AgriFutures Ginger Program RD&E Plan (2022-2027)
The Australian ginger industry is centred around southern Queensland, with some production also occurring in northern New South Wales. In the year ending June 2021, Australia produced 5,184 tonnes of ginger (Horticulture Innovation Australia Limited, 2022). The volume of fresh supply was 2,745 tonnes (53.0%) with a wholesale value of $61.6 million. Overall, the gross value of production (GVP) of the ginger industry has steadily risen over the past seven financial years. After a spike in the value of ginger during the COVID-19 pandemic, the GVP for the 2020-21 financial year was $54.7 million, an increase of more than $3 million from the previous financial year.

For the Australian ginger industry to continue to increase its value, it must find innovative ways to remain competitive in the local market against potential international suppliers with significantly lower costs of production. To safeguard the industry, research, development and extension (RD&E) efforts will focus on identifying and developing new technologies to reduce labour inputs and increase production quality and quantity. The uniqueness and premium quality of Australian ginger will also be investigated to develop new, valuable markets for Australian ginger to increase demand and reduce the potential disruption of international ginger entering local markets.

These challenges and solutions were identified by the industry during stakeholder consultation and have been incorporated as RD&E priorities in the AgriFutures Ginger Program RD&E Plan 2022-2027. These priorities aim to ensure production of high-quality ginger in a sustainable production system, market opportunities, industry engagement and adoption of RD&E, and new technologies are available for the Australian ginger industry.

Program RD&E Plans are a key part of implementing AgriFutures Australia’s broader RD&E strategies, and are the basis on which the organisation invests on behalf of industries.

“The AgriFutures Ginger Program invests in research, development and extension (RD&E) that improves the productivity, profitability and sustainability of the Australian ginger industry. They exist within AgriFutures Australia’s broader vision, to grow the long-term prosperity of Australian rural industries. In partnership with our levied industries, of which the ginger industry is one, we aim to create value by:

1. Maximising the return on investment for your R&D levy
2. Listening to, engaging, collaborating and consulting with our industries
3. Delivering research and innovation that addresses the specific needs of each of our industries
4. Supporting our industries to prepare for and thrive into the future
5. Identifying, linking and testing new technologies, practices and innovations with the potential for our industries to uptake and adopt
6. Assisting our industries to enhance their industry stewardship and build community and consumer confidence.

To further deliver value for the industry, the AgriFutures Ginger Program will also seek to link in with RD&E activities that form part of the organisation’s other focus areas – Emerging Industries, Workforce and Leadership, National Challenges and Opportunities, and Global Innovation Networks.

AgriFutures Australia will continue to work with the ginger industry to ensure the five-year research priorities meet industry needs and are informed by Government priorities. The adoption of RD&E outcomes is fundamental to success, and just as we have with the AgriFutures Ginger Program RD&E Plan, AgriFutures Australia will work with industry and Government stakeholders to ensure the corporation invests in knowledge that is useful and adopted by end users.”

John Smith
General Manager, Research
AgriFutures Australia
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The AgriFutures Ginger Program RD&E Plan 2022-2027 has been developed in consultation with industry to outline the AgriFutures Ginger Program priorities and objectives for research, development and extension (RD&E) for the next five years.

The Australian ginger industry is regionally significant, employing local people throughout the supply chain, and has grown to have an annual farmgate gross value of production (GVP) of more than $50 million in recent years. The industry has operated with a statutory R&D levy since 2010, with the AgriFutures Ginger Program RD&E Plan 2022-2027 the third industry RD&E plan. Each plan builds on previous plan priorities and strategies that have delivered a strong return on investment from levy funds and matching government contributions.

Australian ginger is a high-value crop recognised for its unique flavour composition, the ginger industry must be able to compete beyond price to remain viable into the future. To ensure a continued premium for Australian product and its unique flavour composition, the ginger industry will build on its existing R&D efforts by increasing the focus on agtech development and adoption, as well as exploring product development opportunities domestically and globally.

Through both a review of previous RD&E plan outcomes and information obtained from consultation with industry stakeholders, the following priorities have been identified for the AgriFutures Ginger Program for the next five years:

**Priority 1** Market opportunities

**Priority 2** Technology and innovation

**Priority 3** Industry engagement

**Priority 4** Emerging Industries

The AgriFutures Ginger Program RD&E Plan 2022-2027 further outlines the objectives, strategies, impacts and consequences for each of the Program priorities, as well as giving consideration to the types of activities that will be funded and the associated timing and risks of Program investment. Implementation of the AgriFutures Ginger Program RD&E Plan 2022-2027 will be supported by AgriFutures Australia’s well-established frameworks for Program management, communication and engagement, and monitoring, evaluation and reporting (MER).
## Plan on a page

