Biosecurity Plan for the Sugarcane Industry

A shared responsibility between government and industry

Version 3.0 May 2016

Plant Health AUSTRALIA

CANEGROWERS

Location:	Level 1 1 Phipps Close DEAKIN ACT 2600
Phone:	+61 2 6215 7700
Fax:	+61 2 6260 4321
E-mail:	**biosecurity@phau.com.au**
Visit our web site:	**www.planthealthaustralia.com.au**

An electronic copy of this plan is available through the email address listed above.

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Endorsement

The *Biosecurity Plan for the Sugarcane Industry* (Version 3.0) was formally endorsed by the sugarcane industry (through CANEGROWERS) in March 2016, and all state and territory governments (through the Plant Health Committee) in May 2016. The Australian Government endorses the document without prejudice for the purposes of industries planning needs and meeting the Department's obligations under Clause 13 of the EPPRD. In providing this endorsement the Department notes page 41 of the Plan which states: "This Document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the IRA conducted by the Department of Agriculture and Water Resources which focus only on specific regulated import pathways".

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List of acronyms

ACFA	Australian Cane Farmers Association
ACPPO	Australian Chief Plant Protection Office
APVMA	Australian Pesticides and Veterinary Medicines Authority
ASA	Australian Sugar Industry Alliance
AS/NZS	Australian Standard/New Zealand Standard
ASMC	Australian Sugar Milling Council
BICON	Australian Biosecurity Import Conditions Database
BMP	Best Management Practices
BOLT	Biosecurity On-Line Training
BSES	Bureau of Sugar Experiment Stations
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	State Chief Plant Health Manager
DAF Qld	Department of Agriculture and Fisheries, Queensland
DAFWA	Department of Agriculture and Food, Western Australia
DEDJTR Vic	Department of Economic Development, Jobs, Transport and Resources, Victoria
DPI NSW	Department of Primary Industries, New South Wales
DPIF NT	Department of Primary Industry and Fisheries, Northern Territory
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
EPP	Emergency Plant Pest
EPPRD	Emergency Plant Pest Response Deed
FAO	Food and Agriculture Organization of the United Nations
GBO	General Biosecurity Obligation
HPP	High Priority Pest
IBG	Industry Biosecurity Group
IBMP	Industry Best Management Practice
ICA	Interstate Certification Assurance
ICON	Import Conditions Database
IGAB	Intergovernmental Agreement on Biosecurity
ILC	Industry Liaison Coordinator
ILO	Industry Liaison Officer
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis

ISPM	International Standards for Phytosanitary Measures
MICoR	Manual of Importing Country Requirements
NAQS	Northern Australian Quarantine Strategy
NDP	National Diagnostic Protocol
NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network
NPBS	National Plant Biosecurity Strategy
NPSRT	National Plant Surveillance Reporting Tool
NT	Northern Territory
PaDIL	Pest and Disease Image Library
PHA	Plant Health Australia
PHC	Plant Health Committee
PIRSA	Primary Industries and Regions South Australia
QA	Quality Assurance
R&D	Research and Development
RSD	Ratoon Stunting Disease
SA	South Australia
SARDI	South Australian Research and Development Institute
SDQMA	Sub-Committee for Domestic Quarantine and Market Access
SPC	Secretariat of the Pacific Community
SPHD	Subcommittee on Plant Health Diagnostic
SPS	Sanitary and Phytosanitary
SRA	Sugar Research Australia
TST	Threat Summary Table
Vic	Victoria
WA	Western Australia
WTO	World Trade Organization

Definitions

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

Reporting suspect pests

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

EXECUTIVE SUMMARY

Executive Summary

To ensure its future viability and sustainability, it is vital that the Australian sugarcane industry minimises the risks posed by exotic pests and responds effectively to plant pest threats. The *Biosecurity Plan for the Sugarcane Industry* (*Version 3.0*) is a framework to coordinate biosecurity activities and investment for Australia's sugarcane industry. The Biosecurity Plan provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the sugarcane industry. The Biosecurity Plan formally identifies and prioritises both exotic plant pests (not currently present in Australia) and established plant pests, with a focus on managing future biosecurity challenges. It also provides for an implementation plan and the framework for the *Sugarcane biosecurity manual*, which is a tool for use in the day to day operations of sugarcane farms.

The Biosecurity Plan was developed in consultation with the Sugarcane Industry Biosecurity Group (IBG), a technical group of sugar industry, plant health and biosecurity experts. The IBG was coordinated by Plant Health Australia (PHA) and included representatives from CANEGROWERS, the Australian Sugar Milling Council (ASMC), Sugar Research Australia (SRA), Productivity Services, and relevant state and territory agriculture agencies.

The revision of threat summary tables, constituting a list of more than 240 exotic plant pests and the potential biosecurity threat that they represent to the Australian sugarcane industry was key to the industry biosecurity planning process. Each pest on that list was given an overall risk rating based on four criteria: entry, establishment and spread potential, and economic impact. In this biosecurity plan, established pests and weeds of 'biosecurity significance' for the sugarcane industry were also listed. It is well understood that good biosecurity practice is beneficial for the ongoing management of established pests and weeds, as well as for surveillance and early detection of exotic pests.

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

This Biosecurity Plan is principally designed for decision makers. It provides the sugarcane industry and government with a mechanism to identify exotic plant pests as well as to address

the strengths and weaknesses in relation to the industry's current biosecurity position. It is envisaged that a formal review of this biosecurity plan will be undertaken in five years.

Implementing Biosecurity for the Australian Sugarcane Industry 2016-2020

Following the biosecurity planning process (undertaken through the Sugarcane Industry Biosecurity Group), both industry and government have developed an implementation table that sets out their shared biosecurity goals and objectives for the industry. This section contains a biosecurity implementation table which should act as a guide for biosecurity activities for industry and the government over the upcoming five years (i.e. the life of this Biosecurity Plan). It is intended that the plan is visited by industry and government decision makers regularly through the life of the plan.

This section of the Biosecurity Plan includes a gap analysis of biosecurity programs and resources in place for high priority pests of the sugarcane industry (see Page 21) as well as the Sugarcane Industry Biosecurity Statement which outlines biosecurity risk mitigation and preparedness activities undertaken by the industry (see Page 24).

Biosecurity implementation table

The Biosecurity implementation table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[1] and the National Plant Biosecurity Strategy (NPBS)[2] by providing a clear line of sight between the development of this biosecurity plan and broader plant health policy and legislation.

This table aims to provide the focus and strategic direction for plant biosecurity activities relating to the sugarcane industry over the next five years. The table provides specific recommendations on potential biosecurity activities which both the sugarcane industry and relevant governments could undertake in partnership. This has been developed in an attempt to successfully fill in gaps which have been identified through this biosecurity planning process.

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

This table has been developed in the recognition that biosecurity is a shared responsibility between industry and governments, and for this reason, the biosecurity implementation table has been produced to help coordinate industry and government actions and resources in the biosecurity system, with the view of creating an effective and productive industry and government biosecurity partnership. By implementing the specific actions listed in the biosecurity implementation table, it will not only strengthen the sugarcane biosecurity system, but also the broader plant biosecurity system. Future versions of this document will contain information on the progress made by governments and industry in relation to the biosecurity implementation table.

Table 1. *The biosecurity implementation table for the Australian Sugarcane Industry (2016-2020)*

Biosecurity theme	Action	Responsible party	Due date
Legislative and regulatory issues of importance (aligns with Strategy 1 of NPBS)	• The Queensland Department of Agriculture and Fisheries to provide guidance and training to industry representatives and growers as they transition to the new arrangements associated with the *Biosecurity Act 2014 (the Act)* and the General Biosecurity Obligation (GBO), particularly with respect to management of machinery movements, planting material, varietal selection and biosecurity zones.	DAF QLD	2016 – 2020
	• Finalise the Industry Code of Practice for varietal selection and receive endorsement from industry and government through the appropriate channels.	CANEGROWERS, SRA, ASMC, ACFA, ASA, Sunshine Sugar and DAF QLD	1 July 2016
	• Once legislation is enacted under the Biosecurity Act (2014) industry and government will work together and promote the GBO and conduct training for industry representatives on regulations and update inspector status as according to the new legislation.	DAF QLD, CANEGROWERS, SRA and ASMC	2016 – 2017
Nationally coordinated plant pest surveillance (aligns with Strategy 2 of NPBS, Schedule 4 IGAB)	• Hold an industry workshop and develop a surveillance strategy for the sugar industry informed by government and industry activities.	DAF QLD, NAQS, SNPHS, CANEGROWERS and SRA. Possible involvement of Ramu Agri-Industries.	2016
	• Conduct preliminary trials of industry surveillance data capture with Productivity Services and SRA research plantings.	DAF QLD, CANEGROWERS and SRA	2016/17
	• Investigate the development of an online industry surveillance data capture system, such as an app, as well as incorporation of surveillance recording with Smartcane	CANEGROWERS and SRA	2017

Biosecurity theme	Action	Responsible party	Due date
Building capacity and capability (aligns with Strategy 4 of NPBS, Schedule 6 of IGAB)	• Build on the existing Biosecurity Act Working Group, with this group to help coordinate and prioritise industry's future biosecurity activities and to review implementation of the Biosecurity Plan annually.	CANEGROWERS, ASMC, SRA, PHA and DAF QLD. Possible involvement of NAQS.	February 2016-2020
	• Undertake a levy project to establish a PHA levy and a positive EPPR levy to invest in critical biosecurity projects and to prepare for an exotic pest incursion.	CANEGROWERS and PHA	2016

Biosecurity theme	Action	Responsible party	Due date
Plant biosecurity education and awareness (aligns with Strategy 7 of NPBS, Schedule 6 of IGAB)	• Finalise the development of the sugarcane biosecurity manual and distribute to growers through awareness activities in growing regions.	PHA, SRA, ASMC and CANEGROWERS	2016
	• Undertake on-farm biosecurity training exercises in major growing regions, including farm-visits and promote what could be implemented at the farm level, including awareness about the GBO, Code of Practice, Smartcane and possible levy proposals.	CANEGROWERS, SRA, ASMC and DAF QLD	2016-2017
	• Review and develop detailed information sheets on the following pests and publish them on the SRA website: **Pathogens** Ramu stunt (Tenuivirus), Downy mildew (*Peronosclerospora philippinensis, P. sacchari*) by 1/6/2016 Grassy shoot and Whiteleaf phytoplasma by 1/12/2016 Sugarcane streak mosaic virus (Poacevirus) by 1/6/2017 Leaf scorch (*Stagonospora sacchari*) by 1/12/2017 Leaf scald (*Xanthomonas albilineans*) by 1/6/2018 **Invertebrates** *Chilo* spp. (including *C. auricilius, C. infuscatellus, C. sacchariphagus, C. terrenellus and C. tumidicostalis*) by 1/12/16 Top borer (*Scirpophaga excerptalis*), Pink stalk borer (*Sesamia grisescens*) and African sugarcane stalkborer (*Eldana saccharina*) by 1/6/2017 Sugarcane leafhopper (*Eumetopina flavipes*) and Sugarcane planthoppers (*Perkinsiella vastatrix* and *P. vitiensis*) by 1/12/2017 Sugarcane pyrilla (*Pyrilla perpusilla*) and Root borer (*Polyocha depressella*) by 1/6/2018 Sugarcane whitefly (*Aleurolobus barodensis*) and Sugarcane woolly aphid (*Ceratovacuna lanigera*) by 1/12/2018	SRA	2016-2020
	• Work to incorporate biosecurity best practice guidelines and the GBO into existing industry best management practices guidelines (Smartcane) as well as investigate the development of online training modules to test knowledge.	CANEGROWERS and SRA	2016-2018

Biosecurity theme	Action	Responsible party	Due date
Preparation for pest incursions (aligns with Strategy 3 of NPBS, Schedule 7 of IGAB)	• For CANEGROWERS and SRA to develop the following categorisation requests to submit to PHA: Downy mildew (*P. philippinensis*) and Grassy shoot phytoplasma by 1/12/2016 *Chilo* spp. (including *C. auricilius, C. infuscatellus, C. sacchariphagus, C. terrenellus and C. tumidicostalis*) by 30/6/2017 African sugarcane stalkborer (*E. saccharina*), Root borer (*P. depressella*) and Top borer (*S. excerptalis*) by 30/6/2018 Sugarcane leafhopper (*E. flavipes*), Sugarcane planthoppers (*P. vastatrix* and *P. vitiensis*) and Leaf scald (*X. albilineans*) by 30/6/2019 Sugarcane woolly aphid (*C. lanigera*) and Sugarcane pyrilla (*P. perpusilla*) by 30/6/2020	CANEGROWERS, SRA and PHA	2016 – 2020

Biosecurity theme	Action	Responsible party	Due date
	• Review, develop and finalise the following dossiers / contingency plans: **Pathogens** Ramu stunt (Tenuivirus), Downy mildew (P. *philippinensis, P. sacchari*) by 1/6/2016 Grassy shoot and Whiteleaf phytoplasma by 1/12/2016 Sugarcane streak mosaic virus (Poacevirus) by 1/6/2017 Leaf scorch (*S. sacchari*) by 1/12/2017 Leaf scald (*X. albilineans*) by 1/6/2018 **Invertebrates** *Chilo* spp. (including *C. auricilius, C. infuscatellus, C. sacchariphagus, C. terrenellus and C. tumidicostalis*) by 1/12/2016 Top borer (*S. excerptalis*), Pink stalk borer (*S. grisescens*) and African sugarcane stalkborer (*E. saccharina*) by 1/6/2017 Sugarcane leafhopper (*E. flavipes*) and Sugarcane planthoppers (*P. vastatrix* and *P. vitiensis*) by 1/12/2017 Sugarcane pyrilla (*P. perpusilla*) and Root borer (*P. depressella*) by 1/6/2018 Sugarcane whitefly (*A. barodensis*) and Sugarcane woolly aphid (*C. lanigera*) by 1/12/2018	SRA	2016 – 2020

Biosecurity theme	Action	Responsible party	Due date
Management of established pests and weeds of biosecurity significance (aligns with Strategy 6 of NPBS, Schedule 5 of IGAB)	• Include weeds and established pests of significance in the Sugarcane biosecurity manual.	CANEGROWERS, SRA, ASMC, PHA and DAF QLD	2015/16
	• Prioritise efforts in relation to the containment and management of established pests and weeds.	CANEGROWERS, SRA, ASMC and DAF QLD	2016
	• Review the BMP (Smartcane) and include established pests and diseases and weeds.	CANEGROWERS	2016
	• Investigate the possibility of conducting Fiji leaf gall surveys to determine its distribution and feasibility of eradication.	CANEGROWERS, SRA, ASMC and DAF QLD	2017
	• Determine whether there is interest in conducting a cost-benefit analysis of the annual eradication of *Eumetopina flavipes* in northern Australia.	CANEGROWERS, SRA, ASMC, DAF QLD and NAQS	2018

Biosecurity theme	Action	Responsible party	Due date
Integrated diagnostic network (aligns with Strategy 5 of NPBS, Schedule 4 of IGAB)	• Review, develop and submit final National Diagnostic Protocols to SPHD for endorsement: **Pathogens** Ramu stunt (Tenuivirus) and Downy mildew (*P. philippinensis* and *P. sacchari*) by 1/6/2016 Grassy shoot and Whiteleaf phytoplasma by 1/12/2016 Sugarcane streak mosaic virus (Poacevirus) by 1/6/2017 Leaf scorch (*S. sacchari*) by 1/12/2017 Leaf scald (*X. albilineans*) by 1/6/2018 **Invertebrates** *Chilo* spp. (including *C. auricilius, C. infuscatellus, C. sacchariphagus, C. terrenellus and C. tumidicostalis*) by 1/12/2016 Top borer (*S. excerptalis*), Pink stalk borer (*S. grisescens*) and African sugarcane stalkborer (*E. saccharina*) by 1/6/2017 Sugarcane leafhopper (*E. flavipes*) and Sugarcane planthoppers (*P. vastatrix* and *P. vitiensis*) by 1/12/2017 Sugarcane pyrilla (*P. perpusilla*) and Root borer (*P. depressella*) by 1/6/2018 Sugarcane whitefly (*A. barodensis*) and Sugarcane woolly aphid (*C. lanigera*) by 1/12/2018	SRA and SPHD	2016 - 2020

Biosecurity theme	Action	Responsible party	Due date
Responding to pest incursions (aligns with Strategy 3 of NPBS, Schedule 7 of IGAB)	• Conduct half-day EPPRD training.	CANEGROWERS, SRA, AMSC, ACFA, Sunshine Sugar and PHA	1/12/2016
	• Identify ILO's and ILC's in major growing areas, such as cane grower district managers and for PHA to conduct a 1-day training workshop.	CANEGROWERS, SRA, AMSC, ACFA, Sunshine Sugar and PHA	1/6/2017
	• Review the Evidence Framework for Owner Reimbursement Costs for the Sugarcane Industry (2007)	PHA and CANEGROWERS	2017
	• Run an industry wide simulation exercise with PHA to demonstrate the preparedness of an industry and government(s) to an emergency response.	CANEGROWERS, SRA, AMSC, ACFA, Sunshine Sugar, PHA, DAF QLD and NSW DPI	2017 – 2018
RD&E (aligns with Strategy 8 of NPBS, Schedule 8 of IGAB)	• To be most effective, development of biosecurity R&D priorities that are listed and agreed to in this table should have a mechanism to feed into the SRA investment planning process, allowing prioritisation within the overall R&D portfolio.	SRA	2016 – 2020

Australian sugarcane industry - biosecurity preparedness

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

The following table has been populated with the high priority pests of the sugarcane industry. The aim of this table is to document the current preparedness documents and activities which are available and are currently being undertaken. This will allow industry, governments and R&D agencies to better prepare for these high priority pests and align future activities as listed in the Biosecurity Implementation Table (Table 1).

Table 2. Documents and activities currently available for sugarcane high priority pests[3] [4]

Common name	Scientific name	National diagnostic protocol[5]	Fact sheets[6]	Contingency Plan / Dossier[7]	EPPRD Category
INVERTEBRATES					
HEMPITERA					
Sugarcane whitefly	*Aleurolobus barodensis*	Yes (4)	No	No	3
Sugarcane woolly aphid	*Ceratovacuna lanigera*	Draft (1)	No	No	-
Sugarcane leafhopper (as a vector of ramu stunt disease)	*Eumetopina flavipes*	No	No	Yes (SRA dossier developed)	-
Sugarcane planthopper (as a vector of Fiji leaf gall disease)	*Perkinsiella vastatrix*	No	No	No	-

3 Copies of these documents are available from **www.planthealthaustralia.com.au/resources/pest-information-document-database/**

4 Information presented has been taken from the National Plant Health Status Report 2014 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostic Standards, the Subcommittee on National Plant Health Surveillance or other stakeholders.

5 See Page 87 for more information.

6 See Table 13 for more information.

7 Industry has developed pest specific dossier's, which although are not to the current template of contingency plans, provide information on the exotic pests life cycle, biology, and major means of spread, distribution and control. See Table 14 for further information.

Common name	Scientific name	National diagnostic protocol[5]	Fact sheets[6]	Contingency Plan / Dossier[7]	EPPRD Category
Sugarcane planthopper (as a vector of Fiji leaf gall disease)	*Perkinsiella vitiensis*	No	No	No	-
Sugarcane pyrilla	*Pyrilla perpusilla*	No	No	No	-
LEPIDOPTERA					
Sugarcane internode borer	*Chilo auricilius*	Draft (1)	No	Yes (SRA dossier for *Chilo* spp.)	-
Yellow top borer of sugarcane	*Chilo infuscatellus*	Draft (1)	No	Yes (SRA dossier for *Chilo* spp.)	-
Sugarcane internode borer	*Chilo sacchariphagus*	Draft (1)	No	Yes (SRA dossier for *Chilo* spp.)	-
Dark headed rice borer	*Chilo terrenellus*	Draft (1)	No	Yes (SRA dossier for *Chilo* spp.)	-
Spotted sugarcane stem borer	*Chilo tumidicostalis*	No	No	Yes (SRA dossier for *Chilo* spp.)	-
African sugarcane stalkborer	*Eldana saccharina*	No	Yes	Yes (SRA dossier)	-
Root borer	*Polyocha depressella*	No	No	No	-
Top borer	*Scirpophaga excerptalis*	Draft (1)	No	Yes (SRA dossier for *Scirpophaga* spp.)	-
Pink stalk borer	*Sesamia grisescens*	Draft (1)	Yes	Yes (SRA dossier for *Sesamia* spp.)	2
PATHOGENS					
BACTERIA					
Leaf scald	*Xanthomonas albilineans* (exotic strains- serological groups 2 or 3)	No	No	No	-

Common name	Scientific name	National diagnostic protocol[5]	Fact sheets[6]	Contingency Plan / Dossier[7]	EPPRD Category
FUNGI					
Leaf scorch	*Stagonospora sacchari*	Draft (1)	No	No	3
OOMYCETE					
Downy mildew	*Peronosclerospora philippinensis*	No	No	Yes (CP and SRA dossier developed)	-
Downy mildew	*Peronosclerospora sacchari*	Draft (1)	No	Yes (CP and SRA dossier developed)	3
PHYTOPLASMA					
Grassy shoot (with vector - unknown)	*Grassy shoot phytoplasma*	No	Yes	No	-
White leaf (with vector - Matsumuratettix hiroglyphicus)	*White leaf phytoplasma*	Draft (1)	Yes	No	3
VIRUS					
Sugarcane streak mosaic virus	*Sugarcane streak mosaic virus (Potyvirus)*	No	No	No	4
Ramu stunt (with vector)	*Suspect virus (Tenuivirus)*	Draft (1)	Yes	Yes (SRA dossier developed)	2

Sugarcane Industry Biosecurity Statement

Australia's sugarcane is grown in high-rainfall and irrigated districts areas along coastal plains and river valleys on 2100 km of Australia's eastern coastline - between Mossman in far north Queensland and Grafton in New South Wales. Queensland accounts for about 95% of Australia's raw sugar production, and New South Wales around 5%.

More than 4000 sugarcane farms operate along Australia's eastern seaboard. While the average size of a sugarcane farm is 100 hectares, some are in excess of 1000 hectares. While there are still a number of smaller farms, average farm size is increasing each year, as the number of growers contracts and area farmed expands. This consolidation is occurring through advances in technology and the need for greater economies of scale in farming. The Australian sugarcane industry produces 30-35 million tonnes of cane per year, which when processed, equates to around 4-4.5 million tonnes of sugar.

Australia is the third largest raw sugar supplier in the world, with 80% of Australia's processed sugar exported. The production value of Australia's sugar industry is around $2 billion per annum.

CANEGROWERS is the Plant Health Australia representative organisation for the sugarcane industry. Sugar Research Australia (SRA) is an industry owned company funded by a statutory levy that invests in and manages a portfolio of research, development and extension (RD&E) projects that drive productivity, profitability and sustainability for the Australian sugarcane industry. Both CANEGROWERS and SRA recognise the need for the sugarcane industry to work with the federal, state and territory governments to help reduce the potential for incursions of emergency plant pests that could adversely impact on production, domestic and international trade and the regional economy and environment. The Australian sugarcane industry is also strongly committed to ensuring that responses to any pest incursions that may occur are undertaken as effectively as possible to minimise costs to growers, the industry, other plant industries, government parties and the wider community.

The Sugarcane Industry Biosecurity Plan

The Sugarcane Industry Biosecurity Plan (Version 1.0), consistent with PHA's National Industry Biosecurity Planning Guidelines, was launched in June 2004. A major review of the Sugarcane Industry Biosecurity Plan (Version 2.01) was released in June 2009. Sugar Research Australia provided funding to Plant Health Australia Ltd to conduct a major review of the plan during 2014/2015, which will be released as the Sugarcane Industry Biosecurity Plan version 3.0 at the end of 2015.

The biosecurity plan identifies and prioritises the sugarcane industry's biosecurity risks and provides a framework for risk mitigation and preparedness activities. The awareness section identifies a range of existing industry processes, fact sheets and other sources of information for the 23 high priority pests (HPPs) that can be used to promote biosecurity awareness throughout the industry.

An outcome of the Industry Biosecurity Plan review is the recommendation for the establishment of a Biosecurity Working Group to meet annually in February for the life of the Biosecurity Plan (Version 3.0) and review the Biosecurity Plan and Implementation table. This is in recognition of the joint responsibilities of government and industry to promote better biosecurity practices and preparedness for the sugarcane industry.

National decision making processes

CANEGROWERS will endeavour to ensure that senior and qualified industry delegates are available at short notice to participate in meetings of the Consultative Committee on Emergency Plant Pests or the National Management Group and to take up roles in Local Pest Control Centres or the State Pest Control Headquarters in the event of an incursion.

CANEGROWERS will also endeavour to ensure that all delegates participate in relevant competency and non-competency based training, which is being delivered through Plant Health Australia's Emergency Plant Pest Preparedness Training Program. SRA will have a significant role in most of these activities.

Pest categorisation

Of the 23 high priority pests identified in the Sugarcane Biosecurity Plan, seven have already been categorised for inclusion in Schedule 13 of the EPPRD. CANEGROWERS commits to ensuring appropriate industry technical experts will be available to participate in future meetings of the Categorisation Group to consider either pest categorisation or funding weight calculations for Emergency Plant Pests with multi-industry impacts.

Owner Reimbursement Costs

CANEGROWERS have developed the Evidence Framework for Owner Reimbursement Costs for the Sugarcane Industry (2007)[8]. As outlined in the Sugarcane biosecurity implementation table, CANEGROWERS will work with PHA to review this framework by 2017.

8 **www.planthealthaustralia.com.au/wp-content/uploads/2013/02/Sugarcane-evidence-framework.pdf**

Best Management Practices - Smartcane

Smartcane BMP (**www.smartcane.com.au**) is an industry led, government supported best management practice system for cane growing across Queensland. The Smartcane BMP program offers growers the ability to demonstrate how they manage their farming operations as well as the opportunity to look for improvement in practices for business and environmental sustainability.

The practices contained within the Smartcane BMP program are categorised depending on ability to improve productivity, profitability and stewardship.

The industry has developed a series of seven BMP 'modules' covering a wide range of usual farm activities. The Smartcane BMP modules support continuous improvement and have a review system in place that is underpinned by R&D and proven peer reviewed science.The first three are seen as the key modules:

1. Soil Health and Nutrient Management (key).
2. Weed, Pest and Disease Management (key).
3. Irrigarion and Drainage Management (key).
4. Crop Production and Harvesting Management.
5. Natural Systems Management.
6. Farm Business Management.
7. Workplace Health and Safety .

