CRC PLANT biosecurity

Submission to the House of Representatives Agriculture and Industry Committee Inquiry into Agricultural Innovation

Plant Biosecurity Cooperative Research Centre Submission

25 September 2015

Contents

Key points

- Biosecurity is critical to Australian agriculture's future productivity and growth.
- Emerging technologies will play a vital role in biosecurity efforts that protect Australia's agricultural industry.
- Improved digital infrastructure, security and access will be transformative in delivering innovations in biosecurity management.
- Maximising technological advances will require regulatory review and international collaboration.
- National coordination and investment in biosecurity RD&E will continue to provide the technological advances necessary for Australian agriculture's future.

Background

The Plant Biosecurity Cooperative Research Centre (PBCRC) provides a coordinated national approach to plant biosecurity RD&E in Australia. Through its collaborative research programs including government and industry end-users, PBCRC protects Australian agricultural productivity through science that:

- Identifies pathways for plant pests to enter Australia
- Creates smarter tools and technologies to diagnose, discover and manage plant pests
- Creates improved pest management methods which are integrated into production systems
- Establishes technical networks both in Australia and neighbouring regions to reduce biosecurity risks and maximise regional capacity to deal with plant pests
- Increases knowledge transfer, technology adoption, and community engagement in biosecurity
- Develops training and education to increase national and international plant biosecurity capacity

Over its six year life, PBCRC will have led investment of more than $150m of resources, delivering benefits to Australia and beyond through world class science.

Introduction

The National Food Plan has set a target to increase the value of Australian agriculture and food exports by 45% by 2025. It acknowledges that "Australia's infrastructure and biosecurity systems will support a growing food industry, moving food cost-effectively and efficiently to markets and supporting new export opportunities".[1]

The Australian Government's 2015 Agricultural Competitiveness Whitepaper recognises that issues facing agriculture often go beyond single commodities and require collaboration, cross sectorial and transformational research, and improved extension and adoption.

With regard to biosecurity alone, the growth of agriculture and expansion of trade traffic over the next 15 years will mean:

- more than 300 responses to exotic plant pests
- more than 40 trade incidents related to plant pests
- at least five occurrences of loss of area freedom resulting in export challenges[2]

While our geographic isolation is a natural advantage, pests and diseases know no borders. As a consequence, Australia places a high priority on the maintenance of plant biosecurity and the recently reviewed Rural RD&E Priorities see a stronger focus on biosecurity and adoption of technology. The biosecurity priority is to improve understanding and evidence of pest and disease pathways to help direct biosecurity resources to their best uses, minimising biosecurity threats and improving market access for primary producers.

It is estimated that introduced invertebrate pests (insects and related organisms) cost over $4.7 billion in agricultural production losses annually and a further $750 million in control costs. The total cost of the impact of weeds on agriculture is estimated to be $4.5 billion annually, with some $1.7 billion spent each year on mitigation activities such as cultivation and herbicide application.[3]

To this end, Australia's current and future agricultural productivity must be supported by a strong and comprehensive national biosecurity system.

This submission seeks to demonstrate the vital role technology and innovation will play in ensuring our biosecurity system protects Australian agricultural productivity into the future. It also outlines the barriers to adoption of this technology.

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[1] Australian Government National Food Plan: Our food future, 2013
[2] Agricultural Competitiveness White Paper: Plant Biosecurity Cooperative Research Centre Submission, 2014
[3] National Plant Biosecurity Strategy. Plant Health Australia, 2010

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Emerging technologies

A strong biosecurity shield to protect productivity and improve efficiency in Australian agriculture into the future relies heavily on emerging technology being identified, enabled and adopted.

Innovative diagnostic technologies and virtual collections that support diagnosis will provide early and accurate diagnosis to enable a rapid incursion response that protects Australian agriculture's productivity.

Every day, people working in the agricultural sector need to identify plant pests in order to make decisions about how to manage those pests. Many pests are difficult to identify and those who find them are often a long way from the experts who can help. The longer it takes to identify a pest, the more damage it is likely to cause. In the case of exotic and regulated plant pests, delays in identification can affect our ability to eradicate or contain the pest.

