



Australian Government

Grains Research and
Development Corporation

GRDC Annual Report 2012-2013



GRDC Grains Research &
Development Corporation
Your GRDC working with you



The **Grains Research and Development Corporation** is a statutory authority 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.

Highlights of 2012–13

- The 2013 Grower Survey confirmed that the GRDC's investment strategy is meeting the needs of Australian grain growers. In addition to 90 percent of respondents regarding R&D as critical for the success of their farm business:
 - 76 percent believed they had directly benefited from grains R&D activities over the past five years (Page 11)
 - 77 percent were confident that grains R&D projects were addressing threats to long-term sustainability (Page 18)
 - 77 percent were either comfortable or extremely comfortable paying the levy. (Page 11)
- Analysis of the financial impacts of five groups of GRDC projects showed positive benefit-to-cost ratios in all cases, averaging 3:1 overall and reaching 6:1 for the Managing Climate Variability Program (MCVP) II. (Page 18)
- New crop varieties with improved yield and attributes suited to regional conditions were released: ten wheat, three chickpea, three lentil, one barley, one faba bean, one field pea and one mungbean. (Page 79)
- Australian pre-breeders accessed germplasm from Italy to develop wheat lines with improved dough strength suited to high-value markets such as the South-East Asian baking sector. (Page 30)
- National Variety Trials (NVT) delivered independent and regionally relevant data on new varieties —a recent survey of growers showed that 86 percent of growers were aware of the NVT program and that 93 percent of growers who accessed the information provided by the NVT program considered that it helped to decide which varieties to sow. (Page 12 and 40)
- Two free online tools were launched to support effective farm management decisions:
 - The BFDC Interrogator assists growers and advisers to interpret soil test results to optimise fertiliser application, drawing on soil test – crop response data from more than 5,000 fertiliser trials. (Page 52)
 - Soil Water Express converts data collected from electronic sensors into meaningful soil water information, and uses details of the soil's texture, salinity and bulk density to predict its plant-available water content. (Page 59)
- Two free smartphone apps were released to deliver information where and when it is needed:
 - SoilMapp uses GPS technology to give growers and advisers instant access to information on soils in specific locations, drawing on details of more than 900 soils in the ApSoil database. (Page 60)

Figure 1: Total grain production and cropping area, 2002–03 to 2012–13

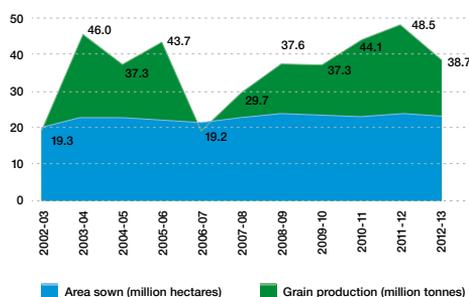
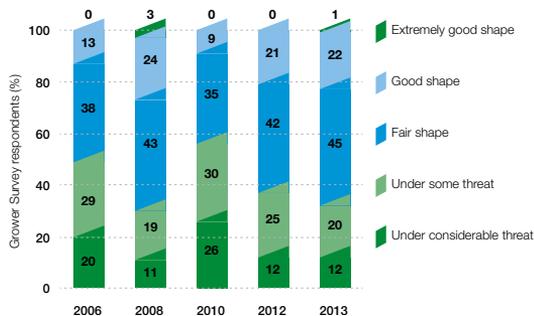


Figure 2: Grower mood towards the state of the Australian grains industry



Source: Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) Australian Crop Reports and Agricultural Commodities (formerly Australian Commodities) reports

Source: GRDC Grower Survey

- CiiMate uses extensive climate and weather data to answer key questions about sowing conditions, heat and cold stress at flowering time, soil water and nitrate levels, comparisons with previous seasons and weather patterns, rainfall, and El Niño indicators. (Page 61)
- The International Chickpea Genetics and Genomics Consortium published extensive new materials on chickpea genotypes, including several with particular importance to Australia. (Page 38)
- WeedSmart, a national program to equip growers and advisers with the tools they need to fight herbicide resistance, was launched in February 2013. (Pages 12 and 42)
- The GRDC continued to support a wide range of capacity-building projects for growers, advisers and the wider industry, including scholarships, awards, conferences and training programs (Page 72)

Operating environment in 2013–14

The main factors expected to influence the GRDC's operating environment in 2013–14 are:

- reduced farm profitability, limiting the financial capacity of growers to adopt the results of RD&E
- a long-term decline in the rate of total factor productivity growth in the Australian grains industry, caused by a range of factors, including rising input prices
- volatility in grain prices, affecting growers' profitability and the GRDC's ability to forecast revenue
- significant changes within the global grain market, including an increase in overseas demand for Australian grain and global food security issues
- climate variability, affecting on-farm decisions and requiring an increase in innovative tools to forecast and manage risks
- the effect of currency exchange rate volatility on gross margins, making it difficult for growers to make planting decisions with confidence
- a continuing decrease in the number of grain farms, along with an increase in the average farm size
- the Wheat Industry Advisory Taskforce's review of wheat export marketing arrangements and the delivery of related 'industry good' functions
- the need to adapt to the requirements of private sector collaboration, to ensure that the Australian grains industry remains competitive on the world stage.

Figure 3: GRDC income in 2012–13

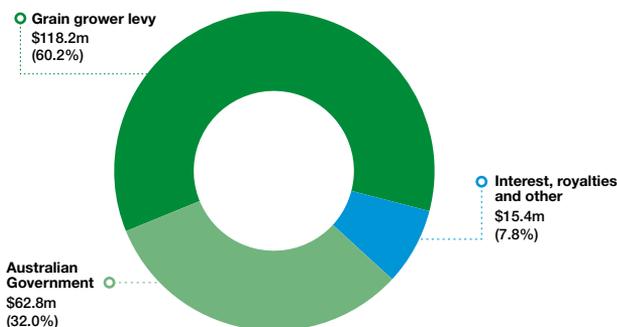


Figure 4: Grain grower levy by crop type in 2012–13

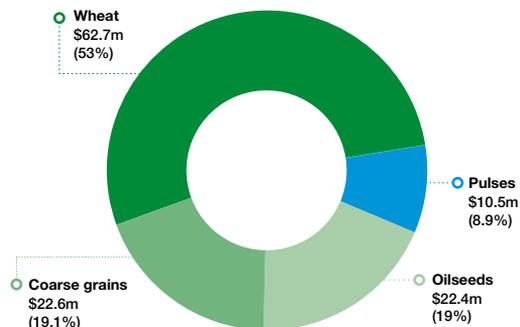
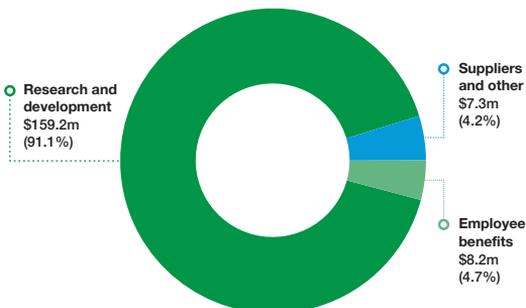


Table 1: Five years at a glance

	2012–13		2011–12	2010–11	2009–10	2008–09
GRDC						
Revenue	\$196.4m	▲	\$177.5m	\$175.5m	\$143.8m	\$150.4m
Expenditure	\$178.0m	▲	\$165.1m	\$154.1m	\$133.4m	\$121.3m
Operating surplus/(deficit)	\$18.4m	▲	\$12.3m	\$20.8m	\$9.8m	\$28.5m
Total assets	\$265.3m	▲	\$230.7m	\$206.0m	\$176.7m	\$159.1m
Total equity	\$180.6m	▲	\$162.2m	\$149.3m	\$128.5m	\$118.7m
Industry contributions	\$118.2m	▲	\$97.7m	\$104.5m	\$74.1m	\$89.1m
Commonwealth contributions	\$62.8m	▲	\$55.9m	\$53.4m	\$50.1m	\$43.9m
R&D expenditure	\$159.2m	▲	\$150.2m	\$140.7m	\$116.8m	\$106.3m
Employee benefits	\$8.2m	▲	\$7.2m	\$6.9m	\$6.4m	\$6.1m
Suppliers	\$7.3m	▲	\$6.7m	\$5.7m	\$5.6m	\$5.2m
Number of full-time GRDC staff ^a	48	▲	46	48	50	49
Number of projects	1,153	▼	1,305	900	868	771
Grains industry						
Estimated number of grain farms ^b	21,265 ^c	–	21,265	19,556	20,989	22,370
Number of grain crops covered by R&D levies	25	–	25	25	25	25
Estimated gross value of production ^d	\$13,606m	▲	\$12,249m	\$11,960m	\$8,573m	\$10,744m
Total grain production—summer and winter crops ('000 tonnes) ^e	38,666	▼	48,513	44,065	37,330	37,609

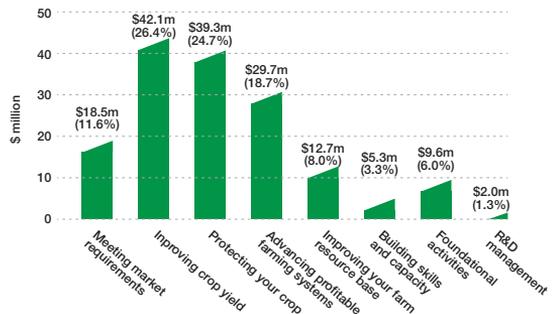
- a Number of full-time GRDC staff as at 30 June each year.
- b Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) estimates for the number of broadacre farms planting at least 100 hectares for grain, oilseed or pulse production. Figures for 2008–09 to 2010–11 restate the estimated numbers of grain farms shown in previous GRDC annual reports following ABARES advice that previous estimates had included non-grain crops.
- c No updated estimate for 2012–13 was available at the time of publication.
- d Latest ABARES estimates for the gross value of production of grains and oilseeds, excluding rice—from the June 2013 *Agricultural Commodities* report.
- e Latest ABARES estimates for total summer and winter crop production, excluding cotton seed and rice—from the June 2013 *Australian Crop Report* and the June 2013 *Agricultural Commodities* report.

Figure 5: GRDC expenditure in 2012–13



Source: GRDC Financial Statements 2012–13

Figure 6: GRDC R&D investment by investment area in 2012–13



Source: GRDC Financial Statements 2012–13

Letter of transmittal

GRDC

**Grains
Research &
Development
Corporation**



Australian Government
**Grains Research and
Development Corporation**

15 October 2013

The Hon Barnaby Joyce MP
Minister for Agriculture
Parliament House
CANBERRA ACT 2600

Dear Minister

I have pleasure in presenting the annual report of the Grains Research and Development Corporation (GRDC) for the year ended 30 June 2013, in accordance with section 9 of the *Commonwealth Authorities and Companies Act 1997* (CAC Act) and section 28 of the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act).

The GRDC is confident that its performance in 2012–13 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 PIERD 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 deliverables described in the portfolio budget statements.

This annual report complies with the planning and reporting requirements prescribed by the CAC Act. GRDC directors are responsible, under section 9 of the CAC Act, for the preparation and content of the report of operations in accordance with the *Commonwealth Authorities (Annual Reporting) Orders 2011* and the *Finance Minister's Orders for Financial Reporting* (the Finance Minister's Orders).

The attached report of operations was made in accordance with a resolution of the corporation's directors on 26 September 2013 and presents fairly the information required by the Finance Minister's Orders.

Yours sincerely

Richard Clark
Chair

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Part 1 — Overview

About the GRDC

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Report from the Chair and the Managing Director

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About the GRDC

Purpose

The Grains Research and Development Corporation (GRDC) is a statutory corporation, operating as a research investment body on behalf of Australian grain growers and the Australian Government.

The GRDC was established in 1990, under the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act), to assist the Australian grains industry 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 grain
- 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
- improve accountability for expenditure on R&D activities.

The Australian grains industry operates across the Australian landscape and makes a major economic contribution at the national, state and regional levels. Geographically, the grains industry is defined by three broad agroecological regions, as described in Figure 7.

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

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 change.

In 2012–13, as part of the Australian Government's Agriculture, Fisheries and Forestry portfolio, the GRDC delivered one outcome towards the portfolio's goal of achieving more sustainable, competitive and profitable Australian agriculture, food, fisheries and forestry industries:

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.

Funding

The GRDC is principally funded by a grower levy and Australian Government contributions.

The levy is 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, faba beans, vetch, peanuts, mungbeans, navy beans, pigeon peas, cowpeas and lentils; and oilseeds—canola, sunflower, soybean, 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 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.

Figure 7: GRDC regions



Shaun Nolan focuses on improving efficiency to increase the net income of his mixed farming enterprise near Roma, Qld. Photo: Clarisa Collis

NORTHERN REGION

The **Northern Region** encompasses Queensland and northern New South Wales.

The region has generally high inherent soil fertility, although there is increasing evidence that this has been run down over time. It has relatively high seasonal rainfall and production variability compared with the other two regions.

Both summer and winter crops are important for profit. Yield depends, to a significant degree, on conservation of soil moisture from summer-dominant rainfall. The Northern Region has the highest diversity of crop production, including maize, sorghum and tropical pulses as well as wheat, barley, winter-growing pulses and oilseeds.

The Northern Region is the largest source of Australia's premium hard high-protein wheat for export and domestic use. Demand for feed grains from the region's important livestock industries is a key driver of grain production.

SOUTHERN REGION

The **Southern Region** encompasses south-eastern Australia, including central and southern New South Wales; Victoria; Tasmania; and south-eastern South Australia.

It has a diverse suite of soils of generally low fertility and with many subsoil constraints, such as salinity, sodicity and toxic levels of some elements, although there are also some areas with very productive soils. Yield potential depends on seasonal rainfall, especially in autumn and spring, and there is less dependence on stored soil moisture than in the Northern Region.

Crop production systems are varied and include many mixed farming enterprises with significant livestock and cropping activities.



Peter Kuhlmann strategically combines varieties and practices to optimise water use efficiency on his property near Mudamuckla, SA. Photo: Jarrad Delaney

WESTERN REGION



Mark Wandel optimises grain yield and quality through early harvesting and effective storage at his property near Esperance, WA. Photo: Evan Collis

The **Western Region** encompasses the cropping areas of Western Australia.

Soil fertility in the region is generally low to very low and yields depend on winter and spring rainfall. Long-term variability in seasonal rainfall and production is lower in the coastal areas than in the Northern and Southern regions.

In many areas, yields are low by world standards; this is compensated for by the large scale and degree of mechanisation of the enterprises.

Wheat, barley, canola and lupins are the dominant crops, and livestock enterprises in mixed farming systems are generally of less importance than in the other regions. The Western Region exports more than 85% of its grain production.

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.

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

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: Elements of the planning and reporting approach

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 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.
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, summarises the planned deliverables, outcomes, performance information and financial statements for a given financial year.
Stakeholder report ^a	Contains information that the GRDC's representative organisation, Grain Producers Australia, needs to carry out its function and advise the Minister on the GRDC's levy rate.
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

In line with section 19 of the PIERD Act, the GRDC Board communicates its strategic directions and performance objectives through a five-year strategic R&D plan.

The GRDC's Strategic R&D Plan for the five financial years to 2016–17 took effect from July 2012. It is designed to achieve a balanced portfolio of short-, medium- and long-term objectives, and describes the strategies that will be applied to achieve those objectives and the performance indicators that will be used to measure success.

The Strategic R&D Plan 2012–17 provides a framework for investment based on six themes that emerged from the RD&E priorities of Australian grain growers and the Australian Government.

From the point of view of grain growers and the wider industry, the plan takes into account the RD&E priorities set out in the *Grains Industry National Research, Development and Extension Strategy*, as well the key RD&E priorities that were identified in the consultation process for the plan's development, as detailed in Table 3.

Table 3: Grains industry priorities

RD&E priority	Objective
Meeting market requirements	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.
Improving crop yield	Genetic yield potential and stability improvement of: <ul style="list-style-type: none"> • cereal varieties • pulse varieties • oilseed varieties.
Protecting your crop	Effective, sustainable and efficient management of: <ul style="list-style-type: none"> • weeds • vertebrate and invertebrate pests • cereal rusts • cereal (non-rust), pulse and oilseed fungal pathogens • nematodes • viruses and bacteria. Biosecurity and pesticide stewardship.
Advancing profitable farming systems	Knowing what is important (key business drivers). Planning strategically (building system benefits and rotations). Responding tactically (individual crop agronomy).
Improving your farm resource base	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.
Building skills and capacity	Grains industry leadership and communication. Capacity building in the extension sector and the R&D sector. Capacity building for growers.

The plan also reflects the key Australian Government R&D priorities identified in:

- the National Research Priorities outlined by the Prime Minister in December 2002, and their associated priority goals
- the Rural R&D Priorities announced to the rural R&D corporations (RDCs) by the Minister for Agriculture, Fisheries and Forestry in May 2007.

More details of the government priorities are provided in Appendix A, which reports on expenditure in each priority area.

Figure 8, an outline of the GRDC's performance framework under the Strategic R&D Plan, demonstrates how the GRDC's investment themes, objectives and corporate strategies flow from the grains industry and government priorities.



Figure 8: Overview of the GRDC performance framework, 2012–17

Government and industry objectives	Australian Government priorities			Industry priorities			
	Primary Industries and Energy Research and Development Act 1989	National Research Priorities	Rural R&D Priorities	Grains Industry National RD&E Strategy	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>Improved accountability for expenditure on R&D activities.</p>	<p>An environmentally sustainable Australia.</p> <p>Promote and maintain good health.</p> <p>Frontier technologies for building and transforming Australian industries.</p> <p>Safeguarding Australia.</p>	<p>Productivity and adding value.</p> <p>Supply chain and markets.</p> <p>Natural resource management.</p> <p>Climate variability and climate change.</p> <p>Biosecurity.</p> <p>Innovation skills.</p> <p>Technology.</p>	<p>Improved processes to build on existing national collaboration.</p> <p>Effective relationship models for private–public coexistence.</p> <p>National research programs, national centres of research capacity and regional networks of applied RD&E under the ‘major-support-link’ framework.</p> <p>National capability planning for human and physical infrastructure.</p> <p>Better and ongoing alignment of stakeholder priorities and RD&E resource allocation.</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	
Intermediate outcomes (5 years)	<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 canola 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. 	
Aspirational outcomes (10+ years)	Australian grain growers maintain and increase access to current and future grain markets by aligning on-farm production practices with quality and functionality requirements.	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.	Australian grain growers managing their farms to maximise profit and reduce risk by adopting effective control of weeds, pests and diseases.	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.	Grain growers valued for adopting practices that improve regional habitat, soil, water and atmosphere resources in a changing climate.	A dynamic Australian grains industry with the skills and capacity to continuously innovate.	
GRDC corporate strategies	Create value	Coordinate nationally	Deliver regionally	Connect globally	Engage with growers and industry		
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.						
GRDC Vision	A profitable and sustainable Australian grains industry, valued by the wider community.						

Annual operational plan

Each year's activities are outlined in an annual operational plan, as required by section 25 of the PIERD 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 indicators set out in the portfolio budget statements.

The annual operational plan is shaped by the investment themes and objectives of the Strategic R&D Plan and informed by feedback on the results of previous GRDC investments and the changing RD&E needs of the Australian grains industry, obtained through:

- engagement with growers, advisers and other industry participants
- consultation through the GRDC regional panels and representative bodies such as Grain Producers Australia, farmers' organisations, Regional Cropping Solutions and similar networks, grower groups, and agribusiness reference groups
- analysis of program reviews, project progress reports and survey results.

The GRDC applies this knowledge through its annual process of investment planning and review to ensure that the RD&E activities it supports will deliver outcomes that meet the needs of the industry and the Australian Government. Table 4 provides examples from the Annual Operational Plan 2012–13.

Table 4: Examples of GRDC investments in activities to meet industry and government RD&E priorities in 2012–13

Industry priorities/ GRDC themes	National Research Priorities	Rural R&D Priorities	Areas of GRDC R&D investment
<i>Advancing profitable farming systems</i>		<i>Productivity and adding value</i>	<p>Research to:</p> <ul style="list-style-type: none"> • improve monitoring of crop performance and consequent agronomic decisions • improve control of weeds, pests and diseases through integrated methods that may include, but do not rely solely on, chemical control • assist growers to better understand, measure and make full use of soil water. <p>Development of safflower varieties with oil compositions suitable for industrial uses that can be integrated into current agricultural systems.</p> <p>Work to bring ultra-low gluten barley and high-amylose wheat to market.</p>
	<i>Promoting and maintaining good health</i>		<p>A collaborative program on post-harvest grain storage that will develop an industry-wide systems approach, integrating a range of tools and treatments, for managing stored-grain insect pests at all critical points in the Australian grains supply chain.</p> <p>A range of projects related to barley quality, including work to:</p> <ul style="list-style-type: none"> • analyse the relationship between alpha-amylase alleles in barley and the processing performance of commercial malts • identify novel sources of resistance to kernel discolouration and pre-harvest sprouting • support the brewing component of the malting barley accreditation process in a joint industry-funded project led by Barley Australia.
<i>Meeting market requirements</i>		<i>Supply chain and markets</i>	

Table 4: Examples of GRDC investments in activities to meet industry and government RD&E priorities in 2012–13 (continued)

Industry priorities/ GRDC themes	National Research Priorities	Rural R&D Priorities	Areas of GRDC R&D investment
<i>Improving your farm resource base</i>	<i>An environmentally sustainable Australia</i>	<i>Natural resource management</i>	<p>Projects to improve water use efficiency from both genetics and agronomic practices.</p> <p>R&D on the management of soil organic matter to improve the health and productive capacity of cropping soils.</p> <p>Work to increase the amount and utilisation of nitrogen from legume–rhizobial symbiosis in farming systems.</p>
		<i>Climate variability and climate change</i>	<p>Research to develop an accurate picture of the greenhouse gas emissions profile of grain production and identify opportunities to modify the profile through changes to management practice.</p> <p>Development of improved seasonal forecasts, weather data and decision tools to enable growers to better plan and manage their cropping enterprises in response to climate variability.</p>
<i>Protecting your crop</i>	<i>Safeguarding Australia</i>	<i>Biosecurity</i>	<p>Work on pre-emptive breeding of crops to incorporate resistance to Russian wheat aphid, Sunn pest and Hessian fly.</p> <p>R&D to identify and rank incursion threats and develop appropriate surveillance activities in response.</p>
<i>Building skills and capacity</i>	<i>Frontier technologies for building and transforming Australian industries</i>	<i>Innovation skills</i>	<p>Training:</p> <ul style="list-style-type: none"> • for grain growers, to assist them in meeting market requirements (e.g. to maintain grain quality during on-farm storage) and adopting improved agronomic practices (e.g. precision agriculture technologies) • for extension personnel and advisers, to meet identified skill requirements • for researchers, particularly to address known skills gaps in some disciplines.
<i>Improving crop yield</i>		<i>Technology</i>	<p>Work in canola pre-breeding which aims to equally and fairly provide advanced germplasm containing important new or improved traits to all Australian private canola breeding companies.</p> <p>An integrated national durum wheat breeding program that delivers superior well-adapted varieties into target areas, contributing to continued growth in national durum production.</p> <p>Work on genome sequencing and bioinformatics.</p>

Annual report

At the end of the financial year, the GRDC publishes an annual report that addresses legislated performance reporting requirements, including those of:

- section 28 of the PIERD Act
- section 9 and Schedule 1 of the *Commonwealth Authorities and Companies Act 1997* (CAC Act), the *Finance Minister's*

Orders for Financial Reporting and the Commonwealth Authorities (Annual Reporting) Orders 2011

- Schedule 2, Part 4, of the *Work Health and Safety Act 2011*
- section 516A of the *Environment Protection and Biodiversity Conservation Act 1999*
- Part II of the *Freedom of Information Act 1982*.

The annual report also meets the GRDC's responsibilities for reporting against the Australian Government portfolio budget statements. In addition to the audited financial statements, it includes assessments of performance against operational and corporate performance indicators.

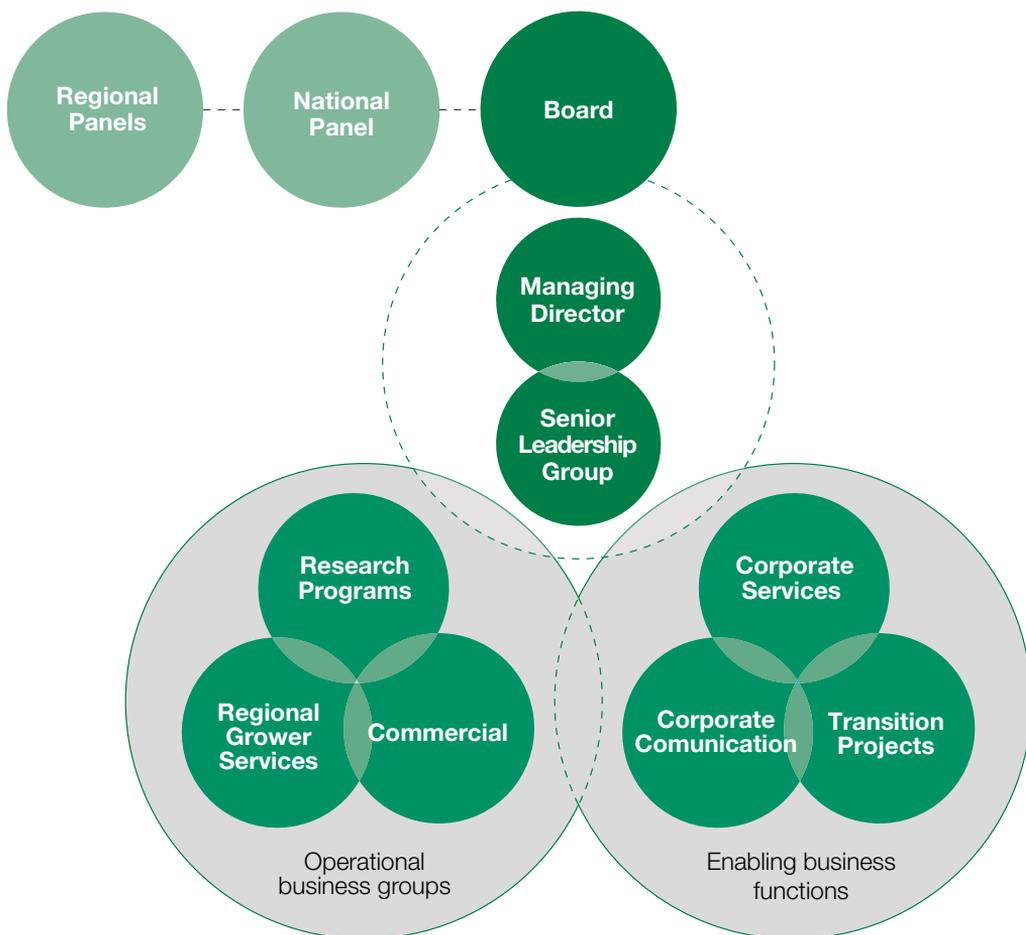
This Annual Report 2012–13 details the GRDC's achievements against the performance framework set out in the Annual Operational Plan 2012–13 and the Strategic R&D Plan 2012–17 (as shown in Figure 8).

Structure

The GRDC's organisational structure is designed to most effectively apply the organisation's resources to achieve its operational and strategic outcomes.

Figure 9 shows the GRDC's organisational structure as at 30 June 2013. More details on the composition, responsibilities and activities of the Board, advisory panels, Senior Leadership Group and business groups are provided in Part 3.

Figure 9: GRDC structure as at 30 June 2013



Relationships

The GRDC works closely with Australian grain growers and the Australian Government to ensure that their RD&E priorities are effectively addressed through GRDC investments. Grower interests are represented through:

- the GRDC's national and regional advisory panels
- the reporting relationships between the GRDC and Grain Producers Australia
- the proactive participation of grower groups in all aspects of RD&E
- grower directors on the GRDC's skills-based Board
- a range of GRDC-supported delivery and communication channels, such as Regional Cropping Solutions networks, grower and adviser updates, and technical workshops on specific issues.

The GRDC holds regular discussions with its portfolio department, which in 2012–13 was the Department of Agriculture, Fisheries and Forestry.

Understanding the importance of RD&E expertise and communication capability in achieving its outcomes, the GRDC also maintains strong connections with its other stakeholders, particularly research partners, including state departments, CSIRO, universities, cooperative research centres, RDCs, and investment partners from the private sector. Links with agribusiness, including farm advisers and agronomists, are growing, both in the performance of RD&E and the delivery of products and services.

Effective partnerships enable the GRDC to leverage resources and research capability; share market knowledge, technologies and intellectual property; and reduce the risk associated with individual, sole-funder investments. The GRDC collaborates with other RDCs, and with other organisations that have an interest in the grains value chain and enterprises at the farm level that are interdependent with grain growing, to increase the return on its investment and deliver greater benefits to the Australian grain grower.

The GRDC also builds strong relationships with organisations overseas, both to broaden the resources available to the Australian grains industry and to access international RD&E efforts that offer potential benefits, such as food security, for the wider Australian community.

Location

Most GRDC staff are located in offices at the following Canberra address:

Grains Research and Development Corporation
Level 1, Tourism House
40 Blackall Street
BARTON ACT 2600

The GRDC owns one floor of Tourism House. The GRDC does not own any research facilities.

The Manager Grower Services North is located in Boggabri, New South Wales; the Manager Grower Services South is located in Parkes, New South Wales; and the Manager Grower Services West is located in Perth, Western Australia.



Regional Grower Services Managers. Left to right: Darren Hughes (West), Sharon O'Keeffe (North), Andrew Rice (South). Photo: Geoff Comfort

Report from the Chair and the Managing Director

While it was a long way from a record poor season, every grain-growing state of Australia recorded a decline in production during the 2012–13 financial year, with some pockets of the country experiencing particularly poor yields, mainly due to a lack of rain during the growing season.

The outcomes of R&D facilitated by the GRDC are a key factor helping Australia's 21,000 grain growers to achieve the best levels of production possible, in poor seasons as well as favourable years, and to increase their profit margins through a range of factors, including the reduction of input costs and the development of niche markets.

In the last two annual reports we highlighted changes to the GRDC's structure, the launch of a new five-year plan for the organisation, and the development of the *Grains Industry National Research, Development and Extension Strategy* (Grains Industry National RD&E Strategy) as critical steps towards a new delivery model for R&D in the grains industry. This year saw the consolidation of that model, which is focused on ensuring that growers get maximum returns on their investment in R&D, leading, in turn, to food production and economic benefits for the wider Australian community. It will be some years before the industry realises the full impact of those changes, but already the benefits are apparent—as this annual report demonstrates through descriptions of a range of research outcomes.

Through leadership, direction and sound investment decisions—all directly influenced by the input of growers—the GRDC is making sure that the grains sector achieves the targets set for its growth and prosperity. The best measure of its success is the results of the 2013 Grower Survey, which show improvements across several key indicators for performance. Since 2012, there has been a significant rise in the proportion of respondents rating the overall performance of GRDC fairly to very high; 79 percent of respondents are now in that category. In addition, 76 percent of growers believe that they have directly benefited from grains R&D activities over the past five years and the majority of growers (77 percent) remain

comfortable or extremely comfortable with paying the R&D levy.

The following sections provide some highlights of GRDC-funded research for 2012–13, as well as a snapshot of grains industry production.

Grains industry production

In 2012–13, dry seasonal conditions adversely affected summer and winter crop yields across the country, causing production declines in every state. Total grains production in Australia fell by 20 percent to 38.7 million tonnes in 2012–13, down almost 10 million tonnes from the record production level of 48.5 million tonnes the previous year. The estimated gross value of production is \$13.6 billion.

Winter crop production fell by 21 percent to 36.3 million tonnes, with the largest decline occurring in Western Australia where production fell 34 percent to 10.9 million tonnes, to match production in New South Wales. The following production figures were recorded for the major winter crops:

- wheat production declined by 26 percent to around 22.1 million tonnes
- barley production fell by 18 percent to 6.8 million tonnes
- canola production bucked the trend and rose by 14 percent to around 3.9 million tonnes.

Overall, summer crop production declined by 16 percent to 2.4 million tonnes. Significantly, sorghum production fell by 23 percent to around 1.7 million tonnes due to a 14 percent fall in the area planted and a 10 percent fall in average yield.

GRDC projects

Over the past year, a total of 1,153 R&D projects were funded by the GRDC, ranging from short-term solution based projects to long-term programs that will, in years to come, deliver step-change breakthroughs to big picture issues such as frost and herbicide resistance. GRDC-supported projects have led to several research advances and the

development of new technology and tools that will assist growers to implement on-farm strategies that increase overall productivity and profit.

In order to give Australian bread wheats a competitive advantage in high-value Asian markets, donor germplasm from Italy was crossed with leading Australian varieties to increase dough strength. Traditionally, Australian growers have relied on expensive practices such as applying high rates of nitrogen to increase protein levels and achieve dough strength qualities. GRDC-funded research is working to integrate the building blocks of protein quality into elite Australian wheat varieties, therefore eliminating the need for further crop input costs. The improved germplasm and related molecular markers will be ready for release to breeders in 2013–14.

More than 630 National Variety Trials (NVT) sites across Australia delivered independent crop variety analysis for 10 grain crops, including wheat, barley, oats, triticale, canola, field pea, lentils, chickpeas, faba beans and lupins. The NVT program has become a vital part of delivering improved varieties to farmers and increasing profit and sustainability in the grains industry. A recent survey of growers showed that 86 percent of growers were aware of the NVT program and that 93 percent of growers who accessed the information provided by the NVT program considered that it helped to decide which varieties to sow.

A total of 20 new varieties were released as a result of GRDC-funded programs or programs developed by the GRDC in partnership with private companies. These varieties promise a range of improved crop attributes as well as yield gains, and will be planted across Australia over coming seasons. One of these varieties, JadeAU⁽¹⁾, is expected to replace its predecessor Crystal⁽¹⁾ as the variety of choice for northern mungbean growers, promising a 12 percent yield increase and improved tan spot and powdery mildew resistance. This increase will potentially earn growers an extra \$63 per hectare and may shift grower perceptions towards considering mungbeans as a summer mainstay crop rather than a mere sequencing option.

As the result of one of GRDC's most significant R&D investments, made in partnership with the Victorian Government, construction of the Australian Grains Genebank has commenced. This centre will provide superior access to

genetic resources for the development of improved crop varieties that are resilient to impediments like frost and rust disease and capable of producing higher yields. The centre will also ensure that Australia's genetic resources are properly preserved into the future, helping to provide a level of security around food production for the centuries to come.

Every grower we talk to tells us that reducing input costs is vital to their long-term business viability. During 2012–13 a national database was launched, as the result of a GRDC-funded project, to help growers optimise their use of fertilisers. As well as reducing the number one input cost for most farm enterprises, good management of fertilisers will build the sustainability of one of our most important natural resources, soil.

GRDC partnerships

The GRDC's Regional Cropping Solutions networks, which were launched during 2011–12, are now working well. Mirroring the Northern Grower Alliance, the regionally based grower groups—four in the Southern Region and five in the Western Region—provide on-the-ground linkages between growers, farming systems groups, agribusiness and researchers. Importantly, they give growers an opportunity to help set priorities for future research, which means that the GRDC's investment decisions are better informed and in line with what growers need. This is the latest development in the GRDC's ongoing campaign to get closer to growers and ensure that the investment growers make in R&D, through the grower levy, is delivering the best possible outcomes. The networks are supported by the GRDC's advisory panel system and GRDC managers in each region.

An example of a new industry initiative supported by GRDC is the WeedSmart campaign, launched in February 2013. This national program is designed to equip growers and advisers with the tools they need to fight the growing problem of herbicide resistance, which is estimated to cost the industry more than \$200 million each year. The campaign website serves as a first point of call on weed management issues, and good weed management practices are promoted through a range of education and communication activities centred on a simple 10-point management plan.

The Australian Export Grains Innovation Centre officially opened during 2012–13 as the result of a \$40 million co-investment between the GRDC and the Western Australian Government. Through its five-year plan, the centre has set a range of targets to enhance the international competitiveness of Australian export grains through science, technology and innovation. It will address significant industry needs, including grain quality for export markets; economic and supply chain analysis; market intelligence; and processing and product functionality. The challenges posed by the need to meet quality requirements for overseas markets, as well as the opportunities that new markets bring, were catalysts for the GRDC's investment in the centre, which will use international linkages to achieve its aims.

There is no doubt that strengthening collaboration with international companies, entities and researchers is essential to ensure that Australian growers receive early access to the latest technology. Australia is not a big player on the global R&D stage and must therefore look for continual opportunities to co-invest and forge strategic partnerships.

From the time of its inception, the GRDC has enjoyed formal strategic alliances with centres such as the International Maize and Wheat Improvement Center (CIMMYT) and the International Center for Agricultural Research in the Dry Areas (ICARDA), working with them on a suite of research projects that benefit Australian grain growers as well as farmers in the developing world. The CIMMYT–Australia–ICARDA Germplasm Evaluation (CAIGE) program ensures that Australian plant breeders have long-term, targeted access to international germplasm.

During 2012–13, the GRDC forged a new international partnership, negotiating Australian involvement in a consortium with Canada, Ethiopia, India and Turkey that seeks to mine the genetic diversity of wild chickpea to drive international chickpea crop improvement. The first phase of the program, which involves collecting and characterising wild chickpea species, has commenced, with the GRDC co-funding the collection of *Cicer reticulatum* in Turkey during 2013.



