



Cooperative Research Centre for National Plant Biosecurity

Annual Report 2008-09

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Cooperative Research Centres Program*



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1 Executive summary

Achievements and activities of the CRC in relation to research, commercialisation/utilisation and education outcomes for the reporting period.

A highlight for the year was the official launch of the Plant Biosecurity Toolbox and Biosecurity Bank in February 2009. Both are world-class plant pest online diagnostic tools and two of the first tangible outputs from our research portfolio. The Plant Biosecurity Toolbox includes photographs and details of pests (including the symptoms and damage they cause) and links them to information and instructions on a range of diagnostic tests to confirm the pest's identity. Closely linked to the toolbox, the Biosecurity Bank enables researchers to locate and order DNA samples and clones of interest to develop and validate diagnostic tests and for biodiversity and genomics research.

Effective surveillance is critical for securing market access. In the past, nearly all field collected surveillance information was recorded manually to paper reducing the rate of capture, integrity, conformity as well as security of the data. As a result, research during the year continued to develop pest surveillance data collection software and hardware using Personal Digital Assistants (PDAs). Throughout the reporting period, the PDA surveillance tool was used in the field by primary industries staff and has resulted in strong end-user acceptance of the product – a key achievement in the delivery of this project.

A positive outcome in our research portfolio was the review of our climate change project by Dr Richard Baker, Central Science Laboratory from York, United Kingdom and our Principal Scientist, Dr James Ridsdill-Smith. The review was conducted in conjunction with Department of Primary Industries, Victoria to assess the extent to which this research is providing world-class science to deliver plant biosecurity outcomes. Through interviews with a number of key policy, research and stakeholder representatives in Melbourne and Canberra, the review panel recognised the project is a positive and necessary activity for Australia's plant industries.

Another highlight in our research portfolio was the development and advances in the use of insect eradication methodologies with collaborators in the United States of America. This research holds strong promise as a component of a new integrated approach to the management of harmful insect incursions.

In early 2009, we supported a three-year seconded appointment of Dr YongLin Ren to the position of Associate Professor of Grain Biosecurity at Murdoch University to help re-build national capacity and research capability in the area of insect pests of post-harvest grain. Dr Ren's substantive position is Principal Scientist for the stored grain research team at the Department of Agriculture and Food, Western Australia. This appointment will contribute to the high-level training for undergraduate and postgraduate students to ensure Australia has future capacity in plant biosecurity research in the area of stored grain.

In our Education and Training Program, we achieved a significant milestone in April 2009 by reaching our target number of PhD students when our 32nd student enrolled at the University of Western Australia. Additionally, our school education strategy which aims to create enthusiasm in science in the younger generation and to raise awareness of plant biosecurity continued to grow. With schools across Australia taking part in our trial program, we have now expanded 'Plant Pest Investigators' nationally with classes in several states of Australia participating enthusiastically.

Our Delivery and Adoption program ensures the implementation of individual project delivery and commercialisation plans. The program was boosted during the year by the completion of delivery frameworks for five key impact areas. Building on from individual project delivery plans, the frameworks provide a holistic plan for delivering the greatest impact over the remaining life of our CRC. The frameworks cover five of our key strategic areas and have been assigned dedicated budgets to ensure output delivery.

Risks, opportunities and responses to the above.

Since the launch of the Plant Biosecurity Toolbox we have already seen significant use and uptake by plant industries worldwide. The Toolbox has provided Australia with the opportunity to demonstrate its high plant health protection standards to the world and will become fundamental as a global tool for diagnosis of plant pests and diseases.

After the launch of the Biosecurity Bank, we have faced risks in terms of ownership of the database and hosting. They are being resolved with negotiations to host the Biosecurity Bank within the Pest and Disease Image Library (PaDIL).

The PDA surveillance tool has already received strong end-user acceptance and we anticipate it will be accepted as the plant surveillance data collection tool of choice. Recognising the opportunities with this project, it has also started a second phase of research. Firstly to deliver the surveillance software to a greater number of surveillance personnel as well as mapping the best method for the integration of collected data into national initiatives. Secondly, it will provide the post-harvest grains industry with a system to digitally collect and collate all grains pests' surveillance information.

The review of our climate change project has provided valuable confirmation that we are on track to assist Australia's agricultural industries understand, adapt and respond to climate change.

We will continue to focus on the development of a new approach to integrated eradication management. Continued advances in sterile insect technology to complement a strong Australian/New Zealand research collaboration in the application of micro-encapsulated pheromone technologies will form the basis of the new approach. The international research partnerships involved in delivering this new approach provide an important opportunity for us to play a leading role in this research across the globe.

Through our initiative of appointing an Associate Professor in Grains Biosecurity, we hope to create an international centre of expertise. While this is an important opportunity for scientific capacity in the grains industry; given the life cycle of CRCs, we can only invest in this appointment for the remainder of our life. We expect that the outputs of the role will demonstrate value to industry so that the position will continue after its three-year term funded by industry, or alternatively by DAFWA or from the university.

While we have reached our target number of PhD students, there is always a risk that students may choose not to continue with their study, and therefore the risk that we do not reach our milestone of 32 completed PhD students. To mitigate this risk, we allow our students to apply for an extension on their candidature. This is in the form of a business case and is assessed on an individual case-by-case basis. We also provide support to our students, as well as professional development to assist their career development. We are also aiming to enrol 40 PhD students by the end of August 2009 to ensure at least 32 PhD projects are completed.

Our school education strategy has received very positive feedback to date and to ensure this is maintained, we will continue to pursue opportunities to promote the program and provide teachers with professional development to better understand plant biosecurity and how to use 'Plant Pest Investigators' as a science unit in the classroom.

Through the remaining life of our CRC, we are looking forward to the delivery and adoption of many of our research outputs. The holistic approach of providing delivery frameworks in five key impact areas will give us the opportunity to have greatest impact for industry and end-users.

Impediments to achievement of the CRC's objectives experienced during the year and strategies adopted to address these.

The global financial crisis reached Australia during the reporting period. While Australia remained relatively unscathed compared to other developed countries, the economic downturn led to significant budget decreases and cuts in human resource capacity in state government agencies. While this domino effect has not impacted on our ability to meet our milestones, we recognise the significance of this scenario as state government agencies contribute in-kind resources to most of our research activities. These budget and human resource cuts could decrease in-kind contributions and subsequently impact on the continuation of our projects. To address this risk, we have enhanced communication with relevant Participants to ensure required resources are still available to achieve our objectives.

Awards, special commendations, CRC highlights.

In December 2008, an independent review panel Chaired by Dr Kevin Sheridan conducted the Third Review of the performance of the CRCNPB. Industry members, Participants, Program Leaders, Management, Board and PhD students were interviewed and the final report was received in February 2009. The feedback from the panel was very positive and although the panel identified 16 recommendations, it stated they were for "improvements and refinements rather than to overcome any identified fundamental flaws in the management or operations of the CRC".

In November 2008, one of our PhD students won the 2009 Northern Territory Young Australian of the Year Award. While the award personally belongs to Ms Rachel Meldrum, we were very proud that she was nominated for her contribution to science and the sustainability of Australia's banana industry. Her PhD project involves researching how the exotic plant disease (Fusarium wilt) is spread in the banana industry and will lead to the development of alternative quarantine strategies to minimise the economic and social impact of possible incursions.

The financial year also saw the successful filing of our first trademark; the Plant Biosecurity Toolbox. The trademark is currently being advertised in IP Australia's Official Journal and will be registered in early 2010 assuming it is not contested.

With climate change becoming a significant biosecurity challenge for agricultural industries, our climate change project team was successful in its proposal for funding from the Asia Pacific Network for Global Change Research (APN). The additional investment will expand the project to research the effects of climate change on major food crops in India and Bangladesh, as well as the continued work in Australia.

Another highlight for this project team was the annual Federation of Scientific Technological Societies (FASTs) 'Science meets Parliament' event which was held in Canberra in March 2009. Project Leader, Dr Jo Luck was successful in a bid to meet three Parliamentarians who had nominated 'Adapting agriculture to climate change' as a topic they were interested in.

1.1 Context and major developments during the year

A brief outline of the industry context in which the CRC operates (e.g. has there been a change in market conditions; have these changes impacted on the ability of the CRC to meet its objectives?).

In July 2008, the *Export Wheat Marketing Bill* came in to effect, allowing accredited organisations to export wheat from Australia freely for the first time since 1939. The bill was passed to bring competition and transparency to the Australian export wheat industry after the Australian Wheat Board scandal.

As a result of this legislation change, the role of three of our industry participants in grain bulk handling also altered significantly as they became Australia's largest grain exporters. While this did not impact on our ability to meet our objectives, the change in legislation highlighted the importance of high-level science to underpin sound biosecurity measures throughout the supply chain. Research in our Post-Harvest Integrity Program will be critical to helping Australia maintain its reputation as an exporter of grain which is free from pests and diseases, and subsequently securing our market access.

In late 2008, the Hon. Tony Burke MP, Minister for Agriculture, Fisheries and Forestry released the findings of an independent review of Australia's quarantine and biosecurity arrangements. The report titled 'One biosecurity; a working partnership' recommends the development of a seamless biosecurity system that fully involves all the appropriate players pre-border, border and post-border. The review panel recognised independent science-based decision making as a critical element in an effective biosecurity system. While many of the recommendations will be implemented during 2009-10 year or later, changes in government structure and legislation will need to be carefully considered as we continue our research and maintaining and building relationships with key stakeholders.

A brief outline of the value of outcomes to date as compared to the expectations outlined in the Commonwealth Agreement or in your original funding application. The response should cover the following questions:

- What were the expected monetary (economic) and non-monetary (such as social, environmental etc.) outcomes of the CRC?
- Is the value of outcomes matching the expectations and if not, what has led to the difference?
- How does the CRC intend to address any issues and maximise the value of outcomes over the remaining life of the CRC.

In the *Commonwealth Agreement* it was noted that while pest incursions directly threaten the viability of Australia's plant industries, the cost varies considerably depending on whether the pest spreads widely or if it can be contained in certain areas and, if so, whether area freedom status can be achieved and recognised.

In response, we have focused on building scientific capability and delivering impact within a biosecurity framework that comprises prevention, identification and detection, surveillance, impact management and post-harvest integrity. During the current year there has been strong progress in all areas and early outcomes are now being extended in line with end-user priorities and expectations.

