Annual Operating Plan 2008-09

CRC PLANT biosecurity

Cooperative Research Centre for National Plant Biosecurity

contents

The Cooperative Research Centre for National Plant Biosecurity is the central coordinating body for plant biosecurity across all Australian states and territories and was established and is supported under the Australian Government's Cooperative Research Centres Program.

Front cover image acknowledgements: Khapra beetle - PaDIL; Grain infected with Khapra beetle - Ministry of Agriculture and Regional Development Archive

executive summary

During 2008-09, the Cooperative Research Centre for National Plant Biosecurity (CRCNPB) will be undertaking a large number of projects, with some projects reaching their initial phase of completion. As a result, publication of research outcomes and further engagement with stakeholders to use research outputs will drive many of our activities.

We are committed to continually evaluating our processes to ensure we manage projects effectively and efficiently. With the high volume of active projects, a detailed assessment will be undertaken of the current research portfolio. As well as assessing research progress against milestones, we will begin to develop a more robust methodology for economic impact analysis.

We will start preparing for our third-year review in the first half of 2008-09, with the actual review expected in late 2008. The third-year review is an opportunity for us to demonstrate progress of activities against the Commonwealth Agreement and showcase our projects. The review will also provide us with a platform to highlight progress towards fulfilling our strategic goals, by demonstrating:

- engagement among members, in particular, our researchers and end-users
- completion of major milestones across all activities at project, program and centre levels
- collaboration on project teams across organisations
- publication of high-quality, high-impact research, and
- adoption of centre outputs by end-users.

The global issue of climate change is a threat to Australia's plant biosecurity and its influence is poorly defined. We recognise the impact includes exotic threats as well as endemic threats where changes in distribution and land use occur. During 2008-09, we will maintain our commitment to research in this area and will explore (and possibly facilitate) development and expansion through the Asia-Pacific Network.

In 2008-09, we will continue to foster international linkages by undertaking collaborative research and activities in the United States, Canada, New Zealand, Thailand, Malaysia, Indonesia, United Kingdom and Europe.

our vision

To be a world leader in the generation, development and delivery of plant biosecurity science and education.

In line with our strategic goals of education, training and developing new and effective international linkages, 2008-09 will see us begin planning for an International Conference in Plant Biosecurity. Partnering with Plant Health Australia, the conference will focus on current plant biosecurity research themes and policy initiatives and is scheduled to be held in Australia in the first half of 2010.

Eradication of an exotic incursion often relies on the removal and destruction (by fire and/or burial) of part, or all of the entire affected plant. During 2008-09, we will continue to develop alternative strategies that result in eradication of the plant pest while minimising economic losses. These strategies will include drastic pruning techniques and non-invasive technologies such as sterile insect techniques and mating disruption.

The school education strategy is a keystone of our Education and Training Program and as such, several classes (along the themes of plant biosecurity) were delivered in primary schools across the Australian Capital Territory in Term 2, 2008. In early 2008-09, we will evaluate the program and the results will drive development of a national program to provide Australian school children with awareness of plant biosecurity issues.

In late 2008, a curriculum-integrated resource suitable for lower primary school children aged 5-8 will be launched in the form of a *Big Book*. This resource will include a variety of activities, stories and poems revolving around the broad themes of plant biosecurity. The *Big Book* will be distributed nationally and internationally.

As always, a number of workshops and training days for both staff and students within CRCNPB will be offered this year. With the Diagnostics Program, we are currently planning training in the area of diagnostics, particularly in relation to training of secondary level diagnosticians as Australia is rapidly losing its diagnostic and taxonomic capacity in relation to plant pests and diseases. As the larger science projects start producing outputs it is planned to deliver the new information and/or technologies through further training days and workshops, in conjunction with the Delivery and Adoption Program.

our mission

To foster scientific collaboration and engage stakeholders to deliver plant biosecurity technologies that will reduce risk to, and ensure sustainability of Australia's plant industries.

overview

The CRCNPB Annual Operating Plan provides information regarding the actions planned for 2008-09 financial year that will support achievement of Commonwealth Outcome and Program Goals.

objectives

The CRCNPB is a not-for-profit scientific organisation. Our objectives are to:

- manage our operations with the capability of pursuing world-class research and training relevant to plant biosecurity
- encourage members and other participants with differing disciplines and backgrounds (through their participation in the CRCNPB) to add value to one another so our performance is greater than that of each member and/or participant acting independently
- increase the skills of people already working in plant biosecurity and train and equip new postgraduate and other students with the skills and attributes of this field
- promote a managed and cooperative approach to research and education in plant biosecurity research to maximise benefits
- carry out education activities for students and for professional development of the persons working in plant biosecurity
- promote the objectives of the Commonwealth Government's CRC Program
- act as trustee of the CRC's intellectual property and commercialisation income, and
- commercialise CRCNPB intellectual property to ensure the maximum benefit accrues to Australia, including Australian industry, environment and the Australian economy generally.

outcomes

The outcomes to be delivered by the CRCNPB are:

1. **prevention:** reduced incidence of harmful pest incursions
2. **identification:** world-class biosecurity capability for early identification of emergency plant pest and pathogens
3. **detection:** more effective national surveillance systems
4. **response:** reduced losses from incursions of emergency plant pests.
5. **response:** cost effective insect pest control practices aligned with market demands
6. **response:** better practices for future risk management in industry
7. **realisation of the benefits of the CRCNPB:** by stakeholders as the result of adoption of improved knowledge-based systems by government and primary producer organisations, and commercialisation of diagnostic and other technologies through the private sector
8. **education:** increased awareness, knowledge and skill levels of industry personnel, and supply of trained scientists involved in the supply chain and import/export pathways.

Source: Commonwealth Agreement Deed of Variation, 1 July 2007

Australian Government CRC Program objective

The CRC Program objective is to enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation.

