trading partners and industry).

Various pest surveillance programs are managed by the Department of Agriculture and Water Resources and the state/territory agriculture departments. Many state/territory departments run general surveillance programs whereby suspect samples can be forwarded and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the vegetable industry (exotic or those under official control in a region or state/territory) are shown in Table 12.

Table 12. *Official surveillance programs that target pests of the vegetable industry (as at December 2016)*[36]

Surveillance program	Pests targeted	Hosts targeted
Australian Government		
Giant African snail surveillance	Giant African snail (*Lissachatina fulica*)	Vegetable and horticultural crops, soil and imported cargo
Leaf miner surveillance	Various including American leafminer/ vegetable leaf miner (*Liriomyza sativae*), American serpentine leaf miner (*Liriomyza trifolii*), Serpentine leaf miner (*Liriomyza huidobrensis*), Tomato leaf miner (*Liriomyza bryoniae*)	Brassicaceae, cucurbitaceae, fabaceae, solanaceae
Melon fruit fly surveillance	Melon fruit fly (*Bactrocera cucurbitae*)	Brassicaceae, cucurbitaceae, fabaceae, solanaceae

[36] Information presented has been taken from the National Plant Health Status Report 2016 and confirmed or updated in December 2016 by the Subcommittee on National Plant Health Surveillance (sub-committee of the Plant Health Committee)

Surveillance program	Pests targeted	Hosts targeted
National plant health surveillance project	Cucumber green mottle mosaic virus	Cucurbitaceae
Northern Australia Quarantine Survey citrus locust surveillance	Citrus or cotton locust (*Chondracris roseai*)	Cotton, banana, sugarcane, rice & maize
Northern Australia Quarantine Survey coffee berry borer surveillance	Coffee berry borer (*Hypothenemus hampei*)	Coffee
Northern Australia Quarantine Survey downy mildew	Downy mildews including Philippine downy mildew (*Peronosclerospora philippinensis*), downy mildew of sugarcane (*P. sacchari*) & downy mildew of sorghum (*P. sorghi*)	Maize, sugarcane, sorghum
Northern Australia Quarantine Survey exotic fruit fly trapping	Exotic fruit flies (*Bactrocera* spp.)	Horticulture
Northern Australia Quarantine Survey gold dust weevil surveillance	Gold dust weevil (*Hypomeces squamosus*)	Maize, citrus, cotton, rice & sugarcane
Northern Australia Quarantine Survey leafhopper surveillance	Leaf hoppers including; Indian cotton leafhopper (*Amrasca devastans*), Sugarcane planthopper or sugarcane leaf hopper (*Perkinsiella vastatrix*)	Cotton, sorghum, maize, Sugarcane, sorghum & maize
Northern Australia Quarantine Survey mealy bug surveillance	Mealy bugs including; pineapple mealy bug (*Dysmicoccus neobrevipes*), Mango mealybug or Madeira mealybug (*Paracoccus marginatus*), Jack Beardsley mealybug (*Pseudococcus jackbersleyi*)	Cucurbits, banana, Mango, coconut, cassava, highly polyphagous
Northern Australia Quarantine Survey potato late blight	Potato late blight (*Phytophthora infestans*)	Potato
Northern Australia Quarantine Survey purple stem borer	Purple stem borer (*Sesamia inferens*)	Grasses incl. sugarcane, cotton, maize, sorghum & rice
Northern Australia Quarantine Survey red spider mite	Red spider mite (*Tetranychus piercei*)	Cotton, bananas
Northern Australia Quarantine Survey spotted stalk borer surveillance	Spotted stalk borer (*Chilo partellus*)	Sugarcane, rice
Watermelon bud necrosis surveillance	Watermelon bud necrosis (*Tospovirus*)	Brassicaceae, Cucurbitaceae, Fabaceae, Solanaceae
Watermelon silver mottle surveillance	Watermelon silver mottle (*Tospovirus*)	Brassicaceae, Cucurbitaceae, Fabaceae, Solanaceae
New South Wales		
Aphids	Multiple species	Field crops, horticulture

Surveillance program	Pests targeted	Hosts targeted
Diseases of cotton	Texas root rot (*Phymatotrichum omnivorum*)	Cotton
Grains Farm Biosecurity Surveillance Program	Cabbage seed weevil (*Ceutorhynchus obstrictus*)	Wheat, barley, canola, lupin
Urban hazard site surveillance	Exotic whiteflies, exotic aphids, exotic leaf miners (*Liriomyza* spp.), brown marmorated stink bug (*Halyomorpha halys*)	Multiple
Tasmania		
Fruit fly trapping program	*Bactrocera tryoni, Ceratitis capitata, Bactrocera dorsalis* and other exotic fruit flies	Fruit trees, fruit and vegetables
Multiple pest surveillance program – Pacific spider mite surveillance	Pacific spider mite (*Tetranychus pacificus*)	Grapevines
Multiple pest surveillance program – Pierce's disease surveillance	Pierce's disease (*Xylella fastidiosa*)	Grapevines
Silverleaf whitefly sticky trap survey	Silverleaf whitefly (*Bemisia tabaci* B-type)	Nursery stock
Queensland		
Cowpea mild mottle mosaic virus surveillance	Cowpea mild mottle mosaic virus	French bean
Endemic and exotic diseases of cotton	Texas root rot (*Phymatotrichum omnivorum*)	Cotton
Grains Farm Biosecurity Program	Sorghum downy mildew (*Peronosclerospora sorghi*), Downy mildew of millet (*Sclerospora graminicola*),	Summer grain crops
Grow Help Australia diagnostic service project	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	Fruit, vegetable and ornamental
Incident response surveys	Cucumber green mottle mosaic virus, various mealybug species, vegetable leaf miner, spider mites	Multiple
Silverleaf whitefly resistance monitoring	Silverleaf whitefly (*Bemisia tabaci* B-type)	Cotton
South Australia		
Market access surveillance	Tomato Yellow leaf curl virus, potato cyst nematode (*Globodera* sp.), bacterial wilt (*Erwinia tracheiphila*)	Multiple vegetables

Surveillance program	Pests targeted	Hosts targeted
Port of entry trapping program for exotic fruit flies	Exotic fruit flies e.g. Melon fruit fly (*Bactrocera cucurbitae*)	Adelaide metropolitan traps
Victoria		
Boil smut surveillance	Boil smut (*Ustilago zeae*)	Corn
Melon necrotic spot virus surveillance	Melon necrotic spot virus	Cucurbitaceae
Western Australia		
Port of entry trapping program for exotic fruit flies	Exotic fruit flies	Western Australia metropolitan traps

Farm surveillance activities

Farm level surveillance involves the participation and interaction of growers, agribusiness and industry representative groups. Examples of the surveillance activities that can be carried out by each of these groups are outlined in Figure 3. Conducting regular surveys of farms and nurseries provides the best chance of spotting new pests early and implementing eradication or management responses.

