



Sustainable
Crop Protection
ARC HUB

LEGACY REPORT

2020-2025



Director

Professor Neena Mitter
FTSE FNAAS GAICD

Deputy Director

Dr Donald Gardiner





EXECUTIVE SUMMARY

The ARC Research Hub for Sustainable Crop Protection was established to tackle one of agriculture’s most pressing challenges—the need for safe, effective, and environmentally sustainable alternatives to chemical pesticides.

Supported by the Australian Research Council (ARC) Industrial Transformation Research Program, the Hub brought together leading scientists, industry partners, and government stakeholders in a multi-disciplinary collaboration spanning five years.

IMPACT AT A **GLANCE**

OUR IMPACT



65+

Publications



\$17M

Total funding



30+

Media features



54

Hub members



\$13M

Grant success



14

Projects



18

Hub partners



20+

Awards



90+

Conference presentations

OUR APPROACH

The Hub's research journey was complex, innovative, and collaborative.

From early discovery phases and case studies to regulatory and industry engagement, the program demonstrated how long-term, government-supported science can lay the groundwork for transformative change.

Our mission was to develop RNA-based fungicides as an innovative alternative to existing chemical fungicides. Central to this mission was the use of double-stranded RNA (dsRNA) designed to silence specific genes in fungal pathogens. This approach enables precise, non-toxic crop protection without genetic modification or chemical residues. Combined with this are developments in formulation; specifically, the use of clay particles as carriers of dsRNA (BioClay™—dsRNA loaded on clay particles).

The Hub has positioned Australia to be in a strong, world-leading position in RNA-based biopesticide development, with an understanding of the regulatory framework, social licence considerations, mechanistic insights and delivery needed to navigate the path to market. It has also fostered a collaborative, multidisciplinary research model and a powerful network of people and organisations. Together, this capability gives Australia the essential building blocks to respond to existing and emerging pest and disease challenges and to contribute meaningfully to global food security through future sustainable crop protection.



WHY THIS HUB WAS NEEDED

THE CHALLENGE FACING AGRICULTURE

Pesticide use underpins crop productivity and global food security.

However, growers face increasing challenges from consumer demand for cleaner produce, phasing out of older toxic chemical pesticides, and the rapid emergence of resistant organisms.

Developing and registering new chemicals are increasingly costly, and the number of products ready to emerge from these pipelines are limited. Together these challenges threaten crop yields and food security. Growers and chemical companies therefore face a shrinking arsenal, while consumer demand for cleaner, safer produce shows no sign of abating. The result is a widening gap between agricultural needs and available solutions. Clearly new, greener solutions are needed.

The ARC Research Hub for Sustainable Crop Protection was established to address this complex and critical challenge. Through a national program of coordinated research, the development of RNA-based biopesticides focussing on major

fungal diseases of horticultural and broad acre crops as a non-GM, non-toxic, specific, ecologically safe and environmentally sustainable solution was enabled.

The ARC Hub for Sustainable Crop Protection built on knowledge amassed through a program of smaller projects. The Hub's organisational approach recognised addressing this complex biotechnology challenge required a transformational multidisciplinary and collaborative framework. It identified and brought together top experts from multiple fields to address the development of this platform and the socio-political issues under the guidance of industry experts to enable market release when ready.

Top experts in fungal pathology, molecular biology, nanotechnology, chemistry, policy, social science, and agrochemical manufacture were engaged from the beginning to tackle this multifaceted problem.

This unique research environment enabled:

- ✓ Integration of trusted leading industry partners to provide focus on end-goals while directly contributing to their attainment through consultation and hands on research.
- ✓ The formation of teams from diverse expertise and perspectives from academic organisations and industry working together to address a significant problem.
- ✓ Capability building relevant to agricultural industry.
- ✓ Risk sharing for the development of innovative new solutions to significant agricultural problems.
- ✓ Accelerated knowledge advancement and a pathway for application.

OUR JOURNEY

2011

BioClay™ concept conceived.



2012

Gates Foundation award boosts BioClay™ development.