The Weed, Pest and Disease Management module supports biosecurity principles and actions. Disease management in sugarcane relies heavily on an integrated approach. Most diseases of sugarcane are not managed by crop protection products alone, or at all, and rely on a combination of hygiene practices, variety selection, fallow management, and use of clean seed of approved varieties.

The Smartcane BMP supports a team of local facilitators throughout Queensland to help growers go through the modules they choose to take on – step by step.

As the grower answers each question, the system tells them if they are 'below', 'at', or 'above' the industry standard for each practice. If any practice is below the industry standard, the grower is shown what they would need to do to reach that mark. If they need some extra help along the way, their local facilitator is there to help the grower through the process.

Biosecurity awareness material and extension services

Both CANEGROWERS and SRA have produced and provide a range of biosecurity awareness materials for growers. This includes:

- Frequent and ongoing communication with industry, including CaneConnection a quarterly magazine, CaneClips which is a compilation of short videos which cover a range of topics, online webinars and industry updates. All of these are frequently updated and are a relevant source of information for the sugarcane industry.
- Biosecurity awareness and education workshops in major growing regions are run to inform growers about pest and disease best management practices as well as the latest in research undertaken by the industry.
- SRA has produced two ute-guide booklets, Diseases of Australian Sugarcane and Pests of Australian Sugarcane, which contain all of the latest information on established and exotic pests and diseases for the Australian Sugarcane industry. These booklets are also available as free e-books.
- In addition to this, PHA is leading an SRA project to develop the Sugarcane Biosecurity Manual (Version 1.0). This project, in collaboration with CANEGROWERS, DAF QLD, ASMC and Productivity Service companies will contain all of the relevant biosecurity information for growers, such as each individual's General Biosecurity Obligation (GBO), biosecurity zones, pest fact sheets as well as a range of other information to help the sugarcane industry protect their properties from established and exotic pests and diseases. The Sugarcane Biosecurity Manual will be released by June 2016.
- Productivity Service companies are organisations that provide clean seed, services to prevent pest and disease spread and extension advice to growers across the sugarcane districts. In most districts Productivity Services staff have been trained to provide machinery inspections and approvals to move machinery between sugarcane biosecurity zones.

Other preparedness activities

As outlined in the Sugarcane Biosecurity Plan (Version 3.0), both CANEGROWERS and SRA have committed to the actions outlined in the biosecurity implementation table. This includes developing and finalising National Diagnostic Protocols, fact sheets and contingency plans/dossiers for all HPPs by 2020 amongst a range of other biosecurity preparedness activities.

SRA plays an active role in the biosecurity management and preparedness of the sugarcane industry. This includes overseeing national breeding programs and the development of resistant varieties, improving the capability for the identification of high priority pest species by

morphological and molecular techniques, as well as conducting surveys for sugarcane pests and diseases in neighbouring countries, such as Papua New Guinea and Indonesia. SRA also has strong links with sugar R&D groups in overseas countries to understand exotic pests and diseases.

INTRODUCTION

Introduction

What is biosecurity and why is it important?

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

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

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

The Plant Biosecurity System in Australia

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

The framework for managing the cooperative partnership for delivering an effective plant biosecurity system is built on a range of strategies, policies and legislation, such as the Intergovernmental Agreement on Biosecurity[9] and the National Plant Biosecurity Strategy[10]. These not only provide details about the current structure, but provide a vision of how the future plant biosecurity system should operate.

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

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

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

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

Plant Health Australia

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

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

PHA is a not-for-profit, subscription-funded public company based in Canberra. PHA's main activities are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 34 plant industry organisations are all members of PHA and each meet one third of the total annual membership subscription. This tripartisan funding model ensures the independence of the company.

The company was formed to address 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. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified and solutions to problems found. PHA's independence and impartiality allow the company to put the interests of the plant biosecurity system first and support a longer-term perspective.

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

The Industry Biosecurity Plan

The Biosecurity Plan for the sugarcane industry was developed in consultation with the Industry Biosecurity Group (IBG), a technical group of industry, plant health and biosecurity experts. The IBG was coordinated by PHA and included representatives from CANEGROWERS, the Australian Sugar Milling Council, Sugar Research Australia, Productivity Services, relevant state and territory agriculture agencies and PHA.

The Biosecurity Plan for the Sugarcane Industry not only details exotic pest threats of the Australian sugarcane industry but also contains information on the current mitigation and surveillance activities being undertaken and identifies contingency plans, fact-sheets and diagnostic protocols that have been developed for pests relevant to the sugarcane industry.The plan is a framework to coordinate biosecurity activities and investment for Australia's sugarcane industry and to address the strengths and weaknesses in relation to industry's current biosecurity position. It provides a mechanism for industry, governments and stakeholders to better prepare for, and respond to, incursions of pests that could have significant impacts on the sugarcane industry.

Biosecurity planning

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

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

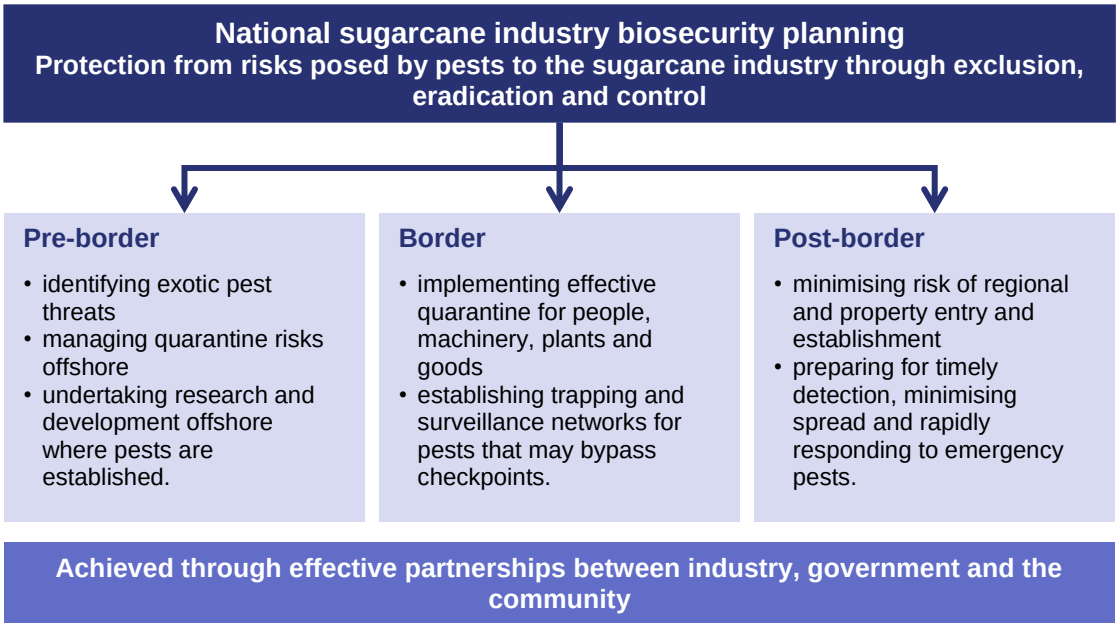


Figure 1. *Industry biosecurity: a shared responsibility*

Industry Biosecurity Plan development

With the assistance of CANEGROWERS, an Industry Biosecurity Group (IBG) was formed to work on the development of the Biosecurity Plan for the Sugarcane Industry. The IBG was coordinated by Plant Health Australia and included representatives from CANEGROWERS,

the Australian Sugar Milling Council, Sugar Research Australia, Productivity Services, relevant state and territory agriculture agencies and PHA (Table 3).

Key steps in the development of the Sugarcane Biosecurity Plan included:

- identifying and documenting key threats to the sugarcane industry
- confirming an agreed high priority pest (HPP) list
- documenting pest-specific fact sheets, contingency plans, diagnostic protocols and surveillance programs for HPPs
- documenting the roles and responsibilities of stakeholder groups.
- developing a biosecurity implementation table for future biosecurity related work to be conducted over the life of this Biosecurity Plan

Table 3. *Members of the sugarcane IBG*

Name	Organisation
Barry Croft	Sugar Research Australia
James Ogden-Brown	Sugar Research Australia
Peter Allsopp	Sugar Research Australia
Nicole Thompson	Sugar Research Australia
Rob Magarey	Sugar Research Australia
Nader Sallam	Sugar Research Australia
Peter Samson	Sugar Research Australia
Matt Kealley	CANEGROWERS
Jim Crane	Australian Sugar Milling Council
Christine Horlock	Department of Agriculture and Fisheries, Queensland
Gary Artlett	Department of Agriculture and Fisheries, Queensland
Anthony Young	Productivity Services, NSW Sugar Milling Cooperative
Rick Beattie	Productivity Services, NSW Sugar Milling Cooperative
Greg Shannon	Productivity Services, Tully Sugar Limited
Sam Malfroy	Plant Health Australia
Alison Saunders	Plant Health Australia

Review processes

With the support of CANEGROWERS and PHA this plan should be reviewed on a 4-5 year basis. The review process will ensure:

- Threat summary tables are updated to reflect current knowledge
- pest risk assessments are current
- changes to biosecurity processes and legislation are documented

- contact details and the reference to available resources is accurate

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

Opportunities to make out of session changes to the Biosecurity Plan, including the addition/subtraction of high priority pests or changes to legislation are currently being investigated. Such changes would need to include consultation and agreement of industry and governments, through Plant Health Committee (PHC). This flexibility will facilitate the plan's currency and relevance.

Document Overview

The Industry Biosecurity Plan developed for the Australian sugarcane industry focuses on three key areas which when considered together identify the biosecurity needs to be implemented through the life of the plan 2015-2020.

Threat identification and pest risk assessments

Guidelines are provided for the identification and ranking of biosecurity threats through a process of qualitative risk assessment. The primary goal is to coordinate identification of exotic pest threats that could impact on productivity, sustainability and marketability and to assess their potential impacts. This plan strengthens risk assessment work already being done both interstate and overseas. Key sugarcane biosecurity threats are detailed in threat summary tables (TST; Appendix 2), along with the high priority pest list (the top ranked plant pest threats for the sugarcane industry). Established pests and weeds of biosecurity significance are also listed in this section of the plan.

Risk mitigation and preparedness

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

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

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

Response management

This section provides a summary of what is in place should the Australian sugarcane industry be faced with responding to an emergency plant pest incursion. Areas covered in this section include the Emergency Plant Pest Response Deed (EPPRD), categorising pests under the EPPRD, PLANTPLAN (a generic response plan for Australian plant industries), industry specific response procedures and industry communication.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

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

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

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

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

Exotic Pests of the Sugarcane Industry

Threat identification

Information on exotic pest threats to the sugarcane 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.

Pest risk assessments

The assessment process used in this Biosecurity Plan was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2 and 11 [Food and Agriculture Organization of the United Nations (FAO), 2004; 2007]. A summary of the pest risk analysis protocol followed in this Biosecurity Plan is shown in Table 4 and the complete protocol used for pest risk analysis in this Biosecurity Plan can be found on the PHA website[11].

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

Modifications of the Department of Agriculture and Water Resources protocol (DAFF 2011) have been made to suit the analysis required in the Biosecurity Plan development process, including, but not limited to:

- **Entry potential:** The determination of entry potential in this Biosecurity Plan takes into account multiple possible pathways for the legal importation of plant material as well as illegal pathways, contamination and the possibility of introduction through natural means such as wind. Therefore the scope is wider than that used by the Department of Agriculture and Water Resources in their IRA process, which only considers legal importation of plants or plant commodities.
- **Potential economic impact** of pest establishment in this document only takes into account the impacts on the sugarcane industry. The Department of Agriculture and Water Resources IRA process has a wider scope, including the effects to all of Australia's plant industries, trade, the environment and public health.
- **Risk potentials and impacts:** The number of categories used in this Biosecurity Plan for describing the entry, establishment, spread and potential economic impact (see 'Description of terms used in pest risk tables', page 41) differs in comparison to that used in the Department of Agriculture and Water Resources IRA process.

11 Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

Table 4. *Summary of pest risk assessment process used in Biosecurity Plans*

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 Biosecurity Plan

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

Risk assessment may be undertaken to various degrees of refinement, depending on the risk information and data available. Assessment may be qualitative, semi-quantitative, quantitative, or a combination of these. The complexity and cost of assessment increase with the production of more quantitative data. It is often more practical to first obtain a general indication of the level of risk through qualitative risk assessment and if necessary, undertake more specific quantitative assessment later [Australian Standard/New Zealand Standard (AS/NZS) ISO 31000, 2009].

At this time, only invertebrate pests (insects, mites, molluscs and nematodes) and pathogens (disease causing organisms) have been identified for exotic pest risk assessment.

Ranking pest threats

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

- What is the probability of entry into Australia, establishment and spread, for each pest?
- What are the likely impacts of the pest on cost of production, overall productivity and market access?

- How difficult is each pest to identify and control and/or eradicate?

The TSTs (Appendix 2) present a list of potential plant pest threats to the sugarcane industry and provide summarised information on entry, establishment and spread potential, the economic consequences of establishment and eradication potential (where available). The most serious threats from the TSTs were identified through a process of qualitative risk assessment[12] and are listed in the HPP list (Table 5).

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

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

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 5.

Entry potential

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

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

Establishment potential

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

Spread potential

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

Economic impact

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

Sugarcane industry high priority exotic pests

Table 5 provides an overview of the top ranked threats to the sugarcane industry. Further details on each pest along with the basis for the likelihood ratings are provided in the threat summary tables (Appendix 2). Assessments may change given more detailed research and the priority list will be reviewed with the Biosecurity Plan on a 4-5 year basis. An explanation of the method used for calculating the overall risk can be found on the PHA website[13].

Table 5. *Sugarcane industry high priority plant pest threat list*

Common name	Scientific name	Host(s)	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
INVERTEBRATES								
HEMIPTERA								
Sugarcane whitefly	*Aleurolobus barodensis*	*Saccharum* spp., *Erianthus aurundinaceum, Erianthus ciliaris, Miscanthus* spp.	Leaf, stem	HIGH	HIGH	HIGH	HIGH	HIGH
Sugarcane woolly aphid	*Ceratovacuna lanigera*	*Saccharum* spp., *Miscanthus* spp., *Alternanthera sessilis, Brachiaria mutica, Cynodon dactylon, Columella trifolia, Digitaria sanguinalis, Eragrostis japonica, Eclipta prostrate, Eleusine* spp.	Leaf	HIGH	HIGH	HIGH	HIGH	HIGH
Sugarcane leafhopper **(as a vector of Ramu stunt disease)**	*Eumetopina flavipes*[14]	*Saccharum officinarum*	Leaf	HIGH	HIGH	HIGH	EXTREME	EXTREME

13 Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

14 *E. flavipes* is a vector for Ramu stunt disease, a plant disease which affects sugarcane. Ramu stunt disease is found throughout Papua New Guinea, but has not been detected in Australia. Virus-free populations of *E. flavipes* are present on *Saccharum* hybrids and *S. officinarum* on many islands in the Torres Strait, and a number of small populations persist on the northern Cape York Peninsula.

Common name	Scientific name	Host(s)	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sugarcane planthopper (as a vector of Fiji leaf gall disease)	*Perkinsiella vastatrix*	*Saccharum* spp., *Sorghum bicolour, Zea mays*	Leaf	HIGH	HIGH	HIGH	EXTREME	EXTREME
***Sugarcane planthopper* (as a vector of Fiji leaf gall disease)**	*Perkinsiella vitiensis*	*Saccharum* spp.	Leaf	HIGH	HIGH	HIGH	EXTREME	EXTREME
Sugarcane pyrilla	*Pyrilla perpusilla*	*Saccharum* spp., *Sorghum bicolour, Avena sativa, Avena fatua, Bambusa arundinacea, Hordeum vulgare, Oryza sativa, Panicum colonum, Panicum maximum*	Leaf	MEDIUM	HIGH	HIGH	HIGH	HIGH
LEPIDOPTERA								
Sugarcane internode borer	*Chilo auricilius*	*Saccharum* spp., *Oryza sativa*, *Dactyloctenium aegyptium, Echinochloa colona, Echinochloa frumentacea, Echinochloa stagnina, Eleusine indica*	Stem	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
Yellow top borer of sugarcane	*Chilo infuscatellus*	*Saccharum* spp., *Panicum miliaceum, Oryza sativa, Sorghum bicolor*	Stem	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
Sugarcane internode borer	*Chilo sacchariphagus*	*Saccharum* spp., *Zea mays, Oryza sativa*, *Sorghum bicolor*	Stem	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
Dark headed rice borer	*Chilo terrenellus*	*Saccharum* spp., other grasses, *Zea mays, Oryza sativa, Oryza latifolia, Eriochloa* spp., *Panicum* spp.	Stem	HIGH	HIGH	HIGH	EXTREME	EXTREME
Spotted sugarcane stem borer	*Chilo tumidicostalis*	*Saccharum* spp.	Stem	MEDIUM	HIGH	HIGH	EXTREME	EXTREME

Common name	Scientific name	Host(s)	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
African sugarcane stalkborer	*Eldana saccharina*	*Saccharum* spp., grasses and sedges	Stem	LOW	HIGH	HIGH	EXTREME	HIGH
Root borer	*Polyocha depressella*	Sugarcane	Roots	LOW	HIGH	HIGH	EXTREME	HIGH
Top borer	*Scirpophaga excerptalis*	*Saccharum* spp., *Sorghum halepense*	Growing points / plant top	HIGH	HIGH	HIGH	EXTREME	EXTREME
Pink stalk borer	*Sesamia grisescens*	*Saccharum* spp., *Pennisetum purpureum, Panicum maximum*	Stem	HIGH	HIGH	HIGH	EXTREME	EXTREME
PATHOGENS								
BACTERIA								
Leaf scald	*Xanthomonas albilineans* (exotic strains- serological groups 2 or 3)	*Saccharum* spp.	Leaf, stem	HIGH	HIGH	HIGH	HIGH	HIGH
FUNGI								
Leaf scorch	*Stagonospora sacchari*	*Saccharum* complex species[15], *Miscanthus sinensis*, *M. floridulus.*	Leaf	MEDIUM	HIGH	HIGH	HIGH	HIGH
OOMYCETE								
Downy mildew	*Peronosclerospora philippinensis*	*Zea mays*, *Saccharum* interspecific hybrids, *S. officinarum,* oats, sorghum, maize	Leaf, stem	MEDIUM	HIGH	HIGH	HIGH	HIGH
Downy mildew	*Peronosclerospora sacchari*	*Saccharum* complex species[16], *Zea mays*	Leaf, stem, inflorescence	MEDIUM	HIGH	HIGH	HIGH	HIGH

15 *Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*, *S. barberi*, *S. sinense*

16 *Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*, *S. barberi*, *S. sinense*

Common name	Scientific name	Host(s)	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
PHYTOPLASMA								
Grassy shoot (with vector)	*Grassy shoot phytoplasma*	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf, stem	MEDIUM	HIGH	HIGH	HIGH	HIGH
White leaf (with vector - *Matsumuratettix hiroglyphicus)*	*White leaf phytoplasma*	*Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*	Leaf, stem	MEDIUM	HIGH	HIGH	HIGH	HIGH
VIRUS								
Sugarcane streak mosaic virus	*Sugarcane streak mosaic virus (Poacevirus)*	*Saccharum* spp.	Leaf	MEDIUM	HIGH	HIGH	HIGH	HIGH
Ramu stunt (with vector)	*Suspect virus (Tenuivirus)*	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf, stem	MEDIUM	HIGH	HIGH	EXTREME	EXTREME

Established Pests of Biosecurity Significance

Introduction

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

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

The pests listed in this section are under active industry management programs either nationally or in specific growing regions. This may include biosecurity zones, coordinated breeding programs for resistance and/or movement restrictions between regions.

Threat identification

Information on established pests of the sugarcane 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

Prioritising pest threats

Although established pests listed in this plan (Table 6) had to meet the criteria listed below for establishment, spread and economic impact, these pests did not undergo a formal pest risk assessment. These pests were considered in an effort to prioritise investment.

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

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

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

Table 6. Established pests of biosecurity significance

Common name	Scientific Name	Hosts	Distribution in Australia	Notifiable in NSW or Qld?	Plant part affected and effect on crop	Comments
INVERTEBRATES						
COLEOPTERA						
Sugarcane weevil borer	*Rhabdoscelus obscurus*	*Saccharum spp.,* palm species	Occurs in central and northern Queensland but not in southern Queensland sugarcane fields.	No	The larvae of the borer live in the stalk causing deterioration and loss of weight in stalks. This reduces yield and sugar content and sugar quality.	Weevil borer is partially controlled by resistant varieties. Insecticide can be used in severe infestations. Biosecurity zones and restrictions on the movement of sugarcane plant material and contaminated machinery in Queensland are designed to prevent the spread of this pest. For more information see **www.sugarresearch.com.au/icms_docs/157653_IS13073_Sugarcane_weevil_borer.pdf**
PATHOGENS						
BACTERIA						
Ratoon stunting disease	*Leifsonia xyli* subsp. *xyli*	*Saccharum* spp.	Ratoon stunting disease (RSD) is present in all sugarcane growing regions of Australia except the Ord River in Western Australia.	No	RSD has no external symptoms. The bacteria live in the xylem cells where they restrict water flow. Small red-brown dots can be seen in nodes. RSD can cause losses of 20-60%. Losses are greater during periods of moisture stress	Control of RSD involves the use of disease-free planting material from approved seed schemes, on-farm plant source inspections, diagnostic laboratories and good crop hygiene. Hot water treatment is used to establish disease-free planting material. General biosecurity zone regulations assist in preventing spread of this disease to growers who have eliminated the disease from their farms and to approved seed plots. For more information see **www.sugarresearch.com.au/icms_docs/164123_ISI3007_RSD.pdf**

Common name	Scientific Name	Hosts	Distribution in Australia	Notifiable in NSW or Qld?	Plant part affected and effect on crop	Comments
Leaf scald	*Xanthomonas albilineans (serotype 1)*	*Saccharum* spp.	Leaf scald is present in all sugarcane growing regions of Australia, except the Ord River in Western Australia. Major epidemics of leaf scald have occurred in the Central and Burdekin regions. The disease is rare in the Bundaberg region.	No	*X. albilineans* can remain latent in some varieties for long periods (> 12 months) while showing no symptoms. Stress can trigger the infected plant to pass from the latent phase to the chronic phase. Chronic infection results in chlorotic (white) stripes and patches of chlorotic tissue on leaves and burning at leaf tips. In some susceptible varieties, leaf scald can cause the sudden death of whole stools.	Control of leaf scald involves the use of disease resistant varieties, disease-free planting material from approved seed schemes and good crop hygiene. Biosecurity zones and restrictions on the movement of sugarcane plant material and contaminated machinery in Queensland are designed to prevent the spread of this disease. For more information see **www.sugarresearch.com.au/icms_docs/164142_Leaf_scaled_IS13002.pdf**
FUNGUS						
Sugarcane smut	*Sporisorum sacchari*	*Saccharum* spp., limited infection of *Rottboellia and Imperata*	Smut is present in all sugarcane growing areas of Australia	No	Smut infects through buds and the fungus grows in association with the meristems in plants. Infected plants produce a characteristic whip-like structure from the meristem and are severely stunted with thin stalks. Severely affected plants can die.	Control of smut is primarily by resistant varieties. Breeding resistant varieties is essential for continued viability of the industry and growers should not plant susceptible varieties. For more information see **www.sugarresearch.com.au/icms_docs/164128_ISI3012_Sugarcane_Smut.pdf**

Common name	Scientific Name	Hosts	Distribution in Australia	Notifiable in NSW or Qld?	Plant part affected and effect on crop	Comments
OOMYCETE						
Pachymetra root rot	*Pachymetra chaunorhiza*	*Saccharum* spp.	Pachymetra root rot is present in all regions but has limited distribution in some districts particularly the Burdekin region where it has only been recorded on a few farms.	No	Pachymetra root rot attacks the primary roots of plants and causes a soft flaccid rot of these roots. Root systems are restricted which can cause yield losses of up to 40%. Plants can tip out of the ground causing loss of plants at harvest and processing problems at the sugar mills due to excessive levels of soil.	The only economically viable control method is to use disease resistant varieties. General biosecurity zone regulations assist in preventing spread of this disease to regions with limited distribution of the disease. For more information see **www.sugarresearch.com.au/icms_docs/164121_ISI3005_Pachymetra_Root_Rot.pdf**
VIRUS						
Fiji leaf gall	*Fiji disease virus* (FDV)	*Saccharum* spp.	Fiji leaf gall virus is confined to the central and southern sugarcane growing regions of Australia, despite the vector (*Perkinsiella saccharicida*) occurring throughout all sugarcane growing regions of Queensland and New South Wales.	Yes, Qld.	The presence of galls on the underside of the leaf blade and midrib is a characteristic of this disease. The galls vary in size from 1 mm to 200 mm in length. Fiji leaf gall can cause severe stunting, profuse tillering and death of plants. Leaves are often shorter than normal and have a ragged edge, giving the appearance that an animal has bitten the top of the plant. The leaves can be darker green in colour than healthy leaves. The growing point often dies, causing side-shooting on stalks. Stunting is particularly severe in ratoon crops and when infected stalks are planted.	Fiji leaf gall is a notifiable disease under Queensland state government legislation. Control is by resistant varieties and disease-free planting material. Biosecurity zones and restrictions on the movement of sugarcane plant material and contaminated machinery in Queensland are designed to prevent the spread of this disease. For more information see **www.sugarresearch.com.au/icms_docs/164119_ISI3003_Fiji_Leaf_Gall.pdf**

Common name	Scientific Name	Hosts	Distribution in Australia	Notifiable in NSW or Qld?	Plant part affected and effect on crop	Comments
Sugarcane striate mosaic-associated virus	*Sugarcane striate mosaic-associated virus*	*Saccharum* spp.	Only present in the Burdekin district of Queensland.	Yes, Qld.	The symptom that characterises this disease is short, fine striations on the leaves. Striations can vary in number from a few to so many that the greater part of the leaf blade is covered. The striations are a lighter green than the normal leaf colour and appear on the youngest leaves first. This disease can cause death of plants and failure of ratoon crops.	The only economically viable control method is to use disease resistant varieties. Regularly obtaining disease-free seed and planting the seed can on areas that are free of the disease are important in management of the disease. Biosecurity zones and restrictions on the movement of sugarcane plant material and contaminated machinery in Queensland are designed to prevent the spread of this disease. For more information see **www.sugarresearch.com.au/icms_docs/171007_Sugarcane_striate_mosaic_IS13127.pdf**
Sugarcane mosaic virus (Strain A)	*Sugarcane mosaic virus (Strain A)*	*Saccharum* spp.	Sugarcane mosaic virus has been recorded in all sugarcane growing regions in Queensland and New South Wales, but is currently restricted to the Southern region, particularly the Bundaberg and Childers districts.	Yes, Qld.	This disease is characterised by a mosaic pattern of various shades of green to yellow on the leaf. The symptoms are most obvious in young rapidly growing leaves. Infected plants can suffer yield losses of 20-30% in ratoons.	The only economically viable control method is to use disease resistant varieties. It is also important to obtain disease-free seed. Biosecurity zones and restrictions on the movement of sugarcane plant material and contaminated machinery in Queensland are designed to prevent the spread of this disease. For more information see **www.sugarresearch.com.au/icms_docs/164120_ISI3004_Sugarcane_Mosaic.pdf**

Established Weeds of Biosecurity Significance

Introduction

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

Although weeds were not formally included in the EPPRD at the time that this Biosecurity Plan was released, weeds may be included or dealt with in a similar way in the future. Therefore, it is critical that the sugarcane industry start reviewing the threat of established weeds to their production system.