Source: Commonwealth Agreement, 18 November 2005

participants

The Cooperative Research Centre for National Plant Biosecurity was established and is supported under the Australian Government's Cooperative Research Centres Program. The CRCNPB is a cooperative venture between the following participant organisations with representation from most states and territories of Australia and plant biosecurity specialists in the country.

core participants

ABB

Australian Government
Department of Agriculture, Fisheries and Forestry

Charles Darwin University

CBH Group
Celebrating 75 years

CSIRO

Department of Agriculture and Food
Government of Western Australia

State Government Victoria
Department of Primary Industries

GrainCorp

GRDC
Grains Research & Development Corporation

La Trobe University

Murdoch University

NSW Department of Primary Industries

Plant Health Australia

Queensland Government
Department of Primary Industries and Fisheries

QUT

Saturn Biotech
Providing Assurance for Agriculture

SARDI
South Australian Research and Development Institute

supporting participants

Charles Sturt University

HAL
Know-how for Horticulture™

Northern Territory Government

Southern Cross University
A new way to think

The University of Adelaide
Australia

The University of Western Australia
Achieving International Excellence

current company status

This section provides a summary of the current status of CRCNPB's administrative arrangements in order to provide context for the planned activities during 2008-09.

governance

- The Board will meet quarterly during 2008-09 with meetings in Darwin, Canberra and Sydney.
- The Finance and Audit Committee will meet at least quarterly during 2008-09 in conjunction with Board meetings.
- CRCNPB's Senior Management team (consisting of CEO, Business Manager and Research Leader) will meet fortnightly to administer the policies and delegations of the Board and provide executive support to the centre.
- CRCNPB's Science Committee will meet monthly by teleconference and quarterly at face-to-face meetings to continue managing program and project plans during 2008-09.

Board members (as at 30 June 2008)

Chairman	Professor John Lovett
Deputy Chairman	Mr Barry Windle
Director	Ms Christine Campbell
Director	Dr Jim Cullen
Director	Professor John Irwin
Director	Mr Chris Richardson
Director	Mr John Sandow

financial structure

Last year's amalgamation of accounts to a simpler financial model has also provided us with the ability to be more analytical, flexible and timely in our financial reporting.

At the same time improvements in project analysis means we are able to produce data specific to our participants across the whole range of our programs and projects. This data analysis provides insight of where there might be gaps in our research funding and in-kind requirements. It is also vital in giving our stakeholders an understanding of what is working and where improvements can be made.

Ultimately, it helps provide us and our stakeholders with the insight it requires to become efficient and effective research players.

management

CRCNPB's management is outlined as follows:

Chief Executive Officer	Dr Simon McKirdy
Research Leader	Dr David Eagling
Business Manager/Company Secretary	Mr Nick Langley
Delivery and Adoption Program Leader	Vacant
Executive Assistant	Ms Lauren Searson-Patrick
Education Officer	Vacant
Project Officer	Ms Carla Tadich
Communications Officer	Ms Kate Scott
Administrative Assistant	Ms Alejandra Cano

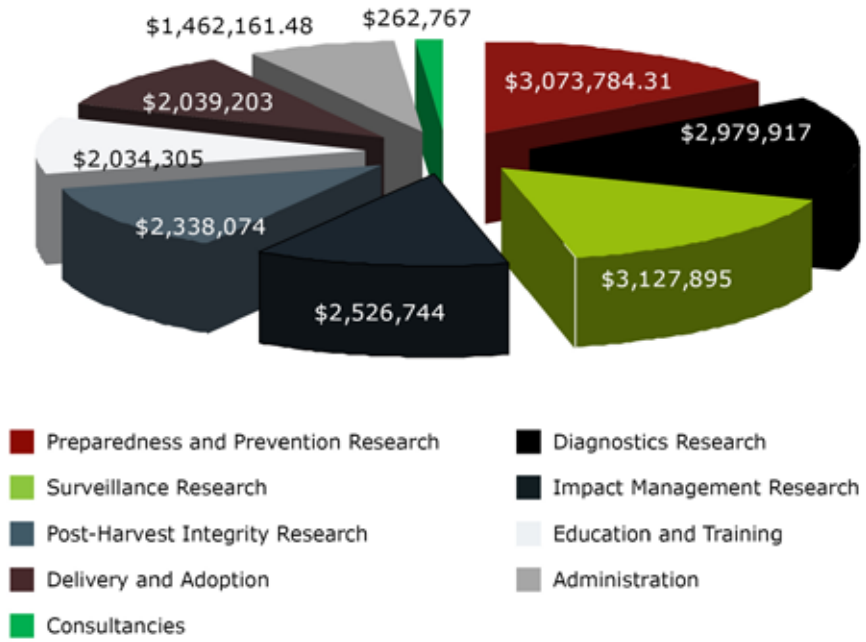
office

Our offices are currently located in Building 6 at the University of Canberra. Along with our growth in staff, the key motivator for moving was to co-locate and develop linkages with other CRCs, such as Invasive Animals. The University of Canberra leases commercial offices to science and research based organisations.

program expenditure

The expected expenditure for each program for 2008-09 is indicated in the following pie chart. The chart also includes the administration function (running costs of the corporation such as remuneration of board and corporate employees and associated costs), as well as consultancies.

2008-09 program expenditure: total $19,844,841 (includes cash and in-kind)



programs and projects

This section provides an overview of the seven programs undertaken by the CRCNPB.

The first five programs focus on innovative research activities across the full biosecurity continuum; pre-border, border, post border. The sixth program focuses on education and training while our final program maximises the adoption of new research.

Details on individual projects will be available on our website **www.crcplantbiosecurity.com.au** from August 2008.

program 1:
preparedness and prevention research

key objectives for 2008-09

- complete development and commence delivery of a project which aims to minimise risk in grain transport and storage
- facilitate expansion of CRCNPB climate change research through the Asia-Pacific Network
- expand CRCNPB risk assessment research through membership of the European Union PRATIQUE consortium
- undertake new ACERA research linkage opportunities

The Preparedness and Prevention Research Program seeks to deliver the knowledge required to underpin decisions on the risk of entry, establishment and spread for exotic plant pests. Improving Australia's capacity to identify threats, to prioritise them and to allocate resources to mitigate, will strengthen the level of preparedness and as such, contribute to Australia's ability to minimise the impact of exotic plant pests.

