Boosting diagnostics for plant production industries

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Biosecurity Extension Community

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BOOSTING DIAGNOSTICS
PLANT BIOSECURITY
A RURAL RESEARCH & DEVELOPMENT FOR PROFIT INITIATIVE

Rural Research and Development for Profit Programme
Keeping Australian farmers at the cutting edge

Australian Government
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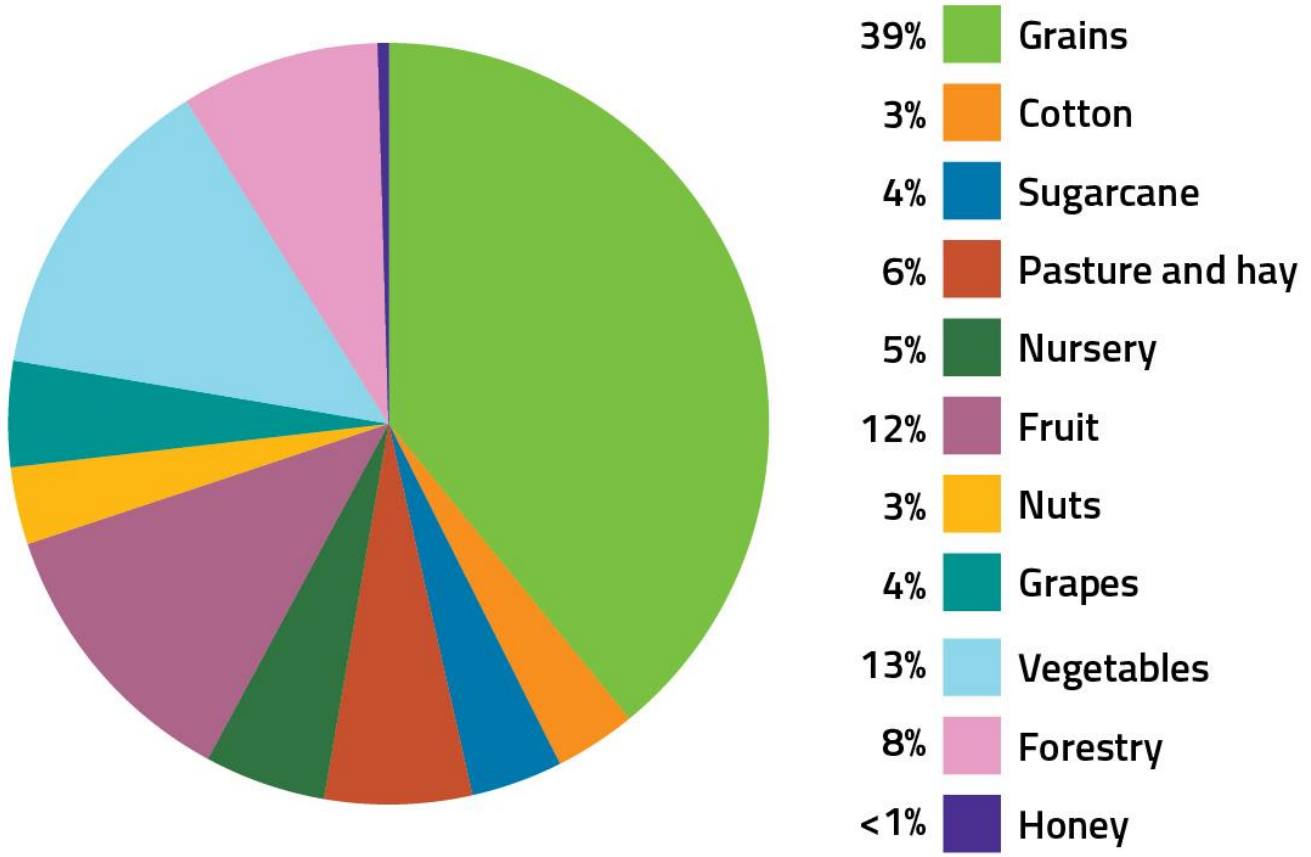
Solving a general problem