Early feedback from end-users has been encouraging and the year has also seen additional achievement through the delivery of outcomes through commercial collaboration. For example a significant achievement during the year saw completion of the statistical designs of a multi-component biosecurity detection surveillance system. This innovative research was undertaken to

support the Gorgon LNG and domestic gas project through a contractual arrangement with Chevron Australia Pty Ltd. The work undertaken by the research team has made a contribution to recent approval of development proposals for the project by the Western Australian State Premier and provides a clear example of efforts to build collaborative research with national businesses to deliver commercial impact on a national scale.

To maximise the value of outcomes over our remaining years of operation, detailed planning in partnership with end-users has led to the development of detailed delivery and adoption activities. Budget activity has also been prioritised to support the execution and implementation of the delivery and adoption plans and to continue to emphasise end-user impact in all research project activity.

An explanation of any major developments or initiatives including:

- Actions undertaken in relation to internal and/or external reviews, recommendations resulting from these reviews, strategies for implementing these recommendations and any resulting difficulties for the CRC anticipated by the Board; and
- Key events and changes of a substantial nature including key staff appointments and/or changes and purchases of major equipment.

Reviews

Third-Year Review

We undertook a full review of our operations at the completion of our third year. The independent review panel provided our Board with a report that incorporated 16 recommendations. A status report on each of the recommendations is provided at Section 9 of the *Annual Report*.

Merriman Review

In June 2008, we independently commissioned a review, chaired by Dr Peter Merriman (*Merriman Review*) to identify investment priorities in the area of chemical and non-chemical strategies for the control of insect pests of stored grains. The final report from the *Merriman Review* was provided to us in January 2009 and incorporated 25 recommendations. We accepted all but one of the recommendations (which fell outside the scope of our research and objectives).

Sections in the review considered each recommendation in detail and presented summaries of “the problem, anticipated product, and justification and, in some instances, skill requirements”. There were more recommendations than can be delivered by resources available if all work were commissioned. Thus, some selectivity will be required to progress the overall set of recommendations. The review suggests areas of high priority.

Some of these recommendations are now in ‘project proposal’ stage and are expected to be started in the 2009-10 financial year. In addition, although outside the original terms of reference for the review, a recommendation on national capacity is being addressed through our support of the position of Associate Professor of Grain Biosecurity at Murdoch University.

In addition the review panel recommended a two-stage process.

A brief first stage involves appreciation of investor needs and responsibilities, including selection of proposed activities to be commissioned as projects. Recommendations were made on planning and protocols for project development to secure shared understanding and commitment in the development of projects from technology to adopted product. This stage should be completed by the end of June 2009.

The second stage proposes selective commissioning of projects on resistance management, alternative chemistries and non chemical methods, within the constraints of funding and expertise. It anticipates that much of this will be complete before the end of the third quarter of 2009. All approved projects would incorporate planning and protocols for product development and adoption developed in stage 1.

Climate Change Review

We had previously undertaken strategic analysis which identified that climate change will alter the risks associated with the biosecurity of Australia's cultivated and natural flora and access of its agricultural products to international markets. Understanding these new threats will enable Australia's plant industries and quarantine agencies to be better prepared to meet and respond to any risks.

In response, we initiated a major research and development project under the leadership of the Victorian Department of Primary Industries (DPI). We strongly support this area of our research and equally support its broader involvement with the Asia Pacific Network for Global Change Research and with the EU PRATIQUÉ 'Development of more efficient risk analysis techniques for pests and pathogens of phytosanitary concern' program.

In March 2009, our Board approved a process for the external review of science projects. The process included review of our portfolio by research area and climate change was timetabled as the first area for review. With DPI, we invited a leading international expert to assess the extent to which this research is providing world-class science to deliver plant biosecurity outcomes. Dr Richard Baker, Central Science Laboratory from York, United Kingdom and our Principal Scientist, Dr James Ridsdill-Smith interviewed a number of key policy, research and stakeholder representatives in Melbourne and Canberra.

Under seven terms of reference the review panel found it is important that agriculture, horticulture and forestry are prepared for the changes ahead due to climate change and as a result recognise this research as a priority for industry. They also found the progress of current research has been very good, considering the length of time the project has been running. The reviewers also noted the requirement for strong statistical input at all stages from planning experiments, analysing results to modelling the data. The reviewers were impressed with the good start the project team has made with publications and, in particular, by raising awareness of their work through conference presentations and workshops.

Fruit-fly Review

During the reporting period, we undertook a science review of two of our projects which focus on fruit-fly management and surveillance. The reviews were undertaken at the request of Horticulture Australia Limited (HAL) who is a co-investor in both projects. The review explored the current progress of both projects and identified opportunities for additional scope of research that will meet industry priorities.

Administration and Governance Review

In the previous reporting period, we initiated an independent review of our internal administrative and governance structures. The outcomes of the review were delivered to us in late 2008 and we have developed a series of policy and procedure manuals which include an Information Management Strategy (IMS). The IMS outlines the procedures for the production and maintenance of the policy and procedures manuals (manual names and who is responsible for them). The IMS specifies that the policy and procedures manuals will be updated on a needs basis (i.e. when changes are required) with full reviews taking place on at least a biennial basis.

Key events and changes

Throughout the reporting period, there were several changes to staff, both as a result of growth in our research portfolio as well as staff moving on to other opportunities.

- Ms Kirsti Birtenshaw left the position of Education Officer in July 2008. This role was filled by Ms Melanie Hay in August 2008.
- Mr Cain Roberts was appointed in the role of Delivery and Adoption Officer in September 2008.
- Mr Scott Baxter commenced in a newly created role of Business Support Officer in December 2008.
- Mrs Kate Scott moved from the position of Communications Officer to a newly created position of Communications Manager in April 2009.
- Ms Alana van Meurs was appointed in the role of Communications Officer in April 2009.
- Ms Carla Tadich moved from the position of Project Officer to a newly created position of Project Manager/Program Coordinator in April 2009.
- Mr John Austen was appointed in the role of Project Officer in April 2009.
- Mr Darryl Hardie left the position of Program Leader for the Surveillance Research Program at the end of June 2009.

2 National research priorities

We are a major contributor to Australia's national research priorities; in particular, the 'Safeguarding Australia' priority to protect Australia from invasive diseases and pests. The proportion of our research that relates to national research priorities and goals is provided in the table below.

Table 1: National Research Priorities and CRC Research

NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
FRONTIER TECHNOLOGIES FOR BUILDING AND TRANSFORMING AUSTRALIAN INDUSTRIES – <i>Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research</i>	
Frontier technologies	3%
Smart information use	4%
Promoting an innovation culture and economy	3%
SAFEGUARDING AUSTRALIA – <i>Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems</i>	
Protecting Australia from invasive diseases and pests	88%
Protecting Australia from terrorism and crime	2%

3 Governance and management

Our Board develops and oversees delivery of our strategic objectives. The skills based Board is made up of a Chair and six other Directors - all independent of our Participants. There were no changes to the Board membership during the reporting period

The Board was established with careful consideration to ensure a broad spectrum of expertise to maximise the value of the Board's input into our direction and management.

The Finance and Audit Committee provides assistance to the Board of Directors in fulfilling its corporate governance and oversight responsibilities in relation to our financial reporting, internal control structure, risk management systems and external audit functions.

The Board Nomination Committee consults with the Participants and Directors to identify suitable candidates to the members for election as Directors.

The names, qualifications, special responsibilities and experience of the Board of Directors in office during the period and until the date of this report are on the following pages.

3.1 CEO, Governing Board Members and Committee Members

Name	Organisation	CRC Position/Role
Dr Simon McKirdy	CRC for National Plant Biosecurity	Chief Executive Officer
Professor John Lovett		Chairman, Board of Directors; Chair, Board Nomination Committee
Mr Barry Windle		Deputy Chair, Board of Directors
Ms Christine Campbell		Board Director; Chair Finance and Audit Committee
Dr Jim Cullen		Board Director
Professor John Irwin		Board Director, Finance and Audit Committee
Mr Chris Richardson		Board Director, Finance and Audit Committee
Mr John Sandow		Board Director
Dr Mike Cole	Department of Agriculture, Fisheries and Forestry	Board Nomination Committee
Mr David Fienberg	Co-operative Bulk Handling Ltd	Board Nomination Committee
Dr David Hall	Industry & Investment NSW	Board Nomination Committee
Associate Professor John Kent	Charles Sturt University	Board Nomination Committee
Dr Shashi Sharma	Department of Agriculture and Food, Western Australia	Board Nomination Committee
Dr Andy Sheppard	Commonwealth Scientific and Industrial Research Organisation	Board Nomination Committee

Key skills of Board members

Name	Key skills
Professor John Lovett	<p>Qualifications: BSc Hons (Agric), PhD</p> <p>Chair: Agrifood Awareness Australia Ltd (2004). Chair: CRC for Greenhouse Accounting (2004-2006). Board member: HRZ Wheats Pty Ltd (2004-2006). Member Executive Board: Global Crop Diversity Trust (2006). Managing Director: Grains Research and Development Corporation (1994-2003). Managing Director: Lovett Associates Pty Ltd (2004). Professor of Agronomy: University of New England (1987-1993). Professor of Agricultural Science: University of Tasmania (1984-1987).</p>
Mr Barry Windle	<p>Qualifications: B AgS and Dip Hort Sci</p> <p>Chair AFMA Great Australian Bight Trawl Fishery Management Advisory Committee (current). Chair Central Hills Water Allocation Plan Advisory Committee, member of the Central NRM Group and Program Advisory Committee- Mount Lofty Ranges NRM Board (current), Former Executive Director: Agriculture, Food and Fisheries, Primary Industries and Resources SA, Executive and Policy roles PIRSA (1988 – 2004). Horticultural Research Officer (1971 – 1988).</p>
Ms Christine Campbell	<p>Qualifications: FCPA, GAICD</p> <p>Executive Chair: Twynam Agricultural Group. CEO (1983) and Financial Controller (1977) Twynam Agricultural Group. Chair: of the National Farmers' Federation Water Taskforce (2005-2006). Chair: Australian Cotton Industry Council (2002-2005). Member: Policy Council of the National Farmers' Federation (2004-2005). Member Executive Committee of the National Farmers' Federation (2002-2004) Chair: Cotton Australia (2001-2003). Private Sector Advisory Panel to International Cotton Advisory Council (2004-2005). Director: Cotton Australia (1999-2005).</p>
Dr Jim Cullen	<p>Qualifications: BA (Hons), PhD</p> <p>Member: Quarantine and Exports Advisory Council (1997-2003). Chief: CSIRO Entomology (1997-2002). Board Member: CRC for Australian Weed Management (Weed Management Systems) (1995-2002) (Acting Director 1995). Member: Australian Weeds Committee (1988-2002). External Advisor (Science and Research): Environmental Risk Management Authority NZ (2002). President: Australian Entomological Society (1997-2000).</p>
Professor John Irwin	<p>Qualifications: BSc Hons (Agric), MSc (Agric), PhD, DSc (Agric)</p> <p>CEO: CRC for Tropical Plant Protection (1999 – 2006). CEO: CRC for Tropical Plant Pathology (1992 – 1999). Professor, School Integrative Biology: University of Queensland (1993 – present). Editor in Chief, Crop and Pasture Science (formerly Australian Journal Agricultural Research) (2009-present) Member: National Crop Improvement Committee, Grains Research and Development Corporation (1991 – 1993). Lecturer, Senior Lecturer, Reader: University of Queensland (1982-1992). Member: Oilseeds Research Council (1989-1991) Plant Pathologist/Research Fellow: Queensland Department of Primary Industries/University of Wisconsin (1972-1982).</p>
Mr Chris Richardson	<p>Qualifications: Diploma in Agriculture, GAICD</p> <p>Chair Biosecurity Council of WA (2008 - present). Chair: Agriculture Protection Board of WA (2002-present). Chair: WA Ovine Johnes Disease Advisory Committee (2004 - present) .Chair: WA Footrot Eradication Campaign Advisory Committee (1999 - present). Board Member: Corredene Pty Ltd. CEO: Australian Merino Society Inc (1999 – present).</p>
Mr John Sandow	<p>Qualifications: BSc MSc MAICD</p> <p>Director, Cooperative Research Centre for Australian Weed Management, (2002-2008), Western Australian Herbicide Resistance Initiative (WAHRI) (2002-November 2007); Member of Steering Committee 'Grain Protection Genes' (GRDC/CSIRO joint venture) (2002-November 2007), GRDC Program Manager - Crop Protection (2002-November 2007), Crop Care Australasia Pty Ltd - National Technical and Development Manager (2001-2002), Marketing Services Manager (2000-2001), Group Product Manager (1998-2000), various product manager and technical roles (1989-1998), Entomologist, Western Australian Department of Agriculture (1979-1989).</p>