<table>
<thead>
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<th>Strategies</th>
<th>Impacts and consequences</th>
<th>Budget</th>
</tr>
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<tbody>
<tr>
<td>1. High quality product and sustainable production systems</td>
<td>1.1 Continue to invest in ensuring up-to-date best management practice guidelines that deliver increased yield and/or quality, and reduce input costs in ginger production</td>
<td>Industry participants have access to evidence to support best management practice ginger production</td>
<td>30%</td>
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<tr>
<td></td>
<td>1.2 Continue to support the development and use of clean, certified ginger seed and new varieties</td>
<td>Clean seed planting material is available to growers</td>
<td></td>
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<td></td>
<td>1.3 Consider cross-sectoral research and innovation partnerships to leverage RD&amp;E investment</td>
<td>Suitable collaborative R&amp;D partnerships and projects are taken advantage of</td>
<td></td>
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<td></td>
<td></td>
<td>There is a decrease in the variability of supply</td>
<td></td>
</tr>
<tr>
<td>2. Market opportunities</td>
<td>2.1 Rapidly identify and prioritise domestic and global product development opportunities</td>
<td>Producers have increased access to new and existing markets</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>2.2 Undertake research to support the development of new and emerging markets for Australian ginger and its production systems</td>
<td>There is growth in the value of the industry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3 Accelerate R&amp;D that develops innovative products and systems for new customer segments (e.g., medical, health and wellness supplements, animal fodder) to ensure the industry is able to compete beyond price</td>
<td>There is a decrease in the time taken from idea to commercialisation</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>There is an increase in the number of R&amp;D projects (i.e., project throughput) that deliver value to levy payers</td>
<td></td>
</tr>
<tr>
<td>3. Technology and innovation</td>
<td>3.1 Investigate and deliver new technologies and big data solutions that are of benefit to the industry</td>
<td>New technologies and tools are delivered to support improvements across the value chain</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>3.2 Investigate and deliver new and improved tools, systems and strategies for the surveillance, prevention and management of pest, weed and disease threats</td>
<td>Industry participants report they are better equipped to monitor, prevent and manage pests, weeds and disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.3 Explore commercial opportunities by facilitating partnerships with participants from across the value chain</td>
<td>There is evidence of effective collaborative partnerships and projects across the AgriFutures Ginger Program</td>
<td></td>
</tr>
<tr>
<td>4. Industry engagement</td>
<td>4.1 Invest in a well-coordinated and effective industry extension program to improve the uptake of BMP guidelines</td>
<td>Growers report the uptake of, or intention to adopt, R&amp;D outputs, new technologies and/or BMPs as a result of the extension program</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>4.2 Provide support to growers so they understand and can adopt and adhere to regulatory requirements</td>
<td>Industry participants value the extension support provided by the AgriFutures Ginger Program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.3 Showcase the success of impactful R&amp;D to demonstrate commercial benefits and drive adoption</td>
<td>There is evidence of industry participants being supported through scholarships, courses and study tours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.4 Support a skilled workforce and industry leaders through targeted activities such as structured courses, scholarships and study tours</td>
<td>There is increased retention and availability of a skilled workforce</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industry participants are confident the future of the industry is in good hands</td>
<td></td>
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</table>
AgriFutures Australia invests in research, innovation and learning initiatives that enhance the profitability and sustainability of the Australian agriculture sector.

Within its Research and Innovation Strategic Plan 2022-2027, AgriFutures Australia established five focus areas, which cover 16 priorities and associated key performance indicators. The five focus areas are:

1. Our Industries
2. Emerging Industries
3. Workforce and Leadership
4. National Challenges and Opportunities
5. Global Innovation Networks

The majority of priorities, strategies and activities outlined in this AgriFutures Ginger Program RD&E Plan 2022-2027 link directly to the ‘Our Industries’ and ‘Workforce and Leadership’ focus areas.

### AgriFutures Australia R&I Strategic Plan priorities

| Category                                                                 | Priority 1                                                                 | Priority 2 (R&I Strategic Plan priority 8 only) | Priority 3                                                                 | Priority 4                                                                 |
|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| **Our Industries**                                                       | Maximising the return on investment for your R&D levy.                                                                           | Supporting the identification and growth of new high-potential rural industries and enterprises that generate revenue from food, fibre, and agitech. | Understanding and responding to the current and future needs of our workforce. Effective leadership is crucial to the ongoing success of Australia’s rural industries. | Exploring, innovating, and collaborating to grow the prosperity of Australian agriculture. Identifying cross-sectoral and nationally significant opportunities and challenges. |
|                                                                          | Listening to, engaging, collaborating, and consulting with our industries.                                                        | Supporting the infrastructure, capacity and resilience of the agricultural workforce and leaders of Australia’s rural industries. | Identifying, understanding, and responding to national challenges and opportunities impacting Australian rural industries. | Establishing new and building on existing regional, national and global innovation partnerships to ensure Australia’s rural industries are leaders in accessing and adopting, as well as developing and exporting, world-leading innovation and technologies. |
|                                                                          | Delivering research and innovation that addresses the specific needs of each of our industries.                                   | Making strategic cross-sector investments to help improve the infrastructure, capacity and resilience of the agricultural workforce and leaders of Australia’s rural industries. | Identifying and developing talent to support and benefit Australia’s rural industries. | Supporting the development of Australian agrifood technologies with the end-user front of mind, to help drive adoption and maximise value for producers, both locally and globally, with the shared vision to build long-term profitability, sustainability and resilience of the global food system. |
|                                                                          | Supporting our industries to prepare for and thrive into the future.                                                             | Identifying and developing talent to support and benefit Australia’s rural industries. | Making strategic cross-sector investments to help improve the infrastructure, capacity and resilience of the agricultural workforce and leaders of Australia’s rural industries. | Supporting the development of Australian agrifood technologies with the end-user front of mind, to help drive adoption and maximise value for producers, both locally and globally, with the shared vision to build long-term profitability, sustainability and resilience of the global food system. |
|                                                                          | Identifying, linking, and testing new technologies, practices, and innovations with the potential for our industries to adopt and take up. | Exploring, innovating, and collaborating to grow the prosperity of Australian agriculture. | Identifying cross-sectoral and nationally significant opportunities and challenges. | Establishing new and building on existing regional, national and global innovation partnerships to ensure Australia’s rural industries are leaders in accessing and adopting, as well as developing and exporting, world-leading innovation and technologies. |
|                                                                          | Assisting our industries to enhance their industry stewardship and build community and consumer confidence.                      | Exploring, innovating, and collaborating to grow the prosperity of Australian agriculture. | Exploring, innovating, and collaborating to grow the prosperity of Australian agriculture. | Establishing new and building on existing regional, national and global innovation partnerships to ensure Australia’s rural industries are leaders in accessing and adopting, as well as developing and exporting, world-leading innovation and technologies. |

### Emerging Industries

Supporting the identification and growth of new high-potential rural industries and enterprises that generate revenue from food, fibre, and agitech.

### Workforce and Leadership

Understanding and responding to the current and future needs of our workforce. Effective leadership is crucial to the ongoing success of Australia’s rural industries.

