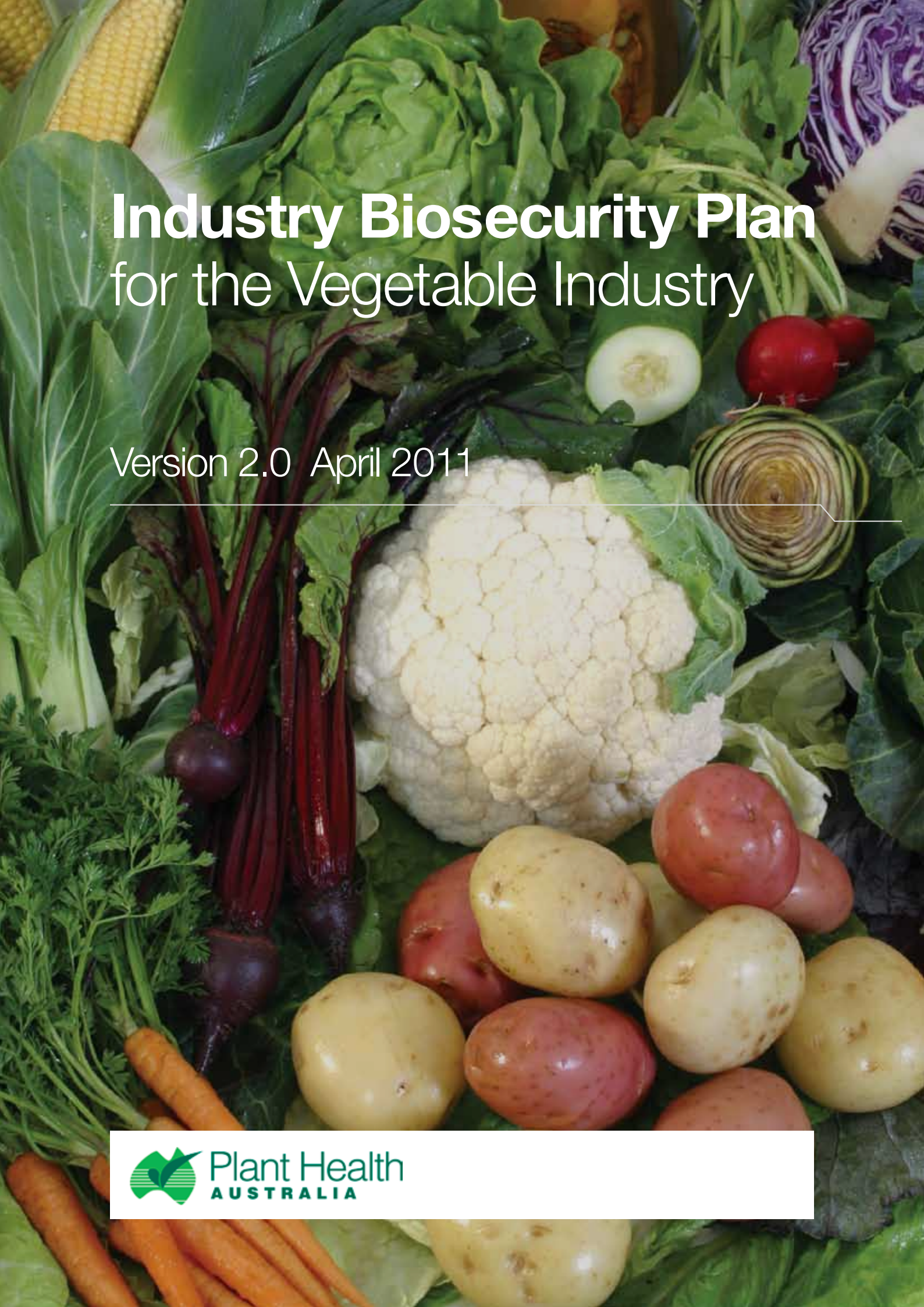

Industry Biosecurity Plan
for the Vegetable Industry

Version 2.0 April 2011

Plant Health AUSTRALIA

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For the review and finalisation of Version 2.0 of this plan, PHA would like to acknowledge the involvement of the following organisations, agencies and/or individuals:

- AUSVEG
- Members of the Industry Biosecurity Group (Table 6)
- Experts and researchers who reviewed the document (Table 7)

Endorsement

The *Industry Biosecurity Plan for the Vegetable Industry* (Version 2.0) was formally endorsed by the vegetable industry (through AUSVEG) in January 2011, and the Australian Government and all state and territory governments (through the Plant Health Committee) in March 2011.

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List of acronyms

ABS	Australian Bureau of Statistics
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service
AS/NZS	Australian Standard/New Zealand Standard
BMP	Best Management Practice
BSG	Biosecurity Services Group
DAFF	Department of Agriculture, Fisheries and Forestry
DAFWA	Department of Agriculture and Food, Western Australia
DEEDI	Department of Employment, Economic Development and Innovation
DPI	Department of Primary Industries
DQMAWG	Domestic Quarantine and Market Access Working Group
EPP	Emergency Plant Pest
EPPRD	Emergency Plant Pest Response Deed
FFEZ	Fruit Fly Exclusion Zone
HAL	Horticulture Australia Ltd
IBG	Industry Biosecurity Group
IBMP	Industry Best Management Practice
IBP	Industry Biosecurity Plan
ICA	Interstate Certification Assurance
ICON	AQIS Import Conditions Database
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis
NAQS	Northern Australian Quarantine Strategy
NGIA	Nursery and Garden Industry Australia
NIASA	Nursery Industry Accreditation Scheme Australia
OCPPO	Office of the Chief Plant Protection Officer
PCN	Potato Cyst Nematode
PHA	Plant Health Australia
PIRSA	Primary Industries and Resources South Australia
PRR	Pest Risk Review
QA	Quality Assurance
QPIF	Queensland Primary Industries and Fisheries
SARDI	South Australian Research and Development Institute
SPHDS	Subcommittee on Plant Health Diagnostic Standards
SPS	Sanitary and Phytosanitary
TFGA	Tasmanian Farmers and Graziers Association
TST	Threat Summary Table
VGA	Vegetables Growers Association, Victoria
WTO	World Trade Organisation

INTRODUCTION

Introduction

Plant Health Australia

Plant Health Australia (PHA) is a public company, with members including the Australian Government, all state and territory governments, and a range of plant industry organisations. The company was formed to address high 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.

AUSVEG

AUSVEG is the national peak industry body representing commercial vegetable and potato growers in Australia. It is committed to securing the industries future and is a key influencer on the direction of research and development projects and the marketing and promotions strategies for advancing the industry domestically and internationally.

Need for biosecurity plans

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic threats. Australia's strong national quarantine system also helps to prevent the introduction of harmful exotic threats to its plant industries. Rapid increases in overseas tourism, imports and mail as well as the potential for pests to enter via natural routes, means that border quarantine alone cannot stop establishment of new pests.

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 procedures to reduce the chance of pests becoming established, and to minimise the impact if a pest incursion occurs.

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, negotiate access to new overseas markets, and reduce the social and economic costs of pest incursions on both growers and the wider community.

The definition of a **pest**[1] used in this document covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that are injurious to plants, plant products or bees. **Exotic pests** are those not currently present in Australia. **Endemic pests** are established within Australia.

The Emergency Plant Pest Response Deed

The Emergency Plant Pest Response Deed (EPPRD) has been negotiated between the government and industry members of PHA to cover the management and funding arrangements of eradication responses to Emergency Plant Pest (EPP) incidents. The EPPRD came into effect on October 26, 2005 and is a formal legally binding agreement between PHA, the Australian Government, all state and territory governments and 26 plant industry signatories including AUSVEG. The EPPRD is based on the following key principles:

- cost minimisation for all parties
- reimbursement to growers whose crops or property are directly damaged or destroyed as a result of implementing an approved Response Plan
- early detection and response
- ensuring rapid responses to exotic pests - excluding weeds in the first instance
- ensuring decisions to eradicate are based on appropriate criteria (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/payment of eligible costs
- an agreed limit for cost sharing (calculated as 2% of local value of production for one year of the Affected industries 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
- a limit in scope (to only cover exotic pest threats relevant to PHA member industries).

For further information on the EPPRD, including copies of the EPPRD, a Fact Sheet or frequently asked questions, visit **www.planthealthaustralia.com.au/epprd**

[1] Formal definition from the International Plant Protection Convention – any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products

Background on the vegetable industry

The vegetable industry is a large and diverse industry, with numerous and widespread crops, locations and climates in Australia. Vegetable production, processing, and retailing are important industries in the Australian economy and society. The industry contributes, in economic and societal terms, to all states and territories and is important in many regional economies (Kiri-ganai research, 2005). Australian Bureau of Statistics (ABS) data indicates that the industry had a gross value of production (GVP) of $AUD 3,012.3 million in 2008-09. The GVP and local value for vegetables in Australia and each state are outlined in Table 1.

Table 1. *Value of vegetable crops in Australia*[2]

	Australia		States and territories: 2008-09							
	2007-08	2008-09	NSW	Vic	Qld	SA	WA	Tas	NT	ACT
Gross value ($m)	3,362.7	3,012.3	322.2	652.4	951.6	476.3	341.0	240.7	28.2	0.1
Local value ($m)	2,841.1	2,537.5	247.9	585.0	733.7	430.3	291.4	223.2	25.9	0.1

The composition of selected crops of the Australian vegetable industry and their value of production and farm gate value is outlined in Table 2. As the potato and the onion industries are each levied separately and have their own Industry Biosecurity Plans, the gross value, size of production, area planted or the main states in Australia for these crops has not been included in Tables 2, 3 or 4.

[2] Australian Bureau of Statistics 2010, various years in AUSVEG 2010

Table 2. *Gross value of Australian vegetable production for selected crops in 2008-09*[2]

Commodity	Value of Production ($m)	Farm Gate Value ($m)
Lettuces	187.0	150.7
Carrots	182.1	131.4
Capsicums, chillies and peppers	119.6	99.4
Broccoli	101.2	91.3
Beans	72.7	64.0
Pumpkins	68.8	40.9
Marrow, squash and zucchini	65.2	56.1
Sweet Corn	55.7	47.8
Cauliflower	49.8	34.0
Celery	44.6	33.6
Cabbages	44.2	29.1
Cucumbers	28.2	24.3
Green Peas	13.7	13.5
Beetroot	13.6	12.3
Parsnips	13.6	11.6

Table 3. *2008-09 production of selected vegetable crops in Australia*[2]

Commodity	Production (tonnes)
Carrots	263,527
Lettuces	164,543
Pumpkins	103,729
Cabbages	78,075
Cauliflower	70,286
Celery	57,804
Sweet corn	51,609
Capsicum, chillies, peppers	49,315
Broccoli	44,420
Beetroot	43,268
Sweet potatoes	42,460

The area planted to the 16 major vegetables in 2008-09 was 91,242 hectares. This is a 5.7% decrease from 2007-08 (ABS 2010, AUSVEG 2010) (Table 4).

Table 4. *Area planted, in Australia, for selectable vegetables in 2007-08 and 2008-09*[2]

Plantings of vegetables	2007-08	2008-09	Annual % change in area planted
Beetroot	1,577	229	-85.5
Broccoli	6,326	6,269	-0.9
Cabbages	1,888	2,060	9.1
Capsicums, chillies and peppers	2,306	2,250	-2.4
Carrots	4,934	5,174	4.9
Cauliflower	2,893	3,121	7.9
Celery	1,046	1,210	15.7
Lettuces	7,307	7,411	1.4
Pumpkins	6,393	5,771	-9.7
Sweet corn	3,505	3,493	-0.3
Sweet potatoes	1,441	1,693	17.5

The largest areas of vegetable production occur in Queensland, Victoria and New South Wales. Queensland also has the largest number of growers and currently accounts for 30% of vegetable farms (AUSVEG, 2010). ABS statistics indicate the total number of vegetable growers producing crops for consumption in 2008-09 was 5,832 and vegetable growers producing crops for seed production in 2008-09 was 930 (ABS 2008-09). The production of certain vegetables is prominent in some states and is depicted in Table 5.

Table 5. *Main growing states in Australia for key vegetable crops, 2008-09*[2]

Product	Main growing states, 2008-09
Carrots	WA, SA, Tas
Lettuce	Qld, Vic
Capsicum, chillies and peppers	Qld
Cauliflowers	Qld, Vic, NSW
Broccoli	Vic, Qld, WA
Pumpkins	Qld
French and runner beans (total)	Qld, Tas
Sweet corn	WA, Qld
Peas (processing)	Tas
Peas (pod)	Qld, NSW

Coverage of the Industry Biosecurity Plan

The Industry Biosecurity Plan for the vegetable industry (hereafter known as the Vegetable IBP) covers the following leviable vegetable crops:

- **Solanaceous** – capsicum, chilli and eggplant
- **Brassicas and leafy vegetables** – cabbage, brussel sprouts, broccoli, cauliflower, lettuce and celery (Asian leafy vegetables to be included in a separate IBP)
- **Root crops** – beetroot, carrot, parsnip and sweet potato
- **Cucurbits** – cucumber, marrow, zucchini and pumpkin
- **Grains and leguminous plants** – French and runner beans, green peas, sweet corn.

For Asian leafy vegetables, due to the significant amount of work involved in preparing Threat Summary Tables and identifying a High Priority Pest list, a separate IBP will be developed for Asian leafy vegetables, and this has been included as a proposed action item (Table 8).

The Vegetable IBP does not include hard onions and potatoes which are levied separately and are covered by their own Industry Biosecurity Plans (found on the Plant Health Australia website at **www.planthealthaustralia.com.au**).

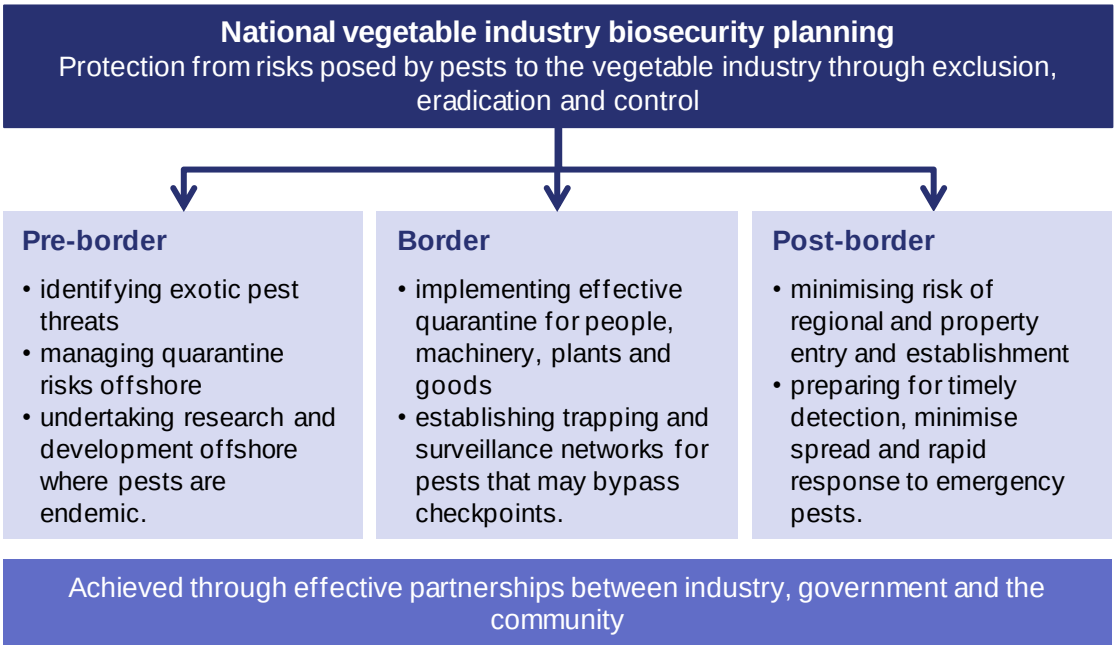
The following vegetables are also excluded from the Vegetable IBP as they are not included under the vegetable levy:

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

What is industry biosecurity planning?

Industry biosecurity is the protection from risks posed by exotic pests through actions such as exclusion, eradication, and control. Effective industry biosecurity relies on all stakeholders, including government agencies, industry, and the public (Figure 1). The components of the plant industry biosecurity continuum have been identified and described in PLANTPLAN. A summary of the incursion management plan from PLANTPLAN (2010) has been summarised in Figure 2.

Figure 1. *Industry biosecurity: a shared responsibility*

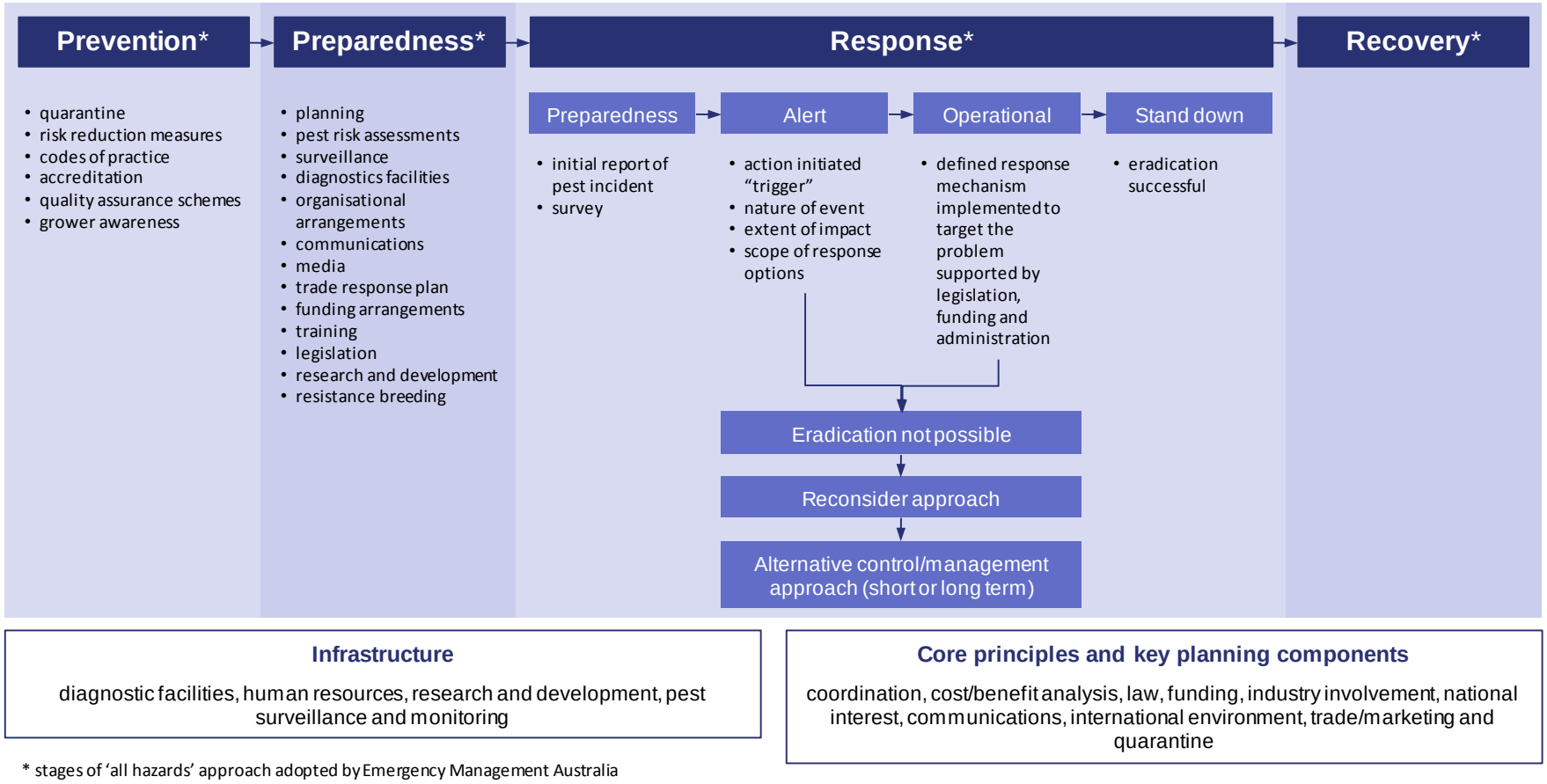


With the assistance of AUSVEG, an Industry Biosecurity Group (IBG), was formed to work on the review of the Vegetable IBP. The IBG included representatives from vegetable industry associations in each relevant state/territory, as well as representatives from relevant state/territory agriculture agencies, the Australian Government, and PHA.

Members of this group are shown in Table 6 and Table 7

.

Figure 2. *Summary of incursion management for plant industries according to PLANTPLAN (2010)*



* stages of 'all hazards' approach adopted by Emergency Management Australia

Table 6. *Members of the Vegetable Industry Biosecurity Group for the Vegetable IBPv2*

Name	Organisation
Mr Jim Collings	Growcom
Mr Mike Redmond	Executive Officer, Grow SA
Mrs Val Bonython	Industry Representative (Grower - SA)
Mr Danny De Ieso	Vegetable IAC / Industry Representative (Grower - SA)
Dr Satendra Kumar	Director Plant Biosecurity, Industry & Investment NSW
Dr Peter Malcolm	Industry & Investment NSW
Dr Alison Anderson	NSW Farmers Association
Mr Paul Gazzola	Industry Representative (Grower - VIC)
Mr Tony Imeson	Executive Officer, VGA VIC
Mr Kon Koroneos	Industry Representative (Grower - VIC)
Mr Tom Schreurs	Industry Representative (Grower - VIC)
Mr Ken Sue	Vegetables WA
Mr Nick Steel	Commodities Manager at TFGA
Mr Andrew Craigie	TFGA

Table 7. *Scientists and others who contributed information for the Vegetable IBPv2*

Name	Organisation
Dr Mali Malipatil	Department of Primary Industries Victoria
Dr James Cunnington	Department of Primary Industries Victoria
Dr Christine Horlock	Biosecurity Qld, DEEDI Queensland
John Duff	Biosecurity Qld, DEEDI Queensland
Barbara Hall	South Australia Research and Development Institute
Dr Nichole Hammond	Dept of Agriculture and Food Western Australia
Dr Marc Poole	Dept of Agriculture and Food Western Australia
Dr Vivien Vanstone	Dept of Agriculture and Food Western Australia
Dr Darryl Hardie	Dept of Agriculture and Food Western Australia
Sarah Sullivan	Industry and Investment New South Wales
Dr Sandra McDougall	Industry and Investment New South Wales
Andrew Watson	Industry and Investment New South Wales
Dr Jianhua Mo	Industry and Investment New South Wales
Dr Victor Rajakulendran	Industry and Investment New South Wales
Jo Slattery	Plant Health Australia
Dr Sharyn Taylor	Plant Health Australia

Key steps in review of the Vegetable IBP included:

- identifying and documenting key threats to the vegetable industry
- confirming the agreed high priority plant pest threat list
- documenting appropriate pest risk reviews
- documenting pest-specific contingency plans for high priority pests
- documenting the roles and responsibilities of stakeholder groups

Document overview

The biosecurity package developed for the Australian vegetable industry focuses on a number of key areas.

Threat identification, pest risk reviews, and incursion management funding arrangements

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 on productivity, sustainability, and marketability and to assess their potential impacts. This plan strengthens risk assessment work already being done both interstate and overseas. Pest risk reviews (PRRs) have been included for individual pests where available[3]. Key vegetable biosecurity threats are detailed in threat summary tables, along with the plant pest threat priority list (the top ranked threats to the vegetable industry).

Risk mitigation plan

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. These include:

- surveillance, awareness and training activities
- exclusion activities

[3] Available for download from the Pest Information Document Database at **www.planthealthaustralia.com.au/pidd**

Contingency plans and response management procedures

PHA has developed PLANTPLAN, a generic emergency response plan for the Australian plant industries. This plan details the procedures required and the organisations responsible in the event of an incursion of an emergency plant pest.

The vegetable industry has developed pest-specific contingency plans for some high priority vegetable pests. These plans will enable government and industry to respond more effectively during an incident. In time, pest-specific contingency plans for all high priority vegetable pests will be developed.