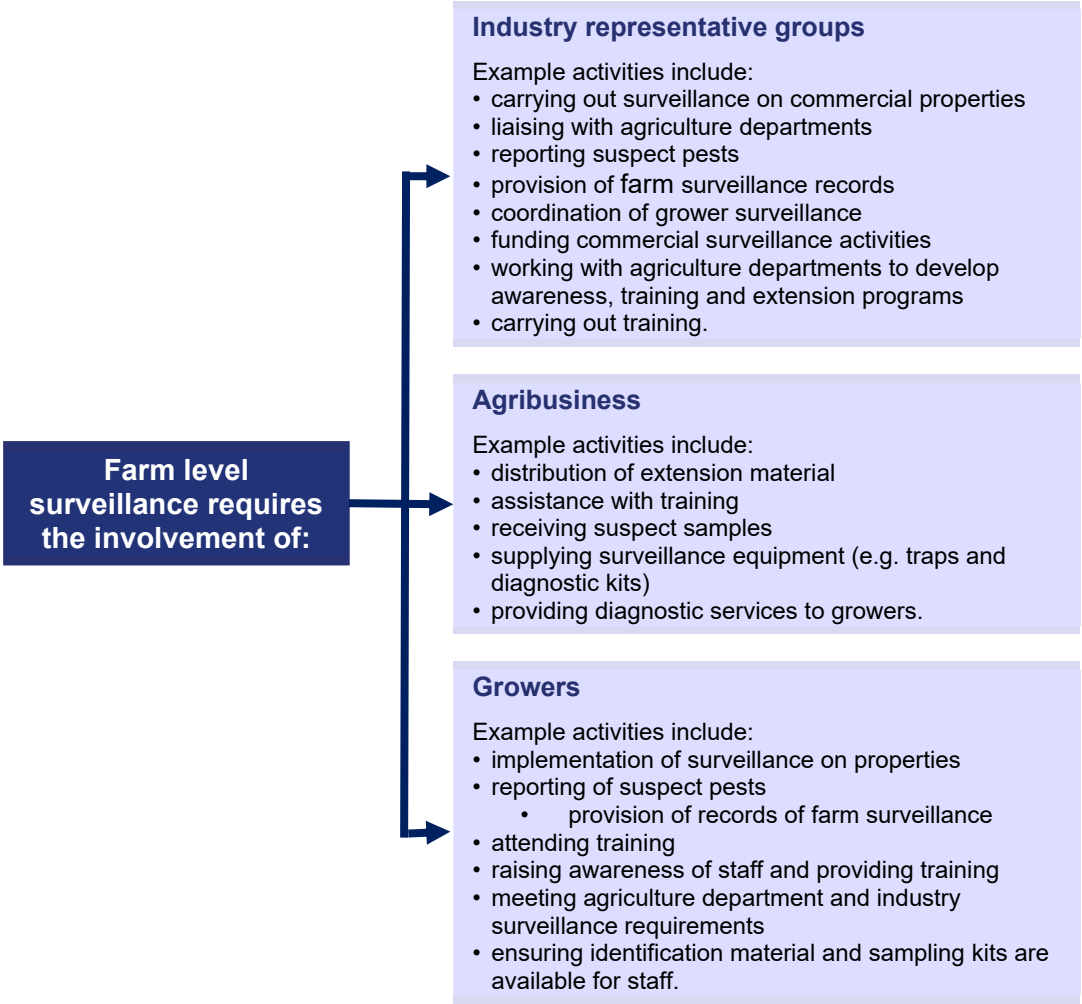

Figure 3. *Examples of farm level surveillance activities*

Training

A key component of biosecurity preparedness is ensuring personnel engaged are suitable and effectively trained for their designated roles in a response. Biosecurity preparedness training is the responsibility of all governments and industries, involved in the biosecurity system.

National EPP Training Program

PHA supports members in training personnel through the delivery of the National EPP Training Program. This program is focussed on ensuring personnel from the governments and

peak industry bodies who will be involved in responses to EPPs have the skills and knowledge to effectively fulfil the roles and responsibilities of their parties, as signatories to the EPPRD. This covers a range of areas, from representatives on the national decision making committees (i.e. the Consultative Committee on Emergency Plant Pests and the National Management Group) through to industry liaison personnel in the State Coordination or Local Control Centres.

In addition to face to face training delivered to members and the provision of simulation exercises, PHA also offers biosecurity training through the Biosecurity Online Training (BOLT) platform which houses a variety of eLearning courses relevant to plant biosecurity. Access to BOLT is free and open to any stakeholder interested in biosecurity, and is available through **www.planthealthaustralia.com.au/bolt**.

For more information on the National EPP Training program, refer to **www.planthealthaustralia.com.au/training**.

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities raise the profile of biosecurity and exotic pest threats to the vegetable industry, which increases the chance of early detection and reporting of suspect pests. Responsibility for awareness material lies with industry and government, with assistance from PHA as appropriate. Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881).

High priority plant pest threat-related documents

Pests listed in Table 1 have been identified as high priority threats to the vegetable industry by members of the TEG. They have been assessed as having high entry, establishment and spread potentials and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

Further information on high priority pests

The websites listed below (Table 13) contain information on pests across most plant industries, including the vegetable industry.

Table 13. *Sources of information on high priority pest threats for the vegetable industry*

Source	Website
Department of Agriculture and Water Resources	**www.agriculture.gov.au**
Pest and Disease Image Library (PaDIL)	**www.padil.gov.au**
DAF Queensland A-Z list of significant plant pests and diseases	**www.daf.qld.gov.au/plants/health-pests-diseases/a-z-significant**
University of California Statewide Integrated Pest Management (IPM) Program	**www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html**
European and Mediterranean Plant Protection Organization (EPPO)	**www.eppo.int/DATABASES/pqr/pqr.htm**

Further information/relevant web sites

A range of government and grower organisation details and websites are provided below (Table 14) for persons seeking further information on vegetable industry biosecurity.