- Plant industries worth approx. $30b
- Reduced capacity in diagnostics in Australia
- Review conducted on Australia's diagnostic capacity
- Identified areas of improvement needed
- If not addressed, could become a significant issue in future



Contribution of plant production industries to total plant gross value of production in 2017-18 (Source: Plant Health Australia)

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Solution: Commonwealth-funded project

- Investment by Department of Agriculture, Water and the Environment's (DAWE) Rural Research and Development for Profit Program funded project - Boosting Diagnostic Capacity for Plant Production Industries

- $4.6 million from DAWE, $3 million from RDCs, and $7 million in-kind.

- 2019 - 2023

- **Objective:** Create maximum value to industry through better partnerships in diagnostic decision-making for biosecurity response efforts.

- Focus areas:
  - Diagnostic capacity building
  - Enhanced diagnostic tools
  - In-field detection and diagnostic blitzes

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GRAINS RESEARCH & DEVELOPMENT CORPORATION

AgriFutures Australia
CRDC COTTON RESEARCH AND DEVELOPMENT CORPORATION
FWPA Forest & Wood Products Australia
Hort Innovation
sra Sugar Research Australia
Wine Australia

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Complex grouping of R&D projects

- Diagnostic capacity building
- Enhanced diagnostic tools
- In-field detection and diagnostic blitzes

BOOSTING DIAGNOSTIC CAPACITY FOR PLANT PRODUCTION INDUSTRIES

PROGRAM MAP

(a Rural R&D for Profit program funded project)

Objective 5.1 – Building industry skills and capability (**industry capability**)

This will be achieved by lifting capability through:-

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Industry Network Training
Tasmanian NPPPs+HPPs - TAS DPIPWE (Jamie Davies)
ASSCT Presentation plus - SRA (Kevin Powell)
NT Farmers Federation - NT DPIR (Maxine Piggott)
(Act 5.1.a)

Workshops & ID Resources
In-field technology -AGVIC (Fiona Constable)
iSPY – SARDI (Danièle Giblot-Ducray)
HPPP IDs - CESAR (Jess Lye)
Tasmanian HPPPs - TAS DPIPWE (Jamie Davies)
(Act 5.1.b)

Evaluate Diagnostic Testing Programs
QDAF (Paul Campbell)
AGVIC (Fiona Constable)
NT DPIR (Maxine Piggott)
PFR NZ (Simon Bulman)
TAS DPIPWE (Jamie Davies)
SARDI (Danièle Giblot-Ducray)
NSW DPI (Toni Chapman)
(Act 5.1.d)

Assay Development
Aphid/Mealy bug LAMP protocols - WAAA (Monica Kehoe)
Begomovirus field + Polerovirus rapid protocols - QDAF (Paul Campbell)
Cyst Nematode genome sequenced + Grapevine high throughput + Fusarium Oxysporum LAMP + Xanthomonas Fragariae high throughput + LAMP protocols - AGVIC (Fiona Constable)
Fusarium Mangiferae LAMP protocol - NT DPIR (Maxine Piggott)
Xanthomonas minION protocol - PFR NZ (Simon Bulman)
Yellow Canopy Syndrome spectral signature protocol -SRA (Kevin Powell)
Cyst Nematode TaqMan MGB protocol - SARDI (Danièle Giblot-Ducray)
(Act 5.1.c)

Objective 5.2 – Increasing diagnostic options for rapid detection (**rapid detection**)

This will be achieved by enhanced tools through:-

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Early Detection Tools
Generic virus+rapid vector ID lab protocols + amplicon sequencing – WAAA (Monica Kehoe)
SWD trap design + endemic cyst nematodes LAMP test - AGVIC (Fiona Constable)
HPPP eDNA+genetic variant protocol (stop/go) - CESAR (Jess Lye)
Xanthomonas MinION protocol – PFR NZ (Simon Bulman)
Xanthomonas citri cg/wgMLST or equivalent – NSW DPI (Toni Chapman)
Xanthomonas exotic bacteria assay + lab sample SOPs for NFBSP – QDAF (Paul Campbell)
(Act 5.2.a)

