Australian Government

Grains Research and Development Corporation

GRDC

GRAINS RESEARCH & DEVELOPMENT CORPORATION

ANNUAL REPORT 2021–22

GRDC

Grains Research and Development Corporation is a corporate Commonwealth entity established to plan and invest in research, development and extension (RD&E) for the Australian grains industry.

Its primary objective is to drive the discovery, development and delivery of world-class innovation to enhance the productivity, profitability and sustainability of Australian grain growers and benefit the industry and the wider community.

Its primary business activity is the allocation and management of investment in grains RD&E

Cover photo: Man in Crop. Photo credit: Shutterstock.

Letter of transmittal

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

7 October 2022

Senator the Hon Murray Watt
Minister for Agriculture, Fisheries and Forestry and Minister for Emergency Management
Parliament House
CANBERRA ACT 2600

Dear Minister

It is my pleasure to present the annual report of the Grains Research and Development Corporation (GRDC) for the year ended 30 June 2022, in accordance with section 46 of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act) and section 28 of the *Primary Industries Research and Development Act 1989* (PIRD Act).

GRDC is confident that its performance in 2021–22 has contributed to a sustainable, productive, competitive and profitable Australian grains industry.

This performance is consistent with GRDC's responsibility to plan, execute and report against the:

- objects of the PIRD Act as they apply to GRDC;
- planned outcomes of GRDC's 2018-2023 Research, Development and Extension Plan and Annual Operational Plan 2021–22;
- outcome and performance measures set out for GRDC in the Agriculture Resources Portfolio Budget Statements 2021–22 and
- core requirements of the Funding Agreement 2020–30, in particular the five performance principles.

The annual report was prepared under the direction of the Board and approved by a resolution of GRDC's directors on 27 September 2022.

Yours sincerely

John Woods
Chairman

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GRAINS RESEARCH & DEVELOPMENT CORPORATION ABN 55 611 223 291

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Overview

About us

The Grains Research and Development Corporation (GRDC) is one of 15 Rural Research and Development Corporations (RDCs) responsible for planning, investing in and overseeing research, development and extension (RD&E) for 25 leviable grain crops.

Our purpose is to invest in RD&E to create enduring profitability for Australian grain growers.

- Invest – we invest to deliver a return on investment to grain growers.
- Research, development and extension – we make investments in RD&E activities in line with the objectives of the *Primary Industries Research and Development Act 1989* (Cth) (PIRD Act).
- Create – we invest to develop innovative approaches to constraints and opportunities and facilitate their adoption.
- Enduring – we invest to drive long-term, sustainable impact on grain-growing businesses and their profitability.
- Profitability – we focus on grower profits, not just productivity.
- Australian grain growers – we exist to deliver value to Australian grain growers. While not all growers will benefit from every investment, we aim to deliver impact to all growers.

Our primary objective is to drive the discovery, development and delivery of world-class innovation to enhance the productivity, profitability and sustainability of Australian grain growers and benefit the industry and the wider community.

The resources available to GRDC for investment in RD&E predominantly arise from levies paid by grain growers and contributions made by the Australian Government, with additional income from interest, royalties and grants.

Enabling legislation

As a corporate Commonwealth entity we are governed by the PIRD Act.

GRDC's Purpose

To invest in research, development and extension to create enduring profitability for Australian grain growers.

Minister

Senator the Hon. Murray Watt

Representative Organisations

Grain Growers Limited

Grain Producers Australia

Australian grains industry at a glance

21,720 Number of levy payers[1]

23.4 **million hectares** Crop sown[2]
(22.7m hectares sown in 2020–21)

62 **million tonnes** Grain produced[3]
(55.8m tonnes produced in 2020–21)

2.5% p.a Total grains industry productivity[4]

5.7% Average rate of return excluding capital appreciation[5]
(3.8% rate of return in 2020–21)

$83.1b Total value of farm production in 2021–22
(up from $68.6b in 2020–21)

$19.1b* Gross value of production[6]
($13.8b in 2020–21)
* Number is derived from 3-year rolling average

Percentage of global grain exports by commodity:

- **12.7%** WHEAT
- **31.3%** BARLEY
- **16.5%** SORGHUM
- **23.6%** OATS
- **3.9%** CANOLA

32.6% Grains industry share of total gross agricultural value[7]

44.3 **million tonnes** Grains exported[8]
(36.5m tonnes in 2020–21)

$22.8b Value of exported grains[9]
($12.4b in 2020–21)

1 Number is derived from ABNs in the Grains Levy Payer Register. It is assumed that each ABN represents an individual levy payer. GRDC is adopting a methodology that recognises the number of levy payers rather than the previously reported number of grain farms.
2 ABARES Annual Crop Report June 2022
3 ABARES Annual Crop Report June 2022
4 ABARES Agricultural Productivity Estimates
5 ABARES Farm Performance
6 ABARES Ag Commodities Statistics June 2022
7 ABARES Ag Commodities Statistics June 2022
8 ABARES Ag Commodities Statistics June 2022
9 ABARES Ag Commodities Statistics June 2022

Chair and Managing Director's Report

Australian grain growers are renowned for being adaptive, resilient and resourceful. When you combine these qualities with world class, innovative and transformational research, development and extension (RD&E), it makes for a highly successful grains industry.

GRDC's role is to support and grow this success by investing in RD&E that delivers a tangible difference on-farm and provides growers with the confidence to make practice changes. Our work aims to help drive the profitability and productivity of grains operations, ensure the industry's sustainability, improve market competitiveness, strengthen our partnerships and ultimately, deliver an impact.

Our RD&E investments are a mix of strategic and tactical projects informed by industry and designed to meet the needs of our key stakeholders - Australian grain growers. These RD&E investments are developed in partnership with researchers, universities, government departments and commercial entities and are managed by a highly experienced GRDC team.

Today we are at the forefront of cutting-edge RD&E as we work to understand how agricultural technology will inform decision-making, increase farm efficiency, examine the options for improved sustainability, and develop key partnerships to address the major challenges facing grain growers into the future.

This year, at a time when sustainability is front of mind, we delivered the results of a CSIRO report we commissioned that showed Australian grain growers are global leaders in low emissions intensity production. The Australian Grains Baseline and Mitigation Assessment report found that the Australian grains industry exhibits low greenhouse gas emissions for each tonne of grain produced compared to other grain producing regions and countries, including the EU, USA, Canada, Russia and Ukraine. This important, robust report sets the critical baseline for the Australian grains sector and will allow us to explore mitigation opportunities that maintain or increase profitability.

We partnered with the Cotton Research and Development Corporation (CRDC) to facilitate two new Business Research and Innovation Initiatives addressing two major challenges facing Australian agriculture. Through this partnership, we collectively secured almost $5 million in additional investment from the Australian Government to help capitalise on the opportunity of renewable hydrogen sources (transforming crops into renewable hydrogen sources) and overcome the challenge of off-target spray drift (revolutionising spray applications to reduce drift).

We also partnered with CRDC in a 'Deployment of spray drift hazard alert warning system for eastern Australia' investment, this is a $5.5 million investment to help minimise spray drift that includes a five-year partnership with Australian agtech company, Goanna Ag. The goal is to develop a spray drift hazard weather warning system that provides real-time weather data and alerts growers and spray operators to the presence of temperature inversions.

In recognition of the increasing role technology plays in grains research, GRDC announced an investment of $25 million in the next frontier of grains research – analytics for the Australian grains industry. This investment will investigate how machine learning (ML), artificial intelligence, data fusion and statistics can support innovation in grains RD&E investments for Australian grain growers.

In a strategic partnership between GRDC, global commercial partner Advanta Seeds and trusted long-term partners, the University of Queensland and Queensland Department of Agriculture and Fisheries, we launched a 5.5 year joint investment worth $11.6 million aiming to address lodging in sorghum. Lodging is consistently rated as the most significant concern facing Australian sorghum growers costing on average $12 million in yield loss annually.

Our co-investment in Chickpea Breeding Australia continued to deliver for growers, with promising results in WA trials of a new chickpea variety, CBA Captain. The variety is part of the Chickpea Breeding Australia initiative; a five-year, $30–million breeding program, that is working to

expand the geographic reach of chickpeas from their traditional northern NSW and Queensland region stronghold into central and southern NSW and WA.

This year, in partnership with the WA Government, we announced our ongoing support for the Australian Export Grains Innovation Centre (AEGIC). Together we committed $24m, that is $3m per annum from each organisation, to support this important, independent research organisation that gathers, analyses and shares market information with the grains industry. Their valuable work guides breeding, market information and assists in identifying market opportunities.

In June, we also committed to re-investing $6 million per annum for another five years to Curtin University's Centre for Crop Disease Management (CCDM). CCDM is Australia's national centre for research targeting grain crop disease issues to deliver sustainable, integrated disease management practices for grain growers now and into the future. CCDM is focused on three major research areas including fungicide resistance, cereal diseases, and canola and pulse diseases.

To ensure grain growers had the opportunity to guide GRDC investment, we successfully launched our National Grower Network meetings across Australia. This new model has been designed to bolster the opportunities for growers and advisers to meet with GRDC Panel members, staff and industry researchers to identify and explore opportunities to develop regionally relevant investments that deliver improvements in productivity and profitability on-farm. In this first year of NGN-driven projects we invested $3.9 million into more than 60 on-the-ground initiatives with partners that include regional farming groups.

While the 2021–22 year saw many new investments, it also ensured long-term GRDC investments into critical RD&E were still making an impact and delivering genuine dividends for growers. An example of this is our investment into canola agronomy, which has been increasingly embraced as a profitable winter crop with annual plantings tripling over the past 20 years.

However, canola comes with production challenges and has been considered high risk due to the level of inputs required and the cost of windrowing. To overcome these challenges, GRDC invested in an extensive range of projects to improve growers' knowledge and management of the crop. Between 2019 and 2022 alone, GRDC made direct investments of more than $30 million into canola RD&E focusing on improving yield and yield drivers. The outcomes from these projects have informed and improved the knowledge of 80% of agronomists consulted through a follow-up survey. The estimated value of practice changes totalled $74 million or $29.60 per hectare in revenue gains.

This year, GRDC's co-investment with CSIRO into dual-purpose canola and farming systems, was also recognised with the CSIRO research team led by Dr John Kirkegaard awarded the 2021 Sir Ian McLennan Impact for Science and Engineering Medal. This award celebrates outstanding practical contributions to industry and recognises research teams that have created value through innovation. The award also highlights the significant investment we have made with our research partners into crops, such as dual-purpose canola, that offer enhanced flexibility and resilience to mixed farming systems.

Other significant gains have been made for growers through more than a decade of GRDC investments into water use efficiency (WUE). This work has established that water productivity (crop yield per unit of water used) increases of more than 40% are possible using improved management practices, like fallow weed management, rotation choice, long-term stubble retention and minimum tillage. In the current season, WUE may not be front of mind for growers, but the variability of the Australian environment means longer term this RD&E will continue to make a difference. Implementing these management tactics can allow growers to produce a crop on decile one or below rainfall which is a game changer.

The RD&E we invest in is delivering at farm level and in seasons when weather conditions are favourable, this is translating to record harvests. Two consecutive seasons of record crops nationally, coupled with prudent financial management of GRDC reserves, has allowed us to increase our annual RD&E expenditure to $180 million.

This current target expenditure puts GRDC at similar RD&E investment levels to the four-year period between 2015 and 2018. However, we are keenly aware levy revenue varies significantly from year-to-year depending on the size of the harvest for our 25 leviable commodities.

In contrast to current conditions, our levy income for the 2019–20 financial year was $95.8 million—a 12 year low.

We take a considered, financially prudent, long-term view to ensure that research investments are consistent and not impacted by seasonal conditions or turned 'on and off' in response to national grain yields and prices.

We also support diverse investments from on-farm agronomy, pests, weeds and disease projects right through to post-farmgate market intelligence to deliver value to Australian grain growers.

Engagement with our key stakeholders remains an integral part of our operation. We connect through our established regional advisory panels where 30 growers, advisers, researchers and industry stakeholders represent the sector to GRDC to inform RD&E investments. Panels ensure investments are developed in the best interests of growers and deliver impact to industry.

Reviewing where and how we invest on behalf of Australian grain growers and ensuring we continue to deliver RD&E that supports long-term grower sustainability and profitability remains GRDC's core purpose. This year we have undertaken extensive industry engagement and consultation to shape and inform our next five-year RD&E plan (2023–2028).

Critically, collaboration and co-operation remain central to everything we do at GRDC. There is not a single RD&E project we invest in without the support and involvement of our research partners, growers or the broader industry. We also partner outside the grains sector to solve those challenges that are bigger than our industry. Strong relationships are at the heart of our business and make our RD&E investments possible.

In closing we would like to thank Cathie Warburton, former General Counsel and General Manager, who stepped forward as Interim Managing Director until March 2022 and paved the way for a seamless and integrated induction to the business for our incoming Managing Director, Nigel Hart.

We would also like to thank our fellow Board Directors, the Regional Panel Chairs and members, the Executive Committee and staff, who work together to ensure GRDC's continued investment in high-quality RD&E on behalf of Australian grain growers. We are proud of the work that we do and the role we play in delivering improvements that result in greater profitability on-farm for Australian grain growers.

Yours sincerely,

John Woods (Chair) and
Nigel Hart (Managing Director)

Grains industry challenges in 2021–22

The Australian grains industry is dynamic and ever evolving. It is a major contributor to the Australian economy, representing 23 % of gross agricultural production. Our growers are recognised globally as innovative, resilient, and highly efficient.

Proven ability to adapt, economies of scale, reputation for safety and quality, and proximity to growth markets are strengths we want to build upon. The fundamental drivers of market demand present an exciting outlook for the Australian grains industry over the coming decades.

The industry isn't without its challenges, perhaps the largest being the need to effectively mitigate grains enterprise production and market risk. Variable seasonal conditions and tight profit margins require effective cost management and business models that enable profit opportunities to be realised in the good years, whilst minimising financial loss in less favourable seasons. These factors, along with changing diets, consumer preferences and community expectations are likely to impact how growers farm in the future.

But we are up to the challenge. A swathe of new technologies present opportunities to discover and deploy new solutions to Australian grain growers. Biotech, fintech and agtech are moving forward at pace, having potential to deliver the next agricultural revolution. Realising these opportunities will require a problem focus (as opposed to a technology push), new partnerships and collaboration across organisations, disciplines and sectors.

Investment and impact in 2021–22

$177.1m
Total investment expenditure
($168.9m in 2020–21)

656
Total number of active investments
(602 in 2020–21)

Investments by objective — Number of investments and investment value

$70.3m	$7.3m	$61.7m	$1.9m	$4.0m
Objective 1	Objective 2	Objective 3	Objective 4	Objective 5

37.9%
New investment

62.1%
Ongoing investments

Intellectual property statistics

23
patent families filed in more than
45
countries

94
commercial agreements including
6
new agreements

124
Plant breeder's rights

GrainInnovate
19 investments and for every dollar invested by GRDC a ratio of **1:36** of co-investment has been contributed by Artesian and other sources.

$6.7m
royalty revenue

19
trademarks

Year in review

Better soil testing could 'save dollars on-farm'

University of Southern Queensland's Professor John Bennett led a $3.3 million investment—the economics of ameliorating soil constraints in the northern region—investigating strategies to overcome two key constraints, dispersive and compacted soils.

Research findings from the five-year project, which involved research partners the Department of Agriculture and Fisheries (DAF) and the University of New England (UNE), delivered new understanding to when growers should use gypsum to improve 'sodic' soils. Gypsum can cost more than $120 per hectare spread. Comparatively, the cost of dispersion analysis can be as little as $4.5 per hectare, depending on the sampling density.

Northern NSW grain grower Jack Pearlman has already benefited from the research findings thanks to a GRDC trial on his family property. The grower, who farms 3300 hectares, had planned to apply gypsum to about 185ha to address what he believed were sodicity issues at an estimated cost of $300/ha. But before he applied the gypsum, he sent soil samples to Dr Roberton and Professor Bennett.

'In just 15 minutes, with an aggregate stability test, they saved us more than $50,000,' Jack said.
Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/national/2021/july/better-soil-testing-could-save-dollars-on-farm

Grain grower Jack Pearlman farms 3300 hectares at North Star in northern New South Wales with his parents Michael and Kylie. He said a test to assess soil stability saved him $50,000 in unnecessary gypsum application. Photo: Melanie Jenson.

New decision-making tool for yellow leaf spot disease

A new decision support tool developed with investment from GRDC will help Australian wheat growers and their advisers to make more informed decisions about managing one of the industry's most damaging diseases, yellow leaf spot.

Rated the most economically damaging wheat disease in the country, yellow leaf spot can cost growers up to $30 per hectare in lost production and management costs in hard-hit seasons.
The new decision support tool is calibrated for use across all the wheat growing regions of Australia.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/national/2021/july/new-decision-making-tool-for-yellow-leaf-spot-disease

A new decision support tool has been developed for yellow leaf spot that is calibrated for use across all the wheat growing regions of Australia. The disease can cost growers up to $30/ha in lost production and management costs in hard hit seasons. Photo: GRDC.

Wild wheat could hold key to crown rot resistance

An innovative new investment will investigate whether an international research finding could be part of the genetic solution for Australian growers managing the costly disease Fusarium crown rot. Caused by the fungus, *Fusarium pseudograminearum*, crown rot is a significant disease for winter cereals such as wheat, barley, durum, triticale and oats, costing the nation's grains industry an estimated $404 million in lost yield annually. The latest crown rot investment will be led by CSIRO and will expand on international research findings last year that discovered crown rot resistance in a wild relative of cultivated wheat – tall wheat grass.

This $1.9 million, three-year research partnership will enable the importation of the newly identified resistance source – gene Fhb7 – to assess how it performs in protecting wheat crop yields from crown rot disease pressure under Australian conditions.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/national/2021/june/wild-wheat-could-hold-key-to-crown-rot-resistance

This new GRDC research partnership with CSIRO is one of many undertaken in recent years with a focus on delivering germplasm and markers for breeders to use to reduce the impact of crown rot disease in wheat. Photo GRDC.

GRDC harvester forums to help growers reduce grain losses

Best practice harvest tactics are a grower's greatest ally in the quest to maximise on-farm profitability at the end of the growing season. But the penalty for not getting it right can be significant; using the Australian Bureau of Agricultural and Resource Economics and Science (ABARES) estimates of crop area and GRDC research, the average farm growing 324 hectares of canola experiences harvest losses of about $24,300 each year.

To assist growers to reduce these losses and improve operations at harvest, GRDC ran a series of half-day forums across Queensland and New South Wales.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/north/2021/august/grdc-harvester-forums-to-help-growers-reduce-grain-losses

CT scans deliver new view for grains research

'CT scans' are relatively common when it comes to medical science, but now the sophisticated technology is being adapted to give researchers a new view of plants.

Computed tomography (CT) scanners are regularly used to make cross sectional or three-dimensional X-ray images of human subjects to help with specialist diagnosis in hospitals across the world. The CT scanner will allow genetic improvements in a range of crop types to be delivered faster to Australian growers.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/national/2021/december/ct-scans-deliver-new-view-for-grains-research

GRDC to invest $25m in next frontier for grains research

GRDC is investing $25 million in an innovative, new analytics investment platform, which will use analytics including machine learning (ML), artificial intelligence, data fusion and statistics to support innovation in grains RD&E investments for Australian grain growers. This investment is about pursuing the next frontier of transformational gains for the grains industry. It is ambitious but has the potential to deliver major changes for the sector.

Full story can be found here: groundcover.grdc.com.au/innovation/industry-insights/grdc-to-invest-$25m-in-next-frontier-for-grains-research

The AAGI investment will use analytics including machine learning (ML), artificial intelligence, data fusion and statistics to support innovation in grains RD&E investments for Australian grain growers.

Genetic solution in the works to maintain high barley yields

A changing climate has made heat stress an inevitable risk to barley yields for Australian growers, but there's optimism a genetic solution could be at hand to preserve productivity.

GRDC's capacity building investment has supported the work of Dr Camilla Hill, who is investigating the practical application of genetics to plant breeding. Dr Hill is currently working on a GRDC investment in conjunction with Murdoch University's Western Crop Genetics Alliance, which aims to identify genes that infer heat tolerance in barley varieties and deliver new genetic resources to Australian barley breeders.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/west/2022/january/genetic-solution-in-the-works-to-maintain-high-barley-yields

Dr Camilla Hill, Murdoch University, preparing barley seeds for analysis by a SeedCount Analysis System to determine the effects of heat stress as part of her GRDC-supported postdoctoral study. Photo: Evan Collis.

New pre-breeding co-investment to tackle sorghum lodging

A new $11.6 million, five-and-a-half-year joint investment is aiming to address lodging in sorghum – an issue that is consistently rated as the most significant concern facing Australian sorghum growers and costing on average $12 million in yield loss annually.

The investment comprises in-kind and cash investment between GRDC, global commercial partner Advanta Seeds and trusted long-term partners University of Queensland (UQ) and the Queensland DAF.

This strategic investment aims to de-couple the relationship between height, yield and lodging to increase the water-limited yield potential of sorghum, reducing grain-fill yield loss by 25%. The knowledge and techniques developed will allow breeders to chase yield harder without greater lodging risk.

Full story can be found here: groundcover.grdc.com.au/innovation/industry-insights/new-pre-breeding-co-investment-to-tackle-sorghum-lodging

GRDC invests in better mouse management for growers ahead of increased activity

Reports of an increase in mouse activity across Australia's grain growing region haven't come as a surprise to industry experts, who were expecting high numbers this year after a bumper harvest and significant outbreak in 2021. Steve Henry, leading mouse expert and research officer at Australia's national science agency, CSIRO, delivered a series of webinars to advise growers across the country as high numbers impacted grain operations.

Full story can be found here: groundcover.grdc.com.au/weeds-pests-diseases/pests/grdc-invests-in-better-mouse-management-for-wa-growers-ahead-of-increased-activity

Western Australian growers should implement an integrated management approach to minimise damage from a potential mouse outbreak, with reports of increased activity across the grain growing region. Photo: CSIRO.

Australian grain: a leader in low emissions intensity production

Australian grain growers are producing low emissions intensity, high quality cereals, pulses and oilseeds, according to a report released by GRDC.

The report, Australian Grains Baseline and Mitigation Assessment, found that the Australian grains industry exhibits low greenhouse gas emissions for each tonne of grain produced compared to other grain producing regions and countries, including the EU, USA, Canada, Russia and Ukraine.

The report established a detailed and robust greenhouse gas (GHG) emissions baseline for the Australian grains sector and explores mitigation opportunities that maintain or increase profitability.

Full story can be found here: groundcover.grdc.com.au/innovation/industry-insights/australian-grain-a-leader-in-low-emissions-intensity-production

GRDC guide helps with farm machinery decision-making

New research into one of the most hotly debated line items on the farm budget, machinery, has resulted in the development of a comprehensive investment guide for Australian grain growers.

GRDC initiated a two-year project, Machinery Investment Options in the Australian Cropping Regions, which investigated/evaluated machinery investment and replacement costs and options to support growers make more informed purchasing decisions.

The investment guide combines information from more than 450 Australian grain growers and includes 30 in-depth case studies, allowing the industry to effectively compare averages for similar size farming operations. The GRDC research found on average, the level of national machinery investment was 34 cents in every dollar of farm income generated (a machinery investment ratio of 0.34).

Full story can be found here: groundcover.grdc.com.au/innovation/precision-agriculture-and-machinery/grdc-guide-helps-with-farm-machinery-decision-making

The new GRDC guide to machinery investment features 30 case studies with grain growers from across Australia. Photo: GRDC.

Updated disease ratings prepare growers for high stripe rust risk

Experts have warned there is a high risk that Australian grain growers, particularly in eastern Australia, will experience stripe rust pressure during the winter growing season, with wet summer conditions and carryover from last year creating the perfect storm for the disease.

The risk of stripe rust in Western Australia is generally lower than in the eastern states, but with infection found in wheat crops in late 2021, growers should not be complacent.

Updated disease ratings for wheat varieties have been published on GRDC's National Variety Trials (NVT) website - which could help growers avoid highly susceptible varieties in light of the risk, or to develop appropriate management plans to minimise impacts.

Full story can be found here: groundcover.grdc.com.au/agronomy/national-variety-trials/updated-disease-ratings-prepare-growers-for-high-stripe-rust-risk

Hyper yielding canola breaks 5 tonne yield target

A GRDC research project pushing the economy-attainable boundaries of wheat, barley and canola has produced a hyper yielding canola crop yielding in excess of six tonnes per hectare.

The four-year GRDC Hyper Yielding Crops research project led by Field Applied Research Australia and spanning the high productivity regions of five states aimed to push what are believed to be the economically attainable yield boundaries of wheat, barley and canola.

The champion yield topped out at 6.49 t/ha in SA. This was sown into a neutral-slightly alkaline Organosol (Peat soil) with high organic matter, following wheat in 2020. 225 kg N combined with the application of 6.7 t/ha animal manure was applied to replicate high fertility soils in a mixed legume rotation.

Full story can be found here: groundcover.grdc.com.au/crops/oilseeds/hyper-yielding-canola-breaks-5-tonne-yield-target

GRDC's Hyper Yielding Crops research project aims to push the yield boundaries of wheat, barley and canola. Photo: GRDC.

New research to increase profitability of ironstone gravel soils

New research into ironstone gravel soils in the western and southern regions of Australia is working to unlock potential and increase the yields of crops planted on this challenging soil type.

The three-year GRDC phase 2 investment aims to provide tools for growers to identify and understand their ironstone gravel soils, and make more informed management decisions on cropping, fertiliser and water.

Led by Dr Francesca Brailsford from Murdoch University, the project is part of a SoilsWest alliance initiative, which also includes the University of Western Australia, Department of Primary Industries and Regions South Australia, Queen's University Belfast and Bangor University.

Full story can be found here: groundcover.grdc.com.au/agronomy/soil-and-nutrition/new-research-to-increase-profitability-of-ironstone-gravel-soils

Gravel soils cover 24% of land used for crop production in southern Western Australia, with further major production regions in South Australia (Eyre Peninsula and Kangaroo Island) and Victoria. Photo: Dr Francesca Brailsford.

Major partnership to deliver spray hazard warning system

The grains and cotton industries announced a $5.5 million investment to help minimise spray drift through a five-year partnership with Australian agtech company, Goanna Ag.

The investment will see GRDC and Cotton Research and Development Corporation (CRDC), in partnership with Goanna Ag, develop a spray drift hazardous weather warning system that will provide real-time weather data and alerts to growers and spray operators about the presence of temperature inversions.

Goanna Ag will establish, operate and maintain a network of 100 Profiling Automatic Weather Stations (PAWS) across the grain and cotton regions of NSW and QLD.

Full story can be found here: groundcover.grdc.com.au/agronomy/spray-drift/major-partnership-to-deliver-spray-hazard-warning-system

Goanna Ag, Chief Operating Officer, Tom Dowling with CRDC's research and development manager, Susan Maas and GRDC manager chemical regulation Gordon Cumming at the announcement of the $5.5 million investment to develop a spray drift hazardous weather warning system across Queensland and New South Wales. Photo: CRDC

Research challenges Durum sowing window and reduces Fusarium Crown Rot risk

New research has challenged the traditional concept of sowing Durum wheat towards the end of its sowing window, with trial results indicating that planting earlier could boost yield potential and minimise the impact of Fusarium Crown Rot, which is tipped to be a big risk for northern growers this season.

Three trials in 2021 looked at the yield benefits of planting Durum earlier in the recommended sowing window to avoid heat stress during grain fill and monitored how depth of sowing impacted crop emergence. The work was done as part of the GRDC and NSW Department of Primary Industry's (DPI) five-year Grains Agronomy and Pathology Partnership (GAPP).

At sites in both southern and northern NSW, Durum varieties recorded a hefty yield penalty when planted at the end of the sowing window (June) versus the start (early to mid-May), with later sown crops yielding between 5 to 31% less.

Full story can be found here: groundcover.grdc.com.au/weeds-pests-diseases/diseases/research-challenges-durum-sowing-window-and-reduces-fusarium-crown-rot-risk

Trial results have shown that growers can plant their Durum crops earlier in the sowing window to prevent yield loss from heat stress during grain fill. Photo: NSW DPI

Frost physiology knowledge base grows

A capacity building project to better understand the effects of frost on grain crops has delivered results to help growers to manage risk with their crop management decisions.

For wheat alone, it is estimated that frost causes losses to the Australian grains industry of at least $400 million per year.

GRDC, in conjunction with state-based Departments of Agriculture and Universities, invests in research to better understand the effects of frost on grain crops and to develop management solutions for growers in frost prone areas.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/national/2022/may/frost-physiology-knowledge-base-grows

Photo GRDC.

New tool helps grain growers preserve beneficial insects on-farm

A critical new tool will help Australian grain growers understand what pesticides to select to preserve 'beneficial' insects that play a critical role in pest management in the paddock.

Pesticides are a key tool for controlling insect pests in grain crops and effectively protect yield and grain quality. However, some chemicals have the potential to harm beneficial insects, such as predators and parasitoids, which have an important role in Integrated Pest Management (IPM).

Different pesticides have different impacts, which has made it challenging for growers to know what chemistry they should use on-farm to preserve these beneficial insects.

Full story can be found here: groundcover.grdc.com.au/weeds-pests-diseases/pests/new-tool-helps-grain-growers-preserve-beneficial-insects-on-farm

This new tool will help preserve beneficial insects in the Australian grains industry such as parasitoid wasps which help control grain aphids. Photo: CESAR.

GRDC on central Queensland 'listening' tour

Grain growers, advisers, researchers and industry stakeholders are regularly offered the chance to share the issues and opportunities for farm profitability with the nation's leading research investor via GRDC's three regional panels.

To ensure RD&E investments are developed and deliver outcomes that meet the needs and priorities of industry, GRDC's Regional Panels undertake annual tours of Australian grain growing areas.

Full story can be found here: grdc.com.au/news-and-media/news-and-media-releases/north/2022/april/grdc-on-central-queensland-listening-tour

Photo: GRDC.

GRDC/NSW DPI research partnership delivers to growers

An innovative, multi-million-dollar partnership that combined the might of Australia's leading research investor, GRDC, with the internationally recognised and applied research capability of the New South Wales DPI to drive change for grain growers was celebrated this year.

Since the Grains Agronomy and Pathology Partnership (GAPP) was officially formed in 2017 to drive innovation and build capacity and capability for the Australian grains industry it has received a total of $64.6 million investment from GRDC and NSW DPI.

The partnership focused on delivering on a range of projects that increased productivity and innovation, as well as the sector's capacity to respond to risk and improve grower profitability through better disease and pest management and reduced input costs.

Full story can be found here: https://groundcover.grdc.com.au/innovation/industry-insights/grdcnsw-dpi-research-partnership-delivers-to-growers

NSW DPI Deputy Director General Kate Lorimer-Ward with GRDC Managing Director Nigel Hart celebrating the achievements of the Grains Agronomy and Pathology Program in Wagga Wagga, NSW.

GRDC's support plants the seed for crop disease breakthroughs

A Curtin University research centre will continue to discover new ways to reduce the economic impact of crop disease for Australian growers, with a further five-year investment of $30 million by GRDC and $62 million by Curtin University.

Established in 2014, the Curtin-based CCDM is a major initiative involving alignment of strategic objectives and co-investment of resources and human capability by Curtin University and the GRDC.