As quarantine (pest and import) risk analysis is a core plank upon which international trade is regulated, the stronger the science base underpinning Australia's trade decisions the stronger the defensible position Australia will be placed to defend them.

The goal of this program is to decrease the incidence and impact of exotic plant pest incursions through contributing to the development of risk analysis systems based on sound science to support decision making. To achieve this, the program has a strategic vision to identify threats across the whole biosecurity continuum, from developing mechanisms to identify pre-emergent threats through to increasing our capacity to deal with known threats. The program recognises that to strengthen Australia's capability of analysing threats, we need to be able to critically review the current approaches used and identify whether they can be improved and where improvements will bring measurable dividends.

A key threatening process to plant biosecurity is climate change. At present the influence of climate change on these factors is poorly defined. Further, we recognise that in climate change, exotic threats are of biosecurity concern, as well as endemic threats. These include changes in distribution and abundance (coupled with changes in land use) and can directly impact on the level of the threat posed and the subsequent priority to industry and jurisdictions. We recognise we have a role in developing the tools and methodologies to engage with policymakers and provide industries with capacity to make informed decisions in regards to their management of the potential impacts of climate change.

program 2:
diagnostics research

key objectives for 2008-09

- complete development and commence delivery of the second phase of research for remote diagnostics
- facilitate expansion of CRCNPB insect diagnostic research through collaboration with Asian research institutions
- extend CRCNPB diagnostic capacity to neighbouring countries

The aim of the Diagnostics Program is to develop and foster world-class capability for early identification of exotic plant pest incursions in Australia by providing data, expertise and diagnostic technology that is accurate, accessible and cost effective.

Diagnostics capability is a core component of Australia's front-line biosecurity system. Those involved in prevention, surveillance, and impact management of exotic plant pests have a basic need for diagnostic information and access to expertise and technological capability to rapidly and accurately identify plant pests.

To provide reliable diagnostic tests for many of the currently listed exotic plant pests the Diagnostics Program will develop:

- diagnostic tests for critical and important pests
- new technology platforms for fast, accurate and cheap delivery of diagnostic tests, and
- systems for the delivery of up-to-date diagnostic information for pests.

Improvements in these three areas will deliver better diagnostic capability that will underpin other important components of our biosecurity system.

program 3:
surveillance research

key objectives for 2008-09

- complete development and commence delivery of the second phase of research for PDAs and sensor technologies
- facilitate expansion of CRCNPB sensor research through collaboration with leading Australian research agencies
- complete development and initiate delivery of sampling methodologies and tools for stored grain

The aim of the Surveillance Program is to develop effective national plant biosecurity surveillance systems based on scientifically sound sampling tools, new technology and innovative survey methods.

Short-term projects will deliver a national exotic plant pest surveillance strategy for grains and national guidelines for surveillance with hand-held equipment. Sensor technology to enhance surveillance trapping and field operator effectiveness are also being investigated.

Medium-term projects will increase surveillance effectiveness, in particular, grain surveillance and fruit fly trapping for market access.

A long-term goal of the surveillance program is to develop a real-time simulation tool for surveillance.

program 4:
impact management research

key objectives for 2008-09

- complete development and commence delivery of new generation diagnostic tools for post-entry quarantine
- facilitate expansion of CRCNPB eradication strategies through collaboration with leading international research agencies
- complete development and initiate delivery of research into safe movement of exotic plant pest samples across state borders

The aim of the Impact Management Research Program is to improve the management of exotic plant pest incursions in Australia. Effective and efficient management of exotic incursions requires the ability to assess the likely success and associated costs and benefits of alternative responses. Despite having one of the most aggressive biosecurity programs in the world, Australia has a limited objective analytical capability to undertake this assessment, either proactively in advance of an incursion or during an eradication response.

The challenge is to improve confidence in the system outputs. This will require development of new modules and the enhancement of existing modules. For example, successful eradication of exotic plant pests will depend critically on the length of time between an initial incursion and its subsequent identification. Therefore the addition of a module covering the socio-economic responses of farmers to incursion management strategies has been identified as a key task.

Finally the eradication of an exotic incursion often relies on the removal and destruction, by fire and/or burial, of part or entire affected plants. The challenge is to develop alternative strategies that result in the eradication of the plant pest while minimising economic losses. There is also a strategic opportunity to develop a generic systems approach for the eradication of exotic plant pests using non-invasive technologies such as sterile insect techniques and mating disruption.

program 5:
post-harvest integrity research

key objectives for 2008-09

- complete development and commence delivery of research on the enhanced application and use of phosphine technology
- respond to the findings and recommendations of an independent review on alternatives to phosphine
- complete development and commence delivery of research to address biosecurity design and management issues for grain storage

The focus of the Post-Harvest Integrity Research Program is the development of practices and technologies that underpin the continued competitiveness of Australian products in local and international markets.

Market access for Australian products depends on the continued supply of safe, high-quality, contaminant-free products to end-users. These products, however, are under serious threat from both endemic and exotic pests, pathogens and mycotoxins which can infest and infect harvested crops at many points in the supply chain. Our challenge in this program is to deliver scientific outputs that will contribute significantly to the effective management of biosecurity threats in the post-harvest sector and support sustained market growth for Australian products.

The goal of the program is to maximise the value, integrity and competitive advantage of Australia's post-harvest supply chain. To achieve this, the program strategy is to develop a portfolio of projects that address both short and longer term priorities.

program 6:
education and training

CRCNPB seeks to deliver the education and training required to enhance skills, develop industry awareness and ensure that Australia has the highest quality plant biosecurity research community. Improving Australia's current and future capacity to detect and diagnose exotic plant pests, manage risks and respond in an adequate and timely manner to threats will be best achieved by providing quality education and training to government, industry, undergraduate and postgraduate students.

As plant biosecurity incursions are often identified by the general public, a strong emphasis is also being placed on raising awareness in the community and in primary and secondary schools.

The Education and Training Program has grown considerably over the past twelve months, both in the number of students we have on board and in the larger education programs being delivered.