Review processes

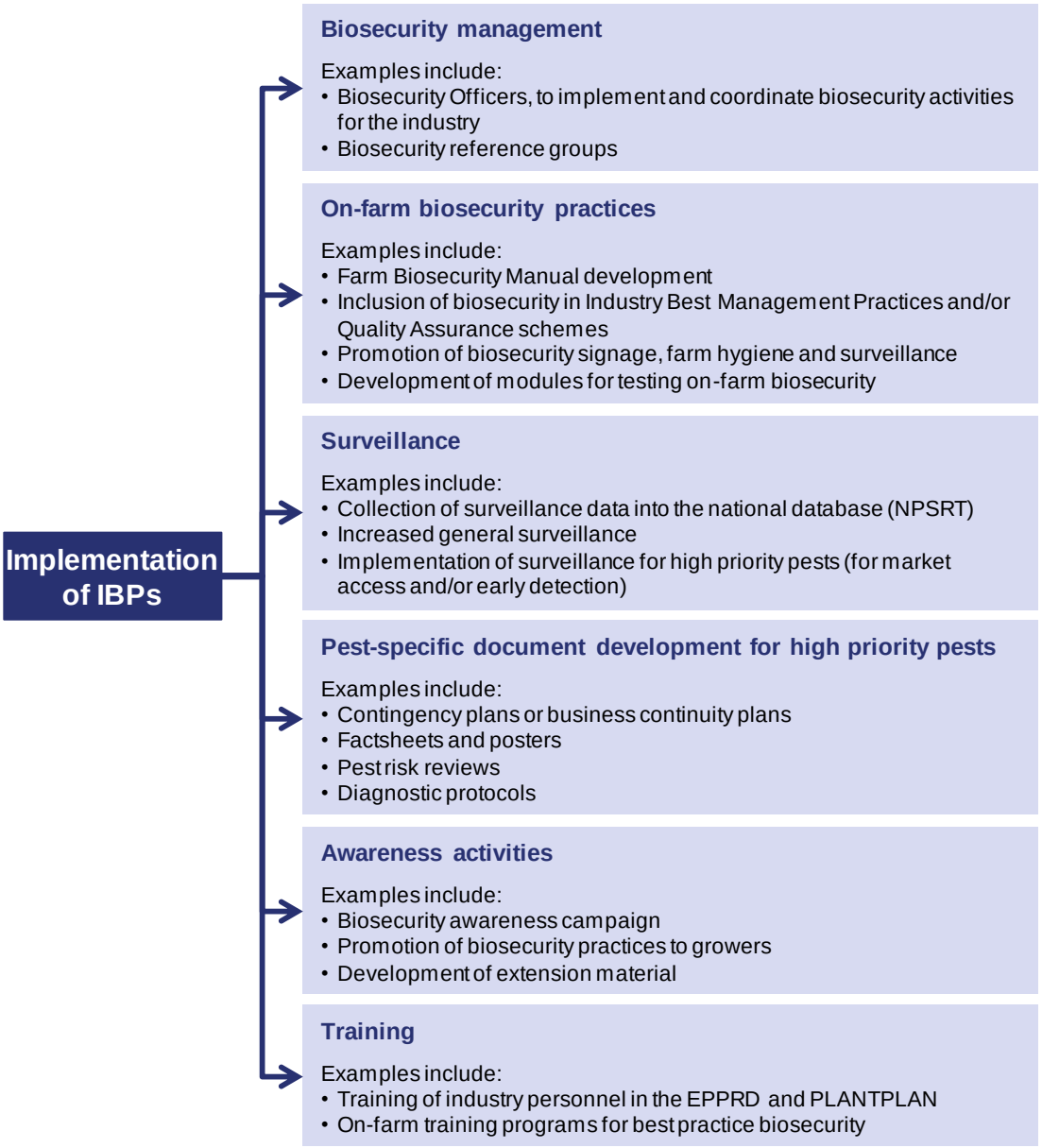
With the support of PHA, the IBG is responsible for reviewing this plan on a 3-4 year basis. The review process will be used to assist determine:

- strategies to maximise the adoption of recommended practices
- where further improvements can be made
- revisions/updates to the plan
- where resources should be allocated to improve or implement the plan.

Biosecurity implementation

The Vegetable IBP provides a framework for the implementation of biosecurity practices within the industry. Currently a range of biosecurity practices are undertaken within the vegetable industry and these are outlined in the Risk Mitigation chapter (page 41). Further implementation within the framework of the Vegetable IBP, such as those practices outlined in Figure 3, should be investigated to increase preparedness in the industry.

Figure 3. *Potential biosecurity implementation activities within the framework of the IBP*



Through the review of the Vegetable IBP, a list of biosecurity action items to be considered by stakeholders in the industry has been developed (Table 8). This list is intended to provide proposed or potential biosecurity priorities for the vegetable industry that are gaps in the current activities listed in the Risk Mitigation section of the Vegetable IBP. Future versions of this document will contain information on the progress made on the listed items.

Table 8. *Biosecurity action items identified by the vegetable industry*

Action item	Details
Peer review of the vegetable Threat Summary Tables (TST)	Comprehensive review of vegetable high priority pest threat list and TSTs. Due to the large number of pests in the TST (> 800 pests) and the significant number of gaps identified by the review of Version 2, a comprehensive assessment is required. Specific resources will be required for industry experts and researchers to provide input for this review.
Development of an IBP for Asian leafy vegtables	Due to the large amount of work required to review and assess pests of Asian leafy vegetables, it is proposed that a separate IBP be developed for this crop. Specific resources may be required for development of this IBP.
Training in responsibilities for committee members and Industry Liaison Officers	At a Consultative Committee for Emergency Plant Pests and National Management Group level, a checklist should be developed and training provided for roles for industry committee members in the event of an incursion. At a regional level, identification and training of potential Industry Liaison Officers (ILOs) in Emergency Plant Pest Response Deed responsibilities and duties for pest incursions is required. A simulation exercise for a pest incursion is needed to provide training and awareness for industry stakeholders.
Development of on-farm biosecurity awareness or training packages for growers	Training and awareness program for industry personnel through the provision of an on-farm biosecurity manual, fact sheets on high priority pests. This training should stress the importance of regular pest checks and record keeping (and how this could provide benefits to market access). On-farm training to be provided to outline the reimbursement process in the event of an incursion to give growers confidence in the system and the desire to notify the State government agency if an incursion occurs.
Investigate levy arrangements to cover biosecurity related activities	Investigate a positive levy to cover EPP responses and/or to cover biosecurity activities within the vegetable industry.
Emergency registration of chemicals for high priority pests	Identification of chemical control requirements for vegetable high priority pest threats and their availability in Australia. Where required, advanced applications for emergency chemical registrations to be prepared and submitted to the APVMA through a collaborative process between state governments and the vegetable industry.

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THREAT IDENTIFICATION, PEST RISK REVIEWS, AND INCURSION MANAGEMENT FUNDING ARRANGEMENTS

Introduction – threat identification and incursion management

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.

Emergency Plant Pests (EPPs) are defined as those that meet one or more of the following criteria:

a) It is a **known exotic plant pest**, the economic consequences of an incident of which would be **economically or otherwise harmful** for Australia, and for which it is considered to be in the regional or national interest to be free of the plant pest
b) It is a **variant form of an established plant pest** which can be distinguished by appropriate investigative and diagnostic methods, and which if established in Australia, would have a regional or national impact
c) It is a **serious plant pest of unknown or uncertain origin** which may, on the evidence available at the time, be an entirely new plant pest, and which if established in Australia would have an adverse economic impact regionally and or nationally
d) It is a **plant pest of potential economic importance** to the area endangered thereby and **not yet present** there or widely distributed and being officially controlled, but is occurring in such a fulminant outbreak form, that an emergency response is required to ensure that there is not either a large scale epidemic of regional or national significance or serious loss of market access.

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 response effectiveness if pest incursions occur. One such mechanism is the EPPRD as it ensures reliable and agreed funding arrangements are in place in advance of emergency plant pest incursions, and assists in the response to emergency plant pest incursions, particularly those identified as key threats.

Identification of high risk 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.

Threat identification

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

- past records
- existing industry protection plans
- relevant experience
- 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, although the issue of weeds may be revisited through future reviews of this plan.

In assessing the Threat Summary Tables during review for the Vegetable IBP v2, experts and agencies noted the significant number of gaps and need for detailed analysis of the pest lists as well as the risk ratings for entry, establishment, spread and economic impact for many pests. Full review of the Threat Summary Tables was deemed to be unachievable within the period available, and a specific research project was suggested as a future requirement (Table 8).

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 organism to identify and control and/or eradicate?

The Threat Summary Tables (TSTs; Appendix 1) present a list of potential plant pest threats to the vegetable industry and provide summarised information on entry, establishment and spread potential, and the economic consequences of establishment (where available).

The most serious threats from the TSTs were identified through a process of qualitative risk assessment and are listed in Table 9. Threats listed in Table 9 are exotic pests, not currently found in Australia. Specific contingency plans will be developed for these threats over time, and will be made available from PHA (see Contingency Planning section of this document, page 73).

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 9 and Table 10.

Life form legend

Fly	Flies and Midges (DIPTERA)
Fun	Fungi
Nem	Nematodes
Vir	Virus

Entry potential

Negligible	Probability of entry is extremely low given the combination of factors including the distribution of the pest source, management practices applied, low probability of pest survival in transit
Low	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 or certain given the combination of factors described above
Unknown	Pest entry potential is unknown or very little of value is known

Establishment potential

Negligible	The pest has no potential to survive and become established
Low	The pest has the potential to survive and become established in approximately one third or less of the range of hosts. 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 no potential for natural spread
Low	The pest has potential for natural spread locally
Medium	The pest has potential for natural spread throughout a physiographic region
High	The pest has potential for natural spread to all production areas
Unknown	Spread potential is unknown or very little of value is known

Economic impact

Negligible	There is no impact on yield, host longevity, production costs or storage
Low	There is minor impact on standing crop and little effect on stored product
Medium	There is moderate impact on crops, but host mortality is rare, storage losses may occur
High	There is severe impact on standing crop, with significant host mortality and/or storage losses
Extreme	There is extreme impact on standing crop, with extreme host mortality and/or storage losses
Unknown	The economic potential of the pest is unknown or very little of value is known

Vegetable industry high priority pest threat list

Table 9 provides the top ranked pest threats to the vegetable industry. Additional pest-specific information is provided in the Threat Summary Tables (Appendix 1) and in the Pest Risk Reviews (PRRs)[4]. Assessments may change given more detailed research, and the priority list will be reviewed within the Biosecurity Plan on a 3-4 year basis.

Table 9. *Vegetable industry high priority pest threat list*

Common name	Life form	Scientific name	Vegetable group	Relevant host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Melon fly	Fly	*Bactrocera cucurbitae*	Cucurbitaceae	Cucumber, giant pumpkin, ornamental gourd	Fruits	HIGH	HIGH	HIGH	HIGH	HIGH
Carrot cyst nematode	Nem	*Heterodera carotae*	Multiple vegetable groups	Carrot, other *Daucus* spp., *Torilis* spp.		MEDIUM	HIGH	HIGH	HIGH	HIGH
Tomato leaf miner	Fly	*Liriomyza bryoniae*	Multiple vegetable groups	Cabbage, cucumber, lettuce, tomato	Leaves	HIGH	MEDIUM	HIGH	HIGH	HIGH
Serpentine leaf miner	Fly	*Liriomyza huidobrensis*	Multiple vegetable groups	Potato, eggplant, beet, capsicum, celery, cucumber, bean, garlic, lettuce, onion, pea, spinach, tomato	Leaves	HIGH	HIGH	MEDIUM	HIGH	HIGH
Vegetable leaf miner	Fly	*Liriomyza sativae*	Multiple vegetable groups	Eggplant, capsicum, celery, cucumber, pea, tomato	Leaves	HIGH	HIGH	HIGH	HIGH	HIGH

[4] These documents are available for download from **www.planthealthaustralia.com.au/pidd**. Refer to Table 24 for a listing of PRR.

Common name	Life form	Scientific name	Vegetable group	Relevant host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
American serpentine leaf miner	Fly	*Liriomyza trifolii*	Multiple vegetable groups	Highly polyphagous. Beetroot, Chinese cabbage, capsicum, celery, cucumber, garlic, lettuce, onion, pea, spinach, tomato	Leaves	HIGH	HIGH	HIGH	HIGH	HIGH
Carrot (rust) fly	Fly	*Psila rosae*	Multiple vegetable groups	Carrot, parsnip, celery, parsley, as well as other members of Apiaceae	Roots, crown, petioles	HIGH	HIGH	MEDIUM-HIGH	EXTREME	EXTREME
Watermelon silver mottle virus group (serogroup IV group)	Vir	*Watermelon silver mottle* (*Tospovirus*), *Groundnut bud necrosis* (*Tospovirus*), *watermelon bud necrosis* (*Tospovirus*)	Multiple vegetable groups	Watermelon, melon, squash, pumpkin, pepper, eggplant, capsicum, cucumber		HIGH	HIGH	HIGH	HIGH	HIGH

Pests requiring more research

Pests listed in Table 10 have been identified by the Vegetable Industry as a priority for additional research to determine their threat to vegetables.

Table 10. *Pests identified as priority pests that require research to determine potential impacts*

Common name	Life form	Scientific name	Primary host	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Zucchini lethal chlorosis virus	Vir	*Zucchini lethal chlorosis virus* (*Tospovirus*)	Zucchini, Cucurbitaceae	UNKNOWN	UNKNOWN	UNKNOWN	HIGH	HIGH-UNKNOWN
Leafminers	Fly	*Liriomyza* spp.	Multiple vegetable groups	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Rust	Fun	*Uromyces lineolatus*[5]	Carrot	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	HIGH-UNKNOWN

[5] Synonym: *Uromyces scirpi*

Pest risk reviews

The assessment of risk posed by exotic pests listed in IBPs is carried out using a pest risk analysis protocol with similarities to that used in Biosecurity Australia (2009). Differences in underlying methodology and in the scope of consideration may result in different risk outcomes between the two protocols. The assessment process used in this IBP was developed in accordance with the International Standards for Phytosanitary Measures (ISPMs) Numbers 2 and 11 (FAO, 2004; 2007). A summary of the pest risk analysis protocol followed in this IBP is shown in Table 11, and the complete protocol used for pest risk analysis in this IBP can be found on the PHA website[6]. Modifications of the Biosecurity Australia protocol have been made to suit the analysis required in the IBP development process, including, but not limited to:

- **Entry potential:** The determination of entry potential in this IBP takes into account multiple possible pathways for the legal importation of plant material as well as through contamination and the possibility of introduction through natural means such as wind. The scope is wider than the scope used by Biosecurity Australia in their Import Risk Analyses.
- **Potential impact** of pest establishment in this document only takes into account the impacts on the vegetable industry. The Biosecurity Australia Import Risk Analyses have 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 for describing the entry, establishment and spread, and the potential economic impact in IBPs (see 'Description of terms used in pest risk tables' above) differs in comparison to that used in Biosecurity Australia (2009). Additionally, the descriptors of these categories focus on impacts to the vegetable industry.

[6] Available from **www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information**

Table 11. *Summary of pest risk assessment process used in IBPs*

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 IBP

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 (AS/NZS-4360, 1999).

When a risk assessment is performed, it is important to document the type of analysis used, the level of confidence in the analysis, and any areas where assumptions have been made or where information is limited or unavailable.

Pest risk reviews (PRRs) for key threats to the vegetable industry are available for download from the Pest Information Document Database on the Plant Health Australia website (**www.planthealthaustralia.com.au/pidd**). New PRRs may be initiated at any time by government or vegetable industry stakeholders, as may updated versions of existing PRRs (when new information becomes available).

Formal Categorisation of pests for inclusion in the Emergency Plant Pest Response Deed

The EPPRD manages the impact of EPPs by establishing an industry/government agreement to cover eradication of emergency pests, reducing delays in securing funding, providing industry with greater involvement in eradication efforts, and removing disincentives to report emergency pests. AUSVEG is a member of PHA and became a signatory to the EPPRD after signing on 20 December 2008.

The EPPRD only covers eradication responses to EPPs when based on an approved EPP Response Plan. Weeds are not covered by the EPPRD at this stage. Under the EPPRD, both industry and government contribute to the total cost of an approved EPP Response with the ratio of contribution determined by the Category of the EPP (Table 12). The Category of the EPP is determined by the Categorisation Group and is based on the relative public versus private benefits of eradication of the EPP.

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

Table 12. *Cost sharing categories*

Category	Description	Funding share
Category 1: Very high public benefits	Pest which if not eradicated would: • cause major environmental damage to natural ecosystems; and/or • potentially affect human health or cause a major nuisance to humans; and/or • cause significant damage to amenity flora; and • have relatively little impact on commercial crops. • This category also covers situations where the pest has a very wide range of hosts including native flora and there is considerable uncertainty as to the relative impacts on the different crops. In short, it is almost impossible to properly determine which industries benefit from eradication and to what extent, and in any case, the incursion primarily affects native flora and/or amenity plants, and/or is a major nuisance if not a health risk to humans.	100% Government
Category 2: High public benefits	Pest which if not eradicated would: • cause significant public losses either directly through serious loss of amenity and/or environmental values and/or effects on households or indirectly through very severe economic impacts on regions and the national economy, through large trade losses with flow on effects through the economy; and • also impose major costs on the industries concerned so that these industries would significantly benefit from eradication.	80% Government 20% Industry
Category 3: Moderate public benefits	Pest which if not eradicated would: • primarily harm the industries concerned but there would also be some significant public costs as well (that is, moderate public benefits from eradication). In this case the pest could adversely affect public amenities, households or the environment, and/or could have significant, though moderate trade implications and/or national and regional economic implications.	50% Government 50% Industry
Category 4: Mostly if not wholly private benefits	Pest which if not eradicated would: • have little or no public cost implications and little or no impacts on natural ecosystems. The affected commercial industries would be adversely affected primarily through additional costs of production, through extra control costs or nuisance costs; and • generally there would be no significant trade issues that would affect national and regional economies.	20% Government 80% Industry

Pest categorisation

The EPPRD outlines a mechanism whereby Industry and Government Parties will contribute to the total cost of a Response to an EPP Incident based on agreed Categories. These Categories determine the ratio each party will pay, based on the relative public and private benefits of EPP eradication. Four Categories are included in the EPPRD, as outlined in Table 12 and Figure 4.

Categorisation of a pest is done to determine the Parties that are most affected and who will therefore be the beneficiaries of an eradication response. It does not indicate its likelihood of eradication or its overall importance i.e. a pest listed as Category 1 is not deemed to be any more or less important than a pest listed as Category 4.

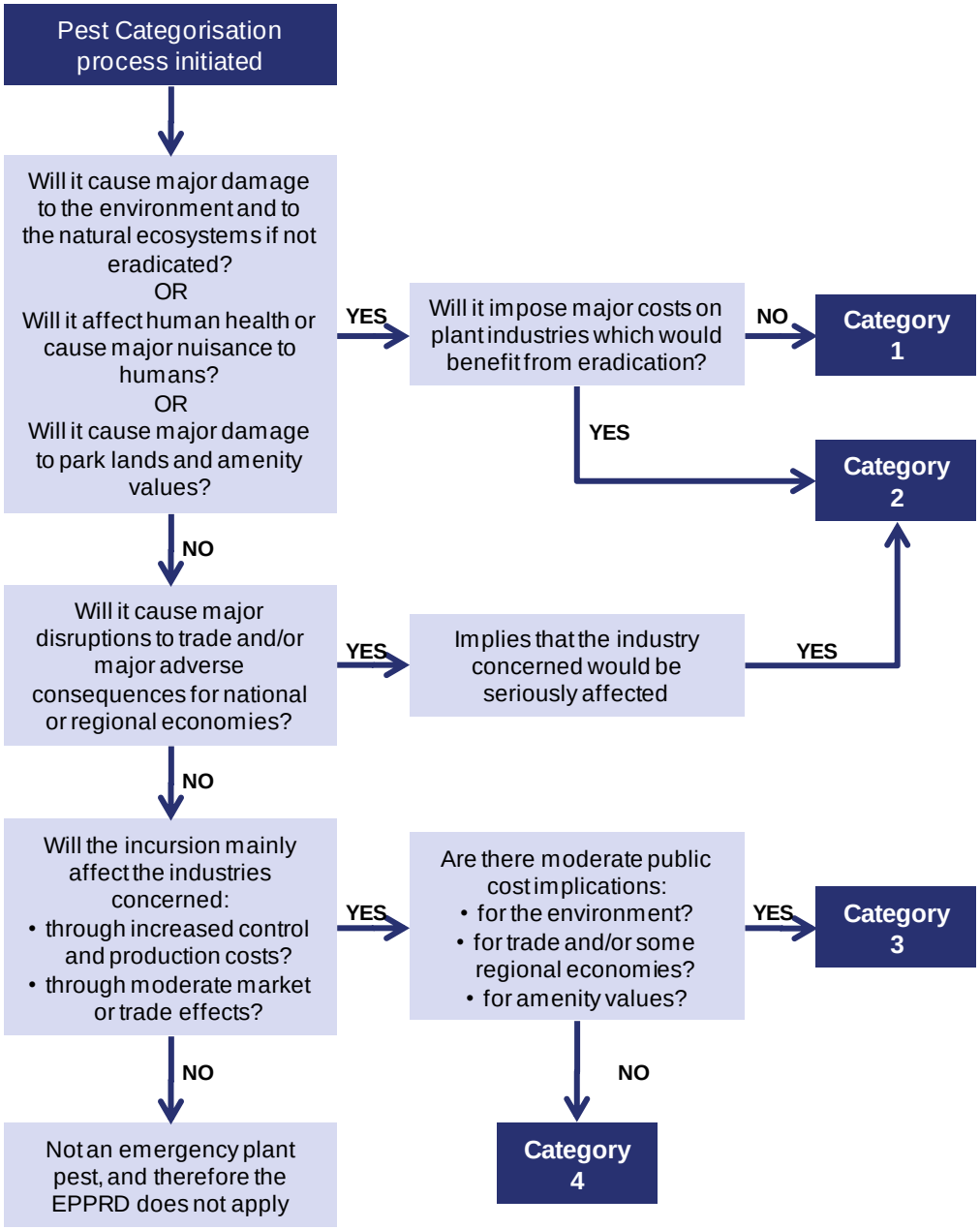
Pests listed in the high priority pest threat list (Table 9) may be put forward for categorisation and inclusion in Schedule 13 of the EPPRD. Other pests identified in TSTs or identified via other means as being priority pests, may also be categorised if required. The process for requesting categorisation of a Pest is set out in Schedule 3 of the EPPRD.

Pests that enter Australia, but which have not been formally categorised are treated as Category 3 until the formal Category has been determined.

The Categorisation Group will be responsible for determining a cost sharing Category applicable for high priority pests. Only Pests meeting the Emergency Plant Pest criteria will be considered for categorisation. Taking into account relevant scientific and other knowledge and experience, the Categorisation Group will consider requests for pest categorisation, re-categorisation or removal from Schedule 13 of the EPPRD. Figure 4 outlines the decision-making process used by the Categorisation Group in deciding pest Categories.

When more than one industry is affected by an Emergency Plant Pest, the Categorisation Group will also determine, and when requested will review, the Funding Weight for each industry. Funding Weights provide a means for calculating each industry's Proportional Share of the total industry contribution if a pest affects multiple industry Parties.

Figure 4. *Summarised pest categorisation decision tree*



Composition of the Categorisation Group

Membership of the Categorisation Group for each industry will comprise (at a minimum):

- an independent chair from Plant Health Australia
- a standing representative of industry parties
- three technical experts [people with specific expertise in the areas of plant pathology or entomology], one nominated by the Australian Government, one nominated by the states/territories and one nominated by plant industry(s)
- a person with relevant economic expertise including social, trade and regional impact assessment
- a nominee from each plant industry or industries Affected by the exotic plant pest being categorised.

The Categorisation Group may also seek advice from:

- a person with human health expertise, if a public health risk may exist
- a conservation representative (e.g. Australian Government Department of Environment and Heritage) or
- other relevant members determined by the independent chair.

Advisers who have specific expertise may accompany members of the Categorisation Group, but will not be part of the decision-making process.

Categorisation Group composition taken from Part 4 of Schedule 8 of the EPPRD.

Vegetable EPPs categorised to date

EPPs for the vegetable industry that have received formal pest categorisation (included within Schedule 13 of the EPPRD) are listed in Table 13.

Table 13. *Formal categories for pests of the vegetable industry as listed in the EPPRD (as at April 2011)*

Scientific name	Common name	Category
Bactrocera dorsalis	Oriental fruit fly	2
Bactrocera papayae	Papaya fruit fly	2
Clavibacter michiganensis subsp. *sepedonicus*	Bacterial ring rot	3
Cryptophlebia leucotreta	False codling moth	2
Globodera rostochiensis	Potato cyst nematode	3
Leptinotarsa decemlineata	Colorado potato beetle	3
Liriomyza sativae	American leafminer	3
Mythimna unipuncta	Armyworm	4
Peridroma saucia	Variegated cutworm	4
Phymatotrichum omnivorum	Texas root rot	2
Potato spindle tuber viroid (*Pospiviroidae*)	Potato spindle tuber viroid	3
Lygus hesperus	Western plant bug	4
Tetranychus piercei	Spider mite	4

References

AS/NZS-4360 (1999) Risk Management Standards Association of Australia, Strathfield, NSW.