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

The weeds listed in this section are under active industry management programs either nationally or in specific growing regions. This may include biosecurity zones, coordinated breeding programs for resistance and/or movement restrictions between regions.

Threat identification

Information on weeds of the sugarcane 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.

Prioritising pest threats

In an effort to prioritise investment for weeds, each of the pests listed in Table 7 had to meet the required definitions for spread, establishment and economic impact listed below.

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

Establishment: The weed, and its reproduction mechanism (i.e. seed, fruit, plant part) has the potential to survive and become established throughout most of the growing regions of the crop. Distribution is not limited by environment conditions that prevail in Australia. Based upon its current distribution in Australia, and known conditions of survival, it is likely to survive in in the majority of regions where the host is grown.

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

Table 7. Weeds of biosecurity significance

Common name	Scientific Name	Distribution in Australia	Notifiable in NSW or Qld?	Effect on crop	Comments
Siam weed	*Chromolaena odorata*	Present between Cairns and Townsville in Queensland.	Yes, Qld and NSW.	Siam weed is considered one of the world's most invasive weeds. It was first identified in Australia in 1994 at several sites along the Tully River in Far North Queensland. Siam weed is a to 2-3 m perennial with a bushy habit forming dense thickets, however, it can also form lianas capable of growing on other vegetation to height of 20 m. Siam weed is capable of out-competing and smothering crops because of its rapid growth rate (around 5 m per year). Because of this, it has the potential to seriously affect agricultural and horticultural production systems, including sugarcane.	Siam weed is a Class 1 declared pest plant under the *Land Protection (Pest and Stock Route Management) Act 2002* and a Class 1 declared pest plant under the *Noxious Weeds Act 1993*. For more information see: **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/siam-weed** and **www.daf.qld.gov.au/__data/assets/pdf_file/0015/50028/IPA-Siam-Weed-PP49.pdf** and **www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/alert/pubs/c-odorata.pdf**
Olive hymenachne	*Hymenachne amplexicaulis*	It is present in various locations from Cape York to as far south as Casino in New South Wales, and in the top end of the Northern Territory.	Yes, Qld and NSW.	Hymenachne is a Weed of National Significance. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. Hymenachne is a perennial, robust grass to 2.5 m tall. It can grow above or below water, with its roots in the ground. It invades permanent water bodies and seasonally inundated wetlands. It blocks waterways, potentially causing flooding and threatening drinking water. It infests and blocks drainage and irrigation channels used for sugar cane and contaminates sugar cane crops.	Olive hymenachne is a declared Class 2 pest plant under *Land Protection (Pest and Stock Route Management) Act 2002* and a Class 1 declared pest plant under the *Noxious Weeds Act 1993*. For more information see: **www.daf.qld.gov.au/__data/assets/pdf_file/0007/77092/IPA-Hymenachne-PP54.pdf** and **www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/h-amplexicaulis.pdf**

Common name	Scientific Name	Distribution in Australia	Notifiable in NSW or Qld?	Effect on crop	Comments
Giant sensitive plant	*Mimosa diplotricha* *(*Syn. *Mimosa invisa)*	Giant sensitive plant is now naturalised in the high rainfall areas of coastal North Queensland from Ingham to Cooktown and also around Mackay.	Yes, Qld and NSW.	Giant sensitive plant is a shrubby or sprawling annual plant, but can also behave as a sprawling perennial vine. Giant sensitive plant is capable of outcompeting crops, such as sugarcane, causing major losses in production. The best control method involves a systematic approach, including the use of herbicides, mechanical removal, such as slashing, burning, releasing biological control agents and good farm hygiene. This involves thoroughly cleaning all machinery before leaving and entering farms or infested fields so seeds are not spread from contaminated areas.	Giant sensitive plant is a declared Class 2 pest plant under *Land Protection (Pest and Stock Route Management) Act 2002.* For more information see: **www.daf.qld.gov.au/__data/assets/pdf_file/0017/67121/IPA-Giant-Sensitive-Plant-PP27.pdf**
Itch grass	*Rottboellia cochinchinensis*	Itch grass is a locally declared weed in the Burdekin region. Itch grass is also common in the Prosperine district and extends south to the Calen area.	No	Itch grass is an erect, coarse, cane–like, annual grass growing to 3 metres in height and is unpalatable to livestock and wildlife. Itch grass has invaded sugarcane fields in several different regions of Australia. It is difficult to manage once established because of its size and rapid growth rate. It is capable of outcompeting sugarcane which can lead to severe crop losses in heavy infestations. The best control method involves a systematic approach, including the use of herbicides and good farm hygiene. This involves thoroughly cleaning all machinery before leaving and entering farms or infested fields so seeds are not spread from contaminated areas.	For more information see: **www.sugarresearch.com.au/icms_docs/164155_Itch_grass_IS13078.pdf** and Reef Catchments has a program related to Itch grass **www.reefcatchments.com.au/**
Sicklepods	*Senna obtusifolia, Senna tora* and *Senna hirsuta*	Dense infestations occur north of Mackay and south-west of Ingham, and parts of the Atherton tablelands	Yes, Qld.	Sicklepods can invade and completely dominate pastures and other disturbed areas such as roadsides, fence lines, creek banks and disturbed areas such as farmland. They have the potential to become major weeds of many crops within a matter of two or three growing seasons. Each of the sicklepods are vigorously growing, very competitive woody shrubs which grow about 1.5-2.5m tall and 1m wide. It is normally an annual, but plants which have been slashed or have survive chemical treatments often reshoot, flower and last another year. Seed reserves of 2000seeds/m^2 have been recorded in dense stands. Seeds can remain viable for up to 10 years.	All three sicklepods are declared Class 2 pest plant under *Land Protection (Pest and Stock Route Management) Act 2002.* For more information see: **www.daf.qld.gov.au/__data/assets/pdf_file/0013/51052/IPA-Sicklepod-PP18.pdf** and **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/sicklepod**

Common name	Scientific Name	Distribution in Australia	Notifiable in NSW or Qld?	Effect on crop	Comments
Singapore daisy	*Sphagneticola trilobata* *(Syn. Wedelia trilobata)*	Found in South-East Queensland and coastal areas of northern and central Queensland.	Yes, NSW.	Singapore daisy is a vigorous ground cover with lush glossy green leaves. The leaves are usually 3 lobed and in pairs up the stem. Singapore diasy produces yellow to orange-yellow daisy flowers about 2 cm across all year round. The flowers are held above the leaves on short stalks. Singapore daisy is a garden escapee and native of tropical America. It is also becoming a problem by invading lawns, irrigated areas and around drains. The best control method involves using a combination of herbicide and pulling up runners. The plant will regrow from the smallest cutting so disposal of waste carefully is critical to ongoing management of this weed. Singapore daisy is becoming problematic in the Wet Tropics and has the potential to invade canelands in most districts. It can spread rapidly and smothers plants, out-competing them for survival.	Singapore daisy is a declared Class 3 pest plant under *Land Protection (Pest and Stock Route Management) Act 2002* and a Class 2 declared pest plant under the *Noxious Weeds Act 1993*. For more information see: **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/singapore-daisy/?a=64000** and **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/singapore-daisy**
Red witchweed	*Striga asiatica*	Present in the Mackay region of Queensland.	Yes, Qld and NSW	Red witchweed is a parasitic plant. It attaches to the host plant roots (such as sugarcane and a number of other grass species) via a specialised swelling called a haustorium. The weed then robs its host of water and nutrients, leading to decreased host plant growth. Red witchweed was first detected on a sugarcane property in Mackay in 2013. As of February 2015, it has been found on five properties in Mackay.	Red witchweed is a Class 1 declared pest plant under the *Land Protection (Pest and Stock Route Management) Act 2002* and a Class 1 declared pest plant under the *Noxious Weeds Act 1993*. Biosecurity Queensland is undertaking surveillance in the Mackay region to determine the spread of the weed and to put control measures in place. Any properties placed under movement restrictions cannot move equipment, soil or plant material on or off an affected property without approval from Biosecurity Queensland. For more information see: **www.sugarresearch.com.au/icms_docs/162584_Red_witchweed_fact_sheet.pdf** and **www.sugarresearch.com.au/icms_docs/166233_Red_witchweed_identification_guide.pdf**

In Queensland, there are three classes of declared plants under the *Land Protection (Pest and Stock Route Management) Act 2002.* These plants are targeted for control because they have, or could have, serious economic, environmental or social impacts. There are legal obligations associated with the control, supply, sale, keeping and transport of declared plants in Queensland. Declaration under state legislation imposes various legal responsibilities for control by landowners on land under their management, including all landowning state agencies. It is illegal to supply a declared plant anywhere in Queensland without a permit issued by Biosecurity Queensland. For more information about each of the following classes, see the following links:

Class 1 - **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/declared-plants/class-1**
Class 2 - **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/declared-plants/class-2**
Class 3 - **www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/declared-plants/class-3**

In New South Wales, there are five classes of declared plants under the *Noxious Weeds Act 1993*. These plants are regulated because they have, or could have, serious economic, environmental or social impacts. Declared weeds have obligations associated with the control, supply, sale, keeping and transport of noxious weeds in New South Wales.

Classes one, two and five are notifiable weeds and have additional requirements to inform the department if found. Declaration under state legislation imposes various legal responsibilities for control by landowners on land under their management, including all landowning state agencies. For more information on declared noxious weeds and their classes in New South Wales visit **www.dpi.nsw.gov.au/aboutus/about/legislation-acts/noxious-weeds**.

RISK MITIGATION AND PREPAREDNESS

Introduction

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/standards**) and Commonwealth and State/Territory legislation.

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

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

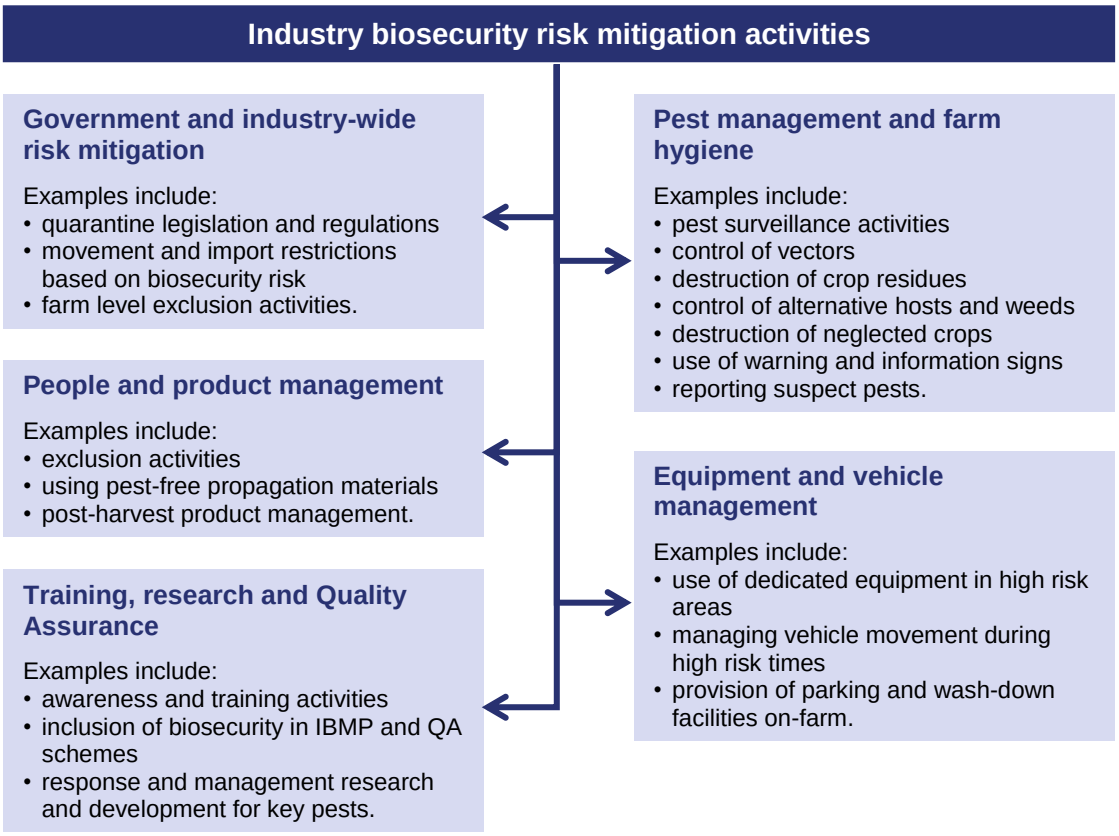


Figure 2. *Examples of biosecurity risk mitigation activities*

Barrier Quarantine

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

National level – importation restrictions

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

The Department of Agriculture and Water Resources 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, the Department of Agriculture and Water Resources undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. The Department of Agriculture and Water Resources 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, the Department of Agriculture and Water Resources assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants. Further information can be found at **www.agriculture.gov.au**.

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

Australia of fruit, seed, or other plant material, is the responsibility of the Department of Agriculture and Water Resources.

The Australian Biosecurity Import Conditions (BICON) database[17] at **www.agriculture.gov.au/import/bicon,** contains the current Australian import conditions for more than 20,000 foreign plants, animal, mineral and biological 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. For export conditions see the Manual of Importing Country Requirements (MICoR) database at **www.daff.gov.au/micor/Plants/.**

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

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

17 Note BICON recently replaced the Import Conditions (ICON) database in November 2015.

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread sugarcane pests is of high importance. Each state/territory has quarantine legislation in place to control the importation of cotton material interstate and intrastate, and to manage agreed pests if an incursion occurs (refer to Table 8). 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 Subcommittee for Domestic Quarantine and Market Access (SDQMA).

Moving plant material between states/territories generally requires permits from the appropriate authority, depending on the plant species and which state/territory 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 sugarcane can be obtained by contacting your local state or territory agriculture agency directly (see Table 8), or through the SDQMA website **www.domesticquarantine.org.au** which lists relevant contacts in each state/territory as well as Interstate Certification Assurance (ICA) documents relating to each state/territory.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state/territory has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Information on vehicle and equipment movement restrictions can be obtained by contacting your local state/territory department of agriculture (Table 8).

Table 8. *Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers*

State	Administering authority	Legislation	Links to quarantine manual[18]	Phone
ACT	Environment ACT **www.environment.act.gov.au**	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*	See NSW conditions	13 22 81
NSW	Department of Primary Industries **www.dpi.nsw.gov.au**	*Plant Diseases Act 1924* *Plant Diseases Regulation 2008* *Noxious Weeds Act 1993* *Noxious Weeds Regulation 2008*	**www.dpi.nsw.gov.au/biosecurity/plant**[19]	02 6391 3384
NT	Department of Primary Industry and Fisheries **www.nt.gov.au/d/Primary_Industry**	*Plant Health Act 2008* *Plant Health Regulations 2011*	**www.nt.gov.au/d/Primary_Industry/index.cfm?newscat1=&newscat2=&header=NT%20Quarantine**	08 8999 2118
Qld	Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland **www.daff.qld.gov.au/4790.htm**	*Plant Protection Act 1989* *Plant Protection Regulation 2002*	**www.daff.qld.gov.au/plants/moving-plants-and-plant-products**	132 523[20] 07 3404 6999[21]
SA	Primary Industries and Regions SA **www.pir.sa.gov.au**	*Plant Health Act 2009* *Plant Health Regulations 2010*	**www.pir.sa.gov.au/biosecuritysa/planthealth/legislation/plant_quarantine_standard**	08 8207 7820
Tas	Department of Primary Industries, Parks, Water and Environment **www.dpipwe.tas.gov.au**	*Plant Quarantine Act 1997* *Weed Management Act 1999*	**www.dpipwe.tas.gov.au/biosecurity/plant-biosecurity/plant-biosecurity-manual**	1300 368 550
Vic	Department of Economic Development, Jobs, Transport and Resources, Victoria **www.agriculture.vic.gov.au**	*Plant Biosecurity Act 2010* *Plant Biosecurity Regulations 2012*	**www.agriculture.vic.gov.au/psb**	136 186
WA	Department of Agriculture and Food **www.agric.wa.gov.au**	*Biosecurity and Agricultural Management Act 2007*	**www.agric.wa.gov.au/qtine/default.asp**	08 9334 1800

18 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

19 Click on the link and download the Plant Quarantine Manual

20 Within Qld

21 Interstate

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from DPI NSW Regulatory Services by phone 02 6391 3384 or by visiting the NSW Department of Primary Industries website **www.dpi.nsw.gov.au/biosecurity/plant**. This website contains the link to the NSW Plant Quarantine Manual.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory (NT) is vested in the Department of Primary Industry and Fisheries (DPIF) under the *Plant Health Act 2008* and *Plant Health Regulations 2011*. The Act enables notifiable pests to be gazetted, quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. Plant import requirements for particular pests, plants or plant related materials are identified in the Regulations. Further information on NT import requirements and treatments can be obtained by contacting NT Quarantine on (08) 8999 2118 or email **quarantine@nt.gov.au.**

For more information refer to the DPIF website (**www.nt.gov.au/d/Primary_Industry**) or the Plant Health Manual (see link in Table 8).

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Queensland, as well as maps of pest quarantine areas, may be obtained from the Biosecurity Queensland part of the DAF Queensland website (**www.daf.qld.gov.au/plants/moving-plants-and-plant-products**). Further details can be obtained from the DAF Queensland Customer Service Centre (13 25 23 within Queensland, or phone 07 3404 6999 or fax 07 3404 6900 interstate).

South Australia

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

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

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

Tasmania

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

General and specific import conditions apply to the importation of plant material into Tasmania to prevent the introduction of pests and diseases into the State. Plants and plant products must not be imported into Tasmania unless State import requirements are met and a Notice of Intention to import has been provided to a Biosecurity Tasmania inspector not less than 24 hours prior to the importation. All consignments must be accompanied by a Plant Health Certificate or Plant Health Assurance Certificate. For further information on import conditions consult the Plant Biosecurity Manual (see link in Table 8).

Victoria

The movement into Victoria of plants and plant products may be subject to a prohibition, or to one or more conditions which may include chemical treatments. These prohibitions and conditions are described on the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) website (see link in Table 8). Some items may need to be presented to a DEDJTR inspector or an accredited business, for checking of details such as correct certification, labelling or treatment.

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

Western Australia

Western Australia is naturally free from a large number of pests and diseases that are present in many other parts of the world. WA's geographical isolation in conjunction with a robust plant biosecurity system including border and intrastate regulations, industry and public awareness campaigns and surveillance programs maintains this status.

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

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

- The requirement for all potential carriers to be presented to an inspector for inspection upon arrival in WA.

- Soil is prohibited entry and imported goods, including containers, must be free from soil.
- Freedom from pests and diseases of quarantine concern to WA.
- In addition to the general requirements, specific requirements are in place for movement into and within the state.

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

Farm level – exclusion activities

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

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

One major way this can be achieved is through management of industry biosecurity at the farm level using exclusion practices. Further detail on potential strategies is included in the Biosecurity Manual for the Sugarcane Industry (see Page 81). This manual outlines farm biosecurity exclusion activities that reduce the chance of pests spreading onto, and between farms.

Other components of the supply chain

This plan has a strong focus on mitigation activities on farm. It is important to consider other sources of threat across the supply chain.

- **Propagation material – Approved seed and tissue culture**

An approved-seed scheme provides cane growers with disease-free seed of varieties that are true-to-type. Disease-free seed (stalks, billets, setts or tissue culture plantlets used for planting) is a key control measure for established systemic diseases of sugarcane, including ratoon stunting disease (RSD), leaf scald, Fiji leaf gall, smut, chlorotic streak and mosaic. This method of providing disease-free seed would be critical in emergency responses to many of the priority exotic disease threats.

Provision of a nucleus of disease-free or approved seed in each mill area in the Australian sugar industry is co-ordinated by SRA, in cooperation with the distribution agents of SRA varieties. In most areas, the distribution agents are local Productivity Service companies. SRA provides the distribution agents with a disease-free supply of new varieties. These varieties have been DNA fingerprinted to ensure correct identification and that they are true-to-type. The distribution agent multiplies the new varieties following strict procedures and sells the approved seed to growers. The growers use the cane as a nucleus to further multiply the varieties on their farm in preparation for planting commercial fields.

All new SRA varieties are covered by Plant Breeder's Rights, and an agreement between SRA and the distribution agent allows the latter to provide these varieties to growers who have signed a PBR License Agreement.

Approved-seed plots follow world's best practice for disease management in sugarcane. Quality-control measures are built into the procedures to ensure that, as far as possible, the disease-free status of the plots is maintained. This involves regular visual inspection and sampling for RSD. Variety integrity is also ensured by sampling leaves of varieties for DNA fingerprinting to ensure that variety identification is correct. SRA Procedures for the Establishment and Operation of Approved seed plots MN07002 provides details of the operation of approved seed plots.

Hot-water treatment plays an important role in the production of approved seed. Industry research has shown that hot-water treatment can control RSD, leaf scald and chlorotic streak, and overseas research has shown that smut can be controlled by hot-water treatment. Hot-water treatment can affect germination, and in many regions cane is first hot-water treated and planted into a mother plot. Cane from the mother plot is used to establish the approved-seed plot from which cane is supplied to growers. The use of the mother-plot system reduces the risk of large areas of germination failure after hot-water treatment. In some districts where insect borne or aerially borne diseases are present, the mother plots are established in a remote area to reduce the risk of spread of these diseases from commercial crops.

Productivity Service companies in the sugar industry provide a service to inspect on-farm plant sources for diseases and other problems with planting material. These inspections provide the sugar industry with surveillance of a broad sample of crops for any disease of concern including early detection of potential incursions. Sugarcane smut was identified for the first time in Queensland by a Productivity Service inspector during a plant source inspection in Queensland in 2006.

- **Transport of sugarcane to mill**

Sugarcane is transported from the farm directly to the sugar mill in bins carried by trucks or cane railways operated by the sugar mills. In the cane railway scenario the bins are loaded at or delivered to sidings, generally situated near to the farms. In road transport systems, the bins of cane are collected from loading pads situated either on farm or near to farms. During transport some pests or diseases could be spread within a region. Although green harvest and trash blanketing of harvested fields is the most common practice in the industry, sugarcane is still burnt before harvest on 25% to 30% of farms for reasons relating to irrigation or crop agronomy. The burning of the crop can reduce the risk of spread of some pests and diseases during transport although in some circumstances the updraft in front of the fire may launch spores of a disease, increasing the risk of spread. In general terms though, because of the bulk of the sugarcane and the continuous movement of cane throughout the harvest period it is very difficult to minimise the spread-of-disease risks during transport. Where a specific pest incursion occurs the risks of spread during transport after harvest would need to be assessed to determine the options available to minimise the risk of spread of the pest.

- **Sugarcane mulch and fodder**

Sugarcane trash (leaf material removed from the cane by the sugarcane harvesters and left in the field) is used extensively as garden mulch in an industry with a value in excess of $20 million per annum. The trash is left in the field for 1-2 months on the soil surface until it dries to approximately 12-25% moisture content and then baled. The bales are often stored for up to 6 months before sale or processing. The bales are moved to processing plants where soil is sifted out of the trash and the trash is cut into pieces less than 10 mm in size before compressing into bags for sale at nurseries and hardware stores throughout Australia. Large processing plants can source bales of trash from a number of regions throughout Queensland. Some bales are sold directly through nurseries or from the farm gate. Unprocessed bales can contain viable stalk pieces that can germinate within the bale if it gets wet and therefore pose a greater risk of spreading pests and diseases.

Sugarcane mulch and bulk sugarcane is sometimes sold to cattle growers for fodder, particularly during periods of drought in inland regions. These cattle production areas are generally many kilometres from sugarcane production areas and therefore present a very low risk to the sugar industry. Generally this is a low risk if the cane is transported via routes that move inland and not along the coast through sugarcane production areas. Queensland Pest Quarantine Area regulations prevent the movement of cane between zones without an inspector’s approval.

Sugarcane mulch could represent a threat for the movement of pests, pathogens and weeds. Western Australia has banned the import of sugarcane mulch because of the risk of spread of weeds, after they found evidence that sensitive weed had been spread in the mulch. Some restrictions were enforced on movement of mulch during the emergency response when smut was found in Queensland in 2006. The risk presented by sugarcane mulch would need to be assessed for each emergency response depending on the biology of the pest.

Surveillance

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

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

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 reduces 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 (i.e. 'passive surveillance'), provided individuals are aware of what to look for and of reporting procedures. Consultants and crop scouts can provide valuable information as they are regularly in the field, and hence can observe any unusual pest activity or symptoms on plants.

National surveillance programs

The Department of Agriculture and Water Resources maintains barrier quarantine services at all international ports and in the Torres Strait region. The Department of Agriculture and Water Resources 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 and wind currents) as part of the Northern Australia Quarantine Strategy (NAQS). NAQS surveillance programs relevant to the sugarcane industry are listed in Table 9.

State surveillance programs

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

The state/territory agriculture department can provide:

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

Various pest surveillance programs are managed by the Department of Agriculture and Water Resources and the state/territory agriculture departments. Many state/territory departments run general surveillance programs whereby suspect samples can be forwarded and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the sugarcane industry (exotic or those under official control in a region or state/territory) are shown in Table 9.