Function and frequency of Board meetings

Our Board meets quarterly in various locations around Australia. During the 2008-09 financial year, there were five Board meetings. Four meetings were regular Board meetings; the February meeting was scheduled for strategic planning. Attendance is indicated below:

Name/Date	12 Aug 08	5 Nov 08	13 Feb 09	10 Mar 09	3 Jun 09
Professor John Lovett	✓	✓	✓	✓	✓
Mr Barry Windle	✗	✓	✓	✓	✓
Ms Christine Campbell	✓	✗	✓	✓	✓
Dr Jim Cullen	✓	✓	✓	✓	✓
Professor John Irwin	✓	✓	✓	✓	✓
Mr Chris Richardson	✓	✓	✓	✓	✓
Mr John Sandow	✓	✓	✓	✓	✓

3.2 Program Leaders

Name	Organisation	CRC Position/Role
Dr Paul De Barro	CSIRO Entomology, Brisbane	Program Leader: Preparedness and Prevention Research Program
Dr Deb Hailstones	Industry & Investment NSW	Program Leader: Diagnostics Research Program
Dr Darryl Hardie	Department of Agriculture and Food Western Australia, Perth	Program Leader: Surveillance Research Program
Ms Jane Moran	Department of Primary Industries Victoria, Melbourne	Program Leader: Impact Management Research Program
Dr Pat Collins	Queensland Primary Industries and Fisheries, Brisbane	Program Leader: Post-Harvest Integrity Research Program
Dr Kirsty Bayliss	Murdoch University, Perth	Program Leader: Education and Training

3.3 Changes to Participants

There were no changes to the Participants of the Cooperative Research Centre for National Plant Biosecurity during 2008-09.

4 Research programs

4.1 Research activities and achievements

Program 1: Preparedness and Prevention Research

The reporting period has seen two of our projects in the Preparedness and Prevention Research Program near completion and several of our projects deliver strong published science outputs. The overall development of the program has seen an increasing level of interconnection between the projects which highlights the program's strategic structure around the biosecurity risk equation [risk = likelihood (entry, establishment, spread) x consequence].

During the reporting period, two projects held major workshops to present the results of the preceding two years research and to elicit feedback from a wide range of agricultural and horticultural industries, federal biosecurity agencies, Plant Health Australia, Australian Biosecurity Intelligence Network and CSIRO. These projects focus on likelihood of entry and consequence and their uses in prioritisation of biosecurity resource allocation. Both workshops were organised through the Education and Training Program and the Delivery and Adoption Program. The first workshop 'Enhanced Risk Analysis Tools: Pest Prioritisation' demonstrated and tested our threat prioritisation tool. This tool combines a tool to elicit expert opinion with a tool to analyse the economic impact. The aim of this workshop was to run an actual prioritisation workshop using the models and processes developed by the team and to then elicit feedback as to how well the process worked and where improvements could be made.

The second workshop 'Technologies Enhancing Biosecurity Preparedness' demonstrated the use of self organising maps (SOMs) to identify threats. This approach was developed as means by which to reduce reliance on expert opinion, by providing a quantitative methodology for assessing the likelihood of establishment based on global species associations. Here we presented the results of the SOMs with a view to eliciting feedback from end-users. The feedback generated a range of interest with invitations to present or further discuss the results with the Biosecurity Services Group, Department of Environment, Water, Heritage and the Arts and National Security Science and Technology Unit.

In 2008-09, two final reports were prepared and distributed to the Australian Government Department of Agriculture, Fisheries and Forestry through the Australian Centre for Excellence in Risk Analysis (ACERA) as an outcome from collaborative projects. Both projects focus on how we assess plant biosecurity risk. The first report discussed the comparison of different countries' approaches to undertaking pest risk assessment and the other on the evaluation of the performance of import risk assessments. The comparison of different countries' approaches to pest risk assessment under ISPM 11 has involved a strong collaboration with PRATIQUE, the EU 7th Framework project to which we are a party. The second project is considering how to evaluate the performance of Australia's import risk assessment process. Both projects have delivered outcomes for the ACERA part of the collaborative project and are now in the process of developing future directions based on the research outcomes from the previous 12 months.

Global climate change raises the potential for a range of biosecurity challenges to agricultural industries. In our climate change project, we consider both the threat from pests and diseases not present in Australia and, the changing threats of those pests and disease already present but which may increase or decrease in distribution and impact. The project has two broad aims, the first is to consider the biological impacts of elevated CO₂ and temperature while the second focuses on how best to communicate the risk of projected distributions and abundance of pests, their likely impacts and the level of uncertainty associated with the projections. The project, through the risk mapping element has developed two major collaborative linkages; the first with

PRATIQUE and the second with 'International Pest Risk Mapping Workgroup' the latter being a collaboration between Australian, European, New Zealand and North American researchers aimed at developing an international standard for the development of risk maps as a risk communication tool.

The project, through its team investigating the role of CO₂ and temperature and the impact of pests and diseases of wheat, has been successful in attracting two years of funding from the Asia Pacific Network for Global Change Research (APN). This additional investment will expand the project by establishing an international network to tackle the effects of climate change on major food crops in India and Bangladesh. Another highlight for the project was the annual Federation of Scientific Technological Societies (FASTs) 'Science meets Parliament' event which was held in Canberra in March 2009. Dr Jo Luck, Project Leader for this project was successful in a bid to meet three Parliamentarians who had nominated 'Adapting agriculture to climate change' as a topic they were interested in.

Two new projects, which will be linked, also joined the program. The aim behind the projects is to produce a tool for incursion response decision makers which will help them respond more effectively to an incursion. The tool will produce outputs that describe the probabilistic distribution of a pest given its mode of spread both spatially and temporally. The tool will also enable decision makers to determine where best to place surveillance efforts and to identify whether containment is an option and where it might be best implemented. One project will develop algorithms to describe how pests and disease spread through the landscape. The aim is to develop a library of spread algorithms that describe a range of different spread modalities. These will link into the second project which will develop the spread description tool. Together the projects will be linked through a user-friendly graphic user interface which will draw upon a library of geographic information systems (GIS) data, insect biology and modes of dispersal.

Program 2: Diagnostics Research

During 2008-09, our Diagnostics Research Program successfully completed the first of its research projects which developed a new molecular test to differentiate the fungus that causes the most serious disease of wheat, Karnal bunt, from other closely related organisms. This enhanced test offers a quicker diagnosis than existing procedures, a vital consideration in responding to quarantine situations. The project has been completed following the independent evaluation of the test in Australian and overseas laboratories. A second project sought to identify marker proteins that are unique to those insect pests of stored grain that are resistant to phosphine; protein markers that might then have been adaptable for use in a simple dipstick-type tools.

Several new research projects have been initiated during the reporting period. One of these is a most innovative project that will take advantage of the newly-generated sequence data from the red flour beetle to identify genes for their olfactory receptors, that is, proteins with exquisite sensitivity for insect pheromones. The project will isolate, characterise and produce functional copies of these receptors, which could subsequently form the basis for a novel biological sensor for use in grain storages to detect insect infestations. The work will bring together a range of new approaches to deliver short-term goals, combined with the prospect of novel applications in the longer-term.

A second new area of work will use a multidisciplinary approach, including molecular biology, behavioural, morphometric and mating studies, to examine the species boundaries within a particular complex of fruit flies. The species currently named as being within the complex are extremely difficult to differentiate morphologically but have different geographic distributions and different listed host ranges, and so impact differently on trade and quarantine. The project seeks to determine the number of taxa within the group and design improved diagnostics to the valid species. The project includes a short term posting of one of the project team to the laboratory of a

collaborating group at the International Atomic Energy Agency in Vienna, where such biological studies can be conducted without compromising Australia's plant biosecurity.

Two new projects are evaluating new diagnostic platforms and show excellent promise in their early stages. One of these is seeking to identify new biomarkers to differentiate plant pathogenic bacteria, using two of the newer discovery platforms, proteomics and metabolomics. Both of these approaches identify functional molecules associated with the plant-pathogen interaction and so may overcome the practical limitations of existing assays based on anonymous, plasmid-borne or incidental targets. Once identified, these biomarkers will be adapted to reliable, high throughput, rapid turn-around diagnostics, offering improved testing methods to one of our key end-user groups, the laboratory diagnosticians. The other project is seeking to further assist laboratory diagnostics by establishing high-throughput diagnostics for plant viruses. The approach binds biological molecules such as oligonucleotides and antibodies to beads of less than a few hundred nanometers in size, to detect pathogens in animal or plant cell extracts or environmental samples. A key advantage is the ability to test for several, up to dozens, of viruses simultaneously, which could dramatically reduce the time required, and so the cost, of testing. This work is conducted in partnership with the Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease, the Queensland Government and Nanomics Pty Ltd.