### National Challenges and Opportunities

Exploring, innovating, and collaborating to grow the prosperity of Australian agriculture.

### Global Innovation Networks

Establishing new and building on existing regional, national and global innovation partnerships to ensure Australia’s rural industries are leaders in accessing and adopting, as well as developing and exporting, world-leading innovation and technologies.
Industry profile

Ginger refers to the rhizome of a plant of a variety of the species *Zingiber officinale*. Ginger growing in Australia is tied to colonisation by the British, with the first ginger seeds and rhizomes brought to the continent on the First Fleet.

Chinese immigration soon after also brought additional ginger rhizomes for cultivation and to meet demand for the product (Ryder, 2010). Today, commercial ginger production occurs in the subtropical and tropical regions of Queensland and northern New South Wales (Australian Ginger Industry Association, 2022). The greatest production occurs in the Sunshine Coast and Wide Bay areas of southeast Queensland. Ginger grown in Queensland accounts for 98% of Australia's ginger production, with plantings in northern NSW and very small areas in the Northern Territory accounting for the remaining 2%, with potential for growth in these areas (Horticulture Innovation Australia Limited, 2022) (Figure 1).

Fresh ginger availability peaks in November-December throughout Australia, however Queensland fresh ginger production is able to provide year-round supply (Horticulture Innovation Australia Limited, 2022). Additional domestic supply, along with most ginger imports, go into processing for products such as powders and syrups, beverages, packaged food products and health and wellness supplements (Figure 2).

In the year ending June 2021, Australia produced 5,184 tonnes of ginger (Horticulture Innovation Australia Limited, 2022). The volume of fresh supply was 2,745 tonnes (53.0%) with a wholesale value of $61.6 million. A small amount was exported while the remaining 46.8% of ginger produced was sent for processing (Horticulture Innovation Australia Limited, 2022). The GVP of Australian ginger has increased over time, only decreasing year-on-year once in the past seven financial years. In the past three financial years, the GVP was more than $50 million (Figure 3).

Australian ginger makes up only a small proportion of global ginger production (~1%), which is otherwise dominated by China and India. Australia is a net importer of ginger, with imports predominantly originating from countries with lower input costs, including China, Vietnam, India, Thailand and Fiji. The Australian fresh supply chain for ginger has historically been serviced by Australian ginger producers, despite the country being a net importer of fresh ginger. Imports of fresh ginger were typically used in processing and never entered the fresh supply chain.

In the past decade, there has been regulatory changes to fresh ginger imports, which has allowed the supply and sale of fresh ginger from Fiji in Australia. This means that the Australian ginger supply is now competing with low-input-cost ginger from Fiji, shifting the industry’s focus towards increasing yield and differentiating the Australian product in the market both domestically and internationally. Australian ginger has only a few key export markets, with New Zealand accounting for 90% of fresh ginger exports in the year ending June 2021. This was followed by Singapore at 7%, and Kiribati, PNG and Hong Kong at 1% each (Horticulture Innovation Australia Limited, 2022).

To ensure the return on investment for Australian ginger growers remains positive, the AgriFutures Ginger Program will increase its R&D focus over the five-year period of the RD&E Plan towards agtech development and adoption to increase yields and/or quality and reduce input costs, exploring domestic market opportunities, and diversifying export markets. This will support continued R&D investment in best management practice in a sustainable production system complemented by continued efforts in extension and capacity building activities.
For the year ending in June 2021, 20% of Australia’s households purchased ginger at least once.

For the year ending in June 2021, the average quantity of ginger purchased per shopping trip was 0.22 kg.

For the year ending in June 2021, the fresh supply volume of ginger available to Australia on a per capita basis was 0.11 kg.

Figure 2: Ginger supply chain and consumer metrics for the year ending June 2021. Source: Horticulture Innovation Australia Limited (2022). Note: Imported ginger entering the fresh supply chain is solely from Fiji.

Figure 3: Volume of production and gross value of production (GVP) of Australian ginger. Sources: Horticulture Innovation Australia Limited (2022); Annual correspondence from the Department of Agriculture, Water and the Environment (DAWE). Note: The GVP figures provided by DAWE to AgriFutures Australia are determined using a three-year rolling average.
Factors influencing the industry’s current operating environment informed the development of a SWOT analysis, which was workshopped with the AgriFutures Ginger Advisory Panel.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>• Return on investment</td>
<td>• High-cost environment (inputs)</td>
</tr>
<tr>
<td>• Active engagement and willing collaboration</td>
<td>• Labour shortage</td>
</tr>
<tr>
<td>with the processing sector</td>
<td>• High cost of labour</td>
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<tr>
<td>• High-quality product and fresh care</td>
<td>• High reliance on a small number of growers</td>
</tr>
<tr>
<td>• Strong grower group</td>
<td>• Lack of access to disease-resistant ginger</td>
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<tr>
<td>• Collegiate industry</td>
<td>varieties</td>
</tr>
<tr>
<td>• Established RD&amp;E model with sufficient funds</td>
<td>• Constraints on suitable land</td>
</tr>
<tr>
<td>• Supportive regulatory framework</td>
<td>• Sustainable management cost</td>
</tr>
<tr>
<td>• Unique flavour profile</td>
<td>• Complex production system</td>
</tr>
<tr>
<td></td>
<td>• Small industry – i.e. issues of scale</td>
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<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
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<tbody>
<tr>
<td>• Soil management to improve fungal load and</td>
<td>• Disease susceptibility</td>
</tr>
<tr>
<td>rotation schedule</td>
<td>• Importing of fresh ginger from low-input-cost</td>
</tr>
<tr>
<td>• Strong Australian brand with differentiated</td>
<td>countries</td>
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<tr>
<td>product</td>
<td>• Adverse changes to the regulatory environment</td>
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<tr>
<td>• Pharmaceuticals, and health and wellnesss</td>
<td>• Biosecurity risks, i.e. fall armyworm</td>
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<tr>
<td>• Collaboration with processors for product</td>
<td>• Volume of production scaling</td>
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<tr>
<td>differentiation and exploration of export</td>
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<tr>
<td>markets</td>
<td></td>
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<tr>
<td>• Access to and adoption of agtech</td>
<td></td>
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<tr>
<td>• Increase availability of varieties</td>
<td></td>
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<tr>
<td>• Building future leaders</td>
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Ginger research

