



Australian Government

**Grains Research and
Development Corporation**

2015–16 GRDC ANNUAL REPORT



grdc.com.au

ABOUT THE GRDC

The **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.

GRDC Vision

A profitable and sustainable Australian grains industry, valued by the wider community.

GRDC Mission

Create value by driving the discovery, development and delivery of world-class innovation in the Australian grains industry.

GRDC Values

We are **committed** and **passionate** about the Australian grains industry.

We value **creativity** and **innovation**.

We build strong relationships and partnerships based on mutual **trust** and **respect**.

We act **ethically** and with **integrity**.

We are **transparent** and **accountable** to our stakeholders.

Letter of transmittal



15 October 2016

The Hon Barnaby Joyce MP
Deputy Prime Minister and
Minister for Agriculture and Water Resources
Parliament House
CANBERRA ACT 2600

Dear Deputy Prime Minister

I have pleasure in presenting the annual report of the Grains Research and Development Corporation (GRDC) for the year ended 30 June 2016, in accordance with section 28 of the *Primary Industries Research and Development Act 1989* (PIRD Act), and section 46 of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act).

The GRDC is confident that its performance in 2015–16 contributed to the industry's and the government's vision for a profitable, internationally competitive and ecologically sustainable Australian grains industry. This achievement is consistent with the GRDC's responsibility to plan, execute and report against the:

- objects of the PIRD Act as they apply to the GRDC
- planned outcomes of the corporation's Strategic R&D Plan 2012–17
- goals and performance measures described in the annual operational plan
- outcome and key performance indicators described in the Agriculture and Water Resources Portfolio Budget Statements.

This annual report complies with the planning and reporting requirements for 2015–16 as prescribed by the PIRD Act, the PGPA Act, the Public Governance, Performance and Accountability Rule 2014 and the Public Governance, Performance and Accountability (Financial Reporting) Rule 2015.

The annual report was prepared under the direction of the Board and approved by a resolution of the corporation's directors on 29 September 2016.

Yours sincerely



John Woods
Chair

cc: Senator the Hon. Anne Ruston, Assistant Minister for Agriculture and Water Resources

Highlights of 2015–16



The GRDC invested more than \$192.8 million in 898 projects to deliver new and improved varieties, practices, technologies and capability to the industry. These projects were delivered by over 2,500 researchers from 283 partner organisations.



In partnership with state governments, the GRDC created new positions for researchers in regional areas of New South Wales, Queensland and Victoria.



The GRDC made a \$10 million commitment to the International Wheat Yield Partnership, which aims to increase the yield potential of wheat by up to 50% in the next 20 years.



The world's first commercially produced gluten-free beer was released, using low-gluten barley developed through a collaboration between the GRDC and CSIRO.



Crop-breeding programs that receive GRDC support released five new varieties: one each of oats, lentils and field peas, and two of lupins.



In the 2016 Grower Survey, 85 percent of growers rated the GRDC's performance as high quality, and 71 percent said they had recently benefited from GRDC activities.



The most comprehensive study ever conducted into the impact of weeds on Australian grains production established a baseline that will guide the GRDC's investments in weed research.



A GRDC regional office network was established, comprising new offices in Adelaide, Dubbo and Toowoomba as well as the existing office in Perth.



The GRDC celebrated 25 years as a leading force in investment in research, development and extension for the Australian grains industry.





76% of growers are comfortable to extremely comfortable paying the levy



82% of growers feel that they directly benefit from grains industry RD&E



85% of growers rate the GRDC's overall performance as investors in grain research as fairly high to very high



71% of growers are confident that grains industry research can respond quickly to emerging crop protection threats

INCOME

\$18m

Interest, royalties and other

\$70m

Australian Government

\$110m

Grain grower levy

\$12m

Suppliers and other

\$10m

Employee benefits

\$193m

Research and development

EXPENDITURE

GRAIN GROWER LEVY

\$51m

Wheat

\$25m

Coarse grains

\$17m

Oilseeds

\$17m

Grain legumes

RD&E INVESTMENTS

\$16m

Meeting market requirements

\$40m

Improving crop yield

\$42m

Protecting your crop

\$34m

Foundational activities and R&D management

\$36m

Advancing profitable farming systems

\$16m

Improving your farm resource base

\$9m

Building skills and capacity



Table 1: Five years at a glance

	2015–16	2014–15	2013–14	2012–13	2011–12
GRDC					
Revenue	\$197.5m ▼	\$203.1m	\$209.1m	\$196.4m	\$177.5m
Expenditure	\$215.0m ▼	\$216.0m	\$184.4m	\$178.0m	\$165.1m
Operating result	–\$17.5m ▼	–\$12.8m	\$24.7m	\$18.4m	\$12.3m
Total assets	\$262.5m ▼	\$278.4m	\$267.7m	\$265.3m	\$230.7m
Total equity	\$173.7m ▼	\$191.3m	\$203.8m	\$180.6m	\$162.2m
Industry contributions	\$110.4m ▼	\$117.5m	\$120.2m	\$118.2m	\$97.7m
Commonwealth contributions	\$70.2m ▲	\$68.0m	\$68.6m	\$62.8m	\$55.9m
R&D expenditure	\$192.8m ▼	\$194.1m	\$165.4m	\$159.2m	\$150.2m
Employee benefits	\$10.5m ▼	\$10.7m	\$9.6m	\$8.2m	\$7.2m
Suppliers	\$9.4m –	\$9.4m	\$8.7m	\$7.3m	\$6.7m
Number of full-time equivalent GRDC staff ^a	67 ▼	75	76	64	57
Number of projects ^b	898 ▼	942	939	920	896
Grains industry					
Estimated number of grain farms ^c	24,000 ▼	25,350	19,101	19,101	20,960
Number of grain crops covered by R&D levies	25 –	25	25	25	25
Estimated gross value of production	\$13,944m ^d ▲	\$13,135m	\$15,413m	\$13,622m	\$12,237m
Total grain production—summer and winter crops ('000 tonnes) ^e	42,279 ▲	40,700	46,361	41,700	49,687

a Number of full-time equivalent GRDC staff at 30 June. Figures for 2011–12 to 2014–15 have been restated as previous annual reports showed full-time staff only.

b Projects that received funding during the financial year.

c Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) estimates. Figures for 2014–15 and 2015–16 represent broadacre farms that produce more than \$40,000 in output value with plantings of at least 40 hectares for grain, oilseed or pulse production. Figures for 2011–12 to 2013–14 are the numbers of broadacre farms with plantings of at least 100 hectares for grain, oilseed or pulse production.

d Latest ABARES forecast for the gross value of production of grains, oilseeds and pulses, excluding rice—from the June 2016 *Agricultural Commodities* report.

e Latest ABARES estimates for total summer and winter crop production, excluding rice—from the June 2016 *Australian Crop Report* and the June 2016 *Agricultural Commodities* report.

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PART 1—OVERVIEW

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About the GRDC

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Reports from the Chair and the Managing Director

As Chair, I am pleased to report that during 2015–16 the GRDC made significant progress in restructuring and re-energising the corporation. As we mark 25 years as a research leader, the Board is repositioning the GRDC to ensure that we have the necessary scale and agility to create enduring value for Australian grain growers.

Over a quarter of a century, we have developed a cohesive, national system for grains research, consolidating grower and government funds into critical areas of R&D. Harvest to harvest, we have worked collaboratively with growers and research partners to overcome both natural and market constraints, increasing farm profitability and strengthening the industry's global competitiveness—to the point where Australia's model of grains R&D is now lauded by other grain-producing countries.

Performance

I am pleased to present this annual report for 2015–16, outlining our performance and achievements in meeting the research priorities of grain growers, government and the GRDC.

Overall, 2015–16 was a successful year for the Australian grains industry. The area sown to winter and summer crops increased by 2 percent and the volume and value of production both increased by 3 percent. In total, Australia produced around 42.3 million tonnes of grain with a gross value of \$13,944 million. However, there were wide variations between cropping areas, as parts of New South Wales experienced above-average growing conditions while rainfall was very low in parts of South Australia, Tasmania and Victoria.

The GRDC recorded a deficit of \$17.5 million, in line with the Board's financial and strategic objectives, which are informed by our vision, shared by industry and government, for a profitable, internationally competitive and ecologically sustainable grains industry.

R&D enables grain growers to extract the best possible return on effort, risk and capital from their grain production activities. In 2015–16, the GRDC

invested more than \$192.8 million in 898 projects focusing on new varieties, practices and technologies that deliver incremental, step-change and transformational outcomes for the industry.

We draw on the experience and knowledge of growers to target our investments and measure our performance. The 2016 Grower Survey indicates that 85 percent of growers rate our performance as high quality, and 71 percent of growers have directly benefited from our RD&E activities in the past five years.

Future-driven strategy

2016 is a turning point for the Board, as it oversees the completion of the Strategic R&D Plan 2012–17, executes a project to transform the GRDC's operating platforms and business model, and develops the next five-year plan to pre-empt and respond to the issues and opportunities for the industry into the future.

In the second half of 2016, the Board will focus on the industry's outlook and the GRDC's strategic direction. Dedicated planning sessions have been undertaken to ensure that we consistently examine long-range risks and opportunities presented by the global market.

Leadership

A vital element of the GRDC's success this year has been the high-level commitment of employees during a sustained period of management and operational change.

I wish to thank John Harvey for his service to the grains industry for the past 17 years, including as GRDC Managing Director for the past six years. Under John's leadership the GRDC has undergone significant growth, and most recently the corporation has undertaken the complex process of organisational renewal and change.

In March, after a rigorous, comprehensive recruitment and due diligence process, the Board announced the appointment of Steve Jefferies as Managing Director. I would like to acknowledge



the passion and commitment of Steve Thomas, who led the organisation as Acting Managing Director prior to Steve Jefferies' taking over in July.

It is a privilege to be Chair of the Board, especially as the GRDC celebrates the milestone of serving growers for 25 years. My fellow directors are an extremely hardworking team, active in their respective regions, who serve as a tremendous conduit between the Board, the grower-focused regional panels and management.

As Managing Director, I am honoured to be appointed to head such an important body and to have the opportunity to continue my career—32 years to date—working with passionate and engaged Australian grain growers. I take great personal and professional pride in being a part of our industry.

Both prior to the announcement of my appointment and as I have settled into the role of Managing Director, I have been fortunate to have met many people who have been prepared to share their insights on the role of grains R&D in driving farm productivity and profitability. This has helped me to take a 'back of the coaster' reading on how the GRDC is tracking. On this initial reading we fell short of some expectations.

I am however proud of a great deal of the work that the corporation has been doing in delivering value for growers, a great deal of which has gone largely unseen or unrecognised by many growers. There are many examples of just this. We will need to be able to demonstrate this value better in the future. I have also been very pleased to see that conscientious efforts are already being made and on track to address some of the issues raised and/or expectations not met.

The heartfelt feedback I have received from growers, advisers, researchers and the broader industry regarding the GRDC gives me great comfort that the Australian grains industry is in fact in safe hands. The GRDC is also largely in the hands of growers.

The telecommunications company Apple sits at the cutting edge of transformational digital innovation and has changed the way we use personal devices, consume music and access information. Apple has a huge R&D arm of 12,000 employees that delivers the transformational innovations critical to its business. My aim as Managing Director is for Australian grain growers to regard, unequivocally, the GRDC as their own consolidated R&D arm. This requires a shift in the mindset of growers, and the GRDC has some work ahead of it to warrant such a shift in perception.

To achieve this shift in perception—to be regarded as the R&D arm of each Australian grains production enterprise—the GRDC needs to be more responsive. This applies in a strategic sense, through our capacity and agility to capture opportunities for growers as they present; in a business sense, through the way we engage, as a partner, with both growers and research agencies; and in a cultural sense, through consistent professionalism in the manner in which we work together.

Improving our responsiveness is core to our becoming a more agile, less bureaucratic, and more transparent organisation focused on driving Australian grain grower profitability through investment in research, development and extension. That is my vision for a trusted and valued GRDC.



How the GRDC is changing

For the past 18 months, the GRDC has undergone a significant process of transformation across multiple fronts. We have restructured our staff profile to increase the GRDC's presence in the regions. Our extensive ideas-capturing network, based around our regional panels, is being reinforced by moving many GRDC functions into regional offices in Adelaide, Dubbo, Perth and Toowoomba. The move has already increased our local engagement, improved our ability to listen to and hear the views of growers, and enabled better coordination and delivery of research outcomes, products and services.

We have changed the underlying administrative processes for managing research investments and updated our digital management and delivery platform. This will help us to be more transparent about our investment decisions and better communicate delivery timeframes and benefits to growers.

We have also incorporated ways in which we can ensure that the research portfolio is more balanced. We do this on behalf of growers, so that we can invest in research that delivers them lower risk incremental gain innovations, slightly higher risk step-change innovations, and even higher risk transformational change innovations in an appropriate balance of risk and reward. Growers can expect to experience the benefits of these changes in the coming years.



Richard Clark
Chair



Steve Jefferies
Managing Director

About the GRDC

Role

The GRDC's 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 grains industry and the wider community.

The GRDC invests in research, development and extension (RD&E) and related activities across a portfolio spanning temperate and tropical cereals, coarse grains, pulses and oilseeds. This involves coordinating and funding activities; monitoring, evaluating and reporting on their impact; and facilitating the dissemination, adoption and commercialisation of their results.

The GRDC does not undertake R&D itself. Rather, it partners with other organisations that have the necessary capabilities to undertake the specialised work.

The GRDC also contributes to the development of strategic national approaches to grains industry RD&E, to reduce fragmentation and duplication, and to help address industry-wide issues such as biosecurity and climate variability.

While its focus is on delivering benefits to its primary stakeholders, Australian grain growers, the GRDC also generates outcomes that benefit other participants in the Australian grains industry value chain, the research community and the wider Australian community.

Relationships

Strong relationships with grain growers and other grains industry stakeholders, particularly in the R&D and agribusiness sectors, allow the GRDC to leverage resources, research capability and knowledge and ensure that GRDC investments effectively meet growers' RD&E priorities.

The GRDC consults the grower community through bodies such as farming systems groups, state farmers' organisations and the grains industry representative organisations: Grain Producers Australia Limited and Grain Growers Limited. Representative groups for other industry sectors liaise with the GRDC through the National Agribusiness Reference Group.

The GRDC's Regional Cropping Solutions networks engage with growers, farming systems groups, agribusiness and researchers in the Southern and Western regions to link growers' local RD&E needs with national agricultural research capability. Grower Solutions Groups in the Northern Region play a similar role. The GRDC's advisory panels and managers of grower services also enable growers, advisers and the GRDC to share information on regional priorities for RD&E.

Under the National Primary Industries Research, Development and Extension Framework, the GRDC is actively involved in the Grains Industry National Research, Development and Extension Strategy Implementation Committee, together with representatives from state departments of agriculture, CSIRO, universities, industry and the Australian Government. The GRDC cooperates on mutually beneficial projects with other rural R&D corporations and works closely with its portfolio department, the Department of Agriculture and Water Resources.

The GRDC also provides opportunities for growers and members of the wider community to contact the GRDC, and access timely, relevant grains information, through:

- events such as field days, forums, conferences and roadshows
- GRDC-supported education and training channels, such as grains research updates
- GRDC online services, such as the website and YouTube channel, apps for mobile devices, and social media accounts.

Collaboration

Collaboration is at the heart of the GRDC's approach to adding value to the Australian grains industry. The majority of the GRDC's investment in RD&E is with partners that co-fund the work and conduct many of the activities. Examples include government agencies; research organisations, including cooperative research centres, universities and other rural R&D corporations; commercial plant breeders and seed companies; agricultural companies and advisers; and grain marketers, exporters and end users.



To leverage Australia's investment in grains R&D as part of the global effort, and access technologies and intellectual property that would otherwise be unavailable, the GRDC collaborates with public and private research organisations overseas. Notable examples include:

- the GRDC's strategic alliances with the International Maize and Wheat Improvement Center (CIMMYT), the International Center for Agricultural Research in the Dry Areas (ICARDA) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- the GRDC's investments in the International Wheat Yield Partnership and the Herbicide Innovation Partnership.

The GRDC also works with commercial partners to deliver the outputs of GRDC-funded research to growers in the form of new technologies and services. Historically, GRDC investment partners have been public institutions such as state governments, CSIRO and universities. Increasingly, however, investment partners include a mixture of large, medium and small enterprises from the public and private sectors.

Legislation

The GRDC was established in 1990, under the *Primary Industries and Energy Research and Development Act 1989*. As a result of amendments made in December 2013, that Act is now known as the *Primary Industries Research and Development Act 1989* (PIRD Act).

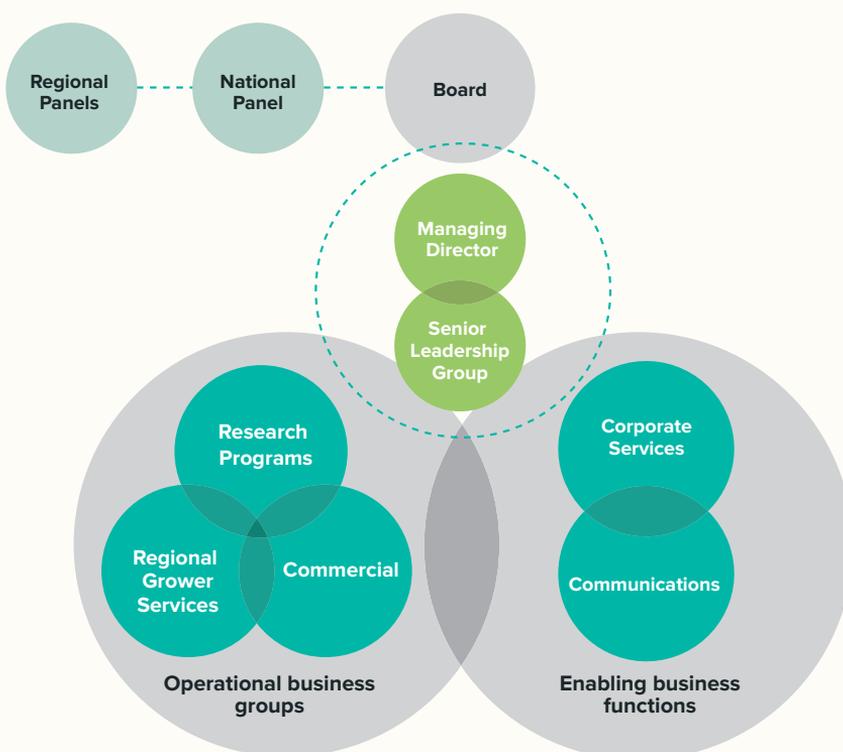
Through its strategic investment in RD&E, the GRDC helps to achieve the functions of the PIRD Act, as described in the annual performance statements in Part 2 of this report.

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

Structure

The GRDC's organisational structure is designed to most effectively apply the organisation's resources to achieve its operational and strategic outcomes. Figure 1 shows the GRDC's organisational structure at 30 June 2016.

Figure 1: Structure at 30 June 2016



Board

The GRDC Board is responsible for the stewardship of the corporation, and oversees corporate governance within the GRDC. Its other functions include setting strategic direction and monitoring the ongoing performance of the business and the Managing Director.

The nine members of the Board combine 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.

More information on the Board is provided in Part 3 of this report.

National Panel

The GRDC Board makes decisions with the support of a national advisory panel comprising the Managing Director, the executive managers, and the chairs of three regional advisory panels.

The National Panel:

- addresses national RD&E priorities across the GRDC's investment portfolio and makes recommendations to the Board
- assists the Board to maintain links with grain growers, the Australian Government, state and territory governments and research partners.

Regional panels

The National Panel is informed by the knowledge and experience of advisory panels representing three distinct grain-growing regions, as described in Figure 2. In September 2015, the GRDC revised the boundaries of the Northern and Southern regions, to reflect shifts in cropping in those regions.

Each regional advisory panel:

- identifies and monitors regional and national grains industry issues that are relevant to the region
- interacts with Regional Cropping Solutions networks, grower groups and other industry stakeholders in the region

- identifies and develops priorities for RD&E investment and recommends them to the National Panel
- informs growers and advisers in the region about the GRDC's strategic direction and R&D investments
- assists the GRDC to monitor the effectiveness of the investment portfolio.

The regional advisory panels are composed of grain growers, agribusiness representatives, researchers and the GRDC's executive managers, with provision for other industry experts to participate as appropriate. Panel members are contracted to carry out their roles and are not employees of the GRDC.

Information on current panel members is available from the GRDC's website and YouTube channel.

Senior Leadership Group

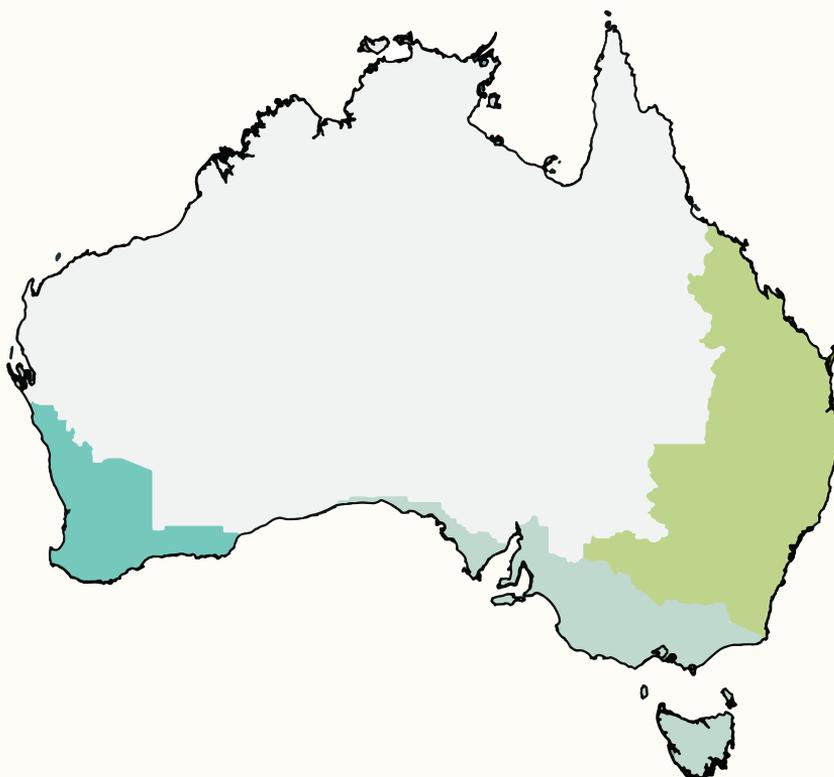
The Senior Leadership Group leads the GRDC's business activities, advises the GRDC Board and implements the Board's decisions. To ensure that the GRDC's operations are monitored and managed efficiently and effectively, the group meets regularly and maintains an annual business schedule.

During 2015–16, the Senior Leadership Group had seven members: the Managing Director, the executive managers from each of the five business groups and the Chief Operating Officer.

The Chief Operating Officer is a temporary executive role established in March 2015 to lead a review of functional processes, procedures and systems, in order to sustain the GRDC in the future and optimise the delivery of benefits to grain growers and the wider community.



Figure 2: GRDC grain-growing regions at 30 June 2016



NORTHERN REGION	SOUTHERN REGION	WESTERN REGION
<p>The Northern Region is the most climatically diverse of the three regions. The climates in the main grain belt range from winter-dominant temperate to summer-dominant subtropical.</p> <p>The region also has the highest diversity of production, including all 25 leviable crops, as well as the highest percentage of mixed farming systems (livestock, cotton and sugar).</p> <p>An increased focus on crop rotation, farming system management, water use efficiency and stubble retention has resulted in more profitable and lower risk systems over time, though the region is still characterised by highly variable yields.</p>	<p>The Southern Region encompasses a range of soils and agroclimatic zones. Soil fertility varies from highly fertile soils through to water-repellent sands, with some areas affected by subsoil constraints. Rainfall is winter dominated and varies significantly by location.</p> <p>Yield potential is highly dependent on winter and spring rainfall. The conservation of soil moisture from often erratic autumn rainfall events is a strong focus.</p> <p>Major crops include wheat, barley, grain legumes and canola. Crop production systems and rotations are highly varied and include intensive continuous cropping systems and mixed farming enterprises (livestock and hay).</p>	<p>In the Western Region soil fertility is generally low and yields depend on winter and spring rainfall.</p> <p>Long-term variability in seasonal rainfall and production in coastal areas is lower than in the Northern and Southern regions.</p> <p>In many areas, yields are low by world standards; this is compensated for by the large scale and degree of mechanisation of the enterprises.</p> <p>Wheat, barley, oats, canola and lupins are the dominant crops, and livestock enterprises in mixed farming systems are generally less important than in the other regions.</p> <p>The region exports more than 85% of its grain production.</p>

Business groups

The GRDC's three operational business groups oversee and manage investments to achieve the outcomes determined under the GRDC's Strategic R&D Plan 2012–17, as follows:

- Research Programs invests in R&D programs that address key grains industry priorities, and ensures that R&D is nationally coordinated and integrated with extension.
- Regional Grower Services delivers the outputs of research in innovative products and services that meet the needs of growers and their advisers in each region.
- Commercial accesses and develops innovation from Australia and overseas to ensure that it is commercialised in a way that optimises benefits for Australian grain growers.

The operational business groups are supported by two enabling business groups:

- Corporate Services is responsible for key enabling activities that provide essential support for the effective governance and administration of the GRDC.
- Communications is responsible for engaging with stakeholders and delivering information to communicate the GRDC's values, focus and achievements.

Planning and reporting

The GRDC has performance reporting obligations set out in legislation, as well as a strong commitment to being accountable to grain growers, the Australian Government and the broader community.

Detailed information on the GRDC's accountability is provided in Part 3. The following sections describe the core elements of the annual cycle of reporting on performance against planned objectives.

Table 2 outlines the elements of the GRDC's planning and reporting framework.

Table 2: Elements of the planning and reporting framework

ELEMENT	PURPOSE
Annual operational plan ^a	Specifies the annual budget, resources and research priorities that give effect to the strategic R&D plan during a given financial year.
Annual procurement plan	Makes procurement information publicly available through the Australian Government's AusTender procurement management website.
Annual report ^a	Provides information on research, development and extension (RD&E) activities and their performance in relation to the goals set in the annual operational plan and portfolio budget statements for a given financial year.
Growers' report ^a	Provides performance information to growers on RD&E activities for a given financial year.
Funding agreement	Sets out the terms and conditions under which money paid to the GRDC by the Commonwealth may be spent for four financial years.
Investment plan	Informs potential research partners about some of the GRDC's new investment priorities for the next financial year and invites interested parties to submit research proposals.
Portfolio budget statements ^a	As part of the Australian Government budget process, summarise the planned outcomes, deliverables, performance information and financial statements for a given financial year.
Stakeholder report ^a	Provides information that assists Grain Producers Australia and Grain Growers Limited to determine whether they need to discuss the GRDC levy rate with the Minister.
Strategic R&D plan ^a	Sets out the GRDC's high-level goals, strategies and performance measures for a five-year period, developed in consultation with stakeholders and approved by the Minister.

^a Available at www.grdc.com.au/About-Us/Corporate-Governance.



Strategic R&D plan

The GRDC Board communicates its strategic directions and performance objectives through a five-year strategic R&D plan.

The Strategic R&D Plan 2012–17 provides a framework for a balanced portfolio of short-, medium- and long-term investments based on six themes that correspond to the key RD&E priorities identified by grain growers, as shown in Figure 3.

The plan also takes into account the RD&E priorities set out in the *Grains Industry National Research, Development and Extension Strategy* and the Australian Government's key objectives for RD&E. (More information on the government priorities is provided in Appendix A of this report.)

Annual operational plan

Each year's activities are outlined in an annual operational plan, as required by section 25 of the PIRD Act.

The annual operational plan describes the activities that the GRDC will undertake to implement the goals of the strategic R&D plan in the financial year ahead. It includes an outcome-based performance measurement framework that is consistent with the outcome, objective, deliverables and performance measures set out for the GRDC in the Agriculture Portfolio Budget Statements.

Annual report

At the end of the financial year, the GRDC publishes an annual report to Parliament that addresses a range of reporting requirements. In 2015–16, the key requirements were set out in:

- legislation, including the PIRD Act, the PGPA Act, the *Work Health and Safety Act 2011* and the *Environment Protection and Biodiversity Conservation Act 1999*
- the Agriculture Portfolio Budget Statements
- the GRDC Funding Agreement 2015–19.

More detail of the requirements is provided in the compliance index of this report.

The annual report includes the audited financial statements, and information on the GRDC's results against corporate and portfolio performance measures.

Performance framework

The GRDC's performance framework under the Strategic R&D Plan 2012–17, as shown in Figure 3, demonstrates how the GRDC's R&D investment themes, objectives and corporate strategies flow from the priorities of the grains industry and government.

As detailed in this annual report, the GRDC measured its performance in 2015–16 in terms of:

- results against the
 - measures set out in the Agriculture Portfolio Budget Statements 2015–16 and reported on in the annual performance statements
 - investment theme outcomes set out in the Strategic R&D Plan 2012–17 and targets set out in the Annual Operational Plan 2015–16
- implementation of corporate strategies
- management of the R&D investment portfolio
- outputs of commercialisation activities and business relationships
- feedback from grain growers and other stakeholders
- achievement of the vision of a profitable and sustainable grains industry, as demonstrated by farm financial performance and total factor productivity.



Figure 3: Performance framework

GOVERNMENT AND INDUSTRY OBJECTIVES	AUSTRALIAN GOVERNMENT OBJECTIVES			INDUSTRY OBJECTIVES	
	Primary Industries Research and Development Act 1989	Science and Research Priorities	Rural Research, Development and Extension Priorities	Grains Industry National Research, Development and Extension Strategy 2014	Industry priorities
	<p>Increased economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of grain.</p> <p>Sustainable use and management of natural resources.</p> <p>More effective use of the resources and skills of the community in general and the scientific community in particular.</p> <p>Development of scientific and technical capacity.</p> <p>Development of the adoptive capacity of grain growers.</p> <p>Improved accountability for expenditure on R&D activities.</p>	<p>Food.</p> <p>Soil and water.</p> <p>Transport.</p> <p>Cybersecurity.</p> <p>Energy.</p> <p>Resources.</p> <p>Advanced manufacturing.</p> <p>Environmental change.</p> <p>Health.</p>	<p>Advanced technology.</p> <p>Biosecurity.</p> <p>Soil, water and managing natural resources.</p> <p>Adoption of R&D.</p>	<p>Better varieties—to lift productivity and value.</p> <p>Improved practices—to enhance productivity and sustainability.</p> <p>Supply chain innovation and market competitiveness.</p> <p>Building farm business and industry capability.</p>	<p>Meeting market requirements.</p> <p>Improving crop yield.</p> <p>Protecting your crop.</p> <p>Advancing profitable farming systems.</p> <p>Improving your farm resource base.</p> <p>Building skills and capacity.</p>

GRDC RD&E INVESTMENT THEMES	1 Meeting market requirements	2 Improving crop yield	3 Protecting your crop	4 Advancing profitable farming systems	5 Improving your farm resource base	6 Building skills and capacity
<p><i>Intermediate outcomes (5 years)</i></p> <ul style="list-style-type: none"> Understanding market opportunities for Australian grain. Crop and variety selection aligned with market requirements. Crop production aligned with market requirements. Grain harvest and storage practices aligned with market requirements. 	<ul style="list-style-type: none"> Genetic yield potential and stability improvement of cereal varieties. Genetic yield potential and stability improvement of pulse varieties. Genetic yield potential and stability improvement of oilseed varieties. 	<ul style="list-style-type: none"> Effective, sustainable and efficient management of weeds. Effective, sustainable and efficient management of vertebrate and invertebrate pests. Effective, sustainable and efficient management of cereal rusts. Effective, sustainable and efficient management of cereal (non-rust), pulse and oilseed fungal pathogens. Effective, sustainable and efficient management of nematodes. Effective, sustainable and efficient management of viruses and bacteria. Biosecurity and pesticide stewardship. 	<ul style="list-style-type: none"> Knowing what is important (key business drivers). Planning strategically (building system benefits and rotations). Responding tactically (individual crop agronomy). 	<ul style="list-style-type: none"> Understanding and adapting to climate variability. Improving soil health. Managing water use on dryland and irrigated grain farms. Understanding and valuing biodiversity. Communication of sustainable production methods. 	<ul style="list-style-type: none"> Grains industry leadership and communication. Capacity building in the extension sector. Capacity building in the R&D sector. Capacity building for grain growers. 	
<p><i>Aspirational outcomes (10+ years)</i></p>	<p>Australian grain growers maintain and increase access to current and future grain markets by aligning on-farm production practices with quality and functionality requirements.</p>	<p>Cereal, pulse and oilseed varieties with significant, sustained and stable improvements in water-limited yield potential over current elite varieties in key agroecological zones and across a range of seasons.</p>	<p>Australian grain growers managing their farms to maximise profit and reduce risk by adopting effective control of weeds, pests and diseases.</p>	<p>Australian grain growers managing farming systems that are able to respond and adapt to changing environmental and market conditions to reduce risk and deliver an increase in profitability.</p>	<p>Grain growers valued for adopting practices that improve regional habitat, soil, water and atmosphere resources in a changing climate.</p>	<p>A dynamic Australian grains industry with the skills and capacity to continuously innovate.</p>

GRDC CORPORATE STRATEGIES	Create value	Coordinate nationally	Deliver regionally	Connect globally	Engage with growers and industry
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GRDC OUTCOME	Australian grain growers utilising new information and products that enhance the productivity, profitability and sustainability of growers and benefit the grains industry and wider community.
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GRDC VISION	A profitable and sustainable Australian grains industry, valued by the wider community.
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Annual performance statements

Statement of preparation

The Board of the Grains Research and Development Corporation (GRDC), as the accountable authority of the GRDC, presents the 2015–16 annual performance statements of the GRDC, as required under paragraph 39(1)(a) 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). In the Board's opinion, these annual performance statements are based on properly maintained records, accurately reflect the performance of the entity, and comply with subsection 39(2) of the PGPA Act.

Purpose

As a rural R&D corporation established under the PIRD Act, with well-defined and established corporate-planning processes that address the requirements of the PGPA Act, the GRDC is not required to publish a corporate plan. In terms of the Commonwealth performance framework, while other corporate entities' purposes are defined in their corporate plans, the GRDC's purpose is to address the objects of the PIRD Act.

The objects of the PIRD Act are to:

- increase the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries
- achieve sustainable use and management of natural resources
- make more effective use of the resources and skills of the community in general and the scientific community in particular
- support the development of scientific and technical capacity
- develop the adoptive capacity of primary producers
- improve accountability for expenditure on R&D activities in relation to primary industries.

Results

In 2015–16, the GRDC achieved its purpose through one outcome, as set out in the Agriculture Portfolio Budget Statements:

New information and products that enhance the productivity, competitiveness and environmental sustainability of Australian grain growers and benefit the industry and wider community, through planning, managing and implementing investments in grains research and development.

The GRDC's performance against the measures set out in the portfolio budget statements is described in Table 3. Information on the GRDC's performance against the Annual Operational Plan 2015–16 can be found in the chapters on themes 1 to 6.



Table 3: Performance against Agriculture Portfolio Budget Statements 2015–16 measures (pages 144–145)

KEY PERFORMANCE INDICATOR	TARGET	RESULT
Australian Export Grains Innovation Centre (AEGIC) joint venture is established and operating appropriately.	Required market information available.	Partially achieved. AEGIC is providing the GRDC and its stakeholders with market information which results in better outcomes for growers.
Growers are interested in the benefits of measuring grain quality to meet customer requirements.	90%	Almost achieved. The GRDC Market Requirements Survey showed that 89% of growers are interested in the benefits of measuring grain quality to meet customer requirements.
Growers storing grain on farm use sealed silos to meet market requirements and provide for the continued effectiveness of pest control measures.	70%	Achieved. The GRDC Market Requirements Survey showed that 72% of growers storing grain on farm use sealed silos to meet market requirements and provide for the continued effectiveness of pest control measures.
New cereal, pulse and oilseed varieties have minimum increases in genetic yield potential per annum as measured in National Variety Trials (NVT).	Cereals 1% Pulses 2% Oilseeds 1.5%	Achieved. NVT analysis has demonstrated that new varieties have yield potential increases greater than target levels.
New varieties currently available meet the expectations of growers.	60%	Achieved. The Grower Survey showed that 79% of growers say that new grain varieties have met their needs fairly to very well.
Growers and advisers use NVT data in selection of varieties to plant.	35% access data, of which 90% consider helpful.	Achieved. The Grower Survey showed that 48% of growers accessed the NVT data and 95% of the growers that accessed the NVT data found it helpful with variety decisions.
Growers and advisers are aware of and use integrated weed, pest or disease management practices.	70% aware 50% use	Achieved. The Grower Survey showed that: <ul style="list-style-type: none"> • 74% of growers were aware of integrated weed management practices, and 82% of growers used such practices • 70% of growers were aware of integrated pest management practices, and 61% of growers used such practices • 61% of growers were aware of integrated disease management practices, and 63% of growers used such practices.
Growers undertake on-farm practices to maintain or improve their biosecurity.	40%	Achieved. The Grower Survey showed that: <ul style="list-style-type: none"> • 53% of growers had undertaken on-farm practices to maintain or improve their biosecurity • 93% of growers were practising on-farm hygiene to reduce the spread of weeds, pests or diseases.
Growers place a high importance on the use of decision tools to assist them with strategic or tactical decision making.	70%	Achieved. The Grower Survey showed that 77% of growers placed high importance on using decision support tools.
Growers have a whole-farm business plan which takes account of strategic opportunities, constraints and risks.	25%	Achieved. The Grower Survey showed that 29% of growers had developed a whole-farm business plan.



Table 3: Performance against Agriculture Portfolio Budget Statements 2015–16 measures (pages 144–145) (continued)

KEY PERFORMANCE INDICATOR	TARGET	RESULT
Growers consider the potential effects of climate change on their farm business when making long-term decisions.	55%	Partially achieved. The Grower Survey showed that 66% of growers were adopting new or different management practices to actively manage climate variability.
Growers undertake activities to improve the condition and productive capacity of their soils.	70%	Achieved. The Grower Survey showed that 94% of growers had undertaken activities to improve the condition and productive capacity of soils.
Growers use nutrient budgeting to better match application with anticipated crop needs.	60%	Achieved. The Grower Survey showed 68% of growers using nutrient budgeting.
Each year Nuffield scholars include people from the grains industry.	At least three.	Achieved. The GRDC supported four Nuffield scholars.
Growers and advisers undertake at least one activity each year to learn more about opportunities to improve farm profit or sustainability.	75%	Partially achieved. In the Products and Services Survey, 53% of growers and 80% of advisers reported that they had participated in GRDC face-to-face extension activities aimed at improving agronomic, farm business and natural resource management capabilities.

Analysis

The GRDC met or exceeded its targets to provide economic, environmental and social returns to stakeholders in 2015–16.

Total grains industry production increased by 3.2 percent and total value increased to \$13,944 million during 2015–16. The value of cereals increased by 2.9 percent and pulses by 63.3 percent, while oilseeds fell by 4.9 percent.

The rate of return for grain growers in the Northern Region increased to 3.8 percent (from 2.4 percent in 2014–15), while the rate of return for growers in the Western Region increased to 4.8 percent (from 4.3 percent). Growers in the Southern Region saw their rate of return fall to 2.1 percent (from 2.3 percent).

The GRDC invested \$192.8 million across 898 projects involving more than 2,500 researchers and scientists from 283 partner organisations to achieve its targets. This included providing support for 17 undergraduate awards, 63 postgraduate awards, six Horizon scholarships, and four Nuffield Australia Farming Scholarships.

Quality targets were met through understanding the demand for various grains based on research conducted by the Australian Export Grains Innovation Centre. Eighty-nine percent of growers were interested in research to better meet the needs of customers. Surveys have been conducted in various projects to better understand the requirements of grain millers and consumers. More than 72 percent of growers increased grain quality by adopting superior handling and storage in 2015.

Targets for higher yielding varieties were met through the provision of new varieties which met market needs and grower requirements. Industry data shows that yields increased by 2.4 percent each for cereals and pulses and 3.2 percent for oilseeds from 2014–15 to 2015–16. In 2016, 48 percent of growers accessed databases which describe the performance traits of new varieties and 95 percent of those growers found the information to be helpful.

Growers are very aware of the costs and increasingly aware of the environmental impacts of applying chemical products to control weeds, pests and diseases. Research is providing information on resistance, natural management strategies and biological control mechanisms.



In 2014, 74 percent of growers were aware of using integrated weed management practices and 70 percent were aware of integrated pest management.

The target of 40 percent of growers undertaking practices to improve their biosecurity has been met, as 53 percent of growers report that they have undertaken this practice change.

Growers have developed their adaptive capacity by using new programs and apps. In 2014, 77 percent of growers reported using a decision support tool to assist with tactical decision making.

In 2014–15, 94 percent of growers said that they managed their soil resources and undertook activities to improve the condition and capacity of soils. Those changes included minimising burning, retaining stubble, crushing weed seed, and managing soil nutrients by including legumes in grain rotations. At the same time, 68 percent of growers said that they used nutrient budgeting to replace nutrients. The relative costs of nutrients and fertilisers may change the relative proportions of nutrients from various sources from year to year.

Farmers can minimise risk and exposure to financial and production risk by developing and maintaining whole-farm plans. In 2015–16, 29 percent of growers reported that they use a plan. The GRDC-funded farm business management tool Ag Profit was used by over 700 growers in 2015–16.

Climate variability has been increasing and growers are considering how they will manage farms under more complex and challenging climate conditions. In 2015–16, 66 percent of farmers adopted new or different strategies and 53 percent considered climate change when developing long-term plans.

The fall in performance in the Southern Region in 2015–16 was due to well below average rainfall in South Australia, Victoria and Tasmania. Northern New South Wales and Queensland received below-average to average rainfall while southern New South Wales received above-average rainfall. The Western Region benefited from average to above-average rainfall.



Theme 1—Meeting market requirements

This theme describes the framework for the GRDC’s investments in grain quality and functionality to help growers maintain and expand access to markets.

Australia’s domestic and international customers seek a consistent supply of grain that is both:

- a quality product that is compliant with statutory and customer-specific requirements
- a functional product that performs reliably for the desired end use.

To deliver the highest value to growers, the GRDC must understand the requirements and the dynamics of current domestic and export markets for feed and food grains, and those of likely future markets.

Through the ‘Meeting market requirements’ theme, the GRDC interacts closely with participants in the Australian grains value chain to better understand market requirements, particularly for quality and functionality, to enable growers to maintain or increase access to current markets, and secure access to new higher valued markets.

Aspirational outcome

Australian grain growers maintain and increase access to current and future grain markets by aligning on-farm production practices with quality and functionality requirements.

Investment in 2015–16

\$15.40 million

The following sections describe some highlights of Theme 1 RD&E during the year. Table 4 details the theme’s performance against strategic measures; portfolio performance measures are addressed in Table 3.

Projects in the pipeline for 2016–17

- Work to expand opportunities in food and beverage markets for sorghum producers in the Northern Region.
- Support for strategic oversight and coordination of grain protection chemicals to maintain market access for Australian exports.



Value of grain characteristics

To assist Australian grain growers to compete globally, the GRDC is supporting projects to collect, analyse and package information on the quality and functionality requirements of key domestic and overseas markets, by value and volume, and to model the effects of changes in demand and supply of grain crops meeting these requirements.

The project is focusing on the countries that represent the top three markets for each grain type (five for barley). Information is being sourced through a range of networks in those markets, including grain traders, end users and peak industry bodies (such as flour milling associations). In Australia, plant-breeding companies and industry bodies such as Wheat Quality Australia, Barley Australia, Grain Trade Australia, Pulse Australia, the Australian Oilseeds Federation and the Australian Grain Exporters Association are being consulted.

For cereals, pulses, oilseeds, sorghum and maize, data is being collected and documented in each market, including through surveys and interviews of industry participants. For five lower volume crops—lupins, field peas, mung beans, maize and lentils—the project is reviewing the available data and identifying possible synergies as well as gaps that need to be addressed.

Data on the needs of end users in key markets will be integrated into information packages for wheat, barley, canola, lupins, field peas, chickpeas, mung beans, maize, lentils and sorghum. Each package will include:

- key quality characteristics of each major end use segment
- weighted quantitative comparisons between characteristics
- the relative value that end users attribute to each characteristic
- primary factors that influence buyer behaviour.

The project applies a rigorous and practical model for ranking grain functionality and quality requirements, developed in consultation with stakeholders to ensure that it meets the expectations of the Australian grains industry. The model can be used in future empirical studies of market requirements and for modelling value flow to growers, taking into account the portion flowing to other supply chain members.

The project will create a foundation upon which grains industry stakeholders can make informed decisions about strategic direction and resource allocation to optimise Australia's opportunities in export markets.

High-yielding cereals for feed markets

The domestic feed grain industry is the largest single market for Australian grains. In 2013–14, domestic livestock industries consumed approximately 8.8 million tonnes of grains, which represented 72 percent of the total animal feed consumed.

The GRDC is a founding member of the Feed Grain Partnership, which integrates R&D initiatives between industries in the livestock feed supply chain. In consultation with the partnership, the GRDC is currently investing in a project to create market opportunities for growers in Australia's high-rainfall cropping systems, through the development of high-yielding, high-energy cereal varieties for use as feed.

Despite having a favourable climate for cereal production, and much higher yield potential than many parts of mainland Australia, Tasmania is a net importer of cereal grains. This is partly because of high demand for feed grain to supply Tasmania's expanding dairy sector.

The GRDC-supported project aims to assist Tasmanian growers to close the yield gap and benefit from the strong feed grain market.



The project:

- evaluates cereal feed lines from Australia and overseas, and identifies the highest yielding options
- identifies and provides information to growers on variety management techniques, including practices tailored for irrigation systems, to lift productivity
- identifies innovative mechanisms for buying and selling feed grains, which specify the energy value of the grains, to encourage further investment in germplasm development
- engages with the dairy industry to promote the value of the metabolisable and digestible energy in feed grain cereals.

The project is based at a new facility, the Tasmanian Feed Grain Centre, and brings together international, national and local expertise and breeders to create a centre of excellence for feed grain cereal production.



Members of the steering group for the hyper-yielding cereals project examine plots at the project trial site at Hagley, Tasmania.
Photo: Tracey Wylie, Foundation for Arable Research

Grain defects in chickpeas

The contribution of pulses to cereal and oilseed cropping rotations is well established. The pulse crops are also becoming increasingly marketable in their own right, as global demand for protein increases. Stronger and more stable prices for Australian pulses will enhance profitability and assist growers to plan their rotations more strategically.

Exports of Australian chickpeas have grown particularly strongly in the recent years, from around 150,000 tonnes in 2004–05 to almost 700,000 tonnes in 2014–15.

Australian chickpeas have a reputation as premium products in major markets such as India and Pakistan.

However, recent increases in grain defects are putting that reputation at risk, and reducing profitability for chickpea growers. The main defects of concern are seed markings ('tiger striping' or 'blotching') and weathering. Growers' ability to avoid the occurrence of defects is hampered by lack of knowledge of the genetic and environmental factors that cause them.

The GRDC is supporting research to help growers minimise defects, in both desi and kabuli chickpeas, through improved varieties and targeted management practices.