Another highlight for the year has been the progress made by existing projects. One focus has been the continued development of our 'digital diagnostics' projects, being the Remote Microscope Network, the Plant Biosecurity Toolbox and the Biosecurity Bank. The Plant Biosecurity Toolbox and Biosecurity Bank were officially launched to industry in February 2009 and continue to be populated with diagnostic information for plant pests and diseases.

The Plant Biosecurity Toolbox is a key resource for laboratory diagnosticians and the curious alike, capturing at one web address all the existing information needed to recognise and identify plant pests and diseases. More than 60 pests have been entered so far, beginning with those identified as the highest priority under the Emergency Plant Pest Response Deed. The information for each pest includes detailed images of the pest and the symptoms it causes on its host, information on its biology and taxonomy and specific diagnostic protocols using morphological, biochemical and molecular means. The site is also being used as an on-line tool to develop new diagnostic protocols, making it unique as a model for two-way information exchange with its end users, such as diagnosticians and the Subcommittee on Plant Health Diagnostic Standards, which is charged with ensuring the delivery of national diagnostic protocols for Australia's key plant pests.

Most of the online tools are housed in the Pest and Disease Image Library* (PaDIL) which is a virtual collection of plant pests and diseases hosted by Museum Victoria. PaDIL has users from over 182 countries with the United States of America making up more than 30 per cent of users. Since its launch, the Plant Biosecurity Toolbox is attracting approximately 25 per cent of all PaDIL traffic, suggesting it is a reputable and well-used plant pest diagnostic tool within industry.

The Remote Microscope Network has expanded significantly this year and new installations are in progress around Australia and internationally. As the reporting period draws to a close, the team have just identified a new product that is an inexpensive, portable alternative to the standard remote microscope equipment that could be combined with a laptop and wireless internet to stream images of pests in the field to experts at remote locations.

Now combined as one project, these digital diagnostic tools enable plant pests and diseases to be identified remotely and in real time using the internet. The online tools also build and nurture collaborative groups within Australia and then network these to international linkages, including New Zealand, Indonesia, Malaysia and Thailand.

**PaDIL is a partnership between the Department of Agriculture, Fisheries and Forestry, Department of Agriculture and Food Western Australia, Museum Victoria, Plant Health Australia, Queensland University of Technology and the Cooperative Research Centre for National Plant Biosecurity.*

Program 3: Surveillance Research

The reporting period has seen another successful year for the Surveillance Research Program with the consolidation of a number of research activities and a continued focus on engagement with end-users to ensure research delivers against end-user priorities. The projects in the portfolio reflect the national drive to develop more effective surveillance tools and methodologies for harmful plant pests and diseases and to enhance the operation of key trade structures such as area freedom.

Most plants used in Australian agriculture have their origins in other countries. However not all of the pests which affect these plants in their native habitats have arrived in Australia and in response, an Emergency Plant Pest Response Deed (EPPRD) has been developed. The EPPRD is a formal legally binding agreement between Plant Health Australia, the Australian Government, all state and territory governments and national plant industry body signatories and covers the management and funding of responses to harmful plant pest and disease incidents. During the year, our researchers developed a number of contingency plans under the EPPRD structure for key harmful plant pests and diseases such as spotted stem borer, Fusarium wilt and corn ear worm and surveillance plans for Russian wheat aphid, Hessian fly and Sunn pest. Research during the year also included a collaborative effort to prepare Australia's grain industry for the possible arrival of the feared stem rust race known as 'Ug99'. This leading work has been termed a Business Continuity Plan and underscores efforts to detail management activities required to limit the impact of key harmful plant pests and diseases arriving in Australia.

With most of Australia's agriculture produce exported; securing and maintaining market access is critical as is the need to demonstrate freedom from certain plant and animal pests and diseases. Surveillance is an important tool for securing market access and accordingly exporting countries now need to provide accurate, credible evidence to confirm absence (i.e. known not to occur) for pest freedom status. In the past, nearly all field collected surveillance information was recorded manually to paper reducing the rate of capture, integrity, conformity as well as security of the data. In response, research during the year culminated in the development of pest surveillance data collection software and hardware using hand-held computers or Personal Digital Assistants (PDAs). This achievement provides chain of evidence control, increases the volume of data collected as well as its integrity through relational databases and seamless data transfer to corporate systems.

To achieve success with PDA applications, a novel approach focused on development in the Windows Mobile environment to allow synchronisation to relational databases built with Microsoft Access and Oracle as well as full Microsoft Office integration. For the PDA database development environment, the research team developed software that was largely wizard driven to encourage collaborators to develop in-house solutions, to share techniques, code and modules. This was a critical development which has resulted in strong end-user acceptance of the PDA products.

Another new approach to the development of PDAs for plant biosecurity surveillance took advantage of software developments for Google Earth and Google Maps, with the team developing the PDA applications to collect digital latitude and longitudes and port them to Google Maps as required for display. Digital latitude and longitudes were chosen over analogue (degrees, minutes and seconds) and UTM (eastings and northings) because they are now considered best practice for geo-referencing by the Global Biodiversity Information Facility. The new PDA software was successfully field trialled with a number of end-users and further applications such as hazard site

pest surveillance, stored grain fumigation monitoring and grain insect resistance testing are under development.

During the year, research to support area freedom again targeted the critical issue of fruit fly surveillance. Project efforts focused on research to improve female lures, trapping for area freedom and the development of a systems approach to fruit fly management. The trapping project used dynamic placement of traps to achieve improvements in the detection of Mediterranean fruit fly with fewer numbers of traps. Results were not as strong for Queensland fruit fly and work continues to modify trap placement to investigate the causes of this difference between fruit fly species.

A significant achievement during the year saw completion of the statistical designs of a multi-component biosecurity detection surveillance system (SS). This innovative research focused on terrestrial non-indigenous species of each of invertebrates, vertebrates and plants and was undertaken in support of a major national infrastructure investment. The methodology required for the SSs was newly developed for this purpose, as there were no existing methodologies that took into account all of the required key specifications. Each SS comprised a range of different detection methods, and were developed using statistical methods to ensure that they meet the end-user specifications of 80% detection power as a minimum. This specification was treated as a hurdle and was exceeded substantially in each SS. Other novel features of the SSs were determination of population level (or detection threshold) by expert elicitation, and the development of an optimisation technique to balance various broad cost considerations such as logistical, environmental and other resource factors.

Prior to this work, no published surveillance design methods integrated information from different sources, such as a trapping grid and structured visual surveys and the project developed a new approach for this purpose. This enabled the use of a variety of information sources, including conventional methods and methods that would not normally be considered, *viz.* the observations of construction staff; even if their efficiency is very low, the number of staff present makes their potential contribution significant and undesirable to ignore.

Program 4: Impact Management Research

The reporting period has seen another successful year for the Impact Management Research Program which has focused on consolidating and building on early research findings to deliver outcomes against end-user priorities. The projects in the portfolio reflect the priority to reduce losses from incursions of harmful plant pests and diseases and to develop new tools to underpin optimal response strategies and pre-emptive crop management strategies.

Building a capacity to respond to changing virulence status in harmful plant pests and diseases is a critical element in managing impact. This is particularly the case where a key strategy in the management of harmful plant pests and diseases is through the development of resistant Australian germplasm. In these instances, plant resistance is commonly achieved through simple genetic resistance mechanisms which can be disadvantaged when there is the capacity for harmful plant pests and diseases to develop a complementary virulence factor.

In response, projects have been developed in order to determine how virulence develops and during the year, a major scientific achievement was reached with the development of RNAi methodology and its successful implementation against salivary gland genes in the pea aphid. The successful proof of gene silencing approaches resulted in individual aphids being unable to feed on plants resulting in high mortality rates. Issues with high mortality of controls remain to be resolved and are the focus of the remaining research efforts along with applications against Russian wheat aphid (RWA) (a key harmful plant pest of concern to the Australian grains industry). Following the achievement, communication with Plant Health Australia was initiated to alter biosecurity response planning for RWA based on the knowledge gained from the project.

The development of novel control strategies is critical to the capacity to manage the impact of harmful plant pests and diseases. In the case of plants, management of a harmful plant disease incursion relies partly on the removal and destruction, by fire and/or burial, of part or entire affected plants. This strategy has proven effective with the eradication of apple scab while recent eradication programs for citrus canker, grapevine leaf rust, black sigatoka and Fireblight have all involved the destruction of host plants.

However this strategy may also result in negative economic and social impacts where affected plant industries are based on perennial species. Earlier research revealed a lack of scientific evidence for the effectiveness of burning or burial of infected perennial tree material. In the previous year, this led to the development of an innovative research model to develop alternative eradication strategies using related endemic pathogens followed by validation of the target exotic pathogen in an overseas country where it is endemic. During May 2009, this approach resulted in the development and implementation of a new eradication protocol for black rot on vines located on the Cornell University research station, New York, USA. The development of protocols to manage a possible incursion of black rot pathogen is a high priority for the Australian viticulture industry and the project team continues to engage with the industry regarding findings from the joint US trials and their implications.

During the year, complementary research to develop incursion management strategies for harmful pests resulted in the successful application of micro-encapsulated pheromone to sterile Medflies which were field released. This novel approach to the management of Medfly underscored the potential of mating disruption and larger trials are planned for late 2009. There was also good progress with the development of advances in sterile insect technology in partnership with USA collaborators which holds strong promise as a component of a new integrated approach to the management of harmful insect incursions.

All high-risk planting material enters Australia via post entry plant quarantine (PEQ) and national plant industries seek rapid access to new germplasm to enable global competitiveness. The time a plant accession spends in PEQ varies from three months to three years, depending on the assessed risk. During this time plants are screened and tested for the presence of exotic diseases. The time limiting step is testing for viruses and this year, a break-through was achieved with the design of a diagnostic test that can reliably detect a group of viruses. The research has been internationally published and peer-reviewed and has the potential to significantly improve the existing diagnostics bottleneck through the application of this strategy to additional virus genera. This capability is especially important in PEQ due to the large number of viruses that are tested for and the risk of imported plant material containing undescribed virus species.

Program 5: Post-Harvest Integrity Research

The reporting period was the second full year of the Post-Harvest Integrity Program which continued the development of new projects addressing end-user priorities and delivered important achievements from existing projects. The projects in this portfolio reflect the grain industry's need for short-term solutions to immediate problems and the strategic need for long-term, sustainable grain biosecurity to underpin market access for Australian produce.