Biosecurity Australia (2009) Draft pest analysis report for '*Candidatus* Liberibacter psyllaurous' in fresh fruit, potato tubers, nursery stock and its vector the tomato-potato psyllid. Biosecurity Australia, 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 PLAN

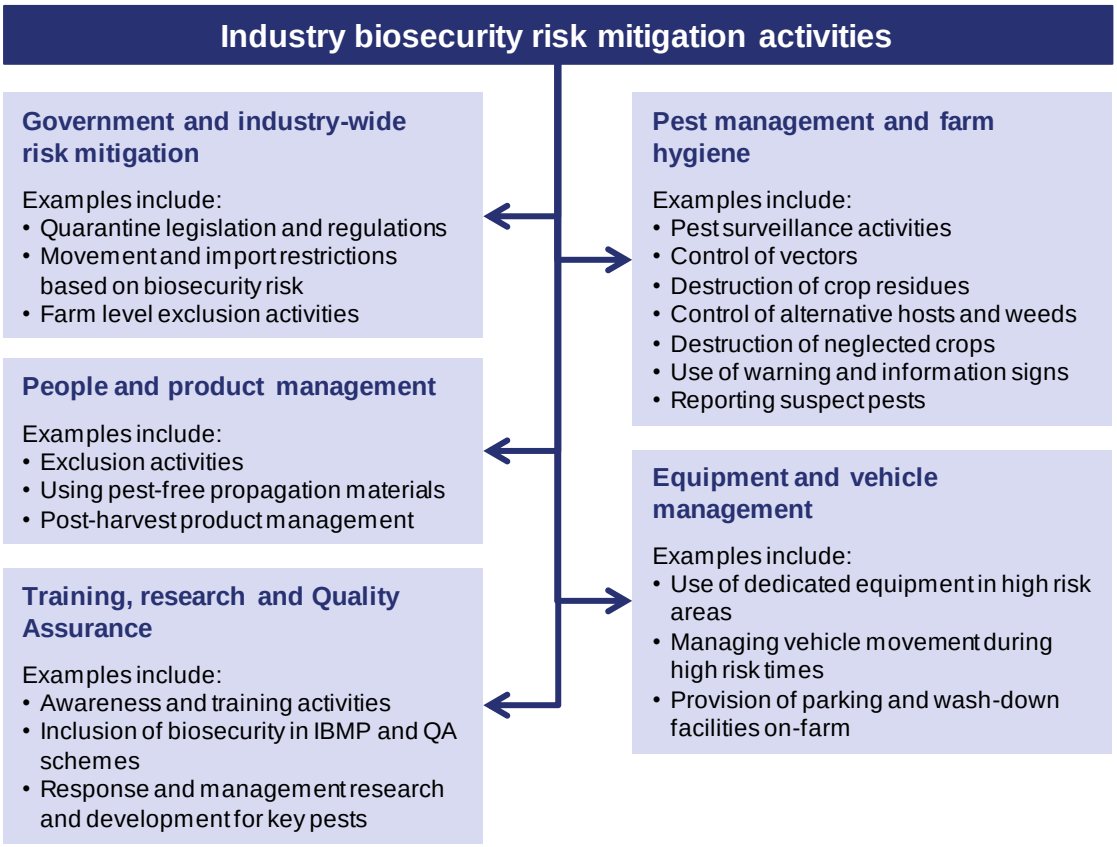
Introduction – risk mitigation

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

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the vegetable industry (Figure 5). Such risk mitigation practices are the responsibility of governments, industry and the community.

A number of key risk mitigation areas are outlined in this section, 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 risk. Each grower will need to evaluate the efficacy of each activity for their situation.

Figure 5. *Examples of biosecurity risk mitigation activities*



Barrier quarantine

Barrier quarantine should be implemented at all levels of the vegetable industry including national, state, regional, and farm levels.

National level – importation restrictions

Responsibility > Australian Government

The Department of Agriculture, Fisheries and Forestry (DAFF) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAFF 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.

DAFF also undertakes research to improve policies and procedures for protecting Australia's animal and plant health and natural environment, and provides technical assistance to further Australia's export market access program.

The WTO Sanitary and Phytosanitary Agreement (SPS Agreement) facilitates international trade while providing a framework to protect the human, animal and plant health of World Trade Organisation members. SPS measures are put in place to minimise negative effects on trade. For plant products these measures are delivered through the International Plant Protection Convention (IPPC) standard setting organizations and collaboration with portfolio industries and exporters. DAFF also undertakes research to improve policies and procedures for protecting Australia's animal and plant health and natural environment, and provides technical assistance to further Australia's export market access program. Further information can be found at **www.daff.gov.au**, or for more information on the IPPC visit **www.ippc.int**.

Biosecurity Services Group (BSG) is an agency of DAFF and 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, BSG

undertakes Import Risk Analyses (IRAs) to determine which products may enter Australia, and under what quarantine conditions. BSG 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, BSG assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants.

The administrative authority for national quarantine is vested in the Australian Quarantine and Inspection Service (AQIS), which is part of BSG, under the *Quarantine Act 1908*. Quarantine policies are developed on the basis of an IRA process. This process is outlined in the Import Risk Assessment Handbook 2007 (DAFF, 2009). AQIS Operations maintains barrier quarantine services at all international ports and in the Torres Straight region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, including any vegetable material, is the responsibility of the AQIS Operations.

The Schedule 5 "Permitted Seeds" list from the *Quarantine Proclamation 1998* is maintained on the Import Conditions (ICON) database at **www.aqis.gov.au/icon**. ICON 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 vegetable plants or plant parts listed on ICON, as listed in Table 14. For export conditions see the PHYTO database at **www.aqis.gov.au/phyto**.

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Administrative authority for national quarantine is vested in AQIS under the *Quarantine Act 1908*. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact AQIS on (02) 6272 3933 or 1800 020 504, or visit the website at **www.aqis.gov.au**.

Table 14. *Import condition summary for vegetables listed in ICON (as at August 2010)*

Brassicas and leafy vegetables

Commodity	End use	Import status	Import permit	Additional comments
Cauliflowers - fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflowers - fresh	Human consumption	Permitted	Required	Condition for import from South Pacific Commission countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflowers - fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflowers - fresh	Human consumption	Permitted	Required	Condition for import from European countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflowers - frozen	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from France. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from Mexico. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from the Netherlands. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment

Commodity	End use	Import status	Import permit	Additional comments
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from the United Kingdom. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cauliflower (*Brassica oleracea*) tissue culture	Nursery stock	Permitted	Required	Condition for import from the USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Broccoli – fresh	Human consumption	Permitted	Required	Condition for import from European countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Broccoli – fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Broccoli – fresh	Human consumption	Permitted	Required	Condition for import from South Pacific Commission countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Broccoli – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Broccoli – frozen	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Brussel sprouts - fresh	Human consumption	Permitted	Required	Condition for import from European countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Brussel sprouts - fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment

Commodity	End use	Import status	Import permit	Additional comments
Brussel sprouts - fresh	Human consumption	Permitted	Required	Condition for import from South Pacific Commission countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Brussel sprouts - fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Brussel sprouts - frozen	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Cabbages - fresh	Human consumption	Permitted	Required	Condition for import from European countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cabbages - fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cabbages - fresh	Human consumption	Permitted	Required	Condition for import from South Pacific Commission countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cabbages - fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cabbages - frozen	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Brassica spp.	Seeds for sowing	See comments		Condition for import from all countries. A large number of species and varieties are currently permitted; check ICON database for the latest information
Brassica spp. - dried	All uses other than as animal foods, fertilisers or growing purposes	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment

Commodity	End use	Import status	Import permit	Additional comments
Lettuce - fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Lettuce - *Lactuca* spp.	Seeds for sowing	See comments		Condition for import from all countries. A number of species and varieties are currently permitted; however, several species are prohibited as they pose a weed risk. Check ICON database for the latest information
Lettuce - *Lactuca* spp.	Nursery stock	See comments		Condition for import from all countries. A number of species and varieties are currently permitted; however, several species are prohibited as they pose a weed risk. Check ICON database for the latest information
Lettuce - *Lactuca indica, L. saligna, L. sativa, L. serriola* and *L. virosa* only	All uses other than as animal foods, fertilisers or for growing purposes	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Celery - fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Celery - fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Celery - frozen	Human consumption	Permitted	Not required	Condition for import from the People's Republic of China. A Quarantine Entry must be lodged with each consignment
Celery - frozen	Human consumption	Permitted	Not required	Condition for import from Spain. A Quarantine Entry must be lodged with each consignment
Celery - seed	Human consumption	Permitted	Not required	Condition for import from Khapra beetle counties (check ICON for updated list). Quarantine Entry must be lodged with each consignment
Celery - seed	Human consumption	Permitted	Not required	Condition for import from non-Khapra beetle counties (check ICON for updated list)

Solanaceous Crops

Commodity	End use	Import status	Import permit	Additional comments
Capsicums – fresh	Human consumption	Permitted	Required	Condition for import from European countries. A Quarantine Entry must be lodged with each consignment
Capsicums – fresh	Human consumption	Prohibited		Condition for import from South Pacific Commission countries.
Capsicums – fresh	Human consumption	Permitted	Required	Condition for import from the USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Capsicums – fresh glasshouse, greenhouse or field grown	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Capsicums – fresh greenhouse grown	Human consumption	Permitted	Required	Condition for import from the Republic of South Korea. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Capsicums – frozen	Human consumption	Permitted	Not required	Condition for import from European countries. A Quarantine Entry must be lodged with each consignment
Capsicums – frozen	Human consumption	Permitted	Not required	Condition for import from the People's Republic of China. A Quarantine Entry must be lodged with each consignment
Capsicum spp. – dried	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Capsicum spp. – powdered	Human consumption	Permitted	Not required	Condition for import from all countries

Commodity	End use	Import status	Import permit	Additional comments
Capsicum spp.	Seeds for sowing	See comments		Condition for import from all countries. A large number of species and varieties are permitted; however, several species are prohibited pending further evaluation. Check ICON database for the latest information
Chillies – fresh	Human consumption	Permitted	Required	Condition for import from European countries. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Chillies – fresh	Human consumption	Prohibited		Condition for import from South Pacific Commission countries.
Chillies – fresh glasshouse, greenhouse or field grown	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Chillies – frozen	Human consumption	Permitted	Not required	Condition for import from New Zealand. A Quarantine Entry must be lodged with each consignment
Chillies – frozen	Human consumption	Permitted	Not required	Condition for import from Vietnam. A Quarantine Entry must be lodged with each consignment

Root crops

Commodity	End use	Import status	Import permit	Additional comments
Beetroot – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Carrots – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment

Commodity	End use	Import status	Import permit	Additional comments
Carrots – frozen	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment
Carrots – dried	All uses other than as animal foods, fertilisers or for growing purposes	Permitted	Not required	Condition for import from all countries
Parsnip – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Parsnip – blanched and frozen	Human consumption	Permitted	Not required	Condition for import from all countries. A Quarantine Entry must be lodged with each consignment

Cucurbits

Commodity	End use	Import status	Import permit	Additional comments
Cucumbers or gherkins – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cucumbers or gherkins – fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Cucumbers or gherkins – frozen	Human consumption	Permitted	Not required	Condition for import from New Zealand. A Quarantine Entry must be lodged with each consignment
Cucumbers or gherkins – preserved in vinegar (acetic acid) or brine	Human consumption	Permitted	Not required	Condition for import from all countries
Cucumis spp.	Seeds for sowing	See comments		Condition for import from all countries. A number of species and varieties are currently permitted; however, several species are prohibited. Check ICON database for the latest information

Commodity	End use	Import status	Import permit	Additional comments
Cucumis spp.	Nursery stock	See comments		Condition for import from all countries. A number of species and varieties are currently permitted; however, several species are prohibited. Check ICON database for the latest information
Marrows, squash or zucchinis – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Marrows, squash or zucchinis – fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Marrows, squash or zucchinis – frozen	Human consumption	Permitted	Not required	Condition for import from New Zealand. A Quarantine Entry must be lodged with each consignment
Cucurbita spp.	Seeds for sowing	See comments		Condition for import from all countries. A number of species and varieties are currently permitted; however, several species are prohibited. Check ICON database for the latest information
Cucurbita spp.	Nursery stock	See comments		Condition for import from all countries. A number of species and varieties are currently permitted; however, several species are prohibited. Check ICON database for the latest information
Pumpkins – fresh	Human consumption	Permitted	Required	Condition for import from New Zealand. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Pumpkins – fresh	Human consumption	Permitted	Required	Condition for import from USA. Phytosanitary certificate required and a Quarantine Entry must be lodged with each consignment
Pumpkins – frozen	Human consumption	Permitted	Not required	Condition for import from New Zealand. A Quarantine Entry must be lodged with each consignment

Commodity	End use	Import status	Import permit	Additional comments
Pumpkins – frozen	Human consumption	Permitted	Not required	Condition for import from India. A Quarantine Entry must be lodged with each consignment
Pumpkins – frozen	Human consumption	Permitted	Not required	Condition for import from the People's republic of China. A Quarantine Entry must be lodged with each consignment
Pumpkins – seeds	Human consumption	Permitted	Not required	Condition for import from Khapra beetle counties (check ICON for updated list). Quarantine Entry must be lodged with each consignment. Fumigation and a Phytosanitary certificate are required
Pumpkins – seeds	Human consumption	Permitted	Not required	Condition for import from non-Khapra beetle counties (check ICON for updated list

State and regional level – movement restrictions

Responsibility > state/territory government

The ability to control movement of materials that can carry and spread vegetable pests is of high importance. Each state has quarantine legislation in place to control the importation of vegetable material and to manage agreed pests if an incursion occurs (refer to Table 15). 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 Domestic Quarantine and Market Access Working Group (DQMAWG).

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 agency directly (Table 15), or through contacts listed on the DQMAWG website **www.domesticquarantine.org.au/go/dqmawg**.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Information on farm vehicle and equipment movement restrictions can be obtained by contacting you local state/territory department of agriculture (Table 15).

***Table 15**. Interstate and inter-regional movement of plant products – legislation, quarantine manuals and contact numbers*

State	Administering authority	Legislation	Links to quarantine manual[7]	Phone
ACT	Environment ACT (**www.environment.act.gov.au**)	*Plant Disease Act 2002*	See NSW conditions	13 22 81
NSW	Department of Industry and Investment (**www.industry.nsw.gov.au/**)	*Plant Diseases Act 1924*	**www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases**	02 9735 9600
NT	Department of Resources (**www.nt.gov.au/d/Primary_Industry**)	*Plant Diseases Control Act 1979*	**www.nt.gov.au/d/Primary_Industry/index.cfm?header=NT%20Entry%20Requirements**	08 8999 5511
QLD	Department of Employment, Economic Development and Innovation (**www.dpi.qld.gov.au**)	*Plant Protection Act 1989* *Plant Protection Regulation 2002*	**www2.dpi.qld.gov.au/health/4058.html**	13 25 23
SA	Primary Industries and Resources (**www.pir.sa.gov.au**)	*Plant Health Act 2009*	**www.pir.sa.gov.au/biosecurity/planthealth**	08 8168 5200
TAS	Department of Primary Industries, Parks, Water and Environment (**www.dpiw.tas.gov.au**)	*Plant Quarantine Act 1997* *Weed Management Act 2000*	**www.dpiw.tas.gov.au/inter.nsf/WebPages/SSKA-7FB94Z?open**	1300 368 550
VIC	Department of Primary Industries (**www.dpi.vic.gov.au**)	*Plant Health and Plant Products Act 1995* *Plant Health and Plant Products Regulations 2006*	**www.new.dpi.vic.gov.au/psb**	13 61 86
WA	Department of Agriculture and Food (**www.agric.wa.gov.au**)	*Plant Diseases Act 1914 and Regulations in 1989*[8]	**www.agric.wa.gov.au/quarantine**	08 9334 1800

[7] If the link does not work, the relevant documents can be found by going to the department home page and checking the quarantine section of each website
[8] Due to be replaced by *Biosecurity and Agricultural Management Act 2007* in 2009

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into or for current regional restrictions within Queensland may be obtained from the Biosecurity Qld, DEEDI website on **www.dpi.qld.gov.au/health/4058.html**. Further details can be obtained from the QDPIF Customer Service Centre using the email form on the website **www.dpi.qld.gov.au/home/229.html**, or phone 13 25 23 (cost of a local call within Queensland) or for interstate callers phone 07 3404 6999, or fax 07 3404 6900.

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from Industry and Investment NSW Regulatory Services by phone 1800 084 811.

At present a Fruit Fly Exclusion Zone (Tri-State FFEZ) is in operation, encompassing certain fruit-growing areas of New South Wales, Victoria and South Australia, including the Murrumbidgee Irrigation Area, Murray Valley, Goulburn Valley, Sunraysia and the Riverland. A map of the FFEZ can be found at **fruitfly.net.au/fruit-fly-exclusion-zone**. It is illegal to take fresh fruit and some vegetables into the FFEZ, and those who fail to dispose of fruit before entering this area face minimum $200 on-the-spot fines. Roadside signs are in place to warn motorists of the FFEZ entry requirements. Random roadblocks are also used to enforce the FFEZ requirements. Further information on the FFEZ can be found at **www.fruitfly.net.au**.

South Australia

Information on pre-importation inspection, certification and treatments and /or certification requirements for movement of fruit or plant material in South Australia may be obtained from PIRSA Biosecurity SA- Plant Health by phone (08) 8168 5200 or fax (08) 8344 6033.

Victoria

Information on pre-importation inspection, certification and treatment requirements may be obtained from the DPI Victoria Plant Standards / or Biosecurity Victoria Regulatory Services office by phone (03) 9210 9390 Knoxfield switch. (**http:// www.new.dpi.vic.gov.au/psb**)

Tasmania

Tasmania has national and international recognition for area freedom status for Fruit Fly. Quarantine Tasmania (DPIPWE) conducts pest and disease surveys to meet legislative and market access requirements which include a program of inspecting more than 900 fruit fly traps that are deployed throughout the State. This Area Freedom Status has resulted in market access for Tasmanian fruit to several countries. Tasmania also has PCN free status.

General and specific import conditions apply to the importation of fruit or plant material into Tasmania to prevent the introduction of pests and diseases into the State. These import conditions are outlined in the Plant Quarantine Manual (**www.dpipwe.tas.gov.au)**.

Western Australia

WA requires plant material (including fruit) of many species to enter through quarantine. Failure to do so may lead to prosecution under the *Plant Diseases Act 1914* and *Regulations 1989*.

For further information on vegetable movement requirements within Western Australia, including disinfestation treatments, contact Quarantine Western Australia (08) 9334 1800 or fax (08) 9334 1880.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory is vested in the Department of Resources under the *Plant Diseases Control Act 1979*. Plant import requirements and notifiable pests are gazetted under this Act. The Act enables quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. For more information refer to the DRNT website (**www.nt.gov.au/d**).

Farm level – exclusion activities

Responsibility > state/territory government, industry/growers

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 or outbreak 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 70). This could be used as a reference source for developing extension material for promoting good farm hygiene.

Nurseries and retailers – 'hitch-hikers'

Responsibility > state/territory government, industry/growers and nursery operators

Nurseries and retail outlets, including chain stores, can be the primary distributors of vegetables nursery material in a region. It is vital to ensure that pests are not introduced into new areas as 'hitch-hikers' on nursery material.

Produce transporters and purchasers for retail outlets (e.g. Woolworths, Bunnings) must obtain advice from state quarantine authorities before moving vegetable material between regions or interstate. Advice in all states is available free of charge from the Domestic Quarantine website (**www.dqmawg.org.au**).

Nursery stock should be labelled in a manner that allows the source to be identified for trace-back purposes. Where pest or disease symptoms are found on nursery stock it is important to identify the causal agent. New or unfamiliar pests should be reported for identification (see Reporting Suspect Pests section on page 71).

Good nursery hygiene practices help to prevent pest spread. The Nursery and Garden Industry Australia (NGIA) Nursery Industry Accreditation Scheme (NIASA) and similar schemes provide guidelines for nursery owners and growing media suppliers for maintaining hygiene standards. Examples of relevant nursery hygiene practices include training of staff to recognise pest and disease symptoms, controlling pests in nursery crops, and sterilisation of growing media and equipment. Information on NIASA can be obtained from the NGIA (**www.ngia.com.au**) or the Nursery and Garden Industry office in your state.

Surveillance

Surveys enhance prospects for early detection, minimise costs of eradication and are necessary to meet the treaty obligations of the World Trade Organization's (WTO) Sanitary and Phytosanitary (SPS) Agreement with respect to the area freedom status of the Australian mainland.

The SPS Agreement gives WTO members the right to impose SPS measures to protect human, animal and plant life and 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 prohibited on proper, science-based quarantine grounds. The Agreement also stipulates that appropriate

surveillance and monitoring are necessary to support claims of area freedom. This is termed "evidence of absence" data and is used to provide support that we have actively looked for pests and not found them.

There are currently no international standards for structured pest surveys. Their 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 general surveillance as part of their normal management procedures, provided individuals are aware of what to look for and of reporting procedures (i.e. 'passive surveillance'). Agronomists and consultants 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

Responsibility > Australian Government, industry (national associations)

AQIS carries out surveillance at all international ports in Australia and in the Torres Strait, including airports and sea ports. Imported agricultural commodities, machinery and other items, as well as passenger baggage and incoming mail, are subject to inspection on arrival by AQIS officers. AQIS maintain inspection points throughout the Torres Strait region.

AQIS 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 surveys cover the coast from Cairns to Broome and extend up to 20 km inland.

NAQS maintain and regularly update target lists of pests with the potential to enter Australia via our northern borders. A number of the pest species on the target list have the potential to

attack vegetables. More information on NAQS activities, and the current list of target species, can be found at the NAQS web site (**www.aqis.gov.au/naqs**).

State surveillance programs

Responsibility > state/territory governments, industry/growers and nursery operators

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 agriculture department is responsible for:

- planning and auditing surveillance systems
- coordinating surveillance activities with those of industry and interstate groups
- provision of diagnostic services
- providing field diagnosticians for special field surveillance
- surveillance of non-commercial sites
- liaising with industry members
- developing communication, training and extension strategies with industry
- carrying out training
- reporting to all interested parties (AQIS, national bodies, trading partners and industry).

Various pest surveillance programs are managed by AQIS and the state/territory agriculture departments. Many state departments run passive 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) are shown in Table 16.

Table 16. *Official surveillance programs that target pests of the Vegetable Industry*[9]

Surveillance program	Pests targeted	State/region	Deliverer
NAQS Pest and Disease Survey	Cucurbit scab, grey leaf spot (maize), Monasporascus root rot and vine decline (cucurbits), False rust (legumes), Philippine downy mildew of maize, Downey mildew of sorghum, Taro leaf blight, Potato leaf blight, Corm and root rot (taro), Bacterial wilt of maize, Leaf scald of maize, Maize dwarf mosaic virus, Sorghum mosaic virus, Indian cotton leafhopper, Spotted stalk borer, Dark headed rice borer, Spotted borer, Cotton locust, Pineapple mealybug, Gold dust weevil, Pea leaf miner, Cabbage leaf miner, Bayberry whitefly, Sugarcane plant hopper, June beetle, Mango mealybug, Purple stem borer, Giant African snail, exotic fruit flies	Northern coastlines of WA, NT, Qld	AQIS
National Asian gypsy moth trapping program	Asian gypsy moth (*Lymantria dispar*)	Urban areas near major ports of entry in NSW, SA, Tas, WA and Vic	I&I NSW, DPI Vic, PIRSA, DPIPWE, Uni of Melbourne, DAFWA, DEEDI
Fruit fly exclusion zone - Medfly	Mediterranean fruit fly (*Ceratitis capitata*)	Agricultural and major urban areas	I&I NSW
Fruit fly exclusion zone - Papaya fruit fly	Papaya fruit fly (*Bactrocera papayae*)	Agricultural and major urban areas	I&I NSW
Peas - Bacterial blight surveillance	Bacterial blight of peas (*Pseudomonas syringae* pv. *pisi*)	Cropping regions	I&I NSW, GRDC
Giant African snail surveillance	Giant African snail (*Achatina fulica*)	Ports of entry in NT	NTDR
Medfly monitoring	Mediterranean fruit fly (*Ceratitis capitata*)	Agricultural and urban regions of NT	NTDR
Melon thrips surveillance	Melon thrips (*Thrips palmi*)	Darwin, Palmerston, Darwin rural area, Adelaide River	NTDR
Exotic fruit fly trapping – Cape York Peninsula	Exotic fruit flies (*Bactrocera* spp.)	Community regions of cape York Peninsula	DEEDI, DAFF
Exotic fruit fly trapping – Torres Strait	Exotic fruit flies (*Bactrocera* spp.)	Community regions of Torres Strait	DAFF
False codling moth surveillance	False codling moth (*Cryptophlebia leucotreta*)	Adelaide and major urban regions of SA	PIRSA

[9] Surveillance programs as listed in the National Plant Health Status Report 2008-09.

