AgriFutures Honey Bee & Pollination Program

2020 Research, Development & Extension Snapshot
Forewords 06

AgriFutures Australia 08

Arena 3 10
Growing Profitability and AgriFutures Honey Bee & Pollination Program

About your levy 11

Advisory Panel 12

Advisory Panel farewells two long serving members 14

Research projects 16

Recently completed research projects 16

Current research projects 16

Objective 1 18
Reduce the incidence and impact of pests and diseases on the beekeeping and pollination services industries.

Probiotic development for bees: analyzing gut bacteria in healthy bees 20

Improving the health of hives used in pollination 22

Investigating factors that influence chalkbrood outbreaks in Australia 24

Objective 2 26
Increase productivity and profitability of beekeepers

Active Australian leptospermum honey: New sources and their bioactivity 28

Selection and development of Australian hygienic honey bee lines 30

Review of honey bee industry levies 32

Market and production potential for Australian produced propolis 34

Review of chemistry associated with honey testing 36

Strategic industry workshop improving floral access for beekeepers 38

Progressing implementation of genetic selection in Australian honey bee 40

Development of honey bee products from a biodiversity hotspot 42

Increasing the value of Australian honey as a health food 44

Objective 3 48
Understanding the role of flora in honey bee management

Objective 4 50
Understand the role of pollination in delivering more productive

Objective 5 52
Promote extension, communication and capacity building

An economic evaluation of AgriFutures Investment in the AgriFutures Honey Bee & Pollination Program (2015-2019) 54

Women in Beekeeping Scholarship - 2018 Queen Rearing Workshop 56

Development of the Honey Bee and Pollination 2019-2024 Strategic Plan 57

News snapshot 58
Honey bee management information for drought and fire affected areas 58

News highlights 59
Go West! AgriFutures Honey Bee & Pollination Advisory Panel heads to Western Australia 59

Making a buzz about bees: Promoting the importance of bees 60

Australian honey abuzz with high-value antibacterial activity 61

Health Bees: A gut feeling probiotics could be the secret to improving the health of the honey 62

Propolis production: A potential boon for the Australian beekeeping industry 64

Arena 1 66
People and Leadership

AgriFutures Rural Women’s Award 67

Claire Moore - 2019 Victorian Winner and National Runner Up 68

Natasha Roebig - 2019 Queensland Rural Women’s Award Winner 70

Arena 2 72
National Challenges and Opportunities

Rural R & D for Profit 73

Securing Pollination 74
Forewords

Welcome to the Annual AgriFutures Honey Bee & Pollination Program RD&E Snapshot

including the selection and development of Australian hygienic honey bee lines as well as the propolis, honey chemistry and levy reviews. Many of which are detailed in this report.

A major focus of the AgriFutures Honey Bee & Pollination Program over the past 12 months has been the evaluation of the Strategic Plan and identifying research objectives and priorities for the next Plan. The AgriFutures Honey Bee & Pollination Strategic Plan (2020-25) will be finalised in late 2020. It will guide the Program and Advisory Panel as we strive to overcome the current challenges of drought and loss of floral habitat.

I would like to thank the Advisory Panel Members for their significant contributions to this process and the Advisor Panel. I would like to pay special mention to retiring members Professor Saul Cunningham (Australian National University) James Kershaw (NSW Beekeeper) for their decade and seven years, respectively of service.

We will continue to work very closely with the Australian Honey Bee Industry Council and state associations to understand the needs of the industry to help drive our RD&E investment recommendations, as well as to develop resources and raise awareness among professional beekeepers, recreational beekeepers and the public, about what they can do to help protect our pollinators.

Regrettably due to the COVID-19 health pandemic we are unable to present the AgriFutures Honey Bee & Pollination Program 2020 RD&E Snapshot to you at the annual conferences however we hope that you find this report as valuable as the previous report.

Dr Doug Somerville
Chair, Advisory Panel
AgriFutures Honey Bee & Pollination Program

2019 and 2020 (to date) have not been without its challenges for the industry and the research, development and extension (RD&E) to support the sustainability and profitability of the industry. The ongoing drought and fires across major beekeeping regions of Australia have destroyed many of our established areas of floral resources, both heathland and forest. The most critical issue for us is the loss of floral resources which may take many decades to recover and now more than ever, research RD&E will help us on our road to recovery.

The resilience of Australia’s beekeepers is reflected in our dynamic RD&E program which aims to safeguard the health of Australia’s bees. While 2018-19 did not see the program run an open call for research due to concerns around dry conditions and levy funding, the program did invest in research around a review into honey chemistry, market and production potential of Australian propolis, and a review into honey bee industry levies. The period also saw the finalisation of a number of projects

Dr Doug Somerville (Chair)
Chair, Advisory Panel
AgriFutures Honey Bee & Pollination Program

2019 and 2020 (so far) have been significant for the AgriFutures Honey Bee & Pollination Program and the industry more broadly.

Annelies McGaw
Manager, Research
AgriFutures Honey Bee & Pollination Program

Notwithstanding the challenges of the drought and fires 2019-20 was a successful year for the AgriFutures Honey Bee & Pollination Program and its research, development and extension (RD&E) investments.

As Doug has outlined, the AgriFutures Honey Bee & Pollination Program Five Year Research, Development & Extension Plan (2014-15 to 2018-19) ended in 2019 and the next Strategic Plan is nearing completion and will be launched later in 2020.

To conclude the previous Five Year RD&E Plan and to inform the development of the new Strategic Plan the Program commissioned an economic evaluation of the AgriFutures Honey Bee & Pollination Program. Evaluating impact is an important step in formulating strategy and so it’s imperative that we look back on the work done to understand the true impact of our current investments in RD&E. The study assessed the cost-to-benefit ratio of 17 research, development and extension projects across the program and found that for every $1 invested by the industry, there was an estimated $6 of value created for levy payers. It’s rewarding to see the returns our levy payers receive from our investment in research. The report also highlights the flow on benefits of this research to Australia’s pollination dependent industries across horticulture and agriculture.

There has also been continued innovation across the industry and recognition of individuals contributions to the industry and agricultural sector. The industry was well represented in AgriFutures Rural Women’s Award (read more about National Runner Up Claire Moore and QLD Winner Natasha Roebig pages 68 - 71), at evokeAG and in AgriFutures Australia’s RD&E investments outside of Arena 3 and the AgriFutures Honey Bee & Pollination Program.

I’m excited to present this year’s RD&E Snapshot. The development of this report and project is supported by funding from the Australian Government Department of Agriculture, Water and the Environment through a grant to promote the importance of bees. In the 2019 report we provided an update on the past five years. This year we’ve focused on 2019-20, and have included highlights for the industry across the AgriFutures Australia portfolio.

I would also like to take this opportunity to thank the Advisory Panel and reiterate our gratitude to Saul and James. Thank you both for your contribution to the Advisory Panel and industry more broadly. I would also like to welcome Dr Rob Manning and Neil Singley to the Advisory Panel.

I look forward to continuing to work with the Advisory Panel, industry and our research providers to ensure the Program supports a productive, sustainable and more profitable industry.


Annelies McGaw
Manager, Research
AgriFutures Honey Bee & Pollination Program
AgriFutures Australia

AgriFutures Australia’s vision is to grow the long-term prosperity of Australian rural industries.

To achieve this AgriFutures Australia has established four distinct arenas representing the organisation’s broad commitments to deliver the priorities of the Australian Government, its stakeholders and its ultimate goal to create thriving rural industries and vibrant regional communities.

1. People and Leadership

Initiatives that attract capable people into careers in agriculture, build the capability of future rural leaders, and support change makers and thought leaders.

2. Growing Profitability

Research and development for established industries that do not have their own Research & Development Corporation (RDC), including the commercial honey bee keeping industry as well as rice, chicken meat, export fodder, thoroughbred horses, ginger, tea tree oil, pasture seeds, and smaller industries including goat fibre, buffalos, kangaroos, deer and ratites.

3. National Challenges and Opportunities

Research and analysis to understand and address important issues on the horizon for the whole of Australian agriculture.

4. Emerging Industries

Research, development and extension to accelerate the establishment and expansion of new rural industries.

Our vision

To grow the long term prosperity of Australian rural industries

Goal

People and Leadership

To support the people driving the future prosperity of Australian rural industries and regional communities by providing them with learning opportunities and experiences.

Growing Profitability

To identify and nurture research and innovation opportunities that are synergistic across rural sectors.

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitability

Growing Profitabil
Goal: To enhance the profitability and sustainability of our levied rural industries.

The Honey Bee & Pollination Program's Strategic Plan guides investment and is focused on five objectives to deliver research outcomes to benefit the industry:

- **Objective 1:** Reduce the incidence and impact of pests and diseases on the beekeeping and pollination services industries.
- **Objective 2:** Increase productivity and profitability of beekeepers.
- **Objective 3:** Understanding the role of flora in Honey Bee management.
- **Objective 4:** Understand the role of pollination in delivering more productive systems.
- **Objective 5:** Promote extension, communication and capacity building.

Each research project funded by the AgriFutures Honey Bee & Pollination Program must address one or more of the objectives defined in the Strategic Plan. It is the Advisory Panel's responsibility to ensure that these objectives are considered and addressed when making investment recommendations. In 2019, the program underwent an economic review to assist in the development of a new Strategic Plan (2020–25). The new Strategic Plan will launch in 2020–21 and will focus on areas such as bee technology, product integrity and quality, pollination, disease and nutrition, resources and extension activities to disseminate research outputs to commercial beekeepers. For more information about the Program, publications and to sign up for regular updates visit agrifutures.com.au/honey-bee.

**Figure 1: Levy Explanation**

- **Total 4.6c/kg sold**
- **Cents collected per kilogram sold**
  - 4.6c/kg sold
  - 0.1 National Residue Testing
  - 0.2 Emergency Plant Pest Response
  - 0.2 Plant Health Australia

**Figure 2: Investment by Program objectives**

- **FY 2017-18**
  - RD&E Investment $474,029
- **FY 2018-19**
  - RD&E Investment $763,902
- **FY 2019-20**
  - RD&E Investment $482,594

**About your levy**

The AgriFutures Honey Bee & Pollination Program manages the investment of the R&D component of the honey levy. The honey levy was first introduced in 1982 and honey that is produced in Australia and sold, exported or used in the production of other goods attracts a levy and export charge.

The levy is charged at 4.6 cents/kilogram and 1.5 cents/kilogram is devoted RD&E (Figure 1). AgriFutures Australia receives the research and development (RD&E) levy allocation to invest in line with the industry objectives of the respective program’s Strategic Plan. AgriFutures Australia also receives Commonwealth matching funding based on 0.5% of the aggregate GVP of all AgriFutures Australia’s levied industries (Arena 3) or half of AgriFutures Australia’s eligible expenditure – whichever is the lesser. This includes expenditure in non-levied industries Arenas 1, 2 and 4 irrespective of their funding source.

AgriFutures Australia’s Board allocates the Commonwealth matching funding to each levied industry program. The respective programs will receive $0.01 per dollar of eligible expenditure (subject to availability of Commonwealth matching funding).

The total program budget comprises of the R&D levy allocation, Commonwealth matching funding (allocated by the AgriFutures Australia Board) and third party contributions (where appropriate).

**Regional communities and the broader Australian economy depend on profitable farms and industries. We know that there is a clear link between economic prosperity and our capacity for innovation and uptake of new technology. Rural industries that are well placed to adopt new ideas and use technology to create productivity benefits establish their competitive advantage and are structured for sustainable growth.**

That’s why AgriFutures Australia invests in research, innovation and learning initiatives that enhance the profitability and sustainability of the agriculture sector. AgriFutures Australia supports rural industries with an R&D levy who do not have an industry specific Research and Development Corporation.

The overarching goal of AgriFutures Australia's Growing Profitability arena (Arena 3) is to enhance the profitability and sustainability of its 13 levied rural industries. The AgriFutures Honey Bee & Pollination Program is no exception. The Program aims to support research, development and extension (RD&E) that will ensure a productive, sustainable and more profitable Australian beekeeping industry and secure the pollination of Australia’s horticultural and agricultural crops. The industry’s investment in RD&E will be critical in helping the agricultural sector hit its shared goal of $100 billion in farm gate value by 2030.
Advisory Panel

The AgriFutures Honey Bee & Pollination Program Advisory Panel consists of industry experts who meet regularly to determine research, development and extension priorities and make program investment recommendations. Advisory Panel members are appointed for three-year terms.

Dr Doug Somerville
(Chair)
NSW Department of Primary Industries

Danny Le Feuvre
(Deputy Chair)
Australian Bee Services

Tiffane Bates
Cooperative Research Centre (CRC) for Honey Bee Products

Dr Diana Leemann
Queensland Department of Agriculture and Fisheries

Ashley Zamek
Hort Innovation

Annelies McGaw
(Manager, Research)
AgriFutures Australia

Sam Malfroy
Wheen Bee Foundation

James Kershaw
NSW Beekeeper

Diana is a mycologist and principal scientist for bee health and entomopollination management with Queensland Department of Agriculture and Fisheries. Diana joined AgriFutures Australia in November 2018 as Manager Research, Development and Extension. Diana has a Bachelor of Science with Honours from the University of Melbourne, a Master of Science from Monash University and a PhD from the University of Queensland. Diana has extensive experience in research, project management and extension in the agricultural sector. Diana is currently involved in research grant writing, project planning and delivery and in-farm extension, particularly around crop and pasture pollination and the health of managed honey bees.

Danny joined AgriFutures Australia in 2008 as a Technical Specialist in Pollination Management. Since that time, he has been involved in various projects and programs, including the Cooperative Research Centre for Pollination and the Prairies and Sequea program. Currently, he is the AgriFutures Business Development Manager, supporting the business development team to deliver and support the AgriFutures Honey Bee & Pollination Program. Danny has extensive experience working in the Australian honey bee industry and has a long track record of successful delivery of research projects and programs.

Annelies joined AgriFutures Australia in November 2018 as Manager Research, Development and Extension. Annelies held positions at the Australian Pesticides and Veterinary Authority in Natural Resources giving her a sound understanding of the operation and influence of natural resources. Annelies joined AgriFutures Australia, AgriFutures Australia, prior to this. Annelies has a Bachelor of Science (Honours) in Plant and Crop Science from Melbourne University and a Masters in Agribusiness Science from Melbourne University. Annelies is completing a Masters in Agribusiness Science from Melbourne University. Annelies is completing a Masters in Agribusiness Science from Melbourne University. Annelies is completing a Masters in Agribusiness Science from Melbourne University.

Tiffane is the founder and managing director of Australian Bee Services based in Ardrossan SA. Prior to this, Tiff was the Apiary Manager for the Centre for Integrative Bee Research (CIBER) and a commercial queen breeder / producer. Tiff’s industry experience spans better bees Western Australia (Pattress Breeding Program), AgriFutures Beekeepers’ Producers’ Committee and Bee Industry Council of WA (BICWA). Tiff has a Bachelor of Science (Hons) in Environmental Biology and a Churchill Fellowship. Tiff joined the AgriFutures Honey Bee & Pollination Advisory Panel in 2017.

Danny is the founder and managing director of Australian Bee Services based in Ardrossan SA. His previous experience includes irrigation consultancy, breeding (D.M. canola, broadacre agronomy, research, development and extension. Danny is an executive on the South Australian Apiarists Association, Chair of the Apiservices Alliance SA, SA state representative at AHBD and sits on several research project steering committees. He has a Bachelor of Applied Science from Melbourne University, and is completing a Masters in Agribusiness at the University of Adelaide. Danny was appointed to the AgriFutures Honey Bee & Pollination Advisory Panel in November 2017.