The physical and chemical interaction of fumigants with grain (sorption) is the key factor influencing behaviour of these gases, which in turn affects their movement in silos and their efficacy against insects. During the year, sorption phenomena were modelled from the unique perspective of the grain as a carrier of sorption surfaces. This, and the determination of a dispersion coefficient which allows the definition of key parameters to be defined, are crucial information facilitating the development of more complex, predictive three-dimensional flow modelling. This is now being undertaken by a new project commissioned early in 2009. Another factor investigated was the phenomenon of interrupted doses of phosphine caused by the diurnal flow of gas inside silos. Field trials revealed that interrupted dosing is a feature of fumigation even

in fan-forced silos. Research showed that phosphine toxicity was cumulative and despite periods of low exposure, insects did not have time to recover from intoxication.

To meet market demand for insect-free grain, farmers may need to fumigate grain stored at low temperatures (20°C or lower). Collaborative research, undertaken on farms in Western Australia, New South Wales and Queensland demonstrated that effective fumigation could be achieved in sealed silos but that much longer fumigation times are required than at higher temperatures. However, the rate of sorption was lower so that higher concentrations of gas can be achieved for longer. The team also observed that older grain was less sorbitive and that lower concentrations of gas tended to occur deep in the grain mass and on the northern side of the silo.

In the reporting period, project collaborators also measured phosphine gas flow in industry storages and are using this information to develop three dimensional models to predict fumigant movement under a wide range of conditions. The project team is demonstrating a high-level of innovation in their use of novel advanced solution techniques to quantify the fluid dynamics of gas movement in porous media. The model will simultaneously account for the varying multiple natural forces that drive gas flow in sealed and 'leaky' storages. This information will be used to improve fumigant application so that insect control is effectively achieved and selection for resistance avoided.

To develop new approaches to managing phosphine resistance based on studies of the movement and colonisation of grain by insects, trapping in farming regions in southern Queensland and southern New South Wales was conducted. These trapping studies have revealed that one major pest, the lesser grain borer, is widely distributed away from grain storages while another, the rust-red flour beetle, are aggregated around silos. Further work shows that lesser grain borer females have mated before leaving silos, that both sexes typically live for three months at 25°C, and that females captured in this way are capable of producing several hundred adult progeny during this time without further mating. In addition, resistance testing showed that there is no difference in resistance gene frequencies between insects caught near silos and those collected in paddocks. Strong phosphine resistance in these pests is conferred by two major genes and mathematical modelling shows that a two-gene model gives substantially different predictions of resistance development in fumigated populations than a single-gene model.

During the year, a national program for monitoring resistance to chemical treatments in insect pests of stored grain was transferred from the Surveillance Program in recognition of its central role in the management of resistance to phosphine and other grain protection chemicals. In early 2009, an independent review of the statistical procedures and related sampling and testing methods used in this project was undertaken. The review also made recommendations on the focus of future research in this area. Subsequently, a new protocol, which included changes to the monitoring strategy, reporting and data management, was developed and implemented nationally. In addition, the project team validated the use of 'impregnated-paper assays' (a quick assay) as an accurate and reliable test for field resistance to a range of grain protectants. Monitoring data show that this program has contributed significantly to the containment of resistance by providing the information essential for effective management.

We have also made a significant contribution to combating a major new phosphine resistance threat. In less than 12 months, and in close collaboration with industry partner GrainCorp, the project team developed a rapid resistance diagnosis test, developed and trialled new fumigation protocols and developed a successful eradication plan.

In 2008, we commissioned an independent external review to identify investment priorities in the area of chemical and non-chemical strategies for the control of insect pests of stored grain (Merriman Review). The recommendations of the review have guided further development of the research portfolio in this program with two new projects developed in 2008-09, each to commence 1 July 2009.

In early 2009, we also commissioned an external review of our research into phosphine resistance management. This review will take place in early September 2009 and its recommendations will be used to guide future investment in this important area.

In line with our strategy to re-build national capacity and research capability in the area of post-harvest grain, in early 2009 we initiated a three-year seconded appointment of Dr YongLin Ren to the position of Associate Professor of Grain Biosecurity at Murdoch University. Dr Ren's substantive position is Principal Scientist for the stored grain research team at the Department of Agriculture and Food, Western Australia. This appointment will contribute to the high-level training for undergraduate and postgraduate students to ensure Australia has future capacity in plant biosecurity research in the area of stored grain.

5 Research collaborations

A national network of scientists has been developed through the deployment of remote microscopes around the nation. Linked to a 'triage' hub in Canberra the network enables scientists and technical staff to have suspect organisms identified much more rapidly than has been possible in the past, turning speed to our advantage in this instance. Rapid detection means that remedial measures to reduce the potential impact of a pest or disease incursion can then be taken quickly and decisively.

During the reporting period, the remote microscope network has been extended 'pre-border' with deployments in Thailand and Indonesia with the financial support of AusAid and the Australian Centre for International Agricultural Research which is an Australian Government statutory authority that operates as part of Australia's Aid Program within the portfolio of Foreign Affairs and Trade.

The remote microscope network is a tangible example of our efforts to not only develop a national network for biosecurity science, but also to link that national network with relevant international initiatives.

A significant achievement during the year saw completion of the statistical designs of a multi-component biosecurity detection surveillance system. This innovative research was undertaken to support the Gorgon LNG and domestic gas project through a contractual arrangement with Chevron Australia Pty Ltd. The work undertaken by the research team has made a contribution to recent approval of development proposals for the project by the Western Australian State Premier and provides a clear example of efforts to build collaborative research with national businesses to deliver commercial impact on a national scale.

Through the quadrilateral scientific collaboration in plant biosecurity (QUADS-SciCo) alliance, we work with Canada, New Zealand and the United States of America to share resources to address biosecurity topics of common interest. During the reporting period we have continued work through the QUADS-SciCo alliance to develop a plant biosecurity training program which can be extended to other interested countries around the globe.

Another key research collaboration links Indigenous communities in northern Australia and Eastern Indonesia to develop informed 'eyes and ears', alert to strange organisms and able to complement the more conventional surveillance activities of regulatory and scientific bodies. During the reporting period this activity has been strengthened through collaboration with a number of Indonesian universities to pursue our objective to build human capacity in biosecurity, to equip it with information and tools, and to link Australia to the best of the world's efforts to reduce the impact of pests and diseases on the plant industries which sustain trade and food security.

Throughout 2008-09, we continued our strong links with PRATIQUE, a consortium under European Union funding that will address the pest risk analysis for major global biosecurity threats.

During the reporting period, we also initiated a partnership with the Australian Biosecurity CRC for Emerging Infectious Disease and Invasive Animals CRC to host an international conference focusing on agricultural and environmental biosecurity. The conference will be the first of its kind worldwide with an aim of providing a forum for stakeholders from across the biosecurity spectrum (including researchers, industry representatives, policy makers, primary producers and importers/exporters) to:

- workshop, network and exchange knowledge on agricultural and environmental biosecurity
- facilitate engagement and cross-fertilisation of ideas between researchers and their end-users (industry, regulators and other end-users), and
- build cross-disciplinary networks across all biosecurity related disciplines.

Conference planning with the two other CRCs has been a major focus for 2008-09 and to the end of the reporting period, planning indicates the conference will be very successful. *Global Biosecurity 2010: safeguarding agriculture and the environment* will be held in Brisbane from 28 February to 3 March in 2010.

6 Commercialisation and utilisation

6.1 Commercialisation and utilisation strategies and activities

Commercialisation and utilisation is the focus of our Delivery and Adoption Program. The program has projects in its own right, but also oversees delivery and adoption of research outputs from our five research programs. A new Delivery and Adoption Officer was appointed during the reporting period with responsibility for managing the program and overseeing delivery and adoption activities across the research portfolio.

A key achievement of the program was the completion of delivery frameworks for five key impact areas. Building on from individual project delivery plans, the frameworks provide a holistic plan for delivering the greatest impact over the remaining life of our CRC. The frameworks cover five of our key strategic areas and have been assigned dedicated budgets to ensure output delivery.

Two key projects moved into the Delivery and Adoption phase during the 2008-09 financial year; PDAs for Biosecurity, and Community-based Biosecurity. The focus of the second phase PDA project will be to continue rolling-out PDA software and units to state agencies to use in urban surveillance activities, as well as developing a phosphine monitoring device and associated PDA software for use by the post-harvest grains industry.

The program also commissioned a new project during the reporting period; Optimal Investment in R&D (research and development) for Plant Biosecurity. This project will develop a generic tool by using economic analyses to capture the optimal implementation and adoption of existing and proposed research and development within a biosecurity system. The project will focus on two initial case studies examining grain biosecurity and fruit fly area freedom and will complement a number of existing projects across the research portfolio.

The Grains Knowledge Network project is progressing well, having successfully appointed Grains Biosecurity Officers (GBOs) in Queensland, South Australia, Victoria and Western Australia. The

project has also successfully developed a Phosphine Communication Strategy, Phosphine Resistance Strategy and a draft change management plan. Over the coming year, the recommendations of these strategies will be implemented by the GBOs in delivering phosphine resistance information to growers. The appointment of GBOs is a co-investment with the relevant state government agencies and Plant Health Australia.

The 2008-09 financial year also saw the Delivery and Adoption Program support a number of high-profile events. In February, we launched the Plant Biosecurity Toolbox and Biosecurity Bank in Melbourne. These online technologies were officially launched by Ms Lois Ransom, Australia's Chief Plant Protection Officer, in front of over eighty delegates. These tools will form part of a suite of CRCNPB products that will sit within the Pest and Disease Image Library (PaDIL), a collaborative project that will also house our Remote Diagnostic Network.

The year also saw the program support two stakeholder workshops for projects from Program 1; Enhanced Risk Analysis Tools and Early Warning Threat Identification. These workshops brought together regulators and industry groups to discuss the use of CRCNPB developed tools in prioritising biosecurity risk. Both industry and government are now working with the project teams and applying the tools to their own biosecurity issues.

The 2008-09 financial year has seen our research program develop to a point where many projects are approaching a delivery phase. This reporting period has seen the Delivery and Adoption Program spend considerable time planning for this and assigning appropriate resources. The frameworks developed and resources dedicated will ensure that 2009-10 financial year will be a significant year for delivery and adoption for the CRCNPB.

6.2 Intellectual property management

We are responsible for identifying, securing, maintaining and protecting any intellectual property (IP) associated with our research operations. Our IP register captures the 'new knowledge' generated by our projects. New knowledge is defined to include both public domain and protected outputs or outcomes (IP). Our IP register classifies new knowledge according to the level of protection deemed to be appropriate.