Table 9. *Official surveillance programs that target pests of the sugarcane industry (as at December 2014)*[22]

Surveillance program	State/region	Sugarcane pests targeted	Host targeted
NAQS pest and disease surveys (multiple surveillance programs)	Australia's northern coastline from Cairns to Broome (Qld, NT and WA)	*Stagonospora sacchari, Fulmekiola serrata, Peronosclerospora philippinensis, Sorghum mosaic virus (Potyvirus), Sesamia grisescens, Peronosclerospora sacchari, Chilo auricilius, Sugarcane streak mosaic virus (Poacevirus) (exotic strains), Perkinsiella vastatrix, Perkinsiella vitiensis, Chilo terrenellus, Ceratovacuna lanigera, Scirpophaga excerptalis, Chilo infuscatellus, Ramu stunt disease* (unknown etiology), *Aleurolobus barodensis, Amblypelta cocophaga, Sesamia inferens*	Tropical horticultural and agricultural species
Jurisdictional programs			
Multiple Pest Surveillance	Brisbane and Gladstone (Qld)	*Dorysthenes buqueti*	Plantation and native forest species, sugarcane, citrus, lychee guava and tropical/subtropical fruit
Sugar industry surveys, seed cane inspections, variety trials and general pest surveys	Sugarcane production areas	A variety of pests are surveyed for.	Sugarcane.

Farm surveillance activities

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

22 Information presented has been taken from the National Plant Health Status Report 2014 and confirmed or updated in January 2015 by the Subcommittee on National Plant Health Surveillance (sub-committee of the Plant Health Committee)

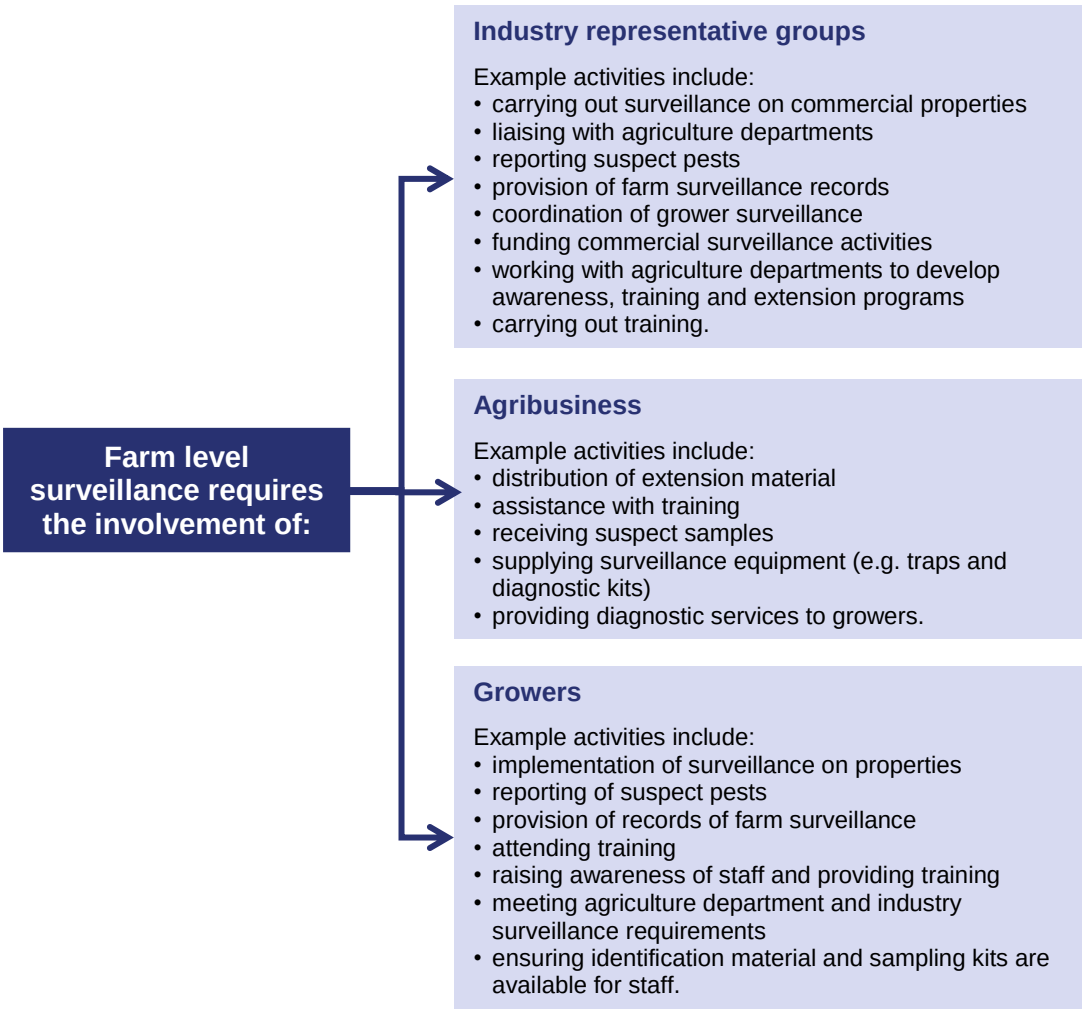


Figure 3. *Examples of farm level surveillance activities*

Industry-wide surveillance activities

The Australian sugar industry has an industry owned research organisation, Sugar Research Australia (SRA), and in most areas, regional industry funded Productivity Service companies. These organisations conduct regular surveillance of crops in the sugar industry. The surveillance is primarily conducted to identify or monitor for established and endemic diseases and pests, however any unusual (potentially exotic) diseases or pests would be identified during these inspections. Unusual findings are reported to local advisory staff, SRA experts or to government authorities. SRA experts regularly train SRA and Productivity Service staff in the identification of established, endemic and exotic diseases and pests.

SRA inspects all of its experiment stations and experiments on grower's properties at least once a year. The total area of SRA trials is approximately 350 ha. The results of these inspections are recorded in experimental work books or electronic files.

Productivity Service companies are usually the first point of contact for growers who find unusual symptoms in their cane. Productivity service companies also provide an inspection service for grower seed cane sources. The Productivity Service staff will inspect prospective seed cane for systemic diseases and pests that may affect germination or spread disease in the seed cane. The extent of this service varies between districts. In addition to responding to grower reports and seed cane inspections, Productivity Service companies will conduct surveys and monitor activity of diseases and pests. The extent and purpose of the surveys will vary from year to year and from region to region. In 2014, Productivity Service companies were asked for their estimate of the percentage of their region that was inspected as part of seed cane and general surveillance during the last twelve months. On average 20% of the whole sugarcane growing area was inspected to some extent (approximately 75,000 ha of the 375,000 ha of sugarcane). In some cases the inspection would be a perimeter survey but in other cases, such as seed cane inspections, more intensive inspections were conducted. As noted above these inspections were primarily for established or endemic diseases or pests but unusual symptoms would be noted if found.

Productivity Service companies also run 'approved seed schemes' for industry. Approved seed plots are located in all regions. These approved seed plots are intensively inspected at least three times per year and great care is taken to prevent spread of diseases within the approved seed. Records of these inspections are kept by the Productivity service staff in notebooks or as electronic records. Some mill areas have GIS systems and all pest and disease records are kept as a layer in the GIS database. The GIS database is also used for storing variety, crop class, productivity and other records. Sugar mills keep detailed maps of their cane suppliers and every farm, and block within a farm, are numbered. Productivity Service staff record any findings against these mill farm and block numbers.

The results of the surveillance are used for local disease and pest management or in some cases for inter-regional management. Movement of sugarcane between biosecurity zones within Queensland is controlled by state government regulation. The policy decisions about the restrictions on movement are based on surveillance information about the incidence of pests and diseases of quarantine concern that have restricted distribution within the industry. The industry relies on the Productivity Services to conduct this surveillance

There is currently no centralised reporting of the surveillance conducted by the industry.

Training

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

National EPP Training Program

PHA supports members in training personnel through the delivery of the National EPP Training Program. This program is focussed on ensuring personnel have the skills and knowledge to effectively fulfil the roles and responsibilities of parties under the EPPRD. This covers a range of areas, from representatives on the national decision making committees (i.e. the Consultative Committee on Emergency Plant Pests and the National Management Group) through to industry liaison personnel in a Local Control Centre.

Under the National EPP Training Program simulation exercises can also be conducted. These simulation exercises of an EPP incursion provide in-depth practical training, assess the preparedness of the industry for a pest incursion, increase understanding of the required roles and resources, identify communication gaps and highlight the interaction between industry and governments during an incursion response.

In addition to face to face training delivered to members and the provision of simulation exercises, PHA also offers biosecurity training through BOLT, an online training platform. Access to BOLT is free and open to any stakeholder interested in biosecurity, and is available through **www.planthealthaustralia.com.au/bolt**.

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

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities raise the profile of biosecurity and exotic pest threats to the sugarcane industry, which increases the chance of early detection and reporting of suspect pests. Responsibility for awareness material lies with industry and government, with assistance from PHA as

appropriate. Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department.

High priority plant pest threat-related documents

Pests listed in Table 5 have been identified as high priority threats to the sugarcane industry by members of the IBG. They have been assessed as having high entry, establishment and spread potentials and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

Further information on high priority pests

In addition to the fact sheets listed in Table 13, the websites listed below (Table 10) contain information on pests across most plant industries, including the sugarcane industry.

Table 10. *Sources of information on high priority pest threats for the sugarcane industry*

Source	Website
Department of Agriculture and Water Resources	**www.agriculture.gov.au**
Pest and Disease Image Library (PaDIL)	**www.padil.gov.au**
Sugar Research Australia	**www.sugarresearch.com.au/page/Growing_cane/Pests_Diseases/**
University of California Statewide Integrated Pest Management (IPM) Program	**www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html**
Knowledge Master[23]	**www.extento.hawaii.edu/Kbase/crop/crop.htm**
European and Mediterranean Plant Protection Organization (EPPO)	**www.eppo.int/DATABASES/pqr/pqr.htm**

23 Developed by University of Hawaii, College of Tropical Agriculture and Human Resources and Hawaii Department of Agriculture

Further information/relevant web sites

A range of government and grower organisation details and websites are provided below (Table 11) for persons seeking further information on sugarcane industry biosecurity.

Table 11. *Relevant sources of further biosecurity information for the sugarcane industry*

Agency	Website/email	Phone	Address
National			
Queensland Cane Growers Organisation (CANEGROWERS)	**www.canegrowers.com.au**	(07) 3864 6444	Level 6, 100 Edward St GPO BOX 1032 Brisbane, QLD 4000
Australian Sugar Milling Council	**www.asmc.com.au**	(07) 3231 5000	IBM Building, Level 3, 348 Edward St GPO BOX 945 Brisbane, QLD 4001
Department of Agriculture and Water Resources	**www.agriculture.gov.au**	(02) 6272 3933 1800 020 504	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	**www.planthealthaustralia.com.au** **biosecurity@phau.com.au**	(02) 6215 7700	Level 1, 1 Phipps Cl Deakin, ACT 2600
Sugar Research Australia	**www.sugarresearch.com.au**	(07) 3331 3333	50 Meiers Road Indooroopilly, QLD 4068
New South Wales			
Department of Primary Industries	**www.dpi.nsw.gov.au/biosecurity/plant**	(02) 6391 3535	Locked Bag 21 Orange, NSW 2800

Agency	Website/email	Phone	Address
Queensland			
Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland	**www.daf.qld.gov.au** **callweb@daff.qld.gov.au**	13 25 23[24] 07 3404 6999[25]	80 Ann Street Brisbane, QLD 4000
Northern Territory			
Department of Primary Industry and Fisheries	**www.nt.gov.au/d/Primary_Industry** **info.DPIF@nt.gov.au**	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
South Australia			
Primary Industries and Regions SA	**www.pir.sa.gov.au** **www.pir.sa.gov.au/pirsa/content/customer_enquiry_form**	(08) 8226 0900	GPO Box 1671 Adelaide, SA 5001
Biosecurity SA-Plant Health	**www.pir.sa.gov.au/biosecuritysa/planthealth**	(08) 8207 7820	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, Parks, Water and Environment	**www.dpipwe.tas.gov.au** **BPI.Enquiries@dpipwe.tas.gov.au**	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Department of Economic Development, Jobs, Transport and Resources	**www.agriculture.vic.gov.au**	136 186	Plant Biosecurity and Product Integrity 475 Mickleham Road Attwood Vic 3049

24 Within Qld
25 Interstate

Agency	Website/email	Phone	Address
Western Australia			
Department of Agriculture and Food	**www.agric.wa.gov.au** **enquiries@agric.wa.gov.au**	(08) 9368 3333	DAFWA 3 Baron-Hay Court South Perth, WA 6151

Farm biosecurity

Introduction

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

Farm biosecurity measures can be used to minimise the spread of such pests before their presence is known or after they are identified, and therefore can greatly increase the likelihood that they could be eradicated. PHA, in conjunction with CANEGROWERS, Sugar Research Australia and the Australian Sugar Milling Council, has developed a Farm Biosecurity Manual for the Sugarcane Industry (**www.planthealthaustralia.com.au/industries/sugarcane**) which outlines farm biosecurity and hygiene measures that help reduce the impact of pests on the industry. The manual covers biosecurity aspects such as:

- recognising the HPPs (established and exotic) of the sugarcane industry
- monitoring for the presence of pests
- reporting anything unusual
- biosecurity obligation of growers under new state biosecurity legislation
- the use of high health status farm inputs such as certified propagation material
- quality and hygiene Best Management Practices
- disposal of waste plant material
- maintenance of records for trace-back and trace-forward purposes
- safe use of chemicals
- managing the movement of people
- visiting overseas farms – what to watch out for when you return
- the use of warning and information signs
- managing the movements of vehicles and machinery
- washdown facilities and designated parking areas.

Pest quarantine areas

Under the existing *Plant Protection Act 1998* (Qld), it is a legal requirement that all sugarcane machinery must be cleaned to be visibly free from soil and plant material and inspected before it can be moved between pest quarantine areas (PQAs) in Queensland. This is in an effort to prevent the spread of sugarcane diseases and has helped prevent the further spread of Fiji leaf gall and Mosaic virus within the Queensland industry. Sugar industry inspectors are

available throughout Queensland to inspect sugarcane machinery. The commercial sugarcane production regions in Queensland are located within these PQAs (Figure 4). For more information about the PQA's, visit **www.business.qld.gov.au/industry/agriculture/land-management/moving-biomatter/sugarcane-machiner**y.[26]

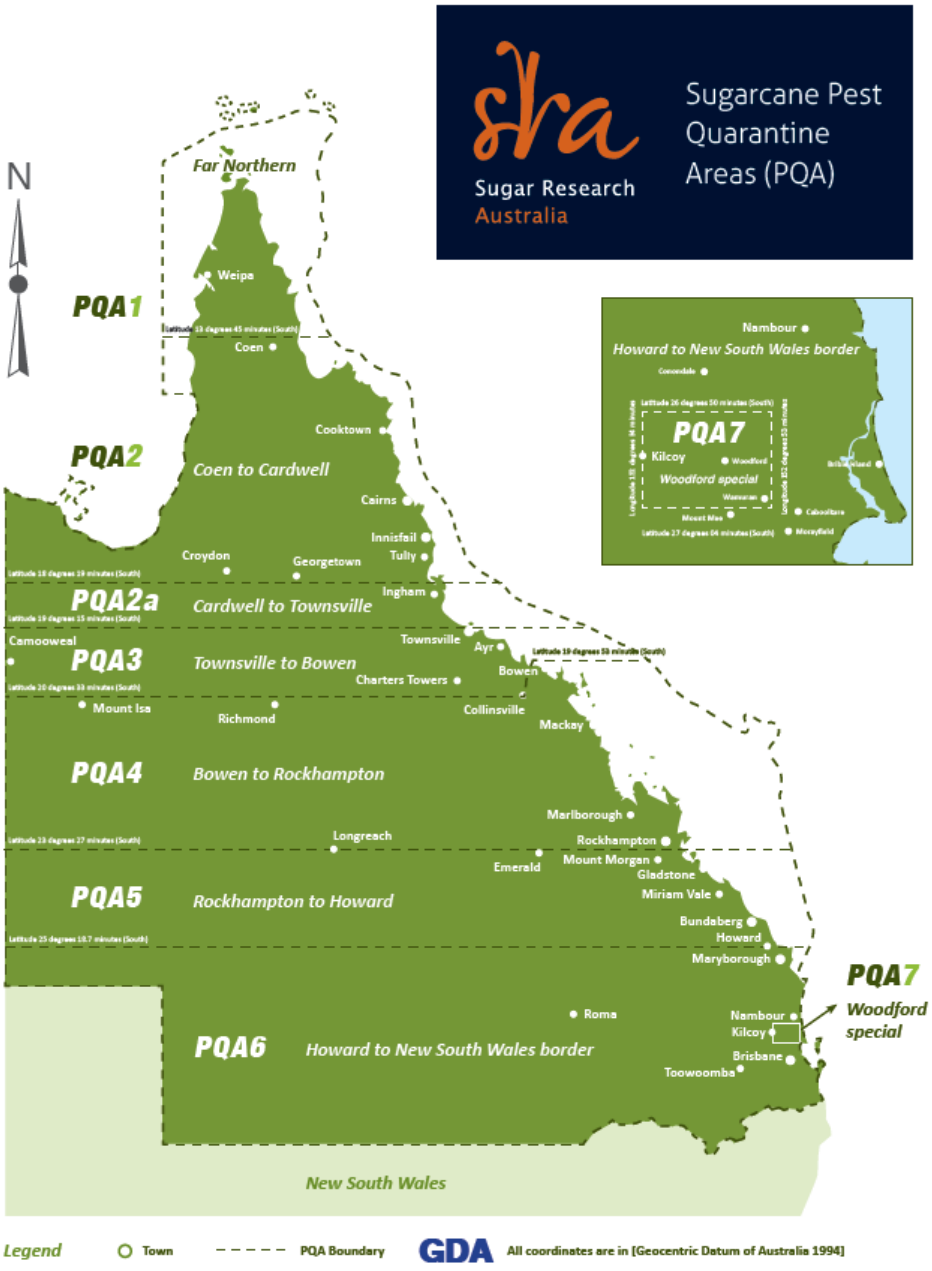


Figure 4. Pest Quarantine Areas in Queensland

[26] From July 2016, legislation for the Queensland Biosecurity Act (2014) will be enacted. This will include legislation that establishes Biosecurity Zones for the sugarcane industry which will replace the existing PQA's. Once this change occurs, this document will be updated accordingly to reflect the new Biosecurity Zones.

Approved varieties

The Chief Executive Officer (CEO) of the Queensland Department of Agriculture and Fisheries approves sugarcane varieties for planting in each of the PQAs in Queensland. The CEO must assess the disease resistance of varieties being considered for approval. Only varieties approved for a PQA can be grown in that PQA. Growing non-approved varieties is an offence under the *Plant Protection Act 1989*. The list of approved varieties for each area can be found in the *Plant Protection (Approved Sugarcane Varieties) Declaration 2003*[27]. In some instances, Plant Protection Act Inspectors can authorise the planting of non-approved varieties for research purposes.

At present, management of the choice of varieties is controlled by the Plant *Protection Act 1989*, *Plant Protection Regulation 2002* and the *Plant Protection (Approved Sugarcane Varieties) Declaration 2003*.[28]

Host plant resistance is the main strategy for disease management in the Queensland sugar industry. An important component of this strategy is the ability to control which varieties can be grown in a region. These regulations prevent the growing of a disease susceptible variety by a small number of growers where the financial impact of growing the variety will not be restricted to this group of growers but will be incurred by all growers in a local region. The decision of a small number of growers to grow susceptible varieties is neither a fair nor reasonable economic consequence for the growing and milling sectors in the district. Because sugarcane is a perennial crop, the industry cannot quickly respond to a disease outbreak and replace susceptible varieties with resistant varieties. Disease epidemics can have serious long-term economic consequences for a district.

For more information about approved varieties, visit the SRA website[29] or the DAF QLD[30] website.

Reporting suspect pests

EXOTIC PLANT PEST HOTLINE
1800 084 881

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.

[27] **www.legislation.qld.gov.au/LEGISLTN/CURRENT/P/PlantProApDc03.pd**
[28] From July 2016, legislation for the Queensland Biosecurity Act (2014) will be enacted. This will include legislation that establishes an Industry Code of Practice for Varietal Selection. Once this change occurs, this document will be updated accordingly.
[29] **www.sugarresearch.com.au/icms_docs/167176_Approved_released_and_reccomended_varieties_IS13124.pdf**
[30] **www.daf.qld.gov.au/plants/field-crops-and-pastures/sugar/approved-sugarcane-varieties**

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

Some sugarcane pests are notifiable under each state or territory's quarantine legislation. The complete list of notifiable pests can be downloaded from the PHA website[31]; however, each state's list of notifiable pests are subject to change over time so contacting your local state/territory agricultural agency (details in Table 8) will ensure information is up to date. Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture agency of the presence of those pests within a defined timeframe (Table 12).

Table 12. *Timeframe for reporting of notifiable pests as defined in state/territory legislation*

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

Suspect material should not generally be moved or collected without seeking advice from the relevant state/territory agriculture agency, as incorrect handling of samples could spread the

[31] Available from **www.planthealthaustralia.com.au/biosecurity/notifiable-pests**

pest or render the samples unsuitable for diagnostic purposes. State/territory agriculture officers will usually be responsible for sampling and identification of pests.

Pest-Specific Emergency Response and Information Documents

To help prepare for an incursion response a listing of pest-specific emergency response and information documents are provided that may support a response. Over time, as more of these documents are produced for pests of the sugarcane industry they will be included in this document and made available through the PHA website, or through industry website. This includes the development of pest-specific information and emergency response documents, such as fact sheets, contingency plans, diagnostic protocols and a summary of surveillance programs currently operating for these high priority pests (see Table 2). These documents and programs should be developed over time for all medium to extreme risk pests listed in the TSTs (Appendix 2: Threat Summary Tables).

Fact sheets

Individual fact sheets or information sheets are a key activity of biosecurity extension and education with growers. Fact sheets provide summary information about the pest, its biology, what it looks like and what symptoms it may cause. They also contain detailed images. For a list of current fact sheets available for sugarcane producers see Table 13.

Table 13. *Sugarcane pests for which fact sheets have been developed by industry, PHA or by state/territory agriculture agencies and the Department of Agriculture and Water Resources*

Common name	Scientific name	Document link
Coconut bug	*Amblypelta cocophaga*	PHA fact sheet **www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Coconut-bug-FS.pdf**
African sugarcane stalkborer	*Eldana saccharina*	SRA biosecurity bulletin **www.sugarresearch.com.au/icms_docs/157737_Bulletin_Vol_23_Biosecurity_feature-Part_3_Pests_that_we_dont_have_and_dont_want-The_African_sugarcane_mothborer_Eldana_sachharina.pdf**
Downy mildew	*Peronosclerospora sacchari* and *P. philippinensis*	SRA fact sheet **www.sugarresearch.com.au/icms_docs/164676_Downy_mildew_IS13089.pdf**

Common name	Scientific name	Document link
Grassy shoot	Phytoplasma (*Candidatus phytoplasma*)	SRA fact sheet **www.sugarresearch.com.au/icms_docs/164678_Green_grassy_shoot_disease_IS13088.pdf**
Ramu stunt	Suspect virus	SRA fact sheet **www.sugarresearch.com.au/icms_docs/164677_Ramu_stunt_IS13090.pdf**
White leaf	White leaf phytoplasma	SRA fact sheet **www.sugarresearch.com.au/icms_docs/164675_White_leaf_disease_IS13087.pdf**

SRA have also developed comprehensive pest and disease field guides which are able to be downloaded electronically in tablet and mobile friendly formats. Publications include:

Diseases of Australian Sugarcane (2015)
www.sugarresearch.com.au/page/Growing_cane/Pests_Diseases/Diseases/Publications

Pests of Australian Sugarcane (2015)
www.sugarresearch.com.au/page/Growing_cane/Pests_Diseases/Pests/Publications/

Contingency plans and dossiers

Contingency Plans, or Dossiers, provide background information on the pest biology and available control measures to assist with preparedness for incursions of a specific pest into Australia. The contingency plan provides guidelines for steps to be undertaken and considered when developing a Response Plan for that pest. Any Response Plan developed using information in whole or in part from this Contingency Plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation. As a part of contingency planning, biological and chemical control options are considered as are options for breeding for pest resistance. Through this planning process, it may be discovered that there are gaps in knowledge. Such gaps should be identified and consequently be considered as RD&E needs to be met within the implementation table. For a list of current contingency plans and dossiers developed for the sugarcane industry see Table 14.

Table 14. *Sugarcane pests for which draft or finalised contingency plans, or dossiers, have been developed*

Common name	Scientific name	Document link
Bakanae	*Gibberella fujikuroi*	PHA contingency plan developed for the rice industry **www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Bakanae-CP-2008.pdf**
African sugarcane borer	*Eldana saccharina*	SRA dossier **www.sugarresearch.com.au/icms_docs/163503_Eldana_saccharina_Dossier.pdf**
Downy mildew	*Peronosclerospora spontanea*	SRA dossier **www.sugarresearch.com.au/icms_docs/163502_Downy_Mildew_Peronosclerospora_spp_Dossier.pdf**
May beetle	*Phyllophaga* spp.	PHA contingency plan developed for the grains industry **www.planthealthaustralia.com.au/wp-content/uploads/2013/03/May-beetle-CP-2008.pdf**
Oriental sugarcane thrips	*Fulmekiola serrata*	SRA dossier **www.sugarresearch.com.au/icms_docs/163508_Oriental_sugarcane_thrips_Fulmekiola_serrata_Dossier.pdf**
Panicle blight	*Burkholderia glumae*	PHA contingency plan developed for the rice industry **www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Panicle-blight-CP-2008.pdf**
Philippine downy mildew of maize	*Peronosclerospora philippinensis*	PHA contingency plan developed for the grains industry **www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Downy-mildew-of-maize-and-sorghum-CP-2009.pdf**
Pink stem borer	*Sesamia inferens*	SRA dossier **www.sugarresearch.com.au/icms_docs/163514_Sesamia_spp_Dossier.pdf**
Ramu stunt disease	Unknown	SRA dossier **www.sugarresearch.com.au/icms_docs/163510_Ramu_stunt_Dossier.pdf**
Root borer	*Polyocha depressella*	SRA dossier **http://www.sugarresearch.com.au/icms_docs/163504_Emmalocera_depressella_Dossier.pdf**
Stem borer	*Sesamia* spp.	SRA dossier **www.sugarresearch.com.au/icms_docs/163514_Sesamia_spp_Dossier.pdf**
Sugarcane downy mildew	*Peronosclerospora* spp.	SRA dossier **www.sugarresearch.com.au/icms_docs/163502_Downy_Mildew_Peronosclerospora_spp_Dossier.pdf**

Common name	Scientific name	Document link
Sugarcane internode borer / Sugarcane stem borer/ Yellow top borer of sugarcane	*Chilo* spp.	SRA dossier **www.sugarresearch.com.au/icms_docs/163500_Chilo_spp_Dossier.pdf**
Sugarcane longhorn stem borer	*Dorysthenes buqueti*	SRA dossier **www.sugarresearch.com.au/icms_docs/163515_Sugarcane_longhorn_stemborer_Dorysthenes_buqueti_Dossier.pdf**
Sugarcane shoot borer	*Tetramoera schistaceana*	SRA dossier **www.sugarresearch.com.au/icms_docs/163516_Tetramoera_schistaceana_Dossier.pdf**
Top shoot borer	*Scirpophaga* spp.	SRA dossier **www.sugarresearch.com.au/icms_docs/163512_Scirpophaga_spp_Dossier.pdf**

National diagnostic protocols

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

Australia has a coherent and effective system for the development of NDPs, and other diagnostic protocols, for plant pests managed by the Subcommittee on Plant Health Diagnostics (SPHD). These protocols are peer reviewed and verified before being nationally endorsed.