Funding
The Australian ginger industry has been supported by an R&D levy since 2010 (previously under the Rural Industries Research and Development Corporation: RIRDC). Prior to 2010, ginger RD&E projects were supported with core funds from RIRDC’s New and Emerging Plant Industries Program, often in partnership with Horticulture Innovation Australia Limited, the Queensland Department of Agriculture and Fisheries, Australian Centre for International Agricultural Research, and voluntary grower contributions.

As an established industry, a statutory R&D levy is placed on all ginger produced in Australia and sold by a producer. The levy funds collected are used for ongoing research and development to the benefit of the ginger industry. For the purpose of the levy, ginger is defined as the rhizome of a plant of a variety of the species Zingiber officinale and seed ginger is ginger that is divided into pieces for planting. Both attract the levy. The levy is 0.5% of the sale price of ginger at the first point of sale. The funds collected by the levy are used for industry RD&E, with a strong focus on grower needs; however, the benefits extend through the supply chain.

Levy rate
0.5% of sale price

Levy collection point
First point of sale

Levy start date
1 April 2011

AgriFutures Australia receives the R&D levy allocation to invest in line with the objectives of the Program’s RD&E Plan. AgriFutures Australia also receives matching funding from the Australian Government, which is allocated to the Program at 50 cents per dollar of eligible research expenditure. The total Program budget comprises the R&D levy allocation, Australian Government matching funding, royalty payments and third-party contributions.

Previous research plans
Following implementation of the R&D levy in 2010, RD&E plans developed in consultation with the Ginger Advisory Panel and the Australian Ginger Industry Association (AGIA) have guided the allocation of Ginger Program RD&E funds.

Ginger Five Year RD&E Plan 2012–2017
The first ginger RD&E plan covered the period 2012–2017 and articulated three objectives:

- Assure industry competitiveness
- Build stronger linkages with customers and the market
- Coordinate the industry’s future direction

A total of 17 projects with an average value of $60,000 were funded between 2012 and 30 June 2016, with a further four projects funded in the second half of 2016. An economic evaluation of a sample of these projects was undertaken near the completion of the plan period. From this evaluation, it was estimated that the benefit–cost ratio for the investment in the Ginger Program during this time was between 8.0 and 19.9 to 1, suggesting that the Program had produced a significant return on investment.

Ginger Five Year RD&E Plan 2017–2022
The most recent RD&E plan for the AgriFutures Ginger Program covered the period 2017–2022. In developing the plan, AgriFutures Australia (then operating as RIRDC), in collaboration with AGIA and industry stakeholders, identified three priority areas for investment over the five-year period:

- Drive on-farm productivity – disease management, innovative technology and certified seed
- Lift the demand for Australian ginger – brand and market research
- Encourage industry engagement – extension, communication, leaders and partners

During the term of the Ginger Five Year RD&E Plan 2017–2022, AgriFutures Australia invested $1.27 million (industry levies and Australian Government matching funding) in 10 projects.

Impact assessment
During 2022, an impact assessment was undertaken to estimate the return on investment from projects funded as part of the Ginger Five Year RD&E Plan 2017–2022. The impact assessment aimed to understand the Program successes, inform the new RD&E Plan, and meet the evaluation requirements of the Australian Government and the Council of Rural Research and Development Corporations (CRRDC).

The assessment considered the economic, environmental and social impacts of investment in seven projects over the term of the Plan; impacts were able to be quantified for four of these. The assessment included projects associated with a broad range of R&D, including extension; industry growth; pests, weeds and disease; and chemical use.

The findings from this evaluation concluded that the benefit–cost ratio for the investment in the Ginger Program from 2017–2022 lied between 2.4 and 6.0 to 1. While this is a decrease compared with the benefit–cost ratio estimated for projects funded under the Ginger Five Year RD&E Plan 2012–2017, it is still in line with the impact achieved by investment in rural research and development projects across Australian agricultural and horticultural industries more broadly.1

The impact assessment confirmed that the AgriFutures Ginger Program continues to deliver a strong return on investment, with net benefits flowing to industry, government and the broader Australian community.

Partnerships
AgriFutures Australia fosters a strong culture of collaboration and relies on a number of key partnerships to deliver the AgriFutures Ginger Program, including:

- AgriFutures Ginger Advisory Panel
- Australian Ginger Industry Association (AGIA)
- Australian university researchers
- Queensland Department of Agriculture and Fisheries

In implementing the AgriFutures Ginger Program, AgriFutures Australia will also look to work collaboratively with other industry-owned RDCs, such as Hort Innovation, to pursue opportunities to leverage limited Program resources and maximise the benefit of investment in cross-sectoral research.

1 An assessment of 111 RDC project cluster evaluations, between 2014 and 2019, found a comparable weighted average benefit-cost ratio of 5.5, with annual weighted average benefit-cost ratios from 3.3 to 9.1 (Agtrans Research, 2019).
Industry consultation

The AgriFutures Ginger Program RD&E Plan 2022-2027 was developed through extensive consultation with ginger producers and industry stakeholders to understand the key change drivers and potential responses by industry over the next five years.