Dr Diana Leemann
Queensland Department of Agriculture and Fisheries

Ashley is the Research and Development Manager of the Pollination Fund, part of the Hort Futures strategic partnership initiative at Hort Innovation. Ashley works with the 35 industries Hort Innovation represents, to address the need to create a sustainable and resilient Australian horticultural sector through improved crop pollination services and pollinator options. Ashley was appointed to the AgriFutures Honey Bee & Pollination Advisory Panel in 2017.

James Kershaw
NSW Beekeeper

James is a fifth generation beekeeper from Southern NSW and is a partner in his family commercial beekeeping operation, Sterling Kershaw & Co. He currently runs 2500 honey production hives and 400 nuclei for queen rearing and has provided a pollination service for almonds since 2007. James has been an active industry member for the past 14 years and has been President of the Southern Tablelands Branch of the NSW Apiarists Association since 2012. James has been a member of AgriFutures Honey Bee & Pollination Advisory Panel since 2014. (Retired mid 2020)

Sam Malfroy
Wheen Bee Foundation

Sam is a commercial queen breeder / producer. Sam worked at Plant Health Australia (2011-2016) where he established and managed many national honey bee and pollination programs. For this work, Sam received the AHBSC Award of Excellence in 2016 for service to the honey bee industry. From 2016-2019 Sam worked at the Department of Agriculture and Water Resources in international trade and market access. Sam is currently employed by the NSW Government (Department of Primary Industries) where he works on regional infrastructure and programs. Sam has been a Director of the Wheen Bee Foundation since 2016, and joined the AgriFutures Honey Bee & Pollination Advisory Panel in 2017.

James is a fifth generation beekeeper from Southern NSW and is a partner in his family commercial beekeeping operation, Sterling Kershaw & Co. He currently runs 2500 honey production hives and 400 nuclei for queen rearing and has provided a pollination service for almonds since 2007. James has been an active industry member for the past 14 years and has been President of the Southern Tablelands Branch of the NSW Apiarists Association since 2012. James has been a member of AgriFutures Honey Bee & Pollination Advisory Panel since 2014. (Retired mid 2020)

Saul is a pollination researcher with more than 20 years experience. He has worked directly with beekeepers in his research on crop pollination, particularly his work in Australia on almond pollination, conducted over six flowering seasons. His research has also taken him around the world, learning about crop pollination and bee health in many countries. Saul has been a member of the AgriFutures Honey Bee & Pollination Advisory Panel since 2014.

(Saul is a pollination researcher with more than 20 years experience. He has worked directly with beekeepers in his research on crop pollination, particularly his work in Australia on almond pollination, conducted over six flowering seasons. His research has also taken him around the world, learning about crop pollination and bee health in many countries. Saul has been a member of the AgriFutures Honey Bee & Pollination Advisory Panel since 2014.)

Tiff is the Apiary Manager for the Centre for Integrative Bee Research (CIBER) and a commercial queen breeder / producer. Tiff’s industry experience spans better bees Western Australia (Pattress Breeding Program), AgriFutures Beekeepers’ Producers’ Committee and Bee Industry Council of WA (BICWA). Tiff has a Bachelor of Science (Hons) in Environmental Biology and a Churchill Fellowship. Tiff joined the AgriFutures Honey Bee & Pollination Advisory Panel in 2017.

Danny is the founder and managing director of Australian Bee Services based in Ardrossan SA. Prior to this, Tiff was the Apiary Manager for the Centre for Integrative Bee Research (CIBER) and a commercial queen breeder / producer. Tiff’s industry experience spans better bees Western Australia (Pattress Breeding Program), AgriFutures Beekeepers’ Producers’ Committee and Bee Industry Council of WA (BICWA). Tiff has a Bachelor of Science (Hons) in Environmental Biology and a Churchill Fellowship. Tiff joined the AgriFutures Honey Bee & Pollination Advisory Panel in 2017.

Dr Doug Somerville
(Chair)
NSW Department of Primary Industries

Danny Le Feuvre
(Deputy Chair)
Australian Bee Services

Tiffane Bates
Cooperative Research Centre (CRC) for Honey Bee Products

Dr Diana Leemann
Queensland Department of Agriculture and Fisheries

Ashley Zamek
Hort Innovation
Thank you for bee-ing so inspiring: AgriFutures Australia farewells long serving Advisory Panel members

AgriFutures Australia would like to thank Ecologist Professor Saul Cunningham and commercial beekeeper, James Kershaw for their contribution to the industry and their determination to see improved research outcomes for commercial beekeepers. Professor Cunningham and Mr Kershaw retired from their positions on the Honey Bee & Pollination Advisory Panel in June 2020 following a decade and seven years, respectively, of service.

Dr Doug Somerville, chair of the AgriFutures Australia Honey Bee & Pollination Advisory Panel, said both Professor Cunningham and James Kershaw brought their experience and knowledge to ensure research and development (R&D) investment aligned with the Program’s RD&E Plan and the industry’s priorities. “Saul has brought significant knowledge of native pollinators and pollination in general and scientific rigour to every discussion,” said Dr Somerville. “James extensive commercial bee keeping experience and his multi-generational approach has provided the Advisory Panel with a clear industry perspective.”

Professor Cunningham, who is the Director of the Fenner School of Environment & Society at the Australian National University, drew on his research expertise in making recommendations and he has enjoyed connecting with the diverse range of experts that have provided research for Agrifutures Australia over that time.

“This diversity has meant I’ve heard from university researchers to chemists as well as beekeepers which has given me an understanding of the challenges faced by beekeepers, which you don’t always read in a book,” said Professor Cunningham.

Fifth generation commercial beekeeper, James Kershaw described his role on the Advisory Panel as one of the best things he has ever done.

“Being on the Advisory Panel gave me some real insights into the broader aspects of the industry and I am most proud of the research projects we invested into small hive beetles and queen pheromones”, said Mr Kershaw.

Dr Somerville extended his gratitude for the contributions that both these men have given over a decade of honey bee and pollination research, development and extension.

Joining him in paying tribute, AgriFutures Australia Manager, Research Annelies McGaw said Professor Cunningham and Mr Kershaw had made significant contributions over a long period of time.

“I would like to thank Professor Cunningham and Mr Kershaw for their outstanding service,” said Ms McGaw.

Ms McGaw also welcomed two new members, research scientist, Dr Rob Manning and commercial apiarist, Neil Bingley to the Advisory Panel.

“We’re pleased to have Dr Manning and Mr Bingley join the panel. Dr Manning has a 27-year long career in honey bee research and highly regarded apiarist Neil Bingley.”

“I look forward to working with Dr Manning and Mr Bingley and introducing them both to the AgriFutures Australia family shortly,” said Ms McGaw.

To learn more about the Honey Bee Advisory Panel and the Program agrifutures.com.au/honey-bee
**Research projects**

**Objective 1**
Reduce the incidence and impact of pests and diseases on the beekeeping and pollination services industries.

**Objective 2**
Increase productivity and profitability of beekeepers.

**Objective 3**
Understanding the role of flora in honey bee management.

**Objective 4**
Understand the role of pollination in delivering more productive systems.

**Objective 5**
Promote extension, communication and capacity building.

### Recently completed research projects

<table>
<thead>
<tr>
<th>Project number</th>
<th>Project title</th>
<th>Start date</th>
<th>Finish date</th>
<th>Principal investigator</th>
<th>Research organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRJ-009004</td>
<td>Selection and development of Australian hygienic honey bee lines</td>
<td>30/09/2015</td>
<td>14/02/2019</td>
<td>Gerds, Jody</td>
<td>Bee Scientifics</td>
</tr>
<tr>
<td>PRJ-011643</td>
<td>Review of honey bee industry levies and fees</td>
<td>14/12/2018</td>
<td>10/04/2019</td>
<td>Clarke, Michael</td>
<td>AgEconPlus</td>
</tr>
<tr>
<td>PRJ-010777</td>
<td>Market and production potential for Australian produced propolis</td>
<td>09/07/2018</td>
<td>31/05/2019</td>
<td>Clarke, Michael</td>
<td>AgEconPlus</td>
</tr>
<tr>
<td>PRJ-011688</td>
<td>Review of chemistry associated with honey tasting</td>
<td>04/03/2019</td>
<td>07/06/2019</td>
<td>Ayton, Jamie</td>
<td>NSPI</td>
</tr>
<tr>
<td>PRJ-009186</td>
<td>Active Australian Leptospermum honey: New sources and their bioactivity</td>
<td>30/08/2014</td>
<td>28/10/2019</td>
<td>Harry, Elizabeth</td>
<td>University of Technology, Sydney</td>
</tr>
<tr>
<td>PRJ-011926</td>
<td>Strategic industry workshop: Improving floral access for beekeepers</td>
<td>06/05/2019</td>
<td>13/12/2019</td>
<td>Paradis, Sarah</td>
<td>Australian Honey Bee Industry Council</td>
</tr>
<tr>
<td>PRJ-011592</td>
<td>Women in beekeeping scholarship: 2018 queen rearing workshop</td>
<td>31/10/2018</td>
<td>17/12/2018</td>
<td>Hughes, Benedict</td>
<td>The Practical Beekeeper</td>
</tr>
<tr>
<td>PRJ-011361</td>
<td>Review of investment in the AgriFutures Honey Bee &amp; Pollination Program 2014–19</td>
<td>14/12/2018</td>
<td>10/04/2019</td>
<td>Clarke, Michael</td>
<td>AgEconPlus</td>
</tr>
<tr>
<td>PRJ-011400</td>
<td>Victorian Apiarists Association Annual Conference 2018</td>
<td>25/05/2018</td>
<td>01/05/2019</td>
<td>Williams, Kerin</td>
<td>Victorian Apiarists Association</td>
</tr>
<tr>
<td>PRJ-011859</td>
<td>New South Wales Apiarists Association Conference sponsorship 2019</td>
<td>29/03/2019</td>
<td>21/05/2019</td>
<td>Riggs, Ross</td>
<td>NSW Apiarists’ Association</td>
</tr>
<tr>
<td>PRJ-011850</td>
<td>2019 Queensland Beekeepers Association annual conference</td>
<td>19/03/2019</td>
<td>21/05/2019</td>
<td>Martin, Jo</td>
<td>Queensland Beekeepers Association</td>
</tr>
<tr>
<td>PRJ-011867</td>
<td>Bee Industry Council of Western Australia conference sponsorship 2019</td>
<td>27/03/2019</td>
<td>28/05/2019</td>
<td>Leyland, Leilani</td>
<td>Bee Industry Council of Western Australia</td>
</tr>
<tr>
<td>PRJ-011877</td>
<td>Tasmanian Beekeepers Association AGM sponsorship 2019</td>
<td>26/03/2019</td>
<td>28/06/2019</td>
<td>Ewington, Marine</td>
<td>Tasmanian Beekeepers Association</td>
</tr>
<tr>
<td>PRJ-011855</td>
<td>South Australian Apiarists Association AGM Sponsorship 2019</td>
<td>26/03/2019</td>
<td>18/06/2019</td>
<td>Pitt, Kyle</td>
<td>South Australian Apiarists Association</td>
</tr>
<tr>
<td>PRJ-011704</td>
<td>Facilitation of AgriFutures Honey Bee &amp; Pollination Strategic Plan Workshop</td>
<td>28/01/2019</td>
<td>31/05/2019</td>
<td>Cameron, John</td>
<td>Independent Consultants Australia Network</td>
</tr>
<tr>
<td>PRJ-011742</td>
<td>Development of the AgriFutures Honey Bee &amp; Pollination Strategic Plan</td>
<td>30/07/2017</td>
<td>1/06/2019</td>
<td>Spicer, Murray</td>
<td>Edward Murray Spicer</td>
</tr>
<tr>
<td>PRJ-012445</td>
<td>Bushfire recovery workshop</td>
<td>28/02/2020</td>
<td>19/05/2020</td>
<td>Clarke, Michael</td>
<td>AgEconPlus</td>
</tr>
<tr>
<td>PRJ-011385</td>
<td>Honey Bee &amp; Pollination Program Communications 2018–2020</td>
<td>27/07/2018</td>
<td>29/05/2020</td>
<td>Pina, Justine</td>
<td>Cox Iniall Communications</td>
</tr>
</tbody>
</table>

### Current research projects

#### Objective 1
Reduce the incidence and impact of pests and diseases on the beekeeping and pollination services industries.

<table>
<thead>
<tr>
<th>Project number</th>
<th>Project title</th>
<th>Start date</th>
<th>Finish date</th>
<th>Principal investigator</th>
<th>Research organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRU-010825</td>
<td>Probiotic development for bees: analysing gut bacteria in healthy bees</td>
<td>13/07/2018</td>
<td>15/08/2020</td>
<td>Nayudu, Murali</td>
<td>University Of Canberra</td>
</tr>
<tr>
<td>PRU-010818</td>
<td>Improving the health of hives used in pollination</td>
<td>23/07/2018</td>
<td>15/07/2020</td>
<td>Hogendorn, Katja</td>
<td>The University of Adelaide</td>
</tr>
<tr>
<td>PRU-010815</td>
<td>Investigating factors that influence chalkbrood outbreaks in Australia</td>
<td>06/07/2018</td>
<td>30/11/2020</td>
<td>Roberts, John</td>
<td>CSIRO Ecosystem Sciences</td>
</tr>
</tbody>
</table>

#### Objective 2
Increase productivity and profitability of beekeepers.

<table>
<thead>
<tr>
<th>Project number</th>
<th>Project title</th>
<th>Start date</th>
<th>Finish date</th>
<th>Principal investigator</th>
<th>Research organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRU-010226</td>
<td>Improving biosecurity resources and better understanding bee health in Australia</td>
<td>15/04/2016</td>
<td>30/07/2019</td>
<td>Turner, Rodney</td>
<td>Plant Health Australia Limited</td>
</tr>
<tr>
<td>PRU-010257</td>
<td>Progressing implementation of genetic selection in Australian honey bees</td>
<td>30/07/2016</td>
<td>09/10/2019</td>
<td>Banks, Robert</td>
<td>University of New England</td>
</tr>
<tr>
<td>PRU-010313</td>
<td>Development of honey bee products from a biodiversity hotspot</td>
<td>30/08/2016</td>
<td>15/05/2020</td>
<td>Hammer, Kate</td>
<td>University of Western Australia</td>
</tr>
<tr>
<td>PRU-010879</td>
<td>Increasing the value of Australian honey as a health food</td>
<td>02/07/2018</td>
<td>01/08/2021</td>
<td>Kokotin, Nural</td>
<td>University of Technology, Sydney</td>
</tr>
<tr>
<td>PRU-010987</td>
<td>CRC for honey bee products</td>
<td>01/07/2017</td>
<td>30/08/2022</td>
<td>Barbour, Liz</td>
<td>CRC for honey bee products</td>
</tr>
</tbody>
</table>
Objective 1

Implement the National Bee Pest Surveillance Program (NBPSP) and encourage ongoing Program funding.

Support genetics research for pests and diseases control: - the development of a test for the detection of Africanized bees to help facilitate the introduction of new genetic stock into Australia; - investigations of the ecology of Apis cerana to enhance the understanding how far this pest will spread in Australia.

Support measures to increase awareness of the need to manage and control endemic pests and diseases including American foulbrood, Nosema apis, Nosema ceranae, European foulbrood, Chalkbrood and sacbrood virus.

Monitor the effectiveness of current control measures to reduce the impact of the Small Hive Beetle with a view to further studies should the impact of this pest increase.

Undertake Tropilaelaps clareae research and ensure incursion response strategies are appropriate and best practice.

Provide industry with tools to ensure wide uptake of an industry QA Program or Code of Practice that include pest/disease control and chemical residue management.