The Hon Peter Walsh MP, Victorian Minister for Agriculture and Food Security, and Keith Perrett, GRDC Chair, turn the first sod at the Australian Grains Genebank site at Horsham, Vic. Photo: Paul Carracher, *The Wimmera Mail–Times*

The year ahead

There is plenty to be optimistic about in the Australian grains sector, which for many decades has shown resilience in the face of production challenges and difficult seasons. The 2013 Grower Survey indicates an increase in industry confidence: the proportion of respondents believing that 'the industry is in good to extremely good shape' has risen slightly, from 21 percent in 2012 to 23 percent in 2013, and a significantly higher proportion of respondents (45 percent from 20 percent) now believe that the industry is in fair shape rather than under some threat.

However, there is no doubt that significant challenges lie ahead, threatening our capacity to increase production and on-farm profits. The impact of issues such as herbicide resistance, frost and disease will continue to increase unless we find solutions through R&D. Establishing new markets will rely on clever intelligence and the development of the right quality attributes. We also face concerns in relation to maintaining capacity within the industry, in terms of R&D capacity as well as extension and on-farm expertise.

Driven by its five-year Strategic R&D Plan and the Grains Industry National RD&E Strategy, the GRDC will continue to tackle these issues and many more. We will forge new partnerships with private enterprise and international entities to ensure that Australia is in a position to maintain a competitive edge.

Next year, we look forward to reporting on a new initiative that we believe will have a major impact on building the nation's R&D capacity. Through the development of long-term bilateral relationships with research organisations, we will provide the level of certainty required to build and shape vital expertise. An industry-led review of the GRDC's governance framework will be another focus in the coming months. Over the past two decades the GRDC has grown, adapted and delivered on its objectives to bolster the Australian grains industry. We need to make sure that we have the right framework in place to meet the challenges of the next 20 years.



Keith Perrett
Chair



John Harvey
Managing Director

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Molecular biologist Chris Blanchard from Charles Sturt University, NSW, has observed cancer-inhibiting properties in faba beans. Photo: Paul Jones

Corporate performance

The GRDC's corporate performance is assessed on the basis of formal surveys and analysis. It is measured against the corporate strategies and performance indicators established in the Strategic R&D Plan 2012–17; the Annual Operational Plan 2012–13; and the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

This section describes the GRDC's corporate performance in 2012–13, in terms of:

- evidence of effective implementation of the corporate strategies set out in the Strategic R&D Plan 2012–17
- feedback obtained from grain growers

- results of the impact assessments of five R&D project groups
- findings on farm financial performance and total factor productivity growth in the grains industry, collated through regular surveys by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

Corporate strategies

Table 5 provides examples of how the GRDC progressed against its performance measures for 2012–13 and its objectives and strategies for 2012–17.

Table 5: Corporate overview

Indicator	Performance
Strategy: Create value	
Deliver value by investing in programs that address the key industry priorities with the greatest potential returns.	<p>The GRDC implemented six themes aligned with key industry priorities and a program logic approach to achieving theme outcomes.</p> <p>In 2012–13, GRDC invested \$159 million in research, development and extension (RD&E) projects, across the six themes and the foundational activities that underpin the delivery of programs that run across multiple themes. The distribution of that total investment was:</p> <ul style="list-style-type: none"> • Theme 1—Meeting market requirements—12% • Theme 2—Improving crop yield—26% • Theme 3—Protecting your crop—25% • Theme 4—Advancing profitable farming systems—19% • Theme 5—Improving your farm resource base—8% • Theme 6—Building skills and capacity—3% • foundational activities—6% • R&D management—1%. <p>Monitoring and evaluation plans for the investment strategies within each theme are being developed. Key financial performance indicators are being built up from the program of work level to the portfolio level.</p>
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 participated in and provided support for several national and cross-sector collaborations, including:</p> <ul style="list-style-type: none"> • Managing Climate Variability • More Profit for Crop Nutrition • the National Mouse Management Working Group • the National Working Party on Pesticide Application • the Primary Industry Centre for Science Education • a cross-industry collaboration on minor chemical use • the development of national strategies for water use in agriculture and soil RD&E. <p>The GRDC's Managing Director participated in the Primary Industries Standing Committee, and two executive managers participated in the National Grains RD&E Strategy Implementation Committee.</p> <p>The GRDC funded 50% of the costs of the Executive Officer supporting the implementation of the <i>Grains Industry National Research, Development and Extension Strategy</i>.</p>

Table 5: Corporate overview *(continued)*

Indicator	Performance
Strategy: Deliver regionally	
Deliver the outputs of research in innovative products and services relevant to growers and their advisers in each region.	<p>The GRDC invested \$1.4 million directly into extension of new technologies and/or practices through:</p> <ul style="list-style-type: none"> regionally based workshop training, delivered by local providers, on grain storage, spray application and precision agriculture regionally based apps for weeds and insects displaying information at a regional scale the appointment of regionally based scientific writers and the development of regional fact sheets and final reports the development of regionally based communications products such as Ground Cover radio podcasts the re-introduction of plain English summaries online to communicate RD&E outcomes across the regions the development of email-based communication for each of the GRDC regions. <p>Enhancements were made to the GRDC website, including the integration of regionally based multimedia content, and publications such as newsletters, fact sheets, <i>Ground Cover</i> magazine, <i>Ground Cover TV</i> and <i>Back Pocket</i> guides were produced and delivered.</p> <p>The GRDC conducted the Information Products and Services Needs Survey, examining grower needs and preferences at a regional scale.</p> <p>Multiple licences were negotiated to enable the delivery of technology in areas such as weed seed destruction, soil testing and variety seed identification. Applications were made to patent further project outputs in 2012–13.</p>
Strategy: Connect globally	
Proactively source new technologies and innovation from around the world for the Australian grains industry.	<p>Ten new projects were contracted under the GRDC's Innovation Investment program, which is a scheme designed to attract proposals with relatively high risk and new ways of approaching issues faced by grain growers.</p> <p>The GRDC was involved in several international collaborations, such as the G20 Wheat Yield Network; the CIMMYT Wheat Yield Consortium; an international genome sequencing consortium investigating the pea (<i>Pisum sativum</i>); and an international collaboration on invasive animal crop pests.</p>
Strategy: Engage with growers and industry	
Actively listen to and engage with growers and the broader grains industry.	<p>The GRDC facilitated closer linkages with Australian grain growers through its Regional Cropping Solutions networks, regional panels and grower and adviser updates, and through interaction with grains representative organisations such as GrainGrowers Limited and the GRDC representative organisation, Grain Producers Australia.</p> <p>The GRDC engages with the National Agribusiness Reference Group to understand issues in the Australian grains industry from an agribusiness perspective and to identify opportunities for GRDC investment to address those issues.</p>

Grower Survey

The GRDC Grower Survey helps the GRDC to assess and improve its performance, particularly in terms of ensuring that research outcomes are being communicated effectively to growers.

The most recent complete Grower Survey was conducted in 2012, addressing the full suite of practice changes that contribute to the GRDC's strategic outcomes. Results of the 2012 Grower Survey are used in the performance overviews for each investment theme in Part 2 of the annual report.

In 2013, the GRDC conducted a short form of the Grower Survey, focusing on corporate measures, new variety adoption and grain storage. The survey obtained detailed feedback from 1,200 growers across Australia, covering the GRDC's three production regions and key agroecological zones.

The survey results in Table 6 present the GRDC's track record of achievement against selected key performance indicators since 2008.

Table 6: GRDC performance against selected key performance indicators, 2008 to 2013, by proportion of growers surveyed (percent)

Key performance indicator	2008	2010	2012	2013
Growers rating GRDC performance very or fairly high	68	69	75	79
Growers directly benefiting from grains R&D activities generally in the past five years	76	67	76	76
Growers directly benefiting from GRDC activities or initiatives	61	55	67	63
Growers confident that grains R&D is addressing threats to long-term sustainability of their farm	73	70	78	77
Growers feeling that new grain varieties met expectations	58	57	60	68
Growers aware of regional panels	55	60	68	68
Growers having direct contact with regional panel members	23	23	27	28
Growers rating the value of regional panels as very or fairly high (amongst growers having direct contact) ^a	–	71	74	77

a Question first asked in 2010.

Impact assessments

The GRDC undertook impact assessment studies of five groups of projects in 2012–13. The studies assessed the economic, social and environmental benefits arising from GRDC investments. They were undertaken through an independent consultant, in accordance with the guidelines developed by the Council of Rural Research and Development Corporation chairs.

In the context of impact assessments, ‘investment criteria’ are used to measure the economic worth of an investment. Investment criteria are produced for the total investment as well as for the GRDC investment only. The investment criteria calculated for each investment are the expected:

- present value of benefits—the discounted value of benefits
- present value of costs—the discounted value of investment costs
- benefit cost ratio—the ratio of the present value of investment benefits to the present value of investment costs
- net present value—the present value of benefits less the present value of costs
- internal rate of return—the discount rate at which an investment has a net present value of zero (that is, where present value of benefits is equal to the present value of costs).

Table 7 summarises the costs and benefits of the project groups in dollar terms, while Table 8 summarises the economic, environmental and social benefits arising from the GRDC investments.

Table 7: Financial benefits identified by impact assessments

Project group	Present value of benefits \$m	Present value of costs \$m	Benefit cost ratio	Net present value \$m	Internal rate of return %
Barley Breeding—Northern Zone	9.2	8.1	1.1:1	1.1	5.1
Chickpea Breeding Program	44.7	15.9	2.8:1	28.8	16.6
Climate Champions Program	1.6	0.6	2.7:1	1.0	79.0
Lentil Breeding	29.2	9.9	2.9:1	19.3	21.7
Managing Climate Variability Program (MCVP) II	53.7	8.7	6.2:1	45.0	37.2

Note: Dollar amounts are calculated in present value terms. The investment criteria are based on a 5% discount rate and 25 years from the last year of investment.

Table 8: Economic, environmental and social benefits identified by impact assessments

Economic benefits	Environmental and social benefits
Barley Breeding – Northern Zone	
<ul style="list-style-type: none"> Contribution to improved attributes of barley grown from releases of new varieties after 2007. Contribution to maintaining barley area in the Northern Region so maintaining rotational benefits from barley to other crops. Potential contribution to maintenance of barley production in the Northern Region providing benefits to localised feedlots via lowered transport costs for barley. 	<ul style="list-style-type: none"> Potentially increased soil health and reduced topsoil loss.
Chickpea Breeding Program	
<ul style="list-style-type: none"> Increased profitability of chickpeas via increased yields, reduced input costs of fungicides, and improved product quality. Potential for increased area of chickpeas grown in cereal rotations with associated productivity and sustainability benefits. Increase in capital value of chickpea germplasm in the program between 2005 and the end of the investment in 2016. Increased area of chickpeas grown on cropping farms leading to benefits to other crops in the rotation. 	<ul style="list-style-type: none"> Reduced use of chemicals (fungicides) in chickpea crops. Improved farmer wellbeing through reduced chemical use. Potentially reduced chemical export to waterways resulting in positive potential impact on regional wellbeing.
Climate Champions Program	
<ul style="list-style-type: none"> Productivity gains. Higher average profits resulting from productivity gains. Improved research resource efficiency. 	<ul style="list-style-type: none"> Greater adoption of farm practices that improve farm environmental sustainability. Improved industry viability due to greater industry preparedness and capacity to adapt to climate change. Improved community viability and stability due to greater preparedness by farmers.
Lentil Breeding	
<ul style="list-style-type: none"> Increased profitability of lentils via increased yields, reduced input costs of fungicides, and improved product quality. Potential for increased area of lentils grown in cereal rotations with associated productivity and sustainability benefits. Increased confidence, profits and expansion for lentil-processing companies. Potential increase in capital value of lentil germplasm in the program between 2000 and the end of the program in 2016. Potential for increased area of lentils grown on cropping farms leading to benefits for other crops in the rotation. 	<ul style="list-style-type: none"> Reduced use of chemicals (fungicides) in growing lentils. Improved farmer wellbeing through reduced chemical use. Reduced use (and hence export to the environment) of nitrogenous fertilisers arising from new areas of lentils. Potentially reduced chemical export to waterways resulting in positive potential impact on regional wellbeing. Increased regional investment and employment.
Managing Climate Variability Program (MCVP) II	
<ul style="list-style-type: none"> Increased farm profits. Reduced farm losses. Enhanced awareness and adoption of climate risk information. Diverse non-farm benefits from improved seasonal and multiweek forecasts. 	<ul style="list-style-type: none"> Better natural resource management. Enhanced scientific knowledge. More efficient industry research resource allocation. Enhanced awareness of climate risk information and capacity to adapt to climate change. Enhanced community preparedness and resilience. Enhanced scientific knowledge.

The GRDC also undertook an aggregate analysis of the 38 project groups that have been

evaluated since 2007. The key financial results of this analysis are highlighted in Table 9.

Table 9: Financial results of aggregate analysis of project groups, 2007–08 to 2012–13

	Present value of benefits \$m	Present value of costs \$m	Benefit cost ratio	Net present value \$m	Internal rate of return %
38 project groups (excludes Australian Cereal Rust Control Program ^a)	2,456.65	433.41	5.67:1	2,023.24	36.0

a The Australian Cereal Rust Control Program project group had benefit and cost flows that interacted with the cash flows from other groups, precluding an internal rate of return estimate. The project group was therefore excluded from the aggregate analysis to generate a valid internal rate of return. When the cereal rust project group is included, the benefit cost ratio increases to 7.32:1.

Farm performance

In order to monitor farm financial performance and productivity trends in the grains industry and other broadacre industries, the GRDC contributes to the funding of a range of surveys and analytical research conducted by ABARES, in particular its annual Australian Agricultural and Grazing Industries Survey.

Financial performance

The Australian Agricultural and Grazing Industries Survey results for 2012–13 showed that although grain production levels were below the record high of 2011–12 due to drier seasonal conditions and reduced yields, higher overall prices for grains, oilseeds and pulses helped producers offset the effect of lower production on crop receipts and farm cash income. In particular:

- Farm cash income averaged \$151,000 per grain-producing farm in 2012–13, showing a 7 percent decrease compared with the average grain-producing farm cash income of \$162,200 in 2011–12, but still 35 percent above the industry average for the 10 years to 2011–12. Farm business profit averaged \$27,000 a farm in 2012–13, down 38 percent from \$43,900 in 2011–12 and down 74 percent from \$103,750 in 2010–11.
- The average farm cash income of cropping specialist farms was around \$234,000 a farm in 2012–13, a 4 percent increase on the average farm cash income of \$224,600 in 2011–12, and around 50 percent above the industry average for the previous 10 years. Farm business profit for cropping specialists averaged \$80,000 a farm, up 25 percent compared to \$63,900 in 2011–12, but down almost half from \$155,320 in 2010–11.

- The average farm cash income for mixed livestock–cropping farms was \$100,000 per farm in 2012–13, a 13 percent decrease from \$115,100 in 2011–12 but around 19 percent above the industry average for the previous 10 years. These farms made an average loss of \$8,000 a farm in 2012–13 compared to profits of \$16,300 the previous year and \$61,020 in 2010–11.

A regional breakdown shows that farm cash income increased by 47 percent in the northern agroecological region to an average of \$113,000 per farm, but declined in the southern and western agroecological regions by 10 percent and 24 percent, to an average of \$151,000 and \$202,000 per farm, respectively.

Farm costs for grain-producing farms remained about the same in 2012–13. Lower interest rates combined with only a small increase in farm debt resulted in reduced interest payments. Expenditure on crop handling and marketing was also lower, due to reduced crop production, although expenditure on chemicals and fertiliser increased due to higher input prices. Overall, decreases in average expenditure on some items offset increases in average expenditure on other items.

Total factor productivity

Total factor productivity (TFP) measures outputs relative to total inputs used to produce the output. Technological advances, improvements in management, and efficient exploitation of economies of scale all influence the rate of growth in productivity. Accordingly, productivity growth can be driven by producers' generating the same amount of output with fewer inputs, increasing output with the same amount of inputs, or increasing output at a faster rate than inputs.

The latest TFP results for broadacre agriculture available from ABARES are for the period between 1977–78 and 2010–11. Results to 2012–13 will become available in two years time.

As shown in Table 10, cropping specialists and mixed crop–livestock farms achieved average annual TFP growth of 1.5 percent and 0.9 percent, respectively, while the broadacre industry average was 1.0 percent. Table 10 also shows that the total factor productivity growth of cropping specialists was similar across the three grain-growing regions.

Over the past 33 years, productivity in the grains industry has been driven by:

- technological advances, such as larger and more efficient machinery, Global Positioning

System (GPS) guidance systems, new herbicides and pesticides, the ability to make genetic improvements to varieties, and new crop varieties

- improved farming practices, such as low-till and no-till farming, precision agriculture, and ‘cropping packages’ that bring multiple technologies together in readily adoptable farming systems
- increased average farm size—larger cropping farms tend to be more productive because of their greater capacity to adopt new technologies, particularly advanced cropping technologies that are only suitable for use on farms above a minimum size.

Table 10: Average total factor productivity growth by broadacre industry and GRDC production region, 1977–78 to 2010–11 (percent per year)

	Input growth (1)	Output growth (2)	Total factor productivity growth (2–1)
Industry			
Total broadacre	–0.9	0.1	1.0
Cropping specialists	1.0	2.6	1.5
Mixed crop–livestock	–1.8	–0.8	0.9
Beef	–0.3	0.6	0.9
Sheep	–2.4	–2.4	0.0
Cropping specialists by region			
Northern	–0.5	1.1	1.7
Southern	1.4	3.0	1.6
Western	2.2	3.7	1.5
All regions	1.0	2.6	1.5

Source: Based on data from the Australian Bureau of Agricultural and Resource Economics and Sciences report *Australian Farm Survey Results 2010–11 to 2012–13*.



Canola crop and silos in the distance near Milvale, NSW. Photo: Arthur Mostead

Climate change focus

Like any industry that depends on natural resources, the Australian grains industry is exposed to the environmental and economic effects of climate change. Recognising the need for an informed and coordinated response, the GRDC applies a climate change strategy across its business.

The GRDC invests in R&D to:

- better understand how natural resource management may help the grains industry to reduce greenhouse gas emissions
- help growers integrate weather data with other resource inputs to predict, plan and manage farm performance
- assist growers to access and use improved seasonal forecasts and tools to manage their farm businesses in response to climate variability
- identify options and develop technology to assist the industry to adapt to climate change and variability.

This work is translated into awareness raising and practical resources to help grain growers respond to climate change and mitigate greenhouse gas emissions in the short-, medium- and long-terms.

Nitrous oxide emissions

The National Agricultural Nitrous Oxide Research Program commenced in 2012–13, replacing the Nitrous Oxide Research Program. Coordinated by the GRDC, the new program addresses the R&D needs of a range of agricultural industries. It uses a network of automated greenhouse gas measuring systems which comprises the most comprehensive agricultural nitrous oxide monitoring network in the world, with systems situated in all major agroecological zones and farming systems in Australia.

The network has captured a wide range of emissions data typical of the diverse natures of Australian soils and agricultural systems. The data have shown that land use and farming systems history have a major impact on nitrous oxide emissions.

In 2012–13, work with sorghum at the program's site at Tamworth, New South Wales, showed that while soil nitrous oxide emission increases with increases in the rate of

application of nitrogen fertiliser, it is likely that the losses as a proportion of applied nitrogen are much the same. The emissions were highly variable both in time, occurring in response to significant rainfall events, and in space, showing large differences between plots.

At the site at Wagga Wagga, New South Wales, the most important findings were that:

- a high rate of nitrogen fertiliser prompts greater nitrous oxide emission
- use of a nitrification inhibitor is more effective than use of green urea in preventing nitrous oxide emission, in dryland grain-producing regions
- compared to no-till practice, tillage appears to increase nitrous oxide emission.

In the Wagga Wagga trials, grain protein increased linearly with increased nitrogen rates, but because of lack of moisture during the grain-filling period no grain yield response was recorded.

Initial attempts at modelling soil nitrous oxide emissions using the Agricultural Production Systems Simulator (APSIM) and the Denitrification and Decomposition Model (DNDC) were compared with measured data from an earlier project at Tamworth. While cumulative emissions of simulated and measured data agreed reasonably well, comparisons at a daily level were not always close. The nitrous oxide emissions modules of both tested models were constructed and calibrated using soil properties from other research sites that are not necessarily representative of the Tamworth soil, and should perform better once updated with local soil information.

Soil carbon sequestration

A new guidebook, *Managing Soil Organic Matter—A Practical Guide*, was made available to growers in September 2013, as a result of a partnership between the GRDC and the Department of Agriculture and Food, Western Australia. In addition to having potential for soil carbon sequestration, organic matter contributes a range of biological, chemical and physical properties of soil and is essential for soil health. This guide provides Australian grain growers with a practical view of what soil carbon can do for their farms.

Grain production under elevated carbon dioxide

In 2012–13, a review of the Free Air Carbon Enrichment (FACE) program based in Horsham, Victoria, recommended that the work of the program continue to be supported, based on its unique capacity to explore long-term effects of environmental carbon dioxide on grain production. A need for further research was identified in the areas of genotype selection for future climates, system homeostasis, grain protein development, and nitrogen transport processes and pest–plant interactions under increased atmospheric carbon levels.

Managing climate variability

The Managing Climate Variability program aims to help farmers to manage risk and make business decisions using reliable climate forecasts, tools to translate the forecasts into applications, and the necessary knowledge to use forecasting resources effectively.



In 2012–13, the program continued to improve weather forecast accuracy, using a dynamic climate model, the Predictive Ocean Atmosphere Model for Australia (POAMA), developed by CSIRO and the Bureau of Meteorology. The program also supported the development of a new decision support tool, CliMate, which provides grain growers with agricultural climate data at their fingertips via a free phone app. For more information, see the case study on page 61.



Entomologist Piotr Trebicki studies the effects of elevated carbon dioxide on aphids in wheat at Horsham, Vic. Photo: Paul Jones

Collaboration

As described in Part 1, collaboration is at the heart of the GRDC's approach to enhancing the profitability and sustainability of the Australian grains industry.

Strategic approach

Table 11 describes how the GRDC uses effective collaboration to implement the five corporate strategies set out in its Strategic R&D Plan 2012–17.

Table 11: The GRDC's collaborative approach to achieving corporate goals

Corporate strategy	Approach
<i>Create value</i> —Deliver value by investing in programs that address the key industry priorities with the greatest potential returns.	Work with growers, industry and researchers to identify issues affecting the grains industry and the GRDC's potential role in addressing the research questions that emerge from them. Identify the outcomes to be achieved from investments, with grain grower input via GRDC regional panels. Invest, monitor and manage each investment through to a new technology or practice change and evaluate the benefits to growers.
<i>Coordinate nationally</i> —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.	Work with industry, researchers and government agencies to implement the <i>Grains Industry National Research, Development and Extension Strategy</i> .
<i>Deliver regionally</i> —Deliver the outputs of research in innovative products and services relevant to growers and their advisers in each region.	Manage the outputs of each GRDC investment through to the adoption of a new technology and/or on-farm practice change by grain growers. Work with growers and their advisers so that growers are equipped to manage risk and optimise profit and sustainability for their particular circumstances.
<i>Connect globally</i> —Proactively source new technologies and innovation from around the world for the Australian grains industry.	Engage with global networks such as the CGIAR centres and private grains R&D investors such as multinational companies.
<i>Engage with growers and industry</i> —Actively listen to and engage with growers and the broader grains industry.	Build structures and processes, such as the Regional Cropping Solutions networks and regional panels, that create a strong, interactive interface with grain growers and their advisers.

International activities

Strengthening collaboration with the key international centres is essential for ensuring that Australian plant breeders are able to obtain the genetic material and associated international knowledge necessary to produce superior varieties.

Australia has been importing wheat germplasm from CIMMYT and the International Center for Agricultural Research in the Dry Areas (ICARDA) since the 1960s. The contribution that their germplasm has made to Australian wheat varietal improvement is considerable.

The GRDC has established formal strategic alliances with both organisations, and works with them on a suite of research projects—the CIMMYT–Australia–ICARDA

Germplasm Evaluation (CAIGE) program—that benefits Australian grain growers as well as farmers in the developing world. The CAIGE program ensures that Australian plant breeders have long-term, targeted access to international germplasm.

To align future activities with the GRDC Strategic Plan 2012–17, the CAIGE program will be expanded to include other crops of importance to the Australian grains industry. The expansion will include targeted access to durum wheat and barley germplasm, in addition to wheat and chickpea, from CIMMYT and ICARDA, as well as chickpea germplasm from the International Crops Research Institute for the Semi-Arid Tropics.

The GRDC also takes part in international collaborations outside the CAIGE program.

One new example in 2012–13 was the establishment of an international consortium—with Canada, Ethiopia, India and Turkey—that seeks to mine the genetic diversity of wild chickpea to drive international chickpea crop improvement. The first phase of the program, which involves collecting and characterising wild chickpea species, has commenced, with the GRDC co-funding the collection of *Cicer reticulatum* in Turkey during 2013.

This investment ensures that Australia will have access to all germplasm and resources generated by the program. Evaluation of reverse-introgressed lines will commence in Australia in 2016, with a view to identifying material containing vegetative and flowering cold tolerance, flowering heat tolerance, terminal drought stress tolerance, tolerance to low pH, and tolerance and resistance to root-lesion nematodes. These traits will enable chickpea production to expand into non-traditional areas which require profitable break crop options.

Collaborative projects

Most of the RD&E activities described in this annual report were supported by the GRDC in collaboration with research partners, such as government agencies, research organisations, plant breeders, seed companies, agricultural companies and advisers, and grain marketers, exporters and end users.

In particular:

- Table 11 provides examples of collaborations that helped the GRDC to achieve its strategic corporate objectives.
- The reports on performance for the six themes describe collaborations that assisted the GRDC to fulfil its performance objectives and achieve its outcome.
- Appendices B and C provide details of the GRDC's RD&E investments.



Australian breeders visit International Maize and Wheat Improvement Center (CIMMYT) facilities in Mexico: (left to right) Matthew Whiting (Longreach Plant Breeders), Gururaj Kadkol (NSW Department of Primary Industries), Osman Abdalla (International Center for Agricultural Research in the Dry Areas), Richard Trethowan (University of Sydney), Robyn McLean (InterGrain), Britt Kalmæier (Australian Grain Technologies) and Ravi Singh (CIMMYT). Photo: CAIGE

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 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.

The following sections describe some highlights of RD&E investments that addressed this theme in 2012–13.

Pre-harvest sprouting in wheat

The effects of pre-harvest sprouting (PHS) on the value of a wheat crop can result in substantial losses to growers in many parts of Australia; in 2010, losses were reported to be as high as \$1 billion in the Northern and Southern regions combined. The introduction of PHS-resistant germplasm into Australian wheat cultivars could eliminate such large economic losses and increase the growing of wheat in high-rainfall zones.

However, although genetic materials and molecular markers for PHS resistance (dormancy) are available, it can be a very difficult trait to achieve. In communication with the GRDC, Australian breeders have consistently described PHS resistance as

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one of the most desirable traits, but identified a range of obstacles that discourage them from deploying available resistance genes in their breeding programs.

The GRDC is supporting research to improve understanding of the genetic and environmental mechanisms involved in PHS and dormancy, provide a wider range of better diagnostic selection tools for PHS resistance, and remove the obstacles identified by breeders.

One project is using advanced genetic tools to speed up the identification of key dormancy genes from diverse elite wheat varieties from many regions of the world. More than 1,000 lines have been analysed. Field trials have been conducted to identify the most robust sources of resistance and the effects of environmental conditions on the expression of dormancy. As well as improved knowledge of the molecular and physical mechanisms that control resistance, the project aims to deliver at least two new sets of quantitative trait loci (QTL) for PHS resistance, and associated molecular markers, to Australian wheat breeders.

Another project is working to develop significantly better PHS screening methods which are based on molecular markers and not susceptible to the environmental effects that limit the efficiency of existing methods. Given the potential to bring in traits with negative

impacts on agronomy, disease resistance or quality when introducing PHS-resistant QTL, a part of this project focuses on comparing lines with and without particular QTL. This sort of information should give Australian breeders greater confidence to exploit genetic material to improve PHS resistance.

Physical qualities in pulses

The market primarily defines the quality of pulses in terms of physical seed characteristics such as size, shape, coat colour and degree of dimpling. For split-pulse products, it includes seed coat adherence to the cotyledon and cotyledon colour.

Current breeding methods for optimising such physical traits involve time-consuming sieving tests that require large amounts of sample, and therefore can be applied only at the advanced stage of the breeding program. Culling for physical traits at a late stage in the breeding program is costly and inefficient.

The GRDC is supporting research to develop a computerised alternative to the sieving method, based on digital image analysis. In the new system, pulse seeds travel along a conveyor belt and through a camera unit where a digital image is taken of each individual seed and height contours are measured by laser. The computer analyses the image data to deliver a profile of the traits of the seed. The process is non-destructive, has a high throughput—with the capacity to photograph around a thousand seeds per minute—and can be applied to a wide range of sample sizes. Testing in Pulse Breeding Australia programs has confirmed that



Pulses. Photo: GRDC

the method is very precise and could replace the sieving process, saving time and expense for breeders.

The new screening technology could also support the development of standardised quality assessment parameters for pulses, similar to those that exist in cereal and oilseed markets. The inability to readily quantify the quality of pulses at delivery currently means that growers may not receive the true market value of their grain. A rapid and reliable method of screening pulses at delivery could improve growers' returns and restore confidence in growing pulses.

Cooking and sensory qualities in pulses

Cooking qualities and sensory attributes, such as taste and texture, are important consumer drivers in the market for pulses. Australian pulse growers need access to improved varieties and agronomic techniques to produce pulses that are acceptable or preferred in high-value export markets.

The GRDC is supporting an international collaboration to improve understanding of consumers' uses and preferences for pulses. The project commenced with an extensive sensory evaluation of the taste, aroma and texture of Australian and Indian chickpea and field pea varieties among consumers in India, Australia's largest export market for pulses. This work will be complemented by a study of Australian consumer preferences and an online survey that aims to cover 1,500 participants from both countries. In addition, an Australian panel will be trained so that sensory evaluation of pulse varieties can be conducted locally.

Initial results have identified clear areas for Australian breeders to target. For example, although Indian consumers eat whole chickpeas mainly as a 'puffed' snack food, the four Australian chickpea varieties submitted for testing simply failed to puff under the processing technique used in India.

Having identified attributes that consumers prefer, the project will investigate their chemical and physiological bases and develop efficient screening methodologies for breeding programs to use in selecting for those attributes. This work includes reviewing and improving the available methods for measuring key attributes, such as cooking time and 'puffability'.

The GRDC is also supporting research to investigate how agronomic practices and environmental conditions influence the expression of cooking quality traits in pulses. Field trials of chickpea, field pea and lentil varieties were conducted over three years in Victoria's Wimmera (two sites) and Mallee (one site) regions. Variable time of sowing was applied to all three seed types; crop topping,

which involves desiccation using a foliar herbicide prior to harvest, was applied to the field pea and lentils. Although results varied between crops and regions, the research clearly showed that a strategic approach to those common agronomic practices, integrated with weather conditions, can have significant benefits for cooking quality and seed size in pulses.



Improved cooking quality attributes are key to accessing high-value markets for pulses in India. Photo: GRDC

Malting quality in barley

The premium for selling barley into the malting market is currently estimated to be worth around \$200 million to Australian growers. To maintain and enhance their share of this valuable market in the face of increasing competition from countries with lower production and distribution costs, Australian barley growers must produce varieties with higher malting quality than the cheaper alternatives.

The GRDC is supporting a project to improve understanding of the basis of malting quality and deliver new genetic material, trait information and selection tools that will equip Australian breeders to apply specific, cost-effective strategies to improve barley quality.

Among the preliminary observations, the researchers have found that near- and mid-infrared spectroscopy shows promise as a rapid, non-destructive method to monitor and measure water uptake and steeping time

in whole barley grain during soaking. This may lead to the development of tools that will assist breeders to measure grain characteristics more efficiently.

The GRDC is also supporting research to help the Australian industry understand how current commercial malting regimes influence the technical performance of Australian barley varieties. This is particularly important in relation to export markets where there is limited opportunity for direct interaction with processors.

In 2012–13, the GRDC provided funding to help establish a national pilot malting facility at Edith Cowan University's Malting and Brewing Research Education Facility in Joondalup, Western Australia. The plant is designed to simulate state-of-the-art commercial malting practice. The system is based on a 'unimalter'—one universal chamber that caters for steeping, germination and kilning—and includes fully integrated computer control of the malting process and monitoring of key variables.



Barley breeder Chengdao Li from the Department of Agriculture and Food, WA, views the malting and brewing facilities at Edith Cowan University. Photo: Evan Collis

A GRDC-supported project is evaluating the relationship between the malts produced by the pilot plant (with batch sizes from 25 kilograms to 100 kilograms) and those produced by commercial malting plants in Australia (with batch sizes from 50 tonnes to 300 tonnes). If the project is able to validate pilot plant results alongside commercial malting trial results, pilot malting trials may replace full-scale commercial malting trials in some instances. This would save time and costs for barley breeders, including by making performance data available earlier in the variety development process.

Grain defects in barley

Australian barley grown for high-value malting markets can be severely devalued if it presents grain defects such as kernel discolouration (including kernel staining and blackpoint) and PHS. In recent years, which have seen unseasonal rain during harvest, a large amount of barley has been discounted or downgraded to feed, causing tens of millions of dollars in losses to the Australian industry.

The GRDC is supporting a project to improve understanding of the genetic and environmental control of tolerance and resistance to grain defects and decrease the risk of grain defects in Australian barley varieties.

The project is analysing more than 2,000 samples from National Variety Trials programs across Australia to evaluate the risk of grain defects in current and potential new Australian barley varieties. Significant numbers of advanced breeding lines display susceptibility to one or more defects: for example, in one set of trials, eight advanced breeding lines exhibited more than 30 percent blackpoint. The results of the analyses are being delivered to Australian breeding programs to inform their decisions about variety development.

The project also aims to deliver improved germplasm, selection tools and screening methods to breeders to help them efficiently develop new barley varieties with improved tolerance to grain defects. The research considers a range of factors—such as malt extract, diastatic power, free amino acids, nitrogen, alpha-amylase activity and seed dormancy—as well as the expression of traits under the environmental conditions in different agroecological regions. In 2012–13, major QTL were identified and improved molecular markers were developed for seed dormancy; markers for blackpoint tolerance are expected to be released in 2013–14.

Case study

Dough strength in wheat

Dough strength is a key aspect of functionality that can give bread wheats a competitive advantage in high-value markets, such as the expanding baking sector in South-East Asia.

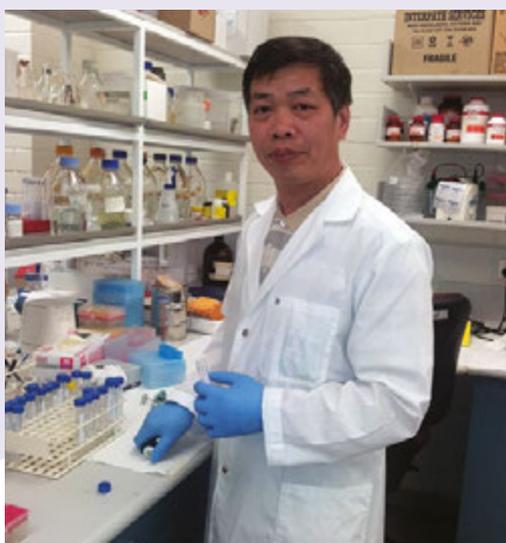
The baking quality of bread wheat is determined by its protein content and composition. Traditionally, Australian growers have attempted to increase dough strength by increasing the total protein of the crop, by applying high rates of nitrogen. This can be both expensive and unreliable, particularly on low-fertility, sandy soils such as those in many grain-growing areas of Western Australia.

At the molecular level, dough strength is conferred by the high molecular weight glutenin subunits of wheat genes. Research has shown that introducing new subunits from wild wheat varieties can sharply increase dough strength and baking performance in bread wheat. The GRDC is supporting work to integrate new glutenin subunits into elite Australian bread wheat varieties.

The project involves a strategic international collaboration with Italian researchers who successfully introduced a new glutenin subunit into durum and bread wheat varieties using conventional breeding techniques. Donor germplasm has been imported from Italy and crossed with nine leading Australian wheat varieties. Molecular markers have been developed to track the new gene.

Successful lines from the project were tested for gluten content, gluten composition, total protein and attributes such as grain weight and water absorption, before the best were selected for large-scale quality testing and benchmarking against the original Australian varieties. Improved germplasm and related molecular markers are expected to be ready for release to Australian commercial breeding programs in 2013–14.

The project is also working on introgressing genes from a Chinese line into Australian cultivars. Developed through a collaboration between researchers from Australia, China and Germany, the line has demonstrated improvements of 40 percent in loaf volume and 200 percent in dough strength.