Table 14. *Relevant sources of further biosecurity information for the vegetable industry*

Agency	Website/email	Phone	Address
National			
AUSVEG	**www.ausveg.com.au** **info@ausveg.com.au**	(03) 9822 0388	Suite 1, 431 Burke Rd Glen Iris, VIC 3146
Department of Agriculture and Water Resources	**www.agriculture.gov.au**	(02) 6272 3933 1800 020 504	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	**www.planthealthaustralia.com.au** **biosecurity@phau.com.au**	(02) 6215 7700	Level 1, 1 Phipps Cl Deakin, ACT 2600
New South Wales			
Department of Primary Industries	**www.dpi.nsw.gov.au/biosecurity/plant**	(02) 6391 3535	Locked Bag 21 Orange, NSW 2800
Queensland			
Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland	**www.daf.qld.gov.au** **callweb@daf.qld.gov.au**	13 25 23[37] 07 3404 6999[38]	80 Ann Street Brisbane, QLD 4000
Northern Territory			
Department of Primary Industry and Resources	**www.dpir.nt.gov.au/about**	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828

[37] Within Qld
[38] Interstate

Agency	Website/email	Phone	Address
South Australia			
Primary Industries and Regions SA	**www.pir.sa.gov.au**	(08) 8207 7820	GPO Box 1671 Adelaide, SA 5001
Biosecurity SA-Plant Health	**www.pir.sa.gov.au/biosecuritysa/planthealth** **PIRSA.planthealth@sa.gov.au**	(08) 8207 7820	33 Flemington Street Glenside, SA 5065
Biosecurity SA-Plant Health Market access and Interstate Certification Assurance	**IRSA.planthealthmarketaccess@sa.gov.au**	(08) 8207 7814	
Biosecurity SA-Plant Health Transport manifest lodgement	**pirsa.planthealthmanifest@sa.gov.au**	Fax: (08) 8124 1467	
South Australian Research and Development Institute	**www.sardi.sa.gov.au** **sardi@sa.gov.au**	(08) 8303 9400	2b Hartley Grove Urrbrae, SA 5064
Tasmania			
Department of Primary Industries, Parks, Water and Environment	**www.dpipwe.tas.gov.au** **BPI.Enquiries@dpipwe.tas.gov.au**	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Department of Economic Development, Jobs, Transport and Resources	**www.economicdevelopment.vic.gov.au/**	136 186	CPHO Group, Division of Market Access and Regulation, Biosecurity Branch Department of Economic Development, Jobs, Transport and Resources 475 Mickleham Road, Attwood, Victoria 3047
Western Australia			
Department of Primary Industries and Regional Development	**www.agric.wa.gov.au/**	(08) 9368 3333	WA DPIRD PO Box 1143 West Perth WA 6872

Farm biosecurity

Introduction

Plant pests can have a major impact on production if not managed effectively. This includes pests already present in Australia and a number of serious pests of vegetable that Australia does not have.

Farm biosecurity measures can be used to minimise the spread of such pests before their presence is known or after they are identified, and therefore can greatly increase the likelihood that they could be eradicated. This section of the document outlines farm biosecurity and hygiene measures to help reduce the impact of pests on the industry.

The biosecurity and hygiene measures outlined here can be considered as options for each farm's risk management. Many of these measures can be adopted in a way that suits a given farm so that each can have an appropriate level of biosecurity.

Farm biosecurity reporting procedures and hygiene strategies to reduce threats covered in this document are:

- selection and preparation of appropriate plant material
- chemical control measures
- control of vectors
- control of alternative hosts
- neglected farms and volunteer plants
- post-harvest handling and produce transport procedures
- use of warning and information signs
- managing the movement of vehicles and farm equipment
- movement of people
- visiting overseas farms/orchards – what to watch out for when you return
- including farm biosecurity in Industry best management practice and quality assurance schemes
- farm biosecurity checklist

Development of an on farm biosecurity plan tailored to the needs of an individual operation is a good way to integrate best practice biosecurity with day to day operations (**www.farmbiosecurity.com.au/planner/**). Further information on farm biosecurity can be found at **www.farmbiosecurity.com.au** or by contacting AUSVEG**.**

Reporting suspect emergency plant pests

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture agency through the Exotic Plant Pest Hotline (1800 084 881). Early reporting enhances the chance of effective control and eradication. Every report will be taken seriously, checked and treated confidentially.

Rapid reporting of exotic plant pests is critical, early detection is our best chance for effective control and eradication. If you find something you believe could be an exotic plant pest, call the Exotic Plant Pest Hotline immediately to report it to your local state or territory government.

If you suspect a new pest, call the Exotic Plant Pest Hotline on 1800 084 881

The one phone number – 1800 084 881 – will connect you with an automated system to allow you to choose the state or territory that your report relates to. You will then be connected with the relevant authority for that jurisdiction. Most lines are only monitored during business hours, but outside of those hours, please leave a message and your call will be returned as soon as an officer is available.

If you are near the border, you may reach a different jurisdiction based on your phone tower, please speak to these officers anyway, they will assist you in getting to the right authority. Biosecurity is a collaborative effort and the states and territories work together.

Some vegetable pests are notifiable under each state or territory's quarantine legislation. Each state or territory's list of notifiable pests are subject to change over time so contacting your local state/territory agricultural agency (details in Table 11) will ensure information is up to date. Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture agency of the presence of those pests within a defined timeframe (Table 15).

Table 15. *Timeframe for reporting of notifiable pests as defined in state/territory legislation*

State/territory	Notifiable pest must be reported within
NSW	24 hours
NT	24 hours
QLD	24 hours
SA	Immediately
TAS	As soon as possible
VIC	Without delay
WA	24 hours

Suspect material should not be moved or collected without seeking advice from the relevant state/territory agriculture agency, as incorrect handling of samples could spread the pest or render the samples unsuitable for diagnostic purposes. State/territory agriculture officers will usually be responsible for sampling and identification of pests.

Preparedness

Pest-specific preparedness and response information documents

To help prepare for an incursion response a list of pest-specific preparedness and response information documents are provided in Table 6 that may support a response. Over time, as more resources are produced for pests of the vegetable industry they will be included in this document and made available through the PHA website. Resources include the development of pest-specific information and emergency response documents, such as fact sheets, contingency plans, diagnostic protocols and a summary of surveillance programs currently in operating for these high priority pests (see **www.planthealthaustralia.com.au/pidd**). These documents and programs should be developed over time for all medium to high risk pests listed in the TSTs (Appendix 2).

Contingency Plans

Contingency Plans provide background information on the pest biology and available control measures to assist with preparedness for incursions of a specific pest into Australia. The contingency plan provides guidelines for steps to be undertaken and considered when developing a response plan for the eradication of that pest. Any response plan developed using information in whole or in part from a contingency plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation.

As a part of contingency planning, biological and chemical control options are considered as are options for breeding for pest resistance. Through the planning process, it may be discovered that there are gaps in knowledge. Such gaps should be identified and consequently be considered as RD&E needs to be met within the implementation table.

For a list of current contingency plans see **www.planthealthaustralia.com.au/pidd**.

National Diagnostic Protocols

Diagnostic protocols are documents that contain information about a specific plant pest, or related group of pests, relevant to its diagnosis. National Diagnostic Protocols (NDPs) are diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDPs include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification.