Confirming its industry-recognised track record for engaging with industry and delivering real-world solutions, the Centre's discoveries include identification of globally significant cases of fungicide resistance among barley diseases and finding the 'master gene' responsible for regulating infection by common wheat pathogens, and by generating germplasm and genetic tools that help growers breed disease-resistant wheat, barley, canola and pulses.

Full story can be found here: groundcover.grdc.com.au/innovation/industry-insights/grdcs-support-plants-the-seed-for-crop-disease-breakthroughs

Stakeholder engagement snapshot

Grains Research Updates

25
number of events
(face to face, livestream and webinars)

circa
4,800
total attendees

Farm Business Updates

1400
attendees
(avg 100 attendees per face-to-face event)

Average value score rated by attendees
8.7/10

16
events, on location and livestream

GRDC subscribers

34,926
Groundcover

28,667
Regional newsletters

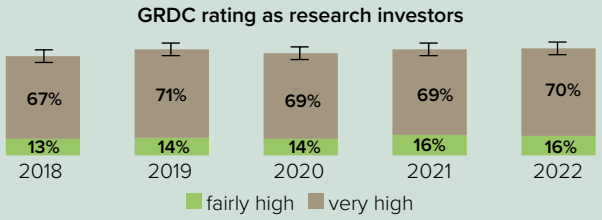
National Grower Network (NGN)

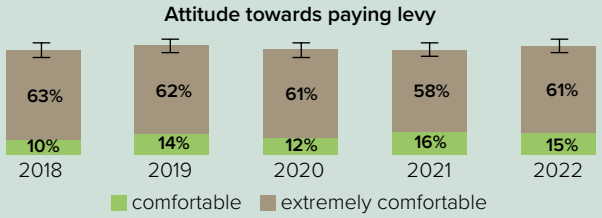
22
NGN forums held nationally

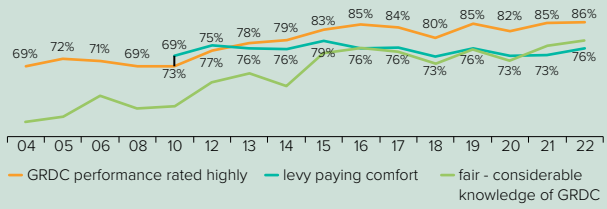
62
investments

100
NGN actions
(investment or variation ideas)

Grower survey







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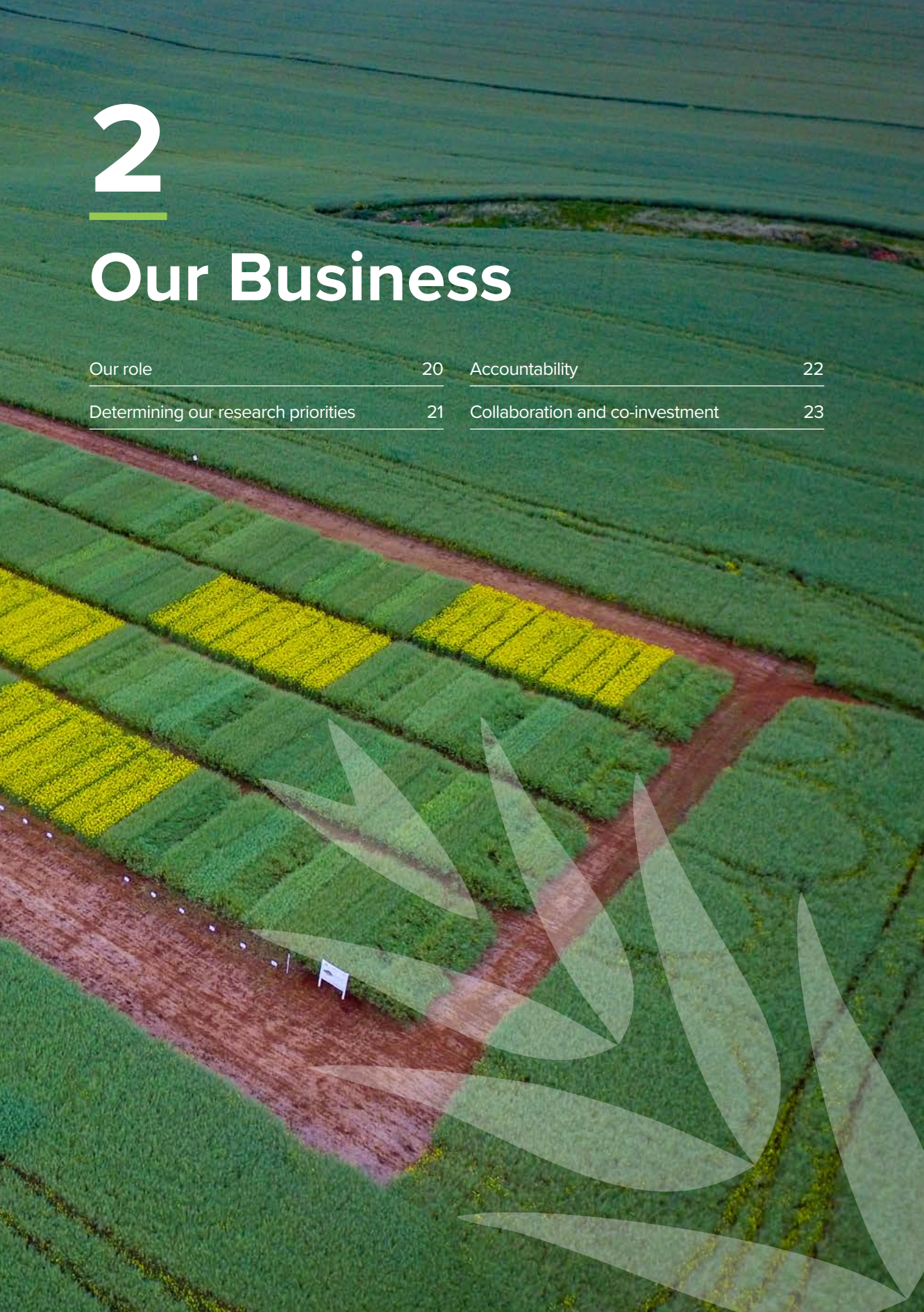
Our Business



Our role

GRDC's role is to invest in and manage a balanced portfolio of RD&E investments on behalf of Australian grain growers and the Australian Government. These investments are developed to improve the environmental, social and economic position of grain growers, benefit the broader agricultural sector and contribute positively to the wider community.

Investment management

GRDC investment decisions consider a broad range of factors and are informed by analysis and consultation, including advice from GRDC's three Regional Panels and engagement with industry through our National Grower Network.

Decision-making starts with understanding the problem, present and future situations, and the value proposition of various possible solutions.

Responsible investment requires active management of a portfolio of investments aligned to an agreed overall investment strategy.

We take this responsibility seriously at GRDC and aim to ensure a balanced investment portfolio that considers both risk and return. Three key areas of risk are broadly considered in portfolio risks assessment by GRDC, these being:

(a) Technical risk – is the research investment technically feasible

(b) Delivery risk – how will growers access the research outputs

(c) Adoption risk – will growers want to adopt the research outputs.

Whilst it is recognised that a combination of multiple, incremental (or small) changes can result in significant improvements in profit, consultation by GRDC with grain growers during the development of the 2018-23 RD&E plan confirmed an increased desire for investment to deliver transformational impact. Higher risk, higher reward investments often come with higher failure rates, but this can be mitigated through portfolio management, including the number of investments GRDC makes in a certain area. Transformational approaches often take longer to deliver tangible grower outcomes and may be less visible versus local development or extension projects.

In the context of GRDC's purpose, return is not focused on direct return on investment to GRDC, but the delivery of benefit to Australian grain growers and the broader community. We are focused upon impact and hence consider the quantum (how much?), speed (by when?) and beneficiaries (who, where?) of impact from RD&E investment.

Our investment portfolio aims for a mix of investments that:

(a) Align to prioritise grower need

(b) Deliver upon the objectives of the RD&E plan

(c) Assess and mitigate technical, adoption and commercial risks

(d) Deliver equitable impact across time, geography and crop

(e) Align to an agreed investment strategy.

Accountability

We have several key stakeholders, being the Australian Government through the Minister for Agriculture, Forestry and Fisheries; the Department of Agriculture, Forestry and Fisheries; and the grains industry's representative organisations, Grain Growers Limited and Grain Producers Australia.

Sources of funds

We are funded through an industry levy and matching Commonwealth contributions. Levies are collected at the first point of sale and based on a percentage of the net farm gate value of the following crops:

- wheat
- coarse grains—barley, oats, sorghum, maize, triticale, millets/panicums, cereal rye and canary seed
- pulses—lupins, field peas, chickpeas, faba beans, vetch, peanuts, mungbeans, navy beans, pigeon peas, soybeans, cowpeas and lentils
- oilseeds—canola, sunflower, safflower and linseed.

The Australian Government matches the levy contributions up to a limit of 0.5% of the three-year rolling average of the gross value of production of the 25 leviable crops. Other sources, including interest, royalties and grants, contribute a smaller proportion of GRDC's income.

In 2021–22, Australian grain growers and the Australian Government co-invested $177.1 million through GRDC into grains RD&E across 656 projects in collaboration with more than 200 research partners.

Collaboration

Collaboration is critical for the effective delivery of RD&E outcomes, so we partner with researchers, research organisations, universities, governments, farming systems groups and growers to deliver RD&E investments, extend outcomes and maximise adoption on-farm.

Grain growers across all three GRDC regions directly contribute to RD&E through their levy contribution, but a significant number also provide their time, knowledge and expertise to contribute to on-farm trials or to inform future RD&E investments.

Determining our research priorities

We engage and consult widely with Australian grain growers, advisers and industry stakeholders to understand and prioritise the constraints and opportunities impacting farming businesses, and with Australian Government to acknowledge its overarching agricultural RD&E objectives.

These priorities help shape our strategic RD&E priorities or Key Investment Targets, which are detailed in our current *2018-2023 RD&E Plan*. We are also accountable to the grains industry through our representative organisations, Grain Growers Limited and Grain Producers Australia.

In understanding the research needs and priorities of the grains industry, GRDC utilises a broad range of engagement and consultation approaches to ensure RD&E investments are informed, meet grower and industry needs and have strategic alignment with GRDC objectives. This engagement and consultation can involve Regional and National Panels and the National Grower Network.

Regional Panels

Each year we work closely with our three regional advisory panels to understand and determine regional and national RD&E opportunities and priorities. Our regional panels, consisting of grain growers, agribusiness practitioners, scientists, GRDC executive managers and other industry experts, provide a vital link between the broader grains sector and GRDC. They help to identify, prioritise and support RD&E investments that address regional constraints and opportunities impacting on-farm profitability.

The regional panel members' roles include engaging with and listening to growers, advisers, researchers and industry stakeholders to understand the different constraints and opportunities that are influencing farm returns and bring that information back to GRDC.

Regional panels are also involved in reviewing investment proposals presented by GRDC staff and providing feedback and advice to GRDC. In partnership with GRDC staff, they also help to extend outcomes from GRDC's investments to the local industry and monitor their effectiveness.

The panels ensure our investments are in the best interests of growers and deliver impact to each grain-growing region.

National Panel

The GRDC National Panel identifies research, development and extension priorities across our investment portfolio and reviews investment proposals that have gone to Regional Panels. The National Panel includes the Chairs of the three regional panels, GRDC's Managing Director and executive managers.

National Grower Network

The National Grower Network (NGN) refers to the community of growers and grains industry stakeholders across Australia's growing regions whom GRDC engages with directly to assist in developing locally relevant RD&E investments.

The NGN was established to:

- support meaningful engagement with grain growers
- improve understanding of local issues
- assist in the development of investments that are locally relevant and have on-farm impact.

The NGN helps to capture ideas, issues, constraints and opportunities for RD&E to enhance grower profitability. To achieve this, GRDC engages with stakeholders through forums that are open to all growers, advisers, researchers and industry parties.

RD&E priorities and continuous investment

Importantly, in addition to immediate and medium-term grains industry priorities, we identify and invest in longer term RD&E designed to ensure the future of the sector and deliver ambitious, innovative, transformational solutions to grain industry challenges.

The current five-year RD&E plan is part of a 10 to 20–year strategy to deliver on GRDC's purpose: *To invest in research, development and extension to create enduring profitability for Australian grain growers*. The plan works to deliver results that maximise growers' long-term profitability with RD&E investment strategies, based on profit drivers: improving yield, maintaining or improving price, optimising costs, and managing risk.

Other key elements of the current RD&E Plan include:

- a flexible and responsive investment approach through a continuous cycle
- greater focus on high reward, transformational research to drive competitiveness
- regional delivery with national coordination and leverage.

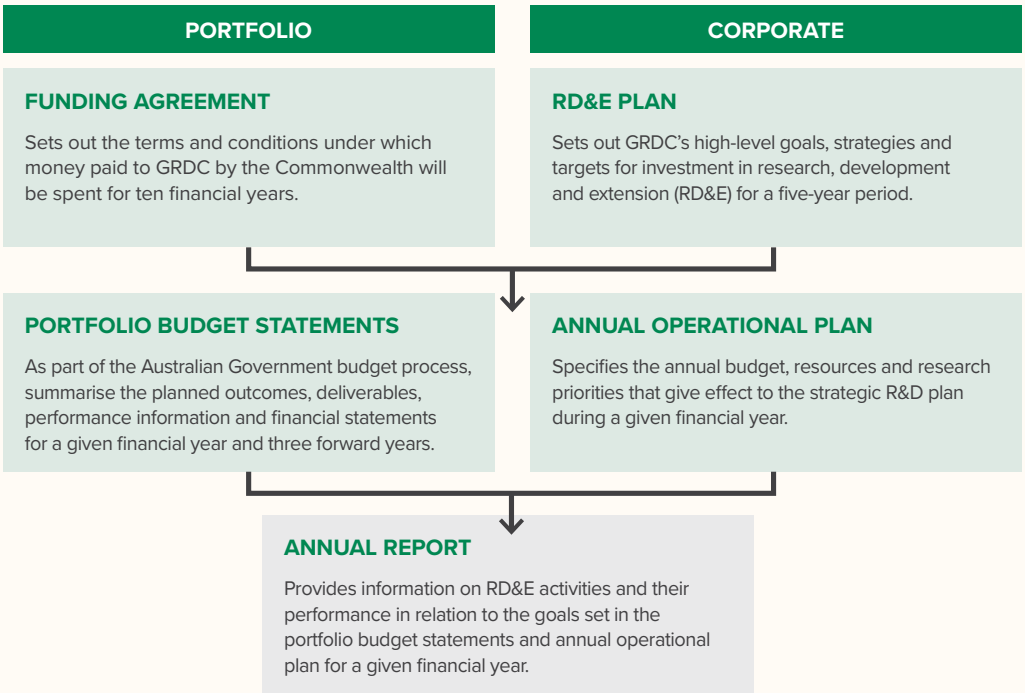
Accountability

We are accountable to the Australian Government through the Minister for Agriculture, Fisheries and Forestry. The government communicates its expectations of GRDC through a funding agreement, Ministerial direction, policy and administration of the PIRD Act. In response to Government expectations, GRDC responds in three main ways: regular communication; compliance with Funding Agreement policy and legislative requirements; and the development of Strategic RD&E Plans, Annual Operating Plans and Annual Reports.

GRDC is accountable to grain growers, the Australian Government and the broader community. More information on meeting those accountability requirements can be found in Part of this annual report.

Figure 1 outlines the core elements of GRDC's annual cycle of planning and reporting against planned objectives and statutory requirements. The documents are available on GRDC's website: grdc.com.au/about/who-we-are/corporate-governance

Figure 1: Planning and reporting framework



Collaboration and co-investment

Co-operation and collaboration are integral to the design, development and delivery of effective RD&E. We work in partnership with state government departments, universities, research organisations, farming systems groups, commercial entities, growers, advisers and industry stakeholders to achieve strategic and tactical RD&E outcomes for the grains industry.

Effective partnerships with co-investors enables GRDC to leverage resources and research capability; share market knowledge, technologies and intellectual property; and reduce the risk associated with individual investments. This approach underpins our investment strategy and helps ensure higher returns for the investments we make on behalf of Australian grain growers.

Significant collaborative arrangements during 2021–22 include:

Grains Australia Limited (GAL)

This company, limited by guarantee, was established in 2020 by GRDC on behalf of Australian grain growers and remains the sole member. GGL, GPA and Grain Trade Australia Limited provide advice to GAL through an advisory committee. GAL delivers a multitude of industry-goodfunctions to serve industry requirements.

GAL's core functions are to establish and maintain a grain variety classification system; provide services that maintain and improve trade and market access; develop long-term market and consumer analysis and product awareness to support longer term demand and value creation and lastly, ensure technical support and training is available for customers of, and participants in the Australian grains industry.

In 2022, GAL established commodity councils for wheat and barley. These councils comprise industry expertise from across the value chain to provide insight and direction for GAL in the execution of its core functions.

Agricultural Innovation Australia Limited

Agricultural Innovation Australia Limited (AIA) is a key element of the Australian Government's National Agricultural Innovation Agenda to modernise Australia's agricultural innovation system. Activities undertaken by AIA will focus on areas with greatest impact across multiple agricultural industries. To avoid duplication of effort, when prioritising opportunities for investment, consideration will be given to existing Research and Development Corporation (RDC) and industry strategies.

As a single point of contact for cross-industry strategies, AIA makes it easier for investors to navigate and partner with the Australian agricultural innovation system. Its agile investment framework will attract contributions from a range of sources, enabling large-scale investment on issues of national importance.

Herbicide Innovation Partnership

The Herbicide Innovation Partnership (HIP) is a co-investment between GRDC and Bayer Crop Science to boost weed research capacity, discovery and development of herbicides with new modes of action.

HIP research places Australian growers' interests at the heart of Bayer's herbicide discovery program. As a part of this commitment, candidate compounds are routinely tested for efficacy against Australian weeds, including herbicide-resistant weed species, at the earliest stages of development, and are trialled in the field in Australian conditions to ensure suitability for Australian farming systems.

Climate initiative

The Council of RDCs commenced a Climate Initiative to drive innovation that creates long-term adaptation to climate change. This Initiative has now developed an investment plan that was launched in February 2021. Its vision is to support a thriving agriculture sector irrespective of climate.

GRDC has worked with Agricultural Innovation Australia (AIA) to invest in a climate related initiative:

- Agri-Climate Outlooks – an initiative led by the Bureau of Meteorology that will enhance seasonal outlook services and provide relevant, interpretable products and services to support better decision-making and greater resilience for Australian farmers, fishers, and foresters.

Joint RDC – Community Trust in Rural Industries Program

The Community Trust in Rural Industries Program is a collaborative partnership involving 11 RDCs along with the NSW DPI and the National Farmers Federation developed to build the capacity of the food and fibre industries to actively engage with community. The aim of the program is to:

- develop capability across the sector to monitor, anticipate and respond to shifts in the levels of trust the community has in Australia's rural industries
- build a common language and collective national narrative around the community trust challenge
- identify common best practice approaches, strategies and interventions for building, rebuilding and maintaining community trust.

Rural Health and Safety Alliance

The Rural Health and Safety Alliance (RSHA) is a partnership led by AgriFutures Australia in collaboration with GRDC and seven other RDCs. The RSHA has recently released a national report that highlights the overlap in health and safety risks across 12 agricultural and fisheries sectors, which result in fatality, injury, and illness.

The report aims to inform the RSHA's cross-sector investment in RD&E projects to reduce the incidence of death and serious injury.

This investment recognises the need for RDCs to work together on a cross-sectoral RD&E strategy for workplace health and safety (WHS). While each sector has specific health and safety challenges, the broader challenges need to be addressed collaboratively and require a strategic approach from the entire agricultural sector. This process is more likely to identify key WHS issues and support targeted and effective research that ensures a healthy and safe agricultural workforce.

Strategic Partnerships

Strategic Partnerships are targeted collaborations with research partners who share our commitment and passion for innovation in the grains sector. Strategic Partnerships are designed to be high impact and deliver a positive return on investment for Australian grain growers. GRDC is investing with partners for an ambitious and clear outcome that addresses common strategic objectives. The RD&E is co-designed to derive maximum value from the strategic co-investment of the parties.

These types of partnerships require at least national, and preferably international, science leadership from the research partner. They enable research continuity, allow for long-term planning and support the development of Australia's research capability and capacity. Grain growers benefit through highly targeted RD&E investments in areas of key importance delivered by leading research organisations who are willing to collaborate to add value and ensure the RD&E is translated into value for Australian grain growers. The strategic and responsive management structures within these partnerships supports flexibility to accelerate the delivery of outcomes.

GRDC currently has several key strategic partnerships including:

Centre for Crop Disease Management (CCDM) – Curtin University and GRDC

As already detailed in this Report, in June this year, GRDC committed to re-investing $6 million per annum for another five years to CCDM.

CCDM is Australia's national centre for research targeting grain crop disease issues to deliver sustainable, integrated disease management practices for grain growers now and into the future. CCDM is focused on three major research areas including fungicide resistance, cereal diseases, and canola and pulse diseases.

Crop disease cost is a major constraint for grain growers so having varietal options and the latest best practice advice allows growers and advisers to optimise their return on investment when it comes to crop selection and fungicide use.

For example, CCDM has done outstanding work identifying, developing and delivering barley germplasm that is resistant to powdery mildew with a total cost of research of $5.91 million, but representing a total benefit to the grains industry of $54.8 million.

This next phase of GRDC's strategic partnership with CCDM is focused on increasing grower profitability in disease challenged and fungicide limited cropping environments.

Australian Grains Genebank (AGG) Strategic Partnership with Agriculture Victoria

GRDC is jointly investing with Agriculture Victoria Research over the next five and half years to deliver improved returns to grain growers through ongoing Australian access to critical genetic resources, improved industry uses of AGG resources and more effective leverage of international genetic resource collections and global crop genetics activities to accelerate delivery of improved grain crops for Australian growers and allied industries.

To achieve its mission of *unlocking the genetic potential of the Australian Grains Genebank to accelerate cereal, oilseed and pulse crop improvement for the benefit of Australian grain growers*, the AGG Strategic Partnership will:

- transform the AGG value proposition through digital and genomic innovation
- strengthen core AGG operational functions
- identify appropriate opportunities and sources of additional investment to expand AGG infrastructure.

Other collaborative arrangements

Australian Export Grains Innovation Centre (AEGIC)

In June 2022, GRDC in partnership with the WA Government committed to investing $24 million - $3 million each per year in AEGIC until 2026.

Established in 2012, AEGIC is an independent, not-for-profit research organisation that gathers, analyses and shares market information with the grains industry to guide breeding, classification and supply of grain to meet key domestic and export market expectations.

The organisation has a pivotal role providing in-depth analyses of current and future economic and consumer demand trends, helping to identify solutions to challenges to Australia's existing markets and targeting new customers in a competitive international market. To help grow demand, AEGIC also informs and educates domestic and export markets on new potential uses for Australian grain.

Other investment partners

GRDC also has a significant portfolio of co-investments with multiple RDCs. This includes work through the Rural R&D for Profit Program, AgVet Forum, Plant Biosecurity Initiative, Feedgrain Partnership, and the Managing Climate Variability program. GRDC's investment with other rural RDCs, is particularly important in addressing cross-sectoral issues defined under the National Primary Industries Research, Development and Extension Framework.

We also actively collaborate and co-invest with state government departments, CSIRO, universities, cooperative research centres, not-for-profits including grower groups, and private sector bodies. Increasingly GRDC is also partnering with agribusiness, including farm advisers and agronomists, to support the efficient and effective delivery and adoption of farm-ready RD&E to grain growers. These partnerships also assist with the identification of constraints and opportunities at paddock level, which in turn helps inform future RD&E investments ensuring they are aligned with the needs of our primary stakeholders, grain growers.

GRDC is also committed to working with world class research entities, including international partners, to allow the grains sector to access international RD&E expertise and/or capacity not available in Australia.

A list of all GRDC 2021–22 investments, including details of partners is provided on the GRDC website.

3

Our performance

Measuring performance

Figure 2: Performance framework

OUR PURPOSE

To invest in research, development and extension to create enduring profitability for Australian grain growers

KEY PERFORMANCE INDICATOR

A minimum of 6 per cent average farm business Rates of Return by 2023

OUR OBJECTIVES

1 Improve yield and yield stability

2 Maintain and improve price

3 Optimise input costs

4 Reduce post-farmgate costs

5 Manage risk to maximise profit and minimise losses

OUR OBJECTIVES INDICATORS

- Minimum yield increases equivalent to:
  - 1% per annum for cereals
  - 2% per annum for pulses
  - 1.5% per annum for oil seeds.

  achieved while identifying and investing in technology for transformational improvement in yield potential and yield stability.
- Minimum 20% closure of the gap between potential and achieved yield over five years.

- Identification of potential new products and investments where a supportive business case can be established.
- Support for and enhancement of current products through identification of opportunities for differentiation and maintenance of current market access programs.

- Maintenance of chemicals costs below the forecast trend for 2018–23, equivalent to $85.50/ha or a ratio of input costs: crop revenue of 0.166.
- Maintenance of fertiliser costs below the forecast trend for 2018–23, equivalent to $84.30/ha or a ratio of input costs: crop revenue of 0.164.

- Timely RD&E-based submissions to government to support policy decision-making.
- Timely addressing of technical barriers to trade issues.

- The number of growers undertaking business training.
- Establishment of a behavioural economics initiative to research grower decision-making.

ENABLING FRAMEWORKS

Data management & analytics | Biosecurity | Grower communication & adoption | Capacity & ability

Impact

GRDC invests on behalf of Australian grain growers to improve the profitability and sustainability of the Australian grains industry across a diverse portfolio that spans regions, farming systems, timeframes and crop types. Measuring impact allows us to effectively assess the value of GRDC RD&E to the Australian grains industry, communities and the broader economy.

GRDC plans and executes its investments against statutory and policy frameworks, which include the PIRD Act, the *Public Governance, Performance and Accountability Act 2013* (Cth) (PGPA Act), a Funding Agreement with the Commonwealth, and internal policies that direct investment portfolio decision-making, monitoring, and reporting.

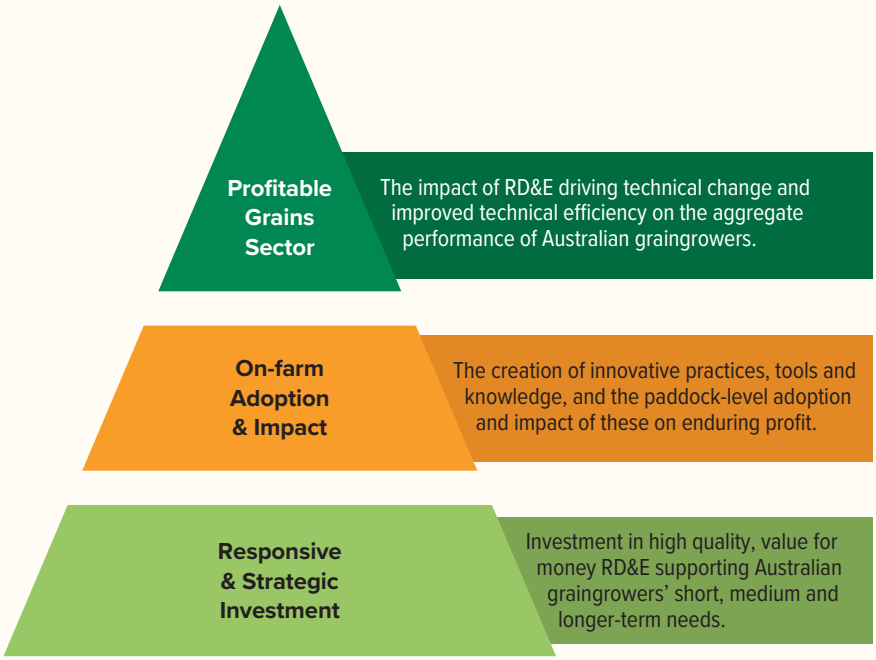
In particular, the Funding Agreement stipulates that RDCs need to demonstrate positive outcomes and delivery of RD&E to levy payers and the broader community. RDCs may demonstrate those outcomes by reporting on investments that have effectively achieved specific RD&E outcomes and priorities. To support reporting of outcomes, GRDC measures the impact of investments and implements improvements based on these evaluations.

Importantly, impact assessment demonstrates accountability for grain grower and public money; allows for analysis on how to effectively invest in RD&E activities; facilitates planning for future R&D investments and offers insights into how to maximise return on investments.

GRDC's RD&E investment portfolio is complex, with short, medium and long-term investments over many scientific disciplines. The stakeholders for communication of impact are diverse and include growers, government and the broader community, who may have differing needs and requirements. For example, levy payers are generally interested in the impact of RD&E outcomes on their farming business or within their region. Other stakeholders may be interested in macro-economic performance indicators, such as the contribution of RD&E to environmental and social outcomes. Others may use impact data to monitor the execution of the RD&E strategy.

GRDC's Impact Framework is segmented into three broad areas measuring GRDC's investment-level impact; the on-farm adoption and impacts of investment outputs; and ultimately, cumulative impacts aggregated at a grains sector level.

Figure 3: RD&E Impact framework



Annual performance statements

Accountable authority statement

I, John Woods, on behalf of the Board, as the accountable authority of the Grains Research and Development Corporation (GRDC), present the 2021–22 annual performance statements, as required under paragraph 39(1)(a) of the *Public Governance, Performance and Accountability Act 2013* (Cth) (PGPA Act) and section 28 of the *Primary Industries Research and Development Act 1989 (Cth)* (PIRD Act).

It is the Board's opinion that these annual performance statements are based on properly maintained records, accurately reflect the performance of GRDC, and are in accordance with subsection 39(2) of the PGPA Act.

Summary of performance

The results against GRDC's performance criteria in the portfolio budget statements and annual operational plan for 2021–22 are outlined in Table 1 on pages 31–35.

Analysis of our performance against targets is on pages 36–41.