The work includes field trials across all major chickpea-growing regions of Australia. The major outcomes will be:

- a map of the incidence of seed markings and weathering, indicating the particular environmental conditions under which different susceptible varieties express the defects
- information on the nature and critical timing of weather events that lead to the defects
- an improved understanding of plant-related factors—such as growth stage, crop architecture and genetic characteristics—that favour the occurrence of defects
- assessment of the means by which the defects affect quality for grain processors
- information to guide the development of tools to mitigate the effects of the defects, including genetic information for use in pre-breeding and breeding for resistance, and image analysis techniques to quantify damage caused by seed markings.



Two samples of Pistol chickpeas contrast grain affected by blotching (left) and unaffected grain (right). *Photo: Kate Keir*



Oil and meal in canola

By focusing on quantity—yield and oil content—Australian breeding programs have significantly enhanced canola as a commercially attractive oilseed crop. A new focus on the properties of oil and meal has potential to improve returns to canola growers.

For example, increased tocopherol content would help to prevent canola oil from oxidising and could be used as a source of vitamin E for dietary supplements and cosmetics. Differences in fatty acid profiles could help to target canola oil for particular end uses. Improving digestibility and protein levels could greatly expand opportunities for canola meal in animal feed markets.

GRDC-supported research has identified germplasm with relevant traits for improving canola oil quality, including fatty acid composition and tocopherols, as well as canola meal components such as acid detergent fibre, neutral detergent fibre and digestibility and nutrition. The germplasm is now being evaluated, to determine how gene–environment interactions affect the expression of those traits.

Field trials are being conducted at a range of sites, covering low-, medium- and high-rainfall patterns, across the main canola-growing regions of Australia. The preliminary results show that, as expected, environment and genotype both have an influence on significant traits.

The trials have also confirmed that some lines have significantly higher tocopherol levels than the levels previously reported for Australian canola, while some have promising levels of components that could potentially be used to improve the usability of canola meal.

To assist breeders to quickly screen for desirable traits in future breeding lines, the project is also developing near-infrared calibrations for as many of the traits as possible.



Researcher Kerrie Graham extracts canola oil for analysis.
Photo: Jamie Ayton, New South Wales Department of Primary Industries



Table 4: Theme 1 performance against Annual Operational Plan 2015–16 measures

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcome: Understanding market opportunities for Australian grain		
The GRDC establishes relationships with the value chain and regulatory authorities to access information about market requirements, trends and opportunities.	Australian Export Grains Innovation Centre (AEGIC) delivers several market reports, including reports on wheat for Indonesia and barley for China.	Achieved. AEGIC delivered reports to the GRDC on wheat for Indonesia, barley in China, and markets for sorghum, canola and pulses.
	The collection of delivery data is expanded to cover all major crop types.	Achieved. The GRDC collected delivery data on major crops and used the information to inform investment decisions.
	AEGIC in-country training for Austrade officers expands the GRDC's information-gathering network.	Achieved. AEGIC provided training and expanded the GRDC's information-gathering network.
The GRDC makes greater use of information on current and potential future markets to guide investment decisions.	Market prioritisation rankings of quality traits are guiding new investment in wheat pre-breeding.	Achieved. Prioritisation rankings of quality traits in wheat were delivered, to inform pre-breeding investments.
Intermediate outcome: Crop and variety selection aligned with market requirements		
A greater proportion of growers and advisers use market information to inform crop and variety selection.	Workshops and presentations from AEGIC inform growers on market movements and demand.	Achieved. AEGIC provided workshops and presentations to growers on market movement and demand.
Increased interaction between grains industry participants (growers, pre-breeders, breeders and value chain participants) and regulatory authorities creates awareness of the quality and functionality market access requirements.	Greater GRDC involvement in Barley Australia, the Australian Oilseeds Federation, the Working Party for Stored Grain, and Wheat Quality Australia ensures that grower needs are represented.	Achieved. The GRDC worked closely with Barley Australia, the Australian Oilseeds Federation, the Working Party for Stored Grains and Wheat Quality Australia, and represented growers needs.
Breeders and pre-breeders use market information to deliver varieties that meet the requirements of current and future markets.	A new framework for the delivery of pre-breeding traits to breeders ensures that the benefits of GRDC investment are realised in new varieties.	Achieved. The GRDC, in partnership with AEGIC, has invested in an economic model to guide investment in the development and use of functionality traits for 10 crops.
Intermediate outcome: Crop production aligned with market requirements		
A greater proportion of growers and advisers use relevant market information to inform decisions about in-crop management practices.	More targeted information from AEGIC and the Feed Grain Partnership informs growers on specific market targets and needs.	Achieved. The GRDC communicated information gathered by AEGIC and the Feed Grain Partnership to growers, to inform their crop-planting decisions.
A greater proportion of grain growers adjust pest, weed and disease management practices to meet market requirements.	Investments with the Grains Industry Market Access Forum, focusing on blackleg in canola and weed seeds, ensure that key markets are maintained and growers are aware of the specific requirements of each market in terms of minimum residue levels and specifications.	Achieved. Communication by the GRDC informed growers of minimum residue levels and specifications, which led to key markets for canola remaining open.

Table 4: Theme 1 performance against Annual Operational Plan 2015–16 measures (continued)

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcome: Grain harvest and storage practices aligned with market requirements		
A greater proportion of growers use harvesting strategies that maximise the opportunity to meet the requirements of their target market.	A grower survey ascertains the key decision-making processes being used around harvest, and the results drive a GRDC education program.	Achieved. The GRDC invested in workshops to extend information on techniques to store grain on farm and reduce the incidence of stored-grain pests.
A greater proportion of growers are aware of the quality and functionality of the grain delivered to their customer or entering contract storage.	Grower surveys identify what quality and functionality measurements are being regularly taken and what percentage of growers are taking them, as the basis for the development of a best practice guide.	The Meeting Market Requirements Survey was last conducted in 2014. The GRDC is reviewing the survey as a means of testing growers' awareness of grain quality requirements.
A greater proportion of growers use storage practices to meet market requirements and provide for the continued effectiveness of pest control measures.	A new strategy is developed to ensure that Australia is able to comply with a limit of zero insects in grain for export.	Achieved. A new crop protection strategy which will help Australia to export grain free of pests was developed.
	Further evaluation of the costs and benefits of storing grain on farm (including the real costs of labour and risk) is delivered through the Stored Grain website.	Achieved. An economic analysis of on-farm grain storage was completed and made available on the Stored Grain website.
The GRDC uses market access information to provide growers with the harvest and storage management packages and tools to comply with market requirements.	New aeration and temperature control devices for stored-grain silos are under development.	Achieved. The GRDC invested in the development of novel technology to reduce the incidence of pests in stored grain.



Case study—Optimising export opportunities for oats

Over the past five years, China has become the largest export market for Australian oats. Around 92,000 tonnes of Australian oats were imported by China during 2013, representing 80 percent of China's total oat imports.

The Chinese demand for Australian oats has experienced a sixteen-fold increase since 2007, and further growth is predicted.

Virtually all Australian oats imported by China are used in the food sector. Since the mid-2000s, consumer awareness that oats are associated with lowering high cholesterol, high blood pressure and high blood sugar has driven a 15 percent annual increase in China's consumption of oat products. Oatmeal as a breakfast dish remains the largest end use for oats, but interest in new Asian food products, such as oat-based rice, beverages, snack bars and noodles, is rising.

The Australian oat industry possesses significant information regarding the quality and functionality requirements of oats for oatmeal breakfast. However, information regarding the functional requirements of the new oat-based Asian food products or the Chinese processors' preferences and priorities for oat quality characteristics is scarce. Australian producers also lack information on how the quality and functionality of Australian oats compare to those of products from key competitors, including domestic Chinese producers.

The GRDC is supporting a project that will fill these knowledge gaps and build Australia's capacity for R&D to improve the competitiveness and profitability of Australian oats in export markets.

Led by the Australian Export Grains Innovation Centre, the project involves collaboration between Australian and Chinese researchers, with activities in both countries. The work in China is focused on Chinese oat varieties and grain processing for products such as oat milk and oat noodles. A survey of Chinese companies is also being conducted to identify market preferences.

The Australian research is defining functional properties of oat starch, fibre and protein and examining their relationships to end product functionality. A dedicated facility for testing and processing grain is being established in Perth, and field trials of current oat varieties and advanced breeding lines are being conducted in South Australia and Western Australia. To help build Australia's expertise in oats for the longer term, the project has employed a PhD student specialising in oat chemistry.

The project will deliver independent and robust market intelligence to inform decision making from pre-breeding to production, enabling Australian oat producers to capture maximum value from opportunities in a major export market.



A researcher tests grain qualities of oats at the Australian Export Grains Innovation Centre laboratory in Perth.
Photo: Australian Export Grains Innovation Centre



Theme 2—Improving crop yield

This theme describes the genetic approaches and associated tools and technologies that can be applied to produce varieties with increased water-limited yield potential (WLYP).

The WLYP of a variety is the maximum yield attainable when the variety is grown under average, rain-fed conditions without the limiting impacts of nutrient deficiency, soil toxicity, weed competition, insect damage and disease.

Although the actual yield that is captured on farm depends on a grower's ability to manage the biotic and abiotic factors that contribute to yield losses (and the cost limitations of management practices), WLYP is genetically determined.

Plant breeders aim to continually improve the WLYP of crops through new varieties. However, for many crops, continued improvements in genetic yield potential and stability are becoming harder to realise.

The 'Improving crop yield' theme focuses on the delivery of new crop varieties with demonstrable improvements in genetic yield potential and yield stability. Given the wide range of farming environments and crop choice, targets will be crop specific and region specific.

Aspirational outcome

Cereal, pulse and oilseed varieties with significant, sustained and stable improvements in water-limited yield potential over current elite varieties in key agroecological zones and across a range of seasons.

Investment in 2015–16

\$39.69 million

The following sections describe some highlights of Theme 2 RD&E during the year. Table 5 details the theme's performance against strategic measures; portfolio performance measures are addressed in Table 3.

Projects in the pipeline for 2016–17

- Development of germplasm with improved crown rot tolerance or resistance for wheat breeders.
- Work to understand the possible trade-offs between performance and yield in high-temperature-tolerant wheat varieties.
- Projects to improve genetic and agronomic options for managing non-rust foliar diseases, through the National Barley Foliar Pathogen Variety Improvement Program.
- International collaborations to diversify the genetic resources for chickpea variety improvement.



Head loss and straw breakage in barley

Head loss occurs at the final stage of plant development, if the structure of the mature plant is unable to withstand environmental forces such as strong winds or storms. Head loss can cause significant yield reductions in barley, particularly in coastal regions. Recent GRDC-funded research observed losses of up to 30 percent in crops of two current varieties, Buloke and Scope, which together account for around 27 percent of barley production.

Straw strength is an important factor in both head loss and a related problem, straw breakage. Straw breakage is more widespread than head loss, and can be a major factor limiting production because it not only results in direct yield loss but also makes harvesting more difficult.

Head loss and straw breakage share common mechanisms but are also controlled by other, different factors. Although GRDC-supported research has tentatively identified genetic and nutritional factors that contribute to the two problems, the results to date have not been sufficiently accurate to be used effectively in breeding programs or cropping systems. The major reason is that expression of head loss and straw breakage heavily relies on environmental conditions—soil, temperature and wind—that vary widely between years and locations.

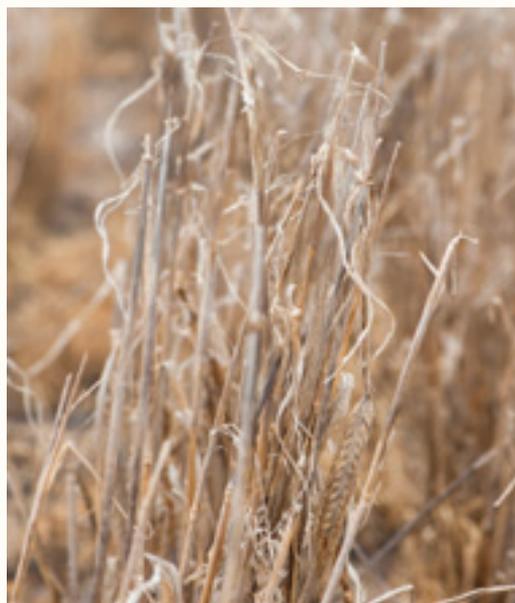
The GRDC is currently funding a project that is building on the lessons of the previous research to deliver:

- accurate information on head loss and straw breakage in current barley varieties and key breeding lines, along with information and molecular tools to equip them to eliminate the problems in future barley varieties, for barley breeders
- a management package on ways to minimise the risk of head loss and straw breakage for Buloke and Scope, along with information on selecting varieties to minimise losses due to head loss and straw breakage in particular cropping environments and systems, for barley growers.

Based in Western Australia, the project has undertaken extensive trials of commonly available barley varieties and advanced breeding lines, ranking them for head retention and straw

strength characteristics. The trials have confirmed that straw strength is a major predictor of head loss, and can be influenced by interactions between copper and potash. Work to further explore the genetic bases for susceptibility to head loss and the factors that contribute to straw breakage is ongoing.

It is expected that growers will have access to high-yielding barley varieties with reduced risk of head loss and straw breakage by 2023.



A barley plant shows the effects of head loss and straw breakage.
Photo: Chengdao Li, CSIRO

Water and heat stresses in pulses

Pulses play a valuable role in cereal-cropping systems by providing a respite from high levels of nitrogen application, breaking the cycle of cereal diseases and providing opportunities for grass weed control. They are also becoming increasingly profitable crops in their own right, as demand for pulses is being driven by the growing markets of China and India.

In most Australian cropping environments, the yield and yield stability of pulse crops are chronically constrained by water stress and heat stress. These stresses, which often occur simultaneously, are expected to increase in frequency and intensity. Even in good seasons, untimely stress episodes during grain set can cause severe yield reductions.

This major constraint on the use of pulses in cropping systems has been hard to address because plant physiology is less well understood in pulses than it is in cereals. The GRDC is supporting research to improve understanding of the critical growth periods for pulses and the ways in which stress during those periods affects yields.

The project is conducting field trials, over four years, at sites in the mid-north of South Australia. They comprise:

- chickpea field trials, focusing on phenology (time to flowering, pod emergence, end of flowering and maturity), growth rate, yield, yield components (such as seed size, seed number and seed abortion), and other physiological indicators such as canopy temperature
- field pea trials, focusing on pod wall ratio (a proxy measurement for seed abortion) and its genetic bases.

For both crops, the aim is to evaluate performance under stress and identify key traits for the development of lines with high yields and improved stress tolerance.

The field research is complemented by use of National Variety Trials data and crop modelling tools. The project also leverages results from similar experiments being conducted in India under an Australia India Strategic Research Fund project led by the South Australian Research and Development Institute. In addition, the project is building long-term R&D capacity for pulses by employing a young scientist to specialise in legume physiology.

The project will ultimately deliver genetic tools and materials that will enable pulse breeders to develop new varieties with significant, sustained and stable yield improvements in Australian environments, and assist growers to adopt management strategies to minimise the risk of yield losses due to stress during critical periods. Collectively, the knowledge and tools generated by the project will lead to both economic and environmental benefits by contributing to increased adoption of pulses in cropping rotations.

Oil content and stability in canola

Canola is the third largest crop in Australia, after wheat and barley, and the most significant oilseed crop. As well as being an effective break crop in cereal rotations, it is profitable in both domestic and export markets and has significant potential for increased exports. In recent years, the Australian canola industry has expanded to cover 2.5 million hectares and contribute approximately \$2 billion to the economy, annually.

The National Brassica Germplasm Improvement Program was established in 2007, with support from the GRDC. Recognising that factors that affect Australian canola production may receive limited attention from multinational plant-breeding companies, the program aims to develop advanced canola germplasm with traits adapted to Australian environments and conditions and to deliver it to breeding companies for development, to ensure that Australian growers have a source of varieties that allow them to compete effectively in world markets.

The program focuses on traits that require long-term R&D investment and are difficult to select using traditional plant phenotyping methods. It works in close consultation with breeding companies, so that research outputs will be readily incorporated into new varieties for rapid adoption by growers.

Identifying genetic material and molecular markers for improved oil content and stability in canola is one of the program's priorities. This would particularly benefit growers in the Northern Region, where the use of canola as a break crop can significantly help to control pests and diseases in cereal rotations but current canola varieties often fail to meet minimum oil content requirements for sale as crops in their own right. Access to lines that deliver high yields with oil content over 45 percent would make canola a profitable choice as a break crop in the region.



Through a GRDC-supported project, researchers are investigating elite Australian canola varieties and germplasm imported from Germany to identify possible sources of improved oil content and stability attributes for target environments in northern New South Wales. Preliminary results of field trials have identified lines that yield up to 1.7 tonnes of grain per hectare with oil content levels up to 49 percent. Research to validate these findings is ongoing.

In addition to improved germplasm and molecular markers for oil content and stability, the project will provide canola breeders with reliable and efficient phenotyping methodologies for the desired traits. This will allow breeders to more readily combine complex traits and develop stable varieties with improved adaptation to varying agricultural conditions.



A canola plant blooms in a variety improvement field trial at Horsham, Victoria. Photo: Paul Jones

Table 5: Theme 2 performance against Annual Operational Plan 2015–16 measures

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcomes:		
Genetic yield potential and stability improvement of cereal varieties		
Genetic yield potential and stability improvement of pulse varieties		
Genetic yield potential and stability improvement of oilseed varieties		
Breeders and industry pre-breeders increase their level of collaborating to identify and prioritise traits, tools and germplasm requirements to support target gains in yield potential and stability.	Strong collaborations between international researchers and Australian breeders are prioritising traits as part of the next phase of the CIMMYT–Australia–ICARDA Germplasm Evaluation (CAIGE) program.	Achieved. Through CAIGE, the GRDC supported research relationships between Australian plant breeders and international plant improvement centres. Breeders visited CIMMYT and ICARDA to select lines for use in Australian breeding programs.
	Arrangements for breeder participation in the National Brassica Germplasm Improvement Program (NBGIP) facilitate efficient transfer of information and outputs to breeders.	Achieved. The NBGIP has biannual meetings with all Australian canola-breeding programs to ensure efficient and effective transfer of project outputs and allow companies to provide advice and direction to NBGIP activities.

Table 5: Theme 2 performance against Annual Operational Plan 2015–16 measures (continued)

PRACTICE CHANGE	TARGET	RESULT
Increased number of pre-breeders develop priority traits in breeder-defined genetic backgrounds, and ready-to-implement selection tools to drive rapid adoption by breeding programs.	Pre-breeding targets are identified for genetic sources of transpiration efficiency, photosynthetic efficiency, heat tolerance and salinity tolerance in wheat.	Achieved. Wheat research has identified genotypic variation for photosynthesis, high-yielding varieties with superior heat tolerance, and a possible source of salt tolerance 5 to 10 times greater than that of commercial varieties.
	Genetic diversity in wild barley is exploited by importing a wild barley mapping population and screening it for drought tolerance, disease resistance and other agronomic traits. Genetic and phenotypic information is delivered to Australian barley breeders so that genetic diversity can be incorporated into adapted varieties.	Achieved. A wild barley population from Germany was screened for drought tolerance and disease resistance. Genetic markers for improved performance were found and will be transferred to Australian breeding programs.
	New yield, phenology, vigour and drought tolerance traits and molecular markers are developed and provided to the narrow-leafed lupin breeding program, to increase breeding efficiency.	Achieved. Lupin lines were screened for molecular markers associated with yield, and several markers were identified that may be applied to improve the efficiency of breeding high-yielding varieties of narrow-leafed lupin.
	Pre-breeding research provides selection tools to accelerate the development of varieties of pulses—including vetch, soybean, mungbean and peanuts—with improved yield, quality traits, agronomic traits, disease resistance and adaptation to regional growing conditions.	Achieved. A system was designed to enable pulse-breeding programs to turn over 5 to 6 generations per year while screening for traits such as tolerances of boron, acidity, salinity and chilling.
Increased number of breeders and pre-breeders use accurate data analysis methods to interpret yield potential, stability and environmental data that inform selection for target production environments.	All CAIGE projects utilise Statistics for the Australian Grains Industry (SAGI) to design and analyse experiments and trials, to increase efficiency and ensure consistent and reliable data and results.	Almost achieved. SAGI conducted an analysis of CAIGE projects and identified changes to experiment and trial designs which, when implemented, will improve the quality of data delivered through CAIGE projects.
Growers and their advisers have greater access to and make greater use of accurate, regionally relevant yield potential and stability data to choose an improved variety.	The GRDC Grower Survey shows continued increases in the proportion of growers who say that: <ul style="list-style-type: none"> • new varieties met their expectations well or very well • NVT information helped them to choose varieties to adopt. 	Achieved. The Grower Survey shows that between 2014 and 2016 the proportion of growers who accessed NVT data increased from 40% to 48%, and the proportion of those growers who found that NVT information helped with variety decisions increased from 90% to 95%.



Case study—Developing wheats for drought conditions

Through improved varieties and practices, Australian growers have dramatically increased the efficiency with which their cropping systems turn water into wheat. In more than half of Australia's wheat-growing regions, water use efficiency increased by at least 50 percent between 1982 and 2012. In some areas the increase was as high as 100 percent.

However, the ability to increase yields through more efficient use of inputs is heavily constrained in the parts of Australia where rainfall is most marginal and variable. In such areas, the greatest scope to improve yields lies in new varieties that have higher water-limited yield potential under drought conditions.

Although breeders have shown interest in developing traits linked to adaptation to dry environments, few such traits have been commercially adopted, because their economic value has not been demonstrated.

To accelerate the development of improved varieties, the GRDC is supporting work to:

- assess traits for potential to improve water uptake, water use efficiency and yield (under well-watered and water-limited conditions)
- validate successful traits in relevant environments
- develop elite lines with enhanced traits
- benchmark new elite lines against current commercial wheats, and demonstrate the relative values of different traits
- design cost-effective, high-throughput phenotyping tools for trait selection
- deliver new germplasm and tools to pre-breeding and breeding programs, and create a forum for engagement between pre-breeders, breeders and growers.

The project involves extensive field trials conducted in managed environment facilities—at Narrabri and Yanco in New South Wales and Merredin in Western Australia—which have irrigation systems that can mimic drought conditions typical of the various wheat-growing regions. This avoids the difficulty of producing reliable findings on performance under drought in open field trials, where the timing and amounts of rainfall are inconsistent from year to year.

The first stage of the research, which assessed a range of traits across multiple genetic backgrounds over four years, showed value in selecting for:

- cooler canopies, greater early vigour and maintenance of green leaf area through grain filling, in all environments
- leaf waxiness and transpiration efficiency, in some environments.

The results overall showed less value in selecting for reduced tillering and greater water-soluble carbohydrate content for increasing grain yield.

The traits currently under investigation are greater early vigour, leaf rolling, alternative dwarfing genes, and rapid grain filling in warm, terminal drought. The project is also refining experimental methods for measuring key indicators of yield, such as leaf area, biomass and canopy architecture.



A researcher uses LIDAR (light detection and ranging) and crop sensor technology to assess green leaf area in a wheat trial plot.
Photo: CSIRO

Theme 3—Protecting your crop

This theme aims to develop cost-effective control options that prevent pests, weeds and diseases from causing crop yield and quality losses, and increase growers' profit.

Existing control measures for pests, weeds and diseases require ongoing review in the light of:

- potential and actual incursions of exotic pests
- changes in regulation of pesticide use and access
- the need to
 - reduce the cost and increase the speed of delivery of resistant and tolerant varieties
 - manage herbicide and pesticide resistance
 - provide ongoing stewardship of gene technology and pesticide products to support long-term access.

The 'Protecting your crop' theme develops the cultural, chemical and genetic options available to manage key pests, weeds and diseases in each region. Management options need to take into account cost-effectiveness, resilience of control strategies and flexibility to fit different farming systems.

Aspirational outcome

Australian grain growers managing their farms to maximise profit and reduce risk by adopting effective, sustainable and efficient control of weeds, pests and diseases.

Investment in 2015–16

\$42.37 million

The following sections describe some highlights of Theme 3 RD&E during the year. Table 6 details the theme's performance against strategic measures; portfolio performance measures are addressed in Table 3.

Projects in the pipeline for 2016–17

- Research into the biology and ecology of snails and slugs, leading to innovative management options.
- Development of an integrated management approach for Russian wheat aphid.
- An integrated weed management project involving all major weeds research centres in the Northern Region.
- A study of herbicide tolerance in pulses.
- Biosecurity work to ensure that Australia is prepared for possible incursions of Karnal bunt and wheat blast.



Root-lesion nematodes

Root-lesion nematodes (RLN), microscopic organisms that feed on root tissues, significantly reduce crop yields in many parts of Australia. Recent estimates suggest that production lost to RLN costs grain growers more than \$250 million each year.

The GRDC supports research to assist growers to reduce the impact of RLN through a blend of variety selection and management practices. This includes work to:

- investigate the spread and severity of RLN and map the incidence of key species
- measure levels of tolerance and resistance in current crop varieties
- accelerate the development of varieties with improved tolerance and resistance
- understand how management practices and soil biota promote the natural suppression of RLN.

About 25 percent of total crop losses due to RLN occur in the Northern Region, where *Pratylenchus thornei* and *P. neglectus* are the dominant species. A GRDC-supported project recently showed that 88 percent of paddocks in southern Queensland and northern New South Wales are affected by one or both species. In collaboration with local farming systems groups and agronomists, the project is developing up-to-date maps of the distribution of RLN across the region.

The project is also investigating a wide range of wheat lines, including wild and synthetic lines from Australia and overseas, to find novel sources of resistance to *P. thornei* and *P. neglectus*. Improved germplasm, including lines with resistance to both species, is being delivered to wheat pre-breeding and breeding programs along with phenotyping tools and molecular markers.

Another GRDC-supported project is conducting field trials to better understand the resistance, tolerance and susceptibility of current field crops, including break crops, to RLN. The project will assign resistance/susceptibility ratings to important cultivars across all the major crops, drawing on dedicated trials and National Variety Trials testing. Relevant results will be used to improve the soil sampling calibrations of PreDicta B, a diagnostic modelling tool that assess the yield risks of soil-borne pathogens prior to sowing, to assist growers and advisers to plan crop rotations.

GRDC-supported research has also confirmed that soil biota can reduce the multiplication of RLN in wheat cropping, particularly in surface soil layers. The research has identified many soil organisms that are capable of suppressing RLN—including *Pasteuria* bacteria, nematode-trapping fungi and predatory nematodes—in soils from the Northern Region. The capacity of soils to suppress RLN can be improved by practices such as stubble retention, reduced tillage and continuous cropping.

Herbicide resistance

Three herbicide groups are vital to weed management in Australian cropping: Group I (2,4-D and others), Group L (paraquat and diquat) and Group M (glyphosate). Widespread resistance to these herbicides would mean substantial costs to grain growers, including the financial costs of alternative weed management strategies and the economic and environmental costs of being unable to utilise profitable rotations or no-till management practices.

The GRDC is investing in projects to understand the evolution of resistance to these herbicides and provide new information and tools to delay the advent of resistance and avoid the effects of resistance in cropping systems.

GRDC-supported research has demonstrated that resistances to glyphosate and 2,4-D are present and increasing across Australia. By screening more than 300 weed samples, the research has:

- confirmed glyphosate resistance in crop weeds in New South Wales, Queensland, Victoria, South Australia and Western Australia, and identified four new weed species with glyphosate resistance (sweet summer grass, red brome, common sowthistle and prickly lettuce)
- confirmed 2,4-D resistance in wild radish in New South Wales and Victoria and capeweed and sowthistle in South Australia.

A list of 200 weeds and their relative risk of developing glyphosate resistance has been developed and published through the website of the GRDC-supported Australian Glyphosate Sustainability Working Group.

The research has shown that the evolution of glyphosate resistance varies from species to species, so conclusions drawn from one weed may not apply to others.



A study of annual ryegrass with resistance to multiple herbicides (glyphosate, paraquat, clethodim, atrazine and amitrole) found no apparent connection between the genetic bases of resistances to various chemicals.

Looking at how resistance moves across the landscape, the research has shown that fence lines, crop margins, channels, drains and road sides are particular problem areas. Trials of fence line weed control methods for glyphosate-resistant ryegrass were conducted in New South Wales, South Australia and Western Australia and identified several effective herbicide mixtures and sequences. Mixtures of paraquat or glufosinate with bromacil were shown to be very effective, and a commercial distributor consequently registered bromacil for this use.

Growers and advisers were able to observe the fence line trials at demonstration days, and project findings were extended to growers and advisers through a range of workshops and publications. The Ryegrass Integrated Management decision support tool has been updated with new functions, including scenarios to assist growers and advisers to explore alternative management strategies for herbicide-resistant weeds.



Annual ryegrass seedlings are used in research by the Australian Herbicide Resistance Initiative in Perth. Photo: Evan Collis

Crown rot in cereals

Crown rot, a fungal disease that affects all cereal crops, can cause yield losses of up to 90 percent in durum wheat and 50 percent in bread wheat or barley. Crown rot has been a major limiting factor in winter cereal production in northern New South Wales, Queensland, South Australia and Victoria for many years; recently it has also emerged as a concern in southern New South Wales and Western Australia.

Although considerable work has been done to identify genetic solutions and management strategies for crown rot, there are large differences in the levels of awareness and availability of locally relevant management information around Australia. To more effectively assist the grains industry to reduce yield and quality losses from the disease, the GRDC is investing in a national program to investigate the epidemiology and management of crown rot and develop proven management strategies tailored for each region.

Crop rotation is currently the most effective management option for crown rot, because a grass-free break from winter cereals is the best way to lower fungus inoculum levels. The program is collecting samples of the various *Fusarium* species that cause crown rot in each region and testing their pathogenicity. Information gathered in this process will be used to refine PreDicta B soil sampling calibrations, to assist growers and advisers to make informed crop rotation choices to reduce crown rot risk.

Thanks in part to the work of the GRDC-supported Crown Rot Initiative, wheat, durum wheat and barley varieties with improved resistance to and/or tolerance of crown rot are becoming available. The program is conducting trials to assess the potential of variety selection to minimise losses in combination with other current and potential management strategies, such as crop rotations, fungicide application, inter-row sowing and stubble management. Trials are being conducted in New South Wales, Queensland, Victoria, South Australia and Western Australia, with input from grower groups.



The national program also has a strong focus on training and supporting growers and advisers in each GRDC region to correctly identify and manage crown rot risk, based on regionally proven management strategies. This includes providing up-to-date guidance such as the revised fact sheets on crown rot that were published for each region as part of the GRDC's GrowNotes Tips and Tactics series in 2016. The latest information is also being shared with growers and advisers through GRDC updates, field days and online materials.



A wheat crop affected by crown rot shows the white heads of diseased plants in contrast to the green heads of healthy plants.
Photo: GRDC

Table 6: Theme 3 performance against Annual Operational Plan 2015–16 measures

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcomes:		
Effective, sustainable and efficient management of weeds		
Effective, sustainable and efficient management of vertebrate and invertebrate pests		
Effective, sustainable and efficient management of cereal rusts		
Effective, sustainable and efficient management of cereal (non-rust), pulse and oilseed fungal pathogens		
Effective, sustainable and efficient management of nematodes		
Effective, sustainable and efficient management of viruses and bacteria		
A greater proportion of growers and their advisers monitor crops for pests, weeds and diseases.	New weed incursions (including herbicide-resistant populations) are identified early and managed as contained populations.	Achieved. No new exotic incursions were recorded in grain-growing areas. New resistant populations were identified and are under management in ryegrass (70), feathertop Rhodes grass (6), barnyard grass (6) and fleabane (4).
	Uptake of non-herbicide tactics is increased by 50% in the Northern and Southern regions.	Achieved. The <i>Impact of Weeds on Australian Grain Production</i> report found that adoption of harvest weeds seed control techniques has increased by 62% across the two regions.
Breeders and pre-breeders use available genetic diversity for resistance and tolerance breeding.	Centre for Crop and Disease Management (CCDM) programs are fully operational, providing markers and germplasm to breeders and identifying changes in rust susceptibility to fungicides.	Achieved. The CCDM is progressing the development of markers for various forms of blotch, ascochyta blight and sclerotinia.

Table 6: Theme 3 performance against Annual Operational Plan 2015–16 measures (continued)

PRACTICE CHANGE	TARGET	RESULT
Growers and their advisers cost-effectively manage pests, weeds and diseases.	Growers and advisers know the costs of weeds in their cropping systems and enact appropriate management tactics to manage weeds and, in particular, herbicide resistance.	Achieved. The GRDC published <i>Impact of Weeds on Australian Grain Production: The cost of weeds to Australian grain growers and the adoption of weed management and tillage practices</i> .
	Training in disease management, integrated weed management and integrated pest management leads to greater adoption of diversified management tactics.	Achieved. Outcomes included a joint forum on fungicide and herbicide resistance held by the CCDM and the Australian Herbicide Resistance Initiative, and insect pest management training and integrated disease management workshops in all regions.
A greater proportion of growers and their advisers use practices to increase pesticide longevity and reduce the risk of resistance.	High-throughput tests are developed for assessing fungicide resistance in foliar pathogens.	Achieved. The CCDM produced high-throughput tests for resistance in powdery mildew in wheat and barley, and blackleg in canola. Baseline resistance levels were established for several other diseases.
	Growers are utilising a range of tactics and advice to implement stewardship that increases pesticide longevity.	Achieved. Grain Producers Australia launched <i>Growing Australian Grain: Safely managing risks with crop inputs and grain on farm</i> . The National Residue Survey showed 99.2% grains industry compliance with maximum residue levels.
Intermediate outcome: Biosecurity and pesticide stewardship		
A greater proportion of growers and their advisers use surveillance and biosecurity measures to manage and prepare for incursion and containment of exotic plant pests, plants and diseases.	New surveillance tools are developed, for local and regional deployment, to improve detection of exotic and established pathogens.	Achieved. Progress was made on developing new sampling techniques and high-throughput surveillance assessments for fungal spores. Key biosecurity materials were reviewed, including the Grains Industry Biosecurity Plan.
Breeders and pre-breeders use available genetic diversity to deliver varieties resistant to high-risk biosecurity threats.	Economic returns of pre-breeding as a pre-emptive tool to manage potential biosecurity incursions are assessed.	Achieved. The Plant Biosecurity Cooperative Research Centre published findings on economic analyses of gene deployment strategies for high-priority exotic pests.
A greater proportion of growers and their advisers manage stewardship of pesticides and varieties to prolong pesticide effectiveness and ensure safety to health and the environment.	Stewardship of pesticides is underpinned by base documents on minimum legal requirements.	Achieved. An insecticide-resistance management plan for redlegged earth mite was published. Work commenced to evaluate a spray application inversion model across agroecological regions.
	Growers have additional tools for managing their spraying operations.	Achieved. The University of Queensland launched the Australian Ground Spray Calculator, a decision support tool that provides information on droplet size, target coverage and drift potential.



Case study—Cutting the costs of crop weeds

Weeds represent some of the largest costs and greatest management challenges to Australian cropping systems. To better understand how R&D can help to remove those barriers to grower profit, the GRDC commissioned the most comprehensive study of the impact of weeds on Australian grain production ever conducted.

Primary data for the study came from interviews with 600 grain growers, who collectively represented approximately two million hectares of cropping land across the 13 major agroecological zones of Australia. The data analysis covers the major crop types of wheat, barley, oats, canola, pulses and sorghum.

The analysis shows that:

- Weeds are costing Australian grain growers approximately \$146 per hectare—\$113 spent on weed control (herbicide and non-herbicide practices) and \$33 foregone in yield losses.
- The overall cost of weeds to growers is around \$3,318 million.
- The overall yield losses caused by weeds amount to around 2.76 million tonnes of grain.

The study breaks down the costs of yield losses due to in-crop and fallow weeds, grain contamination costs and the costs of herbicide and non-herbicide weed control practices. In terms of total yield loss, the most costly crops are ryegrass, wild radish, wild oats and brome grass. Ryegrass is also the major weed in terms of the cost of herbicide resistance, by a wide margin.

The study also examines growers' weed management practices and their perceptions and expectations of current and possible weed management options.

The full report, *Impact of Weeds on Australian Grain Production*, March 2016, is available through the GRDC website.

The GRDC has adopted a multifaceted approach to tackling the challenges of weeds, which includes:

- a longstanding commitment to the Australian Herbicide Resistance Initiative, to enhance understanding of the mechanisms and evolution of herbicide resistance
- a major international collaboration with the Crop Science Division of Bayer, through the Herbicide Innovation Partnership, to accelerate the discovery of solutions to herbicide resistance
- cooperation with governments, agrochemical companies and agribusiness, through the WeedSmart program, to enhance on-farm practices and promote the long-term sustainability of herbicide use
- support for a range of projects to understand the spread and effects of weeds, reduce risk of herbicide resistance and improve and promote integrated weed management, in each grain-growing region.

The new study's up-to-date data will strengthen that approach and help the GRDC to ensure that its weed management investments precisely target the R&D that delivers the greatest benefits to grain growers.



GRDC General Manager Crop Protection Ken Young attends the launch of *Impact of Weeds on Australian Grain Production* with the report's principal author, Rick Llewellyn. Photo: Nicole Baxter

Theme 4—Advancing profitable farming systems

This theme aims to provide growers and their advisers with the tools to design and manage a farming system with the flexibility to adapt and respond; manage risk; and generate profit.

The 'Advancing profitable farming systems' theme:

- ensures that research results from the other themes are integrated on farm
- undertakes production agronomy research for systems development
- provides an important conduit for identifying on-farm production constraints and opportunities to inform activities in other themes.

The investment strategies for this theme differ across agroecological zones and farming systems, and are a combination of:

- applied farming systems research to overcome major, widespread regional constraints
- short-term development and extension activities to improve technologies or practices for a target group of growers in an agroecological zone.

Aspirational outcome

Australian grain growers managing farming systems that are able to respond and adapt to changing environmental and market conditions to reduce risk and deliver an increase in profitability.

Investment in 2015–16

\$35.46 million

The following sections describe some highlights of Theme 4 RD&E during the year. Table 7 details the theme's performance against strategic measures; portfolio performance measures are addressed in Table 3.

Projects in the pipeline for 2016–17

- Research on crop nutrition, including
 - nutrient response curves
 - managing legume and fertiliser nitrogen
 - incorporating lime
 - variable rate technology.
- Research on soil moisture, including management of non-wetting soils and novel techniques to utilise available moisture.
- Review and demonstration of improved rotations and break crops for Western Australian growers.



Cereals in the Northern Region

Yields of cereal crops in the Northern Region often fall well short of their water-limited potential—for wheat, the average yield gap is around two tonnes per hectare. The GRDC has invested in a project to assist cereal growers and their advisers to set and achieve appropriate yield targets for their soil types and preferred varieties.

The project is investigating scope to increase yield through agronomic factors, based on field trials of wheat and sorghum conducted in the north and the central west of New South Wales. Drawing on previous research and the experiences of local growers, the trials are examining the yield effects of six key factors: time of sowing, hybrid selection, row spacing, plant population, nitrogen management and phosphorus management.

As well as confirming the potential to improve yields, the project is clarifying the importance of individual factors and their interactions. For example, preliminary results indicate that:

- Sorghum production can be lifted significantly by managing nitrogen inputs—an increase of two tonnes per hectare was achieved in one trial under dryland conditions. Smaller gains can be made by sowing earlier.
- In wheat production, sowing time and crown rot management have the largest effects on yield.
- Hybrid selection has relatively little impact on sorghum yield.

In 2016–17, the results of three years of sorghum trials and two years of wheat trials will be collated and analysed across the sites and seasons. The differences between current actual and potential achievable yields will be quantified, and key management drivers to close the yield gap will be documented.

Hundreds of growers and advisers have followed the progress of the trials through field walks, GRDC updates and other presentations. The results will also be made available to stakeholders through GRDC factsheets and other publications.



A trial site for sorghum production on the Liverpool Plains, New South Wales. Photo: Loretta Serafin, New South Wales Department of Primary Industries

Canola in the high-rainfall zone

Over the past 20 years, annual crop production has increased nearly twofold for wheat and nearly tenfold for canola in the high-rainfall zone of southern Australia. Research indicates that yields in this zone could be increased much further.

The GRDC is investing in a project to assist wheat and canola growers in high-rainfall areas of the Southern and Western regions to increase both yields and profitability through improved variety selection and crop management.

The project will:

- identify germplasm that is better adapted to the high-rainfall zone, by investigating plant physiological traits that increase yield potential and examining interactions between genotype, environment and management practices
- develop tools to help growers and other stakeholders understand the risks and opportunities associated with applying inputs such as fertiliser to crops with high yield potential
- produce best practice guidelines to assist growers to match inputs more precisely to crop requirements, to improve productivity and reduce the costs and off-site impacts of underutilised inputs.

Field trials to examine how certain traits respond to high-rainfall conditions are underway in both wheat and canola, using commercial varieties and lines provided by CSIRO and breeding companies.

Experiments have been conducted to test how nutrients interact and crops respond when key nutrients are omitted. The results have been used to develop a crop simulation model which quantifies yield response to different levels of nitrogen based on levels of soil sulphur, phosphorus and potassium. The model will be integrated with the diagnostic tool CropPro, to assist growers to predict the economic benefits of applying nitrogen to their crops under given soil nutrient and seasonal conditions.

Results of the project are being made available to growers and advisers through field walks, field days and workshops, as well as articles in *Ground Cover* and other publications.



Canola trials at the managed environment facility at Hamilton, Victoria. Photo: Penny Riffkin, Victorian Department of Economic Development, Jobs, Transport and Resources

Management options for frost

Frost is one of the most significant risks to Australian cereal production and even minor reductions in its effects can significantly improve returns for growers. The GRDC is investing in research to investigate potential crop management options to reduce the impact of frost events.

Farming systems

The GRDC is supporting a project to evaluate the effects on frost of a range of management practices and products, based on extensive field trials across multiple agroecological zones.

Among the key results so far, the trials have demonstrated that:

- Retaining stubble increases the severity and duration of frost, but the amount of stubble required to significantly increase risk is proportional to the yield potential of the cropping environment. Reducing stubble may not reduce frost risk in high-production environments (over five tonnes per hectare), but can significantly increase yields in low-production and medium-production environments.
- Soil amelioration can change the severity and duration of frost events, depending on the changes to the soil surface. Bringing up gravel or reducing non-wetting effects reduces frost, while bringing up a whiter subsoil reduces the ability of soil to absorb heat and thus increases frost. However, trials of specific techniques such as spading and mouldboarding have been inconclusive because of inconsistencies in crop establishment.
- Grazing works to reduce frost risk, by decreasing biomass and compacting soil, and by causing the crop to flower later. Plant growth regulators can also delay flowering, but initial results indicate that the main commercial plant growth regulator actually increases frost damage, so further work is needed.
- By creating a thin crop canopy, conservative seeding and nitrogen fertiliser application rates can reduced both reproductive and stem frost damage.

Five registered and 17 experimental products for reducing frost damage are also being evaluated. So far, four products have been shown to reduce frost damage, while two others have been shown to increase it.



Researchers Richard Bell and Qifu Ma examine a wheat crop at the National Frost Initiative trial site at Aldersyde, Western Australia. Photo: Sue Knights



Nutrient management

In frost-prone areas of Western Australia, low levels of soil nutrients are often combined with adverse environmental conditions (such as dry topsoils) which limit nutrient uptake at the stages when crops are most vulnerable to frost damage.

While it is known that potassium plays a role in protecting crops against frost damage, the roles played by trace elements—such as boron, copper, magnesium, manganese, molybdenum and zinc—are less well understood. It is possible that an adequate supply of a range of nutrients may enhance crop resistance to frost damage through physiological mechanisms such as photosynthesis, production of antioxidant enzymes, tissue hydration, membrane stability and pollen development.

The GRDC is supporting research to establish whether improving crop nutrition can significantly improve frost resistance, based on field trials of wheat and canola in Western Australia.

The project is investigating various combinations of varieties, sowing times and methods of nutrient application, including deep placement in the soil and foliar application. A cocktail of nutrients is applied at levels designed to elevate concentrations of each nutrient in the reproductive parts of the plant during early pollen development and grain filling.

The first round of trials, in 2015, produced strong evidence that crop nutrient management has potential to decrease frost damage. In particular, the trials showed that:

- applications of potassium can reduce the incidence of frost-induced sterility in wheat and the level of pod abortion when exposed to frost in canola
- although applications of trace elements in addition to potassium did not alter the incidence of frost-induced sterility in wheat, they further decreased pod abortion in canola.

In 2016, further trials are being conducted to confirm whether the initial results can be repeated at another site and in another season.

Table 7: Theme 4 performance against Annual Operational Plan 2015–16 measures

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcome: Knowing what is important (key business drivers)		
Information is available in each GRDC agroecological zone about the main opportunities, constraints, and risks to farming systems.	A business case assessing the potential to add value to research and management data through the use of georeferencing technology is developed.	Not achieved. The project to develop the business case was not contracted because no suitable tender was submitted.
Data is also available in each zone about how whole-farm and farming system decisions affect those opportunities, constraints and risks.		
Better methods and tools are developed for comparison and ranking of the impacts of opportunities and risks on farm profit and sustainability, both short and long term.	A report details a timetable and plan (including budget, methodology and capacity) for the redevelopment of the MIDAS model (Model of Integrated Dryland Agricultural Systems) in the Western Region.	Achieved. The report found that growers need access to a whole-farm economic modelling platform, based on credible biophysical information.
A greater proportion of growers and their advisers use information and tools to identify and rank constraints and opportunities to increase profit.		

Table 7: Theme 4 performance against Annual Operational Plan 2015–16 measures (continued)

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcome: Planning strategically (building system benefits and rotations)		
A greater proportion of growers and their advisers are aware of the actual and potential impacts of their management on their farming systems across seasons and across the farm, based on regionally validated data as well as their own records.	A survey is conducted to better understand grower and adviser attitudes to the adoption of break crop research outcomes. The survey report analyses the relative importance of attitudes by agroecological zone and recommends strategies, priorities and objectives for future RD&E to address impediments to and opportunities for greater adoption.	Achieved. The survey identified considerable differences between agroecological zones.
Growers implement long-term, strategic plans to take advantage of identified opportunities, manage constraints and reduce risks, while retaining flexibility to respond to unforeseen events.	A scoping study is conducted to benchmark the agronomic efficiency of applied nitrogen, phosphorus, potassium and sulphur (in terms of kilogram of increased yield per kilogram of nutrient applied), at the farm, regional, agroecological zone and national levels.	Achieved. The study found that the grains industry overall had negative nitrogen and potassium balances—more nutrient was removed in grain than was added in fertiliser—while the phosphorus balance was positive.
Effective management practices for opportunities, constraints and risks are developed, validated and demonstrated in each agroecological zone.	A scoping study is conducted to describe the relationship between the availability of nutrients (particularly nitrogen) and the status of soil organic matter in soils, and how that relationship differs between agroecological zones, soil types and seasons.	Achieved. The study found significant knowledge gaps in several areas.
Intermediate outcome: Responding tactically (individual crop agronomy)		
An increased proportion of growers use crop-specific best management practices to optimise their tactical (within season) agronomy for each individual crop.	A series of ‘fast track’ projects are implemented in each region to address key tactical issues raised at the Regional Cropping Solutions network and grower group level.	Achieved. Thirty-nine fast track projects targeting priority regional issues identified by growers were implemented.
Growers use improved strategies to cost-effectively acquire crop inputs.	Regional Cropping Solutions networks in the Western Region are facilitated and coordinated, to help address local RD&E issues restricting the profitability of grain growers in the region.	Achieved. Twenty-eight fast track projects were funded to address local, seasonal, tactical issues.