Molecular geneticist Wujun Ma from the Department of Agriculture and Food, WA, incorporates baking quality attributes from Italian germplasm into Australian wheat cultivars. Photo: Shadihul Islam

Theme 1 performance overview

Table 12 shows the investment budget and results against performance targets for Theme 1 in 2012–13, in the context of the outcomes defined in the Strategic R&D Plan 2012–17. Table 13 summarises the GRDC's performance against the relevant indicators in the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

Table 12: Theme 1 performance against GRDC strategic measures

Theme 1 – Meeting market requirements

Aspirational outcome (10+ years)

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

Intermediate outcomes (5 years)

Understanding market opportunities for Australian grain—Acquisition and interpretation of information about market requirements, trends and opportunities, in order for the GRDC to make informed RD&E investment decisions and to assist grower decisions.

Crop and variety selection aligned with market requirements—Growers use market information to select crop, variety and cropping sequence that addresses their profit and risk.

Crop production aligned with market requirements—Growers use information on appropriate in-crop management to maximise the potential of delivering grain that meets the quality and functionality requirements of the intended customer.

Grain harvest and storage practices aligned with market requirements—Growers adopt harvest and storage practices to maximise their potential to deliver grain that meets the quality and functionality requirements of the target market.

Investment budget for 2012–13

\$18.56 million

Performance for 2012–13

Understanding market opportunities for Australian grain

Practice changes and key metrics

- 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 joint venture is established and operating appropriately.*
- The GRDC makes greater use of information on current and potential future markets to guide investment decisions.

Targets

Achievements

The GRDC has established effective working relationships with marketers, buyers and traders of Australian grains to access greater information about markets.

Relationships were developed with key contacts through forums such as Wheat Quality Australia (WQA), Barley Australia and the Australian Oilseeds Federation.

More data is available about the likely future scale, growth and longevity of markets and market segments.

Information on the functional requirements of end users in Asia was collected.

Up-to-date information on functionality and regulatory requirements of different markets is available to the GRDC and to growers.

Feedback from Grain Trade Australia on market access has helped identify research needed in the market access areas.

The GRDC makes greater use of market information in its RD&E investment decisions.

Work in Asian wheat markets as well as investigation of the pulse markets helped to direct further investment in areas such as pulse defect elimination.

Increased number of growers use some form of quality assurance system to demonstrate their compliance with technical market access requirements.

Results of the 2012 Grower Survey showed that 87% of growers had undertaken activities to improve production or quality on their farms over the previous three years. This proportion was significantly higher than the 2010 result, 80%.

Table 12: Theme 1 performance against GRDC strategic measures *(continued)*

Performance for 2012–13

Crop and variety selection aligned with market requirements

Practice changes and key metrics

- A greater proportion of growers and advisers use market information to inform crop and variety selection.
- 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.
- Breeders and pre-breeders use market information to deliver varieties that meet the requirements of current and future markets.
 - *Independent wheat variety classification is maintained.*

Targets	Achievements
Increased number of growers adjust crop and variety selection based on market requirement data.	WQA provided a focus for communication about wheat classification. Barley Australia and WQA presented at grower updates promoting the classification systems and market needs.
Breeding programs make greater use of market information in setting quality and functionality targets.	Breeding program representatives attended workshops held by WQA and Barley Australia.

Crop production aligned with market requirements

Practice changes and key metrics

- A greater proportion of growers and advisers use relevant market information to inform decisions about in-crop management practices.
- A greater proportion of grain growers adjust pest, weed and disease management practices to meet market requirements.

Targets	Achievements
Industry best management practice guides for crop management take account of market requirements.	New guides taking crop quality into account were under development.
Increased number of growers are aware of and monitor for receival standards, including quality parameters, adventitious presence and maximum residue levels.	Information on the need to comply with receival standards, including specific information on residue levels and crop specifications, was communicated to growers through the National Working Party on Grain Protection.

Grain harvest and storage practices aligned with market requirements

Practice changes and key metrics

- A greater proportion of growers use harvesting strategies that maximise the opportunity to meet the requirements of their target market.
- A greater proportion of growers are aware of the quality and functionality of the grain delivered to their customer or entering contract storage.
 - *90% or more of growers are aware of and interested in the benefits of measuring grain quality.*
- A greater proportion of growers use storage practices to meet market requirements and provide for the continued effectiveness of pest control measures.
 - *At least 60% of growers storing grain on farm use sealed silos.*
- The GRDC uses market access information to provide growers with the harvest and storage management packages and tools to comply with market requirements.

Targets	Achievements
Industry harvest and storage best management practice guides are developed to include information about technical barriers to trade such as food and feed safety standards, and biosecurity, phytosanitary and sustainability requirements.	Investments to develop new guides are expected to be made in 2014–15.
Increased number of growers are aware of the effects of seasonal risks, harvest and storage practices on grain quality (moisture, damage, or desiccation).	This will be measured by the 2013–14 Farm Practices Survey.
Adoption by growers of practices that preserve grain quality and integrity attributes is increased.	Results of the 2012 Grower Survey showed that 60% of growers were using sealed silos.
Increased number of growers use objective testing methods to substantiate and track the quality and integrity attributes of the grain they deliver to markets.	A survey of growers using objective testing methods will be undertaken in 2013–14.

Table 13: Theme 1 performance against portfolio budget statements measures for 2012–13

Key performance indicator	Target	Result
Australian Export Grains Innovation Centre (AEGIC) joint venture is established and operating appropriately.	AEGIC established and operating	Achieved. The members (the GRDC and the Western Australian Government) committed to an agreement that establishes AEGIC as a company limited by guarantee, and the board and managing director were appointed. The five-year business strategy of the company sets out the scope of activities that are focused on understanding and meeting market requirements for Australian grain exports.
Growers are aware of the benefits of measuring grain quality to meet customer requirements.	90%	This will be measured by the 2013–14 Farm Practices Survey.
Growers storing grain on farm use sealed silos to meet market requirements and provide for the continued effectiveness of pest control.	60%	Achieved. Results of the 2012 Grower Survey showed that 60% of growers were using sealed silos.

What's in the RD&E pipeline for 2013–14?

Research to:

- quantify the cost of the late maturity alpha-amylase (LMA) classification criterion to growers and wheat-breeding programs
- provide LMA detection methods to breeders that enable them to exclude LMA-prone breeding lines and guarantee a continuous flow of new varieties that do not contain the defect.

A project to analyse market opportunities for Australian pulses.

The development of high-throughput, objective quality standard evaluation methods for use by Australian pulse-breeding programs.



Grain storage and transport management practices align with meeting market requirements. Photo: Jim Christie

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.

The following sections describe some highlights of RD&E investments that addressed this theme in 2012–13.

Genetic resources

The future of the Australian grains industry and Australia's long-term food security both depend on secure access to plant germplasm that enables plant breeders to develop new and superior varieties. Australia relies on genetic resources from overseas to introduce traits that can improve grain varieties for local conditions. As a party to the International Treaty on Plant Genetic Resources for Food and Agriculture, Australia has access to germplasm collections around the world—and a responsibility to make its own collections accessible to other parties.

Australia holds extensive assets of genetic resources in the Australian Winter Cereals Collection (in New South Wales), the Australian Tropical Crops and Forages Collection (in Queensland), and the Australian Temperate Field Crops Collection (in Victoria). During the

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development of the *Grains Industry National Research, Development and Extension Strategy*, agreement was reached to consolidate those collections into one dedicated facility, the Australian Grains Genebank. The new facility will hold up to 180,000 samples from Australia and around the world.

With support from the GRDC, the genebank will import, distribute and preserve genetic resources for use by breeders and researchers in Australia and overseas. As well as assisting Australia to meet its treaty obligations and providing a convenient single point of contact for researchers, the new facility will enable the collections to be stored under standardised, best practice conditions.

The Australian Grains Genebank will be located at Horsham, Victoria, which is home to Grains Innovation Park, a national centre for grains pre-breeding and breeding programs. The design of the building was finalised in 2012–13, to specifications decided by the curators of the existing collections. Construction will be completed by November 2013.

Managed environment facilities

As part of its commitment to coordinate nationally and deliver regionally, the GRDC funded the establishment of three managed environment facilities in 2010–11. Located in areas representative of dryland grain-growing regions, at Narrabri and Yanco in New South Wales and



The rain shelters at the managed environment facility at Merredin, WA, accelerate the development of cereal crops with greater drought tolerance. Photo: Tim Setter

Merredin in Western Australia, the facilities provide a regional system of infrastructure for validating pre-breeding traits in the field. The ability to control the testing environment creates unique opportunities to accelerate the development of cereal varieties with high levels of drought tolerance and water use efficiency for production in water-limited environments.

During 2012–13, the three facilities continued to develop key infrastructure elements such as water supply and irrigation, storage, equipment and staff. This included a GRDC-supported project to design and implement a range of new information technology tools and infrastructure to securely capture data from the research conducted at the facilities. As well as storing the data, the new systems will enable results to be integrated with performance data from other environments. They will also make relevant information more accessible to researchers and growers.

During 2012–13, trials commissioned by research projects were conducted at all three facilities, in accordance with agreed protocols and on time. For example, the facilities were used in GRDC-supported projects to:

- evaluate and develop high-quality, high-yielding durum wheat varieties with high tolerance to stress that will help growers

adapt to the increasing frequency of droughts, unseasonal frosts and high temperatures during flowering and grain-filling stages

- identify the precise impact of heat stress on yield and quality in bread wheat, and validate the heat and stress tolerance of wheat genotypes with QTL that have been linked with heat stress tolerance in previous studies
- improve understanding of the role of canopy architecture as a trait for use in improving the productivity of wheat under drought conditions.

Durum wheat varieties

Although it occupies a relatively small segment of Australian grains production, durum wheat is a valuable crop in both local and export markets, where it is used mainly in manufacturing pasta. The availability of Australian durum is critical to the competitiveness of Australian millers and food manufacturers. The quality of Australian durum is very well regarded in high-value markets around the world.

However, the growth of Australian durum wheat production has been inconsistent. In competing with crops such as sorghum and cotton, the available durum varieties have been considered

less attractive in terms of yield and susceptibility to disease. The GRDC is supporting research to develop new durum wheat varieties with improved attributes to assist the Australian durum industry to fulfil its potential.

Durum Breeding Australia (DBA)—formerly known as the Australian Durum Wheat Improvement Program—provides leadership and coordination between durum wheat breeding programs in Australia and overseas. DBA has a Northern Node based in Tamworth, New South Wales, a Southern Node based in Adelaide, and trial sites in New South Wales, South Australia and Victoria.

The breeding work in the Northern Node involves the development of export quality durum wheat varieties that are adapted to conditions in northern New South Wales and southern Queensland, are tolerant to crown rot, and display higher grain yield and better disease resistance than the standard variety Caparoi⁽¹⁾. In the Southern Node, durum wheat varieties that are superior to the standard variety Tjilkuri⁽¹⁾ and attractive to the domestic pasta makers need to be developed. Specifically, DBA aims to deliver durum varieties:

- with consistent or better grain quality, improved crown rot tolerance and 5 percent higher yields than current varieties Caparoi⁽¹⁾ and Jandaroi⁽¹⁾ for the northern zone



Durum wheat trials. Photo: GRDC

- with improved grain quality, including better grain size and yellow pigment than current variety Tjilkuri⁽¹⁾, for the southern zone.

In 2012–13, the program released two new varieties that have demonstrated significantly improved yields with no loss of quality or disease resistance: Yawa⁽¹⁾ and WID802⁽¹⁾.

DBA is also developing an industry-focused strategic plan for durum wheat research, addressing key issues such as the scope of the domestic and export industries, and future variety needs in relation to quality, agronomic requirements and disease resistance. This includes engaging with pre-breeding groups and agribusiness representatives, particularly from grain-handling and milling companies, to build connections and identify shared objectives.

Tactical agronomy

With rainfall in the critical April–May seeding window for southern growers trending lower, the GRDC has supported research to investigate the impact of variety selection and earlier sowing times on the yield of wheat and canola. Sowing early offers the potential to utilise soil moisture from rainfall events outside the growing season. Earlier sown crops also have certain advantages: being in the ground longer means they develop deeper roots; earlier canopy development reduces evaporation; and a longer stem elongation phase leads to higher grain numbers.

One such project that concluded in 2012–13 demonstrated that planting slow maturing wheat varieties earlier in the year could help growers in the Southern Region to maximise yields. The project compared the yield results of slow maturing, milling-quality spring wheats sown early with those of mid-fast maturing varieties sown during the usual sowing window, across trial sites in the high-rainfall zone of Victoria and the medium-rainfall and low-rainfall zones of New South Wales.

Across all sites, slow varieties were shown to produce higher yields than mid-fast varieties. The difference was particularly marked in the medium-rainfall zone, where a slow variety sown in mid-April outstripped a mid-fast variety sown in mid-May by 0.8 tonnes per hectare at Temora in 2011 and 2.1 tonnes per hectare at Junee in 2012.

The trial results were supported by APSIM modelling, which also found that including

a slow maturing wheat variety in a farm program increases the frequency of planting opportunities and allows more crop to be sown and flower on time, increasing average farm yield and reducing production risk.

Other research demonstrated that the introduction of long-season canola types could increase yields in the high-rainfall regions of southern Australia. The study used field data and spatial modelling to determine the expected canola yields of three cultivars—‘spring-short’, ‘spring-long’ and ‘winter’—across areas of south-eastern Australia where average annual rainfall exceeds 400 millimetres.

Spring-long outperformed spring-short across much of the study area. Winter had marked yield advantages over spring-short in particular areas, such as small pockets in New South Wales where winter yields exceeded spring-short yields by up to 60 percent. However, spring-long displayed superior performance over a wider area than winter did and had the greater potential to improve production overall.

These results challenge the current trend among breeders towards selecting earlier maturing cultivars, and provide evidence that new long-season canola types may be required to maximise yields.

Another project examined whether sulphur application is required to optimise nitrogen uptake in cereals grown on sandy soils. This question emerged in the Mallee region of South Australia and Victoria, where a shift towards fertilisers with

lower levels of sulphur and increased removal of sulphur through canola plantings led growers to question whether sulphur levels may become limiting in cereal crops such as barley.

Field trials were conducted throughout the region in 2012, assessing barley growth and yield responses to the rate, timing and form of sulphur application. The results suggest there is unlikely to be a widespread problem of sulphur deficiency in the Mallee, although isolated deficiencies may occur on a paddock-by-paddock basis depending on fertiliser history, crop rotation and product removal.

Because plants take up sulphur in the form of sulphate, which is soluble and prone to leaching, it is likely that sulphur is more accessible to plants later in the season when roots explore the lower soil profile. Deep soil tests revealed sufficient sulphur in the lower soil profile, which may explain the lack of response to added sulphur at most trial sites.

Overall, nitrogen was found to be the key nutrient driving early growth responses at all sites, suggesting that fertiliser expenditure for growers in the region may be best directed towards correcting nitrogen deficiencies.

The results highlight the importance of preparing nutrient budgets based on target yield and protein, together with deep soil testing for available nitrogen and sulphur, to inform fertiliser purchasing decisions.



Barley agronomy trial at Merredin, WA. Photo: Blakely Paynter, DAFWA

Case study

Chickpea varieties

Chickpea is grown as a winter crop in most Australian states. Profitable in its own right, it is also valuable as a break crop in rotation with cereals, fixing nitrogen and reducing the risk of grass weeds and diseases.

Chickpea is also one of the world's most important pulse crops. It is the second most widely grown legume, after soybean, and plays a crucial role in food security, particularly in developing countries.

However, chickpea is sensitive to abiotic stresses—heat, drought and salinity—that are increasingly present in the Australian growing environment. It is also vulnerable to fungal diseases, in particular ascochyta blight and phytophthora root rot. The GRDC is supporting pre-breeding research to develop chickpea lines with improved resistance to both abiotic and biotic stresses.

Breeding efforts to improve chickpea yields have been restricted by limited diversity in the available genetic material. The International Chickpea Genetics and Genomics Consortium was formed to facilitate cooperative research to improve understanding of the chickpea genome architecture and dynamics and to assist chickpea variety improvement.

The consortium is a collaboration between researchers representing 23 organisations from 10 countries. It also receives funding from organisations around the world, including the GRDC and its regular collaborators the International Center for Agricultural Research in the Dry Areas and the International Crops Research Institute for the Semi-Arid Tropics.

In 2012–13, the consortium published details of the genome sequence of a Canadian kabuli chickpea variety and resequenced 90 chickpea genotypes, including several with particular importance to Australia. As well as achieving extremely valuable insights into the relatedness and diversity of the elite chickpea germplasm currently in use, this work has provided thousands of genetic markers and low-diversity genome regions that may be used in the development of superior varieties. This information will be used by Australian researchers such as those at the Australian Centre for Plant Functional Genomics, which also receives funding from the GRDC.

The GRDC is also supporting Australian germplasm enhancement and breeding programs for chickpea, through Pulse Breeding Australia (PBA). PBA coordinates research programs around the country to develop improved pulse varieties tailored for regional conditions and fast-track their delivery to breeders. One new variety, PBA Striker⁽¹⁾, was released by PBA in 2012–13; this early-flowering and early-maturing desi chickpea is well adapted to the short-season environments of southern Australia.



Pulse Breeding Australia team attends the launch of PBA Striker: (left to right) Mark Sweetingham (Department of Agriculture and Food, WA), Kristy Hobson (NSW Department of Primary Industries), Alan Meldrum (Pulse Australia), Bronwyn MacLean (GRDC) and Ian Pritchard (Department of Agriculture and Food, WA). Photo: Nicole Baxter

Theme 2 performance overview

Table 14 shows the investment budget and results against performance targets for Theme 2 in 2012–13, in the context of the outcomes defined in the Strategic R&D Plan 2012–17. Table 15 summarises the GRDC's performance against the relevant indicators in the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

Table 14: Theme 2 performance against GRDC strategic measures

Theme 2—Improving crop yield	
Aspirational outcome (10+ years)	
<i>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.</i>	
Intermediate outcomes (5 years)	
<i>Genetic yield potential and stability improvement of cereal varieties—Growers access and increase production of adapted cereal varieties with a significant yield potential and stability increase over current elite varieties.</i>	
<i>Genetic yield potential and stability improvement of pulse varieties—Growers access and increase production of adapted pulse varieties with a significant yield potential and stability increase over current elite varieties.</i>	
<i>Genetic yield potential and stability improvement of oilseed varieties—Growers access and increase production of adapted oilseed varieties which continue to meet target oil levels with a significant yield potential and stability increase over current elite varieties.</i>	
Investment budget for 2012–13	
\$42.16 million	
Performance for 2012–13	
<i>Genetic yield potential and stability improvement of cereal varieties</i>	
<i>Genetic yield potential and stability improvement of pulse varieties</i>	
<i>Genetic yield potential and stability improvement of oilseed varieties</i>	
Practice changes and key metrics	
<ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> – <i>New cereal varieties have minimum yield increases equivalent to 1% per annum as measured in National Variety Trials (NVT).</i> – <i>New pulse varieties have minimum yield increases equivalent to 2% per annum as measured in NVT.</i> – <i>New oilseed varieties have minimum yield increases equivalent to 1.5% per annum as measured in NVT.</i> • 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. • 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. • 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. <ul style="list-style-type: none"> – <i>New varieties currently available meet the expectations of at least 60% of growers.</i> – <i>40% of growers and their advisers use the NVT online data or attend an NVT field day, and of these 90% consider that the information obtained helped them in deciding which varieties to plant.</i> 	
Targets	Achievements
A best practice breeding chain is in operation for each major crop type, taking a holistic view of genetic improvement from germplasm acquisition and enhancement through to release of superior varieties to the final customer.	All Australian cereal, pulse and oilseed breeding programs made significant advances in the development of best practice breeding programs, through targeted germplasm acquisition; optimisation of breeding processes and support tools; and implementation of leading statistical analysis methodologies.
All breeding programs operate efficiently, as measured by time and funds required to develop regionally adopted superior varieties from acquisition of required traits to delivery.	All breeding programs delivered superior varieties rapidly through the application of best-practice breeding processes. Cereal, pulse and oilseed programs are implementing rapid population advancement methods (multiple generations per year), molecular marker selection of required traits and advanced statistical analysis methods to maximise the rate of genetic yield potential gain in each breeding cycle.

Table 14: Theme 2 performance against GRDC strategic measures (continued)

Performance for 2012–13	
Targets	Achievements
Improved information about variety yield potential and stability under regional conditions is available to growers.	The NVT program extended independent and regionally relevant data on variety yield potential and stability to growers.
Increased number of growers access and use this information to assist their decisions about crop type and variety, and about rotations.	Results of the 2012 Grower Survey showed that 86% of growers were aware of the NVT program; 93% of growers placed value on NVT data; and the number of growers accessing independent data on varietal performance through the program was increasing.
Growers in each major cropping region have access to at least one pulse and one oilseed variety that is consistently profitable and therefore suitable as a rotation crop.	Two lentil cultivars and two pea cultivars addressing specific production constraints or targeted to specific farming practices in southern and western Australian production regions were released by Pulse Breeding Australia.
A significant increase in water-limited yield potential is achieved for each major crop type (cereals, pulses and oilseeds).	<p>In NVT trials of new releases:</p> <ul style="list-style-type: none"> • Australian Prime Hard (APH) wheat variety Suntop^(b) recorded yield increases of up to 8% over dominant APH varieties • chickpea variety PBA Striker^(b) recorded yield increases of up to 7% over PBA Slasher^(b) • Roundup-Ready canola variety GT-50 recorded yield increases above 2% over Roundup-Ready cultivars released in 2011. <p>In addition, new mungbean variety JadeAU^(b) recorded yields up to 12% higher than the dominant variety Crystal^(b) across 38 trials over five years.</p>

Table 15: Theme 2 performance against portfolio budget statements measures for 2012–13

Key performance indicator	Target	Result
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%	<p>Ten wheat varieties and one barley variety were released during the reporting period, showing yield improvements of up to 8% over current dominant cultivars of equivalent quality in NVT trials.</p> <p>Seventeen canola varieties were released by private breeding programs. NVT trials recorded yield increases in excess of 2% for some varieties relative to dominant cultivars in the same herbicide tolerance class.</p> <p>Three chickpea, one faba bean, one field pea and three lentil varieties were released by Pulse Breeding Australia. NVT yield trials of new varieties recorded yield increases of between 2% and 8% relative to existing dominant pulse cultivars.</p>
New varieties currently available meet the expectations of growers.	60%	Achieved. Results of the 2012 Grower Survey showed that 60% of growers felt that new grain varieties met expectations.
Growers and advisers use NVT data in selection of varieties to plant.	40% access data, of which 90% use it	Achieved. Results of the 2012 Grower Survey showed that 93% of growers who accessed the information provided by the NVT program considered that it helped with variety decisions.

What's in the RD&E pipeline for 2013–14?

- Research to develop wheat and barley cultivars with improved yield, quality and adaptation to water-limited environments.
- Work to identify quantitative trait loci (QTL) for wheat yield stability that will enable breeders to develop wheat varieties with increased yield stability in response to heat, water deficit, salinity and cold stress.
- Research using a novel mutation-based strategy to increase seed yield in canola that will enable breeders to develop adapted canola varieties with significantly increased grain size and yield.
- Research using molecular markers to develop canola varieties, adapted to Australian environments, that have resistance to blackleg, increased shattering tolerance and tolerance to drought greater than that of current commercial varieties.
- Proof-of-concept studies examining the potential for transferring staygreen genes from sorghum to other cereals.
- Research to develop, and deliver to all Australian wheat breeders, molecular selection tools for key genes involved in transpiration efficiency in wheat.
- Research on the manipulation of wheat photosynthesis to increase grain yield in order to develop new wheat cultivars with water-limited yield potential increases beyond current theoretical limits.



Chris Moloney harvests his crop near Junee, NSW. Photo: Paul Jones

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 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.

The following sections describe some highlights of RD&E investments that addressed this theme in 2012–13.

Integrated weed management

The GRDC funded a series of workshops for growers and advisers to meet their information needs in relation to integrated weed management, covering issues such as the causes of herbicide resistance, possible alternative weed management tactics, and the role of the Australian Glyphosate Sustainability Working Group. Between 2008 and 2013, the project delivered almost 100 workshops around Australia, receiving very positive feedback from participants.

In addition, information on integrated weed management was extended to growers online through the WeedSmart website, the GRDC's Weedlinks page and the Australian Glyphosate Sustainability Working Group's website, and

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through information products such as videos, papers, posters and press releases. A training resource for advisers, *Integrated Weed Management in Australian Cropping Systems*, first published in 2006, was extensively revised; the new edition will be released in hard copy and online in late 2013.

Insecticides

Among more than 40 recognised invertebrate pests that damage crops at emergence, several mite species (balaustium mite, blue oat mite, bryobia mite and redlegged earth mite) and the lucerne flea are particularly important. GRDC-supported research has recently:

- studied genetic differences in redlegged earth mite populations to predict the likelihood of the spread of resistance and the effectiveness of localised management actions
- conducted field trials to assess economic thresholds for damage caused by redlegged earth mite in canola and wheat and to develop a simple sampling method that growers can use to determine mite numbers in a canola crop
- identified several pesticides that are effective against balaustium mite, for which no chemical controls are currently registered.



Mandalotus weevil is an emerging pest for canola growers in the Southern Region. Photo: Kym Perry, SARDI

Diamondback moth is a major episodic pest of canola and can rapidly develop insecticide resistance. The small number of effective insecticides registered for controlling the moth in canola makes good control difficult and exacerbates the resistance problem. GRDC-supported projects have generated the necessary data for the registration of several new, effective insecticides for the control of diamondback moth.

Mandalotus weevil is an emerging pest of established canola, pulse and cereal crops, for which there are limited effective controls. With GRDC support, researchers are studying the distribution and life cycles of the weevil and trialling various regimes for its control using broad-spectrum pesticides. Although a lot remains to be learned about this relatively new pest, the project has delivered advice on the performance of different seed treatments, sprays and sowing strategies.

Green peach aphid colonises and spreads viral diseases in pulse crops. The GRDC is supporting research to develop a program to monitor insecticide resistance in green peach aphid across all Australian grain-growing regions. The project will also develop new baseline data on aphid species' resistance to four main classes of insecticides: organophosphates, synthetic pyrethroids, carbamates and neo-nicotinoids. The results will inform the development of new resistance management guidelines for several key aphid species and a range of other pests, such as blue oat mite, cabbage white butterfly, green mirid, lucerne flea and onion thrips.

Integrated pest management

The potential for integrated pest management approaches to be more effective and economical than insecticide use alone has been well demonstrated, but it is not always well understood. This is partly because the impacts of pests on crop production have not been well quantified, and traditional insecticide applications still deliver adequate controls for most pests. Because the costs and risks of over-reliance on insecticides are not conspicuous, integrated pest management is struggling to supplant traditional methods.

The GRDC is supporting training for growers and advisers to demonstrate that alternative control methods may be as effective as current practices, with equal or reduced risk. Workshops to increase growers' knowledge of, and confidence in, integrated pest management strategies were delivered in the Northern and Southern regions in 2012–13. The workshops were complemented by a website that provides a convenient point of access to a range of integrated pest management reference materials, including websites hosted by government agencies and downloadable manuals tailored for the Northern and Western regions.

The GRDC also supports the online risk management tool PestFax Map, which allows users to access more than 9,000 reports of pest and disease events in Western Australia, sorted by host and pest and located through an interactive map. The tool, which is hosted by the Department of Agriculture and Food Western Australia, has been well utilised. In 2012, 12,367 maps were generated by 914 users—approximately a threefold increase in both maps and users compared to the totals for the previous year. In 2012–13, versions of the tool were developed and launched for South Australia (hosted by the South Australian Research and Development Institute) and New South Wales and Victoria (hosted by cesar Pty Ltd).

Fungicides

Fungal diseases are the major preventable cause of losses to Australian grain producers. When genetic resistance is not adequate, growers rely on fungicides to protect their crops.



Powdery mildew causes costly losses to the barley industry in WA. Photo: Harry Zhang, Curtin University

Under current regulations, only two types of fungicide are permitted for use on cereals and legumes, leaving the industry highly exposed to the emergence of fungicide resistance. For example, it is estimated that losses to barley powdery mildew have cost Western Australian growers about \$100 million per year since resistance to demethylation inhibitor fungicides emerged in 2009.

The GRDC is supporting research to establish reliable benchmarks for fungicide resistance in Australian grain crops, identify the genetic mutations that contribute to resistance, and test pesticide use strategies—such as low doses, mixes and alternations—to combat resistance. Drawing on the findings of that work, another GRDC-funded project is investigating a wide range of commercial fungicides with potential for use in cereal and legume crops in Australia.

In cereals, the highest priority is powdery mildews, which have been shown to display resistance more quickly than other pathogens. For these, a range of new generation actives will be assessed. The project will also test chemicals that show promise against necrotrophic pathogens (such as net-blotch, scald, stagonospora and tan spot) and rusts in cereals.

The diseases that cause most damage in legumes, ascochyta and botrytis, are known to be sensitive to well-established fungicides not currently registered in Australia. For these, products in the triazole and strobilurin groups will be assessed for possible Australian registration.

The project aims to deliver efficacy data packages that will form the basis of applications, through collaboration with registrants, to the Australian Pesticides and Veterinary Medicines Authority for registration for use in Australia. A wider range of fungicides will enable growers to target their chemical

controls more precisely and to mix and alternate products with different modes of action, thus reducing the risk of resistance.

Crown rot management

Crown rot is a major disease pest in wheat and barley production, particularly in the Northern Region. In 2009, GRDC-supported research showed that crown rot was costing the Australian wheat and barley industries collectively around \$97 million each year. Fungicides are not currently an effective control option for crown rot, and the length of time that infective stubbles survive in paddocks means that crop rotation is often not sufficient to manage the disease adequately.

As a first step to designing more effective crop protection strategies, the GRDC is supporting research to analyse the crown rot pathogen *Fusarium pseudograminearum* and improve understanding of how the virulence of the pathogen has evolved. In 2012–13, the project identified the genome sequence of *F. pseudograminearum* and made it freely available online so it could be accessed by researchers in Australia and overseas. Work has begun to identify which genes make the pathogen virulent, which in turn will help to uncover how the pathogen manipulates the host plant to cause disease.

The GRDC is also supporting projects to develop wheat germplasm that is more crown rot tolerant or resistant. The research is testing lines based on elite bread wheat varieties adapted to each of the grain-growing regions, using a combination of molecular marker technology and conventional crossing strategies. Work is also being done to incorporate resistance into durum wheat from wild durum. The projects have successfully



Crown rot disease in wheat. Photo: GRDC

produced varieties with high yield under crown rot pressure and low symptom development, and made the genetic materials available to commercial wheat breeding companies for continued evaluation and selection.

Blackleg management

Blackleg is the most damaging pathogen of canola in Australia and is capable of causing significant losses in susceptible varieties. Blackleg-resistant cultivars are available, but the blackleg fungus is adept at overcoming resistance. Strategic crop management is the best option to avoid the breakdown of resistance and exposure to significant losses.

The GRDC is supporting work to provide growers with the best options for blackleg management by:

- monitoring the severity and virulence of fungal populations at 36 sites around Australia
- mapping and analysing the genetic basis of virulence in the blackleg pathogen *Leptosphaeria maculans*
- identifying the genetic basis of resistance in canola cultivars
- assessing the efficacy of fungicides and treatment regimes

- developing a national plan and national advice on disease management, and delivering it to growers and advisers.

GRDC-supported research has developed effective screening techniques to determine blackleg resistance in seedlings and adult plants. By combining the results, researchers were able to classify all commercial cultivars into seven groups for use in planning rotations to optimise resistance. All new cultivars will be screened and classified before being released to growers.

The information on resistance groups was made available to growers in the *Blackleg Management Guide* released in July 2012. The guide also contains information on determining the risk of blackleg; monitoring the crop to determine yield losses; best cultural practices; cultivar resistance ratings (with and without fungicide seed treatment); and recommendations on the use of foliar fungicides.

Summaries of all blackleg monitoring data were released on the NVT website, including information about which resistance groups have higher levels of blackleg infection and should be grown with caution in 2013 in particular regions.



The effects of blackleg are very different in resistant (left) and non-resistant (right) canola cultivars. Photo: Ray Cowley

Case study

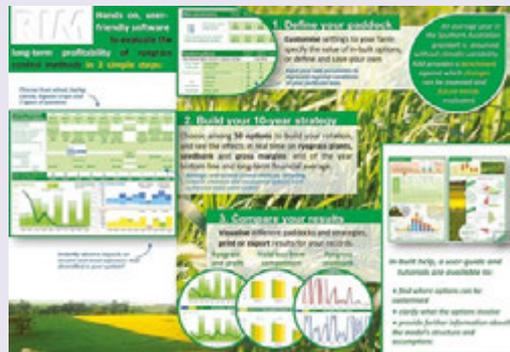
Herbicide resistance

The GRDC supports the Australian Herbicide Resistance Initiative, which works with growers in several sectors of the agricultural industry to develop new knowledge, tools and techniques to manage herbicide resistance. The initiative has been surveying and monitoring resistance in weed populations across the Western Australian grain belt since 1998. The most recent survey was substantially completed in 2012–13. Samples of barley grass, brome grass, ryegrass and wild radish from more than 460 sites were screened for resistance to a range of herbicide chemistries; screening of wild oat is ongoing. The results will be used in developing simulation models and guidelines for herbicide use.

Another GRDC-supported project is working with growers in South Australia, Victoria and Western Australia to better understand the evolution of resistance to glyphosate, paraquat and Group I herbicides. The loss of these three groups of herbicides would mean substantial costs to growers in introducing alternative management strategies, reducing areas under no-till agriculture and using less profitable rotations. Studies of weeds that have shown resistance, such as barnyard grass, brome grass, liverseed grass, ryegrass and wild radish, and summer fallow weeds such as fleabane and sowthistle, will be used to identify the risks of resistance appearing in other weed species and to design field trials to test ideas for better managing resistance.

An upgrade of the Ryegrass Integrated Management (RIM) software was completed in 2012–13, with GRDC support. Designed for growers and advisers in the Southern Region, the free software allows users to evaluate the short- and long-term profitability of ryegrass control methods by testing crop rotation and weed management scenarios for a 10-year period.

WeedSmart, a national program to equip growers and advisers with the tools they need to fight herbicide resistance, was launched at the Global Herbicide Resistance Challenge conference held in Perth in February 2013. Driven by the grains industry, with support from the GRDC, the program makes the best available information conveniently accessible through a website, electronic newsletter and phone app.