John Woods
Chair, GRDC Board

Table 1: GRDC performance against portfolio budget statements measures

KEY PERFORMANCE INDICATOR	TARGET	METHODOLOGY/UNIT OF MEASUREMENT	ACHIEVED	2021–22 RESULTS	PROGRESS/COMMENTS
Purpose *To invest in research, development and extension to create enduring profitability for Australian grain growers.*	A minimum 6% average farm business Rates of Return (RoR) by 2023	Measure is from ABARES Financial performance of cropping farms: 2018–19 to 2020–21 (excluding capital appreciation)	Substantially achieved	In 2021–22 the RoR was 5.7% *Data Source: Financial performance of cropping farms: 2019-20 to 2021–22.*	Based on the 10-year trend, the expected RoR by June 2023 is 4.68%. Two record breaking seasons for grains has produced a significant increase in Rates of Return across all cropping regions.
Objective 1 – Improve yield and yield stability					
Improve yield and yield stability	The impact of RD&E investment in meeting the objective of improving yield will be measured in terms of: • minimum yield increases equivalent to 1% per annum for cereals, 2% per annum for pulses and 1.5% per annum for oilseeds, achieved while identifying and investing in technology for transformational improvement in yield potential and yield stability	The measure is calculated from the year-on-year percentage changes in the 5-year rolling average yields, sourced from the ABARES Australian Crop Report Yield trend gradient adjusted for water availability based on seasonal-adjusted yield trend (kg/mm/ha) (10 year)	Achieved	1.72% increase on the 5–year average for wheat. *The 5-year rolling average wheat yield was 2.09 tonnes per hectare, compared to the 5-year rolling average of 2.05 tonnes per hectare in 2020–21.*	Numbers taken from Impact report has 10 year trend. The measure is calculated from the year-on-year percentage changes in the 5-year rolling average yields, sourced from the ABARES Australian Crop Report. Note, area (ha) is used to calculate weighted yield.
			Not achieved	-2.4% increase on the 5–year average for pulses. *The 5-year rolling average pulse yield was 1.35 tonnes per hectare, compared to the 5-year rolling average of 1.38 tonnes per hectare in 2020–21.*	Numbers taken from Impact report has 10 year trend. The yield decrease is due to the record yield achieved in the 2016-17 season dropping out of the 2021–22 rolling 5-year average.
			Achieved	7.29% increase on the 5–year average for oilseeds. *The 5-year rolling average oilseeds yield was 1.49 tonnes per hectare, compared to the 5-year average of 1.39 tonnes per hectare in 2020–21.*	

KEY PERFORMANCE INDICATOR	TARGET	METHODOLOGY/UNIT OF MEASUREMENT	ACHIEVED	2021–22 RESULTS	PROGRESS/COMMENTS
	• By 2023 a minimum 20 per cent closure of the gap between potential and actual yields	2019 National Paddock Survey (2015–2018 period surveyed)	Not achieved	The 5-year average yield gap in wheat was 29.35 % (2016-2020), derived from comparing the maximum yield average against the 5-year yield average. This result is a widening from the 2018 yield gap, which was 25.78 %. *Data source: 2020 National Variety Trials*	GRDC is continuing to explore yield gap as a measure of profitability and productivity. Developing reliable measures of yield gap, including through the continuation of the National Paddock Survey and exploring Water Use Efficiency as alternative measure is challenging and subject to availability of data and a reliable methodology.
Objective 2 – Maintain and improve price					
Maintain and improve price	• Identification of potential new products that attract premium prices	Active and ongoing investments that deliver improved support for grain prices	Achieved	• Grains Australia's core functions are to establish and maintain a grain variety classification system, provide services that maintain and improve trade and market access; develop long term market and consumer analysis and product awareness to support longer term demand and value creation and lastly, ensure technical support and training is available for customers of, and participants in the Australian grains industry. • GRDC, AEGIC and the Federal Government contributed to an Agricultural Trade and Market Access Cooperation (ATMAC) Program investment focused on pulses and market attributes. • GRDC and a wide group of industry partners invested with CSIRO in its protein roadmap which was launched in March.	

KEY PERFORMANCE INDICATOR	TARGET	METHODOLOGY/UNIT OF MEASUREMENT	ACHIEVED	2021–22 RESULTS	PROGRESS/COMMENTS
	• Identification of opportunities for product differentiation	Current investments in understanding market opportunities	Achieved	• AEGIC identified a market opportunity for soft wheat. Breeders and exporters are conducting research on production and quality to expand the number of varieties. New varieties are in early-stage trials. • GRDC funded an analysis an of The Pulse Protein Landscape – with Bridge2Foods to understand processing options for pulse grains.	
	• Defence of current market access programs	Current disease mitigation and market access investments	Achieved	• Surveys and associated diagnostics of the incidence and severity of diseases of cereals and pulses within the Northern, Southern (VIC & SA) and Western Region,	AFREN II
Objective 3 – Optimise input costs					
Optimise input costs	• Maintain increases in chemistry costs below the five-year trend (2018–2023) equivalent to $85.50/ha or a ratio of input to crop revenue of 0.166	Results are drawn from the 2020–21 ABARES Australian Agricultural and Grazing Industry Survey	Achieved	The result in 2021–22 is a ratio of 0.136 or $100.50 per hectare. *Data source: ABARES Australian Agricultural and Grazing Industry Surveys*	The 10-year average cost is $86.76/ha with costs increasing around 1.65% per year over the past 10 years. Despite the increase in chemical costs the ratio decreased due to total crop receipts increasing around $30 per hectare from the previous year, with chemical costs only increasing by $4 a hectare.

KEY PERFORMANCE INDICATOR	TARGET	METHODOLOGY/UNIT OF MEASUREMENT	ACHIEVED	2021–22 RESULTS	PROGRESS/COMMENTS
	• Maintain increases in fertiliser costs below the five-year trend (2018–2023) equivalent to $84.30/ha or a ratio of input to crop revenue of 0.164	Results are drawn from the 2020–21 ABARES Australian Agricultural and Grazing Industry Survey	Achieved	The result in 2021–22 is a ratio of 0.129 or $95.33 per hectare. *Data source: ABARES Australian Agricutlural and Grazing Industry Surveys*	The 10-year average cost is $90.33/ha with costs increasing around 0.60% per year over the past 10-years. Despite the increase in fertiliser costs the ratio decreased due to total crop receipts increasing around $30 per hectare from the previous year, with fertiliser costs only increasing $13 a hectare.
Objective 4 – Reduce post-farmgate costs					
Reduce post-farmgate costs	• Timely RD&E-based submissions to government to support policy decision-making • Timely addressing of technical barriers to trade issues	Results of research and support for engaging with trading partners	Partially Achieved	• Grain handling and marketing costs decreased by 1.24% from a 5-year (2016-2020) average of $11.38 per tonne to $11.24 per tonne over the subsequent 5-year period (2017-2021). Freight costs increased by 0.26% from $13.95 to $13.98 over the moving 5-year average periods. *Data source: ABARES Agsurf* **On-farm grain storage** • The GRDC Grower survey indicates that approximately 9 in 10 growers surveyed store grain on farm. • Among those storing grain, since 2013, the average storage capacity has trended upwards. On average, 2,193 tonnes of grain can now be stored on these farms.	

KEY PERFORMANCE INDICATOR	TARGET	METHODOLOGY/UNIT OF MEASUREMENT	ACHIEVED	2021–22 RESULTS	PROGRESS/COMMENTS
Objective 5 – Manage risk to maximise profit and reduce losses					
Manage risk to maximise profit and minimise losses	• The number of growers undertaking business training	Results drawn from 2022 GRDC Grower Survey Farm Business Updates data	Achieved	16 Farm Business Updates held during 2021–22 including 9 face-to face. Attended by circa 1400 participants (average of 100 per event).	
	• Establishment of a behavioural economics initiative to research grower decision-making		Not achieved	• The University of Western Australia has developed a research team to conduct behavioural economics research. This research spans several industries. GRDC is examining grains specific requirements in addition to whole farm needs. This group aims to provide information that is relevant to effective decision making and methods that can be employed to remove information barriers.	

Note: Key performance indicators and targets are defined in the Agriculture Portfolio Budget Statements 2021–22 pages 265–286, and GRDC Annual Operational Plan 2021–22, page 4.

Any survey results are taken from the most recent survey in which the target was measured.

Analysis of performance against targets

Profitability – Rates of Return

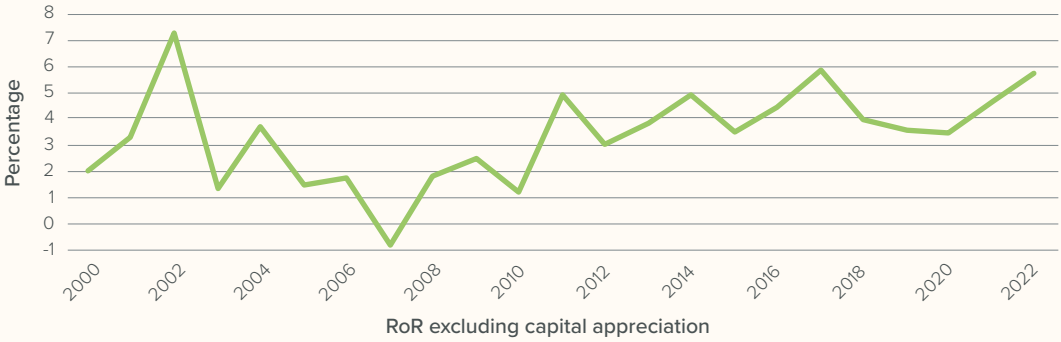
The 2021–22 season brought with it the highest national winter crop production on record, driven by record production in WA and near record production in NSW. This increase in production was result of two consecutive record-breaking seasons. The crop industry gross value was $27 billion, and this represented an increase of 40% on the 2020–21 season. Drought in the northern hemisphere resulted in record or near record high prices for canola and wheat. Canola prices in Europe reached €900 per tonne and US wheat prices reached 1300 cents per bushel.

The largest wheat, barley, canola, faba bean, lentil and sorghum crops produced in Australia were accompanied by above average prices. Wheat averaged $360 per tonne as the market firmed due to supply issues in key northern hemisphere exporting countries.

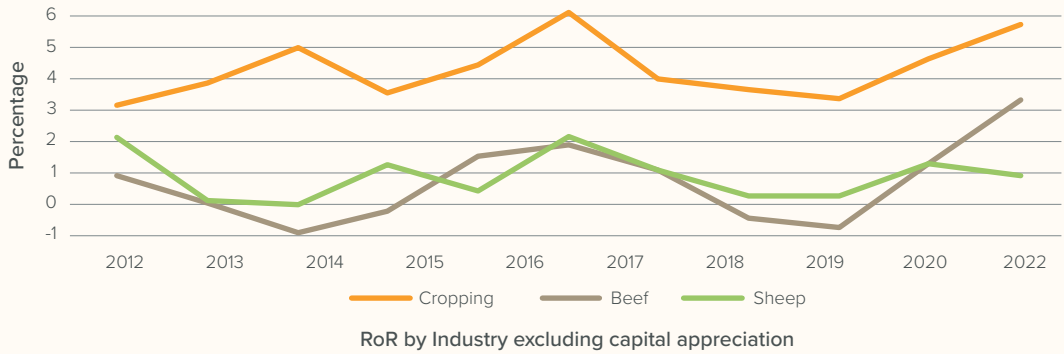
Barley followed suit and traded up to $280 per tonne on average, while canola surged to record highs of $950 per tonne. Lupins and lentils also sold for above average prices at $360 and $900 per tonne respectively.

Due to the higher yields and commodity prices, the national Rate of Return (RoR) for specialist cropping farms excluding capital appreciation increased to 5.7%, which is well above both the five-year average of 4.3%, and the 10–year trend of 4.46%.

Figure 4: Rate of Return 2000–2022 (Specialist Cropping Farms)



Source: ABARES Australian grains: financial performance of grain farms 2019–20 to 2021–22.



Source: ABARES Australian grains: financial performance of grain/livestock farms 2019–20 to 2021–22.

Productivity

Long-term total factor productivity (TFP) growth for the period 1977–78 to 2019–21 for cropping is 1.6% with inputs increasing by 0.9% and outputs by 2.5%.

The breakdown of input factor use is shown in Table 2 for all broadacre, cropping, beef, sheep and mixed livestock. The cropping index was positive one per cent, which indicates that more inputs were used in the 2020–21 season. Cropping land inputs, materials and services increased by 1.1%, 3.9% and 1.6 per cent respectively, while labour use and capital decreased 1.0% and 0.4% respectively.

Table 2: Broadacre average annual input growth, by industry, 1977–78 to 2020–21

	ALL INDUSTRIES	CROPPING	MIXED	SHEEP	BEEF
Land	–0.8	0.9	–1.3	–2.7	0
Labour	–2.2	–1.2	–3.0	–2.9	–0.9
Capital	–1.5	–0.5	–3.0	–3.7	0.2
Materials	1.7	3.7	0.5	–0.3	1.9
Services	–0.3	1.4	–1.2	–1.8	0.6
Total	**–0.8**	**0.9**	**–1.7**	**–2.6**	**0.3**

Source: ABARES Australian Agricultural Grazing Industries Survey

Yield gain (trend)

The record 2021 season was followed by a record 2022, with cereal yields well above the five–year average. It is worth noting the five-year average was impacted by the drought that affected much of eastern Australia through 2019–2020.

However, Queensland NSW and WA all produced their highest yields in the five-year period to 2022. Looking at the five-year averages NSW experienced the largest increase in yield (69%) followed by Queensland (61%) and WA (28%). Victoria and South Australia also experienced modest increases, with yields on average up by 33% across Australia.

Table 3 below shows average wheat yields for the 2022 season relative to the five–year average (2018–2022).

The estimated pulse yield trend is negative (-2.9%), which requires further explanation. Yields for chickpea, field pea and lupins are showing a downward trend as a result of the exceptional, record-breaking pulse harvest in the 2016-17 season, and the reversion to less extreme seasons in following years.

The chickpea yield in 2021–22 was 1.7 tonnes per hectare which was the second highest yield (the highest being in the 2016-17 season), the field pea yield was 1.4 tonnes per hectare, which is the third highest yield, and the lupin yield was 1.9 tonnes per hectare, which is also the second highest yield in the past 10 seasons.

Table 3: Average wheat yield by tonnes by state 2018–2022

STATE	2018	2019	2020	2021	2022	5-YEAR AVERAGE	PERCENTAGE CHANGE
NSW	1.68	0.78	0.83	3.45	3.45	**2.04**	69%
Qld	1.20	1.00	0.95	1.47	2.20	**1.36**	61%
SA	2.05	1.66	1.56	2.31	2.27	**1.97**	15%
Vic	2.54	1.62	2.60	3.18	2.74	**2.54**	8%
WA	1.90	2.28	1.41	2.00	2.61	**2.04**	28%
Average	**1.87**	**1.47**	**1.47**	**2.48**	**2.65**	**1.99**	**33%**

Source: ABARES June 2022 Australian Crop Report

Input costs

Growers had higher input costs due to the wet start to the season, above average in-season rainfall and higher chemical and fertiliser prices driven by global supply shortages.

For example, in 2021 fertiliser costs were $95.33 per hectare, above the target of $84.30/ha and higher than the five-year average of $88.79/ha.

However, fertiliser input cost to total crop cash receipts ratio was 0.129 (against a target of 0.164) indicating efficient use of fertilisers to maximise crop potential. Chemical costs in 2021 were $100.50 per hectare, with an average of $91.84 per hectare over the five–year period to 2021 which was above the target of $85.50 per hectare. As with fertiliser costs, the ratio of chemical costs to total crop cash receipts was 0.136 and this was below the target of 0.166 which is a positive result for growers.

Summary

This performance statement provides commentary of progress against the Key Performance Indicators in the 2018–2023 RD&E Plan. The 2018–2023 RD&E Plan was firmly focused on the profitability of Australian grain growers and the Key Performance Indicators were proxy measures of that profitability. GRDC has commenced consultation and development of the 2023–2028 RD&E Plan. The focus on profitability will remain but additional performance metrics that underpin profit Key Performance Indicators will be developed to better demonstrate GRDC's impact on grower profitability. Other Key Performance Indicators and metrics that track productivity and sustainability of grain growers over time will also be incorporated into the new RD&E Plan.

Benefit Cost Analyses of selected investments

GRDC undertakes Benefit Cost Analysis (BCA) to measure and evaluate the effectiveness and impact of RD&E and demonstrate the outcomes of its investments. GRDC adopts an ex-ante and ex-post approach to predicting and measuring impact. Ex-post analyses use the framework developed by the Council for Rural RDCs.

Adoption rates are calculated using the ADOPT tool developed by the Farming Futures Cooperative Research Centre and updated by CSIRO with financial support from GRDC. GRDC uses a 25–30-year investment period. Net Present Value (NPV) is calculated as the present value of benefits, less the present value of the investments. BC Ratio is calculated as the ratio of benefits to cost of the investment. The Present Value of Investment (PVI) is calculated as the value of the investment 25 years from today discounted to the present.

The following BCAs are relevant for 2021–22 against each objective in the 2018–23 RD&E Plan.

Improving grower profits through longer season wheat crops

GRDC Contract codes: CWF1804-001SAX

Date of analysis: 19/04/2022

Project title: Improving grower profits through longer season wheat crops

Collaborators/partners: Central West Farming Systems

Background:

Growers in central and southern NSW were interested in sowing wheat earlier than the traditional May sowing window. In the regions of interest, there is an average 2.2 million hectares planted to wheat annually. Evidence on how varieties perform in the region when sown earlier was not being met by NVT trials, therefore this project was established to fill this knowledge gap.

There are a number of drivers contributing to growers' desire to sow earlier:

1. Advances in summer fallow management, which have led to improved soil water storage and sowing opportunities.
2. Declining frequency and magnitude of traditional autumn breaks and winter rainfall but some increase in summer rain.
3. Improvements in no-till seeding technology, with greater moisture seeking abilities and more accurate seed placement.
4. An increase in farm size and sowing programs which have lengthened the sowing program for many growers.
5. Improved understanding of pre-emergent herbicide use in early sowing.
6. Reduced risk by being able to spread crops out for seeding and harvest operations particularly when labour access is constrained.

This project increased grower exposure and confidence in longer season wheat varieties, and this was demonstrated by many growers who planted varieties including Longsword, LongReach Kittyhawk, and to some degree DS Pascal, in their cropping programs.

Year of commencement	2018
Year of completion	2021
Present Value of Investment (PVI)	$1.2 million
Present Value of Benefits (PVB)	$4.7 million
Net Present Value (NPV)	$3.5 million
Benefit Cost Ratio	3.99
Objectives	Increase farmer and adviser confidence and to further develop profitable and sustainable farming enterprises based on maximising varietal choice and early sowing window options in Central East NSW, Central West NSW, South East NSW and South West NSW.
Outcomes	Three years of trial work during three very different seasons indicated that longer season wheat varieties can fit this region and can be sown early if the correct environmental conditions are present, such as good soil moisture. Increased grower exposure and confidence in longer season wheat varieties. Demonstrated by many growers including Longsword, LongReach Kittyhawk and to some degree DS Pascal in their cropping programs. Since 2018/19 approximately 9% of delivered wheat tonnes in these regions have been long season wheat varieties. Using monthly rainfall data from 2005 to 2020, Condobolin received enough rainfall in April to justify planting long season wheat varieties every 2.3 years. Growers planting long season wheat varieties in these regions can receive a benefit of up to $64.58/ha.
Environmental benefits	Environmental benefits were not directly exhibited within this investment, as the changes derived related to an alteration to sowing time and the variety used.
Social benefits	The outcome of this investment should increase grower confidence to spread crops out for seeding and harvest operations. This will enable growers to reduce the risk and pressure associated with the timing of operations.

Investments in sodic soils

GRDC Contract codes: COG2009-001CAX, DAW1902-001RTX, MIG1801-001SAX, UOA1507-002RMX

Date of analysis: 18/08/2022, conducted by University of Western Australia

Project title: Analysis of four GRDC investments in sodic soils:

- COG2009-001CAX: 3D soil constraint diagnosis & options for on-the-go-management
- DAW1902-001RTX: Increased grower profitability on soils with sodicity and transient salinity in the eastern grain belt of the Western Region
- MIG1801-001SAX: Tactics for improving rooting depth and crop yield on sodic soils
- UOA1507-002RMX: Improving wheat yields on sodic, magnetic, and dispersive soils.

Collaborators/partners: Colere Group, Department of Primary Industries and Regional Development, Mingenew-Irwin Group Inc, The University of Adelaide.

Background:

Soils with sodic subsoils are widespread in the cropping zone and impose significant limitations to yield by restricting root growth. Crop yields are currently constrained across 7 million hectares of duplex soils nationally. GRDC has invested in a combination of projects nationally to understand current constraints of sodic soils and potential management and genetic solutions to overcome these constraints. Four sodic soil projects were assessed for this ex-post analysis.

GRDC invested in 3D soil constraint diagnosis, options to increase crop available water supply, including water harvesting techniques, gypsum application, stubble management, soil amendments with polymers or organic materials and on-the-go-management options for growers, as well as the development of germplasm with improved tolerance to sodic soils.

These investments contributed to the development of new knowledge and experience, and some are yet to generate a direct economic benefit. Recommendations from these projects will inform further investment to provide growers a tangible economic benefit over the next 5-10 years.

Year of commencement	2015/16
Year of completion	2023/24
Present Value of Investment (PVI)	$21 million
Present Value of Benefits (PVB)	$219 million
Net Present Value (NPV)	$198 million
Benefit Cost Ratio	10.4
Objectives	**3D soil constraint diagnosis & options for on-the-go-management:** • Examine commercially available or emerging technologies that combine 3D soil type data analysis of single or multiple soil constraints at a grower-usable scale. • Develop a better understanding of 3D soil variability and the barriers to adoption of on-the-go 3D soil diagnostics by farmers and advisors. **Increased grower profitability on soils with sodicity and transient salinity in the eastern grain belt of the Western Region:** • Explore and develop soil mitigation and amelioration options for cropping soils constrained by sodicity and transient salinity across the low rainfall eastern grain belt of Western Australia. **Tactics for improving rooting depth and crop yield on sodic soils:** • Investigate the impacts of gypsum on yield, grain quality, soil water levels and fertiliser use. **Improving wheat yields on sodic, magnetic, and dispersive soils:** • Develop germplasm with improved tolerance to sodicity by combining tolerance to various stresses common to sodic soils.

Outcomes	**3D soil constraint diagnosis & options for on-the-go-management:** • A detailed review of available technologies found that no one technology has all the required features or is able to provide all the diagnostics required. A combination of tools will be needed. • 3D diagnostic mapping technologies need to be further developed and commercialised but show technical promise. • 2D mapping provided immediate opportunities for practice change by visualising and specifying multiple soil constraints (rather just a single soil constraint) simultaneously. **Increased grower profitability on soils with sodicity and transient salinity in the eastern grain belt of the Western Region:** • Low rates of Gypsum application (<200kg/ha) in 2021 had no significant effect on crop yields but the combination of water harvesting and in-furrow amendments resulted in significant barley yield increases. • Water harvesting alone using inter-row mounds and hydrophobic hats increased average yield for barley with 0.61 t/ha over the control in ten of the thirteen experiments. • Application of a gravel mulch of 5 cm resulted in wheat grain yield increases of 1.9 t/ha (116%) compared to the control. **Tactics for improving rooting depth and crop yield on sodic soils:** • Using gypsum and ripping on soil types where sodicity is deeper than 30cm is not profitable (no yield responses were observed in the two years of research, and no response observed to the application of gypsum). • Applying mineral mulches (expected annual yield increase of 1.0 t/ha for 10 years after gravel application). **Improving wheat yields on sodic, magnetic, and dispersive soils:** • Germplasm was developed that yielded more than its parents on sodic soils. • Progress was made in developing a marker for high pH tolerance. • A soil-based screening method that may assist rapid screening of germplasm was designed. • A main conclusion was to develop varieties with greater tolerance to sodicity should take account of regional differences.
Environmental benefits	Environmental benefits were hypothesised but not directly measured in any of the investments. Soil amendments could result in better soil cover, improved usage of soil available water, and reduced risk of drainage and salinity. No interviewees identified direct environmental benefits from any of the projects.
Social benefits	The outcomes of this investment should minimise yield variation from sodicity issues in the target regions enabling growers to have more consistent incomes.

Objective 1–Improve yield and yield stability

A goal to close the gap between actual and potential yields is clearly a worthwhile objective. However, delivering enduring profitability to grain growers will also require investments aimed at further extending the yield potential and yield stability of all Australian grain crops. Extending yield potential can be achieved by increasing the genetic yield potential and by limiting the impact of yield constraints (e.g. frost, hostile soils and heat).

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	91	$10.9m
Ongoing	151	$59.4m
Total	242	$70.3m

Maintaining yield stability under the impacts of various environmental factors is an important consideration in limiting exposure to production risk and underpins stability of supply. Investments in this area may involve relatively high risks and long timeframes to delivery.

Key achievements 2021–22

Highlights of investments in 2021–22 that support the achievement of this objective include:

Grains Agronomy and Pathology Partnership (GAPP)

NSW DPI and the GRDC committed to a five-year partnership to drive innovation and build capacity and capability on 1 July 2017. Through the GAPP, $65 million was committed to invest in grains research over a five–year period, delivered across 23 winter crop research projects.

The GAPP also provided a mechanism for NSW DPI to build human capability and acquire new infrastructure to ensure they maintain the core research capacity needed for the grains industry. Beyond the GRDC and NSW DPI partnership, GAPP also fostered national and international linkages with universities, research institutions, industry programs, government departments, and grower solution groups.

A total of 44 separate research projects were supported with investment via the GAPP between 2017–18 and 2020–21, excluding projects involving capital investments or facility maintenance (e.g. buildings, equipment etc.). A Benefit Cost Analysis was undertaken for following projects (or project clusters), representing $18,850,000 combined investment from GRDC and NSW DPI (or approximately 29%) of the total research project investment:

1. Does improving chilling tolerance of chickpea increase and stabilise yield and improve farming system 'fit'?
2. The adaptation of profitable pulses in the central and southern zones of the northern grains region
3. Improving management of Phytophthora root rot of chickpea & BLG302 PhD project
4. Integrated disease management for broadleaf crops in southern and central NSW
5. Pulse integrated disease management —-northern NSW/Queensland
6. Integrated disease management for winter cereals in southern NSW
7. Supporting growers to achieve enduring profitability through improved integrated management of winter cereal diseases in the northern grain region
8. Epidemiology and novel control of stubble-borne pathogens in winter cereals (GAPP PhD).

Analysis of the GAPP projects indicated most successfully generate research findings that could be communicated to growers resulting in practice change that improved farm profitability benefiting the grains sector and broader communities.

However some research findings from GAPP projects required further investigation and/or commercialisation support before being of benefit to growers.

Victorian Grains Innovation Partnership

The GRDC and AVR Victorian Grains Innovation Partnership (VGIP) was established in 2014 for five years and extended until June 2022 when it concluded. Over the eight-year lifetime of the investment GRDC and AVR will have invested $88M:

- investment of $28.5M GRDC cash and $28.3M AVR in-kind in Phase 1: July 2014 to June 2019
- investment of $15.6M GRDC cash and $15.6M AVR in-kind in Phase 2: July 2019 to June 2022.

VGIP Phase 2 had two work programs focused on profitable pulse crops and bridging the profitability gap.

Program 1 – Profitable Pulse Crops

- Project 1A: Alternative Legume Crops in the Southern Region
- Project 1B: Pulse Productivity Improvements – Agronomic / Physiological
- Project 1C: On Farm Pulse Quality Capture
- Program 2 - Bridging the Profitability Gap
- Project 2A: Cereals: Minimising Soil Constraints
- Project 2B: Cereals: Exploiting Rainfall / Double Cropping Options
- Project 2C: Cereals/Pulses: Advanced prediction of waterlogging impacts.

In 2022, an independent external impact evaluation of VGIP Phase 2 was undertaken to formally assess delivery against the VGIP objectives and value of the investment achievements. Overall, the evaluation assessed that VGIP created valuable research that will improve the future profitability of grain growers. Through further investment, farm practice changes aligned with VGIP RDE will create net benefits in the order of $340 million over 30 years on present value terms; a benefit cost ratio of 12.3 to date and was estimated as the present value of future benefits minus the present value of future costs.

Economics of ameliorating soil constraints in the northern region: Soil constraint management and amelioration

Grain, potentially worth billions of dollars, is lost each year in the northern grain growing region because of yield gaps associated with soil constraints. Farm economic losses are aggravated when ameliorants such as gypsum, lime and organic amendments are applied to soil that is unresponsive.

Dispersion induced by sodicity is a major contributor to yield gap problems. Almost 70% of the approximately 11 million hectares in the northern region are estimated to be sodic.

Led by the University of Southern Queensland and in collaboration with Queensland DAF and UNE, this project has made strong progress towards quantifying the nature and distribution of dispersive soil on the highly variable paddocks of the northern region, with field investigations spanning the area from Dulacca in Queensland to Forbes in NSW. Core sites with systematically selected topsoil and subsoil amelioration techniques (replicated) were established on six commercial farms. Demonstration sites were created at another 18 locations to explore the potential for growers to establish their own best-bet trial strips, with crop response and economic viability of ameliorants assessed via header yield monitoring.

To allow thorough economic analysis, the experiments need to be monitored well beyond their current two-year lifespan. Nevertheless, positive yield responses so far more than 30% in some cases, are inspiring.

Genetics of wild germplasm, gene-pool expansion and integrated Accelerated Single-Seed-Descent approach to enhance adaptive potential in chickpea

Chickpeas, like other pulses, are beneficial to rotational cropping systems and a source of protein in the human diet. This project, led by Curtin University in collaboration with University of Western Australia and CSIRO between 2014 and 2021, aimed to broaden genetic diversity in chickpea varieties through the introgression of wild *Cicer reticulatum* and *Cicer echinospermum* chickpea material into current varieties, with the aim to introduce traits adaptive to Australian growing conditions. The project successfully crossed 30 different wild chickpeas with elite Australian varieties and the developed populations were genotyped and seeds deposited with the Australian Grains Genebank.

Wild germplasm with novel sources of resistance to Ascochyta blight (AB) and Sclerotinia stem rot (SSR) were identified. In addition, regions in the genome of domestic and wild chickpea associated with AB and SSR resistance as well as growth habit, time to flowering and pod set, seed shape, size and colour have been identified. In partnership with Chickpea Breeding Australia (CBA), wild chickpea introgression lines were evaluated over two growing seasons to select lines of interest to the breeding program. These developed resources will broaden the genetic diversity in future Australian chickpea breeding programs and can be utilised in future pre-breeding research.

CASE STUDY

Optimising plant establishment, density and spacings to maximise crop yield and profit in the southern and western regions

Snapshot

Grower: Andrew Bennett
Location: Mundulla, South Australia
Farm size: 2200 hectares
Enterprise: Cropping and livestock
Growing season rainfall: 350 millimetres (April to November)
Total annual rainfall: 500mm
Soil types: Deep sand over clay, sandy loams and small areas of black clay
2020 cropping program: 900ha cropped (beans, canola, wheat, oats, barley, lupins and lucerne for grazing) and 1300ha livestock (500 cattle, 3,200 sheep)
Seeding equipment: 9.14 metre (30 foot) 2007 model Bourgault 8810, seeder bar with press wheels and tow-behind 2007 Bourgault 5195 air-cart fitted with three sealed bins.

For Andrew Bennett, good crop establishment is important because plant density leads to weed competition and maximum yields. Emerging plants are closely monitored by Andrew and his agronomist on a bi-weekly to weekly basis, with checks focused on insects, slugs, snails or problems incurred from seeding depth and seeding rates.

'It's a lot easier to fix it early rather than letting it get up and finding a problem,' Andrew says.

Andrew chose his 2007 model Bourgault 8810, 9.14m seeder bar because it was set up the way he wanted it, with a double chute suitable for pastures through to beans. Fourteen years down the track he is still very happy with his purchase.

'I would buy the same one again,' Andrew says. He has made a few modifications along the way to assist with beans reaching the 50mm sowing depth and ensuring he has good seed and herbicide separation through the rows. The only downside for Andrew is the stubble flow around the wheels.

Andrew sows his canola on top of the ground and uses press wheels to give soil-to-seed contact. Image: Supplied

Andrew's tow-behind 2007 Bourgault 5195 air-cart is fitted with three sealed bins with an auger metering system suitable for fine to large seeds. It has a double chute with a single line going out to the bar followed by four primary lines to 36 secondary heads with a 32 mm terminal. He has a Bougold 591 in-cab monitor with cameras in the tanks to monitor the seed level. The row-to-row distribution and metering accuracy is very good at low and high speed.

Andrew sows his canola on top of the ground and uses press wheels to give soil-to-seed contact. He seeds his cereals to a depth of 25 mm and beans at 50 mm. Seeding beans at this depth seems to work well on Andrew's sandy soils but can be challenging on the heavier black clays. He says he monitors the seeding depth at the start of every paddock and again when refilling the seeder.