Case study—Mapping and managing stored soil water

In Australian cropping environments, plant available water capacity is often the main factor determining yields. Increasing seasonal variability in rainfall has highlighted the importance of stored soil water to Australian grains production in recent years.

With support from the GRDC, a range of options have been developed to assist growers to manage the production and financial risks associated with soil water. New ways of measuring and monitoring soil water have been investigated and promoted, and training programs have been delivered to more than 1,000 growers and advisers.

The soil water characteristics of more than 900 Australian soils have been measured and incorporated into the APSoil database, which underpins decision support tools such as APSIM (the Agricultural Production Systems simulator), Yield Prophet and SoilMapp.

These resources are now used as the basis for crop management decisions around Australia, and there is strong demand for more knowledge and extension. The GRDC is supporting a project to meet that demand across the three grain-growing regions.

Working with growers and advisers, the project:

- provides advanced training and mentoring in the use of soil water in crop management decision making
- identifies soil characteristics in areas that have not previously been measured

- characterises soils and measures plant available water capacity
- improves understanding of factors that influence plant available water capacity in particular locations, including landscape factors as well as soil structure and chemistry
- develops new and revised protocols for measuring plant available water capacity.

Training and follow-up workshops have been conducted for industry groups in all regions. The groups have explored the use of soil information from a range of online data and diagnostic tools, including state government services and the Soil Water Express component of APSIM.

More than 250 new soil characterisations have been prepared for addition to APSoil. The methodology for characterising plant available water capacity has been enhanced, with new protocols for duplex soils and gravelly soils, as well as practical tips and tricks, and documentation requirements that will enhance the ability to extrapolate from APSoil sites to other locations.

Around 22 percent of Australia's rain-fed cropping area is currently monitored for soil water. The GRDC project aims to increase that area to 40 percent. Such an increase would mean significant yield benefits for growers, through better matching of inputs to soil water. It would also support the long-term profitability and sustainability of cropping enterprises.



Growers and advisers study the effects of soil density on plant available water capacity at a demonstration site at Lockhart, New South Wales. Photo: Kirsten Verburg, CSIRO

Theme 5—Improving your farm resource base

This theme is focused on protecting and enhancing the farm’s soil, water, habitat and atmospheric resources to maintain production performance under a variable climate and to demonstrate to consumers and the wider community the sustainable nature of Australian grains production.

Australian grain growers operate in a variable climate and will be significantly affected by climate change. In addition, growers will need to react to Australian Government and international policies, programs and market expectations set in response to climate change—for example, in relation to greenhouse gas emissions.

These impacts need to be understood so that the industry can minimise risk and maximise opportunities. The issues of climate variability and change need to be factored into both seasonal and longer term farm business decisions.

Within the context of a changing climate, soil, water, habitat and atmospheric resources need to be improved across the environment in which the industry operates. Soil carbon is declining in many grains catchments, as is soil pH. Although water consumption by agriculture is being reduced and becoming more efficient, water quality in some key catchments requires further management. Native vegetation communities have become highly fragmented, affecting both biodiversity balance and the potential for exploitation as habitat for beneficial organisms.

In addition, as consumers are becoming more interested in how the food they buy is produced, the grains industry needs to be able to communicate its commitment to good stewardship. The ‘Improving your farm resource base’ theme will assist growers, across the industry and as individual producers, to demonstrate that they are using chemicals and fertiliser wisely and caring for the land.

Aspirational outcome

Grain growers valued for adopting practices that improve regional habitat, soil, water and atmosphere resources in a changing climate.

Investment in 2015–16

\$16.37 million

The following sections describe some highlights of Theme 5 RD&E during the year. Table 8 details the theme’s performance against strategic measures; portfolio performance measures are addressed in Table 3.

Projects in the pipeline for 2016–17

- In the Southern Region, work on:
 - increasing production on sandy soils in low- and medium-rainfall areas
 - understanding how applying amendments to subsoils ameliorates subsoil constraints.
- In the Western Region, work on:
 - overcoming constraints to profitable cropping on forest gravel soils
 - increasing water use efficiency, grain yield and profitability in no-till systems.
- Development of innovative approaches to managing subsoil acidity in the Southern and Western regions.



Greenhouse gas emissions

Demand for reliable measures of the environmental impacts of food production is growing among consumers and policymakers in Australia and overseas. The GRDC is investing in a project to benchmark the net amounts of greenhouse gas emissions from grain production systems in Australia and identify opportunities for improvement.

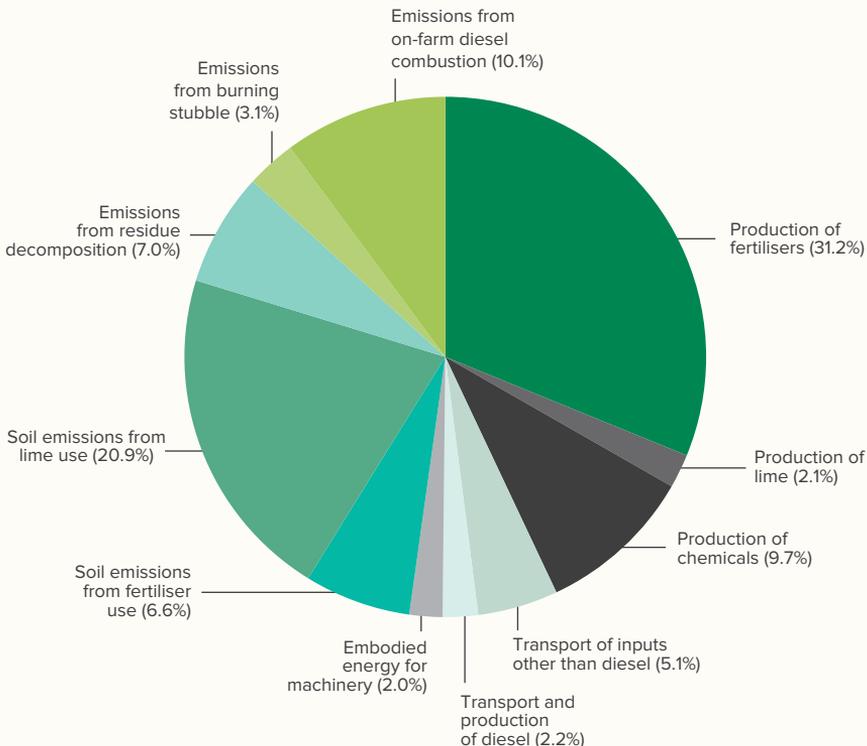
Life cycle assessment is a standardised international framework used to compare the environmental impacts of production systems. The GRDC-supported project is developing life cycle assessment models for major cropping systems in each of the 17 agroecological zones defined by the GRDC, as well as soil function indicators to inform the models.

Databases are being collated to assist the researchers in validating procedures to collect data and developing tools to streamline the construction of inventory and mitigation models. In 2015–16, data was collected in the New South Wales–Victorian Slopes zone, which covers the cropping areas of south-eastern New South Wales and north-eastern Victoria.

Preliminary analyses indicate that the average amounts of carbon dioxide equivalent emissions were 192 kilograms per tonne for wheat, 587 kilograms per tonne for canola and 183 kilograms per tonne for lupins. Analysis of the sources of those emissions found that the major contributors were fertiliser manufacture and soil emissions from lime use, which collectively represented more than half the total emissions for wheat.

The investigation of mitigation strategies suggested that replacing a wheat–wheat rotation with a legume–wheat rotation (while assuming that the displaced wheat production is compensated for by intensification of wheat production in other regions of Australia) would reduce the net emissions intensity of the zone by 14 kilograms of carbon dioxide equivalents per tonne of wheat. Modelling also suggests that more regular applications of lime will result in a 10 percent increase in yield, which offsets increases in emissions due to the increased lime use, so that the overall level of emissions per tonne of wheat produced is reduced.

Sources of carbon dioxide equivalent emissions in the production of 1 tonne of wheat in the New South Wales–Victorian Slopes zone



Subsoil acidity

The national State of the Environment Report for 2011 recognised that soil acidity affects about half of Australia's agriculturally productive soils and costs Australian agriculture more than \$1.5 billion in lost productivity each year.

Acidity in the topsoil is one of the few soil constraints for which there is a profitable solution—the application of lime. However, lime moves slowly into the subsoil, so treatment of subsurface acidity requires a more direct and aggressive approach. Two GRDC-funded projects are working on innovative methodologies to effectively and economically manage subsurface acidity.

In 2015–16, a GRDC-supported project in the Western Region conducted a glasshouse experiment to assay 13 commercially available products for their potential to ameliorate the effects of subsoil acidity in a moderately acidic topsoil (with pH of 4.9) over a highly acidic subsoil (with pH of 4.0). The products included refined and liquid limes, liquid calcium solutions, gypsum, diatomaceous earths, humates and fulvates, and biochars.

After 34 days, lime–sand, dolomite, and wheat–mallee biochar each increased the pH of the subsoil soil while gypsum decreased it. All other treatments had no effect on subsoil pH even at high rates of application. The length of wheat roots in the subsoil was increased at high rates of application of biochars, lime–sand and dolomite only.

Similar glasshouse and laboratory experiments were conducted by a GRDC-supported project in the Southern Region, which showed that poultry litter, poultry manure biochar, mature dairy compost, biosolids and sheep manure can each be used to ameliorate subsoil acidity. However, in every case the changes in pH and aluminium levels were relatively small compared to the effects of lime or dolomite. There was no response to gypsum.

Both projects will take the most promising products into the field for evaluation during 2016.



Researchers Kerry Schirmer and Andrew Price analyse soil samples in a glasshouse experiment. Photo: Guangdi Li, New South Wales Department of Primary Industries

Water repellency on sandy soils

Water repellency develops on sandy soils when soil particles become coated with waxy compounds from the breakdown of organic matter, which delays the infiltration of water into the soil. This causes poor crop establishment; reduces the uptake of water and nutrients, growth and yield; impairs weed management; and makes the soils highly vulnerable to erosion.

Over the past six years, several GRDC-funded projects have investigated ways to overcome water repellency in Western Australia, where around ten million hectares of agricultural soils are affected, and South Australia, where around two million hectares are affected.

Field research and on-farm demonstrations have been conducted to investigate:

- low-cost and short-term mitigation options to manage water repellency during cropping, such as improved furrow sowing with winged points or paired rows, banded or blanket application of wetting agents, on-row seeding, and zero-till with full stubble retention
- high-cost and long-term amelioration options that change the inherent properties of water-repellent soils, such as use of mouldboard plows, rotary spaders or one-way disc plows, and clay delving or spreading.

The mitigation options typically produced yield increases of 5 percent to 15 percent which generally did not persist beyond the cropping season, although sometimes seasonal and agronomic factors meant that little yield benefit was recorded.



In contrast, the amelioration options gave large and long-lasting responses, often producing 20 percent to 40 percent increases in yield lasting five or more years.

The principal advantage of the mitigation options is that they are low cost, which means that growers can afford to use them over large areas. In comparison, the amelioration options are expensive and typically can only be applied to relatively small areas each year.

A whole-farm economic analysis for farms with significant areas affected by soil water repellence (typically, more than 20 percent) demonstrated that returns were optimised when a low-cost mitigation strategy was implemented in conjunction with a progressive amelioration program over time.



A heavy duty multi-spreader applies a clay-rich subsoil over a water-repellent sand in a field trial near Moora, Western Australia. Photo: Stephen Davies, Western Australian Department of Agriculture and Food

Controlled traffic farming

Controlled traffic farming involves using permanent wheel tracks within paddocks, so that areas of crop production and traffic lanes for machinery are separated. This reduces the effects on the crop of soil compaction caused by machinery; wasteful overlaps in seed, fertiliser and chemical applications; chances of getting bogged in wet conditions; fuel costs; and operator fatigue.

The adoption of controlled traffic farming has been slow in low-rainfall cropping zones compared to other areas in Australia. The GRDC is supporting a project to quantify the benefits and costs of controlled traffic farming in the low-rainfall zones and determine whether grower scepticism is justified.

In 2015, field experiments were established in wheat crops at two sites in South Australia and one each in New South Wales and Victoria. Treatments included:

- a control with no heavy vehicle traffic
- one pass of a 30-tonne vehicle before seeding with dry soil
- one pass of a 30-tonne vehicle before seeding with moist soil
- three passes of a 30-tonne vehicle before seeding with moist soil
- deep ripping to loosen any historical compaction.

Preliminary data showed that multiple passes on wet soils decreased yield. On a heavy red soil all trafficking treatments decreased yields, while on lighter soils a single pass under dry conditions had no effect. The trials will be continued for another three years to examine the longevity of these effects.

The trials will be complemented by development sites investigating issues identified as priorities by local grower groups, such as:

- ways to reduce compaction through self-repair or amelioration practices
- the machinery power and fuel savings achievable through controlled traffic farming
- the timeliness and uniformity of chemical and fertiliser applications using controlled traffic farming.

The combination of R&D and strong engagement with growers is identifying the main barriers to adoption of controlled traffic farming in low-rainfall zones.



A deep-ripping treatment is applied in a controlled traffic experiment at the Minnipa Agricultural Centre in South Australia. Photo: Nigel Wilhelm, South Australian Research and Development Institute

Table 8: Theme 5 performance against Annual Operational Plan 2015–16 measures

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcome: Understanding and adapting to climate variability		
Growers integrate weather data with other resource inputs to predict, plan and assess farm performance.	Growers factor into their long-term planning the potential effects of climate change.	Achieved. The Grower Survey showed that 66% of growers were adopting new or different management practices to actively manage climate variability.
Growers use improved seasonal forecasts and tools to manage their farm business in response to climate variability.	A range of farming system options to respond to climate variability and change are developed and tested for each major grain-growing region.	Partially achieved. New mixed farming options that tolerate more variable climates were developed and practices to reduce nitrous oxide emissions were devised and extended to growers.
Growers seek information about the possible impacts of long-term climate changes on crop growth patterns and adopt enterprise and crop decisions and agronomic practices required to optimise profit and manage risk.	Increased number of growers use seasonal forecasts, local climate data and decision tools to help predict and plan likely crop and farming system performance, and in their tactical (seasonal) decisions.	Achieved. The Grower Survey showed that 53% of growers considered the potential effects of climate change when making long-term decisions.
Growers seek information about potential mitigation strategies to reduce on-farm greenhouse gas emissions, and adopt them where feasible.	Increased number of growers are aware of their farms' greenhouse gas emissions profiles and are adopting appropriate mitigation strategies.	Partially achieved. Progress was made on increasing awareness of emissions and impacts of elevated carbon dioxide and determining mitigation strategies.
Researchers incorporate farm-scale data in the improvement of climate and weather modelling.	On-farm weather data is provided to the Bureau of Meteorology, especially in Western Australia.	Achieved. As part of the Managing Climate Variability program, farmers interacted with researchers to improve climate research and forecasting. On-farm data was used to improve modelling.
Intermediate outcome: Improving soil health		
Growers adopt agronomic practices that improve the chemical, physical and biological health of the soil for sustained productivity.	Increased number of growers regularly measure the health (productive capacity) of their soils and incorporate the information into their land use and cropping decisions.	Achieved. The Farm Practices Survey showed that between 2008 and 2014 the proportion of the cropped area: <ul style="list-style-type: none"> • where fertiliser decisions were informed by soil testing increased from 50% to 68% • where lime was applied to correct soil acidity increased from less than 5% to 22%.
Growers understand and manage the impact of farming practices on soil health in order to maintain or increase productive potential.		
Growers increase the extent and quality of ground cover to improve soil health and minimise loss.	Growers are aware of and are adopting management practices that will maintain and improve their soils' productive capacity and minimise losses due to erosion.	Achieved. The Farm Practices Survey showed that: <ul style="list-style-type: none"> • 66% of growers had adopted zero- or no-till, while 81% used zero- or no-till or direct drill • stubble was retained on 45% of the cropped area, and burnt on less than 3% • controlled traffic farming increased to 21% of the cropped area.



Table 8: Theme 5 performance against Annual Operational Plan 2015–16 measures (continued)

PRACTICE CHANGE	TARGET	RESULT
Intermediate outcome: Managing water use on dryland and irrigated grain farms		
Growers manage water quantity and quality on farm to improve efficiency of water use.	Increased number of growers regularly measure soil moisture to set target yields and determine optimum levels of crop inputs (including irrigation water).	Achieved. The Farm Practices Survey showed that since 2008 the proportion of: <ul style="list-style-type: none"> growers measuring plant available moisture at planting increased from 9% to 57% crops where soil moisture was assessed during the cropping season increased from 7% to 34%.
Growers implement appropriate and efficient practices that minimise adverse impacts on surface and groundwater quality leaving the farm.	Increased number of growers assess groundwater levels to avoid the risks of waterlogging and salinity.	Achieved. The Grower Survey showed that the proportion of growers monitoring the depth to the water table has increased slightly from 22% in 2012 to 23%.
	Increased number of growers test the quality of water used on farm (including for stock or for spraying) and of water leaving the farm.	Partially achieved. Anecdotal evidence from research and extension providers indicated that increasing numbers of growers are testing farm water for stock and spraying quality.
Intermediate outcome: Understanding and valuing biodiversity		
Growers and their advisers recognise the potential benefits of biodiversity in the landscape to their farming systems.	Growers develop and adopt vegetation management plans for their farms to assist crop production (e.g. through maintaining beneficial insects or using windbreaks), or to access additional sources of farm income (e.g. from agroforestry or carbon farming).	Achieved. The Farm Practices Survey showed that 35% of farms have a plan for establishing or managing areas of vegetation (remnant native or newly established).
Growers understand the likely effects of alternative land use decisions based on sound data, and use this to make assessments of land capability and use.		
Growers integrate the management of vegetation with high biodiversity value to meet farm business objectives (e.g. managing frost, providing shelter, accessing emerging carbon markets, managing salinity, applying area-wide integrated pest management or maintaining lifestyle objectives/farm aesthetics).	Growers use vegetation plans to assist in identifying and conserving areas of native vegetation important for local or regional biodiversity, production benefits, or farm amenity.	Achieved. The Farm Practices Survey showed that 37% of growers feel that a vegetation plan can be an effective factor for their cropping systems, and is important for biodiversity and farm amenity.
Intermediate outcome: Communication of sustainable production methods		
Growers recognise themselves as sustainable food producers rather than bulk commodity producers.	Increased number of growers adopt quality assurance, environmental management systems or other stewardship approaches to assist them in meeting market requirements, enhance their recognition as producers of quality products, and meet community expectations of sustainable land use.	Achieved. The Farm Practices Survey showed that 17% of growers use a quality assurance or environmental assurance program, which they see as assisting them in accessing markets or receiving price premiums.
Growers communicate their responsible use of farm inputs and the natural resource base to the broader community.		
Growers understand, calculate and communicate the carbon and water footprint of the products they produce.	Growers are aware of and actively participate in catchment management plans and programs.	Partially achieved. Anecdotal evidence from research and extension providers indicated that increasing numbers of growers are participating in catchment management plans and programs.

Case study—Expanding options for mixed farming systems

In a successful mixed farming enterprise, grazing options that complement the dominant cropping system are integrated into the farm business to improve profitability, flexibility, resilience, risk management, resource use and environmental outcomes. Ideally, mixed cropping–livestock systems make efficient use of labour, machinery and farm infrastructure and, where possible, improve soil health and reduce the risk of soil erosion and dryland salinity.

Since 2008, the GRDC has been a funding partner in EverCrop—a series of projects exploring the use of perennial species to increase the adoption of mixed farming options. Led by CSIRO, EverCrop has established a multidisciplinary R&D approach that works with grain growers to develop new and more widely adoptable grazing options.

For example, EverCrop conducted 15 paired pasture–crop paddock evaluations in Queensland and northern New South Wales to monitor soil chemical, physical and biological fertility, plus weeds and diseases. This work addressed constraints to the adoption of true ley pasture phases in cropping systems in the Northern Region.

Other activities in New South Wales have included investigating spring sowing for pasture establishment and spatial arrangement of species in perennial-based mixed pastures, and hosting a perennial pasture and grains field site. Bioeconomic analysis has demonstrated the value of introducing perennial pastures into New South Wales farming systems and clearly highlighted the value of considering risk and farm business profitability when doing so.

In the low-rainfall zones of South Australia and Victoria, recent work has focused on identifying sowing windows for subtropical plant species, based on temperature and soil moisture, across a range of agroecological zones; measuring the feed quality of forage shrubs across soils; and partnering with agronomists and a seed company to extend on-farm trialling of summer-active grasses.

In Western Australia, field work has evaluated companion annual legumes in perennial pasture–cropping systems, while nutrient cycling in pasture–cropping systems is being analysed. Field trials are also being conducted to inform an analysis of the economic potential of the perennial legume *Tedera* for mixed farming systems. *Tedera* shows high levels of establishment, survival and productivity in low-rainfall environments.

Through a companion project, EverCrop Carbon Plus, field activities at Karoonda and Waikerie in South Australia and Moora in Western Australia were complemented by soil carbon experiments. The results did not show a significant economic benefit from carbon sequestration, but did increase understanding of carbon cycling and root growth in perennials.

EverCrop is also developing a tool to determine the performance benefits and trade-offs of the placement of trees and shrubs in a farming landscape. The results will improve the performance of grain-growing farms and provide environmental benefits.



A *Tedera* plant grows in an autumn trial at the Mallee Sustainable Farming site at Karoonda, South Australia.
Photo: Andrew Smith, CSIRO



Theme 6—Building skills and capacity

This theme is focused on generating leadership, innovation and education in the grains sector.

To compete and succeed internationally, the Australian grains industry needs a highly skilled and motivated workforce, including growers, advisers, researchers and managers. The industry has identified several critical challenges:

- the grains industry and farming are becoming increasingly complex, with many types and sources of information that growers need to make decisions
- the number of appropriately skilled researchers and advisers being trained to replace the current generation is inadequate—this is compounded by a large number of experienced people reaching retirement age
- agricultural careers are not traditionally attractive to potential candidates
- the grains industry lacks a whole-of-industry approach to building skills and capacity
- growers are time poor and face succession-planning changes
- the uptake of technology often requires substantial technical support.

Through the ‘Building skills and capacity’ theme, the GRDC has identified opportunities to focus its investment to address these challenges.

Aspirational outcome

A dynamic Australian grains industry with the skills and capacity to continuously innovate.

Investment in 2015–16

\$9.25 million

The following sections describe some highlights of Theme 6 RD&E during the year. Table 9 details the theme’s performance against strategic measures; portfolio performance measures are addressed in Table 3.

Projects in the pipeline for 2016–17

- Continued support for future industry leaders through programs such as Nuffield Australia Farming Scholarships.
- Scholarships for PhD programs in identified areas of industry need.
- Research partnerships and individual awards to strengthen skills capacity among mid- to senior-level researchers and academics.
- Support for growers and advisers undertaking study and professional development activities through the Grower and Adviser Development Program.



Extension Adoption Training and Support Program

The GRDC's Extension Adoption Training and Support Program was designed to help agronomists and extension personnel improve their knowledge of adoption and decision-making processes, presentation techniques, and skills in information transfer.

The 12-month program was offered to experienced advisers in the Southern Region, who took part in:

- a three-day workshop on the latest thinking in extension and adoption practices, followed up by webinars on related topics
- a three-day field tour to observe a range of innovative approaches to technology and extension
- a work-based project to apply learning in a practical situation
- mentoring of others to spread the learning they gained.

An independent impact assessment of the program was conducted in 2015, the final year of the program. The assessment was based on a survey of 25 former participants who collectively represented seven different agroecological zones.

Survey respondents reported that, as a result of the program:

- they had improved their grower communication strategies, the format and delivery of their information, and their presentation skills
- they had gained access to broader networks and a wider range of information, knowledge and tools—including technology, social media, and monitoring and evaluation methodologies—to assist them to engage with clients and address barriers to change
- they had improved their dialogue with growers, and embraced the importance of making time for discussion, valuing interactions, and listening and responding to feedback
- their grower clients were being influenced through access to a wider range of knowledge and improved delivery of key messages.

Overall, respondents felt that the program had reinforced and enhanced their existing client engagement skills while introducing new skills, systems and processes for learning and extension. They agreed that the program had helped to build capacity on many different levels, and said that they would recommend the program to their colleagues.

Regional research capacity

Regional R&D projects and local validation of research outputs are important factors in ensuring that improved information, practices and technology are adopted by growers and advisers. The GRDC is helping to build regional research capacity by supporting the targeted creation of new positions.

The GRDC and the Victorian Government are jointly funding a program that offers agronomy graduates 18-month placements in regional areas, during which the graduates develop their skills and networks while contributing to local research projects. The three graduates appointed in 2015–16 have generated information on issues including frost management, improved agronomic practices for pulses, potential cropping benefits of elevated carbon dioxide concentrations, carbon farming, and identification and management of field crop diseases. Up-to-date information has been communicated to growers, advisers and the wider community through a range of communication activities, including media releases, field days and events.

In Queensland, the GRDC has partnered with the Queensland Government to create 11 positions for scientists, over four years. Six researchers have been appointed: a cereal pathologist, at Warwick; a pulse entomologist, at Kingaroy; and a biometrician, an economist and two weed scientists, at Toowoomba. The remaining five positions will be located at Emerald, Goondiwindi or Toowoomba.

The GRDC and the New South Wales Government have partnered to create 14 research positions:

- In northern New South Wales, a pulse pathologist has been appointed at Tamworth and a crop nutritionist has been appointed at Narrabri. The remaining six positions will be filled over the next 12 months.



- In southern New South Wales, four scientists have been appointed at Wagga Wagga: a canola physiologist, a cereals physiologist, a nutrition agronomist and a weeds agronomist. The two remaining positions will be located at Yanco.

Tertiary education strategy

To remain sustainable and globally competitive, the Australian grains industry needs a workforce with high-level skills and knowledge across many areas, including R&D, production, marketing, communication and policy development. Tertiary education—including vocational education and training, and university training at the undergraduate and postgraduate levels—plays a vital role in maintaining that workforce.

The GRDC is taking a strategic approach to ensure that Australia’s tertiary education sector provides opportunities that attract high-quality students into grains-related disciplines, connect to careers in grains, and address the skills needs of the industry.

The Grains Industry Tertiary Education Strategy was developed by an independent education specialist and adopted by the GRDC in 2016. The strategy identifies key issues to be addressed in relation to:

- increasing industry involvement in tertiary education, to assist students to make educational choices that lead to careers in grains, to enhance the educational offerings, and to match educational outcomes to grains industry activities and objectives
- providing funding for scholarships and bursaries that are tailored to attract high-quality students and support high-value research
- integrating tertiary education with the wider world of grains research and extension, including through accreditation and professional development opportunities for agronomists and other industry personnel.

The strategy makes detailed recommendations on potential investments, based on achieving long-term outcomes and maximising interaction and cooperation between tertiary education providers and the grains industry. Where possible, co-investment with government, education providers, industry organisations and agribusiness will be sought to add value to the GRDC’s commitment.

Grains Industry Research Scholarships

The GRDC offers research scholarships to encourage postgraduate training in disciplines that contribute to the RD&E priorities of the GRDC and the Australian grains industry. The scholarships are awarded on the basis of the applicant’s academic excellence, the topic of the proposed research and the likelihood that the applicant will stay involved in the grains industry.

The GRDC particularly encourages research in disciplines and subject areas that have been identified as having current and future capability gaps, based on audits undertaken by a range of organisations and confirmed through the *Grains Industry National Research, Development and Extension Strategy*.

In 2015–16, the GRDC supported 63 PhD scholars working across a range of subject areas, such as grain quality, grain storage, crop nutrition, variety improvement, pests, herbicide resistance, fungal diseases, extreme weather events, soil testing, cropping systems, science communication and adult education.



Aaron Preston investigates new technologies for testing herbicide resistance in weeds as part of his GRDC-supported PhD research.
Photo: Nicole Baxter

Nuffield Australia Farming Scholarships

The Nuffield Australia Farming Scholarships program gives Australian primary producers the opportunity to travel overseas to study research topics relevant to their farming operations.

As well as increasing practical farming knowledge and management techniques, the scholarships provide a better understanding of the forces shaping international trade policy and consumer sentiment, and technological advances being made overseas.

The GRDC supported scholarships for four grain growers—two from the Southern Region and one each from the Northern and Western regions—in 2015–16.

GRDC NUFFIELD SCHOLARS



James Dempster, from Mingenew in Western Australia, will study the potential for medium-sized, family-owned farms to expand their enterprises by integrating parts of the supply chain.

Angus Duddy, from Quirindi in New South Wales, will investigate how agriculture and mining coexist and whether water and energy outputs from mining can benefit agricultural production.

John Stevenson, from Lockhart in New South Wales, will investigate ways to boost productivity in dryland cropping systems through the plant available water capacity of soils.

Randall Wilksch, from Yeelanna in South Australia, will study broad scale spraying systems used in grains production, and ways to advocate for agriculture through social media.

Photos: Nuffield Australia



Table 9: Theme 6 performance against Annual Operational Plan 2015–16 measures

PRACTICE CHANGE	TARGET	RESULTS
Intermediate outcome: Grains industry leadership and communication		
An increased number of industry participants are engaged in regional and national leadership roles in the Australian grains industry.	Leadership positions within the grains industry can be filled with minimal delay by candidates who have the skills, knowledge and experience required.	Achieved. Investments included support for participants in Nuffield Australia Farming Scholarships, the Australian Rural Leadership Program and the Resilient Grain Leaders Program.
The grains industry communicates information about potential career opportunities to secondary and tertiary students and their parents and career advisers.	The GRDC invests in projects, targeted at students, that promote careers in the grains industry.	Achieved. Projects included the: <ul style="list-style-type: none"> • GRDC agricultural training awards • CSIRO Plant Industry Summer Student Program • Seed to Store initiative • Art4Agriculture grains industry partnership • Careers Harvest website • development of the Grains Industry Tertiary Education Strategy.
The grains industry publicises how it benefits the wider community.	The GRDC publishes articles that promote the role and importance of the grains industry.	Achieved. A number of communication initiatives were implemented to increase the public profile of the contributions that GRDC R&D and grains R&D more generally make to innovation, industry competitiveness, regional growth and grower profitability.
Intermediate outcome: Capacity building in the extension sector		
The extension sector collates and publishes annually its skills requirements and identifies gaps and potential gaps in discipline areas.	The extension sector regularly communicates its training requirements for skilled personnel, including any gaps in discipline areas.	Achieved. The GRDC regularly engaged with the National Agribusiness Reference Group and commissioned a comprehensive national study that identified gaps and extension sector needs.
Increased number of people enrol in targeted agriculture-related disciplines.	The GRDC invests in projects to support students undertaking agriculture-related study.	Achieved. Projects included 63 postgraduate scholarships, 17 undergraduate scholarships, and six Horizon scholarships for undergraduates.
Increased number of qualified graduates are employed in extension roles.	The grains industry has access to suitably qualified and experienced extension personnel.	Achieved. Over 3,900 extension personnel are active in the industry. The Resilient Grain Leaders and Extension Adoption Training and Support programs provided professional development for extension specialists.

Table 9: Theme 6 performance against Annual Operational Plan 2015–16 measures (continued)

PRACTICE CHANGE	TARGET	RESULTS
Increased number of graduates and other extension staff undertake postgraduate/workplace training.	Increased number of undergraduates successfully complete agriculture-related courses.	Target not measured in 2015–16. Workplace training and professional development were provided through: <ul style="list-style-type: none"> research and farm business updates delivered to over 1,000 extension specialists learning opportunities supported for 162 participants in the Grower and Adviser Development Program.
Career pathways within the extension sector retain skilled and experienced personnel.	The proportion of people in the extension sector with relevant graduate and postgraduate qualifications is increasing.	Target not measured in 2015–16. A GRDC-funded project to develop a core body of knowledge in soil science contributed to an increase in the number of extension personnel accredited as soil scientists.
Intermediate outcome: Capacity building in the R&D sector		
The grains industry has a clear understanding of its skills requirements in the short, medium and long terms.	The GRDC, in collaboration with RD&E providers, regularly communicates its anticipated future requirements for skilled personnel.	Achieved. The GRDC identified target research areas for PhD scholarships offered within R&D projects.
Training providers address the grains industry research, development and extension (RD&E) skills gaps in innovative and flexible ways.		The GRDC also commenced work to identify capacity gaps in relation to future investment strategies, and communicated needs through agreements with RD&E providers.
RD&E providers work with the grains industry to develop improved measures of RD&E performance.		Achieved. The GRDC funded 63 PhD scholarships and new research agronomist positions to build research capacity in priority areas, aid succession planning and facilitate mentoring of younger scientists.
Intermediate outcome: Capacity building for grain growers		
Growers recognise the additional knowledge and skills they need to fully understand, adapt and adopt the outputs of RD&E and optimise their benefits.	Increased number of growers regularly use the support of skilled advisers to assist with cropping and business decisions.	Achieved. The Grower Survey showed that since 2014 the proportion of growers who paid for farm management advice has increased from 39% to 50% and the proportion of those growers who paid for crop advice increased from 27% to 36%.
Growers and their advisers participate in relevant training and skills development and apply the knowledge gained to on-farm decisions and practices.	Growers and advisers attend GRDC-supported training courses to increase their knowledge.	Achieved. The Products and Services Survey showed that 20% of growers and 56% of advisers had attended face-to-face GRDC training programs and 59% of growers and 93% of advisers had attended GRDC updates.
Growers apply skills on farm to increase profitability and sustainability.	The GRDC Grower Survey indicates that growers intend to change practices on farm as a result of training and skills development.	Achieved. The Grower Survey showed that 70% of growers had made on-farm practice changes and 60% of those said that the changes were stimulated by GRDC information and training programs.



Case study—Training resilient grains industry leaders

The GRDC's Resilient Grain Leaders program recognises that success as the manager of a cropping enterprise or a small regional business depends on leadership skills as much as management expertise. In 2015–16, the GRDC supported the second round of the popular program to develop highly skilled and effective leaders in the grain grower, researcher and adviser communities.

The program included two face-to-face workshops in each GRDC region, online learning activities, coaching sessions, and an intensive two-day workshop for all participants in Adelaide. Well-respected professionals were engaged to design and present sessions in their specialist areas, which combined to deliver many of the key ingredients for running successful teams and small businesses.

The topics covered included:

- leadership styles
- assessment and understanding of personality types
- formation of teams
- recruitment and employment processes
- evaluation and recognition of staff performance
- policy development and organisational governance
- preparation and procedures for meetings
- time management and delegation
- collaboration and partnerships
- public speaking and engagement.

The program also provided opportunities for interactions with other leadership programs, especially the Nuffield Australia Farming Scholarships program, whose alumni were invited to attend the workshops along with the graduates of the Resilient Grain Leaders program of 2013–14. Each workshop had a GRDC panel member attend to share experiences and provide connections to relevant parts of the GRDC's R&D investment portfolio.

The program participants were selected through a competitive process following a national promotion. The interest was so great that only about 30 percent of the applicants were able to be admitted. The successful applicants were drawn from across the three regions and comprised eight women, two of whom had primary roles on farm, and 21 men. Their ages ranged from 24 to 45, with an average age of 35.

The participants represented a cross-section of the grains value chain: 16 were grain growers, four were in research, and the remaining nine were involved in services such as grain trading and consulting. Seventeen of the participants were leaders of teams of up to three members, while seven were leading teams of four to six. Only five participants were not leading teams in their workplaces.

Each component of the training program was assessed and evaluated. The overwhelming majority of participants reported that they valued the program, and many saw themselves taking on more senior leadership roles in their workplaces as a result of the training.



Leaders from across the grains industry value chain—(from left) Mitch Tuffley, Nic McGregor, Matthew Stenhouse, Glenn McDonald and Frank D'Emden—attend a Resilient Grain Leaders workshop in Perth in July 2015. Photo: Natasha Searle, *Rural Directions*

Corporate strategies

The GRDC's strategic approach to RD&E investment is underpinned by five corporate strategies set out in the Strategic R&D Plan 2012–17 and the Agriculture Portfolio Budget Statements 2015–16.

Table 10 provides examples of how the GRDC delivered against the corporate strategies in 2015–16.

Table 10: Implementation of corporate strategies

OBJECTIVE	ACHIEVEMENTS
Strategy: Create value	
Deliver value by investing in programs that address the key industry priorities with the greatest potential returns.	<p>The GRDC invested in areas with high potential to create value, such as:</p> <ul style="list-style-type: none"> • new, improved crop varieties • independent assessment of regional varietal performance (National Variety Trials) • improved disease resistance in cereals • improved tolerance of abiotic stresses in pulses • applications to the Australian Pesticides and Veterinary Medicines Authority for new uses of chemicals • technology to destroy weed seed • technology to overcome non-wetting soils • increased capability in plant biotechnology • the transition from 'precision agriculture' to 'decision agriculture'.
Strategy: Coordinate nationally	
Ensure that programs are nationally coordinated and the Australian grains industry has access to the RD&E infrastructure and capability that it needs for the future.	<p>The GRDC supported R&D infrastructure and capability through:</p> <ul style="list-style-type: none"> • bilateral relationships, including new arrangements with the South Australian Research and Development Institute, the Department of Economic Development, Jobs, Transport and Resources, Victoria, and Curtin University • national R&D programs, such as Pulse Breeding Australia and Statistics for the Australian Grains Industry • targeted joint projects, such as a partnership to develop autonomous systems for more efficient nutrient management in precision agriculture and a consortium to deliver biological control of weeds.
Strategy: Deliver regionally	
Deliver the outputs of research in innovative products and services relevant to growers and their advisers in each region.	<p>Key channels for delivering research outputs included:</p> <ul style="list-style-type: none"> • GRDC updates, with over 6,000 attendees • GrowNotes interactive flipbooks, with 12 new issues • the Online Farm Trials website, with data for over 3,100 trials, and a new online interface for project summaries • social media, including over 24,000 interactions with over 15,000 unique users • publications on topics such as the impact of weeds, field-scale farm experiments, proximal crop reflectance sensor systems, salt-affected soils and farm planning and decision making, and the 2016 Farm Gross Margin Guide and 2016 Paddock Diary.



Table 10: Implementation of corporate strategies (continued)

OBJECTIVE	ACHIEVEMENTS
Strategy: Connect globally	
Proactively source new technologies and innovation from around the world for the Australian grains industry.	<p>The GRDC connected the industry to international technologies and ideas through:</p> <ul style="list-style-type: none"> • participation in the Herbicide Innovation Partnership, the International Wheat Yield Partnership, the ARC Centre of Excellence in Plant Energy Biology and the Climate Resilient Chickpea Innovation Lab • alliances with the International Maize and Wheat Improvement Center (CIMMYT), International Center for Agricultural Research in the Dry Areas (ICARDA), and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) • support for scholarships and travel awards that assisted Australian grain growers and scientists to study research, technology and farming techniques overseas.
Strategy: Engage with growers and industry	
Actively listen to and engage with growers and the broader grains industry.	<p>Key mechanisms for engaging with growers and industry included:</p> <ul style="list-style-type: none"> • three regional advisory panels, with 30 members including growers, researchers and consultants • four regional offices, with 20 staff including three managers dedicated to grower services • events held across the grain-growing regions, including seven advisory panel meetings, four open forums, over 40 meetings of Regional Cropping Solutions networks and Grower Solutions Groups, and two board meetings • the inaugural GRDC Grower Day at the annual Australian Grains Industry Conference • feedback surveys.

Portfolio management

The GRDC's RD&E investment portfolio in 2015–16 included 898 projects at various stages of development.

The management of the portfolio aims to achieve a spread of projects in terms of:

- strategic investment themes
- the Australian Government's Science and Research Priorities and Rural Research, Development and Extension Priorities
- crop type
- project type (strategic basic research, applied research, experimental development, extension, commercialisation or capacity building)
- time to deliver outcomes to growers (long term or short term)
- probability of overall success (high risks and high potential returns, or lower risks and lower potential returns)
- expected on-farm benefits relative to cost of investment
- expected spillover benefits to industry and the broader community.

The portfolio is grouped into eight categories: one each for the six strategic themes; foundational activities, such as reviews and impact assessments; and investments in R&D management. This enables groupings of projects that support an investment strategy within a theme to be analysed together.

In 2015–16, the impacts of projects in three research areas were assessed in accordance with the impact assessment guidelines released by the Council of Rural Research and Development Corporations in 2014. The analyses were undertaken by the GRDC and external organisations.

The criteria for impact assessments include analysis of financial, economic, environmental and social benefits and costs. The results of the financial analyses of the three project groups in 2015–16 are shown in Table 11; the economic, environmental and social benefits are summarised in Table 12.

Table 11: Financial results of impact assessments

PROJECT GROUP	PRESENT VALUE OF BENEFITS (\$M)	PRESENT VALUE OF COSTS (\$M)	NET PRESENT VALUE (\$M)	BENEFIT: COST RATIO (%)	INTERNAL RATE OF RETURN (%)
Cereal Rust Control Program	2,036.0	53.6	1,983.0	38.0	236.8
Frost Tolerance Breeding Options	5.4	1.1	4.4	5.0	98.0
Legume Nitrogen in Crop Rotations	2.8	0.4	2.5	7.7	27.2

Notes:

Present value of benefits = the discounted value of benefits delivered by the projects. The stream of benefits is accrued over a period of 25 years, commencing from the final year of investment, using a discount rate of 5% per year.

Present value of costs = present value of investments in the projects.

Net present value = present value of benefits less present value of costs.

Benefit:cost ratio = ratio of present value of benefits to present value of costs.

Internal rate of return = the discount rate at which an investment has a net present value of zero; that is, the rate that forces the present value of benefits to equal the present value of costs.



Table 12: Economic, environmental and social benefits identified by impact assessments

ECONOMIC BENEFITS	ENVIRONMENTAL AND SOCIAL BENEFITS
Cereal Rust Control Program	
<p>New germplasm that has been evaluated for rust resistance.</p> <p>3,724 wheat lines imported and 143 wheat lines assessed for resistance.</p> <p>1,234 lines of barley and 656 lines of oats imported, of which 100 lines of oats were resistant to stem rust and 156 were resistant to crown rust.</p> <p>27 adult plant resistance genes identified from local and imported germplasm.</p> <p>Potential for new varieties to increase yield and reduce costs of spray applications in 'rust years'.</p> <p>Increased royalties: for example, over \$10 million in royalties for the wheat variety Mace.</p>	<p>Increased understanding of rust gene expression.</p> <p>Potential for naturally resistant wheat, barley and oat varieties to reduce the need for chemical applications, producing positive benefits to the environment, farm management and staff.</p>
Frost Tolerance Breeding Options	
<p>Potential for large economic benefits (totalling up to \$4 billion), particularly in regions which experience temperatures below -4°C, from identifying varieties that flower later but grain fill earlier to miss hot summer temperatures.</p> <p>Yield increases derived from varieties that enable late flowering and earlier planting.</p>	<p>Increased awareness of varieties that flower in the frost window.</p> <p>Increased consistency of supply and quality of grain for human consumption.</p> <p>Improved resilience of farms.</p>
Legume Nitrogen in Crop Rotations	
<p>Increased knowledge of economic thresholds for synthetic and fixed nitrogen sources.</p> <p>Increased knowledge of the benefits of legumes in rotations.</p> <p>Reduced input costs: legumes supply the lowest cost nitrogen source when pulse crops return over \$300 per tonne.</p>	<p>Use of nitrogen fixed through legumes in place of applied synthetic nitrogen, leading to:</p> <ul style="list-style-type: none"> • lower levels of nitrification and reduced greenhouse gas emissions • reduced nitrogen runoff and therefore reduced nitrogen in waterways and the environment. <p>Greater use of pulses in rotations, leading to:</p> <ul style="list-style-type: none"> • reduced income risk • increased options for optimising the sowing and harvest windows • improved management of grass weeds.

Commercialisation

In many cases, commercial channels are the most efficient means of delivering the benefits of GRDC research investments to growers. The GRDC's commercialisation strategy consists of:

- analysing returns on investments to ensure that the GRDC is investing in areas that deliver on the GRDC's objective of creating enduring profitability for Australian grain growers
- leveraging capital and expertise from co-investors, to optimise opportunities to bring innovative technology to the marketplace
- managing intellectual property, to protect the GRDC's investments and leverage co-investment
- accessing technologies owned by third parties, for evaluation and use in Australia
- identifying appropriate paths to market for each new technology
- managing the GRDC's commercial investments and partnerships.

Usually the GRDC is only one of a number of public and/or private organisations investing in the development of a new technology. Investment partnerships are desirable and necessary not only from a financial viewpoint, reducing the risk to the GRDC in the funding of new technologies, but also because partner organisations bring benefits such as research capacity, market knowledge, commercial expertise, infrastructure and access to complementary technologies. Partnerships also reduce the GRDC's exposure to risk in funding new technologies.

Where the GRDC is a member of a research collaboration using public and private sector funds, it has influence over the terms of commercialisation, and determines them with the other investors to ensure that all parties achieve their desired outcomes.

New crop varieties

In 2015–16, collaborative breeding programs that received financial support from the GRDC released five new varieties: one variety each of oats, lentils and field peas, and two varieties of lupins.

The GRDC collaborates in breeding programs to facilitate the rapid adoption of new, superior varieties by growers, while protecting the interests of the intellectual property owners. In selecting commercial partners, the GRDC and its research partners consider production and communication capabilities and arrangements for the management of end point royalties, including conditions imposed on growers.

In the case of private sector breeding of crops such as wheat and canola, the GRDC has no ownership in new varieties and the responsibility for commercialisation lies with the breeding companies alone. The GRDC is an investor in some private breeding companies.

Commercial partnerships

Research outputs from several GRDC-funded, collaborative R&D programs either reached the marketplace or entered the commercialisation phase in 2015–16:

- The world's first commercially produced gluten-free beer was released by Radeberger, using low-gluten barley produced through a collaboration between the GRDC and CSIRO.
- A successful lupin-breeding program established by a collaboration between the GRDC and the Department of Agriculture and Food, Western Australia, was licensed to Australian Grain Technologies.
- Technology for harvest weed seed management, developed in a collaboration between Ray Harrington (a Western Australian grower), the GRDC and the University of South Australia, was licensed to de Bruin Engineering.



- Non-wetting soil testing and amelioration technologies developed at the Cooperative Research Centre for Polymers, with GRDC funding, were licensed to BASF.

In addition, the GRDC maintained ongoing commercial R&D relationships, including:

- a joint partnership with the Crop Science Division of Bayer, to discover and develop technologies to manage herbicide-resistant weeds
- relationships with CSIRO to develop new health products, such as canola lines producing omega-3 fatty acids (in partnership with Nuseed), and wheat lines producing digestion-resistant starch (through joint investment in Arista Cereal Technologies).

Intellectual property management

The GRDC usually owns a share of all intellectual property generated by research projects that it funds. This consists of registrable intellectual property (plant breeder's rights, patents and trademarks) and non-registrable intellectual property (copyright and trade secrets).

The corporation actively manages its intellectual property to:

- ensure that research outcomes are adopted as quickly and effectively as possible, by either dissemination or commercialisation
- provide access to GRDC intellectual property and gain access to third-party intellectual property where it will facilitate the delivery of research outcomes
- optimise returns on intellectual property investment for growers.