Surveillance program	Pests targeted	State/region	Deliverer
Fruit fly surveillance	Exotic and endemic fruit flies (*Ceratitis capitata*, *Bactrocera* spp.)	Adelaide and major urban regions of SA	PIRSA
Onion smut surveillance	Onion smut (*Urocystis cepulae*)	Adelaide hills, Northern Adelaide, SE Murraylands, Mallee – agricultural regions	PIRSA
Oriental red mite surveillance	Oriental red mite (*Eutetranychus orientalis*)	Adelaide, major urban regions of SA	PIRSA
Potato cyst nematode	Potato cyst nematode (*Globodera pallida, G. rostochiensis*)	Agricultural regions	PIRSA, DPIPWE
Border surveillance inspections	Exotic and endemic fruit flies (*Ceratitis capitata, Bactrocera* spp.)	All major ports of entry in Tas	DPIPWE
Western flower thrips survey	Western flower thrips (*Frankliniella occidentalis*)	Importers premises, entry ports, major nurseries and flower growers in Tas; agricultural regions in Vic	DPIPWE Brij Bugtrap Consultancy P/L
Stem burrowing nematode survey	Stem burrowing nematode of carrot (*Radopholus similis*)	Agricultural regions	DAFF
Fruit fry trapping	Exotic and endemic fruit flies (*Ceratitis capitata, Bactrocera* spp.)	All major ports of entry in Tas	DPIPWE
Melon thrips surveillance	Melon thrips (*Thrips palmi*)	Importers premises, entry ports, major nurseries and flower growers in Tas	DPIPWE
Asparagus stem blight area freedom surveillance	Asparagus stem blight (*Phomopsis* spp.)	Agricultural regions of Vic	DPI Vic
Currant lettuce aphid surveillance	Currant lettuce aphid (*Nasonovia ribisnigri*)	Agricultural regions of WA	DAFWA
Fruit fly monitoring and surveillance	Exotic and endemic fruit flies (*Ceratitis capitata, Bactrocera* spp.)	Agricultural and major urban regions of Vic	DPI Vic
Lettuce leaf blight area freedom surveillance	Lettuce leaf blight (*Pythium tracheiphilum*)	Agricultural regions of Vic	DPI Vic
Melon thrips area freedom surveillance	Melon thrips (*Thrips palmi*)	Agricultural regions of Vic	DPI Vic
Potato cyst nematode soil sampling	Potato cyst nematode (*Globodera pallida, G. rostochiensis*)	Agricultural regions of Vic	DPI Vic
Potato spindle tuber viroid in tomatoes and capsicums	Potato spindle tuber viroid (Pospiviroid)	Agricultural regions of Vic	DPI Vic

Surveillance program	Pests targeted	State/region	Deliverer
PVY surveillance in seed potatoes	Potato Y Potyvirus spp.	Agricultural regions of Vic	Victorian Certified Seed Potato Authority Inc.
Lettuce blight surveillance	Lettuce blight (*Pythium tracheiphilum*)	Gingin WA	DAFWA
Pests and beneficial insects on lettuce	Various insects	Agricultural regions of WA	DAFWA
Potato spindle tuber viroid on vegetables	PSTV d (Pospiviroid)	Carnarvon, WA	DAFWA
Qfly surveillance	*Bactrocera tyroni*	Major urban regions of WA	DAFWA

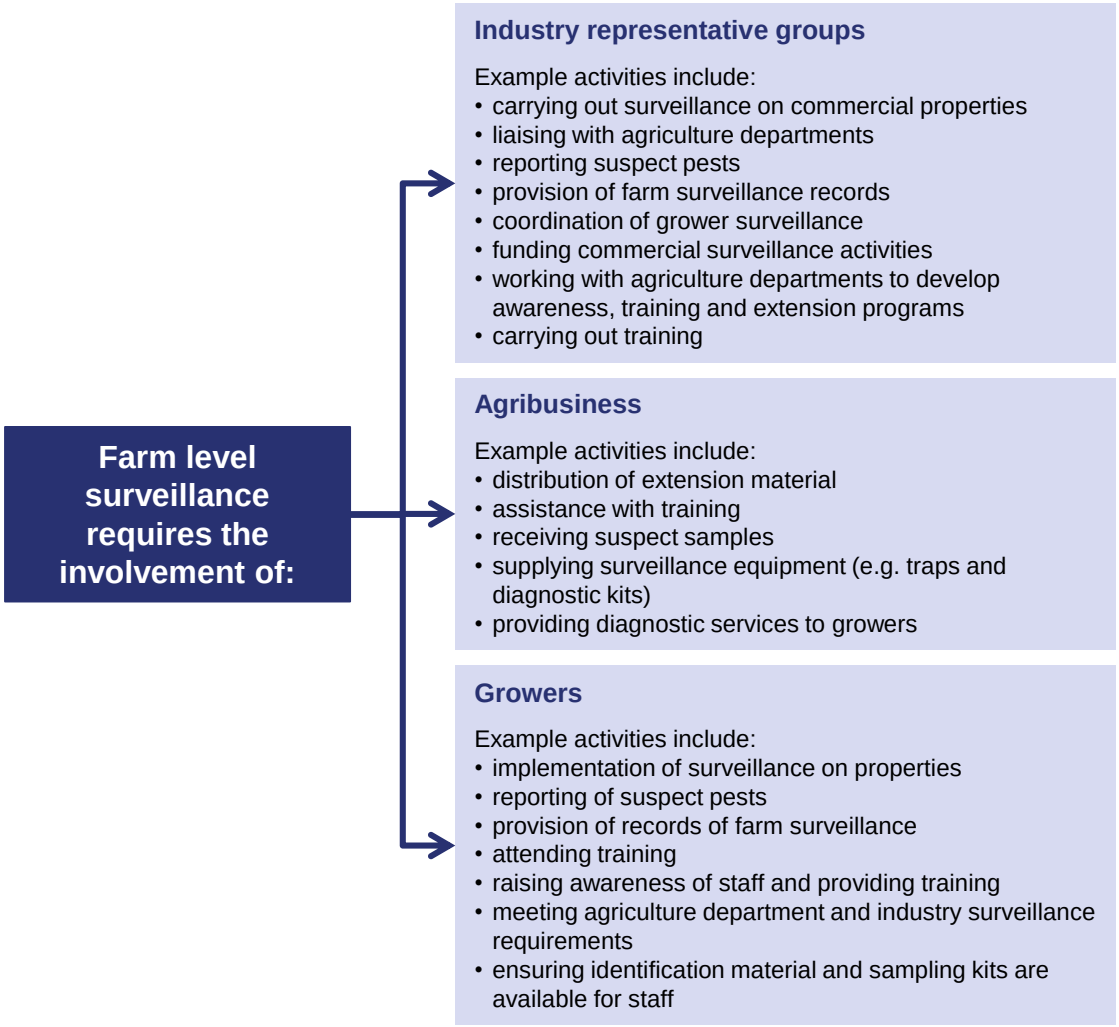
Farm surveillance activities

Responsibility > industry/growers

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 6.

Conducting regular surveys of farms and nurseries provides the best chance of spotting new pests early and implementing eradication or management responses.

Figure 6. *Examples of farm level surveillance activities*



Training

A key component of emergency plant pest preparedness is ensuring suitable and effective training for people involved in responding to emergency plant pest incursions. Effective training is the responsibility of both government and industry.

PHA's national training program for EPP preparedness

The PHA national training program is a program for industry and government personnel who have roles and responsibilities as members of the various committees under PLANTPLAN, the national emergency response plan for the plant industries. This includes training for Industry Liaison Officers (ILOs) and Industry Liaison Coordinators (ILCs).

Training programs will help ensure personnel involved in responding to emergency plant pests are proficient and have the skills required to effectively perform their duties.

Additionally, training material on biosecurity awareness has been developed that is available to all PHA members to assist raising awareness of biosecurity issues (Table 17). This is targeted at industry leaders, agricultural consultants/extension officers, growers and the general community.

Table 17. *Training materials from PHA's National Training Program for EPP preparedness*[10]

Training/briefing material available
Consultative Committee on Emergency Plant Pests
Domestic Quarantine and Market Access Working Group
National Management Group
Industry Liaison Officer/Coordinator
PLANTPLAN incursion response roles - various
Biosecurity awareness (industry leaders, consultants/extension officers, growers, community)
EPPRD awareness training
PHA Biosecurity On-line Training (BOLT)

[10] Refer to the PHA website for the most up-to-date information, or contact PHA for further details

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities (such as the postcard shown in Figure 7) 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.

Figure 7. *Postcard from Plant Health Australia's Plant Health Awareness campaign*

High priority plant pest threat-related documents

Pests listed in Table 9 have been identified as high priority threats to the vegetable industry by members of the Vegetable IBG. They have been assessed as having high entry, establishment and spread potential and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

Fact sheets

In addition to those listed in, fact sheets on pests of the vegetable industry are available from a range of government departments and other sources (Table 18).

Table 18. *Sources of information on high priority pest threats for the vegetable industry*

Pest	Fact sheets available from
American serpentine leaf miner *Liriomyzae trifolii*	• PaDIL (**www.padil.gov.au**) • UC Davis IPM (**www.ipm.ucdavis.edu**)
Carrot cyst nematode *Heterodera carotae*	• DAFWA (**www.agric.wa.gov.au**)
Carrot rust fly *Psila rosae*	• DAFWA (**www.agric.wa.gov.au**)
Melon fly *Bactrocera cucurbitae*	• DAFWA (**www.agric.wa.gov.au**) • PaDIL (**www.padil.gov.au**)
Serpentine leaf miner *Liriomyza huidobrensis*	• PaDIL (**www.padil.gov.au**) • UC Davis IPM (**www.ipm.ucdavis.edu**)
Tomato leaf miner *Liriomyza bryoniae*	• UC Davis IPM (**www.ipm.ucdavis.edu**)
Vegetable leaf miner *Liriomyza sativae*	• PaDIL (**www.padil.gov.au**) • QPIF (**www.dpi.qld.gov.au**) • UC Davis IPM (**www.ipm.ucdavis.edu**)

Further information/relevant web sites

A range of organisation details are provided below (Table 19) for persons seeking further information on vegetable industry biosecurity.

Table 19. *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
Australian Quarantine and Inspection Service	**www.aqis.gov.au**	(02) 6272 3933	18 Marcus Clarke St Canberra, ACT 2601
Australian Government Department of Agriculture, Fisheries and Forestry	**www.daff.gov.au**	(02) 6272 3933	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	**www.planthealthaustralia.com.au** **admin@phau.com.au**	(02) 6215 7700	Suite 5, 4 Phipps Cl Deakin, ACT 2600
New South Wales			
Industry and Investment New South Wales	**www.dpi.nsw.gov.au**	1800 808 095	Locked Bag 21 Orange NSW 2800
Queensland			
Biosecurity Queensland, part of the Department of Employment, Economic Development and Innovation	**www.dpi.qld.gov.au** **callweb@deedi.qld.gov.au**	13 25 23	80 Ann Street Brisbane, QLD 4000

Agency	Website/email	Phone	Address
Northern Territory			
Department of Resources	**www.nt.gov.au/d/Primary_Industry**	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
South Australia			
Primary Industries and Resources	**www.pir.sa.gov.au** **www.pir.sa.gov/customer_enquiry_form**	(08) 8226 0222	GPO Box 1671 Adelaide SA 5001
Biosecurity SA-Plant Health	**www.pir.sa.gov.au/biosecuritysa/planthealth**	(08) 8168 5200	33 Flemington Street Glenside SA 5065
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 and Water	**www.dpiw.tas.gov.au** **BPI.Enquiries@dpipwe.tas.gov.au**	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Victorian Department of Primary Industries	**www.new.dpi.vic.gov.au**	1800 084 881	Plant Biosecurity and Product Integrity, Private bag 15, Ferntree Gully Delivery Centre, Vic 3156
Western Australia			
Department of Agriculture and Food, Western Australia	**www.agric.wa.gov.au** **enquiries@agric.wa.gov.au**	(08) 9334 1800	WA Quarantine and Inspection Service 9 Fricker Rd (cnr Horrie Miller Dr) Perth Airport, WA 6105

Farm biosecurity

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 vegetables that Australia does not have.

Farm biosecurity measures can be used to minimise the introduction and 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.

PHA, in conjunction with some PHA industry members have developed Farm (or Orchard) Biosecurity Manuals tailored for particular industries. These manuals outline farm (or orchard) biosecurity and hygiene measures that help reduce the impact of pests on that particular industry.

These manuals cover biosecurity aspects such as:

- Recognising the high priority pests of the industry
- Managing the movements of vehicles and farm equipment
- Managing the movement of people
- The use of warning and information signs
- Visiting overseas farms/orchards – what to watch out for when return
- Quality and hygiene Best Management Practices
- The use of high health status plant material.

For the vegetable industry a Biosecurity Induction Manual for Bundaberg Horticultural Farms and a Farm Biosecurity Manual for the Northern Adelaide Plains Vegetable Growers have been produced. Manuals can be accessed from the Plant Health Australia website (**www.planthealthaustralia.com.au/go/biosecurity**).

Various biosecurity programs that are currently in operation include:

- Bundaberg Fruit and Vegetable Growers has distributed a new manual designed to provide simple training instructions to implement biosecurity best practices, as well as a supplementary brochure raising awareness of the issue within the region that is distributed throughout local caravan parks, tourist information centres and backpacker hostels.
- Plant Health Australia has established guidelines for the identification and categorisation of biosecurity threats using a qualitative risk assessment process,

including many practices that are pre-emptive, such as surveillance and awareness training, exclusion activities and destruction of crop residues.

- Scholefield Robinson Pty Ltd[11] developed a stepwise guide for introducing biosecurity measures into the vegetable industry in 2009, based on a case study of a location with horticultural diversity. This project (VG 09085) titled 'Scoping study to develop a regional biosecurity framework for the Northern Adelaide Plains' was funded by Horticulture Australia.
- In addition, further practical information on preventing pest and disease management in greenhouses can be found in the "Keep it CLEAN reducing costs and losses in the management of pests and diseases in the greenhouse" (NSW DPI and HAL 2009) and can be found on the Industry and Investment website at **www.dpi.nsw.gov.au/agriculture/horticulture/greenhouse/pest-disease/general/preventing**.

Reporting suspect 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.

Reporting an exotic plant pest carries serious implications and should be done only via the Exotic Plant Pest Hotline. Careless use of information, particularly if a pest has not been confirmed, can result in extreme stress for individuals and communities, and possibly damaging and unwarranted trade restrictions.

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

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in the department of agriculture from the state of origin of the call, who will ask some questions about what you have seen and may arrange to collect a sample. Every report will be taken seriously, checked out and treated confidentially.

In some states and territories, the Exotic Plant Pest Hotline only operates during business hours. Where this is the case, and calls are made out of hours, callers should leave a

[11] Scholefield Robinson Horticultural Services Pty Ltd, Fullarton SA 5063

message and contact details and staff from the department of agriculture will return the call the following business day.

Some vegetable pests are notifiable under each state or territory's quarantine legislation. The complete list of notifiable pests can be downloaded from the PHA website[12].

Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture department of the presence of those pests within a defined timeframe (Table 20).

Table 20. *Timeframe for reporting of notifiable pests as defined in state/territory legislation*

State/territory	Notifiable pest must be reported within
NSW	24 hours
NT	Immediately
Qld	24 hours
SA	Immediately
Tas	As soon as possible
Vic	Without delay
WA	24 hours

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

References

Australian Government Department of Agriculture, Fisheries and Forestry 2009, Import Risk Analysis Handbook 2007 (*updated 2009*), Canberra.

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NSW DPI (2009) Keep it CLEAN Reducing costs and losses in the management of pests and diseases in the greenhouse, New South Wales Department of Primary Industries and HAL.

[12] Available from **www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information**

CONTINGENCY PLANS AND RESPONSE MANAGEMENT PROCEDURES

Introduction – emergency response

Gathering information, developing procedures, and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, Plant Health Australia (PHA) has developed PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing the procedures required and the roles and responsibilities of all parties involved in an incursion response.

Following PLANTPLAN, a set of threat-specific contingency plans will be developed to cover the key exotic pests to the vegetable industry. These pests are detailed in the high priority plant pest threat list (Table 9) and have been identified through a process of qualitative risk assessment. Information will be provided on the host range, symptoms, biology and epidemiology of each pest, along with guidelines for general and targeted surveillance programs, diagnosis, and control. The documents are designed to assist with the development of response plans and are to be used in conjunction with the emergency response guidelines in PLANTPLAN.

This section includes key contact details and any 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. 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.

PLANTPLAN

PLANTPLAN provides a description of the general procedures, management structure and information flow system for the handling of a plant pest emergency at national, state/territory and district levels. This includes the operations of the control centres, principles for the chain of responsibility, functions of sections and role descriptions. PLANTPLAN is a general manual for use by all jurisdictions for all plant pest emergencies.

PLANTPLAN is regularly reviewed and updated to ensure it provides the best possible guidance to plant industries and governments in responding to serious plant pests. The most recent version of PLANTPLAN can be downloaded from the Plant Health Australia website (**www.planthealthaustralia.com.au/plantplan**).

Current response management procedures

Following the detection of a suspect exotic plant pest, the relevant state agency should be immediately notified directly or through the Exotic Plant Pest Hotline. Within 24 hours of the initial identification, the agency, through the State Plant Health Manager, will inform the Office of the Chief Plant Protection Officer (OCPPO) which will notify other relevant Australian Government Departments and relevant state agencies and industry representatives (process outlined in Figure 8). Following the detection or reporting of the pest, the relevant state/territory agriculture agency may collect samples of a suspect pest and seek a positive identification. If the pest is suspected to be an exotic pest (not yet present in Australia), the general process is as outlined in Figure 9.

Figure 8. *Suspect Emergency Plant Pest detection reporting flowchart*

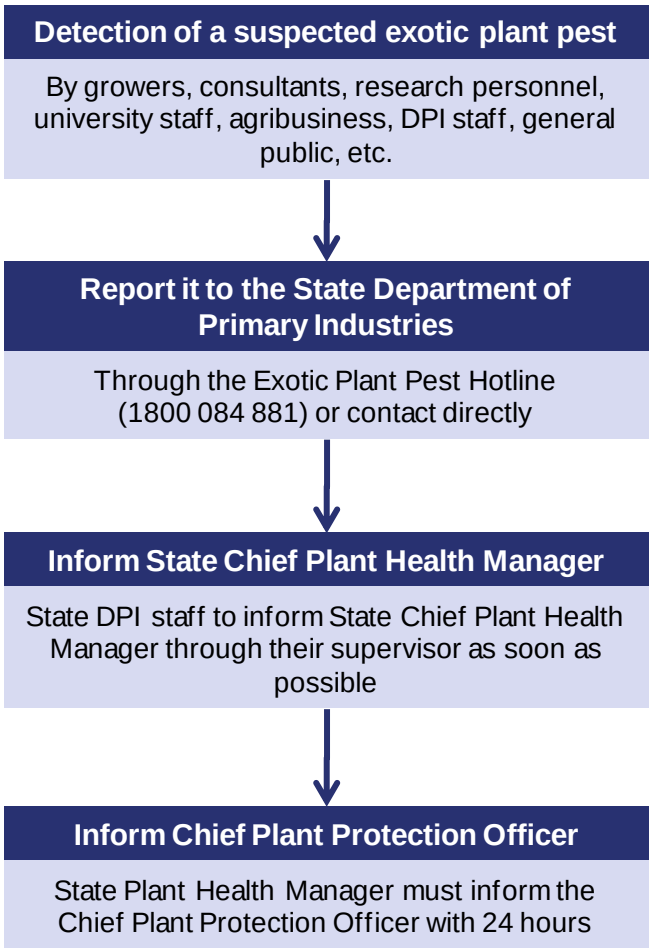
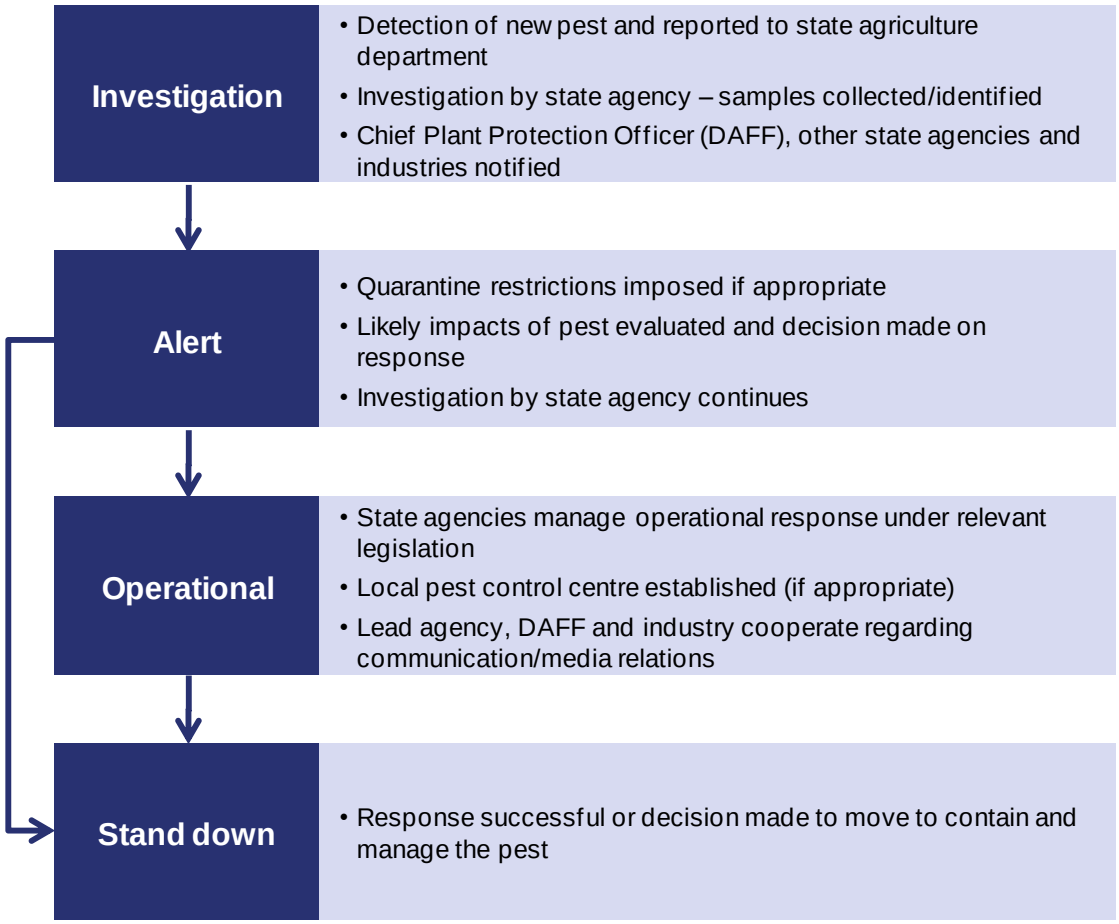


Figure 9. *General decision making and communication chain for a plant pest emergency response*



If the pest is considered potentially serious, then the relevant state/territory agriculture department may adopt precautionary measures. These measures, depending on the pest, may include:

- restriction of operations in the area
- withdrawal of people, vehicles and machinery from the area and disinfestation
- restricted access to the area
- interim control or containment measures.

If a new plant pest is confirmed, technical and economic considerations are reviewed, and a decision made on whether to eradicate, contain or do nothing about the incursion (depending on the feasibility of the response and likely costs and impacts of the pest). Under the EPPRD all decisions are made by Committees with government and industry representation.

During this investigation/alert period, the affected area will be placed under quarantine until a decision is made on whether to eradicate or control the pest. Once a decision has been made on a suitable response, an operational phase is commenced. Eradication or control methods used will vary according to the nature of the pest involved and infested material will be destroyed where necessary. All on ground response operations are undertaken by the relevant state department(s) in accordance with relevant state/territory legislation.

In the stand down phase, all operations are wound down. Where a plant pest emergency was not confirmed, those involved will be advised that the threat no longer exists. Where an eradication or management/control campaign has taken place, quarantine measures will be finalised and reviewed.

Industry specific response procedures

Industry communication

In the event of a pest incursion affecting the vegetable industry, AUSVEG will be the key industry contact point and will have responsibility for relevant industry communication and media relations (see PLANTPLAN for approved communications during an incursion). AUSVEG should be contacted immediately (Table 21) to ensure those appropriate delegate/s are secured for meetings of the Consultative Committee or National Management Group. Regional or state based industry organisations (Table 22) will be informed of the incident through the national industry contact.

Close cooperation is required between relevant government bodies and industry in regards to the effective management of a pest response and media/communication issues. Readers should refer to PLANTPLAN for further information.

Table 21. *Contact details for AUSVEG*

Organisation	AUSVEG		
Website	**www.ausveg.com.au**	**Email**	**info@ausveg.com.au**
Telephone	(03) 9822 0388	**Fax**	(03) 9822 0688
Street address	Suite 1, 431 Burke Rd Glen Iris, VIC 3146	**Mailing address**	PO Box 2042 Camberwell West, VIC 3124

Table 22. *Key vegetable industry contacts*

Name	Organisation	Position	Phone	Email/web address
National				
Richard Mulcahy	AUSVEG	CEO	(03) 9822 0388	**richard.mulcahy@ausveg.com.au**
William Churchill	AUSVEG	Communications Manager	(03) 9822 0388	w**illiam.churchill@ausveg.com.au**
	AUSVEG			**http://ausveg.com.au**
National – R & D organisations				
Kim James	Horticulture Australia	Portfolio Manager, Postharvest and Biosecurity	(08) 9284 7711	**kim.james@horticulture.com.au** **www.horticulture.com.au**
AUSVEG member				
	Growcom		(07) 3620 3844	**http://www.growcom.com.au**
	New South Wales Farmers Association		(02) 8251 1700	**http://www.nswfarmers.org.au/**
	Potato Growers Association of WA		(08) 9841 0834	**http://www.vegetableswa.com.au/**
	Tasmanian Farmers & Graziers Association		(03) 6332 1800	**http://www.tfga.com.au/**
	Vegetable Growers Association of Victoria		(03) 9687 4707	**http://www.vgavic.org.au/**
	Vegetables WA		(08) 9481 0834	**http://www.vegetableswa.com.au/**
	Victorian Potato Growers Council		(03) 5622 3025	
	Virginia Horticulture Centre		(08) 8282 9200	**http://www.virginiahc.com.au/**

Counselling and support services

Provision for counselling and advice on financial support for growers is made available through various agencies as listed in Table 23. Up-to-date information relating to mental health can be found at **www.health.gov.au/mentalhealth**. Local providers of counselling services can be found through contacting your local state or territory agriculture agency or your growers association (Table 22).