Develop non-chemical controls for pest and diseases to ensure Australian apiary products.

Reduction of the incidence and impact of pests and diseases on the pollination services industries.
Reduce the incidence and impact of pests and diseases on the beekeeping and pollination services industries.

Probiotic development for bees: Analysing gut bacteria in healthy bees

Summary

The team's previous work identified a rich diversity of bacterial species inhabiting the gut of healthy bees. Some of this bacteria showed demonstrated strong anti-fungal activity against the chalkbrood pathogen. This project aims to determine the feasibility of commercialising Australian native bee gut bacteria as probiotics for bees. To do this, the team will obtain specific ecological information on the fluctuation of bacterial numbers in healthy bee guts over a year (four seasons). Then, test bacterial isolates with anti-fungal properties in probiotic feeding experiments. This will help to identify bacteria with the best potential to be used as bee probiotic.

Objectives

1. Understand the variation in gut bacterial numbers in healthy bees across a year (i.e., over the four seasons).
2. Characterise the antifungal properties of bee gut bacteria that were isolated in the previous project. The information gained will be used to select the best candidate bacteria for subsequent probiotic experiments in the field.
3. Demonstrate (via probiotic feeding studies) which candidate bacteria can be successfully introduced into and maintained in the bee gut.
4. Identify bacterial species/strains that show good potential for the development of commercial bee probiotics.

The proposed project builds on a previous project funded by AgFutures Honey Bee & Pollination Program (PRJ-000571) and will determine the feasibility of developing bacteria as probiotics for bees.

Research approach

To understand the variation in gut bacteria numbers in healthy bees, healthy hives will be monitored for bacterial gut bacteria (every three to four weeks) from healthy hives across a number of climatic zones (different flora and climatic zones (i.e., in Canberra and on the south coast of Bega) for 15 months. Isolations will be done from five bees at any one time from each hive. Therefore, bacteria will be isolated from 20 bees at one time for sampling. The disease status of the study hives will be accurately monitored by Doug Somerville, to confirm sampling occurred from healthy bee hives.

A number of bacterial species with anti-fungal properties against chalkbrood were isolated in the previous Australia-wide study. This project will supplement this by isolating bacteria to enlarge this collection. As in the previous study, bacteria will be isolated, purified on nutrient agar. Potato dextrose agar bioassays will be used to test previously and newly isolated bacterial strains to determine the antimicrobial activity against chalkbrood and European foul brood pathogens. Molecular characterisation by PCR using hyperpriming will determine the relatedness of bacterial isolates to each other so as many different bacterial types as possible can be screened for. Statistical analysis of growth areas in these bioassays will allow identification of the most potent bee gut bacteria against the bee pathogens. The best bacterial candidate strains will be further characterised for growth characteristics, genetic stability and culturability.

An attempt will be made to determine if there are yeast residing in the gut of bees. This will be done by isolation on modified Sabouraud’s Dextrose Agar (which will be enriched for yeasts if possible). Some of the sampled bee guts for yeast isolation in the first year will be used. Selective media for specific isolation of yeasts only from the environment is currently not available. Basic research on yeast isolation methodology will be done in the first year of the project.

Read more about this project on page 62 and visit agrifutures.com.au/honey-bee-pollination

Photo credit: Lightbox studio

Program funded by AgriFutures Honey Bee & Pollination

The proposed project builds on a previous project funded by AgFutures Honey Bee & Pollination Program (PRJ-000571) and will determine the feasibility of developing bacteria as probiotics for bees.

Progress (to date)

This project will develop a diagnostic tool to assess colony health, using bee gut bacterial numbers (i.e., even before disease symptoms appear in the hive). Early diagnosis could be used to accelerate the recovery of infected hives, and even prevent outbreak of disease (e.g., chalkbrood). This may be extensible to other bee diseases, and be useful in monitoring Colony Collapse Disorder, if it were to arrive in Australia.

From characterising bee gut bacteria the development of a probiotic bacteria that produces gluconic acid is recommended. As gluconic acid is a natural component of honey there would be no issues in using these strains, and they may contribute to higher gluconic acid levels in honey. Bee gut bacterial isolates related to Maccrococcus hajekii, Frigoribacterium sp. and Bacillus senegalensis have been identified to produce gluconic acid. The anti-microbial property of honey is based mostly on the presence of gluconic acid and hydrogen peroxide; produced by the one enzyme in honey bee and bacteria in the bee gut. The concentration of these compounds in honey varies (along with its anti-microbial activity). We recommend doing experiments with pure gluconic acid (which we have started) to determine if this can aid in recovery against chalkbrood, and also increase the level of gluconic acid in honey. Then one could standardise (and perhaps enhance) the level of gluconic acid in honey, to make honey which has more predictable anti-microbial properties.

By monitoring bee gut bacterial numbers we have an accurate measure of colony activity and health. Looking at proportion of bees with high bacterial numbers in a colony over time. There are high bee gut bacterial numbers (i.e., > 10^5 bacteria per gram of bee gut) when bees are active from mid-spring, summer to mid-Autumn. Bee gut bacterial numbers falling of (i.e,. < 10^5 bacteria per gram of bee gut) rest of the time when they are inactive (i.e., late autumn, winter and early spring). This shows there is cyclic variation of numbers of bee gut bacteria over the four seasons. This has not been known previously.

Characterisation of gluconic acid producing bee gut bacteria (e.g., through mass spectroscopy) has been started. These bacteria (and take-all biocontrol Pseudomonas strain ANB) have been marked with natural antibiotic resistance for probiotic testing. We have set up an experiment at a Goulburn apiary to see if gluconic acid feeding can enhance recovery from chalkbrood infection; also to develop a protocol for such experiments, required for future research. Experiments to determine gluconic acid concentration in different honeys, and in bees themselves, will also be started.

Murali Nayudu
University Of Canberra

Principal Investigator:

Commenced → 13/07/2018
Due for completion → 30/01/2021

PRJ-010825

PRJ-000571

21

2020 Research, Development and Extension Snapshot
Summary

This project investigated the effects of three commonly used active ingredients in fungicidal sprays during flowering of almond and canola on the health of honey bee brood. The active ingredients tested were selected from those most commonly used by the industries.

Objectives

1. Produce an in-depth literature review of the effects of the active ingredients commonly used in fungicidal sprays on hive health and native bees, to explore known effects and knowledge gaps.
2. Quantify the amount of active ingredient in pollen brought back to the hive within 24 hours after spraying.
3. Experimentally establish the effects of commonly used fungicidal sprays on survival of nurse bees, and their hypopharyngeal gland development through caged experiments.
4. For those active ingredients that prove harmful to nurse bees, investigate the impact on brood development using whole hive trials.

Research approach

- The project will investigate the effects of three commonly used active ingredients in fungicidal sprays during flowering of almond and canola on the health of honey bee brood. Two of the active ingredients tested will be selected from those most commonly used by the industries. The final choice of active ingredient to be used in feeding trials will be based on the outcome of the literature review and an inquiry among growers of pollination dependent crops.
- To investigate known effects of fungicides on the health of adult workers, nurse bees, brood, overall hive performance and on native bees, we will do an exhaustive and critical literature search and use this information to produce a literature review.
- For at least three commonly used active ingredients the impact of its presence in pollen will be assessed for (a) survival of nurse bees, and (b) their hypopharyngeal gland development. This will be done using feeding experiments of newly enclosed bees in small cages.
- For the ingredients that show significant impact on nurse bees or their hypopharyngeal gland development, the effects on larval development will be investigated using whole hive feeding experiments (following Zaluski et al 2017).
- Care will be taken to use realistic concentrations of the active ingredient, this will be achieved by harvesting the pollen brought back to the hive after spraying in five orchards and (a) using this pollen directly in the small cage feeding trials; and (b) quantifying the amount of active ingredient in the pollen. These concentrations will be used in the hive feeding trials.

Progress (to date)

Initial results, from the literature review, suggest that nearly all fungicides are unlikely to cause major harm to bees, but when used in combination with other fungicides or insecticides, there can be harmful synergistic effects. For these products, our recommendations are that labels should display where farmers can access the information about these synergistic effects.

Further findings and their implications will be presented in the final report.
**Objective 1**

Reduce the incidence and impact of pests and diseases on the beekeeping and pollination services industries.

In Investigating factors that influence chalkbrood outbreaks in Australia

**Summary**

Nosema (N. apis and N. ceranae) and chalkbrood (Ascosphaera apis) are significant honey bee pathogens that reduce hive productivity and cause colony losses. Outbreaks continue to occur and are generally considered the consequence of poor environmental conditions and hive management. Nutritional interventions (such as pollen supplements/substitutes and sugar feeding) and managing the hive environment are the only strategies for beekeepers, but the effectiveness and use of these treatments can be variable, and often goes unassessed. Furthermore, there is still limited understanding for how the available nutrition (natural forage or supplements) affects the quality of brood food and its connection to the disease susceptibility of larvae and adults. This project aims to address the knowledge gaps and improve the use of nutritional interventions in disease management.

---

**Research approach**

Experiment one aims to identify genetic and environmental factors influencing current chalkbrood outbreaks through a systematic and comprehensive comparison of infected and uninfected colonies.

This experiment involves the participation of two commercial beekeeping operations located in NSW that have experienced recent outbreaks of chalkbrood. During late spring and summer samples of adult bees and infected larvae will be collected from infected and uninfected colonies. The target will be to analyse 40 colonies from each beekeeper, with equal numbers of infected and uninfected colonies samples. Infected colonies will have a moderate to high infection.

Experiment two aims to determine whether innate larval resistance (due to the queen’s genetics) is a primary factor influencing the observed variation in chalkbrood incidence within apiaries. For this experiment, an apiary from a commercial beekeeper experiencing an outbreak of chalkbrood infection will be identified and the queens collected from four highly infected and four uninfected colonies. Adult bees, infected larvae, wax, honey and pollen will be collected from original colonies for examination of genetic diversity and spore contamination.

Original colonies will also be assessed for hygienic behaviour using standard methods before queen removal. These queens will be re-established in a new hive environment with a package of bees at the CSIRO Canberra research apiary. Once established, queens will be restricted to one side of a frame to lay eggs for approximately 24 hours using a queen excluder push-in cage. When larvae are three days old, brood frames will be removed and larvae inoculated with 5ul of chalkbrood spore solution and returned to the colony.

A combination of single and mixed chalkbrood strain infection may also be examined. Levels of chalkbrood infection will be compared between colonies seven days later and larvae collected for quantitative PCR to test differences in immunocompetence (activity of immune genes).

---

**Progress (to date)**

Preliminary analysis has identified the genetics of colonies and of the fungal pathogen remain important factors in chalkbrood outbreaks and warrant further investigation.

Our results, to date, show that chalkbrood infected colonies had lower effective mating frequency but not total number of mates. This suggests that queens may be adequately mated but are producing more brood with susceptible genotypes. This would explain reduced effective mating frequency observed as susceptible genotypes become under-represented in the worker population.

The chalkbrood strains identified are consistent with the findings of Jody Gerds (work PRJ-0039994). Strain A is most prevalent in NSW. Interestingly strain B was found in two colonies which had the most severe observed infections. It is still unclear how different strains are influencing outbreaks and we have no knowledge of the relative virulence of these two strains. We plan to explore variation in larval susceptibility to chalkbrood and compare the virulence of strains A and B in our next experiment.

There are currently no established molecular methods for quantifying chalkbrood spore levels in colonies. However, we have adapted two genetic markers that appear to have good sensitivity based on a serially diluted sample with a known spore level. With further optimisation and validation this could be a good tool for future investigations.

Another 12 colonies were classed as ‘acute infections’ because they had recovered when re-assessed two months later. We plan to also analyse these colonies genetic diversity, chalkbrood strains, pollen levels and chalkbrood spore levels in pollen.

---

Register for updates on this project and the AgriFutures Honey Bee & Pollination Program at agrifutures.com.au/honey-bee-pollination
Objective 2

Increase productivity and profitability of beekeepers

Strategies

- Facilitate genetic improvement in the Australian honey bee industry including through the introduction of superior queen bees.
- Facilitate genetic improvement to lift bee hygienic behaviour and control pests and diseases.
- Increase the efficiency of beekeeping operations by rapid identification of queen bees in beehives.
- Facilitate the development of at least one new Australian apiary product.
- Undertake industry production and financial benchmarking to raise average industry productivity for beekeepers working under similar conditions.
Objective 2

Increase productivity and profitability of beekeepers

Active Australian leptospermum honey: New sources and their bioactivity

**Summary**

This project aimed to provide a rigorous evidence base for the value of Australian leptospermum honey as a therapeutic agent that is as effective as manuka honey against bacteria. Leveraging the preliminary work by Carter and Blair, we undertook a comprehensive and systematic survey of leptospermum honey from throughout the major beekeeping areas of Australia. The survey included a chemical and antimicrobial analysis of these honeys to identify those that have the highest antibacterial activity as correlated with MGO/DHA levels. We examined honeys for broadspectrum antibacterial activity and test for synergy when honey is combined with commonly used antifungals and antibacterials. Our findings provide useful scientific information for those producing and marketing Australian Leptospermum honey.

**Objectives**

1. Perform a comprehensive, Australia-wide survey of leptospermum honeys to identify floral sources and geographic locations that yield honey, and to test the antimicrobial activity of this honey to identify those with high levels of activity.
2. Determine whether antibacterial activity in Australian leptospermum honey correlates with chemical components, methylglyoxal (MGO) and dihydroxyacetone (DHA), as is the case for manuka honey from New Zealand.
3. Determine the presence of DHA in the nectar of Australian Leptospermum species and investigate its potential to predict the bioactivity of honey.
4. Test active Australian leptospermum honey against fungal pathogens to determine if the antifungal and antibacterial activity have the same mode of action, and whether these honeys are synergistic with another antifungal agent.

**Research approach**

The project was divided into four activities:

1. Identifying and mapping of Australian leptospermum species from sample (honey and nectar) collections and field work.
3. Quantifying key chemical compounds in leptospermum honey and nectar samples, and investigating links to the bioactivity of honey.
4. Determining the susceptibility of clinical isolates of fungal pathogens to honey, and investigating the synergy of honey with a known antifungal (lactoferrin).

**Key findings & implications**

1. Identifying Australian leptospermum species and locations with potential for producing bioactive honey:
   - Australia is abundant in leptospermum species, and several of these produce honeys with high levels of antibacterial activity.
   - Sources of active leptospermum honey are distributed across most Australian states.
   - Australian leptospermum honeys contain methylglyoxal (MGO) at varying levels, and this is influenced by floral and geographic source.
   - Australia has several geographic ‘hotspots’ for the production of active leptospermum honey.
2. The relationship between the antibacterial activity and chemistry of Australian leptospermum honey:
   - There is a strong positive linear correlation between MGO and non-peroxide activity (NPA) in Australian leptospermum honey, similar to New Zealand manuka honey.
   - Storage of young honeys with high dihydroxyacetone (DHA) levels at 22 °C for approximately one year is ideal to maximise the conversion of DHA to MGO.
   - The NPA of Australian leptospermum honey is stable for long periods of time (up to seven years) when stored at refrigeration conditions (4 °C in the dark).

**Recommendations**

The industry should consider:

- Developing and licensing a unified means of assaying and labelling antibacterial and antifungal honeys – including, but not limited to, leptospermum honeys.
- Funding work to develop a robust and reliable assay for measuring hydrogen peroxide type activity in honeys.
- Developing and implementing standardised measures and labelling of other ‘bioactive’ properties of honey, for example, antiinflammatory, wound healing, immunomodulatory, and prebiotic activity.
- Funding further work into investigating the antifungal activity of honey, and consider developing honey based antifungal products and/or marketing honey for use as a dermatophyte cream.
- Funding work on developing chemical and/or biological or genetic marker panels to authenticate the floral and geographic source of honeys.