2014

Patents secured; Queensland Government grant; Nufarm joins.



2015

Glasshouse trials show protection.



2017

BioClay™ gains international momentum; Nature Plants article sparks global interest; HIA grant awarded.



2019

Partnerships deepen and development pathways strengthen; ARC Industrial Transformation Research Hub funding approved.



2020

ARC Research Hub launched to drive sustainable crop protection.



2025

Hub closes, leaving a legacy of insight, collaboration and progress.



SCIENTIFIC EXCELLENCE AND KNOWLEDGE

The ARC Research Hub for Sustainable Crop Protection significantly advanced fundamental and applied knowledge across multiple critical aspects underpinning the development of RNAi-based technologies for crop protection. These advances provide an essential foundation for future product development and deployment.

KEY ACHIEVEMENTS



Biological and technical foundations

- Case studies demonstrating RNA-based fungicides can provide targeted protection.
- Understanding dsRNA movement into and within plants.
- Uncovering considerable diversity between organisms with respect to their susceptibility to dsRNA.
- Significant advancement in design of RNA molecules to eliminate potential or perceived off-target effects.



Delivery, regulation and adoption

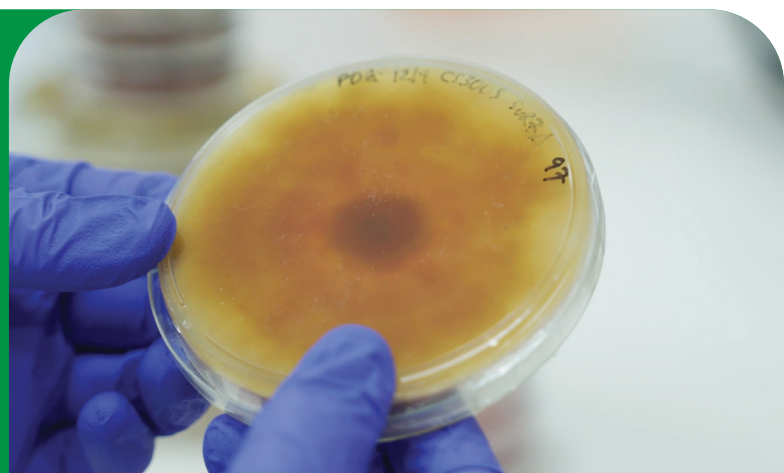
- Fundamental insights into RNA-based crop protection and BioClay™ delivery, paving the way for future products.
- Increased understanding of regulatory landscape and need for global cohesion.
- Understanding the current social landscape to facilitate future public acceptance and adoption of RNAi technology.



Outputs, capability and reach

- Novel intellectual property and patent.
- Preparing the workforce of tomorrow through training of early and mid-career researchers and PhD students.
- **Breakthrough publications** in leading journals on multiple aspects of RNA-based sustainable crop protection attracting global interest and collaborations.

These achievements can now be translated to protecting crops from a broader range of pests and pathogens. Through this program, the Hub strengthened the dsRNA design pipeline creating capability that can be applied across future biopesticide development.





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A real benefit of this type of program is that it's really industry focused, starting with the problems that industry face. For the cotton industry, it's about a key disease issue and elevating the science to address those issues in an impactful way.

Susan Maas, Innovation Broker | Cotton Research Development Corporation

PARTNERSHIPS AND NETWORKS

CROSS-SECTOR COLLABORATION AT NATIONAL SCALE

This program brought together a powerful combination of leaders and stakeholders across industry, research development corporations, government, and universities.

Our close partnership with Nufarm combined industry relevant expertise across formulation science and regulatory development with academic experts to create a roadmap for RNAi biopesticide production.

This close partnership also facilitated integration of industry best standards and practices for conducting and analysing trials with expertise from Hub partners to perform these trials.