In addition to NDPs, pest identification information is available through published articles and diagnostic protocols developed internationally. Taking this into account, SPHD have developed a scoring system to assist stakeholders to assess the quality of existing protocols for diagnosing pests in the Australian context (Table 15).

This system can be used by industry and government to identify gaps in preparedness and prioritise development of diagnostic resources. This system may also provide a level of confidence for biosecurity agencies on the reliability of a diagnosis generated by a diagnostic protocol/method.

Table 15. *Diagnostic resource scoring system*

Rating scale	Diagnostic protocol status
1	An unpublished protocol submitted to a diagnostician in Australia as part of an active response to a plant pest/disease incursion. A first draft of a National Diagnostic Protocol submitted more than 5 years ago to SPHD
2	A first draft of a NDP submitted within the last 5 years to SPHD
3	A diagnostic method published in a refereed journal paper within the last 5 years
4	A European Plant Protection Organisation (EPPO), North American Plant Protection Organisation (NAPPO) or New Zealand Ministry for Primary Industries (NZ MPI) endorsed protocol
5	A draft NDP undergoing review by SPHD
6	A draft NDP assessed for endorsement
7	A NDP endorsed by SPHD or an EPPO, NAPPO, NZ MPI endorsed protocol verified under Australian conditions
8	An International Plant Protection Convention (IPPC) protocol

For a list of current national diagnostic protocols, or draft diagnostic protocols, developed for the sugarcane industry see the following table.

Table 16. *Sugarcane high priority pests for which diagnostic protocols exist*

Scientific name	Common name	Protocol rating	Protocol comments
Aleurolobus barodensis	Sugarcane whitefly	4	EPPO Protocol
Ceratovacuna lanigera	Sugarcane woolly aphid	1	Draft NDP
Chilo auricilius	Sugarcane internode borer	1	Draft NDP
Chilo infuscatellus	Yellow top borer of sugarcane	1	Draft NDP
Chilo sacchariphagus	Sugarcane internode borer	1	Draft NDP
Chilo terrenellus	Dark headed rice borer	1	Draft NDP
Peronosclerospora sacchari	Downy mildew	1	Draft NDP
Scirpophaga excerptalis	Top borer	1	Draft NDP
Sesamia grisescens	Pink stalk borer	1	Draft NDP
Stagonospora sacchari	Leaf scorch	1	Draft NDP
Ramu stunt (with vector)	Suspect virus (Tenuivirus)	1	Draft NDP

Scientific name	Common name	Protocol rating	Protocol comments
White leaf (with vector - Matsumuratettix hiroglyphicus)	White leaf phytoplasma	1	Draft NDP

Endorsed NDPs are available on the National Plant Biosecurity Diagnostic Network (NPBDN) website (**www.plantbiosecuritydiagnostics.net.au**), together with additional information regarding their development and endorsement.

Diagnostic information for some sugarcane pests is also available from PaDIL (**www.padil.gov.au**) or the PHA (**www.planthealthaustralia.com.au/pidd**).

Research, Development and Extension

Research, development and extension – linking biosecurity outcomes to RD&E priorities

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

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

Sugar Research Australia Limited (SRA) was established on 1 July 2013 as an industry-owned company that invests in and manages a portfolio of RD&E projects that drive productivity, profitability and sustainability for the Australian sugar industry.

SRA is responsible for the direct provision of RD&E as well as the ongoing management and investment of funds received from industry levy payers and government, for the benefit of the sugar industry and for the wider public good. SRA's main sources of funds come from a

statutory levy paid by sugarcane growers and millers, matching funds from the Commonwealth Government and investments from the Queensland Government. SRA has a Strategic Plan which runs from 2013/14 to 2017/18.[32]

Exotic diseases and pests represent a significant threat to the continued security of cane supply for the Australian sugar industry. Cooperating with federal, state government departments and sugar industry organisations to prevent entry of these pests and to prepare for possible incursions is a high priority for the SRA biosecurity program.

SRA also has an active international research portfolio addressing some of the high priority exotic threats. Current research projects (in 2015) include:

- Integrated disease management of sugarcane streak mosaic in Indonesia. (Jointly funded with Australian Centre for International Agricultural Research)
- Securing Australia from PNG biosecurity threats – Ramu stunt virus, *Peronosclerospora sacchari* (Downy mildew), and *Sesamia grisescens, Chilo terrenellus, Scirpophaga excerptalis* and *Rhabdoscelus obscurus* borers

SRA researchers are active members of the International Society of Sugar Cane Technologists' Plant Pathology and Entomology Committees which have triannual workshops. These international links are valuable for identifying new developments and new threats. In collaboration with SRA plant breeding activities, the biosecurity program aims to breed disease and pest-resistant varieties and support quarantine and disease-free seed cane programs. Research on high priority established pests is a priority for SRA. A number of serious pests and diseases have limited distribution and SRA works closely with State governments and industry organisations to prevent the spread of these pests and diseases.,

Reference

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

32 **www.sugarresearch.com.au/icms_docs/188322_Strategic_Plan_201314-201718.pdf**

RESPONSE MANAGEMENT

Introduction

Gathering information, developing procedures and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, PHA is the custodian of the EPPRD and coordinated the development of PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing the procedures required and the roles and responsibilities of all Parties involved in an incursion response.

The following section provides details of the EPPRD and PLANTPLAN and also includes key contact details and communication procedures that should be used in the event of an incursion in the sugarcane industry.

The Emergency Plant Pest Response Deed

PHA is the custodian of the Emergency Plant Pest Response Deed (EPPRD). 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 31 national plant industry body signatories. CANEGROWERS is a member of PHA and became a signatory to the EPPRD on the 28th of October 2004.

The EPPRD has been negotiated between government and industry members of PHA to cover the management and funding arrangements of eradication responses to Emergency Plant Pest (EPP) Incidents, including the potential for owner reimbursement costs for growers. It also formalises the role of plant industries' participation in decision making, as well as their contribution towards the costs related to approved responses.

The ratification of the EPPRD by government and industry members significantly increased Australia's capacity to respond to emergency plant pest incursions. The key advantage of the EPPRD is a more timely, effective and efficient response to plant pest incursions, while minimising uncertainty over management and funding arrangements. Other significant benefits include:

- potential liabilities are known and funding mechanisms are agreed in advance
- industry and government are both involved in decision making about mounting and managing an emergency plant pest response from the outset
- reimbursement to growers whose crops or property are directly damaged or destroyed as a result of implementing an approved Response Plan
- a consistent and agreed national approach for managing incursions
- wider commitment to risk mitigation by all parties through the development and implementation of biosecurity strategies and programs
- motivation and rationale to maintain a reserve of trained personnel and technical expertise
- provision of accountability and transparency to all parties.
- Cost Sharing of eligible costs
- an Agreed Limit for Cost Sharing (calculated as 2% of the local value of production for one year of the Affected Industry Party or as defined in Schedule 14 of the EPPRD). The Agreed Limit can be exceeded with the agreement of Affected Parties.

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

PLANTPLAN

Underpinning the EPPRD is PLANTPLAN, the agreed technical response plan for an emergency plant pest incident. It provides nationally consistent guidelines for response procedures, outlining the phases of an incursion (investigation and alert, operational and stand down[33]), as well as the key roles and responsibilities of industry and government during each of the phases.

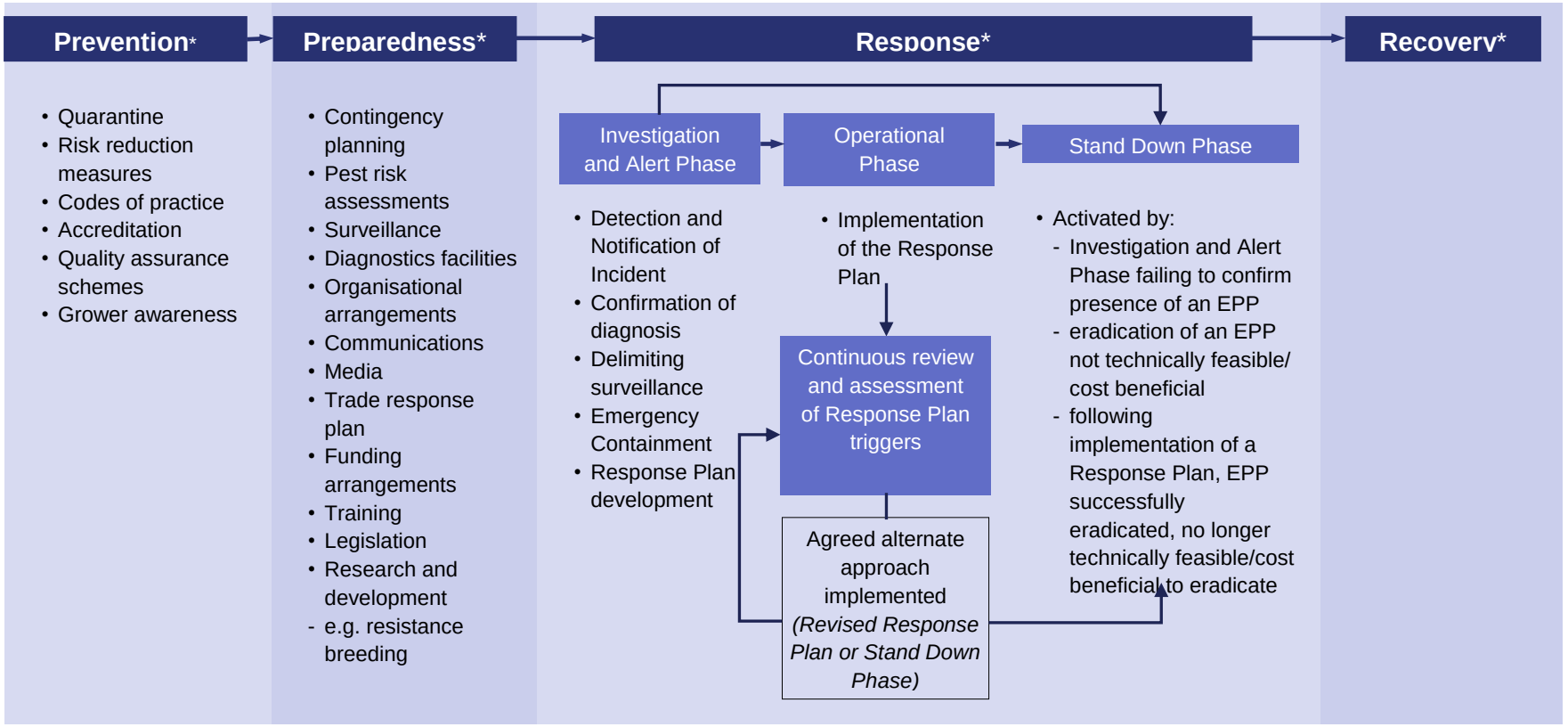
PLANTPLAN also provides a description of the management structures and information flow systems for the handling of a plant pest emergency at national, state/territory and district levels as well as guidelines, SOPs, forms/templates and jobcards. Guidance is provided for the operation of control centres, as well as outlining principles for the chain of responsibility, functions of sections, and role descriptions. PLANTPLAN is a general manual for use by all Government and Industry Parties during Plant Pest emergencies. PLANTPLAN incorporates best practice in emergency plant pest responses, and is updated regularly to incorporate new information or address gaps identified by the outcomes of incident reviews.

33 As of December 2014, the inclusion of Transition to Management programs is currently being assessed for inclusion into the EPPRD and PLANTPLAN.

PLANTPLAN is an appendix to the Emergency Plant Pest Response Deed and is endorsed by all signatories. PLANTPLAN is supported by individual industry biosecurity planning that covers industry and pest specific information, risk mitigation activities and contingency plans. It also provides a focus for training personnel in operational response and preparedness procedures. This ensures that the best possible guidance is provided to plant industries and governments in responding to serious Plant Pests.

The incursion management plan from PLANTPLAN (2016) has been summarised in Figure 5.

For more information about PLANTPLAN visit
www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/



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

Figure 5. *Summary of incursion management for plant industries according to PLANTPLAN (2016)*

Formal Categorisation of Pests for Inclusion in the EPPRD

The following section outlines one aspect of the EPPRD - the categorisation of EPPs.

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

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.

Categorisation of a Plant Pest is carried out to determine the Parties that are 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. an EPP listed as Category 1 is not deemed to be any more or less important than an EPP listed as Category 4.

Any Plant Pest considered by a Party to meet the definition of an EPP can be put forward for categorisation and inclusion in Schedule 13 of the EPPRD. Pests listed in the HPP threat list (Table 5) may provide a starting point for Industry to prioritise development of Categorisation requests as they have been determined to be of high priority to the Industry. 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 and the Guidelines for the Preparation of a Categorisation Request will be available from the PHA website **www.planthealthaustralia.com.au**.

How to Respond to a Suspect EPP

Following the detection of a suspect EPP, the relevant state agency should be immediately notified either directly or through the Exotic Plant Pest Hotline. Within 24 hours of the initial identification, the agency, through the State Chief Plant Health Manager (CPHM), will inform

the Australian Chief Plant Protection Office (ACPPO) who will notify all state agencies, relevant industry representatives and PHA (this process is outlined in Figure 6).

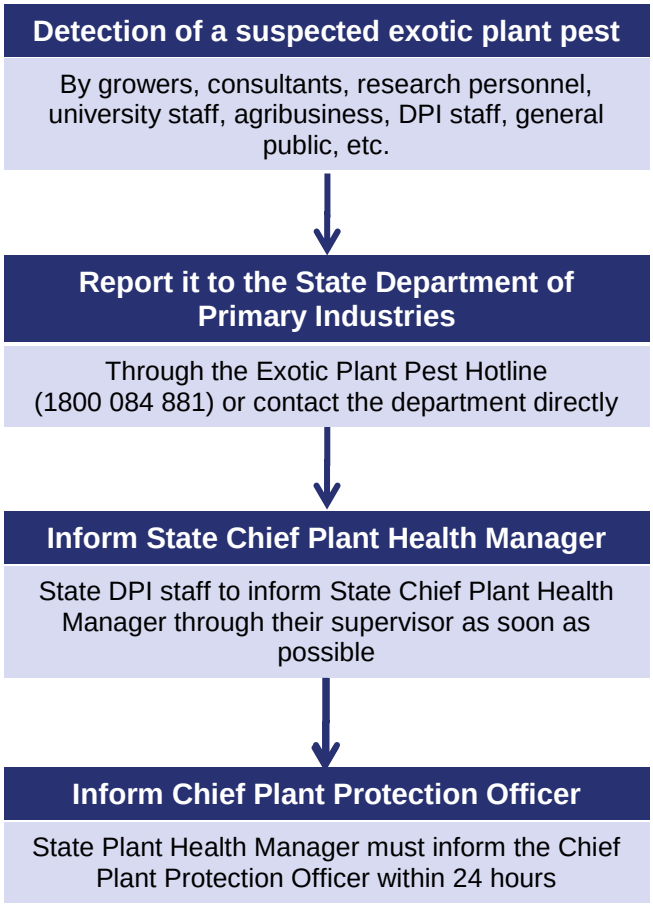


Figure 6. Suspect exotic plant pest detection reporting flowchart

Following the detection or reporting of the pest, the relevant state/territory agriculture agency will seek a confirmatory diagnosis from another laboratory, usually within a different jurisdiction. If the pest is suspected to be an EPP (meeting one of the four main criteria within the EPPRD), the general process (as described in PLANTPLAN) is as outlined in Figure 7.

If the pest is considered potentially serious and/or suspected to be an EPP, the relevant state/territory agriculture department will usually adopt precautionary emergency containment measures. These measures, depending on the Plant Pest, may include:

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

If an EPP is confirmed, technical and economic considerations are reviewed, and a decision made on whether to eradicate (managed under the EPPRD and a Response Plan) or take another course of action (potentially to contain or do nothing - long term management). Under the EPPRD all decisions are made by Committees with government and industry representation. At the Consultative Committee on Emergency Plant Pests (CCEPP) level, these decisions relate to the technical feasibility of eradication of the EPP in question. From a National Management Group (NMG) perspective, they relate to technical advice from the CCEPP as well as financial considerations.

During the Investigation and Alert Phase (Figure 7), the Affected area will be placed under quarantine until a decision is made on whether to eradicate the pest or not. If a decision has been made to pursue eradication and a Response Plan under the EPPRD is approved by the NMG, efforts enter the Operational Phase (Figure 7). Eradication methods used will vary according to the nature of the EPP involved and infested/infected material will be destroyed where necessary. All on ground response operations are undertaken by the relevant state agricultural department(s) in accord with the approved Response Plan and the relevant state/territory legislation.

In the Stand Down Phase (Figure 7), all operations are wound down. Where a plant pest emergency is not confirmed, those involved will be advised that the threat no longer exists. Where the EPP is successfully eradicated, the situation should begin to return to ‘normal’. Where the EPP is not able to be eradicated, future long term management and control options may be investigated. In all cases, the response is reviewed and any lessons learnt will be used to improve the system for the future.

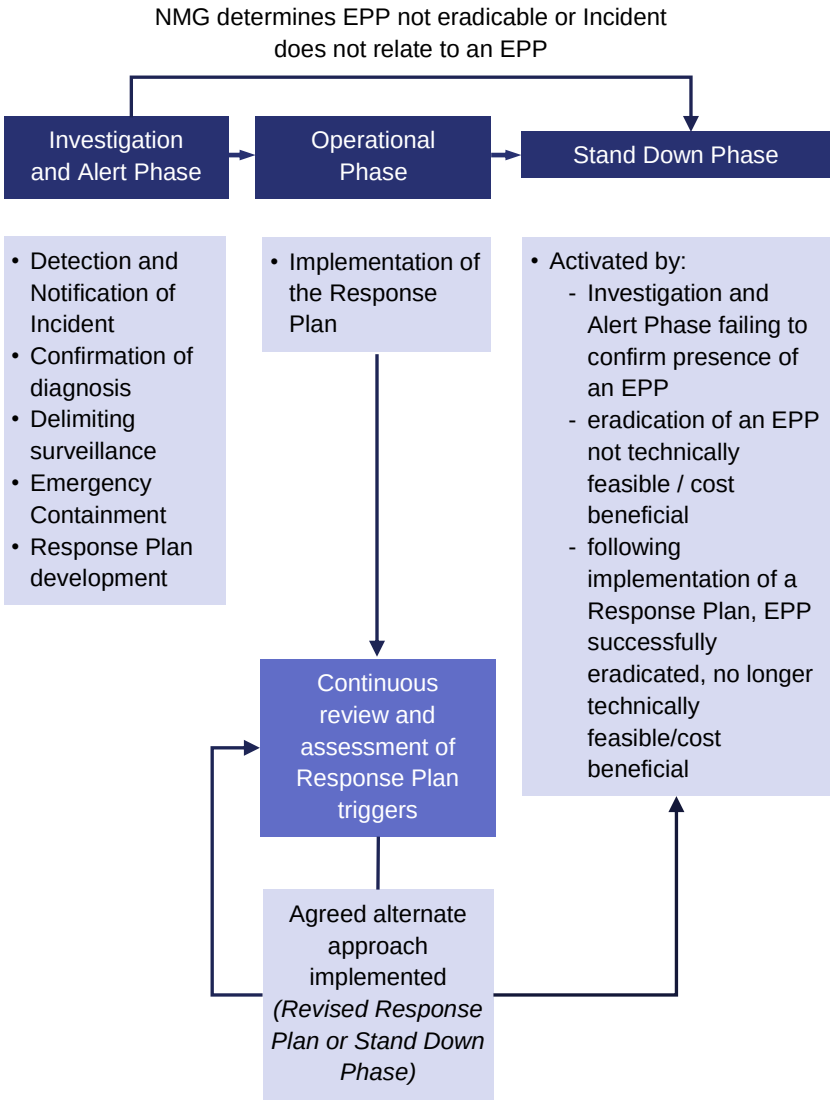


Figure 7. *General decision making and communication chain for a plant pest emergency response*

Industry Specific Response Procedures

Industry communication

As a signatory of the EPPRD, CANEGROWERS is the key industry contact point if an incursion affecting the sugarcane industry is detected, and will have responsibility for relevant industry communication and media relations (see PLANTPLAN for information on approved communications during an incursion). The contacts nominated for the CCEPP and the NMG by CANEGROWERS should be contacted immediately (Table 17) regarding any meetings of the CCEPP or NMG. It is important that all Parties to the EPPRD ensure their contacts for these committees are nominated to PHA and updated swiftly when personnel change.

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

Table 17. *Contact details for CANEGROWERS*

Website	**www.CANEGROWERS.org.au**
Address	Level 6, 100 Edward Street GPO BOX 1032 Brisbane QLD 4000
Contacts	Matt Kealley Senior Manager – Environment and Natural Resources
Email	Matt_Kealley@CANEGROWERS.com.au
Phone	(07) 3864 6444
Mobile	0407 657 779

References

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

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

DAFF (2011) Final pest risk analysis report for 'Candidatus Liberibacter species' and their vectors associated with Rutaceae. Department of Agriculture, Fisheries and Forestry, Canberra.

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

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

PLANTPLAN (2016) PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 2.0. (**www.planthealthaustralia.com.au/plantplan**).

APPENDIX 1: PROFILE OF THE AUSTRALIAN SUGARCANE INDUSTRY

Background on the Sugarcane Industry

Industry profile

The Australian Cane Growers Council Ltd (CANEGROWERS) was formed in 1925 and is the national peak body for Australian sugarcane growers. CANEGROWERS vision is to ensure a secure and profitable future for all sugarcane growers. Based in Queensland, the state that produces around 95% of Australia's raw sugar output, the CANEGROWERS national office represents the interests of sugarcane producers Australia wide.

The CANEGROWERS organisation exists to:

- Provide strong leadership for cane growers within a viable sugarcane industry
- Deliver effective representation and valuable services to all sugarcane growers
- Ensure sugarcane grower strength and influence at local, district and state/national/international levels through unity and shared common values.

For many years Queensland State Government regulations made it compulsory for all sugarcane producers in Queensland to belong to CANEGROWERS, but since 2000 membership has been voluntary. CANEGROWERS membership of around 80% of the national industry is amongst the highest for agricultural organisations in Australia. Membership of CANEGROWERS is made up of around 3760 large and small, corporate and family owned, irrigated and dryland growers in both Queensland and New South Wales.

The operations of CANEGROWERS are funded at all levels through annual fees paid by those growers who choose to become members, supplemented by income from various commercial activities. Members determine the amount of membership fee, which is generally calculated on the basis of an amount per tonne of cane harvested.

Membership of CANEGROWERS ensures that grower's needs are represented at the highest possible levels of industry and government decision-making. Structurally, CANEGROWERS comprises autonomous business units at the regional level, which are controlled by elected grower directors. Each of the Queensland's 21 sugar growing regions nominates a member to the CANEGROWERS Policy Council. The Policy Council in turn elects a Board every three years of eight grower directors and an independent Director, making up the nine-person Board.

In 15 major cane growing regions, grower-controlled companies operate CANEGROWERS offices from which professional staff provide a range of services and represent the special interests of members locally. This corporate structure provides local autonomy and control of assets and is well placed to deliver improved representative outcomes and member services.

The Australian Sugar Milling Council (ASMC) is a voluntary organisation, established in 1987 to represent Australian raw sugar mill owners and operators. The ASMC is the peak policy forum for mill owners and has as its mission to drive a profitable and sustainable sugar industry. The ASMC works with its members, other industry organisations and government to develop and promote policies that enhance the commercial development of the sugar industry in Australia.

Productivity Service companies are regional companies that are funded from a voluntary industry levy on growers and millers. The companies are managed by a board made up of elected growers and representatives of the milling company in the region. The companies provide extension, approved seed cane and on-farm services to growers. Staff of the Productivity Services are trained in the identification and control of pests and diseases and have a regulatory inspection role to enable the movement of machinery between biosecurity zones.

Crop production profile

Sugarcane (hybrid between *Saccharum officinarum* and *S. spontaneum*) is a member of the grass family (Poaceae) and is widely cultivated, providing around 70% of the world's sugar (Cope *et al.* 2010). Sugarcane is a tall grass, which looks like a bamboo cane, and grows 3-6 metres high with stems ranging from 25-45 millimetres in diameter.

It is believed that sugarcane originated in New Guinea, and was taken to the Americas by the explorer Christopher Columbus on his second expedition there in 1493 (Cope *et al.* 2010). Sugarcane is now grown in more than 70 countries, mainly in the tropics, but also in some sub-tropical areas. Regions that grow sugarcane include Africa, temperate Asia, tropical Asia, Australia, the Pacific, southeastern USA, Mexico, and South America. India and Brazil produce about half the world's cane sugar, while Australia is commonly in the top 10 of world producers.

Sugarcane is grown by replanting part of a mature cane stalk. Farmers cut some of the fully grown cane stalks into lengths of about 40 centimetres called 'setts' or 'billets'. The setts are planted by special machines, which drop them into furrows, add fertiliser and cover them with soil.

Sugarcane needs strong sunlight, fertile soil and a large amount of water throughout the year (at least 1.5 metres of rain each year or access to irrigation) to grow. After 2-3 weeks new shoots grow from buds on the joints of the setts and break through the surface of the soil. Up to 12 stalks grow from each sett, forming what is known as the stool of sugarcane.

A crop of cane takes about 9-16 months to grow in Queensland. In northern New South Wales (where it is cooler) it takes 18-24 months to grow. Typically, a cropping cycle comprises one plant crop and 3-4 ratoon (regrowth) crops. When harvested, the cane is usually about 2-4 metres tall.

Australia's sugarcane is harvested during the drier months between June and December each year - depending on the weather.

Australia's sugarcane is grown in high-rainfall and irrigated districts areas along coastal plains and river valleys on 2100 km of Australia's eastern coastline - between Mossman in far north Queensland and Grafton in New South Wales (Figure 8). Queensland accounts for approximately 95% of Australia's raw sugar production, and New South Wales around 5%.