Table 23. *Counselling and financial counselling services*

Organisation	Contact
Lifeline	**13 11 14** (24 hours) **www.lifeline.org.au** Anyone can call Lifeline. The 13 11 14 service offers a counselling service that respects everyone's right to be heard, understood and cared for. We also provide information about other support services that are available in communities around Australia.
Mensline	**1300 789 978** (24 hours) **www.menslineaus.org.au** Mensline Australia is a dedicated service for men with relationship and family concerns.
Kids Help Line	**1800 551 800** (24 hours) **www.kidshelpline.com.au** Kids Help Line is Australia's only free, confidential and anonymous, telephone and online counselling service specifically for young people aged between 5 and 25.
BeyondBlue	**1300 224 636** **www.beyondblue.org.au** *beyondblue* is an independent, not-for-profit organisation working to increase awareness and understanding of depression, anxiety and related substance-use disorders throughout Australia and reduce the associated stigma
Centrelink	**1800 050 585** (Farm Assistance) **13 23 16** (Drought Assistance Hotline) **www.centrelink.gov.au** The Exceptional Circumstances Relief Payment (ECRP) is delivered by Centrelink on behalf of the Department of Agriculture, Fisheries and Forestry. The payment provides assistance to farmers living in 'exceptional circumstances' affected areas who are having difficulty meeting family and personal living expenses.

Organisation	Contact
Rural Financial Counselling Service	**1800 686 175** (free call for referral to your nearest Rural Financial Counselling Service provider) **www.daff.gov.au/agriculture-food/drought/rfcs** Rural financial counsellors can: • help clients identify financial and business options • help clients negotiate with their lenders • help clients adjust to climate change through the Climate Change Adjustment Program, identify any advice and training needed and develop an action plan • help clients meet their mutual obligations under the Transitional Income Support program • give clients information about government and other assistance schemes • refer clients to accountants, agricultural advisers and educational services • refer clients to Centrelink and to professionals for succession planning, family mediation and personal, emotional and social counselling.

Pest-specific emergency response and information documents

As part of the implementation of the IBP, pest-specific information and emergency response documents, such as fact sheets, contingency plans, pest risk reviews and diagnostic protocols should be developed over time for all medium to high risk pests listed in the threat summary tables (Appendix 1). Currently, a number of these documents have been developed for pests of the vegetable industry (Table 24) and are available for download from the pest information document database at **www.planthealthaustralia.com.au/pidd**.

Table 24. *Pest-specific information documents for the vegetable industry*[13]

Common name	Scientific name	Pest risk review	Fact sheet	Contingency plan
Melon fly	*Bactrocera cucurbitae*	✓		
Oriental fruit fly	*Bactrocera dorsalis*	✓[14]	✓[15]	
Spotted stem borer	*Chilo partellus*			✓[16]
Bacterial ring rot	*Clavibacter michiganensis* pv. *sepedonicus*		✓	
Carrot cyst nematode	*Heterodera carotae*	✓		✓[17]
Colorado potato beetle	*Leptinotarsa decemlineata*		✓	
Tomato leaf miner	*Liriomyza bryoniae*	✓	✓	✓
Serpentine leaf miner	*Liriomyza huidobrensis*	✓	✓	✓
Vegetable leaf miner	*Liriomyza sativae*	✓	✓[18]	✓
American serpentine leaf miner	*Liriomyza trifolii*	✓	✓	✓[19]
Carrot (rust) fly	*Psila rosae*	✓	✓	✓[16]

Threat-specific contingency plans

It is recommended that over time, threat-specific contingency plans will be completed for the exotic threats identified in the high priority plant pest list (Table 9). As contingency plans are developed they will be uploaded onto the Plant Health Australia website (**www.planthealthaustralia.com.au/pidd**).

The guideline for development of threat-specific contingency plans[20], prepared by Dr Peter Merriman and Dr Simon McKirdy will be used as a basis for developing these plans.

National diagnostic standards for priority plant pest threats

National diagnostic standards have been commissioned for a number of exotic/emergency plant pests. These protocols would be used nationally in the event of an incursion, thus ensuring a rapid response and nationally consistent test results that are directly comparable. However, given the rapid development of improved molecular diagnostic techniques, these protocols need to be regularly reviewed and updated.

[13] Copies of these documents are available from **www.planthealthaustralia.com.au/pidd**
[14] Pest risk reviews completed for Apple and Pear, Avocado, Cherry and Tropical IBPs
[15] Additional fact sheet developed for Apple and Pear IBP
[16] Developed for the grains industry
[17] Developed as a HAL project
[18] Additional fact sheet developed for the Onion IBP
[19] Developed for the grains industry – combined contingency plan for *Liriomyza* spp
[20] Available from **www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information**

The development and endorsement of these protocols is managed by the Subcommittee on Plant Diagnostic Standards (SPHDS). Diagnostic standards that have been formally endorsed nationally are available on the SPHDS website (**www.daff.gov.au/sphds**). Prior to endorsement, completed draft protocols are made available on the pest information document database (**www.planthealthaustralia.com.au/pidd**). Further information on diagnostic standards and their endorsement process can be found on the SPHDS website. Some diagnostic protocols are underway and diagnostic scholarships have been awarded to researchers to develop protocols for the following vegetable pests:

- Zebra chip – *Liberibacter* sp.;
- Tomato/potato psyllids;
- Colorado potato beetle;
- *Verticillium dahliae* (defoliating strains).

APPENDIX 1: THREAT SUMMARY TABLES

Vegetable industry threat summary tables

The information provided in the threat summary tables (TSTs) is a basic overview of plant pest threats to the vegetable industry. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Gaps in the risk ratings indicate that experts could provide no additional information. Assessments may change given more detailed research, and given the large number of pests and gaps in the information, it is recommended a further more comprehensive review of all TSTs is required.

The TSTs are grouped based on primary vegetable group affected, as outlined in Table 25.

Table 25. *Pest groupings used in the TSTs*

Vegetable group	Invertebrate TST	Pathogen TST
Solanaceae (capsicum, chilli and eggplant)	Table 26	Table 27
Potatoes	Refer to the Potato IBP[21]	Refer to the Potato IBP
Brassicaceae and leafy vegetables	Table 28	Table 29
Root crops	Table 30	Table 31
Onions	Refer to the Onion IBP	Refer to the Onion IBP
Cucurbitaceae	Table 32	Table 33
Grains and leguminous vegetable plants		
- beans	Table 34	Table 35
- peas	Table 36	Table 37
- maize	Table 38	Table 39

For a description of the ratings used in threat summary tables refer to end of the threat summary tables.

[21] Available from **www.planthealthaustralia.com.au/biosecurity/potato**

Solanaceae

Invertebrate and pathogen pest threats for potatoes can be found in the Potato IBP.

Table 26: *Vegetable industry invertebrate threat summary table for solanaceous crops (capsicum, chilli and eggplant)*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Striped leaf beetle	Btle	*Acalymma bivittatum*	Capsicum, beans, eggplant, *Cucurbitaceae*	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
	Bug	*Acanthocoris scaber*	Chilli, swamp morning glory	Leaves, stems, fruit	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Squash bug	Bug	*Acanthocoris scabrator*	Capsicum, pumpkin, tomato, mango, mulberry, eggplant	Leaves, stems, fruit	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Winter cherry bug	Bug	*Acanthocoris sordidus*	Sweet potato, tomato, eggplant	Leaves, stems, fruit	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Death's head hawkmoth	Lep	*Acherontia atropos*	Sugarbeet, lantana, tomato, privet, oleander, tobacco, olive, potato, eggplant	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Small death's head hawkmoth	Lep	*Acherontia styx*	Soybean, gourd, tomato, tobacco, eggplant, sesame, mungbean	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
	Locu	*Acrida exaltata*	Capsicum, goose grass, purple nutsedge, rice	Above ground	LOW	MEDIUM	MEDIUM	LOW	LOW
Stink bug	Bug	*Acrosternum marginatum*	Capsicum, okra, soybean, tomato, tobacco, beans	Leaves, stems, fruit	LOW	MEDIUM	MEDIUM	LOW	LOW
Otidid fly	Fly	*Acrosticta apicalis*	Peanut, cotton, sweet potato, eggplant	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Heart and dart moth	Lep	*Agrotis exclamationis*	Solanaceae, cabbage, maize	Whole plant,	UNKNOWN	MEDIUM	MEDIUM	UNKNOWN	
Turnip moth	Lep	*Agrotis segetum*	Polyphagous	Leaves, roots	MEDIUM	MEDIUM-HIGH	HIGH	UNKNOWN	

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Btle	*Alcidion bicristatum*	Eggplant	UNKNOWN					
Eggplant stem borer	Btle	*Alcidion deletum*	Eggplant	Stem	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
	Btle	*Alcidion socium*	Eggplant	Stem	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
	Bug	*Aleurotrachelus trachoides*	Capsicum, *Citrus*, lettuce, tomato, *Cucurbitaceae, Brassicaceae*	Leaves	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Indian cotton jassid	Bug	*Amrasca*[22] *devastans*	Polyphagous	Leaves	LOW	HIGH	HIGH	MEDIUM	
Pepper weevil	Btle	*Anthonomus eugenii*	Capsicum, chilli	UNKNOWN					
Eggplant bud weevil	Btle	*Anthonomus pulicarius*	Eggplant	UNKNOWN					
Green white spotted bug	Bug	*Arvelius albopunctatus*	Capsicum, tomato, eggplant	Whole plant	LOW-MEDI	MEDIUM	MEDIUM	LOW	LOW
	Bug	*Aspidiotus excisus*	Eggplant	Leaves, stems	LOW-MED	MEDIUM	MEDIUM	LOW	LOW
Akee fringed scale	Bug	*Asterolecanium pustulans*	Pigeon pea, akee, coconut, coffee, silky oak, mango, eggplant, cocoa	Leaves, stems	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
	Locu	*Atractomorpha acutipennis*	Capsicum	Above ground plant	LOW	MEDIUM	MEDIUM	LOW	LOW
Tomato/potato psyllid	Bug	*Bactericera cockerelli*	Potatoes, tomatoes, capsicums, eggplants, peppers & other solanaceous crops	Above ground plant	High	High	High	High	High
	Fly	*Bactrocera atrisetosa*	Tomato, zucchini, cucumber	Fruit	MODERATE	MODERATE	MODERATE	LOW	LOW
Carambola fruit fly	Fly	*Bactrocera carambolae*	Polyphagous	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH

[22] Synonym: Amrasca *biguttula biguttula*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Melon fruit fly	Fly	*Bactrocera cucurbitae*	Cucurbits, tomato, guava, papaya, beans	Fruits and new growth in cucurbits	HIGH	HIGH	HIGH	HIGH	HIGH
Oriental fruit fly	Fly	*Bactrocera dorsalis*	Polyphagous	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
Malaysian fruit fly	Fly	*Bactrocera latifrons*	Solanaceae	Fruit	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Papaya fruit fly	Fly	*Bactrocera papayae*	Polyphagous	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
New Guinea fruit fly	Fly	*Bactrocera trivialis*	Grapefruit, chilli, peach, guava	Fruit	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Stem weevil	Btle	*Baris torquatus*	Eggplant	Stems	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
	Btle	*Bisaltes bimaculatus*	Capsicum						
	Btle	*Brachyomus octotuberculatus*	Capsicum, *Citrus*						
	Bug	*Catorhintha guttala*	Eggplant	Leaves, stems, fruit	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
	Bug	*Ceroplastes dugesii*	Eggplant	Leaves, stems	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Small snow scale	Bug	*Chionaspis minor*	Eggplant, cotton, pigeon pea	Leaves, stems	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
	Locu	*Chrotogonus trachypterus*	Capsicum, chickpea, cotton, sunflower, cowpea	Whole plant					
Brinjal mealybug	Bug	*Coccidohystrix insolita*	Eggplant, pigeon pea	Whole plant	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
	Btle	*Conchyloctenia tigrina*	Eggplant	Leaves	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
	Bug	*Corecoris fuscus*	Capsicum, beans	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
	Bug	*Corythaica carinata*	Cassava, eggplant, passionflower	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Eggplant lacewing bug	Bug	*Corythaica cyathicollis*	Eggplant, tomato	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Lacebug	Bug	*Corythaica monacha*	Eggplant	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Cotton lacebug	Bug	*Corythaica gossypii*	Eggplant, peanut, pigeon pa, capsicum, papaya, cassava, banana, beans, sugar cane	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Devil grasshopper	Locu	*Diabolocatantops axillaris*	Okra, cotton, sunflower, tomato, beans, pea, sesame, eggplant, sorghum	Whole plant					
	Btle	*Diabrotica ochreata*	Eggplant, *Cucurbitaceae*						
	Btle	*Diaprepes marginatus*	Eggplant						
	Snail	*Diplosolenodes occidentale*	*Brassicaceae*, capsicum, lettuce, tomato, beans						
Blue red leaf beetle	Btle	*Disonycha eximia*	Capsicum, sugarbeet, beans, *Cucurbitaceae*						
Gray pineapple mealybug	Bug	*Dysmicoccus neobrevipes*	Polyphagous	Leaves, stems	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Green and brown stinkbug	Bug	*Edessa meditabunda*	Okra, pigeon pea, Citrus, beans, cassava, cotton, soybean, eggplant, cocoa, tomato, potato	Inflorescence Vegetative parts	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
	Bug	*Edessa rufomarginata*	Eggplant, soybean, potato	Vegetative parts	LOW-MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Cotton leafhopper	Bug	*Empoasca decipiens*	Wide host range[23]	Leaves	LOW	HIGH	HIGH	MEDIUM	MEDIUM
	Btle	*Epicauta waterhousei*	Eggplant						
	Btle	*Epilachna diffinis*	Eggplant	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW

[23] Including chilli, capsicum and eggplant

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Btle	*Epilachna ocellata*	Eggplant, capsicum, cucumber, tomato, bean, radish, potato, mungbean	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
	Btle	*Epilachna phillipinensis*	Eggplant, tomato	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Large 28-spotted lady beetle	Btle	*Epilachna vigintioctomaculata*	Eggplant, panax, potato	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Potato flea beetle	Btle	*Epitrix cucumeris*	*Cucurbitaceae,* potato, tomato, tobacco, eggplant	Leaves	UNKNOWN	LOW	MEDIUM	LOW	
Tobacco flea beetle	Btle	*Epitrix hirtipennis*	*Citrus*, sweet potato, tomato, tobacco, eggplant, potato	Leaves					
	Btle	*Epitrix pilosa*	Eggplant, tobacco						
	Bug	*Euschistus bifibulus*	Capsicum, tomato, beans, eggplant, *Cucurbitaceae*						
Eggplant stemborer	Lep	*Euzophera osseatella*	Eggplant, potato	Stems	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Stem borer	Lep	*Euzophera perticella*	Eggplant	Stems	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
	Btle	*Faustinus apicalis*	Eggplant, sunflower, tomato, tobacco						
	Btle	*Faustinus cubae*	Capsicum						
	Thri	*Frankliniella bispinosa*	Capsicum, *Citrus*, strawberry, tobacco, roses, rye, wheat, wild radish	Leaves, flowers	LOW	LOW	MEDIUM	MEDIUM	LOW
Tobacco thrips	Thri	*Frankliniella fusca*	Peanut, capsicum, watermelon, soybean, cotton, tomato, tobacco, maize, cowpea	Leaves, flowers	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Blossom thrips	Thri	*Frankliniella insularis*	Pigeon pea, capsicum, papaya, citrus, coconut, sweet potato, banana, tobacco, beans	Leaves, flowers	LOW	LOW	MEDIUM	MEDIUM	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Flower thrips	Thri	*Frankliniella intonsa*	Polyphagous	Leaves, flowers	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Pale potato cyst nematode	Nem	*Globodera pallida*	Tomato, eggplant, potato	Roots, tubers	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Golden potato cyst nematode (exotic pathotypes)[24]	Nem	*Globodera rostochiensis*	Tomato, eggplant, potato	Roots, tubers	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
	Btle	*Gonocephalum dorsogranosum*	Capsicum						
American cotton bollworm	Lep	*Helicoverpa zea*	Polyphagous	Leaves, flowers	LOW	HIGH	HIGH	MEDIUM	LOW
Tobacco budworm	Lep	*Heliothis virescens*	Polyphagous	Leaves, flowers, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Oriental tea tortrix	Lep	*Homona magnanima*	Tea, persimmon, azalea, apple, *Citrus, Prunus*, pear, roses, eggplant	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
	Lep	*Hypercompe icasia*	Tomato, beans, guava, eggplant						
Cotton jassid	Bug	*Jacobiasca lybica*	Pigeon pea, cotton, tomato, eggplant, potato	Leaves	LOW	HIGH	HIGH	MEDIUM	MEDIUM
	Lep	*Lacanobia suasa*	Capsicum, cabbage, lucerne						
Colorado potato beetle	Btle	*Leptinotarsa decemlineata*	Solanaceae	Leaves, stems		UNKNOWN	MEDIUM	UNKONWN	
	Lep	*Lineodes cyclophora*	capsicum						
Tomato leaf miner	Fly	*Liriomyza bryoniae*	Polyphagous	Leaves	HIGH	HIGH	MEDIUM	HIGH	HIGH
Serpentine leafminer	Fly	*Liriomyza huidobrensis*	Polyphagous	Leaves	HIGH[25]	MEDIUM	MEDIUM	HIGH	HIGH

[24] Eradicated in WA. Occurs in Vic. Risk of re-introduction to pest free areas. Risk of new incursions. Risk of introduction of additional pathotypes – only Ro1 type known to occur in Aust.

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Vegetable leaf miner[26]	Fly	*Liriomyza sativae*	Polyphagous	Foliage	HIGH	HIGH	MEDIUM	HIGH	HIGH
American serpentine leafminer[27]	Fly	*Liriomyza trifolii*	Polyphagous	Foliage	HIGH	HIGH	MEDIUM	HIGH	HIGH
	Btle	*Litostylus strangulatus*	Capsicum, pigeon pea, guava, cotton						
	Bug	*Lizerius cermelii*	Capsicum						
Beet webworm	Lep	*Loxostege sticticalis*	Polyphagous	Leaves, stems, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Bishop bug	Bug	*Lygus rugulipennis*	Cucumber, eggplant, soybean, lettuce, strawberry	Reproductive parts	MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Tomato hornworm	Lep	*Manduca quinquemaculata*	Capsicum, tomato, tobacco, eggplant, potato	Whole plant	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Tobacco hornworm	Lep	*Manduca sexta*	Capsicum, tomato, tobacco, sesame, potato	Whole plant	LOW	HIGH	HIGH	MEDIUM	LOW
Root knot nematode	Nem	*Meloidogyne ethiopica*	Capsicum, cabbage, gourd, lettuce, tomato, bean, cowpea	Roots, tubers					
Root knot nematode	Nem	*Meloidogyne mayaguensis*	Capsicum, coffee, tomato, tobacco, guava, eggplant	Roots, tubers					
	Bug	*Micrutalis malleifera*	Tomato, eggplant						
	Fly	*Milichiella lacteipennis*	Eggplant, cotton						
	Btle	*Myllocerus subfasciatus*	Eggplant, potato						
False root-knot nematode	Nem	*Nacobbus aberrans*	Polyphagous	Roots, tubers					
Beet leafhopper	Bug	*Neoaliturus tenellus*	Sugarbeet, tomato	Leaves				UNKNOWN	

[25] Has been intercepted coming into Australia
[26] Synonyms: Cabbage leaf miner, Serpentine leaf miner, Tomato leaf miner, Vegetable leaf miner
[27] Synonyms: Chrysanthemum leaf miner, Serpentine leaf miner

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Eggplant stem borer	Lep	*Neoleucinodes elegantalis*	Tomato, eggplant	Stems	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Croton bug	Bug	*Orthezia praelonga*	*Citrus*, eggplant, coffee						
Papaya mealybug	Bug	*Paracoccus marginatus*	Papaya, *Hibiscus,* cassava, avocado, eggplant	Stems, leaves	LOW-MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Pearly underwing moth (variegated cutworm)	Lep	*Peridroma saucia*	Capsicum, cabbage, tomato, beetroot, lettuce, artichoke, lucerne, tobacco, maize	Whole plant	MEDIUM	HIGH	HIGH	UNKNOWN	
	Hym	*Pheidologeton diversus*	Capsicum, potato						
Cassava mealybug	Bug	*Phenacoccus madeirensis*	Oats, cotton, capsicum, *Hibiscus*, lantana, cassava, eggplant, potato	Whole plant	LOW-MEDIUM	MEDIUM	MEDIUM	MEDIUM	
	Lep	*Phycita melongenae*	Eggplant						
Stink bug	Bug	*Piezodorus guildinii*	Pigeon pea, capsicum, soybean, cotton, lentil, sweet potato, lucerne, rice, beans	Leaves, flowers, seeds	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Tobacco leaf folder	Lep	*Pilemia perusialis*	Eggplant, beans, sugarbeet, tobacco, tomato	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Lesser snow scale	Bug	*Pinnaspis strachani*	Polyphagous	Leaves, stems, fruit	MEDIUM	MEDIUM	HIGH	LOW	LOW
Omnivorous leaf roller	Lep	*Platynota stultana*	Capsicum, cotton, *Citrus*, peach, pomegranate, pear, grape, maize	Leaves, fruit	LOW	MEDIUM	MEDIUM	LOW	LOW
	Locu	*Plebeiogryllus guttiventris*	Capsicum	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
	Bug	*Pseudococcus variegatus*	Eggplant						
	Btle	*Psylliodes chlorophana*	Eggplant						

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Lep	*Scrobipalpa ergasima*	Eggplant						
	Lep	*Selepa docilis*	Eggplant						
Costa Rican armyworm	Lep	*Spodoptera albula*	Polyphagous	Leaves	LOW	HIGH	HIGH	MEDIUM	LOW
Southern armyworm	Lep	*Spodoptera eridania*	Polyphagous	Leaves, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Fall armyworm	Lep	*Spodoptera frugiperda*	Polyphagous	Leaves, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Lateral lined armyworm	Lep	*Spodoptera latifascia*	Peanut, *Brassicaceae,* capsicum, carrot, cotton, sweet potato, tomato, tobacco, beans, maize	Leaves, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Cotton leafworm	Lep	*Spodoptera littoralis*	Polyphagous	Leaves, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Yellow striped armyworm	Lep	*Spodoptera ornithogalli*	Polyphagous	Leaves, fruit	LOW	HIGH	HIGH	MEDIUM	LOW
Pepper bud moth	Lep	*Symmetrischema capsicum*	Capsicum						
	Btle	*Systena s-littera*	Sugarbeet, pigeon pea, soybean, *Cucurbitaceae*, carrot, sweet potato, tomato, cassava, beans, sugarcane, eggplant						
Peach bud mite	Mite	*Tarsonemus waitei*	Tomato						
Mites (exotic sp.)	Mite	*Tetranychus* spp.	Polyphagous	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Rose thrips	Thri	*Thrips fuscipennis*	Roses, capsicum, strawberry white clover						
Longhorn beetle	Btle	*Trachyderes succintus*	Eggplant, pineapple, *Citrus*	Stems					
Whitefly	Bug	*Trialeurodes abutiloneus*	Capsicum, soybean, lettuce, cotton, cassava	Leaves					

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
South American tomato moth or tomato leafminer	Lep	*Tuta absoluta*	Tomato, potato, eggplant, other solanaceous plants	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH
Black sweet potato beetle	Btle	*Typophorus nigritus*	Capsicum, sweet potato, sugarcane	Leaves					
	Lep	*Udea ferrugalis*	Sugarbeet, capsicum, sotbean, maize						
Eggplant lace bug	Bug	*Urentius hystricellus*	Eggplant, tomato, cotton	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
	Fly	*Xanthaciura connexionis*	Eggplant						

Table 27. *Vegetable industry pathogen threat summary table for solanaceous crops (capsicum, chilli and eggplant)*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Andean mottle of potato	Vir	*Andean potato mottle virus*	Capsicum, chilli, eggplant, potato	Leaves			[28]		
Beet curly top virus[29]	Vir	*Beet curly top virus*	Wide host range[30]	Whole plant	LOW	HIGH	HIGH[31]	LOW	LOW
Zebra chip		*Candidatus* Liberibacter psyllaurous	Pepper, chilli, potato, tomato, capsicum, tamarillo	Whole plant					
Eggplant leaf spot	Fun	*Cercospora physalidis*	Eggplant, solanaceae	Leaves		HIGH	HIGH		
Chilli veinal mottle virus	Vir	*Chilli veinal mottle virus*	Capsicum, chilli, tobacco	Leaves, fruit			[32]		
Bacterial ring rot	Bac	*Clavibacter michiganensis* subsp. *Sepedonicus*	Potato, tomato, currant tomato, eggplant	Whole plant	MEDIUM	HIGH	HIGH	UNKNOWN	
Phomopsis blight of eggplant	Fun	*Phomopsis vexans*[33]	Eggplant, capsicum, tomato	Whole plant					
Eggplant mosaic virus	Vir	*Eggplant mosaic virus*	Eggplant, tomato, nightshade		LOW[34]	LOW	LOW[35]		
Tomato vein yellowing virus	Vir	*Eggplant mottled dwarf virus*	Eggplant, tomato	Whole plant					
Wilt of eggplant	Fun	*Fusarium oxysporum f. melongenae*	Eggplant		LOW	MEDIUM	MEDIUM	HIGH	
Frog-eye leafspot of pepper	Fun[36]	*Passalora capsicicola*	Capsicum	Leaves, fruit	MEDIUM	LOW	LOW		