**Research approach**

1. The antifungal and synergistic effects of Australian honey:
   - Honeys with ‘hydrogen peroxide type activity’ are generally more potent against fungal pathogens than leptospermum honeys.
   - Antifungal activity of honey exhibits a very different mode of action compared to its antibacterial activity.
   - There is no synergistic activity between honey and the antifungal agent, lactoferrin.
Selection and development of Australian hygienic honey bee lines

Summary

This four-year project investigated the relationship between honey bees and the most economically significant pathogen affecting the Australia honey bee industry, Ascosphaera apis, the fungus responsible for chalkbrood disease. This study investigated genetic variation of A. apis in Australia situated in a global context, then details the process of selecting and breeding for hygienic behaviour, a social immune response of honey bees known to confer resistance to chalkbrood. This study further identified potential reasons why the globally accepted field assay to select for this important trait may not be applicable to Australian conditions, leading on to the testing of two field assays that could potentially be useful for honey bee queen breeders to identify chalkbrood-resistant breeding stock.

The broader context of this work is to breed disease resistance and resilience into Australian honey bee stocks before the arrival of Varroa mites with the goal of mitigating the harmful effects of the devastating parasite.

Research approach

- A beekeeper assisted national survey was conducted to create a spatial distribution of A. apis genetic diversity. Fungal culturing and molecular work was then conducted in a laboratory setting.
- A wide-scale field study conducted in nine beekeeping operations in QLD, NSW, VIC and TAS examined hygienic behaviour in honey bees.
- A combination of field and laboratory studies identified volatile organic compounds associated with A. apis infected larvae, and gauged the response of hygienic bees to the identified volatiles.
- A field study assessed the predictive capacity of a colony’s response to experimentally infected larvae on the likelihood of a colony having a chronic chalkbrood infection.
- Larvae were reared in a laboratory setting and experimentally challenged with two genetic A. apis variants to assess strain virulence and colony susceptibility.

More research into the effect of low nutrition on chalkbrood outbreaks would greatly benefit beekeepers. Currently, the effect of the pollen quality that bees use to produce brood food and its effect on larval resistance to infection is not fully understood. Identifying key nutritional stressors may help beekeepers develop supplementary feeding to reduce chalkbrood outbreaks. Understanding the influence of hotter weather on colony health and chalkbrood development may also help beekeepers rethink their operations.

Bees with rapid hygienic behaviour have been shown globally to be effective at reducing brood diseases. To some extent, they also lessen the impact of pests such as Varroa. This project shows that many colonies in Australia exhibit rapid hygienic behaviour, which is a good foundation for ongoing work on developing hygienic lines of bees.

This project is the first to document gene variation of Australian A. apis fungus from a global perspective. No genetic variants of the fungus seem to be more virulent than others at infecting whole colonies. It’s more likely that other factors, e.g. hive management, environment (bee nutrition and temperature stress), and honey bee genetics, are responsible for the incidence and severity of infection.

Although this project found no relationship between rapid hygienic behaviour and chalkbrood infection, different breeding strategies can breed bees with rapid hygienic behaviour. The Australian honey bee industry can be confident that existing hygienic traits will provide social immunity in our colonies.

One important implication is that to have bees resistant to endemic diseases before Varroa becomes established, the industry must develop a selection test for Australian conditions that can predict the level of disease in a colony.

Key findings & implications

This project found that at least six genetically distinct strains of the fungus are present in Australia. Although some are widespread, knowing the type of strain doesn’t help with predicting the level of chalkbrood infection in a hive. Trying to determine the virulence of strains is also difficult – one experiment showed no clear evidence that a single fungus strain or a combination of strains vary in virulence. More work is needed to better understand the genetic component to disease resistance and application in honey bee breeding... A focused effort to breed only from non-chalkbrood colonies would be a good start.

Compared to global populations, Australian honey bee colonies have a high level of hygienic behaviour. Although hygienic colonies are not necessarily more resistant to chalkbrood infection, it is still recommended that queen bee breeders use the freeze-killed brood assay to refine rapid hygienic behaviour in their breeding lines. In time, the benefits (pest and disease tolerance) may outweigh the costs (labour and time). If queen breeders use this assay regularly, they will be better prepared for pest and disease outbreaks.

Objective 2

Increase productivity and profitability of beekeepers
Increase productivity and profitability of beekeepers

Review of honey bee industry levies

The Australian honey bee industry is changing. Commercial beekeeper numbers and honey production are either static or in decline. The price paid to beekeepers for honey is increasing and the channels used by beekeepers to market their honey is fracturing. Sales are shifting from a small number of large honey packers from whom it is cost effective to collect levy to a large number of diffuse marketing channels. As the honey sector of the industry fractures into many marketing channels, making collection of levy difficult and expensive, the paid pollination sector fractures into many marketing channels, making collection of levy difficult and expensive, the paid pollination sector.

This review found:

- The value of the R&D component of the levy has been eroded by CPI increases, the loss of plant industry funds to complete pollination R&D projects and does not capture the full amount of government matching payments that are available to it.
- There is a shortfall in the Biosecurity component of the levy and additional funds are required to replace capital transferred from Animal Health Australia, transferred to the National Residue Survey and to expand the Biosecurity Officer program.

Recommendations

1. Reform of the existing levy on honey
   a. R&D levy increase: Increase levy rate by 1c/kg to 2.5c/kg
   b. Biosecurity levy increase: Increase levy rate from 0.1c/kg to 1.6c/kg
   c. Establish a new statutory marketing levy: 2c/kg to promote Australian honey
   d. Investigate a 2% Ad valorem levy: Convert R&D, Biosecurity and NRS (and possibly Marketing) levies to a percentage of value at first point of sale.

2. New statutory pollination levy
   a. R&D levy on pollination: $1/hive of new pollination levy allocated to R&D
   b. Biosecurity levy on pollination: $1/hive of new pollination levy allocated to biosecurity

These options for honey bee industry levy reform are summarised in the Executive Summary of the full final report (agrifutures.com.au/review-honey-bee-levies) and have been presented to industry for its consideration.

Summary

The levy was first introduced 14 December 1962 and honey that is produced in Australia, and sold, exported or used in the production of other goods, attract a levy and export charge. The levy addresses biosecurity, residue testing, Plant Health Australia (PHA) membership and research and development (managed by AgriFutures Honey Bee Program).

The Australian honey bee industry is changing. To secure the future of the Australian honey bee industry it is important to understand the adequacy of current levies and options for levy reform.

This project reviewed the industry's current levies and fees and made a series of recommendations on an appropriate levy structure to serve the industry in the future.

Objective 2

Increase productivity and profitability of beekeepers

Objectives

1. Current levy rates paid by the honey bee industry including the compulsory National Honey Levy administered by the DAWR and State-based compulsory/voluntary fees and charges.
2. Where levy money goes, and how effective it is in achieving outcomes for industry.
3. The sustainability of the current national levy structure.
4. Levy rates required to service industry needs and priorities.
5. Options for amending existing levy rates and charges.

Research approach

A series of stakeholder consultations with the Australian Honey Bee Industry Council, AHBC, AgriFutures Australia, Plant Health Australia (PHA), National Residue Survey and the Department of Agriculture and Water Resources.

This project reviewed the industry's current levies and fees and made a series of recommendations on an appropriate levy structure to serve the industry in the future.

PRJ-011643

Commenced → 14/12/2018
Completed → 14/02/2019

Principal Investigator: Michael Clarke
Organisation: AgEconPlus Pty Ltd

To view the final report and the results of this study visit agrifutures.com.au/review-honey-bee-levies
Objectives

1. Understand the status of propolis production in New Zealand and Australia.
2. Investigate the market for Australian produced propolis.
3. Determine the potential for additional profitable Australian propolis production.
4. Ensure commercial beekeepers are engaged in the project, assist with its design and are aware of project results.

Research approach

A small number of commercial beekeepers with an interest in propolis harvest were surveyed to determine their information needs. A survey was also completed with commercial beekeepers that currently harvest propolis or had past experience with propolis supply. Where possible, interviews were carried out with researchers investigating the chemical composition and medicinal qualities of propolis. A literature review was completed to better understand propolis uses, composition, production processes and world supply. An understanding of the status of propolis production in New Zealand was developed through interviews with Ministry of Agriculture New Zealand apiculture specialists, beekeepers and propolis processors. A preliminary analysis of the financial return to Australian beekeepers from propolis harvesting and processing into simple products (tinctures) was completed. Conclusions were drawn on the impact of low cost Chinese imports, the competitive advantages of Australian propolis, and the profitability of propolis supply by Australian beekeepers in different forms.

Key findings & implications

Market for Australian produced propolis

The market for propolis products in Australia, including re-export of consumer products to Asia, has grown rapidly and is forecast to grow at an average 10% per annum through to 2022. Australia imports an estimated 60 to 80 tonne per annum of pure propolis and propolis harvested by Australian beekeepers could at least partially offset some of this imported material. Companies with a potential future interest in raw Australian propolis include a honey packer, an established processor looking at new, more effective medical treatments. Beekeepers interested in propolis production in Australia

Recommendations

The industry should consider further investment in the development of standards/specifications for raw Australian propolis, assessment of which flora produce the most useful propolis and investigation of whether propolis is recoverable from existing honey processing operations. In time, it is possible that the Australian industry might reach a size comparable to the New Zealand propolis industry, create opportunities in the value chain and deliver new, more effective medical treatments. Beekeepers interested in propolis production should:

• Buy a small number of mats and trial them for at least a year.
• Weigh propolis recovered from mats and the scraping method separately – some potential buyers have indicated that they are only interested in propolis recovered from mats.
• Keep a record of the time required to crack mats and scrape hive material to decide on level of labour needed for your business.
• Follow up with potential buyers to determine willingness to purchase, standards etc.
• Rework guide budgets to determine whether propolis harvest is economically viable for the business.

Potential for additional profitable propolis production in Australia

Using “best estimate” assumptions, harvest of raw propolis is modestly profitable. Propolis harvesting appears to be a useful addition to total income for all beekeepers, especially smaller operations where the beekeeper is more likely to have uncommitted time and additional income may provide a boost to overall enterprise viability. For example, raw propolis production in a 100 hive enterprise has the ix potential to add $900/year to net revenue if paid labour is used and $1,400/year if the owner’s labour is employed and has no opportunity cost. The economics of raw propolis production is enhanced for all beekeepers if the processor provides a New Zealand style mat pickup and extraction service. Mat pickup and extraction is thought to require access to at least five tonne of raw propolis and substantial capital for processing equipment if a sustainable enterprise is to be created. Production of value added propolis tincture is relatively straightforward and is profitable for beekeepers for the “best estimate” assumptions used.
**Objective 2**

Increase productivity and profitability of beekeepers

### Review of chemistry associated with honey testing

**PRJ-011685**

**Committed** → 4/03/2019  
**Completed** → 7/06/2019

**Principal Investigator:** Jamie Ayton  
**Organisation:** NSW Department of Primary Industries

#### Objectives

1. Identify and review current and new analytical techniques for honey analysis and the limitations of these techniques.
2. Evaluate the chemistry of Austrian honey based on past research. Including determination of limitations of different analytical techniques given the particular floral characteristics of Australian derived honey, as well as the effect of supplementary feeding on analytical results.
3. Review national and international regulatory policies and guidelines on honey testing and the determination of honey adulteration.
4. Provide recommendations as to which analytical methods are likely to be the most appropriate for the Australian honey industry.

#### Key findings & implications

While there are many different analytical techniques for the determination of adulteration in honey, two particular methods, isotopic ratio mass spectrometry (IRMS) and Nuclear Magnetic Resonance (NMR) spectroscopy are the main techniques to have gained acceptance in some regions in the past. However, these methods have inherent problems. The IRMS technique only detects adulteration from C4 sugars, so samples adulterated with sugars with the same isotopic ratio as honey, such as rice or wheat, are unable to be detected. There is also some concern that inter and intra-laboratory errors occur with this method, causing some concern about the accuracy and precision of the method. While considerable effort has gone into developing a database for NMR spectroscopy analysis, most of the honey used in the database has been sourced from Europe, Asia, North and South America and relatively few from Australia. As a result, Australian honey which is analysed using the NMR spectroscopy technique generally does not conform to the database and therefore produces erroneous reports.

Analytical techniques such as liquid chromatography - isotopic ratio mass spectrometry (LC-IRMS), infrared spectroscopy (such as NIR, MIR and Raman), liquid chromatography - mass spectrometry (LC-MS) and gas chromatography - mass spectrometry (GC-MS) for investigating various chemical compounds or markers in honey have been investigated in this review. There are opportunities to further investigate some of these techniques to determine their suitability for Australian honey.

It is important the Australian honey industry, including stakeholders such as producers, wholesalers, retailers, exporters and policy makers work toward developing systems which can be used to determine the authenticity of Australian honey, thereby regaining consumer confidence.

#### Recommendations

It is recommended that the Australian honey industry adopts some immediate strategies to regain consumer confidence in honey. These include:

- The development of a chemistry based quality assurance program/code of practice based on simple quality tests. Although these programs may not necessarily include complicated analytical techniques to identify adulteration, they have been used in other industries, such as the Australian olive industry, to improve the overall quality of the products and have gained acceptance from industry and consumers.
- Market surveillance to determine compliance with domestic and international regulations. Screening methods using technology such as near infrared (NIR), mid infrared (MIR) or Raman spectroscopy could be developed and used to undertake some of the analyses, providing a quick, inexpensive alternative for producers to have their honey tested.

#### Summary

Recent media attention regarding alleged honey adulteration and quality issues has raised some concerns in the Australian honey industry. There are concerns that the analytical techniques used to identify adulterated honey samples, as well as those techniques which measure honey quality, need to be reviewed to determine which methods are suitable.

A literature was undertaken to investigate the different analytical techniques available to determine the authenticity and quality parameters of honey and how these may be applied to Australian honey. The literature review will be used by the industry to inform strategies to ensure the problem is overcome.

To view the final report and further information about this project visit agrifutures.com.au/review-honey-chemistry
This project aims to arm the Australian Honey Bee Industry Council (AHBIC) and state beekeeping bodies with the knowledge required to develop a strategic approach to beekeeper access to public lands, provide policy analysis that is relevant to state government policy makers and key recommendations for research, development and extension recommendations. The objectives of the project were to:

• Investigate the current situation and issues regarding floral resource access, on a state-by-state basis.

• Understand the impact of identified issues on the beekeeping industry e.g. controlled burns, timber harvesting.

• Incorporate workshop findings into a statement of best practice, transformational policy making and strategic actions.

• Provide a summary of relevant past research looking at beekeeper access to floral resources on public lands.

The Australian beekeeping industry is heavily reliant on eucalypt and other forest for honey production and the safe overwintering of honey bees. Much of this forest is held within the public estate. Over time, changes in the tenure of public land and public land management practices have decreased both beekeeper access to essential floral resources and the quality of the remaining resource. Beekeepers require support and guidance to better engage with Government and other stakeholders to support long-term resource access and the viability of the honey bee industry.

Summary

The workshop has shown that public land in each Australian state is essential for honey production and the provision of pollination services. Access to public resources and the quality of the remaining resources for which beekeeper access is available has been eroded over the last 25 years. There are inconsistencies in policy between states and a shift from current to best practice would secure the ongoing pollination of Australian crops.

A plan has been detailed for beekeepers to pursue policy change. State governments and in particular, their Ministers for the Environment are critical to a favourable outcome.