The GRDC seeks protection of its intellectual property where to do so will achieve the above objectives, and maintains a register of its registered intellectual property.

Patents

During 2015–16, the GRDC reviewed its patent portfolio, looking at alignment to GRDC strategy and likelihood of delivery of the technology to growers within the remaining patent life.

At 30 June 2016, the GRDC had an interest in 22 patent families.

Plant breeder's rights

The GRDC's plant breeder's rights (PBR) portfolio consists of 155 granted certificates of PBR and 18 applications for PBR across 20 different crop species.

In 2015–16, the GRDC and its research partners lodged four new PBR applications and surrendered six certificates of PBR. Most of the activity in the PBR portfolio was related to the progression to grant of applications for new varieties released by the Mungbean Breeding Program and the Pulse Breeding Australia chickpea, lentil and field pea programs.

Trademarks

At 30 June 2016, the GRDC held 16 trademarks either in its own right or jointly.

Business relationships

Many of the 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 13 describes the companies in which the GRDC had shares or membership at 30 June 2016. In most cases, the GRDC also nominated one or more directors to the company's board.



Table 13: Companies in which the GRDC had shares or membership at 30 June 2016

NAME	ACTIVITY	GRDC ROLE
Companies limited by guarantee		
Australian Crop Accreditation System Ltd ACN 093 984 902	Provides cereal variety details online for farmers and advisers, and manages National Variety Trials.	Is a member of the company and pays the company for services. Nominates a director.
Australian Export Grains Innovation Centre Limited ACN 160 912 032	Provides R&D related to the Australian export grains industry.	Is a member of the company. Nominates a director.
Grains & Legumes Nutrition Council Limited ACN 117 442 510	Identifies and communicates the health benefits of grain food products.	Is a member of the company and provides research funding. Does not nominate a director.
Invasive Animals Ltd ACN 114 965 276	Serves as the intellectual property (IP) holding/management company for the Invasive Animals Cooperative Research Centre.	Is a member of the company. Does not nominate a director.
Plant Biosecurity CRC ACN 115 589 707	Serves as the IP holding/management company for the Plant Biosecurity Cooperative Research Centre.	Is a member of the company. Does not nominate a director.
Wheat Quality Australia Limited ACN 147 439 656	Manages and delivers the wheat variety classification process.	Is a member of the company and pays the company for services. Nominates a director.
Companies limited by shares		
Arista Cereal Technologies Pty Ltd ACN 122 450 962	Undertakes development and commercialisation of high-amylose wheat.	Is a 21% shareholder. Nominates a director.
Australian Centre for Plant Functional Genomics Pty Ltd ACN 102 769 808	Conducts functional genomics research into abiotic stress.	Is a 19% shareholder and provides research funding in return for equity. Does not nominate a director.
Australian Grain Technologies Pty Ltd ACN 100 269 930	Undertakes commercial wheat and barley breeding.	Is a 39% shareholder. Nominates three directors.
InterGrain Pty Ltd ACN 128 106 945	Undertakes commercial wheat and barley breeding.	Is a 25% shareholder. Nominates a director.



Stakeholder feedback

The GRDC undertakes a range of surveys to gather feedback from stakeholders to assist in measuring the performance of the corporation and its RD&E investments. The key surveys are the Grower Survey, the Farm Practices Survey, the Research Partner Survey and the Products and Services Survey.

In annual surveys, such as the Grower Survey, subsets of questions are asked at two-yearly or three-yearly intervals, to reduce the completion time for each survey and encourage maximum participation. In particular, questions related to the adoption of RD&E outputs are asked less often once the target proportion of growers has taken up a particular practice or technology.

Questions relating to growers' attitudes are asked every year, to ensure that the GRDC stays in touch with changing perceptions and priorities.

The Grower Survey has a particular focus on helping the GRDC to assess and improve its performance in communicating research outcomes to growers. A total of 1,200 growers are invited to take part in the survey, including growers from each agroecological zone.

Results of the Grower Survey are used to address specific targets in the performance tables of this report. The results in Table 14 track the GRDC's overall performance in key areas since 2013.

Table 14: Responses to key Grower Survey measures, by growers surveyed, 2013 to 2016

RESPONSE	2013 %	2014 %	2015 %	2016 %
Rating GRDC performance as very or fairly high	79	79	83	85
Having directly benefited from grains R&D activities generally in the previous five years	76	73	83	82
Having directly benefited from GRDC activities or initiatives	63	62	71	71
Feeling that new grain varieties met expectations well	68	70	76	79
Being aware of regional panels	68	67	72	80
Having had direct contact with regional panel members	28	26	29	33
Rating the value of regional panels as very or fairly high (<i>proportion of growers aware of the panels</i>)	77	76	78	79

Grains industry performance

The GRDC contributes to the funding of certain studies by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) to ensure that the Australian grains industry has access to evidence-based analysis of grains production, financial performance and productivity. Information in this section is derived from research and reports generated by ABARES.

Growing conditions

Growing conditions during the 2015–16 season were average in parts of the Northern Region, including northern New South Wales and Queensland. Southern areas of the Northern Region were above average for rainfall.

Southern Region rainfall was below average or very much below average, according to the Bureau of Meteorology definitions. South Australia, Victoria and Tasmania each received very little rainfall, which reduced financial returns to the region.

The majority of areas in the Western Region received average to above average rainfall.

Crop production

The 2015–16 crop, including winter and summer crops, was produced on 22,414,000 hectares, a 2 percent increase on the area used for the total 2014–15 crop. Crops that were grown on a larger area included chickpeas (increased by 56 percent), lupins (11 percent) and wheat and barley (both 5 percent). The area sown decreased for canola (by 17 percent) and triticale (7 percent).

The volume of the crop increased by 3 percent to 42,279,000 tonnes in 2015–16. This included a major increase in the production of chickpeas, from 555,000 tonnes to 1,013,000 tonnes (83 percent), and increases in the production of wheat (5 percent) and sunflower (15 percent). Production decreased in field peas (29 percent), triticale (15 percent) and canola (15 percent).

The value of the 2015–16 crop increased by 3 percent to \$13,944 million. This result reflected:

- increases in the value of
 - chickpeas, by 124 percent to \$706 million
 - lupins, by 10 percent to \$176 million
- decreases in the value of
 - field peas, by 25 percent to \$90 million
 - triticale, by 22 percent to \$45 million
 - sorghum, by 12 percent to \$587 million
 - canola, by 9 percent to \$1,619 million.

The average chickpea yield per hectare increased by 16 percent, while average wheat yields increased by 4 percent and average barley yields increased by 5 percent. In contrast, the average yield per hectare of field peas fell by 1 percent, while soybean yields decreased by 1 percent.

Farm financial performance

The Western Region recorded the highest average farm income, farm business profit and rate of return in 2013–14 and 2014–15. In both years, average rate of return was nearly double that recorded in the next best performing region. The Western Region is also expected to be the best performing region in 2015–16, as Table 15 shows.



Table 15: Farm financial performance, by region, 2013–14 to 2015–16

AVERAGE PER FARM	UNIT	2013–14	2014–15	2015–16 (ESTIMATE)
Northern				
Farm cash income	\$	154,000	185,000	257,000
Farm business profit	\$	29,000	55,000	134,000
Rate of return (excluding capital appreciation)	%	1.9	2.4	3.8
Southern				
Farm cash income	\$	207,000	202,000	189,000
Farm business profit	\$	79,000	48,000	45,000
Rate of return (excluding capital appreciation)	%	3.3	2.3	2.1
Western				
Farm cash income	\$	378,000	390,000	398,000
Farm business profit	\$	249,000	176,000	215,000
Rate of return (excluding capital appreciation)	%	6.4	4.3	4.8

Source: ABARES, *Australian grains: financial performance of grain farms 2013–14 to 2015–16*.

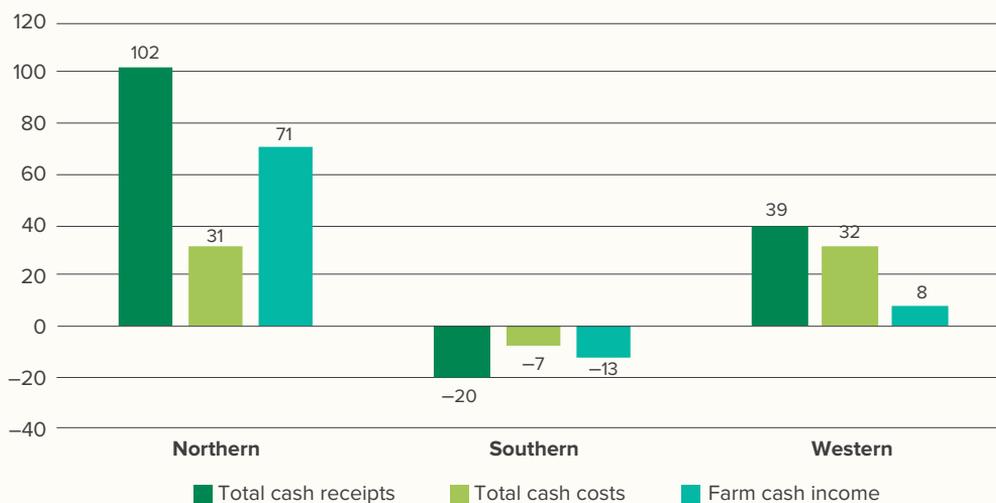
Trends in performance

Between 2013–14 and 2014–15, the Northern Region experience a significant increase in average farm cash incomes, while the

Southern Region experienced a small decrease and the Western Region experienced a small increase.

These trends are predicted to continue between 2014–15 and 2015–16, as Figure 4 shows.

Figure 4: Forecast changes in farm cash income, by region, 2014–15 to 2015–16, \$'000



Source: ABARES, *Australian grains: financial performance of grain farms 2013–14 to 2015–16*.



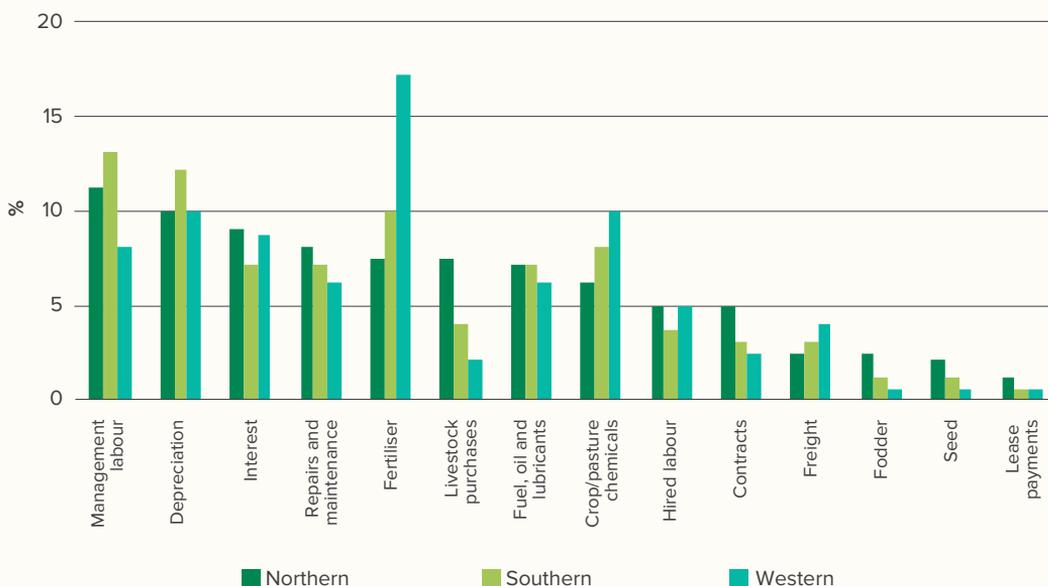
Composition of cash costs

From 2000–01 to 2014–15, owner/manager/family labour, depreciation and fertiliser were the three items accounting for the largest shares of total cash costs in the Northern and Southern regions. The other items accounting for more than 5 percent of total cash costs in both regions were repairs and maintenance, interest, crop/pasture chemicals and fuel/oil/lubricants.

In the Western Region, fertiliser was the largest cost item, at 17 percent of total cash costs. The next largest items—crop and pasture chemicals, depreciation, freight and marketing expenses—each accounted for about 10 percent. Other items accounting for more than 5 percent were owner/manager/family labour, repairs and maintenance, interest, and fuel.

Figure 5 shows the relative shares of key cost items in each region.

Figure 5: Key cash costs, by region, 2000–01 to 2014–15



Source: ABARES, *Australian grains: financial performance of grain farms 2013–14 to 2015–16*.

Grains industry productivity

Productivity growth is determined as an increase in output beyond any associated increase in input (or a decrease in the quantity of inputs needed to produce a unit of output).

Productivity growth is generally measured over the long term because it is treated as an indicator of technological progress, which can involve significant time lags in both on-farm implementation and realised benefits. Further, short-term variability in productivity can reflect seasonal conditions rather than shifts in underlying technology or efficiency.

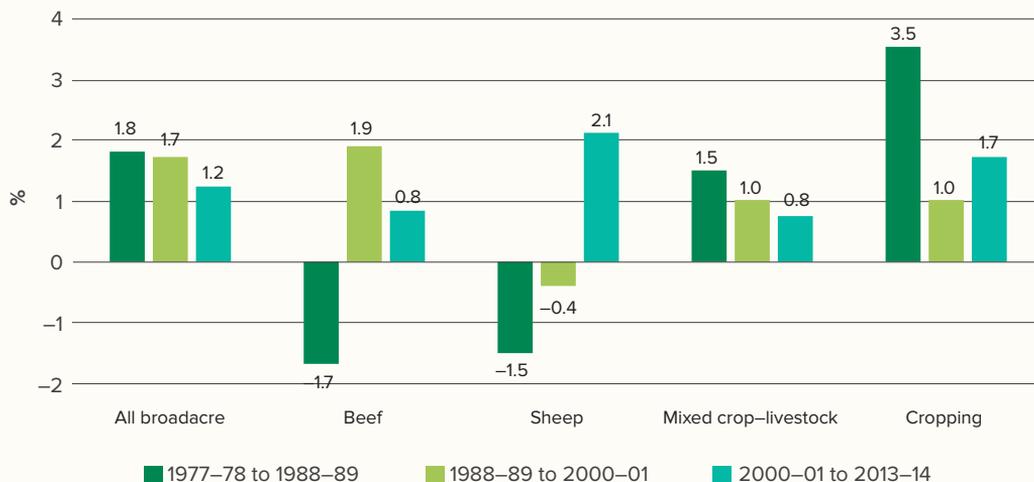
Total factor productivity

ABARES measures total factor productivity (TFP), which takes into account the full range of inputs and outputs on farm.

The cropping industry has the highest TFP growth of all agricultural industries and, with the exception of the sheep industry, had the highest TFP growth in the past decade. Average TFP growth of cropping specialists (1.5 percent per year) exceeded that for mixed crop–livestock (0.9 percent per year) between 1977–78 and 2013–14. Figure 6 shows trends in TFP growth for broadacre agricultural industries.



Figure 6: Average total factor productivity growth, by industry, 1977–78 to 2013–14



Source: ABARES, *Australian grains: financial performance of grain farms 2013–14 to 2015–16*.

For cropping specialists, TFP growth in the Southern Region averaged 1.9 percent per year between 1977–78 and 2013–14, as shown in Table 16. This was driven by strong output growth which outpaced growth in inputs.

Average TFP growth in the Northern and Western regions was slightly slower, at 1.4 percent per year on average, although the drivers of growth differed between the regions. In the Western Region, productivity growth was driven by relatively large expansions of both inputs and outputs, while the Northern Region had the lowest growth in inputs and outputs of all three regions.

Table 16: Average annual total factor productivity growth of cropping enterprises, 1977–78 to 2013–14

	INPUT GROWTH %	OUTPUT GROWTH %	PRODUCTIVITY GROWTH %
Cropping specialists			
All regions	1.1	2.6	1.5
Southern Region	1.0	2.9	1.9
Northern Region	0.6	1.9	1.4
Western Region	2.2	3.6	1.4
Mixed crop–livestock			
All regions	-1.7	-0.8	0.9
Southern Region	-1.5	0.1	1.6
Northern Region	-1.4	-1.0	0.5
Western Region	-2.4	-1.3	1.1

Note: Input and output growth values may not total productivity growth values, due to rounding.

Source: ABARES, *Australian grains: financial performance of grain farms 2013–14 to 2015–16*.



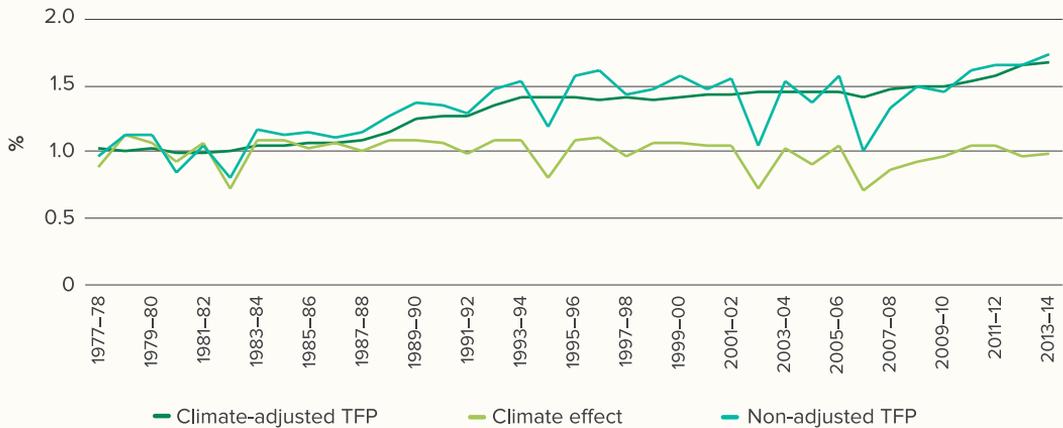
Climate-adjusted productivity

ABARES calculates climate-adjusted TFP through a climate effect index that was generated by mapping spatial climate data to individual farms in the ABARES farm surveys database, using geographic information system techniques.

Climate variables taken into account include rainfall, temperature and soil moisture.

Figure 7 shows the average estimated climate-adjusted TFP for crop farms from 1977–78 to 2013–14. The climate-adjusted series displays significantly less annual volatility than the non-adjusted TFP series.

Figure 7: Climate-adjusted total factor productivity (TFP) of cropping, 1977–78 to 2013–14



Source: ABARES, *Australian grains: financial performance of grain farms 2013–14 to 2015–16*.





PART 3—OUR ORGANISATION

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Board

At 30 June 2016, the GRDC Board comprised nine directors. Figure 8 provides details of the board members' appointments, qualifications and experience.

Figure 8: Members of the Board in 2015–16



Richard Clark

ADFM, FAICD

Chair (Non-executive)

Term: 1 October 2013 to 30 September 2016

Member: Remuneration Committee

Richard runs an intensive grain enterprise, focusing on summer and winter cereals, pulses, and oilseeds, at Tullooka, New South Wales.

Richard is a graduate of the Orange Agricultural College and a fellow and graduate of the Australian Institute of Company Directors. He has extensive experience as a director and chairman of organisations in the agricultural sector and the grains industry in particular.

Richard's experience includes the positions of founding Chair of the New South Wales Farmers' Association Grains Research Committee and Chairman of the Wheat Research Foundation of New South Wales.

He has served as a director of Advantage Wheats, ChemCert Australia, the Grain Foods Cooperative Research Centre and Quality Farms Australia, and was a director of the GRDC from 1996 until 2002.



Andrew Barr

BAGSc, PhD, GAICD

Director (Non-executive)

Term: 4 November 2014 to 30 September 2017

Member: Finance, Risk and Audit Committee

As a plant breeder at the South Australian Research and Development Institute and the University of Adelaide, Andrew took part in releasing 25 varieties of oats and barley. He also taught plant breeding and genetics at undergraduate and postgraduate levels.

Andrew has worked in international agriculture and food security, including with the International Center for Agricultural Research in the Dry Areas (ICARDA) and the International Maize and Wheat Improvement Center (CIMMYT).

Andrew is an adjunct professor in the School of Agriculture, Food and Wine at the University of Adelaide and a director of the Australian Grain Growers Co-operative. He manages a broadacre cropping enterprise in the lower north of South Australia.



Jeremy Burdon

BSc (Hons), PhD, Hon DSc, FAA, FTSE, MAICD

Director (Non-executive)

Term: 4 November 2011 to 30 September 2017

Member: Commercial Committee; Remuneration Committee (Chair)

Jeremy has an international reputation in evolutionary biology, with particular expertise in epidemiology and genetics. He has contributed to research in areas such as cereal rust control, pre-breeding and the biological control of weeds.

From late 2003 to 2012, Jeremy led CSIRO Plant Industry, taking responsibility for the development of its scientific capability; the strategic direction of its work; and its financial health and staff training.

Since then he has continued his research interest in the application of evolutionary principles to farming systems through an appointment as an Honorary Fellow in CSIRO.

He served for six years on the Board of Trustees of Bioversity International and currently serves as the Chair of the Australian Academy of Science's National Committee for Agriculture, Fisheries and Food. In that role he is leading the production of a decadal plan for agricultural science.



Helen Garnett

PSM, BSc (Hons), PhD, FTSE, FAICD

Director (Non-executive)

Term: 4 November 2014 to 30 September 2017

Member: Remuneration Committee

Helen is an accomplished director and leader, building on an earlier research career, including with industry, in pathogenesis and the development of diagnostics. She was awarded the Public Service Medal (2004) and the Centenary Medal (2000) for scientific and institutional leadership.

Helen is Chair of Delta Electricity and Chair of the Australian Centre for Plant Functional Genomics. She is a non-executive director of Carbon Energy Limited, ABM Resources NL, the National Centre for Vocational Education Research, the Crawford Fund and the Museum and Art Gallery of the Northern Territory.

Helen was previously Chair of the Australian Biosecurity Intelligence Network, a non-executive director of the Grape and Wine Research and Development Corporation, a director of Energy Resources of Australia Ltd, Vice-Chancellor of Charles Darwin University, and Chief Executive of the Australian Nuclear Science and Technology Organisation.



Kim Halbert

BComm, GAICD

Deputy Chair (Non-executive)

Term: 4 November 2011 to 30 September 2017

Term as Deputy Chair: 10 April 2012 to 3 November 2014; 27 January 2015 to 30 September 2017

Member: Finance, Risk and Audit Committee (Chair); Remuneration Committee

Kim is a grain producer in the mid-west region of Western Australia, where he undertakes numerous production trials and engages in innovative farming practices.

He has experience in the management and conservation of natural resources, which he demonstrated in his role as a member of the management committee overseeing Natural Heritage Trust project funding for the Arrowsmith Catchment Group.

Kim has a strong interest in the marketing of grain, which is reflected in his participation on a number of boards, including the board of Wheat Exports Australia. As a director of the Geraldton Port Authority, the second largest grain-exporting port in Australia, he consulted with grain marketers, bulk handlers and grower organisations.





Roseanne Healy

BA(Ec), MBA, MBR(Com), GAICD

Director (Non-executive)

Term: 4 November 2014 to 30 September 2017

Member: Finance, Risk and Audit Committee

Formerly an economist and business analyst, Roseanne is a corporate adviser specialising in strategy, enterprise risk management and corporate governance.

Roseanne was previously a director of the Rural Industries Research and Development Corporation.

She is Chair of the Dairy Authority of South Australia, Chair of Peninsula Leisure Pty Ltd, and a non-executive director of HomeStart Finance, CUFA Ltd, GP partners Australia, and Vinehealth Australia.

Roseanne is Independent Director of Nyamba Buru Yawuru Ltd, one of Australia's largest native title holder corporate groups, and Board Advisor to the Central Australian Aboriginal Congress Aboriginal Corporation.



David Shannon

B.Arch(Hons), NCFM (Durham), GAICD

Director (Non-executive)

Term: 4 November 2014 to 30 September 2017

Member: Commercial Committee

David is a grain and livestock producer with more than 30 years experience of farming in South Australia and Tasmania. In 1987, David was awarded an Australian Nuffield Scholarship to study grain legume production in Europe.

David has held many chair and director positions in the agricultural industry. He spent 15 years on the GRDC's Southern Regional Panel, including eight years as Chair.

David is the Independent Chairman of Mutooroo Pastoral Company.



John Woods

BAppSc

Director (Non-executive)

Term: 8 March 2012 to 30 September 2017

Member: Commercial Committee (Chair); Finance, Risk and Audit Committee

John owns and operates a cropping enterprise in northern New South Wales and southern Queensland, where he also participates in summer crop R&D trials and innovative new techniques.

He has a strong interest in economic policy that affects agriculture, reflected in the positions he has held in industry and on community advisory bodies such as the National Rural Advisory Council, National Agricultural Monitoring System and Agricultural Finance Forum.

John also has experience in technology transfer and extension of R&D, which he demonstrated in his roles as Chairman ChemCert Training Queensland and as a ChemCert Trainer to the grains and cotton industries. The extension and adoption of best management practice was integral to his role as Queensland Manager Cotton Australia.





John Harvey

BRurSc, GDRE, GCBA, GAICD

Managing Director

*Term: 1 March 2011 to
8 April 2016*

John is a graduate of the Australian Institute of Company Directors. He is a director of the Australian Crop Accreditation System and was a director of the Value Added Wheat Cooperative Research Centre.

Before becoming Managing Director of the GRDC, John was on the management boards of Pulse Breeding Australia, Barley Breeding Australia and the National Soybean Breeding Program.

John joined the GRDC in November 1997 as Program Manager Farming Systems. He became Manager R&D Programs in 2001, Executive Manager Varieties in 2005 and Managing Director in March 2011.

His background is in agricultural extension and research, development and extension management. He previously worked with the Queensland Department of Primary Industries.



Steve Thomas

BAGSc, PhD, GAICD

Acting Managing Director

Term: 9 April 2016 to 3 July 2016

Steve has an honours degree in agricultural science and a PhD in molecular biology from the University of Adelaide, and is a graduate of the Australian Institute of Company Directors. He has undertaken postdoctoral research in international and national laboratories.

Steve joined the GRDC in 2009 as Executive Manager Practices. He became Executive Manager Research Programs in 2011, Executive Manager Commercial in 2013, Chief Operating Officer in 2015 and Acting Managing Director in 2016.

Prior to joining the GRDC, Steve was Director of Rural Innovation at the New South Wales Department of Primary Industries, where he was responsible for animal, crop and pasture genetics and improvement programs as well as biotechnology activities.

He has served on the boards of Australian Sheep, Barley Breeding Australia, Enterprise Grains Australia, Novozymes Biologicals Australia and the Value Added Wheat Cooperative Research Centre.



Appointments

Members of the GRDC Board are selected and appointed in accordance with the *Primary Industries Research and Development Act 1989* (PIRD Act).

Under that Act, the Minister is responsible for the selection and appointment of the Chair of the 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 Act, in consultation with the industry representative organisations declared under the 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.

On 27 April 2016, the Minister extended the appointments of Jeremy Burdon, Kim Halbert and John Woods for a further one-year period until 30 September 2017. Kim Halbert's term as Deputy Chair was also extended to 30 September 2017.

Former Managing Director John Harvey left the GRDC on 8 April 2016. Steve Thomas was appointed Acting Managing Director from 9 April until 3 July 2016, when Steve Jefferies took up his appointment as Managing Director.

Policies and practices

The Board reviewed its roles and responsibilities during 2015–16 and approved a new Board Charter on 23 September 2015. 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:

- induction and continuous education—New board members participate in a formal induction process, and all board members undergo a process of continuous education.
- disclosure of interests—Directors must comply with the GRDC's policy and procedures for conflict of interest and with legislative requirements regarding material personal interests. The Board reviews declarations of conflicts of interest at the start of each meeting and directors regularly update their declarations.
- independent professional advice—With the Chair's approval, directors may obtain independent professional advice, at the GRDC's expense, on matters arising in the course of their duties.
- 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.
- external review—The Board periodically commissions an external review of its performance. The next review is scheduled for October 2016.

Committees

At 30 June 2016, the Board had three committees, as described in Table 17. 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.



Table 17: Board committees

ROLE	MEMBERSHIP
Commercial Committee	
<p>Reviews, evaluates and makes recommendations to the Board and management on matters relating to:</p> <ul style="list-style-type: none"> • the strategic oversight of the GRDC in regard to its planning processes related to the integration of research, development, commercialisation and adoption processes • the commercial and R&D interaction between the GRDC and the private sector, including R&D partnerships, commercial structures and other joint ventures • the development of draft policies regarding ownership of project intellectual property, risk-sharing and licensing conditions with research and commercialisation partners to assist with the adoption of the results of R&D • corporate governance and risk management in the area of commercialisation and adoption of the results of R&D, including oversight of the GRDC's role and investments in companies that undertake such commercialisation and adoption • intellectual property management, protection and enforcement as necessary for the commercialisation of the results of R&D. 	<p>Three non-executive directors appointed by the Board.</p>
Finance, Risk and Audit Committee	
<p>Assists the Board in fulfilling its corporate governance responsibilities and reviews the GRDC's:</p> <ul style="list-style-type: none"> • financial reporting process • internal control system • risk management strategy and processes • internal and external audits • process for monitoring compliance with laws and regulations and the Board's code of conduct • financial statements. 	<p>At least three non-executive directors appointed by the Board.</p>
Remuneration Committee	
<p>Reviews and makes recommendations to the Board on matters relating to the remuneration and performance policy of the GRDC and the remuneration and performance of the Managing Director.</p>	<p>Chair, Deputy Chair and two other non-executive directors appointed by the Board.</p>



Meetings

During 2015–16, the Board held three meetings in Canberra and one meeting each in Adelaide, Melbourne and Orange. Directors joined the regional advisory panels on their spring tours in September 2015.

Each director's attendance at meetings during the year is set out in Table 18.

Table 18: Attendance at board and committee meetings

MEMBERS	BOARD		COMMERCIAL COMMITTEE		FINANCE, RISK AND AUDIT COMMITTEE		REMUNERATION COMMITTEE	
	Meetings attended	Meetings held and eligible to attend	Meetings attended	Meetings held and eligible to attend	Meetings attended	Meetings held and eligible to attend	Meetings attended	Meetings held and eligible to attend
<i>At 30 June 2016</i>								
Andrew Barr	5	6	–	–	2	4	–	–
Jeremy Burdon	6	6	3	3	–	–	2	2
Richard Clark	6	6	–	–	–	–	2	2
Helen Garnett	6	6	–	–	–	–	1	2
Kim Halbert	6	6	–	–	4	4	2	2
Roseanne Healy	6	6	–	–	4	4	–	–
David Shannon	5	6	3	3	–	–	–	–
Steve Thomas	1	1	–	–	–	–	–	–
John Woods	6	6	3	3	4	4	–	–
<i>Departed 8 April 2016</i>								
John Harvey	5	5	–	–	–	–	–	–



Accountability

The GRDC is accountable to Australian grain growers and the Australian Government for its performance in addressing their identified priorities. The GRDC also meets its responsibilities under its governing legislation and the broader legal framework for corporate Commonwealth entities.

Australian Government

Responsible minister

During 2015–16, the GRDC was accountable to the Australian Parliament through the Hon. Barnaby Joyce MP in his role as Minister for Agriculture and Water Resources.

Government priorities

The GRDC's strategies and investments actively address the Australian Government's Science and Research Priorities and Rural Research, Development and Extension Priorities. Since May 2015, those priorities have superseded the Strategic Research Priorities and Rural R&D Priorities, which were addressed in the Annual Operational Plan 2015–16.

Ministerial directions and policy orders

The GRDC fully complies with relevant directions made by ministers under the PIRD Act, the *Public Governance, Performance and Accountability Act 2013* (PGPA Act) or other Commonwealth legislation.

Under section 143 of the PIRD Act, the Minister may give written orders to the GRDC as to the performance of its functions and the exercise of its powers. No such orders were given in 2015–16.

Under section 22 of the PGPA Act, the Minister for Finance may give written directions to the GRDC regarding complying with the general policies of the government. No such directions were given in 2015–16.

Funding agreement

On 1 June 2015, the GRDC signed a funding agreement with the Department of Agriculture in line with the requirements of PIRD Act. The funding agreement sets out the terms and conditions under which money paid to the GRDC by the Commonwealth may be spent during the period from June 2015 to June 2019.

Grains industry

Representative organisations

Under section 11 of the PIRD Act, the GRDC is accountable to Australian grain growers through the industry's representative organisations. In 2015–16, Grain Producers Australia Limited (GPA) and Grain Growers Limited (GrainGrowers) were the joint representative organisations as declared by the Minister under the Act.

Each year, the GRDC prepares a stakeholder report to assist the representative organisations to formulate advice to the Minister on setting the research levy rates which provide the basis for the corporation's income. The Stakeholder Report 2016–17 was provided to GPA and GrainGrowers in April 2016.

The GRDC also reported to its representative organisations as part of the consultation processes for the development of the new five-year R&D plan, the annual operational plan and the annual report.

Industry priorities

In setting directions for 2015–16 (the fourth year of the Strategic R&D Plan 2012–17), the GRDC identified industry priorities through direct consultations with GPA and GrainGrowers, local research advisory committees, grower groups, grower organisations and individual grain growers. The key industry priorities were incorporated into the Annual Operational Plan 2015–16. The GRDC's achievements in meeting the industry priorities during 2015–16 are discussed in Part 2 of this report.



Funding

The GRDC is principally funded by levies paid by grain growers and Australian Government contributions. Other sources, including interest, royalties and grants, contribute a small proportion of the GRDC's income.

The levies paid by growers are based on the net farm gate value of the annual production of 25 crops:

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

Farm gate value of production differs from the gross value of production, as farm gate value deducts costs of storage, handling, freight and 'free on board' costs.

The Australian Government matches the levy contributions up to a limit of 0.5 percent of the three-year rolling average of the gross value of production of the 25 leviable crops.

In 2015–16, a levy rate of 0.99 percent applied to all leviable crops covered by the GRDC, with the exception of maize, which was levied at 0.693 percent. The levies were imposed and collected as stipulated by the:

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

Proceeds from levies in 2015–16 are recorded in Note 1.2B of the notes to the financial statements.

The GRDC paid the Department of Agriculture and Water Resources \$511,199 for the collection and management of levies in 2015–16.

Corporate governance

The GRDC Board is committed to robust corporate governance systems and processes and places a high value on continuously improving the GRDC's performance in this area.

Key activities during 2015–16 included:

- complying with governance and reporting arrangements under the PGPA Act
- analysing the GRDC's strategic and operational risks
- reviewing and refreshing the risk management policy and risk management framework
- updating the Board Charter, the fraud control policy and plan, and the conflict of interest policy
- finalising a complaints-handling policy and an intellectual property management and commercialisation policy
- implementing a revised policy and procedures framework.

The intranet is the key repository for information and guidance for GRDC staff and includes all policies, procedures and related guidance. The GRDC also publishes information about its governance and operations on its website.

Code of conduct and ethics

The GRDC Code of Conduct sets out the principles and expected standards of behaviour for directors, staff and regional advisory 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. All staff have access to the code via the intranet.

Acting ethically and with integrity is a key component of the GRDC Values, which guide the actions of all directors, staff and panel members.



Risk management and fraud control

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

The Board considers a strategic risk report at its monthly meeting and reviews the operational risks every six months or more often if significant changes arise in the operating environment.

The GRDC conducts external assessments of its business risk and fraud risk every two years. The next fraud risk review is due to take place in late 2016.

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

The GRDC's Managing Director is satisfied that:

- A fraud risk assessment and fraud control plan have been prepared in compliance with section 10 of the Public Governance, Performance and Accountability Rule 2014.
- Appropriate fraud prevention, detection, investigation and reporting procedures and processes are in place as specified in the GRDC's Fraud Control Plan 2014–16.
- No incidents of fraud were detected in 2015–16.

The Board is satisfied that the GRDC's fraud control policies, procedures and initiatives are in accordance with the requirements of the PGPA Act.

Indemnities and insurance premiums

The 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 2015–16 was \$28,352.

Environmental objectives

The principles of ecologically sustainable development (ESD) and environmental performance set out in the *Environment Protection and Biodiversity Conservation Act 1999* are embodied in the outcomes of the GRDC.

Achieving sustainable use and management of natural resources is one of the GRDC's core functions under the PIRD Act. It is also a key element of the Australian Government and grains industry priorities that shape the Strategic R&D Plan 2012–17, and the themes that underpin the GRDC's investments in research, development and extension.

In 2015–16, the GRDC supported many projects that contributed to ESD objectives, such as work to:

- improve farm productivity while reducing environmental impact, for example through tactical agronomy, tillage and stubble management, enhanced farming systems and locally adapted varieties
- understand, preserve and improve soil, water and air quality, for example through management practices that reverse soil acidification, compaction and depletion of organic matter and nutrients, and farm production systems that minimise greenhouse gas emissions
- improve integrated management strategies for weeds, pests and diseases, to reduce reliance on chemical control options
- optimise biological diversity in rural landscapes, for example by increasing the range of crops grown in rotation, including legumes, and by exploiting pest-suppressive landscapes and disease-suppressive soils
- foster the economic, environmental and social health of the grains industry, in the present and the longer term, through collaboration, education and knowledge sharing.



At the operational level, the GRDC is committed to managing its corporate activities with minimal impact on the environment. For example:

- The GRDC’s largest office, in Canberra, is located in a building with a National Australian Built Environment Rating System (NABERS) 5-star rating. An energy-efficient free-air liquid cooling system is used in the room that houses the GRDC’s key ICT infrastructure.
- Where possible, the GRDC uses ICT meeting solutions to reduce the need for staff travel.
- The GRDC’s printing services contract requires the provider to comply with ISO 14000 environmental management standards and Australian Government policies related to ESD.

Work health and safety

The GRDC’s work health and safety (WHS) 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. The GRDC’s WHS policy and procedures are reviewed regularly and meet the requirements of the *Work Health and Safety Act 2011*.

Table 19 summarises the GRDC’s results in relation to reportable indicators of WHS performance in 2015–16.

Table 19: 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 the GRDC.	<p>The GRDC offered staff members flu vaccinations and provided fresh fruit daily.</p> <p>All existing first aid attendants were sent to refresher training courses and three new first aid attendants were appointed.</p> <p>The work health and safety framework and policy were refreshed to account for regional offices.</p>
Health and safety outcomes (including the impact on injury rates of workers) achieved as a result of initiatives.	<p>Incident reporting is slowly increasing, demonstrating increased awareness of work health and safety.</p> <p>The injury incident rate decreased to 0.014 injury per full-time equivalent staff member.</p>
Statistics of any notifiable incidents of which the GRDC became aware that arose out of the conduct of businesses or undertakings by the GRDC.	Two minor incidents occurred. The GRDC internally investigated the incidents and determined that such incidents were unlikely to occur again. Minor control measures were put in place.
Details of any investigations conducted during the year that relate to the businesses or undertakings of the GRDC, including details of all notices given to the GRDC under Part 10 of the <i>Work Health and Safety Act 2011</i> .	No investigations were conducted and no notices were given.
Other matters as required by the guidelines approved on behalf of the Parliament by the Joint Committee of Public Accounts and Audit.	No other matters were required to be reported.



External scrutiny

No judicial or administrative tribunal decisions recorded in 2015–16 had, or may have, a significant effect on the operations of the GRDC.

The GRDC was not subject to reviews by the Parliament, the Commonwealth Ombudsman or the Office of the Australian Information Commissioner in 2015–16.

The GRDC was not the subject of any report by the Auditor-General in 2015–16, other than the audit of the GRDC's annual financial statements. The Auditor-General's independent audit report on the GRDC's financial statements for 2015–16 is presented on pages 86–87 of this report.

Significant activities and changes

The GRDC Board writes to the Minister after each board meeting, outlining all key decisions and actions taken at the meeting. This communication includes particulars of any significant decisions or issues as described in section 19 of the PGPA Act.

The Board advised the Minister of a number of significant decisions or issues during 2015–16, including:

- the transformation of systems, processes, structure and culture to better equip the GRDC to meet the changing needs of Australian grain growers and the wider Australian community

- the implementation of a 'hub and spoke' model to increase the GRDC's regional presence, including the establishment of regional offices in Adelaide, Dubbo and Toowoomba (in addition to the existing regional office in Perth)
- the appointment of Steve Jefferies as Managing Director
- ongoing consultation with the industry representative organisations, GPA and GrainGrowers.

Location

To strengthen the GRDC's connection with growers, many of the GRDC's functions have moved from Canberra into new offices across the regions, enhancing local coordination and delivering tailored benefits to growers. Regional staff will have a particular focus on short-term and medium-term projects that address priority issues relating to farming systems, agronomy, soils, weeds, pests and diseases.

Regional offices have been established in Adelaide, Dubbo (New South Wales), Perth and Toowoomba (Queensland). Contact details are listed inside the back cover of this report.





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Independent auditor's report



INDEPENDENT AUDITOR'S REPORT

To the Minister for Agriculture and Water Resources

Report on the Annual Financial Statements

I have audited the accompanying annual financial statements of the Grains Research and Development Corporation for the year ended 30 June 2016, which comprise:

- Statement by the Directors, Managing Director and Section Head Finance;
- Statement of Comprehensive Income;
- Statement of Financial Position;
- Statement of Changes in Equity;
- Cash Flow Statement; and
- Notes comprising a Summary of Significant Accounting Policies and other explanatory information.

Opinion

In my opinion, the financial statements of the Grains Research and Development Corporation:

- (a) comply with Australian Accounting Standards and the *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015*; and
- (b) present fairly the financial position of the Grains Research and Development Corporation as at 30 June 2016 and its financial performance and cash flows for the year then ended.

Accountable Authority's Responsibility for the Financial Statements

The Accountable Authority of the Grains Research and Development Corporation is responsible under the *Public Governance, Performance and Accountability Act 2013* for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards and the rules made under that Act and is also responsible for such internal control as the Accountable Authority determines is necessary to enable the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

My responsibility is to express an opinion on the financial statements based on my audit. I have conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. These auditing standards require that I comply with relevant ethical requirements relating to audit engagements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's

GPO Box 707 CANBERRA ACT 2601
19 National Circuit BARTON ACT
Phone (02) 6203 7300 Fax (02) 6203 7777



judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements 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 entity's internal control. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of accounting estimates made by the Accountable Authority of the entity, as well as evaluating the overall presentation of the financial statements.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

Independence

In conducting my audit, I have followed the independence requirements of the Australian National Audit Office, which incorporate the requirements of the Australian accounting profession.

Australian National Audit Office



Jodi George
Audit Principal

Delegate of the Auditor-General

Canberra
19 August 2016



Statement by the directors, Managing Director and Section Head Finance

GRAINS RESEARCH AND DEVELOPMENT CORPORATION

STATEMENT BY THE DIRECTORS, MANAGING DIRECTOR AND SECTION HEAD FINANCE

In our opinion, the attached financial statements for the year ended 30 June 2016 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 and its subsidiary 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 R M Clark CHAIRMAN	Dr S P Jefferies MANAGING DIRECTOR	Mrs D K Jakubowski SECTION HEAD FINANCE
19 August 2016	19 August 2016	19 August 2016

Statement of comprehensive income

For the period ended 30 June 2016

	NOTES	CONSOLIDATED		CORPORATION		ORIGINAL BUDGET \$'000
		2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000	
NET COST OF SERVICES						
Expenses						
Employee benefits	1.1A	10,490	10,741	10,490	10,741	11,535
Research and Development	1.1B	192,796	194,107	196,796	194,107	-
Suppliers	1.1C	9,440	9,374	9,440	9,374	206,827
Depreciation and amortisation	2.2A	934	733	934	733	1,338
Write-down and impairment of assets	1.1D	1,364	1,040	1,364	1,040	-
Loss on disposal of assets	1.1E	19	-	19	-	-
Total expenses		215,043	215,995	219,043	215,995	219,700
Own-source Income						
Own-source revenue						
Interest	1.2A	1,016	2,134	963	2,134	4,480
Industry contributions	1.2B	110,370	117,466	110,370	117,466	113,438
Project refunds	1.2C	3,739	3,675	3,739	3,675	3,286
Royalties	1.2D	4,451	5,358	4,451	5,358	5,840
Grants income	1.2E	527	936	527	936	420
Other revenue	1.2F	817	508	817	508	-
Total own-source revenue		120,920	130,077	120,867	130,077	127,464
Gains						
Gain on disposal of investments	1.2G	290	54	290	54	-
Change in fair value through profit or loss	1.2G	6,113	5,019	6,113	5,019	-
Total gains		6,403	5,073	6,403	5,073	-
Total own-source income		127,323	135,150	127,270	135,150	127,464
Net cost of services						
Revenue from Government	1.2H	70,225	67,986	70,225	67,986	69,128
Share of surplus/(deficit) of associates and joint ventures accounted for using the equity method		-	29	-	29	-
Surplus/(Deficit) attributable to the Australian Government		(17,495)	(12,830)	(21,548)	(12,830)	(23,108)
OTHER COMPREHENSIVE INCOME						
Items not subject to subsequent reclassification to net cost of services						
Changes in asset revaluation surplus	2.2A	(190)	388	(190)	388	-
Total other comprehensive income/(loss)		(190)	388	(190)	388	-
Total comprehensive income/(loss)		(17,685)	(12,442)	(21,738)	(12,442)	(23,108)
Total comprehensive income/(loss) attributable to the Australian Government		(17,685)	(12,442)	(21,738)	(12,442)	(23,108)

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

Budget Variances Commentary

Statement of Comprehensive Income

The Employee Expenses variance was due to the announcement of a Corporation restructure after the budget was set. The restructure resulted in a number of staff redundancies and several vacant positions for a significant portion of the financial year.

The budget for Suppliers was not split between Research and Development and Suppliers, but needs to be compared to both of these lines. The consolidated Suppliers and Research and Development variance relates to the elimination on consolidation of the Corporation's contribution to the Grains & Cropping R&D Trust of \$4 million.

Depreciation and amortisation was less than budget because the amount of Intangibles (software) purchased during the year for the Core Systems Replacement Project was less than expected.

The budget for Interest Income needs to be compared with both Interest Income and Change in Fair Value Through Profit or Loss (which includes the income from the Corporation's managed funds). Interest Income and Change in Fair Value Through Profit or Loss was more than budget due to both higher returns and a larger average cash and investment balance during the year.

Industry Contributions were less than budget due to grain prices and wheat production being lower than budgeted.

Royalties were less than budget because wheat production for the year was lower than anticipated.