The school education strategy is a keystone of our Education and Training Program and as such, several classes (along the themes of plant biosecurity) were delivered in primary schools across the Australian Capital Territory in Term 2, 2008. In late 2008, we will introduce the second part of our school program with the official launch of the plant biosecurity *Big Book*.

The national plant biosecurity postgraduate curriculum is due to receive its first student intake in January 2009. This cohort of students will commence training in the Graduate Certificate [Plant Biosecurity]. Units covered in this Certificate include three introductory pest biology units (Pathogens, Invertebrates and Weeds), as well as units in Detection and Diagnostics and Plant Biosecurity in Practice. There has been strong support for the curriculum from all state and federal agencies and we look forward to the curriculum launch with much anticipation.

key objectives for 2008-09

- complete enrolment of 32 PhD students
- extend the biosecurity schools program to a national audience
- enrol the first plant biosecurity postgraduate degree students

program 7:
delivery and adoption

The goal of the Delivery and Adoption program is to achieve realisation by stakeholders of the benefits of CRCNPB's research activities. This will be demonstrated through adoption of improved knowledge-based systems by government, universities and plant industry organisations, and commercialisation of new technologies through the private sector. To ensure maximum adoption of new plant biosecurity technologies and skills, the program's activities have a focus on project delivery planning and developing private and public partnerships for knowledge transfer of CRCNPB's outputs.

We recognise that a successful delivery strategy will depend on positive consultation with product end-users throughout the development life cycle. Facilitation of effective three-way researcher-industry-regulator engagement strategies are a core concern for this program.

Key objectives for 2008-09

- complete delivery plans for all active CRCNPB science projects
- complete development and commence delivery of knowledge grains network
- complete an economic analysis of CRCNPB research activities

In 2008-09, CRCNPB's Delivery and Adoption Program will continue to undertake strategic research to improve our ability to deliver plant biosecurity tools, knowledge and technology to industry around issues like phosphine resistance, focusing on communication and practice change for improved biosecurity outcomes.

From a simple public communication perspective, the concept of biosecurity is inherently complex, carrying with it a range of social, scientific, regulatory and commercial influences that mean that the term itself is not easy to communicate, nor indeed to achieve engagement at a level that might lead to improved risk management practices. Such complexity makes risk communication a key issue for agribusiness and regulatory agencies operating at the industry, regional, and individual levels. We recognise the development of strategies to improve awareness, engagement and adoption of plant biosecurity knowledge are critical to this effort.

Commonwealth Agreement: outcomes, outputs and milestones

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Preparedness and Prevention Research	Prevention	1.1	Knowledge to underpin decisions on risk of entry, establishment and spread for emergency plant pests.	1.1.1 Establish Program End-User Group including PHA and Biosecurity Australia	Dec 05	Participants Committee	D
				1.1.2 Review biosecurity plans prepared by the plant industries with the Steering Committee to identify key issues to be explored quantitatively	Mar 06	CRC10067 CRC10068	PD
				1.1.3 Analysis of risk perception in communities and industries completed.	Jun 09	CRC10010 CRC10067 CRC10068 CRC60011 CRC60063 CRC60103 CRC60104	PD
		1.2	New risk assessment, economic and complex system models for biosecurity.	1.2.1 Select biological systems to develop models to predict the spread of different functional groups of emergency plant pests.	Mar 06	CRC10010 CRC60002 CRC50089 CRC60002 CRC60003 CRC60033 CRC60076 CRC30120	D
				1.2.2 Risk assessment models based on complex systems theory/economic modelling further developed and validated.	Dec 09	CRC10001 CRC10010	D
				1.2.3 The most robust system for emergency plant pest prioritisation determined.	Dec 09	CRC10010	D
				1.2.4 The influence of climate change on emergency plant risk assessment determined.	Dec 10	CRC10071	D
				1.2.5 Field testing of new models completed.	Jun 12	CRC10010	PD

* **D** – Delivered **PD** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Preparedness and Prevention Research	Prevention	1.3 More efficient and effective responses to Emergency Plant Pests through better understanding of their biology and epidemiology.	1.3.1	Gaps in knowledge requiring research about selected emergency pests identified.	Jun 06	CRC50089 CRC60002 CRC60003 CRC60017 CRC60033 CRC60037 CRC60038 CRC60040 CRC60042 CRC60044 CRC60046 CRC60056 CRC60097 CRC60106 CRC60111 CRC60120	D
			1.3.2	Complete research on the biology and epidemiology of selected species to better manage emergency plant pests.	Jun 11	CRC50089 CRC60002 CRC60003 CRC60033 CRC60042 CRC60097 CRC60106 CRC60109 CRC60111 CRC60120	PD
		1.4 Effective strategies for the containment of resistance through the supply chain (gene flow).	1.4.1	Identification of the contribution of the key variables to selection for phosphine resistance.	Jun 10	CRC50089	PD
Delivery and Adoption		D1.1 New models utilised to combine comparative risk analysis and risk assessment to predict threats.	D1.1.1	Apply risk communication to biosecurity and deliver through the education program.	Dec 07	CRC10001 CRC10010 CRC60011 CRC60063 CRC60103	D
			D1.1.2	Risk assessment models based on complex systems theory/economic modelling delivered to state agencies for testing and validation.	Jun 09	CRC10001 CRC10010	D
			D1.1.3	New models of risk prediction delivered to agencies for use on selected emergency plant pests.	Jun 12	CRC10001 CRC10010 CRC60033 CRC60044 CRC60120	D
		D1.2 Establish End-User Advisory Group for each Research Program to prioritise, monitor and advise on delivery.	D1.2.1	Identify key stakeholders and representatives for each research program.	Mar 06	CRC20031	D
			D1.2.2	Determine priorities and establish projects.	Mar 06		D
			D1.2.3	Develop project progress evaluation system to enable establishment and monitoring of priorities.	Mar 06	Workshop	D