Recommendations

The workshop recommended a national overarching approach to the pursuit of transformational policy change along with specific priorities for each state. The workshop findings will inform AHBIC activities and will be relevant to state government policy making and AgriFutures Honey Bee & Pollination Program research priorities.

Recommendations for priority projects arising from the workshop include:

1. AHBIC development of a public lands access policy document using the current workshop report as a foundation.

2. AgriFutures Honey Bee & Pollination Program give consideration to funding a position paper on controlled burning and its impact on beekeeping.

3. AgriFutures Honey Bee & Pollination Program give consideration to funding a research project to clarify the legal status of public land sites i.e. what rights are attached to a permit, an authority, a licence and a lease.

To view the final report and further information about this project visit agrifutures.com.au/floral-resources
Progressing implementation of genetic selection in Australian honey bee

**Objective 2**

Increase productivity and profitability of beekeepers

**Summary**

**Previous project** PRJ-009276 - Genetic Evaluation of Australian honey bees using BLUP procedures, demonstrated proof-of-concept for the application of BLUP methods to genetic evaluation of Australian bees. The datasets analysed in that project were small, and limited in detail of pedigree, but results show the existence of useful genetic variation in production and health traits, providing the basis for genetic improvement.

This follow-up project aims to progress genetic improvement of Australian honey bees for production and health traits through a combination of:

- Analysis of queen relationships in the breeding program of the Horner family to enable more powerful genetic analysis than was possible in the previous project.
- Working with the Horners with assistance of NSW DPI to collect health data, including rapid hygienic behaviour, for inclusion in this analysis, and other breeders if they can be identified.
- Collection of DNA samples from other breeding programs - including the Better Bees program and any others with suitable data - to build a relationship map of Australian queen breeding programs. This map will underpin genetic evaluation of queens from different breeding programs and inform breeders on the degree of inbreeding in the Australian population.
- Working with NSW DPI and others in industry to develop educational material on practical breeding programs.
- Consultation with industry on scope for a coordinated queen evaluation program to extend the work conducted by AQBBA to include more traits, including recommendations for the collection and management of queen bee breeding data for use in science-based breeding programs.
- If importation of semen is permitted, the project should genotype such semen to allow inclusion of new stock into the relationship map of the population.

**Objectives**

Implementing genetic evaluation:

1. Collect more data on production and health traits from the Horner family breeding program, and if possible, from queen breeders across Australia.
2. Genotype queens, and funds permitting samples of drones and workers, from the Horners’ program, to build a genetic relationship map across their entire program.
3. Using pedigree data and genotypes, analyse the full population in that program, and subject to availability of data, other programs.

**Research approach**

- Analysis of queen relationships in the breeding program of the Horner family to enable more powerful genetic analysis than was possible in the previous project.
- Working with the Horners with assistance of NSW DPI to collect health data, including rapid hygienic behaviour, for inclusion in this analysis, and other breeders if they can be identified.
- Collection of DNA samples from other breeding programs - including the Better Bees program and any others with suitable data - to build a relationship map of Australian queen breeding programs. This map will underpin genetic evaluation of queens from different breeding programs and inform breeders on the degree of inbreeding in the Australian population.
- Working with NSW DPI and others in industry to develop educational material on practical breeding programs.
- Consultation with industry on scope for a coordinated queen evaluation program to extend the work conducted by AQBBA to include more traits, including recommendations for the collection and management of queen bee breeding data for use in science-based breeding programs.
- If importation of semen is permitted, the project should genotype such semen to allow inclusion of new stock into the relationship map of the population.

**Progress (to date)**

- The research team are progressing analysis of production and scored traits data collected by the Horners, and in parallel, finalising decision-making regarding the most appropriate genotyping method and laboratory to use for initial analysis of DNA samples of queens collected at the Horners and in the Western Australia breeding program.
- The process in regard to identifying and selecting the most appropriate genotyping service has been difficult; ideally we will work with a lab in Australia and which can provide readily usable genotypes. This is challenging because to date there has been limited large-scale genotyping of honeybees in Australia (or elsewhere). However, we are confident that we are close to a solution.
- The production and scored traits data is readily usable; it consists of queen and queen mother ID, honey production data, and scores for a number of subjectively assessed traits. The analysis will generate estimated breeding values (EBVs) for the queens and queen mothers for all traits. Our aim is to complete the analysis of 6 “lines” maintained by the Horner’s using the method.

For more information about this project visit agrifutures.com.au/honey-bee-pollination
Increase productivity and profitability of beekeepers

Development of honey bee products from a biodiversity hotspot

Objectives

The overall objective of this research project was to characterise the spectrum of antimicrobial activity and chemical composition of Western Australian honeys. The specific objectives of this research were to:

- Conduct a thorough investigation of the antimicrobial activity of Western Australian honey
- Characterise the physicochemical properties of the honeys from each floral source (including hydrogen peroxide and MGO levels, total phenolics and anti-oxidant activity) and determine whether these correlate with antimicrobial activity
- Compare the activity of Western Australian honey to commercial medicinal honey and pasture honey and evaluate the medicinal niche of WA honeys based on the antimicrobial data.
- Relate the characteristics of each honey sample to site bee floral activity.
- Investigate the logistics of developing a medicinal honey product for the export market.

Summary

Western Australia, and in particular the South-West corner of Western Australia, is a biodiversity hotspot with a very high endemic species, diversity and richness. As a result of bees foraging on each unique species, a wide variety of floral honeys are produced. For this project, research was conducted on honeys derived from a broad range of these endemic flowering plants to establish antibacterial activity profiles for many of the dominant monofloral honeys, and to investigate rare or unusual honeys for which little data are available. This research provides rigorous scientific data to support the long-held beliefs that many Western Australian honeys, such as those derived from Jarrah (Eucalyptus marginata), Marri (Corymbia calophylla) and Karrri (Eucalyptus diversicolor), possess relatively high antibacterial activity. It also provides comprehensive data for a wide range of Western Australian honeys that have not been investigated previously. Honeys with high antibacterial and anti-oxidant activity typically attract a higher sale price, which increases the profitability and value of the beekeeping industry.

Research approach

Western Australia is a biodiversity hotspot of endemic flora. This opens the opportunity for beekeepers to create unique products with different health attributes. The experience Western Australia has already gained through the development of the Jarrah honey as a unique chemically-pure product with both antibacterial and anti-oxidant activity provides the impetus to brand and market other sources.

This project will screen Western Australian honey for antibacterial activity, both of which will be measured in this project. To ensure honey source accuracy, pollen traps will be set to confirm the floral species contributing to the honey. This collection will be done in conjunction with the West Australian beekeeper group and Department of Parks and Wildlife.

All honeys will be assessed for their anti-microbial activity, which in most honeys, is due to the enzymatic production of hydrogen peroxide. However, non-peroxide honeys (of which Manuka honey is one) can display significant antibacterial effects even when the hydrogen peroxide activity is blocked. Alternate mechanisms will be investigated, including methyl glyoxal (MGO) levels, pH and sugar content (osmorality).

Honey is rich in phenolic acids and flavonoids, which exhibit a wide range of biological effects and act as natural antioxidants. The tendency of Western Australian honeys to be darker in colour suggests that this may be an important attribute in the region and can contribute to anti-oxidant activity, both of which will be measured in this project.

This information will provide the basis for market stratification planned for the Western Australian beekeeper cooperative which is focusing on the export market.

For further information about this project visit agrifutures.com.au/honey-bee-pollination

Progress (to date)

To date, 230 honeys have been collected from around Western Australia from a broad range of floral sources. Honeys from more than ten different genera have been collected, including Eucalyptus, Corymbia, Banksia, Callistemon, Calothamnus, Melaleuca, Acacia, Eremophila, Nuytsia and Grevillia. Within these, more than ten different Eucalyptus species have been sampled as well as multiple Banksia species. Further monofloral honeys are currently being collected so that a minimum of five honeys of each floral type have been collected. For the more common floral sources such as Jarrah (Eucalyptus marginata) and Marri (Corymbia calophylla) approximately 20 different honey samples of each have been obtained.

Testing is continuing for antimicrobial and anti-oxidant activity and physiochemical parameters including colour, hydrogen peroxide, moisture content, pH and total phenolics. Tests have also been conducted with several comparator honeys, including multi-floral or pasture type honeys, as well as several Manuka honeys with varying levels of MGO and antibacterial activity.
Objective 2

Increase productivity and profitability of beekeepers

Increasing the value of Australian honey as a health food

The specific R&D objectives are:

1. To perform a pilot human clinical study investigating the effect of daily honey consumption on the composition of gut microbes in patients suffering with gut-related conditions. This will determine whether the laboratory results are translatable, and will increase the acceptance of honey as an effective prebiotic. There may also be commercialisation potential for a new prebiotic honey product as a treatment for gut-related diseases, complementing the prophylactic product (for healthy people) currently on the market. The overall reputation, profile and price of Australian honey as a natural product for health care and medicine will also be enhanced.

2. To identify honeys for screening, focusing on predominant floral varieties from each state that do not currently demand premium market prices. Consideration will be given to identifying and focusing on the top eucalypts by volume of honey production. We will aim to source two floral varieties from each state (QLD, NSW, VIC, TAS, SA and WA), screening ~12 eucalypt-derived honeys in total. The honey samples will be “digested” to simulate passage through the digestive tract, using a method that Cokcetin developed during her PhD. This involves pre-treatment with digestive enzymes (amylase, pepsin, pancreatin and bile salts) to mimic the upper gastrointestinal tract (including the mouth and stomach), followed by dialysis to remove the simple sugars (fructose and glucose) that would normally be absorbed in the small intestine. The remaining complex sugars will be tested for their prebiotic activity. A commercially available prebiotic sugar (inulin, currently the ‘gold standard’ prebiotic) will also be included as a control in the in vitro model screen. Honey samples will be stored in airtight containers in the dark at 4°C for the duration of the study.

Honey Section

We will liaise closely with beekeeping industry experts to identify honeys for screening, focusing on predominant floral varieties from each state that do not currently demand premium market prices. Consideration will be given to identifying and focusing on the top eucalypts by volume of honey production. We will aim to source two floral varieties from each state (QLD, NSW, VIC, TAS, SA and WA), screening ~12 eucalypt-derived honeys in total. The honey samples will be ‘digested’ to simulate passage through the digestive tract, using a method that Cokcetin developed during her PhD. This involves pre-treatment with digestive enzymes (amylase, pepsin, pancreatin and bile salts) to mimic the upper gastrointestinal tract (including the mouth and stomach), followed by dialysis to remove the simple sugars (fructose and glucose) that would normally be absorbed in the small intestine. The remaining complex sugars will be tested for their prebiotic activity. A commercially available prebiotic sugar (inulin, currently the ‘gold standard’ prebiotic) will also be included as a control in the in vitro model screen. Honey samples will be stored in airtight containers in the dark at 4°C for the duration of the study.

In vitro gut model (objective 1):

Honey prebiotic activity will be investigated using in vitro microcosms modelling the human gut, via a previously used assay (PRJ-000041) that Cokcetin further developed during her PhD. Microcosms will be established using stool samples (providing the numerous and complex gut bacteria) from patients with a gut-related disease(s), e.g. irritable bowel syndrome. We have an established relationship with a clinical gut specialist, who will advise on gut diseases and help to source patient samples. Once a suitable gut condition to test in the screen has been identified, we will source stool samples for the in vitro screen from at least four patients with the identified condition for the screen. All microcosm experiments will be conducted under anaerobic conditions, to mimic the lower gut conditions. The change in numbers and types of bacteria in the microcosms following honey or inulin treatment will be monitored using DNA sequencing. DNA will be extracted from the microcosms using extraction kits, and analysed using a 16S-DNA-sequencing approach (MiSeq, Illumina) available on site at UTS. The function of the microbes in the microcosm will be investigated by monitoring the production of the beneficial short chain fatty acids (SCFA). We will focus predominantly on the three SCFA, namely acetic acid, propionic acid, and butyric acid, which have known health benefits to the host such as having a protective role against the development of numerous bowel diseases (including colon cancer). SCFA production will be monitored using standard methods, and analysed with a gas chromatography-mass spectrometry (GC-MS) unit fitted with a volatile fatty acid column. Cokcetin has previous experience with this method, and GC-MS facilities are available on site at UTS.

Summary

This project will provide high quality scientific evidence for the health benefits of Australian honey’s natural, safe and affordable products to promote or restore a healthy gut. This will be done using clinical samples from patients with gut related complaints for in vitro investigations, followed by a pilot clinical study.

Research approach

For more information about this project visit agrifutures.com.au/honey-bee-pollination

Objective 2
Progress (to date)

Sampling and testing protocols has now been finalised, and are currently optimising these to ensure that we can obtain maximum usable data from the clinical trial samples. We aim to collect data showing how eating honey influences changes in the microbial populations, metabolites produced in the gut, changes in immune factors that are involved in the immune response and specifically, inflammation, and changes in the genes or proteins expressed in the epithelial barrier of the gut, which can be indicative of a ‘leaky’ gut, where the barrier is compromised or damaged. These factors will be key in helping to identify the most appropriate gut related conditions that can be targeted for treatment with honey.

We have identified cohorts who are suitable participants for our trial, and the recruitment process is underway. Participants will be asked to keep a brief diet diary, using a mobile phone app, which broadly measures the macros in the individual’s diet (e.g. grams of protein, fibre, carbohydrate, fat etc.), which may help with correlation analyses upon data collection. They will also be asked to record how they ate their daily dose of honey.

We have been liaising with other researchers specialising in analytical chemistry to investigate the ‘bioactive’ components in honey responsible for the prebiotic activity. Currently, we are working on establishing a new collaboration with a research group in New Zealand as well as internally at UTS, to identify what specific ingredients in honey may be contributing to the prebiotic and anti-inflammatory action of honey when it is eaten. We anticipate that the identification of these bioactive ingredients, particularly if they are beyond the oligosaccharide contents of the honeys, can provide an industry and commercialisation opportunity for a ‘new’ therapeutic honey measure.

Research approach (continued)

The prebiotic activity of the honeys will be assessed by how well the honeys: 1) promote the growth of the beneficial bacteria (bifidobacteria and lactobacilli), 2) reduce potentially harmful bacteria (clostridia and enterics), and 3) promote SCFA production. Honey treatments will be compared to a no treatment control (negative control), containing no honey or inulin in microcosms and an inulin treated control (positive control). The top two honey varieties with the highest prebiotic potential based on the in vitro screen will be selected for further testing in the pilot clinical study.

Pilot human clinical study (objective 2):

Upon identifying a promising disease and honey treatment combination(s) from Objective 1, we will recruit patients (~ 20) for a pilot clinical study, recording patient details including age, sex, dietary preferences, and honey and prebiotic or probiotic consumption prior to commencement. We will use a randomised, double-blind, cross-over design that Collett used during her PhD (PRJ-0059910, based on Wallace et al. (2010) BR J NUTR 103(7):1023). The study will run in phases, each of which will last for four weeks:

- **Phase 1:** Washout, honey excluded from diet.
- **Phase 2:** Daily consumption of 20g honey A (determined from above in vitro work).
- **Phase 3:** Washout, honey excluded from diet.
- **Phase 4:** Daily consumption of 20g honey B (determined from above in vitro work)

Stool samples will be collected at the end of each phase (total four per patient), and changes in the numbers and types of bacteria will be analysed using 16S DNA sequencing.

Phase 1 acts as the ‘baseline’ (i.e. a control) gut microbial profile to which the honey treatments will be compared for changes in the numbers and types of gut bacteria. Analysis of Phase 3 will help to determine if a potential change during honey treatment reverts to the baseline profile when the treatment is stopped. Phases 2 and 4 will illuminate the impact of honey on the gut microbes of individuals suffering from gut disease.
Objective 3

Understanding the role of flora in honey bee management

Strategies

Measure the extent of chemical residues in hives that have been used to pollinate canola and almonds.