Statement of financial position

as at 30 June 2016

	NOTES	CONSOLIDATED		CORPORATION		ORIGINAL BUDGET \$'000
		2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000	
ASSETS						
Financial assets						
Cash and cash equivalents	2.1A	15,271	82,534	6,618	82,534	69,142
Trade and other receivables	2.1B	31,853	26,097	31,953	26,097	16,484
Investments in managed funds	2.1C	197,009	150,891	197,009	150,891	135,872
Other investments	2.1D	4,215	6,815	4,215	6,815	6,285
Total financial assets		248,348	266,337	239,795	266,337	227,783
Non-financial assets						
Land and buildings	2.2A	7,189	3,390	7,189	3,390	3,127
Property, plant and equipment	2.2A	778	924	778	924	373
Intangibles	2.2A	3,782	615	3,782	615	6,279
Other non-financial assets	2.2B	961	2,335	961	2,335	2,200
Total non-financial assets		12,710	7,264	12,710	7,264	11,979
Assets held for sale	2.3	1,461	4,760	1,461	4,760	-
Total assets		262,519	278,361	253,966	278,361	239,762
LIABILITIES						
Payables						
Suppliers	2.4A	3,402	2,049	3,402	2,049	69,497
Research and development	2.4B	72,934	77,232	72,934	77,232	-
Other payables	2.4C	8,564	3,464	4,064	3,464	-
Total payables		84,900	82,745	80,400	82,745	69,497
Provisions						
Employee provisions	2.5A	2,028	2,162	2,028	2,162	2,250
Other provisions	2.5B	1,941	2,119	1,941	2,119	1,941
Total provisions		3,969	4,281	3,969	4,281	4,191
Total liabilities		88,869	87,026	84,369	87,026	73,688
Net assets		173,650	191,335	169,597	191,335	166,074
EQUITY						
Retained surplus		62,176	80,221	58,123	80,221	56,448
Asset revaluation surplus		2,574	2,764	2,574	2,764	2,376
Contracted research reserve		108,900	108,350	108,900	108,350	107,250
Total equity		173,650	191,335	169,597	191,335	166,074

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

Budget Variances Commentary

Statement of Financial Position

Please refer to the various Cash Flow Statement variance explanations for the Cash variance to budget.

Receivables were more than budget due to the inclusion of the convertible note, which was not budgeted for, and an underestimate of the Revenue from Government receivable.

Investments in Managed Funds were more than budget due to the transfer of surplus cash into a new cash management fund during the year - the decision to invest in the cash management fund was made after the budget was prepared.

Other Investments were less than budget due to the unforeseen reclassification of Arista Cereal Technologies Pty Ltd to Assets Held for Sale at year-end and the write-down of InterGrain Pty Ltd, which was not budgeted for.

The Land and Buildings variance relates to the reclassification of Tourism House from Assets Held for Sale - this asset was budgeted to be sold by year-end.

Intangibles were less than budget due to the deferral of some of the costs associated with the new information management system to next financial year as well as savings in the delivery of the systems to date.

The budget for Supplier Payables was not split between Research and Development and Supplier Payables, but needs to be compared to both of these lines.

Supplier Payables were more than budget due to the amount of prior-year project accruals that remain unpaid at year-end.

Other Payables relates to Unearned Grant Income - it had been assumed that the expenditure relating to these grants would have been made prior to year end.



Statement of changes in equity

as at 30 June 2016

	NOTES	CONSOLIDATED		CORPORATION		ORIGINAL BUDGET
		2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000	
RETAINED EARNINGS						
Opening balance						
Balance carried forward from previous period		80,221	96,901	80,221	96,901	78,456
Adjusted opening balance		80,221	96,901	80,221	96,901	78,456
Comprehensive income						
Surplus/(Deficit) for the period		(17,495)	(12,830)	(21,548)	(12,830)	(23,108)
Total comprehensive income		(17,495)	(12,830)	(21,548)	(12,830)	(23,108)
Transfers between equity components		(550)	(3,850)	(550)	(3,850)	1,100
Closing balance as at 30 June		62,176	80,221	58,123	80,221	56,448
ASSET REVALUATION RESERVE						
Opening balance						
Balance carried forward from previous period		2,764	2,376	2,764	2,376	2,376
Adjusted opening balance		2,764	2,376	2,764	2,376	2,376
Comprehensive income						
Other comprehensive income		(190)	388	(190)	388	-
Total comprehensive income		(190)	388	(190)	388	-
Closing balance as at 30 June		2,574	2,764	2,574	2,764	2,376
CONTRACTED RESEARCH RESERVE						
Opening balance						
Balance carried forward from previous period		108,350	104,500	108,350	104,500	108,350
Adjusted opening balance		108,350	104,500	108,350	104,500	108,350
Transfers between equity components		550	3,850	550	3,850	(1,100)
Closing balance as at 30 June		108,900	108,350	108,900	108,350	107,250
TOTAL EQUITY						
Opening balance						
Balance carried forward from previous period		191,335	203,777	191,335	203,777	189,182
Adjusted opening balance		191,335	203,777	191,335	203,777	189,182
Comprehensive income						
Surplus/(Deficit) for the period		(17,495)	(12,830)	(21,548)	(12,830)	(23,108)
Other comprehensive income		(190)	388	(190)	388	-
Total comprehensive income		(17,685)	(12,442)	(21,738)	(12,442)	(23,108)
Transfers between equity components		-	-	-	-	-
Closing balance as at 30 June		173,650	191,335	169,597	191,335	166,074

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

Budget Variances Commentary

Statement of Changes in Equity

Please refer to the commentary in the Statement of Comprehensive Income regarding the Operating Deficit variance.

The Transfers Between Equity Components variance was due to the decision by the Board to increase the R&D expenditure budget for 2016-17 from that included in the 2015-16 Budget. The Contracted Research Reserve is equal to 55% of the following year's R&D expenditure budget.

The variance in the Asset Revaluation Reserve movement was due to the revaluation decrement for Tourism House - this asset had been budgeted to be sold during the financial year.



Cash flow statement

For the period ended 30 June 2016

	NOTES	CONSOLIDATED		CORPORATION		ORIGINAL BUDGET \$'000
		2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000	
OPERATING ACTIVITIES						
Cash received						
Industry contributions		110,336	117,530	110,336	117,530	113,438
Commonwealth contributions		67,570	72,889	67,570	72,889	67,963
Interest		6,934	7,979	6,881	7,979	4,480
Grants income		5,767	5,200	1,267	5,200	420
Other		11,066	13,289	10,316	13,289	9,715
Net GST received		17,334	15,330	18,384	15,330	20,683
Total cash received		219,007	232,217	214,754	232,217	216,699
Cash used						
Research and development		214,575	191,691	218,975	191,691	-
Suppliers		11,090	10,732	11,090	10,732	225,802
Employees		10,624	10,664	10,624	10,664	11,485
Total cash used		236,289	213,087	240,689	213,087	237,287
Net cash from/(used by) operating activities	3.1	(17,282)	19,130	(25,935)	19,130	(20,588)
INVESTING ACTIVITIES						
Cash received						
Sale of property, plant and equipment		-	-	-	-	3,802
Investments		45,749	9,180	45,749	9,180	20,000
Total cash received		45,749	9,180	45,749	9,180	23,802
Cash used						
Purchase of property, plant and equipment		1,835	2,749	1,835	2,749	6,110
Investments		93,895	5,828	93,895	5,828	4,000
Shares		-	400	-	400	-
Total cash used		95,730	8,977	95,730	8,977	10,110
Net cash from/(used by) investing activities		(49,981)	203	(49,981)	203	13,692
Net increase/(decrease) in cash held		(67,263)	10,153	(75,916)	10,153	(6,896)
Cash and cash equivalents at the beginning of the reporting period		82,534	72,381	82,534	72,381	76,038
Cash and cash equivalents at the end of the reporting period	2.1A	15,271	82,534	6,618	82,534	69,142

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

Budget Variances Commentary

Cash Flow Statement

Industry Contributions Cash Received were less than budget due to grain prices and wheat production being lower than budgeted.

Interest Income Cash Received was more than budget due to both higher returns and a larger average cash and investment balance during the year.

The budget for Cash Used - Suppliers was not split between Cash Used - Research and Development and Cash Used - Suppliers, but needs to be compared to both of these lines.

Cash Received - Sale of Property, Plant and Equipment was less than budget because the expected sale of Tourism House did not occur.

The variance for Cash Received - Investments and Cash Used - Investments related to the transfer of surplus cash to a new cash management fund during the financial year (the decision to invest in the fund was made after the budget was set).

The purchase of Property, Plant and Equipment was less than budget due to the deferral of some of the costs associated with the Core System Replacement Project to next financial year as well as savings in the delivery of the project to date.



Notes to and forming part of the financial statements

For the year ended 30 June 2016

Overview

The Grains Research and Development Corporation (the Corporation) is an Australian Government controlled entity, established in 1990 as a statutory corporation under the *Primary Industries Research and Development Act 1989*. It is a not-for-profit entity. The Corporation is structured to meet the following outcome:

Outcome 1 – New information and products that enhance the productivity, competitiveness and environmental sustainability of Australian grain growers and benefit the industry and wider community, through planning, managing and implementing investments in grains research and development.

The continued existence of the Corporation in its present form and with its present programs is dependent on Government policy.

For the purposes of AASB 10 *Consolidated Financial Statements*, consolidated financial statements are prepared to include the Corporation's subsidiary, the Grains and Cropping R&D Trust.

Basis of Preparation

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

The Corporation and Group's consolidated financial statements have been prepared in accordance with:

- a) *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015 (FRR)* for reporting periods ending on or after 1 July 2015; and
- b) Australian Accounting Standards and Interpretations issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and in accordance with historical cost convention, except for certain assets and liabilities 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.

New Australian Accounting Standards

Adoption of new Australian Accounting Standard Requirements

No accounting standard has been adopted earlier than the application date as stated in the standard.

There were no new standards, revised standards, interpretations and amendments to standards that were issued prior to the signing of the Statement by Directors, Managing Director and Section Head Finance and were applicable to the current reporting period that had a material effect on the Corporation's financial statements, nor are expected to have a future material effect on the Corporation's financial statements.



Future Australian Accounting Standard Requirements

There were no new standards, revised standards, interpretations and amendments to standards that were issued by the Australian Accounting Standards Board prior to the signing of the Statement of Directors, Managing Director and Section Head Finance that are expected to have a material impact on the Corporation's financial statements for future reporting periods.

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 the Grains and Cropping R&D Trust are included in note 7.1.

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.

Note 1.1: Expenses

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
1.1A – Employee Benefits				
Wages and salaries	8,964	9,197	8,964	9,197
Superannuation				
Defined contribution plans	906	964	906	964
Defined benefits plans	183	221	183	221
Leave and other entitlements	(91)	(1)	(91)	(1)
Separation and redundancies	528	360	528	360
Total employee benefits	10,490	10,741	10,490	10,741

Accounting Policy

Accounting policies for employee related expenses is contained at note 2.5A.



2016	CONSOLIDATED					
	CROSS-COMMODITY \$'000	COARSE GRAINS \$'000	GRAIN LEGUMES \$'000	OILSEEDS \$'000	WHEAT \$'000	TOTAL \$'000
1.1B – Research and Development						
National	129,044	1,090	5,641	170	4,147	140,092
Northern region	11,454	-	300	-	15	11,769
Southern region	24,157	6	-	-	540	24,703
Western region	14,675	-	-	431	1,126	16,232
TOTAL	179,330	1,096	5,941	601	5,828	192,796
2015	179,036	1,140	6,431	1,618	5,882	194,107

2016	CORPORATION					
	CROSS-COMMODITY \$'000	COARSE GRAINS \$'000	GRAIN LEGUMES \$'000	OILSEEDS \$'000	WHEAT \$'000	TOTAL \$'000
1.1B – Research and Development						
National	133,044	1,090	5,641	170	4,147	144,092
Northern region	11,454	-	300	-	15	11,769
Southern region	24,157	6	-	-	540	24,703
Western region	14,675	-	-	431	1,126	16,232
TOTAL	183,330	1,096	5,941	601	5,828	196,796
2015	179,036	1,140	6,431	1,618	5,882	194,107

The aforementioned classification of national and regional payments is informed by investment recommendations by the three Regional Panels and the National Panel. The project outcomes may, however, have impacts across one or more regions.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
1.1C – Suppliers				
Goods and services supplied or rendered				
Staff travel and accommodation	1,425	1,339	1,425	1,339
Consultants	66	4	66	4
Panel expenses	2,115	2,297	2,115	2,297
Communications	127	95	127	95
Corporate governance	964	579	964	579
Corporate services	2,178	2,435	2,178	2,435
Levy collection costs	511	634	511	634
Other	742	763	742	763
Total goods and services supplied or rendered	8,128	8,146	8,128	8,146
Goods supplied	59	45	59	45
Services supplied	8,069	8,101	8,069	8,101
Total goods supplied	8,128	8,146	8,128	8,146



	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
1.1C – Suppliers				
Other supplier expenses				
Operating lease rentals in connection with				
Minimum lease payments	1,247	1,181	1,247	1,181
Workers compensation expenses	65	47	65	47
Total other suppliers	1,312	1,228	1,312	1,228
Total suppliers	9,440	9,374	9,440	9,374

Leasing commitments

The Corporation in its capacity as lessee has entered into the following leases:

NATURE OF LEASE	GENERAL DESCRIPTION OF LEASE AGREEMENT
Leases for office accommodation	<p>Lease payments are subject to annual reviews in accordance with the lease agreements.</p> <p>The lease of the Canberra office commenced on 1 May 2014 for a period of 10 years. There is an option to extend the lease term for 4 years. The annual review of this lease is a fixed percentage increase. As part of the lease agreement, a cash incentive of \$1,785,525 (GST exclusive) was received, which has been applied as a rent-free period at the beginning of the lease term.</p> <p>The lease of the Adelaide office commenced on 4 February 2016, with 5 rights of renewal of 1 year each. The annual review for this agreement is based on CPI.</p> <p>The lease of the Dubbo office commenced on 8 February 2016 for a period of 5 years. There is an option to extend the lease term for 5 years. The annual review for this agreement is based on CPI. As part of the lease agreement, a rent-free period was provided at the beginning of the lease term.</p> <p>The lease of the Toowoomba office commenced on 15 March 2016 for a period of 5 years. The annual review for this agreement is based on CPI.</p>
Motor vehicles - staff	<p>Leased as part of salary packages</p> <p>No contingent rentals exist</p>
Franking machine	<p>A rental agreement for a period of 5 years exists for the franking machine, after this time it is usually replaced with new rental equipment</p>

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Commitments for minimum lease payments in relation to non-cancellable operating leases are payable as follows:				
Within 1 year	1,367	1,227	1,367	1,227
Between 1 to 5 years	5,036	4,504	5,036	4,504
More than 5 years	3,174	4,294	3,174	4,294
Total operating lease commitments	9,577	10,025	9,577	10,025

Accounting Policy

Operating lease payments are expensed on a straight-line basis which is representative of the pattern of benefits derived from the leased assets.



	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
1.1D – Write-down and Impairment of Assets				
Asset write-downs and impairments from:				
Investments (shares) – revaluation decrement	1,138	1,040	1,138	1,040
Convertible note embedded derivative – revaluation decrement	226	-	226	-
Total write-down and impairment of assets	1,364	1,040	1,364	1,040
1.1E – Loss on Disposal of Assets				
Loss on Disposal of Assets from:				
Obsolete plant & equipment	19	-	19	-
Total loss on disposal of assets	19	-	19	-

1.2: Own-source Revenue and Gains

Own-Source Revenue

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
1.2A – Interest				
Deposits	915	2,134	862	2,134
Convertible notes	101	-	101	-
	1,016	2,134	963	2,134

Accounting Policy

Interest revenue is recognised using the effective interest method.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Note 1.2B – Industry Contributions				
Coarse grains	24,982	27,266	24,982	27,266
Grain legumes	16,883	10,241	16,883	10,241
Oilseeds	17,531	16,110	17,531	16,110
Wheat	50,974	63,849	50,974	63,849
Total industry contributions	110,370	117,466	110,370	117,466

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 are recognised when they are entitled to be received by the Corporation.



	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Note 1.2C – Project Refunds				
Cross commodity	3,518	3,653	3,518	3,653
Coarse grains	133	(33)	133	(33)
Grain legumes	50	19	50	19
Oilseeds	-	2	-	2
Wheat	38	34	38	34
Total project refunds	3,739	3,675	3,739	3,675

Accounting Policy

Project refunds are recognised upon receipt of the refund when it relates to prior years expenditure and when the funds accrued are not required for the completion of the project.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Note 1.2D – Royalties				
Coarse grains	1,855	2,301	1,855	2,301
Grain legumes	913	1,205	913	1,205
Oilseeds	227	268	227	268
Wheat	1,408	1,566	1,408	1,566
Other	48	18	48	18
Total royalties	4,451	5,358	4,451	5,358

Accounting Policy

Royalties are recognised when the royalty is entitled to be received by the Corporation and when it can be reliably measured.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Note 1.2E – Grants Income				
Total grants income	527	936	527	936

Accounting Policy

Grants income is revenue paid to the Corporation for the purpose of funding specific research and development projects. Grants and other non-reciprocal contributions from non-government entities are recognised as revenue when the Corporation obtains control over the assets comprising the contributions. Control is normally obtained upon receipt. Grants from government entities are recognised on a systematic basis over the periods in which the Corporation recognises as expenses the related costs for which the grants are intended.



	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Note 1.2F – Other Revenue				
Levy penalties	150	124	150	124
Groundcover advertising income	232	274	232	274
Publications revenue	16	27	16	27
Net proceeds on disposal of IP	366	-	366	-
Car park rental	47	49	47	49
Other income	6	34	6	34
Total other revenue	817	508	817	508

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Gains				
Note 1.2G – Other Gains				
Gain on disposal of investments	290	54	290	54
Change in fair value through profit or loss	6,113	5,019	6,113	5,019
Total other gains	6,403	5,073	6,403	5,073

Accounting Policy

Gain on disposal of investments

Gains from the disposal of investments are recognised when control of the asset has passed to the buyer.

Note 1.2H – Revenue from Government				
Department of Agriculture PIRD Act 1989 contribution	70,225	67,986	70,225	67,986

Accounting Policy

Revenue from Government

Revenue paid to the Corporation under Section 32 of the *Primary Industries Research and Development Act 1989*, representing 0.5% of the three-year moving average of gross value of production of grains, is for the purpose of funding research and development activities. Revenues from Government are recognised when they are entitled to be received by the Corporation.

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 the Corporation) is recognised as Revenue from Government by the Corporation unless the funding is in the nature of an equity injection or loan.



2.1: Financial Assets

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.1A – Cash and Cash Equivalents				
Interest bearing cheque account	6,612	3,337	6,612	3,337
Money market call account	-	70,599	-	70,599
Business online saver account	6	8,598	6	8,598
Trust account	8,653	-	-	-
Total cash and cash equivalents	15,271	82,534	6,618	82,534

Accounting Policy

Cash is recognised at its nominal amount. Cash and cash equivalents include:

- cash on hand; and
- demand deposits in bank accounts with an original maturity of 3 months or less that are readily convertible to known amounts of cash and subject to insignificant risk of changes in value.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.1B – Trade and Other Receivables				
Goods and services receivables				
Goods and services	20,484	18,023	20,484	18,023
Other	8,472	8,074	8,572	8,074
Total goods and services receivables	28,956	26,097	29,056	26,097
Other receivables				
Security deposits receivable	22	-	22	-
Convertible notes receivable	2,875	-	2,875	-
Total other receivables	2,897	-	2,897	-
Total trade and other receivables (net)	31,853	26,097	31,953	26,097
Trade and other receivables (net) expected to be recovered				
No more than 12 months	28,956	26,097	29,056	26,097
More than 12 months	2,897	-	2,897	-
Total trade and other receivables (net)	31,853	26,097	31,953	26,097
Trade and other receivables aged as follows:				
Not overdue	30,873	24,987	30,973	24,987
Overdue by:				
0 to 30 days	930	4	930	4
31 to 60 days	1	-	1	-
61 to 90 days	-	-	-	-
more than 90 days	49	1,106	49	1,106
	980	1,110	980	1,110
Total trade and other receivables	31,853	26,097	31,953	26,097

No indicators of impairment were found for trade and other receivables.



During the reporting period, the Corporation entered into a Convertible Note Agreement with InterGrain Pty Ltd for the amount of \$3,000,000 (principal). The Corporation receives the equivalent of the 12 month Australian Bank Bill Swap Reference Rate (at each 30 June anniversary) plus 2% based on the principal. The notes are contracted to mature 84 months after the issue date, at which time the principal and interest is to be repaid, unless a mandatory, automatic or voluntary conversion to ordinary shares occurs prior to maturity. The embedded derivative component of the convertible note was separately brought to account on inception and is disclosed at note 2.1D.

Accounting Policy

Loans and Receivables

Trade receivables and other receivables that have fixed or determinable payments that are not quoted in an active market are classified as 'loans and receivables'. Loans and receivables are measured at amortised cost using the effective interest method less impairment.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.1C – Investments in Managed Funds				
BT Fixed Interest Individually Managed Fund	77,585	60,142	77,585	60,142
At market value				
BT Cash Management Individually Managed Fund	40,868	-	40,868	-
At market value				
QIC Individually Managed Fund	78,556	-	78,556	-
At market value				
UBS Individually Managed Fund	-	58,010	-	58,010
At market value				
Equity Trustees Individually Managed Fund	-	32,739	-	32,739
At market value				
Total investments	197,009	150,891	197,009	150,891

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.



	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.1D – Investments – Other				
Shares in unlisted companies				
Australian Grain Technologies Pty Ltd	11,386	11,386	11,386	11,386
Provision for diminution in share value	(7,171)	(7,171)	(7,171)	(7,171)
	4,215	4,215	4,215	4,215
Australian Centre for Plant Functional Genomics Pty Ltd	21	21	21	21
Provision for diminution in share value	(21)	(21)	(21)	(21)
	-	-	-	-
Arista Cereal Technologies Pty Ltd ¹	-	4,400	-	4,400
Provision for diminution in share value	-	(2,939)	-	(2,939)
	-	1,461	-	1,461
InterGrain Pty Ltd	7,200	7,200	7,200	7,200
Provision for diminution in share value	(7,200)	(6,061)	(7,200)	(6,061)
	-	1,139	-	1,139
Other investments				
Convertible notes – embedded derivative	-	-	-	-
	-	-	-	-
Gross Investments – Other	18,607	23,007	18,607	23,007
Total provision for diminution in share value	(14,392)	(16,192)	(14,392)	(16,192)
Net investments - Other	4,215	6,815	4,215	6,815

¹This investment was transferred to Assets Held for Sale during the reporting period.

The shares held are ordinary shares.

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

Accounting Judgements and Estimates

The Corporation has made the following estimate:

- The valuation of unlisted shares held by the Corporation at each reporting date is equivalent to the Corporation's share of net assets of each company.
- The valuation of the embedded derivative component of the convertible note was based on the net asset position of the company.



2.2: Non-Financial Assets

2.2A – Reconciliation of the Opening and Closing Balances of Property, Plant and Equipment and Intangibles

Reconciliation of the opening and closing balances of property, plant and equipment and intangibles – 2016

	CONSOLIDATED						TOTAL \$'000
	LEASEHOLD LAND \$'000	BUILDINGS ON LEASEHOLD LAND \$'000	PROPERTY, PLANT & EQUIPMENT \$'000	OTHER INFORMATION MANAGEMENT SYSTEM \$'000	SOFTWARE \$'000	INTELLECTUAL PROPERTY \$'000	
As at 1 July 2015							
Gross book value	-	3,723	1,038	727	1,306	140	6,934
Accumulated depreciation and impairment	-	(333)	(114)	(727)	(831)	-	(2,005)
Net book value 1 July 2015	-	3,390	924	-	475	140	4,929
Additions:							
By purchase	-	66	134	-	1,629	6	1,835
Revaluations and impairment recognised in other comprehensive income	-	(90)	-	-	-	-	(90)
Depreciation and amortisation expense	-	(377)	(261)	-	(296)	-	(934)
Transfer from assets held for sale	742	3,558	-	-	-	-	4,300
Other movements	-	-	-	-	-	-	-
Work in progress	-	-	-	-	1,828	-	1,828
Disposals:							
Other	-	-	(19)	-	-	-	(19)
Net book value 30 June 2016	742	6,447	778	-	3,636	146	11,749
Net book value as at 30 June 2016 represented by:							
Gross book value	742	7,157	1,119	727	4,763	146	14,654
Accumulated depreciation, amortisation and impairment losses	-	(710)	(341)	(727)	(1,127)	-	(2,905)
Net book value 30 June 2016	742	6,447	778	-	3,636	146	11,749



Reconciliation of the opening and closing balances of property, plant and equipment and intangibles – 2016

CORPORATION							
	LEASEHOLD LAND \$'000	BUILDINGS ON LEASEHOLD LAND \$'000	PROPERTY, PLANT & EQUIPMENT \$'000	OTHER INFORMATION MANAGEMENT SYSTEM \$'000	SOFTWARE \$'000	INTELLECTUAL PROPERTY \$'000	TOTAL \$'000
As at 1 July 2015							
Gross book value	-	3,723	1,038	727	1,306	140	6,934
Accumulated depreciation and impairment	-	(333)	(114)	(727)	(831)	-	(2,005)
Net book value 1 July 2015	-	3,390	924	-	475	140	4,929
Additions:							
By purchase	-	66	134	-	1,629	6	1,835
Revaluations and impairment recognised in other comprehensive income	-	(190)	-	-	-	-	(190)
Depreciation and amortisation expense	-	(377)	(261)	-	(296)	-	(934)
Transfer from assets held for sale	742	3,558	-	-	-	-	4,300
Other movements							
Work in progress	-	-	-	-	1,828	-	1,828
Disposals:							
Other	-	-	(19)	-	-	-	(19)
Net book value 30 June 2016	742	6,447	778	-	3,636	146	11,749
Net book value as at 30 June 2016 represented by:							
Gross book value	742	7,157	1,119	727	4,763	146	14,654
Accumulated depreciation, amortisation and impairment losses	-	(710)	(341)	(727)	(1,127)	-	(2,905)
Net book value 30 June 2016	742	6,447	778	-	3,636	146	11,749

No indicators of impairment were found for property, plant and equipment and intangibles.

No property, plant or equipment and intangibles are expected to be sold or disposed of within the next 12 months.

Revaluation of non-financial assets

All revaluations were conducted in accordance with the revaluation policy stated below. A formal revaluation of property, plant and equipment was also conducted by Australian Valuation Solutions Pty Ltd as at 30 June 2014.

Reconciliation of the opening and closing balances of property, plant and equipment and intangibles – 2015

CONSOLIDATED								
	LEASEHOLD LAND \$'000	BUILDINGS ON LEASEHOLD LAND \$'000	PROPERTY, PLANT & EQUIPMENT \$'000	OTHER PROPERTY, PLANT & EQUIPMENT \$'000	INFORMATION MANAGEMENT SYSTEM \$'000	SOFTWARE \$'000	INTELLECTUAL PROPERTY \$'000	TOTAL \$'000
As at 1 July 2014								
Gross book value	690	5,241	212	727	1,188	127	8,185	
Accumulated depreciation and impairment	-	-	-	(727)	(633)	-	(1,360)	
Net book value 1 July 2014	690	5,241	212	-	555	127	6,825	
Additions:								
By purchase	-	1,792	826	-	118	13	2,749	
Revaluations and impairment recognised in other comprehensive income	52	336	-	-	-	-	388	
Transfer to assets held for sale	(742)	(3,558)	-	-	-	-	(4,300)	
Depreciation and amortisation expense	-	(421)	(114)	-	(198)	-	(733)	
Net book value 30 June 2015	-	3,390	924	-	475	140	4,929	
Net book value as at 30 June 2015 represented by:								
Gross book value	-	3,723	1,038	727	1,306	140	6,934	
Accumulated depreciation, amortisation and impairment losses	-	(333)	(114)	(727)	(831)	-	(2,005)	
Net book value 30 June 2015	-	3,390	924	-	475	140	4,929	



Reconciliation of the opening and closing balances of property, plant and equipment and intangibles – 2015

	CORPORATION						TOTAL \$'000
	LEASEHOLD LAND \$'000	BUILDINGS ON LEASEHOLD LAND \$'000	OTHER PROPERTY, PLANT & EQUIPMENT \$'000	INFORMATION MANAGEMENT SYSTEM \$'000	SOFTWARE \$'000	INTELLECTUAL PROPERTY \$'000	
As at 1 July 2014							
Gross book value	690	5,241	212	727	1,188	127	8,185
Accumulated depreciation and impairment	-	-	-	(727)	(633)	-	(1,360)
Net book value 1 July 2014	690	5,241	212	-	555	127	6,825
Additions:							
By purchase	-	1,792	826	-	118	13	2,749
Revaluations and impairment recognised in other comprehensive income	52	336	-	-	-	-	388
Transfer to assets held for sale	(742)	(3,558)	-	-	-	-	(4,300)
Depreciation and amortisation expense	-	(421)	(114)	-	(198)	-	(733)
Net book value 30 June 2015	-	3,390	924	-	475	140	4,929
Net book value as at 30 June 2015 represented by:							
Gross book value	-	3,723	1,038	727	1,306	140	6,934
Accumulated depreciation, amortisation and impairment losses	-	(333)	(114)	(727)	(831)	-	(2,005)
Net book value 30 June 2015	-	3,390	924	-	475	140	4,929



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. 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.

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.

Revaluations

Following initial recognition at cost, property, plant and equipment are carried at fair value less subsequent accumulated depreciation and accumulated impairment losses. Valuations 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 depend 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 reversed 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-off 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:

	2016	2015
Buildings on leasehold land	25 years	25 years
Other infrastructure, plant & equipment	3 to 12 years	3 to 12 years

Assets purchased with research payments

Assets purchased with research payments may revert to the Corporation at the end of the research project period and will be accounted for appropriately at that date. During the financial year no research assets reverted to the Corporation (2015: \$NIL).



Impairment

All assets were assessed for impairment at 30 June 2016. 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 its 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.

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 internally developed software for internal use.

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:

	2016	2015
Information management system	2.5 years	2.5 years
Other software	4 years	4 years

All software assets were assessed for indications of impairments as at 30 June 2016.

Development costs

Research 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.

All intangible assets were assessed for indications of impairment as at 30 June 2016.

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.2B – Other Non-Financial Assets				
Accrued interest	22	151	22	151
Accrued income	782	1,472	782	1,472
Prepayments	157	123	157	123
Lease incentive	-	589	-	589
Total other non-financial assets	961	2,335	961	2,335

All non-financial assets are expected to be recovered in no more than 12 months.

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

Accrued interest

The interest rates range from 0.90% to 2.00% (2015: 1.15% to 2.50%) and the frequency of payments is monthly.



2.3: Assets Held for Sale

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
The following assets have been classified as held for sale:				
Investments – shares in unlisted companies	1,461	460	1,461	460
Land and buildings on leasehold land	-	4,300	-	4,300
Total assets held for sale	1,461	4,760	1,461	4,760

2.4: Payables

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.4A – Suppliers				
Trade creditors – external parties	808	1,444	808	1,444
Accrued expenses – external parties	2,594	605	2,594	605
Total supplier payables	3,402	2,049	3,402	2,049
Supplier payables are expected to be settled in:				
No more than 12 months	3,067	1,849	3,067	1,849
More than 12 months	335	200	335	200
Total supplier payables	3,402	2,049	3,402	2,049

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 are expected to be settled in:				
No more than 12 months	72,565	77,082	72,565	77,082
More than 12 months	369	150	369	150
Total research and development payables	72,934	77,232	72,934	77,232
2.4C – Other Payables				
Unearned grant income – related parties	8,564	3,464	4,064	3,464
Total other payables	8,564	3,464	4,064	3,464
Other payables are expected to be settled in:				
No more than 12 months	8,564	1,155	4,064	1,155
More than 12 months	-	2,309	-	2,309
Total other payables	8,564	3,464	4,064	3,464



2.5: Provisions

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
2.5A – Employee Provisions				
Leave	2,028	2,162	2,028	2,162
Total employee provisions	2,028	2,162	2,028	2,162
Employee provisions are expected to be settled in:				
No more than 12 months	1,548	1,724	1,548	1,724
More than 12 months	480	438	480	438
Total employee provisions	2,028	2,162	2,028	2,162

Accounting Policy

Liabilities for 'short-term employee benefits' (as defined in AASB 119 *Employee Benefits*) and termination benefits due within twelve months of the end of the reporting period are measured at their nominal amounts.

Other long-term 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 on the basis of 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 takes into account attrition rates and pay increases through promotion and inflation.

Superannuation

The Corporation's staff are members of the Commonwealth Superannuation Scheme (CSS), the Public Sector Superannuation Scheme (PSS), the PSS Accumulation Plan (PSSap), AustralianSuper or an approved superannuation scheme of their choice.

The CSS and PSS are defined benefit schemes for the Australian Government. The PSSap is a defined contribution scheme.

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 9.5% of superannuable salaries.

As at 30 June, superannuation contributions payable were \$NIL (2015: \$NIL).



	CONSOLIDATED		
	LEASE INCENTIVE	PROVISION FOR MAKE GOOD	TOTAL
	\$'000	\$'000	\$'000
2.5B – Other Provisions			
As at 1 July 2015	1,577	542	2,119
Amounts used	(178)	-	(178)
Total as at 30 June 2016	1,399	542	1,941

	CORPORATION		
	LEASE INCENTIVE	PROVISION FOR MAKE GOOD	TOTAL
	\$'000	\$'000	\$'000
2.5B – Other Provisions			
As at 1 July 2015	1,577	542	2,119
Amounts used	(178)	-	(178)
Total as at 30 June 2016	1,399	542	1,941

	CONSOLIDATED		CORPORATION	
	2016	2015	2016	2015
	\$'000	\$'000	\$'000	\$'000
Other provisions are expected to be settled in:				
No more than 12 months	179	179	179	179
More than 12 months	1,762	1,940	1,762	1,940
Total other provisions	1,941	2,119	1,941	2,119

The Corporation currently has an agreement for the leasing of premises which have 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 present value of this obligation.



3.1: Cash Flow Reconciliation

Reconciliation of cash and cash equivalents as per Statement of Financial Position to Cash Flow Statement

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Cash and cash equivalents as per:				
Cash Flow Statement	15,271	82,534	6,618	82,534
Statement of Financial Position	2.1A 15,271	82,534	6,618	82,534
Difference	-	-	-	-
Reconciliation of net cost of services to net cash from/(used by) operating activities:				
Net cost of services	(87,720)	(80,845)	(91,773)	(80,845)
Revenue from Government	70,225	67,986	70,225	67,986
Share of surplus/(deficit) of associates	-	29	-	29
Adjustments for non-cash items				
Depreciation/amortisation	934	733	934	733
Net write down of financial assets	1,364	1,040	1,364	1,040
Loss on disposal of assets	19	-	19	-
Share of net (surplus)/loss of associates	-	(29)	-	(29)
Revaluation of investments	(223)	808	(223)	808
Gain on disposal of investments	(290)	-	(290)	-
Movements in assets and liabilities				
Assets				
(Increase)/decrease in trade and other receivables	(3,114)	(16,683)	(2,981)	(16,683)
(Increase)/decrease in lease incentive asset	589	1,026	589	1,026
(Increase)/decrease in other non-financial assets	785	21,974	785	21,974
(Increase)/decrease on accrued interest on convertible notes	(101)	-	(101)	-
Liabilities				
Increase/(decrease) in employee provisions	(134)	78	(134)	78
Increase/(decrease) in lease incentive provision	(178)	(179)	(178)	(179)
Increase/(decrease) in trade and other payables	562	23,192	(4,171)	23,192
Net cash from operating activities	(17,282)	19,130	(25,935)	19,130



4.1: Senior Management Personnel Remuneration

	CONSOLIDATED		CORPORATION	
	2016 \$	2015 \$	2016 \$	2015 \$
Short-term employee benefits:				
Salary	1,738,097	1,500,976	1,738,097	1,500,976
Performance bonuses	188,606	150,205	188,606	150,205
Total short-term employee benefits	1,926,703	1,651,181	1,926,703	1,651,181
Post-employment benefits:				
Superannuation	193,336	166,649	193,336	166,649
Total post-employment benefits	193,336	166,649	193,336	166,649
Other long-term employee benefits:				
Annual leave	120,844	102,511	120,844	102,511
Long service leave	36,304	31,089	36,304	31,089
Total other long-term benefits	157,148	133,600	157,148	133,600
Termination benefits	-	107,682	-	107,682
Total senior executive remuneration expenses	2,277,187	2,059,112	2,277,187	2,059,112

The total number of senior management personnel that are included in the above table are 14 individuals (2015: 19 individuals).

4.2: Related Party Disclosures

The following persons were Directors of the Grains Research and Development Corporation during the year:

Mr Richard Clark (Chair)
 Mr Kim Halbert (Deputy Chair)
 Dr Jeremy Burdon
 Mr John Woods
 Dr Andrew Barr
 Dr Helen Garnett
 Mr David Shannon
 Ms Roseanne Healy
 Mr John Harvey (Executive Director – term finished 8 April 2016)
 Dr Stephen Thomas (Acting Executive Director – appointed 9 April 2016)

The aggregate remuneration of Directors is disclosed in note 4.1.

No loans were made to the Directors or Director-related entities during the reporting period.

Several directors of the Corporation hold directorships with other organisations. Any transactions between the Corporation and those organisations with a Director common to the Corporation or any dealings between the Corporation and the Directors individually are conducted using commercial and arms-length principles.



Other Transactions with Directors or Director-Related Entities

Consolidated reporting entity and the Corporation

DIRECTOR	ORGANISATION AND POSITION HELD	NATURE OF TRANSACTION	EXPENDITURE PAID TO ENTITY \$'000	INCOME RECEIVED FROM ENTITY \$'000
Dr H Garnett	Sugar Research Australia – <i>Director</i>	Grant for research project	-	50
Dr H Garnett	Australian Centre for Plant Functional Genomics Pty Ltd – <i>Chair</i>	Funding for research projects	1,049	-
Total			1,049	50



5.1: Financial Instruments

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
5.1A – Categories of Financial Instruments				
Financial Assets				
Loans and receivables				
Cash and cash equivalents	15,271	82,534	6,618	82,534
Trade and other receivables	23,381	18,023	23,381	18,023
Total loans and receivables	38,652	100,557	29,999	100,557
Available-for-sale financial assets				
Shares in unlisted companies	4,215	6,815	4,215	6,815
Total available-for-sale financial assets	4,215	6,815	4,215	6,815
Financial assets at fair value through profit or loss (designated)				
Managed funds	197,009	150,891	197,009	150,891
Total financial assets at fair value through profit or loss (designated)	197,009	150,891	197,009	150,891
Total financial assets	239,876	258,263	231,223	258,263
Financial Liabilities				
Financial liabilities measured at amortised cost				
Payables	73,742	78,676	73,742	78,676
Total financial liabilities measured at amortised cost	73,742	78,676	73,742	78,676
Total financial liabilities	73,742	78,676	73,742	78,676

Accounting Policy

The Corporation classifies its financial assets in the following categories:

- financial assets at fair value through profit or loss;
- held-to-maturity investments;
- available-for-sale financial assets; and
- loans and receivables.

The classification depends on the nature and purpose of the financial assets and is determined at the time of initial recognition. Financial assets are recognised and derecognised upon trade date.

Effective interest method

Income is recognised on an effective interest rate basis except for financial assets at fair value through profit or loss.



Financial assets at fair value through profit or loss

Financial assets are classified as financial assets at fair value through profit or loss where the financial assets:

- a) have been acquired principally for the purpose of selling in the near future;
- b) are derivatives that are not designated and effective as a hedging instrument; or
- c) are parts of an identified portfolio of financial instruments that the Corporation manages together and has a recent actual pattern of short-term profit-taking.

Assets in this category are classified as current assets.

Financial assets at fair value through profit or loss 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.

Available-for-sale financial assets

Available-for-sale financial assets are non-derivatives that are either designated in this category or not classified in any of the other categories.

Available-for-sale financial assets are recorded at fair value. Gains and losses arising from changes in fair value are recognised directly in reserves (equity) with the exception of impairment losses. Interest is calculated using the effective interest method and foreign exchange gains and losses on monetary assets are recognised directly in profit or loss. Where the asset is disposed of or is determined to be impaired, part (or all) of the cumulative gain or loss previously recognised in the reserve is included in surplus or deficit for the period.

Where a reliable fair value cannot be established for unlisted investments in equity instruments, these instruments are valued at cost. The Corporation holds shares in the following unlisted companies:

- Australian Grain Technologies Pty Ltd (holding: 39%);
- Australian Centre for Plant Functional Genomics Pty Ltd (holding: 19%);
- InterGrain Pty Ltd (holding: 25%).

Australian Grain Technologies Pty Ltd and InterGrain Pty Ltd conduct R&D for the development of new crop varieties and are responsible for the commercialisation and adoption of those varieties. Australian Centre for Plant Functional Genomics Pty Ltd conducts R&D activities relating to seed technology and new wheat varieties. The success and ability to generate future economic benefits are subject to uncertainty and the Corporation believes that this will impair the carrying values of the investments.

The Corporation has established a *provision for diminution in share value* to record a reduction in the value of each of these investments based on the Corporation's estimate of the trading performance of each company. A review of the trading performances will be performed annually and the provisions adjusted accordingly. The provision for each investment is disclosed at note 2.1D. The provision will remain effective until such time as the Corporation believes that the investment would generate sufficient future economic benefits from a successfully marketed product or service and an active market for the investment exists. The investment would then be measured at fair value.

Impairment of financial assets

Financial assets are assessed for impairment at the end of each reporting period.

Financial assets carried at amortised cost – if there is objective evidence that an impairment loss has been incurred for loans and receivables or held-to-maturity investments held at amortised cost, the amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows discounted at the asset's original effective interest rate. The carrying amount is reduced by way of an allowance account. The loss is recognised in the Statement of Comprehensive Income.



Available-for-sale financial assets – if there is objective evidence that an impairment loss on an available-for-sale financial asset has been incurred, the amount of the difference between its cost, less principal repayments and amortisation, and its current fair value, less any impairment loss previously recognised in expenses, is transferred from equity to the Statement of Comprehensive Income.

Financial assets carried at cost – if there is objective evidence that an impairment loss has been incurred, the amount of the impairment loss is the difference between the carrying amount of the asset and the present value of the estimated future cash flows discounted at the current market rate for similar assets.

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 fair value through profit or loss

Financial liabilities at fair value through profit or loss are initially measured at fair value. Subsequent fair value adjustments are recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest paid on the financial liability.

Other financial liabilities

Other 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).



	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
5.1B – Net Gains or Losses on Financial Assets				
Loans and receivables				
Interest revenue	1,016	2,134	963	2,134
Net gain on loans and receivables	1,016	2,134	963	2,134
Available-for-sale financial assets				
Impairment	(1,138)	(1,040)	(1,138)	(1,040)
Net (loss) on available-for-sale financial assets	(1,138)	(1,040)	(1,138)	(1,040)
Financial assets at fair value through profit or loss				
Change in fair value	(226)	-	(226)	-
Net (loss) on financial assets at fair value through profit and loss	(226)	-	(226)	-
Financial assets at fair value through profit or loss (designated)				
Change in fair value	6,113	5,073	6,113	5,073
Net gain on financial assets at fair value through profit and loss (designated)	6,113	5,073	6,113	5,073
Net gain on financial assets	5,765	6,167	5,712	6,167

There was no net gain or loss on financial liabilities.

Note 5.1C – Fair Value of Financial Instruments

The carrying amount of all financial assets and financial liabilities approximate their fair value.

Note 5.1D – Credit Risk

The Corporation's maximum exposure to credit risk at reporting date in relation to each class of recognised financial assets is the carrying amount of those assets as indicated in the Statement of Financial Position.

Fair values through profit or loss (designated) investments are restricted to securities that are in accordance with 59(b) of the PGPA Act, including, as a minimum, a Standard and Poor's long-term rating of A-. Further restrictions are imposed under the policies and procedures of the Corporation. The majority of loans and receivables are contributions from the Australian Government.

The Corporation manages its credit risk through:

- a) A monthly review by management of the Corporation's investments:
 - to ensure that they are in accordance with section 59 of the PGPA Act and the Corporation's policies and procedures; and
 - to assess how the individually managed fund investments are performing against the set benchmark (the Bloomberg AusBond Government Index 0-5 years);
- b) A biannual review by the Finance, Risk and Audit Committee of the performance of the Corporation's individually managed funds in comparison with other fund managers with a similar investment profile; and
- c) Policies and procedures that guide employees in managing debtors.

The Corporation holds collateral for the convertible note to mitigate against credit risk.



Credit quality of financial assets not past due or individually determined as impaired

	NOT PAST DUE NOR IMPAIRED 2016 \$'000	NOT PAST DUE NOR IMPAIRED 2015 \$'000	PAST DUE OR IMPAIRED 2016 \$'000	PAST DUE OR IMPAIRED 2015 \$'000
Consolidated				
Cash and cash equivalents	15,271	82,534	-	-
Trade and other receivables	22,401	16,913	980	1,110
Convertible notes - embedded derivative	-	-	226	-
Managed funds	197,009	150,891	-	-
Shares in unlisted companies	4,215	6,815	14,392	19,419
Total	238,896	257,153	15,598	20,529
Corporation				
Cash and cash equivalents	6,618	82,534	-	-
Trade and other receivables	22,401	16,913	980	1,110
Convertible notes - embedded derivative	-	-	226	-
Managed funds	197,009	150,891	-	-
Shares in unlisted companies	4,215	6,815	14,392	19,419
Total	230,243	257,153	15,598	20,529

Ageing of financial assets that are past due but not impaired for 2016

	0 TO 30 DAYS \$'000	31 TO 60 DAYS \$'000	61 TO 90 DAYS \$'000	90+ DAYS \$'000	TOTAL \$'000
Consolidated					
Receivables	930	1	-	49	980
Total	930	1	-	49	980
Corporation					
Receivables	930	1	-	49	980
Total	930	1	-	49	980

Ageing of financial assets that are past due but not impaired for 2015

	0 TO 30 DAYS \$'000	31 TO 60 DAYS \$'000	61 TO 90 DAYS \$'000	90+ DAYS \$'000	TOTAL \$'000
Consolidated					
Receivables	4	-	-	1,106	1,110
Total	4	-	-	1,106	1,110
Corporation					
Receivables	4	-	-	1,106	1,110
Total	4	-	-	1,106	1,110



The following assets have been individually assessed as impaired:

	CONSOLIDATED		CORPORATION	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Shares in unlisted companies	14,392	19,419	14,392	19,419
Convertible notes – embedded derivative	226	-	226	-
Total	14,618	19,419	14,618	19,419

Factors that have been considered in assessing the shares and the embedded derivative as impaired include:

- the continued uncertainty in the success and ability of the companies to generate future economic benefits; and
- the decrease in the net assets of the companies.

Note 5.1E – Liquidity Risk

The exposure to liquidity risk is based on the notion that the Corporation will encounter difficulty in meeting its obligations associated with financial liabilities.

The Corporation has minimal exposure to liquidity risk. The Corporation receives funding from industry through levies and contributions from the Australian Government. In addition, the Corporation has controls in place to ensure that it has adequate resources to meet its financial obligations and has no past experience of default.

Maturities for non-derivative financial liabilities 2016

	ON DEMAND \$'000	WITHIN 1 YEAR \$'000	1 TO 2 YEARS \$'000	2 TO 5 YEARS \$'000	> 5 YEARS \$'000	TOTAL \$'000
Consolidated						
Payables	-	73,373	369	-	-	73,742
Total	-	73,373	369	-	-	73,742
Corporation						
Payables	-	73,373	369	-	-	73,742
Total	-	73,373	369	-	-	73,742

Maturities for non-derivative financial liabilities 2015

	ON DEMAND \$'000	WITHIN 1 YEAR \$'000	1 TO 2 YEARS \$'000	2 TO 5 YEARS \$'000	> 5 YEARS \$'000	TOTAL \$'000
Consolidated						
Payables	-	78,526	150	-	-	78,676
Total	-	78,526	150	-	-	78,676
Corporation						
Payables	-	78,526	150	-	-	78,676
Total	-	78,526	150	-	-	78,676

The Corporation had no derivative financial liabilities in both the current and prior year.