In 2014, 30.816 Mt of cane was harvested from 363,270 ha in Queensland while NSW produced 1.543 Mt of cane from 14,461 ha. In the period 2004-2014, annual production of cane in Australia varied between 27.457 Mt (2010) and 38.294 Mt (2005). In the same period, induustry average sugar levels (CCS) varied between 12.83 (2010) and 14.62 (2009). The annual hectares harvested declined from 417,778 ha in 2004 to 305,050 ha in 2010 (63,000 hectares unable to be harvested because of wet conditions and stood over until 2011), but has risen since then to 377,422 ha in 2014.

The dominant varieties in Queensland in 2013, accounting for almost 83% of production, were Q208A (34.8%), KQ228A (20.7%), Q183A (12.4%), Q200A (11.9%) and Q232A (4.0%). The dominant varieties in NSW in 2013, accounting for 51% of production, were Q203A (13.8%), BN83-3120 (10.9%), Empire (7.6%), BN81-1394 (6.6%), Q211A (6.5%) and Q208A (5.7%).

Figure 8 *Sugarcane growing regions of Australia (Source: ASMC 2016)*

The value of the sugar produced in Queensland in 2014 was estimated in the order of $2.1 billion with more than $1.5 billion coming from export sales. Major export markets for Australia include China, Indonesia, Japan, Korea and Malaysia.

Australian refineries process around 20% of Australia's raw sugar into white (refined) sugar and liquid sugar products and other specialty products such as Golden Syrup, treacle and coffee sugar. Around 80% of Australia's production is exported overseas as 'raw' sugar, where it is further processed.

The Australian sugar industry is continuing activities to enhance the value of Australian raw sugar exports by facilitating trade and creating market opportunity resulting in unrestricted market access for Australian raw sugar. The objective is to:

- Achieve a more favourable world market environment for Australian raw sugar exports
- Remove export subsidies, the most pernicious form of market distortion
- Remove non-tariff barriers to Australian sugar exports
- Secure the full inclusion of sugar in all trade agreements.

Sugarcane is grown widely in South East Asia, including Papua New Guinea. Wild sugarcane varieties are native to Papua New Guinea, South East Asia and India. Sugarcane is also a traditional crop of the inhabitants of the Torres Strait islands and is grown in gardens throughout these islands. Islanders and others (e.g. Vietnamese) who have moved to the Australian mainland also cultivate sugarcane in their gardens and it is not uncommon to see sugarcane growing in home gardens in many of the coastal cities in Australia.

The Australian sugarcane industry has traditionally supported the strict control of movement of cane into Australia from other countries by the Australian Government, and state government legislation controlling movement between the cane growing regions within Australia. No plant material (cuttings or true seed) is allowed into the country without first going through quarantine channels.

International trade in sugarcane product is largely restricted to processed sugar and molasses rather than plant material, therefore there are negligible trade issues. Importation of germplasm for breeding purposes is vitally important to the sugarcane industry. Recently there has been an increased interest in the trade of used sugarcane machinery, use of sugarcane in traditional cooking, and sale of sugarcane for garden mulch and stock feed. Close relatives of sugarcane such as species of *Miscanthus* are popular ornamental garden plants. *Saccharum edule* is a type of wild sugarcane grown in Papua New Guinea and Fiji for the aborted flower which is eaten as a sweet vegetable. There have been small plots of this plant grown in Queensland to supply South Pacific islanders with this highly valued traditional food.

The increased interest in sugarcane and its relatives for other uses has raised concerns about quarantine and the movement of pests and diseases. The incursion of sugarcane smut into the main growing areas in Queensland in 2007 highlighted the biosecurity risks to the industry (Croft *et al.,* 2008).

References

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APPENDIX 2: THREAT SUMMARY TABLES

Sugarcane Industry Threat Summary Tables

The information provided in the TSTs (invertebrates, Table 18 and pathogens, Table 19) is an overview of exotic plant pest threats to the sugarcane industry. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control[34] or eradication may be included in these tables where appropriate. Full descriptions of the risk rating terms can be found on page 41. An explanation of the method used for calculating the overall risk can be found on the PHA website[35]. Additional information on a number of the pests listed in the TSTs can be found in pest-specific information documents (Page 85).

Invertebrates

Table 18. *Sugarcane invertebrate threat summary table*

'Unknown' indicates insufficient information available to make an assessment of risk

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
ACARI (Mites e.g. spider and gall mites)								
Spider mite	*Oligonychus pratensis*	Alliaceae, Solanaceae, Poaceae, Fabaceae, Convovulaceae,	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
COLEOPTERA (Beetles and weevils)								
Rose Beetle	*Adoretus spp.* including, *A. compressus* and *A. versutus*	Hosts of *A. compressus* include African oil palm, sugarcane, sorghum, cocoa, maize. Hosts of *A. versutus* include wattles, taro, yam, hibiscus root, beans, roses, sugarcane, cocoa, grape and ginger	Leaf	NEGLIBIBLE	HIGH	HIGH	VERY LOW	NEGLIGIBLE

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

35 Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Black sugarcane beetle	*Alissonotum impressicolle*	Sugarcane	Roots	LOW	HIGH	HIGH	VERY LOW	NEGLIGIBLE
Sugarcane beetle	*Alissonotum pauper*	Sugarcane	Roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Leaf Beetle	*Apogonia destructor*	Fabaceae, sugarcane	Leaf	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Bamboo tiger longicorn	*Chlorophorus annularis*	Banmboo, citrus, cotton, sugarcane and maize	Stem	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Aserruchador de la caña	*Compsus serrans*	Sugarcane		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Citrus weevil	*Diaprepes abbreviata*	Sugarcane	Above ground parts	LOW	MEDIUM	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane root borer	*Diaprepes famelicus*	Sugarcane	Roots	LOW	MEDIUM	UNKNOWN	UNKNOWN	UNKNOWN
Golden leaf weevil	*Diaprepes splengleri*	Cirtus, mango, mimosa, guava, sugarcane	Leaves and roots	LOW	MEDIUM	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane longhorn stem borer	*Dorysthenes buqueti*	*Bambusa vulgaris, S. officinarum,* cassava	Stems	LOW	HIGH	HIGH	HIGH	MEDIUM
Hardback beetle	*Dyscinetus spp. including D. dubius, D. picipes and D. geminatus*	Poaceae including sugarcane	Above ground parts	LOW	UNKNOWN	UNKNOWN	HIGH	UNKNOWN
Lesser corn Stalk borer	*Elasmopalpus lignosellus*	Polyphagous legumes, grains and horticultural crops	Whole plant	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Bidentate scarab	*Euetheola bidentata*	Pineapple, palms and grasses including sugarcane rice		LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Citrus weevil	*Exophthalmus vittatus*	Citrus and sugarcane	Roots	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Green weevil	*Hypomeces squamosus*	Polyphagous including grasses, avocado, tobacco, cotton, sunflower	Whole plant	MEDIUM	HIGH	UNKNOWN	UNKNOWN	UNKNOWN

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Black sugarcane beetle	*Heteronychus licas* (syn *Heteronychus corvinus Heteronychus mashunus*)	Poaceae including sugarcane, rice, wheat, millet and maize	Stem and sett	LOW	HIGH	HIGH	MEDIUM	LOW
White grub	*Holotrichia consanguinea*	Legumes and grasses (including sugarcane)	Roots	LOW	HIGH	HIGH	MEDIUM	LOW
White grub	*Holotrichia serrata*	Legumes, tobacco, rubber, potato and grasses (including sugarcane)	Whole plant	LOW	MEDIUM	MEDIUM	UNKNOWN	UNKNOWN
White grub	*Holotrichia sinensis*	Sugarcane		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
White grub	*Lachnopus aurifer*	Sugarcane and citrus		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
White grub	*Lachnosterna jamaicensis* syn *Phyllophaga jamaicana*	Legumes and grasses (including sugarcane)	Roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Blanchard's canegrub	*Lepidiota blanchardi*	*Saccharum* spp., other grasses	Roots	LOW[36]	HIGH	HIGH	LOW[37]	VERY LOW
Canegrub	*Lepidiota discedens*	*Saccharum* spp.	Roots	LOW[38]	HIGH	HIGH	LOW[39]	VERY LOW
Pruinose canegrub	*Lepidiota pruinosa*	*Saccharum* spp., other grasses	Roots	LOW[40]	HIGH	HIGH	LOW[41]	VERY LOW
Ramu canegrub	*Lepidiota reuleauxi*	*Saccharum* spp., *Imperata cylindrical, Panicum maximum, Pennisetum purpureum, Zea mays*, other grasses.	Roots	LOW[42]	HIGH	HIGH	LOW[43]	VERY LOW
White grub[44]	*Lepidiota stigma*	*Saccharum* spp., *Manihot esculenta*, grasses	Roots	LOW[45]	HIGH	HIGH	LOW[46]	VERY LOW

36 Most likely to enter via soil or infested plant material. Present in the Philippines (also nearest known location).
37 It is similar to Australian white grub species. Spread could be facilitated by confusion with local species.
38 Most likely to enter via infested plant material or soil. Present in Thailand and Indonesia. Indonesia nearest location to Australia known.
39 It is similar to Australian white grub species. Spread could be facilitated by confusion with local species.
40 Most likely to enter via soil or infested plant material. Present in the Philippines and Indonesia. Indonesia nearest known location to Australia.
41 It is similar to Australian white grub species. Spread could be facilitated by confusion with local species
42 Most likely to enter via infested plant material or soil. Present in Papua New Guinea (also nearest location to Australia known)
43 It is similar to Australian white grub species. Spread could be facilitated by confusion with local species
44 Synonyms: sugarcane white grub, sugarcane grub, canegrub
45 Most likely to enter via soil or infested plant material. Present in China, Thailand and Indonesia. Closest location to Australia known is Indonesia.
46 It is similar to Australian white grub species. Spread could be facilitated by confusion with local species.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Canegrub	*Leucopholis near armata*	*Saccharum* spp., other grasses	Roots	LOW[47]	HIGH	HIGH	LOW[48]	VERY LOW
White grub	*Leucopholis rorida*	*Saccharum* spp., *Manihot esculenta*, grasses	Roots	LOW[49]	HIGH	HIGH	LOW	VERY LOW
Rough black hard-back	*Ligyrus cuniculus*	Yam, sweet potato, Poaceae including sugarcane		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Black sugarcane chafer	*Ligyrus ebenus*	Sugarcane, banana	Shoots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Common wireworm	*Melanotus communis*	Sugarcane and potato	Roots	LOW	HIGH	HIGH	MEDIUM	LOW
Sugarcane wireworm	*Melanotus tamsuyensis*	Sugarcane	Leaves and stems	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
West Indian cane weevil	*Metamasius hemipterus*	Coconut, banana, sugarcane	Stem	LOW	HIGH	HIGH	MEDIUM	LOW
Cane leaf beetle	*Myochrous armatus*	Tobacco, sugarcane, sweet potato	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
White grubs	*Phyllophaga* spp. including*: P. antiguae, P. helleri, P. plaei, P. smithi, P. subnitida*	Poaceae including sugarcane	Roots	LOW	HIGH	HIGH	LOW	VERY LOW
Red weevil[50]	*Rhynchophorus ferrugineus*	Sugarcane*, Cocos nucifera, Metroxylon* spp., *Elaeis guineensis, Phoenix dactylifera*	Stem, roots	LOW[51]	HIGH	HIGH	VERY LOW[52]	NEGLIGIBLE
South American palm weevil	*Rhynchophorus palmarum*	Sugarcane, palms	Above ground parts	LOW	HIGH	HIGH	VERY LOW	NEGLIGIBLE

47 Most likely to enter via infested plant material or soil. Present in Indonesia (also closest known location to Australia).

48 It is similar to Australian white grub species. Spread could be facilitated by confusion with local species.

49 May enter via infested plant material or soil. Present in Indonesia. Nearest known location Java.

50 Synonyms: coconut weevil, red palm weevil, red-striped palm weevil, snout weevil

51 May enter via infested plant material. Present in South America, Central America, India, Pakistan, China, Taiwan, Cambodia, Vietnam, the Philippines, Thailand, Indonesia, and Papua New Guinea (nearest known location to Australia).

52 This weevil is primarily a pest of palms and damage to sugarcane is low. In sugarcane, the roots and underground stem are destroyed.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
New Guinea rhinoceros beetle[53]	*Scapanes* spp. including: *S. australis* and *S. australis grossepunctatus*	*Saccharum* spp., *Cocos nucifera, Musa paradisiacal,* palms	Stem	LOW[54]	HIGH	HIGH	VERY LOW[55]	NEGLIGIBLE
DIPTERA (Flies and midges)								
West Indian canefly[56]	*Saccharosydne saccharivora*	Poaceae including sugarcane	Above ground parts	LOW	HIGH	HIGH	MEDIUM	LOW
HEMIPTERA (Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)								
Brown sugarcane scale	*Aclerda takahashii*	Sugarcane	Leaf	MEDIUM	HIGH	HIGH	UNKNOWN	UNKNOWN
Yellow-sided froghopper	*Aeneolamia flavilatera*	Poaceae including rice and sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Froghopper	*Aeneolamia varia*	Poaceae including rice and sugarcane	Leaf	LOW	HIGH	HIGH	MEDIUM	LOW
Sugarcane whitefly	*Aleurolobus barodensis*	*Saccharum* spp., *Erianthus aurundinaceum, Erianthus ciliaris, Miscanthus* spp.	Leaf, stem	HIGH[57]	HIGH	HIGH	HIGH[58]	HIGH
Coconut bug	*Amblypelta cocophaga*	Papaw, *Ceiba pentandra*, navel orange, coconut, melon, *Eucalyptus deglupta*, Macaranga, mango, cassava, Passiflora quadrangularis, peach, winged bean, sugarcane), cocoa	Stem	HIGH[59]	HIGH	HIGH	UNKNOWN	UNKNOWN
Brown sugarcane scale	*Aspidiella sacchari*	Poaceae including sugarcane	Leaves, stems	HIGH	HIGH	HIGH	UNKNOWN	UNKNOWN

53 Synonyms: black beetle, rhinoceros beetle

54 May enter via infested plant material or soil. Present in Indonesia, Papua New Guinea, Solomon Islands and Bismarck Islands. Nearest known location to Australia is eastern Papua New Guinea.

55 In sugarcane, the adult bores into the top of the plant. There may be a decrease in yield due to the damage to the crown. This insect may pose more of a threat to newly planted cane fields.

56 Vector of Sugarcane yellow leaf phytoplasma Arocha et al, 2005

57 Most likely to enter via wind-assisted flight of adults or infested plant material. Found in India, Pakistan, Taiwan, the Philippines, Thailand, Malaysia and Indonesia. Nearest known location to Australia is Java. Check BICON for current import conditions.

58 This whitefly causes direct feeding damage causing a yellowing and desiccation to the leaves. This reduces photosynthetic capacity and the excreted honeydew increases production of sooty moulds, both of which reduce yield and quality.

59 Wide spread in Indonesia, Fiji and PNG.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
White scale of sugar cane[60]	*Aulacaspis tegalensis*	*Saccharum* spp., *Erianthus arundinaceus*	Leaf, stem	HIGH[61]	HIGH	HIGH	LOW[62]	LOW
Chinch bug	*Blissus leucopterus*	Poaceae including sugarcane, oat, maize and rye	Leaves and stems	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Spittlebug	*Callitettix versicolour*	Sugarcane	Leaves and stems	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Oriental chinch bug	*Cavelerius saccharivorus*	Sugarcane	Leaves and stems	UNKNOWN	UNKNOWN	UNKNOWN	MEDIUM[63]	UNKNOWN
Sugarcane woolly aphid	*Ceratovacuna lanigera*	*Saccharum* spp., *Miscanthus* spp., *Alternanthera sessilis, Brachiaria mutica, Cynodon dactylon, Columella trifolia, Digitaria sanguinalis, Eragrostis japonica, Eclipta prostrate, Eleusine* spp.	Leaf	HIGH[64]	HIGH	HIGH	HIGH[65]	HIGH
	Chlorotettix minimus	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
South African maize leafhopper (Insect only))	*Cicadulina mbila*	*Saccharum* spp., *Zea mays*, other grasses.	Stem	LOW[66]	HIGH	HIGH	LOW[67]	VERY LOW
South African maize leafhopper (as a vector with Maize Streak Virus)	*Cicadulina mbila*	*Saccharum* spp., *Zea mays*, other grasses.	Stem	LOW	HIGH	HIGH	HIGH	MEDIUM

60 Synonym: sugarcane scale

61 May enter via infested plant material. Present in Uganda, Kenya, Tanzania, Madagascar, Seychelles, Mauritius, Reunion, Taiwan, Thailand, Malaysia, the Philippines, Indonesia, Papua New Guinea and the Torres Strait Islands. Nearest known location Thursday Island.Check BICON for current import conditions.

62 The photosynthetic capacity of the plant can be affected, thereby reducing yield and quality of sugar. Sooty moulds can also have this effect. Leaves become discoloured and desiccated due to feeding. Chlorotic spots or blotches are caused by the feeding insects along the leaf blade. Stems become desiccated or rot due to the removal of the wax layer. Reduced yields of sucrose are a result of heavy infestation. Reduced bud germination and set growth can result from the presence of the scale.

63 Significant pest of sugarcane in Japan.

64 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Nepal, Bangladesh, India, China, Taiwan, Japan, Myanmar, Malaysia, Thailand, the Philippines, Fiji, Solomon Islands, Indonesia and Papua New Guinea. Nearest known location to Australia is Port Moresby, Papua New Guinea.Check BICON for current import conditions.

65 Heavy infestations can lead to a reduction in the photosynthetic capacity of the plant leading to a decrease in yield and quality of sugar. Honeydew excreted by the aphids will lead to the production of sooty moulds which can have the same effects.

66 Most likely to enter via infested plant material. Present in Yemen, Sweden, Swaziland, Uganda, Kenya, Zimbabwe, Tanzania, South Africa, India, Mauritius and Reunion. Closest locality Reunion. Check BICON for current import conditions.

67 Low for direct damage by the insect. High because it is a vector of Maize Streak Disease and Uba Cane Virus.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Cotton lacebug	*Corythuca gossypii*	Okra, peanut, beans, capsicum, pawpaw, cassava, banana, sugarcane, eggplant	Leaf	LOW	HIGH	HIGH	UNKNOWN	UNKNOWN
Large sugarcane froghopper	*Delassor tristis*	Sugarcane	Stem	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sharpshooter, Leafhopper	*Draeculacephala mollipes*	Poaceae including sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Black hopper of sugarcane	*Eoeurysa flavocapitata*	*Saccharum officinarum*	Leaf	LOW[68]	HIGH	HIGH	LOW[69]	VERY LOW
Sugarcane leafhopper (insect only)	*Eumetopina flavipes*[70]	*Saccharum officinarum*	Leaf	HIGH[71]	HIGH	HIGH	LOW[72]	LOW
Sugarcane leafhopper (as a vector of ramu stunt virus)	*Eumetopina flavipes*[70]	*Saccharum officinarum*	Leaf	HIGH	HIGH	HIGH	EXTREME	EXTREME
Green leafhopper	*Hortensia similis*	Legumes and grasses (including sugarcane)	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Kiritshenkella sacchari	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane lacewing bug	*Leptodictya tabida*	Maize, Guinea grass, Johnson grass, barnyard grass , bamboo, sugarcane	Leaf	LOW	HIGH	HIGH	MEDIUM	LOW
Sugarcane spittlebug	*Mahanarva fimbriolata*	Poaceae including sugarcane	Roots	LOW	HIGH	HIGH	MEDIUM	LOW
Sugarcane scale	*Melanaspis glomerata*	Sugarcane	Leaves and stems	LOW	HIGH	HIGH	MEDIUM	LOW

68 May enter via infested plant material or wind. Present in Bangladesh, China, Taiwan, East Indies, Thailand and West Malaysia (nearest known location to Australia).Check BICON for current import conditions.

69 Low since this species does not transmit diseases. The leaves become yellow and dry due to the feeding of this insect. Red streaks appear around the egg laying site. Disruption of the photosynthetic capacity of the plant occurs through feeding and the establishment of sooty moulds on the excreted honeydew. This leads to a reduction in yield and sugar quality.

70 E. flavipes is a vector for Ramu stunt disease, a plant disease which affects sugarcane. Ramu stunt disease is found throughout Papua New Guinea, but has not been detected in Australia. Virus-free populations of E. flavipes are present on Saccharum hybrids and S. officinarum on many islands in the Torres Strait, and a number of small populations persist on the northern Cape York Peninsula

71 Has already reached Australia. Most likely entry pathways are via wind-assisted flight of adults or infested plant material from the north. Present in Malaysia, New Caledonia, Papua New Guinea, the Philippines, Indonesia, Torres Strait Islands, and northern Cape York Peninsula.

72 Low for direct damage to the crop but high for losses due to the introduction of Ramu stunt disease which is not in Australia, if this occurs. Control of the pest would be expensive and difficult.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Plant hopper	*Myndus crudus*	Palms and Poaceae including sugarcane	Roots	LOW	HIGH	HIGH	UNKNOWN	UNKNOWN
Plant hopper	*Omolicna cubana*	Okra and sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane planthopper (insect only)[73]	*Perkinsiella bicoloris*	*Saccharum* spp.	Leaf	HIGH[74]	HIGH[75]	HIGH	LOW[76]	LOW
Sugarcane planthopper (as a vector unknown)[77]	*Perkinsiella bicoloris*	*Saccharum* spp.	Leaf	HIGH	HIGH[78]	HIGH	UNKNOWN[79]	UNKNOWN
Sugarcane planthopper (insect only)[80]	*Perkinsiella diagoras*	*Saccharum* spp.	Leaf	HIGH[81]	HIGH	HIGH	LOW[82]	LOW
Sugarcane planthopper[83] (as a vector unknown)	*Perkinsiella diagoras*	*Saccharum* spp.	Leaf	HIGH[84]	HIGH	HIGH	UNKNOWN[85]	UNKNOWN
Sugarcane planthopper[86] (insect only)	*Perkinsiella lalokensis*	*Saccharum* spp. (sugarcane).	Leaf	HIGH[87]	HIGH	HIGH	LOW[88]	LOW

73 Synonym: sidewinder

74 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea.

75 Biology is not known, however this pest is likely to be similar to the local sugarcane planthopper *P. saccharicida*.

76 Direct damage to the crop would not be great, however the damage due to transmission of Fiji leaf gall disease could be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

77 Synonym: sidewinder

78 Biology is not known, however this pest is likely to be similar to the local sugarcane planthopper *P. saccharicida*.

79 Direct damage to the crop would not be great, however the damage due to transmission of Fiji leaf gall disease could be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

80 Synonym: sidewinder

81 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Check BICON for current import conditions.

82 Direct damage to the crop would not be great, however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and dessication of the tissue.

83 Synonym: sidewinder

84 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Check BICON for current import conditions.

85 Direct damage to the crop would not be great, however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and dessication of the tissue.

86 Synonym: sidewinder

87 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and desiccation of the tissue. Check BICON for current import conditions.

88 Direct damage to the crop would not be great, however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Unknown if a vector.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sugarcane planthopper[89] (as a vector unknown)	*Perkinsiella lalokensis*	*Saccharum* spp. (sugarcane).	Leaf	HIGH[90]	HIGH	HIGH	UNKNOWN[91]	UNKNOWN
Sugarcane planthopper[92] (insect only)	*Perkinsiella papuensis*	*Saccharum* spp.	Leaf	HIGH[93]	HIGH	HIGH	LOW[94]	LOW
Sugarcane planthopper[95] (as a vector unknown)	*Perkinsiella papuensis*	*Saccharum* spp.	Leaf	HIGH[96]	HIGH	HIGH	UNKNOWN[97]	UNKNOWN
Sugarcane planthopper[98] (insect only)	*Perkinsiella rattlei*	*Saccharum* spp.	Leaf	HIGH[99]	HIGH	HIGH	LOW[100]	LOW
Sugarcane planthopper[101] (as a vector unknown)	*Perkinsiella rattlei*	*Saccharum* spp.	Leaf	HIGH[102]	HIGH	HIGH	UNKNOWN[103]	UNKNOWN

89 Synonym: sidewinder

90 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and desiccation of the tissue. Check BICON for current import conditions.

91 Direct damage to the crop would not be great, however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Unknown if a vector.

92 Synonym: sidewinder

93 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and desiccation of the tissue. Check BICON for current import conditions.

94 Direct damage to the crop would not be great, however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Unknown if a vector.

95 Synonym: sidewinder

96 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and desiccation of the tissue. Check BICON for current import conditions.

97 Direct damage to the crop would not be great, however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Unknown if a vector.

98 Synonym: sidewinder

99 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea and New Caledonia. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and desiccation of the tissue. Check BICON for current import conditions.

100 Direct damage to the crop would not be great; however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Unknown if a vector.

101 Synonym: sidewinder

102 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea and New Caledonia. Feeding and the production of sooty moulds will lead to reduced photosynthetic capacity. The feeding will produce lacerations on the leaves with subsequent reddening and desiccation of the tissue. Check BICON for current import conditions.

103 Direct damage to the crop would not be great; however, if a virus vector, the damage due to virus transmission (Fiji leaf gall disease) would be extremely high, especially in Queensland north of Proserpine which is currently virus-free. Unknown if a vector.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sugarcane planthopper[104] (insect only)	*Perkinsiella saccharivora*	*Saccharum* spp.	Leaf	LOW[105]	HIGH	HIGH	LOW[106]	LOW
Sugarcane planthopper[107] (as a vector unknown)	*Perkinsiella saccharivora*	*Saccharum* spp.	Leaf	LOW[108]	HIGH	HIGH	UNKNOWN[109]	UNKNOWN
Sugarcane planthopper[110] (insect only)	*Perkinsiella vastatrix*	*Saccharum* spp., *Sorghum bicolour, Zea mays*	Leaf	HIGH[111]	HIGH	HIGH	LOW[112]	LOW
Sugarcane planthopper[113] (as a vector of Fiji Leaf Gall Virus)	*Perkinsiella vastatrix*	*Saccharum* spp., *Sorghum bicolour, Zea mays*	Leaf	HIGH[114]	HIGH	HIGH	EXTREME[115]	EXTREME
Sugarcane planthopper[116]	*Perkinsiella vitiensis*	*Saccharum* spp.	Leaf	HIGH[117]	HIGH	HIGH	LOW[118]	LOW

104 Synonym: sidewinder

105 Most likely to enter via infested plant material. Present in India and the Philippines. Closest known location is the Philippines. Check BICON for current import conditions.