NDPs Developed/Finalised
Tropilaelaos Mite – TAS DPIPWE (JamieDavies)
Cereal+Potato cyst nematodes & Grapevine Red Blotch & Xanthomonas Fragariae & SWD - AGVIC (Fiona Constable)
Xanthomonas citri subsp Malvacearum – NSW DPI (Toni Chapman) & PFR NZ (Simon Bulman)
Cotton Leaf Roll Dwarf & Begomovirus – cotton & Xanthomonas Axonpopodis pu allii & Cotton Leaf Curl – QDAF (Paul Campbell)
Cryptotermes (drywood termite) – NT DPIR (Maxine Piggott)
Bursaphelenchus (pine-wood & red ring nematodes) & cyst nematodes – CSIRO (Mike Hodda)
Exotic cyst nematodes -SARDI (Danièle Giblot-Ducray)
(Act 5.2.d)

Reference Collections
National Insect (Nematode) Collection – CSIRO (Mike Hodda)
National Collection of Fungi -AGVIC (Fiona Constable)
WINC + Emu database – SARDI (Danièle Giblot-Ducray)
Tasmanian Collection Holdings- TAS DPIPWE (Jamie Davies)
(Act 5.2.c)

Geographical Origin Protocols
Cross sectoral HPPPs - Lincoln NZ (Karen Armstrong)
(Act 5.2.e)

SPHD Adoption/Endorsement of NDPs
Tropilaelaos Mite – TAS DPIPWE (JamieDavies)
Cereal+Potato cyst nematodes & Grapevine Red Blotch & Xanthomonas Fragariae & SWD - AGVIC (Fiona Constable)
Xanthomonas citri subsp Malvacearum – NSW DPI (Toni Chapman) & PFR NZ (Simon Bulman)
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Cryptotermes (drywood termite) – NT DPIR (Maxine Piggott)
Bursaphelenchus (pine-wood & red ring nematodes) & exotic cyst nematodes – CSIRO (Mike Hodda)
Exotic cyst nematodes -SARDI (Danièle Giblot-Ducray)
Apids/Mealy Bug – WAAA (Monica Kehoe)
(Act 5.2.f)

Objective 5.2 – Increasing diagnostic options for rapid detection (**rapid detection**)

This will be achieved by enhanced tools through:-

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Train against NDPs
HPPP workshops – SARDI (Danièle Giblot-Ducray)
Tasmanian HPPP presentations & factsheets - TAS DPIPWE (Jamie Davies)
(Act 5.3.a)

Incursion Scenario
TBC 3-5 day workshop – PHA (Natalie O'Donnell)
(Act 5.3.b)

Blitzes
Surveillance + response – NT DPIR (Maxine Piggott)
Surveys – QDAF (Paul Campbell)
Bioblitzes & sample collection kits – TAS DPIPWE (Jamie Davies)
AUSPestCheck data entered – SARDI (Danièle Giblot-Ducray
(Act 5.3.c)

Proficiency Testing
Ring test assays - QDAF (Paul Campbell) + NSW DPI (Toni Chapman) + AGVIC (Fiona Constable) + PFR NZ (Simon Bulman)
3-4 national labs – TAS DPIPWE (Jamie Davies)
Sequencing dry lab – NSW DPI (Toni Chapman)
(Act 5.3.c)

Case study: Using *Xanthomonas citri subsp. Malvacearum* as a model organism for increasing bacterial diagnostic capacity

NSW GOVERNMENT | Department of Primary Industries

NSW DPI:

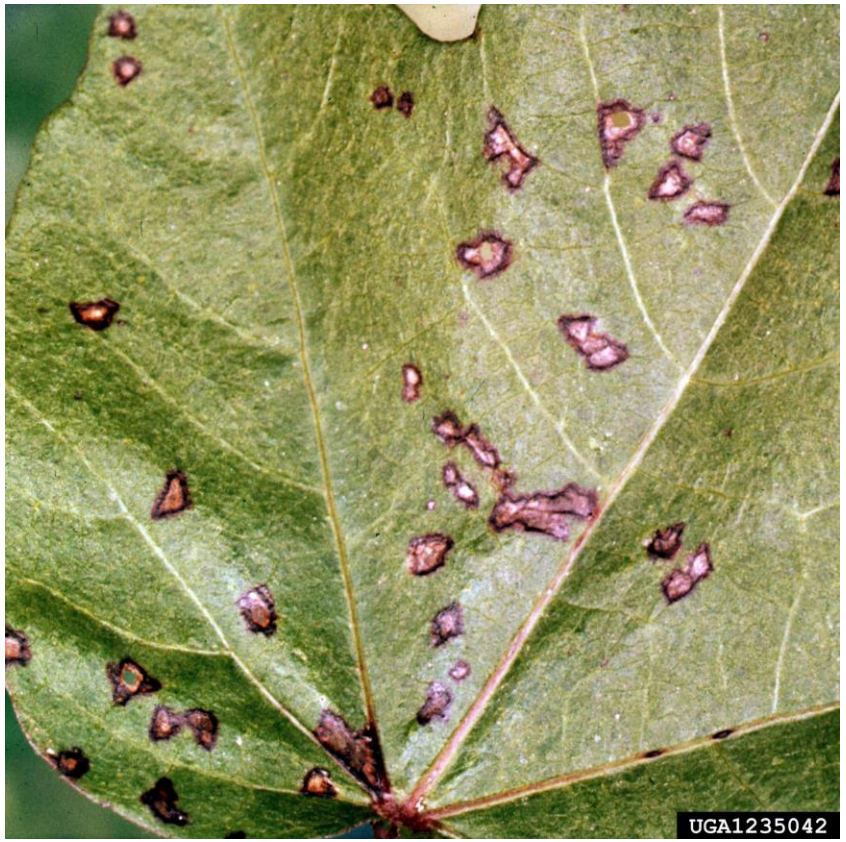
- Using *Xanthomonas* as a model organism for the development of new techniques for identification
- Determine current diversity of *Xanthomonas* in Australia
- Human capabilities through employment of PhD student

Plant & Food RESEARCH
RANGAHAU AHUMARA KAI

Plant and Food Research NZ:

- Develop diagnostic protocols for *Xanthomonas*

Cross collaboration is key!



Bacterial blight of cotton
Source: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

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Case study: Nematode diagnostics

CSIRO:

- Developing human capabilities (succession planning)
- Developing collections of local and exotic nematodes
- Updating national diagnostic protocols and producing information resources

SARDI:

- High throughput diagnostics for exotic cyst nematodes including development of molecular assays for two species
- Tests are efficient and effective

Agriculture Victoria:

- Build capability in cyst nematode taxonomy (*Heterodera*) - PhD student
- Utilise suitable genomics approaches to identify suitable molecular markers for species identification
- Develop diagnostic tests to detect key cyst nematodes in soil

How does this fit within our community?

- BEC connects extension professionals.
- Significant investment into diagnostics through this project.
- Sharing diagnostics with industry is critical.
- Written communications, field days, pest and disease management workshops, webinars – endless opportunities.

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Acknowledgements

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Project lead

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RDCs

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FWPA
Forest & Wood Products Australia

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Wine Australia

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LINCOLN UNIVERSITY
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NORTHERN TERRITORY GOVERNMENT

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Plant Health AUSTRALIA

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SOUTH AUSTRALIA

Government of South Australia
Primary Industries and Regions SA

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sra
Sugar Research Australia

Tasmanian Government

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