Tools such as the Pest and Disease Image Library (PaDIL), a publicly available online national database that provides more than 48,000 images of approximately 7,000 species of exotic pests, pathogens and other species across Australasia, is used to support the diagnosis of agricultural pests and diseases. State agricultural departments use PaDIL in conjunction with laboratory testing, as a reference tool to identify insects or disease symptoms that have been found in crops by growers.

All images and data are available on the web and can be retrieved in a number of ways, allowing for mapping and comparison of different species, and identification through high quality imagery.

Pestpoint, a virtual diagnostic network that harnesses the power of social media for pest identification, presents a novel and highly effective option for incursion response. Pestpoint provides a secure web-space for regional networks to collaborate and identify damaging plant pests. The collection and sharing of field information and images is fully documented and collated in a searchable database. The tool relies on regional connectivity between growers and plant diagnosticians for pest identification and its efficacy in rural and remote areas is constrained by good access to the internet.

Remote microscope networks which have been established by the PBCRC in parts of Australia and South East Asia, mean pest identifications can be made remotely, drawing from the collective experience of the members of a network. With the decline in taxonomic expertise and the demand for greater pest intelligence for both biosecurity and pest management, remote diagnostics can play a role in using existing expertise more effectively while capturing pest incidence information (surveillance) that would not otherwise be recorded.

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Diagnostic technologies to support improved biosecurity infrastructure also provide increased efficiencies in agricultural practices. For example, the development and adoption of an integrated internet-based bioinformatics toolkit by PBCRC, has the potential to improve efficiency in crop breeding programs. Imported plants are currently held in Post Entry Quarantine (PEQ) for up to two years in order to be screened for viral pathogens. This delays growers' access to elite propagation stocks and hinders their ability to accelerate breeding programs. A digital toolkit to streamline virus and viroid diagnosis and surveillance procedures will potentially reduce quarantine time to months.

Cutting-edge surveillance technologies also promise to strengthen the biosecurity shield that protects Australian agricultural productivity.

Developments in sensor-based technologies and rapid diagnostic methods over the past five to ten years has allowed use of cost-effective sensors which can rapidly deliver high-throughput and detailed information of genetic sequences of pests and diseases of agriculture.

For example, the use of smart traps for insect detection (eg. fruit fly or Asian honey bee) that automatically detect insects entering the trap and send a digital signal to a central data collection point, would reduce the cost of manual visual inspections of traps.

Advancements in the use of small unmanned aerial systems (drones) for biosecurity surveillance in wheat fields, vineyards and orchards is another example of technological advancement and potential.[4]

Drones generally provide increased operational flexibility and visibility over land-based detection methods. They can provide coverage over large areas and monitor remote, dangerous or difficult to access locations. They offer a non-invasive monitoring approach that can target site-specific threats, which in turn allows for directed treatment and management.

By combining mature drone technology and advanced sensing systems, important disease and pest specific data can be collected in novel ways.

Sensors capable of detecting biosecurity threats in various stages of their lifecycle include spore traps, acoustic sensors and electromagnetic imaging devices. They can provide information on pre and post infection crop status to help discriminate healthy and unhealthy crop regions, or to prevent an outbreak or spread of potential threats.

[4] CRC5055 Evaluating Unmanned Aircraft Systems for Deployment in Plant Biosecurity, Authors Aaron Mcfadyen Felipe Gonzalez Duncan Campbell David Eagling, 16 May 2014

Pest interception at ports may also be possible along with advanced aerial mapping for quarantine related tasks.

Large and diverse in-field data sets can potentially be obtained which will help improve the accuracy of pest/disease discrimination. In turn, directed and early application of treatments and fertilisers could be applied to improve crop yield or protect export goods. This can significantly improve agricultural production efficiencies, minimising the need for ground vehicles and physical crop damage.

Surveillance technologies also offer significant potential in detection and diagnosis of pests and diseases both domestically and in the broader geographic region.

Barriers to adoption

Significant benefit will be captured upon broader use and integration of these technologies, yet barriers to adoption continue to hinder more rapid progress.

Internationally-agreed regulatory frameworks around data management and security, and IT infrastructure that guarantee these, are essential to the process of capturing data that informs biosecurity management.

For example, **regulatory considerations** around general airspace need to be addressed to see the benefits of drones in biosecurity management fully realised.