Background and potential IP from our projects is identified as part of the development and recommendation stages of all new projects. In identifying IP, we liaise with project and program leaders to ascertain what IP a project is likely to produce and whether this IP will have a commercial application. All IP generated is captured by an IP register that forms part of our online project management system with restricted access to ensure confidentiality.

We have taken steps to protect IP arising from our projects by stipulating confidentiality in individual project agreements. Our IP Manual contains policies and procedures to enable the preservation of suitable protection on all non public domain IP. The manual has been developed in compliance to the National Principles of IP Management and is administered by our Business Manager and Delivery and Adoption Officer, both of whom received IP training during the 2008-09 financial year. In ensuring the efficacy of the IP register in being up-to-date with project development, the Board is provided with an update on the IP status of all projects across the research portfolio each quarter.

During the 2008-09 financial year, a thorough audit of our IP register was conducted. This included updating the status of all IP in the register, ensuring all project IP had been adequately captured and assessing the suitability of pursuing formal protection of CRCNPB IP. The audit also captured all IP developed by student projects. The financial year also saw the successful filing of our first trademark; the Plant Biosecurity Toolbox. The trademark is currently being advertised in IP Australia's Official Journal and will be registered in early 2010 assuming it is not contested.

Our IP arrangements ensure that our technologies will accrue maximum benefits to Australia by releasing material suitable for the public domain while keeping potential commercial successes confidential. This includes IP arrangements between non-participant collaborators, particularly with National ICT Australia and Nanomics Biosystems, where specific IP agreements have been signed. As the development of our technologies continue to advance, arrangements for their commercialisation, technology transfer and accrual of national benefits will continue to develop commensurately. These arrangements will follow the basic premise of assessing the cost to us versus the return to us, our participants and the return to Australia.

6.3 Communication strategy

We have recognised and prioritised communication as a key activity during the reporting period. To audit existing communication activities and to facilitate two-way communication, an external agency was engaged to conduct an independent communication survey throughout July and August 2008.

Overall, the survey results were positive, however some respondents felt communication could be enhanced through improving the website, sending more newsletters and a need for more information on our project activities.

The launch of our new corporate website in August 2008 addressed some of the concerns raised by survey respondents. The new website has current information on our research activities including project pages, news and links to plant biosecurity related organisations. A designated members' area was also developed to provide members with an area where they can download information on our project selection process, project scoring, corporate templates and more. In addition, our newsletter *The Leaflet* has been distributed every second month with positive feedback from recipients and an increase in subscription from industry.

In an effort to communicate with agricultural plant related industries, we work closely with our participant organisations (including Plant Health Australia and Grains Research and Development Corporation) who act as conduit to disseminate information arising from our research activities. This allows us access to their extensive distribution lists so that our communication is targeted appropriately. In addition, in 2008-09 we sponsored several industry related conferences (such as the banana industry) in an effort to provide them with information about the scientific research being conducted to support the sustainability of their industry.

A communication strategy was developed in early 2009 to provide overarching guidance for our corporate communication activities, both internally and externally. The communication strategy recognises that successful knowledge transfer and extension training to industry is underpinned by effective communication activities, which will form part of the Delivery and Adoption Program. Recognising the importance communication plays in developing linkages with industry, and to help deliver the communication strategy, a full-time Communications Officer was appointed in April 2009, bringing the communication team to two full-time resources.

6.4 End-user involvement and CRC impact on end-users

End-user name	Relationship with CRC	Type of activity and end-user location	Nature/scale of benefits to end-user	Actual or expected benefit to end-user		
Australian Government (DAFF)	Department of Agriculture, Fisheries and Forestry (DAFF)	Participant	Biosecurity Management (National)	Better preventative systems, diagnostic tests, surveillance methods, and impact management tools.	Reduced risk of incursions and improved capacity for incursion response and management.	
	Australian Quarantine Inspection Service (DAFF)	Participant	Quarantine Services (National)		Better diagnostic tests expected to increase accuracy and efficiency of quarantine detection systems.	
	Biosecurity Australia (DAFF)	Participant	Quarantine Assessment and Policy Advice (Canberra)		Improved surveillance data and modelling for quarantine assessments and policy advice.	Enhanced data expected to help ensure pest-free status and maintain international export markets.
	Northern Australian Quarantine Strategy (DAFF)	Participant	Quarantine services (North Australia)		More accurate, efficient and cost-effective quarantine detection systems.	Better diagnostic tests expected to increase accuracy and efficiency of quarantine detection systems.
	Office of the Chief Plant Protection Officer (DAFF)	Participant	Biosecurity Management (National)		Improved risk analysis, diagnostics, surveillance and response strategies for biosecurity threats.	Enhanced data and strategies expected to help ensure pest-free status and maintain international export markets.
State Governments	Department of Agriculture and Food, Western Australia	Participant	Biosecurity Management (Western Australia)	Better preventative systems, diagnostic tests, surveillance methods, and impact management tools.	Reduced risk of incursions and improved capacity for incursion response and management.	
	Department of Primary Industries, Victoria	Participant	Biosecurity Management (Victoria)			
	Department of Primary Industries and Resources South Australia (PIRSA)	Participant	Biosecurity Management (South Australia)			
	Industry & Investment New South Wales	Participant	Biosecurity Management (New South Wales)			
	Northern Territory Department of Regional Development Primary Industry, Fisheries and Resources	Participant	Biosecurity Management (Northern Territory)			
	Queensland Primary Industries and Fisheries (DEEDI)	Participant	Biosecurity Management (Queensland)			

Research Providers	Australian Centre for International Agricultural Research (ACIAR)	Collaborative Research Provider	Biosecurity Management (International)	Better preventative systems, diagnostic tests, surveillance methods, and impact management tools.	Reduced risk of incursions and improved capacity for incursion response and management.
	CABI	Collaborative Research Provider	Biosecurity Management (International)	Better preventative systems, diagnostic tests, surveillance methods, and impact management tools.	Reduced risk of incursions and improved capacity for incursion response and management.
	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Participant	Biosecurity Management (National)	Better diagnostic and surveillance tools.	Enhanced research capability to protect Australia's plant industries.
	Grains Research and Development Corporation (GRDC)	Participant	Biosecurity Management (National)	A high plant biosecurity status is maintained for plant industries.	Reduced risk of incursions and improved capacity for incursion response and management.
	Horticultural Australia Limited (HAL)	Participant	Biosecurity Management (National)	A high plant biosecurity status is maintained for plant industries.	Reduced risk of incursions and improved capacity for incursion response and management.
	International government agencies	Collaborative Research Providers	Biosecurity Management (International)	Better preventative systems, diagnostic tests, surveillance methods, and impact management tools.	Reduced risk of incursions and improved capacity for incursion response and management.
	Rural Industries Research and Development Corporation (RIRDC)	Collaborative Research Provider	Biosecurity Management (National)	A high plant biosecurity status is maintained for plant industries.	Reduced risk of incursions and improved capacity for incursion response and management.
Industry	ABB Grain Ltd	Participant	Biosecurity Management (SA and Vic)	Market access and trade maintained through enhanced grain storage.	Minimised impact of phosphine and protectant resistance in stored grain insect populations.
	Chevron	Industry	Biosecurity Management (WA)	Minimised environmental impact of industry activities.	Provide a high-level of confidence in biosecurity status of areas where industry is operating and tools to ensure accountability to government on retaining pristine environment.
	Co-operative Bulk Handling Limited	Participant	Biosecurity Management (WA)	Market access and trade maintained through enhanced grain storage.	Minimised impact of phosphine and protectant resistance in stored grain insect populations.
	GrainCorp Ltd	Participant	Biosecurity Management (Vic, NSW and Qld)	Market access and trade maintained through enhanced grain storage.	Minimised impact of phosphine and protectant resistance in stored grain insect populations.

Industry	OrdGuard	Industry	Biosecurity Management (WA)	Better preventative systems, diagnostic tests, surveillance methods, and impact management tools.	Reduced risk of incursions and improved capacity for incursion response and management.
	Plant Industry SMEs*	Industry	Principal beneficiaries of CRCNPB outputs (National)	CRCNPB outputs will minimise economic, social and environmental impacts of future pest incursions leading to increased export opportunities and stable production costs.	Enhanced plant biosecurity will ensure market access and enable new market potential. Production costs will not increase due to minimising impact of future incursions.
	Saturn Biotech	Participant	Commercialisation (Perth)	New technologies and tools will provide faster, more cost-efficient and accurate diagnostics	Outputs from diagnostic projects will enhance Saturn Biotech's service provision to the plant industries.
Industry/ government coordination	Plant Health Australia	Participant	Plant Health Management (National)	Better biosecurity planning and communication tools.	Reduced risk of incursions and improved capacity for incursion response and management.

* Plant Industry SMEs

A3P, Almond Board of Australia, Apple and Pear Australia Limited, Australian Banana Growers' Council, Australian Citrus Growers' Inc, Australian Cotton Growers' Research Association Inc, Australian Dried Fruits Association Inc., Australian Honey Bee Industry Council, Australian Macadamia Society Ltd, Australian Mango Industry Association, Australian Nut Industry Council, Australian Olive Association Ltd, Australian Passionfruit Industry Association, Australian Processing Tomato Research Council Inc., Australian Table Grape Association, Australian Walnut Industry Association, AUSVEG, Avocados Australia, CANEGROWERS, Canned Fruit Industry Council, Cherry Growers of Australia Inc., Grains Council of Australia, Growcom, Nursery and Garden Industry Australia, Onions Australia, Ricegrowers' Association of Australia, Strawberries Australia, Summerfruit Australia Ltd, Winegrape Growers Association of Australia, Winemakers' Federation of Australia.

7 Education and Training

The foundation of our Education and Training Program has always been our postgraduate training program, which aims to increase the capacity of plant biosecurity in Australia. In 2008-09 we exceeded our goal of 32 PhD enrolments and as we now enter our fifth year of operations, our focus moves to assisting these students in completing their theses. Two of our PhD students are due to submit in late 2009 with more due in early 2010.

The highlight for many of our PhD students is the annual workshop that we offer them to assist in their professional development. Carol Morris and her colleagues from Southern Cross University presented interactive workshops on project and IP management and leadership skills. Ern Kostas from Co-operative Bulk Handling Limited also attended as a guest speaker to highlight the importance of our industry partners.