Australia has a coherent and effective system for the development of NDPs for plant pests managed by the Subcommittee on Plant Health Diagnostics (SPHD). NDPs are peer reviewed and verified before being endorsed by Plant Health Committee (PHC).
Endorsed NDPs are available on the National Plant Biosecurity Diagnostic Network (NPBDN) website (**www.plantbiosecuritydiagnostics.net.au**), together with additional information regarding their development and endorsement.

Diagnostic information for some vegetable pests is also available through the PHA website **www.planthealthaustralia.com.au/pidd**. For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies, available from the PHA website.

Research Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or extension of knowledge will have been identified and need to be documented in the implementation table. Some of these gaps will require further research and development (e.g. understanding risk pathways, developing surveillance programs or diagnostic protocols, developing tools to facilitate preparedness and response, developing IPM or resistance breeding strategies), other gaps will require communication or extension of that knowledge to various target audiences (developing awareness raising materials, undertaking training exercises, running workshops, consideration of broader target audiences).

It is important that the RD&E gaps identified through this plan feed directly into the normal annual RD&E priority setting and strategic planning activities that an industry undertakes. This is fundamental if an industry is to progress biosecurity preparedness and response throughout the life of the biosecurity plan.

Market access

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

The SPS Agreement provides WTO member countries with the right to use sanitary and phytosanitary measures to protect human, animal and plant life or health. Under this agreement countries are allowed to specify consistent, science-based conditions aimed at providing sanitary and phytosanitary protection but not unnecessarily restricting trade. The establishment of exotic pests in Australia may result in conditions on Australian exports that previously did not apply and in some cases, may result in the short or long term loss of overseas markets, depending on the significance of the pest to the trading partner and the availability of options to reduce the risk to acceptable levels. These options could include measures such as pest free areas or place of production or treatments e.g. cold or fumigation. The time taken to regain access will depend on the availability and acceptance of measures to reduce risk and the receiving markets risk appetite.

Market access for the vegetable industry

Export is a high priority for the vegetable industry. The Australian vegetable industry have identified Japan, Singapore, the United Arab Emirates, New Zealand, Malaysia and Kuwait as existing markets for vegetable exports. Potential markets the vegetable industry may move into are China, South Korea, Japan, Taiwan and Indonesia. The development of these markets may be hampered by the establishment of exotic pests. To this end, the likelihood of entry restrictions being imposed by these ten markets if a high priority pest is detected in Australia has been summarised below (Table 16 and Table 17).

***Table 16**. Likelihood of entry restrictions being imposed for existing markets if an exotic high priority pest establishes in Australia*

High Priority Pest	Japan	Singapore	United Arab Emirates	New Zealand	Malaysia	Kuwait
INVERTEBRATES						
Achatina achatina (Giant African snail)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Lissachatina fulica (Giant African land snail)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Aphis fabae (Bean aphid)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Aulacophora foveicollis (Red pumpkin beetle)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Bactrocera carambolae (Carambola fruit fly)	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Bactericera cockerelli (Tomato/potato psyllid)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present
Bactrocera cucurbitae (Melon fruit fly)	Currently not known to be present	Present	Present	Currently not known to be present	Present	Currently not known to be present
Bactrocera dorsalis (Oriental fruit fly)	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Bactrocera passiflorae (Fijian fruit fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Bactrocera trivialis (New Guinea fruit fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Bemisia tabaci (Silverleaf whitefly)	Present	Present	Present	Currently restricted distribution	Present	Present
Delia antiqua (Onion fly)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present

High Priority Pest	Japan	Singapore	United Arab Emirates	New Zealand	Malaysia	Kuwait
Delia floralis (Summer cabbage fly)	Present but a restricted distribution	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Delia florilega (Bean seed fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Eumerus strigatus (Lesser bulb fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Halyomorpha halys (Brown marmorated stink bug)	Present	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Liriomyza bryoniae (Tomato leaf miner)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Liriomyza huidobrensis (Pea/Serpentine leafminer)	Present but a restricted distribution	Present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Liriomyza sativae (American leafminer)	Present but a restricted distribution	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Liriomyza trifolii (American serpentine leafminer)	Present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Lygus hesperus (Western plant bug)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Phytomyza gymnostoma (Allium leafminer)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Psila rosae (Carrot rust fly)	Present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present
Rhizoglyphus setosus (Bulb mite)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present

High Priority Pest	Japan	Singapore	United Arab Emirates	New Zealand	Malaysia	Kuwait
Thaumatotibia leucotreta (False codling moth)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Trichoplusia ni (Cabbage looper)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Tuta absoluta (South American tomato moth)	Present	Currently not known to be present	Present but a restricted distribution	Currently not known to be present	Currently not known to be present	Present
PATHOGENS AND NEMATODES						
Alternaria humicola (Leaf spot)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Colletotrichum higginsianum (Anthracnose)	Currently not known to be present	Present but a restricted distribution	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Colletotrichum lentis (Lentil anthracnose)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Groundnut bud necrosis virus	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Harpophora maydis (Late wilt)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Heterodera carotae (Carrot cyst nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Heterodera ciceri (Chickpea cyst nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Meloidogyne enterolobii (Root knot nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Meloidogyne naasi (Barley root knot nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present

High Priority Pest	Japan	Singapore	United Arab Emirates	New Zealand	Malaysia	Kuwait
Phytophthora infestans (A2 mating type) (Late blight)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Puccinia agrophila	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Puccinia opizii (Lettuce rust)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Puccinia spp. (exotic species) (Alliaceae rust)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Rhizoctonia solani f.sp. sasakii (Banded leaf and sheath spot)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Uromyces lineolatus (Apiaceae rust)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Watermelon bud necrosis virus	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present

Table 17. *Likelihood of entry restrictions being imposed for potential markets if an exotic high priority pest establishes in Australia*

High Priority Pest	China	South Korea	Japan	Taiwan	Indonesia
INVERTEBRATES					
Achatina achatina (Giant African snail)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Lissachatina fulica (Giant African land snail)	Present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present
Aphis fabae (Bean aphid)	Present	Present	Present	Present	Currently not known to be present

High Priority Pest	China	South Korea	Japan	Taiwan	Indonesia
Aulacophora foveicollis (Red pumpkin beetle)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Bactrocera carambolae (Carambola fruit fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present
Bactericera cockerelli (Tomato/potato psyllid)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Bactrocera cucurbitae (Melon fruit fly)	Present but a restricted distribution	Currently not known to be present	Currently not known to be present – eradicated in 1993	Present	Present
Bactrocera dorsalis (Oriental fruit fly)	Present	Currently not known to be present	Currently not known to be present – previously eradicated	Present	Present
Bactrocera passiflorae (Fijian fruit fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Bactrocera trivialis (New Guinea fruit fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present
Bemisia tabaci (Silverleaf whitefly)	Present but a restricted distribution	Present	Present	Present	Currently not known to be present
Delia antiqua (Onion fly)	Present but a restricted distribution	Present	Present	Currently not known to be present	Currently not known to be present
Delia floralis (Summer cabbage fly)	Present but a restricted distribution	Present	Present	Currently not known to be present	Currently not known to be present
Delia florilega (Bean seed fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Eumerus strigatus (Lesser bulb fly)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Halyomorpha halys (Brown marmorated stink bug)	Present	Present	Present	Present	Currently not known to be present
Liriomyza bryoniae (Tomato leaf miner)	Present	Present	Present	Present	Present