Good size and quality seed are keys to good crop establishment

Good size and quality seed are key to reliably achieving good crop establishment.

'The plumper the grain is and the fuller the grain is, the more energy it has in it to get going,' Andrew says.

Sowing time is also critical. Andrew plants his cereals in late April to early May, while canola and beans are planted in early May. He plants beans dry, which gives him the chance to knock down any weeds before the plant comes up. 'The beans can sit there for three weeks before they germinate,' Andrew says.

Paddock selection and rotation is very important. Andrew tries to avoid burning stubbles but will do the odd narrow windrow burn of canola stubble to control ryegrass and snails. To reduce wheat stubble load, Andrew grazes cattle with a molasses blend to help with digestion and lambs are fed on bean stubbles.

Spreading clay to increase his soil fertility

Over the past few years Andrew has been focusing on improving his soil health. He has sandy loam soils over clay, and in some areas the clay is up to 30m deep while in other areas, it is nearly at surface level. Andrew has been deep ripping where possible and in the deeper sand, he has been delving and spreading clay to increase his soil fertility.

While this is a slow process, with 80% of his sandy country completed, Andrew says it has enabled him to double the production on his improved soil. It is a very expensive exercise costing around $400-$500 a hectare, however, without the underlaying clay this approach would not have been an option for Andrew.

Challenges

Andrew says his greatest challenge is early weed germination, so getting good coverage to choke out the weeds is essential. Seeding depth is very important to get right.

'If seeding depth is too deep the plant uses more energy to get out of the ground so therefore is slower to get growing,'

The crop that presents the greatest challenge for Andrew is oats, due to chemical control options for ryegrass management. He also has issues with rhizoctonia but is getting around it with the use of more zinc. Andrew's top tips to improve crop establishment are:

- weed control
- seeding depth
- early monitoring for pest and disease.

CASE STUDY

Improving farming system efficiency in southern NSW

Study shows 'tweaking' pays handsome dividends

Key points

- With land prices continuing their upward trajectory, CSIRO Agriculture and Food's Dr John Kirkegaard says there is even more of an imperative to improve efficiency and profitability.
- The three-year Southern NSW Farming Systems project, with GRDC, CSIRO and NSW Department of Primary Industries co-investment, has demonstrated where increased profit can be found.
- The research showed a range of ways to achieve a profit lift that will be suitable for farms with and without livestock, and operators who may or may not be willing to grow pulses.

New research shows more profit is available for those willing to make even just a few adjustments to their farming systems.

The changes – including shifting to March sowing and allowing sheep to graze cereal and canola crops, integrating appropriate legumes into the system, and applying appropriate nitrogen rates – were all explored in a three-year farming systems project with GRDC, CSIRO and NSW Department of Primary Industries (DPI) co-investment.

CSIRO Agriculture and Food chief research scientist Dr John Kirkegaard spearheaded the research with teams led by CSIRO's Tony Swan and NSW DPI's Mat Dunn.

Dr Kirkegaard says the Southern NSW Farming Systems project showed average annual earnings before interest and tax (EBIT) for the different farming systems ranged from $200 to $1200 per hectare.

'From 2018 to 2020 at Wagga Wagga, Greenethorpe, Condobolin and Urana, experiments showed there were farming systems achieving $150 to $250/ha more than the standard May-sown and grain-only canola/wheat/barley or grain-only canola/wheat/wheat,' Dr Kirkegaard says.

'Profit and efficiency in terms of dollars per millimetre of rainfall can be lifted by making some simple, but targeted, changes to your cropping sequence, sowing time and nitrogen strategy.

'There isn't a single recipe for improving returns, but a range of ways to achieve a profit lift that will be suitable for farms with and without livestock, and operators who may or may not be willing to grow pulse crops.'

Research approach

Since 2017, CSIRO and NSW DPI researchers worked with local agronomists and growers to establish farming systems experiments at four sites across southern and central NSW.

Grower collaborators nominated the baseline systems for each site, which included either canola/wheat/wheat or canola/wheat/barley sown from late April to early May (timely) and a conservative or low (decile two) nitrogen strategy.

Also established was a range of other more-diverse cropping sequences that included different legume options. These were high-value legumes (lentils, chickpeas), low-value legumes (lupins, faba beans) and a multiple-end-use forage option (vetch) grazed and/or cut for hay.

In some sequences, the researchers explored the interaction of early (from March) sowing with and without grazing by livestock, and timely (late April to early May) sowing, and two nitrogen strategies: conservative or low (targeting decile-two season yield potential) and optimistic or high (targeting decile-seven yield potential).

Overall, 25 different systems were established at the Wagga Wagga, NSW, core site. Grower and consultant collaborators also selected a subset of 16, 12 and 11 farming systems for Greenethorpe, Condobolin and Urana respectively.

At Greenethorpe, NSW, researchers established 16 farming systems. Photo: CSIRO

At all sites, the systems evaluated were replicated three times and phased (alternated) to capture seasonal interactions. In addition, a 'flexible' treatment managed by consultant collaborators, at each site, was included to investigate the value of a more 'tactical' approach.

Management protocols for inputs and decisions such as tillage and stubble management, variety choice, herbicide, fungicide and pesticide applications were agreed by the project team. Decisions were based on best practice and were reviewed continuously. In addition to baseline sampling and soil characterisation, the researchers collected common measurements to fully understand each system's performance.

Data gathered

The data collected enabled further research via the Agricultural Production Systems sIMulator (APSIM) and an analysis of the economic returns from various systems and long-term risk.

Data gathered included:

- soil water and mineral nitrogen before sowing and after harvest to 1.8 metres (1.4m at Wagga Wagga)
- crop production (biomass, yield), product quality and nutrient removal
- soil disease (soil inoculum) and weed assessments (seedbank levels), crop observations
- forage production and quality, and estimated animal production on grazed crops
- legume nitrogen fixation estimates
- costs of variable inputs (fertiliser, seed, pesticides), operations and crop income
- on-site climate variables.

Key findings

At all sites, the rainfall recorded in 2018 and 2019 was among the lowest 10 to 20% of figures on record (decile one to two). In 2020, the rainfall was in the top 10 to 20% of rainfalls on record (decile eight to 10).

Despite this extreme seasonal variability, Dr Kirkegaard says the study yielded some important findings.

At Condobolin, NSW, researchers established 12 different farming systems. Photo: Mat Dunn

'The average EBIT ranged from $200 to $1200/ha, with some systems demonstrating resilience by showing stability in ranking across years,' Dr Kirkegaard says.

'At all sites, the three-year average annual EBITs calculated for farming systems showed some systems achieved $150 to 250/ha above the baseline canola/wheat/wheat/ and canola/wheat/barley farming systems sown in May with conservative or decile-two nitrogen strategies.'

At two sites, he says, there were farming systems that produced annual average profit that was $700/ha more than the baseline.

Some of the diverse cropping sequences with legumes outperformed the canola/wheat/barley and canola/wheat/wheat sequences at all sites during the dry seasons and at two out of the four sites in the wet 2020 season.

Dr Kirkegaard says this resulted from the profitability of the legumes, and in some cases the significant legacy of increased

soil water (an extra 20 to 60mm) and/or soil nitrogen (an extra 50 to 100kg/ha) available to subsequent crops.

'The legacies of extra water left at harvest had diminished by the following sowing, in some cases, due to reduced soil cover after the pulses, but this depended on the pattern of summer fallow rainfall,' he says.

'Of the non-grazed farming systems, the most consistently profitable system was timely sown, high-value legume, which was either chickpeas or lentils followed by canola and then wheat with a decile-two nitrogen strategy.'

Early sowing

In all years, Dr Kirkegaard says, early sown and grazed wheat and canola crops were highly profitable.

'Farming systems with early sown and early grazed crops were two to three times more profitable than non-grazed equivalents in the dry seasons, even without the added income of the grain harvest, and highly profitable in wetter years,' he says.

'Nonetheless, the legacies of dry soil reduced available grazing biomass and grain yields in the second dry year, especially on the shallower soil at Wagga Wagga.'

Farming systems that included grazing were highly profitable. Photo: CSIRO

Grazed wheat and canola crops produced more forage and higher grain yields, he says, demonstrating they were responsive to higher nitrogen supplied by fertiliser and via legume crops grown in rotation.

'In all cases, the early sown and non-grazed farming systems were less profitable than the baseline, partly because of the limited variety choice for this practice and the high value of the grazed forage,' he says.

Nitrogen strategies

Dr Kirkegaard says the optimistic (high) nitrogen strategy provided increased biomass for grazing crops or hay cuts but had either no effects or negative effects on grain yield and profit in the dry 2018 and 2019 seasons.

'Nonetheless, nitrogen that was not used in the dry seasons carried over to improve biomass and grain yields in the wet 2020 season, where residual nitrogen from the legume crops and applied fertiliser significantly increased grain yields,' he says.

Accordingly, the decile-seven nitrogen strategy was more profitable over three years than the decile-two strategy in the canola/wheat/wheat/ and the wheat/canola/barley systems.

NSW Department of Primary Industries research officer Mat Dunn in an early grazed crop of Hyola Feast CL at the Wagga Wagga, NSW, site. Photo: Nicole Baxter

'In diverse sequences that included pulse crops, the decile-two nitrogen strategy was more profitable over three years than the decile-seven nitrogen strategy, as the legumes provide fixed nitrogen at no cost.'

Dr Kirkegaard says average annual EBIT were calculated over the three-year period from 2018 to 2020 for each system and these were ranked from highest to lowest.

'We used actual "spot" costs and prices and compared the results with long-term average costs and prices,' he says. 'The analysis showed, with a few exceptions, that there

were only minor changes to the ranking of the systems that were cost or price dependent.'

Simulation studies

CSIRO farming systems scientist Dr Jeremy Whish performed a range of long-term simulation studies, which capture the water and nitrogen impact only (not weeds and disease).

Dr Kirkegaard says these showed the annual median EBIT of different systems in the range of $400/ha to $1400/ha, which was consistent with the experimental outcomes.

The results also showed important interactions between sites and systems. For example, Dr Kirkegaard says earlier sowing and more-robust nitrogen strategies were more profitable at the high-rainfall Greenethorpe site and less profitable at the lower-rainfall Condobolin site.

'Interestingly, at all sites, the diverse crop sequences incorporating legumes with lower nitrogen rates are generating some of the highest gross margins with less variability across seasons,' he says.

'These diverse options also combine higher average profit with higher profit in the lowest 20% of years, demonstrating their value in reducing risk and increasing resilience because they are more water efficient in average and poor seasons.'

Disease levels

Disease inoculum levels were measured in 2018 (before) and after the three-year phases in the different sequences (2021) varying in diversity (intensity of cereals).

Dr Kirkegaard says all sites were initially relatively free of serious cereal root disease levels, with only crown rot at Urana in the high-risk category and take-all at Greenethorpe in the medium risk category.

'Over the course of the experiment, there were relatively few concerning increases in disease levels overall, however there were significant changes at some sites in disease inoculum levels according to the sequences.'

Some of the consistent and noteworthy shifts in disease inoculum levels included:

- increases in crown rot inoculum at all sites in cereal dominated sequences and reductions in more-diverse sequences, with crown rot disease expressed significantly in the dry 2018 and 2019 seasons
- increases in *Pratylenchus neglectus* inoculum at most sites across the years with the highest populations in continuous wheat and canola/wheat sequences (both hosts for the nematodes) and lower populations in diverse sequences including non-host legumes
- presence of *Pratylenchus thornei* at Wagga Wagga and Urana (low levels) where it increased in diverse and baseline sequences (canola is the only non-host)
- at Greenethorpe, Rhizoctonia and yellow leaf spot increased in cereal dominated sequences but not to damaging levels.

In terms of disease expression, he says, the major disease observed in 2018 and 2019 was crown rot.

'In the wetter 2020, leaf diseases were more critical, with a significant number of fungicides used to control disease in all crops,' he says. 'Before fungicide was applied in July, the severity of yellow leaf spot was ranked at Greenethorpe.'

The results showed continuous wheat (wheat/wheat/wheat) had the highest disease severity at 4.5 on a zero to 5 ranking, followed by the baseline (canola/wheat/wheat) at 3.2 and the diverse systems (legume/canola/wheat) the lowest at 1.0 to 2.0.

Dr Kirkegaard says wheat yields in 2020 were also influenced by cropping intensity.

By way of example, he pointed to the Wagga Wagga results, where the continuous wheat (one-in-one intensity) yielded 5.2t/ha of grain.

'The one-in-two canola/wheat/canola sequence and two-in-three canola/wheat/wheat or canola/wheat/barley rotation yielded 6.4 to 6.9t/ha," he says. "Diverse sequences with only one wheat in three years yielded 7.0 to 7.5t/ha.'

In addition, he says, the more-diverse rotations were more responsive to higher nitrogen, indicating higher grain yields may have resulted from healthier roots.

Weed control

Initially, Dr Kirkegaard says, there were no problematic weeds at any of the sites.

'We used best-practice weed management in each system, so the effects of different farming systems on weeds are reflected more in the average annual weed control cost and in changes in weed number and spectrum based on weed seedbank counts,' he says.

'After three years, overall weed numbers declined at Greenethorpe and Urana by about 50% and remained relatively unchanged at Wagga Wagga and Condobolin.'

By 2020, there were few differences in weed numbers between the different systems at all sites.

'At Wagga Wagga, where toad rush and annual ryegrass were issues, and Urana, where toad rush, Indian hedge mustard and wild oats were the main weeds, there was no difference between the different farming systems,' he says.

'At Greenethorpe, where fumitory, mustard, fleabane, prickly lettuce and Shepherd's purse were the key weeds, weed numbers were lower in continuous wheat, presumably because effective control of broadleaf weeds occurred every year.'

Interestingly, Dr Kirkegaard says grazing also appeared to reduce weed numbers.

'There was no annual ryegrass issue in the experiments, but glyphosate-resistant ryegrass was encroaching from the surrounding paddocks,' he says.

'At Condobolin, there were lower weed numbers in the canola/wheat/canola system, presumably because of the option to use herbicide-tolerant canola every second year.'

Herbicide costs

Dr Kirkegaard says some of the important observations about weed control costs included:

- the baseline systems canola/wheat/wheat or canola/wheat/barley, timely sown with decile-two nitrogen, were among the most expensive for herbicide costs at all sites
- grazed treatments tend to have lower weed control costs partly because of withholding periods and that grazing provides some control of early weeds
- farming systems with fallow treatments have low average weed costs
- the most diverse options that include legumes have lower herbicide costs than the baseline treatments.

'The baseline canola/wheat/wheat and canola/wheat/barley farming systems are not generating weed problems but have higher herbicide costs than the diverse systems at all sites,' he says. 'This will be part of the reason for the higher EBITs in the diverse systems compared to the baseline systems.'

Experiments at all four sites will continue for another three years to explore the long-term impacts of different seasonal conditions, farming systems, sowing times and nitrogen strategies on system profitability, efficiency and risk in converting rainfall to profit.

Objective 2–Maintain and improve price

Maintaining current market positions will depend on maintaining the premium quality of Australian grain. Important functions driving the maintenance of premium quality include Australia's grain classification systems as well as the effective and prompt management of trade and market access issues as they arise.

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	9	$0.8m
Ongoing	20	$6.5m
Total	29	$7.3m

Traceability and demonstrated food safety are also likely to remain key customer requirements and are expected to increase in importance in the short-to-medium term. While the export of bulk commodities will remain a significant part of future Australian grain trading, opportunities to change the functionality and/ or composition of traditional commodities will underpin future increases in demand and prices.

Key achievements 2021–22

Examples of investments in 2021–22 that support the achievement of this objective include:

Better sorghum: larger grain with more protein

Grain sorghum is Australia's most important summer feed grain and a major export, particularly to China. Sorghum has a reputation of having low protein content, poor digestibility compared to other feed grains, and often small or variable grain size. University of Queensland has developed genetically modified (GM) sorghum lines with gene knockouts to increase grain size, increase grain protein content and increase total grain digestibility. These sorghums can be used to make feed rations requiring 40% less soybean meal (hence lower cost) with no effects on poultry growth and feed conversion ratios. Gene edited lines have now been made to replicate these improved traits, and these lines will not require licensing as GMOs in Australia. To be useful to growers, the traits will need to be incorporated in commercially relevant backgrounds and field tested in commercial hybrid combinations with industry partners.

Seed storage protein in sorghum is notorious for low digestibility and can have adverse impacts on starch availability. In addition, small or variable grain size, a common problem in sorghum, results in yield losses to the farmer and higher processing costs for feed rations and human food uses.

An investment with the University of Queensland has taken three independent genetically modified (GM) approaches to increase grain size, grain protein content and grain protein digestibility. This project has now generated over 70 independent transgenic (GM) lines which have one or more of the following: 1. Increased grain size/weight; 2. Improved grain protein content; 3. Higher grain protein digestibility. These plants have been phenotyped in the glasshouse, and under Office of the Gene Technology Regulator have been phenotyped under field conditions. Lines were assessed for yield, protein content, protein digestibility and seed size.

Building on work in an earlier Australian Research Council (ARC) Discovery project, lines have been produced with downregulated or truncated constructs of:

1. Three G-protein gamma sub-units known to regulate grain size and/or grain number
2. GGC1 (a GrainSize3 gene)
3. GGC2
4. GGC3 (a dense and erect panicle gene)
5. A protein foldase gene involved in packaging seed storage protein in developing endosperm.

Across the life of the project, it was demonstrated through trials that one of the GGC1 lines always had the highest protein content and largest grain size. The foldase lines also had high protein content, but unlike the other lines the protein was significantly more digestible, and this was accompanied by larger grain size. In the field experiments the transgenic lines were demonstrated to outyield the Tx430 control line, driven by either grain size or grain number.

Lines were grown in the field for poultry feeding trials at the University of Sydney. In 2019, seven transgenic lines were tested and three selected for further testing in 2021. The most effective test was undertaken in 2021, showing that in sorghums with high protein (15-16%) and digestibility, diets made to be 22% protein and the same energy level were able to reduce the use of imported soybean meal by around 100 kg/tonne of feed, and also reduce the vegetable oil content. Overall, the use of high protein and highly digestible sorghums was equivalent to feeds from commercial sorghums, such as the industry-preferred hybrid Liberty. The best feeds with foldase line sorghums reduced the cost of feed by around $100 per tonne, predominantly by the lower usage of imported soybean meal. The benefits to the animal industries would give a strong price signal for sorghums with these traits, particularly when marketed as high protein, high digestibility sorghums.

In summary, the poultry feeding trials and field trials have demonstrated considerable benefits from better sorghums, which are required to improve the market value of Australian sorghum domestically and internationally.

Improving Australian malt barley flavour to address Chinese brewing requirements

This investment with the University of Adelaide is conducting field trials to assess potential genotype by environment (GxE) effects on malt flavour using a selection of key malting varieties that are suited to growing in Australia. In consultation with Statistics for the Australian Grains Industry (SAGI), a multi-phase statistical design was developed, and replicated trials have been undertaken on elite Canadian, European and Australian barleys, targeting production environments preferred by Chinese producers, as well as contrasting environments (Tasmania). To date, the GxE study has shown that the flavour compounds that can be attributed to coming from the barley itself is dependent on both the barley variety genetics as well as the growing conditions. The effect of different malting regimes is still unknown at this stage.

The investigation of elite barleys (those preferred by brewers) has led to the identification of 18 flavour compounds of interest.

The effect of malting conditions is currently being investigated, with the cooperation of Coopers Maltings, and results will be available at the conclusion of the project in latter part of 2022.

Genetic approaches to reduce the nitrogen dilution effect and increase nitrogen-use efficiency (NUE) in wheat

The project led by Murdoch University has dissected the genetic architecture underlying high nitrogen use efficiency (NUE) and grain protein content (GPC) in key Australian wheat cultivar Spitfire and an Israeli wheat variety Bethlehem.

Specifically, six double haploid (DH) wheat populations were generated from crossing Spitfire and Bethlehem with high yield Australian wheat varieties such as Mace, Gregory, Westonia and Suntop; 22 NUE, GPC and yield related traits were evaluated at six different field locations across NSW and WA; wheat genetic resources such as genetic linkage maps and consensus maps were also generated using the 90k Single Nucleotide Polymorphism chip (SNP chip) or 12k tGBS® arrays; and a total of 616 Quantitative Trait Loci (QTL) were detected. The project also conducted metabolomics and proteomics studies in relation to the nitrogen remobilisation from leaf to grain.

Overall, this project has produced several wheat lines of interest, developed and validated several molecular markers for use by breeders, and generated considerable knowledge related to NUE and GPC. These resources will be made available to the Australian wheat breeders for breeding high NUE and GPC wheat varieties.

Objective 3–Optimise input costs

On farm

International comparison of average input costs per tonne confirms that Australian growers have relatively high costs of production.

A wide range of opportunities exist that can lead to incremental and transformational reductions in input costs while optimising productivity. The challenge is to identify and prioritise the incremental opportunities to match costs with production at a regional scale while also identifying transformational opportunities on a national scale.

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	58	$14.0m
Ongoing	111	$47.7m
Total	169	$61.7m

Key achievements 2021–22

Examples of investments in 2021–22 that support the achievement of this objective include:

Dryland Legume Pasture Systems

The Dryland Legume Pasture Systems (DLPS) project ran over five years from 2017 to 2022 across four states and focused on improved management and better quantify benefits for animal and crop production within mixed-farming systems. The project was a co-investment by GRDC, the Australian Government Rural R&D for Profit program, Meat and Livestock Australia (MLA) and Australian Wool Innovation (AWI).

It supported legume pasture research at Murdoch University, the South Australian Research and Development Institute (SARDI), CSIRO, the Western Australian Department of Primary Industries and Regional Development (DPIRD), and New South Wales Department of Primary Industries (NSW DPI) and Charles Sturt University, as well as 10 grower groups across WA, SA, Victoria and southern NSW.

The DLPS focused on aerial-seeded legume species, which can be harvested on-farm. Combined with twin or summer sowing, a small amount of seed can be established across the farm at minimal cost. These hard-seeded varieties provide 'legumes on demand' that regenerate from the seedbank in the soil after one or more years of cropping.

Lasting benefits of these novel species include increased agility in the choice of crop or pasture production and the production of a highly nutritious forage for livestock, with the potential to reduce methane and greenhouse gas emissions for meat and wool production systems.

Future Farm Phase 2: Improving farmer confidence in targeted N management through automated sensing and decision support

The Future Farm Project was established to re-examine and improve the way in which soil and crop sensors, along with other data, are used to inform decisions about input management and to provide a way of automating the process from data acquisition, through analysis, to the formulation and implementation of decision options. Using nitrogen (N) fertiliser management as a 'use-case', the project sought to enable enhanced grower confidence in N decision-making through the generation of site-specific management models.

The project developed and/or evaluated several frameworks through which N decisions might be made using remote and proximal sensing technologies and other data sources (e.g. seasonal weather and historical yield). Some frameworks followed mechanistic agronomic thinking whilst others were underpinned by new data-driven methods, 'artificial intelligence' (AI) and 'machine learning' (ML). A critical element of each was the use of an on-farm experiment (OFE) comprising 'N-rich' and 'N-zero' strips which, along with the standard rate used by a grower at any given site, enable prediction of the spatially variable crop response and estimation of the economically optimum N rate (EONR) based on both yield and grain protein.

The project also developed a 'common sensor platform' (CSP) to enable real-time collection and integration of decision input data from multiple sensors, including a novel machine vision (MV) sensor, processing of the decision algorithm (see above) and implementation of the decision through a variable rate controller.

Objective 4–Reduce post-farmgate costs

GRDC will continue to support R&D into understanding the variables that drive supply chain costs, to inform policy on these issues.

In addition, GRDC will consider transformational investments with the capacity to disrupt current freight dynamics, as well as developing extension packages that assist growers in minimising post-farm-gate costs.

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	3	$0.2m
Ongoing	6	$0.6m
Total	9	$0.8m

Key achievements 2021–22

Examples of investments in 2021–22 that support the achievement of this objective include:

Grains Sector GHG Baseline and Mitigation Project

In 2020 GRDC commissioned CSIRO to prepare a report to establish a detailed and robust greenhouse gas (GHG) emissions baseline for the Australian grains sector.

This year GRDC released the findings of The Australian Grains Baseline and Mitigation Assessment, which found that the Australian grains industry exhibits low greenhouse gas (GHG) emissions for each tonne of grain produced compared to other grain producing regions and countries, including the EU, USA, Canada, Russia and Ukraine.

The 18–month research initiative provides critical baseline data around the current level of GHG emissions for our industry. Establishing a detailed and robust GHG emissions baseline for the Australian grains sector will allow us to explore mitigation opportunities that maintain or increase profitability.

This type of information will also be increasingly important for the Australian grains industry in maintaining access to global markets.

Importantly, CSIRO researchers found in their assessment of measures that would maintain or improve average production across the sector and that it would be possible to increase production dramatically while keeping net on-farm emissions more or less constant

While this is not the same as reducing emissions, it is a critical finding. The next step is to determine what information and tools growers could need to make these modelled scenarios reality.

Six scenarios were modelled to reduce emissions intensity: current rotations and nitrogen rate, best practice nitrogen application, perfect nitrogen management, optimised rotation, green ammonia fertiliser and controlled traffic farming.

These are key areas where GRDC has a long track record of RD&E investment and where we will continue to invest to drive profitability for growers and enhance environmental outcomes.

Critically this report provides the grains industry a realistic pathway towards reducing the greenhouse gas intensity of Australian grain production that could be achieved as part of a profitable grain growing business sector.

On-farm emissions contribute about 60% of emissions, while about 40% come from emissions associated with agricultural inputs.

Fertilisers were a critical source of GHG emissions both from their production and use on farm. Hence, there is a clear opportunity is to improve fertiliser application practices that increase production and overall GHG intensity. Further, significant reduction of those emissions can be expected in the longer term via the production of green fertilisers and (other) decarbonisation of energy supply. Offsetting of emissions via reforestation seems the most likely option to reduce absolute emissions and this could be compensated for by increasing production on remaining land.

Absolute GHG mitigation potential in the Australian grains sector is limited due to an intrinsic trade-off between total emissions and production. Given widely supported goals to increase production, it is unrealistic to expect significantly reduced absolute total emissions, given the essential role that carbon and nitrogen play in plant growth, but Scope 1 emissions are shown to reduce in the high-nitrogen scenarios in some regions. Setting targets in terms of GHG intensity, combined with minimum conditions around Scope 1 emissions and production, is the most realistic and in line with recommendations made by the National Farmers' Federation.

More detailed information is available at GRDC GreenHouse gas emissions.

National resistance monitoring for insect pests of stored grain

A national program, led by the University of Queensland aims to survey 100 farms per year in the northern, southern and western regions and undertake resistance diagnoses of several thousand pest populations over the life of the project. This will deliver a comprehensive assessment of resistance nationally, with implications for pest and resistance management.

The national resistance monitoring program has a long history and critical research outputs, including early detection of new resistances and trends in frequency of strong resistance in major pests over time. It underpins the implementation of integrated pest and resistance management strategies across all sectors of grain storage.

Based on the farm visits undertaken over the last 12 months, approximately 48% of the farms sampled in the southern region and 25 per cent in the western region had no live insects. Compared to this, all farms in the northern region harboured at least one pest population and the majority of them harbour at least two to three species belonging to the five major pest species. Although the western and northern regions are yet to reach their survey target of 100 farms, the project teams are continuing make up this shortfall in their respective regions.

Based on the results to date across Australia, five species seem to be problematic on farm both in terms of prevalence and resistance developments: *T. castaneum*, *R. dominica*, *O. surinamensis*, *S. oryzae* and particularly the rusty grain beetle, *Cryptolestes ferrugineus*. Several Cryptolestes species are found on farms but so far, characterisation work indicates that only C. ferrugineus can develop strong resistance. Although strong resistance is yet to be detected in *O. surinamensis*, this species continues to increase in detection with weak resistance. It is noted that the current phosphine label rates can control strong resistance in all species except C. ferrugineus, which needs special attention. Currently sulfuryl fluoride is the registered alternative fumigant that can be effective against the strongly resistant populations of this species.

On-farm strong resistance frequency continues to rise in the northern region (24%), followed by southern region (10%). For bulk handling companies (BHCs), strong resistance in *C. ferrugineus* seems to be the major issue both in the southern and northern regions. The frequency of strong resistance in this species has risen to 64% in the northern region from the 35% recorded in the previous year (2019–20), whereas it has come down to 40% in the southern region from the frequency of 48% recorded in 2019–20.

The western region has reported three strongly phosphine resistant *T. castaneum* populations, collected from farms. The research team has advised the relevant growers to undertake remedial actions to contain and eradicate these populations on their properties. While follow up visits and sample collections to these properties are planned, these resistant populations are currently being cultured for re-testing and sent over to the DAF laboratories in Queensland for a cross-test.

Recent interaction with managers of major BHCs as well as several growers suggest that there are likely to be more pest and resistance problems in the current year due to a bumper harvest as well as predictions for significant increase in temporary storages such as bunkers.

A comparative analysis of Australia's main containerised grain supply chains

This market analysis project was developed to enable the Australian grains industry to better understand the nature and costliness of container grain supply chains, as well as enable the containerised trade to grow and become more cost-efficient and reliable.

A collaboration between AEGIC, GRDC and the South Australian Grains Industry Trust (SAGIT), this project relied on extensive consultation with stakeholders to identify key issues with containerised grain trade, which have been exacerbated by the current global shortage of shipping containers. Analysis of these issues and the factors contributing to them produced valuable information that could be used to encourage policy reform, such as benchmarking the cost effectiveness of containerised grain supply chains against bulk supply chains, and identifying opportunities to enhance cost efficiencies.

A report from this project 'Improving Australia's containerised grain exports' was provided to the Productivity Commission in May 2022 to help inform their enquiry into Australia's Maritime Logistics System. The reports key findings were:

- Australia regularly exports over three million metric tonnes (MMT) of grain in containers annually. There are about 100 grain container packing businesses in Australia, the majority located in NSW, Victoria and Queensland. On average 30 per cent of total grain exports from these three states occurs in containers.

- Australia also regularly exports around one MMT of fodder in containers each year to key markets in Japan and China.
- Relative to bulk export, containers offer a more flexible export mechanism with costs, prior to the escalation of ocean freight charges in 2020 and 2021, being not greatly different from the costs of Australia's bulk grain supply chains. However, by far the main cost component of containerised grain supply chains is sea freight, which has more than quadrupled since 2020, severely impacting containerised grain and fodder exports.
- Cost increases and limited container mobility due to COVID-19 have reduced the profitability of containerised grain exports. Many Australian businesses exposed to the problems in exporting containerised grain and fodder have suffered substantial losses or a reduction in profits from 2020 to 2022, despite the volume of containerised grain being maintained.
- Government and industry actions can generate enduring value for the Australian containerised grain and fodder export industry. These actions are not simple, band-aid remedies but are strategically worthwhile actions. Some are relatively easy to implement quickly, while others are liable to prove more challenging to introduce. Both sets of actions could create and protect enduring value for Australia's export of grain and fodder in containers.

Understanding future grain quality preferences

This project with AEGIC was developed to allow the Australian grains industry to better understand customers' grain quality preferences, and this influences classification standards and grade segregation decisions. Other project outcomes included:

- positioning Australian grain growers to better produce varieties that are more competitive with other countries
- aiming to enable the Australian industry to be more agile in meeting the requirements of key 'high volume' markets, while also servicing 'low volume, high value' markets, making Australian grain more resilient to competition in the long-term.