* **D** – Delivered **PD** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Diagnostics Research	Identification	2.1 Comprehensive, world-class diagnostics for emergency plant pests available through national and international databases.	2.1.1	Priorities and agreements on data standards, diagnostics and databases established through international workshops.	Jun 06	CRC20012	D
			2.1.2	Formal agreements for CRCNPB as contributor for data entry to national and international databases and managing organisations. Data quality control/ validation protocols established and network of CRC collaborators established.	Jun 08	CRC20012	D
			2.1.3	Comprehensive diagnostic data sets for emergency pests and pathogens submitted to accessible national and international databases.	Jun12	CRC20004 CRC20012 CRC20031 CRC20082 CRC20093 CRC60042	D
		2.2 New robust, cost-effective diagnostic tools for accurate identification of specific emergency plant pests and pathogens developed, improved and made available.	2.2.1	Workshops to identify priority diagnostics completed.	Dec 06	Workshop	D
			2.2.2	New robust, cost-effective technology based on existing intellectual property evaluated.	Jun 09	CRC20025 CRC20030 CRC20054 CRC20055 CRC20057 CRC20080 CRC20082 CRC20110 CRC60017 CRC60037 CRC60040 CRC60043 CRC60046	D
			2.2.3	Suite of new technology novel tools and innovative enabling technology developed, validated and made available.	Jun 12	CRC20025 CRC20030 CRC20054 CRC20055 CRC20082 CRC20093 CRC60017 CRC60037 CRC60043 CRC60046 CRC60070 CRC60074 CRC60107	D

* **D** – Delivered **PD** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs	Commonwealth Milestones		Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Diagnostics Research	Identification	2.3 Innovative technology to underpin surveillance and rapid, early detection of emergency plant pests developed and validated.	2.3.1	Protocols established for extraction and processing of nucleic acids, proteins or metabolites from survey samples for molecular diagnostic assays.	Jun 07	CRC20030 CRC20031 CRC60017 CRC60037 CRC60043 CRC60046 CRC60070 CRC60074 CRC60107	D
			2.3.2	Enabling technology for diagnostics for priority threats (including DNA, molecular diagnostic data and microarray analysis technology) developed and tested.	Jun 12	CRC20004 CRC20030 CRC20031 CRC20054 CRC20057 CRC20080 CRC20082 CRC60017 CRC60037 CRC60043 CRC60046 CRC60070 CRC60074 CRC60107	D
			2.3.3	Sensitive, microarray 'first screen' technology validated and, where appropriate, commercially delivered.	Jun 12	CRC20030 CRC60043	D
		2.4 High-speed, ready access to diagnostic services, protocols and expertise.	2.4.1	Network of facilitators, protocols and experts identified and data submitted to coordinating bodies.	Dec 10	CRC20025	D
			2.4.2	Virtual diagnostic facilities established, functional and accessible.	Dec 11	CRC20025	D
		2.5 Effective strategies for the containment of resistance through the supply chain.	2.5.1	Microsatellite markers for gene flow analysis.	Dec 10	CRC20057 CRC20080	D
		2.6 Improved technology for the treatment of biosecurity risks	2.6.1	Polymerase chain reaction tests for rapid identification of Khapra beetle.	Jun 09	CRC20082 CRC60046	D

* **D** – Delivered **PD** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs	Commonwealth Milestones		Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Delivery and Adoption	D2.1	Comprehensive, world-class diagnostics for emergency plant pests available through national and international databases.	D2.1.1	Priorities and agreements on data standards, distance diagnostics and databases established through international workshops.	Jun 06	CRC20012 CRC20025	D
			D2.1.2	Formal agreement for CRCNPB as contributor for data entry to national and international databases and managing organisations. Data quality control/ validation protocols established and network of CRC collaborators established.	Jun 08	CRC20012 CRC20055	D
			D2.1.3	Comprehensive diagnostic data sets for emergency plant pests and pathogens submitted to accessible, national and international databases.	Jun 12	CRC20012 CRC60042	D
	D2.2	Delivery of diagnostic tests to end-users.	D2.2.1	Licensing agreement executed with company for commercial tests or agreement reached with participants for non-commercial tests.	Jun 08	CRC20004 CRC20030 CRC20031 CRC20054 CRC20080	D
			D2.2.2	Marketing of test availability to producers and delivery of first test to industry.	Jun 08	CRC20004 CRC20030 CRC20031	D
			D2.2.3	Production of laboratory manual and training of relevant staff.	Jun 12	CRC20004 CRC20025 CRC20030	D
Surveillance Research	Detection	3.1 Develop technically sound, cost-effective surveillance procedures that are linked to information databases, GIS datasets and other technologies, to capture all relevant survey data required to accurately define Australia's plant health status and detect emergency plant pests.	3.1.1	Evaluate and enhance data collection for emergency plant pest surveys through assessment of hand-held tablet and pocket PC sample devices and other relevant technologies.	Dec 07	CRC30014	D
			3.1.2	Evaluation of remote sensing for detecting the presence and spread of emergency plant pests and their hosts.	Dec 08	CRC30015	D
			3.1.3	Development of auto-reporting traps and systems to detect and transmit the presence of emergency plant pests in remote areas and other selected applications.	Jun 09	CRC30023	D
			3.1.4	Development of generic precision surveillance simulation tools for selected emergency plant pest groups.	Dec 11	CRC30032 CRC30062 CRC30073 CRC30084 CRC30086 CRC60034 CRC60041 CRC60076	D
			3.1.5	Evaluate the usefulness of urban surveillance in the early detection of emergency plant pests.	Jun 10		PD
			3.1.6	Develop national standards and methodologies for recruiting and training surveillance staff.	Jun 10	CRC30020	D
	3.2	Improved technology for the treatment of biosecurity risks.	3.2.1	Go/no go decision on feasibility of using chemometrics for early warning of breaches of grain security.	Mar 09	CRC20081	D