Note 5.1F – Market risk

Sensitivity analysis of the risk that the Corporation is exposed to for 2016

RISK VARIABLE		CHANGE IN RISK VARIABLE	EFFECT ON	
			NET COST OF SERVICES 2016 \$'000	EQUITY 2016 \$'000
Consolidated				
Interest rate risk	Interest	+0.3%	(1,282)	(1,282)
		-0.3%	1,282	1,282
Currency Risk	USD	+10.5%	8	8
		-10.5%	(9)	(9)
Corporation				
Interest rate risk	Interest	+0.3%	(1,282)	(1,282)
		-0.3%	1,282	1,282
Currency Risk	USD	+10.5%	8	8
		-10.5%	(9)	(9)

Sensitivity analysis of the risk that the Corporation is exposed to for 2015

RISK VARIABLE		CHANGE IN RISK VARIABLE	EFFECT ON	
			NET COST OF SERVICES 2016 \$'000	EQUITY 2016 \$'000
Consolidated				
Interest rate risk	Interest	+0.40%	(1,458)	(1,458)
		-0.40%	1,458	1,458
Currency Risk	USD	+10.9%	2	2
		-10.9%	(5)	(5)
Currency Risk	GBP	+10.9%	1	1
		-10.9%	(3)	(3)
Corporation				
Interest rate risk	Interest	+0.40%	(1,458)	(1,458)
		-0.40%	1,458	1,458
Currency Risk	USD	+10.9%	2	2
		-10.9%	(5)	(5)
Currency Risk	GBP	+10.9%	1	1
		-10.9%	(3)	(3)



Interest rate risk

Interest rate risk refers to the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market interest rates. The Corporation is exposed to interest rate risk primarily from managed funds.

A 30 basis point (2015: 40 basis points) change is deemed to be reasonably possible and is used when reporting interest rate risk.

The method used to arrive at the possible risk of 30 basis points was based on both statistical and non-statistical analysis. The statistical analysis has been based on the cash rate for the past five years issued by the Reserve Bank of Australia (RBA) as the underlying dataset. This information is then revised and adjusted for reasonableness under the current economic circumstances.

Currency risk

Foreign currency risk refers to the risk that the fair value or future cash flows of a financial instrument will fluctuate due to changes in foreign exchange rates. The Corporation is exposed to foreign exchange currency risk primarily through undertaking certain transactions denominated in foreign currency.

The Corporation is exposed to foreign currency denominated in US dollars.

The method used to arrive at the possible risk of 10.5 per cent was based on both statistical and non-statistical analyses. The statistical analysis has been based on main currency's movement for the last five years. The five main currencies that the Commonwealth is exposed to are USD, EUR, GBP, JPY and NZD. This information is then revised and adjusted for reasonableness under the current economic circumstances.

Other price risk

The Corporation is not exposed to other price risk.

Note 5.2: Fair Value Measurements

The following tables provide an analysis of assets and liabilities that are measured at fair value. The different levels of the fair value hierarchy are defined below.

Level 1: Quoted prices (unadjusted) in active markets for identical assets or liabilities that the Corporation can access at measurement date.

Level 2: Inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly.

Level 3: Unobservable inputs for the asset or liability.



Note 5.2A – Fair Value Measurements, Valuation Techniques and Inputs Used

FAIR VALUE MEASUREMENTS AT THE END OF THE REPORTING PERIOD					
	2016 \$'000	2015 \$'000	CATEGORY (LEVEL 1, 2 OR 3) ^{3,4}	VALUATION TECHNIQUE(S) AND INPUTS USE	
Financial assets					
Investments in managed funds	197,009	150,891	Level 1		
Convertible notes – embedded derivative	-	-	Level 3	Binomial Opting Pricing Model	Net Asset Value/share (per management accounts)
Total financial assets	197,009	150,891			
Non-financial assets²					
Leasehold land	742	-	Level 3	Market Approach	Price per square metre
Building on leasehold land	3,368	-	Level 3	Income Approach	Rental price per square metre Capitalisation rate
Leasehold improvements	3,079	3,390	Level 3	Depreciated Replacement Cost	Replacement cost new Consumed economic benefit/ Obsolescence of asset
Other property, plant and equipment	778	924	Level 2	Market Approach	Adjusted market transactions
Total non-financial assets	7,967	4,314			
Total fair value measurements of assets in the Statement of Financial Position	204,976	155,205			

1. No change in valuation technique occurred during the period

2. Fair value measurements – highest and best use differs from current for non-financial assets (NFAs). The Corporation's assets are held for operational purposes of deriving a profit. The current use of the assets is considered the highest and best use.

3. There has been no transfers between levels 1 and 2 during the year

4. The remaining assets and liabilities reported by the Corporation are not measured at fair value in the Statement of Financial Position.



Note 5.2B – Reconciliation for Recurring Level 3 Fair Value Measurements

Recurring Level 3 fair value measurements – reconciliation of assets

	FINANCIAL ASSETS				NON-FINANCIAL ASSETS				TOTAL		
	CONVERTIBLE NOTES – EMBEDDED DERIVATIVE				LAND		BUILDINGS			LEASEHOLD IMPROVEMENTS	
	2016	2015	2016	2015	2016	2015	2016	2015		2016	2015
\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	
As at 1 July	-	-	-	690	-	3,310	3,390	1,484	3,390	5,484	
Total gains/(losses) in net cost of services ¹	(226)	-	-	-	-	(88)	(377)	(333)	(603)	(421)	
Total gains/(losses) in other comprehensive income ²	-	-	-	52	(190)	336	-	-	(190)	388	
Transfers from/(to) held for sale	-	-	742	(742)	3,558	(3,558)	-	-	4,300	(4,300)	
Transfer from work in progress	-	-	-	-	-	-	-	447	-	447	
Purchases	226	-	-	-	-	-	66	1,792	292	1,792	
Total as at 30 June	-	-	742	-	3,368	-	3,079	3,390	7,188	3,390	

1. These gains/(losses) are presented in the Statement of Comprehensive Income under Depreciation and Amortisation and Write-down and Impairment of Assets

2. These gains/(losses) are presented in the Statement of Comprehensive Income under Changes in Asset Revaluation

6.1: Reporting of Outcomes

	OUTCOME 1 ¹		TOTAL	
	2016 \$'000	2015 \$'000	2016 \$'000	2015 \$'000
Consolidated				
Expenses				
Departmental	215,043	215,995	215,043	215,995
Total	215,043	215,995	215,043	215,995
Other own-sourced income				
Departmental				
Interest	1,016	2,134	1,016	2,134
Industry contributions	110,370	117,466	110,370	117,466
Project refunds	3,739	3,675	3,739	3,675
Royalties	4,451	5,358	4,451	5,358
Grants income	527	936	527	936
Other revenue	817	508	817	508
Gain on disposal of investments	290	54	290	54
Change in fair value through profit and loss	6,113	5,019	6,113	5,019
Total other own-sourced income	127,323	135,150	127,323	135,150
Net cost of outcome delivery	87,720	80,845	87,720	80,845
Corporation				
Expenses				
Departmental	219,043	215,995	219,043	215,995
Total	219,043	215,995	219,043	215,995
Other own-sourced income				
Departmental				
Interest	963	2,134	963	2,134
Industry contributions	110,370	117,466	110,370	117,466
Project refunds	3,739	3,675	3,739	3,675
Royalties	4,451	5,358	4,451	5,358
Grants income	527	936	527	936
Other revenue	817	508	817	508
Gain on disposal of investments	290	54	290	54
Change in fair value through profit and loss	6,113	5,019	6,113	5,019
Total other own-sourced income	127,270	135,150	127,270	135,150
Net cost of outcome delivery	91,773	80,845	91,773	80,845

1. Outcome 1 is described in the Notes Overview.



Note 7.1: Assets Held in Trust

The Grains and Cropping R&D Trust (the Trust) was established during the reporting period and the Corporation is the trustee of the Trust. The purpose of the Trust is to identify, acquire and develop an R&D property for the purpose of carrying on scientific research in agriculture.

Trust monies are not available for other purposes of the Corporation and are recognised in the consolidated financial statements. At the period-end, the Corporation holds no non-monetary assets in trust.

The trust deed indemnifies the Corporation in respect of any liabilities incurred relating to the execution of its role as the Trustee, limited to the trust assets, and liabilities in relation to the trust property.

Movement summary of monies held in trust:

	2016 \$'000	2015 \$'000
Grains and Cropping R&D Trust		
As at 1 July	-	-
Contributions received	8,500	-
Interest received	54	-
Total amount held in trust as at 30 June	8,554	-







Appendices

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Appendix A—Expenditure on government research priorities

The Australian Government's research, development and extension priorities with relevance to the GRDC's investments are identified in the Science and Research Priorities, announced in May 2015, and the Rural Research, Development and Extension Priorities, released in May 2015. Those priorities have superseded the Strategic Research Priorities and Rural R&D Priorities, which were used in the development of the Annual Operational Plan 2015–16.

The following tables summarise the total expenditure allocated against the Australian Government's Science and Research Priorities and Rural Research, Development and Extension Priorities within the 2015–16 financial year. The allocation of funds is shown in both dollar and percentage terms for each investment theme.



Table A1: Expenditure on Science and Research Priorities

	FOOD		SOIL-AND WATER		TRANSPORT		CYBERSECURITY		ENERGY		RESOURCES		ADVANCED MANUFACTURING		ENVIRONMENTAL CHANGE		HEALTH		OTHER ^a		TOTAL		
	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	
Meeting market requirements	15.40		-		-		-		-		-		-		-		-		-		-		15.40
Improving crop yield	39.69		-		-		-		-		-		-		-		-		-		-		39.69
Protecting your crop	42.37		-		-		-		-		-		-		-		-		-		-		42.37
Advancing profitable farming systems	-		35.46		-		-		-		-		-		-		-		-		-		35.46
Improving your farm resource base	-		12.14		-		-		-		-		4.23		-		-		-		-		16.37
Building skills and capacity	1.82		1.66		-		-		-		-		0.31		0.06		0.06		-		0.06		9.25
Foundational activities	1.61		0.02		-		-		-		-		0.01		-		-		-		-		26.14
R&D management	4.49		0.03		-		-		-		-		0.80		-		-		-		2.79		8.11
Total \$m	105.38		49.31		-		-		-		-		5.35		0.06		0.06		-		32.69		192.79
	%		%		%		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Meeting market requirements	7.99		-		-		-		-		-		-		-		-		-		-		7.99
Improving crop yield	20.59		-		-		-		-		-		-		-		-		-		-		20.59
Protecting your crop	21.97		-		-		-		-		-		-		-		-		-		-		21.97
Advancing profitable farming systems	-		18.39		-		-		-		-		-		-		-		-		-		18.39
Improving your farm resource base	-		6.30		-		-		-		-		2.19		-		2.19		-		-		8.49
Building skills and capacity	0.94		0.86		-		-		-		-		0.17		0.03		0.17		0.03		2.80		4.80
Foundational activities	0.83		0.01		-		-		-		-		0.01		-		0.01		-		12.71		13.56
R&D management	2.33		0.02		-		-		-		-		0.41		-		0.41		-		1.45		4.21
Total %	54.65		25.58		-		-		-		-		2.78		0.03		2.78		-		16.96		100.00

^a Other includes a number of investments that relate to commercialisation, impact assessment, evaluation of the portfolio and adoption of R&D projects.



Table A2: Expenditure on Rural Research, Development and Extension Priorities

	ADVANCED TECHNOLOGY	BIOSECURITY	SOIL, WATER AND MANAGING NATURAL RESOURCES	ADOPTION OF R&D	OTHER ^a	TOTAL
	\$m	\$m	\$m	\$m	\$m	\$m
Meeting market requirements	–	–	–	15.40	–	15.40
Improving crop yield	39.69	–	–	–	–	39.69
Protecting your crop	–	42.37	–	–	–	42.37
Advancing profitable farming systems	–	–	–	35.46	–	35.46
Improving your farm resource base	–	–	15.26	1.11	–	16.37
Building skills and capacity	–	–	–	9.25	–	9.25
Foundational activities	3.24	0.02	0.04	22.53	0.31	26.14
R&D management	4.45	0.06	0.84	1.94	0.82	8.11
Total \$m	47.38	42.45	16.14	85.69	1.13	192.79
	%	%	%	%	%	%
Meeting market requirements	–	–	–	7.99	–	7.99
Improving crop yield	20.59	–	–	–	–	20.59
Protecting your crop	–	21.97	–	–	–	21.97
Advancing profitable farming systems	–	–	–	18.39	–	18.39
Improving your farm resource base	–	–	7.91	0.58	–	8.49
Building skills and capacity	–	–	–	4.80	–	4.80
Foundational activities	1.68	0.01	0.02	11.69	0.16	13.56
R&D management	2.31	0.03	0.43	1.01	0.43	4.21
Total %	24.58	22.01	8.36	44.46	0.59	100.00

^a Other includes a number of investments that relate to commercialisation, impact assessment and evaluation of the portfolio.

Appendix B—GRDC projects

SUMMARY OF GRDC PROJECT EXPENDITURE (\$)	
Theme 1—Meeting market requirements	15,399,065
Theme 2—Improving crop yield	39,687,526
Theme 3—Protecting your crop	42,365,428
Theme 4—Advancing profitable farming systems	35,458,598
Theme 5—Improving your farm resource base	16,369,846
Theme 6—Building skills and capacity	9,251,916
Foundational activities	26,148,217
R&D management	8,115,043
Total	192,795,639

Expenditure by project and group project (\$)

THEME 1—MEETING MARKET REQUIREMENTS		EXPENDITURE \$
AE000002	Australian Export Grain Innovation Centre	4,210,000
AE000003	Research capacity in barley malting and brewing	50,000
AE000005	Market intelligence	223,158
AE000006	Market intelligence	439,720
AE000007	Oats for export	419,874
BA000009	Pilot brewing for malting barley lines	75,600
BRI00042-1	Wheat classification variety operations	1,756
CRY000001	Management Services Agreement	3,300
CSP00145	Omega-3 canola collaborative research project	181,512
CSP00193	Novel approaches against late maturity alpha-amylase—Knockout	183,505
CSP00196	Commercialisation of barley for malt and beer	180,000
DAN00194	Increasing market value of canola through improved quality traits	299,918
DAN00196	Eliminating grain defects in chickpeas	304,993
DAS00152	Intellectual Property Sub-Licence and Materials Supply Agreement	45,000
DAV00132	Objective high-throughput technologies for the pulse industry	180,000
FAR000003	Hyperyielding cereals—A feed grain initiative	418,956
GGL000003	Australian wheat export markets	178,994
GOG000009	Grains and Legumes Nutrition Council	180,000
MCM000001	Coordination of registration of grain storage chemicals and codex attendance	99,250
NCA00010	Improving market signals for GRDC and the grains industry to enhance delivery to customers	108,000
NCA00011	National grain end point royalty reporting and analysis	100,000
NPB00013	Plant Biosecurity Cooperative Research Centre—Grain Storage Research and Development Program	4,000,000
PRB000001	Improving on-farm grain storage management practices through technical training and extension	469,868
QUT000006	New technology for stored grain pest management—Phase 2	304,190
UA00126	Increasing malt extract and the export competitiveness of Australian barley	61,724
UA00150	Late maturity alpha-amylase: A molecular marker based, high-throughput, precise screening protocol	646,529



THEME 1—MEETING MARKET REQUIREMENTS		EXPENDITURE \$
UA00153	Novel approaches against late maturity alpha-amylase	284,748
UMU00043	Novel glutenin subunits for extra functionality to Australian wheat cultivars	65,000
UMU00047	Barley grain defects	300,000
UMU00051	Reduce barley head loss and straw breakage by genetics and management	250,000
UQ00077	A genetic x environmental characterisation of the risk for late maturity alpha-amylase across the main wheat-producing shires of Australia	146,220
WQA00002	Wheat variety classification services	820,000
WQA00004	Australian prime hard zone expansion—Season 3	167,250
THEME 1—MEETING MARKET REQUIREMENTS TOTAL		15,399,065

THEME 2—IMPROVING CROP YIELD		EXPENDITURE \$
ACP00002	Australian Centre for Plant Functional Genomics Phase II	160,000
ACP00008	Australian Centre for Plant Functional Genomics Phase II	500,000
ACP00009	Three high-value genes (Vacuolar Proton Pyrophosphatase 1 (AVP1), Phosphorus Starvation Tolerance 1 (PSTOL1) and Nicotianamine Synthase (NAS)) for higher wheat yield—International Wheat Yield Partnership	276,063
ACP00010	Benchmarking and field validation of transgenic frost tolerance wheat lines	272,727
AMC00017	Managed environment facility research implementation coordinator	40,160
AMC00018	Frost Steering Committee	12,529
ANU00021	Molecular tools for the modulation of transpiration efficiency in wheat	260,000
ANU00023	Plants better adapted to moisture stress and increased soil strength	210,000
ANU00024	Identification of superior Rubiscos in wheat relatives and introgression into elite wheat varieties for increased yield	500,000
ANU00025	Using next-generation approaches to exploit phenotypic variation in photosynthetic efficiency to increase wheat yield	181,416
ANU00027	Improving yield by optimising energy use efficiency	779,789
BBC00007	National Frost Initiative	90,000
BRO00001	Frost Steering Committee	15,000
BWD00022	Crop variety extension in Victoria	36,500
CAS00004	Common seed 'bulk-up' to provide seed for all relevant GRDC research investments	322,500
CBC00001	Frost Steering Committee	15,000
CFF00008	Assessment of leaf area index, tiller survival and short delay in flowering as candidate traits for tolerance to early drought in wheat	39,400
CFF00009	Molecular markers for root hair traits and enhanced phosphorus use efficiency in wheat	489,725
CIM00018	Identification and utilisation of novel sources of resistance to crown rot and the root-lesion nematodes in adapted spring and durum wheat	223,985
CIM00019	Enhanced delivery of CIMMYT germplasm to Australia	50,000
CIM00020	Focused improvement of durum wheat germplasm from CIMMYT for yield potential, drought and biotic constraints	149,970
COR00049	Western Australian Barley Variety Guide	15,739
COR00050	Queensland Wheat Variety Guide	15,640
COR00051	South Australia Sowing Guide	9,970
COR00052	Victorian Sowing Guide	11,580
COR00053	Western Australian Wheat Variety Guide	11,077
CSA00041	Better irrigated wheat germplasm	346,457
CSP00148	High-throughput and remote trait measurement	308,078



THEME 2—IMPROVING CROP YIELD		EXPENDITURE \$
CSP00157	Australian Soybean Breeding Program	500,000
CSP00168	Photosynthesis traits for raising wheat yield potential	450,000
CSP00175	Maintaining wheat grain number under reproductive-stage drought conditions	340,000
CSP00179	Raising water productivity: Trait assessment for Australian rainfed wheat	300,000
CSP00180	Maintaining yield stability of wheat under spring frosts	350,000
CSP00183	Pedigree-based association genetic analysis of wheat phenology	342,143
CSP00185	Collection, phenotyping and exploitation of wild <i>Cicer</i> genetic resources for chickpea improvement	504,096
CSP00197	Frost Steering Committee	15,000
CSP00199	Validation trials for dwarfing genes, vigour x management interactions, and preliminary assessment of rate of grain-filling	300,000
CSP00200	Improving wheat yields by increasing coleoptile length and water productivity	200,000
CSP00202	Identification of wheat frost tolerance loci using a combination of genetics, biochemistry and molecular approaches	491,058
DAN00151	Pulse Breeding Australia—National Chickpea Breeding Program	1,300,000
DAN00163	Durum Breeding Australia	1,200,000
DAN00178	Curation of mapping populations—Barley and wheat	225,000
DAN00190	Quarantine of cereals and pulses	95,000
DAN00208	National Brassica Germplasm Improvement Program—Phase II	1,600,000
DAQ00172	National Mungbean Improvement Program	300,000
DAQ00185	Barley germplasm progression	210,683
DAS00120	Pulse Germplasm Enhancement Program—National coordination	25,000
DAS00121	Pulse Germplasm Enhancement Program—Abiotic stresses	250,000
DAS00129	National Oat Breeding Program—Healthy and productive grain varieties for the future	1,014,237
DAS00148	Australian Pastures Genebank	122,410
DAS00149	Vetch varieties for grain and hay production for Australian farmers	395,245
DAS00158	Program Leader Environment for National Frost Initiative	13,901
DAV00118	Pulse Breeding Australia—Field Pea Breeding Program	1,000,000
DAV00119	Pulse Breeding Australia—Lentil Breeding Program	816,320
DAV00126	Molecular markers for pulse-breeding programs	750,000
DAV00127	Using next-generation genetics to accelerate variety improvement in bread wheat, durum and barley	931,212
DAV00131	Australian Grains Genebank—Phase 2	1,000,000
DAV00134	Diagnostic services for pulse germplasm enhancement and breeding programs	62,485
DAW00234	Determining yield under frost—One degree at a time	300,000
DAW00237	Lupin breeding for Australia	1,250,000
DAW00238	Development of lupin molecular markers tagging yield quantitative trait locus genes and yield-related phenology traits	385,000
ERC00001	Frost Steering Committee	15,000
FA21-1	Crop variety information extension—Expenses	5,600
FWC00006	Coordinator for Pulse Breeding Australia	66,570
GIM00001	Grains industry market access project	125,000
GLC00001	Frost Steering Committee	15,000
HCP00001	Extension of winter crop variety information in Queensland	36,100
ICA00010	Mining the ICARDA germplasm collection for biotic and abiotic priority traits	146,560



THEME 2—IMPROVING CROP YIELD		EXPENDITURE \$
ICA00011	Pre-emptive chickpea pre-breeding for biotic stresses and germplasm enhancement for abiotic stresses	199,141
ICA00012	Focused improvement of ICARDA/Australian durum germplasm for abiotic tolerance	150,000
ICA00013	Improving heat tolerance of wheat	179,901
ICA00014	Application of focused identification of germplasm strategy in Australian environment	166,882
IGP00004	Evaluation of barley-breeding lines in the Northern Region	706,440
KAL00004	Extension of winter crop variety information in Western Australia	35,000
MOR00001	Frost Steering Committee	15,000
MPF00001	Frost Steering Committee	15,000
NFC00002	Frost Steering Committee	15,000
PCA00003	Australian Peanut Breeding Program	380,000
PRC00001	Frost Steering Committee	15,000
RTA00001	Frost Steering Committee	15,000
SHE00011	Frost Steering Committee	15,000
SKC00002	National Frost Initiative	50,000
UA00127	Pulse Breeding Australia—Australian Faba Bean Breeding Program	1,054,679
UA00136	Australian National Frost Program—Coordination and phenotyping	500,000
UA00143	Australian Wheat and Barley Molecular Marker Program—Genetic analysis	1,000,000
UA00145	Development of salinity-tolerant wheat and barley	849,805
UA00147	Genetic analysis of heat tolerance in wheat	398,975
UA00148	Trait discovery in wild barley using the nested-association mapping population HEB-25	150,000
UA00152	Genomic selection: Development and utilisation in a commercial wheat-breeding program	82,000
UA00159	Improving wheat yields on sodic, magnesic, and dispersive soils	990,943
UA00160	Australian Research Council Industrial Transformation Research Hubs: Genetic diversity and molecular breeding for wheat in a hot and dry climate	750,000
UA00162	Screening of frost tolerance in cereals	1,175,050
ULA00009	The effects of heat stress on programmed cell death and floret sterility in wheat	149,916
UM00045	Expanding the brassica germplasm base through collaboration with China and India	215,000
UMU00044	Identifying low pH tolerance and effective rhizobia for wild <i>Cicer</i> to improve adaptation to acid sandy soils	164,765
UMU00046	Improved adaption of barley to acid soils	450,000
UMU00048	Genetic approaches to reduce the nitrogen dilution effect and increase nitrogen use efficiency in wheat	850,000
UMU00049	Maintenance of grain plumpness and transfer of heat tolerance into Australian barley germplasm	393,348
UQ00068	Delivery of wheat root traits that contribute to water-limited yield stability	279,984
UQ00070	Sorghum Core Pre-breeding Program	750,000
UQ00073	National Barley Coordination Project	138,081
US00056	Research Project 1: Superior water use efficiency through improved mesophyll conductance	133,700
US00057	Identification of genetic variation for heat tolerance in wheat germplasm of relevance to the northern grains region	129,260
US00058	Capacity building to support research and plant breeding at the I.A. Watson Grains Research Centre	341,979
US00059	Research Capacity Building: GRDC Senior Lectureship in Agronomy/Plant–Soil–Microbe Interactions	192,984
US00060	Research Capacity Building: GRDC Senior Lectureship in Plant Physiology	192,984



THEME 2—IMPROVING CROP YIELD		EXPENDITURE \$
US00061	Exploring beneficial genotype, environment and management interactions for crop yield: Effects on soil health	233,742
US00068	A novel mutation-based strategy to increase seed yield in canola	242,115
US00071	Screening for drought tolerance under well-watered conditions: A rapid method to predict wilting point of grain crops	17,298
US00072	Evaluation of wheat germplasm derived from Indian materials for specific traits of importance to the Australian cropping environment	40,000
US00073	Exploitation of international grains in Australia: Coordinated importation, quarantine and evaluation, data management and communication	266,565
US00078	Screening techniques for tolerance to heat in wheat: Review and recommendations	62,716
US00080	A national approach to improving heat tolerance in wheat through more efficient carbon allocation	223,089
US00081	Introgression of heat-tolerant genes to broaden genetic variation in current wheat-breeding populations	804,177
US00082	Increasing carbon capture by optimising canopy resource distribution	127,436
US00083	Australian Research Council Industrial Transformation Research Hubs: Legumes for sustainable agriculture	1,000,000
USQ00017	Assessing collections of wild chickpea relatives for resistance to root-lesion nematodes	106,021
UT00027	Transpirational control and oxidative stress tolerance traits as components of salinity stress tolerance in cereals	200,159
UWA00159	Tools for accelerated breeding and screening for abiotic stress in grain legumes	249,966
YOU00002	Frost-focused identification of germplasm strategy	31,500
THEME 2—IMPROVING CROP YIELD TOTAL		39,687,526

THEME 3—PROTECTING YOUR CROP		EXPENDITURE \$
AKC00006	Registration of minor use chemicals for the grain industry	267,600
AMC00016	Development of yield response curves for cereal foliar and root and crown pathogens	34,520
ANU00026	Biosecurity preparedness of the grains industry against wheat blast	7,000
ARN00001	Support of the Australian Glyphosate Sustainability Working Group	20,000
AUE00001	Widening the use pattern on diuron in Queensland broadacre cropping	7,200
CES00003	Aphid and insecticide resistance management in oilseed and pulse crops	400,000
CFF00010	Genetic solution to crown rot in barley	136,951
CIM00017	Australian Cereal Rust Control Program—CIMMYT delivery of resistant germplasm and surveillance for resistance in Australian cultivars	300,000
CLO00001	Southern Agribusiness Trial Extension Networks—Identify options for the control of glyphosate resistant ryegrass	5,630
CSA00051	Investigation into the possible recent incursion of an insecticide-resistant biotype of green peach aphid into Australia	8,500
CSE00058	Future National Invertebrate Pest Initiative forums: Towards more sustainable pest management practices	70,000
CSE00059	New knowledge to improve the timing of pest management decisions in grain crops	459,314
CSP00155	Reverse genetics for the development of wheat cultivars with improved resistance to necrotrophic pathogens	300,000
CSP00161	Australian Cereal Rust Control Program—Triple rust resistance project	1,500,000
CSP00162	Inducing suppression of fusarium crown rot complexes	209,215
CSP00164	Australian Cereal Rust Control Program—Molecular marker program collaborative project	661,410
CSP00182	Genetically improving wheat's ability to outcompete weeds	380,000



THEME 3—PROTECTING YOUR CROP		EXPENDITURE \$
CSP00192	Development of gene deployment strategies: Using evolutionary principles to optimise the deployment of genetic resistance in crops	350,000
CUR00016	Australian Centre for Necrotrophic Fungal Pathogens—Fungicide benchmarks; Project Phase 2	173,475
CUR00020	Managing on-farm biosecurity risk through pre-emptive breeding: The case of rust in field pea and lentil	199,348
CUR00022	Fungicide resistance management strategy and communications	100,000
CUR00023-BA	Centre for Crop and Disease Management	5,632,688
DAN00172	Managing crop disease—Improving chickpea pathogen resistance	260,000
DAN00175	National crown rot epidemiology and management program	665,033
DAN00176	Northern New South Wales integrated disease management	310,000
DAN00177	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—Southern New South Wales	341,675
DAN00202	New tools and germplasm for Australian pulse and oilseeds breeding programs to respond to changing virus threats	452,999
DAN00203	Effective genetic control of septoria tritici blotch	400,000
DAQ00186	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—Queensland	460,376
DAQ00190	Maintaining a barley pre-breeding capability in Queensland	200,000
DAQ00191	Sorghum Midge Testing Scheme	14,518
DAQ00196	Delivery of improved invertebrate pest management in the northern grains region	549,894
DAQ00201	National Pest Information Service	350,000
DAS00131	Improving weed management in pulse crops through herbicide tolerance—Part B	328,000
DAS00132	Improving weed management in pulse crops through herbicide tolerance—Part A	40,000
DAS00133	Improved resistance to oat pathogens and abiotic stress management	300,000
DAS00134	Improved management of snails and slugs	29,044
DAS00136	New fungicide technologies for crown rot management	150,000
DAS00137	National improved molecular diagnostics for disease management	450,000
DAS00139	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—South Australia	360,000
DAS00144	Competitive ability evaluation of wheat and durum varieties	79,500
DAS00154	White grain disorder in wheat	137,643
DAS00155	Diamondback moth control and insecticide resistance management	281,857
DAV00117	Pulse Germplasm Enhancement Program—Resistance to biotic stresses	300,000
DAV00129	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—Victoria	400,000
DAV00144	Cereal and pulse cultivar resistance ratings for the Southern Region	254,561
DAW00228	National pathogen management modelling and delivery of decision support	680,190
DAW00229	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—Western Australia	609,997
DAW00230	PestFax Map II—National	153,306
DAW00231	Management of spray drift through inversion risk awareness	144,942
DAW00245	Yield loss response curves for host resistance to leaf, crown and root diseases in wheat and barley	60,000
DAW00248	Effective genetic control of <i>Stagonospora nodorum</i> blotch	396,001
DAW00251	Investigate and extend effective and reasonably priced monitoring and control methods for snails and slugs in the Albany and Esperance port zone	12,500



THEME 3—PROTECTING YOUR CROP		EXPENDITURE \$
DAW00256	Building crop protection and production agronomy research and development capacity in regional Western Australia	1,785,000
DEP00002	Push notifications to enable proactive management of pests, weeds and diseases	280,000
FAR00002	Improved fungicide use for cereal rust control	100,000
GRD223-1	Irrigation infrastructure	1,193,112
GTL00002	Endophyte cereals	450,000
GWC00004	Australian Cereal Rust Control Program—Commercialisation scoping studies	50,000
IAC00002	Surveillance and forecasts for mouse outbreaks in Australian cropping systems	69,000
IAC00003	Development of a new rodenticide	200,000
ICN00020	Current invertebrate pest management options risk matrix	12,139
ICN00022	Investment review	36,909
MRE00002	Air inversion modelling to manage spray drift	374,998
NP50	Harrington Destructor	-6,693
PBC00002	Extending biosecurity preparedness and surveillance strategies and developing a chemical supply framework for pest incursions	230,282
PBC00003	New tools for field grains surveillance and diagnostics of high-priority pests	800,528
PHA00004	Provision of independent technical and secretarial services to the National Working Party for Pesticide Application	55,000
PHA00010	Development of pre-emptive Australian Pesticides and Veterinary Medicines Authority emergency permits for exotic plant pest incursion containment and control	149,989
PHA00011	Extending chemical usefulness	100,000
PHA00012	The facilitation of Category 25 submissions in the Australian grain industry	600,000
PHA00016	Biosecurity preparedness for the grains industry—High-throughput diagnostic for Karnal bunt	30,000
PYC101-1	Northern integrated weed management—Expenses	361
RDP00015	Grain Weeds Advisory Committee	150,000
SFS00032	Harvest weed seed control for the southern high-rainfall zone	299,740
SHE00009	Crown Rot Initiative projects	84,000
SYN00009	Investment review	30,000
TFC00001	Control of snails and slugs—Investment case for new products for snail and slug control	56,400
THA00001	Management of residual herbicides in broadacre cropping	18,600
UA00141	Advancement of new stem genes for stem and leaf rust resistance from uncultivated relatives of wheat	269,940
UA00144	Improved herbicide efficacy and longevity in southern no-till farming systems	149,935
UA00149	Improving integrated weed management practice of emerging weeds in the Southern and Western regions	849,446
UA00156	Emerging weeds—Seed-bank biology of emerging weeds	551,456
UA00157	Development of tools to accelerate nematode resistance gene deployment	275,000
UA00158	Mechanisms, evolution and inheritance of resistance	299,746
UCS00020	Weed management in the Southern Region mixed farming systems—Strategies to combat herbicide resistance	528,961
UCS00024	Surveillance of herbicide-resistant weeds in Australian grain cropping	167,801
UM00048	National coordination of invertebrate pest research and insecticide resistance management	100,000
UM00049	Management of insecticide resistance in redlegged earth mite and screening new mode of action chemistry	375,000
UM00050	'Proof of concept' for approaches designed at increasing disease resistance to fungal pathogens of canola	169,250



THEME 3—PROTECTING YOUR CROP		EXPENDITURE \$
UM00051	National Canola Pathology Program including new molecular knowledge, pathogen evolution and control technologies	1,134,402
UM00052	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—National chickpea pathology program	155,210
UM00053	Development of new non-chemical weed control technologies—Microwave control of weeds	249,825
UQ00062	Improving integrated weed management practices in the Northern Region	450,000
UQ00080	New uses for existing chemistry	239,991
US00063	Australian Cereal Rust Control Program—Durable genes	956,076
US00064	Australian Cereal Rust Control Program—National breeding support	136,050
US00067	Australian Cereal Rust Control Program—Towards 2019 and a century of monitoring cereal rust pathogens in Australia	571,530
US00070	Accelerating the utilisation and deployment of durable adult plant resistance to leaf rust in barley	199,079
US00074	Development of genetic tools for Australian barley crops against leaf rust	599,616
US00075	Integrated genetic solutions to crown rot in wheat	1,197,895
USA00016	The application of bent leg technologies to higher speed tined seeding of cereal grains	26,200
USQ00013	Managing crop diseases—Improving crown rot resistance in durum	220,000
USQ00019	Genetic control of nematode species affecting major crops—Germplasm enhancement for nematode control in cereals and pulses	549,855
USQ00021	National nematode epidemiology and management program	815,184
UT00030	Effective control of barley yellow dwarf virus in wheat	300,000
UWA00134	Developing and promoting integrated pest management in Australian grains	65,950
UWA00154	Strategies to provide resistance to the economically important fungal pathogen <i>Rhizoctonia solani</i>	300,000
UWA00165	Options for improved insecticide and fungicide use and canopy penetration in cereals and canola	199,860
UWA00168	Smart use of fertilisers to minimise and manage the risk of pest infestations in growing canola	149,720
UWA00170	Emerging foliar diseases of canola	170,000
UWA00171	Australian Herbicide Resistance Initiative—Phase 5	1,800,000
UWA00172	WeedSmart—Stage Three	129,800
WCA00004	Reduced herbicide usage through application technology	468,398
THEME 3—PROTECTING YOUR CROP TOTAL		42,365,428

THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		EXPENDITURE \$
AAM00001	National and International Regional Crop Benchmarking Network	107,350
AAM00003	Increasing profitability through the utilisation of combined technologies to target input strategies to productive capacity of soils	30,000
AAM00005-A	Deep ripping, 'deeper' deep ripping and water use efficiency	144,942
ACC00007	GRDC extension and training program	120,000
ACO00020-A	Farming after Fire, workshops for growers impacted by the Pinery Bushfire	37,150
AEA00006-A	Developing strategies for growers in both the low-rainfall zone and high-rainfall zone to have an integrated weed management approach and successfully manage herbicide-resistant annual ryegrass	200,000
AGG00002	Growing high-yielding crops on sandy soils	8,750
AKI00001	Southern Agribusiness Trial Extension Networks—Poor nodulation of beans in Kangaroo Island	6,250
AMP00010	Phenology research and data provision: Slope, aspect and elevation	274,050
APR00001	Practical financial figures for farm business management	562,500



THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		EXPENDITURE \$
APT00001	Economics of closing the yield gap in the northern grains region	200,499
ARP00002	Assess the yield response of cereals to gypsum applications in the Wimmera	6,146
AVP00003-A	Compaction mitigation options for growers in the Albany and Kwinana West port zones	33,000
BWD00021	More Profit from Crop Nutrition II—Extension and training Southern Region	95,832
BWD00024	Maintaining profitable farming systems with retained stubble—Victoria and Tasmania	719,999
BWD00025	National paddock survey initiative	90,000
BWD00028-A	Farming after the drought—On-farm decision making	72,454
CDG00001	Northern Agribusiness Trial Extension Networks—Deep placement fertiliser	22,000
CFI00010	Financial analysis of grain-growing businesses across the Northern Region	60,000
CIC00027	Case studies frost and farm business management—Kwinana East zone	31,805
CIC00033-A	Case studies of growers using novel techniques to utilise available moisture in the Kwinana East port zone	22,500
CMA00002	Assessing forecast and management options for mitigating extreme temperature impacts on grains	180,050
CMA00003	Linking Agricultural Production Systems sIMulator based management tools with Predictive Ocean Atmosphere Model for Australia seasonal forecasts	300,000
CMP00001-A	Case study of different rotations and break crops for Western Australian growers	24,750
CRA00004	Cultivar crown rot tolerance trials	55,000
CRC00004	Improving spray fallow techniques for better moisture conservation, better winter and summer weed control and more profitable grain crops	65,840
CSA00036	More Profit from Crop Nutrition II—Analysis frameworks to support profitable fertiliser use	182,007
CSA00039	Better irrigated wheat agronomy	249,726
CSA00050	Northern farming systems—Integrating research solutions for profitable outcomes	413,571
CSA00055	Benchmarking and validating the yield gap in each agroecological zone	78,540
CSA00056	Developing farming systems for the low-rainfall zone of Western Australia	649,340
CSO00045	Soil spectroscopy capability	154,236
CSP00165	More Profit from Crop Nutrition II—Phosphorus use efficiency: Rhizosheath project	47,493
CSP00169	Achieving stable and high canola yield across the rainfall zones of Western Australia	430,502
CSP00170	Measuring and managing soil water in Australian agriculture	687,388
CSP00174	Maintaining profitable farming systems with retained stubble in NSW South West Slopes and Riverina	361,666
CSP00178	Increasing yield and reducing risk through early sowing in the southern grains region	450,000
CSP00184	Generating baseline data to identify, quantify and manage soil constraints of the western plains of New South Wales	134,944
CSP00186	Maintaining profitable farming systems with retained stubble—Component 1—Research support	321,516
CWF00018	Maintaining profitable farming systems with retained stubble—Central West New South Wales	423,667
CWF00020	Overdependence on agrochemicals	150,000
DAN00150	Sorghum in the western zone	150,000
DAN00152	The strategic use of tillage within conservation farming	399,871
DAN00165	More Profit from Crop Nutrition II—Program coordination and communication	220,000
DAN00166	More Profit from Crop Nutrition II—Making better fertiliser decisions for cropping systems in Australia—Phase 2	214,300
DAN00167	Variety-specific agronomy packages for southern, central and northern New South Wales	683,072
DAN00168	Regional soil-testing guidelines for the Southern Region	220,627
DAN00171	Northern Pulse Agronomy Initiative—New South Wales	386,151
DAN00173	Management of barley and barley cultivars for the Southern Region	540,189



THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		EXPENDITURE \$
DAN00181	Northern Region high-yielding cereal agronomy—New South Wales	150,025
DAN00184	Evaluation and agronomic management of dual-purpose cereal varieties for New South Wales mixed farming systems	204,894
DAN00191	Nitrogen-fixing break crops and pastures for high-rainfall zone acid soils	161,850
DAN00192	Southern New South Wales soybean agronomy project	120,000
DAN00195	Tactical crop agronomy of sorghum and maize in the Northern Region—New South Wales component	184,022
DAN00197	Tactical crop agronomy for selected crops in the Northern Region—Safflower, linseed and sunflower	149,992
DAN00198	Southern irrigated cereal and canola varieties achieving target yields	400,000
DAQ00180	Extension of nitrogen fixation program outputs to end users—Northern Region	60,000
DAQ00181	Optimising nitrogen fixation of grain legumes—Northern Region	125,177
DAQ00183	More Profit from Crop Nutrition II—Extension and training—Northern Region	100,000
DAQ00192	Northern farming systems—Integrating research solutions for profitable outcomes	80,000
DAQ00204	Growers solution project for coastal/hinterland Queensland and New South Wales north coast	350,239
DAQ00205	GRDC grower solutions—Extension for the Northern Region (Central Queensland)	215,153
DAS00126	Southern Region Regional Cropping Solutions Network	21,000
DAS00128	Optimising nitrogen fixation of grain legumes—Southern Region	149,987
DAS00145	Maintaining profitable farming systems with retained stubble—Component 1—Coordination support	80,200
DAS00146	More Profit from Crop Nutrition II—Managing micronutrient deficiencies in cropping systems of eastern Australia	333,344
DAS00147	Benchmarking wheat yield against nitrogen use	270,000
DAS00157	Nitrogen and water interactions	48,932
DAS00161	Gene by environment for better management trial	40,000
DAS00162-A	Validating recent research on break crop options in the low-rainfall zone to determine the best options for the different climate, soil type and biotic stress situations	300,000
DAS00162-B	To validate the persistence of common residual herbicides being used across the low-rainfall zone under current farming systems (which are dominated by stubble retention and no-till crop establishment) and to develop techniques to monitor and manage their presence and impact on subsequent crops	75,000
DAS00162-C	Validation of weed control strategies for 5 difficult to control summer weeds	500,000
DAV00113	Expanding the use of pulses in the Southern Region	450,285
DAV00150	Understanding the implications of new traits on adaptation, crop physiology and management of pulses in the Southern Region	554,595
DAW00221	Optimising nitrogen fixation of grain legumes—Western Region	128,221
DAW00222	More Profit from Crop Nutrition II—Regional soil-testing and nutrient guidelines: Western Region	166,667
DAW00223	More Profit from Crop Nutrition II—Extension and training: Western Region	150,000
DAW00224	Management of barley and barley cultivars in Western Australia	720,666
DAW00227	Tactical break crop agronomy in Western Australia	1,180,054
DAW00239	More Profit from Crop Nutrition II—Managing micronutrient deficiencies in cropping systems of Western Australia	142,948
DAW00241	Farming systems to improve crop tolerance to frost	1,608,414
DAW00249	Tactical wheat agronomy for the west	730,328
DAW00250	Evaluation and report on the effectiveness of yield predicting tools	10,000
DAW00253	Early seeding—A climate change adaptation method in the north-east agricultural region of Western Australia	12,500



THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		EXPENDITURE \$
DER00020	A better understanding of the sociological factors influencing the adoption of break crop research	20,000
DMA00003	Southern Agribusiness Trial Extension Networks—Crop response to phosphate fertiliser	6,250
ELF00001-A	Investigating double break (or stacked rotation) options	25,000
ENG00001	Transitioning family farming businesses	10,000
EPF00001	Maintaining profitable farming systems with retained stubble—Upper Eyre Peninsula	310,000
EPF00002-A	Validation of real-time soil nitrate using ion exchange technology	207,675
FAR00004-A	Understanding or evaluating the effectiveness of fungicides to manage septoria and leaf rust	180,000
FEL00001	Supporting partner agreement—Show us your nods	3,000
FFC00010	Canola early sowing management systems: Grazing canola to modify maturity and water use	36,070
FFC00011-A	Regionally specific agronomy projects: Early seeding trials for the Kwinana West port zone	48,700
FGI00010	Grain and Graze 3—Western Region	600,000
FMO00003-A	Review and demonstration of different rotations and break crops for Western Australian growers—Western Australia Crop Sequence Calculator Workshops	22,017
FUT00001	Case studies to review methods for defining within-paddock management zones—Kwinana West zone	12,000
GOA00002	GRDC grower solutions—North	559,536
GPC00001	Extension of nitrogen fixation outputs to end users—Western Region	60,000
HFG00007	Southern Agribusiness Trial Extension Networks: Alternative insect management strategies to maintain and increase beneficial species, avoid insecticide resistance and reduce personal exposure to insecticides	6,250
HIL00002	Western Region Regional Cropping Solutions Network—Facilitation and coordination	1,256,440
ICN00016	Integrated weed management extension—Northern Region	506,553
IMA00008	Southern Agribusiness Trial Extension Networks—Cultural impacts on annual ryegrass seed numbers prior to sowing	6,250
IPN00003	Nutrient performance indicators	146,357
KIS00002	Understanding Map Layers for Variable Rate Technology II—Kwinana extension	16,800
KIS00003-A	Machinery replacement options for growers in the Kwinana West port zone	32,000
KJH00001	Tender evaluations	7,925
LEA00002	Profitable farming systems with retained stubble on lower Eyre Peninsula	153,450
LEA00003	Southern Agribusiness Trial Extension Networks—Weed master trial paddocks	4,950
LIE00010-A	Best bet management of ameliorated non-wetting soils for the Geraldton port zones	127,747
LYH00003	Develop monitoring, evaluation, reporting and improvement strategy for the frost initiative	30,000
MDF00001	Reducing variety selection risk through understanding varietal performance with different management packages	13,000
ME00002	Evaluation of proposals for positions as members on the Regional Cropping Solutions Network	1,000
MF00004	Southern Region Regional Cropping Solutions Network	198,817
MF00006	Maintaining profitable farming systems with retained stubble—South-east and Kangaroo Island regions	114,135
MIG00015	Improving the understanding of nitrogen use efficiency and soil–water interactions	21,250
MIG00016-A	Deep ripping, 'deeper' deep ripping and water use efficiency	45,784
MRT00001	GRDC database	4,800
MSF00003	Maintaining profitable farming systems with retained stubble—Mallee	392,667
NGA00004	GRDC Grower Solutions—North	1,230,010
NYA00001	Herbicide Resistance Survey	39,512
ORM00017	GRDC Farm Business Updates—Western Region	250,000



THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		EXPENDITURE \$
PAL00019	Australian broadleaf cropping project	650,000
PFS74-1	GRDC Grower Solutions—West—Expenses	1,909
PIG00010	Organisation and facilitation of Partners in Grain WA Inspire Summit trial	7,500
PLN00012	Threshold and cost of hand-weeding low-density wild radish	18,900
PLN00013-A	Assessment of business training options for Western Australia farm business managers	22,500
PLN00013-B	Assessment of some harvest weed seed management options for Kwinana West, Kwinana East and Esperance port zone growers	70,000
POO00001	Southern Agribusiness Trial Extension Networks: Key drivers to production and profitability gains in the Mallee	6,250
PRE00004	Western Region Regional Cropping Solutions Network—Fast-track projects	2,880
QK00001	Soil Constraints—West Steering Committee	1,511
RAI00005	Western Region Regional Cropping Solutions Network—Fast-track projects	2,840
RDP00013	The integration of technical data and profit drivers for more informed decisions	375,000
RDP00018-A	Evaluating in-furrow liquid delivery systems	100,000
RIC00001	GRDC update and Regional Cropping Solutions Networks annual report editorial services	16,748
RPI00009	Maintaining profitable farming systems with retained stubble—Riverine Plains region	330,517
SAM00001	Evaluating the use of precision agriculture technology to increase the efficacy of slug baiting systems in no-till cropping systems	12,100
SCF00004-A	Effective baiting options for the control of conical snails in the Albany port zone	80,957
SEP00014	Investigations of available technology tools for in-season management decisions—Esperance port zone	69,920
SEP00015	Production and distribution of South East Premium Wheat Growers Association fire recovery case studies	16,500
SEP00016-A	Case studies of growers managing inputs using variable-rate technology	40,000
SFS00028	Grain and Graze 3—Extension and delivery on mixed farming benefits in the Southern Region	650,000
SFS00030	Southern Agribusiness Trial Extension Networks—Impact canola establishment within the high-rainfall zone	8,700
SFS00034-A	Quantifying the impact of current control strategies on the population dynamics of important emerging pest species	75,000
SKC00006	GRDC Western Region machinery field days—Display creation and management	30,000
SPA00012-A	Big data—Opportunities to improve farm profitability in the low-, medium- and high-rainfall zones across the Southern Region	50,000
SYN00007	Case study—Economic assessment of soil zonation	8,025
SYN00008	Early seeding—A knowledge gap strategy for very early season starts	12,450
SYN00010-A	Early seeding options in the Kwinana East port zone	43,250
TAR00004	Western Region Regional Cropping Solutions Network—Fast-track projects	17,050
TAR00005	Is triazine-resistant silver grass a looming threat for the mixed cropping belt in central and southern Western Australia	33,265
TAR00006	Best practice net blotch management in Scope barley and interactions with pre-harvest head loss	29,000
TEK00002	Wodjil Workout—Rise of the pH	56,000
TRE00001	Strategies for amending these poorly performing sands	4,094
TRE00002	Strategies for amending these poorly performing sands	6,237
UA00138	Extension of nitrogen fixation program outputs to end users—Southern Region	104,890
UA00154	Phosphorus requirements to accompany high nitrogen fertiliser levels	26,510
UA00155	Nutrient stratification and subsurface soil testing	46,486
UMU00045	Farming systems to improve crop tolerance to frost: Crop nutrient management	123,433



THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		EXPENDITURE \$
UNE00020	Quantifying and understanding root variation in winter cereals	418,672
UNE00022	Evaluating testing methods for phosphorus and potassium soil reserves	225,000
UNF00002	Maintaining profitable farming systems with retained stubble—Upper north South Australia	130,200
UQ00063	Regional soil testing guidelines for the northern grains region	473,944
UQ00067	Queensland Pulse Agronomy Initiative to increase the reliability and yield of summer and winter pulses	411,319
UQ00074	High-yielding cereal agronomy in the northern grains region	202,043
UQ00075	Tactical crop agronomy for maize and sorghum in the Northern Region	180,878
UQ00078	Deep placement of nutrients	348,217
UQ00079	Organic matter and nutrient availability	61,184
US00079	Improving farmer confidence in targeted nitrogen management through automated decisions	350,744
USQ00014	New tools to measure and monitor soil moisture	199,932
USQ00022	Protecting your crop—Intelligent infrastructure	237,257
UWA00169	Use of chemicals to increase frost tolerance in Australian crops	107,431
VAS00003	Evaluation of proposals for positions as members on the Regional Cropping Solutions Network	1,000
VIC00009	Northern Region Regional Cropping Solutions Network	101,593
VIC00010	Correct crop sequencing for irrigated double cropping	324,870
VIS00001	Legume management for economic nitrogen production in the low-rainfall areas of north-west Victoria	6,025
VIS00002	Legume management for economic nitrogen production in the low-rainfall areas of north-west Victoria	44,700
WAN00021	Dry seeding in Western Australia	390,840
WDM00011	GRDC Paddock Diary	31,646
WES00001	Quantification of soil testing versus electromagnetic surveys (EM38) and γ-ray spectrometry data for the Geraldton port zone	52,750
WMG00003-A	Investigating double break (or stacked rotation) options	29,487
WMG00003-B	Compilation of lime trial results and grower case studies	20,000
YCR00003	Maintaining profitable farming systems with retained stubble—Yorke Peninsula and the Mid North of South Australia	258,333
THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS TOTAL		35,458,598

THEME 5—IMPROVING YOUR FARM RESOURCE BASE		EXPENDITURE \$
ACT00004	Application of controlled traffic farming in the low-rainfall zone	450,000
AEA00005	Delivering multiple benefit messages—A partnership with natural resource management—Southern Region	210,000
AEL00001	Tender evaluations	3,296
BN00001	Soil Constraints—West Steering Committee	1,602
BWH00001	Tender evaluations	2,866
CLT00001	Frost check	80,000
COR00048	National Agricultural Nitrous Oxide Research Program—Consolidated publication	98,143
COU00001	Managing Climate Variability Program Phase IV—Review of the communications program	26,600
CPU00002	Open access publication in the <i>Soil Research</i> journal—'Nitrous Oxide in Soils'	10,000
CRF00002	Coordination and extension of the improved management of soil organic matter for profitable and sustainable cropping	170,000
CSA00044	EverCrop: Developing new mixed farming options	1,050,000



THEME 5—IMPROVING YOUR FARM RESOURCE BASE		EXPENDITURE \$
CSA00045	Linking crop protection, weeds and native vegetation management—On-the-ground natural resource management action to benefit grain growers	149,585
CSE00057	Achieving least-cost greenhouse gas abatement—Opportunities in Australian grains farms	160,000
CSP00177	Water balance of conservation farming systems—Phase 4	92,919
CSP00198	Spatial temperature measurement and mapping tools to assist growers, advisers and extension specialists manage frost risk at farm scale	454,491
CSP00203	Increasing production on sandy soils in low- and medium-rainfall areas of the Southern Region	897,578
CT00001	Soil Constraints—West Steering Committee	1,900
CWF00019	Soil acidity and pH management for Central West farming districts	80,000
DAF00004-05	Quantifying nitrous oxide losses and nitrogen use efficiency in grains cropping systems on clay soils with contrasting soil carbon status and land management	47,274
DAF00004-10A	Managing an integrated, data synthesis and modelling research network for reducing nitrous oxide emissions from Australian soils	6,656
DAF00004-17A	An integrated assessment of management practices for reducing nitrous oxide emission and improving nitrogen use efficiency for subtropical dairy systems	95,933
DAN00169	Building resilient and profitable grain-cropping systems through improved knowledge of soil organic carbon fractions and their functionality	300,000
DAN00180	Does increased herbicide use impact on key soil biological processes?	249,961
DAN00186	Identifying national opportunities for grains emissions mitigation and other environmental improvement, using life cycle assessment and the Australian Agricultural Life Cycle Inventory (AusAglLCI) database	500,000
DAN00189	National independent quality assurance and germplasm maintenance for <i>Rhizobium</i> inoculants	169,937
DAN00206	Innovative approaches to managing subsoil acidity in the southern grains region	489,921
DAQ00182	Improved management of soil organic matter for profitable and sustainable cropping	110,000
DAQ00199	Soil Constraints—West Steering Committee—Coordination and communication	100,000
DAV00137	Maintaining productivity and quality of wheat under elevated carbon dioxide	1,000,000
DAV00147	A business case for future R&D in soil management for increasing grain production the south-east high-rainfall zone	92,983
DAV00148	Climatedogs go national	29,500
DAV00149	Understanding the amelioration processes of the subsoil application of amendments in the Southern Region	806,580
DAW00201	Identification and characterisation of disease-suppressive soils in the Western Region	48,547
DAW00225	Soil organic matter extension and communication in Western Australia	55,000
DAW00236	Soil acidity is limiting grain yield—Western Australia	320,000
DAW00242	Subsoil constraints—Understanding and management	880,000
DAW00243	Minimising the impact of soil compaction on crop yield	284,985
DAW00244	Delivering enhanced agronomic strategies for improved crop performance on water-repellent soils in Western Australia	1,805,000
DAW00252	Innovative approaches to managing subsoil acidity in the Western Region	490,079
ECO00012	Delivery of the Managing Climate Variability Program Phase IV—Climate Knowledge and Communications Program	263,659
ICF00008	Soils under an irrigated environment	236,142
LIE00008	Working together to deliver multiple benefit messages to growers through a whole systems approach to soil management.	239,400
LIE00009	The search for innovation—Grower trip to the Ord River Irrigation Area	15,000
MCC00011	National Agricultural Nitrous Oxide Research Program evaluation of performance	228
MCV00035	Managing Climate Variability Program Phase IV—Program Coordinator	53,590



THEME 5—IMPROVING YOUR FARM RESOURCE BASE		EXPENDITURE \$
MCV00036	Predictive Ocean Atmosphere Model for Australia seasonal forecast value	181,623
MCV00037	Can advances in mid-term weather forecasts reduce emissions from nitrogen fertiliser?	24,242
MCV00039	GRDC Nominee Director	12,893
MCV00040	Managing Climate Variability Program Phase IV—Project management committee	212
MCV00041	Improved skill for regional climate in the Access-based Predictive Ocean Atmosphere Model for Australia	193,290
MCV5	Managing Climate Variability Program Phase V—Investment	1,000,000
MFR33-1	National Soils Research, Development and Extension Strategy secretariat costs—Expenses	35,000
MP00001	Soil Constraints—West Steering Committee	6,500
POL00001	Polymers for improving soil moisture management and cropping productivity	300,000
RSS00010	Soil acidity is limiting grain yield—South Australia	60,000
SFS00026	Soil acidity is limiting grain yield—Southern Victoria	40,000
UA00115	Improving phosphorus use efficiency in wheat and barley	275,000
UF00008	Beneficial Microbes Program 2—Progressing new microbial products for Australian grain production to commercialisation	350,000
UM00044	Climate Change Research Strategy for Primary Industries	45,000
UM00056	Developing and applying an equilibrium displacement model	81,906
UMU00040	Maintenance of rhizobial germplasm resources	40,000
UNE00023	Coordination of Nitrogen Fixation Program 2014–15 and 2015–16	60,000
UQ00081	Costs of edaphic stress to the Australian grains industry	280,000
US00065	Understanding the molecular basis for desiccation tolerance of rhizobia for improved survival on seed	72,532
USQ00020	Australian CliMate development	420,862
UWA00163	Long-term no-till farming systems	250,081
VAS00001	Soil biology consultation	1,500
WMG00002	Development of self-testing, diagnostic protocols for compaction	9,850
THEME 5—IMPROVING YOUR FARM RESOURCE BASE TOTAL		16,369,846

THEME 6—BUILDING SKILLS AND CAPACITY		EXPENDITURE \$
ACO00001	Delivery of technical workshops—Understanding National Variety Trials, Crop Nutrition and Water Use Efficiency	195,000
ACO00004	GRDC education resources	206,613
ACO00011	GRDC capacity building website and alumni communication support	30,736
ACO00012	GRDC Seed to Store Careers—‘More than gumboots and tractors’ Careers Advisers Initiative	171,250
ACO00015	Management of GRDC partnership with Bayer Youth Ag-Summit	5,668
ACS00002	GRDC travel support—Genetically Modified Crops Coexistence Conference	4,412
AOF00010	Conference sponsorship—18th and 19th Australian Research Assembly on Brassicas	–3,750
ARL00009	GRDC support for the Australian Rural Leadership Program	100,000
ATA97	ATA—Students to study at Western Australian College of Agriculture Cunderdin	12,000
ATA98	ATA—Students to study at the Longerenong College Victoria	9,000
ATA99	ATA—Students to study at Tocal College New South Wales	12,000
BAE00026	Science and Innovation Awards for Young People in Agriculture	45,454
BSK27-1	Grains industry leadership, grains industry career awareness and attraction and grains industry tertiary education expenses	2,500
BSK35-1	GRDC alumni events—Invoices	579



THEME 6—BUILDING SKILLS AND CAPACITY		EXPENDITURE \$
CFM00010	Conference sponsorship—Crawford Fund Annual Development Conference—The Business of Food Security: Profitability, Sustainability and Risk	10,000
CHI00003	GRDC supporting partner of the Career Harvest website	2,000
CSP00176	CSIRO Plant Industry Summer Student Program	80,000
DAN00185	Post-doctoral fellow—Soil nutritional chemistry in southern grains farming systems	70,000
DAN00200	Building research capacity in the northern grains region—NSW	1,105,501
DAN00201	Building research capacity in the southern grains region—NSW	596,760
DAN00210	GRDC Emerging Leader Award	15,000
DAQ00194	Building research capacity in the northern grains region—Queensland	1,300,841
DAS00113	Pulse Breeding Australia—PhD—Improving metribuzin tolerance in lentil	30,000
DAS00142	Traineeships in Applied Grains Research	73,421
DAS00150	Physiology of yield determination in chickpea	8,000
DAV00142	Pulse Breeding Australia—PhD—Increasing lentil tolerance to heat waves using genetic solutions	13,500
DAV00143	Improving practices and adoption through strengthening development and extension capability and delivery in the Southern Region—Regional research agronomists	550,000
DER00021	Understanding grower needs for access to knowledge—data collection and formation of a GRDC strategy	385,700
EDE00002	Alumni communications services	350,000
FA20-1	Industry national RD&E strategy—Expenses	21,906
GCS10872	Conference sponsorship—65th Australasian Grain Science Conference	4,125
GCS10947	Conference sponsorship—Victorian No-Till Farmers Association 13th Annual Conference	7,500
GCS10966	Conference sponsorship—WAFarmers Taking Care of Business, Mingenew	3,000
GCS10971	Conference sponsorship—Australian Summer Grains Conference	45,400
GCS10987	Conference sponsorship—NSW Farmers Annual Conference	8,000
GCS10988	Conference sponsorship—ABARES Outlook 2016, Outlook 2017 and Outlook 2018	8,182
GCS10991	Conference sponsorship—13th International Symposium on Pre-Harvest Sprouting in Cereals 2016	5,000
GCS10992	Conference sponsorship—On the Pulse	5,000
GCS10993	Conference sponsorship—Hopetoun Women on Farms Gathering 2016	5,000
GCS10994	Conference sponsorship—Productive Soils in the Low Rainfall Zone Field Day	5,000
GCS10995	Conference sponsorship—2016 Hermitage Research Facility Schools Plant Science Competition	5,000
GCS10997	Conference sponsorship—Victorian Farmers Federation Annual Grains Conference	15,000
GCS10998	Conference sponsorship—Ag & Foodtech Symposium	10,000
GCS11000	Conference sponsorship—66th Annual Conference of the Australasian Grain Science Association	5,000
GCS11003	Conference sponsorship—9th International Symposium on Septoria Diseases of Cereals	5,000
GCS11004	Conference sponsorship—9th Australasian Soilborne Diseases Symposium	5,000
GCS11005	Conference sponsorship—Oral History Project on the Development and Early Introduction of Direct Drilling in the Winter Rainfall Areas of Australia	10,000
GCS11008	Conference sponsorship—South Australian No-Till Farmers Association Annual Conference	10,000
GCS11009	Conference sponsorship—WA Farmers Annual Conference 'AgVersity'	10,000
GCS11010	Conference sponsorship—Victorian No-Till Farmers Association 14th Annual Conference	15,000
GCS11011	Conference sponsorship—Mallee Sustainable Farming Mallee Research Updates 2016	5,000
GCS11012	Conference sponsorship—Innovation Generation 2016	25,000



THEME 6—BUILDING SKILLS AND CAPACITY		EXPENDITURE \$
GCS11013	Conference sponsorship—7th International Nitrogen Conference	10,000
GGA00006	Conference sponsorship—Australian Universities Crops Competition	15,000
GIA00003	Capacity building framework for the Western Australian grains industry	199,120
GRA00004	Northern Agribusiness Trial Extension Networks—Herbicide resistance in no-till systems in southern New South Wales	6,250
GRS10248	GIRS—(US) Regulation and long-distance movement of nutrient starvation-responsive plant microRNAs	3,799
GRS10258	GIRS—(US) Characterising potential symbiosome membrane proteins essential to the legume–rhizobium symbiosis	13,898
GRS10290	GIRS—(RMIT) Forms, analysis and stability of vitamin E and selenium in grains and grain products	13,898
GRS10329	GIRS—(ANU) Investigating the role of root architecture regulators as mediators of environmental information in root development	3,475
GRS10404	GIRS—(UWA) Detection and epidemiology of spring aphids in canola	23,741
GRS10405	GIRS—(UQ) Manipulating seed storage proteins to enhance sorghum digestibility	21,367
GRS10407	GIRS—(UA) Characterisation of novel forms of beta-glucanase in malting barley	26,115
GRS10408	GIRS—(UMU) Spatial and temporal distribution of severe weather events and their impact on grain crops	4,748
GRS10421	GIRS—(UQ) Development of functional molecular markers for key agronomic traits in the cultivated peanut, using next-generation sequencing technologies	14,245
GRS10432	GIRS—(ANU) Communicating controversial science to farmers	28,489
GRS10440	GIRS—(Sunshine Coast) Investigation of metabolic regulatory genes and hormones in pest snails	2,374
GRS10460	GIRS—(UWA) Characterisation of <i>Arabidopsis</i> nitrilases and 14-3-3 interactions in the processes of photosynthetic loss, leaf senescence and plant stress	7,122
GRS10474	GIRS—(UA) Nanotechnology and chemical-free approach for the protection of stored grain	16,619
GRS10483	GIRS—(UCS) Determination of genetic markers for herbicide resistance in annual ryegrass using diversity array technology	22,806
GRS10486	GIRS—(ANU) Assessing the biology impact of wheat-infecting <i>Botryosphaeria</i> spp.	32,051
GRS10490	GIRS—(UA) Identification of arabinoxylan biosynthetic genes in plants	3,561
GRS10505	GIRS—(ANU) Investigating the role of gamma-aminobutyric acid in pathogenicity in fungal wheat diseases	30,863
GRS10507	GIRS—(UQ) Identification of blackleg resistance genes in canola	7,122
GRS10564	GIRS—(CUR) Effector gene prediction from fungal pathogen genome assemblies	14,254
GRS10566	GIRS—(UWA) Understanding the strategies of outstanding performers in dryland farming enterprises	26,115
GRS10658	GIRS—(UQ) Regulation of the production of the mycotoxin deoxynivalenol by <i>Fusarium graminearum</i> and its according virulence on wheat and barley	29,044
GRS10661	GIRS—(UQ) Brewer nutrient recovery from wastewater using electrodialysis	30,255
GRS10664	GIRS—(UCS) Canola quality—The influence of processing parameters on valuable minor components	29,044
GRS10666	GIRS—(UWA) Are we going against the grain in training? Developing an adult education framework for the farming community	29,044
GRS10667	GIRS—(UQ) Identification of candidate genes for blackleg resistance in <i>Brassica juncea</i>	29,044
GRS10683	GIRS—(ANU) What are the epigenetic mechanisms involved in regulating stress response in <i>Arabidopsis thaliana</i> and <i>Brachypodium distachyon</i>	29,044
GRS10686	GIRS—(UA) Biological farming systems: is there a role for mycorrhizas and organic amendments in the grain industry?	29,044
GRS10687	GIRS—(ANU) Ribonucleic acid secondary structure and the regulation of metabolism	29,044



THEME 6—BUILDING SKILLS AND CAPACITY		EXPENDITURE \$
GRS10690	GIRS—(UA) Manipulating and understanding barley phenology to maximise yield potential	29,044
GRS10691	GIRS—(UQ) Investigations into the biology and management of <i>Neocosmospora</i> root rot of peanuts in Australia.	21,783
GRS10692	GIRS—(UWA) The influence of cereal monoculture and high crop residue levels on mineral nitrogen availability under long-term no-tillage systems.	29,044
GRS10694	GIRS—(UWA) Investigating the molecular basis of thermal acclimation in plant mitochondria	29,044
GRS10695	GIRS—(UQ) Novel sources of disease resistance in brassica	29,044
GRS10698	GIRS—(UW) Studies in novel grains for the Australian food supply	29,044
GRS10699	GIRS—(UF) Alternative respiratory genes can improve tolerance to abiotic stresses in cereals	29,044
GRS10780	GIRS—(ANU) Components of immunity to <i>Stagonospora nodorum</i> in wheat	29,044
GRS10781	GIRS—(UA) Cereal transport proteins involved in boron toxicity tolerance: How natural variation and sequence diversification relate to structural and functional properties	24,798
GRS10783	GIRS—(UNC) The molecular characterisation of vernalisation in safflower via the development of genomic and transcriptomic resources	22,044
GRS10796	GIRS—(UMU) Exploring sugar metabolism in bread wheat for improving drought tolerance	19,363
GRS10926	GIRS—(QUT) Automated weed and plant recognition for agricultural applications	29,386
GRS10927	GIRS—(US) Conjoint use of soil near-infrared and X-ray fluorescence spectroscopy in the field	29,386
GRS10929	GIRS—(RMIT) Modification of photosynthesis by gene replacement in crop plants	26,386
GRS10930	GIRS—(USQ) Mechanisms of action of different wheat resistance quantitative trait locus to the root-lesion nematodes <i>Pratylenchus thornei</i> and <i>Pratylenchus neglectus</i> in lines from Australia and the CIMMYT program in Turkey	29,386
GRS10931	GIRS—(UA) Evaluating the abiotic stress tolerance of transgenic wheat and barley	29,386
GRS10932	GIRS—(USQ) A comparison of the growth patterns of three root pathogens in wheat	29,386
GRS10933	GIRS—(UF) Structural and functional analysis of wheat stem rust resistance proteins	29,386
GRS10934	GIRS—(ANU) Stabilising flowering time of wheat in response to autumn rainfall decline in the southern cropping region of Australia	29,386
GRS10935	GIRS—(UWA) Genomic research to improve the value of the narrow-leaved lupin (<i>Lupinus angustifolius</i>) grain	29,386
GRS10936	GIRS—(UF) Epigenetic control of grain stress tolerance via short interfering ribonucleic acid	29,386
GRS10938	GIRS—(UA) Molecular and genetic characterisation of early aleurone development in barley and wheat	29,386
GRS10939	GIRS—(UMU) Symbiotic effectiveness and genetic stability of <i>Mesorhizobium</i> root nodule bacteria	29,386
GRS10940	GIRS—(UQ) Investigating the relationship between stress tolerance genes and grain quality in barley (<i>Hordeum vulgare</i>)	29,386
GRS10941	GIRS—(UQ) Identification of nitrate transporters and corresponding regulatory and metabolic genes under variable conditions of nitrate supply in diverse <i>Sorghum bicolor</i> genotypes for improved nitrogen use	29,386
HPC00001	Developing a GRDC grains industry leadership strategy and investment plan	55,439
HYS00001	GRDC Recognising and Rewarding Excellence Award	25,000
IPR00003	Vavilov–Frankel Fellowship	7,068
JKC00001	Grains industry tertiary education strategy	57,628
KG200002	Situational analysis of grains industry quality assurance	15,000
NUF00010	Nuffield Australia Farming Scholarships	156,000
NYS00003	National Youth Science Forum	50,000
OXI00001	Lentils: The Ute Guide app—application and website	4,440
PIS00002	Travel award—(PIS) Attend XVIII International Plant Protection Congress, Berlin, Germany	4,707



THEME 6—BUILDING SKILLS AND CAPACITY		EXPENDITURE \$
PR325-1	Capacity maintenance—Managing grower and adviser human capacity for long-term sustainability of the grains industry	28,192
PYA00002	Art4Agriculture Program Grains Industry Partnership	83,383
RDC00008	Contribution to the Collaborative Venture for Farming and Fishing Health and Safety Initiative	60,000
RDC00010	Horizon Scholarship sponsorship	60,000
RDC00011	Horizon Scholarship sponsorship	120,000
RDP00014	Resilient grain leaders	120,599
SCM00001	GRDC 25th Anniversary Film	34,711
SEP00012	Technology integration workshops in the Western Region	120,000
TAY00003	GRDC grains industry careers awareness and attraction strategy	30,000
UA00146	Protecting Your Crop Theme PhD Scholarship—Diamondback moth dispersal and colonisation of Australian canola crops	29,044
UCS00022	Protecting Your Crop Theme PhD Scholarship—Mechanisms of weed suppression by early vigour and other novel wheat genotypes	25,235
UCS00023	Protecting Your Crop Theme PhD Scholarship—Mechanisms of weed suppression by early vigour and other novel wheat genotypes	29,000
UM00054	Protecting Your Crop Theme PhD Scholarship—Predicting insect pest issues in Australian grain crops	25,235
US00069	Enhancing human capacity for soil knowledge transfer and decision making for a sustainable grains industry	440,758
USA00017	Building capacity in stored grain facilities research	130,000
UW00004	Capacity building for statistics	100,000
UW00007	Statistical input to wheat quality trials	64,884
UWA00173	Capacity building to understand plant energy efficiency in harsh environments	200,000
VGA00001	Publishing current and historic grower group trials on GRDC web platform	75,000
THEME 6—BUILDING SKILLS AND CAPACITY TOTAL		9,251,916

FOUNDATIONAL ACTIVITIES		EXPENDITURE \$
AAC00007	Australian Grains Industry Conference—Grower Day	10,000
AAM00004	Nutrition workshop in Western Region	1,200
ABP00003	Provision of grains industry value chain contact details to the GRDC suitable for integration into the GRDC's customer relationship management database	89,180
ABS00003	Study tour to Western Australia	15,000
ACO00016	Regional science writers—Southern	442,516
ACO00022	GRDC corporate and regional displays	35,795
ADD00001	Wordpress software update for the Managing Climate Variability Program	1,737
AGG00003	Eyre Peninsula farming systems tour	15,000
ANV00013	Ground Cover TV	351,999
ANV00017	Video services to record, edit and publish two videos demonstrating and explaining key factors in successful incorporation of pre-emergent herbicides for the most effective weed control and to minimise crop damage	30,095
ARD00001	Creation of a business case considering feasibility of developing a membership database and membership identification process for levy payers	67,000
ARN00003	Provision of content and images for revised version of GRDC Weeds Ute Guide app	47,275
BJW00001	Nutrition workshop in Western Region	800
BWD00027	Building understanding of governance and risk management expectations of grower group boards	12,440



FOUNDATIONAL ACTIVITIES		EXPENDITURE \$
CAS00005	Field trial auditing and reporting for GRDC investments	148,428
CAS00007	Assessment of late maturity alpha-amylase field risk	210,250
CCS72-1	Corporate communication activity—Expenses	110,371
CIC00028	Northern Region field day support	80,000
CIC00029	Northern regional communication services	691,040
CIC00030	Western regional communication services	573,170
CIC00031	Regional science writers—Northern	582,397
CIC00032	Regional science writers—Western	507,910
CIC00033-B	Southern Region GrowNotes for lupins	57,456
CIC00033-C	Western Region GrowNotes for lupins and durum wheat	112,453
CNG00002	GRDC website performance monitoring	6,200
COPO0001	Nutrition workshop in Western Region	800
COR00035	Converting of information from research reports for a grower audience	200,000
COR00036	Ground Cover Direct publications catalogues	54,739
COR00037	Provision of editorial, production, printing and distribution of GRDC's <i>Ground Cover</i> newspaper and <i>Ground Cover</i> supplements	1,498,839
COR00054-A	Southern Region GrowNotes for lentils, faba beans and field peas services	267,030
COR00054-B	Southern Region GrowNotes for vetch	42,770
COR00054-C	Western Region GrowNotes for lentils	44,610
COR00054-D	Western Region GrowNotes for vetch	23,570
CUR00026	Statistics for the Australian Grains Industry—Western node	572,675
DAQ00207	Yield testing field pea varieties and experimental lines in the Northern Region	14,252
DAQ00208	Statistics for the Australian Grains Industry—Northern node	627,650
DAW00254	Furrow formation and inter-row compaction for improved wheat production in water-limited environments of the wheat belt of Western Australia	12,000
EAA00001	Portfolio modelling for variety selection—Model development	79,000
ECG00001	Stakeholder and community relations—Engagement strategy development and service delivery	45,000
ECG00002	Stakeholder and community relations—Engagement strategy development and service delivery	30,000
EDE00001	Communication services	76,111
EXF00001	eXtensionAUS—Trial	1,689
EXF00002	eXtensionAUS—Technology and training support	102,801
FA14-1	GRDC website redevelopment—Phase III—Expenses	41,980
FA14-2	Social media initiative	7,041
FA14-3	Website redevelopment expenses	38,836
FA25-1	Australian Biotechnology Council of Australia—Expenses	40,000
FA32-1	GRDC GrowNotes—Expenses	210
FA32-2	GRDC publications expenses	43,122
FA34-1	Media monitoring and analysis—Expenses	8,531
FA43-1	Baker's Dozen—Expenses	12,814
FMO00002	Nutrition workshop in Western Region	800
GCS10342	Conference sponsorship—Outlook	7,273
GIA00004	GRDC grains research updates—Western Region	387,961
GPA00004	Consultation and project activities	90,000



FOUNDATIONAL ACTIVITIES		EXPENDITURE \$
GRF00002	Study Tour—Globalising Growers	27,000
GS20-2	Western Australia communications campaign	17,381
ICN00021	GRDC research updates—Northern Region	394,220
ICY69-1	National Variety Trials	8,069,755
ISE00001	Media monitoring services	189,469
JLC00013	Final report editing for GRDC website for advisers and growers	231,450
KDI00029	Farmer of the Year—Sponsorship of Grain Grower of the Year Award	20,000
KQU00002	GRDC Knowledge Library prototype	145,500
KQU00003	External collaboration and workflow system	15,000
KQU00004	GRDC products and services trends analysis	10,677
MDE00003	Customer relationship management consultancy and campaign development	391,820
NNT00001	GRDC rebrand	31,500
NZX00002	Provision of marketing content for GrowNotes	85,000
OBR00004	Ground Cover radio and regional weekly update audio programs	113,850
OBR00005	Production of radio program/podcast GRDC Driving Agronomy	65,000
ORM00013	GRDC business updates—Northern Region	186,925
ORM00014	GRDC research updates—Southern Region	712,350
ORM00015	GRDC farm business updates—Southern Region	802,350
ORM00016	Planning, sourcing and producing content for a GrowNotes publication on farm business models	169,590
PNS00019	Case study development	10,000
PNS00020	Southern regional communication services	728,938
PTP00003	Promotion of Farming the Business at the GRDC farm business updates	24,640
RDP00016	National Agribusiness Reference Group	84,900
RHC00007	GRDC products and services market research	66,755
RHC00008	Branding strategy implementation	12,600
RHC00008-1	Branding strategy implementation—Expenses	131
RHC00010	Branding strategy implementation	153,600
RPI00010	West Australian Herbicide Resistance Study Tour	15,000
RRA00038	Bookshop payment gateway	3,500
RWB00002	Rural Focus interviews with the Western Panel	10,400
SBM00002	Ute Guide apps and mobile resources	270,000
SBM00003	GrowNotes—Tips and tactics for publication and website	150,000
SBM00004	GRDC GrowNotes pilot—Northern Region	1,000
SBM00008	Technical GrowNote—Herbicide use (national)—Pilot	9,976
SBM00009	Western Region GrowNotes for oats and barley	99,971
SBM00010	Northern Region GrowNotes for oats and soybeans	99,971
SBM00011	Southern Region GrowNotes for wheat and barley	99,971
SBM00012	Northern GrowNotes updates for wheat, barley, durum and chickpeas	98,936
SBM00013-A	Western Region GrowNotes for chickpeas, faba beans and field peas	205,736
SBM00013-B	Southern Region GrowNotes for chickpeas	79,049
SBM00013-C	Southern Region GrowNotes for durum wheat, oats, triticale and cereal rye services	241,072
SBM00013-D	Western Region GrowNotes for triticale	55,345
SBM00013-E	Northern Region GrowNotes for faba beans, sorghum and sunflowers	89,020



FOUNDATIONAL ACTIVITIES		EXPENDITURE \$
SBM00013-F	Northern Region updated GrowNotes for field peas, safflower and canola	89,020
SBM00013-G	Northern Region updated GrowNotes for maize, mungbeans and peanuts	89,020
SBM00013-H	Northern Region GrowNotes for lentils, lupins and vetch	113,702
SBM00013-I	Northern Region GrowNotes for cereal rye and triticale	66,978
SFS00033	Build on existing experience and information in Australia on the use of cover crops	13,000
SKC00004	GRDC Western Region machinery field days display creation and management	6,889
SKC00005	Tender evaluations	1,667
SOK00001	Increasing crop uptake of fertiliser by improving soil pH/health with prilled liming agents, prilled humate and vesicular aurbuscular mycorrhizal seed dressing	19,991
SOU00001	Nutrition Workshop in Western Region	1,494
SQU00001	Provision of website services for GRDC	469,335
UA00164	Southern regional node of Statistics for the Australian Grains Industry (SAGI)	644,919
UB00003	Online farm trials research—Developing new technologies to improve access to and adoption of research findings	390,000
UB00004	Online final reports research—Innovative knowledge management approaches to support greater research uptake	295,000
UNK00002	Services to assist the GRDC in monitoring and evaluating the performance of its contracted project work within the Southern Region portfolio	2,000
UW00005	Statistics for the Australian Grains Industry	1,079,116
WZ00001	GRDC website Weatherzone	4,922
FOUNDATIONAL ACTIVITIES TOTAL		26,148,217

R&D MANAGEMENT		EXPENDITURE \$
AAA00009	GRDC Nominee Director	5,000
ACC00009	Tender evaluations	2,400
ACO00019	Co-sponsorship with SAGIT of the Seed to Store YouTube clip competition—Promoting the Australian grains industry	23,000
ACO00021	Western Australian genetically modified canola impact study report	2,420
AEG00008	Wheat stock information	220,000
AFL00004	Big data in grains industry in Australia	2,000
AGL00022	Plant breeding research, impact assessment and market intelligence for selected summer and winter pulse crops	52,000
AGP2	GRDC Nominee Director	54,770
AMC00020	Final report evaluations	1,800
AMC00021	Services to assist the GRDC in monitoring and evaluating the performance of its contracted project work within the research programs portfolio	7,400
ANV00018	Video segments for the Spread, delve, spade, invert booklet	16,234
APL00003	Co-funding contribution: Coordinator for feed grain research and development partnership	7,143
ATRO0030	An impact assessment of GRDC investment in the Australian Cereal Rust Control Program	25,581
BAE00027	Australian Agricultural and Grazing Industries Survey and Grains Reports	568,211
BBC00009	Tender evaluations	3,000
BBE00029	GRDC Nominee Director	6,008
BEC00001	Tender evaluations	1,200
BLU00001	Grains Industry Group—Design the future model to deliver on-farm productivity research in Western Australia	30,000
BOA00002	Tender evaluations	1,800



R&D MANAGEMENT		EXPENDITURE \$
CAN00004	Warehouse and distribution of the GRDC's publications, periodicals and promotional material	100,000
CCP00006	Proximal sensing for profitable and sustainable farming—Commercial development and investment strategy plan	45,000
CON00001	Industry survey of crop modelling landscape and applications	2,500
CON00002	Consultancy services for providing insights and recommendations of crop modelling	5,000
CSH00001	Tender evaluations	675
CSP00201	Improving farmer confidence in targeted nitrogen management through automated sensing	378,205
DAL00001	People in agriculture	28,000
DAS00159-BA	South Australian Research and Development Institute—Bilateral agreement	687,078
DER00022	Grower Survey	34,450
DER00023	Research Partner Survey	52,800
DER00024	Grower Survey	64,265
DER00025	GRDC Farming Practice Survey	65,315
DJE00001	Soil Constraints—West Steering Committee	1,902
DLP00001	GRDC Nominee Director and Chair	12,144
DLP00002	GRDC Nominee Director	23,289
DLP00003	GRDC Nominee Director	20,600
DTT00001	Development of a grains industry strategy to help address the supply chain infrastructure issues that impact Australia's competitiveness	163,000
DYE00001	Big data in grains industry in Australia	17,000
FA04-1	Council of Rural Research and Development Corporations membership contribution and project allowance	120,000
FA05-1	Directorship—Expenses	25,190
FA08-1	Impact assessment and portfolio analysis—Expenses	3,500
FA41-1	CSIRO Bilateral	3,647
GOC00001	Data cleansing and data migration	4,363
GRD217-1	Investment planning—Expenses	240,350
GRD226-1	Soil Constraints—West Steering Committee—Operating expenditure	1,935
GRD228-1	Strategic investment—Commercial	8,838
GRD231-1	Strategic investment—Research programs	46,306
GRD232-1	Strategic investment—Regional grower services	56,650
GRD236-1	Analysis—Corporate communications—Expenses	10,000
GRD237-1	Panel member involvement in theme activities, projects and investment process—Expenses	48,056
GUI00004	Tender evaluations	4,769
GWC00005	Investment review	24,037
GWC00006	Assessment of potential novel herbicides investment	4,400
JDI00001	Tender evaluations	13,279
JNA00002	Investment review	5,950
JNA00003	Tender evaluations	4,800
JNA00004	Services to assist the GRDC in monitoring and evaluating the performance of its contracted project work within the research programs portfolio	3,600
JOL00011	Investment review	12,166
JOL00012	International Wheat Yield Partnership	8,160
JOL00013	Final report evaluations	1,700
JSS00001	Investment review	932



R&D MANAGEMENT		EXPENDITURE \$
JST00001	Tender evaluations	3,300
KG00003	Collecting data to measure practice change for Meeting Market Requirements theme strategy	25,000
KHU00001	Services to assist the GRDC in monitoring and evaluating the performance of its contracted project work within the research programs portfolio	3,600
KIP00002	Tender evaluations	2,410
LAY00001	Consultancy progress report evaluation	1,800
LIK00001	Big data strategy for the grain industry	19,339
LUK00001	Big data in grains industry in Australia	16,704
LYH00004	To facilitate a strategic monitoring, evaluation, reporting and improvement workshop for the nitrogen fixation program	3,243
MAP00001	Consultancy progress report evaluation	2,000
MAT00001	Tender evaluations	1,636
MAT00002	Tender evaluations	4,388
MCD00002	Tender evaluations	1,200
MEL00001	Investment review	3,000
MEL00002	Western Region Regional Cropping Solutions Network—Application review	1,000
MLP00004	Tender evaluations	3,600
MOT00001	GRDC Communications Strategy	793,826
NBC00001	GRDC Nominee Director	6,987
NBC00002	GRDC Nominee Director	15,000
NFC00003	Tender evaluations	2,400
NFC00004	Tender evaluations	14,000
PIE00001	Primary Industries Education Foundation Australia—Grains industry education resource and extension materials	75,000
PJG00001	Strategic planning support	16,720
PLT00003	Soil Constraints—West Steering Committee	30,213
PLU00001	Tender evaluations	3,600
PLU00002	Facilitator for GRDC Nutrition Workshop in the Western Region	3,600
PLU00003	Consultancy progress report evaluation	1,400
PRN00001	Assist with data cleansing and data migration	4,600
RAA00003	Final report evaluations	2,770
RAA00004	Big data—Future Farm automation and robotics	40,323
RAA00005	Tender evaluations	1,200
RAA00006	Services to assist the GRDC in monitoring and evaluating the performance of its contracted project work within the research programs portfolio	4,200
RAA00007	Services to assist the GRDC in monitoring and evaluating the performance of its contracted project work within the research programs portfolio	3,600
RAA00008	Future Farm—Program Management Group meeting	1,200
RAI00006	Touring Tasmania	15,000
RBI00001	GRDC Nominee Director	21,623
RDC00014	Improved use of seasonal forecasting to increase farmer profitability	800,973
RDEM6-1	Development of data sources for evaluation and reporting of progress in GRDC investment themes	30,980
RDEM6-3A	International Wheat Yield Partnership Management—Expenses	33,984
RDEM9-1	Intellectual property management	253,934



R&D MANAGEMENT		EXPENDITURE \$
RDM00001	GRDC Nominee Director	41,000
RDP00017	The challenge of enterprise diversity and its impact on herbicide resistance in the Northern Region	15,000
RPI00011	South America agricultural study tour	30,000
RYA00001	Tender evaluations	2,640
RYA00002	Tender evaluations	14,652
SCO00001	Tender evaluations	4,800
SCO00002	Consultancy progress report evaluation	1,200
SHE00012	Tender evaluations	1,800
SHE00013	Tender evaluations	5,075
SON00003	Tender evaluations	1,320
SON00004	Tender evaluations	8,634
SPI00003	Path to market assessment for inoculants	12,518
SPI00004	Intellectual property review	59,656
SPI00005	Commercial landscape analysis	18,909
SPI00006	Investment review	47,574
SPI00007	New investment due diligence project	41,186
SPI00008	National Brassica Germplasm Improvement Program—Intellectual property due diligence investigation	10,000
SPI00009	Patentability assessment	10,000
TAP00004	GRDC Nominee Director	48
TAP00009	GRDC Nominee Director	27,300
TAP00010	Tender evaluations	1,200
TIA00002	Investment review	5,060
TRE00003	New Zealand study tour	30,000
USQ00023	Glasshouses—Infrastructure	2,000,000
VAL00001	Assist with data cleansing and data migration	2,800
VAS00002	Tender evaluations	1,200
VL00002	GRDC Nominee Director	64,500
WIN00001	Consultancy progress report evaluation	1,000
YAO00001	Assist with data cleansing and data migration	2,800
R&D MANAGEMENT TOTAL		8,115,043
TOTAL		192,795,639

ABARES = Australian Bureau of Agricultural and Resource Economics and Sciences, ANU = Australian National University, ATA = Agricultural Training Award, CIMMYT = International Maize and Wheat Improvement Center, CSIRO = Commonwealth Scientific and Industrial Research Organisation, CUR = Curtin University of Technology, Western Australia, GIRS = Grains Industry Research Scholarship, ICARDA = International Center for Agricultural Research in the Dry Areas, NSW = New South Wales, PIS = Primary Industries and Regions of South Australia, QUT = Queensland University of Technology, RMIT = RMIT University, SAGI = Statistics for the Australian Grains Industry, SAGIT = South Australian Grains Industry Trust, Sunshine Coast = University of the Sunshine Coast, UA = University of Adelaide, UCS = Charles Sturt University, UF = Flinders University, UMU = Murdoch University, UNC = University of Newcastle, UQ = University of Queensland, US = University of Sydney, USQ = University of Southern Queensland, UWA = University of Western Australia, WA = Western Australia



Appendix C—Joint R&D projects

Joint R&D projects and partners

GRDC PARTNERS	PROJECT ID	PROJECT	START	FINISH
Agrarian Management, Precision Agriculture	AAM00005-A	Deep ripping, 'deeper' deep ripping and water use efficiency	15 Apr 2016	28 Feb 2019
ACO, UA	ACO00004	GRDC education resources	1 Jul 2014	30 Jun 2016
ARC, DEDJTR, SARDI, UA, UM, UQ	ACP00002	Australian Centre for Plant Functional Genomics Phase II	1 Jan 2008	30 Jun 2017
ACPPFG, UA, UM	ACP00009	Three high-value genes (Vacuolar Proton Pyrophosphatase 1 (AVP1), Phosphorus Starvation Tolerance 1 (PSTOL1) and Nicotianamine Synthase (NAS)) for higher wheat yield—International Wheat Yield Partnership	1 Jan 2016	31 Dec 2018
Australian Controlled Traffic Farming Association, BCG, DEDJTR, SARDI, Society of Precision Agriculture Australia	ACT00004	Application of controlled traffic farming in the low-rainfall zone	1 Jul 2014	30 Jun 2019
AEGIC, DAFWA, ECU	AEG00003	Research capacity in barley malting and brewing	1 Jul 2013	30 Jun 2016
AEGIC, DAFWA	AEG00005	Market intelligence	1 Jul 2014	30 Jun 2016
AEGIC, DAQ, DEDJTR, DAFWA, UCS, USA	AEG00006	Market intelligence	15 Apr 2015	30 Jun 2016
AEGIC, DAFWA, UQ	AEG00007	Oats for export	1 Jul 2015	30 Jun 2018
Agalign Consulting, AGT, AVP Consulting	AGL00022	Plant breeding research—Impact assessment and market intelligence for selected summer and winter pulse crops	26 Apr 2016	30 Aug 2016
AKC Consulting, Agalign Consulting	AKC00006	Registration of minor use chemicals for the grain industry	1 Jul 2013	30 Jun 2016
ANU, CIMMYT, UA, UWA	ANU00027	Improving yield by optimising energy use efficiency	1 Jan 2016	31 Dec 2018
AEC, APL, DA, MLA, PRC	APL00003	Co-funding contribution: Coordinator for feed grain research and development partnership	1 Jul 2015	30 Jun 2016
Ag Profit Pty Ltd, ORM Pty Ltd	APR00001	Practical financial figures for farm business management	22 Jun 2012	30 Jun 2017
Agripath Pty Ltd, DAQ	APT00001	Economics of closing the yield gap in the northern grains region	1 Jul 2013	30 Jun 2016
Agronomo, ICAN	ARN00001	Support of the Australian Glyphosate Sustainability Working Group	30 Jun 2013	30 Jun 2018
agVivo Pty Ltd, Revell Science	AVP00003-A	Compaction mitigation options for growers in the Albany and Kwinana West port zones	1 May 2016	28 Feb 2019
BA, Barrett Burston Malting Co, Cargill Malt Co, Carlton and United Breweries, DAQ	BA00009	Pilot brewing for malting barley lines	30 Jun 2015	30 Jun 2018
BCG, Back Paddock, Bates Ag, Cropfacts, DAN, IP, ICC, SARDI, Sparke Agricultural & Associates	BWD00021	More Profit from Crop Nutrition II—Extension and training Southern Region	1 Jul 2012	30 Jun 2017
BCG, ICC, SFS, VNTFA	BWD00024	Maintaining profitable farming systems with retained stubble—Victoria and Tasmania	1 Jul 2013	30 Jun 2018