Industry stakeholders were engaged at various stages of plan development through participation in surveys, a scenario planning exercise, and review of the draft plan. These stakeholders included:

- AgriFutures Ginger Advisory Panel
- Australian Ginger Industry Association (AGIA)

Outcomes

Trends and drivers

The consultation process allowed for detailed consideration of the industry’s current operating environment and identified 12 key trends and drivers likely to affect the industry in the future (Table 1). This initial survey was open to all industry participants and distributed via AgriFutures Australia, AGIA and other key industry member media channels to gain insights on key industry trends and drivers from as many industry participants as possible. A subgroup of industry participants were then asked to rank the 12 trends identified from the initial survey to determine the trends with most uncertainty and likely to have the most impact on the industry.

Future scenarios

Increasing legislative and regulatory uncertainty and ‘More disruptive agtech and innovative advancements’ were rated as those with the most uncertainty and greatest potential impact on the operating environment in which the AgriFutures Ginger Program conducts its activities. This information was used to conduct an in-depth scenario planning exercise with industry stakeholders to contemplate and identify a range of plausible futures.

Consideration of potential future scenarios (Figure 5) allowed industry stakeholders to workshop the implications and potential response options for investment through the AgriFutures Ginger Program. The robustness of each of the identified response options was tested against each of the future scenarios, should they eventuate. The outcomes of this work have informed the development of priorities, objectives and strategies for the AgriFutures Ginger RD&E Plan 2022-2027 (Figure 4).

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**Figure 4:** Timeline of key steps in the development of the AgriFutures Ginger Program RD&E Plan
Water scarcity

Consumers are increasingly demanding food alternatives driven by shifting preferences for healthier alternatives and ethical production. This shift has led to a change in consumption patterns and dietary make-up. Ginger, which is considered a ‘superfood’ across the world, is known to have several health benefits. Due to this shift in consumer preferences towards healthy and immune-boosting diets, ginger is growing in popularity and is becoming a bigger part of consumer diets.

The recruitment and retention of farming staff in the agricultural industry is becoming increasingly difficult due to a dwindling succession pool, lower margins, and a shift to a more casual labour force. A wider range of careers available to younger individuals has also decreased the interest in farming and agriculture. This, coupled with the growing age of current farmers, is creating pressure on the availability of personnel. A shortage of experienced labour increases costs and reduces efficiency.

Technological advances are ushering in a new age of automation and robotisation as machines increasingly match or outperform human performance in a range of work activities. For agriculture, the automation of harvesting processes has the potential to significantly lift farming productivity, increase efficiency and reduce costs through innovative technologies such as drones, spatial mapping, camera technology and decision-making software.

The impact of climate change is becoming more apparent, particularly with more extreme weather events and rising sea levels. As agriculture is highly dependent on climatic conditions, climate change adaptation and mitigation will become a significant focus for sustained and efficient production. Poor weather conditions can lead to a reduction in the total land area cultivated and extreme weather conditions, such as extremely dry and wet seasons, can discourage growers from cultivating large areas of ginger.

The increasingly noticeable effects of climate change are driving the trend of sustainability as an ever-increasing issue in the public’s consciousness, and this trend is leading more businesses and (international) governments to take action (e.g., emissions reduction). One example in the agriculture industry is the growing trend of farmers looking to the long-term sustainable use of farming land to avoid permanent impacts to soil. In the domestic ginger industry, collaboration with the relevant public and private sector organisations could facilitate sustainable land use for ginger, keeping the industry productive and safe from diseases.

Table 1: Trends that will shape the Australian ginger industry’s operating environment

<table>
<thead>
<tr>
<th>Driver</th>
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<tr>
<td>1 Water scarcity</td>
<td>Water is becoming a scarcer resource in many parts of Australia due to climate change. Variable rainfall and droughts have led to low water storage levels, causing concern about the adequacy of water supplies. Since water is required for irrigation in agriculture, a reduced supply of water leads to a decrease in production and yield loss. Ginger production requires a significant amount of water and increased scarcity of water is expected to put pressure on ginger production in Australia.</td>
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<tr>
<td>2 Transition of diets</td>
<td>Consumers are increasingly demanding food alternatives driven by shifting preferences for healthier alternatives and ethical production. This shift has led to a change in consumption patterns and dietary make-up. Ginger, which is considered a ‘superfood’ across the world, is known to have several health benefits. Due to this shift in consumer preferences towards healthy and immune-boosting diets, ginger is growing in popularity and is becoming a bigger part of consumer diets.</td>
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<td>3 Shortage of personnel</td>
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<td>The increasingly noticeable effects of climate change are driving the trend of sustainability as an ever-increasing issue in the public’s consciousness, and this trend is leading more businesses and (international) governments to take action (e.g., emissions reduction). One example in the agriculture industry is the growing trend of farmers looking to the long-term sustainable use of farming land to avoid permanent impacts to soil. In the domestic ginger industry, collaboration with the relevant public and private sector organisations could facilitate sustainable land use for ginger, keeping the industry productive and safe from diseases.</td>
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<td>7 The rise of biotechnology</td>
<td>Technological advancements and innovations are increasing the variety and availability of products made through cellular and biomolecular processes. Driven by continued technological advancements, biotechnological innovations are advancing rapidly and are providing significant opportunities for diverse industries. For the ginger industry, these opportunities include the mitigation of risks such as disease, while improving sustainability and efficiency. Furthermore, improvements in biotechnology can also mitigate the risks associated with importing ginger roots, which may bring exotic diseases that can lead to significant or even complete yield loss.</td>
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<td>8 The rise of urbanisation</td>
<td>Across the globe, particularly in developing countries, there is a strong and sustained trend of people moving from the countryside into cities. Dense urban areas are closely associated with outsized economic output and innovative capacity, thereby increasingly becoming focal areas for people and organisations. Yet, strong and sustained urbanisation is also associated with encroachment of farming land, potentially leading to a scarcity of high-quality land for ginger.</td>
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<tr>
<td>9 Influence of social media</td>
<td>Social media and online networking platforms are becoming an increasingly conventional means of engaging with consumers, and the agriculture industry is no exception. Social media has the power to shape and influence the views of the general public and politicians. Although often positive, social media also enables misinformation to spread, such that it outweighs rational decision making. The sustained growth of social media could help with highlighting the benefits of ginger for both consumption and application. These positive benefits could lead to an increase in demand for ginger.</td>
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<tr>
<td>10 Rising use of Ayurvedic products</td>
<td>A traditional form of medicine derived from natural sources such as plants, animals and minerals, Ayurvedic medicine has continued to grow in popularity beyond Asia. It is deemed to be free of side-effects and covers a wide range of health issues. Ginger, a ‘superfood’ well-known for its anti-inflammatory and digestive properties, is an important herb in Ayurveda. Its wide range of health benefits allows its integration in a variety of products, creating greater acceptance and the potential for strong and sustained additional growth in demand.</td>
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<tr>
<td>11 Rising Asia</td>
<td>Over the past 40 years, Asia has continued its rise to global significance through strong and sustained economic growth and an ever-greater presence in global trade networks, capital, and innovation. This has enabled the region’s ongoing industrialisation. Growing demand and productivity has permitted countries such as India and China to become some of the largest exporters and global leaders in the production of high-quality ginger. Australian high-quality ginger has opportunities to expand into the global market and can compete against the leaders, provided production costs are reduced with the help of technology.</td>
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<td>12 Increasing legislative and regulatory uncertainty</td>
<td>Since 2010, Australia has had five different Prime Ministers. Changes in Commonwealth Governments and the accompanying changes in policies relevant to Australian agriculture sector result in uncertain operating environments for many farmers. For example, the changing policy position on biosecurity laws and arrangements, like the funding of an Emergency Plant Pest Response Levy and the importation of fresh ginger (e.g., from Fiji), can have serious impacts on the sustainability and the viability of the ginger industry.</td>
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Figure 5: A graphic representation of potential future scenarios for the ginger industry as identified through industry consultation and described during the Scenario Planning Workshop by industry representatives.
Program goal