Develop better understanding of the interaction between native flora/fauna and honey bees.

Communicate to policy makers research outcomes regarding the role of public forest flora to the beekeeping and pollination services industries.

Develop technologies and techniques for determining floral resource yields.

Invest in research to determine native flora flowering cycles.

Determine climate change impact on floral production and the beekeeping and pollination services industries.

Develop advice, based on research about pyrrolizidine alkaloids that could inform FSANZ as to the allowable level of pyrrolizidine alkaloids in food.

There is currently no direct investment under Objective 3.
Objective 4

Strategies

Invest in understanding the optimal deployment of hives for key crops to ensure effective pollination that delivers increased yield and productivity.

Support investigations into whether non-honey bee pollinators or artificial or mechanical techniques would deliver cost-effective pollination.

There is currently no investment under Objective 4 as the Research and Development for Profit Securing Pollination project is focused on this objective.

Understand the role of pollination in delivering more productive systems.
Objective 5

Promote extension, communication and capacity building.

Strategies

- Ensure honey bee and pollination program RD&E outputs are in a form that is suitable for internet delivery and association newsletters of state honey bee associations and industries reliant on honey bee pollination.
- Extend information about how to prepare hives that will deliver high quality pollination services.
- Extend information about how pollination services can deliver more productive systems.
- Support capacity building initiatives, such as increasing beekeeper leadership skills.
- Sponsor conferences at which researchers present the results of their Honey Bee and Pollination Program funded project, so as to increase adoption of RD&E project outputs.
- Fund travel that pursues the Program's objectives.
- Inform the public and policy makers about the Program's findings.
- Deliver a Honey Bee and Pollination Program Newsletter three times per year.
- Investigate collaborative funding opportunities with other industries and agencies, including Cooperative Research Centres, that are aligned with the aim and objectives of this plan and agricultural policies.

There is currently no investment under Objective 4 as the Research and Development for Profit Securing Pollination project is focused heavily in this area.
An economic evaluation of AgriFutures investment in the AgriFutures Honey Bee & Pollination Program (2015-2019)

**Objectives**

1. Inform industry, the community and Government about the net benefits derived from investment in AgriFutures Honey Bee & Pollination Program.
2. Support research, development and extension planning and decision making through detailing returns on investment from the previous Strategic Plan (2015-19).
3. Signal to researchers and collaborators how research projects and research performance are evaluated by AgriFutures Australia.
4. Ensure good governance and transparency in the administration and management of the AgriFutures Honey Bee & Pollination Program.

**Research approach**

The process used to select investments for this evaluation was in accord with the Impact Assessment Guidelines of the CRRDC (CRRDC, 2018), as well as the evaluation requirements of AgriFutures Australia. The process entails the definition of the population of projects in the program, a scanning process to identify projects with significant impact and an economic evaluation of the significant benefits compared with not only the costs of the projects that contributed to the benefits, but also the costs of all projects in the population.

AgriFutures Australia provided an original list of 35 projects for inclusion in the evaluation. Based on the terms of reference and previous impact assessments (e.g. Agritrends Research, 2018), 17 projects were selected for program evaluation.

The present value of benefits (PVB) and the present value of costs (PVC) were used to estimate investment criteria of net present value (NPV) and benefit cost ratio (BCR) at a discount rate of 5%. The PVB and PVC are the sums of the discounted streams of benefits and costs. The internal rate of return (IRR) was estimated from the annual net cash flows. The modified internal rate of return (MIRR) was estimated using a reinvestment rate of 5%. All costs and benefits were expressed in 2017-18 dollars (the most recently completed financial year) and discounted to 2017-18. Investment criteria were estimated for 0, 5, 10, 15, 20, 25 and 30 years from the year of the last research investment for the program. However, the 30 year benefit time frame was used in summary performance reporting and in all sensitivity analyses.

Cost for each project included the cash contributions of the program (including both AgriFutures Australia and industry investment), as well as any other resources sourced and included in the analysis and any additional costs (e.g. commercialisation and extension) required to achieve uptake were considered. A counterfactual was developed that recognised previous investment and the possibility of investment occurring outside the program and being supported by other funding parties (e.g. Australian Research Council, the CRC for Honey Bee Products) in the absence of AgriFutures Australia support.

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions. Sensitivity analyses were undertaken for discount rate.

Two analyses were carried out at the AgriFutures Honey Bee & Pollination Program level. The first analysis referred to projects where significant impacts were identified and valued. In the first instance the PVB was compared to the specific investment in the projects (a total of five projects) generating the benefits. This process was likely to estimate an upper bound set of investment criteria for the program investments as the analysis focused on the highest impact projects.

The second program level analysis refers to the same set of valued benefits from the five projects but compared them to the total investment in the program population (17 projects). As there are likely to be some positive benefits from the projects where impacts were not valued, the results from this second analysis are likely to represent a lower bound set of investment criteria for the program.

**Summary**

As part of its governance process, AgriFutures Australia requires an impact assessment of past investment in each Program’s Strategic Plan.

This project assessed the benefit cost ratio of 17 RD&E projects across the AgriFutures Honey Bee & Pollination Program. It took into account proposals, reports and results, as well as key publications and found an estimated $4+ return for every $1 invested by industry.

To view the final report visit agrifutures.com.au/honey-bee-pollination

**PRJ-011631**

**Committed** → 14/12/2018
**Completed** → 19/04/2019

**Principal Investigator:** Michael Clarke
**Organisation:** AgEconPlus Pty Ltd

**Key findings & implications**

Total funding for the five projects where impacts were valued totalled approximately $2.83 million (present value terms) and produced aggregate total expected benefits of $11.68 million (present value terms). This gave an estimated NPV of $8.85 million, a BCR of 4.1 to 1, an IRR of 15.9% and a MIRR of 6.7%.

When the benefits of the impacts valued were compared to the total investment in all 17 projects in the population, this lowered the investment criteria. Funding for all projects in the population totalled approximately $6.85 million (present value terms). When compared to the same value of benefits for the five projects ($11.68 million), the investment produced an estimated NPV of $4.83 million (present value terms), a BCR of 1.7 to 1, an IRR of 8.8% and a MIRR of 4.1%

It can be concluded, given the assumptions made, that the BCR for the investment in the AgriFutures Honey Bee & Pollination Program 2015-2019 lies somewhere between 1.7 and 4.1 to 1.

The result from the analysis show that industry, the community and Government is expected to derive net benefits from investment in the AgriFutures Honey Bee & Pollination Program 1 July 2015 to 31 December 2018 and these results are consistent with ABARES (2016) survey findings that revealed that the majority of beekeepers reported an increase in production of between 5% and 25% as a result of research for the five year period to 1 July 2015.
Jacqueline would like to run a small boutique queen rearing operation and learn new skills that would improve her ability to graft cells and raise queens. According to Jacqueline the workshop has given her the confidence to know that the work she is doing with my own bees is on the right path, and the new skills she has learnt as she takes her work as a small “queen rearer” to the next level.

“As a biologist, I see queen rearing as part of a big system where everything is connected and if something is manipulated correctly it will have a positive effect on other things, so every single part is fundamental. In fact, even the smallest detail is extremely important to the success and quality of any bee business. I gained some of those insights from this course and as a result I am better off for this,” said Jacqueline.

Women in Beekeeping Scholarship: 2018 Queen Rearing Workshop

**Recipient: Jacqueline Bourke**

Jacqueline would like to run a small boutique queen rearing operation and learn new skills that would improve her ability to graft cells and raise queens.

According to Jacqueline the workshop has given her the confidence to know that the work she is doing with my own bees is on the right path, and the new skills she has learnt as she takes her work as a small “queen rearer” to the next level.

“As a biologist, I see queen rearing as part of a big system where everything is connected and if something is manipulated correctly it will have a positive effect on other things, so every single part is fundamental. In fact, even the smallest detail is extremely important to the success and quality of any bee business. I gained some of those insights from this course and as a result I am better off for this,” said Jacqueline.

This scholarship recognised and celebrated the many women who have taken a significant role in beekeeping, education, and research playing a key role in the progress of the Australian beekeeping industry.

**Development of the AgriFutures Honey Bee and Pollination 2020-2025 Strategic Plan**

**Summary**

Behind every great hive is a great woman.

In November 2018, The Practical Beekeeper (Benedict Hughes) and Bee Scientifics (Jody Gerdts) delivered their fourth annual queen rearing workshop in Melbourne. As part of the workshop the annual Women in Beekeeping – Queen Rearing Scholarship for a female beekeeper to attend was supported by AgriFutures Honey Bee & Pollination Program. The successful candidate was Jacqueline Bourke from NSW.

This scholarship recognised and celebrated the many women who have taken a significant role in beekeeping, education, and research playing a key role in the progress of the Australian beekeeping industry.

For further information about this project and the Strategic Plan visit agrifutures.com.au/honey-bee-pollination
Honey bee management information for drought and fire affected areas

Summary

Summer may be officially over and whilst conditions have improved, beekeepers are being urged to continue to focus on the health of their hives. In difficult times, the fundamentals of managing water, nectar and pollen remain the same but in order for hives to remain healthy through adversity, extra vigilance may be required.

Water - Even as we leave summer behind, beekeepers are reminded that water is the most essential ingredient for a colony’s survival, particularly in weather beyond 35°C and beyond, with strong colonies consuming up to a litre per day. Ensure bees have access to a clean, fresh water source and that measures have been put in place to prevent bees drowning.

Nectar - Whether choosing to feed in-hive or externally, beekeepers should take measures to ensure the correct processes are adhered to in all conditions. If externally feeding it is important to prevent livestock from drinking syrup, as this can be fatal.

Pollen - Drought has a particularly big impact on fresh pollen available to colonies due to the elimination of flowering herbs, pasture and weeds. Colonies will continue to breed while nectar or syrup (1:1) is available in order stimulate the colony. Once fresh pollen stores are depleted, colonies will begin to consume stored pollen. Once these stocks run out, the population will decline.

It may be necessary to explore supplementary feeding which can be expensive but necessary to support populations when pollen is scarce. The fact sheet explains the correct process for supplementary feeding wether in-hive or in an open feeder.

Go West! AgriFutures Honey Bee & Pollination Advisory Panel heads to Western Australia

The Cooperative Research Centre for Honey Bee Products (CRC HBP) is looking forward to continued collaboration and cooperation with the AgriFutures Honey Bee & Pollination program, following a recent visit by the AgriFutures Australia Honey Bee & Pollination Advisory Panel, Liz Barbour, CEO, CRC HBP welcomed the AgriFutures Honey Bee & Pollination Program delegation to Western Australia in October and acknowledged the importance of communication.

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

One of the highlights of the meeting was the opportunity for 16 PhD students to present to AgriFutures Australia Honey Bee & Pollination Advisory Panel about their research projects; receive live feedback and be reassured that some of the outcomes they were striving towards were important for the industry and would have a tangible impact. Danny Le Feuvre, deputy chair, AgriFutures Honey Bee & Pollination Program Advisory Panel said the delegation was impressed and enthusiastic about the progress the PhD students had been making in their research projects.

“We learnt a great deal from the researcher presentations. It was incredibly uplifting to see how these research projects have evolved over time. These students are doing important work, and many of them did not grasp the gravity of their findings so it was quite rewarding to reassure them that they were making crucial discoveries. the CRC HBP and AgriFutures have a strong outcomes for entire industry.

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

Outside of the classroom, the AgriFutures Honey Bee & Pollination Program delegates took the opportunity to travel around Perth and meet with beekeepers and pollination service providers and provide updates on AgriFutures Honey Bee & Pollination Programs priorities and listen to some of the unique challenges and complexities of the Western Australian industry. There was also a tour of the state-of-the-art research facilities that the University of Western Australia has to offer. A walk around the research labs and a briefing on some of the work being undertaken around nanotechnology and complex analytical tools provided additional context to the research being done in Western Australia. Continuing to foster a close connection between the CRC HBP and AgriFutures Honey Bee & Pollination Program is a top priority for both organisations moving forward. According to Liz, working together will bring strong outcomes for entire industry.

Please refer to the full open source fact sheet developed by Dr Doug Somerville with support from the AgriFutures Honey Bee & Pollination Program and Australian Honey Bee Industry Council, the resource is available via agrifutures.com.au/honey-bee-pollination

“Go West! AgriFutures Honey Bee & Pollination Advisory Panel heads to Western Australia

The Cooperative Research Centre for Honey Bee Products (CRC HBP) is looking forward to continued collaboration and cooperation with the AgriFutures Honey Bee & Pollination program, following a recent visit by the AgriFutures Australia Honey Bee & Pollination Advisory Panel, Liz Barbour, CEO, CRC HBP welcomed the AgriFutures Honey Bee & Pollination Program delegation to Western Australia in October and acknowledged the importance of communication.

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

Outside of the classroom, the AgriFutures Honey Bee & Pollination Program delegates took the opportunity to travel around Perth and meet with beekeepers and pollination service providers and provide updates on AgriFutures Honey Bee & Pollination Programs priorities and listen to some of the unique challenges and complexities of the Western Australian industry. There was also a tour of the state-of-the-art research facilities that the University of Western Australia has to offer. A walk around the research labs and a briefing on some of the work being undertaken around nanotechnology and complex analytical tools provided additional context to the research being done in Western Australia. Continuing to foster a close connection between the CRC HBP and AgriFutures Honey Bee & Pollination Program is a top priority for both organisations moving forward. According to Liz, working together will bring strong outcomes for entire industry.

Please refer to the full open source fact sheet developed by Dr Doug Somerville with support from the AgriFutures Honey Bee & Pollination Program and Australian Honey Bee Industry Council, the resource is available via agrifutures.com.au/honey-bee-pollination

“Go West! AgriFutures Honey Bee & Pollination Advisory Panel heads to Western Australia

The Cooperative Research Centre for Honey Bee Products (CRC HBP) is looking forward to continued collaboration and cooperation with the AgriFutures Honey Bee & Pollination program, following a recent visit by the AgriFutures Australia Honey Bee & Pollination Advisory Panel, Liz Barbour, CEO, CRC HBP welcomed the AgriFutures Honey Bee & Pollination Program delegation to Western Australia in October and acknowledged the importance of communication.

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

Outside of the classroom, the AgriFutures Honey Bee & Pollination Program delegates took the opportunity to travel around Perth and meet with beekeepers and pollination service providers and provide updates on AgriFutures Honey Bee & Pollination Programs priorities and listen to some of the unique challenges and complexities of the Western Australian industry. There was also a tour of the state-of-the-art research facilities that the University of Western Australia has to offer. A walk around the research labs and a briefing on some of the work being undertaken around nanotechnology and complex analytical tools provided additional context to the research being done in Western Australia. Continuing to foster a close connection between the CRC HBP and AgriFutures Honey Bee & Pollination Program is a top priority for both organisations moving forward. According to Liz, working together will bring strong outcomes for entire industry.

Please refer to the full open source fact sheet developed by Dr Doug Somerville with support from the AgriFutures Honey Bee & Pollination Program and Australian Honey Bee Industry Council, the resource is available via agrifutures.com.au/honey-bee-pollination

“Go West! AgriFutures Honey Bee & Pollination Advisory Panel heads to Western Australia

The Cooperative Research Centre for Honey Bee Products (CRC HBP) is looking forward to continued collaboration and cooperation with the AgriFutures Honey Bee & Pollination program, following a recent visit by the AgriFutures Australia Honey Bee & Pollination Advisory Panel, Liz Barbour, CEO, CRC HBP welcomed the AgriFutures Honey Bee & Pollination Program delegation to Western Australia in October and acknowledged the importance of communication.