106 Direct damage to the crop would not be great, however, as a virus vector, the damage due to transmission of Fiji leaf gall disease would be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

107 Synonym: sidewinder

108 Most likely to enter via infested plant material. Present in India and the Philippines. Closest known location is the Philippines. Check BICON for current import conditions.

109 Direct damage to the crop would not be great, however, as a virus vector, the damage due to transmission of Fiji leaf gall disease would be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

110 Synonym: sidewinder

111 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Central America, Tanzania, Somalia, Uganda, Kenya, Japan, Taiwan, Thailand, Malaysia, the Philippines, Borneo, Indonesia and Papua New Guinea. Nearest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

112 Direct damage to the crop would not be great, however, the damage due to transmission of Fiji leaf gall disease would be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

113 Synonym: sidewinder

114 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Central America, Tanzania, Somalia, Uganda, Kenya, Japan, Taiwan, Thailand, Malaysia, the Philippines, Borneo, Indonesia and Papua New Guinea. Nearest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

115 Direct damage to the crop would not be great, however, the damage due to transmission of Fiji leaf gall disease would be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

116 Synonym: sidewinder

117 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Fiji, Samoa, Niue and Papua New Guinea. Nearest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

118 Direct damage to the crop would not be great, however, the damage due to transmission of Fiji leaf gall disease would be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sugarcane planthopper[119] (as a vector of Fiji Leaf Gall Virus)	*Perkinsiella vitiensis*	*Saccharum* spp.	Leaf	HIGH[120]	HIGH	HIGH	EXTREME[121]	EXTREME
Sugarcane red bug	*Phaenacantha saccharicida*	Poaceae including sugarcane, sorghum and maize	Leaf	MEDIUM	HIGH	HIGH	MEDIUM	LOW
Black bug	*Phthia picta*	Cucurbits, tomato and Poaceae including sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Coffee mealybug	*Planococcus kenyae*	Polyphagous including *Annona spp.*, *Bauhinia spp.*, Beetroot, pigeon pea, cirtus, coffee, yam, sweet potato, passionflower, beans, guava, cocoa, Solanaceae and sugarcane	Above ground parts	LOW	HIGH	HIGH	UNKNOWN	UNKNOWN
Brazilian leafhopper	*Protalebrella brasiliensis*	Carrot, Poaceae including sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Pulvinaria scale	*Pulvinaria iceryi*	*Saccharum* spp., *Agropyron repens, A. schinzii, Cymbopogon giganteus, Cynodon dactylon*, *Digitaria didactyla, D. scalarum*	Leaf, stem	HIGH[122]	HIGH	HIGH	LOW[123]	LOW
Black bug	*Pycnoderes quadrimaculatus*	Cucurbits, carrot, sugarcane	Leaf and stem	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

119 Synonym: sidewinder

120 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Fiji, Samoa, Niue and Papua New Guinea. Nearest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

121 Direct damage to the crop would not be great, however, the damage due to transmission of Fiji leaf gall disease would be extremely high, especially in Queensland (north of Proserpine) which is currently virus-free.

122 Most likely to enter via wind-assisted flight of adults or infested plant material. Found in Florida and Georgia (USA), Kenya, Tanzania, Uganda, Zambia, Zimbabwe, South Africa, Madagascar, Mauritius, Reunion, China, and possibly Papua New Guinea (record unconfirmed). Check BICON for current import conditions.

123 High losses where heavy infestation occurs without parasitism. Feeding results in a reduction in growth, premature death of the leaves and chlorosis. The leaf edge will have a yellow stripe. Plants will fail to ratoon and will die in severe infestations.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sugarcane pyrilla[124]	*Pyrilla perpusilla*	*Saccharum* spp., *Sorghum bicolour, Avena sativa, Avena fatua, Bambusa arundinacea, Hordeum vulgare, Oryza sativa, Panicum colonum, Panicum maximum*	Leaf	MEDIUM[125]	HIGH	HIGH	HIGH[126]	HIGH
	Rhizoecus epicopus	Sugarcane	Roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Red-striped sugarcane scale	*Saccharipulvinaria iceryi*	Sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Yellow sugarcane aphid	*Sipha flava*	Poaceae including sugarcane, wheat, millet and sorghum	Leaves and stems	LOW	HIGH	HIGH	HIGH[127]	MEDIUM
Two lined spittlebug	*Tomaspis basalis* syn. *Prosapia bicincta basalis*	Sugarcane	Leaf	UNKNOWN	HIGH	HIGH	UNKNOWN	UNKNOWN
HYMENOPTERA (Ants, bees and wasps)								
Leaf cutting ant	*Acromyrmex octospinosus*	Citrus, coffee, cucurbits, yam, cotton, sweet potato, mango, cassava, avocado, sugarcane, cocoa	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Leaf cutting ants	*Atta spp. including Atta cephalotes, Atta insularis, Atta laevigata, Atta sexdens*	Polyphagous including Pinaceae, Poaceaea, Rosaceae and tropical fruit crops	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
ISOPTERA (Termites)								
	Coptotermes havilandi	Sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Coptotermes heimi	Sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

124 Synonym: sugarcane leafhopper

125 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Afghanistan, Nepal, India, Pakistan, Bangladesh, Sri Lanka, China, Myanmar, Thailand, Cambodia, Laos, Vietnam and Indonesia. Closest known location Indonesia. Check BICON for current import conditions.

126 When infestations reach epidemic proportions sugar recovery is less than 50 per cent.

127 Vector of sugarcane mosaic potyvirus.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
West Indian Subterraneans	*Heterotermes spp. including H. cardini, H. convexinotatus, H. tenuis*	Legumes and grasses (including sugarcane)	Stem and sett	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Macrotermes barneyi	Sugarcane	Stem and roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Macrotermes gilvus	Sugarcane	Stem and roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Whiteant	*Microtermes obesi*	Peanut, coconut, jute, sugarcane, wheat	Stem and roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Nasutitermes corniger, N. costalis, N. nigriceps, N. rippertii	Sugarcane	Stem and roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Termites	*Odontotermes spp. O. assmuthi, O. formosanus, O. takensis*	Sugarcane	Setts, shoots, canes and also stubble	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane termite	*Pseudacanthotermes militaris*	Sugarcane	Sett and stem	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Subterranean Termite	*Reticulitermes spp. including R. flavipes, R. speratus*	Sugarcane	Roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
LEPIDOPTERA (Butterflies and moths)								
Cutworm	*Agrotis repleta*	Peanut, Brassicaceae, pigeon pea, Cucurbitaceae, sweet potato, beans, sugarcane, tomato, potato	Leaves and stems	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Bamboo leaf roller	*Algedonia coclesalis*	Bamboo, sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Anicla infecta	Sugarbeet, cotton, sugarcane, sweet potato and other grasses	Leaves, stems	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Automeris illustris	Sugarcane	Leaves and stems	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane borer moth	*Blastobasis graminea*	Sugarcane, sorghum, maize	Above ground parts	LOW	MEDIUM	MEDIUM	UNKNOWN	UNKNOWN
Banana stem borer	*Castniomera licus*	Banana, sugarcane, coconut	Stem	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Owl-eye butterfly	*Caligo illioneus*	Banana, sugarcane, coconut	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Santo Domingo cane butterfly	*Callisto pulchella*	Sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane internode borer[128]	*Chilo auricilius*	*Saccharum* spp., *Oryza sativa*, *Dactyloctenium aegyptium, Echinochloa colona, Echinochloa frumentacea, Echinochloa stagnina, Eleusine indica*	Stem	MEDIUM[129]	HIGH	HIGH	EXTREME[130]	EXTREME
Yellow top borer of sugarcane[131]	*Chilo infuscatellus*	*Saccharum* spp., *Panicum miliaceum, Oryza sativa, Sorghum bicolor*	Stem	MEDIUM[132]	HIGH	HIGH	EXTREME[133]	EXTREME
Coastal stalk borer	*Chilo orichalcociliellus*	Poaceae, sugarcane	Stem	VERY LOW	HIGH	HIGH	NEGLIGIBLE	NEGLIGIBLE
Durra stalk borer[134]	*Chilo partellus*	*Saccharum* spp., *Coix lacryma-jobi, Vigna unguiculata,* grasses, *Oryza sativa,* millet, *Pennisetum glaucum, Sorghum bicolor*	Leaf, stem	LOW[135]	HIGH	HIGH	LOW[136]	VERY LOW

128 Synonyms: sugarcane moth borer, stalk borer, stem borer, rice stalk borer, gold fringed moth, gold fringed rice borer

129 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in Mauritius, Nepal, Pakistan, India, Bangladesh, Sri Lanka, Bhutan, China, Taiwan, Hong Kong, Myanmar, Vietnam, Thailand, the Philippines, Malaysia, Indonesia and Papua New Guinea. Nearest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

130 There are no similar pests in Australia so the damage to crops, yield and sugar quality would be high.

131 Synonyms: shoot borer, internode borer, top borer, early shoot borer, yellow top borer

132 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in India, Bangladesh, Pakistan, Afghanistan, Tajikistan, Uzbekistan, China, Taiwan, Vietnam, Korea, Thailand, Myanmar, Malaysia, the Philippines, Indonesia and Papua New Guinea. Nearest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

133 There are no similar pests in Australia so the damage to crops, yield and quality could be high.

134 Synonyms: Durra stem borer, pink borer, sorghum stem borer, spotted sorghum stem borer, spotted stalk borer, spotted stem borer

135 May enter via wind-assisted flight of adults or infested plant material. Present in Yemen, Sudan, Ethiopia, Malawi, Mozambique, Somalia, Kenya, Zambia, Tanzania, Uganda, Botswana, Swaziland, Zimbabwe, Togo, Cameroon, South Africa, India, Pakistan, Bangladesh, Afghanistan, Nepal, Sri Lanka, Comoros, Cambodia, Vietnam, Laos, Thailand and Indonesia (nearest known location to Australia). Check BICON for current import conditions.

136 There are no similar pests in Australia so the damage to crops, yield and quality could be high. This insect has been described as a minor pest of sugarcane, but it is a serious pest on maize and sorghum. The leaves become dry and withered where they are fed upon by the first instar larvae. Leaves in the whorls are most affected. Later instars feed on the growing stems resulting in dead hearts. The third instars bore into the stem.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sugarcane internode borer[137]	*Chilo sacchariphagus*	*Saccharum* spp., *Zea mays, Oryza sativa*, *Sorghum bicolor*	Stem	MEDIUM[138]	HIGH	HIGH	EXTREME[139]	EXTREME
Dark headed rice borer[140]	*Chilo terrenellus*	*Saccharum* spp., other grasses, *Zea mays, Oryza sativa, Oryza latifolia, Eriochloa* spp., *Panicum* spp.	Stem	HIGH[141]	HIGH	HIGH	EXTREME[142]	EXTREME
Spotted sugarcane stem borer	*Chilo tumidicostalis*	Sugarcane	Stem	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
Stalk borers	*Diatraea* spp including *D. albicrinella, D. busckella, D. centrella, D. grandiosella, D. impersonatella, D. lineolata, D. rosa, D. saccharalis*	Sugarcane and Poaceae including sorghum, maize and millet	Leaf and stem	LOW	HIGH	HIGH	HIGH	MEDIUM
Sugarcane leafminer	*Dicranoctetes saccharella*	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
African sugarcane stalkborer	*Eldana saccharina*	Sugarcane, grasses and sedges	Above ground parts	LOW	HIGH	HIGH	EXTREME	HIGH
	Euproctis spp. including *E. minor, E. xanthorrhoea* and *E. virguncula*	Malvaceae and Poaceae, including sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Granulate cutworm	*Feltia subterranea*	Alliaceae, Solanaceae and Poaceae including sugarcane	Leaves and stems	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

137 Synonyms: spotted borer, stem borer, stalk borer, Mauritius spotted cane borer, sugarcane stalk borer, sugarcane stemborer

138 Most likely to enter via infested plant material. Present in Mexico, India, Madagascar, Mauritius, Reunion, Comoros, China, Taiwan, Singapore, Japan, Vietnam, Malaysia, the Philippines and Indonesia. Nearest known location to Australia is Indonesia. Check BICON for current import conditions.

139 There are no similar pests in Australia so the damage to crops, yield and quality could be high

140 Synonym: dark headed striped borer

141 May enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea, South Asia and sometimes found in the Torres Strait Islands. Check BICON for current import conditions.

142 There are no similar pests in Australia so the damage to crops, yield and quality could be high. This insect has been described as a major pest of sugarcane in Malaysia.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Leucophlebia lineata	Poaceae including sugarcane and maize		LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Maize webworm	*Marasmia trapezalis*	Poaceae including sugarcane	Leaf	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Grass looper	*Mocis latipes*	Poaceae including sugarcane	Above ground parts	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Mycalesis horsfieldii	Sugarcane and rice	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Mythimna spp. Including: *M. humidicola, M. latiuscula, M. microgonia, M. salita, M. unipuncta*	Sugarcane	Leaf	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Sugarcane bud moth	*Neodecadarchis flavistriata*	Sugarcane, banana, coconut, pineapple	Shoots	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane skipper	*Nyctelius nyctelius*	Sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sugarcane leafroller	*Omiodes accepta*	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Banana moth	*Opogona sacchari*	Banana, Poaceae including sugarcane and bamboo	Stems	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Skippers	*Panoquina* spp. Including: *P. nero, P. sylvicola*	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Rice skipper	*Parnara guttatus*	Poaceae including bamboo, rice and sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
	Phalera combusta	Poaceae including sugarcane, sorghum and maize	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Giant borer	*Phragmataecia castaneae*	Poaceae including sugarcane	Stem	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Root borer	*Polyocha depressella*	Sugarcane	Roots	LOW	HIGH	HIGH	EXTREME	HIGH
Stem borers	*Sesamia spp.* including *S. cretica, S. nonagrioides*	Poaceae including sugarcane	Stem	LOW	MEDIUM	HIGH	MEDIUM	LOW
Stem borer	*Sesamia calamistis,*	Poaceae including sugarcane	Stem	LOW	MEDIUM	HIGH	HIGH	MEDIUM
Top borer[143]	*Scirpophaga excerptalis*	*Saccharum* spp., *Sorghum halepense*	Growing points/plant top	HIGH[144]	HIGH	HIGH	EXTREME[145]	EXTREME
Pink stalk borer[146]	*Sesamia grisescens*	*Saccharum* spp., *Pennisetum purpureum, Panicum maximum*	Stem	HIGH[147]	HIGH	HIGH	EXTREME[148]	EXTREME
Pink stem borer[149]	*Sesamia inferens*[150]	*Saccharum* spp., *Eleusine coracana, Zea mays, Miscanthus sinensis, Elaeis guineensis, Elaeis oleifera, Oryza sativa, Sorghum bicolour*, *Vigna radiate, Triticum* spp., cereals, millet	Stem	MEDIUM[151]	HIGH	HIGH	MEDIUM[152]	MEDIUM
Fall armyworm	*Spodoptera frugiperda*	Preference for Poaceae, including sugarcane, but will also feed on Aliaceae, Fabaceae, Solanaceae, Brassicaceae, Cyperaceae , Chenopodiaceae, Convovulaceae, Asteraceae, Cucurbitaceae, Malvaceae and Musaceae	Above ground parts	LOW	HIGH	HIGH	MEDIUM	LOW

143 Synonym: top shoot borer

144 Most likely to enter via wind-assisted flight of adults or infested plant material. Present in India, Pakistan, Bangladesh, China, Thailand, and Papua New Guinea. Closest known location is Papua New Guinea. Check BICON for current import conditions.

145 In India, damaged cane has resulted in a 36 per cent reduction in yield. In Australia, this could be even higher without the benefits of biological control. Sugar quality would also be affected.

146 Synonyms: sugarcane borer, shoot borer, Ramu shoot borer

147 May enter via wind-assisted flight of adults or infested plant material. Present in Papua New Guinea. Check BICON for current import conditions.

148 An 18 per cent reduction in sugar production has been reported due to infestation by this pest. This species is a major constraint on the production of sugarcane in Papua New Guinea.

149 Synonyms: shoot borer. Top borer, pink rice borer, purple stem borer, Ragi stem borer, violet stem borer

150 Uncertain taxonomy

151 May enter via wind-assisted flight of adults or infested plant material. Present in India, Pakistan, Bangladesh, Sri Lanka, China, Taiwan, Japan, Korea, Vietnam, Myanmar, Thailand, Malaysia, the Philippines, Indonesia, Papua New Guinea and the Solomon Islands. Closest known location to Australia is Papua New Guinea. Check BICON for current import conditions.

152 This insect may have the same potential for damage as Sesamia grisescens which is a major constraint on sugar cane production in Papua New Guinea.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Cotton leafworm	*Spodoptera littoralis*	okra, Alliaceae, Scrophulariaceae, Fabaceae, Cucurbitaceae, Convovulaceae, Brassicaceae, Theaceae, Rutaceae, Apiaceae, Asteraceae, Rosaceae, Musaceae, Poaceae	Above ground parts	LOW	HIGH	HIGH	MEDIUM	LOW
Grey borer of sugarcane[153]	*Tetramoera schistaceana*	*Saccharum* spp., *Cyperus rotundus,* other *Gramineae*	Stem	LOW[154]	HIGH	HIGH	LOW[155]	VERY LOW
ORTHOPTERA (Grasshoppers and locusts)								
	Amblytropidia trinitatis	Sugarcane	Leaves, stems	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Gray katydid grasshopper	*Bucrates capitata*	Poaceae including sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Citrus locust	*Chondracris rosea*	Citrus, soybean, cotton, sweet potato, rice, sugarcane (both *S. officinarum* and *S. spontaneum*), teak and maize	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Rice grasshopper	*Hieroglyphus banian*	Legumes and grasses (including sugarcane)	Leaf	LOW	HIGH	HIGH	MEDIUM	LOW
Longhorned grasshopper	*Neoconocephalus spp. N. maxillosus, N. triops*	Poaceae including sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Six-fingered mole-cricket	*Neocurtilla hexadactyla*	Beans, sugarcane, tomato, pea, maize	Roots	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
	Orphulella punctata	Coffee, cassava and Poaceae including rice and sugarcane	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Bombay locust	*Patanga succincta*	Fabaceae, tobacco, Poaceae including sugarcane, sorghum and maize	Above ground parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

153 Synonyms: grey borer, sugarcane shoot borer

154 Most likely to enter via infested plant material. Nearest known infestations found in Indonesia. Present in Mauritius, Reunion, Sri Lanka, China, Taiwan, Japan, Vietnam, Malaysia, the Philippines and Indonesia. Check BICON for current import conditions.

155 Damage to young tillers will result in cane having to be replanted leaving uneven crop growth and maturity. Internode damage can be high which will lead to decreased yields and sugar quality.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Mole cricket	*Scapteriscus variegatus*	Tomato, sugarcane and maize	Roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
South American locust	*Schistocerca* spp. Including: *S. americana, S. cancellata, S. columbina, S. gregaria, S. nitens*	Brassicas, cotton, sweet potato, rice, beans, citrus, sugarcane and maize	Above ground parts	UNKNOWN	HIGH	HIGH	HIGH	UNKNOWN
THYSANOPTERA (Thrips)								
Oriental sugar cane thrips	*Fulmekiola serrata*	*S. officinarum*	Leaves	HIGH	HIGH	HIGH	LOW	LOW
Grass thrips	*Haplothrips aculeatus*	Poaceae including sugarcane		UNKNOWN	UNKNOWN	UNKNOWN	MEDIUM	UNKNOWN

Pathogens and nematodes

Table 19. *Sugarcane pathogen and nematode threat summary table*

'Unknown' indicates insufficient information available to make an assessment of risk

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
BACTERIA (including mycoplasma-like organisms and phytoplasmas)								
Goss's bacterial wilt & leaf blight	*Clavibacter michiganensis* subsp. *Nebraskensis*	Poaceae including sorghum, maize and sugarcane	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Grassy shoot (without vector)	Phytoplasma	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf, stem	LOW[156]	LOW	LOW	LOW[157]	LOW
Grassy shoot (with vector unknown)	Phytoplasma	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf, stem	MEDIUM[158]	HIGH	HIGH	HIGH[159]	HIGH
Green grassy shoot (without vector)	Phytoplasma (*Candidatus phytoplasma*)	*Saccharum* spp.	Leaf, stem	LOW	LOW	LOW	LOW	LOW
Green grassy shoot (with vector unknown)	Phytoplasma (*Candidatus phytoplasma*)	*Saccharum* spp.	Leaf, stem	LOW	HIGH	HIGH	HIGH	MEDIUM
Stinking rot	*Pseudomonas desaiana (Burkholdia desaiana)*	*Saccharum* spp.	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN

156 Present in Bangladesh, India, Malaysia, Myanmar, Nepal and Sri Lanka. Because of the confusion about the vector(s) responsible for transmission of grassy shoot disease, it is difficult to assess the risk of natural spread. Illegal import of cuttings represents a significant risk.

157 Grassy shoot disease can cause losses of up to 70 per cent in some fields. Affected plants produce little or no millable cane. Grassy shoot is the third most important disease of sugarcane in India.

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Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Bacterial sun spot	*Pseudomonas spp. (syn Burkholdia* spp.)	*Saccharum* spp.	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Stalk rot	*Pseudomonas syringae pv. lapsa*	Poaceae including sugarcane, sorghum and maize	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
White leaf (without vector)	White leaf phytoplasma	*Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*[160]	Leaf, stem	LOW[161]	LOW[162]	LOW[163]	LOW[164]	LOW
White leaf (with vector *Matsumuratettix hiroglyphicus*)	White leaf phytoplasma	*Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*[165]	Leaf, stem	MEDIUM[166]	HIGH[167]	HIGH[168]	HIGH[169]	HIGH
Leaf scald	*Xanthomonas albilineans*[170] (exotic strains- serological groups 2 or 3)	*Saccharum* spp.	Leaf, stem	HIGH[171]	HIGH[172]	HIGH[173]	HIGH[174]	HIGH

160 Possibly other grasses but this has not been confirmed by definitive studies

161 Present in Taiwan and Thailand. Natural spread of white leaf disease via planthoppers (*Matsumuratettix hiroglyphicus*) is possible but the limited reports of spread outside the countries in which it occurs suggests that this is a low risk. Spread by illegal import of cuttings is possible. The widespread occurrence in Thailand would suggest this is the most likely source of the disease. Authorised germplasm exchange could present a risk for entry of the disease. Even if the disease did escape through quarantine the absence of the vector would mean the disease would not be able to spread from the infected plants. Hot water treatment does not appear to be effective for white leaf disease.

162 The suitability of environments in Australian canegrowing districts for the white leaf phytoplasma and its vector, *M.hiroglyphicus* is unknown

163 White leaf disease can be spread by planting infected cuttings and by the planthopper, *Matsumuratettix hiroglyphicus* Matsumura. The vector carries the phytoplasma in a persistent manner, becoming infectious 14 to 40 days after feeding on an infected plant.

164 White leaf is a serious disease in Thailand and Taiwan. Yield losses in severely affected fields can be so great that it is no longer viable to harvest the fields. White leaf is considered the most serious disease of sugarcane in Thailand. In Taiwan, the disease was important in the past but extensive control programs have reduced its importance.

165 Possibly other grasses but this has not been confirmed by definitive studies

166 Present in Taiwan and Thailand. Natural spread of white leaf disease via planthoppers (*Matsumuratettix hiroglyphicus*) is possible but the limited reports of spread outside the countries in which it occurs suggests that this is a low risk. Spread by illegal import of cuttings is possible. The widespread occurrence in Thailand would suggest this is the most likely source of the disease. Authorised germplasm exchange could present a risk for entry of the disease. Even if the disease did escape through quarantine the absence of the vector would mean the disease would not be able to spread from the infected plants. Hot water treatment does not appear to be effective for white leaf disease.

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170 Three distinct serotypes and at least eight DNA groups. Serotype 1 is in Australia and serotypes 2 and 3 are exotic

171 Previously referred to as serotypes 1, 2 or 3. Found in 57 countries including Australia (which has Serotype 1 only). Existing serotype present in all sugar growing regions in Australia except the Ord River district. Serotype has now been replaced by haplotype, with the taxonomy of this pest evolving rapidly (pers. comm. Barry Croft).

172 Existing serotype present in all sugar growing regions in Australia except the Ord River district

173 Infected cuttings produce a high percentage of infected plants. The bacterium can be spread by wind-blown rain, particularly during severe weather events. Readily spread by cutting implements such as knives and mechanical harvesting and planting equipment. High risk of spread in latently infected cuttings.

174 Leaf scald is a serious disease which can cause significant yield losses and loss of highly susceptible varieties. Severe losses can occur if there are high levels of disease and moisture stress

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Gumming	*Xanthomonas axonopodis* pv. *vasculorum*	*Saccharum* complex species[175], *Zea mays*, *Dictyosperma album*, *Roystonea regia, Areca cathecu*, *Thysanolaena maxima, Tripsacum fasciculatum*	Leaf, stem	LOW[176]	HIGH[177]	HIGH[178]	LOW[179]	VERY LOW
FUNGI								
Alternaria leaf spot	*Alternaria alternata (Sugarcane infecting strains)*	Very broad host range including apple, strawberry, sugarcane, citrus, stonefruit, Alliums, cruciferous crops, Solanaceous crops, pistachio, flower crops and others	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Baker's leaf spot	*Bakerophoma sacchari*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Ramu orange leaf	Basidiomycete fungus[180]	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Dry rot	*Botryosphaeria quercuum*	European beech, sugarcane	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Brown spot	*Cercospora longipes*	*Saccharum* complex species[181]	Leaf	MEDIUM[182]	HIGH[183]	HIGH[184]	LOW[185]	LOW
Black spot	*Cerocospora acerosum*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN

175 *Saccharum* interspecific hybrids, *S. officinarum*, S. *spontaneum*, *S. robustum*, *S. edule*, *S. barberi*, *S. sinense*

176 Not by natural spread. Spread by illegal import of cuttings is possible.

177 Gumming disease was widespread in all cane growing districts of Australia when it was present earlier in this century.

178 The bacterium is spread by wind-blown rain. The disease can be spread by cutting implements and by planting infected cuttings.

179 Gumming was a major disease in Australia until the early 1930s. With the replacement of the noble canes (*S. officinarum*) with interspecific hybrids, the disease decreased in significance. A recent epidemic occurred in Mauritius in the 1980s which caused significant yield losses.

180 Unknown causal agent

181 *Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*, *S. barberi*, *S. sinense*

182 Found in 34 countries, including Indonesia and Papua New Guinea. Natural spread is unlikely. Illegal movement of sugarcane is the most likely means of entry into Australia. Brown spot is not a risk in germplasm exchange. High risk areas for entry are the Torres Strait, Cape York and northern cities.