South East Asian markets remain the largest purchasers of Australian wheat exports. The two largest wheat-based food segments within these markets are bread and noodles. To continue to be a preferred supplier to these markets, the Australian industry must supply grain that meets the needs of millers, bread makers and noodle manufacturers.

Wheat Quality Australia (WQA) initially requested AEGIC's assistance to analyse and understand current and future end-use trends for wheat in Australia's major wheat markets in 2017. This project updated these findings so that current market insights can be considered by industry when making classification and investment decisions.

Technical staff employed in flour milling and noodle and baked goods manufacturing in Indonesia, Vietnam, Malaysia, Thailand and the Philippines were surveyed on the importance of a range of attributes when selecting wheat for noodles and baking applications. The 21 grain and flour quality characteristics attributes were ranked in order of importance with maximum and minimum acceptable values for the quality characteristics also being identified.

The findings regarding noodles reinforced our current understanding of wheat quality preferences with the most important attributes relating to colour and textural properties. For bread, the preferred wheat quality attributes remain related to volume and dough characteristics.

Objective 5–Manage risk to maximise profit and minimise losses

Risk is an important part of the profit equation.

Risk management that is too conservative can limit profit in above-average production years, while approaches that are too aggressive can expose the grower to equity issues that adversely impact profit and future operations. In addition, grower attitude to risk is a key determinant of the speed and scale of uptake of new technology.

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	4	$2.4m
Ongoing	5	$1.6m
Total	9	$4.0m

Key achievements 2021–22

Examples of investments in 2021–22 that support the achievement of this objective include:

AgScore

The AgScore project investigated new methods to extract greater value from seasonal climate forecasts. The project had three work packages. The first involved a comparison of the skill (accuracy) of seasonal climate forecasts from multiple general circulation models (climate models) at different times in the year and in different locations.

Overall, the signal to noise ratio was very low, and no model consistently stood out. This analysis reinforced the 'autumn skill gap' wherein seasonal forecasts have poor accuracy in autumn and progressively better skill as the season progresses.

The second work package looked for novel ways to couple the forecast with crop simulation models to test a climate model's ability to produce more actional agricultural metrics. To illustrate the problem, an accurate forecast of above average rainfall likely will not translate to above average yield if that rainfall comes in drizzles and at the wrong time. Work package two revealed nuanced insights, but the value gained from those insights is dwarfed by the complexity and computational requirements required to derive them.

The third work package investigated the value of a 'perfect' seasonal climate forecast for various on-farm decisions. For two main reasons, even a 'perfect' forecast had relatively little economic value. That is partly because decisions influenced by a forecast, like what crop to sow and how much N to apply, are heavily influenced by other factors. The second reason is that growers tend to be risk averse in response to a favourable forecast. They tend not to adjust their management practices, even in situations where it is agronomically possible to do so and the upside risk of adjusting a practice is much greater than the downside risk.

AgScore was led by CSIRO, partnering with Weather Intelligence, a company that provides climate analytics services and research for the mining, energy and agricultural industries in Australia. The project was co-funded under the Managing Climate Variability (MCV) program, a collaboration between GRDC, MLA, AgriFutures Australia, Cotton RDC and Sugar Research Australia Ltd.

Framework performance in 2021–22

Biosecurity

Aims to invest in RD&E that is:

- *strategic, collaborative and coordinated to minimise grains biosecurity threats to production and trade in the context of common cross–industry objectives.*
- *contributing to the optimal management of grains industry plant biosecurity risks across the pre and post boundary continuum at national, state, region and farm levels with regard to pests, weeds and diseases that are either exotic (not yet established in Australia) or established (present in Australia).*

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	1	$0.03
Ongoing	15	$1.5m
Total	16	$1.53m

Key achievements 2021–22

Development of identification resources and enhancing diagnostics capacity for High Priority Plant Pests

A part of the Australian Government Rural R&D For Profit program, this investment with Cesar aimed to increase capability among growers and agronomists to identify exotic pests. This included identification of 'early indicators' and development of collection and diagnostic protocols to perform analysis which would allow delimiting activities to be directed towards 'hotspot' regions to increase the speed and efficiency of delimiting surveillance during an incursion. The identification of biotypes and development of diagnostic protocols would enable biosecurity agencies to better predict pest spread and establishment and develop effective control options.

Cesar has now completed resource development (Fact Sheets) on the 20 High Priority Plant Pests (HPPPs) that were identified by the initial gap analysis. These will be hosted on the Plant Health Australia portal. They are also expected to be integrated into the AUSVEG industry training workshops being held this year as part of this project.

Also completed is the 'Early indicators assessment using eDNA approaches for High Priority Plant Pests (HPPPs)' report, which summarises the suitability of applying environmental DNA (eDNA) approaches for sampling and detection of 34 HPPPs. These HPPPs were prioritised with emphasis on recent global emerging invertebrate pests. The report provides a synopsis of each pest and measures the opportunities for applying eDNA based methods against a set of criteria. The report identifies the top 10 HPPPs where opportunities exist to apply eDNA methods. Other HPPPs were also identified as good candidates for applying eDNA methods but lacked information for some criteria (e.g. genetic data or opportunities for DNA aggregation during sampling).

An extensive desktop analysis on the identification and prioritisation of risks posed by genetic variants of exotic HPPPs was also conducted. 20 HPPPs were reviewed, based on the Plant Health Committee list, and then refined to account for concerns specific to industry biosecurity plans, emerging pests, and pests where there are significant knowledge gaps. Each HPPP literature review is available for other RDCs and industry groups.

Capacity and ability

The Capacity and Ability (C&A) Framework defines the intent and broad principles for GRDC's approach to develop and maintain the people, infrastructure, and delivery pathways to ensure the continued success of the Australian grains industry.

In addition, the C&A framework refines the relatively broad statutory scope of GRDC's investment in C&A to provide a greater strategic focus guided by principles for investment to deliver identified C&A priorities.

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	53	$7.7m
Ongoing	51	$2.7m
Total	104	$10.4m

Key achievements 2021–22

Australian Rural Leadership Program

The Australian Rural Leadership Program (ARLP) is a 15-month leadership development course for individuals committed to responding to regional, rural and remote Australia's complex challenges and opportunities. GRDC sponsors the ARLP to build leadership capacity in the Australian grains industry, providing an opportunity for grains industry applicants to complete the program. It is crucial for the success of the Australian grains industry to have individuals who can lead innovation and adoption of grains R&D. In 2021–22, GRDC sponsored two grains industry participants, Julie Andreazza and Jason Gabb.

Growers as Innovators - Year 3

This program led by Farmers2Founders (F2F) helps build agrifood tech and innovation solutions that deliver real commercial benefit and impact across agrifood and fibre at both individual farm business and industry level.

During 2021–22 the program successfully delivered: the continuously available online Journey Starter Program (self-paced eight modules for aspiring entrepreneurs to test their readiness); two cohorts of the six-week Hatch Program where participants validate their customer segments and value proposition; the first cohort of the eight-week Hone Program during which founders convert the idea into a real business venture; and the new five-month Harvest Commercialisation Accelerator aimed at supporting the scaleup of early stage agrifood tech and innovation ventures.

In addition, a new community platform (Farmers2Founders HQ) which included activities with our alumni and delivery of the first stage of a new information and capability building webinar series was produced. An early prototype of the Muster platform was developed, aimed at communicating industry challenges and finding problem-solution fit between producer problem statements and available solutions.

Grains Research Scholarships

GRDC Grains Research Scholarships (GRSs) support PhD candidates to deliver innovative research solutions to address constraints or opportunities for Australian grain growers to help improve their farm business sustainability and profitability.

We also invest in developing researcher capacity and ability to ensure we have continued access to researchers with the skills and expertise to deliver world class grains R&D for Australian grain growers.

GRDC is currently supporting 26 early career researchers through its GRS program.

Nuffield Scholars

Two grains industry Nuffield scholars, Jarrod Amery and Josh McIntosh, were supported during 2021–22.

Jarrod's study program will include visits to leading farm businesses around the world, to understand the common threads of success, including how to achieve a sustainable work/life balance, pathways to expansion and diversification, as well as how to encourage new entrants into farming

After travelling throughout major agricultural producing countries, including China and the United States, Jarrod plans to share his findings with peers, to help build a culture within Australian farming that promotes entrepreneurship and knowledge sharing.

Josh plans to explore low-rainfall or semi-arid cropping areas in Central America, arid regions of Africa and Israel, and low-rainfall areas of Australia.

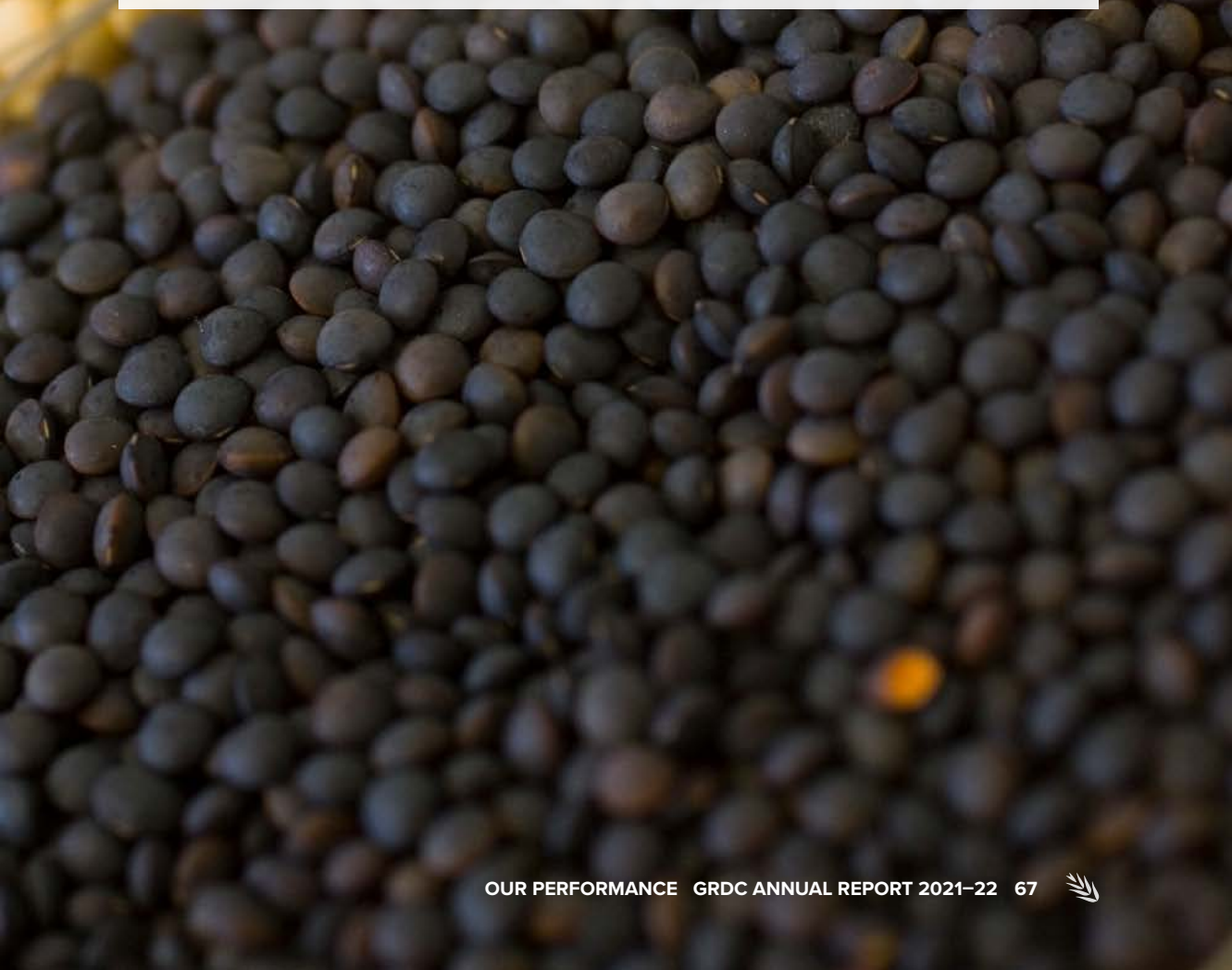
He will investigate how to promote and maintain a healthy and profitable soil microbiome in low rainfall, broadacre, organic mixed farming systems. The soil microbiome is the complete set of microorganisms living within the soil. As part of his study, he will explore farm practices that quantifiably increase the capacity of soil to produce healthy plants, and which can be applied within a low-cost production system centred on gradual improvement.

Data management and analytics

This Framework aims to enable researchers and growers to capture and exploit data relevant to the grains industry, including R&D experimentation, paddock and farm, production, and economic, and environmental characterisation data. There are six strategic elements:

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	20	$2.6m
Ongoing	22	$9.6m
Total	42	$12.2m

- *Capture valuable data;*
- *Make data accessible and actively share data and learnings;*
- *Invest in analytics to create innovative insights and value;*
- *Measure investment impact;*
- *Ensure we have a workforce that has the necessary data and analytics skills and capacity; and,*
- *Apply governance for effective data usage.*



Key achievements 2021–22

Deep learning for early detection and classification of crop disease and stress

The aim of this GRDC project was to develop deep learning algorithms for the automatic detection of wheat stress using a variety of remote sensing data. More specifically, the project focused on the development and evaluation of deep learning models for the detection of yellow rust disease, Fusarium, salt and frost stress using two types of available remote sensing field data, i.e., hyperspectral and multispectral data.

The project led to research outputs and achievements such as a transfer learning framework for hyper-spectral data classification with a conditional generative adversarial network.

The proposed framework addresses the problem of data scarcity as there is usually very limited labelled data to learn a given classification task. This is a major bottleneck as fully supervised deep learning techniques require large-scale labelled datasets to achieve high performance.

The project delivered a spectral-spatial residual network for hyperspectral image classification with a small training data size. Compared to state-of-the-art architectures for processing 3D hyperspectral data, the proposed two-streams network improves the spectral and the spatial feature extraction while enabling the construction of a deeper and wider network with fewer parameters. This makes it particularly suitable for high-performance classification tasks when the amount of available labelled data is small.

Also completed was a Spectral Convolution and Attention Network (SCAN) for wheat stress classification and interpretation using hyperspectral data. The proposed network exploits dilated convolutions on the spectral data to capture the long dependencies between bands. It also integrates a spectral attention module to explain SCAN's prediction by outputting which bands the model gives more attention to, and a Nested-Unet deep learning framework for multispectral imagery segmentation.

The work in this project was recognised through the 2021 Eureka Award for Growth in Innovation and Entrepreneurship for contribution to the development of deep learning algorithms for the early detection and classification of crop disease and stress.

The project's outputs and achievements have been showcased on a website (ai-crop-stress-detection.com) enabling users to upload data, process it online and visualize or download classification output results. The developed website aims to encourage technology uptake and establish partnerships with growers to provide tailored AI solutions for precision agriculture.

Grower communications and extension

This Framework builds on the significant progress that GRDC has made to date in communicating R&D outcomes to growers while increasing focus on extension that leads to increased technology adoption and practice change on farm.

The Framework also reflects GRDC's recognition of the changing extension landscape in Australia and aims to leverage and strengthen existing extension channels.

2021–2022 INVESTMENT SUMMARY		
RD&E	**Projects**	**Investment**
New	10	$0.5m
Ongoing	19	$5.9m
Total	29	$6.4m

Key achievements 2021–22

Farm Business Updates

During 2021–22, face-to-face Farm Business Updates were delivered in nine locations—Griffith, NSW; Port Lincoln, South Australia; Esperance, Western Australia; Dowerin Western Australia; Bendigo, Victoria; Corowa NSW; Swan Hill, Victoria; Horsham, Victoria; and Naracoorte, South Australia.

Five national online events were hosted for topics including:

- farm machinery investment – finding the sweet spot
- farm safety – changing the culture
- farm workforce recruitment
- communicating with influence.

A further two online events were held in the northern region.

Grains Research Updates

Southern region

During 2021–22 Update participation was maintained through a combination of face-to-face delivery and livestream. In total 2,236 people participated in the fifteen (15) GRDC Grains Research Updates staged in the southern region over the last 12 months. A total of 2,236 people attended face-to-face or via livestream the six-day livestream series and nine regional, one-day updates. Face to face events were held in Campbell Town, Tasmania; Woomelang, Victoria; Dimboola, Victoria; Naracoorte, South Australia; Loxton, South Australia and Donald, Victoria.

Northern region

While COVID-19 continued to have an impact on the delivery of face-to-face events, six events were hosted in person. The locations for these events were Jerilderie, NSW; Hillston, NSW; Millmerran, Queensland; Nindigully, Queensland; Theodore, Queensland; and Rolleston, Queensland.

A further seven events across NSW and Queensland were delivered by livestreaming. Close to 1900 people registered to attend events either in person, or through livestreamed webinars.

Western region

In the western region the Grains Research Update series was run over six days as in an online format due to ongoing COVID-19 restrictions. More than 700 people attended across the six days to hear RD&E results from 50 presentations.

4

Our organisation

People and governance

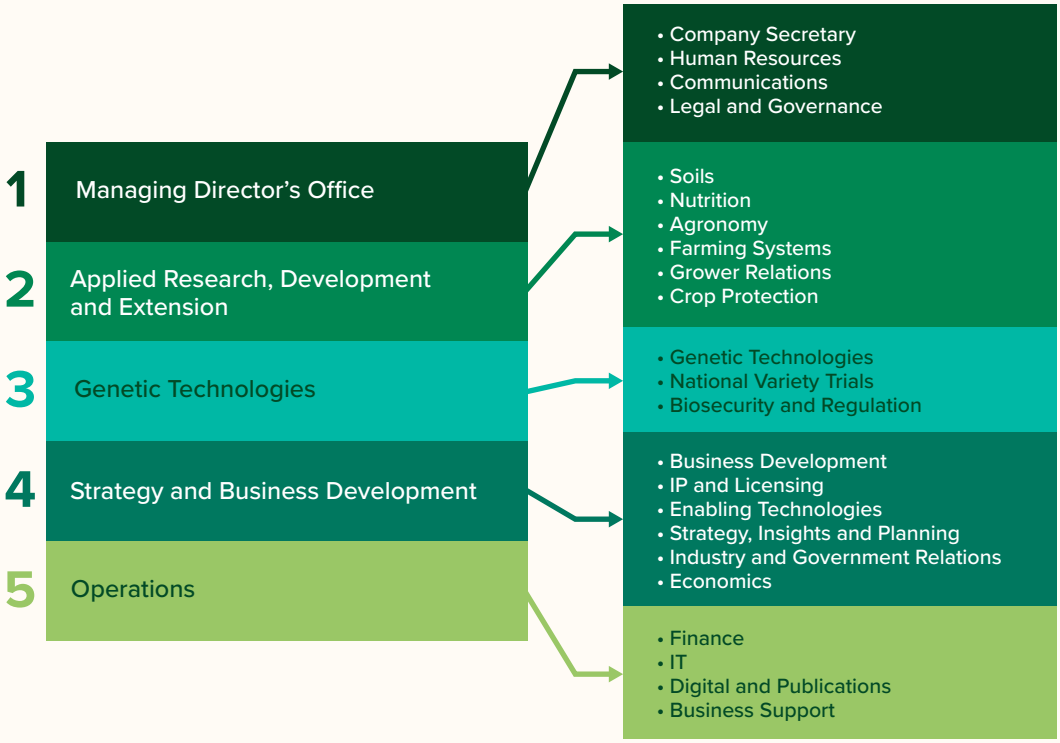
GRDC's purpose is to invest in research, development and extension (RD&E) to create enduring profitability for Australian grain growers.

We invest in and manage RD&E projects to deliver new and improved varieties, farming practices, technologies and capability to the Australian grains industry. These investments drive the discovery, development and delivery of world-class innovation.

Our role includes co-ordinating and investing in RD&E activities; monitoring, evaluating and reporting on the impact of R&D activities on the grains industry and the wider community; and facilitating the dissemination, adoption and commercialisation of the results of R&D.

Structure

Figure 5: Structure at 30 June 2022



Board and Executive

GRDC's Board is responsible for the stewardship of the Corporation and oversees corporate governance within GRDC. The Board's functions include setting strategic direction and monitoring the ongoing performance of the business and the Managing Director. More information on the Board is provided in Part 3 of this report.

The Executive Committee is comprised of the Managing Director and the General Managers of GRDC's business groups, along with the General Counsel and Company Secretary, Head of Human Resources and Head of Communications. The Executive Committee leads GRDC's business activities, advises the Board and implements the Board's decisions. It meets regularly to ensure that GRDC's operations are monitored and managed efficiently and effectively.

Business groups

At 30 June 2022, GRDC had five business groups with subgroups as follows:

Managing Director's Office–Company Secretary; Human Resources; Communications; and Legal and Governance

Applied Research, Development and Extension— Soils, Nutrition, Agronomy and Farming Systems; Grower Relations; Crop Protection

Genetic Technologies — Genetic Technologies; National Variety Trials; and Biosecurity and Regulation

Strategy and Business Development—Business Development; IP and Licensing; Enabling Technologies; Strategy, Insights and Planning; Industry and Government Relations; and Economics

Operations—Finance; IT; Digital and Publications; and Business Support

Investment planning and assessment are performed by cross-functional teams involving input from relevant units across GRDC, while individual investment contracts are negotiated and monitored by managers within relevant units.

Advisory panels

Four advisory panels provide input on priorities and proposals for RD&E investment.

The National Panel:

- assesses national RD&E priorities across GRDC's investment portfolio and makes recommendations on investment priorities and investment proposals to the Managing Director
- assists the Managing Director to maintain links with grain growers, advisers and research partners.

There are three regional advisory panels, one for each grain growing region. These panels are comprised of grain growers, agribusiness representatives, industry stakeholders, researchers and a GRDC General Manager. These regional panels provide advice and input to GRDC staff and the National Panel.

More information on the advisory panels is provided on the GRDC website, at grdc.com.au/about/what-we-do/regional-panels.

Board

Directors

At 30 June 2022, the Board comprised nine directors, of which eight are non-executive Directors and one is an executive Director.

The Board has combined expertise in business management; commodity production, processing and marketing; economics; finance; management and conservation of natural resources; environmental and ecological matters; R&D administration; science and technology; technology transfer; communication; and public administration.

Directors at 30 June 2022

John Woods
BAppSc, MAICD

Appointed: 8 March 2012 to 30 September 2016

Appointed as Chair: First term – 1 October 2016 to 30 September 2019 Second term – 1 October 2019 to 30 September 2022

Third Term –1 October 2022 to 30 September 2023

Member: Remuneration People and Performance Committee

John is partner and manager of a broadacre agribusiness based in northern New South Wales and southern Queensland. He has responsibility for all business aspects, including financial management, production and crop husbandry, marketing and logistics, resource management and work health and safety. He is also Chair of R&R Hire Services in Queensland.

John has a history of working collaboratively with a range of public and private organisations in the development, extension and adoption of new technology.

He was Chairman of the Science Advisory Group of the National Agricultural Monitoring System (NAMS) between 2005 and 2009, and a member of the NAMS Advisory Reference Group and Steering Committee. He also spent six years, to 2005, on the National Rural Advisory Council.

John was Chairman of ChemCert Training Queensland from 2002 to 2004 and has held positions with Cotton Australia and Farmsafe Queensland.

Nigel Hart
Managing Director

Appointed: 28 March 2022

Nigel grew up in southern New South Wales and has spent more than 25 years working in executive and leadership positions in large scale infrastructure, port, warehousing and supply chains operations for the grains sector, both within Australian and internationally.

Nigel has worked as an expert consultant on a range of projects in the grain supply chain from international benchmarking of bulk and container supply chains, plant protein manufacturing, hybrid wheat commercialisation, digital strategies for supply chain optimisation and the design and development of a 1.3mmt grain export terminal.

He was previously Global Director (Ports) at Archer Daniels Midland where he led the development of a global port's growth and productivity strategy across Asia, Europe, South America and the USA.

Prior to this he spent 15 years at GrainCorp culminating in his position as Group General Manager – Storage and Logistics where he led the storage and logistics operations, grain accumulation and domestic customer management teams across the east coast of Australia.

Nigel has a bachelor's degree in Agriculture from Western Sydney University, is a Fellow of the Australian Institute of Company Directors and successfully completed the Advanced Management Program at Harvard Business School in 2013.

Richard Dickmann
BForSci (Hons), MAgrSc, GAICD

Director (Non-executive)

Appointed: 1 October 2020 to 30 September 2023

Growing up on a southern Victorian farm, Richard obtained a bachelor's degree in Forest Science at the University of Melbourne and a Master of Science in Agriculture at the University of Sydney. Richard worked in state government agricultural extension in New South Wales and Victoria and in crop insurance industry. Richard then undertook a 20-year international career in agribusiness, with postings to France, Singapore, Japan, China and Germany. Richard gained broad experience in research prioritization, marketing, global product management and commercial operations.

Returning to Australia in 2009, Richard undertook roles in new business development and public and government affairs. Richard worked to identify new business opportunities combining the innovation power of Australian and international organisations. Richard is currently managing his own consulting business focusing on innovation, commercialisation and sustainability strategies across Australia's agri-food industries.

Richard is a graduate of the Australian Institute of Company Directors and currently sits on the advisory boards of the Australian Plant Phenomics Facility and the ARC Centre of Excellence for Plant Success in Nature and Agriculture. Richard was formerly a Director of Cotton Grower Services Pty Ltd and a member of the Bayer Australia Ltd Board.

Roseanne Healy
BA(Econ), MBA, MBR(Com), GAICD

Deputy Chair

Director (Non-executive)

Appointed: 4 November 2014, reappointed to 30 September 2023

Member: Audit and Risk Committee (Chair from 6 December 2017)

Member: Remuneration People and Performance Committee

Roseanne Healy started out in strategic advisory and investment banking at JB Were in Australia. She has built a successful career over two decades as a corporate advisor to several ASX listed companies in the resources, retail, and automotive sectors as well as being an experienced board chair and director on both private and government boards.

A former tribunal member for the Office of Consumer and Business Affairs and CEO influencing Australia's economic credentials and investment in infrastructure, resources, food, and agriculture.

Roseanne currently leads Enterprise Corporation, an Australian corporate advisory and boutique private equity firm, and is a non-executive director on both government and private company boards including the Murray Darling Basin Commission, Dairy Australia, Pristine Foods, Airborne Research Australia, Swarmer, and Cashflow Manager.

Roseanne holds a Bachelor of Economics/Arts; and a Master of Business Research (Commerce) and MBA from the University of Adelaide. She later returned to study a Bachelor of Laws at the University of Adelaide.

Roseanne is also a graduate of the AICD (International).

Richard Heath
BSc (Hons), GAICD

Director (Non-Executive):

Appointed: 1 October 2017, reappointed to 30 September 2023

Chair: Remuneration People and Performance Committee (from 9 December 2020)

Richard grew up on a family farm on the Liverpool Plains in north-west New South Wales. He managed the cropping operations of the farm for nearly 20 years, overseeing production of wheat, barley, chickpea, faba beans, canola, sorghum, sunflowers, mungbean and cotton. Richard has been an early adopter of new farming technologies and travelled on a Nuffield scholarship in 2003 to research precision applications of fertiliser.

Richard is the Executive Director of the Australian Farm Institute, an independent agricultural policy research organisation. Prior to this role, Richard was Associate Professor of Agronomy and Farm Management at the University of Sydney, with responsibility for the management of the university's north-west farms group, including the Plant Breeding Institute at Narrabri.

Richard was a member of GRDC's Northern Regional Panel from 2005 to 2011 and was a director of Nuffield Australia Farming Scholars from 2011 to 2017. He is currently a member of the external advisory committee of CSIRO Agriculture and Food.

Bob Nixon
Director (Non-Executive)

Appointed: 1 October 2020 to 30 September 2023

Member: Audit and Risk Committee (from 9 December 2020

Bob manages a family farming business in the 300mm annual rainfall North-eastern wheatbelt of Western Australia. The family grow wheat, barley, canola, lupins, field peas and serradella cover crop. He has a strong interest in crop agronomy, soil health and resilient farming systems and communities.

Bob is past Chair of the Grain Industry Association of WA (GIWA) from 2017 to 2020. He currently sits on the WA Soil and Land Conservation Council and is an active member of his local Liebe Grower Group. He completed a Nuffield Scholarship in 2014 looking into 'Mitigating Risk in a Dry and Variable Climate' in response to the drying out and increase in seasonal variability of the WA cropping belt. Bob was awarded the GRDC Seed of Light in 2019 for his work in managing soil constraints.

Andrew Spencer
BAgSc, GAICD

Director (Non-executive)

Appointed: 1 October 2020 to 30 September 2023

Member: Audit and Risk Committee (from 9 December 2020)

Andrew is the manager of his own consulting business in the Monaro Region of NSW. He has previously been a senior executive of diverse agriculture and agribusiness organisations, spanning more than 30 years in four countries.

From 2005 to 2019, Andrew was the Chief Executive Officer of Australian Pork Limited, the industry services and representative body for Australia's pork producers.

Prior to this time, he worked in the agricultural biotechnology, chemical and seed business in Australia, Europe and Africa particularly working in crops such as cereals, cotton, canola and rice. His roles included country management, global product management, crop business management and business development.

Andrew is the current Chair of the Australian Farm Institute, Sheep Producers Australia Ltd and PorkScan Pty. Ltd., a small technology company in the pork industry. He is also a director of the Red Meat Advisory Council Ltd.

Andrew studied agricultural science at the University of Melbourne.

Sharon Starick
BAgSc

Director (Non-executive)

Appointed: 30 November 2018, reappointed to 30 September 2023

Member: Audit and Risk Committee (from 9 December 2019 to 30 September 2020 and then from 9 December 2020).

Since 1993, Sharon and her husband have been producing grain and pork in the Mallee region of South Australia. Her extensive knowledge of sustainable primary production was developed through a degree in Agricultural Science through Adelaide University, her own on-farm practices and past participation in Mallee Sustainable Farming and the South Australian No-Till Farmers Association. Through Sharon's strong interest in policy development and collaboration within Australian agriculture, she currently holds the positions of Chair of Animal Health Australia, Director of the Regional Investment Corporation and Committee member, Murray Plains Farmers.

She also has a passion for natural resource management and conservation that is reflected in her past involvement as Chair of the South Australian Murray–Darling Basin Natural Resources Management Board and as a member of South Australia's Natural Resources Management Council, the Australian Landcare Council and the Community Advisory Committee for the Murray–Darling Basin Ministerial Council. As a past director of Land & Water Australia, Sharon has experience in strategic planning for research and extension. Sharon is a past participant in the Murray-Darling Basin Leadership Program and was awarded the RIRDC Rural Women's Award for South Australia in 2003.

Gemma Walker
BAgrBus, MAICD

Director (Non-executive)

Appointed: 1 October 2020 to 30 September 2023

Gemma Walker and her husband run a mixed cropping and sheep property near Munglinup, in the Western Australia's south-east. In addition, she has worked for many years managing farming systems groups to deliver development and extension activities. These included Mallee Sustainable Farming and the Southeast Premium Wheat Growers Association.

Gemma is passionate about empowering all stakeholders in the grains industry to work together to build a sustainable and progressive supply chain which enables Australian growers and processors to profitably produce high quality goods for new and existing domestic and international markets.