With Australia's drone industry booming, the 2014 Parliamentary Inquiry recognised the substantial social and economic benefits of drone technology to Australian society but identified a need for sustained attention to privacy implications and legalities.[5]

Internet security is a non-negotiable for adoption of many of the technological advances that are available to better protect Australian agriculture. Digital infrastructure that supports and guarantees data security is essential in the surveillance and diagnostic process.

Effective and efficient biosecurity surveillance programs and pest management will require a higher level of automation and technical sophistication and an increased dependence on affordable technologies and digital infrastructure.

At a purely practical level, improved **internet accessibility** for rural and remote Australia is essential.

The current level of connectivity of Australian farmers and regional communities to basic mobile and broadband services is relatively low. It limits the use of new

[5]The House of Representatives Standing Committee on Social Policy and Legal Affairs report: Eyes in the sky – Inquiry into droves and the regulation of air safety and privacy 2014

technologies to improve on-farm biosecurity, such as remote and in-field diagnosis of pests and diseases, and novel surveillance tools such as smart traps and drones.

A national and more expansive broadband coverage with high speed connection that provides access to new technology to protect crops could be transformative. High speed internet connection will also support new biosecurity diagnostic and surveillance systems used to protect crops from devastating pest and disease incursions. It will facilitate the transfer of knowledge across networks and communities to better protect Australia's agricultural productivity.

Maximising new technologies for the benefit of Australian agriculture requires significant and **enduring resources**, including sustained investment in RD&E.

The evidence is clear, as supported by Keogh (2014)[6], and the Australia Council of Deans of Agriculture (2010)[7], that the dollars available to RD&E in Australia have been reducing. Current resourcing of biosecurity RD&E is low and presents a risk to the long-term effectiveness of Australia's biosecurity shield and agricultural productivity.

There is a **declining human resource and capacity base** supporting plant biosecurity research and diagnostics within Australia. An extensive survey on plant pathology and entomology capability undertaken by Howie (2006[8] and 2012[9]) found that there are declining skills and capabilities within these areas, important skills to underpin Australia's RD&E plant biosecurity system, and provide the skills sets for diagnostics, surveillance and emergency responses.

Extension services have also experienced widespread reduction with those traditionally offered by the State and Territories to support agricultural development and growth, now being delivered through private providers. There are issues around the sustainability of this model, as the private providers traditionally have been trained by state governments and then left to become consultants[10].

National and coordinated leadership in biosecurity to ensure strategic and efficient investment in innovation, infrastructure and capability is essential to underpin the productivity of Australian agriculture for the future.

[6] Optimising future extension systems in the Australian grains industry, M.Keogh, M and C. Julian, 2014.
[7] Submission to the Productive Commission Inquiry into Australian Rural Research and Development Corporations, Australian Council of Deans of Agriculture, 2010
[8] 2006 Plant Pathology and Entomology Capability Study, B. Howie
http://www.austentsoc.org.au/AES/Documents/APPS_AES_Survey%202012_Mar5.pdf
[9] 2012 Plant Pathology and Entomology Capability Study, B. Howie
http://www.austentsoc.org.au/AES/Documents/APPS_AES_Survey%202012_Mar5.pdf
[10] Optimising future extension systems in the Australian grains industry, M.Keogh and C.Julian, 2014. O

Delivering effective biosecurity outcomes is complex, relying on the capabilities and interactions of many government agencies, industries, communities and individuals. As a cross-sectoral issue, biosecurity currently struggles to achieve the scope and collaboration required to support Australian agriculture.

Specific biosecurity challenges highlight the need for national coordination and leadership. For example, national coordination and leadership has been prioritised in the National Fruit Fly Research Development and Extension Plan recommendations[11], and further supported in the more recent consultation on the Regional prioritisation of the National Fruit Fly Research, Development and Extension Plan[12].

Virtual collections – like PaDIL – whose collective benefits impact both public and private sectors would also benefit from national leadership and coordination. Clarity around their management and resourcing would facilitate broader adoption and use into the long term.

PBCRC recommends that barriers to new and emerging technologies for agricultural biosecurity are prioritised, and the technical, policy and regulatory framework support adoption and take up of new technologies. Further investment and national coordination in biosecurity RD&E should be a priority for delivering innovation and ensuring Australian agriculture's efficiency and productivity.

[11] http://www.pbcrc.com.au/research/fruit-fly-plan
[12] Plant Biosecurity CRC, September 2015, Regional prioritisation of the National Fruit Fly Research, Development & Extension Plan