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

Outside of the classroom, the AgriFutures Honey Bee & Pollination Program delegates took the opportunity to travel around Perth and meet with beekeepers and pollination service providers and provide updates on AgriFutures Honey Bee & Pollination Programs priorities and listen to some of the unique challenges and complexities of the Western Australian industry. There was also a tour of the state-of-the-art research facilities that the University of Western Australia has to offer. A walk around the research labs and a briefing on some of the work being undertaken around nanotechnology and complex analytical tools provided additional context to the research being done in Western Australia. Continuing to foster a close connection between the CRC HBP and AgriFutures Honey Bee & Pollination Program is a top priority for both organisations moving forward. According to Liz, working together will bring strong outcomes for entire industry.

Please refer to the full open source fact sheet developed by Dr Doug Somerville with support from the AgriFutures Honey Bee & Pollination Program and Australian Honey Bee Industry Council, the resource is available via agrifutures.com.au/honey-bee-pollination

“Go West! AgriFutures Honey Bee & Pollination Advisory Panel heads to Western Australia

The Cooperative Research Centre for Honey Bee Products (CRC HBP) is looking forward to continued collaboration and cooperation with the AgriFutures Honey Bee & Pollination program, following a recent visit by the AgriFutures Australia Honey Bee & Pollination Advisory Panel, Liz Barbour, CEO, CRC HBP welcomed the AgriFutures Honey Bee & Pollination Program delegation to Western Australia in October and acknowledged the importance of communication.

“Resources devoted to research in the honey bee and pollination industry can be scarce, so it’s imperative that the work of the CRC HBP and AgriFutures Honey Bee & Pollination Program is complementary and we’re not overlapping. This visit was a great opportunity for us to share research progress and align on important research outcomes.”

Outside of the classroom, the AgriFutures Honey Bee & Pollination Program delegates took the opportunity to travel around Perth and meet with beekeepers and pollination service providers and provide updates on AgriFutures Honey Bee & Pollination Programs priorities and listen to some of the unique challenges and complexities of the Western Australian industry. There was also a tour of the state-of-the-art research facilities that the University of Western Australia has to offer. A walk around the research labs and a briefing on some of the work being undertaken around nanotechnology and complex analytical tools provided additional context to the research being done in Western Australia. Continuing to foster a close connection between the CRC HBP and AgriFutures Honey Bee & Pollination Program is a top priority for both organisations moving forward. According to Liz, working together will bring strong outcomes for entire industry.

Please refer to the full open source fact sheet developed by Dr Doug Somerville with support from the AgriFutures Honey Bee & Pollination Program and Australian Honey Bee Industry Council, the resource is available via agrifutures.com.au/honey-bee-pollination
Pollination remains a critical factor for the agriculture plays in supporting food production, could not have been more timely for the industry and the program. The Australian honey bee industry has welcomed a $1.5 million grant from the Australian Government Department of Agriculture, Water and the Environment to AgriFutures Australia raise awareness and ensure bee health and longevity.

According to AgriFutures Honey Bee & Pollination Advisory Panel Chair, Dr Doug Somerville the grant, dedicated to promoting the crucial role the humble bee plays in supporting food production, could not have been more timely for the industry and the program.

"The fires in northern NSW and South East Queensland have destroyed many of our established areas of floral resources, both heath land and forest, and the grant among other priority areas will help vital research, development and extension (RD&E) to better understand floral resource management and the effects different approaches has on bees," said Dr Somerville.

"We've heard of some lucky escapes from our bee keepers and their hives so we are relieved our bee keepers are safe. The most critical issue for us is the loss of floral resources which may take many decades to recover."

While we enjoy the honey of the 12,000 registered Australia beekeepers and their half a million hives there is a lot more to the industry the role of the humble bee in agriculture and horticulture should not be underestimated. The annual economic value of honey bee pollination in Australia is $14.2 billion. In addition honey and beeswax generate about $45 million a year in farm gate value.

Pollination remains a critical factor for the agriculture industry if we were to reach our shared goal of $100 billion by 2030. It is essential for staples like apples and pears, cherries, berries, almonds and canola—that's why we need to maintain the health of our bees and reduce risks to their population. AgriFutures Australia is committed to working with industry to deliver the research and development outcomes that meet Australia’s needs.

The report found that specific chemical components relating to antibacterial activity of several Australian Leptospermum honeys was similar to that of its Manuka counterpart in New Zealand.

For more about AgriFutures Honey Bee & Pollination Program and this grant visit agrifutures.com.au/honey-bee-pollination

“ We learnt a great deal from the researcher presentations. It was incredibly uplifting to see how these research projects have evolved over time.”

The grant will also assist RD&E to enable early identification of bee and hive health problems with non-obtrusive methods, improve bee health and support the identification of floral resources to address dependence on public lands.

Australia has at least seven Leptospermum species that produce honey with exceptionally high levels of antibacterial activity, providing the scientific basis to facilitate the entry of Australian honey producers into premium medicinal markets. That's research led by University of Technology Sydney Professor Liz Harry, in conjunction with researchers from the University of Sydney and University of the Sunshine Coast.

Funded by the AgriFutures Honey Bee & Pollination Program, Professor Harry, Director of the UTS three institute, and the collaborative research team tested more than 5000 honey samples and 200 nectar samples, covering more than 50 species of Leptospermum. Praised for its antibacterial and healing properties, medical-grade honey sourced from Leptospermum plants has become a modern treatment for wounds and skin infections.

The study found at least seven Australian Leptospermum species produced medical-grade honey with exceptionally high antibacterial activity and many other Leptospermum species that produced honeys with therapeutically beneficial activity, as well as others that would fall under high-value premium table honeys. University of Technology Sydney Research Associate Dr Nural Cokcetin said the research pinpointed several Australian regions, such as south-east Queensland, northern New South Wales and western Tasmania, as ‘hot spots’ to yield these high value honeys.

“Australia has 84 of the 87 species of Leptospermum. Yet before this study, the antimicrobial activity of our Leptospermum species was almost unknown, both locally and globally,” said Dr Cokcetin.

“The research puts Australian honey producers on the world stage, positioning them as a leading and potentially abundant source of medical grade and high-value Leptospermum honey.”

It also discovered that appropriate storage conditions of Australian Leptospermum honey was vital to reach its full potential, and outlined key differences between anti-fungal and antibacterial traits.

AgriFutures Honey Bee & Pollination Manager, Research Annelies McGaw said the latest research was an important step in enhancing the worth and profitability of Australian honey.

"The research provides scientific evidence to support marketing claims that enable Australian honey producers to gain access to premium therapeutic-based markets," said Ms McGaw.

"Its findings are an important tool to help build the sustainability of Australia’s beekeeping industry. It also presents a stimulus for diversification of commercial honey production in Australia."

Ms McGaw said the research team had communicated findings extensively and generated significant interest from members in the beekeeping industry, as well as in scientific and medical fields.

"The report shows that Australian honey could play a pivotal role in the clinical prevention and management of health conditions, such as skin and wound infections," said Ms McGaw.

"More broadly, it provides key recommendations to further advance the value of Australian honey and make it easier for beekeepers, consumers and the medical community to understand its importance."

To access the report, visit agrifutures.com.au/ publications. For more information about the project visit ozhoneyproject.wordpress.com

For more details about Australian honey abuzz with high-value antibacterial activity, see the report, “High-Value Antibacterial Activity in Australian Honey.”

News highlights
Health Bees: A gut feeling Probiotics could be the secret to improving the health of the honey bee

It’s not easy, being a bee. The crucial task of pollination rests heavily on their tiny thoraces. Of the 110 crop species that feed 90 per cent of the world, 70 are pollinated by honey bees. In Australia alone, more than 65 per cent of both horticultural and agricultural crops depend on honey bees — so anything that threatens bees also casts a worrying shadow over the country’s food production.

At the same time, there’s a host of pests and diseases that have bees firmly in their sights — these range from chalkbrood, a fungus that mummifies bee larvae with a cottony, chalk-white covering, to the fat-sucking Varroa mite, an important vector for bee viruses. Varroa mites can decimate entire bee populations; this mite is one of the main reasons for the decline of the honey bee population overseas. Microbiologist Dr Murali Nayudu is a Research Associate and Adjunct Associate Professor with the University of Canberra’s Faculty of Science and Technology and says colony collapse disorder (CCD) is another concern. "[It’s] a phenomenon in which the majority of a colony’s worker bees mysteriously leave, abandoning queen, nurse bees and larvae," he says.

So far, Australian honey bees have enjoyed good fortune when it comes to both the Varroa mite and CCD due to the diligence of the bee industry.

"This is the only country in the world where bees remain safe from the Varroa mite, and we are so far unaffected by CCD," Murali says. "With globalisation, and increasing travel and trade, who knows how long this will last?"

The government currently has sentinel hives in place near major ports, such as Port Kembla - these form the first line of defence to alert the industry if Varroa mites reach our shores.

"Currently, when you get disease signs in a colony, the disease is already entrenched," Murali says. "So, we need a way to assess colony health early. Eles from colonies infested with chalkbrood have far fewer bacteria than bees from healthy colonies."

"We want to build on the idea that bacteria numbers can help to diagnose a disease before other signs of the disease can be detected. If bacterial numbers drop, that could indicate the presence of a pathogen and herald the outbreak of a disease."

In this context, monitoring colony health and developing new diagnostic markers for bee diseases is important.

Funded by AgriFutures Australia, the project has Murali working in collaboration with the University’s Associate Professor Dr Michael Frese. This project is only possible through the practical support in providing bee hives and practical knowledge provided by Honey Bees Technical Specialist, from the NSW Department of Primary Industries, Dr Doug Somerville.

Chalkbrood is the focus of the project because it is the major disease affecting honey bees in Australia, says Michael. The project looks at the role probiotics can play in maintaining colonies, using native Australian bee gut bacteria to help them to resist and recover from chalkbrood. Results have been extremely encouraging — and as a bonus, the use of probiotics is a natural solution that won’t affect honey production or quality. "Australian honey is one of the most natural in the world," Michael says. "Our honey is largely free of antibiotics. Tetracycline is the only chemical allowed to be used to fight bacterial infections and it can only be used with veterinary approval. For this reason, we are now searching for a non-chemical method to control chalkbrood disease, keeping with the ‘clean green’ nature of Australian honey."

The University’s honey bee group has isolated bee gut bacteria that can inhibit the chalkbrood fungus and is using this to develop probiotics for bees. The researchers currently characterise a number of different bacterial strains to determine which bacteria are most suited for an effective probiotic treatment.

"The probiotic bacteria kill the chalkbrood fungus by releasing compounds that dissolve the walls of the hyphae," Murali says. The process takes about eight to 10 days.

"Because of the complexity of the mechanism — more than one factor leads to the destruction of the hyphae — there is comparatively less likelihood of the fungus becoming resistant to a treatment with probiotics," Murali says. Bees in the study are fed a sugar solution. This helps the bees to keep their metabolic rates up, which further aids in the recovery of chalkbrood infected colonies.

"They can only do all this if they are active, which is why it’s important to keep their metabolic rates up," Michael says. The group is currently testing feeding bees a sugar solution that is laced with probiotic bacteria; using the ability of the bacteria to inhibit the chalkbrood pathogen. While finding a treatment was important, Murali thinks the project’s greater value lies in the fact that its findings may also help to maintain bee health.

"We want to use the probiotics developed as a prophylactic as well," he says.

For the original story, please visit canberra.edu.au/uncover/magazine
Propolis Production: A Potential Boon for the Australian Beekeeping Industry

Australian beekeepers could earn an extra $1,400 a year by incorporating propolis production into their annual honey harvest, according to a new report commissioned by AgriFutures Australia.

Propolis is a resinous mixture that honey bees produce from saliva, beeswax and the exude of tree buds, sap flows and other botanical sources. While considered a by-product of bees, its powerful medicinal properties have been increasingly recognised in recent years.

In his report, Mr Clarke looks to New Zealand as a valuable model for which to create a thriving propolis industry in Australia. He also highlights the growing interest from companies in sourcing Australian produced propolis and a pathway for Australian beekeepers to enter the market.

About propolis

Propolis is a resinous mixture used by honey bees as both a sterilising agent and a sealant for unwanted open spaces in a hive. It can be harvested by scraping hive components such as supers and frames; however, the most effective method is when a plastic mat is inserted above the hive’s top super and underneath the lid.

Raw propolis sourced directly from the hive can be further refined and concentrated into smaller volumes, thereby increasing any medicinal benefits. Refinement is not difficult, but is usually part of an established manufacturing process that requires scale, appropriate equipment and technical knowledge.

Refrined propolis is made into a range of consumer products, such as tablets, tinctures, lozenges, toothpaste and soap. While the medicinal qualities of propolis are well researched, new studies have shown the substance to be an effective antimicrobial that may be useful in the treatment of skin cancers.

Status of propolis production in New Zealand

New Zealand has a lucrative and expanding propolis industry with the majority sourced from poplar, willow and birch trees. The nation produces around 30 tonnes of raw propolis every year and has two key propolis processors.

Raw propolis supply has proven beneficial for New Zealand beekeepers, even for those with small apiaries. On average, a New Zealand hive produces 200 grams of raw propolis every year and beekeepers receive between $NZ54 and $NZ187/kg for this product.

Propolis harvest is becoming increasingly popular for New Zealand beekeepers, given that:

- Production can be incorporated with existing activities and completed during honey harvest
- There is no loss of honey or pollination fee income from the addition of propolis mats
- Limited labour is required, especially if unscraped mats are supplied to the processor
- Capital outlay is limited, mats may be provided by the processor and can be stored in cool room/freezer
- Processors pay on recovered yield and will purchase raw propolis with as little as 15% pure propolis
- High prices are achieved for raw propolis with an upward trend in price of the product.

Status of propolis production in Australia

There is only a handful of beekeepers that currently harvest propolis in Australia. The actual propolis yield in Australia varies and depends on location and hive specifics. That said, a number of its regions have high production levels similar to that of colder countries like New Zealand.

More research on the chemistry of Australian propolis needs to be undertaken, but early studies show that it may have additional unique and potentially useful properties. While there has been an absence of consistent buyers, the tide is starting to turn with businesses looking to join the supply chain.

Market opportunities for Australian produced propolis

The market opportunity for propolis production in Australia, which includes re-export of consumer products to Asia, is expected to grow 10% per annum to 2020. Australia imports up to 80 tonnes of pure propolis every year, which could be partially offset by future propolis production in Australia.

To realise this opportunity beekeepers might partner with one of several companies with an interest in raw Australian propolis, including:

- Honey packers
- An established processor looking for additional supply
- A New Zealand processor exploring opportunities to set up in Australia
- A buyer of imported pure propolis

The full report provides a list of current and potential buyers of raw propolis from Australian beekeepers.

For the Australian industry to be profitable, it will need to achieve price premiums of between 200% and 300%. The report suggests that if the product is well marketed and builds on Australia’s clean, green image, these large premiums can be achieved.

Benefits for Australian beekeepers

Propolis harvest is moderately profitable and especially useful for smaller operators, who can incorporate the process into their usual honey bee harvest at particular times of the year.

Using best estimate assumptions, raw propolis production in a 100-hive enterprise can add $800 a year to net revenue if external labour is used and $1,400 a year if the owner’s labour is used. Additionally, Australian beekeepers will see greater outcomes should the processor provide a New Zealand style mat pick up and extraction service.