To invest in RD&E that improves the productivity, profitability and sustainability of the Australian ginger industry.
Objective
Improve the quality, productivity and profitability of Australian ginger.

Justification
Growth in on-farm productivity remains essential to ensure growers remain profitable and able to supply competitively priced ginger. The importation of fresh ginger from countries with lower production costs remains a significant threat to the domestic industry. While improved on-farm productivity will help the industry remain competitive, it is increasingly important that the industry is able to compete beyond price through production of high-quality product using sustainable production methods.

Strategies
1.1 Continue to invest in ensuring up-to-date best management practice guidelines that deliver increased yield and/or quality, and reduce input costs in ginger production
1.2 Continue to support the development and use of clean, certified ginger seed and new varieties
1.3 Consider cross-sectoral research and innovation partnerships to leverage RD&E investment

Activities
New and existing investment under this priority may include the following research areas:
- Chemical minor use permit research
- Improving ginger to future proof the industry against pests and diseases
- Collaborative partnerships with other Rural RDCs and horticultural industry participants to unlock relevant R&D, technologies and innovations, leveraging the Program’s investment
- Research to support continual improvement to best management practice
- R&D in support of the maintenance of food safety and quality assurance to ensure industry competitiveness

Impacts and consequences
- Industry participants have access to evidence to support best management practice ginger production
- Clean seed planting material is available to growers
- Suitable collaborative R&D partnerships and projects are taken advantage of
- There is a decrease in the variability of supply

Risk management
Intellectual property protection will be required where there are commercial opportunities available to the benefit of the industry. There is a risk that the wrong parameters are targeted for breeding new varietals, and that the varieties and farming systems do not meet the needs of future ginger growers or target markets. This is a risk the industry is willing to take to potentially drive significant gains in production. The risk will be mitigated through monitoring and review of investment and RD&E outputs. Any ginger breeding program will also have the opportunity to incorporate the results from other projects relating to market opportunities and BMP in production systems to help mitigate risk and ensure producers adopt R&D outputs. This will also require succession planning in both the grower and research communities to ensure valuable knowledge is not lost, as this would require reskilling of the workforce and would set back progress. Strategies identified in Priority 4 are intended to assist with mitigating this risk.

Indicative budget allocation
30%
Objective
Ensure the Australian ginger industry has the R&D needed to maintain and grow its markets.

Justification
As noted in Priority 1, the industry needs to be able to compete beyond price through production of high-quality product using sustainable production methods. To ensure it is able to do this, research is needed to understand the opportunities that exist in both new and existing markets, and to develop innovative products and systems for these customer segments. Further, it will be necessary to ensure that industry has the evidence and tools needed to meet market specifications.

Strategies
2.1 Rapidly identify and prioritise domestic and global product development opportunities
2.2 Undertake research to support the development of new and emerging markets for Australian ginger and its production systems
2.3 Accelerate R&D that develops innovative products and systems for new customer segments (e.g., medical, health and wellness supplements, animal fodder) to ensure the industry is able to compete beyond price

Activities
New and existing investment under this priority may include the following research areas:
- Desktop scan of domestic and global market opportunities
- Understanding of market specifications and ensuring alignment of industry best practice
- Development of diagnostic tools to validate the benefits and unique attributes of Australian ginger
- Determining and monitoring of baseline metrics to support continuous improvement through the establishment of industry-wide KPIs and targets

Impacts and consequences
- Producers have increased access to new and existing markets
- There is growth in the value of the industry
- There is a decrease in the time taken from idea to commercialisation
- There is an increase in the number of R&D projects that deliver value to levy payers

Risk management
The Australian ginger industry is reliant on a small number of growers to maintain the majority of supply. These growers also reside within a concentrated geographical location, with approximately 98% located in southeast Queensland. The industry is comparatively small and therefore the capacity to service market opportunities may be hindered. Program investment into new market opportunities will need to be targeted to ensure opportunities with high return on investment are taken advantage of, to build initial capacity to expand the industry both domestically and internationally. Industry capacity to implement will be developed in tandem with Priority 4.