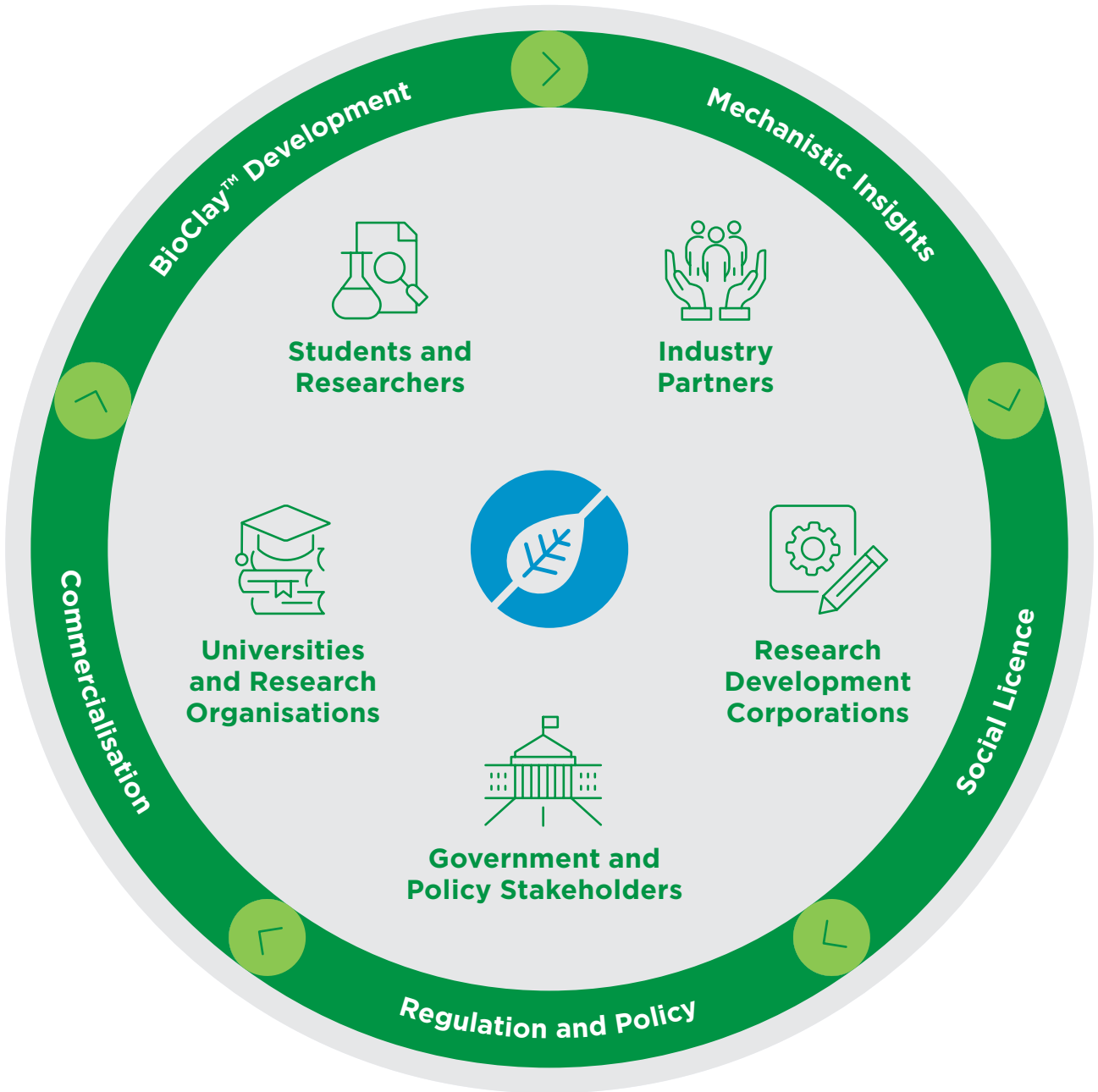
Regular cross-sector connections and discussions with partners from the Research Development Corporations (RDCs) representing the major agricultural crops (Grains Research Development Corporation, Hort Innovation, Cotton Research Development Corporation, Wine Australia) both individually and in larger groups, ensured the project scope and focus was targeted to grower requirements. Regular engagement helped align research priorities with real-world expectations.