Next steps for beekeepers with an interest in propolis production

For beekeepers interested in propolis production, the report recommends Australian beekeepers to:

- Buy a small number of mats and trial them for at least a year
- Weigh propolis recovered from mats and the scraping method separately – some potential buyers have indicated that they are only interested in propolis recovered from mats.
- Keep a record of the time required to crack mats and scrape hive material to decide on level of labour needed for your business.
- Follow up with potential buyers, such as major honey packers, propolis importers, processors and consumer product manufacturers, to determine willingness to purchase, standards etc.
- Rework guide budgets provided in the report to determine whether propolis harvest is economically viable for the business.

The full report ‘Market and Production Potential for Australian Produced Propolis’ can be accessed at agrifutures.com.au/propolis
To build prosperous and sustainable rural industries, we need rural leaders with the skills and knowledge to make informed decisions about the future of their enterprises and industries. We know that skilled leadership is one of the most crucial elements in the health and prosperity of any rural industry. That’s why we continue to invest in leadership, capacity building, and skills development programs including the startup. business, Rural Women’s Award, Horizon Scholarship, Ignite Network, and our Levied Industries Capacity Building Program.

We believe that human capacity to drive improvements in competitiveness through the adoption of R&D outcomes and innovation is just as important as the research itself. While new technologies, systems, processes, and business models are important, people are the critical element in ensuring the growth of Australian rural industries.

Our goal is to support the people driving the future prosperity of Australian rural industries and regional communities by providing them with learning opportunities and experiences. The honey bee and pollination industry was well represented in AgriFutures People & Leadership Programs in 2019. The Rural Women’s Award and the Horizon Scholarship program acknowledged bright, young beekeeping entrepreneurs excelling in the industry and agricultural sector. The determination, motivation, and skills of these individuals is to be admired, and is a strong reflection of the Australian honey bee and pollination industry at large. For more information about these programs and opportunities visit agrifutures.com.au/people-leadership.

The AgriFutures Rural Women’s Award is Australia’s leading award to recognise, celebrate and acknowledge exceptional rural women. Over the past two decades, the Rural Women’s Award has provided 293 women from a range of industries with the opportunity to achieve positive change for rural and regional Australia through diverse and innovative projects relating to primary industries.

The Award provides a platform to inspire and support Australian women to use their talents and abilities to benefit their industries and communities, and award recipients become part of a strong Alumni, that together, shape the perception of women in regional and rural Australia, and provides a significant network to support their future endeavours. Each state and territory winner receives a $10,000 bursary for innovative ideas and projects, access to professional development opportunities, and alumni networks. AgriFutures Australia is committed to the future growth and advancement of the Award as a means of identifying, celebrating, and empowering women. The Rural Women’s Award is one of many AgriFutures Australia initiatives ensuring our rural industries prosper now, and into the future.

In 2019 New South Wales remote work advocate, Jo Palmer, founder of Pointer Remote Roles, was named the AgriFutures Rural Women’s Award National Winner, with Victorian beekeeper Claire Moore named National Runner Up and Queensland beekeeper Natasha Roebig awarded Queensland’s Rural Women’s Award Winner.

Lear more about Claire Moore and Natasha Roebig on pages 68-71 and visit agrifutures.com.au for more on past winners and who should apply.
Claire Moore

2019 Victorian Winner and National Runner Up

Always fascinated by queen breeding, Claire decided early on she would prefer to be a queen breeder than a beekeeper for honey. Claire met her partner Paul while volunteering making sandwiches for homeless people in inner city Melbourne.

Removing barriers to beekeeping

Life has been hectic for Victorian Mum and businesswoman Claire Moore since she was announced the AgriFutures Rural Women’s Award National Runner-Up in a glittering ceremony in Canberra on Wednesday 11 September 2019. Returning to Victoria with a new determination following the awards ceremony, Claire admitted she was honoured to be named National Runner-Up which has also led to some new fears being faced.

“Growing up in a small town near the Great Ocean Road called Bellbrae and attending Geelong College later moving to Melbourne where I was working for closed its doors in Australia and that’s when she moved into bees full time. But it’s not been all smooth sailing. Claire’s Mother died of cancer in mid-2016 and in September 2016 Paul developed epilepsy and had a tough time finding the right medication and spent the next eighteen months controlling his seizures. It was during this time, Claire lived a double life, working in an office during the day while at night attending beekeeping clubs to learn more from commercial beekeepers. She would see her work mate’s eyes glaze over when she spoke about bees and the mailroom politely asked if she could have her queen bees posted “elsewhere” when her hives needed re-queening.

Always fascinated by queen breeding, Claire decided early on she would prefer to be a queen breeder than a beekeeper for honey. Claire met her partner Paul while volunteering making sandwiches for homeless people in inner city Melbourne. Paul is a horticulturalist and is always in the backyard. Claire purchased her first hive (which she still has) in 2007. Naively, she brought the hive home in the back of a two door hatchback with bees escaping while driving down the Eastern Highway! Claire and Paul have always been passionate about sustainability and they converted their backyard into a massive veggie patch with fruit trees, bees and chickens. Their backyard has been featured in newspapers and on television many times as a model of suburban sustainability.

When their first child Hugh was born in 2011 the couple purchased ten acres in Kyneton. Claire wanted to be a full time keeper and Paul was tired of inner city traffic going from garden to garden. In 2013-14 they designed and built a sustainable house that was a finalist in the UN World Environment Day Green Build Awards on their ten acres and moved to Kyneton permanently. They’ve also had two more children, Freya in 2014 and Will in 2016. The couple started a pastured egg business and now run 1200 hens (they were lucky enough to be the first farm in Victoria to obtain a low density pastures poultry permit) and they attend farmers markets nearly every weekend.

The business is going fabulously, but the passing of Claire’s Mother at 68 has reinforced the old adage of how short life really is. Chatting in the palliative care ward, Claire’s Mother told her, “I don’t have time for cancer, I still have so much to do”. That’s when Claire decided she had to get going on her beekeeping and queen breeding dreams and to apply for the AgriFutures Rural Woman’s Award. I am very thankful I applied for the AgriFutures Rural Woman’s Award which has enriched my life in so many ways. I am now working on increasing my hive numbers, rearing queens and running my first event in The Good Life Farm Co Hive Share program,” said Claire.

“I was nervous about teaching but I’ve ended up really enjoying it and I’m enjoying it so much I have started a qualification in ‘Training and Assessment.’”

Adding: “At times I’ve found the process frustrating as I’m my harshest critic and a perfectionist to boot so I have had to stop being so hard on myself.”

“I have achieved a lot in less than 8 months and now I would like to take stock of what I’ve learnt, increase my hives and work for a larger Commercial Beekeeper for practical experience before applying for the Artificial Insemination Program.”

Claire has also applied for funding for a Beekeeping and farming program on her farm which will increase jobs in her home town including NDIS jobs which if she can get it across the line will be a huge win for the local economy.
Natasha Roebig

2019 Queensland Rural Women’s Award Winner

Winning the 2019 Queensland AgriFutures Rural Women’s Award has given Natasha Roebig an even greater opportunity to pursue her passion for providing education about sustainable beekeeping and raising awareness about ethical apiculture practices. Natasha’s latest focus is on developing interactive resources for schools that will give students a ‘bee’s eye view’ of the hive system using technologies like virtual reality and augmented reality.

“We want to encourage young people, women and families to enter our industry and learn sustainable beekeeping trade skills.”

Natasha is the Co-Founder and Owner of Bee All Natural, a multi-award winning bee conservation business that produces raw honey, infused honey and innovative products using native bush foods, repurposed fruit and ethically sourced spices to create creamed honey.

The business is based in Jimboomba, in South East Queensland, and includes an interactive training facility that promotes innovative research and ethical beekeeping practices. Natasha said, “We want the art of beekeeping to go on, not die out. We want to be able to use the traditional techniques our mentor beekeepers know alongside smart farming practices so the industry can continue and thrive.

“It’s really important to us that we provide a safe learning environment where this knowledge can be shared. We want beekeeping to be an industry that all cultures and people from any background can come into and learn about. Making beekeeping a real family experience is one of our goals.”

The training facility at Jimboomba run by Bee All Natural includes state of the art classroom and Agricultural College (ATAC). Through this connection there is now an education platform to teach people about sustainable beekeeping. Natasha said, “We're becoming a credible source for relevant regulatory updates and we work closely with Queensland and Australian biosecurity agencies as well as AgriFutures to help ensure all beekeepers are well informed and on board with securing our future.

“Beekeeping is a primary industry and if there are happy and healthy bees then the environment gets the pollination it needs, which helps agricultural industries of all kinds.”

Natasha explained, “At the moment it’s hard for backyard beekeepers to get the right information about setting up and managing their hives, and the information they can find is often conflicting and confusing which poses a real risk to commercial honey production and pollination.”

It was this difficulty finding reliable information when Natasha and her husband Jason started their own beekeeping journey, that inspired them to start an inclusive training facility. What started as a hobby to help manage their daughter Miranda’s eczema has turned into a successful business with a number of products and hives located across South East Queensland and Northern New South Wales. Natasha said, “On advice from our doctor and naturopath we wanted to try raw honey and beeswax as a treatment for Miranda’s eczema and so we stumbled into the world of honey and bees in 2013.”

“We struggled at that time to find someone to help us learn how to keep bees and so we recognised that there’s a real need for structured education and a framework to help people learn about beekeeping,”

Over the past few years as they have been impacted by drought Natasha and Jason have had to reduce their hive numbers and have used the time as an opportunity to upscale the education aspect of the business.

“We’ve been maintaining 150 hives, down from a peak of 300, for disease biosecurity but we haven’t harvested any honey in the last year,” Natasha said.

“Through the Rural Women’s Award I’ve been able to connect with other industries and now our education focus goes beyond in person training and now we’re working on developing some augmented reality (AR) and virtual reality (VR) programs so we can introduce beekeeping into schools.”

“We aim to remove learning barriers and provide students with equal learning opportunities. We want students to be able to experience life as a bee, learn about the hives and explore their way through it, all from the comfort of their classrooms across Australia.”

“This kind of technology development is an expensive enterprise though so we’ve only been in the early stages.”

Natasha said winning the Queensland Rural Women’s Award in 2019 put their business and their training facility on a big public platform. “It’s allowed us to team up with other industries, learn from them the tools for expanding our education program and taught us how to work more effectively with communities and different levels of governments.”

“With the award bursary, the investment from Westpac, we’ve been able to improve our website for marketing, procure tools and equipment, and most importantly education.”

For Natasha and Jason, developing the training facility was just the first step. She says, “It’s time to establish a real platform for education about ethical and sustainable beekeeping.”

“Innovation and education are how we will secure the future of this industry. So many people now know that bees are essential to pollination and helping to grow our fruit and vegetables, and if people are keen to get involved there should be no barriers to beekeeping.”

Natasha said, “An education program for backyard beekeeping should be a priority for Australia’s biosecurity agencies. “

“We’ll keep providing inclusive training at our facility and work on developing education programs for youth and the community so even more people can learn about our amazing honey bees and sustainable beekeeping.”
Australian rural industries are faced with challenges and opportunities that are both industry-specific and common across rural sectors. Beyond the commodity level, rural industries require leadership to identify and respond to national rural issues and enhance shared benefits.

Unlike other Rural Research and Development Corporations, that represent one or a few similar industries, AgriFutures Australia manages research, development and extension (RD&E) for a diverse portfolio of plant and animal industries, and is uniquely placed to assist Australian rural industries to prioritise and drive cross-sectoral RD&E. AgriFutures Australia brokers partnerships, facilitate priority setting and provide advice to strengthen the national agricultural research and innovation effort and complements individual industry RD&E by investing in research of cross-sectoral value, in areas such as climate change, natural resource management, and safety and welfare. These Programs include (but are not limited to):

- evokeAG
- National Rural Issues
- Emerging technologies
- ExtensionAUS

Nationally coordinated initiatives including: The Climate Research Strategy for Primary Industries (CRSPI), Rural Health and Safety Alliance (RSHA), Biocontrol of Weeds, Securing Pollination, Plan Bee, Q Fever, Australian Biomass and Bioenergy Assessment.

Goal: To identify and nurture research and innovation opportunities that are synergistic across rural sectors.

The honey bee and pollination industry is well represented by AgriFutures Australia’s investment in Arena 2. There is currently an ExtensionAUS platform, “Professional Beekeepers’ (managed by NSW DPI), which showcases the exciting work being done in the field, as well as the Rural Research and Development for Profit program Securing Pollination. These are all collaborative programs to promote the honey bee and pollination industry. For more information about these programs visit agrifutures.com.au

Rural R&D for Profit program

Australian agriculture and horticulture relies on pollination from honey bees. It’s estimated that 65 per cent of horticultural and agricultural crops produced in Australia require pollination services. Some of the most important questions and concerns currently facing pollination dependent industries will be answered in an Australian first, multi million dollar research project.

AgriFutures Australia has been awarded a grant through the second round of the Australian Government’s Rural R&D for Profit Programme to deliver the project called Securing Pollination for More Productive Agriculture: Guidelines for effective pollinator management and stakeholder adoption. This project will support collaboration between Australia’s most knowledgeable bee and pollination researchers to assess the contribution of pollinators to nine Australian crops (apples pears, lucerne, almonds, canola, melons, blueberries, raspberries and mangoes), investigate reestablishing native vegetation to support pollinator food and nesting resources, and use new technologies to communicate the findings to farmers.

Developing strategies to enhance productivity and profitability, the project will provide detailed scientific information on pollinator effectiveness and densities, bee movements, and pollination distances. The assessment of pollinator habitats, particularly foraging and nesting plants, will also assist in developing strategies against the Varroa mite.
AgriFutures Honey Bee & Pollination Program

Australian agriculture and horticulture relies on pollination from honey bees. It’s estimated that 65% of horticultural and agricultural crops produced in Australia require pollination services. Some of the most important questions and concerns currently facing pollination dependent industries will be answered in an Australian first, multi million dollar research project.

AgriFutures Australia has received funding through the second round of the Australian Government’s Rural R&D for Profit program to deliver the project “Securing Pollination for More Productive Agriculture: Guidelines for effective pollinator management and stakeholder adoption” (Securing Pollination). This project supports collaboration between Australia’s most knowledgeable bee and pollination researchers to assess the contribution of pollinators to nine Australian crops (apples, pears, lucerne, almonds, canola, melons, blueberries, raspberries and mangoes), investigate reestablishing native vegetation to support pollinator food and nesting resources, and use new technologies to communicate the findings to farmers.

Developing strategies to enhance productivity and profitability, the project will provide detailed scientific information on pollinator effectiveness and densities, bee movements, and pollination distances. The assessment of pollinator habitats, particularly foraging and nesting plants, will also assist in developing strategies against the Varroa mite.

For more visit agrifutures.com.au/securing-pollination

arena 2

Securing Pollination

Project partners

- Horticulture Innovation Australia
- University of Sydney
- University of Adelaide
- University of New England
- Adelaide and Mount Lofty Ranges Natural Resources Management Board
- Almond Board of Australia
- Apple and Pear Growers Association (SA)
- Australian Mango Industry Association
- Australian Melon Association
- Australian National University
- Costa Group
- Department of Environment Water and Natural Resources SA
- Greening Australia
- Lucerne Australia
- Native Vegetation Council
- Natural Resources Northern and Yorke
- O’Connor NRM
- Primary Industries and Resources SA
- Raspberries and Blackberries Australia
- South Australian Apiarist Association
- Terrestrial Ecosystems Research Network
- Eco-informatics
- Trees For Life

Project funding

This project is supported by funding from the Australian Government’s Department of Agriculture and Water Resources as part of its Rural R&D for Profit program. Under the Rural R&D for Profit Program, AgriFutures Australia received:

Grant funding: $5,265,000
Cash contributions from partners: $3,409,447
In kind contributions from partners: $5,135,457

Total project resources: $13,799,904