* **D** – Delivered **PD** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Delivery and Adoption	Detection	D3.1	A new generation of world-class and cost-effective surveillance tools and methodologies developed for emergency plant pests of national importance.	D3.1.1 Current surveillance practices and methodologies benchmarked against our leading trading partner e.g. USA, NZ and Japan.	Nov 07	CRC30009 CRC30014 CRC30039	PD
				D3.1.2 Transparent national surveillance standards agreed for emergency plant pests of national significance.	Jun 08	CRC30009 CRC30015 CRC30020 CRC30022 CRC30023 CRC30032	D
				D3.1.3 Competency standards defined for surveillance staff involved in national surveillance networks.	Jun 09	CRC30020	D
				D3.1.4 Surveillance prediction tools developed and incorporated into national surveillance networks.	Jun 11	CRC30039 CRC30073 CRC30084 CRC30086	D
				D3.1.5 Cost-effective surveillance protocols for emergency plant pests of national importance accepted by major trading partners.	Jun 12	CRC30009 CRC30015 CRC30022 CRC30023 CRC30039 CRC30086	D

* **D** – Delivered **PD** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Impact Management Research	Response	4.1	Tools to underpin optimal response strategies, area freedom protocols and pre-emptive crop management strategies. Capacity to evaluate and validate incursion response strategies through predictive simulation system.	4.1.1 Identify the modelling and pre-emptive tools needed to fill knowledge gaps.	Jun 06	CRC30073 CRC30084 CRC40007 CRC60008	D
				4.1.2 Develop economic module of predictive simulation system incorporating national cost benefit analysis methodology.	Jun 08	CRC40007	D
				4.1.3 Incorporate socio-economic factors into economic module.	Jun 07	CRC40007	D
				4.1.4 Develop terrestrial observation module of predictive simulation system.	Jun 08	CRC60008	D
				4.1.5 Develop scientifically sound protocols for strategies utilised in incursion management.	Jun 08	CRC40016 CRC40024 CRC40035 CRC40049 CRC40050	D
				4.1.6 Predictive simulation system developed incorporating biological, geographical, social and economic factors.	Jun 10	CRC30073 CRC40007	D
		4.2	Capacity to respond to new virulence in emergency plant pests.	4.2.1 Develop understanding of varying virulence in high priority emergency plant pests.	Jun 06	CRC40005 CRC40006 CRC60040 CRC60111	D
				4.2.2 Virulence determinants identified for at least two high priority emergency plant pests.	Jun 10	CRC40005 CRC40006 CRC50098	D
		4.3	Enhanced disinfestation technologies for both imported and exported plant produce.	4.3.1 Detailed review of non-chemical disinfestation technologies completed.	Jun 06	CRC50092	D
				4.3.2 Effectiveness of non-chemical disinfestation technologies assessed.	Jun 08	CRC50092	D
				4.3.3 Improved non-chemical disinfestation technologies implemented.	Jun 12		PD
		4.4	Scientifically validated hygiene science strategies for incursion response.	4.4.1 Assessment of secure packaging for emergency plant pests completed.	Dec 06	CRC40035	D
				4.4.2 Validated hygiene science strategies made available for incursion management.	Jun 10		PD
		4.5	Novel control/containment strategies developed.	4.5.1 Crop destruction technologies for perennial tree/vine crops evaluated.	Jun 08	CRC40016 CRC40024	D
				4.5.2 Crop destruction technologies for annual crops evaluated.	Jun 10	CRC60045	PD
				4.5.3 Evaluate non-destructive strategies for control/containment.	Jun 10	CRC40016 CRC40024 CRC40049 CRC40050	D

* **D** – Delivered **P** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Delivery and Adoption	Response	D4.1	Tools to underpin surveillance and response delivery.	D4.1.1 Tools to underpin surveillance and response delivery developed.	Dec 10	CRC40005 CRC40006 CRC40007 CRC30009 CRC40024 CRC40050 CRC40087	D
				D4.1.2 Manuals prepared and training workshops held to communicate results to appropriate agencies.	Dec 10	CRC30009 CRC40006	D
				D4.1.3 Tools and models implemented and incorporated in operational processes of industry and government.	Dec 12	CRC40005 CRC40006 CRC30009 CRC40016 CRC40024 CRC40035	D
Post-Harvest Integrity Research	Response – grain biosecurity	5.1	Effective strategies for the containment of resistance through the supply chain.	5.1.1 Commence testing for two major genes to gather data on resistance gene frequency.	Dec 09	CRC20057 CRC20080	D
		5.2	Improved technology for the treatment of biosecurity risks.	5.2.1 An automatic controller for integrated aeration/fumigation suitable for all storages.	Jun 09	CRC50059	D
		5.3	Grain treatments that do not exceed maximum residue limits.	5.3.1 A model of phosphine residues after multiple fumigation over a range of moisture contents.	Jun 09		PD
		5.4	Changed practices on farm, and within the supply chain.	5.4.1 Design and implement a national industry survey to establish baseline and evaluate practice changes.	Jun 08	CRC50089 CRC50092 CRC70096	D
Delivery and Adoption		D5.1	New technologies to manage resistance.	5.1.1 Registration of an alternative treatment for stored grain and production plans negotiated with commercial partner.	Jun 11	CRC50060	PD
		D5.2	National Grains Extension Strategy; better practices for future risk management in industry.	5.2.1 Delivery of an integrated grain protection protocols targeting specific sectors of the grain supply chain.	Jun 11	CRC50098 CRC70096	D
				5.2.2 Incursion response plan based on quantitative knowledge of the dynamics of the grain supply chain.	Jun 12	CRC50089 CRC50098	PD
				5.2.3 Implementation of a national phosphine resistance containment strategy.	Jun 12	CRC50098	PD