[28] Contact transmission, no vector species is known (Büchen-Osmond 2006)
[29] Synonym: Potato green dwarf disease
[30] Includes sugarbeet, tomato, cucurbits, bean, potato and pepper
[31] Vectored by leafhopper that is already present in Australia; Not seed transmitted (Büchen-Osmond 2006)
[32] Vectored by aphids; Transmission by mechanical inoculation and grafting; Seed transmission not reported (Büchen-Osmond 2006)
[33] Recorded on eggplant in Australia. Simmonds, J.H. 1966. Host index of plant diseases in Queensland. Queensland Department of Primary Industries, Brisbane: 111. (6767)
[34] Only found in the Caribbean Islands (Trinidad, Tobago)
[35] Spread by Epitrix (not found in Australia)

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Pepino mosaic virus	Vir	*Pepino mosaic virus*	Pepino, tomato	Leaves, fruit	MEDIUM	HIGH	HIGH	UNKNOWN	
Pepper golden mosaic virus	Vir	*Pepper golden mosaic virus*	Capsicum, chilli, tobacco, tomato						
Pepper mottle virus	Vir	*Pepper mottle virus*	Capsicum						
Pepper vein banding virus	Vir	*Pepper vein banding virus*	Capsicum						
Pepper veinal mottle virus	Vir	*Pepper veinal mottle virus*	Capsicum, chilli, tomato, tobacco, eggplant,						
Peru tomato mosaic virus	Vir	*Peru tomato mosaic virus*	Capsicum, tomato, black nightshade, cape gooseberry						
Late blight[37] (exotic strains)	Fun	*Phytophthora infestans*	Potato, tomato, *Solanum* spp.	Whole plant	UNKNOWN	HIGH	HIGH	UNKNOWN	
Potato virus A (exotic strains)	Vir	*Potato virus A*	Potato, capsicum, tobacco		LOW	HIGH	HIGH	UNKNOWN	
Tomato black ring virus (TBRV) (sub group)	Vir	*Tomato black ring virus*	Polyphagous	Whole plant	HIGH[38]	HIGH	LOW[39]	LOW	VERY LOW
Tomato bushy stunt virus	Vir	*Tomato bushy stunt virus*	Capsicum, tomato, eggplant	Whole plant	[40]		[41]		

[36] Six counts found on APPD in NT and QLD, so possibly endemic
[37] A2 mating type, and exotic strains of both the A1 the A2 mating types
[38] Movement in bulbs may be an issue. Seed transmission occurs for some.
[39] *Longidorus attenuatus* is a vector of the potato bouquet strain; *L. elongatus* (exotic to Australia) is a vector of the beet ringspot strain
[40] Seed transmitted at a low rate (Büchen-Osmond 2006)
[41] Transmitted by mechanical inoculation, grafting, not transmitted by contact between hosts, seed transmitted at a low rate (Büchen-Osmond 2006)

Brassicaceae (crucifers) and leafy vegetables

Table 28. *Invertebrate threat summary table for pests of the Brassicaceae family and leafy vegetables*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Wireworm	Btle	*Agriotes lineatus*	Polyphagous	Roots, leaves	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Cabbage whitefly	Fly	*Aleyrodes proletella*	Cabbage	Leaf	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Beet worm	Lep	*Autographa nigrisigna*	Cabbages, potato, cowpea	Leaves, stems, flowers, fruit	NEGLIGIBLE	MEDIUM	HIGH	VERY LOW	NEGLIGIBLE
Swede midge	Fly	*Contarinia nasturtii*	Cabbage, cauliflower, broccoli, brussel sprouts	Leaves and heads of cauliflower, broccoli	LOW	LOW	LOW	LOW	LOW
Brassica pod midge	Fly	*Dasineura brassicae*	Cabbage, cauliflower	Gall forming fly	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Cabbage Root fly	Fly	*Delia radicum*	Cabbage, cauliflower, broccoli		LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Saltmarsh caterpillar	Lep	*Estigmene acrea*	Brassicaceae, beans	Leaves	NEGLIGIBLE	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Crucifer, caterpillar	Lep	*Evergestis forficalis*	Cabbage, cauliflower, brussel sprout	Whole plant. Stunted growth if infected as seedlings, discoloured leaves which wilt and roots black and rotten.	UNKNOWN	UNKNOWN	UNKNOWN	LOW	LOW – UNKNOWN
		Liriomyza brassicae							
Cabbage moth	Lep	*Mamestra brassicae*	Onions, garlic, leek, sugarbeet, cabbage, cauliflowers, brussel sprouts, lettuce, tomato, common bean, potato, maize	Leaves, flowers, fruit	UNKNOWN	NEGLIGIBLE	MEDIUM	MEDIUM	NEGLIGIBLE – UNKOWN

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Bertha armyworm	Lep	*Mamestra configurata*	Polyphagous	Leaves, pods	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
False root knot	Nem	*Nacobbus batatiformis*	Wide host range[42]	Underground plant parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
False root-knot nematode	Nem	*Nacobbus dorsalis*	Wide host range[43]	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
		Nasonovia ribis-nigri biotype 1							
Cabbage caterpillar (European great white cabbage butterfly)	Lep	*Pieris brassicae*	Cabbage, cauliflower, broccoli, brussel sprout,	Leaves. Pupae are likely to settle in curds/heads.	HIGH[44]	MEDIUM	MEDIUM	LOW	VERYLOW
Flea beetles	Btle	*Phyllotreta* spp. (including *P. albionica, P. chotanica, P. atra, P. striolata, P. flexuosa, P. nemorum, P.cruciferae*	Brassicas (cauliflower, brussel sprout, cabbage)	Larvae feeding on underground may result in decreased vigour or damage to underground crops. Adults mainly feed on leaves.	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Lesion nematode	Nem	*Pratylenchus delattrei*			LOW[45]	UNKNOWN	UNKNOWN	MEDIUM[46]	LOW-UNKNOWN
Scarlet mealybug	Bug	*Pseudococcus calceolariae*	Polyphagous	Leaves, stems, flowers, fruit	LOW	MEDIUM	MEDIUM	LOW	VERYLOW
Cabbage looper	Lep	*Trichoplusia ni*	Cabbage, turnip, spinach, crucifers, cucurbits	Leaves	LOW	HIGH	HIGH	LOW	VERYLOW

[42] Including potato, tomato, sugarbeet, cabbages, broccoli, turnip, lettuce, cucumber, peas, carrot, eggplant and capsicum.
[43] Including Brassicaceae, Cucurbitaceae and Solanaceae
[44] Present in New Zealand
[45] Not likely to enter on seed; could enter with soil or roots as it is endoparasitic
[46] Significant yield losses reported in US, India and Korea

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Spotted cutworm	Lep	*Xestia c-nigrum*	Onion, celery, beetroot, grape, oats, cabbages, cauliflower, tomato, lettuce, maize, potato	Leaves, stems, fruit	NEGLIGIBLE	MEDIUM	HIGH	LOW	NEGLIGIBLE

Table 29. *Pathogen threat summary table for pests of the Brassicaceae family and leafy vegetables*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Celery brown spot	Fun	*Acremonium apii*	Celery	Leaves, stem					
Aster yellows	Plo	Aster yellows phytoplasma	Numerous plant hosts from many families, including many vegetables	Whole plant		HIGH[47]	HIGH[48]	MEDIUM[49]	MEDIUM-UNKNOWN
Fusarium wilt of lettuce	Fun	*Fusarium oxysporum* f. sp. *lactucae*[50]	Lettuce		UNKNOWN[51]	MEDIUM	MEDIUM	HIGH	
Lettuce infectious yellows	Vir	*Lettuce infectious yellows virus* (*Crinivirus*)	Wide host range[52]	Whole plant		MEDIUM	MEDIUM[53]	LOW[54]	VERY LOW-UNKNOWN
Downy mildew[55]	Fun	*Hyaloperonospora brassicae* f. sp. *brassicae*	Brassicas	Foliage					
Downy mildew	Fun	*Hyaloperonospora brassicae* f. sp. *raphani*	Raphanus	Foliage					
Downy mildew	Fun	*Hyaloperonospora cochleariae*	Armoracia	Foliage	UNKONWN	LOW-MEDIUM	MEDIUM	HIGH	
Lettuce rust	Fun	*Puccinia opizii*	Lettuce						

[47] WA does have Hairy root, which shows very similar symptoms.
[48] Spread by Gray aster leafhopper plus other *Transmissi* spp. Not seed Transmissible.
[49] Insecticides for leafhoppers. General reduction in quantity and quality of yield.
[50] APPD 2010 lists 2 isolates of *F. oxysporum* on lettuce 1 in NSW and 1 in WA
[51] Seed-borne
[52] Including beet, carrot, all cucurbits, lettuce, spinach. Also present in many weed species.
[53] Transmitted by whitefly – *Bemisia tabaci*.
[54] Controlled through elimination of the whitefly vector, allowing a host free period and removing host weed species
[55] There are records of the synonym *Peronospora parasitica* on brassica around Australia (APPD 2010). All three *Hyaloperonospora brassicae* spp. need to be looked at further to determine the correct names, host ranges and present distribution

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Verticillium wilt	Fun	*Verticillium dahlia*	Lettuce [56]						

[56] Verticillium dahliae is in Australian but not recorded on lettuces, but is an issue in the USA. It may be a different race for lettuce and can be seed borne.

Root crops

Table 30. *Invertebrate threat summary table for pests of root crops (except for onions that can be found in the Onion IBP)*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Carrot cyst nematode	Nem	*Heterodera carotae*	Carrot other *Daucus* spp., *Torilis* spp., olives.	Underground plant parts	MEDIUM	HIGH[57]	HIGH[58]	HIGH[59]	HIGH
Jar worm, mole cricket	Locu	*Gryllotalpa gryllotalpa*	Cucumber, *Frageria*, cotton, turf grasses, sugarbeet, carrot, tobacco, potato, maize, lettuce	Young roots	NEGLIGIBLE	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Carrot beetle	Btle	*Ligyrus gibbosus*	Carrot & a number of weeds	Roots	NEGLIGIBLE	MEDIUM	MEDIUM	LOW	NEGLIGIBLE
Carrot weevil	Btle	*Listronotus oregonensis, L. texanus*	Carrot, parsnip, celery, parsley	Roots, crown, petioles	MEDIUM	HIGH	MEDIUM	MEDIUM	LOW
Aster leafhopper	Bug	*Macrosteles quadrilineatus*	Polyphagous	Leaves, flowers, fruit	UNKOWN	NEGLIGIBLE	MEDIUM	MEDIUM	LOW-UNKNOWN
Root-knot nematode	Nem	*Meloidogyne chitwoodi*	Maize, sweet corn, carrot, tomato, common bean, potato	Tubers, roots	LOW[60]	HIGH[61]	UNKNOWN	MEDIUM[62]	LOW-UNKNOWN
False root knot	Nem	*Nacobbus batatiformis*	Wide host range[63]	Underground plant parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
False root-knot nematode	Nem	*Nacobbus dorsalis*	Wide host range[64]	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Lesion nematode	Nem	*Pratylenchus delattrei*			LOW[65]	UNKNOWN	UNKNOWN	MEDIUM[66]	LOW-UNKNOWN

[57] Occurs in regions with Mediterranean climate
[58] Can persist as cysts in soil for 10 years. May be spread via soil on machinery and on carrots being shipped interstate.
[59] Causes seedling mortality and root forking so reduces carrot quality
[60] Endoparasite so could enter on plant roots or in soil
[61] Wide host range and suitable climatic regions throughout Australia
[62] A major parasite of many vegetables
[63] Including potato, tomato, sugarbeet, cabbages, broccoli, turnip, lettuce, cucumber, peas, carrot, eggplant and capsicum.
[64] Including Brassicaceae, Cucurbitaceae and Solanaceae
[65] Not likely to enter on seed; could enter with soil or roots as it is endoparasitic

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Carrot rust fly	Fly	*Psila rosae*	Carrot, parsnip, celery, parsley, lovage, *Apiaceae*	Roots, leaves	HIGH	HIGH	HIGH	HIGH	HIGH
Brown gourd-shaped weevil	Btle	*Scepticus uniformis*	Carrot, burdock	Roots	NEGLIGIBLE	MEDIUM	MEDIUM	LOW	NEGLIGIBLE

[66] Significant yield losses reported in US, India and Korea

Table 31. *Pathogen threat summary table for pests of root crops (except for onions that can be found in the Onion IBP)*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sweet potato leaf curl virus	Vir	*Sweet potato leaf curl virus* (*Begomovirus*)	Sweet potato	Leaves	[67]				
Sweet potato rust	Fun	*Coleosporium ipomoeae*	Sweet potato						
Carrot mosaic virus	Vir	*Carrot mosaic virus* (*Potyvirus*)	Carrot	Leaves, petioles	NEGLIGIBLE	UNKNOWN	UNKNOWN	UNKNOWN	NEGLIGIBLE-UNKNOWN
Carrot thin leaf virus	Vir	*Carrot thin leaf virus* (*Potyvirus*)	Carrot	Leaves[68]	NEGLIGIBLE[69]	UNKNOWN	UNKNOWN	UNKNOWN	NEGLIGIBLE-UNKNOWN
Phoma root rot	Fun	*Leptosphaeria libanotis*[70]	Carrot	Roots	UNKNOWN[71]	UNKNOWN	HIGH[72]	NEGLIGIBLE	LOW-UNKNOWN
Phoma canker	Fun	*Phoma complanata*	Parsnip						
Downy mildew	Fun	*Plasmopara nivea*[73]	Carrot, celery, parsley and other Apiaceae	Leaves, seed	MEDIUM[74]	LOW[75]	LOW-MEDIUM	MEDIUM	LOW
Umbel rot	Fun	*Phomopsis dauci*	Carrot		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Texas root rot	Fun	*Phymatotrichum omnivorum*	Highly polyphagous[76]	Roots		HIGH	LOW[77]	HIGH	LOW-UNKNOWN
Downy mildew	Fun	*Plasmopara umbelliferarum; P.crustosa; P.nivea*	Carrot						

[67] Whitefly vector
[68] Generally does not affect carrot yield or quality
[69] Virus transmitted by a vector, *Cavariella aegopodii, Myzus persicae*; Aphididae. Not transmitted by seed. Can be a problem when it occurs with other diseases.
[70] Synonym: *Phoma rostrupi*
[71] Disease is seedborne
[72] If seed not tested free of pathogen
[73] Synonyms: *P. crustosa,* and *P. umbelliferum*
[74] Strains affecting other Apiaceae occur in America and Asia.
[75] May establish in Tasmania and other areas with cool, moist climates
[76] Attacks over 200 spp. of plants, including, members of the families Anacardiaceae, Berberidaceae, Bignoniaceae, Brassicaceae, Celastraceae, Chenopodiaceae, Convolvulaceae, Ebenaceae, Elaeagnaceae, Euphorbiaceae, Ginkgoaceae, Grossulariaceae, Lauraceae, Loganiaceae, Meliaceae, Moraceae, Nyctaginaceae, Oleaceae, Papaveraceae, Passifloraceae, Poaceae, Polygonaceae, Protaceae, Rhamnaceae, Rutaceae, Salicaceae, Scrophulariaceae, Simaroubaceae, Solanaceae, and Ulmaceae.
[77] Soil borne fungi

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Crater rot	Fun	*Rhizoctonia carotae*	Numerous plant hosts including carrot	Whole plant		MEDIUM	MEDIUM[78]	LOW[79]	EXTREMELY LOW-UNKNOWN
Streptomycete soil rot	Fun	*Streptomyces ipomoeae*	Sweet potato	Roots					
Leaf rot	Fun	*Typhula variabilis*	Carrot	Leaves	LOW	LOW	LOW	NEGLIGIBLE	NEGLIBIBLE
Rust	Fun	*Uromyces lineolatus*[80]	Carrot		UNKNOWN	MEDIUM[81]	HIGH	HIGH	HIGH-UNKNOWN

[78] Infected plant debris or infested soil. Space plants widely.
[79] Losses of 4-10% recorded in USA
[80] Synonym: *Uromyces scirpi*
[81] May need an alternate host (Cyperaceae) to complete life cycle

Cucurbitaceae

Table 32. *Invertebrate threat summary table for pests of the Cucurbitaceae family*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Striped cucumber beetle	Btle	*Acalymma vittatum*	Cucurbitaceae	Seedlings, roots, leaves, stems, flowers, fruit	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM
	Fly	*Bacterocera atrisetosa*	Tomato, zucchini, cucumber	Fruit	MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Melon fly	Fly	*Bactrocera cucurbitae*	Cucumber, giant pumpkin, ornamental gourd	Fruit[82]	HIGH[83]	HIGH	HIGH[84]	HIGH	HIGH
	Fly	*Bactrocera decipiens*	Pumpkin, other cucurbits	Fruit	MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Cucurbit fly	Fly	*Dacus ciliatus*	Cucurbits	Fruit	LOW[85]	MEDIUM	MEDIUM	LOW	LOW
Banded cucumber beetle	Btle	*Diabrotica balteata*							
Spotted cucumber beetle	Btle	*Diabrotica undeciumpunctata howardi*							
Lesion nematode	Nem	*Pratylenchus delattrei*			LOW[86]	UNKNOWN	UNKNOWN	MEDIUM[87]	LOW-UNKNOWN

[82] Larvae tunnel in fruit; the associated bacteria cause it to rot. Oviposition puncture marks often visible. Flowers, stems and roots may also be attacked
[83] Natural dispersal, carried in infested fruit or wind-borne from PNG, males respond to cue lure.
[84] Known to disperse long distances
[85] Mode of spread: in host fruits. Fruit will show signs of oviposition punctures.
[86] Not likely to enter on seed; could enter with soil or roots as it is endoparasitic
[87] Significant yield losses reported in US, India and Korea

Table 33. *Pathogen threat summary table for pests of the Cucurbitaceae family*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Acremonium 107ypocotyls rot	Fun	*Acremonium cucurbitacearum*	Seedling melon, cucumber, watermelon	Seedlings	LOW	HIGH[88]	MEDIUM[89]	LOW[90]	EXTREMELY LOW
Cucurbit yellow stunting disorder virus	Vir	*Cucurbit yellow stunting disorder virus* (*Crinivirus*)	Cucurbits	Whole plant, mainly leaves	UNKNOWN[91]	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Cucurbit aphid-borne yellow virus	Vir	*Cucurbit aphid-borne yellow virus* (*Polerovirus*)		Leaves					
Phomopsis black rot and purple stem	Fun	*Diaporthe melonis*[92]	Watermelon, melon, cucumber	Fruit		UNKNOWN	MEDIUM – HIGH[93]	UNKNOWN	MEDIUM-UNKNOWN
Net spot	Fun	*Leandria momordicae*	Cucumber	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN[94]	UNKNOWN
Melon yellow spot virus	Vir	*Melon yellow spot virus* (*Tospovirus*)	Curcubits, capsicums	Whole plant	UNKNOWN	HIGH[95]	HIGH[96]	UNKNOWN	
Bacterial wilt of maize	Bac	*Pantoe a stewartii*	Sweet corn, cucumber		UNKNOWN[97]				
Squash leaf curl	Vir	*Squash leaf curl virus* (*Begomovirus*)	Cucumber, melon, watermelon, squash, pumpkin, ornamental gourd, beans	Leaves, growing points		UNKNOWN	MEDIUM[98]	UNKNOWN	MEDIUM-UNKOWN

[88] Infection can occur over a wide range of temps
[89] Survives in and spreads via soil
[90] Controlled with fungicides and cultural practices
[91] Vector: white fly (*Bemisia tabaci*)
[92] Synonym: *Phomopsis cucurbitae*
[93] Can be seedborne in melon
[94] Causes severe defoliation
[95] Attacks a wide range of species
[96] Transmitted by thrips species present in Australia
[97] Vector: Corn flea beetle. Details of vector can be found in the Grains IBP.
[98] Transmitted by whitefly – *Bemisia tabaci*

Common name	Life form	Scientific name	Relevant hosts	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Watermelon silver mottle virus group (serogroup IV)	Vir	*Watermelon silver mottle* (*Tospovirus*), *Groundnut bud necrosis* (*Tospovirus*), *watermelon bud necrosis* (*Tospovirus*)	Watermelon, melon, squash, pumpkin, pepper, eggplant, capsicum, cucumber	Whole plant	HIGH[99]	HIGH[100]	HIGH[101]	HIGH	
Whitefly transmitted Begomoviruses	Vir								
Zucchini lethal chlorosis virus	Vir	*Zucchini lethal chlorosis virus* (*Tospovirus*)	Zucchini	Whole plant[102]		UNKNOWN	UNKNOWN	HIGH	HIGH-UNKNOWN

[99] close proximity to south east Asia
[100] Capsicum chlorosis viruses have already shown ability of tospoviruses to establish in Australia
[101] Both *Thrips palmi* and *Frankliniella schultzei*, major vectors of this group, are present in Australia
[102] Plants may be stunted, die, or do not yield marketable fruit. Leaves may show yellowing or mottling.

Grains and leguminous plants

Table 34: *Vegetable industry invertebrate threat summary table for pests of beans*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Striped leaf beetle	Btle	*Acalymma bivittatum*	Capsicum, beans, eggplant, *Cucurbitaceae*	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Bean weevil	Btle	*Acanthoscelides argillaceus*	Beans, runner beans, lima bean						
Stink bug	Bug	*Acrosternum marginatum*	Okra, soybean, capsicum, beans, tobacco, tomato	Reprodutive parts					
	Bug	*Acrosternum pallidoconspersum*	Chickpea, soybean, beans, castor bean, sorghum, cowpea	Reproductive parts					
	Bug	*Agalliana ensigera*	Soybean, beans, broad bean						
Indian cotton jassid	Bug	*Amrasca devastans*[103]	Polyphagous	Leaves	LOW	HIGH	HIGH		
Black bean aphid	Bug	*Aphis fabae*	*Beta* spp., beans, *Vicia* spp.	Leaves	LOW				
Bean pod weevil	Btle	*Apion godmani*	Beans	Pods					
Silber Y moth	Lep	*Autographa gramma*							
Melon fruit fly	Fly	*Bactrocera cucurbitae*	cucurbits, beans, papaya, tomato, guava	Fruit	HIGH	HIGH	HIGH	HIGH	HIGH
	Btle	*Bruchidius atrolineatus*	Chickpea, soybean, lentil, beans, adzuki bean, mungbean, cowpea						
	Btle	*Bruchidius incarnatus*	Broad bean, pigeon pea, chickpea, lupin, pea, beans						
	Thri	*Caliothrips phaseoli*	Beans, lentil, soybean, maize	Leaves	LOW	HIGH			
	Btle	*Cerotoma arcuata*	Soybean, cassava, beans, cowpea						

[103] Synonym: *Amrasca biguttula biguttula*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Btle	*Cerotoma facialis*	Beans						
Red horned leaf beetle	Btle	*Cerotoma ruficornis*	Soybean, sweet potato, potato, beans						
	Btle	*Cerotoma salvinii*	Pigeon pea, beans						
	Bug	*Chauliops fallax*	Soybean, adzuki bean, beans	Reproductive parts					
African pod bug	Bug	*Clavigralla elongata*	Pigeon pea, beans, hyacinth bean, cowpea	Pods, seeds	LOW				
African pod bug	Bug	*Clavigralla tomentosicollis*	Pigeon pea, beans, spinach, cowpea	Pods, seeds	LOW				
	Lep	*Cydia fabivora*	Soybean, lima bean, beans						
	Btle	*Cyrtozemia cognata*	Guar, beans, mungbean, cowpea						
Bean seed fly	Fly	*Delia platura*							
Banded cucumber beetle	Btle	*Diabrotica balteata*	Melons, gourds, beans, soybean, sweet potato, winged bean						
Lesser corn stalk borer	Lep	*Elasmopalpus lignosellus*	Polyphagous						
Cotton leafhopper	Bug	*Empoasca decipiens*	Wide host range[104]	Leaves	LOW	HIGH	HIGH	MEDIUM	MEDIUM
	Btle	*Epilachna ocellata*	Okra, eggplant, beans, capsicum, mungbean tomato, radish, potato,	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Bean ladybeetle	Btle	*Epilachna varivestis*	Lime, soybean, beans, cowpea	Leaves	LOW	MEDIUM	MEDIUM	LOW	LOW
Salt marsh caterpillar	Lep	*Estigmene acraea*	Beans, *Brassicaceae*	Foliage	LOW	MEDIUM	MEDIUM	LOW	VERY LOW