“Research is needed to understand the opportunities that exist in both new and existing ginger markets, and to develop innovative products and systems for these customer segments.”

Indicative budget allocation
20%
Objective
Support the development of innovation and technology across the value chain.

Justification
Consultation with industry participants identified agtech and innovation as a key trend and driver of change for the industry in the future. Unlocking technology and innovation presents a real opportunity for the industry to increase productivity across the value chain. Further, there is opportunity to leverage investment and unlock new information and knowledge through collaborative partnerships with other RD&E, agriculture and horticulture industry providers.

Strategies
3.1 Investigate and deliver new technologies and big data solutions that are of benefit to the industry
3.2 Investigate and deliver new and improved tools, systems and strategies for the surveillance, prevention and management of pest, weed and disease threats
3.3 Explore commercial opportunities by facilitating partnerships with participants from across the value chain

Activities
New and existing investment under this priority may include the following research areas:
- Reviewing the biosecurity plan for the Australian ginger industry
- Automating disease detection in seed ginger stock
- Site-specific weed control for ginger cropping systems
- Investing in new and emerging technologies to support increased productivity and profitability, e.g. automation, diagnostics and impactful innovation
- Collaboration with participants from across the value chain to understand their technological needs and identify innovations that exist that could benefit the industry

Impacts and consequences
- New technologies and tools are delivered to support improvements across the value chain
- Industry participants report they are better equipped to monitor, prevent and manage pests, weeds and disease
- There is evidence of effective collaborative partnerships and projects across the AgriFutures Ginger Program

Timing
Supporting technology and innovation across the value chain will require ongoing investment over the five-year term of the RD&E Plan, however there is likely to be a need for greater upfront investment to support investigation, identification and prioritisation work. Opportunities that may arise through collaboration with research partners and/or value chain participants may influence the timing of Program investment under this priority.

Risk management
It is recognised that investment in technology and innovation is inherently risky, and this highlights the importance of facilitating strong relationships across the different parts of the industry value chain to better understand each of their needs. Risk in this area will also be mitigated through rapid testing and prototyping, and, where appropriate, consideration of opportunities to leverage Program investment and share risk with R&D partners.

Indicative budget allocation
20%
Industry engagement

Objective
Build the adaptive capacity and resilience of the Australian ginger industry.

Justification
Effective extension is essential to the increased adoption of R&D outcomes and innovations, and the engagement of a broad range of industry participants across the value chain. Successful succession planning is also essential to the continued success of the Australian ginger industry. This priority will link closely with the other priorities.

Strategies
4.1 Invest in a well-coordinated and effective industry extension program to improve the uptake of BMP guidelines
4.2 Provide support to growers so they understand and can adopt and adhere to government regulatory requirements
4.3 Showcase the success of impactful R&D to demonstrate commercial benefits and drive adoption
4.4 Support a skilled workforce and industry leaders through targeted activities such as structured courses, scholarships and study tours

Activities
New and existing investment under this priority may include the following research areas:
- Ginger industry extension project to extend the R&D outcomes from the other priorities outlined in the RD&E Plan
- Promotion of capacity building opportunities
- Partnerships and engagement across the value chain and with other industries
- Opportunistic industry engagement, drawing on expertise outside the ginger industry
- Partnerships with the public and private sector to identify effective measures to protect the industry from exotic pests
- Collaboration with Plant Health Australia to establish appropriate biosecurity arrangement

Impacts and consequences
- Growers report the uptake of, or intention to adopt, R&D outputs, new technologies and/or BMPs as a result of the extension program
- Industry participants value the extension support provided by the AgriFutures Ginger Program
- There is evidence of industry participants being supported through scholarships, courses and study tours
- There is increased retention and availability of a skilled workforce
- Industry participants are confident the future of the industry is in good hands

Timing
Investment in industry engagement activities, including communication, extension and adoption, will require ongoing and consistent investment over the five-year term of the RD&E Plan.

Risk management
It is important that R&D outputs lead to best practice and improve the productivity and profitability of the Australian ginger industry. Industry capacity will need to be built through targeted engagement opportunities throughout the value chain to ensure resources are not spread too thin and the outcomes from Program investment are not jeopardised. Efforts to minimise this risk will include ensuring that all projects that receive funding through the AgriFutures Ginger Program consider the needs of end users and how R&D outputs will be communicated. Industry engagement through Program investment will be necessary to clearly and effectively communicate research outcomes to end users to ensure the greatest impact is achieved from Program resources.

Indicative budget allocation
30%
Communication, extension and adoption

The AgriFutures Ginger Program RD&E Plan 2022-2027 has been developed in consultation with industry stakeholders to identify the RD&E investment priorities and key outcomes sought by the industry over a five-year period. The RD&E Plan will be used to guide and balance the AgriFutures Ginger Program’s investment in activities to promote the productivity, profitability and sustainability of the Australian ginger industry.

The RD&E Plan is targeted at researchers and collaborators for when they develop research proposals, and guides the AgriFutures Ginger Program in the investment of Program funds. More broadly, the RD&E Plan provides producers of ginger and other key stakeholders with information on the future direction of industry RD&E and investment of levy funds.

Details of contracted projects, program updates and the outcomes of projects will be published on the AgriFutures Australia website and across a variety of AgriFutures Australia’s communications channels. Stakeholder engagement will primarily be through:

• The AgriFutures Ginger Advisory Panel
• Industry updates sent via the AgriFutures Ginger Program subscription list (opt-in)
• Australian Ginger Industry Association (AGIA)

Stakeholder engagement will also be achieved through direct engagement with researchers and consultants conducting projects under the AgriFutures Ginger Program.

The Program will use communications expertise on an as-needs basis to develop communications resources to demonstrate the progress, outcomes and return on investment of AgriFutures Ginger Program projects, in line with the AgriFutures Australia Communications Strategy.