* **D** – Delivered **P** – Partially Delivered

CRCNPB Program	C'wealth Outcomes	Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Education and Training	Increased awareness	6.1	At least 32 PhD graduates with the following characteristics: • Specific PhD training in Plant Biosecurity. • A broad understanding of the plant biosecurity industry. • Certified formal training in intellectual property management and commercialisation, and in business acumen.	6.1.1 Recruitment of full-time Education Officer.	Sep 06		D
				6.1.2 Development of an Education and Training Plan.	Dec 06		D
				6.1.3 First 16 PhD students recruited.	Dec 06	CRC60002 CRC60003 CRC60008 CRC60011 CRC60017 CRC60033 CRC60034 CRC60037 CRC60038 CRC60040 CRC60041 CRC60042 CRC60043 CRC60045 CRC60046 CRC60056	D
				6.1.4 First 16 completed compulsory coursework.	Dec 07	CRC60002 CRC60003 CRC60008 CRC60011 CRC60017 CRC60033 CRC60034 CRC60037 CRC60038 CRC60040 CRC60041 CRC60042 CRC60043 CRC60045 CRC60046 CRC60056	D
				6.1.5 Second 16 PhD students recruited.	Jun 10	CRC60063 CRC60070 CRC60074 CRC60075 CRC60076 CRC60097 CRC60103 CRC60104 CRC60106 CRC60107 CRC60109 CRC60111	PD

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CRCNPB Program	C'wealth Outcomes		Commonwealth Outputs		Commonwealth Milestones	Completion Date	CRCNPB Project	Milestones fully addressed by CRCNPB projects*
Education and Training	Increased awareness	6.1	At least 32 PhD graduates with the following characteristics: • Specific PhD training in Plant Biosecurity. • A broad understanding of the plant biosecurity industry. • Certified formal training in intellectual property management and commercialisation, and in business acumen.	6.1.6	Second 16 PhDs completed compulsory coursework.	Jun 11	CRC60063 CRC60070 CRC60074 CRC60075 CRC60076 CRC60097 CRC60103 CRC60104 CRC60106 CRC60107 CRC60109 CRC60111-	PD
				6.1.7	First cohort submitted PhD theses.	Dec 10	CRC60043	PD
				6.1.8	Second cohort submitted PhD theses.	Dec 12		PD
		6.2	Provide short courses and vocational training undertaken.	5.2.1	First short courses and vocational training developed.	Jun 06		D
				5.2.2	First short courses and vocational training undertaken.	Dec 06		D

* **D** – Delivered **PD** – Partially Delivered

progress against CRCNPB's Strategic Plan

CRCNPB Program		CRCNPB actions from Strategic Plan		CRCNPB Projects
Preparedness and Prevention Research	A1.1	Develop knowledge to underpin risk analysis decisions on entry, establishment and spread of emergency plant pests.	CRC10001 CRC10067	Early warning of pre-emergent emergency plant pest threats Evaluating risk analysis systems
	A1.2	Develop new risk assessment models for biosecurity.	CRC10010 CRC10068	Enhanced risk analysis tools Comparison of quarantine risk analysis systems
	A1.3	Devise more efficient and effective responses to emergency plant pests through better understanding of their biology and epidemiology.	CRC10071	Climate change
Diagnostics Research	A2.1	Develop and validate comprehensive diagnostic and taxonomic reference data and link to national and international reference collection databases.	CRC20012 CRC20055	A national diagnostic database for emergency plant pests DNA databank
	A2.2	Develop new, robust and cost-effective diagnostic tools for accurate identification of emergency plant pests.	CRC20004 CRC20030 CRC20054 CRC20057 CRC20080 CRC20093	Enhancing the detection of *Tilletia indica* (the cause of Karnal bunt) Nanobead diagnostic system Plant bacteria platforms Phosphine resistance - proteomics Phosphine resistance - molecular Increasing diagnostic capacity in Thailand
	A2.3	Develop innovative high-throughput technology to underpin large-scale surveillance and early detection of emergency plant pest incursions.	CRC20030 CRC20031 CRC20082 CRC20084	Nanobead diagnostic system Detection *Phytophthora kernoviae* and *P. ramorum* Khapra beetle diagnostics Plant bacteria platforms
	A2.4	Develop high speed and ready access to best available diagnostic services, protocols and expertise.	CRC20025 CRC20031	Improved emergency plant pest identification through a web-based remote microscope system Detection *Phytophthora kernovaiae* and *P. ramorum*
Surveillance Research	A3.1	Develop technically sound and cost-effective surveillance procedures.	CRC30020 CRC30062	Selection and training of quarantine and/or surveillance staff Agricultural internet monitoring system
	A3.2	Develop surveillance procedures that are linked to information databases, GIS datasets and other technologies.	CRC30009 CRC30073 CRC30084 CRC30086	Grains surveillance strategy Surveillance simulation platform Biosecurity quarantine model system Sampling strategies - stored grain
	A3.3	Develop surveillance technologies that capture all the relevant survey data required to accurately define Australia's plant health status, including confirmation of pest-free areas, and detect emergency plant pests.	CRC30014 CRC30015 CRC30016 CRC30022 CRC30023 CRC30032 CRC30039	PDA assisted surveillance Hyperspectral pathogen detection Resistance monitoring - phosphine and protectants Female lures fruit fly trapping system Smart trap scoping study Flying spore traps Fruit fly area freedom

CRCNPB Program	CRCNPB actions from Strategic Plan		CRCNPB Projects	
Impact Management Research	A4.1	Develop tools to underpin optimal response strategies, area freedom protocols and pre-emptive crop management strategies, including the capacity to evaluate and validate incursion response strategies through predictive simulation systems.	CRC40007 CRC40049 CRC40050	Predictive economic model A community based model to manage emergency plant pests Post-entry quarantine – Australia/New Zealand
	A4.2	Develop capacity to respond to new virulence in emergency plant pests.	CRC40006	Russian wheat aphid
	A4.3	Develop enhanced dis-infestation technologies for both imported and exported plant produce.		
	A4.4	Develop scientifically validated hygiene science strategies for incursion response.	CRC40035	An integrated approach to the eradication of arthropod emergency plant pests
	A4.5	Develop novel control/containment/recovery strategies.	CRC40016 CRC40024	Pathogen eradication strategies Insect eradication
Post-Harvest Integrity Research	A5.1	Build and maintain capability for tactical response to emerging threats to post-harvest integrity.	CRC50092 CRC50089	Review of chemical and non-chemical alternatives to phosphine Insect ecology and phosphine resistance
	A5.2	Maintain phosphine as a cost-effective pest control treatment by addressing resistance, safety and environmental issues.	CRC50059 CRC50089 CRC50092 CRC50098	Fumigation technology Insect ecology and phosphine resistance Review of chemical and non-chemical alternatives to phosphine Fumigation protocols for flat grain beetles
	A5.3	Develop new technologies to control pests in the supply chain.	CRC50059 CRC50060 CRC50092 CRC50098	Fumigation technology Cool grain fumigation Review of chemical and non-chemical alternatives to phosphine Fumigation protocols for flat grain beetles
	A5.4	Manage the risk of potential threats to human and animal health in the supply chain.	CRC50092	Review of chemical and non-chemical alternatives to phosphine
	A5.5	Develop flexible storage technologies to minimise potential biosecurity threats from multi-commodity systems.		