Theme 3 performance overview

Table 16 shows the investment budget and results against performance targets for Theme 3 in 2012–13, in the context of the outcomes defined in the Strategic R&D Plan 2012–17. Table 17 summarises the GRDC's performance against the relevant indicators in the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

Table 16: Theme 3 performance against GRDC strategic measures

Theme 3—Protecting your crop	
Aspirational outcome (10+ years)	
<i>Australian grain growers managing their farms to maximise profit and reduce risk by adopting effective, sustainable and efficient control of weeds, pests and diseases.</i>	
Intermediate outcomes (5 years)	
Effective, sustainable and efficient management of weeds —Growers use a combination of new genetic, biological, cultural and chemical weed management tools to reduce crop losses and minimise control costs.	
Effective, sustainable and efficient management of vertebrate and invertebrate pests —Growers use a combination of new genetic, biological, cultural and chemical tools to reduce crop losses and minimise control costs of vertebrate and invertebrate pests.	
Effective, sustainable and efficient management of cereal rusts —Growers use a combination of new genetic, cultural and fungicide management tools to reduce crop losses and minimise control costs of cereal rusts.	
Effective, sustainable and efficient management of cereal (non-rust), pulse and oilseed fungal pathogens —Growers use a combination of new genetic, cultural and fungicide management tools to control cereal (non-rust), pulse and oilseed root and foliar fungal diseases.	
Effective, sustainable and efficient management of nematodes —New genetic, biological and cultural management tools for the control of nematodes are delivered.	
Effective, sustainable and efficient management of viruses and bacteria —Growers use a combination of new genetic and cultural management tools for the control of viruses and bacteria.	
Biosecurity and pesticide stewardship —Effective biosecurity and science-based support is available for pesticide and genetic technology stewardship.	
Investment budget for 2012–13 \$39.26 million	
Performance for 2012–13	
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	
Practice changes and key metrics	
<ul style="list-style-type: none"> • A greater proportion of growers and their advisers monitor crops for pests, weeds and diseases. • Breeders and pre-breeders use available genetic diversity for resistance and tolerance breeding. • Growers and their advisers cost-effectively manage pests, weeds and diseases. • A greater proportion of growers and their advisers use practices to increase pesticide longevity and reduce the risk of resistance. <ul style="list-style-type: none"> – More than 70% of growers are aware of integrated weed, pest or disease management practices, and 50% use some form of integrated management methods on their farm. 	
Targets	Achievements
New and cost-effective control methods for weeds, pests and diseases, including new chemistries and non-chemical control tactics, are delivered to the grains industry.	<p>New herbicide data packages for the control of ryegrass, summer grasses and fleabane were submitted for registration, in collaboration with manufacturers.</p> <p>Phenoxy herbicides were registered for control of fleabane and minor use permits were issued for control of feathertop Rhodes grass.</p> <p>An emergency permit was delivered for fungicide-resistant barley powdery mildew in Western Australia.</p> <p>The Harrington Weed Seed Destructor was commercially released to industry.</p>

Table 16: Theme 3 performance against GRDC strategic measures *(continued)*

Performance for 2012–13	
Targets	Achievements
Regionally validated information is readily available to growers and advisers about the benefits (both financial and from avoidance of resistance to chemicals) of integrated methods for control of weeds, pests and diseases.	<p>Knowledge of harvest weed seed management was improved.</p> <p>Cultural management of blackleg in canola through variety selection was improved.</p> <p>Tools to determine benefits of integrated weed management were delivered with updates to the Ryegrass Integrated Management (RIM) software.</p>
Increased number of growers are adopting integrated control methods.	Results of the 2012 Grower Survey showed improvements in the proportion of growers who changed practices directly or indirectly as a result of GRDC information, activities or supported projects in relation to protecting crops from weeds (57%), pests (48%) and diseases (59%).
Growers have the skills to monitor crops and correctly identify weeds, pests and diseases, as well as beneficial organisms; determine whether or not control is warranted; and select the most suitable control method for their situation.	Training workshops in weed, pest and disease management, including identification methods, were delivered to growers and advisers.
Breeding programs efficiently use the available genetic diversity to improve varietal resistance to weeds, pests and diseases.	Improved molecular diagnostics and field calibration tools for the management of soil-borne disease were delivered.
Growers reduce their planting of varieties known to be susceptible to pests and diseases, including to disease vectors.	Results of the 2012 Grower Survey showed that 87% of growers were selecting varieties for pest and disease resistance.
Periodic compilations of industry data demonstrate that cost savings are being achieved in the control of weeds, pests and diseases.	A new management structure for the Australian Cereal Rust Control Program was established, to ensure greater uptake of genetic material by breeders.
The GRDC and other industry participants use these compilations to guide investment decisions.	A report on the economic impacts of invertebrate pests was published, building on reports on crop disease impacts used by the GRDC and industry.
Biosecurity and pesticide stewardship	
Practice changes and key metrics	
<ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> – <i>At least 50% of growers undertake on-farm practices to maintain or improve their biosecurity.</i> • Breeders and pre-breeders use available genetic diversity to deliver varieties resistant to high-risk biosecurity threats. • 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. <ul style="list-style-type: none"> – <i>90% of growers undertake activities to delay the onset of or manage herbicide resistance in weed populations.</i> 	
Targets	Achievements
Growers are aware of assessments of biosecurity threats to the grains industry, adopt on-farm biosecurity measures, and know what to do in the event of an incursion.	<p>Contingency plans for 18 exotic pests and one exotic weed were prepared and/or reviewed.</p> <p>Grain biosecurity risk mitigation material was audited.</p>
Pre-breeding programs are developing germplasm with a high resistance to identified high-risk biosecurity threats.	<p>A project to raise and promote biosecurity awareness among growers and consultants was conducted in conjunction with the Grains Farm Biosecurity Program.</p> <p>Surveillance plans to capture data from general surveillance for early detection of Russian wheat aphid, Hessian fly and Sunn pest, including options for pre-breeding to address these biosecurity threats, were developed.</p>

Table 17: Theme 3 performance against portfolio budget statements measures for 2012–13

Key performance indicator	Target	Result
Growers and advisers are aware of and use integrated weed, pest or disease management practices.	70% aware, 50% use	Results of the 2012 Grower Survey showed that: <ul style="list-style-type: none"> • 72% of growers were aware of and 45% of growers used integrated weed management practices • 73% of growers were aware of and 40% of growers used integrated pest management practices • 58% of growers were aware of and 29% of growers used integrated disease management practices.
Growers undertake on-farm practices to maintain or improve their biosecurity.	50%	Results of the 2012 GRDC Grower Survey showed that 91% of growers were practising on-farm hygiene to reduce the spread of weeds, pests or disease.

What's in the RD&E pipeline for 2013–14?

- Work to ensure that the Australian grains industry has in place an appropriate pesticide containment response to rapidly and effectively respond to the top 15 exotic high-priority plant pests while maintaining grain yield and market access.
- Research to manage on-farm biosecurity risks in wheat and pulses through pre-emptive breeding of elite varieties with genetic resistance to emergency plant pests, thereby mitigating the potential economic impact of high-risk incursions.
- Research to develop and commercialise metarhizium-based biopesticides for the cost-effective and sustainable control of aphids in canola and other sucking insects in pulses.
- Research to reduce the economic impact of herbicide resistance on the grains industry through the development of new, non-chemical weed control strategies.
- A project to enable growers to cost-effectively manage crown rot in cereal crops and its impacts on production, through the delivery of new tools in combination with variety resistance and improved cultural practices.
- Work to commercialise a new biopesticide for the control of pythium and rhizoctonia, resulting in a reduction in soil-borne disease damage and a consequent yield increase.



Strategic application of fertiliser, informed by soil test data, improves productivity and profitability. Photo: Brad Collis

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.

The following sections describe some highlights of RD&E investments that addressed this theme in 2012–13.

Lower losses from lodging

Wheat grown under irrigation in the Northern Region is vulnerable to lodging—damage to a plant when the effects of a heavy canopy, wet soil and wind combine to buckle the stem or lever the roots from the ground. Yield losses caused by lodging can severely reduce both the efficient use of water and nitrogen and the total yield; in 2008, farm-gate losses due to lodging were conservatively estimated at \$20 million across the region.

The GRDC is supporting research to identify agronomic practices which, in combination with lodging-resistant cultivars, will help growers to eliminate lodging and significantly increase the average yields of their wheat crops.

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Lodging affects a susceptible wheat variety in a trial at Gatton, Qld. Photo: Allan Peake

In 2012–13, field trials of more than 40 commercial wheat varieties made good progress towards achieving these objectives, despite challenging climatic conditions that reduced the effectiveness of some experiments. In the first year of trials:

- varieties that were highly susceptible to lodging tended to be so across locations and seasons

- some varieties, at the same location and under the same irrigation schedule, responded very differently to alternative agronomic management treatments
- managing the growth rate of the canopy by applying less nitrogen at sowing and then reapplying nitrogen during plant growth significantly improved yield, even in lodging-susceptible varieties
- the use of plant growth regulators showed an increase in yield under the high nitrogen at sowing treatment but had no effect on yield under the delayed nitrogen treatment.

As well as supporting the belief that best practice agronomic management could virtually eliminate losses due to lodging, some of the trials conducted in 2012 indicated the potential for a significant additional increase in the average yield of irrigated wheat in the Northern Region. The trials are ongoing, and recommendations for improved practices are expected to be available for growers in early 2014.

Benefits of broadleaf species

Including broadleaf species such as brassicas and legumes in the cropping sequence for cereals can help to reduce the incidence of weeds, pests and diseases and improve soil fertility. However, across the Southern Region, the area sown to canola or pulses has dramatically declined in recent years.

Although seasonal considerations such as low rainfall may have contributed, it seems that the main cause of this trend has been the perception that broadleaf options are not as profitable as cereals. This focus on immediate returns may overlook the potential longer term benefits of the broadleaf phase for the performance of subsequent crops. The GRDC is supporting research to re-evaluate the full value of integrating broadleaf species in the cereal cropping sequence.

The work is being conducted in conjunction with growers and their advisers across the lower rainfall, high-rainfall and irrigated cropping zones of the Southern Region. By examining various combinations of genotype, environment and management approaches, it aims to produce:

- whole-of-rotation economic analyses that provide information on income stability along



Break crops have a beneficial impact on productivity, profit, weed management and nitrogen supply.
Photo: Emma Leonard

with risk profiles and comparisons of the impacts of various grain price and fertiliser cost scenarios

- extension packages that provide practical guidance to help growers decide when it is best to use broadleaf options, based on soil water, available nitrogen, weeds, disease status and timing, taking into account seasonal conditions and commodity prices.

The work so far has confirmed that break crops have a beneficial impact on productivity, profit, weed management and nitrogen supply. For example:

- between 2010 and 2012, across both dry and wet growing seasons, sequences that included break crops were often more profitable than continuous wheat, and the ratios of profit:input cost for break crops were often higher than those for wheat crops
- growing pulses for brown manure loses money in the year in which they are grown, but achieves excellent grass weed control, high nitrogen inputs and residual carryover of soil water

- a clean fallow and the use of break crops can control ryegrass more cheaply and effectively than the best options available for in-crop control of ryegrass in wheat.

Better fertiliser decisions

Although efficient use of nutrient inputs plays a major role in profitability, grain growers do not always optimise their fertiliser use decisions by following recommendations based on soil testing. Some growers and advisers are sceptical about the ability of soil testing to explain crop response, or about the quality of the soil test–crop response data used.

With support from the GRDC, the Making Better Fertiliser Decisions for Cropping in Australia (BFDC) project is working to address those doubts and equip growers to make the best decisions about nutrient inputs. The project is developing:

- a national database of available soil test–crop response trials undertaken to assess the nitrogen, phosphorus, potassium and sulphur status of soils used for the production of cereal, pulse and oilseed crops
- an online tool, the BFDC Interrogator, through which all data held in the national database can be used in the interpretation of soil test results, based on criteria such as cropping region or soil type
- training resources and publications to make the BFDC soil test–crop response calibration data available to the grains and fertiliser industries.

The national database and the decision-making tool went online in July 2012 and are being continually updated as results of fertiliser trials become available. By the end of 2012, the database held the results of approximately 5,200 experiments.

Importantly, the database has been recognised as the 'best available' dataset in Australia by Fertcare®, the quality assurance and accreditation program endorsed by the Australian Fertiliser Services Association and Fertilizer Australia.

The GRDC is also supporting research to develop new soil test–crop response data for areas with particular nutrient issues. This includes a project to develop improved soil test interpretation guidelines and nutrient management strategies for major crops in the Northern Region, where declines in phosphorus,

sulphur and potassium are increasing the need to strategically apply fertiliser to improve productivity and water use efficiency. During 2012–13, the project conducted field and glasshouse trials and exchanged information with growers and advisers at industry updates and field days, as well as providing information for a GRDC fact sheet on phosphorus management.



The BFDC Interrogator allows users to conduct detailed searches of the extensive national database. Photo: Simon Speirs, NSW Department of Primary Industries

Solutions for non-wetting soils

Across the Southern and Western regions, up to 10 million hectares of soils are water-repellent (non-wetting) or at risk of becoming so. Water repellence causes uneven water filtration, which results in poor establishment of crops and pastures and reduces the efficiency of their water and nutrient use. It also has longer term implications for productivity: it limits the effectiveness of weed control, which in turn contributes to the development of herbicide resistance, and it increases the risk of surface soil erosion. Research has shown that effective management of soil water repellence can increase grain crop yields by as much as 100 percent.

The GRDC is supporting research to develop effective management strategies for water repellence across several agroecological regions and soil types in South Australia and Western Australia. In 2012–13, this work included:

- a critical review of established approaches, taking into account published and unpublished literature and grower knowledge
- studies of the effects—on the paddock and the plant—of stubble and tillage management regimes; sowing tools and techniques; soil-wetting agents; and soil inversion and clay spreading
- communication with growers and their advisers, through grower updates, forums and field days and a dedicated website, to share experiences of existing practices and spread new knowledge.

By combining growers' experience and previous work with new research, the project is identifying areas with high potential for the development of improved agronomic practices. For example, informed by growers' observations that plants emerge poorly in dry-sown paddocks, research has confirmed that disturbing a non-wetting soil while it is dry can worsen its water repellency. Laboratory work is continuing to determine the mechanisms behind this effect, while field tests are underway to explore ways of overcoming it.

The project will deliver recommendations on both short-term and longer term approaches to improve productivity on non-wetting soils and ameliorate water repellency. As well as economic and environmental benefits for Australian growers, the outcomes may have benefits for agricultural production around the world.



Inverting the topsoil through mouldboard ploughing can be an effective management option for non-wetting soils.
Photo: Evan Collis

Theme 4 performance overview

Table 18 shows the investment budget and results against performance targets for Theme 4 in 2012–13, in the context of the outcomes defined in the Strategic R&D Plan 2012–17. Table 19 summarises the GRDC’s performance against the relevant indicators in the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

Table 18: Theme 4 performance against GRDC strategic measures

Theme 4—Advancing profitable farming systems	
Aspirational outcome (10+ years)	
<i>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.</i>	
Intermediate outcomes (5 years)	
<i>Knowing what is important (key business drivers)</i> —Identification and understanding of the opportunities, risks and potential impacts of key farming practices in each agroecological zone is improved.	
<i>Planning strategically (building system benefits and rotations)</i> —Growers adopt integrated management of opportunities and constraints to increase profit and minimise risk across seasons (above the five-year rolling average).	
<i>Responding tactically (individual crop agronomy)</i> —Gross margin generated from the major crops in each agroecological zone is increased.	
Investment budget for 2012–13 \$29.75 million	
Performance for 2012–13	
<i>Knowing what is important (key business drivers)</i>	
Practice changes and key metrics	
<ul style="list-style-type: none"> Information is available in each GRDC agroecological zone about the main opportunities, constraints, and risks to farming systems. <ul style="list-style-type: none"> <i>The GRDC receives information at least annually via the Regional panels.</i> 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 greater proportion of growers and their advisers use information and tools to identify and rank constraints and opportunities to increase profit. <ul style="list-style-type: none"> <i>70% of growers place a high importance on the use of decision tools to assist them with strategic or tactical decision-making.</i> 	
Targets	Achievements
Data about the key opportunities, constraints and risks to profitable farming systems is available for each GRDC agroecological zone.	Technical capacity to collect, store, analyse and report farm business data was developed.
Validated tools are available to enable growers and advisers to assess and rank opportunities, constraints and risks, to assist long-term planning of enterprises and farming systems, and to benchmark crop and farm performance.	The Better Fertiliser Decisions for Cropping Systems project launched an online database and a decision-making tool for growers, the BFDC Interrogator.
Data is available showing the changes in profit, cash receipts, input costs and other financial indicators being achieved by growers who have adopted the strategic and tactical optimisation of their farming system.	A suite of grower fact sheets and farm business management newsletters was delivered, focusing on issues relevant to growers such as analysing enterprise risk; income volatility and risk in mixed farming; and business decision-making.

Table 18: Theme 4 performance against GRDC strategic measures *(continued)*

Performance for 2012–13	
<i>Planning strategically (building system benefits and rotations)</i>	
Practice changes and key metrics	
<ul style="list-style-type: none"> A greater proportion of growers and their advisers are aware of the actual and potential impacts of their management on the farming systems across seasons and across the farm, based on regionally validated data as well as their own records. 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. <ul style="list-style-type: none"> More than 25% of growers have developed a whole-farm business plan which takes account of strategic opportunities, constraints and risks. Effective management practices for opportunities, constraints and risks are developed, validated and demonstrated in each agroecological zone. 	
Targets	Achievements
Increased number of growers use their knowledge of the cross-season effects of management practices to optimise their cropping system for both opportunities and constraints (for example, to improve long-term water use and nutrient use efficiencies, or to control weeds, pests and diseases).	Results of the 2012 Grower Survey showed that: <ul style="list-style-type: none"> 61% of growers had grown pulses in the previous five years, ranging from 56% in New South Wales to 71% in Queensland. 62% of growers had adopted industry-recognised best practice, with 32% saying their adoption decision was at least partially due to GRDC information, activities or supported projects.
Strategic decisions and practices are tested, validated and demonstrated in each agroecological zone, and captured in regionally relevant best management practice publications.	Master classes, benchmarking and national workshops on water use efficiency were conducted. Analyses to gauge the water use efficiency impacts of interventions at a whole-farm scale were completed.
<i>Responding tactically (individual crop agronomy)</i>	
Practice changes and key metrics	
<ul style="list-style-type: none"> An increased proportion of growers use crop-specific best management practices to optimise their tactical (within season) agronomy for each individual crop. Growers use improved strategies to cost-effectively acquire crop inputs. 	
Targets	Achievements
Annual, crop-specific decisions and practices are tested, validated and demonstrated in each agroecological zone, and captured in regionally relevant best management practice publications.	The <i>Wheat Variety Guide for WA 2013</i> was produced and delivered to over 6,500 industry representatives through the GRDC's grower direct mail service. Timely information to improve growers' skills in variety selection and management was delivered through crop updates and grower field days.

Table 19: Theme 4 performance against portfolio budget statements measures for 2012–13

Key performance indicator	Target	Result
Growers place a high importance on the use of decision tools to assist them with strategic or tactical decision-making.	70%	Results of the 2012 Grower Survey showed that 75% of growers placed high importance on using decision support tools for running their farming enterprises.
Growers have a whole-farm business plan which takes account of strategic opportunities, constraints and risks.	25%	Results of the 2012 Grower Survey showed that 49% of growers had formal agronomic plans for their farms.

What's in the RD&E pipeline for 2013–14?

Research seeking ways to:

- maintain profitable farming systems with retained stubble
- improve delivery of information on soil fertility and nutrition
- measure and monitor soil water in the Northern and Western regions
- develop profitable break crops for the Western Region.

Work to quantify and reduce the gap between actual and potential yields for wheat in key agroecological zones.

The development of decision support tools to assist Southern Region barley growers to select barley cultivars and management practices suited to their business structures and regional market requirements.



Luke Arbuckle takes advantage of soil moisture from flooding in Talwood, Qld. Photo: Clarisa Collis

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 assists growers, across the industry and as individual producers, to demonstrate that they are using chemicals and fertiliser wisely and caring for the land.

The following sections describe some highlights of RD&E investments that addressed this theme in 2012–13.

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Strategic tillage

Reduced tillage, along with other conservation farming practices such as stubble retention and opportunistic crop rotations, has well-demonstrated benefits for cropping systems. However, extended periods of reduced tillage can cause a build-up of weeds and pests and have negative effects on soil health, such as:

- favouring soil-borne diseases around the roots of some crop varieties
- leaving lime on the surface, where it has little benefit in counteracting soil acidity
- causing stratification of nutrients near the surface, where they are less accessible to plants
- compounding the effects of compaction by livestock.

The GRDC is supporting two projects to provide growers with the best possible information on which to base their decisions to till or not till.

One project, based in the Northern Region, is investigating whether strategic tillage undoes the long-term soil improvement achieved under no-till systems. The research is being conducted on properties with long-term no-till farming systems at five locations in New South Wales and Queensland.

Early findings showed that one-time tillage significantly reduced the densities of common in-crop weeds and tended to increase crop yields, although not significantly. Conversely, tillage treatments generally slightly lowered soil density, soil moisture prior to seeding, and the quantities of soil organic carbon and available phosphorus in the top layer of soil.

The second project, based in the Southern Region, is examining whether the agronomic and economic benefits of strategic tillage may exceed any agronomic costs caused by damage to soil structure. Based at a CSIRO trial site at Harden, New South Wales, the project also involves test sites on three properties with contrasting soil types and agronomic circumstances.

In initial observations across all sites, tillage had a positive impact on the production of dry matter—although this did not translate into significant yield improvements—and soil chemical properties were generally less stratified. Some soil physical properties were adversely affected, however, indicating increased susceptibility to erosion and compaction.

Both projects are drawing on the experiences of growers and providing opportunities for growers and advisers to observe some of the trials in action. Growers and advisers are also being kept in touch with progress through GRDC updates and other industry forums.

Pest-suppressive landscapes

Some landscapes are less prone to invertebrate pest infestations than others, suggesting that there are features of landscapes that may be managed as part of an integrated approach to managing pests. The GRDC is supporting a project to study the role of remnant native vegetation in natural pest suppression.

Field experiments were conducted in areas of the Darling Downs, Queensland, the southern mixed farming region of New South Wales, and the Stirling Range, Western Australia. The research found key differences between regions, which may have implications for management strategies. For example, the diversity of beneficial species per site is highest in pasture and lucerne in New South Wales, while in Western Australia it is highest in remnant native vegetation. Beneficial diversity

is also high in remnant native vegetation in Queensland, but in that state seasonal variations are more evident and winter crops have higher diversity than summer crops.

The project was also able to make some general observations in 2012–13:

- the management of weeds in remnant native vegetation is crucial to reducing pest populations
- planting native species may encourage beneficial insects
- pest damage rapidly increases once native vegetation habitat drops below 10 percent of the farm area
- while pests move from native vegetation into crops at the start of the season, probably from weed patches, beneficial insects also move from the native vegetation into the crop early in the season
- a smaller total area of undisturbed habitat is required for effective pest suppression if there are clusters of undisturbed habitat and any insecticide use is low-frequency and targeted, not broad spectrum.

Drawing on the field work, the researchers have developed computer models to simulate features and scenarios that result in pest-suppressive landscapes, and to test the effectiveness of field, farm, and landscape scale options for integrated pest management. The results are expected to be delivered to growers in 2013–14 in the form of new integrated pest management guidelines and field day and workshop presentations.

Disease-suppressive soils

Surveys of the incidence and severity of cereal root disease in Western Australia were conducted during the early 1980s and repeated from 2006 to 2008. Comparison of the results of the two surveys shows that the incidence and/or severity of root diseases increased significantly.

The later survey shows that the highest levels of all root diseases in Western Australia occur in the southern, high-rainfall zone of the state. Effective methods of controlling root diseases are necessary for the grains industry in that region to achieve its best possible yields and fulfil its potential for expansion.



Soil microbiologist Pauline Mele from La Trobe University, Vic., looks for soil microorganisms that suppress disease in grain crops. Photo: Department of Primary Industries, Vic.

In Western Australian crop production, the suite of cultural management options for the four major root diseases—rhizoctonia, take-all, root lesion nematodes and crown rot—is limited. Growers and agronomists require further ways to integrate disease management with other paddock management requirements. Biological control through disease-suppressive soils could be one solution.

A suppressive soil is one in which a disease either does not establish or establishes but is not severe, despite the presence of the pathogen, the host plant and favourable conditions. The suppressive quality is determined by the balance of beneficial organisms in the soil, which in turn depends on the soil's moisture, temperature and carbon:nitrogen ratio. Improving the suppressive ability of a soil takes time, but biological control can be more effective than fungicide use and involve lower economic, environmental and health costs.

The GRDC is supporting research to identify and characterise disease-suppressive soils in the

southern part of the Western Region, based on a survey of soil samples from more than 200 sites. Between 2010 and 2012, 42 sites were identified as potentially suppressive to one or more of the four major root diseases. Work is continuing to refine the methods for assessing disease suppression, validate suppression in the promising samples, and identify factors which may contribute to the development of suppression.

Soil water

Knowledge of soil water—a soil's water-holding capacity and potential for drainage and runoff, and the quantity of water stored in the soil at seasonal decision points such as sowing time—is a valuable decision-making tool for grain growers. Effective management of soil water can have significant benefits for yield and reduce the costs and environmental impacts associated with fertiliser use. The GRDC is supporting research to help growers access and apply information on their soil water resources.

A recently completed project assessed current technologies for characterising and monitoring soil water resources on farm, including fixed sensor devices, mobile electromagnetic devices and modelling. The conclusion was that none of the available tools provides a complete solution for all management strategies and soil types. For example, fixed probes allow for continuous logging, but provide data for only a very small area. Portable electromagnetic devices are more accurate than fixed devices for soils that are prone to swelling and shrinking, but their accuracy can be strongly affected by soil salinity.

To simplify the task of converting data collected in the field into usable soil profiles, the researchers developed a free online tool, Soil Water Express. Soil Water Express converts electronic sensor output to meaningful soil water information and uses details of the soil's texture, salinity and bulk density to predict its plant-available water content.

The research also found that simulation of the water balance via APSIM is likely to be as accurate as direct measurement. The recent project added information on the water-holding capacity of an additional 245 soils to the ApSoil database of APSIM, bringing the total to around 930. The Yield Prophet® interface accesses the power of APSIM to enable growers to test crop management scenarios based on their own soil data.



The SoilMapp app for mobile devices efficiently delivers information in the field. Photo: CSIRO

The ApSoil database also underpins SoilMapp, an app developed through the project and released for Apple devices in 2012–13. SoilMapp uses GPS technology to give growers and advisers instant access to information on soils in specific locations, and is available for free download.

Helping growers and advisers to understand and benefit from techniques of soil management was an important part of the project, which delivered information through industry events as well as specialist training for more than 130 agronomists.

Water quality

Agricultural practices can cause soil disturbance, exposure of bare soil and changes in water use patterns which in turn cause erosion and increase sediment and agricultural loads in affected water systems. Deterioration of water quality as a consequence of run-off from agricultural lands has come into focus worldwide as increased demand for food has pushed production into less stable environments and community attitudes have demanded more environmental accountability.

The ability to quantify the water quality signatures of land use and management practices, along with their effects on their environments, is necessary to support effective natural resource management. A reliable method of documenting the effects of land use and management practices on water quality

would help the Australian grains industry to demonstrate how it is meeting or surpassing its environmental objectives, and to understand and address any deficiencies.

The GRDC is supporting a project to quantify the impacts of land management on sediment, nutrient and pesticide loss from grain farms, building on the HowLeaky? decision support software initially developed by Queensland Government researchers. The software assists users to explore the effects of vegetation (including crops, pastures and trees), climates, soil types and management regimes on key aspects of the water balance: evapotranspiration, run-off and deep drainage.

The project has collated the results of more than 130 research studies dealing with hydrology and water quality related to land use and management. Summary reports, datasets and 'best bet' vegetation and soil parameter files for those studies were published on the HowLeaky? website in 2012–13. That information, much of which was previously not publicly available, is now readily accessible for growers and advisers as well as future researchers.

The project is using the data from the previous studies to quantify links between land use, land management and water quality and validate and improve water quality simulation models. The results will be used to develop a version of HowLeaky? that is customised for regional conditions, as well as regional best management practices manuals.

Case study

Climate information

The Managing Climate Variability program helps to equip Australian farmers to manage climate risk and make business decisions through reliable climate forecasts, tools to translate the forecasts into applications, and the necessary knowledge to use forecasting resources effectively. The GRDC is one of the founding partners of the program.

The program and its predecessors have been delivering decision support tools to farmers and advisers for more than 20 years. The program recently drew on the experiences of the designers and the users of those tools to develop a new-generation decision support tool, CliiMate.

CliiMate uses extensive resources of historical and near-real time data to deliver climate and weather information to farmers in a way that suits their particular farm management requirements. The user interface includes analysis tools to answer questions about sowing conditions, heat and cold stress at flowering time, soil water and nitrate levels, comparisons with previous seasons and weather patterns, rainfall, and El Niño indicators.

CliiMate reflects the success of another priority of the Managing Climate Variability program: improving the accuracy of multiweek forecasting. As described in last year's annual report, this project has used the Bureau of Meteorology's Predictive Ocean Atmosphere Model for Australia to replace less effective statistical methods of forecasting rainfall and temperature over periods longer than a week.

Taking advantage of smartphone technology to deliver information to farmers where and when they need it, CliiMate is available as a free phone app for Apple devices. The new app has been very well received: it was downloaded 3,000 times in the first six weeks after its release in December 2012. Versions for Android devices and web browser interfaces became available in March 2013 and can be accessed at www.australianclimate.net.au.



Theme 5 performance overview

Table 20 shows the investment budget and results against performance targets for Theme 5 in 2012–13, in the context of the outcomes defined in the Strategic R&D Plan 2012–17. Table 21 summarises the GRDC’s performance against the relevant indicators in the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

Table 20: Theme 5 performance against GRDC strategic measures

Theme 5—Improving your farm resource base	
<p>Aspirational outcome (10+ years)</p> <p><i>Grain growers are valued for adopting practices that improve regional habitat, soil, water and atmosphere resources in a changing climate.</i></p>	
<p>Intermediate outcomes (5 years)</p> <p>Understanding and adapting to climate variability—Farm business plans provide the flexibility to respond to the risks and opportunities of a changing and variable climate.</p> <p>Improving soil health—Soil health is improved and soil, nutrient and chemical losses are reduced.</p> <p>Managing water use on dryland and irrigated grain farms—Water use efficiency, quality and availability are improved on dryland and irrigated grain farms that manage the risk of off-farm impacts, including soil, nutrient and chemical run-off, and dryland and irrigated salinity.</p> <p>Understanding and valuing biodiversity—Biodiversity is managed on farm for ecosystem services (such as habitat, amenity, pollination and profitability).</p> <p>Communication of sustainable production methods—Markets and the broader community recognise the environmental credentials of grain farm businesses.</p>	
<p>Investment budget for 2012–13</p> <p>\$12.63 million</p>	
Performance for 2012–13	
<p>Understanding and adapting to climate variability</p> <p>Practice changes and key metrics</p> <ul style="list-style-type: none"> • Growers integrate weather data with other resource inputs to predict, plan and assess farm performance. • Growers use improved seasonal forecasts and tools to manage their farm business in response to climate variability. • 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. <ul style="list-style-type: none"> – 60% of growers consider the potential effects of climate change on their farm business when making long-term decisions. • Growers seek information about potential mitigation strategies to reduce on-farm greenhouse gas emissions, and adopt them where feasible. • Researchers incorporate farm-scale data in the improvement of climate and weather modelling. 	
Targets	Achievements
Growers factor into their long-term planning the potential effects of climate change.	Work was undertaken to quantify the impacts of elevated carbon dioxide on grain yield and quality.
A range of farming system options to respond to climate variability and change is developed and tested for each major grain-growing region.	A project examining the benefit-to-cost ratio of a range of adaptive management options in 14 agroecological zones was established.
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.	The Predictive Ocean Atmosphere Model for Australia (POAMA) model was released as the basis of the official Bureau of Meteorology seasonal forecast. The CliMate app was released to provide local climate information for use in tactical decision-making.
Increased number of growers are aware of their farm’s greenhouse gas emissions profile, and are adopting appropriate mitigation strategies.	A series of life cycle analysis pilots to quantify the levels of emissions from grain production were established.
<p>Improving soil health</p> <p>Practice changes and key metrics</p> <ul style="list-style-type: none"> • Growers adopt agronomic practices that improve the chemical, physical and biological health of the soil for sustained productivity. <ul style="list-style-type: none"> – 60% or more of growers undertake activities to improve the condition and productive capacity of their soils. • 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. 	

Table 20: Theme 5 performance against GRDC strategic measures *(continued)*

Performance for 2012–13	
Targets	Achievements
Increased number of growers regularly measure the health (productive capacity) of their soils, and incorporate this information into their land use and cropping decisions.	The website soilquality.org was established to allow growers to benchmark the health of their soils. A baseline survey of grower practice will be undertaken in 2013–14.
Growers are aware of and are adopting management practices that will maintain and improve their soils' productive capacity and minimise losses due to erosion.	The use of nutrient budgeting, precision agriculture, variable rate technology, controlled traffic and no-till cropping is being monitored.
Managing water use on dryland and irrigated grain farms	
Practice changes and key metrics	
<ul style="list-style-type: none"> • Growers manage water quantity and quality on farm to improve efficiency of water use. • Growers implement appropriate and efficient practices that minimise adverse impacts on surface and groundwater quality leaving the farm. <ul style="list-style-type: none"> – At least 65% of growers use nutrient budgeting to better match application with anticipated crop needs. 	
Targets	Achievements
Increased number of growers regularly measure soil moisture to set target yields and determine optimum levels of crop inputs (including irrigation water).	More rapid estimates of plant available water were under development. A water use efficiency initiative established management principles to make better use of available water.
Increased number of growers assess groundwater levels to avoid the risks of waterlogging and salinity.	Results of the 2012 Grower Survey showed that 22% of growers were monitoring the depth to the watertable.
Increased number of growers test the quality of water used on farm (including for stock or for spraying) and of water leaving the farm.	A baseline survey of grower practice will be undertaken in 2013–14.
Understanding and valuing biodiversity	
Practice changes and key metrics	
<ul style="list-style-type: none"> • Growers and their advisers recognise the potential benefits of biodiversity in the landscape to their farming systems. • 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). 	
Targets	Achievements
Growers develop and adopt vegetation management plans for their farm to assist crop production (e.g. through maintaining beneficial insects or use of windbreaks), or to access additional sources of farm income (e.g. from agroforestry or carbon farming).	Projects examined how vegetation management can assist in improving beneficial insect numbers on farm.
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.	A baseline survey of grower practice will be undertaken in 2013–14.
Communication of sustainable production methods	
Practice changes and key metrics	
<ul style="list-style-type: none"> • Growers recognise themselves as sustainable food producers rather than bulk commodity producers. • 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. 	
Targets	Achievements
Increased number of growers adopt some form of quality assurance, environmental management system or other stewardship scheme to assist them in meeting market requirements, enhance their recognition as producers of quality products, and meet community expectations of sustainable land use.	A baseline survey of grower practice will be undertaken in 2013.
Growers are aware of and actively participate in catchment management plans and programs.	A baseline survey of grower practice will be undertaken in 2013.

Table 21: Theme 5 performance against portfolio budget statements measures for 2012–13

Key performance indicator	Target	Result
Growers consider the potential effects of climate change on their farm business when making long-term decisions.	60%	Results of the 2012 Grower Survey showed that 52% 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.	60%	Results of the 2012 Grower Survey showed an increase in the proportion of growers improving soil condition as indicated by increased use of lime (50%), gypsum (51%) and controlled traffic (29%)
Growers use nutrient budgeting to better match application with anticipated crop needs.	65%	Results of the 2012 Grower Survey showed an increase in the proportion of growers using nutrient budgeting, to 56% from 50% in 2010.

What's in the RD&E pipeline for 2013–14?

Research to increase growers' and advisers' confidence in:

- diagnosing surface and subsoil acidity limitations to crop growth
- using a range of strategies to ameliorate subsoil acidity, based on estimates of the risks and returns to liming.

Work to ensure that growers will have continued access to the world's best quality rhizobial and non-rhizobial inoculants along with best practice guidelines for their use.

Research to quantify the effects of soil type, soil moisture, soil temperature, tillage and residue management on herbicide residue levels.

A scoping study to investigate frameworks that would enable the grains industry to be recognised by stakeholders and the wider community for its environmental credentials.



Twin-crop sowing of soybeans and sunflowers in the Northern Region. Photo: Daniel Rodriguez

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.

The following sections describe some highlights of RD&E investments that addressed this theme in 2012–13.

Industry leadership and communication

The GRDC invests in a range of activities aimed at supporting current and potential future members of the Australian grains industry to lead, learn, change, innovate and advance the industry.

Conference support

The GRDC's Grains Industry Conference Support program provides sponsorship assistance to organisations wishing to conduct a conference, workshop or seminar

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that directly benefits the Australian grains industry. In 2012–13, the program supported 30 events across a host of locations, including capital cities and regional centres.

Australian Rural Leadership Program

Managed by the Australian Rural Leadership Foundation, the Australian Rural Leadership Program is a part-time course, conducted over 17 months, that offers rural leaders a range of learning opportunities around Australia and overseas. The program's objective is to produce a network of informed, capable and ethical leaders who are able to work collaboratively to advance the interests of their industries and communities and rural Australia in general. The GRDC supported two participants in the program in 2012–13.

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 two grain growers in 2012–13.



Matthew Hill, from Esperance, WA, will use his GRDC-supported Nuffield Australia scholarship to study harvest residue management. Photo: Nuffield Australia



Lachlan Seears, from Lucindale, SA, will use his GRDC-supported Nuffield Australia scholarship to study supply chain management. Photo: Nuffield Australia

Horizon Scholarships

Managed by the Rural Industries Research and Development Corporation, the Horizon Scholarship program provides financial support, professional development and industry placements for undergraduates studying agriculture. It is tailored for young people who are passionate about agriculture and ready to expand their networks and learn new skills. In 2012–13, the GRDC supported three Horizon Scholars as they started their degrees.

Primary Industry Centre for Science Education

The GRDC is a partner in the Primary Industry Centre for Science Education, which is supported by the Australian Government, universities, rural RDCs and primary industry bodies. It aims to increase the number of professionals in agribusiness and agricultural research by attracting students into tertiary-level primary industry science courses. The centre delivers high school science classroom activities, teachers' professional development programs, teaching resources, student camps and industry placement programs.

National Youth Science Forum

The National Youth Science Forum assists young Australians to become the next generation of scientists and engineers supporting a sustainable future for the nation. The program encourages Year 12 students to enter science- or engineering-based university courses and associated careers. The forum includes intensive residential programs, follow-up seminars and visits to university campuses and industry sites around Australia.

In January 2013, the forum comprised three 12-day residential forum events—two in Canberra and one in Perth—collectively attended by 450 students. GRDC staff members gave presentations, including information about their own journeys through agricultural science; mounted displays about the GRDC; and talked to students about careers in agriculture and the role of scientists in the grains industry.

Capacity building for the R&D sector

The GRDC invests directly or through partnerships with other organisations to increase the capacity of the R&D sector to meet the needs of the Australian grains industry.

Grains Industry Research Scholarships

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

In 2012–13, the GRDC supported 22 PhD scholars working across a range of subject areas, including:

- investigating metabolic regulatory genes and peptides in pest snails
- manipulating seed storage proteins to enhance sorghum digestibility
- developing functional molecular markers for key agronomic traits in the cultivated peanut, using next-generation sequencing technologies
- using mathematical and computational modelling for the phenotypic analysis of cereal plants
- examining the responses of maize roots to nitrogen supply
- understanding the strategies of outstanding performers in dryland farming enterprises.

Grains Industry Undergraduate Honours Scholarships

The GRDC offers scholarships to encourage undergraduates to undertake honours studies in disciplines that contribute to the RD&E priorities of the GRDC and the Australian grains industry. These scholarships are awarded on the basis of academic excellence and the quality and relevance of the research proposal to the grains industry. In 2012–13, the GRDC supported 23 honours scholars.