We are keen to ensure that all of our students receive every opportunity to produce high quality research that is acknowledged by international audiences. A number of our students have established strong international collaborative links and have spent time working in overseas laboratories, assisted by our travel scholarships. Several PhD students have also presented their research at international conferences over the year, and we are actively encouraging these students to convert these presentations into peer-reviewed publications over the next 12 months.

On the training front, an exciting new vocational training course for the Grains Industry commenced development this year. This course is aimed at increasing knowledge and awareness of plant biosecurity within the grain storage industry, in particular managers of bulk grain storages (bulk handlers) and farmers storing grain on farm (producers). The course is being written by Charles Sturt University and it is also expected that the state Grain Biosecurity Officers will play an integral role in both development and delivery. A pilot of the course is due to be run by the end of 2009.

Three workshops were run throughout the course of the year, to transfer know-how and other practical information arising from our work to industry and other end users. These included a workshop on 'Distribution of fumigants in grain stores' arising from work conducted in our Post-Harvest Integrity Research Program and two workshops to transfer information from projects in our Preparedness and Prevention Research Program. The latter two workshops 'Enhanced Risk Analysis Tools: Pest Prioritisation' and 'Technologies Enhancing Biosecurity Preparedness' were particularly well attended by a diverse range of stakeholders and both resulted in further interest from industry and government organisations including further testing of the new tools.

Our school education strategy aims to create enthusiasm in science in the younger generation and to raise awareness of plant biosecurity and continued to grow throughout the reporting period. Ms Melanie Hay was appointed as Education and Training Officer in August 2008 and under her guidance we completed the trial primary school program with a very successful 'Scientists of Tomorrow' event held at CSIRO's Discovery Centre in November. Hosted by Ruben Meerman 'The Surfing Scientist', schools which had participated in our primary school activities throughout 2008 came together to share their ideas on remote microscopes, spore catchers and emergency response vehicles, and compete for the end of year prizes. The students' enthusiasm and understanding of plant biosecurity was clearly reflected in their presentations and impressed all of those who attended the event. Our school program has now been expanded to a national level under the banner of 'Plant Pest Investigators' with teachers from all states of Australia keenly participating.

On the same day as our summit, Australia's former Chief Scientist Dr Jim Peacock launched our new plant biosecurity big book, *Plant Pest Investigation*, to a group of fifty kindergarten children. The book is used as part of the primary school unit and is also available for purchase separately.

8 Glossary of terms

Acronym	Meaning
ACIAR	Australian Centre for International Agricultural Research
ACERA	Australian Centre of Excellence for Risk Analysis
ASEAN	Association of Southeast Asian Nations
AQIS	Australian Quarantine and Inspection Service
CBH	Co-operative Bulk Handling Limited
CEO	Chief Executive Officer
CRC	Cooperative Research Centre
CRCNPB	Cooperative Research Centre for National Plant Biosecurity
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DAFWA	Department of Agriculture and Food, Western Australia
DEEDI	Department of Employment, Economic Development and Innovation
DPIVIC	Department of Primary Industries, Victoria
EPP	Emergency Plant Pest
EU	European Union
GIS	geographic information system
GRDC	Grains Research and Development Corporation
HAL	Horticulture Australia Limited
ICT	information and communications technology
IP	Intellectual property
LBAM	Light brown apple moth
MAF	New Zealand Ministry of Agriculture and Forestry
NICTA	National ICT Australia
I&NSW	Industry & Investment New South Wales
NZ	New Zealand
OCPPPO	Office of the Chief Plant Protection Officer
PaDIL	Pest and Disease Image Library
PDA	personal digital assistant
PHA	Plant Health Australia Ltd
PhD	Doctor of Philosophy
PIRSA	Department of Primary Industries and Research South Australia
QPI&F	Queensland Primary Industries and Fisheries
QUADS	Quadrilateral Agreement on Plant Health
QUT	Queensland University of Technology
R&D	research and development
RIRDC	Rural Industries Research and Development Corporation
SME	small to medium-sized enterprise
SPHDS	Subcommittee on Plant Health Diagnostic Standards
SS	Surveillance systems
UA	University of Adelaide
USA	United States of America
UWA	University of Western Australia

9 Third Year Review

We undertook a full review of our operations at the completion of our third year. An independent review panel was selected, chaired by Dr Kevin Sheridan. The other panel members were Dr Craig Phillips, Mr David Crawford and Professor Elizabeth Deane (appointed by DIISR).

Our Board was responsible for commissioning and overseeing the review and implementing any recommendations arising from the review. The Board formed a subcommittee consisting of Professor John Lovett, Mr Barry Windle and Professor John Irwin. The subcommittee set the terms of reference for the review (along the lines of the broad terms of reference) as determined by DIISR.

The independent review panel provided our Board with a report that incorporated 16 recommendations. A status report on each of the recommendations is provided in the table below.

9.1 Third Year Review Recommendations

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
<p>Recommendation 1:</p> <p>Greater end-user involvement in all phases of the project cycle</p>	<p>Yes</p> <p>(ongoing)</p>		<p>The CRCNPB Board has identified this as an area that needs to be improved in some of the research activities undertaken by the CRCNPB. The involvement of end-users in CRCNPB projects is significant and is critical if delivery and adoption of outcomes is to be achieved.</p> <p>The current research portfolio has a range of end-user engagement. The stored grain component of the portfolio, which represents approximately 50% of the total research budget, has very strong end-user engagement throughout the project cycle. This is achieved through the Grains Advisory Panel which plays an active role from project development through to delivery and adoption. A number of other research projects, that represent approximately 25% of the portfolio, have end-user engagement through advisory or liaison committees. These committees meet at regular intervals each year and assess progress of the project and provide advice to the CRCNPB. The remaining group of projects have only had end-user engagement at specific points in the project cycle such as the consultancy process undertaken during project development.</p> <p>To enhance the level of engagement with end-users throughout the project</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
			<p>cycle the CRCNPB employed a Delivery and Adoption Officer in late 2008. The Delivery and Adoption Officer is engaging with Program Leaders to develop greater involvement strategies. The officer is also fostering and developing working relationships with participant organisations to increase end-user engagement in the project cycle.</p> <p>The CRCNPB will investigate the best strategy to achieve greater end-user engagement in its entire research portfolio, taking into consideration the possibility of forming additional advisory committees that will have engagement in specific projects (or groups of projects). The strategy will also explore who are the relevant end-users and the changing role of end-users as a project progresses from development to delivery. For some components of the research portfolio it may be appropriate to engage end-users who currently have no involvement with the CRCNPB.</p>
<p>Recommendation 2:</p> <p>That the strategic planning process includes legacy planning</p>	<p>Yes</p> <p>In progress</p>		<p>The CRCNPB Board has identified this as an area that needs to be considered as the CRCNPB enters its fourth year. Discussions will commence in the 2009-10 financial year with participants and other stakeholders to begin the process of legacy and succession planning. An initial meeting to begin legacy planning discussions was held with Participants on 5 March 2009</p> <p>The CRCNPB has identified four considerations in determining legacy and succession planning for the current centre.</p> <ol style="list-style-type: none"> 1. Second term: The CRCNPB will bring together current Participants plus other stakeholders to determine the most appropriate form a second term of the CRCNPB should take to ensure it maximises the outputs of the current term while taking account of new priorities. These discussions will determine what have been the outstanding contributions made to the Australian Biosecurity system by the current CRC. 2. Intellectual Property (IP) and project outputs/outcomes: The CRCNPB will identify and develop a range of emerging technologies arising from current research activities along with associated IP. Other organisations will be identified that can continue the

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
			<p>development through to delivery and adoption of project outputs/outcomes and maintain management of the IP generated.</p> <p>3. Capacity building: The CRCNPB is actively undertaking capacity building through the training of PhDs and appointment of postgraduate researchers into the Australian biosecurity system. The CRCNPB offers each PhD candidate additional training opportunities that assist in development of a career pathway. To maximise the benefits from this capacity building the CRCNPB will consider options to assist with commencing careers. One possibility for discussion will be the short term placement of PhD graduates within participant organisations.</p> <p>4. Resources: Through the current cooperation the CRCNPB has compiled a significant level of investment in plant biosecurity research. If the CRCNPB is not successful in bidding for a second term there will be a need to identify and source resources equivalent to the current level of investment in plant biosecurity. It is vital that Australia's plant biosecurity status continues to improve and keep abreast of its international market competitors.</p> <p>As part of its normal planning cycle the CRCNPB will conclude a full review of its current strategic plan in mid 2009. This review will include the incorporation of legacy and succession strategies. The review will re-assess how the current activities align with the national research agenda, determined by Australian governments, and the priorities identified by the industry sector. Current participants, other stakeholders in plant biosecurity research and future stakeholders will be engaged in the review.</p>
<p>Recommendation 3:</p> <p>Development of a Board charter</p>	<p>Yes</p>		<p>A Board Charter was finalised in April 2009 and was based on the requirements placed on the Board by the <i>Corporations Act</i>, the Company's <i>Constitution</i>, the <i>Commonwealth Agreement</i> and the <i>Participants Agreement</i> and the Company's <i>Strategic Plan</i>. The Charter covers the Board's:</p> <ul style="list-style-type: none"> • Purpose