CRCNPB Program	CRCNPB actions from Strategic Plan		CRCNPB Projects	
Education and Training	A6.1	To support Honours candidates and up to 32 PhD candidates.	CRC60002 CRC60003 CRC60008 CRC60011 CRC60017 CRC60026 CRC60027 CRC60028 CRC60029 CRC60033 CRC60034 CRC60037 CRC60038 CRC60040 CRC60041 CRC60042 CRC60043 CRC60044 CRC60045 CRC60046 CRC60051 CRC60052 CRC60056 CRC60063 CRC60070 CRC60074 CRC60075 CRC60076 CRC60077 CRC60097 CRC60103 CRC60104 CRC60105 CRC60106 CRC60107 CRC60109 CRC60111 CRC60120	Lettuce aphids (PhD) Ascochyta wind tunnel (PhD) Terrestrial observation predictive systems (PhD) Ordguard community engagement (PhD) Detection in pathogen mixtures (PhD) Citrus canker fingerprinting (Hons) Scarab beetle barcoding (Hons) Fusarium head blight characterisation (Hons) Taxonomy of *Phytophthora citricola* (Hons) Hosts of *Phytophthora ramorum* (PhD) Bavesian surveillance systems (PhD) Fire blight diagnostics (PhD) Epiphyas revision (PhD) Luteovirus (PhD) Surveillance systems analysis (PhD) *Phytophthora* taxonomy (PhD) Microarrays for virus diagnostics (PhD) Nematode taxonomy (PhD) *Phytophthora* in nurseries (PhD) Khapra beetle (PhD) Silverleaf whitefly in Sydney (Hons) Biopesticides for incursion management (Hons) White fly systematics (PhD) Women in biosecurity (PhD) Tomato leaf curl nano (PhD) Smut fungi (PhD) NICTA smart trap (PhD) Spore modelling (PhD) Fruit fly (Hons) Fusarium TR 4 (PhD) Citrus greening in communities (PhD) Biosecurity policy (PhD) Assessment of Big Book (Hons) Fruit fly parasitoid (PhD) Nano banana viruses (PhD) Fruit fly host use (PhD) Russian wheat aphid (PhD) Glassy wing sharpshooter (PhD)
	A6.2	Provide specific training for PhD and Honours candidates in plant biosecurity, a broad understanding of the plant biosecurity industry, and certified formal training in intellectual property management, commercialisation and business acumen.	Professional Development Workshops	Communicating effectively Scientific writing Networking skills Plant biosecurity awareness Intellectual property management (Sep 2008) Project management and leadership (Sep 2008)
	A6.3	Deliver short course and vocational training for the plant biosecurity community which includes industry, neighbouring countries and technology end-users.	CRC20004 CRC20012 CRC20112 CRC60069 CRC60072 CRC60114	Karnal bunt diagnostics National diagnostic database (PaDIL) Aphid diagnostic training School education strategy Master Class in plant biosecurity Crawford Fund PNG training course Grains biosecurity course (Nov 08)
	A6.4	To support the development of a national undergraduate curriculum in plant biosecurity.	CRC60047	National plant biosecurity curriculum
	A6.5	Develop biosecurity coursework for vocational training.	CRC60047	National plant biosecurity curriculum Grains biosecurity course (Nov 08)

CRCNPB Program	CRCNPB actions from Strategic Plan		CRCNPB Projects	
Delivery and Adoption	A7.1	Deliver an effective communication strategy.	CRC70036	National communication strategy framework
	A7.2	Utilise models to combine comparative risk analysis and risk assessment to predict threats.	CRC10001 CRC10010	Early warning threat identification Enhanced biosecurity planning tools
	A7.3	Deliver comprehensive, world-class diagnostics data on emergency plant pests through accessible national and international databases.	CRC20012	National diagnostic database
	A7.4	Deliver diagnostic tests to end-users.	CRC20004 CRC20031 CRC20054 CRC20057 CRC20080	Improved Karnal bunt diagnostics Detection of *Phytophthora ramorum* Plant bacteria frameworks Phosphine resistance - preteomics Phosphine resistance - molecular
	A7.5	Utilise a new generation of world-class and cost-effective surveillance tools and methodologies for emergency plant pests of national importance.	CRC30014 CRC30022 CRC30039 CRC30062	PDA - Assisted surveillance Female lures fruit fly trap Fruit fly area freedom Agricultural internet monitoring systems
	A7.6	Deliver tools to underpin surveillance and response.	CRC30009 CRC30014 CRC30015 CRC30022 CRC30023 CRC30032 CRC30039 CRC30062 CRC30073 CRC30084 CRC30086 CRC30116	Grains surveillance strategy PDA - Assisted surveillance Hyperspectral pathogen detection Female lures fruit fly trap Smart trap scoping study Flying spore traps Fruit fly area freedom Agricultural internet monitoring systems Surveillance simulation platform Biosecurity quarantine model system Sampling strategies for stored grain Resistance monitoring
	A7.7	Establish an end-user advisory group to prioritise, monitor and advise on delivery.		Grains Advisory Panel
	A7.8	Develop strategies and protocols for community education and engagement in plant biosecurity systems.	CRC40049 CRC60011 CRC60063 CRC60069 CRC60103 CRC30104 CRC70096	Community based model to manage emergency plant pests Community engagement in biosecurity Women in biosecurity Schools education strategy Citrus greening communities Biosecurity policy in communities Grain knowledge networks

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