GRDC Travel Awards

GRDC Travel Awards are granted to researchers and students within the Australian grains industry who wish to travel to participate in events or activities that align with the GRDC's corporate objectives and demonstrate benefit to the Australian grains industry. In 2012–13, the GRDC granted 15 applications to travel to destinations in Australia, Canada, Chile, China, Germany, Japan, Portugal, Norway, Singapore, South Africa and the United States.

Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry

ABARES manages a program of awards to encourage science, innovation and technology in rural industries and to advance the careers of young scientists through national recognition of their research ideas. The GRDC sponsored one award in 2012–13 (for more information, see the case study on page 70).

CSIRO Plant Industry Summer Student Program

The CSIRO Plant Industry Summer Student Program is tailored for second- and third-year university students with an interest in pursuing research careers relevant to plant-based industries, including the grains sector. Successful students work alongside research scientists at CSIRO Plant Industry sites, and have the opportunity to learn new approaches and understand the importance of scientific research in the context of the delivery of practical outcomes. Positions on the program are awarded on the basis of academic merit. In 2012–13, the GRDC supported seven of the 35 students who took part.

Vavilov–Frankel Fellowship Fund

The Vavilov–Frankel Fellowship Fund aims to encourage the conservation and use of plant genetic resources by enabling outstanding young scientists from developing countries to carry out relevant, innovative research outside their own countries.

In 2012–13 the GRDC supported Awais Rasheed from Pakistan. Awais will contribute to the wheat pre-breeding program in Pakistan by looking at how the genetic resources in wild relatives of wheat can play a role in breeding new varieties.

Capacity building for advisers

Professional extension providers working in agriculture and natural resource management are important allies in the GRDC's efforts to achieve positive practice change in the grains industry. The GRDC supports opportunities for extension providers to maintain or build their knowledge and skills.

Agribusiness Training Program

Over the past three years, the GRDC partnered with the Agribusiness Training Program (AgT) to help Western Australian extension providers access the training they needed to keep up to date in serving the grains industry. AgT, a Western Australian Government initiative, is well recognised for providing quality training for professionals working in agriculture, horticulture and natural resource management.

Through the GRDC project, 18 training events involving a total of 256 participants were held. AgT conducted evaluations of every course; for the five courses held in 2012–13, post-course surveys indicated that 94 percent of participants considered the training to be worthwhile or extremely worthwhile.

Technology Adoption Workshops

Over the past four years, the GRDC funded Technology Adoption Workshops, which delivered communications skills training to

agronomists, extension officers and researchers across all three GRDC regions. The workshops showed participants techniques to help them understand their clients' needs and match new technology and concepts to those needs. This included ways to recognise the values that underpin farm management decisions and provide information in a format that is both appropriate and appealing.

Some workshop participants rated the GRDC's Technology Adoption Workshops as among the best training they have attended in extension. Participants consistently reported that they had gained new insights and practical tools that they would immediately introduce into their programs.

Adviser updates

The GRDC's adviser updates provide targeted information to agribusiness to assist them to provide the best and latest advice to grain growers. The updates are presented at two-day events; in 2012–13 events were held in Coonabarabran and Temora, New South Wales; Goondiwindi, Queensland; Adelaide, South Australia; Ballarat, Victoria; and Perth, Western Australia. Collectively, the events attracted more than 1,800 participants.

Highly valued sessions included:

- in the Northern Region—pre-emergent herbicide behaviour in the soil, management options for glyphosate-resistant grasses, weed seed capture and nitrogen nutrition



A record crowd attends the 2013 Adviser Update at Goondiwindi, Qld. Photo: GRDC

- in the Southern Region—enhancing mental and emotional resilience, optimising wheat yield through sowing dates, using new information and communications technology and social media to provide advice, and managing blackleg and sclerotinia
- in the Western Region—herbicide resistance, barley marketing, NVT results for wheat, and the competitiveness of Australia as a source of grain exports.

The 2012–13 adviser updates were enhanced by new uses of technology. For example, at the Western Australian Agribusiness Crop Updates 2013, jointly hosted by the GRDC and the Department of Agriculture and Food Western Australia, participants were provided with free wi-fi access and an ‘Event App’ for use through smartphones and tablets. The app enabled users to access information about sponsors, speakers and the program; download the papers presented; and complete and submit evaluations.

Feedback from advisers was positive, indicating that they would be likely to attend GRDC updates in future.

Capacity building for grain growers

The GRDC provides support, training opportunities and resources to help grain growers access additional skills and new knowledge and apply them to their farm enterprises.

GRDC Industry Development Awards

GRDC Industry Development Awards are offered to Australian grain growers or groups working directly with growers, to support study tours, travel or training approved by the GRDC. The aim is to develop new skills, build relationships and acquire new information that will contribute to the sustainability and profitability of the grains industry.

In 2012–13, the GRDC granted 15 awards, to support activities in areas such as:

- market and agronomic opportunities for pulses
- increases in the yields of cereal crops in New Zealand
- herbicide resistance

- sustainable farming in the Mallee region
- precision agriculture and information and communication technology
- the changing nature of agricultural training
- grain production and declining rainfall in South Australia
- farming systems and the move to continuous cropping.

Grower updates

For more than a decade, the GRDC has been delivering the outcomes of GRDC-supported research directly to growers through its research update seminars. The seminars are presented at capital cities and regional centres across all three grain-growing regions. In some cases, they are delivered in conjunction with grower groups.

The topics presented at grower research updates reflect the key issues of the location and season. Some topics that attendees found particularly valuable in 2012–13 included:

- canola—including harvesting techniques and ways to improve profitability
- weed management—including problem weeds, herbicide resistance, pre-emergent herbicides and non-herbicide approaches to reducing the weed seed bank
- nitrogen nutrition
- spray application and drift management
- cereal diseases—including management of crown rot and yellow leaf spot, and making better use of fungicides
- improving water use efficiency through aligning time of sowing with variety selection
- grain marketing.

Across the three regions, 37 grower updates were held and collectively attracted almost 2,900 participants in 2012–13. Favourable feedback and high levels of satisfaction were recorded across all regions and groups. Many growers who completed feedback surveys felt that the updates had provided them with new information that would assist them to adopt new practices or improve farm management.

Case study

Award-winning barley researcher

Australian exports account for around one-third of the world's malting barley, and demand for Australian barley is increasing, particularly in Asian countries such as China. However, the yield and grain quality of most malting barleys are reduced under saline conditions, particularly in times of drought. Salinity currently affects some Australian barley-growing areas and is predicted to significantly increase across Australia's agricultural regions.

Zhong-Hua Chen, a research lecturer from the University of Western Sydney, is combining techniques from crop physiology, molecular biology, biophysics and molecular breeding to identify genes and develop genetic markers for salinity tolerance in malting barley. The research is focusing on stomatal guard cells—specialised leaf cells that control the flow of carbon dioxide, which the plant uses to make food via photosynthesis, and regulate water loss.

Zhong-Hua is working with a range of barley lines, including salt-tolerant varieties from China and the United States, to identify molecular markers associated with superior stomatal guard cell traits under salinity stress. He says, 'I already have in mind a few candidate genes that might be responsible. Where a particular barley line has a stronger expression of that gene we will cross it with a current salt-sensitive Australian malting barley variety, and hope to introduce the trait.'

In 2012–13, Zhong-Hua received the GRDC-sponsored Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry for his research. He also received the highest honour in the award program, the prestigious Minister for Agriculture, Fisheries and Forestry's Award.

Zhong-Hua says, 'I appreciate this award very much as it will help cover research, travel and conference expenses. Ultimately, this research will contribute to the success of breeding programs for salt-tolerant barley. The research may also have application to other cereal crops, allowing farmers to better adapt to the threat of salinity.'

He plans to publish his research in peer-reviewed, open-access journals to communicate the findings to fellow researchers in disciplines such as plant physiology, environmental biology and plant breeding.



Award winner Zhong-Hua Chen examines wheat under drought stress at the University of Western Sydney, NSW. Photo: David Wong

Theme 6 performance overview

Table 22 shows the investment budget and results against performance targets for Theme 6 in 2012–13, in the context of the outcomes defined in the Strategic R&D Plan 2012–17. Table 23 summarises the GRDC’s performance against the relevant indicators in the Agriculture, Fisheries and Forestry Portfolio Budget Statements 2012–13.

Table 22: Theme 6 performance against GRDC strategic measures

Theme 6—Building skills and capacity	
Aspirational outcome (10+ years)	
<i>A dynamic Australian grains industry with the skills and capacity to continuously innovate.</i>	
Intermediate outcomes (5 years)	
Grains industry leadership and communication —The Australian grains industry has the leadership and communication capacity to proactively engage with the broader Australian community.	
Capacity building in the extension sector —Australia has a skilled agricultural extension sector with access to appropriately skilled people.	
Capacity building in the R&D sector —Australia has world-class R&D personnel with the appropriate skills to meet current and future needs of the Australian grains industry.	
Capacity building for grain growers —Growers recognise the benefits to their businesses of acquiring additional skills and knowledge and hence the value of their participation in training and continuous learning.	
Investment budget for 2012–13 \$5.28 million	
Performance for 2012–13	
Grains industry leadership and communication	
Practice changes and key metrics	
<ul style="list-style-type: none"> An increased number of industry participants are engaged in regional and national leadership roles in the Australian grains industry. <ul style="list-style-type: none"> At least three Nuffield scholars are from the grains industry each year. The grains industry communicates information about potential career opportunities to secondary and tertiary students and their parents and career advisers. The grains industry publicises how it benefits the wider community. 	
Targets	Achievements
Leadership positions within the Australian grains industry can be filled with minimal delay by candidates who have the skills, knowledge and experience required.	The GRDC supported two participants in the Australian Rural Leadership Program and two recipients of Nuffield Australia Farming Scholarships.
Capacity building in the extension sector	
Practice changes and key metrics	
<ul style="list-style-type: none"> The extension sector collates and publishes annually its skills requirements and identifies gaps and potential gaps in discipline areas. Increased number of people enrol in targeted agriculture-related disciplines. Increased number of qualified graduates are employed in extension roles. Increased number of graduates and other extension staff undertake postgraduate/workplace training. Career pathways within the extension sector retain skilled and experienced personnel. 	
Targets	Achievements
The extension sector regularly communicates its training requirements for skilled personnel, including any gaps in discipline areas, and provides these to training organisations.	The GRDC made an annual call for technical workshops to address identified areas for further industry skill development. Workshops were funded for risk management, national variety testing, integrated weed and cereal foliar disease management and crop nutrition. The GRDC also provided extension training and adoption training and support across the Southern Region.

Table 22: Theme 6 performance against GRDC strategic measures (continued)

Performance for 2012–13	
Targets	Achievements
Training opportunities available through vocational education and training (VET) programs, graduate and postgraduate studies, and non-award courses, meet the needs of the sector.	The GRDC supported the Sustainable Grain Production stream of the University of New England's Graduate Certificate in Agriculture and Diploma in Agriculture. This provides accredited, tertiary-level training that is specific to the grains industry and available through part-time, distance education programs.
Increased number of undergraduates successfully complete agriculture-related courses.	The GRDC supported a number of initiatives aimed at increasing the number of students studying grains-relevant university courses.
Proportion of people in the extension sector with relevant graduate and post-graduate qualifications is increasing.	Enrolments in the Sustainable Grain Production stream at the University of New England have steadily increased, from 64 in 2011 to 127 in 2012 and 156 in 2013.
Capacity building in the R&D sector	
Practice changes and key metrics	
<ul style="list-style-type: none"> • The grains industry has a clear understanding of its skills requirements in the short, medium and long term. • Training providers address the grains industry RD&E skills gaps in innovative and flexible ways. • RD&E providers work with the grains industry to develop improved measures of RD&E performance. 	
Targets	Achievements
The grains industry, in collaboration with RD&E providers, regularly publishes reviews of its anticipated future requirements for skilled personnel, including any gaps in discipline areas, and provides these to training organisations.	<p>The GRDC invested in a range of scholarships and training awards to increase the R&D capacity of the grains sector.</p> <p>The GRDC co-sponsored the:</p> <ul style="list-style-type: none"> • Primary Industry Centre for Science Education • National Youth Science Forum • CSIRO Plant Industry Summer Student Program • Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry.
The industry and its RD&E providers are maintaining or increasing the skills and capacity available, in line with the Grains Industry National RD&E Strategy.	<p>The GRDC invested in a range of scholarships and training awards to increase the R&D capacity of the grains sector.</p> <p>Support was provided for:</p> <ul style="list-style-type: none"> • 15 Travel Awards • 15 Industry Development Awards • 45 university scholarships • 30 conferences • two Nuffield Australia Farming Scholarships • two Australian Rural Leadership Program participants • three Horizon Scholarships • one Vavilov–Frankel Fellowship.
Capacity building for grain growers	
Practice changes and key metrics	
<ul style="list-style-type: none"> • Growers recognise the additional knowledge and skills they need to fully understand, adapt and adopt the outputs of RD&E and optimise their benefits. • Growers and their advisers participate in relevant training and skills development and apply the knowledge gained to on-farm decisions and practices. <ul style="list-style-type: none"> – <i>At least 65% of growers and advisers undertake at least one activity each year to learn more about opportunities to improve farm profit or sustainability.</i> • Growers apply skills on farm to increase profitability and sustainability. 	
Targets	Achievements
Increased number of growers regularly use the support of a skilled adviser to assist with cropping decisions.	The 2013 Information and Products Needs Survey demonstrated that retail and fee-for-service advisers were growers' preferred sources of farm business and crop management information, with core strengths in weeds (62%), crop nutrition (53%), and harvesting and storage (67%).
Targets	Achievements
An increased proportion of growers and advisers are undertaking further education, training and skills development to enable them to make better use of RD&E outputs.	Grains research updates attracted almost 2,900 growers nationwide.

Table 23: Theme 6 performance against portfolio budget statements measures for 2012–13

Key performance indicator	Target	Result
Each year Nuffield scholars include people from the grains industry.	At least three	Partially achieved. The GRDC supported two scholars from the grains industry: Matthew Hill from Western Australia, and Lachlan Seears from South Australia.
Growers and advisers undertake at least one activity each year to learn more about opportunities to improve farm profit or sustainability.	65%	Achieved. In the 2013 GRDC Grower Survey, 67% of growers reported that they (53%) or another person from their farm (14%) had undertaken at least one activity over the past year to learn more about opportunities to improve farm profit or sustainability.

What's in the RD&E pipeline for 2013–14?

Continued support for capacity-building awards in the grains industry, including PhD and honours scholarships, GRDC Agricultural Training Awards, workshops, visiting fellowships, postdoctoral fellowships, industry placements, cadetships and a 'grains industry gap year'.

Continued support for the Primary Industry Centre for Science Education and other programs which encourage school leavers to enter agriculture by improving understanding of and promoting the career opportunities available in science-based primary industries.

A pilot project to improve grower and industry adoption of social media and new electronic technologies to improve access to information on a range of grains industry topics.

A series of technical workshops for growers and advisers on crop nutrition, water use efficiency and the use of National Variety Trials data to make improved varietal decisions on farm.



Growers gather with traders, breeders, researchers and agronomists to share the latest knowledge on pulses.
Photo: Clarisa Collis

Enabling functions

The GRDC's Corporate Services business group works with the Corporate Communication unit of the Managing Director's office, the Transition Projects unit and the three operational business groups to implement the GRDC's corporate strategies and achieve the planned outcomes of the GRDC's investment themes.

Corporate Services is responsible for key enabling activities that provide essential support

for the corporation's responsibilities under the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act) and the *Commonwealth Authorities and Companies Act 1997* (CAC Act), and equip the operational business groups to perform their functions.

Table 24 summarises the enabling functions and their overarching objectives as defined in the Annual Operational Plan 2012–13.

Table 24: Enabling functions in 2012–13

Enabling function	Objective
Corporate governance and legal services	Maintain a robust system of governance and protection of the GRDC's legal interests.
Planning processes and reporting	Inform stakeholders of the corporation's goals, strategies and achievements.
Information management systems	Support R&D information access needs and records management as well as the business computing and telecommunication requirements of the organisation.
Risk management	Ensure that business risks are identified, assessed and appropriately managed.
Quality management	Be recognised as a quality-driven organisation, through quality leadership, continuous improvement and appropriate accreditation.
Human resource management	Maintain best practice in human resource management and remain clearly focused on delivering business objectives.
Finance and administration	Manage the accounting and treasury functions in accordance with statutory obligations and requirements and the direction of the GRDC Board.
Corporate strategy and communication	Support the implementation of the Strategic R&D Plan 2012–17.

Each year, the GRDC establishes a work plan to guide staff on the objectives that the corporation expects to achieve. The Board assesses the overall performance of the GRDC based on the

criteria established in the work plan. Table 25 sets out the GRDC's performance against the objectives and measures in the Work Plan 2012–13.

Table 25: Performance against work plan measures for 2012–13

Key performance indicator	Result
<i>Key objective: Strategic direction of the corporation is established and supported by industry and government.</i>	
<p>The five-year R&D plan:</p> <ul style="list-style-type: none"> clearly describes investment themes, strategies and performance measures is approved by the Minister and supported by the representative organisation and wider stakeholder base fully complies with the <i>Primary Industries and Energy Research and Development Act 1989</i>. 	<p>The GRDC's Strategic R&D Plan 2012–17 was approved by the Minister on 19 June 2012 and publicly launched at the Australian Grains Industry Conference on 31 July 2012.</p> <p>The plan provides a framework for investment based on six themes, and describes the strategies that will be applied to achieve those objectives and the performance indicators that will be used to measure success.</p>
<i>Key objective: GRDC's existing RD&E portfolio delivers maximum value to Australian grain growers</i>	
<p>Current projects are reviewed for alignment with new themes and strategies.</p>	<p>Themes, intermediate outcomes, practice changes and performance metrics are identified in the Strategic R&D Plan 2012–17.</p> <p>All 2012–13 projects were mapped to the relevant theme, investment strategy and supporting program of work.</p> <p>All investment proposals were viewed in context with theme program logics.</p>

Table 25: Performance against work plan measures for 2012–13 *(continued)*

Key performance indicator	Result
Systems and processes are working effectively to manage project performance.	R&D providers gave positive feedback through the GRDC's Research Partner Survey. However, significant work remains to be done on systems and processes.
Relevant project outputs are delivered to growers in appropriate products and/or services.	Project outputs were delivered to growers through: <ul style="list-style-type: none"> • technology, such as barley variety identification services and soil phosphorus measurement tools • communications, such as reports, publications, <i>Ground Cover</i> magazine, <i>Ground Cover</i> radio and online content • events, such as industry forums and grower and adviser updates.
<i>Key objective: New investments are focused on delivering value</i>	
Detailed investment strategies for each theme and a process for regular updates are developed.	The high-level investment process was revamped. Investment strategies were developed using a program logic framework. Associated monitoring evaluation, review and improvement plans were well progressed.
Clearly defined and measurable key performance indicators are developed for each theme.	The 2012 GRDC Farm Practices Survey was completed. The survey results will be important baseline data for tracking key on-farm practice changes.
The GRDC has evidence that each theme is delivering results that are regionally relevant.	Feedback from growers and advisers indicated that projects were delivering relevant results in each region. Results of the 2013 Grower Survey showed that 76% of grain growers surveyed believe they have directly benefited from grains R&D activities over the past five years.
Projects are contracted within agreed timeframes and prior to commencement of research.	Contracting for 2012–13 was completed by 30 June 2013.
<i>Key objective: GRDC investments are nationally coordinated</i>	
As far as practical for GRDC, the key performance indicators in the Grains Industry National RD&E Strategy are achieved.	Seventy-five percent of the key performance indicators for implementing the Grains Industry National RD&E Strategy were implemented by 30 June 2013.
Four national centres of research capability are established as described in the Grains Industry National RD&E Strategy.	Three centres—the Australian Export Grains Innovation Centre in Western Australia, the Australian Grains Genebank in Victoria, and the IA Watson Research Centre in New South Wales—have been established. A fourth centre is on hold, pending support from the Queensland Government.
<i>Key objective: Regional grower services deliver innovative products and services to the grain industry</i>	
An integrated suite of GRDC information products and services is defined to build grower and adviser knowledge, awareness, skills and aspirations on agronomically important issues.	The GRDC provided: <ul style="list-style-type: none"> • workshops and seminars, including grower, adviser and farm business management updates and issue-specific workshops • publications, including guides, fact sheets, newsletters and project summaries • audiovisual content, including CDs, DVDs and material for download • online content, including websites and social media postings • media content, including press releases and articles.
New and existing products or services are delivered to target audiences, and their impacts are evaluated.	Results of the 2012 Grower Survey showed that: <ul style="list-style-type: none"> • 77% of growers surveyed regarded GRDC information as a source of influencing practice change • <i>Ground Cover</i> magazine (98%) and its supplements (92%) were identified as being among the most influential and valued sources of information • respondents valued GRDC products, including factsheets, ute guides and the GRDC website.

Table 25: Performance against work plan measures for 2012–13 *(continued)*

Key performance indicator	Result
<i>Key objective: GRDC's global interaction is expanded with both private and public sector organisations</i>	
A preliminary business case, strategy and plan are developed, based upon a gap analysis of themes.	The business case, strategy and plan are under development.
The five major life science companies that operate in Australia and other, small entrepreneurial life science companies are engaged with a view to increasing collaboration.	The GRDC is developing relationships with large and small life science companies in Australia, including through personal contact by the Chair and members of the Senior Leadership Group.
Opportunities for participating in global initiatives in the public sector are explored.	The GRDC took part in global initiatives in areas such as germplasm improvement to improve yield and disease resistance.
<i>Key objective: The GRDC's commercial value to industry is optimised</i>	
The Board is able to make decisions supported by a business case containing appropriate information.	Multiple business cases were prepared to support the Board with key investment decisions.
<i>Key objective: An appropriate governance framework is maintained within the corporation</i>	
There is evidence that policies have been customised to reflect the GRDC's operating environment.	The GRDC reviewed 50% of policies, procedures and guidelines and commenced work on the amalgamation of the operating and quality manuals.
Staff are provided with regular training (at least two sessions per year).	Staff participated in fraud control, risk management and freedom of information training. Staff were provided with regular updates on changes to policies and procedures.
ISO 9001:2008 accreditation is maintained.	ISO accreditation was renewed successfully in February 2013.
Operating expenditure is less than or equal to the Board-approved budget.	Operating expenditure was within budget.
Necessary documentation to meet the entire corporation's legal and statutory obligations is prepared (including the portfolio budget statements, annual operational plan and annual report, and compliance reports on matters such as freedom of information, work health and safety, and privacy).	All compliance obligations were fulfilled.
The Strategic Risk Register, Business Risk Register, Fraud Control Plan and Protective Security Policy Framework are maintained.	All risk and fraud registers were maintained and updated monthly. The Protective Security Manual and Fraud Control Plan were in place and up to date.
<i>Key objective: Capabilities of the corporation are developed and expanded</i>	
Human resources policies and procedures are consistent with the enterprise agreement.	New human resources policies, procedures and guidelines, consistent with the enterprise agreement, were finalised.
Staff (and, where relevant, panel members) receive mentoring and training to ensure a high standard of work health and safety and a high-level understanding of policies and procedures and appropriate use of them, management of staff, and workplace issues.	Eleven training sessions were provided for all staff, covering topics such as communication, resilience, motivation, leadership and management skills.
Information systems are maintained and protected, and information technology facilities are prepared to match the medium term needs of the corporation.	The IT Disaster Recovery Plan is an integral part of the Business Continuity Plan, which was updated following a test exercise in December 2012. A memorandum of understanding covering the sharing of facilities in emergencies was finalised with the Rural Industries Research and Development Corporation and Australian Pork Limited.
<i>Key objective: The GRDC demonstrates accountability to Australian grain growers and other stakeholders</i>	
Key documents, including the annual operational plan, annual report, growers' report, financial audits and stakeholders' report, are accepted by the Minister and/or the grower representative organisation.	All corporate documents were approved by the Minister and distributed to the grower representative organisation.

Table 25: Performance against work plan measures for 2012–13 *(continued)*

Key performance indicator	Result
Regular contact and communication is maintained with the Minister's office, the portfolio department, growers, the grower representative organisation, key research partners, researchers, advisers, staff, panels and other stakeholder groups.	Effective communication was achieved through meetings, spring tours, engagement with grower representative organisations, stakeholder briefings, consultations, grower and research partner surveys and visits to research partner organisations.
Key stakeholders understand the GRDC's strategic direction.	Feedback from key stakeholders confirmed that they understood the GRDC's strategy.
<i>Key objective: Reportable work health and safety incidents are minimised</i>	
A work health and safety plan is developed and implemented.	A work health and safety plan was drafted and is in the approval process.

Portfolio management

The GRDC's RD&E investment portfolio in 2012–13 included more than 1,000 projects, at various stages of development. The management of the investment portfolio aims to achieve a spread of projects in terms of:

- GRDC investment themes
- the National Research Priorities and Rural R&D Priorities
- crop type
- project type (strategic basic, applied, experimental development, extension, commercialisation or capacity building)
- delivery time to growers of R&D outcomes (long-term projects versus short-term projects)
- probability of overall success (high-risk long shots versus lower risk sure bets)
- level of expected on-farm benefits relative to investment required
- induced spillover benefits to industry
- expected benefits to be achieved for the broader community.

The GRDC's portfolio is grouped into seven categories: the investments addressing the six strategic themes, and investments in foundational activities such as reviews and impact assessments. This enables groupings of projects that support an investment strategy within a theme to be analysed together.

The GRDC previously assessed groups of projects based on topics of interest at a particular point in time. The GRDC is now assessing the programs of work that are part of its program logic approach to achieving outcomes to benefit Australian grain growers and the wider community. Programs of work

are being assessed in terms of their expected relative benefit flow to growers, industry and the broader community. The assessments include economic, social and environmental impacts, as described in Table 8 of this report.

The GRDC undertakes a range of activities to ensure that individual projects achieve their objectives and scheduled milestones, and that the R&D portfolio as a whole continues to address industry and government stakeholder priorities. The approaches used to monitor, evaluate and manage projects depend on project characteristics: for example, projects with standard GRDC research agreements are evaluated and managed differently from projects involving unincorporated joint ventures.

The portfolio monitoring system includes internal guidelines and/or procedures for:

- identifying and managing risks associated with individual projects during planning and implementation stages
- evaluating progress reports for project performance against objectives and milestones—each year, a satisfactory progress report must be submitted to the GRDC before further payments will be made to the research provider
- conducting formal reviews of targeted investment areas.

Seven formal reviews were conducted in 2012–13, in the areas of crown rot; a national molecular marker program; a national invertebrate pest RD&E program; profitable break crop and pasture sequences in Western Australia; communication, extension and grower engagement in soil biology; durum breeding; and a contribution to a review of the Australian Centre for Plant Functional Genomics.

Commercialisation

The GRDC's primary aim is to make new technology available to grain growers as quickly and as cost-effectively as possible. In some cases, the benefits of GRDC research investments can be most efficiently delivered to growers through the commercial production of the research outputs. Commercialisation is a means of delivering technology to Australian grain growers, so that they can more effectively compete in global grain markets, and securing technology adoption.

Commercialisation strategy

The GRDC achieves its objective in commercialising research outputs through:

- ensuring commercialisation activities are aligned with the GRDC's five core strategies and are relevant to the strategies of the six investment themes
- leveraging capital and expertise from co-investors, to maximise opportunities to bring technology to the marketplace and give grain growers access to technology
- developing comprehensive business plans for delivering satisfactory returns to grain growers and investors.

As part of the overall commercialisation strategy, the GRDC recognises that the following are necessary for commercialisation: a sustainable market size, expertise, funds and distribution channels. Usually the GRDC is only one of a number of organisations investing in the development of new technologies by public and/or private organisations. Investment partnerships are desirable and necessary because they reduce the risk to the GRDC in the funding of new technologies, and because partner organisations can bring benefits, apart from financial resources and research capacity, such as market knowledge and access to complementary technologies.

Where the GRDC is a member of a research consortium using public and private sector funds, it has influence over the terms of commercialisation, and determines these in collaboration with the other investors to ensure that a proper balance is struck among the needs of all members of the consortium.

While the most usual path to market for commercial research products from GRDC

research investment will be through licensing to suitable partners, investments in joint ventures and companies to deliver the products will be considered based on the merits of business cases that demonstrate that this will deliver the best outcome for the industry.

In selecting investment structures, the GRDC follows its internal guidelines and identifies and implements the most appropriate structure for holding its equity in each business arrangement. The GRDC position is that all commercial entities with which it is involved should have appropriate boards that possess the broad range of skills required to provide oversight for the business.

The GRDC continues to seek new business opportunities that arise from its research portfolio, with the aim of providing benefit firstly to growers and secondly to the GRDC and its research partners. For each commercial business opportunity, the GRDC seeks investment of resources from the partners that will profit from the development and widespread uptake of the new technology. This is an important part of using GRDC investment funds to leverage funds from other sources—including, in this area, commercial investment funds—for the benefit of growers.

Commercialisation outcomes

Every commercialisation task is unique, and the process of bringing products and technology to market must be undertaken on a project-by-project basis. A cross-section of commercialisation work undertaken in 2012–13 is described below.

New crop varieties

In 2012–13, the GRDC was actively involved in the release and commercialisation of several new crop varieties that were released by breeding programs with financial support from the GRDC. The GRDC's primary objective was to encourage rapid adoption of the new, superior varieties by growers, while protecting the interests of the intellectual property owners.

In selecting commercial partners, the GRDC and its research partners take into consideration capabilities such as the ability to produce quality

seed, the ability to market seed successfully, and the targets for seed production and variety uptake. The management and collection of end point royalties, including the terms and conditions imposed on growers, are also taken into consideration.

In the case of commercially bred crops such as wheat the GRDC has no ownership in new varieties and the responsibility for commercialisation lies with the breeding companies alone. However, the GRDC is an investor in some of the breeding companies and reports on the variety releases from all of its breeding-related investments, regardless of whether they are publicly funded or commercial enterprises.

In 2012–13, the new crop varieties commercialised (that is, new varieties for which there is a significant amount of seed available commercially to growers) comprised:

- ten wheat varieties—Dart⁽¹⁾, Gazelle⁽¹⁾, Grenade CL Plus⁽¹⁾, Merlin⁽¹⁾, Phantom⁽¹⁾, Shield⁽¹⁾, Suntop⁽¹⁾, Trojan⁽¹⁾, WID802⁽¹⁾ and Yawa⁽¹⁾
- three lentil varieties—PBA Ace⁽¹⁾, PBA Bolt⁽¹⁾ and PBA Herald XT⁽¹⁾
- three chickpea varieties—Ambar, Neelam⁽¹⁾ and PBA Striker⁽¹⁾
- one barley variety—SY Rattler⁽¹⁾
- one faba bean variety—PBA Warda⁽¹⁾
- one field pea variety—PBA Pearl⁽¹⁾
- one mungbean variety—JadeAU⁽¹⁾.

New products

Through the Commercial business group, the GRDC progressed the development and commercialisation of several new products in 2012–13.

A patent has been lodged describing a novel process able to extract nitrogen and potassium from a waste water source. This project has already developed a process to extract phosphorus in a crystalline form and has the potential to reduce the future cost of fertiliser inputs by recycling nutrient from previously unavailable sources. Pilot plants were established in Beenleigh, Queensland, and Nowra, New South Wales, in early 2013.

A GRDC collaboration with major chemical company BASF and the Cooperative Research Centre for Polymers has been established to explore the use of designer polymers for reducing the effect of non-wetting soils. The first

field trials were recently laid out in the Western Australian wheat belt and will be assessed through the 2013–14 season.

Together with the South East Premium Wheat Growers Association, the University of Tasmania and Danish enzyme company Novozymes, the GRDC took a barley brewing concept based on a proprietary enzyme product to brewers in Cambodia, China and Vietnam. The use of the proprietary enzyme additives and raw barley (rather than other adjuncts) in their brewing processes was shown to be cost effective and to produce a quality beer. The barley brewing process has the potential to increase the demand for good quality Australian barley in these key markets.

The first inoculation of a modern cereal species with a neotyphodium endophyte was achieved in a joint project with New Zealand companies Grasslanz Technology and AgResearch. The endophyte appears to assist the plant in defending against pests and pathogens through the production of specific metabolites. The lead endophyte strain was successfully inoculated into an elite variety and is now being evaluated by commercial breeders.

Commercial agreements

During 2012–13, the GRDC held discussions and negotiations with potential commercial partners in Australia and overseas to take key technologies to market.

A novel test for barley variety identification, based on the outcomes of GRDC-supported research on diversity arrays technology, has been extended to include wheat. The identification service will be provided on a commercial basis by GrainGrowers Limited's analytical laboratories. Like the barley variety identification test, this service is a world first and will ensure that Australian growers are able to buy and maintain quality seed for sowing.

The Queensland Department of Agriculture, Fisheries and Forestry and the GRDC have licensed their Northern Region barley breeding program to the Australian cereal-breeding company InterGrain Pty Ltd. This transaction will ensure the continued development of barley varieties with good adaptation for the Northern Region.

A licence agreement which allows the GRDC to access technology for the detection of late-maturity alpha-amylase in wheat was finalised with Bayer CropScience. The GRDC has the right to sublicense in Australia.

Case study

Enzyme brewing partnership

The Asian brewing industry is extremely price sensitive—Asian brewers regularly add up to 60 percent rice as ‘starch adjuncts’ to their brews as a means to minimise raw material costs. With such price-sensitive markets in mind, Danish company Novozymes A/S launched its Ondea® Pro enzyme product, which allows raw barley to be substituted for malted barley in brewing.

Novozymes is a world-leading bio-solutions company that manufactures over 700 products for more than 30 different industries. It is already well connected in the Asian brewing industry as a supplier of enzymes that assist in the liquefaction of rice starch in the widely used ‘starch adjunct’ brewing methods.

With strong R&D and technical support for customers, Novozymes invited breweries to trial the product and familiarise themselves with the concept. Asian brewers in Vietnam, Cambodia and the Philippines in particular responded with immediate interest.

After trialling small pilot-scale brews, a number of breweries around the world have since increased their adoption to commercial scale. In Europe this was a relatively smooth transition, as breweries could easily access locally grown barley, and several large eastern-European breweries are now using the technology commercially. In Asia this process has not been as simple.

Australian barley is an obvious fit to this emerging brewing market in Asia. A GRDC-supported project at the University of Tasmania showed that Australian malting varieties are well suited to the enzyme-brewing process, and that some specific varieties stand out as exceptional. Australia has the ability to supply reliable quality and has a regional freight advantage for delivering grain to Asia.

The barley for enzyme brewing is essentially a direct food input and, as such, requires alternative supply methods to those of wheat or feed barley. A level of secondary processing is required to achieve the relatively high standards required for grain size and cleanliness. In addition, breweries expect that the enzyme-brewing barley will look and behave like malt, which is usually cleaned and prepared by the supplier to meet the brewer’s specifications.

In order for the growers and grain traders to understand and be able to respond to the needs of these brewers, the University of Tasmania project has developed a ‘brewing barley’ specification that will ensure that the end user has a predictable and reliable input. If Australia can deliver raw barley with the qualities that Asian brewers seek and in the quantities that they need in order to expand into enzyme brewing on a commercial scale, there is a bright future for Australian grain exports in this emerging market.



Demonstration brews made with the new enzyme product and locally grown barley are poured at the Taste of Tasmania Festival. Photo: Kevin Redd

Intellectual property management

The GRDC usually owns a share of all intellectual property generated by research projects 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.

The GRDC (together with research partners) registers intellectual property where to do so will achieve the above objectives, and maintains a register of its registered intellectual property.

Patents

During 2012–13, the GRDC continued to file and prosecute a number of patent applications and to maintain a number of patents. All except one patent family of applications is held in conjunction with research partners.

The GRDC holds interests in 33 patent families.

Plant breeder's rights

In 2012–13, the GRDC and its research partners:

- lodged 16 new plant breeder's rights (PBR) applications
- withdrew no new PBR applications
- surrendered eight certificates of PBR.

At 30 June 2013, the GRDC co-owned 146 plant varieties covered by PBR and 37 PBR applications.

Trademarks

At 30 June 2013, the GRDC held:

- 11 registered trademarks
- three accepted composite marks in classes 9, 16, 41 and 42
- four trademark families, granted in a combination of classes
- one word mark, granted in class 42
- one composite mark, granted in classes 31 and 42.

Business relationships

Most of the GRDC's business relationships are governed by contracts, such as research agreements and the licensing of the resulting intellectual property. However, in several cases the most effective way to encourage innovation in the grains industry is to establish a company or unincorporated joint venture. Key reasons for deciding to set up a company or joint venture include more effective management of intellectual property; more focused governance; ease of interaction with the private sector; and, in the case of cooperative research centres, government policy.

Table 26 describes the companies in which the GRDC had shares or membership at 30 June 2013. In most cases the GRDC also nominated one or more directors to the company's board.