Importantly, the RD&E Plan has identified industry engagement as one of its four priorities. This will include continued investment in an industry extension program and other capacity building activities to drive the adoption and uptake of R&D outcomes and innovations. An indicative budget allocation of 30% has been made to implement the identified strategies that underpin this priority.
Financial position and investment projections

The GVP of Australian ginger has increased over time, only decreasing year-on-year once in the past seven financial years. In the past three financial years, the GVP was more than $80 million.

Given the relatively consistent growth experienced by the industry, it is predicted that the current demand and lack of international competition on the domestic market persists, the AgriFutures Ginger Program expenditure will increase over the lifetime of the AgriFutures Ginger Program RD&E Plan 2022-2027 compared with the current RD&E spend. This will be bolstered by an increase in expenditure at the start of the RD&E Plan to reduce AgriFutures Ginger Program reserves, in line with the reserves policy, which have accumulated since the introduction of the ginger levy and the start of the AgriFutures Ginger Program.

Annual assessments by AgriFutures Australia and the AgriFutures Ginger Advisory Panel will be completed to ensure that new investment decisions align with industry growth and consider factors affecting the industry, such as pest and disease incursion, drought, and market demand. Priority 2 of this RD&E Plan, ‘Market opportunities’, also aims to mitigate some of this risk and enable the industry to identify and capitalise on opportunities, thus helping to ensure the continued sustainability of the AgriFutures Ginger Program.

Reserves policy

In support of its overarching investment aims, AgriFutures Australia holds financial reserves as a supporting tool within the AgriFutures Australia Investment Framework to manage risk derived from fluctuations in income. All AgriFutures Australia Programs have a reserves policy as agreed by the Program Advisory Panel to ensure the endurance of the Program when faced with adversity, such as a drop in production resulting in lower levy funding available to fund current research commitments.

The Program reserves policy is managed to maintain an amount in reserve equivalent to the annual RD&E spend. The underlying objective of holding financial reserves is to maximise the Program’s investment in RD&E, consistent with its business objectives, while enabling sufficient funds to be available to cover contracted liabilities and to maintain RD&E capacity. The reserves policy is intended as a guideline only, and is subject to change due to extreme circumstances, which may result in changes to the policy.

RD&E Program management

AgriFutures Ginger Program RD&E investments are guided by the AgriFutures Ginger Advisory Panel. AgriFutures Australia’s Industry Advisory Panels are responsible for developing and ranking industry research priorities and research proposals within the RD&E Plans framework, and providing recommendations on the allocation of RD&E contributions to the AgriFutures Australia Board. The Advisory Panel also plays a key role in facilitating information sharing between industry stakeholders and AgriFutures Australia.

AgriFutures Australia has committed resources to the Program, including a Research Manager and a Research Coordinator. The Research Manager is formally a member of the Ginger Advisory Panel.

Program investments are made annually in a combination of short, medium and long-term priorities. AgriFutures Australia will request project proposals focused on specific research priorities.

Risk management

The identification of any potential risks to industry, specifically to the achievement of outcomes from RD&E investment, is an important component of AgriFutures Australia’s strategic planning processes. The identification of key risks and appropriate mitigation measures have been considered for each of the identified priorities and are outlined in the respective sections of the AgriFutures Ginger Program RD&E Plan 2022-2027.

Implementation and governance

Commercialisation and intellectual property management

The key objective of AgriFutures Australia’s intellectual property (IP) and commercialisation activities is to use IP rights and commercialisation opportunities to promote and enhance adoption of R&D outputs, to create a more profitable, dynamic and sustainable Australian rural sector.

AgriFutures Australia takes a proactive approach to identifying, developing and delivering IP from R&D projects. IP is delivered for adoption through communication, extension and commercialisation activities. The aim is to identify, IP early in the project planning process and assess its development as the project progresses.

Commercialisation opportunities for IP as products and services are assessed as the project progresses. IP is assessed within a Commercialisation Readiness Assessment Matrix that underpins progress and measurement of commercial impact for AgriFutures Australia. The matrix assesses the maturity of the project against (i) technology readiness; (ii) market and consumer knowledge; (iii) supply, manufacturing and distribution knowledge; and (iv) financial, revenue and cost models.

If a prospective opportunity is progressed to producing a product or service, a commercialisation strategy will be developed. Commercialisation of IP will be undertaken using the most appropriate approach, including licensing, selling or establishing a joint venture or ‘spin-off’ company.
Monitoring, evaluation and reporting

Alignment with the AgriFutures Australia MER framework
Monitoring, evaluation and reporting of the AgriFutures Ginger Program RD&E Plan 2022-2027 will be undertaken in line with the AgriFutures Australia Evaluation Framework, developed to support AgriFutures Australia’s overarching Strategic R&I Plan 2022-2027. Outputs and performance impacts of Program investments are systematically evaluated through the Evaluation Framework and summarised in the AgriFutures Australia Annual Report.

Ongoing project evaluation
Projects funded under the AgriFutures Ginger Program are evaluated through their life, with milestones being assessed to ensure investment continues to be relevant. This evaluation information is also captured in AgriFutures Australia’s project management system. Each project has a communication plan, which ensures R&D findings are disseminated effectively and efficiently. Findings are published on AgriFutures Australia’s website, unless there are cogent reasons why publication is not appropriate, such as when a commercialisation opportunity is pursued.

Mid-term evaluation of the plan
A mid-term evaluation of the AgriFutures Ginger Program RD&E Plan 2022-2027 will be undertaken in the last year of the RD&E Plan. The final evaluation will include a cost-benefit analysis of a selection of projects consistent with the guidelines for the assessment of performance impacts developed by the Council of Rural Research and Development Corporations, and will be published on AgriFutures Australia’s website. AgriFutures Australia also participates in the Council’s process for aggregation of performance impact evaluations undertaken across the Rural RDCs. The final evaluation will inform the development of the next RD&E Plan.

Plan lifecycle
The lifecycle of the AgriFutures Ginger Program RD&E Plan 2022-2027 is shown in Figure 6.

References