183 Brown spot has been reported to cause significant loss of leaf area in tropical and sub-tropical climates, and it is likely that the disease could establish in many districts of the Australian sugarcane industry.

184 Spores of the fungus are produced on both sides of the leaf and are spread by wind-blown rain. Spores can be carried on leaf material adhering to cuttings.

185 Brown spot is generally considered to be of minor economic importance but one report from Louisiana (USA) measured yield losses of up to 12 per cent. On a recent study tour of South Africa by SRA (formerly known as BSES) pathologists, many fields were observed with severe leaf scorching caused by a heavy infestation of brown spot.

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
	Cintractia pulverulenta	Sugarcane	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Veneer blotch	*Deightoniella papuana*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Leaf Blast	*Didymosphareria taiwanensis*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	MEDIUM	UNKNOWN
Diplodia rot	*Diplodia* sp.	*Saccharum* spp.		VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
White speck (rash)	*Elsinoë sacchari* (syn. *Sphaceloma sacchari*)	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Inflorescence binding	*Ephelis pallida*	Poaceae	Inflorescence	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Powdery mildew	*Erysiphe graminis* (sugarcane infecting strains)	Poaceae	Leaf, stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Zonate foot rot	*Fomes* sp.	*Saccharum* spp.	Root	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Red line disease	*Fusarium* sp.	*Saccharum* spp.	Leaf, stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Fusarium wilt	*Fusarium sacchari*	*Saccharum* spp.	Vascular system/ stem	VERY LOW	UNKNOWN	UNKNOWN	MEDIUM	UNKNOWN
Fusarium sett or stem rot	*Fusarium tricinctum* (sugarcane infecting strains)[186]	*Saccharum* spp.	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Zonate leaf spot	*Gloeocercospora sorghi*	Sugarcane, pearl millet, sorghum, Johnson grass, Sudan grass, maize	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN

186 Currently present in Australia, but it is believed that the sugarcane strain is exotic. Only limited information available.

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Helminthosporium leaf spot, target blotch	*Helminthosporium purpurascens, H. portoricebsis, Setosphaeria rostrata (sugarcane infecting strains), Deschslera tetramera*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Collar rot	*Hendersonina sacchari*	*Saccharum* spp.	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Leaf blight	*Leptosphaeria taiwanensis* (Syn. *Saccharicola taiwanensis*)	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf	LOW[187]	MEDIUM[188]	HIGH[189]	LOW[190]	VERY LOW
Glume blight	*Mycosphaerella holci*	Poaceae including sugarcane	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Leaf-splitting disease	*Mycosphaerella striatiformans*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Myriogenospora leaf binding, tangle top	*Myriogenospora aciculispora*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Culm and midrib rot	*Papularia vinosa*	Various Poaceae including sugarcane and maize	Stem, leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Leaf blast	*Paraphaeospaeria michotii*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Red leaf spot of sugarcane	*Passalora vaginae*	Sugarcane	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Periconia leaf spot	*Periconia sacchari*	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN

187 Present in India, the Philippines, Japan and Taiwan. The disease is not carried systemically within cuttings of sugarcane. The risk of natural spread of the disease or spread in authorised imports of germplasm to Australia would be negligible. Spread on illegally imported cuttings could occur.

188 Only high rainfall areas

189 Spread by wind blown rain over limited distances

190 Leaf blight causes significant loss of green leaf area but no study of the effect of the disease on yield has been reported. The disease is only a serious problem in high rainfall areas.

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Rust	*Puccinia erythropus*	Poaceae including sugarcane	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Phyllosticta leaf spot	*Epicoccum sorghi* (syn. *Phyllosticta sorghina*)	*Saccharum* spp.	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Black stripe	*Pseudocercospora atrofiliformis*	Poaceae	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Black stem rot	*Pseudoseptoria* (Syn. *Selenophoma obtusa*)	Poaceae	Stem	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Leaf scorch	*Saccharicola bicolor*	*Saccharum* spp,	Leaf	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Floral smut	*Sporisorium cruentum* (Syn. *Sphacelotheca cruenta*)	Poaceae including sorghum, maize and sugarcane	Inflorescence	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Floral smut	*Sorosporium indicum*	Sugarcane	Inflorescence	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Floral smut	*Sphacelotheca erianthi*	*Saccharum* spp.	Inflorescence	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Covered smut	*Sphacelotheca macrospora*	Poaceae especially *Miscanthus* sp., *Saccharum* spp.	Inflorescence	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Floral smut	*Sporisorium sacchari* (Syn. *Ustilago courtoisi Sphacelotheca schweinfurthiana, S. sacchari*)	Poaceae, especially *Saccharum* spp.	Inflorescence	VERY LOW	UNKNOWN	UNKNOWN	VERY LOW	UNKNOWN
Leaf scorch	*Stagonospora sacchari*	*Saccharum* complex species[191], *Miscanthus sinensis*, *M. floridulus.*	Leaf	MEDIUM[192]	HIGH[193]	HIGH[194]	HIGH[195]	HIGH

191 *Saccharum* interspecific hybrids, *S. officinarum, S. spontaneum, S. robustum, S. edule, S. barberi, S. sinense*

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Root and basal stem rot	*Xylaria arbuscula*	*Saccharum* spp.	Roots and stems	LOW	HIGH	MEDIUM	HIGH	MEDIUM
NEMATODES								
Sting nematode	*Belonolaimus longicaudatus*	Sugarcane, turf grass, corn, sorghum, rye, millet,, oats, wheat, clover, Lucerne, cotton, potato, soybean, strawberry, beans, cabbage, pepper and melons	Root	NEGLIGIBLE	MEDIUM	MEDIUM	MEDIUM[196]	NEGLIGIBLE
Sugarcane cyst nematode	*Heterodera sacchari*	Poaceae including rice and sugarcane	Root	MEDIUM	HIGH	HIGH	MEDIUM[197]	MEDIUM
Cyst nematode	Heterodera zeae	Corn, sugarcane and sorghum	Root	MEDIUM	HIGH	MEDIUM	HIGH[198]	MEDIUM
Lance nematode	*Hoplolaimus indicus*	Rice, banana, cauliflower, chilli, citrus, corn, cotton, cowpea, chrysanthemum, cucumber, eggplant, mango, mung bean, peanut, pepper, pigeon pea, potato, radish, sugarcane, sweet potato and tomato	Root	NEGLIGIBLE	HIGH	LOW	MEDIUM[199]	NEGLIGIBLE
Lance nematode	*Hoplolaimus pararobustus*	Banana, oil palm, cotton, citrus, coffee, cowpea, grapevine, guava, mango, papaya, pineapple, rice, roses, sorghum, sugarcane, tea and wheat	Root	NEGLIGIBLE	MEDIUM	LOW	MEDIUM[200]	NEGLIGIBLE

192 The natural spread of leaf scorch to Australia is unlikely. The disease is currently found in Asia (Bangladesh, Indonesia, India, Japan, the Philippines, Taiwan, Thailand, and Vietnam), Africa (Nigeria, South Africa), Central and South America (Argentina, Cuba, and Panama) and the Hawaii (USA). Nearest known locations to Australia are Indonesia (Sumatra) and the Philippines. Further spread in Indonesia or from the Philippines to Papua New Guinea would increase the risk of entry into Australia (NB: leaf scorch was reported for the first time on Java, the main island for commercial sugarcane production in Indonesia, in 2002 which further increases the risk to Australia). Spread via illegally imported cuttings or leaf pieces is possible. The spread of the disease to Sumatra in the early 1980s is thought to have been associated with an unauthorised import of cane from Taiwan. Transmission by leaf residues on machinery poses a definite high risk for entry of this pathogen.

193 The epidemiology of leaf scorch disease would suggest that the disease would establish and be more severe in the wet tropical regions, but it could also cause some losses in other regions when environmental conditions are favourable.

194 Spores are dispersed by wind-blown rain and on contaminated leaves or cuttings.

195 Leaf scorch is an important disease in Taiwan, the Philippines and more recently Indonesia (Sumatra). Yield losses of up to 30 per cent have been reported.

196 A destructive species of nematode capable of causing major damage to commercial crops. Considered the main nematode pest in Florida, US. Impact is dependent on soil type. **http://entnemdept.ufl.edu/creatures/nematode/sting_nematode.htm**

197 Considered a potential serious pest of sugarcane, despite lack of field experimentation **http://nematode.unl.edu/pest14.htm**

198 Is a widespread pest, from North Africa to India and can cause damage to sugarcane **http://www.fao.org/docrep/v9978e/v9978e05.htm**

199 Present in Bangladesh, China, India and Iran and has been reported to cause plant stunting in sugarcane fields **http://nematode.unl.edu/pest43.htm**

200 Often associated with a decline of sugarcane and other plants in Africa and Asia **http://www.fao.org/docrep/v9978e/v9978e05.htm** and **http://nematode.unl.edu/pest50.htm**

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Needle nematode	*Longidorus laevicapitatus*	Sugarcane	Root	NEGLIGIBLE	MEDIUM	LOW	HIGH[201]	NEGLIGIBLE
Groundnut testa nematode	*Aphelenchoides arachidis*	Peanut, corn, rice and sugarcane	Root	HIGH[202]	HIGH	HIGH	MEDIUM[203]	MEDIUM
Coffee root-knot nematode	*Meloidogyne exigua*	Amaranthus, banana, coffee, cucumber, onion, pepper, rice, stagger weed, sugarcane, tomato and watermelon	Root	LOW	MEDIUM	MEDIUM	MEDIUM[204]	LOW
Root-knot nematode	*Meloidogyne africana*	Coffee, corn, cowpea and sugarcane	Root	NEGLIGIBLE	MEDIUM	MEDIUM	MEDIUM[205]	NEGLIGIBLE
Root-knot nematode	*Meloidogyne kikuyensis*	Coffee, cowpea, kikuyu grass and sugarcane	Root	LOW	MEDIUM	MEDIUM	MEDIUM[206]	LOW
OOMYCETES								
Dry top rot	*Ligniera vasculorum*	*Saccharum* spp.	Whole plant	LOW	LOW	LOW	LOW	VERY LOW
Leaf-splitting disease	*Peronosclerospora miscanthi*	*Saccharum* spp.	Leaf	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Leaf-splitting disease	*Peronosclerospora northii*	*Saccharum* spp.	Leaf	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Downy mildew[207]	*Peronosclerospora philippinensis*	*Zea mays*, *Saccharum* interspecific hybrids, *S. officinarum,* oats, sorghum, maize	Leaf, stem	MEDIUM[208]	HIGH[209]	HIGH[210]	HIGH[211]	HIGH

201 Known to attack sugarcane in many African countries **http://www.fao.org/docrep/v9978e/v9978e05.htm**

202 Aphelenchoides sp. are amongst the most common nematodes detected moving on produce, ornamentals and nursery stock (pers. comm. Dr Mike Hodda, CSIRO)

203 Sugarcane is not the major host, but can suppress yield. Only reported in Nigeria. **http://nematode.unl.edu/pest35.htm**

204 Wide distribution throughout South America. Coffee is the major host but has been reported on sugarcane **http://nematode.unl.edu/pest38.htm**

205 Decline of sugarcane has been associated with this pest. Only present in Africa **http://nematode.unl.edu/pest59.htm**

206 Decline of sugarcane has been associated with this pest. Only present in Africa **http://nematode.unl.edu/pest56.htm**

207 Listed on the United States of America's Bioterrorism target list

208 *P. philippinensis* is seed borne in moist grain. Present in Asia, including China, India, Indonesia, the Philippines, Nepal and Thailand. The pathogen is widespread in Indonesia having been reported in West Papua, Java, Maluku, Sulawesi and Sumatra.

209 The primary host (maize) and alternative hosts occurs across northern Australia.

210 Wind is the most important agent in spore dispersal. Storms may give a sudden scattering of the disease over several kilometres in the path of a storm.

211 Philippine downy mildew is potentially the most destructive disease of maize in Asia. In some regions of the Philippines growers have been forced to abandon maize production. The disease is most severe in rainy seasons. P. philippinensis is also an important pathogen of sugarcane in some countries.

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Downy mildew	*Peronosclerospora sacchari*	*Saccharum* complex species[212], *Zea mays*[213]	Leaf, stem, inflorescence	MEDIUM[214]	HIGH[215]	HIGH[216]	HIGH[217]	HIGH
VIRUSES AND VIROIDS								
Maize streak virus (without vector)	*Maize streak virus (Mastrevirus)*	Maize, *Saccharum* spp.	Leaf[218]	LOW	LOW	LOW	LOW	LOW
Maize streak virus (with vector *Cicadulina mbila*)	*Maize streak virus (Mastrevirus)*	Maize, *Saccharum* spp.	Leaf[219]	LOW	HIGH	HIGH	MEDIUM	LOW
Red leaf mottle	*Peanut clump virus* (*Poaceaevirus*)	Aizoaceae, Amaranthaceae, Chenopodiaceae, Cucurbitaceae, Poaceae, Leguminosae, Scrophulariaceae and Solanaceae	Leaf, stem	LOW[220]	HIGH[221]	HIGH[222]	LOW[223]	VERY LOW
Mosaic	*Sorghum mosaic virus* (*Potyvirus*)	*Saccharum officinarum, Sorghum bicolor*	Leaf	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM

212 *Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*, *S. robustum*, *S. edule*, *S. barberi*, *S. sinense*

213 Highly susceptible

214 Currently found in Fiji, India, Indonesia, Japan, Papua New Guinea, the Philippines, Taiwan, and Thailand. Spread of downy mildew to Australia by wind-blown spores is not considered possible because of the delicate nature of the conidia. Downy mildew could be introduced into Australia in illegally imported plants or cuttings from Papua New Guinea, Irian Jaya or Fiji.

215 When downy mildew occurred in Australia it was present and caused significant yield losses in all districts of the Australian sugarcane industry. The disease therefore has potential to establish and significantly affect all districts if an incursion occurs.

216 Spores only travel around 400m. Spread in infected cuttings.

217 Downy mildew is reported to be a very severe disease with extensive yield losses in susceptible varieties. In Papua New Guinea, losses were estimated at up to 15 per cent in susceptible varieties. Up to 36 per cent of clones imported to Papua New Guinea are too susceptible for commercial production and 50 per cent of Australian clones are susceptible. Restrictions on the use of susceptible varieties would affect the yield potential in areas where the disease is present.

218 This virus has a leafhopper insect vector (*Cicadulina mbila*)

219 This virus has a leafhopper insect vector (*Cicadulina mbila*)

220 Peanut clump virus has been reported in sugarcane from Burkina Faso, Senegal and Sudan, as well as on peanuts from India. The disease is transmitted in soil by the fungus *Polymyxa graminis*, a common soil inhabitant, and by planting infected cuttings. Due to the limited distribution of this virus the likelihood of entry via illegally imported cuttings is low. Importation for authorised germplasm exchange is possible and the symptoms may be confused with genetic effects, however it is unlikely that there will be a need to import sugarcane from the known affected countries.

221 The vector of peanut clump virus (*Polymyxa graminis)* is a common fungal soil inhabitant and therefore there is a potential for the disease to spread in many sugarcane districts. However, not enough is known about the disease in sugarcane to determine the likely extent of the disease.

222 The disease is transmitted in soil by the fungus, *Polymyxa graminis*, and by planting infected cuttings

223 Red leaf mottle can cause significant yield losses of up to 6 per cent in the plant crop but losses are less in ratoon crops

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Mosaic	*Sugarcane mosaic virus* (*Potyvirus*) (exotic strains)[224]	Sorghum halepense, *Saccharum officinarum*	Leaf, stem	MEDIUM[225]	HIGH[226]	HIGH	MEDIUM[227]	MEDIUM
Sugarcane streak mosaic virus	*Sugarcane streak mosaic virus* (*Poacevirus*)	*Saccharum* spp.	Leaf	MEDIUM	HIGH	HIGH	HIGH	HIGH
Streak (without vector)	*Sugarcane streak virus* (*Mastrevirus*) syn. *Sugarcane streak virus (Monogeminivirus)*	*Cenchrus echinatus, Saccharum officinarum*	Leaf	LOW	LOW	LOW	LOW	LOW
Streak (with vector)	*Sugarcane streak virus* (*Mastrevirus*) syn. *Sugarcane streak virus (Monogeminivirus)*	*Cenchrus echinatus, Saccharum officinarum*	Leaf	LOW	HIGH	HIGH	MEDIUM	LOW
Ramu stunt (without vector)	Suspect virus[228]	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf, stem	MEDIUM[229]	LOW	LOW	LOW[230]	NEGLIGIBLE

224 The stains from Australian sugarcane are closely related to those from the USA and South Africa. There are at least 2 separate Chinese lineages (from maize), a separate USA lineage (from Maize in Iowa) and European lineage. Pathogenicity studies have not been performed to compare these lineages. Whether there are other strains out there is unknown.

225 Found in 69 countries including Australia. In Australia only strain A of SCMV and the closely related Johnson grass mosaic virus have been reported. Natural spread of other strains to Australia is unlikely. Nearest known location to Australia (exotic strains) is Indonesia. Entry of mosaic on illegally imported cuttings of sugarcane or a wide range of other grasses is a high risk. Mosaic symptoms have been detected in authorised introductions of *Cynodon dactylon* and *Miscanthus sinensis* recently imported into Australia. *Miscanthus* is valued as an ornamental plant, often with variegation of the leaves, which makes detection of mosaic symptoms difficult. Authorised germplasm exchange presents a risk of entry of mosaic viruses because of the wide host range and therefore many species involved in the risk and the widespread occurrence of the viruses in nearly all the major sugarcane producing countries and other countries where grasses may be imported from.

226 Sugarcane mosaic generally only causes significant disease losses in the sub-tropical regions of the world. In Australia, SCMV has only rarely been reported north of Mackay. It is likely that any new strains would also be most important in the central and southern cane growing districts.

227 Mosaic has caused serious losses in many countries, particularly in sub-tropical areas. Losses have been measured up to 50 per cent in susceptible varieties.

228 Ramu stuntis thought to be caused by a novel virus related to the genus Tenuivirus.

229 Found in the Ramu Valley of Papua New Guinea. Natural spread of the planthopper vector of Ramu stunt to commercial sugarcane fields is considered to be a high risk because of its current common occurrence in the Torres Strait and Cape York. Because the distribution of the pathogen outside the Ramu Valley is unknown, the risk of the pathogen being present in the vector cannot be determined. Ramu stunt could be introduced into Australia in illegally imported plants or cuttings.

230 Ramu stunt caused a severe epidemic in the small Ramu Sugar plantation in Papua New Guinea in 1985-1986 with a 40 per cent reduction in yield over the whole plantation. Drastic measures had to be taken to limit the damage or yield losses would have increased in subsequent years. Up to 30 per cent of all clones imported to the Ramu Sugar plantation from overseas are susceptible to Ramu stunt.

Common name	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall Risk
Ramu stunt (with vector)	Suspect virus[231]	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf, stem	MEDIUM[232]	HIGH	HIGH[233]	EXTREME[234]	EXTREME

231 Ramu stunt is thought to be caused by a novel virus related to the genus Tenuivirus.

232 Found in the Ramu Valley of Papua New Guinea. Natural spread of the planthopper vector of Ramu stunt to commercial sugarcane fields is considered to be a high risk because of its current common occurrence in the Torres Strait and Cape York. Because the distribution of the pathogen outside the Ramu Valley is unknown, the risk of the pathogen being present in the vector cannot be determined. Ramu stunt could be introduced into Australia in illegally imported plants or cuttings.

233 Ramu stunt is transmitted by the island sugarcane planthopper *Eumetopina flavipes* (Hemiptera: Delphacidae) and by the planting of infected stalk material. Ramu stunt disease is widespread throughout Papua New Guinea, but has not been detected in Australia. Virus-free populations of *E. flavipes* are present on Saccharum hybrids and *S. officinarum* on many islands in the Torres Strait, and a number of small populations persist on the northern Cape York Peninsula. Both the vector and the virus would need to be transported concurrently for the disease to become established and spread within Australia.

234 Ramu stunt caused a severe epidemic in the small Ramu Sugar plantation in Papua New Guinea in 1985-1986 with a 40 per cent reduction in yield over the whole plantation. Drastic measures had to be taken to limit the damage or yield losses would have increased in subsequent years. Up to 30 per cent of all clones imported to the Ramu Sugar plantation from overseas are susceptible to Ramu stunt.

Pests of unknown distribution, biology or cause

Table 20. *Sugarcane pests of unknown distribution, biology or cause*

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Comments
INVERTEBRATES								
ACARI (Mites e.g. spider and gall mites)								
Sugar leaf mite	*Oligonychus indicus*	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
COLEOPTERA (Beetles and weevils)								
White grub	*Heteronychus robustus*	Sugarcane	Above and below ground plant parts	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
White grub	*Holotrichia reynaudi*	Peanut, sugarcane	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Areca white grub	*Leucopholis lepidophora*	Sugarcane, rice, maize and peanut	Roots	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Sri Lankan weevil	*Myllocerus undecimpustulatus*	Wide host range including: sugarcane, mango, pomegranate, citrus, peach, lychee, eggplant	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
HEMIPTERA (Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)								
Sugarcane black bug	*Cavelerius excavatus*	*Sugarcane*	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
	Tetraneura coimbatorensis	*Saccharum* spp., *Ulmus wallichii*, *Neyaudia arundinaceae*, possibly other Gramineae	Leaf	UNKNOWN[235]	UNKNOWN	UNKNOWN	UNKNOWN	

235 May enter via wind-assisted flight of adults or infested plant material. Found in India, Pakistan, New Guinea and Indonesia. Nearest known location to Australia is Indonesia. Check BICON for current import conditions.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Comments
	Tropidecephala serendiba	*Saccharum* spp.	Leaf	UNKNOWN[236]	UNKNOWN	UNKNOWN	UNKNOWN[237]	
ISOPTERA (Termites)								
Termite	*Odontotennes obesus*	Sugarcane, peanut, wheat, sunflowers	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
LEPIDOPTERA (Butterflies and moths)								
	Cosmopterix pallidifasciella	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
	Cyclocephala amazona signata	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Slug moth	*Parasa bicolor*	Sugarcane, rice	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Dark small-branded swift	*Pelopidas mathias*	Rice, sugarcane, bamboo, oats, barley, sorghum, wheat, maize	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Jute hairy caterpillar	*Spilosoma obliqua*	Jute (*Corchorus* spp.), sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
ORTHOPTERA (Grasshoppers and locusts)								
Short-horned grasshopper	*Gastrimargus transversus*	Sugar, cereals, millet, rice	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
	Hieroglyphus nigrorepletus	Sugarcane, rice, millet, wheat, maize	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
PATHOGENS								
BACTERIA (including mycoplasma-like organisms and phytoplasmas)								
Bacteriosis	Undetermined	*Saccharum* spp.	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen

236 May enter via infested plant material. Present in India, Sri Lanka and West Malaysia (nearest known location to Australia). Check BICON for current import conditions.

237 Low if considering direct damage to the crop but high if the insect is capable of transmitting plant diseases. This sap sucker decreases the photosynthetic capacity of the plant due to feeding and to the production of sooty moulds on the excreted honeydew. This will result in a decrease in yield and quality. Leaves become desiccated and withered with continued feeding.

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Comments
Indian sugarcane yellow leaf phytoplasma	*Indian sugarcane yellow leaf phytoplasma*	Sugarcane	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
Western x disease phytoplasma	*Western x disease phytoplasma*	Sugarcane	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
FUNGI								
Wilt complex	*Acremonium implicatum*	*Saccharum* spp.	Vascular system/ stem	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
Leaf spot of grasses	*Helminthosporium halodes*	Coconut, oil palm, sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Pestalotia Leaf spot	*Pestalotia fuscescens* var. *sacchari*	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Stalk rot disease	*Phaeocytostroma sacchari*	Sugarcane	Stalk	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Twisted leaf disease	*Phoma sorghina* var. *saccharum*	Sugarcane	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
OOMYCETES								
Downy mildew	*Peronosclerospora spontanea*	*Saccharum* interspecific hybrids, *S. officinarum*, *S. spontaneum*	Leaf, stem	UNKNOWN[238]	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
VIRUSES AND VIROIDS								
Reovirus (South Africa)	Reovirus	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this disease. It is thought to be from the same family of Fiji leaf gall disease

238 Found in the Philippines and Thailand

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Comments
Sobemovirus (Papua New Guinea)	Sobemovirus	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
Sugarcane mild mosaic virus	Possible member of the Closteroviridae	Sugarcane, rice	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	Vectored by Pink sugarcane mealybug (*Saccharicoccus sacchari*)[239]
Sugarcane red leaf mottle virus	Pecluvirus	Sugarcane	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Sugarcane streak Egypt virus	Mastrevirus	Sugarcane	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Sugarcane streak Mauritius virus	Mastrevirus	Sugarcane	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Sugarcane streak Reunion virus	Mastrevirus	Sugarcane	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Sugarcane yellow leaf virus	Polerovirus	Sugarcane	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
UNKNOWN AGENTS								
Dwarf disease of sugarcane	Unknown	Sugarecane	Whole plant	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	
Ramu leaf scorch	Undetermined	*Saccharum* interspecific hybrids, *S. officinarum*	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN[240]	No information on this pathogen
Ramu streak	Undetermined	*Saccharum* spp.	Leaf	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
Sereh	Undetermined	*Saccharum officinarum*	Leaf, stem	UNKNOWN[241]	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen

239 See: Lockhart BEL, Autrey LJC, Comstock JC (1992) Partial purification and serology of sugarcane mild mosaic virus, a mealybug-transmitted closterolike virus. *Phytopathology* 82: 691-695.

240 Significant leaf scorching in some seasons. Some yield loss may occur.

241 Carried in cuttings

Common name	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Comments
Ring mosaic	Undetermined	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
Sembur	Undetermined	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen
Spike	Undetermined	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	First reported in: Sharma SL and Jha JN (1957) “Spike” (a new) disease of sugarcane. Proceedings of the Indian Academy of Sciences – Section B. 45: 16-20.
White stripe	Undetermined	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	No information on this pathogen

Plant Health Australia
Level 1, 1 Phipps Close
Deakin ACT 2600

Phone 02 6215 7700
Fax 02 6260 4321
Email biosecurity@phau.com.au
www.planthealthaustralia.com.au

Canegrowers
Level 6, 100 Edward St
Brisbane QLD 4000

Phone 07 3864 6444
Fax 07 3864 6429
Email info@canegrowers.com.au
www.canegrowers.com.au

EXOTIC PLANT PEST HOTLINE
1800 084 881

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