Table 26: Companies in which the GRDC had shares or membership as at 30 June 2013

Name	Activity	GRDC role
Companies limited by guarantee		
Agricultural Biotechnology Council of Australia Ltd ACN 103 817 296	Provides information about gene technology to enable informed debate.	Is a member of the company and provides research funding. Nominates a director.
Australian Crop Accreditation System Ltd ACN 093 984 902	Provides cereal variety details online for farmers and advisers, manages the National Variety Trials.	Is a member of the company and provides research funding. 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.
Barley Australia Ltd ACN 111 117 321	Provides leadership for the development of the barley industry in Australia.	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. Nominates a director.
Invasive Animals Ltd ACN 114 965 276	Serves as the management company for the Invasive Animals Cooperative Research Centre (CRC).	Is a member of the company and provides research funding.
Plant Biosecurity CRC ACN 115 589 707	Serves as the management company for the Plant Biosecurity CRC.	Is a member of the company and provides research funding.
Wheat Quality Australia Limited ACN 147 439 656	Manages and delivers the wheat variety classification process.	Is a member of the company. Nominates two directors.
Companies limited by shares		
Arista Cereal Technologies Pty Ltd ACN 122 450 962	Undertakes development of high-amylose wheat.	Is a 21 percent shareholder. Nominates one director.
Australian Centre for Plant Functional Genomics Pty Ltd ACN 102 769 808	Conducts functional genomics research into abiotic stress.	Is a 19 percent shareholder and provides research funding.
Australian Grain Technologies Pty Ltd ACN 100 269 930	Undertakes commercial wheat breeding.	Is a 39 percent shareholder and provides research funding. Nominates three directors.
Canola Breeders Western Australia Pty Ltd ACN 097 299 619	Undertakes commercial canola breeding focused on Western Australian low-rainfall areas with some adaptation to other regions of Australia.	Is a 39 percent shareholder. Nominates one director.
HRZ Wheats Pty Ltd ACN 106 590 434	Develops high-yielding milling wheat varieties for Australia's high-rainfall zone.	Is an 18 percent shareholder. Nominates one director.
InterGrain Pty Ltd ACN 128 106 945	Undertakes commercial wheat and barley breeding.	Is a 27 percent shareholder. Nominates one director.
Novozymes Biologicals Australia Pty Ltd ACN 119 069 617	Develops and markets inoculant products to benefit growers.	Is a 50 percent shareholder and provides research funding. Nominates two directors.

Part 3—Our Organisation



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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 of the Managing Director.

Board members

At 30 June 2013, the Board comprised nine directors: Keith Perrett (Chair), John Harvey (Managing Director), Richard Brimblecombe,

Jeremy Burdon, Jenny Goddard, Kim Halbert, Robert Lewis, Sharon Starick and John Woods.

As illustrated in Figure 10, the Board has combined expertise in business management; corporate governance; commodity production, processing and marketing; finance; risk management; management and conservation of natural resources and the environment; R&D administration; science, technology and technology transfer; intellectual property management; and public administration.

Figure 10: Members of the GRDC Board in 2012–13
Directors as at 30 June 2013



Keith Perrett: Chair (Non-executive)

Appointed: 1 October 2007, reappointed until 30 September 2013

Keith farms his 2,100 hectare Gunnedah property in northern New South Wales. He produces wheat, barley, cotton, sunflower, sorghum, sheep and cattle.

He was the Chairman of the National Rural Advisory Council, which advises the Australian Government on rural issues, including Exceptional Circumstances declarations.

Keith was President of the Grains Council of Australia between April 2001 and April 2005. He is a past Chairman of the New South Wales Farmers' Association Grains Section, and has represented the grains industry at state and federal levels.

Keith was the Chairman of the Wheat Research Foundation of New South Wales between 2000 and 2007. He was also a member of the Governing Council of the Plant Breeding Institute of the University of Sydney between 1997 and 2003 and Chairman from 2000 to 2007.

John Harvey BRurSc, GDRE, GCBS, MAICD: Managing Director

Appointed: 1 March 2011

John is a graduate member of the Australian Institute of Company Directors. He is a director of Australian Crop Accreditation System Limited 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 (RD&E) management. He previously worked with the Queensland Department of Primary Industries.

Figure 10: Members of the GRDC Board in 2012–13 (continued)

Directors as at 30 June 2013 (continued)



Richard Brimblecombe MBA, MAICD: Director (Non-executive)

Appointed: 4 November 2011, until 30 September 2014

Member: Finance, Risk and Audit Committee

Richard has held senior executive positions across a range of industries spanning financial services, commodity processing and marketing, rural services and renewable energy, with prominent companies including Suncorp Bank, Namoi Cotton Co-operative Ltd, Landmark, CBA and Quantum Power Limited.

His executive positions in the financial services industry have developed his finance skills, while his engagement with the agricultural production, processing and marketing sectors has enhanced his understanding of the economics of the grains industry.

As the former non-executive chairman and now Chief Executive Officer and managing director of Quantum Power Limited, a company in the renewable energy sector, Richard has significant experience in the development, evaluation and execution of R&D strategy.

Jeremy Burdon BSc (Hons), PhD, Hon DSc, FAA, FTSE, MAICD: Director (Non-executive)

Appointed: 4 November 2011, until 30 September 2014

Jeremy has an international reputation in evolutionary biology, with particular expertise in epidemiology and genetics. His research has contributed in a wide range of areas, including 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. The division has a strong reputation for the execution of high-quality research and the delivery of research outcomes to industries, including the grains industry.

Since then he has taken up a CSIRO Fellow position in which he is developing approaches for the application of evolutionary principles to farming systems.

He is a member of the board of Bioversity International and a member of the Consultative Group on International Agricultural Research.

Jenny Goddard BComm (Hons): Director (Non-executive)

Appointed: 11 November 2008, reappointed until 30 September 2014

Chair: Finance, Risk and Audit Committee

Jenny works as a director and an economic and public policy consultant. She has 24 years of experience as an economic policy adviser to the Australian Government, initially in the Department of the Treasury and later in the Department of the Prime Minister and Cabinet, where she worked until May 2008.

Her 11 years as a senior executive officer in the Department of the Prime Minister and Cabinet include four years as a deputy secretary with policy responsibility for the economic, industry, infrastructure and environment, and Cabinet divisions; and the Council of Australian Governments Secretariat.

Jenny is a commissioner with the Australian Fisheries Management Authority and a director of the ACTEW Corporation. She was the inaugural Chair of the Australian Solar Institute Board.

Jenny has extensive experience in and understanding of government policies, processes and administration, including detailed knowledge of Australian Government Cabinet and Budget processes.

Figure 10: Members of the GRDC Board in 2012–13 (continued)

Directors as at 30 June 2013 (continued)



Kim Halbert BComm, GAICD: Deputy Chair (Non-executive)

Appointed: 4 November 2011, until 30 September 2014

Appointed as Deputy Chair: 10 April 2012 until 30 September 2014

Member: Finance, Risk and Audit Committee

Since 1980, Kim has been 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 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.

Robert Lewis BSc (Hons), Hon DSc, PSM, FTSE: Director (Non-executive)

Appointed: 4 November 2011, until 30 September 2014

Robert was Chief Executive Officer/Executive Director of the South Australian Research and Development Institute (SARDI) for 18 years, a position from which he retired in June 2010.

Robert's leadership of SARDI, the principal institution for public sector research in life sciences for the South Australian Government, demonstrates his depth of experience in research, research management, public and private sector policy and governance, intellectual property management, and commercialisation.

Sharon Starick BAgSc (Hons): Director (Non-executive)

Appointed: 4 November 2011, until 30 September 2014

Member: Finance, Risk and Audit Committee

Since 1993, Sharon has been producing grain and pigs in the Mallee region of South Australia. Her extensive knowledge of sustainable primary production was developed through her own on-farm practices and participation in Mallee Sustainable Farming Inc. and the South Australian No-Till Farmers Association.

Sharon's strong interest in natural resource management and conservation is reflected in her membership of South Australia's Natural Resources Management Council, the Australian Landcare Council, the South Australian Murray–Darling Basin Natural Resources Management Board, and the Community Advisory Committee for the Murray–Darling Basin Ministerial Council. As a director of Land & Water Australia, Sharon has experience in strategic planning for research and extension.

John Woods BAppSc: Director (Non-executive)

Appointed: 8 March 2012, until 30 September 2014

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 role as Chairman Chemcert Training Queensland, and as a Chemcert Trainer to the Grains and Cotton industry. As Queensland Manager Cotton Australia, the extension and adoption of best management practice was integral to his role.

Board selection

The Minister responsible for the GRDC selects and appoints the Chair of the Board. The Managing Director is selected by the Board, and holds office at the corporation's pleasure.

The GRDC Selection Committee is chosen by the Minister, on advice from the grains industry representative organisation (currently Grain Producers Australia) and in consultation with other grower organisations. The Selection Committee nominates five to seven GRDC directors. Appointment of directors nominated through this mechanism is subject to ministerial approval.

Board Secretary

Jeff Derix, General Counsel, is the Board Secretary. The role of the Board Secretary is to:

- ensure that Board minutes, resolutions and action plans are correctly recorded
- help ensure that action plans are closed out within agreed timeframes
- prepare Board agendas
- collate and distribute Board papers and other related documents.

Finance, Risk and Audit Committee

At 30 June 2012, the Board had one committee, the Finance, Risk and Audit Committee. The committee assists the Board in fulfilling its corporate governance responsibilities and reviews the GRDC's:

- 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.

The Board receives formal reports from the committee, and any decisions the Board makes in relation to the reports are recorded in the minutes of the subsequent Board meeting.

The membership of the committee comprises at least three of the non-executive members of the Board.

Roles, responsibilities and code of conduct

The roles and responsibilities of members of the Board, and their code of conduct, are documented in the GRDC Operating Manual. The Board reviews its roles and responsibilities in July each year.

Induction and training

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 *Commonwealth Authorities and Companies Act 1997* (CAC Act) requirements regarding material personal interests and with the GRDC's policy and procedures for conflict of interest. The Board reviews declarations of conflicts of interest at the start of each Board meeting and directors regularly update their conflict of interest 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 Board and committee duties.

Relationship with the Senior Leadership Group

The Senior Leadership Group has an advice and implementation role in relation to the Board. The group investigates and recommends matters for the Board to consider. It also implements Board decisions in accordance with approved policies and procedures, including an approval authority schedule that sets out the necessary delegations.

Performance monitoring and review

At the start of each year the Board sets out priorities in a detailed work plan for the corporation. The Board reviews the corporation's performance against the work plan throughout the year. This is a key factor in determining the level of any performance bonuses paid to GRDC staff.

At the start of each year the Board also sets its own annual key performance objectives. The Board reviews its performance against these objectives throughout the year. At each meeting the Board uses a checklist to review its performance against agreed effectiveness indicators.

The Board periodically commissions an external review of its performance. In 2013 the Board engaged Ashurst Australia (formerly Blake Dawson) to conduct a detailed review of the Board's performance, including by testing the Board's performance against the findings and recommendations of reviews that were conducted by Blake Dawson in 2003, 2004, 2007 and 2010 (and described in previous annual reports).

In May 2013, Ashurst Australia provided its latest report, which included a number of recommendations for ongoing improvement. The report concluded that:

It is evident from the 2013 Review that the GRDC places value on good governance, and implements a range of measures to achieve this. Similarly to previous reviews, the GRDC has strengthened its approach to and implementation of governance requirements since the 2010 Review.

The Board and GRDC management are implementing the recommendations of the review.

Meetings

The GRDC Board holds six to seven meetings every 12 months, teleconferences as required, and tours to GRDC regions. During 2012–13 the Board held five meetings in Canberra and one meeting in Melbourne. Directors joined the regional panels on their Spring Tours in September 2012.

Each director's attendance at meetings during the year is set out in Table 27.

Table 27: Attendance at Board and Board committee meetings, 2012–13

Members	Board		Finance, Risk and Audit Committee	
	Meetings attended	Meetings held and eligible to attend	Meetings attended	Meetings held and eligible to attend
Richard Brimblecombe	5	6	4	4
Jeremy Burdon	6	6		
Jenny Goddard	6	6	4	4
Kim Halbert	6	6	3	4
John Harvey	6	6		
Robert Lewis	6	6		
Keith Perrett	6	6		
Sharon Starick	6	6	4	4
John Woods	6	6		

Advisory panels

The panel system is a key strength of the GRDC. The Board makes decisions with the support of the National Panel, which in turn is informed by the knowledge and experience of three regional panels. This network helps to ensure that GRDC investments are directed towards the interests of all its stakeholders and deliver benefits as relevant products and services in each grain-growing region. The efforts and expertise of this network of growers, advisers and researchers are crucial to the GRDC's success.

The Northern Regional Panel, Southern Regional Panel and Western Regional Panel represent Australia's three grain-growing regions. Each regional panel:

- identifies and monitors regional and national grains industry issues that are relevant to the region
- interacts with grower groups, research advisory committees and other interested parties in the region to exchange information
- identifies and develops priorities for RD&E investment and recommends these to the National Panel
- keeps growers and advisers in the region informed about the GRDC's strategic direction, investment portfolio and research projects

- assists staff in monitoring 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 role and are not employees of the GRDC. The GRDC Operating Manual covers the roles, responsibilities, code of conduct, remuneration and selection guidelines for panel members.

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.

The National Panel is composed of the three regional panel chairs and the GRDC's Managing Director and executive managers.

Panel members as at 30 June 2013 are listed in Table 28. Biographical information on panel members is available from the GRDC's website and YouTube channel.

Table 28: Regional panel membership as at 30 June 2013

Chair	Deputy Chair	Members	
Northern Regional Panel			
James Clark	John Sheppard	Vicki Green Keith Harris William Martel Jodi McLean Aaron Sanderson	Loretta Serafin Mark Sutherland Rob Taylor Stephen Thomas
Southern Regional Panel			
David Shannon	Peter Schwarz	Chris Blanchard Neil Fettel Susan Findlay Tickner Chris Jones Stuart Kearns	Richard Konzag Bill Long John Minogue Keith Pengilley
Western Regional Panel			
Peter Roberts	Mike Ewing	Ralph Burnett John Even Susan Hall Paul Kelly Kit Leake	Vince Logan Narrelle Moore William Ryan Shauna Stone

Senior Leadership Group

The Senior Leadership Group (SLG) 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 SLG meets regularly and maintains and updates an annual business schedule.

The SLG has six members: the Managing Director, John Harvey, the executive managers from each of the four business groups, and the Executive Manager Transition Projects.

Transition Projects was established in April 2013 to investigate, with GRDC stakeholders, legal structures to sustain the GRDC in the future in order to optimise the delivery of benefits to grain growers and the wider community.

The management structure as at 30 June 2013 is shown in Figure 9 in Part 1. Information on the roles and backgrounds of the SLG members is shown in Figure 11.

Figure 11: Members of the GRDC Senior Leadership Group in 2012–13



John Harvey: Managing Director

John joined the GRDC in 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.

John is a graduate member of the Australian Institute of Company Directors. He is a director of Australian Crop Accreditation System Limited and was a director of the Value Added Wheat Cooperative Research Centre (VAWCRC). He was on the management boards of Pulse Breeding Australia, Barley Breeding Australia and the National Soybean Breeding Program until becoming GRDC Managing Director.

John's background is in agricultural extension and research, development and extension (RD&E) management. He previously worked with the Queensland Department of Primary Industries.

Stephen Thomas: Executive Manager Research Programs

Stephen joined the GRDC as Executive Manager Practices in 2009 and became Executive Manager Research Programs in 2011. He manages all aspects, including performance, of the GRDC's R&D investments.

Stephen is a graduate member of the Australian Institute of Company Directors. He was a director of the VAWCRC and has held board positions with Enterprise Grains Australia and the Australian Sheep Industry CRC.

Stephen was Director of Rural Innovation at the New South Wales Department of Primary Industries and a member of the New South Wales Expert Committee on Gene Technology. Stephen has an honours degree in agricultural science and a PhD in molecular biology from Adelaide University. He has undertaken postdoctoral research in Australia and overseas.

Figure 11: Members of the GRDC Senior Leadership Group in 2012–13 (continued)



Stuart Kearns: Executive Manager Regional Grower Services

Stuart joined the GRDC in 1998 as the Northern Panel Officer and later took on the additional role of Policy Advisor. He became Program Facilitator within the Product and Service Delivery group in 2002, Manager—Validation and Adoption in 2005, and Executive Manager Regional Grower Services in 2012.

Stuart has primary accountability for building, leading and managing the GRDC's Regional Grower Services Business Group to deliver research outputs in innovative products and services that create awareness and practice change and meet the needs of growers and their advisers.

Stuart is President of the ACT and Southern NSW Division of the Australian Institute of Agricultural Science and Technology. He was Chairman of the local organising committee for the fifth World Congress for Conservation Agriculture, and has held management positions in the Grain & Graze Program for mixed farming enterprises.

Vince Logan: Executive Manager Commercial

Vince joined the GRDC in 1996 as Business Manager. He was appointed Executive Manager Business Development in 2001, Executive Manager New Products in 2004 and Executive Manager Commercial in 2011. Vince manages all aspects, including performance, of the GRDC's commercial R&D investments.

Vince is a CPA and a graduate member of the Australian Institute of Company Directors. He is a director of Novozymes Biologicals Australia Pty Ltd and Arista Cereal Technologies Pty Ltd. He has been a board member of Pulse Australia Limited, GrainGene, the VAWCRC and Australian Grain Technologies Pty Ltd.

Vince comes from a background of 17 years in finance and marketing roles in the petroleum industry.

Leecia Angus: Executive Manager Corporate Services

Leecia joined the GRDC in 2005 as Manager Wheat and Barley Breeding. She was appointed Executive Manager Corporate Strategy & Impact Assessment in May 2009. In July 2011, Leecia became Executive Manager Corporate Services, in which role she manages the enabling functions of the GRDC.

Leecia holds an honours degree in science and a Graduate Diploma in Applied Finance and Investment. She is a graduate of the Australian Institute of Company Directors and the Australian Rural Leadership Program.

Vanessa Goss: Executive Manager Transition Projects

Vanessa joined the GRDC in 2013 as Executive Manager Transition Projects. Vanessa is responsible for investigating, with GRDC stakeholders, optimal legal structures for the investment in RD&E and delivery of benefits to grain growers and the wider community into the future.

Vanessa is a lawyer and company secretary by profession and developed her career managing multidisciplinary corporate service teams across a range of diverse organisations. She has significant experience in achieving transformational change in both the public sector and the commercial sector.

Vanessa has worked in several industry sectors, including sugar, cotton and horticulture. Most recently, she held the position of Chief Executive Officer with the Council of Rural Research and Development Corporations.

Vanessa has a bachelor of law degree.

Business groups

The GRDC's three operational business groups—Research Programs, Regional Grower Services, and Commercial—oversee and manage investments to achieve the outcomes determined under the GRDC's Strategic R&D

Plan 2012–17. The operational business groups are supported by the enabling business group, Corporate Services.

Table 29 provides details of the role of each group.

Table 29: GRDC business groups

Mandate	Priorities	Functional areas
Operational business groups		
<i>Research Programs</i>		
<p>Create value for Australian grain growers by investing in R&D programs that address key grains industry priorities, enhance competitiveness and sustainability and generate the greatest potential return for growers and the wider community.</p> <p>Ensure that R&D programs are nationally coordinated and integrated with extension so that the Australian grain industry has access to a highly capable and effective research, development and extension (RD&E) sector with the infrastructure and capability to meet future industry needs.</p>	<p>Design R&D programs focused on addressing issues identified by stakeholders.</p> <p>Deliver R&D outcomes that are adoptable and therefore have an impact at the farm level.</p> <p>Provide scientific advice to stakeholders to assist in the identification of issues.</p> <p>Provide national coordination and regional linkages that ensure that R&D is focused and adoptable.</p> <p>Ensure that R&D capability is maintained in core areas.</p>	<ul style="list-style-type: none"> • Agronomy • Capacity building • Climate change • Crop protection • Farming systems • Gene discovery • Germplasm enhancement • Oilseeds, pulses and summer crop breeding • Resource management • Soils and environment • Statistics • Theme coordination • Trial operations • Winter cereal breeding
<i>Regional Grower Services</i>		
<p>Deliver the outputs of research in innovative products and services that meet the needs of growers and their advisers in each region.</p>	<p>Understand growers' needs (listen to what is important).</p> <p>Develop new and improved grower-orientated products and services.</p> <p>Deliver high-value regionally relevant products and services to growers and advisers.</p> <p>Evaluate the performance and impact of GRDC products and services on growers' performance.</p>	<ul style="list-style-type: none"> • Brand management • Information management and delivery • North, south and west communication and coordination • North, south and west regional program development • Publications • Technical/scientific communication • Webmaster services
<i>Commercial</i>		
<p>Access and develop innovation from Australia and overseas to ensure that it is commercialised in such a way that the overall benefit to Australian grain growers is optimised.</p>	<p>Identify the opportunities provided within the GRDC R&D portfolio to form more commercial partnerships to deliver benefits to the Australian industry.</p> <p>Expand the GRDC's global reach in order to increase the availability of technology to the Australian industry.</p> <p>Assess the value of the GRDC's commercially orientated investments.</p> <p>Ensure that the GRDC's investment in intellectual property and commercial enterprises continues to be focused on providing a return on investment.</p>	<ul style="list-style-type: none"> • Commercial enterprises • Commercial farm technologies • Commercial grain technologies

Table 29: GRDC business groups (continued)

Mandate	Priorities	Functional areas
Enabling business group		
<i>Corporate Services</i>		
<p>In the context of the GRDC delivering benefits to its stakeholders, provide:</p> <ul style="list-style-type: none"> the supporting services required for the GRDC to plan, conduct, report on and assess the effectiveness of its operations processes to assist the operational business groups to achieve their objectives support for effective governance of the GRDC by the Board. 	<p>Plan to satisfy corporation objectives.</p> <p>Establish business processes to optimally support all business groups in the GRDC.</p> <p>Provide services to the operational business groups (human resources, information technology, records management and evaluation).</p> <p>Report for risk and compliance purposes.</p> <p>Perform financial forecasting, reporting and budgeting.</p> <p>Provide legal advice to the corporation.</p> <p>Conduct performance evaluation, including impact assessment.</p> <p>Perform portfolio and business analysis.</p>	<ul style="list-style-type: none"> Business processes Compliance Finance Human resources and industrial relations Impact assessment Information technology Legal Office management Planning, strategy and reporting Procurement Records management



Commercial business group. Left to right: (back row) Andreas Betzner, Bettina Garrett, Paul Meibusch, Jody Higgins; (front row) Vince Logan (Executive Manager). Photo: Geoff Comfort

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 Commonwealth statutory authorities.

Accountability to the Australian Government

Responsible minister

Under the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act), the GRDC was accountable to the Australian Parliament through the Minister for Agriculture, Fisheries and Forestry, Senator the Hon. Joe Ludwig, in 2012–13.

Australian Government priorities

The GRDC's strategies and investments actively address the Australian Government's National Research Priorities and ministerial research priorities for rural R&D. These priorities are discussed in detail in Part 1 and the GRDC's achievements in meeting them during 2012–13 are discussed in detail in Part 2.

On 21 June 2013, the Australian Government announced the Strategic Research Priorities, which will replace the National Research Priorities. Reporting against the National Research Priorities will conclude at the end of 2013–14.

Ministerial directions

The PIERD Act and the *Commonwealth Authorities and Companies Act 1997* (CAC Act) provide that the responsible minister or the Finance Minister may direct the GRDC with respect to the performance of its functions and the exercise of its powers, or require it to provide information.

In July 1998, the responsible minister, the Minister for Primary Industries and Energy, issued a direction requiring the GRDC to comply with the reporting requirements of the *Guidelines on Funding of Consultation Costs by Primary Industries and Energy Portfolio Statutory Authorities*.

On 1 December 2004, the Finance Minister issued the Finance Minister's (CAC Act Procurement) Directions 2004, requiring the GRDC to comply with the *Commonwealth Procurement Guidelines*.

On 18 December 2006, the Finance Minister required the GRDC to provide an annual report on compliance and financial sustainability, under section 16(1)(c) of the CAC Act. The requirements are detailed in Finance Circular 2008/05 Compliance Reporting—CAC Act bodies.

On 23 September 2008, the Minister for Agriculture, Fisheries and Forestry directed the GRDC to adopt the Australian Government Bargaining Framework.

The GRDC is complying with the directions.

General policies of the government

Until 1 July 2008, under section 28 of the CAC Act, the responsible minister could notify the GRDC Board of any general Australian Government policies that apply to the GRDC.

The GRDC had been notified of the following policies as at 30 June 2008:

- *Commonwealth Fraud Control Guidelines 2011* (replacing *Commonwealth Fraud Control Guidelines 2002*)
- Finance Circular No. 2006/06 Australian Government Foreign Exchange Risk Management Guidelines (replacing Finance Circular 2002/01 and Finance Circular 2004/11)
- Finance Circular No. 2005/09 Australian Government Cost Recovery Guidelines (replacing Finance Circular 2002/02)
- *National Code of Practice for the Construction Industry* and the associated Implementation Guidelines
- Australian Government Property Ownership Framework 2005
- Australian Government Protective Security Policy Framework (replacing Protective Security Manual 2005).

Section 28 of the CAC Act has been amended, and now provides that from 1 July 2008 the GRDC must comply with any General Policy

Order made by the Finance Minister, to the extent that it applies to the GRDC. At 30 June 2013, the Finance Minister had not made any General Policy Orders that apply to the GRDC.

Accountability to the grains industry

Industry representative

Under the PIERD Act, the GRDC is made accountable to Australian grain growers through the industry's representative organisation, Grain Producers Australia (GPA). The GRDC also consults widely with a range of other grower organisations.

Grains industry priorities

In setting directions for 2012–13 (the first year of the Strategic R&D Plan 2012–17), the GRDC identified industry priorities through direct consultations with GPA, local research advisory committees, grower groups, grower organisations and individual grain growers. The key industry priorities were incorporated into the GRDC Annual Operational Plan 2012–13. The priorities are discussed in detail in Part 1 and the GRDC's achievements in meeting them during 2012–13 are discussed in detail in Part 2.

Stakeholder report

Each year the GRDC prepares a stakeholder report to assist the representative organisation to formulate advice to the Minister on setting the research levy rates which provide the basis for the corporation's income. The draft stakeholder report for 2013–14 was provided to GPA in October 2012 for comment. The final Stakeholder Report 2013–14 was provided to GPA in June 2013.

The GRDC also prepares a growers' report each year. This shortened form of the GRDC annual report provides a reader-friendly summary of how the GRDC operates, the corporation's financial situation, and highlights of research investments. The 2011–12 report was circulated to growers and other *Ground Cover* subscribers in January 2013.

Industry levy rates

In 2012–13, 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 2012–13 are recorded in Note 4B of the Notes to the Financial Statements.

The GRDC paid the Australian Government Department of Agriculture, Fisheries and Forestry \$479,521 for the collection and management of levies in 2012–13.

Consultation arrangements

The GRDC paid \$140,193 (plus GST) to GPA for industry consultation and project work during 2012–13, in accordance with the *Guidelines on Funding of Consultation Costs by Primary Industries and Energy Portfolio Statutory Authorities*.

Of those funds, GPA used \$108,155 to cover its costs of preparing for and attending, and travel and accommodation costs of representatives of other grower groups attending, formal consultative meetings with the GRDC. GPA attends formal meetings to consider grains industry strategic directions and concerns and to assess the GRDC's performance against industry expectations.

The balance, \$32,038, was paid for GPA to conduct project work to further grains industry interests in particular technical areas, by:

- researching technical issues arising through the National Working Party on Pesticide Application
- working with the National Working Party on Grain Protection to support grains industry access to certain grain protectant products.

Obligations under the Commonwealth Authorities and Companies Act

Accountability

A system of accountability and reporting obligations for the GRDC, reflecting its obligations under the PIERD Act, is set out under the CAC Act. Under the CAC Act, the GRDC is obliged to:

- prepare an annual report (in the prescribed form, including a report of operations), and give it to the responsible minister by 15 October each year (section 9)
- ensure that any subsidiary's financial statements are audited by the Auditor-General (section 12(1))
- prepare and provide to the responsible minister interim reports during a financial year, if required by the Finance Minister by notice in the Gazette (section 13)
- prepare and provide budget estimates (section 14)
- provide the responsible minister (in writing) with particulars of any proposal of the GRDC to undertake any one of a number of significant events (section 15)
- keep the responsible minister informed of the operations of the GRDC and its subsidiaries and provide such reports, documents and information as that minister or the Finance Minister requires (section 16)
- invest any reserves in accordance with the manners listed in section 18 or approved by the Finance Minister (approved under *Commonwealth Authorities and Companies Act 1997—Investment Approval 2008/01—Grains Research and Development Corporation and Commonwealth Authorities and Companies Act 1997—Investment Approval 2008/01—Dematerialised equivalents*)
- comply with any General Policy Orders of the Australian Government to the extent that the General Policy Order applies to it (sections 28 and 48A)
- ensure that the general policies of the Australian Government as notified to the corporation before 1 July 2008 are carried out (Table A Item 71).

Conduct of officers

The CAC Act imposes specific standards of general conduct for directors and other officers. Sections 22–27P ensure that officers of Commonwealth authorities are subject to standards of conduct comparable to those required of officers of companies under the *Corporations Act 2001*.

In particular, a director must disclose to a meeting of the Board the nature of any material personal interest in a matter to be considered by the Board and, unless otherwise determined by the Board or the Minister, ensure that he or she is not present at deliberations and does not take part in any decision on the relevant subject matter (section 27F to section 27K). These requirements are reinforced by the GRDC's policy and procedures regarding conflict of interest.

Sanctions

A civil penalty regime is contained in the CAC Act (Schedule 2), to deal with any breach by directors of:

- annual reporting rules (section 11)
- accounting records (section 20)
- their general duty to exercise care and diligence (section 22)
- their general duty to act in good faith (section 23)
- their duty to not make improper use of the position of director to gain an advantage or cause detriment (sections 24 and 25).

Independent audits

The Auditor-General, under the CAC Act, is required to audit each Commonwealth authority's financial statements. In addition, the *Auditor-General Act 1997* confirms the power of the Auditor-General's staff to carry out performance audits of Commonwealth authorities and, in this role, to obtain documents and information.

The Auditor-General's Independent Audit Report on the GRDC for 2012–13 is presented on pages 106–107.

Judicial decisions and reviews by outside bodies

In 2012–13, the GRDC was not affected by judicial decisions or reviews by administrative tribunals, the Auditor-General, parliamentary committees, the Commonwealth Ombudsman or the Office of the Australian Information Commissioner.

Significant events

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 events', pursuant to section 15 of the CAC Act.

The Minister was advised of the following significant events decided by the Board during 2012–13:

- the GRDC's investment in a new commercial barley-breeding program in the Northern Region, with joint venture parties Viterro Ltd and the Queensland Department of Agriculture, Fisheries and Forestry
- an increase in the GRDC's investment in Arista Cereal Technologies Pty Ltd
- the cessation of the GRDC's membership of Barley Australia Ltd.



Zoltan Lukacs, GRDC Strategic Planning and Reporting, accepts a Gold Award for the *GRDC Annual Report 2011–12* from Tim Sheehy, Chairman of the Australasian Reporting Awards. Photo: Bright Light Photography

Corporate governance

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

Key activities during 2012–13 included:

- external review of board governance
- revision of delegations of authority
- assessment of major investment opportunities
- ongoing review of policies; risk assessment and management; and monitoring to ensure that compliance obligations were met.

Policies and procedures

In continuously improving the GRDC's corporate governance, the corporation is guided by the Australian National Audit Office *Better Practice Guide: Public Sector Governance*.

The GRDC Operating Manual, which is available to the Board and all staff members, describes the corporation's:

- policies and procedures
- roles and responsibilities (including those of the Board and its committees)
- Code of Conduct
- approval authority schedule, which sets out delegations from the Board to management under the PIERD Act.

Code of Conduct

The GRDC Code of Conduct is published as part of the GRDC Operating Manual. 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 policies section on the GRDC intranet.

Risk management and fraud control

Risk management has been embraced throughout the GRDC as a tool to assess risks at the strategic, operational and project levels.

The GRDC prepares a regular business environment report to the Board. This report is used to update the GRDC's situation analysis and identify developing risks.

The SLG and Board conduct a detailed review of the GRDC's strategic risks at least every six months.

The GRDC conducts external business risk and fraud risk assessments every two years. External provider Oakton completed an external business risk and fraud risk assessments in conjunction with GRDC management in December 2011, and subsequent staff training took place in May 2012.

To ensure that the business and fraud risks identified in the Business Risk Assessment and Fraud Control Plan are fully monitored and regularly updated, the Executive Manager Corporate Services and the Compliance Office prepare a business risk assessment report and a fraud control action plan. The SLG, in consultation with managers, updates the report and action plan each month. The Board reviews these documents at each meeting, as does the Finance, Risk and Audit Committee.

The SLG also conducts a full review of the business risk assessment report and the fraud control action plan every six months. The business risk report template was prepared in accordance with risk management standard AS/NZS ISO 3100:2009 Risk Management—Principles and Guidelines.

The GRDC's Managing Director is satisfied that:

- a fraud risk assessment and fraud control plan have been prepared that comply with the *Commonwealth Fraud Control Guidelines*
- appropriate fraud prevention, detection, investigation and reporting procedures and processes are in place
- annual fraud data that complies with the *Commonwealth Fraud Control Guidelines* has been collected and reported to the Australian Institute of Criminology.

The GRDC is insured by Comcover, the Australian Government's self-managed fund for insurance risks. Each year the GRDC participates in Comcover's Risk Management Benchmarking Program. The March 2013

benchmarking survey rated the GRDC at 7.6 out of 10—the ‘peer group’ of 15 small agencies’ average was 6.9 out of 10.

Quality assurance

The GRDC’s Quality Management System has ISO9001:2008 quality assurance accreditation from SGS Australia.

In 2012–13, regular internal audits were conducted by a contracted certified auditor. In February 2013, a successful external surveillance audit was conducted by SGS Australia and the GRDC’s certification to the ISO9001:2008 standard was continued.

In addition, the SLG formally reviewed the quality system every six months. All aspects of the quality system were considered at the quality management review meetings, including required improvements, complaints, non-conformances and commendations.

The audits demonstrate that the quality management system is robust, is being used correctly and continues to be a useful tool for business improvement.

Indemnities and insurance premiums for officers

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 2012–13 was \$10,968.

Environmental objectives

The principles of ecologically sustainable development (ESD) 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 PIERD 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 which underpin the GRDC’s RD&E investment decisions.

This annual report describes many GRDC-supported projects that contributed to ESD objectives, such as work to:

- improve productivity while reducing environmental impact, for example through tactical agronomy, tillage and stubble management, break crops, and varieties adapted for local conditions
- understand and preserve soil and water quality
- optimise biological diversity, for example in 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. In 2012–13, this included reducing paper consumption and waste by increasing the use of electronic document systems. A slight increase in electricity consumption during the year was attributable to increases in staff numbers and working hours.

Privacy

The GRDC’s privacy policy and procedures form part of the GRDC Operating Manual. The GRDC’s annual Personal Information Digest entry as at 30 June 2013 has been lodged with the Office of the Australian Information Commissioner. The digest may be viewed at the commissioner’s website (www.oaic.gov.au).

Freedom of information

Agencies subject to the *Freedom of Information Act 1982* (FOI Act) are required to publish information to the public as part of the Information Publication Scheme (IPS). Under Part II of the FOI Act each agency must display on its website a plan showing what information it publishes in accordance with the IPS requirements.

Relevant information on the GRDC’s information, including its IPS plan, is available from the GRDC’s website, at www.grdc.com.au/About-Us/Freedom-of-Information/Information-publication-scheme.

People management

The GRDC values its people highly and recognises that attracting, developing and retaining the right staff are fundamental to the ongoing success of the corporation. Individual performance is monitored and rewarded, excellence is encouraged, and training and development needs are identified as part of performance management, in order to meet the requirements of the GRDC now and in the future.

Staff

Table 30 summarises the GRDC's personnel structure at 30 June 2012, while Table 31 lists individual staff members by position.