[104] Including chilli, capsicum and eggplant

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Bug	*Euschistus crenator*	*Cucurbitaceae*, beans, castor bean, maize	Leaves, flowers, seed,	MEDIUM	MEDIUM	LOW	LOW	VERY LOW
Dingy cutworm	Lep	*Feltia jaculifera*	Beans, sunflower, maize	Below ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Flower thrips	Thri	*Frankliniella intonsa*	Polyphagous	Flowers	MEDIUM	HIGH	HIGH	LOW	LOW
	Btle	*Gynandrobrotica equestris*	Beans, cowpea						
American cotton bollworm	Lep	*Helicoverpa zea*	Polyphagous	Leaves, flowers	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Tobacco budworm	Lep	*Heliothis virescens*	Polyphagous	Leaves, flowers, fruit	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Pigeon pa cyst nematode	Nem	*Heterodera cajani*	Pigeon pea, guar, beans, sesame, cowpea, *Vigna* sp., pea	Roots	LOW	LOW			
Common green sugarcane leafhopper	Bug	*Hortensia similis*	Peanut, pigeon pea, *Cucurbitaceae*, tomato, soybean, rice, beans, *Poaceae*, sugarcane	Leaves, flowers	MEDIUM	MEDIUM	LOW	LOW	VERY LOW
Green cloverworm	Lep	*Hypena scabra*	Lucerne, soybean, beans, sorghum	Leaves	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Bristly cutworm	Lep	*Lacinipolia renigera*	Beans, maize	Below ground,	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Serpentine leafminer	Fly	*Liriomyza huidobrensis*	Polyphagous	Leaves	HIGH[105]	MEDIUM	MEDIUM	HIGH	HIGH
Vegetable leaf miner[106]	Fly	*Liriomyza sativae*	Polyphagous	Foliage	HIGH	HIGH	MEDIUM	HIGH	HIGH
American serpentine leafminer[107]	Fly	*Liriomyza trifolii*	Onion, garlic, chives	Foliage	HIGH	HIGH	MEDIUM	HIGH	HIGH

[105] Has been intercepted coming into Australia
[106] Synonyms: Cabbage leaf miner, Serpentine leaf miner, Tomato leaf miner, Vegetable leaf miner
[107] Synonyms: Chrysanthemum leaf miner, Serpentine leaf miner

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Bug	*Lygus gemellatus*	Beans, onion, cucumber, maize, sunflower	Shoots, fruits	LOW	HIGH	HIGH	UNKNOWN	
Tarnished plant bug	Bug	*Lygus lineolaris*	Polyphagous	Shoots, fruit	LOW	HIGH	HIGH	UNKNOWN	
Cabbage moth	Lep	*Mamestra brassicae*	Wide host range including beans	Leaves, flowers, fruits	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Bean flower thrips	Thri	*Megalurothrips sjostedti*	Beans, cowpea, pigeon pea	Flowers	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Soybean webworm	Lep	*Omiodes indicata*	Peanut, beans, sugarbeet, *Fabaceae*, soybean, lantana, tobacco, cowpea	Leaves	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Bean leaf beetle	Btle	*Ootheca bennigseni*	Beans, cowpea	Leaves	MEDIUM	MEDIUM	LOW	LOW	VERY LOW
Stink bug	Bug	*Piezodorus guildinii*	Pigeon pea, capsicum, beans, soybean, sweet potato, lentil, lucerne, rice	Leaves, seeds, flowers	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
	Lep	*Rachiplusia nu*	Soybean, sunflower, honey clover, beans					UNKNOWN	
Western bean cutworm	Lep	*Richia albicosta*	Beans, maize	Below ground, seedlings	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Pod-sucking bug	Bug	*Riptortus dentipes*	Soybean, beans, sorghum, mungbean, cowpea	Fruits, stems	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Soybean thrips	Thri	*Sericothrips variabilis*	Soybean, tomato, beans, cowpea, cotton	Flowers, fruits, leaves	MEDIUM	HIGH	HIGH	LOW	LOW
Southern armyworm	Lep	*Spodoptera eridania*	Wide host range including beans		LOW	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Fall armyworm	Lep	*Spodoptera frugiperda*	Polyphagous	Leaves, fruit	LOW	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Cotton leafworm	Lep	*Spodoptera littoralis*	Polyphagous	Leaves, fruit	LOW	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Yellow striped armyworm	Lep	*Spodoptera ornithogalli*	Polyphagous	Leaves, fruit	LOW	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Gray hairstreak	Lep	*Strymon melinus*	Beans, sycamore	Leaves	LOW	LOW	LOW	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
S-lettered leaf beetle	Btle	*Systena basalis*	Sweet potato, potato, beans, tomato, sugarcane	Leaves, roots	MEDIUM	MEDIUM	LOW	LOW	VERY LOW
Redheaded flea beetle	Btle	*Systena frontalis*	Beans, sweet potato	Leaves, roots	MEDIUM	MEDIUM	LOW	LOW	VERY LOW
Desert spider mite	Mite	*Tetranychus desertorum*	Cotton, cassava, beans, cowpea	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Pacific spider mite	Mite	*Tetranychus pacificus*	Cotton, grape, *Prunus*, soybean, beans, melon	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
	Mite	*Tetranychus piercei*	Peanut, papaya, sweet potato, banana, beans, castor bean	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
South American tomato moth or tomato leafminer	Lep	*Tuta absoluta*	Tomato, potato, eggplant, other solanaceous plants	Whole plant	HIGH	HIGH	HIGH	HIGH	HIGH
Style-stunt nematode	Nem	*Tylenchorhynchus acutus*	Soybean, lucerne, to0bacco, sorghum, beans	Roots					
Bean leafroller	Lep	*Urbanus proteus*	Pigeon pea, beans	Leaves	LOW	LOW	LOW	LOW	VERY LOW
Red lettuce aphid	Bug	*Uroleucon ambrosiae*	Beans, melons	Leaves, flowers, fruits,	MEDIUM	MEDIUM	MEDIUM	LOW	LOW
	Bug	*Veneza zonata*	Soybean, beans, maize	Leaves, stems, fruits	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Mexican bean weevil	Btle	*Zabrotes subfasciatus*	Beans	Seeds	HIGH[108]	MEDIUM	MEDIUM	LOW	LOW
	Nem	*Zygotylenchus guevarai*	Oats, chickpea, beans, pea, broad bean, pansy, grape, maize	Roots					

[108] Several interception reported on APPD at NSW border

Table 35: *Vegetable industry pathogen threat summary table for pests of beans*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Artichoke yellow ringspot virus	Vir	*Artichoke yellow ringspot virus*	Dill, artichoke, tobacco, beans, broad bean	Whole plant			[109]		
Bean golden mosaic virus	Vir	*Bean golden mosaic virus*[110]	Soybean, beans, lima bean	Whole plant					
Bean golden yellow mosaic virus	Vir	*Bean golden yellow mosaic virus*	Beans	Whole plant					
Pod mottle of bean	Vir	*Bean pod mottle virus*	Beans, soybean, legumes	Whole plant					
Bean rugose mosaic virus	Vir	*Bean rugose mosaic virus*	Beans, soybean	Whole plant					
Curly top	Vir	*Beet curly top virus*	Wide host range including beans	Whole plant	LOW	HIGH	HIGH[111]	LOW	LOW
Angular mosaic of beans	Vir	*Cowpea mild mottle virus*	Beans, soybean, cowpea, peanut, tomato	Whole plant			[112]		
Cowpea severe mosaic virus	Vir	*Cowpea severe mosaic virus*	Beans, soybean, mungbean, cowpea						
Soybean powdery mildew	Fun	*Erysiphe diffusa*	Soybean, beans, pea, mungbean, cowpea	Leaves					
Powdery mildew of pea	Fun	*Erysiphe pisi var. pisi*	Wide host range including beans	Leaves, pods					
Milk vetch dwarf luteovirus	Vir	*Milk vetch dwarf nanovirus*	Beans, pea, broad bean, soybean	Whole plant	LOW	HIGH	HIGH[113]	UNKNOWN	UNKNOWN

[109] Vectored by *Bemisia tabaci*, some isolates transmitted by mechanical inoculation and grafting; not transmitted by contact, seed or pollen (ICTVdB 2010)
[110] Record of this virus in ACT (APPD 2004) no longer there, needs to be checked further
[111] Vectored by leafhopper that is already present in Australia; Not seed transmitted (Büchen-Osmond 2006)
[112] Vectored by whitefly; Seed transmission occurs in some hosts, not clear (ICTVdB 2010)
[113] Vector present in Australia

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Pea early-browning virus	Vir	*Pea early-browning virus*	Lupin, lucerne, beans, broad bean, pea	Whole plant	LOW	HIGH[114]	LOW[115]	LOW[116]	NEGLIBLE
Soybean rust	Fun	*Phakopsora meibomiae*	Soybean, beans	Leaves					
	Fun	*Phoma exigua var. diversispora*	Beans, cowpea	Leaves, pods					
Texas root rot	Fun	*Phymatotrichum omnivorum*	Highly polyphagous[117]	Roots		HIGH	LOW[118]	HIGH	LOW-UNKNOWN
Bacteriosis	Bac	*Pseudomonas cannabina pv. cannabina*[119]	Beans						
Seedling rot of conifers	Fun	*Pythium sylvaticum*	Beans, carrot, barley, soybean, lucerne	Seedlings	LOW				
Quail pea mosaic virus	Vir	*Quail pea mosaic virus*	Soybean, beans						
Flowery spot of bean	Fun	*Mycovellosiella phaseoli*[120]	Beans, rice bean						
Red clover vein mosaic virus	Vir	*Red clover vein mosaic virus*	Lucerne, beans, pea, chickpea, purple clover	Whole plant	HIGH[121]	HIGH	HIGH[122]	MEDIUM	MEDIUM
Southern bean mosaic virus	Vir	*Southern bean mosaic virus*	Soybean. Black gram, beans, cowpea	Whole plant			[123]		
Soybean chlorotic mottle virus	Vir	*Soybean chlorotic mottle virus*	Soybean, beans, cowpea	Whole plant					

[114] High seed transmission rates have been reported in pea fields
[115] Nematode vectors not present in Australia
[116] Locally important in nematode infested areas
[117] Attacks over 200 spp. of plants, including, members of the families Anacardiaceae, Berberidaceae, Bignoniaceae, Brassicaceae, Celastraceae, Chenopodiaceae, Convolvulaceae, Ebenaceae, Elaeagnaceae, Euphorbiaceae, Ginkgoaceae, Grossulariaceae, Lauraceae, Loganiaceae, Meliaceae, Moraceae, Nyctaginaceae, Oleaceae, Papaveraceae, Passifloraceae, Poaceae, Polygonaceae, Protaceae, Rhamnaceae, Rutaceae, Salicaceae, Scrophulariaceae, Simaroubaceae, Solanaceae, and Ulmaceae.
[118] Soil borne fungi
[119] Synonym: *Pseudomonas syringae pv. cannabina*
[120] Synonym: *Ramularia phaseoli*
[121] Seed-borne
[122] Four of seven vectors present in Australia
[123] Transmitted by an insect (Chrysomelidae) in a semi-persistent manner, by mechanical inoculation; transmitted by grafting; transmitted by seed, by pollen to the seed and by pollen to the pollinated plant (Büchen-Osmond 2006)

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Tobacco necrosis satellite virus	Vir	*Tobacco necrosis satellite virus*	Beans	Whole plant					
Ringspot of beet	Vir	*Tomato black ring virus*	Wide host range including beans	Whole plant			[124]		
Bacterial blight of cowpea	Bac	*Xanthomonas axonopodis pv. vignicola*	Hyacinth bean, beans, black gram, cowpea	Leaves, pods, seeds	HIGH	HIGH	HIGH	UNKNOWN	
Leafspot	Bac	*Xanthomonas campestris pv. cannabis*	Hemp, cucumber, soybean, mulberry, tobacco, beans	Leaves, seeds	MEDIUM	MEDIUM	HIGH	UNKNOWN	

[124] Nematode vector (*Longidorus* spp.); Seed transmission occurs in many host species with rates 3-83% reported (CABI 2010)

Table 36: *Invertebrate threat summary table for pests of green peas*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Pea moth	Lep	*Cydia nigricana*	Pigeon pea, pea, wheat, sweet pea, vetch	Pods	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Tomato budworm	Lep	*Helicoverpa viriscens*	Polyphagous	Above ground	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Pea leaf weevil (Britain)	Btle	*Sitona lineatus*	Polyphagous legumes	Foliage	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Turnip moth	Lep	*Agrotis segetum*	Polyphagous	Cotyledons (seed, leaves, root & stem)	MEDIUM	MEDIUM	HIGH	MEDIUM	LOW
Fall armyworm	Lep	*Spodoptera frugiperda*	Polyphagous	Seedlings & cotyledons (seed, leaves, root & stem)	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Garden springtail	Spri	*Bourletiella hortensis*	Polyphagous	Seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchidius albopictus*	Chickpea, field pea	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchidius incarnatus*	Chickpea, faba, field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchidius mulunguensis*	Field pea	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchidius murinus*	Field pea	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchus brachialis*	Field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchus rufimanus*	Chickpea, faba, field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchus rufipes*	Faba, field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchus tristiculus*	Chickpea, faba, field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchus tristis*	Faba, field pea	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Bruchus ulicis ulicis*	Field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Seed-beetle	Btle	*Callosobruchus analis*	Chickpea, faba, field pea, lentil	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Seed-beetle	Btle	*Callosobruchus theobromae*	Field pea	Pods & seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Pea leafminer	Fly	*Chromatomyia horticola*	Polyphagous Asteraceae, Brassicaceae, Fabaceae	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Siamese grain beetle	Btle	*Lophocateres pusillus*	Rice, maize & numerous legumes	Storage	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Spider mite	Mite	*Petrobia apicalis*	Faba, field pea	Foliar	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Pea and bean weevil	Btle	*Sitona lineatus*[125]	Beans, pea	Leaves, roots					
Spotted bean weevil	Btle	*Sitona macularius*	Chickpea, lentil, pea, vetch & broad bean	Pods	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Canadian spider mite	Mite	*Tetranychus canadensis*	Polyphagous	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Spider mite	Mite	*Tetranychus yusti*	Field pea	Foliage	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
	Thri	*Thrips angusticeps*	Beans, pea						
Cabbage looper	Lep	*Trichoplusia ni*	Polyphagous	Foliage	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Serpentine leafminer	Fly	*Liriomyza huidobrensis*	Polyphagous include faba bean and Lathyrus	Leaves	LOW				

[125] Conflicting reports as to whether or not it is present in Australia

Table 37: *Pathogen threat summary table for pests of green peas*

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Leaf spot	Fun	*Alternaria humicola*[126]	Temperate pulses, mainly lentils		Vegetative & seed-borne	HIGH seed-borne	HIGH	MEDIUM soil & seed-borne	HIGH reported to be human pathogen	HIGH
Red clover vein mosaic virus	Vir	*Red clover vein mosaic virus* (*Carlavirus*)	Polyphagous legumes		Vegetative & seed-borne	HIGH seed-borne	HIGH	HIGH four of seven vectors in Australia	MEDIUM presence of vectors and hosts in Australia	MEDIUM
Broad bean stain	Vir	*Broad bean stain virus* (*Comovirus*)	Polyphagous legumes		Vegetative & seed-borne	MEDIUM seed-borne	HIGH high seed transmission rates	LOW vectors not present in Australia	MEDIUM faba bean yield losses up to 70%, lentil yield losses up to 77%	LOW
Broad bean true mosaic virus	Vir	*Broad bean true mosaic virus* (*Comovirus*)	Field pea, broad bean, tick bean, vetch		Vegetative & seed-borne in faba beans & vetch	MEDIUM seed-borne	HIGH high seed transmission rates	LOW vectors not present in Australia	MEDIUM yield loss up to 50% in broad bean, local losses only	LOW
Pea enation mosaic	Vir	*Pea enation mosaic virus* (*Enamovirus* + *Umbravirus*)	Wide range of temperate pulses & pasture legumes	Leaves		LOW one report of PEMV seed-borne in peas (1.5%)	HIGH	HIGH	MEDIUM yield loss of 66%, most important virus of pea in USA	LOW

[126] Identity unclear Spores can not be distinguished from other small-spored species. Simmons (2007) *Alternaria*: An identification Manual.

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Pea stem necrosis virus	Vir	*Pea stem necrosis virus* (Unclassified)	Field pea		Vegetative & seed-borne	HIGH seed-borne	HIGH presence of vector and host in Australia	HIGH vector in Australia where field peas grown, virus seed transmissible	LOW	LOW
Pea streak virus	Vir	*Pea streak virus* (*Carlavirus*)	Polyphagous legumes	Whole plant		LOW not seed-borne	HIGH	HIGH aphid vector present in Australia	MEDIUM 4th most important virus disease of peas in US	LOW
Peanut stunt virus	Vir	*Peanut stunt virus* (*Cucumovirus*)	Peanut, field pea, lupin	Leaves, fruit & seed		MEDIUM low seed transmission	HIGH	HIGH	LOW	LOW
Leptosphaerulina americana	Fun	*Leptosphaerulina americana*	Grass pea, field pea, common vetch	Leaves	Seed-borne	LOW	MEDIUM	HIGH if seed-borne MEDIUM if not seed-borne	LOW	VERY LOW
Broad bean mottle virus	Vir	*Broad bean mottle virus* (*Bromovirus*)	Polyphagous legumes	Leaves	Seed-borne	LOW	MEDIUM	LOW vectors not present in Australia	LOW	NEGLIGIBLE
Pea early browning virus	Vir	*Pea early browning virus* (*Tobravirus*)	Wide range of temperate pulses & pasture legumes	Whole plant	Seed-borne	LOW	HIGH high seed transmission rates have been reported in field peas	LOW nematode vectors not present in Australia	LOW locally important in nematode infested areas	NEGLIGIBLE
Clover yellow mosaic virus	Vir	*Clover yellow mosaic virus* (*Potexvirus*)	Clover, field pea, apple, lucerne	Leaves		LOW	UNKNOWN	HIGH vector present in Australia	LOW	UNKNOWN

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Black-leaf, pea black-leaf	Fun	*Fusicladium pisicola*	Field pea	Whole plant	Very little info available	NEGLIGIBLE	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Macrosporium caudatum	Fun	*Alternaria caudata*	Field pea	Whole plant	Very little info available	NEGLIGIBLE	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Milk vetch dwarf virus	Vir	*Milk vetch dwarf virus* (*Nanovirus*)	Field pea, broad bean, milk vetch	Vegetative parts	Not seed-borne	LOW	HIGH	HIGH vector present in Australia	UNKNOWN	UNKNOWN
Collar rot, ozonium wilt, root rot	Fun	*Ozonium texanum* var. *parasiticum*	Polyphagous legumes, cotton, barley, tomato, potato	Whole plant	Very little info available	NEGLIGIBLE	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Pea mild mosaic virus	Vir	*Pea mild mosaic virus* (*Comovirus*)	Field pea		Vegetative & seed-borne. Only found in NZ	HIGH seed-borne	MEDIUM	MEDIUM no vector transmission, narrow host range	UNKNOWN symptoms may go unnoticed	UNKNOWN
Plantago mottle virus	Vir	*Plantago mottle virus* (*Tymovirus*)	Field pea, soy bean	Leaves		LOW not seed-borne	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Cladosporium blight, white blight of sweet pea, white mould	Fun	*Ramularia deusta* var. *alba*	Polyphagous legumes	Whole plant	Very little info available	NEGLIGIBLE	UNKNOWN	UNKNOWN	MEDIUM	UNKNOWN
Tomato black ring virus	Vir	*Tomato black ring virus* (*Nepovirus*)	Field pea, chickpea and lupin	Whole plant		LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN

Table 38: *Invertebrate threat summary table for pests of maize*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Leaf miner spp., specific to Poaceae	Fly	*Agromyza oryzae*	*Hordeum, Triticum, Triticosecale, Oryza*, possibly *Zea*	Above ground	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Spotted maize beetle	Btle	*Astylus atromaculatus*	Maize but wider range	Seed & kernels at tip of ear	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Maize stalk borer	Btle	*Busseola fusca*	Maize, sorghum	Leaves, stalk & ear damage	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Maize black thrips	Thri	*Caliothrips striatoptera*	Maize	Leaves & ears	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Corn flea beetle	Btle	*Chaetocnema pulicaria*	Maize, but wider host range	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Coastal stalk borer	Btle	*Chilo orichalcociliella*	Maize, sorghum, finger millet & sugarcane	Leaves, stalk & ear damage	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Spotted stalk borer, Pink borer[127]	Btle	*Chilo partellus*	Maize, millet, rice, sugarcane & sorghum	Leaves, stalk & ear damage	LOW	MEDIUM	HIGH	HIGH	MEDIUM
Leaf miner spp., specific to Poaceae	Fly	*Chromatomyia horticola*	*Hordeum, Triticum, Triticosecale, Oryza*, possibly *Zea*	Above ground	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Corn rot webworm	Lep	*Crambus calignosellus*	Maize	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Flat grain beetle	Btle	*Cryptolestes turcicus*	Maize	Stored grain	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
False codling moth	Lep	*Cryptophlebia leucotreta*	Maize, extremely polyphagous	Ears	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Large black flour beetle	Btle	*Cynaeus angustus*	Maize	Stored grain	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM

[127] Risk ratings for this pest have been modified following the development of a pest-specific contingency plan in 2009

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Corn leafhopper	Bug	*Dalbulus maidis*	Maize	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Black maize beetle	Btle	*Heteronychus licas*	Maize, sugar cane, rice	Seedlings	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Harvester termite	Iso	*Hodotermes mossambicus*	Maize	Seedlings	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
European corn borer	Btle	*Ostrinia nubilalis*	Maize, cereals, millets	Leaves, stalk & ear	MEDIUM	MEDIUM	HIGH	MEDIUM	MEDIUM
English grain aphid[128]	Bug	*Sitobion avenae*	Poaceae	Above ground	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Khapra beetle	Btle	*Trogoderma granarium*	Stored products	Seed, dried products	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Turnip moth	Lep	*Agrotis segetum*	Cabbage, cotton, maize potato, turnip	Cotyledons (seed, leaves, root & stem)	MEDIUM	MEDIUM	HIGH	MEDIUM	LOW
Black slug	Slug	*Arion ater*	Polyphagous	Whole plant	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Square-necked grain beetle	Btle	*Cathartus quadricollis*	*Zea mais,* but other Poaceae	Stored grain	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Broadnosed grain weevil	Btle	*Caulophilus oryzae*	Chickpea, maize, millet, prob. other cereals in field & storage	Stored grain	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Wheat thrips	Thri	*Haplothrips tritici*	Poaceae	Above ground	MEDIUM	MEDIUM	HIGH	MEDIUM	LOW
Corn earworm (American cotton bollworm)[129]	Lep	*Helicoverpa zea*	Maize, cotton, Sorghum, tomato, sunflower, soyabean, pigeon pea, okra, kidney bean, eggplant & beans	Above ground	LOW	HIGH	HIGH	MEDIUM	LOW
Tomato budworm	Lep	*Helothis viriscens*	Polyphagous	Above ground	LOW	HIGH	HIGH	MEDIUM	LOW
Field cricket	Locu	*Acheta testaceus*	Maize	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Rose Beetle	Btle	*Adoretus compressus*	Cocoa, maize, oil palm & sugarcane	Leaves & ears	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

[128] Risk ratings for this pest have been modified following the development of a pest-specific contingency plan in 2009 (refer to **Error! Reference source not found.**)
[129] Risk ratings for this pest have been modified following the development of a pest-specific contingency plan in 2009 (refer to **Error! Reference source not found.**)

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Wheat stink bug	Bug	*Aelia acuminata*	*Hordeum, Triticum, Triticosecale*	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Wheat stink bug	Bug	*Aelia rostrata*	*Hordeum, Triticum, Triticosecale*	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf miner spp., specific to Poaceae	Fly	*Agromyza ambigua*	*Hordeum, Triticum, Triticosecale, Oryza*, possibly *Zea*	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf miner spp., specific to Poaceae	Fly	*Agromyza megalopsis*	*Hordeum, Triticum, Triticosecale, Oryza,* possibly *Zea*	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Indian cotton jassid	Bug	*Amrasca biguttula biguttula*	Cotton, orka, maize, potato & soybean	Leaves	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Bear caterpillar	Lep	*Amsacta gangis*	Maize, sugarcane	Leaves & ears (flowers)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Thrips	Thri	*Anaphothrips sudanensis*	Maize, rice & sugarcane	Leaves & flowers	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Locust	Locu	*Atractomorpha crenulata*	Maize, cowpea, jute, rice & sugarcane	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf miner spp., specific to Poaceae	Fly	*Cerodontha denticornis*	*Hordeum, Triticum, Triticosecale, Oryza*, possibly *Zea*	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf miner spp., specific to Poaceae	Fly	*Chromatomyia fuscula*	*Hordeum, Triticum, Triticosecale, Oryza*, possibly *Zea*	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf miner spp., specific to Poaceae	Fly	*Chromatomyia nigra*	*Hordeum, Triticum, Triticosecale, Oryza*, possibly *Zea*	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Tomato looper, Green Garden Looper	Lep	*Chrysodeixis chalcites*	Maize, beans, cabbage, tomato, potato	Leaves	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Maize leafhopper	Bug	*Cicadulina mbilaa*	Maize	Leaves	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Northern corn rootworm	Btle	*Diabrotica longicornis*	Maize	Seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Southern corn rootworm	Btle	*Diabrotica undecimpunctata*	Maize but wider range	Seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Western corn rootworm	Btle	*Diabrotica virgifera*	Maize but wider range	Seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Paddy hispa	Btle	*Dicladispa armigera*	Rice, maize, sugarcane & wheat	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Awl nematode	Nem	*Dolichodorus heterocephalus*	Celery, sweet corn, water chestnut	Roots	LOW	UNKNOWN	UNKNOWN[130]	LOW[131]	VERV LOW - UNKNOWN
Silkworm moths	Lep	*Dreta petola*	Maize, sugarcane, bamboo & various grasses	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Grain ladybird	Btle	*Epilachna similis*	*Triticum*, winter cereals, *Sorghum Zea*	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Western province grain worm	Btle	*Eremnus cerealis*	*Triticum* & winter cereals (adults on *Vitis*)	Cotyledons (seed, leaves, root & stem)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Tropical yellow tail moth	Lep	*Euproctis virguncula*	Rice sugarcane & maize	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Leafhopper	Bug	*Exitianus exitosus*	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Marbled grasshopper	Locu	*Gastrimargus marmoratus*	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Red spotted sap beetle, Picnic beetle	Btle	*Glischrochilus fasciatus*	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Four spotted sap beetle	Btle	*Glischrochilus quadrisignatus*	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Grass leafhopper	Bug	*Graminella nigrifrons*	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Grass leafhopper	Bug	*Graminella sonora*	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