High Priority Pest	China	South Korea	Japan	Taiwan	Indonesia
Liriomyza huidobrensis (Pea/Serpentine leafminer)	Present but a restricted distribution	Present	Present but a restricted distribution	Present	Present but a restricted distribution
Liriomyza sativae (American leafminer)	Present	Currently not known to be present	Present but a restricted distribution	Currently not known to be present	Present
Liriomyza trifolii (American serpentine leafminer)	Present	Present	Present	Present	Present
Lygus hesperus (Western plant bug)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Phytomyza gymnostoma (Allium leafminer)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Psila rosae (Carrot rust fly)	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present
Rhizoglyphus setosus (Bulb mite)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present
Thaumatotibia leucotreta (False codling moth)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Trichoplusia ni (Cabbage looper)	Present	Present	Present	Present	Present
Tuta absoluta (South American tomato moth)	Currently not known to be present	Currently not known to be present	Present	Currently not known to be present	Currently not known to be present
PATHOGENS AND NEMATODES					
Alternaria humicola (Leaf spot)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Colletotrichum higginsianum (Anthracnose)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Colletotrichum lentis (Lentil anthracnose)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present

High Priority Pest	China	South Korea	Japan	Taiwan	Indonesia
Groundnut bud necrosis virus	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Harpophora maydis (Late wilt)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Heterodera carotae (Carrot cyst nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Heterodera ciceri (Chickpea cyst nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Meloidogyne enterolobii (Root knot nematode)	Present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Meloidogyne naasi (Barley root knot nematode)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Phytophthora infestans (A2 mating type) (Late blight)	Present	Present	Present	Currently not known to be present	Present
Puccinia agrophila	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Puccinia opizii (Lettuce rust)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Puccinia spp. (exotic species) (Alliaceae rust)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Rhizoctonia solani f.sp. sasakii (Banded leaf and sheath spot)	Present	Present	Present	Present	Present
Uromyces lineolatus (Apiaceae rust)	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present
Watermelon bud necrosis virus	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present	Currently not known to be present

Implementation actions

To help maintain or facilitate market access, in the event of an incursion, the vegetable industry in partnership with the Department of Agriculture and Water Resources and the relevant state and territory governments should develop the following, for the pests identified in Table 16 and Table 17:

- Surveillance plan including a method for collecting and storing surveillance data
- Diagnostic protocols that have been assessed in the Australian environment
- Biosecurity treatment measures (e.g. irradiation or fumigation)

Implementation of these actions will be required for all pests as this data will also be crucial for maintaining interstate trade should an incursion occur within Australia, resulting in a restricted distribution or quarantine zone. The implemented system should also take into account the likelihood of having entry restrictions imposed by overseas trade partners for those pests identified as possible in Table 16. A single system will facilitate market access discussions for both domestic and international trade and will minimise the potential disruption to the industry.

References

Department of Agriculture, Fisheries and Forestry (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

RESPONSE MANAGEMENT

Introduction

Gathering information, developing procedures, and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, PHA coordinated the development of PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing the procedures required and the roles and responsibilities of all Emergency Plant Pest Response Deed (EPPRD) signatories affected by an Emergency Plant Pest (EPP).

The following section includes key contact details and communication procedures that should be used in the event of an incursion in the vegetable industry. Additionally, a listing of pest-specific emergency response and information documents are provided that may support a response. Over time, as more of these documents are produced for pests of the vegetable industry they will be included in this document and made available through the PHA website.

The Emergency Plant Pest Response Deed

A fundamental component of the Australian plant biosecurity system is the EPPRD, which is an agreement between the Australian government, the state/territory governments, 33 plant industries (including AUSVEG) and PHA (collectively known as the signatories), that allows the rapid and efficient response to Emergency Plant Pests (EPPs). The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for eradication responses of EPPs.

The EPPRD provides:

- A national response management structure that enables all governments and plant industry signatories affected by the EPP to contribute to the decisions made about the response.
- An agreed structure for the sharing of costs to deliver eradication responses to EPPs detected in Australia. Costs are divided between signatories affected by the EPP in an equitable manner based on the relative potential impact of the EPP.
- A mechanism to encourage reporting of EPP detections and the implementation of risk mitigation activities.

- a mechanism to reimburse growers whose crops or property are directly damaged or destroyed as a result of implementing a Response Plan
- early detection and response
- rapid responses to EPPs (excluding weeds)
- decisions to eradicate are based on appropriate criteria (e.g. eradication must be technically feasible and cost beneficial)
- an industry commitment to biosecurity and risk mitigation and a government commitment to best management practice
- Cost Sharing of eligible costs
- an Agreed Limit for Cost Sharing (calculated as 2 % of the local value of production for one year of the Affected Industry Party or as defined in Schedule 14 of the EPPRD). The Agreed Limit can be exceeded with the agreement of Affected Parties.
- an effective industry/government decision-making process.

For further information on the EPPRD, including copies of the EPPRD, Fact Sheets or Frequently Asked Questions, visit **www.planthealthaustralia.com.au/epprd** and **www.planthealthaustralia.com.au/epprd-qa**.

PLANTPLAN

PLANTPLAN outlines the generic approach to response management under the EPPRD and introduces the key roles and positions held by industry and government during a response. The document is supported by a number of operating guidelines, job cards and standard operating procedures that provide further detail on specific topics. PLANTPLAN underpins the EPPRD and is endorsed by all EPPRD signatories.

The current version of PLANTPLAN and supporting documents are available on the PHA website (**http://www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/**).

For more information about PLANTPLAN and the supporting document visit **www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/**

Funding a response under the EPPRD

The following section outlines how eradication responses are nationally cost shared between affected industries and governments.

A copy of the EPPRD can be downloaded from the PHA website (**www.planthealthaustralia.com.au/epprd**).

Cost sharing a response

Affected industries and governments invest in the eradication of EPPs and share the costs of an agreed response plan, this is referred to as 'cost sharing'. Not all activities in a response are eligible to be cost shared, with some activities considered as normal commitments[39] for signatories.