GRDC PARTNERS	PROJECT ID	PROJECT	START	FINISH
BCG, CSIRO	BWD00025	National paddock survey initiative	1 May 2014	15 Mar 2019
CAS, Kalyp Agriculture Pty Ltd	CAS00004	Common seed 'bulk-up' to provide seed for all relevant GRDC research investments	1 Apr 2014	30 Mar 2019
CAS, InterGrain, WQA	CAS00007	Assessment of late maturity alpha-amylase field risk	30 May 2015	30 Jun 2018
Cesar, CSIRO	CES00003	Aphid and insecticide resistance management in oilseed and pulse crops	30 Jun 2015	30 Jun 2019
CSIRO, DAFWA	CFF00008	Assessment of leaf area index, tiller survival and short delay in flowering as candidate traits for tolerance to early drought in wheat	2 Mar 2015	2 Mar 2016
Aglink, SARDI, Climate and Agricultural Support Pty Ltd	CTL00001	Frost check	1 Jul 2015	30 Jun 2016
CSIRO, SARDI	CMA00002	Assessing forecast and management options for mitigating extreme temperature impacts on grains	1 Jun 2014	31 May 2017
CSIRO, UWA	CSA00029	National integration of crop sequence strategies and tactics	1 Jul 2010	30 Jun 2016
AEGIC, CSIRO, DAQ, DAFWA	CSA00036	More Profit from Crop Nutrition II—Analysis frameworks to support profitable fertiliser use	1 Sep 2012	31 Aug 2015
USQ	CSA00041	Better irrigated wheat germplasm	1 Jul 2012	30 Jun 2018
AgEconPlus, AMC, CSIRO, UQ, UWA	CSA00043	Impact of weeds on Australian grain production and adoption of no-till cropping practices	1 Jul 2013	31 Dec 2015
CSIRO, DAFWA, DAN	CSA00044	EverCrop: Developing new mixed farming options	1 Jul 2013	30 Jun 2017
CSIRO, DAQ, UQ	CSA00050	Northern farming systems—Integrating research solutions for profitable outcomes	30 Jun 2014	30 Jun 2019
CSIRO, Cesar	CSA00051	Investigation into the possible recent incursion of an insecticide-resistant biotype of green peach aphid into Australia	30 Jun 2014	31 Dec 2015
CSIRO, DAQ	CSE00055	Crop sequences to manage soil pathogens and reduce the yield gap of northern grain production	1 Jun 2011	30 Jun 2016
ANU, CSIRO	CSE00056	Bioroutes to urea fertilisers	1 Jul 2010	30 Jun 2015
Cesar, CSIRO, DAFWA, DAN, SARDI, UM	CSE00059	New knowledge to improve the timing of pest management decisions in grain crops	3 Jan 2015	30 Jun 2020
CSIRO, UWA	CSO00044	Understanding biological farming inputs	30 Jun 2014	20 Jun 2017
CSIRO, DAFWA	CSP00143	New strategies for phenotyping reproductive-stage frost and chilling tolerance in wheat	1 Dec 2010	30 Jun 2016
AEGIC, CSIRO, DAFWA	CSP00144	Genetic analysis of wheat quality using MAGIC (multiparent advanced generation intercross) populations	1 Jul 2010	30 Mar 2016
BCG, CSIRO, CWFS, DAN, DEDJTR, FLR, ICC, MFM, RPI, SFS	CSP00146	Facilitating increased on-farm adoption of broadleaf species in crop sequences to improve grain production and profitability	1 Jul 2010	31 Mar 2016
CSIRO, DAN	CSP00157	Australian Soybean Breeding Program	30 Jun 2012	30 Jun 2017
CSIRO, DAFWA	CSP00160	Refining variety and management recommendations to improve productivity and resource use efficiency of dual-purpose crops in Australia	3 Jun 2012	31 Dec 2015



GRDC PARTNERS	PROJECT ID	PROJECT	START	FINISH
CSIRO, CIMMYT, US	CSP00164	Australian Cereal Rust Control Program—Molecular marker program collaborative project	1 Jul 2012	30 Jun 2017
CSIRO, FLR	CSP00174	Maintaining profitable farming systems with retained stubble in NSW South West Slopes and Riverina	30 Jun 2013	30 Jun 2018
CSIRO, UW	CSP00175	Maintaining wheat grain number under reproductive-stage drought conditions	1 Jul 2013	30 Jun 2017
CSIRO, FAR	CSP00178	Increasing yield and reducing risk through early sowing in the southern grains region	1 Jul 2013	30 Jun 2016
CSIRO, UQ	CSP00179	Raising water productivity: Trait assessment for Australian rainfed wheat	1 Jul 2013	30 Jun 2018
CSIRO, DAQ	CSP00180	Maintaining yield stability of wheat under spring frosts	1 Jul 2013	30 Jun 2017
CSIRO, DAFWA, UA	CSP00182	Genetically improving wheat's ability to outcompete weeds	1 Jul 2013	30 Jun 2019
CSIRO, UA, DEDJTR	CSP00183	Pedigree-based association genetic analysis of wheat phenology	1 Jan 2014	1 Jul 2018
CSIRO, DAN, SARDI	CSP00187	Optimised canola profitability—Understanding the relationship between physiology and tactical agronomy management	30 Jun 2014	30 Jun 2019
Aglink Agricultural Consultants, CSIRO, DAFWA, DEDJTR, Geospatial Intelligence Solutions, PNK Consulting, SARDI, UA, UWA	CSP00198	Spatial temperature measurement and mapping tools to assist growers, advisers and extension specialists manage frost risk at farm scale	1 Jul 2015	30 Jun 2019
CSIRO, ULA	CSP00200	Improving wheat yields by increasing coleoptile length and water productivity	1 Jun 2015	30 Jun 2017
CSIRO, DEDJTR, US, USQ	CSP00201	Improving farmer confidence in targeted nitrogen management through automated sensing	1 Nov 2015	30 Apr 2017
Ag Grow Agronomy, CSIRO, MSF, PIRSA, USA	CSP00203	Increasing production on sandy soils in low- and medium-rainfall areas of the Southern Region	30 Jun 2016	1 Jul 2021
CUR, DEDJTR, ICARDA, PBA	CUR00020	Managing on-farm biosecurity risk through pre-emptive breeding: The case of rust in field pea and lentil	1 Jun 2013	30 Jun 2018
CUR, UWA	CUR00022	Fungicide resistance management strategy and communications	30 Nov 2013	30 Nov 2017
CUR, DAN, UT, UWA	CUR00024	Genetics of wild germplasm, gene pool expansion and integrated assisted single seed descent approach to enhance adaptive potential in chickpea	30 Jun 2014	30 Jun 2019
CUR, DAFWA	CUR00026	Statistics for the Australian Grains Industry—Western node	30 Jun 2016	1 Jul 2021
CWFS, DAN	CWF00018	Maintaining profitable farming systems with retained stubble—Central West New South Wales	30 Jun 2013	30 Jun 2018
BCG, CWFS, UCS, DAN, MSF, SARDI	CWF00020	Overdependence on agrochemicals	1 Jul 2014	30 Jun 2017
DAN, UCS, UQ	DAN00117	Development of molecular markers for application in Australian canola breeding	1 Jul 22008	30 Jun 2016
DAN, DAFWA, DEDJTR, SARDI, USQ	DAN00151	Pulse Breeding Australia—National Chickpea Breeding Program	1 Jul 2011	30 June 2016



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CSIRO, DAN, FLR, UCS	DAN00152	The strategic use of tillage within conservation farming	30 Jun 2011	30 Jun 2016
DAN, UA	DAN00163	Durum Breeding Australia	30 Jun 2012	30 Jun 2017
DAN, Back Paddock Company, KIP Consulting	DAN00165	More Profit from Crop Nutrition II—Program coordination and communication	25 Jun 2012	30 Jun 2017
Back Paddock Company, Geographic Web Solutions, DAN, DAQ, DAFWA, International Plant Nutrition Institute, KIP Consulting, SARDI, UCS, UMU	DAN00166	More Profit from Crop Nutrition II—Making better fertiliser decisions for cropping systems in Australia—Phase 2	25 Jun 2012	30 Jun 2017
DAQ, DAN	DAN00167	Variety-specific agronomy packages for southern, central and northern New South Wales	30 Jun 2012	30 Jun 2017
Aggrov Agronomy, DAN, FLR, MFM, SFS, UCS	DAN00168	Regional soil testing guidelines for the Southern Region	1 Jul 2012	30 Jun 2017
DAN, US	DAN00169	Building resilient and profitable grain-cropping systems through improved knowledge of soil organic carbon fractions and their functionality	12 Apr 2013	30 Jun 2017
DAN, DAQ, UA	DAN00172	Managing crop disease—Improving chickpea pathogen resistance	1 Jun 2013	30 Jun 2018
BCG, DAN, SARDI	DAN00173	Management of barley and barley cultivars for the Southern Region	25 Jun 2013	30 Jun 2018
Biosecurity NSW, DAN, ICARDA	DAN00174	Managing on-farm biosecurity risk in wheat through pre-emptive breeding	30 Jun 2013	31 May 2018
DAN, DAQ, DEDJTR, DAFWA, SARDI	DAN00175	National crown rot epidemiology and management program	30 Jun 2013	30 Jun 2018
DAN, DAQ, DEDJTR, DAFWA, SANTFA, UA, US, USC, UWA	DAN00180	Does increased herbicide use impact on key soil biological processes?	1 Jul 2013	1 Jun 2018
CSIRO, DAN, Life Cycle Strategies	DAN00186	Identifying national opportunities for grains emissions mitigation and other environmental improvement, using life cycle assessment and the Australian Agricultural Life Cycle Inventory (AusAgLCI) database	1 Jul 2014	30 Jun 2017
DAN, US	DAN00189	Australian Inoculants Research Group: National independent quality assurance and germplasm maintenance for <i>Rhizobium</i> inoculants	1 Jul 2013	30 Jun 2017
CSIRO, DAN, Holbrook Landcare Network	DAN00191	Nitrogen-fixing break crops and pastures for high-rainfall zone acid soils	1 Jul 2014	30 Jun 2018
Australian Oilseeds Federation, Australian Oils Research, DAN, UM, Yerugan Crop Research	DAN00194	Increasing market value of canola through improved quality traits	30 Jun 2014	30 Jun 2017
DAN, DAQ	DAN00195	Tactical crop agronomy of sorghum and maize in the Northern Region—New South Wales component	1 Jul 2014	30 Jun 2017
DAN, DAQ, SARDI, UNE, USQ, UWS	DAN00196	Eliminating grain defects in chickpeas	30 Jun 2014	30 Jun 2017
DAN, DAQ, DEDJTR, DAFWA, ICARDA, UQ	DAN00202	New tools and germplasm for Australian pulse and oilseeds breeding programs to respond to changing virus threats	1 Apr 2015	30 Jun 2020
ANU, DAN	DAN00203	Effective genetic control of septoria tritici blotch	1 Jul 2015	30 Jun 2020
CSIRO, DAN, UCS, ULA	DAN00206	Innovative approaches to managing subsoil acidity in the southern grains region	1 Jan 2015	30 Jun 2020



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DAN, DA, UWA	DAN00208	National Brassica Germplasm Improvement Program—Phase II	1 Jul 2015	30 Jun 2020
DAQ, PCA, USQ	DAQ00186	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—Queensland	30 Jun 2013	30 Jun 2018
ANU, DAN, DAQ, DEDJTR, DAFWA, SARDI, UA, USQ, UT	DAQ00187	National barley foliar pathogen variety improvement program	30 Jun 2013	30 Jun 2018
DAQ, UQ	DAQ00190	Maintaining a barley pre-breeding capability in Queensland	1 Jul 2013	30 Jun 2019
DAN, DAQ	DAQ00192	Northern farming systems—Integrating research solutions for profitable outcomes	30 Jun 2014	30 Jun 2019
BCG, DAN, DAQ, DAFWA, UCS	DAQ00197	Cultural management options for herbicide-resistant weeds	1 Jan 2015	31 Aug 2015
Coretext, DAQ, DAFWA, DSITI, McKellar Consulting, UA, UQ	DAQ00199	Soil Constraints—West Steering Committee—Coordination and communication	1 Jul 2015	30 Jun 2020
DAN, DAQ, DEDJTR, DAFWA, DSITI, SARDI, UNS, UQ, UW	DAQ00200	Soil Constraints Initiative—management of sodic and magnesic soils	1 Jan 2015	30 Jun 2020
Cesar, DAQ, DAFWA, SARDI	DAQ00201	National Pest Information Service	1 Jul 2014	30 Jun 2018
BGA Agriservices, CSIRO, DAQ, DAN	DAQ00204	Growers solution project for coastal/hinterland Queensland and New South Wales north coast	1 Jul 2015	30 Jun 2020
SARDI, UA	DAS00113	Pulse Breeding Australia—PhD—Improving metribuzin tolerance in lentil	1 Jul 2010	30 Jun 2016
BCG, CSIRO, CWFS, MSF, SARDI, UNFS	DAS00119	Profitable crop sequencing in the low-rainfall areas of south-eastern Australia	1 Jul 2010	31 Mar 2016
SARDI, UA	DAS00121	Pulse Germplasm Enhancement Program—Abiotic stresses	1 Jul 2011	30 Jun 2016
CSIRO, SARDI, USA	DAS00125	Fungicide control of <i>Rhizoctonia</i> —Part A	1 Jul 2011	30 Jun 2016
SARDI, UA	DAS00128	Optimising nitrogen fixation of grain legumes—Southern Region	1 Jul 2012	30 Jun 2017
RIRDC, DAFWA, SARDI	DAS00129	National Oat Breeding Program—Healthy and productive grain varieties for the future	1 Jul 2012	30 Jun 2017
SARDI, UA	DAS00131	Improving weed management in pulse crops through herbicide tolerance—Part B	30 Jun 2013	30 Jun 2018
SARDI, US	DAS00133	Improved resistance to oat pathogens and abiotic stress management	1 Jun 2013	30 Jun 2018
CSIRO, SARDI, UM	DAS00134	Improved management of snails and slugs	30 Jun 2013	30 Jun 2016
SARDI, USA	DAS00136	New fungicide technologies for crown rot management	30 Jun 2013	30 Jun 2016
DAN, DAQ, DEDJTR, DAFWA, SARDI	DAS00137	National improved molecular diagnostics for disease management	30 Jun 2013	30 Jun 2018
DAN, SARDI, UQ	DAS00140	Improving yield and reliability of field peas and chickpeas under water deficit	30 Jun 2013	30 Jun 2017
DAFWA, DAN, DAQ, IP, International Plant Nutrition Institute, SARDI, UCS	DAS00146	More Profit from Crop Nutrition II—Managing micronutrient deficiencies in cropping systems of eastern Australia	1 Apr 2014	30 Jun 2017
AWI, DA, MLA, RIRDC, SARDI	DAS00148	Australian Pastures Genebank	1 Jul 2013	30 Jun 2018
RIRDC, SARDI	DAS00149	Vetch varieties for grain and hay production for Australian farmers	30 Jun 2014	30 Jun 2017
SARDI, UA	DAS00155	Diamondback moth control and insecticide resistance management	30 Nov 2014	3 Nov 2017



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SARDI, UQ	DAS00157	Nitrogen and water interactions	3 Jan 2015	31 Dec 2015
DAN, DEDJTR, SARDI	DAV00113	Expanding the use of pulses in the Southern Region	1 Jul 2010	30 Jun 2016
DAN, DEDJTR, SARDI	DAV00119	Pulse Breeding Australia—Lentil breeding	30 Jun 2011	31 Oct 2016
DAN, DEDJTR, UA	DAV00126	Molecular markers for pulse-breeding programs	30 Jun 2013	30 Jun 2016
CSIRO, DEDJTR	DAV00127	Using next-generation genetics to accelerate variety improvement in bread wheat, durum and barley	30 Jun 2013	30 Jun 2018
AVRDC, CIMMYT, DAN, DAQ, DEDJTR, ICARDA, ICRISAT, USDA	DAV00131	Australian Grains Genebank—Phase 2	30 Jun 2013	30 Jun 2017
DEDJTR, UM	DAV00137	Maintaining productivity and quality of wheat under elevated carbon dioxide	1 Jul 2014	30 Jun 2017
DEDJTR, UM	DAV00142	Pulse Breeding Australia—PhD—Increasing lentil tolerance to heat waves using genetic solutions	30 Jun 2014	30 Jun 2017
DEDJTR, SARDI, UA	DAV00144	Cereal and pulse cultivar resistance ratings for the Southern Region	1 Jul 2015	30 Jun 2020
Clemation, DA, DAFWA, DEDJTR, HAL, MLA, QUT, RIRDC, SRA	DAV00148	ClimateDogs go national	1 Jul 2015	30 Jun 2016
DAN, DEDJTR, PIRSA, SARDI, SFS, ULA, UM, USA, UT	DAV00149	Understanding the amelioration processes of the subsoil application of amendments in the Southern Region	30 Jun 2016	30 Jun 2021
DEDJTR, SARDI	DAV00150	Understanding the implications of new traits on adaptation, crop physiology and management of pulses in the Southern Region	30 Jun 2016	30 Jun 2019
DAFWA, FG, LIE, MIG, WANTFA	DAW00213	Putting the focus on profitable break crop and pasture sequences in Western Australia	1 Jul 2010	30 Jun 2016
DAFWA, UMU	DAW00221	Optimising nitrogen fixation of grain legumes—Western Region	1 Jul 2012	30 Jun 2017
DAN, DAQ, DEDJTR, DAFWA, MGP, SARDI, UWA	DAW00228	National pathogen management modelling and delivery of decision support	30 Jun 2013	30 Jun 2018
CUR, DAFWA	DAW00229	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—Western Australia	30 Jun 2013	30 Jun 2018
DAFWA, Micrometeorological Research and Educational Services	DAW00231	Management of spray drift through inversion risk awareness	1 Jul 2013	30 Jun 2016
Corrigin Farm Improvement Group, DAFWA, UA	DAW00234	Determining yield under frost—One degree at a time	1 Jan 2014	30 Jun 2018
DAFWA, DAN, SARDI	DAW00237	Lupin breeding for Australia	30 Jun 2014	30 Jun 2016
CSIRO, DAFWA, UWA	DAW00238	Development of lupin molecular markers tagging yield quantitative trait locus genes and yield-related phenology traits	30 Jun 2014	30 Jun 2019
CSBP, DAFWA, UMU	DAW00239	More Profit from Crop Nutrition II—Managing micronutrient deficiencies in cropping systems of Western Australia	1 Jun 2014	30 Jun 2017
AGT, DAFWA, InterGrain, UA, UMU, UT	DAW00240	Manipulating barley phenology to maximise yield potential	30 Jun 2014	30 Jun 2019
DAN, DAFWA, BCG, Living Farm, UA	DAW00241	Farming systems to improve crop tolerance to frost	1 Jul 2014	30 Jun 2016



GRDC PARTNERS	PROJECT ID	PROJECT	START	FINISH
CSIRO, DAFWA, LIE, PAA	DAW00242	Subsoil constraints—Understanding and management	1 Jul 2014	30 Jun 2019
CSIRO, DAFWA, UMU	DAW00244	Delivering enhanced agronomic strategies for improved crop performance on water-repellent soils in Western Australia	1 Jul 2014	30 Jun 2019
DAN, DAQ, DEDJTR, DAFWA	DAW00245	Yield loss response curves for host resistance to leaf, crown and root diseases in wheat and barley	30 Jun 2014	30 Jun 2019
CUR, DAFWA, UA, USQ	DAW00247	Improved genetic solutions for management of yellow spot in wheat	1 Jun 2015	30 Jun 2020
DAFWA, UMU, UT	DAW00248	Effective genetic control of <i>Stagonospora nodorum</i> blotch	1 Jun 2015	30 Jun 2020
DAFWA, RSS, UWA,	DAW00252	Innovative approaches to managing subsoil acidity in the Western Region	1 Apr 2015	30 Jun 2020
DAFWA, Planfarm	DAW00253	Early seeding—A climate change adaptation method in the north-east agricultural region of Western Australia	1 Apr 2015	31 Mar 2016
Cesar, C-Qual Agritelligence, DAQ, DAFWA, DEDJTR, Delta Ag NSW, Roberts Ltd, SARDI, Syngenta	DEF00002	Push notifications to enable proactive management of pests, weeds and diseases	1 Jul 2014	30 Jun 2019
FAR, SFS	FAR00003	Hyperyielding cereals—A feed grain initiative	30 Jun 2015	30 Jun 2020
AglInnovate, Agvivo, DAFWA, FG	FGI00010	Grain and Graze 3—Western Region	1 Mar 2013	1 Mar 2017
Corrigin Farm Improvement Group, FG, Planfarm, PAA, Tincurrin Rural Services	FUT00001	Case studies to review methods for defining within-paddock management zones—Kwinana West zone	2 Feb 2015	31 Jan 2016
AEGIC, DAN, GGL	GGL00003	Evaluating the quality of competitor varieties in Australian wheat export markets	1 Jul 2014	30 Jun 2016
DAFWA, GPC	GPC00001	Extension of nitrogen fixation outputs to end users—Western Region	1 Jul 2012	30 Jun 2017
CSIRO, IAC	IAC00002	Surveillance and forecasts for mouse outbreaks in Australian cropping systems	1 Oct 2012	30 Jun 2017
CSIRO, DAN, ICC, PAA	ICF00008	Soils under an irrigated environment	1 Jul 2014	30 Jun 2017
Agricultural Consulting & Extension Services, ICAN	ICN00016	Integrated weed management extension—Northern Region	1 Jul 2014	30 Jun 2017
International Plant Nutrition Institute, SFS, UM	IPN00003	Nutrient performance indicators	1 Jul 2015	31 May 2016
CSIRO, LEADA, SARDI	LEA00002	Profitable farming systems with retained stubble on lower Eyre Peninsula	30 Jun 2013	30 Jun 2018
Aglime, LIE, MIG, Southern Dirt, West Midlands Group	LIE00008	Working together to deliver multiple benefit messages to growers through a whole systems approach to soil management	31 Mar 2014	30 Jun 2017
CSBP, DAFWA, LIE, MIG, UMU	LIE00010-A	Best bet management of ameliorated non-wetting soils for the Geraldton port zones	1 May 2016	28 Feb 2018
CSIRO, DA, DAFWA, HAL, MLA, RIRDC, SRA	MCV00036	Predictive Ocean Atmosphere Model for Australia seasonal forecast value	1 Jun 2014	30 Nov 2016
DA, DAFWA, HAL, MLA, QUT, RIRDC, SRA	MCV00037	Can advances in mid-term weather forecasts reduce emissions from nitrogen fertiliser?	1 Jul 2013	30 Jun 2016
DA, DAFWA, HAL, MLA, RIRDC, SRA	MCV00038	Australian CliMate development	23 Jun 2014	30 Aug 2016



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DA, DAFWA, HAL, MLA, RIRDC, SRA	MCV00039	Managing Climate Variability Program Phase IV—Independent chair	1 Jul 2013	30 Jun 2016
DA, DAFWA, HAL, MLA, RIRDC, SRA	MCV00040	Managing Climate Variability Program Phase IV—Project management committee	1 Jul 2013	30 Jun 2016
BOM, DA, DAFWA, HAL, MLA, RIRDC, SRA	MCV00041	Improved skill for regional climate in the Access-based Predictive Ocean Atmosphere Model for Australia	23 Jun 2014	28 Feb 2017
DA, DAFWA, HAL, MLA, RIRDC, SRA	MCV00042	Managing Climate Variability Program Phase IV—Communication support and administration	1 Jul 2013	30 Jun 2016
AgKI, MFM, SARDI	MFM00006	Maintaining profitable farming systems with retained stubble—South-east and Kangaroo Island regions	25 Jun 2013	30 Jul 2018
DEDJTR, MSF	MSF00003	Maintaining profitable farming systems with retained stubble—Mallee	30 Jun 2013	30 Jul 2018
AEC, NUF, RIRDC, MLA, FRDC, HAL, Wine Australia, CRDC, Nufarm, CBH Group, John Deere, Cotton Australia	NUF00010	Nuffield Australia Farming Scholarships	1 Jul 2012	30 Jun 2017
ANU, CSIRO, DEST, UNS, UQ, UWA	NYS00003	National Youth Science Forum	15 Aug 2015	30 Jun 2016
AOF, DAN, PAL	PAL00019	Australian broadleaf cropping project	1 Sep 2013	31 Aug 2016
PBC, PHA, QUT, UMU	PBC00002	Extending biosecurity preparedness and surveillance strategies and developing a chemical supply framework for pest incursions	1 Oct 2012	30 Jun 2017
DAQ, PBC, SARDI, USQ	PBC00003	New tools for field grains surveillance and diagnostics of high-priority pests	1 Jul 2012	30 Jun 2017
DAQ, PCA	PCA00001	Australian Peanut Genetic Improvement Program	1 Jul 2007	30 Jun 2015
AKC Consulting, PHA	PHA00010	Development of pre-emptive Australian Pesticides and Veterinary Medicines Authority emergency permits for exotic plant pest incursion containment and control	30 Jun 2013	30 Jun 2016
AKC Consulting, PHA	PHA00012	The facilitation of Category 25 submissions in the Australian grain industry	1 Apr 2014	30 Jun 2017
Australian Environment Agency, CSIRO, PHA	PHA00014	Determining equivalent zones of agriculture for the generation of registration data	1 Apr 2014	31 Dec 2015
D'Estrees Entomology & Science Services, PHA	PHA00016	Biosecurity preparedness for the grains industry—High-throughput diagnostic for Karnal bunt	2 May 2016	26 Sep 2016
BASF, CSIRO, Polymer CRC Ltd, Swinburne University of Technology, UNE, UWA	POL00001	Polymers for improving soil moisture management and cropping productivity	1 Jul 2012	30 Jun 2017
DAQ, QUT	QUT00006	New technology for stored grain pest management—Phase 2	1 Jun 2015	30 May 2017
AgBiTech, QUT	QUT00007	A new biopesticide for diamondback moth management in canola	30 Jun 2014	31 Dec 2016
AWI, CRDC, DA, HAL, FRDC, MLA, RIRDC, SRA	RDC00008	Contribution to the Collaborative Venture for Farming and Fishing Health and Safety Initiative	1 Jul 2012	30 Jun 2017
AEC, ANZ Bank Australia, CRDC, HAL, McCaughey Memorial Institute, MLA, RIRDC, SRA	RDC00010	Horizon Scholarship sponsorship	1 Jun 2013	1 Mar 2018



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AEC, ANZ Bank Australia, CRDC, HAL, McCaughey Memorial Institute, MLA, RIRDC, SRA	RDC00011	Horizon Scholarship sponsorship	1 Jul 2014	30 Jun 2019
FAR, PAL, RPI	RPI00009	Maintaining profitable farming systems with retained stubble—Riverine Plains region	30 Jun 2013	30 Jun 2018
DAFWA, Stirling to Coast Farmers	SCF00004-A	Effective baiting options for the control of conical snails in the Albany port zone	1 Apr 2016	30 Jun 2017
NRS, SFS	SFS00026	Soil acidity is limiting grain yield—Southern Victoria	1 Jan 2014	30 Jun 2018
Ag Excellence Alliance, BCG, MSF, SARDI, SFS	SFS00028	Grain and Graze 3—Extension and delivery of mixed farming benefits in the Southern Region	1 Jan 2014	31 Dec 2017
FLR, MFM, RPI, SFS	SFS00032	Harvest weed seed control for the southern high-rainfall zone	1 Jul 2015	30 Jun 2018
Hyden Rural Merchandise, Synergy Consulting	SYN00008	Early seeding—A knowledge gap strategy for very early season starts	1 Apr 2015	31 Mar 2016
Tarwonga Pty Ltd, Planfarm, ConsultAg, UWA	TAR00005	Is triazine-resistant silver grass a looming threat for the mixed cropping belt in central and southern Western Australia	1 Aug 2015	1 Feb 2016
Tarwonga Pty Ltd, ConsultAg	TAR00006	Best practice net blotch management in Scope barley and interactions with pre-harvest head loss	1 Jul 2015	30 Mar 2016
Agtrans Research, Terra Fertilis	TFC00001	Control of snails and slugs—Investment case for new products for snail and slug control	15 Jan 2016	1 Jun 2016
ACPCFG, SARDI, UA	UA00115	Improving phosphorus use efficiency in wheat and barley	1 Jul 2009	30 Jun 2016
DEDJTR, UA, ULA, UNE	UA00119	Assessing management options for enhanced soil phosphorus availability using rotations	1 Jan 2011	31 Dec 2015
DAFWA, UA	UA00126	Increasing malt extract and the export competitiveness of Australian barley	30 Jun 2011	5 Feb 2015
DAN, SARDI, UA, US	UA00127	Pulse Breeding Australia—Australian Faba Bean Breeding Program	30 Jun 2011	30 Jun 2016
UA, USA	UA00135	Improved functionality of grain storage products	1 Jan 2015	30 Jun 2016
DAFWA, UA	UA00136	Australian National Frost Program—Coordination and phenotyping	1 Jul 2011	30 Jun 2016
SARDI, UA	UA00138	Extension of nitrogen fixation program outputs to end users—Southern Region	1 Jul 2012	30 Jun 2017
CSIRO, UA	UA00139	More Profit from Crop Nutrition II—Tactical foliar phosphorus fertilisation of dryland crops	1 Mar 2013	1 Mar 2016
CIMMYT, UA, UWA	UA00141	Advancement of new stem genes for stem and leaf rust resistance from uncultivated relatives of wheat	1 Jul 2012	30 Jun 2017
CSIRO, UA, UWA	UA00145	Development of salinity-tolerant wheat and barley	1 Jul 2013	31 Dec 2016
ACPCFG, DAN, UA	UA00147	Genetic analysis of heat tolerance in wheat	30 Jun 2014	31 Dec 2018
UCS, DAFWA, DAN, SFS, UA	UA00149	Improving integrated weed management practice of emerging weeds in the Southern and Western Regions	30 Jun 2014	30 Jun 2017



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ACPGF, SARDI, UA	UA00150	Late maturity alpha-amylase: A molecular marker based, high-throughput, precise screening protocol	1 Jul 2014	30 Jun 2018
AGT, UA	UA00152	Genomic selection: Development and utilisation in a commercial wheat-breeding program	1 Jun 2014	1 Jun 2017
DAQ, DEDJTR, SARDI, UA	UA00155	Nutrient stratification and subsurface soil testing	3 Jan 2015	12-10-2015
DAN, DAFWA, UA, UQ	UA00156	Emerging weeds—Seed-bank biology of emerging weeds	1 May 2015	30 Jun 2020
SARDI, UA, USQ	UA00157	Development of tools to accelerate nematode resistance gene deployment	1 Jul 2015	30 Jun 2020
DAFWA, DEDJTR, DAN, SARDI, UA, UQ, USQ	UA00159	Improving wheat yields on sodic, magnesic, and dispersive soils	1 Jul 2015	30 Jun 2020
DAFWA, UA	UA00162	Screening of frost tolerance in cereals	1 Jul 2015	30 Jun 2020
UB, NRS, SFS, International Plant Nutrition Institute	UB00003	Online Farm Trials Research—Developing new technologies to improve access to and adoption of research findings	5 Jun 2013	30 Jun 2016
UA, UCS	UCS00020	Weed management in the Southern Region mixed farming systems—Strategies to combat herbicide resistance	30 Jun 2013	30 Jun 2018
DAQ, UA, UCS, UWA	UCS00024	Surveillance of herbicide-resistant weeds in Australian grain cropping	1 Jul 2015	30 Jun 2020
SARDI, UD, UF	UF00008	Beneficial Microbes Program 2—Progressing new microbial products for Australian grain production to commercialisation	1 Jul 2013	30 Jun 2017
CSIRO, ULA	ULA00009	The effects of heat stress on programmed cell death and floret sterility in wheat	30 Jun 2014	30 Jun 2018
AEC, Agriculture, AGWA, AMPC, APL, AWI, CRDC, CSIRO, DA, DAN, DAQ, DAT, DEDJTR, DAFWA, DNT, FRDC, FWPA, HAL, MLA, RIRDC, SARDI, UM	UM00044	Climate Change Research Strategy for Primary Industries	1 Jun 2011	30 Jun 2017
SARDI, UM, UWA	UM00045	Expanding the brassica germplasm base through collaboration with China and India	1 Jul 2011	30 Jun 2017
Cesar, UM	UM00048	National coordination of invertebrate pest research and insecticide resistance management	1 Jul 2013	30 Jun 2018
Cesar, CSIRO, DAFWA, UM, UWA	UM00049	Management of insecticide resistance in redlegged earth mite and screening new mode of action chemistry	30 Jun 2013	30 Jun 2016
ULA, UM, UWA	UM00050	'Proof of concept' for approaches designed at increasing disease resistance to fungal pathogens of canola	30 Jun 2013	30 Jun 2018
CSIRO, DAN, DAFWA, MGP, SARDI, UM	UM00051	National Canola Pathology Program, including new molecular knowledge, pathogen evolution and control technologies	1 Jun 2013	30 Jun 2018
DAN, DEDJTR, UM	UM00052	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—National chickpea pathology program	30 Jun 2013	30 Jun 2018



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UM, UWA	UM00053	Development of new non-chemical weed control technologies—Microwave control of weeds	1 Jul 2013	30 Jun 2018
CSIRO, UM	UM00054	Protecting Your Crop Theme PhD Scholarship—Predicting insect pest issues in Australian grain crops	10 Mar 2014	9 Mar 2017
SARDI, UM	UM00055	Control of grain pest molluscs	30 Jun 2014	30 Jun 2016
DAFWA, UMU	UMU00040	Maintenance of rhizobial germplasm resources	1 Jul 2012	30 Jun 2017
DAFWA, UMU	UMU00041	More Profit from Crop Nutrition II—Assessing the nutritional benefits of clay amendment and cultivation of sands	1 Jul 2012	31 Jan 2016
DAFWA, FG, UMU	UMU00045	Farming systems to improve crop tolerance to frost: Crop nutrient management	1 Jul 2014	30 Jun 2016
DAFWA, UMU, UT	UMU00046	Improved adaptation of barley to acid soils	1 Jan 2015	30 Jun 2020
DAFWA, UMU, DAQ	UMU00047	Barley grain defects	1 Jul 2015	30 Jun 2019
AGT, DAFWA, InterGrain, UMU	UMU00048	Genetic approaches to reduce the nitrogen dilution effect and increase nitrogen use efficiency in wheat	1 Jun 2015	31 May 2020
AGT, DAFWA, InterGrain, UMU	UMU00049	Maintenance of grain plumpness and transfer of heat tolerance into Australian barley germplasm	30 Jun 2016	29 Jun 2021
DAFWA, UMU	UMU00051	Reduce barley head loss and straw breakage by genetics and management	30 Jun 2014	30 Jun 2017
CSIRO, UNE	UNE00020	Quantifying and understanding root variation in winter cereals	30 Jun 2013	30 Jun 2016
SARDI, UNE	UNE00021	Field trials of attract-and-kill for diamondback moth	1 Apr 2014	31 Oct 2016
DAN, DAQ, DSITI, UNE	UNE00022	Evaluating testing methods for phosphorus and potassium soil reserves	1 Mar 2015	30 Mar 2019
UNFS, RSS, Northern Grower Alliance, AgriPartner Consulting, Barry Mudge Consulting, Fenceline Consulting, Hot Tin Roof Consulting, MsAg Consulting, Rufous and Co	UNF00002	Maintaining profitable farming systems with retained stubble—Upper north South Australia	13 Jan 2007	30 Jun 2018
DAN, DAQ, UQ	UQ00062	Improving integrated weed management practice in the Northern Region	1 Jul 2011	30 Jun 2016
DAN, DAQ, DSITI, UNE, UQ	UQ00063	Regional soil testing guidelines for the northern grains region	1 Jul 2012	30 Jun 2017
DAQ, UQ	UQ00067	Queensland Pulse Agronomy Initiative to increase the reliability and yield of summer and winter pulses	1 May 2013	30 Jun 2018
DAQ, UQ	UQ00068	Delivery of wheat root traits that contribute to water-limited yield stability	1 Jul 2013	30 Jun 2018
DAQ, UQ	UQ00070	Sorghum Core Pre-breeding Program	1 Jul 2013	30 Jun 2017
DAQ, UQ, US	UQ00073	National Barley Coordination Project	30 Jun 2014	30 Jun 2018
DAQ, UQ	UQ00074	High-yielding cereal agronomy in the northern grains region	1 Jul 2014	30 Jun 2017
Conservation Farmers, UQ	UQ00075	Tactical crop agronomy for maize and sorghum in the Northern Region	1 Jul 2014	30 Jun 2017
DAN, DAQ, UNE, UQ	UQ00078	Deep placement of nutrients	1 May 2015	30 Jun 2019
DAN, DAQ, DEDJTR, DAFWA, QUT, UQ, UWA	UQ00079	Organic matter and nutrient availability	4 Apr 2015	30 Dec 2015



GRDC PARTNERS	PROJECT ID	PROJECT	START	FINISH
DAN, UA, UQ	UQ00080	New uses for existing chemistry	1 Jun 2015	30 Jun 2020
CSIRO, DSITI, UQ	UQ00081	Costs of edaphic stress to the Australian grains industry	1 Jun 2015	30 Jun 2017
ANU, US	US00056	Research Project 1: Superior water use efficiency through improved mesophyll conductance	1 Apr 2012	31 Mar 2017
DAN, US	US00065	Understanding the molecular basis for desiccation tolerance of rhizobia for improved survival on seed	1 Jul 2013	30 Jun 2017
DAN, US	US00067	Australian Cereal Rust Control Program—Towards 2019 and a century of monitoring cereal rust pathogens in Australia	1 Jul 2012	30 Jun 2017
UQ, US, USQ	US00069	Enhancing human capacity for soil knowledge transfer and decision making for a sustainable grains industry	1 Nov 2013	31 Mar 2016
DAQ, UQ, US	US00070	Accelerating the utilisation and deployment of durable adult plant resistance to leaf rust in barley	1 Jul 2013	30 Jun 2019
US, UQ, UWA	US00071	Screening for drought tolerance under well-watered conditions: A rapid method to predict wilting point of grain crops	30 Jun 2013	30 Jun 2016
AGT, DAN, DEDJTR, DAFWA, UA, UQ, US	US00073	Exploitation of international grains in Australia: Coordinated importation, quarantine and evaluation, data management and communication	30 Jun 2014	29 Jun 2018
CSIRO, US	US00074	Development of genetic tools for Australian barley crops against leaf rust	1 Jul 2015	30 Jun 2020
CSIRO, DAQ, US, USQ	US00075	Integrated genetic solutions to crown rot in wheat	1 Jul 2015	30 Jun 2020
CSIRO, QUT, USQ, US	US00079	Future Farm—Improving Crop Yield theme—Review phase: Intelligent decisions—Improving farmer confidence in targeted nitrogen management through automated decisions	1 Feb 2016	30 Jun 2017
AGT, ANU, UNC, US	US00080	A national approach to improving heat tolerance in wheat through more efficient carbon allocation	30 Jun 2016	30 Jun 2021
AGT, Bayer, DEDJTR, InterGrain, Longreach Plant Breeders, US	US00081	Introgression of heat-tolerant genes to broaden genetic variation in current wheat-breeding populations	30 Jun 2016	30 Jun 2021
DAN, DAQ, SARDI, USQ	USQ00013	Managing crop diseases—Improving crown rot resistance in durum	1 Jun 2013	30 Jun 2018
DAFWA, NRS, USQ, UWA	USQ00016	The components of risk in farm profit	1 Jul 2014	30 Sep 2015
DHM Environmental Software Engineering Pty Ltd, USQ	USQ00020	Australian CliMate development	1 Oct 2015	30 Sep 2017
DAFWA, DAN, DAQ, DEDJTR, SARDI, USQ	USQ00021	National nematode epidemiology and management program	30 Jun 2013	30 Jun 2018
US, USQ	USQ00022	Protecting your crop—Intelligent infrastructure	1 Nov 2015	31 Dec 2016
CSIRO, DAT, DAFWA, UNE, UT	UT00030	Effective control of barley yellow dwarf virus in wheat	1 Jul 2013	30 Jun 2019
UA, UCS, UW, UWA	UW00004	Capacity building for statistics	1 Jul 2010	30 Jun 2016
CUR, DAQ, UA, UCS, UW, UWA	UW00005	Statistics for the Australian Grains Industry	1 Jul 2011	30 Jun 2016



GRDC PARTNERS	PROJECT ID	PROJECT	START	FINISH
CSIRO, UWA	UWA00145	Innovative approaches to resistance to necrotrophic pathogens and sap-sucking insect pests	1 Jul 2010	30 Jun 2016
CSIRO, UWA	UWA00154	Strategies to provide resistance to the economically important fungal pathogen <i>Rhizoctonia solani</i>	1 Jun 2012	30 Jun 2016
DAFWA, UWA	UWA00158	Detection and epidemiology of winter/spring aphids and redlegged earth mites	1 Nov 2012	30 Sep 2015
UWA, WANTFA	UWA00163	Long-term no-till farming systems	1 Jul 2013	30 Jun 2016
DAFWA, SARDI, UQ, UWA	UWA00165	Options for improved insecticide and fungicide use and canopy penetration in cereals and canola	1 Nov 2013	30 Dec 2016
CSBP, DAFWA, MIG, UWA	UWA00168	Smart use of fertilisers to minimise and manage the risk of pest infestations in growing canola	30 Jun 2014	30 Nov 2018
DAQ, DAFWA, UQ, UWA	UWA00169	Use of chemicals to increase frost tolerance in Australian crops	1 Jul 2014	30 Jun 2016
DAN, DAQ, Planfarm, UCS, UWA	UWA00171	Australian Herbicide Resistance Initiative—Phase 5	30 Jun 2015	30 Jun 2020
DAN, ICC	VIC00010	Correct crop sequencing for irrigated double cropping	1 Jul 2013	30 Jun 2016
CSIRO, DAFWA, Planfarm, UWA, WANTFA	WAN00021	Dry seeding in Western Australia	13 Jan 2013	30 Jun 2017
AEGIC, BA, ECU	WCA00003	Pilot Malting Australia—Commercial malting validation	1 Jan 2013	31 Dec 2015
Ag Consulting Co, Aglink Agricultural Consultants, Yerugan Crop Research	YCR00003	Maintaining profitable farming systems with retained stubble—Yorke Peninsula and the Mid North of South Australia	1 Jul 2013	30 Jun 2018

ACO = AgCommunicators Pty Ltd, ACPFG = Australian Centre for Plant Functional Genomics, AEC = Australian Egg Corporation, AEGIC = Australian Export Grains Innovation Centre, Agriculture = Department of Agriculture, AgKI = Agriculture Kangaroo Island, AGT = Australian Grain Technologies, AGWA = Australian Grape and Wine Authority, AMC = Allan Mayfield Consulting, AMPC = Australian Meat Processor Corporation, ANU = Australian National University, AOF = Australian Oilseeds Federation, APL = Australian Pork Ltd, ARC = Australian Research Council, AVRDC = AVRDC—The World Vegetable Center, AWI = Australian Wool Innovation Ltd, BA = Barley Australia, BCG = Birchip Cropping Group, BOM = Bureau of Meteorology, CAS = Australian Crop Accreditation System, CIMMYT = International Maize and Wheat Improvement Center, CRDC = Cotton Research and Development Corporation, CSBP = CSBP Wesfarmers, CSIRO = Commonwealth Scientific and Industrial Research Organisation, CUR = Curtin University of Technology, CWFS = Central West Farming Systems, DA = Dairy Australia, DAFWA = Department of Agriculture and Food, Western Australia, DAN = Department of Primary Industries NSW, DAQ = Department of Agriculture and Fisheries Queensland, DAT = Department of Primary Industries, Parks, Water and Environment Tasmania, DEDJTR = Department of Economic Development, Jobs, Transport and Resources, Victoria, DEST = Department of Education, Science and Training (now Department of Education, Employment and Workplace Relations), DNT = Department of Land Resource Management, Northern Territory, DSITI = Department of Science, Information Technology and Innovation, Queensland, ECU = Edith Cowan University, FAR = Foundation for Arable Research, FG = Facey Group, FLR = FarmLink Research, FRDC = Fisheries Research and Development Corporation, FWPA = Forest and Wood Products Australia Limited, GGL = GrainGrowers Limited, GPC = Global Pasture Consultants, GRDC = Grains Research and Development Corporation, HAL = Horticulture Australia Ltd, IAC = Invasive Animals CRC, ICAN = Independent Consultant Australia Network, ICARDA = International Center for Agricultural Research in the Dry Areas, ICC = Victorian Irrigated Cropping Council Inc, ICRISAT = International Crops Research Institute for the Semi-Arid Tropics, IP = Incitec Pivot, LEADA = Lower Eyre Agricultural Development Association, LIE = Liebe Group, MFM = MacKillop Farm Management Group, MGP = Marcroft Grains Pathology Pty Ltd, MIG = Mingenev Irwin Group, MLA = Meat and Livestock Australia, MSF = Mallee Sustainable Farming, NRS = Nicon Rural Services, NUF = Australian Nuffield Farming Scholars Association, PAA = Precision Agriculture Australia, PAL = Pulse Australia Limited, PBA = Pulse Breeding Australia, PBC = Plant Biosecurity Cooperative Research Centre, PCA = Peanut Company of Australia, PHA = Plant Health Australia, PIRSA = Primary Industries and Regions SA, PRC = Pork CRC Limited, QUT = Queensland University of Technology, RIRDC = Rural Industries Research and Development Corporation, RPI = Riverine Plains Inc, RSS = Rural Solutions South Australia, QUT = Queensland University of Technology, SANTFA = South Australian No-Tillage Farming Association, SARDI = South Australian Research and Development Institute, SFS = Southern Farming Systems, SRA = Sugar Research Australia (formerly Sugar Research and Development Corporation), UA = University of Adelaide, UB = Federation University Australia, UCS = Charles Sturt University, UD = Deakin University, UF = Flinders University, ULA = La Trobe University, UM = University of Melbourne, UMU = Murdoch University, UNC = University of Newcastle, UNE = University of New England, UNFS = Upper North Farming Systems, UNS = University of New South Wales, UQ = University of Queensland, US = University of Sydney, USA = University of South Australia, USC = Southern Cross University, USDA = United States Department of Agriculture, USQ = University of Southern Queensland, UT = University of Tasmania, UW = University of Wollongong, UWA = University of Western Australia, UWS = University of Western Sydney, VNTFA = Victorian No-Till Farmers Association, WANTFA = WA No-tillage Farmers Association, WQA = Wheat Quality Australia Limited







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Abbreviations list

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
APSIM	Agricultural Production Systems sIMulator
CIMMYT	International Maize and Wheat Improvement Center
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ESD	ecologically sustainable development
GPA	Grain Producers Australia Limited
GrainGrowers	Grain Growers Limited
GRDC	Grains Research and Development Corporation
ICARDA	International Center for Agricultural Research in the Dry Areas
Minister, the	Minister for Agriculture and Water Resources
PBR	plant breeder's rights
PGPA Act	<i>Public Governance, Performance and Accountability Act 2013</i>
PIRD Act	<i>Primary Industries Research and Development Act 1989</i>
R&D	research and development
RD&E	research, development and extension
RLN	root-lesion nematodes
TFP	total factor productivity
WHS	work health and safety
WLYP	water-limited yield potential



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REQUIREMENT	SOURCE	PART OF THE REPORT
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R&D activities	Paragraph 28(a)(i)	18–54
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Impact of R&D activities on the grains industry	Paragraph 28(a)(ii)	14–69
Revisions of the R&D plan	Paragraph 28(a)(iii)	None to report
Agreements under sections 13 and 14	Paragraph 28(a)(iv)	None to report
Patents and commercialisation	Paragraph 28(a)(v)	61–62
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Parliamentary standards of presentation	Section 17BC	Throughout
Plain English and clear design	Section 17BD	Throughout
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Governance	Paragraph 17BE(m)	80–81
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Collaborations not covered by ss. 13 and 14 of the PIRD Act	Paragraph 11.10(d)	None to report
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GRDC contact details

OFFICE	ADDRESS	PHONE
Adelaide	Industry House, National Wine Centre of Australia Corner of Hackney and Botanic Roads Adelaide SA 5000	02 6166 4740
Canberra	4 National Circuit Barton ACT 2600	02 6166 4500
Dubbo	PO Box 4262, Dubbo East LPO Dubbo East NSW 2830	02 6166 4531
Perth	Suite 4, 12 Brodie Hall Drive Bentley WA 6102	08 9230 4600
Toowoomba	c/o PO Box 5367 Kingston ACT 2604	04 7283 2502