[130] Generally limited to moist habitats
[131] Although *Dolichodorus heterocephalus* can be devastating where it occurs (USA), outbreaks are localised

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Edible grasshopper	Locu	*Homorocoryuphus nitidulus vicinus*	Maize	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Lance nematode	Nem	*Hoplolaimus columbus*	Wide host range, including maize	Leaves, roots	LOW	UNKNOWN	UNKNOWN	LOW	VERY LOW - UNKNOWN
Gold dust weevil, green weevil	Btle	*Hypomeces squamosus*	Maize, citrus, rice, sugarcane & tobacco	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Grain slugs, Lema & Oulema	Btle	*Lema erythrodera*	Cereals	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Grain slugs, Lema & Oulema	Btle	*Lema melanopa*	Cereals	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
White grub	Btle	*Lepidiota stigma*	Sugarcane, maize, cassava & coffee	Below ground, seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Chinese rice bug	Bug	*Leptocorisca chinensis*	Rice, maize & soybean		MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
White grub, toy beetle	Btle	*Leucopholis irrorata*	Maize & sugarcane	Below ground, seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Siamese grain beetle	Btle	*Lophocateres pusillus*	Rice, maize & wide variety of legumes	Stored grain	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Ground termite	Iso	*Macrotermes giluvus*	Maize, sugarcane & grasses	Below ground, seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Maize tassel beetle	Btle	*Megalognatha rufiventris*	Maize	Ears	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
West Indian cane weevil	Btle	*Metamasius hemipterus*	Sugarcane, banana, maize	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Maize silk beetle	Btle	*Monolepta bifasciata*	Maize, cassava	Ears	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Armyworm	Lep	*Mythimna unipuncta*	Maize, cereals	Leaves, stems, grain	LOW	HIGH	HIGH	MEDIUM	LOW
Shiny rice weevils	Btle	*Nematocerus* spp.	Maize but wider range	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
False chinch bug	Bug	*Nysius natalensis*	*Triticum, Triticosecale*	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Oligonychus mite	Mite	*Oligonychus pratensis*	*Triticum, Triticosecale*	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Cereal bettle	Btle	*Oulema gallaeciana*	Cereals	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Blue cereal beetle	Btle	*Oulema lichenis*	Cereals	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Red cereal leaf beetle	Btle	*Oulema melanopus*	Cereals	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Cereal beetle	Btle	*Oulema rufocyanea*	Cereals	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Bombay locust	Locu	*Patanga succincta*	Maize but wider range	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf folders	Lep	*Pelopidas conjucta*	Rice, sugarcane & maize	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Rice skipper	Lep	*Pelopidas mathias*	Rice (secondary of maize, barley, oats, sugarcane & sorghum)	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Sugarcane leafhopper	Bug	*Perkinsiella vastatrix*	Maize but wider range	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Sugarcane red bug	Bug	*Phaenacantha saccharicida*	Sugarcane, maize	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Mexican grain beetle	Btle	*Pharaxanotha kirschi*	Maize but wider range	Stored grain	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
White grubs	Btle	*Phyllophaga* spp.	Maize, beans, rice, sugarcane, sorghum & sugarcane	Below ground, seedlings	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Barley flea beetle	Btle	*Phyllotreta vittula*	Polyphagous Brassicaceae, Fabaceae	Cotyledons (leaves & stem)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Lesion nematode	Nem	*Pratylenchus delattrei*			LOW[132]	UNKNOWN	UNKNOWN	MEDIUM[133]	LOW-UNKNOWN

[132] Not likely to enter on seed; could enter with soil or roots as it is endoparasitic
[133] Significant yield losses reported in US, India and Korea

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Larger grain borer, Greater grain borer	Btle	*Prostephanus truncatus*	Maize & dried cassava	Stored grain	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Jack Beardsley mealybug	Bug	*Pseudococcus jackbeardsleyi*	Maize but wider range	Leaves	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Indian sugarcane leafhopper	Bug	*Pyrilla perpusilla*	Sugarcane, (maize a secondary host)	Leaves	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Stubby-root nematode	Nem	*Quinisulcius acutus*	Maize, sweet corn and potato		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Western bean cutworm	Lep	*Richia albicosta*	Maize but wider range	Below ground, seedlings	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Desert locust	Locu	*Schistocerca gregaria*	Maize but wider range	Whole plant	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Wheat aphid, spring green aphid	Bug	*Schizaphis graminum*	Wheat, barley, sorghum, oats, maize, rice & rye	Leaves, ears	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Chafer grubs	Btle	*Schizonycha* spp.	Maize	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Black rice bug	Bug	*Scotinophara coarctata*	Rice, maize	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Pink stalk borer	Btle	*Sesamia calamistis*	Maize but wider range	Leaves, stalk & ear	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Purple stem borer	Lep	*Sesamia inferens*	Poaceae to Cyperaceae	Above ground	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Fall armyworm	Lep	*Spodoptera frugiperda*	Polyphagous	Cotyledons (seed, leaves, root & stem)	LOW	MEDIUM	MEDIUM	MEDIUM	VERY LOW
Canadian spider mite	Mite	*Tetranychus canadensis*	Polyphagous	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Sinhai spider mite	Mite	*Tetranychus sinhai*	*Hordeum, Triticum, Triticosecale, Zea, Helianthus*	Leaves	LOW	MEDIUM	HIGH	MEDIUM	VERY LOW
Tetranychus truncates	Mite	*Tetranychus truncates*	Maize, beans, cassava, carrot, cotton, ground nut & oil palm	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
American black flour beetle	Btle	*Tribolium audax*	Maize	Stored grain	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Flour beetle	Btle	*Tribolium brevicornis*	Grain, flour & pollen	Seed	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Large flour beetle	Btle	*Tribolium destructor*	Grain, flour & pollen	Seed	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Black flour beetle	Btle	*Tribolium madens*	Grain, flour & pollen	Seed	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Glabrous cabinet beetle	Btle	*Trogoderma glabrum*	Wide range of stored products including raw grains & processed foods	Seed	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Trogoderma beetles other than Khapra beetle (Cabinet beetles)	Btle	*Trogoderma inclusum*	*Zea* & wide range of stored products including raw grains & processed foods	Seed, dried products	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Trogoderma beetles other than Khapra beetle (Cabinet beetles)	Btle	*Trogoderma ornatum*	*Zea* & wide range of stored products including raw grains & processed foods	Seed, dried products	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Trogoderma beetles other than Khapra beetle (Cabinet beetles)	Btle	*Trogoderma simplex*	*Zea* & wide range of stored products including raw grains & processed foods	Seed, dried products	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Trogoderma beetles other than Khapra beetle (Cabinet beetles)	Btle	*Trogoderma sternale*	*Zea* & wide range of stored products including raw grains & processed foods	Seed, dried products	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Valanga grasshopper	Locu	*Valanga nigricornis*	Teak, maize & sugarcane	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Mexican bean beetle	Btle	*Zabrotes subfasciatus*	Polyphagous	Seed	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Corn stem borer, pink stalk borer, sorghum borer	Lep	*Sesamia cretica*	Rice, pearl millet, sugarcane, sorghum, wheat, maize	Growing points, leaves & stems	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

Table 39: *Pathogen threat summary table for pests of maize*

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Bacterial stalk rot	Bac	*Erwinia dissolvens*	Maize, sweet corn, tobacco		UNKNOWN [134]	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Late wilt, slow wilt	Fun	*Harpophora maydis*	Maize	Leaves & stems		HIGH pathogen is soil & seed-borne	HIGH	HIGH can survive as sclerotia on debris	HIGH yield loss up to 40% in Egypt, found in India & Egypt though isolates differ slightly	HIGH
Maize dwarf mosaic	Vir	*Maize dwarf mosaic virus* (*Potyvirus*)	Maize, johnson grass	Whole plant		MEDIUM virus is seed transmitted at 0.4%	HIGH wide secondary host range, including sugar-cane	HIGH >15 species of aphids transmit the virus	HIGH significant yield losses in the USA	HIGH
Philippine downy mildew of maize	Fun	*Peronosclerospora philippinensis*	Sugarcane, sorghum, maize & teosinte	Whole plant		HIGH pathogen is seed born in moist grain, widespread in Indonesia	HIGH maize as well as alternate weed hosts occur across northern Australia	HIGH close proximity of Indonesia to Australia, storms & high winds may scatter spores	HIGH potentially most destructive disease of maize in Asia, can stop maize production	HIGH
Downy mildew of sorghum	Fun	*Peronosclerospora sorghi*	Sorghum & maize	Whole plant		HIGH seed-borne, carried in trash & soil, long-lived oospores	HIGH enter on untreated imported grain used in feedlots, may remain undetected for long period	HIGH proximity of PNG to Australia, range increased in last 20 yrs, wind major role in dispersal	HIGH major disease of sorghum & maize in USA, PNG & Philippines	HIGH

[134] Seed transmission unknown

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Maize cyst nematode	Nem	*Heterodera zeae*	Oats, barley, rice, sorghum, wheat, maize	Roots		MEDIUM could enter in soil contaminating seed or equipment, cysts highly resistant to desiccation	HIGH large number of secondary hosts on which it could establish	MEDIUM easily spread in soil as contaminant in equipment & seed	HIGH serious pest in warmer areas	MEDIUM
Stewart's disease (Bacterial wilt)	Bac	*Pantoea stewartii*	Maize, sweetcorn	Whole plant		LOW seed transmission is very low or doubtful	MEDIUM	MEDIUM vectored by flea beetles (particularly *Chaetocnema pulicaria*)	HIGH major disease in Nth, Central & Sth America, Eastern Europe	MEDIUM
Grey leaf spot	Fun	*Cercospora zeae-maydis*	Maize	Whole plant		MEDIUM	LOW is trash-borne & pathogenic only on maize	MEDIUM China nearest known location, residues with maize seed most likely means of spread	MEDIUM serious threat to maize in USA & Africa, up to 50%	LOW
Lance nematode	Nem	*Hoplolaimus galeatus*	Maize & other woody or gramin-aceous plant, turfgrass	Roots		MEDIUM Could enter in soil contaminating seed or equipment	MEDIUM mainly a pest of turfgrass but hosts are widespread & several generations/year	MEDIUM easily spread in soil as contaminant in equipment & seed	MEDIUM damage to cotton, pine, oak, wheat & turf grasses, yield loss in maize in USA	LOW
Needle nematode	Nem	*Longidorus breviannulatus*	Maize, peaches, barley	Roots	Present in New Zealand, vector of Arabis mosaic virus.	MEDIUM could enter in soil contaminating seed or equipment	MEDIUM moderate host range & several generations/year	MEDIUM easily spread in soil as contaminant in equipment & seed	MEDIUM important pathogen of corn in USA	LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Lesion nematode	Nem	*Pratylenchus delattrei*	Maize, cotton	Roots		MEDIUM Could enter in soil contaminating seed or equipment	MEDIUM	MEDIUM easily spread in soil as contaminant in equipment & seed	MEDIUM important pathogen of corn in USA, India & Korea	LOW
Bacterial stalk rot	Bac	*Pseudomonas syringae* pv. *lapsa*	Maize, Sorghum	Stalk		HIGH seed-borne, can survive in soil for up to 9 months	MEDIUM	MEDIUM	LOW little economic importance	LOW
Peanut scab		*Sphaceloma arachidis*	Peanuts			LOW-MEDIUM could enter in soil contaminating seed or equipment	MEDIUM pathogenicity restricted to genus Arachis	MEDIUM spread by rain splashed conidia only	MEDIUM major pathogen of peanuts in Brazil	LOW
Goss's bacterial wilt & blight	Bac	*Clavibacter michiganensis* ssp. *nebraskensis*	Sugarcane, sudan grass, sorghum, teosinte, maize	Whole plant	Could enter ins soil containing seed or equipment	MEDIUM bacterium is seed-borne	MEDIUM	HIGH	LOW found only in USA, losses up 50%	VERY LOW
Spiral nematode	Nem	*Helicotylenchus pseudorobustus*	Oats, barley, rye, wheat, maize & grapevine	Roots	Found in NZ, USA, Europe, Asia.	LOW could enter in soil contaminating seed or equipment	MEDIUM moderate host range & several generations/year	MEDIUM easily spread in soil as contaminant in equipment & seed	LOW weak to moderate pathogen	VERY LOW
Lance nematode	Nem	*Hoplolaimus columbus*	Cotton, soybean, also maize	Roots		MEDIUM could enter in soil contaminating seed or equipment	MEDIUM hosts are widespread & several generations/year	MEDIUM easily spread in soil as contaminant in equipment & seed	LOW important parasite of soybean & cotton in USA	VERY LOW for grains HIGH for cotton
Eye spot; brown spot	Fun	*Kabatiella zeae*	Maize	Stalk, leaves & cob		LOW	MEDIUM	MEDIUM	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Maize chlorotic dwarf	Vir	*Maize chlorotic dwarf virus* (*Waikavirus*) (MCDV)	Johnson grass, maize, pearl millet, sorghum & wheat	Whole plant		LOW	HIGH infects sorghum, Johnson grass	NEGLIGIBLE vectored by leaf hoppers, not in Australia	HIGH has caused significant yield losses in the USA	VERY LOW
Root-knot nematode	Nem	*Meloidogyne chitwoodi*	Potatoes, tomatoes, lesser barley, wheat, grasses, oat, maize & fabaceae, brassicaceae	Roots	Different races occur	MEDIUM could enter in soil contaminating seed or equipment	HIGH wide host range & is widely distributed in rest of world	MEDIUM easily spread in soil as contaminant in equipment & seed	HIGH for potato, infects wheat & maize grown in rotation with potatoes. High market access risk	MEDIUM for vegetable industry
False root knot nematode	Nem	*Nacobbus dorsalis*	Sugarbeet, Poaceae not a host	Roots		MEDIUM could enter in soil contaminating seed or equipment	LOW	MEDIUM easily spread in soil as contaminant in equipment & seed	LOW	VERY LOW
Downy mildew	Fun	*Peronosclerospora sacchari*	maize, sugar-cane	Whole plant	Endemic to PNG & last present in commercial crops in Australia in 1959	MEDIUM internally seed-borne in maize at moderate level	MEDIUM	MEDIUM spread of conidia by wind from PNG unlikely	LOW yield losses up to 15% in PNG	VERY LOW
Mexican corn cyst nematode	Nem	*Punctodera chalcoensis*	Maize	Roots		MEDIUM could enter in soil contaminating seed or equipment	MEDIUM confined to temperate regions	MEDIUM easily spread in soil as contaminant in equipment & seed	LOW economically important in Mexico, present in Mexico only	VERY LOW
Rice black streaked dwarf	Vir	*Rice black streaked dwarf virus* (*Fijivirus*)	Rice, maize, wheat, barley, oats	Whole plant		LOW	MEDIUM grasses are wild hosts	MEDIUM one leafhopper vector in Australia	LOW	VERY LOW

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Downy mildew of pearl millet	Fun	*Sclerospora graminicola*	Maize, sorghum, Johnson grass, pearl millet	Leaves (usually lower leaves)		MEDIUM seed-borne	LOW	MEDIUM	LOW on maize	VERY LOW
Dagger nematode	Nem	*Xiphinema mediterraneum*	Maize	Roots		Very little information has been gathered on their relationship with corn	MEDIUM appears to be more damaging under grapevines - vector for fanleaf virus	MEDIUM easily spread as soil contaminant in equipment & seed	LOW to maize HIGH to grapevine	VERY LOW for maize MEDIUM for grapevine
Awl nematode	Nem	*Dolichodorus heterocephalus*	Celery, sweet corn & water chestnut	Roots		LOW-MEDIUM could enter in soil contaminating seed or equipment	LOW prefers very moist conditions & not particulary resistant to desiccation	MEDIUM spread in water & in soil as contaminant in equipment & seed	LOW can be devastating in USA but outbreaks are localised	VERY LOW-NEGLIGIBLE
Horse's tooth	Fun	*Claviceps gigantea*	Maize	Inflorescence & seeds		NEGLIGIBLE seed-borne but disease confined to alpine areas of Mexico	NEGLIGIBLE not enough rainfall in Australia	NEGLIGIBLE	MEDIUM cool, very high rainfall favours development	NEGLIGIBLE
Maize bushy stunt	Plo	Maize bushy stunt phytoplasma	Maize	Whole plant		NEGLIGIBLE	LOW	MEDIUM vectored by leaf hoppers	NEGLIGIBLE	NEGLIGIBLE
Maize chlorotic mottle	Vir	*Maize chlorotic mottle virus* (*Machlomovirus*)	Maize	Whole plant		HIGH seed transmission	LOW maize the known host, beetle & thrip vectors not in Australia	LOW	LOW	NEGLIGIBLE
Maize rayado fino	Vir	*Maize rayado fino virus* (Marafivirus)	Maize, teosinte	Whole plant		NEGLIGIBLE no report of being seed-borne or seed transmitted	NEGLIGIBLE	NEGLIGIBLE vectored by *Dalbulus maidis*, not in Australia	LOW losses of up to 40-50% in maize	NEGLIGIBLE

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Maize streak	Vir	*Maize streak virus* (*Mastrevirus*)	Maize, sorghum, wheat, grasses	Whole plant		NEGLIGIBLE not seed transmitted	LOW	NEGLIGIBLE vectored by leaf hoppers (partic. Genus *Cicadulina*), not in Australia	MEDIUM in Africa, India, Madagascar & Yemen, yield losses up to 100% in Africa	NEGLIGIBLE
Maize white line mosaic	Vir	*Maize white line mosaic virus* (Unclassified)	Maize, crabgrass	Leaves & roots		NEGLIGIBLE seed-borne but no seed transmission, distribution limited to only 4 US States	LOW	NEGLIGIBLE vectored by a number of genera of leaf hoppers, not in Australia	UNKNOWN	NEGLIGIBLE
Corn stunt	Plo	*Spiroplasma kunkelii*	Maize	Whole plant		LOW one report of seed-borne	LOW	MEDIUM vectored by leaf hoppers	LOW	NEGLIGIBLE
Ear rot	Fun	*Barriopsis fusca*				UNKNOWN	HIGH	HIGH	UNKNOWN	UNKNOWN
Cynodon chlorotic streak	Vir	*Cynodon chlorotic streak virus* (*Nucleorhabdovirus*) (CCSV)	Cynodon dactylon, maize	Leaves		LOW no report of transmission by seed	UNKNOWN planthopper vector	UNKNOWN	UNKNOWN	UNKNOWN
Bacterial stalk rot	Bac	*Erwinia dissolvens*	Maize, sorghum, tobacco	Stalks at ground level	Favoured by high humidity, temperature, rainfall & overhead irrigation	UNKNOWN seed transmission unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Guinea grass mosaic	Vir	*Guinea grass mosaic virus* (*Potyvirus*) (GGMV)	Grasses, maize	Leaves	Probably restricted to tropical Africa, no vector known	LOW not seed-borne or transmitted	UNKNOWN transmitted by vectors	UNKNOWN	UNKNOWN distribution in USA only second to that of maize dwarf mosaic	UNKNOWN
Maize eyespot	Vir	*Maize eyespot virus* (*Unclassified*)	Maize, oats, barley, wheat	Whole plant		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Maize gooseneck stripe	Vir	*Maize gooseneck stripe virus* (*Unclassified*)	Maize			MEDIUM not seed-borne or transmitted	UNKNOWN	UNKNOWN transmitted by the planthopper	UNKNOWN	UNKNOWN
Maize Iranian Mosaic	Vir	*Maize iranian mosaic virus* (*Nucleo-rhabdovirus*)	Maize, sorghum, barley	Leaves		UNKNOWN	UNKNOWN	UNKNOWN transmitted by insect vectors	UNKNOWN	UNKNOWN
Maize line virus	Vir	*Maize line virus* (unclassified)	Maize			LOW no report of being seed-borne or transmission by seed	UNKNOWN	UNKNOWN transmitted by the planthopper, *Peregrinus maidis*	UNKNOWN	UNKNOWN
Maize mottle	Vir	*Maize mottle virus* (*Begomovirus*) syn. *Chlorotic stunt virus*	Maize	Leaves, seed, shoots	Leaf mottling in young leaves, chlorosis of older leaves, stunting of plants, tassel abortion,yield loss, bending of shoots	UNKNOWN	UNKNOWN	UNKNOWN transmitted by insect vectors	UNKNOWN	UNKNOWN
Maize raya gruesa virus	Vir	*Maize raya gruesa virus* (unclassified)	Maize			LOW not seed-borne or transmitted by seed	UNKNOWN	UNKNOWN transmitted by the planthopper	UNKNOWN	UNKNOWN
Maize rough dwarf virus	Vir	*Maize rough dwarf virus* (*Fijivirus*)	Maize, barley perennial ryegrass, oats, wheat		Occurs sporadically in Europe, no longer appears to be of major importance	LOW not seed-borne or seed transmissible	UNKNOWN many wild hosts	UNKNOWN vectored by planthoppers	MEDIUM significant yield losses	UNKNOWN

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Maize streak virus	Vir	*Maize streak virus* (*Monogeminivirus*) (MSV)	Maize, sorghum, wheat. Poaceae.	Whole plant	Found in Africa, India, Madagascar & Yemen	LOW not seed-borne or seed transmissible	UNKNOWN	UNKNOWN transmitted by Cicadulina genus leafhopper	UNKNOWN yield losses up to 100% in Africa	UNKNOWN
Yellow Leaf blight	Fun	*Mycosphaerella zeae-maydis*	Maize, sweetcorn	Leaves		LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Rajasthan downy mildew	Fun	*Peronosclerospora heteropogonis*	Maize	Whole plant	Reported as *P. sorghi* but *P. heteropogoni* infects *Heteropogon contortus, P. sorghi* doesn't	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Tar spot	Fun	*Phyllachora maydis*	Maize	Leaves & kernels in cobs		LOW obligate parasite	UNKNOWN	UNKNOWN	LOW Latin America – cool, humid areas at high elevations	UNKNOWN
Texas root rot	Fun	*Phymatotrichopsis omnivora*	Polyphagous, cotton	Roots		MEDIUM not seed-borne but could enter as sclerotia on debris or soil	MEDIUM wide host range	LOW		UNKNOWN
Tropical rust	Fun	*Physopella zeae*	Maize, sweet corn, teosinte, tripsacum	Leaves	Appears to be limited to warm, humid areas of central & Sth America & the Caribbean, not reported in USA	MEDIUM windblown spores	UNKNOWN	UNKNOWN	LOW	UNKNOWN

Common name	Life form	Scientific name	Primary host	Plant part affected	Other information	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Stubby-root nematode	Nem	*Quinisulcius acutus*	Maize, sorghum, soybean, sweet potato & wheat	Roots		LOW-MEDIUM could enter in soil contaminating seed or equipment	UNKNOWN	MEDIUM easily spread in soil as contaminant in equipment & seed	UNKNOWN	UNKNOWN
Banded Leaf & sheath spot	Fun	*Rhizoctonia solani* f. *sasakii*	Maize, polyphagous families	Leaves, leaf sheaths & stalks	Hot, humid environments in the tropics & sub-tropics – minor importance	HIGH seed-borne, 60% seed incidence recorded	HIGH	UNKNOWN	UNKNOWN	UNKNOWN
Brown stripe downy mildew	Fun	*Sclerophthora rayssiae*	Maize	Leaves		MEDIUM seed-borne in seed with >14% moisture, survives as oospores in debris & soil	LOW most severe in areas with 100-200cm rain/year	UNKNOWN	UNKNOWN 63% yield loss in India	UNKNOWN

Life form legend

Bac	Bacteria
Btle	Beetles, weevils, etc. (COLEOPTERA)
Bug	Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers (HEMIPTERA)
Fly	Flies and midges (DIPTERA)
Fun	Fungus
Iso	Termites (ISOPTERA)
Lep	Butterflies and moths (LEPIDOPTERA)
Locu	Locusts and grasshoppers (ORTHOPTERA)
Mite	Mites (e.g. spider and gall mites (ACARI))
Nem	Nematode
Plo	Phytoplasma-like organism
Thri	Thrips (THYSANOPTERA)
Vir	Virus

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