Gemma is currently a Non-Executive Director on Rural Edge Limited Board (formerly Partners in Grain), Non-Executive Director on Esperance Organised Primary Producers and is a committee member of the Southern Biosecurity Group. Her Board roles have included National and Deputy Chair of Partners in Grain and Committee roles in business development and human resource management.

She has previously served as a GRDC Western Region Panel Member for seven years and as a Board or Committee Member on Muresk Institute of Agriculture Board, the Wheatbelt Area Consultative Committee, Grains West Reference Group, and the Rural Media Association (WA) Committee.

In South Australia, Gemma has held appointments on the Loxton Research Centre Consultative Committee and the AgExcellence Alliance Executive Committee in addition to her membership of the Mildura Young Professionals Network Executive Committee and Women Advancing Rural Communities group in Victoria.

Recognised for her significant contribution to sustainable agriculture at the National Landcare Awards, Gemma has also been a finalist in the AgriFutures Australia WA Rural Women's Awards.

The following Director departed GRDC in 2021–22

Cathie Warburton
BA LLB, Dip Ed studies, GAICD

Interim Managing Director

Top L to R: Nigel Hart, Richard Heath, Andrew Spencer, John Woods, Richard Dickmann, Bob Nixon.
Bottom L to R: Roseanne Healey, Sharon Starick, Gemma Walker.

Board selection

Members of GRDC Board are selected and appointed in accordance with the *Primary Industries Research and Development Act 1989* (Cth). Under the PIRD Act, the Minister is responsible for the selection and appointment of the Chair of GRDC Board. The Managing Director is selected by the Board and holds office at the Corporation's pleasure.

All other Board members are selected by a selection committee, appointed by the Minister under the PIRD Act, in consultation with the industry representative organisation declared under the PIRD Act and other grower organisations. The selection committee is responsible for nominating five to seven candidates to be appointed as GRDC directors. Nominations are made to the Minister and formal appointment of directors is made by the Minister.

In 2021–22 the Chair was appointed for a further one-year term until 30 September 2023.

Committees

At 30 June 2022, the Board had two Committees, as described in Table 4. The Board receives formal reports from the Committees, and any decisions that the Board makes in relation to those reports are recorded in the minutes of the subsequent Board meeting.

Policies and practices

The Board Charter sets out the responsibilities and processes of the Board, including the code of conduct for directors. The Board reviews this document at least once a year.

Key policies and practices of the Board include:

1. Independent professional advice: With the Chair's approval, directors may obtain independent professional advice, at GRDC's expense, on matters arising in the course of their duties.
2. Performance monitoring: The Board sets out a detailed plan for the Corporation at the start of each year and reviews the Corporation's performance against the plan throughout the year. This is a key factor in determining the level of any performance bonuses paid to GRDC staff.

Table 4: Board Committees

ROLE	MEMBERSHIP
Audit and Risk Committee	
Assists the Board in fulfilling its corporate governance responsibilities and reviews GRDC's: • external financial and performance reporting processes • internal control system • risk management strategy and processes • internal and external audits • statutory reporting obligations	At least three non-executive directors appointed by the Board.
Remuneration People and Performance Committee	
Reviews and makes recommendations to the Board on matters relating to: • the recruitment, remuneration, development, performance and retention policies of GRDC, including strategic workforce planning and organisational development • fostering a performance culture • the selection, remuneration and performance of the Managing Director • the development and performance of the Board	Chair, and three other non-executive directors appointed by the Board.

Meetings

During 2021–22 the Board held 8 meetings.

Each director's attendance at meetings during the year is set out in Table 5.

Table 5: Attendance at Board and Committee meetings, 2021–22

MEMBERS	BOARD		REMUNERATION PEOPLE AND PERFORMANCE COMMITTEE	
	MEETINGS ATTENDED	MEETINGS HELD AND ELIGIBLE TO ATTEND	MEETINGS ATTENDED	MEETINGS HELD AND ELIGIBLE TO ATTEND
Richard Dickmann	7	8	n/a	n/a
Nigel Hart	2	2	n/a	n/a
Roseanne Healy	8	8	6	6
Richard Heath	7	8	6	6
Bob Nixon	8	8	n/a	n/a
Andrew Spencer	8	8	n/a	n/a
Sharon Starick	8	8	n/a	n/a
Gemma Walker	8	8	n/a	n/a
Cathie Warburton	7	7	2	2
John Woods	8	8	5	6

Audit and Risk Committee

GRDC's Audit and Risk Committee reports to the Board. Membership of the Committee is comprised of four GRDC Directors that are appointed by the Board. The work of the Committee is articulated in an annual workplan, and the Charter for the Committee is published on GRDC's website: https://grdc.com.au/about/who-we-are/our-structure/our-board

Table 6: 2021–22 Audit and Risk Committee membership and meetings

MEMBERSHIP OF GRDC'S AUDIT AND RISK COMMITTEE IN 2021–22	MEMBER'S EXPERIENCE	NO. OF MEETINGS ELIGIBLE TO ATTEND	NO. OF MEETINGS ATTENDED	REMUNERATION FOR THE PERIOD 2021–22 (AS PER THE REMUNERATION TRIBUNAL DETERMINATION)
Ms Roseanne Healy Appointed: Chair from 6 December 2017 to 30 September 2020 and then from 9 December 2020.	• BA(Econ), MBA, MBR(Com) • Graduate of the Australian Institute of Company Directors • Over 20 years of corporate advisory experience and expertise in strategy, investment analysis, due diligence and corporate governance • Managing Director of Enterprise Corporation, Chair of Plexus Research Pty Ltd and Dairysafe. Non-executive director of Dairy Australia Ltd, Airborne Research Australia Ltd, Cashflow Manager Pty Ltd, Swarmer Pty Ltd, Food Manufacturing and Services Pty Ltd and Member, National Water Grid Advisory Body • Previously a director of the Rural Industries Research and Development Corporation, Great Artesian Oil & Gas Ltd, Maximus Resources, Marmota Energy Ltd, Tidewater Funds Management Ltd and HomeStart Finance	7	7	$16,320
Mr Bob Nixon Appointed: 9 December 2020	• Manages a grain farming business in Western Australia • Past Chair of the Grain Industry Association of WA (GIWA) from 2017 to 2020 • Currently sits on the WA Soil and Land Conservation Council and is an active member of the local Liebe Grower Group • Nuffield Scholarship in 2014	7	7	$8,160

MEMBERSHIP OF GRDC'S AUDIT AND RISK COMMITTEE IN 2021–22	MEMBER'S EXPERIENCE	NO. OF MEETINGS ELIGIBLE TO ATTEND	NO. OF MEETINGS ATTENDED	REMUNERATION FOR THE PERIOD 2021–22 (AS PER THE REMUNERATION TRIBUNAL DETERMINATION)
Mr Andrew Spencer Appointed: 9 December 2020	• BAgSc, GAICD • Graduate of Australian Institute of Company Directors • Senior leadership positions in diverse agriculture and agribusiness organisations, spanning more than 30 years in four countries • Former Chief Executive Officer of Australian Pork Limited (2005–2019) • Current Chair of the Australian Farm Institute, Sheep Producers Australia Ltd and PorkScan Pty Ltd	7	7	$8,160
Ms Sharon Starick Appointed: 9 December 2019 to 30 September 2020 and then from 9 December 2020	• Grain and pork producer in Mallee region of South Australia • Chair of Animal Health Australia • Director of the Regional Investment Corporation • Committee member, Murray Plains Farmers • Past Chair of the South Australian Murray–Darling Basin Natural Resources Management Board • Previously, a member of South Australia's Natural Resources Management Council, the Australian Landcare Council and the Community Advisory Committee for the Murray–Darling Basin Ministerial Council • Past Director of Land and Water Australia • Agrifutures Rural Women's Award for South Australia in 2003	7	7	$8,160

Accountability and governance

Legislation

GRDC was established in 1990 under the *Primary Industries Research and Development Act 1989 (Cth)* (PIRD Act).

As a corporate Commonwealth entity, GRDC is subject to the requirements of the *Public Governance, Performance and Accountability Act 2013* (Cth) (PGPA Act) and other Commonwealth legislation.

Accountability to the Australian Government

GRDC is part of the Australian Government's Agriculture portfolio.

During 2021–22 the Hon David Littleproud MP was Minister for Agriculture and Northern Australia from 2 July 2021 to 23 May 2022. Following a federal election on 21 May 2022, Senator the Hon. Murray Watt was sworn in as Minister for Agriculture, Fisheries and Forestry and Minister for Emergency Management on 1 June 2022.

Ministerial directions

GRDC fully complies with relevant directions made by Ministers under the PIRD Act, the PGPA Act or other Commonwealth legislation.

Under section 143 of the PIRD Act, the Minister for Agriculture may give written directions to GRDC as to the performance of its functions and the exercise of its powers. No such directions were given in 2021–22.

Under section 22 of the PGPA Act, the Minister for Finance may give written directions to the Corporation regarding complying with the general policies of the government. No directions were given in 2021–22.

Funding agreement

Section 33(4) of the PIRD Act allows the Minister to enter into a Funding Agreement with GRDC. A new Funding Agreement with the Commonwealth was negotiated and agreed in April 2020. The Funding Agreement is underpinned by Performance Principles to guide GRDC's performance against the requirements of the Funding Agreement.

Significant events

The Chair of the GRDC Board writes to the Minister after each Board meeting, outlining all key decisions. Significant events in 2021–22 reported to the Minister were:

- the appointment and commencement of GRDC's new Managing Director, Nigel Hart, in March 2022
- the appointment of Mr. Andrew Russell as the Chair of the Southern Regional Panel, the appointment of Mr. Arthur Gearon as the Chair of the Northern Regional Panel and the re-appointment of Mr. Darrin Lee as the Chair of the Western Regional Panel
- the Board's June 2022 meeting being held in Perth after two years of being unable to visit Western Australia. This coincided with visits to numerous stakeholders and the announcement of $12m funding support for the Australian Export Grains Innovation Centre and $30m investment by GRDC in the Curtin University-based Centre for Crop Disease Management.

Government RD&E priorities

GRDC's RD&E investment strategies, as articulated in each five-year RD&E plan, are designed to address the Australian Government's Science and Research Priorities in the National Agricultural Innovation Policy Statement. GRDC's RD&E investments to meet the priorities are detailed in Appendix C.

Accountability to the grains industry

GRDC is accountable to the Australian grains industry through the industry's representative organisations, as described in the PIRD Act, and consults widely with other industry organisations and grower groups.

Representative organisations

Grain Growers Limited and Grain Producers Australia Limited are the declared representative organisations under section 7 of the Act.

GRDC meets with the industry representative organisations at least once every six months and provides a formal opportunity for them to review GRDC's performance annually.

GRDC paid Nil to Grain Growers Limited and $2,791.66 (GST incl.) to Grain Producers Australia Limited for industry consultation costs during 2021–22, in accordance with section 15 of the PIRD Act.

Business relationships

Many of GRDC's business relationships are governed by research agreements, licence agreements to commercialise resulting intellectual property, and agreements which procure services.

In some cases, the formation of companies and joint venture partnerships (for profit or not for profit) is the most effective way to deliver technologies, services, information and policy advice to Australian grain growers and the wider grains industry.

Table 7 describes the companies in which GRDC had shares or membership at 30 June 2022. In most cases GRDC also nominated one or more directors to the company's board.

Table 7: Companies in which GRDC had shares or membership at 30 June 2022

NAME	ACTIVITY	GRDC ROLE
Companies limited by guarantee		
Agricultural Innovation Australia Limited ACN 644 777 293	Facilitates joint investment and collaboration in cross-industry agricultural issues of national importance.	Is a member of the company. Does not nominate a director.
Australian Export Grains Innovation Centre Limited ACN 160 912 032	Provides research and development related to the Australian export grains industry.	Is a member of the company. Nominates a director.
Grains Australia Limited ACN 637 983 487	An industry-good company with functions to enhance the competitiveness and profitability of the Australian grains industry across the value chain in domestic and international markets.	Is the sole member of the company. Does not nominate a director.
Companies limited by shares		
Australian Grain Technologies Pty Ltd ACN 100 269 930	Undertakes commercial wheat and barley breeding.	Is a 39.11% shareholder. Nominates three directors.
InterGrain Pty Ltd ACN 128 106 945	Undertakes commercial wheat and barley breeding.	Is a 42.06% shareholder. Nominates one director.

Industry levies

In 2021–22, a levy rate of 0.99% applied to all leviable crops covered by GRDC, except for maize, which was levied at 0.693%.

The levies were imposed and collected as stipulated by the:

- *Primary Industries (Excise) Levies Act 1999 (Cth)*, supported by the Primary Industries (Excise) Levies Regulations 1999 (Cth), Schedules 4, 12, 20 and 25
- *Primary Industries Levies and Charges Collection Act 1991 (Cth)*, supported by the Primary Industries Levies and Charges Collection Regulations 1991 (Cth), Schedules 8, 19, 29 and 34.

GRDC paid the Department of Agriculture, Fisheries and Forestry $730,485.11 for the collection and management of levies in 2021–22.

Corporate governance

The GRDC Board has overall responsibility for corporate governance within the organisation and places high value on continuously improving GRDC's performance in this area.

Key corporate governance activities overseen by the GRDC Board in 2021–22 included:

- regular strategic risk reporting
- reporting on compliance with statutory obligations
- approval of statutory documents including the 2020–21 Annual Report and the 2022–23 Annual Operational Plan

and the following new or revised policies:

- Complaints Handling Policy
- Procurement Policy
- IP Management and Commercialisation Policies and Procedures
- WHS Strategy and Reporting Framework
- Risk Management Policy and Framework.

Risk management and fraud control

GRDC continually reviews and refines its risk management framework to reflect changes in the business environment and GRDC's structure.

The Board considers a strategic risk report each time it meets and reviews the operational risks every six months, or more often if significant changes arise in the operating environment.

GRDC commissions external assessments of its fraud risk every two years. A fraud and corruption risk assessment was completed and the Fraud Control Plan updated in June 2022. There were no incidences of fraud in GRDC in 2021–22.

The Board's Audit and Risk Committee oversees the preparation and implementation of GRDC's risk management initiatives and fraud control policy and plan.

Independent audits

The Auditor-General is required to audit each Commonwealth entity's financial statements. In addition, the *Auditor-General Act 1997* (Cth) confirms the power of the Auditor-General's office to carry out performance audits of Commonwealth entities and, in this role, to obtain documents and information.

The Auditor-General's independent audit report on GRDC's financial statements for 2021–22 is presented on pages 90–121.

Code of conduct

GRDC Code of Conduct sets out the principles and expected standards of behaviour for directors, staff and panel members. New directors and staff members are introduced to the code during induction, and presentations on the code are made to staff at regular intervals.

Indemnities and insurance premiums for officers

GRDC holds directors' and officers' liability insurance cover through Comcover. During the year, no indemnity-related claims were made. The cost of directors' and officers' indemnity insurance for 2021–22 was $13,375.37 (GST excl.)

Judicial decisions and reviews by outside bodies

In 2021–22, GRDC was not affected by judicial decisions or reviews by administrative tribunals, parliamentary committees, the Commonwealth Ombudsman or the Office of the Australian Information Commissioner.

Work health and safety

GRDC's work health and safety mission is to create a workplace environment where the health, safety and wellbeing of employees are highly valued and people are encouraged and supported to adopt and maintain a healthy lifestyle.

Table 8 summarises GRDC's results in relation to reportable indicators of work health and safety performance in 2021–22.

Table 8: Work health and safety performance

INDICATORS	PERFORMANCE
Initiatives undertaken during the year to ensure the health, safety and welfare of workers who carry out work for GRDC	• Implementation and integration of the GRDC COVID-19 Safety Plan • A Business Continuity Plan Working Group was established in March 2020 and remains in place for continuous monitoring of COVID-19 and the changing requirements in each of our office locations • Influenza vaccination program offered to all staff • In-vehicle driver training offered to staff and panel members who drive GRDC vehicles • Implementation of a Safe Spaces Initiative which calls for all staff to pause for 20 minutes on the last Friday of every month and focus on creating a safe and healthy working environment • Resilience training • Mental Health First Aid training • Counselling and employee support through the Employee Assistance Program • A WHS audit of all GRDC premises was completed • To facilitate safe remote working, an online tutorial 'Workstation Setup Assessment' was provided to all staff. All staff who engage in ongoing work from home arrangements are required to complete a home-based work health and safety evaluation which is signed by their General Manager
Health and safety outcomes (including the impact on injury rates of workers) achieved as a result of initiatives	Nil notifiable incidents and four hours lost to injury.
Statistics of any notifiable incidents of which GRDC became aware that arose out of the conduct of businesses or undertakings by GRDC	Nil notifiable incidents.
Details of any investigations conducted during the year that relate to the businesses or undertakings of GRDC, including details of all notices given to GRDC under Part 10 of the *Work Health and Safety Act 2011 (Cth)*	No investigations conducted.
Other matters as required by the guidelines approved on behalf of the Parliament by the Joint Committee of Public Accounts and Audit	Nil

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Financial statements

Financial Performance Summary

Revenue

In recent times GRDC's revenue has been extremely variable. The 2021–22 financial year was no exception as levy revenues were up 42% on the previous year, and 133% on 2019–20. GRDC's total revenue in 2021–22, including government contributions and other income was $343.4m. This was 70% higher than the budget published in the 2021–22 Portfolio Budget Statement of $203.6m. This significant increase signifies the outstanding grain growing and market conditions and is a record-breaking total revenue value for a second year in a row.

These outstanding industry conditions have generated a $95.7m government contribution, being an increase of 39% on last year. The government contribution is calculated from the 3–year rolling average of industry Gross Value of Production.

Other own-source revenues are largely in line with budget. Higher dividends and earnings from contracts with customers are offset by lower interest and project refunds, reflecting the challenging fixed income and cash markets.

Expenditure

Total expenditure in 2021–22 was $2.7m below budget and $8.8m higher than the previous year. This is due to an increase to RD&E expenditure of $8m, not including a further $2m of payments to Grains Australia Limited which is removed on consolidation. Operational expenditure is consistent with last year and $2.98m lower than budget primarily because of reduced accommodation and travel costs due to the COVID-19 pandemic.

GRDC's 2021–22 overhead rate post allocation to RD&E activities is at 8.7% of total expenditure. This is 0.4% lower than the 2020–21 rate of 9.1% and is mainly due to the increase in RD&E expenditure.

Changes in equity

GRDC returned an operating surplus of $131m in 2021–22.

GRDC continues to invest in GrainInnovate and hold shares in the unlisted companies, Australian Grain Technologies (AGT) and Intergrain. GRDC's exposure to fixed interest funds in the recent extremely adverse fixed interest market resulted in a net loss of 5.8% of funds invested. Although, in combination with other balance sheet investments and due to relatively strong industry performance by AGT and Intergrain the net comprehensive income gain has been $14.4m.

In combination, (i.e. increased operating surplus plus other comprehensive gains) GRDC's total comprehensive income for 2021–22 was $145.4m. Consequently, equity has increased by $145.4m to a closing balance of $422.3m.

Statement of financial position

The increase in equity is reflected in the statement of financial position primarily through the $147.5m increase to financial assets, comprising mainly cash, and a slight increase in payables of $3.4m. Other categories within the statement of financial position are relatively unchanged on last year.

GRDC continues to actively manage reserves so that the impact of RD&E investments is optimised, and expenditure is smoothed over the medium term.

Established in August 2020, Grains Australia (GAL) is an industry company limited by membership that is to undertake certain industry-good functions. At year end GAL was the sole member of Wheat Quality Australia (WQA) and therefore GAL was required to consolidated WQA into its financial statements. As GRDC remains the sole member of GAL, GRDC's 2021–22 financial statements are consolidated to again include GAL (and consequently WQA).

Independent Auditor's Report

Australian National
Audit Office

INDEPENDENT AUDITOR'S REPORT

To the Minister for Agriculture, Fisheries and Forestry

Opinion

In my opinion, the financial statements of the Grains Research and Development Corporation and its subsidiaries (together the Consolidated Entity) for the year ended 30 June 2022:

(a) comply with Australian Accounting Standards – Simplified Disclosures and the *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015*; and

(b) present fairly the financial position of the Consolidated Entity as at 30 June 2022 and its financial performance and cash flows for the year then ended.

The financial statements of the Consolidated Entity, which I have audited, comprise the following as at 30 June 2022 and for the year then ended:

- Statement by the Directors, Managing Director and Chief Financial Officer;
- Consolidated Statement of Comprehensive Income;
- Consolidated Statement of Financial Position;
- Consolidated Statement of Changes in Equity;
- Consolidated Cash Flow Statement; and
- Notes to and forming part of the financial statements comprising a summary of significant accounting policies and other explanatory information.

Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of the Consolidated Entity in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) to the extent that they are not in conflict with the *Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Accountable Authority's responsibility for the financial statements

As the Accountable Authority of the Consolidated Entity, the Directors are responsible under the *Public Governance, Performance and Accountability Act 2013* (the Act) for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Simplified Disclosures and the rules made under the Act. The Directors are also responsible for such internal control as the Directors determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Directors are responsible for assessing the ability of the Consolidated Entity to continue as a going concern, taking into account whether the entity's operations will cease as a result of an administrative restructure or for any other reason. The Directors are also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the assessment indicates that it is not appropriate.

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38 Sydney Avenue, Forrest ACT 2603
Phone (02) 6203 7300

Auditor's responsibilities for the audit of the financial statements

My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Consolidated Entity's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Accountable Authority;
- conclude on the appropriateness of the Accountable Authority's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Consolidated Entity's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Consolidated Entity to cease to continue as a going concern;
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation; and
- obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Consolidated Entity to express an opinion on the financial report. I am responsible for the direction, supervision and performance of the Consolidated Entity audit. I remain solely responsible for my audit opinion.

I communicate with the Accountable Authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office

Fiona Sheppard
Acting Executive Director

Delegate of the Auditor-General

Canberra
16 September 2022

Statement by the Directors, Managing Director and Chief Financial Officer

In our opinion, the attached financial statements for the year ended 30 June 2022 comply with subsection 42(2) of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act), and are based on properly maintained financial records as per subsection 41(2) of the PGPA Act.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Corporation will be able to pay its debts as and when they fall due.

The statement is made in accordance with a resolution of the directors.

Signed_____	Signed_____	Signed_____
Mr J D Woods Chairman	Mr N Hart Managing Director	Mr M W Priest Chief Financial Officer
15 September 2022	15 September 2022	15 September 2022

Consolidated Statement of Comprehensive Income

For the period ended 30 June 2022

	NOTES	2022 $'000	2021 $'000	ORIGINAL BUDGET 2022 $'000
NET COST OF SERVICES				
Expenses				
Employee benefits	1.1A	**14,737**	14,434	14,858
Research and development	1.1B	**177,158**	168,879	193,076
Suppliers	1.1C	**14,133**	12,128	-
Depreciation and amortisation	2.2A	**6,245**	6,161	6,655
Finance costs	1.1D	**139**	158	540
Losses from asset sales	1.1E	**-**	4	-
Other expenses	1.1F	**30**	1,844	-
Total expenses		**212,442**	**203,608**	**215,129**
Own-source Income				
Own-source revenue				
Revenue from contracts with customers	1.2A	**12,167**	8,866	14,854
Industry contributions	1.2B	**223,146**	157,279	119,207
Interest	1.2C	**1,218**	2,049	1,932
Project refunds	1.2D	**4,785**	6,100	-
Dividends	1.2E	**2,308**	617	1,500
Rental income	1.2F	**63**	171	182
Other revenue	1.2G	**948**	111	-
Total own-source revenue		**244,635**	**175,193**	**137,675**
Gains				
Gains from sale of assets	1.2H	**59**	-	-
Gains from business combinations	1.2H	**1,294**	-	-
Total gains		**1,353**	**-**	**-**
Total own-source income		**245,988**	**175,193**	**137,675**
Net cost of services		**33,546**	**(28,415)**	**(77,454)**
Revenue from Government	1.2I	**95,666**	68,829	64,950
Share of associates and joint ventures accounted for using the equity method		**1,775**	(472)	-
Surplus / (Deficit)		**130,987**	**39,942**	**(12,504)**
OTHER COMPREHENSIVE INCOME				
Items not subject to subsequent reclassification to net cost of services				
Changes in asset revaluation reserve			-	-
Items subject to subsequent reclassification to net cost of services				
Gains on financial assets at fair value through other comprehensive income	1.3A	**14,413**	19,456	-
Total comprehensive income / (loss)		**145,400**	**59,398**	**(12,504)**

The above statement should be read in conjunction with the accompanying notes.

Consolidated Statement of Financial Position

As at 30 June 2022

	NOTES	2022 $'000	2021 $'000	ORIGINAL BUDGET 2022 $'000
ASSETS				
Financial assets				
Cash and cash equivalents	2.1A	**184,857**	68,822	50,811
Trade and other receivables	2.1B	**22,132**	12,385	25,317
Equity accounted investments	2.1C	**12,134**	5,859	-
Investments in managed funds	2.1D	**115,041**	121,725	89,847
Other investments	2.1E	**109,670**	87,503	78,747
Total financial assets		**443,834**	**296,294**	**244,722**
Non-financial assets[1]				
Buildings	2.2A	**12,337**	14,476	12,092
Property, plant and equipment	2.2A	**904**	1,528	1,425
Intangibles	2.2A	**14,301**	12,055	12,766
Other non-financial assets	2.2B	**180**	304	407
Total non-financial assets		**27,722**	**28,363**	**26,690**
Total assets		**471,556**	**324,657**	**271,412**
LIABILITIES				
Payables				
Suppliers	2.4A	**2,335**	2,015	38,100
Research and development	2.4B	**28,646**	26,250	-
Other payables	2.4C	**2,738**	2,128	1,500
Total payables		**33,719**	**30,393**	**39,600**
Interest bearing liabilities				
Leases	2.5	**12,386**	14,034	12,676
Total interest-bearing liabilities		**12,386**	**14,034**	**12,676**
Provisions				
Employee provisions	3.1	**2,600**	2,779	3,634
Other provisions	2.6	**542**	542	542
Total provisions		**3,142**	**3,321**	**4,176**
Total liabilities		**49,247**	**47,748**	**56,452**
Net assets		**422,309**	276,909	214,960
EQUITY				
Retained surplus		**311,917**	178,617	109,254
Contracted research reserve		**110,000**	97,900	105,706
Asset revaluation reserve		**392**	392	-
Total equity		**422,309**	**276,909**	**214,960**

1 Right-of-use assets are included in the following line items: buildings, property, plant and equipment.
The above statement should be read in conjunction with the accompanying notes.

Consolidated Statement of Changes in Equity

For the period ended 30 June 2022

	NOTES	2022 $'000	2021 $'000	ORIGINAL BUDGET 2022 $'000
RETAINED EARNINGS				
Opening balance				
Balance carried forward from previous period		**178,617**	115,369	117,358
Adjusted opening balance		**178,617**	115,369	117,358
Comprehensive income				
Surplus / (Deficit) for the period		**130,987**	39,942	(12,504)
Other comprehensive surpluses		**14,413**	19,456	-
Total comprehensive income / (loss)		**145,400**	59,398	(12,504)
Transfers between equity components		**(12,100)**	3,850	4,400
Closing balance as at 30 June		**311,917**	178,617	109,254
ASSET REVALUATION RESERVE				
Opening balance				
Balance carried forward from previous period		**392**	392	12,206
Adjusted opening balance		**392**	392	12,206
Comprehensive income				
Other comprehensive income / (loss)		**-**	-	-
Total comprehensive income / (loss)		**-**	-	-
Transfers between equity components		**-**	-	-
Closing balance as at 30 June		**392**	392	12,206
CONTRACTED RESEARCH RESERVE				
Opening balance				
Balance carried forward from previous period		**97,900**	101,750	97,900
Adjusted opening balance		**97,900**	101,750	97,900
Transfers between equity components		**12,100**	(3,850)	(4,400)
Closing balance as at 30 June		**110,000**	97,900	93,500
TOTAL EQUITY				
Opening balance				
Balance carried forward from previous period		**276,909**	217,511	227,464
Adjusted opening balance		**276,909**	217,511	227,464
Comprehensive income				
Surplus / (Deficit) for the period		**130,987**	39,942	(12,504)
Other comprehensive surpluses		**14,413**	19,456	-
Total comprehensive income / (loss)		**145,400**	59,398	(12,504)
Closing balance as at 30 June		**422,309**	276,909	214,960

The above statement should be read in conjunction with the accompanying notes.

Consolidated Cash Flow Statement

For the period ended 30 June 2022

	NOTES	2022 $'000	2021 $'000	ORIGINAL BUDGET 2022 $'000
OPERATING ACTIVITIES				
Cash received				
Industry contributions		**205,459**	157,161	119,207
Receipts from Government		**92,389**	64,778	60,020
Interest		**1,083**	1,749	1,786
Grants receipts		**2,358**	5,184	-
Dividends		**2,308**	617	1,500
Net GST received		**9,173**	16,562	18,798
Other		**34,528**	12,845	17,720
Total cash received		**347,298**	258,896	219,031
Cash used				
Research and development		**187,995**	196,503	212,273
Suppliers		**16,344**	14,255	
Employees		**15,173**	14,252	14,728
Interest payments on lease liabilities		**140**	159	140
Total cash used		**219,652**	225,169	227,141
Net cash from / (used by) operating activities		**127,646**	33,727	(8,110)
INVESTING ACTIVITIES				
Cash received				
Proceeds from sales of property, plant and equipment		**59**	-	-
Proceeds from loan repayments		**-**	1,512	-
Investments		**1,000**	30,000	33,506
Total cash received		**1,059**	31,512	33,506
Cash used				
Purchase of property, plant and equipment		**5,414**	4,394	4,000
Purchase of financial instruments		**1,070**	1,748	-
Purchase of investments		**4,500**	2,001	16,691
Total cash used		**10,984**	8,143	20,691
Net cash from investing activities		**(9,925)**	23,369	12,815
FINANCING ACTIVITIES				
Cash used				
Principal payments of lease liabilities		**1,970**	1,910	2,132
Total cash used		**1,970**	1,910	2,132
Net cash (used by) financing activities		**(1,970)**	(1,910)	(2,132)
Net increases in cash held		**115,751**	55,186	2,573
Cash and cash equivalents at the beginning of the reporting period		**68,822**	13,636	48,238
Adjustment cash and cash equivalents at the beginning of the reporting period		**284**	-	-
Cash and cash equivalents at the end of the reporting period	2.1A	**184,857**	68,822	50,811

The above statement should be read in conjunction with the accompanying notes.

Notes to and forming part of the financial statements

For the year ended 30 June 2022

Overview

Objectives of the Grains Research and Development Corporation

The Grains Research and Development Corporation is an Australian Government controlled entity. It is a not-for-profit entity. The Grains Research and Development Corporation's (GRDC) purpose is to invest in research, development and extension (RD&E) to create enduring profitability for Australian grain growers.

The Basis of Preparation

The financial statements are required by section 42 of the *Public Governance, Performance and Accountability Act 2013*.

The financial statements have been prepared in accordance with:

(a) *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015* (FRR); and

(b) Australian Accounting Standards and Interpretations – including simplified disclosures for Tier 2 Entities under AASB 1060 issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The consolidated financial statements have been prepared on an accrual basis and in accordance with historical cost convention, except for certain assets and liabilities that are at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position. The financial statements are presented in Australian dollars and values are rounded to the nearest thousand dollars unless otherwise specified.