Support through the Australian Research Council means what we collectively bring into a collaboration gets amplified. It also means we've got common goals all pointing to the same outcome, whether it's an industry that wants to remain sustainable and profitable, a research institution that wants to develop research capacity, new knowledge, and provide the impact of the work that they're doing, or it's the Australian Government demonstrating how our research is driving the Australian economy. It's a collaboration where different groups with different needs, but a common goal can come together.

Ben Callaghan, R&D Manager | Horticulture Innovation Australia Ltd

OUR MODEL



CAPACITY TO IMPACT

BUILDING AUSTRALIA'S FUTURE RESEARCH CAPABILITY

Through its multi-institutional model, the Hub has strengthened Australia's research capability and capacity.

The Hub supported the development of early career researchers, PhD candidates, and technical specialists—cultivating a highly skilled workforce equipped to tackle future agricultural challenges. The Hub accelerated cross-disciplinary research and created lasting capability across participating institutions.

Early career researchers were equipped with multidisciplinary skills spanning molecular biology, formulation science, field trial setup and analysis, stakeholder engagement, development of regulatory packages for new biopesticide technologies, and assessment of grower and end-user acceptance to support market readiness.

This cohort of researchers are now employed across universities, government agencies, and industry—amplifying the Hub's impact through distributed expertise and applying it to new challenges.

The program created strong, lasting connections between universities, industry, and the public sector. It also established new cross-sector pathways for future collaboration, field trial networks, and knowledge-sharing. These partnerships have laid a foundation for long-term innovation in sustainable crop protection.



54

Hub Members Total



12

Chief Investigators



17

Partner Investigators



15

Postdoctoral Researchers and Research Assistants



10

Higher Degree by Research Students



“

By being a part of this ARC Hub, it gave me the chance to collaborate with researchers across the country; people working in government, as well as industry partners. It gave me a broader perspective of how this technology can be taken forward.

Pratyush Ravichander, PhD candidate | The University of Queensland

REFLECTIONS AND THE PATH FORWARD

Transformational agricultural technologies involve inherent uncertainty compounded by long development cycles, ambiguous regulatory pathways, seasonal testing and market adoption time.

The ARC Industrial Transformation Research model proved essential—with no single institution possessing the multidisciplinary expertise and resources required for RNAi biopesticide development.

Government co-investment enabled sustained collaboration across institutional boundaries, creating synergies that exceeded the sum of individual contributions. This approach demonstrated how strategic public investment can drive innovation that private investment cannot support independently.

LOOKING AHEAD—DIRECTOR'S VISION

RNA-based biopesticides provide substantial possibilities for sustainable and climate smart biological solutions for crop and animal health, biosecurity and boosting trade, exports, and global competitiveness. The vision forward is an agriculture RNA innovation and manufacturing precinct along with continued knowledge advancement to apply RNA-technology to crop protection.

Key next phase priorities



Discovery and innovation: from design to fundamental insights to novel delivery platforms.



Infrastructure: establishing facilities to scale production and adoption of RNA solutions.



Validation and scaling: supporting regulatory approval and scaled up trials to bring solutions to market.



Capability building: supporting sector development through training and knowledge-sharing.



Manufacturing: sovereign capability in dsRNA manufacturing and formulation ingredients to meet industry needs.



Thought leadership: offering evidence-based frameworks to inform policy and guide best practices.

Transformational agricultural technologies require patient capital, collaborative research, and strategic government investment. Such investment builds capability, creates knowledge, and establishes foundations for future innovation that benefits farmers, consumers, and the environment.



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The true measure of research is not when it ends, but how it continues to shape the future. Guided by RNA, grounded in collaboration, and driven by impact—this is a legacy that continues to grow, and one I am deeply committed to carrying forward.

Professor Neena Mitter, Director | ARC Research Hub for Sustainable Crop Protection

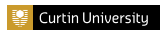


Sustainable Crop Protection ARC HUB

In partnership with



Supported by



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Botrytis in Grapes

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Botrytis in Pulses

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Sclerotinia in Canola

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Verticillium in Cotton

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Fusarium in Cereals

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