Table 30: Personnel structure as at 30 June 2013

Type of employment	Male	Female	Total
Full-time permanent	28	20	48
Part-time permanent	1	5	6
Temporary	2	5	7
Parental leave	0	3	3
Total	31	33	64

Table 31: Staff as at 30 June 2013

	Position	Occupant
Managing Director's area	Managing Director	John Harvey
	Executive Assistant	Wynette Neil (P)
	Manager Communications	Jane O'Brien (T)
	Communications Coordinator	Julianna Burgess
Research Programs	Executive Manager	Stephen Thomas
	Administrative Coordinator Capacity	Merrilyn Baulman
	Senior Manager Natural Resources	Martin Blumenthal
	Project Manager Resource Management	Tanya Robinson
	Administrative Coordinator	Tom Langley
	Senior Manager Plant Health	Rohan Rainbow
	Manager Plant Health Technologies	Ken Young
	Project Manager Plant Health	Vacant
	Administrative Coordinator	Wendy Bosci
	Senior Manager Breeding Programs	Brondwen MacLean
	Manager Capacity Building	Kathleen Allan (P)
	Project Manager Breeding Programs	Vacant
	Administrative Coordinator	Teri-Ann Fewson
	Senior Manager Operations and Farm Practices	Peter Morrison
	Manager Trial Operations	Tom Giles
	Project Manager Farm Practices	Alexandra Murray (T)
	Senior Manager Discovery	Juan Juttner
	Manager Yield and Quality Traits	Jorge Mayer
	Manager Protection Traits	Francis Ogbonnaya
	Project Manager Traits	Omid Ansari

Table 31: Staff as at 30 June 2013 (continued)		
	Position	Occupant
Regional Grower Services	Executive Manager	Stuart Kearns
	Administrative Coordinator	Tom Riethmuller (T)
	Administrative Coordinator	Carolyn Pearson (P)
	Senior Manager Products and Services	Kyle Thoms
	Publishing Manager	Maureen Cribb
	Manager Delivery Platforms	Tom McCue
	Webmaster	Nikki Watson
	Manager Grower Services West	Darren Hughes
	Manager Grower Services North	Sharon O’Keeffe
	Manager Grower Services South	Andrew Rice
Commercial	Executive Manager	Vince Logan
	Administrative Coordinator	Sara Gordon (T)
	Senior Manager Commercial Grain Technologies	Jody Higgins
	Manager Commercial Farm Technologies	Paul Meibusch
	Senior Manager Commercial Enterprises	Andreas Betzner
	IP Officer	Bettina Garrett
Corporate Services	Executive Manager	Leecia Angus
	General Counsel and Corporate Secretary	Jeff Derix (P)
	Corporate Lawyer	James Macintyre
	Board Support Officer	Mary Dalton (T)
	Section Head Finance and Audit	Vincent Fernandes (A)
	Senior Accountant	Nino Divito
	Contracts Coordinator	Klaudia Skazlic
	Accountant—Reporting	Johan Pienaar
	Human Resources Coordinator	Cerasela Muller
	Contract Payments Officer	Carmen Jiang
	Accounts Payable Officer	Diana Barry
	Section Head Planning Processes and Reporting	Noelia Grech (P)
	Strategic Planning and Reporting	Zoltan Lukacs
	Compliance Officer	Catherine Wells
	Manager IT Facilities	Bob Watson
	System Administrator	Kris Bade (T)
	Network Support Officer	Brendan Lawler
	Manager Business Processes and Procurement	Cathy Stewart
	Impact, Business and Portfolio Analyst	Jan Edwards (A)
	Manager Records and Building	Ross Thompson
	Receptionist	Michelle Priest (P)
		Lisa Jones (T)
	Transition Projects	Executive Manager

A = acting, P = part-time permanent, T = temporary

Note: Three staff members were on parental leave on 30 June 2013: Zoe Morosini (Project Manager Plant Health), Kylie Dunstan (Manager Communication) and Danielle Jakubowski (Section Head Finance and Audit).



GRDC staff attend a team-building exercise in November 2012. Photo: GRDC

Recruitment, retention and succession management

During 2012–13, nine people were recruited to fill GRDC vacancies. Four of the vacancies arose from the establishment of new positions: Manager Plant Health Technologies, Manager Capacity Building, Senior Manager Operations and Farm Practices, and Executive Manager Transition Projects.

The GRDC continued to attract sound people from the agricultural and research sectors, indicating that the organisation continues to have a strong reputation as an employer. The GRDC has also been successful in retaining experienced staff; its turnover rate was 10.2 percent in 2012–13. Six staff members left the GRDC in 2012–13.

The GRDC conducts a formal succession planning process each year, taking into consideration internal and external factors that might affect the organisation and its people. Staff are considered according to their potential to take up certain roles, based on past results and performance. People identified as having good potential to take on new roles are encouraged and assisted to develop their skill in case an opportunity should arise.

Performance management

The GRDC's performance management process provides a framework to discuss and assess each staff member's progress towards agreed management objectives. In addition, competencies are reviewed and training needs are identified.

Learning and development

The GRDC encourages staff to undertake external education to enhance their skill set and professional development and continue their career growth, which eventually benefits GRDC business outcomes.

In 2012–13, several staff members continued formal study and other members of staff attended short courses and conferences. The GRDC is proud to have supported:

- five employees who attended managerial and leadership training programs
- 23 employees who attended training and development courses.

Monthly staff briefings and regular face-to-face communications such as social club activities and team-building excursions keep staff informed, involved, valued and cohesive in their commitment to and ownership of grains RD&E and GRDC initiatives.

Enterprise agreement

The GRDC Enterprise Agreement 2011–13 became effective on 9 December 2011 and will expire on 31 December 2013. It has been posted on the GRDC's intranet and all employees are familiar with its provisions.

A new Workplace Consultative Committee was selected by staff in 2012–13. Its role is mainly to discuss work-related matters with management.

Equal employment opportunity

Staff are employed under terms and conditions consistent with the *Equal Employment Opportunity (Commonwealth Authorities) Act 1987*. Equal opportunity employment is prescribed in the employment policy set out in the GRDC Operating Manual, and in the provisions of the GRDC Enterprise Agreement 2011–13.

Consistent with a wish to support staff members who have family responsibilities, the GRDC has been accommodating reasonable requests from staff members who require flexible working arrangements in order to meet family commitments while remaining in the workforce. Three female members of staff were on parental leave at 30 June 2013. The GRDC participates in the Australian Government's Paid Parental Leave scheme and staff benefit from financial support from the scheme as well as the GRDC's paid parental leave.

The GRDC welcomes new members of staff from within Australia and from around the world, and is proud that its workforce enjoys cultural diversity while remaining harmonious and cohesive.

The GRDC ensures that its employment policies and procedures comply with the requirements of the *Disability Discrimination Act 1992* in the broader context of the *National Disability Strategy 2010–20*, and seeks to remove obstacles that may discourage people with disabilities from contributing to the work of the GRDC.

Analysis of the GRDC workforce for 2012–13 shows that, compared to last year, both the gender profile and the age profile remained steady. Table 32 shows the age and gender profile of GRDC staff for the past two reporting periods.

Table 32: Breakdown of staff by age and gender as at 30 June 2013

	Number	Percentage
20–30 years	7	11
31–40 years	21	33
41–50 years	17	27
51–60 years	18	28
>60 years	1	1
Female	33	52
Male	31	48
Total	64	100

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 is highly valued and people are encouraged and supported to maintain or adopt a healthy lifestyle. During 2012–13, the GRDC designed and implemented WHS programs as part of the framework developed in 2012 in compliance with the *Work Health and Safety Act 2011*.

The GRDC has designed a Workplace Health and Safety Management System made up of:

- commitment, leadership and participation—including management commitment and leadership, worker participation, and policy
- planning—including hazard and risk identification and assessment, and defined WHS objectives and targets
- implementation—including hazard and risk control measures, emergency preparedness and response plans, identified competencies and related training, and documentation
- evaluation and corrective action—including monitoring and measurement (based on defined performance indicators), incident investigation and analysis, and preventive and corrective action
- management review and continual improvement.

Consultation on the implementation of the WHS framework takes place through the WHS Committee, an advisory body that assists management to improve WHS performance within the workplace, and through managers' meetings with their staff and with nominated health and safety representatives.

The guidelines supporting the system include Risk Identification Guidelines, Risk Rating Guidelines, Safe Travel Guidelines and a register of hazards, control measures and corrective actions and monitoring, as well as a Business

Continuity Plan for cases of natural disasters. Table 33 outlines measures that the GRDC implemented to promote a safe workplace for healthy staff.

Table 33: GRDC work health and safety performance in 2012–13

Indicators	Performance
Health and wellbeing initiatives	<p>The GRDC offered to staff, free of charge:</p> <ul style="list-style-type: none"> • flu vaccinations (annually) • acquisition of a defibrillator • fresh fruit (daily) • opportunities to participate in health promotion and fitness programs (such as the Global Corporate Challenge) • counselling, for staff members and members of their families, through its Employee Assistance Program.
Training and awareness of work health and safety (WHS) requirements	<p>The GRDC provided:</p> <ul style="list-style-type: none"> • induction information on WHS and the importance the GRDC gives to health and wellbeing, for new staff • training on emergency procedures, for new staff • building evacuation and fire drill training, for all staff • senior first aid training, for four staff members • defensive driver training for new staff who will be frequently required to drive as part of their role • WHS competencies and the role of the WHS Committee were defined, along with the WHS issue resolution process and consultation mechanism.
Improved internal security arrangements	<p>Compliance with the Protective Security Manual continued to be implemented in stages. The internal alarm system was tested and found to be working well.</p>
Workplace facilities maintained to a high standard	<p>Activities to ensure that facilities were well maintained included:</p> <ul style="list-style-type: none"> • twice-yearly inspection of fire extinguishers • training for fire wardens • annual checking and restocking of the first aid kit • annual checking and tagging of electrical leads and power cords • annual radiation check of microwave ovens • regular inspection of smoke detectors • regular cleaning of carpets.
Statistics of any accidents or dangerous instances	<p>There were four incidents and one near miss during 2012–13. Two incidents related to trips and falls, one was dehydration and one was a vehicle accident. The near miss was in the 'fall' category. The GRDC took action by implementing engineering control measures (for the trips) as well as elimination (for the near miss).</p>
Investigations conducted, including notices given	<p>One investigation was conducted, related to the incident category 'trips, slips and falls'. No directions or notices were given to the GRDC.</p>

Financial Statements

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Independent auditor's report



INDEPENDENT AUDITOR'S REPORT

To the Minister for Agriculture, Fisheries and Forestry

I have audited the accompanying financial statements of the Grains Research and Development Corporation for the year ended 30 June 2013, which comprise: a Statement by the Directors, Managing Director and Acting Section Head Finance and Audit; the Statement of Comprehensive Income; Balance Sheet; Statement of Changes in Equity; Cash Flow Statement; Schedule of Commitments; and Notes comprising a Summary of Significant Accounting Policies and other explanatory information.

Directors' Responsibility for the Financial Statements

The directors of the Grains Research and Development Corporation are responsible for the preparation of the financial statements that give a true and fair view in accordance with the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*, including the Australian Accounting Standards, and for such internal control as is necessary to enable the preparation of the financial statements that give a true and fair view and 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 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 Grains Research and Development Corporation's preparation of the financial statements that give a true and fair view 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 Grains Research and Development Corporation's internal control. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of accounting estimates made by the directors, as well as evaluating the overall presentation of the financial statements.

GPO Box 707 CANBERRA ACT 2601
19 National Circuit BARTON ACT 2600
Phone (02) 6203 7300 Fax (02) 6203 7777

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.

Opinion

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

- (a) have been prepared in accordance with the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*, including the Australian Accounting Standards; and
- (b) give a true and fair view of the matters required by the Finance Minister's Orders including the Grains Research and Development Corporation's financial position as at 30 June 2013 and of its financial performance and cash flows for the year then ended.

Australian National Audit Office



Carla Jago
Executive Director
Delegate of the Auditor-General
Canberra
8 August 2013

Statement by directors and chief financial officer

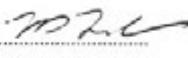
GRAINS RESEARCH AND DEVELOPMENT CORPORATION

STATEMENT BY THE DIRECTORS, MANAGING DIRECTOR AND ACTING SECTION HEAD FINANCE AND AUDIT

In our opinion, the attached financial statements for the year ended 30 June 2013 are based on properly maintained financial records and give a true and fair view of the matters required by the Finance Minister's Orders made under the Commonwealth Authorities and Companies Act 1997, as amended.

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

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

Signed..... 	Signed..... 	Signed..... 
Mr K G Perrett CHAIRMAN	Mr J E Harvey MANAGING DIRECTOR	Mr V Fernandes ACTING SECTION HEAD FINANCE AND AUDIT
8 August 2013	8 August 2013	8 August 2013

Statement of comprehensive income

for the period ended 30 June 2013

	Notes	2013 \$'000	2012 \$'000
EXPENSES			
Employee benefits	3A	8,160	7,219
Research and Development	3B	159,237	150,231
Supplier expense	3C	7,295	6,697
Depreciation and amortisation	3D	363	381
Write-down and impairment of assets	3E	2,973	535
Total expenses		178,028	165,063
LESS:			
OWN-SOURCE INCOME			
Own-source revenue			
Interest	4A	2,565	3,296
Industry contributions	4B	118,192	97,714
Project refunds	4C	1,476	1,380
Royalties	4D	5,274	4,900
Grants income	4E	1,726	3,104
Other revenue	4F	562	402
Total own-source revenue		129,795	110,796
Gains			
Gain-investments	4G	-	904
Change in fair value through profit and loss	4G	3,625	9,901
Total gains		3,625	10,805
Total own-source income		133,420	121,601
Net cost of services			
Revenue from Government	4H	62,846	55,935
Share of surplus/(deficit) of associates and joint ventures accounted for using the equity method	5C	148	(156)
Surplus attributable to the Australian Government		18,386	12,317
OTHER COMPREHENSIVE INCOME			
Changes in asset revaluation surplus	6B	-	597
Total other comprehensive income		-	597
Total comprehensive income		18,386	12,914
Total comprehensive income attributable to the Australian Government		18,386	12,914

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

Balance sheet

As at 30 June 2013

	Notes	2013 \$'000	2012 \$'000
ASSETS			
Financial assets			
Cash and cash equivalents	5A	72,253	77,860
Trade and other receivables	5B	30,645	24,072
Investments accounted for using the equity method	5C	262	114
Investments in managed funds	5D	147,391	113,767
Investments—other	5E	7,811	8,107
Total financial assets		258,362	223,920
Non-financial assets			
Land and buildings	6A,C	5,704	5,900
Property, plant and equipment	6B,C	209	256
Intangibles	6D,E	635	245
Other non-financial assets	6F	367	355
Total non-financial assets		6,915	6,756
Total assets		265,277	230,676
LIABILITIES			
Payables			
Suppliers	7A	923	602
Research and development	7B	81,766	66,187
Total payables		82,689	66,789
Provisions			
Employee provisions	8A	1,973	1,658
Total provisions		1,973	1,658
Total liabilities		84,662	68,447
Net assets		180,615	162,229
EQUITY			
Retained surplus		85,726	69,936
Asset revaluation surplus		3,913	3,913
Capital commitment reserve		1,150	-
Contracted research reserve		89,826	88,380
Total equity		180,615	162,229

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

Statement of changes in equity

for the period ended 30 June 2013

	Retained surplus		Asset revaluation surplus		Contracted research reserve		Capital commitment reserve		Total equity	
	2013 \$'000	2012 \$'000	2013 \$'000	2012 \$'000	2013 \$'000	2012 \$'000	2013 \$'000	2012 \$'000	2013 \$'000	2012 \$'000
Opening balance										
Balance carried forward from previous period	69,936	64,069	3,913	3,316	88,380	81,730	-	200	162,229	149,315
Adjusted opening balance	69,936	64,069	3,913	3,316	88,380	81,730	-	200	162,229	149,315
Comprehensive income										
Other comprehensive income	-	-	-	597	-	-	-	-	-	597
Surplus for the period	18,386	12,317	-	-	-	-	-	-	18,386	12,317
Total comprehensive income	18,386	12,317	-	597	-	-	-	-	18,386	12,914
Transfers between equity components	(2,596)	(6,450)	-	-	1,446	6,650	1,150	(200)	-	-
Closing balance as at 30 June	85,726	69,936	3,913	3,913	89,826	88,380	1,150	-	180,615	162,229

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

Cash flow statement

for the period ended 30 June 2013

	Notes	2013 \$'000	2012 \$'000
OPERATING ACTIVITIES			
Cash received			
Industry contributions		118,210	97,725
Commonwealth contributions		57,839	55,892
Interest		7,813	10,532
Grants income		2,562	4,502
Other		7,724	8,079
Total cash received		194,148	176,730
Cash used			
Research and development		143,748	138,961
Employees		8,258	7,187
Suppliers		6,565	6,777
Net GST paid		2,804	2,418
Total cash used		161,375	155,343
Net cash from (used by) operating activities	9	32,773	21,387
INVESTING ACTIVITIES			
Cash received			
Investments		-	14,000
Total cash received		-	14,000
Cash used			
Purchase of property, plant and equipment		510	178
Investments		35,193	7,247
Shares		2,677	351
Total cash used		38,380	7,776
Net cash from (used by) investing activities		(38,380)	6,224
Net increase (decrease) in cash held		(5,607)	27,611
Cash and cash equivalents at the beginning of the reporting period		77,860	50,249
Cash and cash equivalents at the end of the reporting period	5A	72,253	77,860

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

Schedule of commitments

as at 30 June 2013

	2013 \$'000	2012 \$'000
BY TYPE		
Commitments receivable		
Net GST recoverable on commitments	(24,497)	(18,601)
Total commitments receivable	(24,497)	(18,601)
Commitments payable		
Capital commitments		
Investments ¹	1,150	-
Total capital commitments	1,150	-
Other commitments		
Operating leases ²	508	268
Research projects forward program ³	268,958	204,340
Total other commitments	269,466	204,608
Total commitments payable	270,616	204,608
Net commitments by type	246,119	186,007
BY MATURITY		
Commitments receivable		
One year or less	(8,607)	(8,006)
From one year to five years	(15,890)	(10,595)
Over five years	-	-
Total commitments receivable	(24,497)	(18,601)
Commitments payable		
Capital commitments		
One year or less	1,150	-
From one year to five years	-	-
Total capital commitments	1,150	-
Research project commitments		
One year or less	94,417	87,896
From one year to five years	174,541	116,444
Over five years	-	-
Research projects commitments	268,958	204,340
Operating lease commitments		
One year or less	258	171
From one year to five years	250	97
Over five years	-	-
Total operating lease commitments	508	268
Total commitments payable	270,616	204,608
Net commitments by maturity	246,119	186,007

Note: Commitments are GST inclusive where relevant.

1 The nature of capital commitments relates to share purchases.

2 Operating leases comprise:

<i>Nature of the lease</i>	<i>General description of leasing arrangement</i>
Motor vehicles—staff	Leased as part of salary packages No contingent rentals exist
Franking machine	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

3 Research project forward program commitments are amounts payable in respect of contracted Research Agreements held between the GRDC and research providers as at 30 June 2013.

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

Notes to and forming part of the financial statements

for the year ended 30 June 2013

Note 1: Summary of Significant Accounting Policies

1.1 Objective of the GRDC

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 and Energy Research and Development Act 1989*. It is a not-for-profit entity. The primary objective of the Corporation is to support effective competition by Australian grain growers in global grain markets, through enhanced profitability and sustainability. By strategically investing in research and development (R&D) and the delivery of R&D outputs, the Corporation works to achieve one 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.

1.2 Basis of Preparation of the Financial Statements

The financial statements are general purpose financial statements and are required by clause 1(b) of Schedule 1 to the *Commonwealth Authorities and Companies Act 1997*.

The financial statements have been prepared in accordance with:

- (a) Finance Minister's Orders (FMOs) for reporting periods ending on or after 1 July 2012; 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 and values are rounded to the nearest thousand dollars unless otherwise specified.

Unless an alternative treatment is specifically required by an accounting standard or the FMOs, assets and liabilities are recognised in the balance sheet when and only when it is probable that future economic benefits will flow to the Corporation or a future sacrifice of economic benefits will be required and the amounts of the assets or liabilities can be reliably measured. However, assets and liabilities arising under executor contracts are not recognised unless required by an accounting standard. Liabilities and assets that are unrecognised are reported in the Schedule of Commitments.

Unless alternative treatment is specifically required by an accounting standard, income and expenses are recognised in the Statement of Comprehensive Income when, and only when, the flow, consumption or loss of economic benefits has occurred and can be reliably measured.

1.3 Significant Accounting Judgements and Estimates

In the process of applying the accounting policies listed in this note, the Corporation has made the following estimates that have the most significant impact on the amounts recorded in the financial statements:

- (a) The valuation of unlisted shares held by the Corporation (as detailed in note 1.11) at each balance date is equivalent to the Corporation's share of net assets of each company.

No other accounting assumptions or estimates have been identified that have a significant risk of causing material adjustment to carrying amounts of assets and liabilities within the next reporting period.

1.4 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.

The following new standards, revised standards, interpretations and amendments to standards were issued prior to the sign-off date, were applicable to the current reporting period and had a financial impact on the Corporation:

Note 1: Summary of Significant Accounting Policies *(continued)*

1.4 New Australian Accounting Standards *(continued)*

Standard/Interpretation		Impact on the Corporation
AASB 9	Financial Instruments – December 2010 (Principal)	Changes to presentation, however, no significant impact on financial statements.
AASB119	Employee Entitlements – September 2011 (Principal)	Changes may impact accounting treatment and disclosure requirements.
AASB 2011-9	Amendments to AAS – Presentation of Items of Other Comprehensive Income	This will not affect the measurement of any of the items recognised in the balance sheet or the profit or loss in the current period. Revised presentation of comprehensive income.
AASB 13	Fair Value Measurement	Provides further guidance on measuring fair value and extends fair value hierarchy disclosures to all assets and liabilities carried at fair value.
AASB 2011-8	Amendments to Australian Accounting Standards arising from AASB 13	AASB 13 establishes a new definition of 'fair value' and general requirements for entities measuring and disclosing assets and liabilities at fair value.
AASB 2011-10	Amendments to Australian Accounting Standards arising from AASB 119 (September 2011)	Employee benefit disclosures are to be prepared in accordance with PRIMA.
AASB 2012-5	Amendments to Australian Accounting Standards arising from Annual Improvements 2009–2011 Cycle	As appropriate.
AASB 9	Financial Instruments [Issued Dec 2009]	Reduction in number of categories of financial instruments. There may be reclassification of financial instruments classified as available for sale and loans and receivables to the two remaining categories – amortized cost and fair value.
AASB 119	Employee Benefits	Single approach for recognition and measurement of defined benefit plans. Revised recognition rules for termination payments. New definition for short-term employee benefits.

Other new standards, revised standards, interpretations and amendments to standards that were issued prior to the sign-off date and are applicable to the current reporting period did not have a financial impact, and are not expected to have a future financial impact on the Corporation.

Future Australian Accounting Standard Requirements

The following new standards, revised standards, interpretations and amendments to standards were issued by the Australian Accounting Standards Board prior to the sign-off date, which are expected to have a financial impact on the Corporation for future reporting periods:

Standard/Interpretation		Impact on the Corporation
AASB 2012-6	Financial Instruments – January 2015	Changes may impact on classifications of financial assets and liabilities.

Other new standards, revised standards, interpretations and amendments to standards that were issued prior to the sign-off date and are applicable to future reporting periods are not expected to have a future financial impact on the Corporation.

Note 1: Summary of Significant Accounting Policies *(continued)*

1.5 Revenue

Revenue from the sale of goods is recognised when:

- a) the risks and rewards of ownership have been transferred to the buyer;
- b) the entity retains no managerial involvement or effective control over the goods;
- c) the revenue and transaction costs incurred can be reliably measured; and
- d) it is probable that the economic benefits associated with the transaction will flow to the entity.

Revenue from rendering of services is recognised by reference to the stage of completion of contracts at the reporting date. The revenue is recognised when:

- a) the amount of revenue, stage of completion and transaction costs incurred can be reliably measured; and
- b) the probable economic benefits associated with the transaction will flow to the entity.

The revenues described in this note are revenues relating to the core activities of the Corporation.

Revenue from Government

Revenue paid to the Corporation under Section 32 of the *Primary Industries and Energy 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 agencies (appropriated to the agency as a CAC Act body 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.

Industry contributions

Revenue paid to the Corporation under Section 30 of the *Primary Industries and Energy 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.

Interest revenue

Interest revenue is recognised using the effective interest method as set out in AASB 139 *Financial Instruments: Recognition and Measurement*.

Project refunds

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.

Royalties

Royalties are recognised when the royalty is entitled to be received by the Corporation.

Grants income

Grants income is revenue paid to the Corporation for the purpose of funding specific research and development projects. Grants and other non-reciprocal contributions are recognised as revenue when the Corporation obtains control over the assets comprising the contributions. Control is normally obtained upon receipt.

1.6 Gains

Sale of assets

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

Gain – Investments

Gains from a change in the accounting treatment of share investments are recognised at the time the change is required to be made (for example, at the time significant influence is lost).

Note 1: Summary of Significant Accounting Policies *(continued)*

1.7 Employee Benefits

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.

The nominal amount is calculated with regard to the rates expected to be paid on settlement of the liability.

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. No provision has been made for sick leave as all sick leave is non-vesting and the average sick leave taken in future years by employees of the Corporation is estimated to be less than the annual entitlement for sick leave.

The leave liabilities are calculated on the basis of employees' remuneration at the estimated salary rates that apply 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. In applying this method, the accrued long service leave for each employee as at reporting date is probability weighted, based on the Australian Government probability profile. The amount obtained for each employee is then discounted using the ten year Treasury Bond rate. The total estimated liability for the Corporation is the sum of the liabilities for each employee. The estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

Separation and redundancy

The Corporation recognises a provision for termination when it has developed a detailed formal plan for the terminations and has informed those employees affected that it will carry out the terminations.

Superannuation

Staff of the Corporation 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 by the Department of Finance and Deregulation'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% of superannuable salaries.

As at 30 June, superannuation contributions payable were \$6,733, (2012: \$23,773).

1.8 Leases

A distinction is made between finance leases and operating leases. Finance leases effectively transfer from the lessor to the lessee substantially all the risks and rewards incidental to ownership of leased assets. An operating lease is a lease that is not a finance lease. In operating leases, the lessor effectively retains substantially all such risks and benefits.

The Corporation has no finance leases. Operating lease payments are expensed on a straight-line basis which is representative of the pattern of benefits derived from the leased assets.

1.9 Research and Development (R&D) Contracts

The Corporation recognises project liabilities through project agreements that require the research partner to perform services, provide facilities, or to meet required specifications or eligibility criteria. In these cases, the initial payment is recognised as a liability and expense when the agreement is sent for signing to the other party and the specifications or eligibility criteria have been agreed by the research partner to the Corporation's satisfaction. The remaining payments are recognised to the extent that the services required have been performed.

Note 1: Summary of Significant Accounting Policies *(continued)*

1.10 Cash

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

- 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.

1.11 Financial Assets

The Corporation classifies its financial assets in the following categories:

- (a) financial assets at fair value through profit or loss;
- (b) held-to-maturity investments;
- (c) available-for-sale financial assets; and
- (d) 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

The effective interest method is a method of calculating the amortised cost of a financial asset and of allocating interest income over the relevant period. The effective interest rate is the rate that exactly discounts estimated future cash receipts through the expected life of the financial asset, or, where appropriate, a shorter period.

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. Interest earned on financial assets at FVPL is included in note 4A.

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 has acquired shares in the following unlisted companies:

- Australian Grain Technologies Pty Ltd (holding: 39.11%);
- Australian Centre for Plant Functional Genomics Pty Ltd (holding: 18.17%);
- Arista Cereal Technologies Pty Ltd (holding: 21.28%);
- InterGrain Pty Ltd (holding: 27.30%);
- Canola Breeders Western Australia Pty Ltd (holding: 39.25%); and
- HRZ Wheats Pty Ltd (holding: 18.16%)

The above companies conduct research and development activities relating to seed technology, new wheat varieties, high amylose wheat and the development of canola 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.

Note 1: Summary of Significant Accounting Policies *(continued)*

1.11 Financial Assets *(continued)*

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 done annually and the provisions adjusted accordingly. The provision for each investment is disclosed at note 5E. 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.

Held-to-maturity investments

Non-derivative financial assets with fixed or determinable payments and fixed maturity dates that the Corporation has the positive intent and ability to hold to maturity are classified as held-to-maturity investments. Held-to-maturity investments are recorded at amortised cost using the effective interest method less impairment, with revenue recognised on an effective yield basis.

Loans and receivables

Trade receivables, loans 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. Interest is recognised by applying the effective interest rate.

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.

1.12 Investments in Associates

The Corporation's investments in its associates are accounted for using the equity method.

Under the equity method, investments in associates are carried in the Corporation's balance sheet at cost as adjusted for post-acquisition changes in the Corporation's share of net assets of the associates. Goodwill relating to an associate is included in the carrying amount of the investment. After the application of the equity method, the Corporation determines whether it is necessary to recognise any impairment loss with respect to the net investment in associates.

1.13 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 yield basis.

The effective interest method is a method of calculating the amortised cost of a financial liability and of allocating interest expense over the relevant period. The effective interest rate is the rate that exactly discounts estimated future cash payments through the expected life of the financial liability, or, where appropriate, a shorter period.

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).

Note 1: Summary of Significant Accounting Policies *(continued)*

1.14 Contingent Liabilities and Contingent Assets

Contingent liabilities and contingent assets are not recognised in the Balance Sheet but are reported in the relevant schedules and notes. They may arise from uncertainty as to the existence of a liability or asset, or represent an asset or liability in respect of which the amount cannot be reliably measured. Contingent assets are disclosed when settlement is probable but not virtually certain and contingent liabilities are disclosed when settlement is greater than remote.

As at 30 June 2013 the Corporation held no contingent liabilities or contingent assets.

1.15 Acquisition of Assets

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 (with the exception of investments in equity instruments that do not have a quoted market price in an active market and whose fair value cannot be reliably measured) 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.

1.16 Property, Plant and Equipment

Asset recognition threshold

Purchases of property, plant and equipment are recognised initially at cost in the Balance Sheet, 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.

Revaluations

Fair values for each class of asset are determined as shown below:

Asset Class	Fair Value Measured at:
Land	Market selling price
Building	Market selling price
Infrastructure, plant and equipment	Market selling price

Following initial recognition at cost, property, plant and equipment were carried at fair value less subsequent accumulated depreciation and accumulated impairment losses. Valuations were 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 depended upon the volatility of movements in market values for the relevant assets.

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

Any accumulated depreciation as at the revaluation date is eliminated against the gross carrying amount of the asset and the asset 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:

	2013	2012
Buildings on leasehold land	25 years	25 years
Other infrastructure, plant & equipment	3 to 12 years	3 to 12 years

Note 1: Summary of Significant Accounting Policies *(continued)*

1.16 Property, Plant and Equipment *(continued)*

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 (2012: \$NIL).

Impairment

All assets were assessed for impairment at 30 June 2013. 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 sell 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.

1.17 Intangibles

The Corporation's intangibles comprise software for internal use and development costs.

Software

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:

	2013	2012
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 2013.

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 2013.

1.18 Taxation

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

Revenues, expenses and assets are recognised net of GST except:

- (a) where the amount of GST incurred is not recoverable from the Australian Taxation Office; and
- (b) for receivables and payables.

Note 2: Events After the Reporting Period

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

Note 3: Expenses

	2013 \$'000	2012 \$'000
3A—Employee Benefits		
Salaries and wages	7,048	5,871
Superannuation		
Defined contribution plans	729	660
Defined benefits plans	88	124
Leave and other entitlements	295	399
Separation and redundancies	-	165
Total employee benefits	8,160	7,219

2013	Cross-commodity \$'000	Coarse grains \$'000	Grain legumes \$'000	Oilseeds \$'000	Wheat \$'000	Total \$'000
3B—Research and Development						
National	101,920	1,118	5,830	1,500	3,947	114,315
Northern Region	9,606	-	300	-	325	10,231
Southern Region	19,510	-	-	688	559	20,757
Western Region	12,199	-	497	788	450	13,934
TOTAL	143,235	1,118	6,627	2,976	5,281	159,237
2012	140,459	2,090	1,973	1,420	4,289	150,231

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

	2013 \$'000	2012 \$'000
3C—Suppliers		
Goods and services		
Staff travel and accommodation	1,256	1,097
Consultants	33	30
Panel expenses	2,321	1,959
Program team expenses	-	17
Communications	51	65
Corporate governance	236	210
Corporate services and legal	2,357	2,149
Levy collection costs	479	645
Other	562	522
Total goods and services	7,295	6,694
Goods and services are made up of:		
Provision of goods—external parties	90	117
Rendering of services—external parties	7,205	6,577
Total goods and services	7,295	6,694

Note 3: Expenses (continued)

	2013 \$'000	2012 \$'000
3C—Suppliers (continued)		
Other supplier expenses		
Operating lease rentals—external parties		
Minimum lease payments	-	3
Total other supplier expenses	-	3
Total supplier expenses	7,295	6,697
3D—Depreciation and Amortisation		
Depreciation:		
Property, plant and equipment	82	82
Buildings	196	195
Total depreciation	278	277
Amortisation:		
Intangibles:		
Information Management System	11	13
Software	74	91
Total amortisation	85	104
Total depreciation and amortisation	363	381
3E—Write-down and Impairment of Assets		
Asset write-downs and impairments from:		
Investments (shares)—revaluation decrement	2,973	535
Total write-down and impairment of assets	2,973	535

Note 4: Income

	2013 \$'000	2012 \$'000
OWN-SOURCE REVENUE		
Note 4A—Interest		
Deposits	2,565	3,296
Total interest	2,565	3,296
Note 4B—Industry Contributions		
Coarse grains	22,583	19,550
Grain legumes	10,453	7,376
Oilseeds	22,443	16,841
Wheat	62,713	53,947
Total industry contributions	118,192	97,714

Note 4: Income *(continued)*

	2013 \$'000	2012 \$'000
Note 4C—Project Refunds		
Cross commodity	1,340	1,038
Coarse grains	62	3
Grain legumes	42	-
Oilseeds	-	5
Wheat	32	334
Total project refunds	1,476	1,380
Note 4D—Royalties		
Coarse grains	1,591	1,428
Grain legumes	965	497
Oilseeds	209	396
Wheat	1,992	1,974
Other	517	605
Total royalties	5,274	4,900
Note 4E—Grants Income		
Commonwealth	1,494	2,664
Industry	230	440
State and Territory Government	2	-
Total grants income	1,726	3,104
Note 4F—Other Revenue		
Levy penalties	204	95
Groundcover advertising income	192	230
Publications revenue	104	-
Other income	62	77
Total other revenue	562	402
GAINS		
Note 4G—Other Gains		
Gain on change in accounting treatment of share investment	-	904
Change in fair value through profit and loss	3,625	9,901
	3,625	10,805
REVENUE FROM GOVERNMENT		
Note 4H—Revenue from Government		
Commonwealth contributions	62,846	55,935
Total revenue from Government	62,846	55,935

Note 5: Financial Assets

	2013 \$'000	2012 \$'000
5A—Cash and Cash Equivalents		
Interest bearing cheque account	1,058	575
Money market call account	61,499	65,949
Business online saver account	9,696	11,336
Total cash and cash equivalents	72,253	77,860

	2013 \$'000	2012 \$'000
5B—Trade and Other Receivables		
Goods and services		
Goods and services—related entities	21,017	16,028
Goods and services—external parties	650	1,097
Total receivables for goods and services	21,667	17,125
Other receivables		
GST receivable from the Australian Taxation Office	8,978	6,947
Total other receivables	8,978	6,947
Total trade and other receivables	30,645	24,072

Receivables are aged as follows:		
Not overdue	30,364	23,656
Overdue by:		
0 to 30 days	45	115
31 to 60 days	-	-
61 to 90 days	-	-
more than 90 days	236	301
	281	416
Total receivables	30,645	24,072

All receivables are expected to be recovered in no more than 12 months. No indicators of impairment were found for trade and other receivables.

5C—Investments Accounted for Using the Equity Method

Investments in associates:		
Novozymes Biologicals Australia Pty Ltd	262	114
Total equity accounted investments	262	114

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

Details of investments accounted for using the equity method

Name of entity	Principal activity	Reporting date	Ownership	
			2013 %	2012 %
Novozymes Biologicals Australia Pty Ltd*	Soil inoculant research and development	30 September	50.0	50.0

* Incorporated in Australia

Note 5: Financial Assets *(continued)*

Summarised financial information of associates:

	2013 \$'000	2012 \$'000
Balance sheet		
Assets	1,071	907
Liabilities	(547)	(678)
Net assets	524	229
Statement of comprehensive income		
Income	625	385
Expenses	(732)	(707)
Net (deficit)	(107)	(322)
Share of associates' net surplus/(deficit)		
Share of net surplus/(deficit) before tax	148	(156)
Income tax expense	-	-
Share of associates' net surplus/(deficit) after tax	148	(156)
5D—Investments in Managed Funds		
BT Individually Managed Fund	58,508	57,174
At market value		
UBS Individually Managed Fund	58,364	56,593
At market value		
ANZ Individually Managed Fund	30,519	-
At market value		
Total investments	147,391	113,767

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 18(3)(d) of the CAC Act to hold the investments listed above.

	2013 \$'000	2012 \$'000
5E—Investments—Other		
<i>Shares in unlisted companies</i>		
Australian Grain Technologies Pty Ltd	11,386	11,386
Provision for diminution in share value	(7,171)	(7,171)
	4,215	4,215
Australian Centre for Plant Functional Genomics Pty Ltd	21	21
Provision for diminution in share value	(8)	(8)
	13	13
Arista Cereal Technologies Pty Ltd	3,600	3,200
Provision for diminution in share value	(2,288)	(1,990)
	1,312	1,210
InterGrain Pty Ltd	7,200	7,200
Provision for diminution in share value	(5,392)	(5,392)
	1,808	1,808

Note 5: Financial Assets (continued)

	2013 \$'000	2012 \$'000
5E—Investments—Other (continued)		
Canola Breeders Western Australia Pty Ltd	3,227	950
Provision for diminution in share value	(3,227)	(950)
	-	-
HRZ Wheats Pty Ltd	1,499	1,499
Provision for diminution in share value	(1,036)	(638)
	463	861
Gross Investments—Other	26,933	24,256
Total provision for diminution in share value	(19,122)	(16,149)
Net Investments—Other	7,811	8,107

The shares held are ordinary shares. All such investments are expected to be recovered in more than 12 months.