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
			<ul style="list-style-type: none"> • Membership <ul style="list-style-type: none"> ○ Composition ○ Duties and Responsibilities ○ Appointment ○ Remuneration ○ Removal • Procedures
Recommendation 4: Regular reviews of the policy & procedures manual	Yes		<p>The CRCNPB Board agrees that the policy and procedures manuals require regular reviews. The policy and procedures manuals which are currently in use and/or under development include an Information Management Strategy (IMS). The IMS outlines the procedures for the production and maintenance of the policy and procedures manuals (manual names and who is responsible for them). The IMS specifies that the policy and procedures manuals will be updated on a needs basis (ie when changes are required) with full reviews taking place on at least a biennial basis.</p>
Recommendation 5: Extension of the KPI reporting structure & measurement	No	<p>This will be implemented as part of the review of the <i>Strategic Plan</i> and will be completed in the first half of the 2009-10 financial year.</p>	<p>The use of performance indicators in the CRCNPB <i>Strategic Plan</i> has led to some confusion. This was highlighted by the use of the wording 'more consistent' in the Review. In light of this confusion, the CRCNPB will reword these performance indicators to measures, as this was the original intent. The CRCNPB has an extensive measurement system in place that enables effective progress tracking and reporting. The CRCNPB currently utilises the Commonwealth milestones as its KPIs within this measurement system.</p> <p>The current performance measures listed in the <i>Strategic Plan</i> are being used by the CRCNPB in a non reporting manner but will now be incorporated into the annual planning cycle through the Operational Plan and <i>Annual Report</i>. As part of the review noted above, the CRCNPB will re-appraise the performance measures, assess their relevance and devise a reporting system that best suits the needs of the CRCNPB. Reporting against the measures will assist in planning the future needs and directions of the CRCNPB.</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
<p>Recommendation 6:</p> <p>Development of a stakeholder management system</p>	<p>No</p>	<p>Competing priorities have not allowed the Stakeholder Management System to be developed and implemented. It is expected to be developed and implemented by the end of 2009.</p> <p>In the meantime, management have been active in attending meetings with key stakeholders including the Chief Plant Protection Officer, as well as a briefing to key staff in the Department of Agriculture, Fisheries and Forestry. Management have also continued to devote significant resources to the Grains Advisory Panel and Chevron.</p>	<p>The stakeholder management system will be enhanced as part of the ongoing strategic planning and evaluation process. This recommendation is integrally linked with Recommendation 1 and 7. As a first step, CRCNPB management will explore relationships with key stakeholders and assess strategies to effectively manage and foster these relationships. CRCNPB has devoted considerable resources to stakeholder management but accepts that further work is required to build the relationships with the research, operational and policy sections of government agency participants. In many cases it is acknowledged by participants that these sections do not always work together effectively within an agency.</p> <p>The Board has directed that the stakeholder management plan includes:</p> <ul style="list-style-type: none"> • key participant organisations • industry representative organisations, and • representatives from Government (ie, policy makers). <p>The tactics of the stakeholder management plan will include personal contact visits from key CRCNPB staff, stakeholder executive level engagement with Board members to coincide with Board meetings where appropriate and engagement through Participants Committee meetings and a Science Exchange. Where appropriate, the CRCNPB will also arrange 'briefing sessions' where the activities of the CRCNPB can be highlighted to external stakeholders.</p> <p>The CRCNPB Board recognises that to be successful, the stakeholder management plan should also have a mechanism for monitoring and evaluation.</p>
<p>Recommendation 7:</p> <p>Development of a comprehensive communications strategy</p>	<p>Yes</p>		<p>To address this recommendation, a communication strategy was developed by the Communications Manager. This comprehensive communication strategy identified the key stakeholders, communication objectives and messages for each audience.</p> <p>The CRCNPB also recognises that communication is a two-way process and will be engaging with stakeholders to gain insight into the most effective</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
Recommendation 8: Refinement of the research portfolio presentation	Yes (In progress)		<p>means of encouraging this to occur.</p> <p>Several images to identify the holistic view of our research were drafted and workshopped with the Science Committee and the Board. After Board feedback and management discussion it does not appear that a suitable image which clearly represents our research across the biosecurity continuum could be developed. In promoting our research it will be necessary to emphasise how the programs fit across the biosecurity continuum.</p>
Recommendation 9: Regular Science Forums	Yes (In progress)		<p>A Science Exchange is scheduled for 22 – 24 September 2009. All CRC researchers, students, staff, Participants Committee, Board as well as industry members will be invited to attend.</p> <p>The Science Exchange will include two full days of presentations, scientific posters, workshops, meetings and the opportunity to network and exchange ideas on the research portfolio.</p> <p>In addition to this, the Science Committee is also using its face-to-face meetings in various cities as an opportunity to engage researchers and students by asking them to present their research projects.</p> <p>In 2010, the CRCNPB is partnering with two other CRCs to host an international conference titled <i>Global Biosecurity 2010: safeguarding agriculture and the environment</i>. This conference will also provide CRC researchers with an opportunity to exchange ideas and network with delegates in an international forum.</p>
Recommendation 10: Clear articulation pathways to adoption for all research projects	Yes (In progress)		<p>The CRCNPB employed Mr Cain Roberts to the position of Delivery and Adoption Officer in late 2008. A detailed value survey has been completed to engage end-users and assist in identifying adoption pathways. The identification of end-beneficiaries for project outputs is currently being addressed.</p> <p>As well as ensuring that all relevant end-users are identified and engaged, this process will also enable identification of beneficiaries of project outputs. In many cases the end beneficiaries will differ from the end-users and this will be articulated in pathways identified. The stakeholder management plan</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
			<p>that will be implemented will consider the inclusion of end beneficiaries.</p> <p>While the primary focus of the CRCNPB has been on agriculture and horticulture, it is also recognised that the outputs for many research activities are relevant for the environmental sector and that they will represent a key end-user. As such the environmental sector will be included in the development of pathways to adoption.</p>
<p>Recommendation 11:</p> <p>Increased investment in prevention research</p>	<p>Yes</p> <p>(In progress)</p>		<p>In response to this recommendation the Board has initiated an evaluation of the current balance of investments across the biosecurity continuum to better understand and manage the balance of the research portfolio.</p> <p>Prevention as a biosecurity tool is a key responsibility of Australian Quarantine and Inspection Service (AQIS). Through greater end-user engagement with groups such as AQIS, the CRCNPB will ensure it has research activities that focus on entry pathway management in Australia.</p> <p>The CRCNPB is already developing projects that address entry pathways for exotic plant pests. These projects include; assessing the risk of passengers carrying exotic pathogens on clothing when they return from overseas, developing more effective post entry quarantine testing protocols for plants, and evaluating the various pathways of entry into Australia. It seems likely that there will be more opportunities for research aimed at prevention. The projects will provide methodology/technology to assist in decreasing the potential for entry of exotic pests.</p>
<p>Recommendation 12:</p> <p>Evidence of research benefits is captured</p>	<p>Yes</p> <p>(In progress)</p>		<p>As the CRCNPB enters its fourth year there will be a steady increase in the outputs of research. As highlighted in the response to Recommendation 5 the CRCNPB will use a 'score card' system to provide evidence of the benefits resulting from research activities. The score card will need to incorporate a register of adoption and identify meaningful measures in the early phases of project activity.</p> <p>The CRCNPB has a diverse group of stakeholders. At commencement of activities the CRCNPB determines a baseline from which the stakeholder adoption success of deliverables can be measured. The CRCNPB can then</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
			<p>determine the science contribution to the Australian biosecurity system.</p> <p>Evaluation of benefit cost analysis methods and the 'Maximum Potential Benefit' system currently being used by the Pork CRC will be undertaken. If suitable they will be adapted for use by the CRCNPB.</p> <p>The approach undertaken to provide evidence will address this issue of different stakeholder groups and will consider the differing social values as they relate to biosecurity.</p>
<p>Recommendation 13:</p> <p>Potential benefits to Australia's natural environment are explicitly considered</p>	<p>Yes</p> <p>(In progress)</p>		<p>The Board has initiated a review to highlight the benefits that will arise for the environment from the current research portfolio. While the majority of the portfolio is addressing issues for the agriculture/horticulture sector of Australia, the original mandate of the CRCNPB, the outcomes from many projects will also provide benefits to natural ecosystems. Through consultancies the CRCNPB has also now undertaken some direct research that is targeted at natural ecosystems. The CRCNPB has also taken a generic science approach in developing research projects and the outcomes will be directly applicable to a broad range of areas in plant biosecurity including the environment.</p> <p>As part of the review follow up, and improved stakeholder engagement, consideration will also be given to identify processes to communicate the benefits of the research to a broader group of stakeholders including the environmental sector.</p> <p>As stated in the response to Recommendation 9, the CRCNPB is currently involved in the convening of a conference in 2010 that will focus on both agriculture and the environment.</p> <p>The CRCNPB will strongly consider the inclusion of direct environmental research in the next term of the CRC.</p>
<p>Recommendation 14:</p>	<p>Yes</p>		<p>The Board has requested that a review of the current process for evaluating project performance be undertaken. The review will also include re-assessing</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
<p>Development of a more robust tool for evaluating project performance</p>			<p>the format in which the evaluation is reported.</p> <p>Currently the Science Committee assesses each project on the basis of project performance and quality of science. The current process may require weighting of criteria and reporting scores against all criteria rather than providing an overall rating. A matrix reporting system will be explored taking into account all criteria.</p> <p>To provide a greater degree of assessment for project performance the CRCNPB has commenced a process of independent review of research areas that will be overseen by the CRCNPB Principal Scientist. These reviews will focus on the quality of science and the end-user relevance of the outputs being undertaken in each of the project areas.</p>
<p>Recommendation 15:</p> <p>Appropriate use of social scientists</p>	<p>Yes</p>		<p>The benefit of accessing social scientists has been identified, for example, through 'community awareness' projects in train in Australia and off-shore. Through these activities the CRCNPB has already identified that engagement of social scientists is critical to ensure effective delivery and adoption of research outcomes. The CRCNPB has recently appointed a Delivery and Adoption Officer who has qualifications in social science and the Communications Manager has training in social science.</p> <p>CRCNPB has also invested in several projects, including PhDs, that are based around social science. We are engaging social scientists to:</p> <ul style="list-style-type: none"> • achieve better understanding of strategies and benefits from research, • achieve greater community engagement in project activities, and • improve raising awareness of project activities.. <p>The CRCNPB will explore other opportunities to engage social scientists in research activities. Social values and responses to issues will be considered in all research activities.</p>

Recommendation	Implemented (Y or N)	Reasons why not implemented	Strategies to implement
<p>Recommendation 16:</p> <p>Implementation of appropriate staff development programs</p>	<p>Yes</p> <p>(In progress)</p>		<p>Staff recruitment is initiated when a resource gap within the CRCNPB is identified to the Board. 'Filling the gap' may be addressed by recruiting the skills or by providing training for current employees as deemed appropriate. This process is, at present, not formalised as a program.</p> <p>One of the policy and procedures documents currently under development is the Human Resources manual. This manual will outline:</p> <ul style="list-style-type: none"> • the process for skills gap identification • the recruitment processes including the addressing of skills gaps within job descriptions, and • the staff review process to enable staff development to match the skills gaps identified. <p>Much of the staff development currently undertaken is in-house, on-the-job training. This recognises the unique needs of the organisation and has made use of skills and experience of existing staff. External training has been utilised to provide specialist knowledge in areas such as intellectual property, commercialisation and software applications.</p> <p>Further, staff development has been undertaken through team building exercises which have promoted the effectiveness of the staff as a working team.</p> <p>The CRCNPB is investigating options for leadership training of Program Leaders.</p> <p>The Board again looks forward to the formalisation of the staff development process through the Human Resource manual before the end of June 2009.</p> <p>The CRCNPB will also investigate the possibilities of seconding participant staff to the Canberra office for short-term activities as a means to increase staff development both within management and within participants. There may also be possibilities for seconding office staff into participants for short-term activities.</p>