The cost shared costs of a response are divided between affected industries and governments in an equitable manner directly related to the benefit of eradicating the EPP. These relative benefits are represented by the category of the pest, with the overall view that 'the higher the benefit, the greater the investment'.

There are four categories for EPPs, as shown in Table 19. The category indicates how the funding will be split between government and industries; with the governments funding the share of public benefit and industry funding the share of private benefit. It does not indicate its likelihood of eradication or its overall importance i.e. an EPP listed as Category 1 is not deemed to be any more or less important than an EPP listed as Category 4.

Table 18 *Response funding allocation between Government and Industry for an EPP*

Category of EPP	Government Funding	Industry Funding
Category 1	100%	0%
Category 2	80%	20%
Category 3	50%	50%
Category 4	20%	80%

[39] Further information can be found in the guideline document for Normal Commitments for Parties to the Emergency Plant Pest Response Deed available to download from http://www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/.

Pest categorisation

The list of categorised EPPs can be found in *schedule 13 of the EPPRD*. In the event that a response plan is endorsed for an uncategorised EPP, cost sharing will commence using the default category (category 3), and may be revised later.

Any signatory to the EPPRD can request for additional pests to be categorised and added to schedule 13 of the EPPRD. Contact **EPPRD@phau.com.au** for more information and guidance on this process.

Once a substantiated request has been received by PHA a group of independent scientific technical experts (known as the categorisation group) will be convened to assess all known information about the EPP to identify the public and private benefits. Full details can be found in *clauses 7 and 9 of the EPPRD*.

Vegetable's EPPs categorised to date

EPPs for the vegetable industry that are categorised and listed within schedule 13 of the EPPRD[40] are listed in Table 19.

Table 19. *Formal categories for pests of the vegetable industry listed on schedule 13 of the EPPRD (as at 31 August, 2017)*[41]

Formal Category	Scientific name	Common name
2	*Bactrocera dorsalis*	Oriental fruit fly
2	*Candidatus* Liberibacter psyllaurous	*Candidatus* Liberibacter psyllaurous
2	*Cryptophlebia leucotreta*	False codling moth
2	*Phymatotrichum omnivorum*	Texas root rot
2	*Xylella fastidiosa*	Pierce's disease
3	*Liriomyza sativae*	Vegetable leaf miner
3	*Bactericera cockerelli*	Tomato/potato psyllid
3	*Clavibacter michiganensis subsp. sepedonicus*	Ring rot
3	*Globodera rostochiensis*	Potato cyst nematode
3	*Leptinotarsa decemlineata*	Colorado potato beetle

[40] For the latest version of *schedule 13*, refer to the EPPRD version found at **www.planthealthaustralia.com.au/epprd**.

[41] Note scientific and common names are listed as they appear in the EPPRD

Formal Category	Scientific name	Common name
3	*Peronosclerospora sacchari*	Sugarcane downy mildew
4	*Lygus hesperus*	Western plant bug
4	*Mythimna unipuncta*	Army worm
4	*Peridroma saucia*	Variegated cutworm
4	*Tetranychus piercei*	Spider mite

How to respond to a suspect EPP

Following the detection of a suspect EPP, the relevant state agency will be notified either directly or through the Exotic Plant Pest Hotline. Within 24 hours of the state agency having a reasonable suspicion that they are dealing with an EPP the, Chief Plant Health Manager (CPHM) of the state or territory, will inform the Australian Chief Plant Protection Officer (ACPPO). All signatories affected by the EPP (both government and industry) are then notified immediately, and a Consultative Committee on Emergency Plant Pests (CCEPP) meeting is convened (this process is outlined in Figure 4). Only the industry signatories affected by the EPP are engaged in the response process. These are determined based on the known hosts of the EPP.

All positive detections of EPPs or suspect EPPs must undergo secondary identification from an independent laboratory. Confirmation of the identification should not delay the reporting of the EPP to the ACPPO or the CCEPP.

Figure 4. *Reporting suspect EPPs and notification process*

Once a pest is notified to the CCEPP, all signatories that are affected by the EPP play a part in the national management of EPP response. This is primarily through the two national decision making committees, both of which AUSVEG have a representative on:

- The Consultative Committee on Emergency Plant Pests (CCEPP) which provide technical expertise on the response
- The National Management Group (NMG) which acts on recommendations from the CCEPP and make the final decisions about EPP responses and funding.

Technical and economic considerations are reviewed, and a decision made on whether to eradicate using the cost sharing mechanisms under the EPP (i.e. develop a response plan) or take another course of action (potentially to contain or do nothing which will mean long term management of the pest).

The relevant state/territory agriculture department is responsible for the on ground response to EPPs and will adopt precautionary emergency containment measures if appropriate. Depending on the nature of the EPP, measures could include:

- restriction of operations in the area

- disinfection and withdrawal of people, vehicles and machinery from the area
- restricted access to the area
- control or containment measures.

Each response to an EPP is applied differently due to the nature of the incursion, however each follow the defined phases of a response as summarised **Error! Reference source not found.**. Further information about the response processes under the EPPRD can be found in the PHA Foundation Course and National EPP Response Management BOLT courses[42].

In the instances that an EPP is confirmed, the CCEPP convened to make).

Owner reimbursement costs

Owner Reimbursement Costs (ORCs) are included in the shared costs of a response and are available to eligible growers to alleviate the financial impacts of crops or property that are directed to be destroyed under an agreed response plan.

ORCs were developed to encourage early reporting and increase the chance of successful eradication. ORCs are paid to the owner and cover direct costs associated with implementing a response plan, including:

- Value of crops destroyed,
- Replacement of lost capital items and
- Fallow periods

ORCs are only available when there is an approved response plan under the EPPRD, and only to industries that are signatories to the EPPRD, such as the vegetable industry.

The value of ORCs is directed by the **ORC Evidence Frameworks** and is based on an agreed valuation approach developed for each industry.

Further information about ORCs is available from **www.planthealthaustralia.com.au/biosecurity/incursion-management/owner-reimbursement-costs/**

[42] All of PHA's BOLT courses are feely available at **https://pha.canopihr.com.au**

Industry specific response procedures

Industry communication

AUSVEG are the peak industry body for the vegetable industry[43], i.e. signatory to the EPPRD, and will be the key industry contact point if a plant pest affecting the vegetable industry is detected and responded to using the arrangements in the EPPRD. AUSVEG will have responsibility for relevant industry communication and media relations (see PLANTPLAN for information on approved communications during an incursion). The contacts nominated for the CCEPP and the NMG by AUSVEG will be contacted (Table 20) regarding any meetings of the CCEPP or NMG. It is important that all Parties to the EPPRD ensure their contacts for these committees are nominated to PHA and updated swiftly when personnel change.