Principles of Consolidation

AASB 10 requires a parent entity that is in a group to present consolidated financial statements that consolidate its investments in its controlled entities. The parent and the controlled entities apply consistent accounting policies, have the same reporting period and the effects of all transactions and balances between the entities are eliminated in full. The consolidated financial statements incorporate the assets and liabilities of all entities controlled by the Corporation as at 30 June and the results of the controlled entities for the year then ended. Details of Grains Australia Limited and Wheat Quality Australia Limited are included in note 5.4.

Going Concern

The directors have, at the time of approving the financial statements, a reasonable expectation that the Group has adequate resources to continue in operational existence for the foreseeable future. Thus, they continue to adopt the going concern basis of accounting in preparing the financial statements.

Impact of COVID 19

The GRDC has reviewed the impact of COVID 19 on its financial statements for FY 2022 (and FY 2021) and although there have been reductions to travel and accommodation costs associated with travel restrictions in place during FY 2022 (and FY 2021) and staff absences due to illness, there has been no material impact on the FY 2022 financial statements. The valuations of shareholdings in AGT and InterGrain in FY 2022 have also been reviewed by management and there has been no material impact to the valuations due to COVID 19, the war between Russia and the Ukraine, or increases in inflation.

New Accounting Standards

Adoption of New Australian Accounting Standard Requirements

All new standards that were issued prior to the sign-off date and are applicable to the current reporting period did not have a material effect on the entity's financial statements.

Standard/ Interpretation	Nature of change in accounting policy, transitional provisions, and adjustment to financial statements
AASB 1060 *General Purpose Financial Statements* – Simplified Disclosures for For-Profit and Not-for-Profit Tier 2 Entities	AASB 1060 applies to annual reporting periods beginning on or after 1 July 2021 and replaces the reduced disclosure requirements (RDR) framework. The application of AASB 1060 involves some reduction in disclosure compared to the RDR with no impact on the reported financial position, financial performance, and cash flows of the entity.

Taxation

The Corporation is exempt from all forms of taxation except Fringe Benefits Tax (FBT) and the Goods and Services Tax (GST).

Events After the Reporting Period

There was no subsequent event that had the potential to significantly affect the on-going structure and financial activities of the Corporation.

Comparatives

No adjustments have been made to comparatives to ensure consistency with 2021–22 disclosures.

Significant Accounting Estimates

Under AASB 9 *Financial Instruments*, shares in unlisted companies are required to be measured at fair value on initial application and then subsequently measured at fair value at the end of each reporting period. In FY 2021 the GRDC engaged Ernst and Young (EY) to complete the revaluations of their shares in AGT and InterGrain. In FY 2022 the GRDC again engaged EY to complete the revaluations of their shares in AGT and InterGrain. Like FY 2021 the valuation for FY 2022 was completed as a full and complete valuation.

The Discounted Cash Flow approach (DCF) was the primary valuation methodology applied to derive the concluded enterprise value range, based on Management's forecast cash flows and a weighted average cost of capital ('WACC') reflecting the cash flow risks. The GRDC have reviewed and accepted the valuations and have taken up the valuation adjustments from the lower end of the valuation range. This is consistent with the approach taken in FY 2021. Further details and fair value adjustments of the specific valuations can be seen at Note 2.1E.

Budget Variance Commentary

The following tables provide a comparison of the original budget as presented in the 2021–22 Portfolio Budget Statements (PBS) to the 2021–22 outcome as presented in accordance with Australian Accounting Standards for the Corporation. The Budget is not audited. Explanations of major variance are provided below.

Variances are considered to be 'major' based on the following criteria:

- The variance between budget and actual is greater than +/- 10% of the original budget and $10 million for a line item; or
- The variance between budget and actual is greater than 2% of the relevant sub-total (i.e. total expenses, total income, total assets or total liabilities) and $10 million for a line item, or
- An item below this threshold but is considered important for the reader's understanding or is relevant to an assessment of the discharge of accountability and to an analysis of performance of the Corporation.

MAJOR VARIANCE AND EXPLANATIONS	AFFECTED LINE ITEMS
Statement of Comprehensive Income	
Total own source revenue was up on budget by 77% ($106m) due to higher Industry contributions. Industry contributions were higher than budget because gross volume of production, demand and prices were all very high throughout the year.	Industry contributions Total own source revenue
Surplus / (Deficit) has a variance to budget of $142m, made up of $104m higher than budget Industry contributions, and $31m of higher than budgeted revenue from government, which was also positively impacted by the higher gross volume of production achieved in FY 2022.	Research and development Industry contributions Revenue from Government Surplus / (Deficit)
Statement of Financial Position	
Total financial assets and total assets are higher than budget because of the exceptional industry value generated overall. Near perfect weather conditions resulting in higher volumes of grain produced and therefore higher levies received have had a positive impact on cash and cash equivalents, and trade and other receivables, investment in managed funds, and the valuations in other investments.	Cash and cash equivalents Trade and other receivables Investments in managed funds Other investments Total financial assets Total assets
Total liabilities are lower than budgeted following continued efforts to reduce research and development payables, resulting in a reduction in research and development expenses accrued at 30 June 2022.	Research and development payables Total liabilities
Total equity and net assets were positively impacted by the exceptionally good year the industry had in FY 2022.	Net assets Total equity
Cash Flow Statement	
Total cash received was positively impacted by higher industry contributions and receipts from government in this financial year. Both line items were higher than budgeted due to the exceptional results achieved by the industry throughout the financial year.	Industry contributions Receipts from government Total cash received
Record levels of levies and Commonwealth contributions received have resulted in net cash from operating expenses finishing above budget for the year.	Net cash from operating activities
Net cash from investing activities was lower than budget as less cash was redeemed from managed funds during the year. A higher portion of cash was held at bank to mitigate against managed fund performance, and for operational cash flow purposes.	Investments Total cash received
The overall result of such a positive year produced net increases to cash held of $134m higher than budget. This significant difference is largely the result of higher industry contributions and revenue from government, and because of less cash used for operational expenditure	Industry contributions Revenue from government Cash and cash equivalents at the end of the reporting period

Financial Performance

1.1: Expenses

	2022 $'000	2021 $'000
1.1A – Employee Benefits		
Wages and salaries	**13,273**	12,433
Superannuation		
Defined contribution plans	**1,379**	1,375
Defined benefit plans	**91**	129
Leave and other entitlements	**(155)**	168
Separation and redundancies	**149**	329
Total employee benefits	**14,737**	14,434

Accounting Policy

Accounting policies for employee related expenses are contained in People and relationships section (Note 3.1).

	2022 $'000	2021 $'000
1.1B – Research and Development		
Research and development not for profit	**172,449**	162,309
Research and development for profit	**3,649**	5,874
Research and development consultants	**1,060**	696
Total research and development	**177,158**	168,879
1.1C – Suppliers		
Goods and services supplied or rendered		
Staff travel and accommodation	**2,390**	589
Consultants	**214**	827
Contractors	**5,322**	4,914
Corporate communications	**344**	446
Corporate governance	**217**	133
Corporate services	**4,082**	3,481
Levy collection costs	**730**	841
Other[1]	**835**	846
Total goods and services supplied or rendered	**14,104**	12,077
Goods supplied	**105**	79
Services supplied	**13,999**	11,998
Total goods and services supplied or rendered	**14,104**	12,077
Other suppliers		
Workers compensation expenses	**24**	25
Short-term leases	**5**	26
Total other suppliers	**29**	51
Total suppliers	**14,133**	12,128

1 The Corporation had consolidated audit fees of $97,500 in FY 2022 (2021: $82,900).

The Corporation has short-term lease commitments of $5,000 at 30 June 2022 (2021: $26,000). The above lease disclosures should be read in conjunction with the accompanying notes 1.1D, 1.2F, 2.2A and 2.5.

Accounting Policy

Short-term leases and leases of low-value assets

The Corporation has elected not to recognise right-of-use assets and lease liabilities for short-term leases of assets that have a lease term of 12 months or less and leases of low-value assets (less than $10,000). GRDC recognises the lease payments associated with these leases as an expense on a straight-line basis over the lease term.

	2022 $'000	2021 $'000
1.1D – Finance Costs		
Interest on lease liabilities	**139**	158
Total finance costs	**139**	158

The above lease disclosures should be read in conjunction with the accompanying notes 1.1C, 1.2F, 2.2A and 2.5.

Accounting Policy

All borrowing costs are expensed as incurred.

	2022 $'000	2021 $'000
1.1E – Losses from Asset Sales		
Loss from asset sales from:		
Plant & equipment	**-**	4
Total loss on asset sales	**-**	4
1.1F – Other Expenses		
Change in fair value through profit or loss	**30**	1,844
Total other expenses	**30**	1,844

1.2: Own-source Revenue and Gains

Own-source Revenue

	2022 $'000	2021 $'000
1.2A – Revenue from contracts with customer		
Sale of goods	**2**	3
Rendering of services	**12,165**	8,863
Total revenue from contracts with customers	**12,167**	8,866

Disaggregation of revenue from contracts with customers

Revenue from contracts with customers has been broken down into three categories: Major product/service lines representing revenue from royalties, grants for research and development, and revenue received from advertising in Groundcover. Revenue has also been broken down by type of customer, illustrating those revenues are derived from multiple sources including Australian Government, State and Territory Governments and non-government entities. Revenue is split to show the amount of revenue received over time and point in time.

Major product/service line:		
IP licencing (royalties)	**6,656**	4,068
Research and development services (grant funded)	**3,217**	4,417
Groundcover advertising (print and online)	**260**	221
Other	**2,034**	160
	12,167	8,866

	2022 $'000	2021 $'000
1.2A – Revenue from contracts with customer		
Type of customer:		
Australian Government entities (related parties)	**2,983**	3,748
State and Territory Governments	**2,527**	2,575
Non-government entities	**6,657**	2,543
	12,167	8,866
Timing of transfer of goods and services:		
Over time	**3,217**	4,417
Point in time	**8,950**	4,449
	12,167	8,866

Accounting Policy

Revenue from the sale of goods is recognised when control has been transferred to the buyer. AASB 15 *Revenue from Contracts with Customers* applies to all contracts with customers, except for contracts that are within the scope of other standards, such as leases, insurance contracts and financial instruments. AASB 1058 *Income of Not-for-Profit* applies to transactions where the consideration to acquire an asset is significantly less than fair value and principally to enable GRDC to further its objectives, and the receipt of volunteer services, with some exceptions.

The following is a description of principal activities from which GRDC generates its revenue:

Royalties are in scope of AASB 15 and recognised at a point in time. Revenue from royalties is recognised when the GRDC is entitled and it can be reliably measured. There has been no change to how Royalties are currently recognised. Under AASB 15, the royalty arrangement would be considered a licence for intellectual property. Sales based on usage royalties promised in exchange for a licence to IP are recognised only when the later of the following occurs: subsequent sale or usage occurs; and performance obligations have been satisfied.

GRDC receives grants to complete specific research and development performance obligations. Each grant has been separately considered to determine whether it satisfies the AASB requirements to be accounted for as revenue from a contract with a customer, or whether AASB 1058 applies in full. Where the agreement creates an enforceable obligation for GRDC to transfer a specific good or service to a customer, AASB 15 applies. GRDC has determined that many of its grants are to deliver specific performance obligations, and therefore AASB 15 applies. In such cases, revenue is recognised as (or when) the performance obligation is satisfied. Where no sufficiently specific performance obligation can be identified, GRDC applies AASB 1058 and recognising income immediately on receipt.

Advertising income revenue for FY 2022 and FY 2021 is recognised, under AASB 15, when the advertising is published (point in time).

Publications revenue for FY 2022 and FY 2021 is recognised, under AASB 15, at a point in time when the publications are sold.

The transaction price is the total amount of consideration to which GRDC expects to be entitled in exchange for transferring promised goods or services to a customer. The consideration promised in a contract with a customer may include fixed amounts, variable amounts, or both. GRDC will adopt the practical expedient when adopting the AASB 15.

Receivables for goods and services, which have 30-day terms, are recognised at the nominal amounts due less any impairment allowance account. Collectability of debts is reviewed at end of the reporting period. Allowances are made when collectability of the debt is no longer probable.

	2022 $'000	2021 $'000
1.2B – Industry Contributions		
Coarse grains	**43,165**	33,575
Grain legumes	**19,353**	15,749
Oilseeds	**57,291**	29,267
Wheat	**103,337**	78,688
Total industry contributions	**223,146**	157,279

Accounting Policy

Revenue paid to the Corporation under Section 30 of the *Primary Industries Research and Development Act 1989,* where a research levy is attached to grain producers' output, is for the purpose of providing funds for research and development. Industry contributions (under AASB 1058) are recognised as control is gained.

	2022 $'000	2021 $'000
1.2C – Interest		
Deposits	**148**	1
Managed funds	**1,070**	1,748
Convertible notes	**-**	153
Loans	**-**	147
Total interest	**1,218**	2,049

Accounting Policy

Interest revenue is recognised using the effective interest method.

	2022 $'000	2021 $'000
1.2D – Project Refunds		
Project refunds	**4,785**	6,100
Total project refunds	**4,785**	6,100

Accounting Policy

Project refunds are recognised upon receipt of the refund when it relates to prior years expenditure and when the funds accrued are no longer required for the completion of the project.

	2022 $'000	2021 $'000
1.2E – Dividends		
Other	**2,308**	617
Total dividends	**2,308**	617

Accounting Policy

The full amounts of the interim and final dividends are recognised in the year to which they relate even though the payment may not be received until the following year.

	2022 $'000	2021 $'000
1.2F – Rental Income		
Operating lease – Other[1]	**63**	171
Total rental income	**63**	171

Operating Leases

1. Department of the Prime Minister and Cabinet vacated the space when their lease expired in November 2021. The space is listed with the Department of Finance property register with interest from several potential tenants being considered.

Within 1 year	**47**	57
Total undiscounted lease payments received	**47**	57

The above lease disclosures should be read in conjunction with the accompanying note 1.1C, 1.1D, 2.2A, and 2.5.

	2022 $'000	2021 $'000
1.2G – Other Revenue		
Levy penalties	**591**	111
National Variety Trials Revenue	**357**	-
Total other revenue	**948**	111
1.2H – Other Gains		
Gains from sale of assets	**59**	-
Gains from business combinations	**1,294**	-
Total other gains	**1,353**	-
1.2I – Revenue from Government		
Department of Agriculture, Water and Environment[1]		
PIRD Act 1989 contribution	**95,666**	68,829
Total Commonwealth Contributions	**95,666**	68,829

1 From 1 July 2022 the Department of Agriculture, Water and Environment will become the Department of Agriculture, Fisheries and Forestry (DAFF) because of the Federal Government Machinery of Government changes.

Accounting Policy

Revenue from Government

Revenue paid to the Corporation under Section 32 of the *Primary Industries Research and Development Act 1989,* representing no more than 0.5% of the gross value of production of grains, is for the purpose of funding research and development activities. Revenues from Government (under AASB 1058) are recognised as control is gained.

Funding received or receivable from non-corporate Commonwealth entities (appropriated to the non-corporate Commonwealth entity as a corporate Commonwealth entity payment item for payment to this entity) is recognised as Revenue from Government by the corporate Commonwealth entity unless the funding is an equity injection or a loan.

1.3: Gains/(Losses) through Other Comprehensive Income

	2022 $'000	2021 $'000
1.3A – Gains/(Losses) on financial assets at fair value through other comprehensive income		
Shares in unlisted companies	**22,167**	21,070
Investments in managed funds	**(7,754)**	(1,614)
Total other Gains/(losses)	**14,413**	19,456

This note is being added to provide clarity on what makes up the gain on financial assets at fair value through other comprehensive income.

Financial Position

2.1: Financial Assets

	2022 $'000	2021 $'000
2.1A – Cash and Cash Equivalents		
Cash at bank	**184,857**	68,822
Total cash and cash equivalents	**184,857**	68,822
2.1B – Trade and Other Receivables		
Goods and services receivables		
Goods and services	**4,222**	9,369
Accrued income	**12,398**	224
Total goods and services receivables	**16,620**	9,593
Other receivables		
Statutory receivables	**5,449**	2,767
Security deposits receivable	**63**	25
Total other receivables	**5,512**	2,792
Total trade and other receivables (net)	**22,132**	12,385

No impairment loss allowance was recognised for trade and other receivables in FY 2022.

Accounting Policy

Financial assets

Trade receivables, loans and other receivables that are held for the purpose of collecting the contractual cash flows where the cash flows are solely payments of principal and interest, that are not provided at below-market interest rates, are subsequently measured at amortised cost using the effective interest method adjusted for any loss allowance.

	2022 $'000	2021 $'000
2.1C – Equity accounted investments		
Grains Innovation Investment Trust[1]	**12,134**	5,859
Total investments accounted for using the equity method	**12,134**	5,859

Details of investments accounted for using the equity method

		Ownership
	2022	2021
Name of entity	**%**	%
Grains Research Development Corporation[1]	**100**	100

1 The investment in Grains Innovation Investment Trust is expected to be for more than twelve months.

2 The value of the Grains Innovation Investment Trust is based on the net asset value which is $12.1m (2021: $5.9m)

Accounting Policy

Jointly Controlled Entities

Interests in jointly controlled entities in which the entity is a venture (and so has joint control) are accounted for using the equity method. Under the equity method, investments in the associates are carried in GRDC's statement of financial position at cost as adjusted for post-acquisition changes in GRDC's share of net assets of the associates. Goodwill relating to an associate is included in the carrying amount of the investment. There was no goodwill to include in the carrying value this financial year. After the application of the equity method, GRDC determines whether it is necessary to recognise any impairment loss with respect to the net investment in associates. No impairment loss was recognised this financial year.

	2022 $'000	2021 $'000
2.1D – Investments in Managed Funds		
Managed Funds Investments		
At market value	**115,041**	121,725
Total managed funds investments	**115,041**	121,725

Individually managed funds

The funds are available at call. Interest rates will vary to reflect varying market interest rates.

Ministerial approval

The Corporation has received approval under paragraph 59(1)(b)(iii) of the *Public Governance, Performance and Accountability Act 2013* to hold the investments listed above.

Accounting Policy

Managed funds are valued at *Fair Value Through Other Comprehensive Income (FVOCI).* Full details of GRDC's accounting policies for investments in managed funds are contained in Note 5.1A.

	2022 $'000	2021 $'000
2.1E – Other Investments		
Shares in unlisted companies[1]		
Australian Grain Technologies Pty Ltd (AGT)[2]	**79,329**	65,692
InterGrain Pty Ltd[3]	**30,431**	21,811
Total shares in unlisted companies	**109,670**	87,503
Net other investments[4]	**109,670**	87,503

The shares held are ordinary shares.

All such investments are expected to be recovered in more than 12 months.

1 Under AASB 9 *Financial Instruments*, shares in unlisted companies are required to be measured at fair value on initial application and then subsequently measured at fair value at the end of each reporting period.

The Corporation has applied the irrevocable election to measure the equity instruments at fair value through other comprehensive income. On derecognition or reclassification, the cumulative gains or losses in other comprehensive income will not be recycled to profit or loss.

2 On 30 June 2021, AGT shares were valued at the fair value of $65.7m in accordance with AASB 9. On 30 June 2022, the shares were subsequently revalued at $79.3m with the gain in fair value of ($13.6m) being recognised in other comprehensive income.

3 On 30 June 2021, InterGrain shares were valued at the fair value of $21.8m in accordance with AASB 9. On 30 June 2022, the shares were subsequently revalued at $30.4m with the gain in fair value of ($8.6m) being recognised in other comprehensive income.

4 In accordance with AASB 9 Financial Instruments, Net Other Investments have increased from $87.5m in FY 2021 to $109.7m in FY 2022 a positive net change of ($22.2m) due to revaluation of the shares held in AGT and InterGrain.

On 11 December 2020 GRDC registered an industry goods company limited by guarantee (Grains Australia Limited) where GRDC is the only member. On 30 June 2022 GRDC remains the sole member of Grains Australia. The operating results of Grains Australia have been incorporated into these financial statements along with a high-level overview of Grain Australia results for FY 2022.

On 1 July 2021 GAL became the sole member of Wheat Quality Australia Limited (WQA), an industry-based company limited by guarantee. As GAL had 100% ownership of WQA for FY 2022, WQA is a subsidiary of GRDC as GRDC controls GAL and controls WQA. The operating results of WQA have been incorporated into these financial statements through consolidation with GAL.

Accounting Policy

Accounting policies for other investments are contained in Note 5.1A and further details can be found in Significant Accounting Estimates.

2.2: Non-Financial Assets

	BUILDINGS $'000	PROPERTY, PLANT & EQUIPMENT $'000	INTANGIBLES $'000	TOTAL $'000
2.2A – Reconciliation of the Opening and Closing Balances of Property, Plant and Equipment and Intangibles – 2022				
Total as at 30 June 2021 represented by:				
Gross book value	21,034	4,922	22,397	**48,353**
Accumulated depreciation, amortisation and impairment losses	(6,558)	(3,394)	(10,342)	**(20,294)**
Total as at 30 June 2021	**14,476**	**1,528**	**12,055**	**28,059**
Additions:				
Purchase	-	56	4,895	**4,951**
Right-of-use assets	240	96	-	**336**
Depreciation and amortisation expense	(441)	(568)	(3,104)	**(4,113)**
Depreciation on right-of-use assets	(1,938)	(194)	-	**(2,132)**
Other movements				
Work in progress	-	-	455	**455**
Disposals: Other	-	(14)	-	**(14)**
Total as at 30 June 2022	**12,337**	**904**	**14,301**	**27,542**
Total as at 30 June 2022 represented by:				
Gross book value	21,274	5,060	27,747	**54,081**
Accumulated depreciation, amortisation and impairment losses	(8,937)	(4,156)	(13,446)	**(26,539)**
Total as at 30 June 2022	**12,337**	**904**	**14,301**	**27,542**
Opening carrying amount of right-of-use assets	12,972	176	-	**13,148**
Closing carrying amount of right-of-use assets	13,200	311	-	**13,511**

Revaluations of non-financial assets and intangible assets

No revaluations were required or took place in FY 2022 or FY 2021.

Accounting Policy

Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes the fair value of assets transferred in exchange and liabilities undertaken. Non-financial assets are initially measured at their fair value plus transaction costs where appropriate.

Assets acquired at no cost, or for nominal consideration, are initially recognised as assets and income at their fair value at the date of acquisition, unless acquired as a consequence of restructuring of administrative arrangements. In the latter case, assets are initially recognised as contributions by owners at the amounts at which they were recognised in the transferor's accounts immediately prior to the restructuring.

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost in the statement of financial position, except for purchases costing less than $2,000, which are expensed in the year of acquisition (other than where they form part of a group of similar items which are significant in total).

The initial cost of an asset includes an estimate of the cost of dismantling and removing the item and restoring the site on which it is located. This is particularly relevant to 'make good' provisions in property leases taken up by the Corporation where there exists an obligation to restore the property to its original condition. These costs are included in the value of the Corporation's leasehold improvements with a corresponding provision for the 'make good' recognised.

Lease Right of Use (ROU) Assets

Leased ROU assets are capitalised at the commencement date of the lease and comprise of the initial lease liability amount, initial direct costs incurred when entering into the lease less any lease incentives received. These assets are accounted for by Commonwealth lessees as separate asset classes to corresponding assets owned outright but included in the same column as where the corresponding underlying assets would be presented if they were owned.

On initial adoption of AASB 16 the GRDC has adjusted the ROU assets at the date of initial application by the amount of any provision for onerous leases recognised immediately before the date of initial application. Following initial application, an impairment review is undertaken for any right of use lease asset that shows indicators of impairment and an impairment loss is recognised against any right of use lease asset that is impaired. No impairment was recognised for ROU assets in FY 2022.

Revaluations

Following initial recognition at cost, property, plant and equipment (excluding ROU assets) are carried at fair value (or an amount not materially different from fair value) less subsequent accumulated depreciation and accumulated impairment losses. Valuations are conducted with enough frequency to ensure that the carrying amounts of assets did not differ materially from the assets' fair values as at the reporting date. The regularity of independent valuations depended upon the volatility of movements in market values for the relevant assets.

Revaluation adjustments are made on a class basis. Any revaluation increment is credited to equity under the heading of asset revaluation reserve except to the extent that it reversed a previous revaluation decrement of the same asset class that was previously recognised in the surplus/deficit. Revaluation decrements for a class of assets are recognised directly in the surplus/deficit except to the extent that they reverse a previous revaluation increment for that class.

Any accumulated depreciation as at the revaluation date is eliminated against the gross carrying amount of the asset and the asset is restated to the revalued amount.

Depreciation

Depreciable property, plant and equipment assets are written down to their estimated residual values over their estimated useful lives to the Corporation using, in all cases, the straight-line method of depreciation.

Depreciation rates (useful lives), residual values and methods are reviewed at each reporting date and necessary adjustments are recognised in the current, or current and future reporting periods, as appropriate.

Depreciation rates applying to each class of depreciable asset are based on the following useful lives:

	2022	2021
Buildings	**25 years**	25 years
Other property, plant & equipment	**2 to 12 years**	2 to 12 years

The depreciation rates for ROU assets are based on the commencement date to the earlier of the end of the useful life of the ROU asset or the end of the lease term.

Impairment

All assets were assessed for impairment at 30 June 2022. Where indications of impairment exist, the asset's recoverable amount is estimated, and an impairment adjustment made if the asset's recoverable amount is less than it's carrying amount.

The recoverable amount of an asset is the higher of its fair value less costs to disposal and its value in use. Value in use is the present value of the future cash flows expected to be derived from the asset. Where the future economic benefit of an asset is not primarily dependent on the asset's ability to generate future cash flows, and the asset would be replaced if the Corporation were deprived of the asset, its value in use is taken to be its depreciated replacement cost.

There were no impairments to GRDCs assets in FY 2022.

Derecognition

An item of property, plant and equipment is derecognised upon disposal or when no further economic benefits are expected from its use or disposal.

Intangibles

The Corporation's intangibles comprise software and intellectual property. Software is carried at cost less accumulated amortisation and accumulated impairment losses. Software is amortised on a straight-line basis over its anticipated useful life as follows:

	2022	2021
Information management system	**6 years**	6 years
Other software	**2.5 to 6 years**	2.5 to 6 years

Intellectual property is carried at cost less accumulated depreciation and is depreciated on a straight-line basis over its anticipated useful life.

All intangible assets were assessed for indications of impairment as at 30 June 2022.

Development costs

Research and development costs are expensed when incurred. An intangible asset arising from development expenditure is only recognised when technical feasibility studies identify that the expenditure will deliver future economic benefits and these benefits can be measured reliably. Other development expenditure is recognised in the Statement of Comprehensive Income as an expense when incurred.

Following initial recognition of development expenditure, the cost model is applied requiring the asset to be carried at cost less any accumulated amortisation and accumulated impairment losses.

	2022 $'000	2021 $'000
2.2B – Other Non-Financial Assets		
Prepayments	**180**	304
Total other non-financial assets	**180**	304

All Other Non-Financial Assets are expected to be recovered in no more than 12 months.

No indicators of impairment were found for non-financial assets.

2.4: Payables

	2022 $'000	2021 $'000
2.4A – Suppliers		
Trade creditors – external parties	**1,266**	842
Accrued expenses – external parties	**1,069**	1,173
Total suppliers	**2,335**	2,015
Settlement is usually made within 30 days apart from those payables with specific settlement terms after 30 days.		
2.4B – Research and Development		
Research and development payables	**10,276**	4,709
Accrued research and development	**18,370**	21,541
Total research and development payables	**28,646**	26,250
2.4C – Other Payables		
Salaries & Wages	**477**	764
Unearned grant income – related parties	**2,261**	1,364
Total other payables	**2,738**	2,128

Accounting Policy

Accounting policies for payables are contained in Note 5.1A. Refer to Note 1.2A regarding the Corporation's accounting policy on grant income.

2.5 – Leases

	2022 $'000	2021 $'000
Lease liabilities – Motor Vehicles	**427**	564
Lease liabilities - Buildings	**11,959**	13,470
Total leases	**12,386**	14,034
Maturity analysis – contractual undiscounted cash flows		
Within 1 year	**2,088**	2,165
Between 1 to 5 years	**10,011**	7,815
More than 5 years	**153**	4,054
Total leases	**12,252**	14,034

Total cash outflow for leases for the year ended 30 June 2022 was $2.1m (2021: $2.1m).

Accounting Policy

Leases

For all new contracts entered into, the GRDC considers whether the contract is, or contains a lease. A lease is defined as 'a contract, or part of a contract, that conveys the right to use an asset (the underlying asset) for a period of time in exchange for consideration'.

Once it has been determined that a contract is, or contains a lease, the lease liability is initially measured at the present value of the lease payments unpaid at the commencement date, discounted using the interest rate implicit in the lease, if that rate is readily determinable, or the department's incremental borrowing rate.

Subsequent to initial measurement, the liability will be reduced for payments made and increased for interest. It is remeasured to reflect any reassessment or modification to the lease. When the lease liability is remeasured, the corresponding adjustment is reflected in the right-of-use asset or profit and loss depending on the nature of the reassessment or modification.

2.6: Other Provisions

	PROVISION FOR MAKE GOOD[1] $'000	TOTAL $'000
As at 1 July 2021	542	542
Total as at 30 June 2022	**542**	542

The Corporation currently has an agreement for the leasing of premises which has provisions requiring the Corporation to restore the premises to their original condition at the conclusion of the lease. The Corporation has made a provision to reflect the cost of this obligation. No change has been made to the value of this provision in FY 2022.

People and Relationships

3.1 – Employee Provisions

	2022 $'000	2021 $'000
Leave	**2,600**	2,779
Total employee provisions	**2,600**	2,779

Accounting Policy

Liabilities for short-term employee benefits and termination benefits expected within twelve months of the end of reporting period are measured at their nominal amounts. Other long-term employee benefits are measured as net total of the present value of the defined benefit obligation at the end of the reporting period minus the fair value at the end of the reporting period of plan assets (if any) out of which the obligations are to be settled directly.

Leave

The liability for employee benefits includes provision for annual leave and long service leave. The leave liabilities are calculated based on employees' remuneration at the estimated salary rates that applied at the time the leave is taken, including the Corporation's employer superannuation contribution rates, to the extent that the leave is likely to be taken during service rather than paid out on termination. The liability for long service leave has been determined by using the Australian Government shorthand method. The estimate of the present value of the liability considers attrition rates and pay increases through promotion and inflation.

Separation and Redundancy

Provision is made for separation and redundancy benefit payments. The Corporation recognises a provision for termination when it has developed a detailed formal plan for the terminations and has informed those employees affected that it will carry out the terminations.

Superannuation

The Corporation's staff are members of the Commonwealth Superannuation Scheme (CSS), the Public Sector Superannuation Scheme (PSS), the PSS Accumulation Plan (PSSap), or other Superannuation funds held outside of the Australian Government.

The CSS and PSS are defined benefit schemes for the Australian Government. The PSSap and other superannuation schemes are defined contribution schemes.

The liability for defined benefits is recognised in the financial statements of the Australian Government and is settled by the Australian Government in due course. This liability is reported in the Department of Finance's administered schedules and notes.

For CSS and PSS members, the Corporation makes contributions based on the rates determined by an actuary to be sufficient to meet the current costs to the Government. The Corporation accounts for the contributions as if they were contributions to defined contribution plans.

For AustralianSuper and other approved superannuation schemes, the Corporation contributes a minimum of 10% of superannuable salaries.

As at 30 June 2022, superannuation contributions payable was $Nil (2021: $Nil).