Close cooperation is required between relevant government and industry bodies to ensure the effective development and implementation of a response to an emergency plant pest, and the management of media/communication and trade issues. Readers should refer to PLANTPLAN or undertake the relevant BOLT courses for further information.

Table 20. *Contact details for AUSVEG Ltd*

Website	**www.ausveg.com.au/**
Postal address	PO BOX 138 Camberwell VIC 3124
Email	**info@ausveg.com.au**
Phone	(03) 9882 0277
Fax	(03) 9882 6722

[43] For further information on AUSVEG refer schedule 7 available at **http://www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/**

References

PLANTPLAN (2017) PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 1. (**www.planthealthaustralia.com.au/plantplan**).

APPENDIX 1: PROFILE OF THE AUSTRALIAN VEGETABLE INDUSTRY

Vegetable industry background

To develop any biosecurity plan it is critical to understand the profile and context of the industry.

Industry profile

AUSVEG is the national peak industry body, representing Australian vegetable and potato growers. Their members include Growcom, NSW Farmers Association, NT Farmers Association, Potato Growers Association of WA, Tasmanian Farmers & Graziers Association, AUSVEG Vic, Vegetables WA and AUSVEG SA.

This association is involved in a number of projects to improve the productivity and sustainability of the vegetable industry. The vegetable industry is multifaceted, combining approximately 6000 growers across 3259-5832 farms (Horticulture Innovation Australia Limited, 2017b) and spanning numerous types of vegetable crops, including potatoes, across the various growing regions within Australia.

During the financial year ending June 2015, the industry produced 3.15 million tonnes of vegetables (2014-15 Australian Horticulture Statistics Handbook). The value of production was $3.53 billion while the wholesale value of the fresh supply was $3.99 billion. This was broken down into 64% of vegetables produced that were used for fresh vegetable supply, 30% for processing and 5% for fresh vegetable export.

The Biosecurity Plan for the Vegetable Industry covers the following leviable vegetable crops:

- Apiaceae (e.g. carrots, celery, parsley, parsnips)
- Fabaceae (e.g. peas and beans)
- Asteraceae (e.g. lettuce)
- Brassicaceae (e.g. cabbage, radishes, broccoli, cauliflower)
- Cucurbitaceae (e.g. cucumber, zucchini, pumpkins)
- Amaranthaceae (e.g. beetroot, silver beet)
- Poaceae (e.g. sweet corn)
- Solanaceae (e.g. eggplant, capsicum, chilli)
- Alliaceae (e.g. leeks, culinary shallots)

Background information on each crop is provided below.

Apiaceae

The Apiaceae or Umbelliferae family contains edible plants such as carrots (*Daucus carota*), celery (*Apium graveolens*), parsley (*Petroselinum crispum*) and parsnips (*Pastinaca sativa*).

Carrots production occurs primarily in the southern states of Australia, with a large volume of carrots grown for the export market in Western Australia. The main varieties grown are standard carrots (90% of fresh production), Dutch carrots (3% of fresh production) and processing carrots (7% of fresh production). In 2015 there was 4,623 hectares of carrots, which produce approximately 291,600 tonnes per annum, valued at approximately $190.4 million (Horticulture Innovation Australia Limited, 2017a).

Celery production occurs in most states of Australia, with the majority of production occurring in Victoria. Most of the celery grown in Australia is destined for the fresh local market, with a small but growing fresh export market. In 2014 there was 1,695 hectares of celery, which produce approximately 57,500 tonnes per annum, valued at approximately $45.3 million (Horticulture Innovation Australia Limited, 2017a).

Parsley, despite being a small horticultural industry, is grown across all of Australia except in the Northern Territory. The varying weather conditions across the country results in fresh parsley available to the domestic market through the year. The main variety is ‘common’ parsley with dark green flat leaves or ‘Italian or continental’ parsley with dark green lobed leaves. In 2009 there were 200 ha of parsley planted, producing 2003 tonnes worth $8.2 million (AUSVEG, 2014).

Parsnips are grown across most states of Australia. Almost all of the parsnips grown in Australia are destined for the fresh market. In 2015 there was approximately 3,300 tonnes per annum, valued at approximately $9.2 million (Horticulture Innovation Australia Limited, 2017a).

Fabaceae

The Fabaceae family is more commonly known as the legume family and contains peas (*Pisium sativum*) and beans (e.g. *Phaseolus* spp.).

Peas are grown across most states of Australia with the majority of production occurring in Victoria and Queensland. The fresh market accounts for one third of all peas grown in Australia, comprising primarily of two varieties (snow peas and sugar snap peas), while garden peas are the variety most commonly processed. In 2015 there was approximately 20,680 tonnes per annum, valued at approximately $42 million (Horticulture Innovation Australia Limited, 2017a).

Beans refers to green beans, French beans, runner beans and navy beans. Green bean production occurs primarily in Queensland. Excluding navy beans (which are commonly sold tinned) the 2015 production area for beans was 6,210 hectares, producing approximately 29,900 tonnes worth $74.2 million (Horticulture Innovation Australia Limited, 2017a).

Asteraceae

AUSVEG covers lettuce (*Lactuca sativa*), which are from the Asteraceae family. The 2014/15 Australian Horticulture Statistics Handbook separates head lettuce, lettuce products that are typically sold in a headed form, such as iceberg, cos and oak varieties from fresh lettuce leaves predominantly sold loose for salads. This Biosecurity Plan for the Vegetable Industry treats them the same as they will both be affected by the same pests and diseases. Most lettuce, regardless of its end use, is grown close to major population centres on the east coast of Australia. During 2015 the production area for head lettuce was 6,907 hectares, producing approximately 122,700 tonnes worth $131.2 million. Leafy salad vegetables produced 54,579 tonnes in 2015 at a production value of $315.3 million (Horticulture Innovation Australia Limited, 2017a).

Brassicaceae

In the Brassica family (Brassicaceae) AUSVEG covers cabbage (*Brassica oleracea*), radish (*Raphanus raphanistrum*), broccoli and cauliflower (*Brassica oleracea*).

Cabbage production occurs in most states of Australia with production occurring during the winter months. In 2014 the production area was 2,146 hectares, producing approximately 66,900 tonnes worth $33.3 million (Horticulture Innovation Australia Limited, 2017a).

NSW and Western Australia grow radish in Australia. There are several types of radish with globe, oval, oblong and long and red or white as the main varieties. The most common in Australia is round red radishes referred to as Cherry Belles or Scarlet Globes.

Broccoli and cauliflower is grown in most states of Australia during the winter months. Victoria produces the most broccoli while Victoria and Queensland produce the most cauliflower. Modifications of broccoli include baby broccoli and Broccolini™ (a cross between broccoli and the leafy Asian vegetable 'Gai Lan'). In 2015, 68,571 tonnes of broccoli was produced worth $188.7 million. Cauliflower produced 63,510 tonnes in 2015 worth $48.9 million (Horticulture Innovation Australia Limited, 2017a).

Cucurbitaceae

AUSVEG covers cucumber (*Cucumis sativus*), zucchini (*Cucurbita pepo*) and pumpkins (*Cucurbita sp.*) which belong in the Cucurbitaceae family.

Within Australia the majority of cucumbers are grown in protected cropping systems using covers or high-tech glasshouses. The largest cucumber producers are in Bowen, Queensland or in the Riverland region of South Australia. The main cucumber varieties are continental, Lebanese and baby

cucumbers. During 2014, 733 hectares grew cucumbers with 83,109 tonnes of production worth $147.2 million (Horticulture Innovation Australia Limited, 2017a).

Zucchini is grown in most states of Australia, with the majority of production occurring in Queensland and Victoria. 2,351 hectares of zucchinis were grown in 2014 with 33,658 tonnes produced. This equalled a production value of $53.4 million (Horticulture Innovation Australia Limited, 2017a).

Pumpkins are grown in many states of Australia, with the majority of production occurring in New South Wales and Queensland. Some major pumpkin varieties include kent (also known as jap pumpkins), butternut and Queensland blue. During 2014, the production area for pumpkin was 6,257 hectares, producing approximately 115,400 tonnes worth $59.7 million (Horticulture Innovation Australia Limited, 2017a).

Amaranthaceae

Beetroot and silverbeet or swiss chard are different varieties of the same *Beta vulgaris* species. Silverbeet is often called spinach but they are different vegetables. They are however both members of the Amaranthaceae family.

The 2014/15 Australian Horticulture Statistics Handbook combines information on English spinach and silverbeet. Grown around Australia approximately 6,928 tonnes worth $15.5 million was produced in 2015 (Horticulture Innovation Australia Limited, 2017a).

Beetroot production occurs predominantly in Queensland. Volumes grown for processing have decreased in recent years. During 2014, 718 hectares of beetroot was grown which produced 13,296 tonnes of the root vegetable worth $9.7 million (Horticulture Innovation Australia Limited, 2017a).

Poaceae

Sweet corn is represented under AUSVEG and belongs to the Poaceae family. Sweet corn refers to the sweet varieties of corn that are grown for human consumption, and does not include maize or other similar broadacre corn crops. However, due to the overlap with exotic pests and diseases the biosecurity plan for the vegetable industry did not make this distinction.

Sweet corn is grown across Australia with the majority of production in New South Wales and Queensland. The production area of sweet corn was 6,865 hectares during 2014 with 60,099 tonnes worth $62.9 million (Horticulture Innovation Australia Limited, 2017a).

Solanaceae

Eggplant or aubergine (*Solanum melongena*), capsicum, chilli or peppers (*Capsicum* sp.) belong to the Solanaceae family.

Eggplants are grown in most states of Australia, with the majority of production occurring along the east coast. Currently, most eggplants are grown outdoors. However, in the southern states, increasing volumes are being grown year-round in greenhouses. The eggplant production area in 2014 was 765 hectares with 8,461 tonnes produced worth $17.5 million (Horticulture Innovation Australia Limited, 2017a).

Capsicums or bell peppers are grown in most states of Australia. The majority of production is grown outdoors in Queensland. The industry are moving towards producing capsicums in high-tech greenhouses in the southern states. In 2015, the production area was 1,950 hectares with 71,634 tonnes produced worth $144.7 million (Horticulture Innovation Australia Limited, 2017a).

Chillies are grown in most states of Australia. The majority of chillies are currently grown in Queensland. The production area in 2014 was 222 hectares with 2,152 tonnes produced worth $8.6 million (Horticulture Innovation Australia Limited, 2017a).

Alliaceae

Leeks (*Allium ampeloprasum*), shallots (*Allium cepa* or *Allium ascalonicum*) and onions (*Allium cepa*) belong to the Alliaceae family. Leeks and culinary shallots are represented by AUSVEG and included in the Biosecurity Plan for the Vegetable Industry. Bulb onions, represented by Onions Australia, are covered by a separate Biosecurity Plan for the Onion Industry.

Leeks are grown predominantly in Victoria. Almost all of the leeks grown in Australia are destined for the fresh market. The production area during 2014 was 673 hectares producing 8,951 tonnes of leek valued at $15.9 million (Horticulture Innovation Australia Limited, 2017a).

In Australia, spring onion and shallots are often used interchangeably. Shallots marketed in NSW are similar to true spring onions. The production area during 2007/08 for spring onions and shallots was 537 hectares and produced 7,818 tonnes at an estimated gross value of $21.5 million (Onions Australia, 2017).

Vegetable crops not covered by this Biosecurity Plan

The Vegetable BP does not include hard potatoes, hard onions, melons, or tomatoes which are not covered by the vegetable levy. PHA has written separate biosecurity plans for these crops (found through the Plant Health Australia website at **www.planthealthaustralia.com.au/**). Leafy vegetables

are excluded from this biosecurity plan due to the significant amount of work involved in preparing Threat Summary Tables and identifying a High Priority Pest list.

The following vegetables are also excluded from the Vegetable BP as they are not included under the vegetable levy:

- Asparagus
- Garlic
- Herbs (other than fresh culinary shallots and parsley)
- Mushrooms
- Seed sprouts

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APPENDIX 2: THREAT SUMMARY TABLES

Vegetable industry threat summary tables

The information provided in the threat summary tables (available as a standalone document from **http://bit.ly/2hPjpG0**[44]) is an overview of exotic plant pest threats to the vegetable industry. More than 760 exotic plant pests were identified. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control[45] or eradication may be included in these tables where appropriate. However, vegetable pests that are established but regionalised within Australia are not covered by TSTs, but may be assessed in state biosecurity plans. Assessments may change given more detailed research, and will be reviewed with the biosecurity plan.

Full descriptions of the risk rating terms can be found on page 98. An explanation of the method used for calculating the overall risk can be found on the PHA website[46]. Additional information on a number of the pests listed in the TSTs can be found in pest-specific information document (Table 6).

Currently the TSTs include pest of Apiaceae (carrots, celery, parsley, parsnips), Fabaceae (peas, beans), Asteraceae (lettuce), Brassicaceae (cabbage, radishes, broccoli, cauliflower), Cucurbitaceae (cucumber, zucchini, luffa, pumpkins), Amaranthaceae (beetroot, silver beet), Poaceae (sweet corn), Solanaceae (eggplant, capsicum, chilli) and Alliaceae (leeks, spring onion and shallot). Should other vegetable commodities be included in the future this list will expand.

[44] Please contact PHA if you have difficulty accessing this document.

[45] Official control defined in ISPM No. 5 as the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests

[46] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

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