3.2: Key Management Personnel Remuneration

Key management personnel are those persons having authority and responsibility for planning, directing, and controlling the activities of GRDC, directly or indirectly, including any director (whether executive or otherwise) of that entity. The Corporation has determined the key management personnel to be the Directors, including the Managing Director. Key management personnel remuneration is reported in the table below:

	2022 $'000	2021 $'000
Short-term employee benefits	**782**	765
Post-employment benefits (superannuation)	**81**	105
Other long-term employee benefits	**-1**	2
Termination benefits	**-**	320
Total key management personnel remuneration expenses[1]	**862**	1,192

The total number of key management personnel that are included in the above table are 9 individuals (2021: 9 individuals). During 2021 there were various changes to GRDC Board with some members reaching the end of their term and new members appointed, as such the number of key management personnel increased to 9 during the year.

In 2022 there were no changes to GRDC Board, as such the number of key management personnel remained at 9 during the year.

Additionally, to the amounts disclosed in the table above, the Corporation had three fee-for-service contracted arrangements for the provision of Key Management Personnel services during the year. The Corporation incurred director fees in relation to the following Directors: Helen Garnett (Director in FY 2021) of $Nil (2021: $12,858), Sharon Starick $42,929 (2021: $51,432), Gemma Walker $35,414 (2021: $12,878), and Andrew Spencer $Nil (2021: $35,916). Total KMP remuneration $938,771 (2021: $1,305,084).

1 The above key management personnel remuneration excludes the remuneration and other benefits of all Cabinet Ministers and the Portfolio Minister. The Portfolio Minister's remuneration and other benefits are set by the Remuneration Tribunal and are not paid by the Corporation.

3.3: Related Party Disclosures

Related party relationships:

The Corporation is an Australian Government controlled entity. Related parties to this Corporation are Directors, Key Management Personnel including the Executive, and other Australian Government entities.

Transactions with related parties:

Given the breadth of Government activities, related parties may transact with the government sector in the same capacity as ordinary citizens. Such transactions include the payment or refund of taxes, receipt of a Medicare rebate or higher education loans. These transactions have not been separately disclosed in this note.

Several directors of the Corporation and their close family members hold directorships with other organisations. Any transactions between the Corporation and those organisations or any dealings between the Corporation and the Directors and their close family members individually are conducted using commercial and arms-length principles.

The Corporation received research services from Charles Sturt University for an amount of $Nil (2021: $790,903). At the time of payment, Chris Blanchard was both a Director of the Corporation (until 30 September 2020) and a Director of the Charles Sturt University, Functional Grain Centre. There is no balance outstanding at year end.

The Corporation received research services from Australian Farm Institute for an amount of $Nil (2021: $1,443). At the time of payment, Andrew Spencer was a Director of the Corporation and the Chair of the Australian Farm Institute, Richard Heath was also a Director of the Corporation and an Executive Director of the Australian Farm Institute. There is no balance outstanding at year end.

The Corporation received research services from Dairy Australia for an amount of $788.61 (2021: $31,940). At the time of payment, Roseanne Healy was a Director of the Corporation and a Director of Dairy Australia. Transactions have been conducted on normal commercial terms. There is no balance outstanding at year end.

The Corporation received research services from Rural Edge Australia for an amount of $15,125 (2021: $12,375). At the time of payment, Gemma Walker was a Director of the Corporation and a Director of Rural Edge Australia. There is no balance outstanding at year end.

All transactions have been conducted on normal commercial terms and no loans were made to the Directors or Director-related entities during the reporting period or in FY 2021/2022.

3.4: Supplementary Information for the Parent Entity[1]

	2022 $'000	2021 $'000
Statement of Comprehensive Income		
Total expenses	**212,725**	205,958
Total own-source revenue	**259,303**	196,263
Revenue from Government	**95,666**	68,829
Total comprehensive income/(loss)	**143,244**	59,134
Statement of Financial Position		
Total current assets	**441,609**	202,880
Total assets	**469,336**	324,302
Total current liabilities	**33,655**	32,320
Total liabilities	**49,183**	47,655
Net assets	**420,153**	276,647
Equity		
Reserves	**110,392**	98,293
Retained surplus	**309,761**	178,354
Total equity	**420,153**	276,647

1 The parent entity (Grains Research and Development Corporation (GRDC) is the sole member of the subsidiary (Grains Australia Limited (GAL)). The subsidiary is an industry based; public company limited by guarantee which was incorporated on 11 December 2019 which did not trade until FY 2021. The parent entity is required to pay $10 to the subsidiary if the subsidiary is wound up. Apart from this the parent entity does not guarantee the subsidiary's debts, there are no contingent liabilities, and there are no capital commitments for PPE. From 1 July 2021 GAL was also the sole member of Wheat Quality Australia Limited (WQA), an industry-based company limited by guarantee. As GAL had 100% ownership of WQA for FY 2022, WQA is a subsidiary of GRDC as GRDC controls GAL and controls WQA. GAL is required to pay $10 to WQA if it is wound up.

Significant accounting policies

The accounting policies of the parent entity are consistent with those of the consolidated entity, as disclosed in note 1, except for the following:

1. Depreciation of office equipment is depreciated within 0-3 years in the subsidiary whereas office equipment is depreciated 2-12 years.

Managing Uncertainties

4.1 Unquantifiable contingencies

At 30 June 2022 the Corporation has engaged legal representation in relation to an ongoing intellectual property matter. The Corporation was successful at trial and on appeal although the damages quantum is to be reconsidered at a new trial. It is not currently possible to determine the amount of cash inflows resulting from this matter. Cash outflows are highly unlikely to occur because costs are not awarded in the jurisdiction where the litigation is underway, and the Corporation is not defending an allegation that would result in damages being awarded against it. In any event, the Corporation maintains a professional indemnity insurance policy. The Corporation believes if unsuccessful in defence of any proceedings related to this issue, insurance will indemnify for damages or judgments $Nil (2021: $NIL).

Accounting Policy

Contingent liabilities and contingent assets are not recognised in the statement of financial position but are reported in the notes. They may arise from uncertainty as to the existence of a liability or asset or represent an asset or liability in respect of which the amount cannot be reliably measured. Contingent assets are disclosed when settlement is probable but not virtually certain and contingent liabilities are disclosed when settlement is greater than remote.

5.1: Financial Instruments

	2022 $'000	2021 $'000
5.1A – Categories of Financial Instruments		
Financial assets at amortised cost		
Cash and cash equivalents	**184,857**	68,822
Trade and other receivables	**3,832**	2,204
Total financial assets at amortised cost	**188,689**	71,026
Financial assets at fair value through other comprehensive income		
Investments in managed funds	**115,041**	121,725
Total financial assets at fair value through other comprehensive income	**115,041**	121,725
Financial assets at fair value through other comprehensive income (investments in equity instruments)		
Shares in unlisted companies[1]	**109,670**	87,503
Total financial assets at fair value through other comprehensive income (investments in equity instruments)	**109,670**	87,503
Total financial assets	**413,400**	280,254
Financial Liabilities		
Financial liabilities measured at amortised cost		
Payables	**30,975**	28,143
Total financial liabilities measured at amortised cost	**30,975**	28,143
Total financial liabilities	**30,975**	28,143

1 GRDC owns shares in two unlisted companies, 39.11% of AGT and 42.06% of InterGrain.

Accounting Policy

Financial assets

The Corporation, in line with AASB 9 *Financial Instruments,* classifies its financial assets in the following categories:

(a) financial assets at fair value through other comprehensive income; and

(b) financial assets measured at amortised cost.

The classification depends on both the Corporation's business model for managing the financial assets and contractual cash flow characteristics at the time of initial recognition. Financial assets are recognised when the Corporation becomes a party to the contract and, as a consequence, has a legal right to receive or a legal obligation to pay cash and derecognised when the contractual rights to the cash flows from the financial asset expire or are transferred upon trade date.

Financial Assets at Amortised Cost

Financial assets included in this category need to meet two criteria:

1. the financial asset is held in order to collect the contractual cash flows; and
2. the cash flows are solely payments of principal and interest (SPPI) on the principal outstanding amount.

Amortised cost is determined using the effective interest method.

Effective Interest Method

Income is recognised on an effective interest rate basis for financial assets that are recognised at amortised cost.

Financial Assets at Fair Value Through Other Comprehensive Income (FVOCI)

Financial assets measured at fair value through other comprehensive income are held with the objective of both collecting contractual cash flows and selling the financial assets and the cash flows meet the SPPI test.

Any gains or losses as a result of fair value measurement or the recognition of an impairment loss allowance is recognised in other comprehensive income.

Financial Assets at Fair Value Through Profit or Loss (FVTPL)

Financial assets are classified as financial assets at fair value through profit or loss where the financial assets either don't meet the criteria of financial assets held at amortised cost or at FVOCI (i.e., mandatorily held at FVTPL) or may be designated.

Financial assets at FVTPL are stated at fair value, with any resultant gain or loss recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest earned on the financial asset.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period based on Expected Credit Losses, using the general approach which measures the loss allowance based on an amount equal to *lifetime expected credit losses* where risk has significantly increased, or an amount equal to *12-month expected credit losses* if risk has not increased.

The simplified approach for trade, contract and lease receivables is used. This approach always measures the loss allowance as the amount equal to the lifetime expected credit losses.

A write-off constitutes a derecognition event where the write-off directly reduces the gross carrying amount of the financial asset.

Financial liabilities

Financial liabilities are classified as either financial liabilities 'at fair value through profit or loss' or other financial liabilities. Financial liabilities are recognised and derecognised upon 'trade date'.

Financial Liabilities at Amortised Cost

Financial liabilities, including borrowings, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

Supplier and other payables are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

	2022 $'000	2021 $'000
5.1B – Net Gains or Losses on Financial Assets		
Financial assets at amortised cost		
Interest revenue	**148**	148
Net gains on financial assets at amortised cost	**148**	148
Investments in equity instruments at fair value through other comprehensive income (designated)		
Gains / (Losses) recognised in equity	**22,167**	21,070
Net gains / (losses) on investments in equity instruments at fair value through other comprehensive income (designated)	**22,167**	21,070
Financial assets at fair value through other comprehensive income		
Interest Revenue	**1,070**	1,748
Change in fair value	**(7,754)**	(1,614)
Net gains on financial assets at fair value through other comprehensive income	**(6,684)**	134
Financial assets at fair value through profit or loss		
Interest Revenue	**-**	153
Change in fair value	**(30)**	(1,844)
Net (losses) / gains on financial assets at fair value through profit or loss	**-**	45
Net gains on financial assets	**15,601**	19,661

There was no net gains or losses on financial liabilities.

5.2: Fair Value Measurements

Accounting Policy

The Corporation measures its managed fund investments using Level 1 inputs, that is, using quoted prices in active markets for identical assets that the Corporation can access at measurement date.

The share in unlisted companies is valued at fair value each year, in line with AASB 9 *Financial Instruments*, using Level 2 and Level 3 inputs.

Valuations of non-financial assets are conducted with sufficient frequency to ensure that the carrying amounts of assets do not differ materially from the assets' fair values as at the reporting date. The regularity of independent valuations depends upon the volatility of movements in market values for the relevant assets. Non-financial assets are measured using a range of Level 2 and Level 3 inputs.

The Corporation measures its Leasehold improvements using Level 3 inputs at the reporting date, using the Depreciated replacement cost valuation methodology.

The Corporation measures its Other property, plant and equipment using Level 2 inputs, using adjusted market transactions as a basis.

	FAIR VALUE MEASUREMENTS AT THE END OF THE REPORTING PERIOD	
	2022 $'000	2021 $'000
5.2A – Fair Value Measurement		
Financial assets		
Investments in managed funds[1]	**115,041**	121,725
Shares in unlisted companies[2]	**109,670**	87,503
Total financial assets	**224,711**	209,228
Non-financial assets		
Leasehold improvements[1]	**1,063**	1,504
Other property, plant and equipment[1]	**826**	1,352
Total non-financial assets	**1,889**	2,856
Total fair value measurements of assets in the Statement of Financial Position	**226,600**	212,084

1 No change in valuation technique occurred during the period.

2 The valuation for FY 2022 and FY 2021 were complete valuations. The GRDC have reviewed and accepted the valuations and have taken up the valuation adjustments from the lower end of the valuation range, consistent with last year's approach. Further details on valuation assumption are detailed in Significant Accounting Estimates.

5.3: Current/Non-Current Distinction for Assets and Liabilities

	NOTES	2022 $'000	2021 $'000
Assets expected to be recovered in:			
No more than 12 months			
Cash and cash equivalents	2.1A	**184,857**	68,822
Trade and other receivables	2.1B	**22,132**	12,385
Investments in managed funds	2.1D	**115,041**	121,725
Other non-financial assets	2.2B	**180**	304
Total no more than 12 months		**322,210**	203,236
More than 12 months			
Equity accounted investments	2.1C	**12,134**	5,859
Other Investments	2.1E	**109,670**	87,503
Buildings	2.2A	**12,337**	14,476
Property, plant and equipment	2.2A	**904**	1,528
Intangibles	2.2A	**14,301**	12,055
Total more than 12 months		**149,346**	121,421
Total assets		**471,556**	324,657
Liabilities expected to be settled in:			
No more than 12 months			
Payables			
Suppliers	2.4A	**2,335**	2,015
Research and development	2.4B	**28,646**	26,250
Other payables	2.4C	**2,738**	2,128
Leases	2.5	**2,088**	2,165
Employee provisions	3.1	**1,934**	2,008
Total no more than 12 months		**37,741**	34,566
More than 12 months			
Leases	2.5	**10,298**	11,869
Employee provisions	3.1	**666**	771
Other provisions	2.6	**542**	542
Total more than 12 months		**11,506**	13,182
Total liabilities		**49,247**	47,748

5.4: Subsidiary Controlled by the GRDC

DETAILS OF INVESTMENTS IN SUBSIDIARIES	OWNERSHIP	
	2022 $'000	2021 $'000
NAME OF ENTITY	%	%
Grains Australia Limited[1]	**100**	100

1 Grains Research and Development Corporation (GRDC) is the sole member of Grains Australia Limited (GAL), an industry-based company limited by guarantee. From 1 July 2021 GAL was also the sole member of Wheat Quality Australia Limited (WQA), an industry-based company limited by guarantee. As GAL had 100% ownership of WQA for FY 2022, WQA is a subsidiary of GRDC as GRDC controls GAL and controls WQA.

	2022 $'000	2021 $'000
Statement of Comprehensive Income		
Total expenses	**2,794**	479
Total revenue	**3,810**	742
Total comprehensive income	**1,016**	263
Statement of Financial Position		
Total current assets	**2,604**	374
Total assets	**2,604**	374
Total current liabilities	**185**	108
Total liabilities	**185**	111
Net assets	**2,419**	263
Equity		
Retained surplus	**2,419**	263
Total equity	**2,419**	263

6

Appendices

Appendix A

Executive remuneration PGPA Rule Section 17 BE (ta)

Information about remuneration for key management personnel

NAME	POSITION TITLE	SHORT-TERM BENEFITS			POST-EMPLOYMENT BENEFITS	OTHER LONG-TERM BENEFITS		TERMINATION BENEFITS	TOTAL REMUNERATION
		BASE SALARY	BONUSES	OTHER BENEFITS AND ALLOWANCES	SUPERANNUATION CONTRIBUTIONS	LONG SERVICE LEAVE	OTHER LONG-TERM BENEFITS		
Nigel Hart*	Managing Director	104,713	8,024	10,308	11,621	1,757	-	-	136,423
Cathie Warburton**	Acting Managing Director	307,731	37,192	6,533	37,754	-3,184	-	-	386,026
John Woods	Board Chair	77,620	-	-	7,792	-	-	-	85,412
Roseanne Healy	Board Member	58,889	-	-	6,620	-	-	-	65,509
Richard Heath	Board Member	38,810	-	-	3,896	-	-	-	42,706
Richard Dickmann	Board Member	38,810	-	-	3,896	-	-	-	42,706
Robert Nixon	Board Member	46,970	-	-	4,715	-	-	-	51,685
Sharon Starick	Board Member	42,929	-	-	-	-	-	-	42,929
Andrew Spencer	Board Member	46,247	-	-	4,715	-	-	-	50,962
Gemma Walker	Board Member	35,414	-	-	-	-	-	-	35,414

* Relates to the period 28 March 2022 to 30 June 2022

** Relates to the period 1 July 2021 to 22 April 2022

Information about remuneration for senior executives

TOTAL REMUNERATION BANDS	NUMBER OF SENIOR EXECUTIVES	SHORT-TERM BENEFITS			POST-EMPLOYMENT BENEFITS	OTHER LONG-TERM BENEFITS		TERMINATION BENEFITS	TOTAL REMUNERATION
		AVERAGE BASE SALARY	AVERAGE BONUSES	AVERAGE OTHER BENEFITS AND ALLOWANCES	AVERAGE SUPERANNUATION CONTRIBUTIONS	AVERAGE LONG SERVICE LEAVE	AVERAGE OTHER LONG-TERM BENEFITS	AVERAGE TERMINATION BENEFITS	AVERAGE TOTAL REMUNERATION
$295,001- $320,000	1	246,599	34,685	1,701	28,048	4,292	-	-	315,325
$320,001- $345,000	2	265,515	33,770	-	29,343	2,550	-	-	331,178
$345,001- $370,000	1	225,946	35,496	60,747	31,147	5,053	-	-	358,389

Information about remuneration for other highly paid staff

For a reporting period that begins on or after 29 June 2021 and ends on or before 30 June 2022, the standard financial year, the threshold remuneration for OHPS is $235,000.

TOTAL REMUNERATION BANDS	NUMBER OF OTHER HIGHLY PAID STAFF	SHORT-TERM BENEFITS			POST-EMPLOYMENT BENEFITS	OTHER LONG-TERM BENEFITS		TERMINATION BENEFITS	TOTAL REMUNERATION
		AVERAGE BASE SALARY	AVERAGE BONUSES	AVERAGE OTHER BENEFITS AND ALLOWANCES	AVERAGE SUPERANNUATION CONTRIBUTIONS	AVERAGE LONG SERVICE LEAVE	AVERAGE OTHER LONG TERM BENEFITS	AVERAGE TERMINATION BENEFITS	AVERAGE TOTAL REMUNERATION
$235,001- $245,000	3	195,841	12,702	6,635	21,019	657	-	-	236,854
$270,001- $295,000	2	186,193	14,877	9,608	24,200	4,616	-	45,333	284,827
$295,001- $320,000	1	243,441	22,417	1,733	25,938	3,490	-	-	297,019

Appendix B

Employee statistics

All Ongoing Employees Current Report Period (2021–2022)

	MALE			FEMALE			INDETERMINATE			TOTAL
	FULL TIME	PART TIME	TOTAL MALE	FULL TIME	PART TIME	TOTAL FEMALE	FULL TIME	PART TIME	TOTAL INDETERMINATE	
NSW	1	0	1	0	0	0	0	0	0	1
Qld	6	0	6	9	0	9	0	0	0	15
SA	10	0	10	3	1	4	0	0	0	14
Tas	0	0	0	0	0	0	0	0	0	0
Vic	2	0	2	1	0	1	0	0	0	3
WA	2	0	2	4	2	6	0	0	0	8
ACT	15	0	15	18	3	21	0	0	0	36
NT	0	0	0	0	0	0	0	0	0	0
External Territories	0	0	0	0	0	0	0	0	0	0
Overseas	0	0	0	0	0	0	0	0	0	0
Total	**36**	**0**	**36**	**35**	**6**	**41**	**0**	**0**	**0**	**77**

All Non-Ongoing Employees Current Report Period (2021–2022)

	MALE			FEMALE			INDETERMINATE			TOTAL
	FULL TIME	PART TIME	TOTAL MALE	FULL TIME	PART TIME	TOTAL FEMALE	FULL TIME	PART TIME	TOTAL INDETERMINATE	
NSW	-	-	-	-	-	-	-	-	-	-
Qld	-	-	-	-	-	-	-	-	-	-
SA	-	-	-	-	-	-	-	-	-	-
Tas	-	-	-	-	-	-	-	-	-	-
Vic	-	-	-	-	-	-	-	-	-	-
WA	-	-	-	-	-	-	-	-	-	-
ACT	-	-	-	-	-	-	-	-	-	-
NT	-	-	-	-	-	-	-	-	-	-
External Territories	-	-	-	-	-	-	-	-	-	-
Overseas	-	-	-	-	-	-	-	-	-	-
Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

All Ongoing Employees Previous Report Period (2020–2021)

	MALE			FEMALE			INDETERMINATE			TOTAL
	FULL TIME	PART TIME	TOTAL MALE	FULL TIME	PART TIME	TOTAL FEMALE	FULL TIME	PART TIME	TOTAL INDETERMINATE	
NSW	1	0	1	0	0	0	0	0	0	*1*
Qld	6	0	6	8	0	8	0	0	0	*14*
SA	8	1	9	1	2	3	0	0	0	*12*
Tas	0	0	0	0	0	0	0	0	0	*0*
Vic	2	0	2	1	0	1	0	0	0	*3*
WA	2	0	2	6	1	7	0	0	0	*9*
ACT	19	0	19	16	4	20	0	0	0	*39*
NT	0	0	0	0	0	0	0	0	0	*0*
External Territories	0	0	0	0	0	0	0	0	0	*0*
Overseas	0	0	0	0	0	0	0	0	0	*0*
Total	**38**	**1**	**39**	**32**	**7**	**39**	**0**	**0**	**0**	**78**

All Non-Ongoing Employees Previous Report Period (2020–2021)

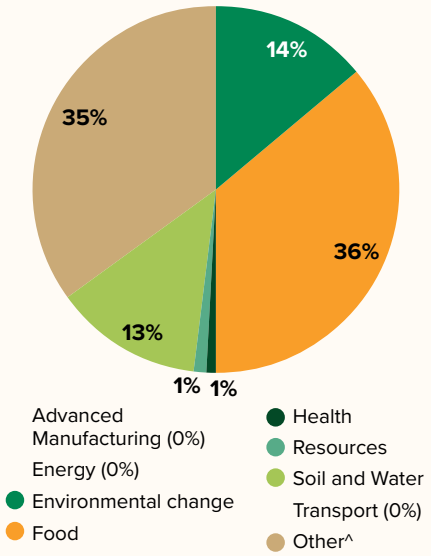
	MALE			FEMALE			INDETERMINATE			TOTAL
	FULL TIME	PART TIME	TOTAL MALE	FULL TIME	PART TIME	TOTAL FEMALE	FULL TIME	PART TIME	TOTAL INDETERMINATE	
NSW	-	-	-	-	-	-	-	-	-	-
Qld	-	-	-	-	-	-	-	-	-	-
SA	-	-	-	-	-	-	-	-	-	-
Tas	-	-	-	-	-	-	-	-	-	-
Vic	-	-	-	-	-	-	-	-	-	-
WA	-	-	-	-	-	-	-	-	-	-
ACT	-	-	-	-	-	-	-	-	-	-
NT	-	-	-	-	-	-	-	-	-	-
External Territories	-	-	-	-	-	-	-	-	-	-
Overseas	-	-	-	-	-	-	-	-	-	-
Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Appendix C

Expenditure against the National Science and Research Priorities and Rural R&D Priorities

The following figures summarise the total expenditure allocated against the Australian Government's Science and Research Priorities and Rural Research, Development and Extension Priorities within the 2021–22 financial year. The allocation of funds from GRDC research, development and extension portfolio is shown in both dollar and percentage terms for each priority. More information on the National Science and Research Priorities can be found at www.industry.gov.au/data-and-publications/science-and-research-priorities

Figure 6: Australian Government Science and Research Priorities percentage value of total GRDC expenditure in 2021–22

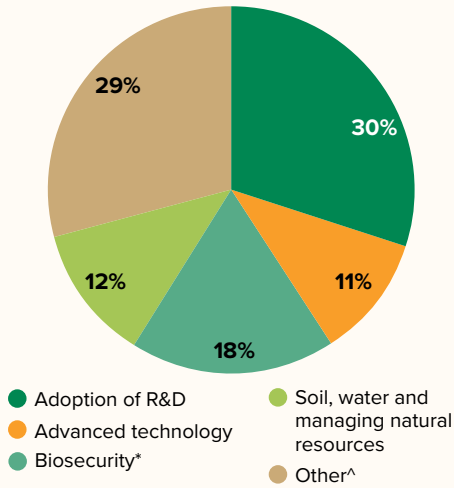


^ Other includes R&D Management cost, Framework investments such as website, publications, data management, biosecurity and all other investments that are not consistent with the National Science and Research Priorities definitions.

Note: GRDC contributes to several of the National Science and Research Priorities. The full list and definitions of the National Science and Research Priorities can be found at: https://www.industry.gov.au/data-and-publications/science-and-research-priorities

- The National Agricultural Innovation Policy Statement – Priorities took effect from 11 October 2021, replacing the Rural RD&E priorities. For this reporting period GRDC is reporting against the Rural RD&E Priorities and will provide a full year report of expenditure against the National Agricultural Innovation Policy Statement – Priorities in the 2022–23 annual report. The priorities are: Australia is a trusted exporter of premium food and agricultural products by 2030.
- Australia will champion climate resilience to increase the productivity, profitability and sustainability of the agricultural sector by 2030.
- Australia is a world leader in preventing and rapidly responding to significant pests and diseases through futureproofing our biosecurity system by 2030.
- Australia is a mature adopter, developer, and exporter of digital agriculture by 2030.

Figure 7: Australian Government Rural Research, Development and Extension Priorities percentage value of total GRDC expenditure in 2021–22



*Biosecurity includes all expenditure related to pests, diseases, and weeds as well as specific biosecurity activities.

^ Other includes R&D Management costs, and Framework investments such as website maintenance, publications, data management, biosecurity and all other investments that are not consistent with the definitions of the Priorities.

7

References

Abbreviations list

AASB	Australian Accounting Standards Board
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ADOPT	Adoption Diffusion Outcome Prediction Tool
AEGIC	Australian Export Grains Innovation Centre
AGT	Australian Grain Technologies
AIA	Agricultural Innovation Australia Limited
AgVet	Agricultural and veterinary chemicals
APVMA	Australian Pesticides and Veterinary Medicines Authority
ATMAC	Agricultural Trade and Market Access Corporation
BCA	Benefit Cost Analysis
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DNA	deoxyribonucleic acid
EU	European Union
GAL	Grains Australia Limited
GRDC	Grains Research and Development Corporation
GST	goods and services tax
GVP	Gross Value of Production
HIP	Herbicide Innovation Partnership
HRZ	high rainfall zone
LMA	late maturity a-amylase
LRZ	low rainfall zone
Minister, the	Minister for Agriculture and Northern Australia
N	nitrogen
NPV	Net Present Value
NVT	National Variety Trials
PAW	plant available water
PBA	Pulse Breeding Australia
PBR	plant breeder's rights
PGPA Act	*Public Governance, Performance and Accountability Act 2013* (Cth)
PIRD Act	*Primary Industries Research and Development Act 1989* (Cth)
QAAFI	Queensland Alliance for Agriculture and Food Innovation
R&D	research and development
RDCs	research and development corporations
RD&E	research, development and extension
RHSA	Rural Health and Safety Alliance
RoR	Rate of Return
SNPs	single nucleotide polymorphisms
WHS	Work, health and safety
WLYP	water-limited yield potential
WUE	water use efficiency

Compliance index

REQUIREMENT	SOURCE	PART OF THE REPORT
***Primary Industries Research and Development Act 1989* (Cth) (PIRD Act)**		
R&D activities	Paragraph 28(a)(i)	1. Overview, pp. 20–25 3. Our Performance pp. 28–70
Marketing activities funded by levy	Paragraph 28(a)(ia)	Not applicable
Expenditure on R&D activities	Paragraph 28(a)(ii)	Page 8, Chapter 3 Our Performance pp. 28–70 Chapter 4. Financial Statements
Impact of R&D activities on the grains industry	Paragraph 28(a)(ii)	Chapter 1, Overview, pp. 20–25 Chapter 3, Our Performance pp. 28–70 Benefit-Cost analyses pp. 38–41
Revisions of the R&D plan	Paragraph 28(a)(iii)	Not applicable
Agreements under sections 13 and 14	Paragraph 28(a)(iv)	Published as Attachment 'R&D Expenditure' on GRDC website https://grdc.com.au/about/who-we-are/corporate-governance/annual-reports
Patents and commercialisation	Paragraph 28(a)(v)	p. 8
Companies	Paragraph 28(a)(vi) and (vii)	Pgs. 23 ,32, 85, 90, 98, 108, 115 and 121
Real property	Paragraph 28(a)(viii)	Chapter 4, Financial Statements pp. 90–121
Assessment of operations	Paragraph 28(b)	Annual Performance Statements, pp. 30–38
Contribution to the objects of the Act	Paragraph 28(c)	Chapter 1, Overview, pp. 20–25 Annual Performance Statements pp. 30–38 Chapter 3, Our Performance pp. 28–70 Chapter 4, Financial Statements pp. 90–121
Sources and expenditure of funds	Paragraph 28(d)	Chapter 4, Financial Statements pp. 90–121
Selection committee report	Paragraph 141 (1)	Not applicable
Public Governance, Performance and Accountability Rule 2014		
Approval of the report by directors	Section 17BB	Letter of transmittal pg. i
Parliamentary standards of presentation	Section 17BC	Throughout
Plain English and clear design	Section 17BD	Throughout
Enabling legislation	Paragraph 17BE(a)	Pgs. 2, 22, 29–30, 80, 84–85
Legislated objects and functions	Paragraph 17BE(b)(i)	Inside front cover and pg. 84
Purpose	Paragraph 17BE(b)(ii)	Pgs. 2, 22, 28, 31, 74, 98
Responsible minister	Paragraph 17BE(c)	Pgs. 2, 84
Ministerial directions	Paragraph 17BE(d) and (f)	None to report
Policy orders	Paragraphs 17BE(e) and (f)	None to report
Annual performance statements	Paragraph 17BE(g)	Pp.30–38

REQUIREMENT	SOURCE	PART OF THE REPORT
Significant issues related to financial compliance	Paragraph 17BE(h) and (i)	None to report
Information on members of the accountable authority	Paragraph 17BE(j)	Pgs. 76–79, 81, 82 and Appendix A
Organisational structure	Paragraph 17BE(k)	Page 74
Location	Paragraph 17BE(l)	Inside rear cover
Governance	Paragraph 17BE(m)	Pp. 74–86
Related entity transactions	Paragraphs 17BE(n) and (o)	Pp. 114–115
Significant activities and changes	Paragraph 17BE(p)	Page 84
Judicial decisions or decisions of administrative tribunals	Paragraph 17BE(q)	None to report
Reports by the Auditor-General, a parliamentary committee, the Commonwealth Ombudsman or the Office of the Australian Information Commissioner	Paragraph 17BE(r)	None to report
Information from subsidiaries	Paragraph 17BE(s)	Pgs. 23, 32, 85, 90, 98, 108, 115, 121
Indemnity and insurance	Paragraph 17BE(t)	Page 86
The following information about the audit committee for the entity: (a) a direct electronic address of the charter determining the functions of the audit committee; (b) the name of each member of the audit committee; (c) the qualifications, knowledge, skills or experience of each member of the audit committee; (d) information about each member's attendance at meetings of the audit committee; (e) the remuneration of each member of the audit committee.	Paragraph 17BE(taa)	Pp. 80–83
Information about executive remuneration	Paragraph 17BE(ta)	Appendix A
Compliance index	Paragraph 17BE(u)	Pp. 135–140
Other reporting requirements		
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