Note 6: Non-Financial Assets

	2013 \$'000	2012 \$'000
6A—Land and Buildings		
Leasehold land—fair value	1,000	1,000
Total land	1,000	1,000
Buildings on leasehold land—fair value	4,900	4,900
Accumulated depreciation	196	-
Total buildings	4,704	4,900
Total land and buildings	5,704	5,900
No indicators of impairment were found for land and buildings. No land and buildings were expected to be sold or disposed of within the next 12 months.		
6B—Property, Plant and Equipment		
Property, plant and equipment—fair value	372	338
Accumulated depreciation	(163)	(82)
Total property, plant and equipment	209	256
Movement in asset revaluation reserve		
Increment for buildings	-	597
Decrement for property, plant and equipment	-	-
Total movement in asset revaluation reserve	-	597

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

No property, plant or equipment is 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 at Note 1.

No revaluation decrements were expensed during the year (2012: \$NIL).

A formal revaluation of land and building was conducted by an independent valuer, the Australian Valuation Office as at 30 June 2012. It has been assessed that the carrying amount of land and building does not materially differ from fair value at 30 June 2013.

A formal revaluation of property, plant and equipment was conducted by the Australian Valuation Office as at 30 June 2011. It has been assessed that the carrying amount of property, plant and equipment does not materially differ from fair value at 30 June 2013.

Note 6: Non-Financial Assets (continued)

	Leasehold Land \$'000	Buildings on Leasehold Land \$'000	Other Property, Plant & Equipment \$'000	Total \$'000
6C—Reconciliation of the Opening and Closing Balances of Property, Plant and Equipment 2013				
As at 1 July 2012				
Gross book value	1,000	4,900	338	6,238
Accumulated depreciation and impairment	-	-	(82)	(82)
Net book value 1 July 2012	1,000	4,900	256	6,156
Additions:				
By purchase	-	-	35	35
Revaluations and impairment recognised in other comprehensive income	-	-	-	-
Depreciation expense	-	(196)	(82)	(278)
Disposals:				
Other disposals	-	-	-	-
Net book value 30 June 2013	1,000	4,704	209	5,913
Net book value as at 30 June 2013 represented by:				
Gross book value	1,000	4,900	372	6,272
Accumulated depreciation and impairment losses	-	(196)	(163)	(359)
Net book value 30 June 2013	1,000	4,704	209	5,913
6C—Reconciliation of the Opening and Closing Balances of Property, Plant and Equipment 2012				
As at 1 July 2011				
Gross book value	1,000	4,890	242	6,132
Accumulated depreciation and impairment	-	(392)	-	(392)
Net book value 1 July 2011	1,000	4,498	242	5,740
Additions:				
By purchase	-	-	96	96
Revaluations and impairment recognised in other comprehensive income	-	597	-	597
Depreciation expense	-	(195)	(82)	(277)
Disposals:				
Other disposals	-	-	-	-
Net book value 30 June 2012	1,000	4,900	256	6,156
Net book value as at 30 June 2012 represented by:				
Gross book value	1,000	4,900	338	6,238
Accumulated depreciation and impairment losses	-	-	(82)	(82)
Net book value 30 June 2012	1,000	4,900	256	6,156

Note 6: Non-Financial Assets (continued)

	2013 \$'000	2012 \$'000
6D—Intangibles		
Information management system—at cost	727	725
Accumulated amortisation	(727)	(715)
Total information management system	-	10
Software—at cost	988	516
Accumulated amortisation	(468)	(394)
Total software	520	122
Intellectual property—at cost	115	113
Accumulated amortisation	-	-
Total intellectual property	115	113
Total intangibles	635	245

No indicators of impairment were found for intangible assets.

No intangibles are expected to be sold or disposed of within the next 12 months.

	Information Management System \$'000	Software \$'000	Intellectual Property \$'000	Total \$'000
6E—Reconciliation of the Opening and Closing Balances of Intangibles 2013				
As at 1 July 2012				
Gross book value	725	516	113	1,354
Accumulated amortisation and impairment	(715)	(394)	-	(1,109)
Net book value 1 July 2012	10	122	113	245
Additions				
By purchase	1	472	2	475
Amortisation expense	(11)	(74)	-	(85)
Net book value 30 June 2013	0	520	115	635
Net book value as at 30 June 2013 represented by:				
Gross book value	727	988	115	1,830
Accumulated amortisation and impairment	(727)	(468)	-	(1,195)
Net book value 30 June 2013	-	520	115	635

Note 6: Non-Financial Assets (continued)

	Information Management System \$'000	Software \$'000	Intellectual Property \$'000	Total \$'000
<i>6E (continued) – Reconciliation of the Opening and Closing Balances of Intangibles 2012</i>				
As at 1 July 2011				
Gross book value	725	448	99	1,272
Accumulated amortisation and impairment	(702)	(303)	-	(1,005)
Net book value 1 July 2011	23	145	99	267
Additions				
By purchase	-	68	14	82
Amortisation expense	(13)	(91)	-	(104)
Net book value 30 June 2012	10	122	113	245
Net book value as at 30 June 2012 represented by:				
Gross book value	725	516	113	1,354
Accumulated amortisation and impairment	(715)	(394)	-	(1,109)
Net book value 30 June 2012	10	122	113	245

	2013 \$'000	2012 \$'000
6F—Other Non-Financial Assets		
Accrued interest	188	242
Accrued income	146	83
Prepayments	33	30
Total other non-financial assets	367	355

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 2.00% to 3.63% (2012: 2.95% to 5.07%) and the frequency of payments is monthly.

Note 7: Payables

	2013 \$'000	2012 \$'000
7A—Suppliers		
Trade creditors—external parties	489	295
Accrued expenses—external parties	434	307
Total supplier payables	923	602

All supplier payables are expected to be settled within 12 months. Settlement is usually made within 30 days.

Note 7: Payables *(continued)*

	2013 \$'000	2012 \$'000
7B—Research and Development		
Research and development—external parties	81,766	66,187
Research and development payables are expected to be settled in:		
No more than 12 months	78,065	62,103
More than 12 months	3,701	4,084
Total research and development payables	81,766	66,187

Note 8: Provisions

	2013 \$'000	2012 \$'000
8A—Employee Provisions		
Leave	1,973	1,658
Total employee provisions	1,973	1,658
Employee provisions are expected to be settled in:		
No more than 12 months	1,521	1,220
More than 12 months	452	438
Total employee provisions	1,973	1,658

Note 9: Cash Flow Reconciliation

Reconciliation of cash and cash equivalents as per Balance Sheet to Cash Flow Statement

	Notes	2013 \$'000	2012 \$'000
Cash and cash equivalents as per:			
Cash Flow Statement		72,253	77,860
Balance Sheet	5A	72,253	77,860
Difference		-	-

Note 9: Cash Flow Reconciliation *(continued)*

Reconciliation of net cost of services to net cash from operating activities:

	2013 \$'000	2012 \$'000
Net cost of services	(44,608)	(43,462)
Add revenue from Government	62,846	55,935
Add share of (deficit) of associates	148	(156)
Adjustments for non-cash items		
Depreciation/amortisation	363	381
Net write down of financial assets	2,973	535
Share of net (surplus)/loss of associates	(148)	156
Revaluation of investments	1,568	(2,654)
Gain-investments	-	(904)
Changes in assets/liabilities		
(Increase)/decrease in trade and other receivables	(6,425)	(27)
(Increase)/decrease in other non-financial assets	(3)	(11)
(Increase)/decrease in employee provisions	315	399
(Increase)/decrease in trade and other payables	15,744	11,195
Net cash from operating activities	32,773	21,387

Note 10: Directors' Remuneration

	2013	2012
The number of non-executive directors of the Corporation included in these figures are shown below in the relevant remuneration bands:		
\$0 – \$29,999	1	11
\$30,000 – \$59,999	6	1
\$60,000 – \$89,999	1	1
Total	8	13
	\$	\$
Total remuneration received or due and receivable by directors of the Corporation	320,558	269,816

Remuneration of executive directors is included in Note 12: Executive Remuneration.

The directors of the Corporation are appointed by the Minister—Agriculture, Fisheries and Forestry, Australia.

Note 11: Related Party Disclosures

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

Mr Keith Perrett (Chair)
 Ms Jennifer Goddard (reappointed 4 November 2011)
 Mr Richard Brimblecombe (appointed 4 November 2011)
 Dr Jeremy Burdon (appointed 4 November 2011)
 Mr Kim Halbert (appointed 4 November 2011, Deputy Chair—appointed 10 April 2012)
 Professor Robert Lewis (appointed 4 November 2011)
 Ms Sharon Starick (appointed 4 November 2011)
 Mr John Woods (appointed 8 March 2012)
 Mr John Harvey (Executive Director)

Several directors of the Corporation hold directorships with other companies. Any transactions between the Corporation and companies with a Director common to the Corporation would be conducted using commercial and arms-length principles.

Note 12: Executive Remuneration

	2013 \$	2012 \$
12A—Senior Executive Remuneration Expenses for the Reporting Period		
Short-term employee benefits:		
Salary	1,114,838	1,165,939
Annual leave accrued	93,714	98,811
Performance bonuses	124,163	151,514
Total short-term employee benefits	1,332,715	1,416,264
Post-employment benefits:		
Superannuation	71,203	85,050
Total post-employment benefits	71,203	85,050
Other long-term benefits:		
Long service leave	29,299	32,691
Total other long-term benefits	29,299	32,691
Termination benefits	-	99,694
Total senior executive remuneration expenses	1,433,217	1,633,699

Notes

- Note 12A is prepared on an accrual basis (therefore the performance bonus expenses disclosed above may differ from the cash "Bonus paid" in Note 12B).
- Note 12A excludes acting arrangements and part-year service where total remuneration expensed for a senior executive was less than \$180,000.

Note 12: Executive Remuneration *(continued)*

12B—Average Annual Reportable Remuneration Paid to Substantive Senior Executives During the Reporting Period

Average annual reportable remuneration ¹	2013						Total \$
	Substantive Senior Executives No.	Reportable salary ² \$	Contributed Superannuation ³ \$	Reportable Allowances ⁴ \$	Bonus Paid ⁵ \$		
Total remuneration (including part-time arrangements):							
\$180,000 to \$209,999	-	-	-	-	-	-	-
\$210,000 to \$239,999	3	200,746	14,598	29	18,104	233,477	233,477
\$240,000 to \$269,999	1	220,113	14,603	132	22,609	257,457	257,457
\$330,000 to \$359,999	1	301,319	12,807	176	44,366	358,668	358,668
Total	5						
Average annual reportable remuneration ¹	2012						Total \$
	Substantive Senior Executives No.	Reportable salary ² \$	Contributed Superannuation ³ \$	Reportable Allowances ⁴ \$	Bonus Paid ⁵ \$		
Total remuneration (including part-time arrangements):							
\$180,000 to \$209,999	2	164,196	13,031	44	19,758	197,029	197,029
\$210,000 to \$239,999	2	184,405	12,937	176	23,253	220,771	220,771
\$240,000 to \$269,999	1	228,922	1,544	-	15,836	246,302	246,302
\$300,000 to \$329,999	2	268,899	16,557	110	26,747	312,313	312,313
Total	7						

Notes

- This table reports substantive Senior Executives who received remuneration during the reporting period. Each row is an averaged figure based on headcount for individuals in the band.
- 'Reportable salary' includes the following:
 - gross payments (less any bonuses paid, which are separated out and disclosed in the 'bonus paid' column);
 - reportable fringe benefits (at the net amount prior to 'grossing up' to account for tax purposes);
 - exempt foreign employment income; and
 - salary sacrificed benefits.
- The 'contributed superannuation' amount is the average actual cost to the entity for provision of superannuation benefits to substantive senior executives in that reportable remuneration band during the reporting period.
- 'Reportable allowances' are the average actual allowances paid as per the 'total allowances' line on individuals' payment summaries.
- 'Bonus paid' represents average actual bonuses paid during the reporting period in that reportable remuneration band. The 'bonus paid' within a particular band may vary between financial years due to various factors such as individuals commencing with or leaving the entity during the financial year.

Note 12: Executive Remuneration (continued)

12C—Average Annual Reportable Remuneration Paid to Other Highly Paid Staff During the Reporting Period

2013						
Average annual reportable remuneration ¹	Staff No.	Reportable salary ^{2,6} \$	Contributed Superannuation ^{3,6} \$	Reportable Allowances ⁴ \$	Bonus Paid ⁵ \$	Total \$
Total remuneration (including part-time arrangements)	2	164,818	14,738	22	6,575	186,153
\$180,000 to \$209,999						
Total	2					
2012						
Average annual reportable remuneration ¹	Staff No.	Reportable salary ^{2,6} \$	Contributed Superannuation ^{3,6} \$	Reportable Allowances ⁴ \$	Bonus Paid ⁵ \$	Total \$
Total remuneration (including part-time arrangements)	-	-	-	-	-	-
\$180,000 to \$209,999						
Total	-					

Notes

- This table reports staff:
 - who were employed by the Corporation during the reporting period;
 - whose reportable remuneration was \$180,000 or more for the financial period; and
 - were not required to be disclosed in Tables A, B or director disclosures.
 Each row is an averaged figure based on headcount for individuals in the band.
- 'Reportable salary' includes the following:
 - gross payments (less any bonuses paid, which are separated out and disclosed in the 'bonus paid' column);
 - reportable fringe benefits (at the net amount prior to 'grossing up' to account for tax purposes);
 - exempt foreign employment income; and
 - salary sacrificed benefits.
- The 'contributed superannuation' amount is the average cost to the corporation for the provision of superannuation benefits to other highly paid staff in that reportable remuneration band during the reporting period.
- 'Reportable allowances' are the average actual allowances paid as per the 'total allowances' line on individuals' payment summaries.
- 'Bonus paid' represents average actual bonuses paid during the reporting period in that reportable remuneration band. The 'bonus paid' within a particular band may vary between financial years due to various factors such as individuals commencing with or leaving the corporation during the financial year.
- Various salary sacrifice arrangements were available to other highly paid staff including superannuation, car parking, motor vehicle and expense payment fringe benefits. Salary sacrifice benefits are reported in the 'reportable salary' column, excluding salary sacrificed superannuation, which is reported in the 'contributed superannuation' column.

Note 13: Remuneration of Auditors

The cost of financial statement audit services provided to the Corporation was:

	2013 \$	2012 \$
Australian National Audit Office	28,000	26,000

No other services were provided by the auditors of the financial statements.

Note 14: Financial Instruments

	2013 \$'000	2012 \$'000
14A—Categories of Financial Instruments		
Financial Assets		
Loans and receivables:		
Cash and cash equivalents	72,253	77,860
Trade and other receivables	21,667	17,125
Total	93,920	94,985
Available-for-sale:		
Shares in unlisted companies	7,811	8,107
Total	7,811	8,107
Fair value through profit or loss (designated):		
Managed funds	147,391	113,767
Total	147,391	113,767
Carrying amount of financial assets	249,122	216,859
Financial Liabilities		
At amortised cost:		
Payables	82,255	66,482
Total	82,255	66,482
Carrying amount of financial liabilities	82,255	66,482

Note 14: Financial Instruments (continued)

Note 14B—Net Income and Expense from Financial Assets

	2013 \$'000	2012 \$'000
Loans and receivables		
Interest revenue (note 4A)	2,565	3,296
Net gain from loans and receivables	2,565	3,296
Available-for-sale		
Impairment (note 3E)	(2,973)	(535)
Net (loss) from available-for-sale	(2,973)	(535)
Fair value through profit or loss (designated)		
Change in fair value through profit and loss (note 4G)	3,625	9,901
Net gain from fair value through profit and loss	3,625	9,901
Net gain from financial assets	3,217	12,662

There was no net income or expense from financial liabilities.

Note 14C—Fair Value of Financial Instruments

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

Fair value measurements categorised by fair value hierarchy

The following table provides an analysis of financial instruments that are measured at fair value, by valuation method.

The different levels are defined below:

Level 1: fair value obtained from unadjusted quoted prices in active markets for identical instruments.

Level 2: fair value derived from inputs other than quoted prices included in Level 1 that are observable for the instrument, either directly or indirectly.

Level 3: fair value derived from inputs that are not based on observable market data.

Fair value hierarchy for financial assets

	Level 1 2013 \$'000	Level 1 2012 \$'000	Level 2 2013 \$'000	Level 2 2012 \$'000	Level 3 2013 \$'000	Level 3 2012 \$'000
Financial assets at fair value						
through profit or loss						
Managed funds	147,391	113,767	-	-	-	-
Total	147,391	113,767	-	-	-	-

There were no transfers between levels (2012: \$NIL).

Note 14: Financial Instruments (continued)

Note 14D—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 balance sheet.

Fair value through profit or loss investments are restricted to securities that are in accordance with paragraphs 18(a) – (d) of the CAC 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 cash and levies from industry.

The Corporation manages its credit risk through:

- A monthly review by management of the Corporation's investments:
 - to ensure that they are in accordance with section 18 of the CAC Act and the Corporation's policies and procedures; and
 - to assess how the investments are performing against various benchmarks (including the Cash Rate, the 90 Day Bank Bill Index and the UBS Government Bond Index 0-5 years);
- A biannual review by the Finance, Risk and Audit Committee of the performance of the Corporation's individually managed funds in comparison with other managed funds investing in the Australian Bond and Australian Cash sectors; and
- Policies and procedures that guide employees in managing debtors.

The Corporation holds no collateral to mitigate against credit risk.

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

	Not past due nor impaired 2013 \$'000	Not past due nor impaired 2012 \$'000	Past due or impaired 2013 \$'000	Past due or impaired 2012 \$'000
Cash and cash equivalents	72,253	77,860	-	-
Trade and other receivables	21,386	16,709	281	416
Managed funds	147,391	113,767	-	-
Shares in unlisted companies	7,811	8,107	19,122	16,149
Total	248,841	216,443	19,403	16,565

Ageing of financial assets that are past due but not impaired for 2013

	0 to 30 days \$'000	31 to 60 days \$'000	61 to 90 days \$'000	90+ days \$'000	Total \$'000
Receivables	45	-	-	236	281
Total	45	-	-	236	281

Ageing of financial assets that are past due but not impaired for 2012

	0 to 30 days \$'000	31 to 60 days \$'000	61 to 90 days \$'000	90+ days \$'000	Total \$'000
Receivables	115	-	-	301	416
Total	115	-	-	301	416

The following assets have been individually assessed as impaired:

	2013 \$'000	2012 \$'000
Shares in unlisted companies	19,122	16,149

Factors that have been considered in assessing the shares 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 14: Financial Instruments (continued)

Note 14E—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 experience of default.

Maturities for non-derivative financial liabilities 2013

	On demand \$'000	Within 1 year \$'000	1 to 2 years \$'000	2 to 5 years \$'000	> 5 years \$'000	Total \$'000
Payables	-	78,554	3,294	407	-	82,255
Total	-	78,554	3,294	407	-	82,255

Maturities for non-derivative financial liabilities 2012

	On demand \$'000	Within 1 year \$'000	1 to 2 years \$'000	2 to 5 years \$'000	> 5 years \$'000	Total \$'000
Payables	-	62,398	3,755	329	-	66,482
Total	-	62,398	3,755	329	-	66,482

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

Note 14F—Market Risk

Sensitivity analysis of the risk that the Corporation is exposed to for 2013

	Risk variable	Change in risk variable	Effect on	
			Profit or loss 2013 \$'000	Equity 2013 \$'000
Interest rate risk	Interest	+1.20%	4,468	4,468
		- 1.20%	(4,465)	(4,465)
Currency risk	USD	+15.7%	5	5
		-15.7%	(7)	(7)

Sensitivity analysis of the risk that the Corporation is exposed to for 2012

	Risk variable	Change in risk variable	Effect on	
			Profit or loss 2012 \$'000	Equity 2012 \$'000
Interest rate risk	Interest	+1.40%	(3,902)	(3,902)
		- 1.40%	3,904	3,904
Currency risk	USD	+15%	21	21
		-15%	(28)	(28)

Note 14: Financial Instruments (continued)

Note 14F—Market Risk (continued)

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.

The table above details the interest rate sensitivity analysis of the Corporation at the reporting date, holding all other variables constant. A 120 basis point (2012: 140 basis point) 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 120 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 table above details the effect on the profit and equity as at the reporting date from a 15.7 percent (2012: 15 percent) favourable/unfavourable change in AUS dollars against US dollars with all other variables held constant.

The method used to arrive at the possible risk of 15.7 percent was based on both statistical and non-statistical analyses. The statistical analysis has been based on main currencies 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 15: Financial Assets Reconciliation

	Notes	2013 \$'000	2012 \$'000
Financial assets			
Total financial assets as per balance sheet		258,362	223,920
Less: non-financial instrument components:			
Other receivables	5B	8,978	6,947
Investments accounted for using the equity method	5C	262	114
Total non-financial instrument components		9,240	7,061
Total financial assets per financial instruments note		249,122	216,859

Note 16: Compensation and Debt Relief

No compensation or debt relief payments were made during the reporting period (2012: \$NIL).

Note 17: Reporting of Outcomes

Corporation activity involves the identification, co-ordination, funding and evaluation of research and development for the Australian grains industry. The financial statements provide a detailed overview of the Corporation's total financial operations for the year ended 30 June 2013. The Corporation operates predominantly in one industry, the grains industry and in one geographical area, being Australia.

Note 17A—Net Cost of Outcome Delivery

	Outcome 1		Total	
	2013 \$'000	2012 \$'000	2013 \$'000	2012 \$'000
Expenses				
Departmental	178,028	165,063	178,028	165,063
Total	178,028	165,063	178,028	165,063
Other own-sourced income				
Departmental				
Interest	2,565	3,296	2,565	3,296
Industry contributions	118,192	97,714	118,192	97,714
Project refunds	1,476	1,380	1,476	1,380
Royalties	5,274	4,900	5,274	4,900
Grants income	1,726	3,104	1,726	3,104
Other revenue	562	402	562	402
Gain—investments	-	904	-	904
Change in fair value through profit and loss	3,625	9,901	3,625	9,901
Total other own-sourced income	133,420	121,601	133,420	121,601
Net cost of outcome delivery	44,608	43,462	44,608	43,462

Outcome 1 is described at Note 1.1.

Note 17: Reporting of Outcomes *(continued)*

Note 17B—Major Classes of Departmental Expense, Income, Assets and Liabilities by Outcomes

	Outcome 1		Total	
	2013 \$'000	2012 \$'000	2013 \$'000	2012 \$'000
Expenses				
Research and development	159,237	150,231	159,237	150,231
Employees	8,160	7,219	8,160	7,219
Suppliers	7,295	6,697	7,295	6,697
Depreciation and amortisation	363	381	363	381
Write-down of assets	2,943	535	2,943	535
Total expenses	178,028	165,063	178,028	165,063
Income				
Revenues from Government	62,846	55,935	62,846	55,935
Interest	2,565	3,296	2,565	3,296
Industry contributions	118,192	97,714	118,192	97,714
Project refunds	1,476	1,380	1,476	1,380
Royalties	5,274	4,900	5,274	4,900
Grants	1,726	3,104	1,726	3,104
Other revenue	562	402	562	402
Gain—investments	-	904	-	904
Change in fair value through profit and loss	3,625	9,901	3,625	9,901
Share of surplus/(deficit) of associates and joint ventures accounted for using the equity method	148	(156)	148	(156)
Total income	196,414	177,380	196,414	177,380
Assets				
Cash and cash equivalents	72,253	77,860	72,253	77,860
Trade and other receivables	30,645	24,072	30,645	24,072
Investments in managed funds	147,391	113,767	147,391	113,767
Investments accounted for using the equity method	262	114	262	114
Investments—other	7,811	8,107	7,811	8,107
Land and buildings	5,704	5,900	5,704	5,900
Infrastructure, plant and equipment	209	256	209	256
Intangibles	635	245	635	245
Other non-financial assets	367	355	367	355
Total assets	265,277	230,676	265,277	230,676
Liabilities				
Employee provisions	1,973	1,658	1,973	1,658
Suppliers payables	923	602	923	602
Research and development payables	81,766	66,187	81,766	66,187
Total liabilities	84,662	68,447	84,662	68,447

Outcome 1 is described at Note 1.1.

Appendices

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Appendix A—Expenditure on government research priorities

Australian Government R&D priorities are identified in:

- the National Research Priorities outlined by the Prime Minister in December 2002, and their associated priority goals
- the Rural R&D Priorities announced to the rural R&D corporations by the Minister for Agriculture, Fisheries and Forestry in May 2007

- a letter written to the GRDC Chair by the Minister for Agriculture, Fisheries and Forestry in May 2012.

Table 34 shows the relationships between the government's research priorities and the associated goals.

Table 34: Australian Government research priorities and associated goals

National Research Priorities^a				
<i>An environmentally sustainable Australia</i>	<i>Promoting and maintaining good health</i>	<i>Frontier technologies for building and transforming Australian Industries</i>		<i>Safeguarding Australia</i>
A1: Water—a critical resource	B1: A healthy start to life	C1: Breakthrough science	D1: Critical infrastructure	
A2: Transforming existing industries	B2: Ageing well, ageing productively	C2: Frontier technologies	D2: Understanding our region and the world	
A3: Overcoming soil loss, salinity and acidity	B3: Preventive healthcare	C3: Advanced materials	D3: Protecting Australia from invasive diseases and pests	
A4: Reducing and capturing emissions in transport and energy generation	B4: Strengthening Australia's social and economic fabric	C4: Smart information use	D4: Protecting Australia from terrorism and crime	
A5: Sustainable use of Australia's biodiversity		C5: Promoting an innovation culture and economy	D5: Transformational defence technologies	
A6: Developing deep earth resources				
A7: Responding to climate change and variability				
Rural R&D Priorities				
<i>Productivity and adding value</i>	<i>Supply chain and markets</i>	<i>Natural resource management</i>	<i>Climate variability and climate change</i>	<i>Biosecurity</i>
Improve the productivity and profitability of existing industries and support the development of viable new industries	Better understand and respond to domestic and international market and consumer requirements and improve the flow of such information through the supply chain, including to consumers	Support effective management of Australia's natural resources to ensure primary industries are both economically and environmentally sustainable	Build resilience to climate variability and adapt to and mitigate the effects of climate change	Protect Australia's community, primary industries and environment from biosecurity threats
Supporting the Rural R&D Priorities				
<i>Innovation skills</i>		<i>Technology</i>		
Improve the skills to undertake research and apply its findings		Promote the development of new and existing technology		

a On 21 June 2013, the Australian Government announced the Strategic Research Priorities, which will replace the National Research Priorities. Reporting against the National Research Priorities will conclude at the end of 2013–14.

The following tables summarise the total expenditure allocated against the Australian Government's National Research Priorities and priorities for rural R&D within the 2012–13 financial year (see Table 3 in Part 1 for a summary of how GRDC investments addressed these priorities). The allocation of funds is shown in both dollar and percentage terms for each output group.

Table 35: Australian Government National Research Priorities, dollar and percentage values

National Research Priorities	Frontier technologies for building and transforming Australian industries														Total ^b									
	An environmentally sustainable Australia							Promoting and maintaining good health								Safeguarding Australia								
	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	C1	C2	C3		C4	C5	D1	D2	D3	D4	D5	Other ^a	
\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m	
1 Meeting market requirements	0.05	0.82	-	-	-	-	0.16	-	-	0.35	-	-	7.47	1.63	0.52	0.65	-	-	2.35	-	-	-	4.56	18.56
2 Improving crop yield	1.69	0.10	0.75	-	-	-	1.25	-	-	-	-	-	30.78	0.36	0.07	3.03	-	-	4.13	-	-	-	-	42.16
3 Protecting your crop	0.18	0.48	0.74	-	0.03	-	-	-	-	-	-	-	11.40	0.20	0.06	0.64	-	-	25.48	-	-	-	0.05	39.26
4 Advancing profitable farming systems	1.87	-	0.62	-	-	-	0.25	-	-	-	-	-	19.15	-	1.00	6.74	-	-	0.12	-	-	-	-	29.75
5 Improving your farm resource base	2.17	0.46	0.97	-	0.07	-	3.28	-	-	-	-	-	5.44	-	-	0.01	-	-	0.13	-	-	-	0.10	12.63
6 Building skills and capacity	0.02	-	-	-	-	-	-	-	0.06	-	-	-	0.10	-	0.11	4.80	-	-	0.19	-	-	-	-	5.28
Foundational activities	0.03	-	-	-	-	-	-	-	0.03	-	-	-	1.39	-	0.38	6.99	-	-	-	-	-	-	0.79	9.61
R&D management	-	-	-	-	-	-	-	-	-	-	-	-	1.74	-	-	0.09	-	-	-	-	-	-	0.16	1.99
Total	6.01	1.86	3.08	-	0.10	-	4.94	-	-	0.44	-	-	77.47	2.19	2.14	22.95	-	-	32.40	-	-	-	5.66	159.24

Table 35: Australian Government National Research Priorities, dollar and percentage values (continued)

National Research Priorities	Frontier technologies for building and transforming Australian industries															Total ^a								
	An environmentally sustainable Australia					Promoting and maintaining good health					Safeguarding Australia													
	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	C1	C2	C3	C4		C5	D1	D2	D3	D4	D5	Other ^b	
1 Meeting market requirements	0.03	0.52	-	-	-	-	0.10	-	-	0.22	-	-	4.68	1.03	0.32	0.41	-	-	1.48	-	-	-	2.86	11.65
2 Improving crop yield	1.06	0.06	0.48	-	-	-	0.79	-	-	-	-	-	19.33	0.22	0.04	1.90	-	-	2.60	-	-	-	-	26.48
3 Protecting your crop	0.11	0.30	0.46	-	0.02	-	-	-	-	-	-	-	7.17	0.13	0.04	0.40	-	-	16.00	-	-	-	0.03	24.66
4 Advancing profitable farming systems	1.18	0.39	-	-	-	-	0.16	-	-	-	-	-	12.03	-	0.63	4.23	-	-	0.07	-	-	-	-	18.69
5 Improving your farm resource base	1.36	0.29	0.61	-	0.05	-	2.05	-	-	-	-	-	3.41	-	-	0.02	-	-	0.08	-	-	-	0.06	7.93
6 Building skills and capacity	0.01	-	-	-	-	-	-	-	0.03	-	-	-	0.06	-	0.07	3.02	-	-	0.12	-	-	-	-	3.31
Foundational activities	0.02	-	-	-	-	-	-	-	0.02	-	-	-	0.88	-	0.24	4.37	-	-	-	-	-	-	0.50	6.03
R&D management	-	-	-	-	-	-	-	-	-	-	-	-	1.09	-	-	0.06	-	-	-	-	-	-	0.10	1.25
Total	3.77	1.17	1.94	-	0.07	-	3.10	-	-	0.27	-	-	48.65	1.38	1.34	14.41	-	-	20.35	-	-	-	3.55	100.00

Associated goals: A1: Water – a critical resource; A2: Transforming existing industries; A3: Overcoming soil loss, salinity and acidity; A4: Reducing and capturing emissions in transport and energy generation; A5: Sustainable use of Australia's biodiversity; A6: Developing deep earth resources; A7: Responding to climate change and variability; B1: A healthy start to life; B2: Ageing well, ageing productively; B3: Preventive healthcare; B4: Strengthening Australia's social and economic fabric; C1: Breakthrough science; C2: Frontier technologies; C3: Advanced materials; C4: Smart information use; C5: Promoting an innovation culture and economy; D1: Critical infrastructure; D2: Understanding our region and the world; D3: Protecting Australia from invasive diseases and pests; D4: Protecting Australia from terrorism and crime; D5: Transformational defence technologies.

a Other includes a joint rural R&D corporation program on farm health and safety and a number of investments that relate to commercialisation.

b Total does not include investments covering emerging issues, project reviews, innovation investments, impact assessments, project variation or evaluation/monitoring.

Table 36: Australian Government Rural R&D Priorities, dollar and percentage values

Rural R&D Priorities	Productivity and adding value		Supply chain and markets		Natural resource management		Climate variability and climate change		Biosecurity		Innovation skills		Technology		Other ^a		Total ^b		
	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%	
Theme 1 – Meeting market requirements	7.98		8.87		0.03		0.18		1.47		–		0.03		–		–		18.56
Theme 2 – Improving crop yield	30.63		1.52		2.89		1.36		3.90		1.55		0.31		–		–		42.16
Theme 3 – Protecting your crop	15.00		0.50		1.57		–		22.11		0.03		0.04		0.01		–		39.26
Theme 4 – Advancing profitable farming systems	23.46		0.10		3.30		0.30		0.51		2.18		–		–		–		29.75
Theme 5 – Improving your farm resource base	6.37		0.10		2.87		3.12		0.07		–		–		0.10		–		12.63
Theme 6 – Building skills and capacity	1.64		0.05		0.01		0.02		0.17		3.46		–		–		–		5.28
Foundational activities	3.92		0.18		0.09		–		–		4.70		0.04		0.79		–		9.61
R&D management	0.18		–		–		–		–		1.45		0.20		0.16		–		1.99
Total	89.18		11.04		10.76		4.98		28.23		13.37		0.62		1.06				159.24
	%		%		%		%		%		%		%		%				%
Theme 1 – Meeting market requirements	5.01		5.57		0.02		0.11		0.92		–		0.02		–		–		11.65
Theme 2 – Improving crop yield	19.24		0.95		1.82		0.85		2.45		0.98		0.19		–		–		26.48
Theme 3 – Protecting your crop	9.42		0.32		0.98		–		13.89		0.02		0.02		0.01		–		24.66
Theme 4 – Advancing profitable farming systems	14.74		0.06		2.07		0.19		0.32		1.37		–		–		–		18.69
Theme 5 – Improving your farm resource base	3.99		0.06		1.81		1.96		0.05		–		–		0.06		–		7.93
Theme 6 – Building skills and capacity	1.03		0.03		0.01		0.01		0.10		2.17		–		–		–		3.31
Foundational activities	2.46		0.11		0.05		–		–		2.95		0.03		0.50		–		6.03
R&D management	0.11		–		–		–		–		0.91		0.13		0.10		–		1.25
Total	56.00		6.93		6.76		3.12		17.73		8.40		0.39		0.67				100.00

a Other includes a joint rural R&D corporation program on farm health and safety and a number of investments that relate to commercialisation.

b Total does not include investments covering emerging issues, innovation investments, project variation or share write-downs.

Appendix B—GRDC project list

Number	Title	Expenditure \$
THEME 1—MEETING MARKET REQUIREMENTS		
AEG00001-4	Australian Export Grain Innovation Centre—Selection of Chair	6,562
AEG00002	Australian Export Grain Innovation Centre	5,650,000
AGL00018	Report the terms and conditions for access to ticket-by-variety data at point of delivery	48,000
ANU00019	Understanding the production risks from necrotrophic fungi	39,930
BBE00015	Wheat variety identification	19,908
CFF00003	Elimination of pre-harvest sprouting in wheat	373,534
CFF00004	Australian Prime Hard zone evaluation	323,000
CSP00144	Genetic analysis of wheat quality using MAGIC (multiparent advanced generation intercross) populations	690,000
CSP00145	Omega-3 canola collaborative research project	900,000
CSP00151	New knowledge and tools to manage food and feed harvest quality	220,000
CSP00153	Coeliac Friendly Cereals—Phase 5	361,638
CSP00167	Crop Biofactories Initiative 3	1,800,118
DAN00139	Improving food quality and end-use market acceptance of Australian pulses—cooking and sensory	129,330
DAN00158	Increasing market value of canola through improved quality traits	197,862
DAR00007	Wheat Variety Identification DNA Quality Testing—Phases 2 and 3	427,700
DAS00114	Provision of test reagents for antibody-based late maturity alpha-amylase detection to researchers and breeders	40,000
DAS00135	National surveillance of grains to manage food and feed safety market risks—Node C	270,000
DAV00114	Improving food quality and end-use acceptance of Australian pulses	121,700
DAV00132	Objective high-throughput technologies for the pulse industry	180,000
GGL00001	The economic value of functional characteristics of Australian wheat in selected Asian markets	289,600
GOG00007	Grains and Legumes Nutrition Council—Membership subscription	100,000
GOG00008	Grains and Legumes Nutrition Council—Health & Nutrition	250,000
NP81-1	Variety identification for wheat	33,780
NPB00013	Plant Biosecurity CRC—Grain Storage Research and Development Program	1,500,000
PAD00001	Improving on-farm grain storage management practices through technical training and extension	653,108
PCL00008	Pork CRC projects related to grain handling and statistical analysis	120,000
PNP00001	Increasing the value and marketability of feed grains for the grains industry	95,000
QUT00005	New technology for stored grain pest management	227,383
UA00108	Barley quality: Characterisation of genetic variation for alpha-amylase alleles	116,000
UA00120	Breeding tools to predict gene effects influencing adaptation and grain quality in dry environments	265,166
UA00122	Understanding the genetic control of hectolitre weight and screenings under normal growing conditions	150,000
UA00126	Increasing malt extract and the export competitiveness of Australian barley	350,000
UA00130	Pre-harvest sprouting resistance in wheat	170,000
UA00131	Black point in wheat	46,340
UA00132	Yellow pigments in wheat and wheat-based end-products	252,000

Number	Title	Expenditure \$
UA00133	Late maturity alpha-amylase in wheat	435,000
UA00135	Improved functionality of grain storage products	215,140
UCS00015	Canola proteins for optimal food functionality	15,000
UMU00036	Integration of an extra glutenin subunit into Australia wheat cultivars	183,238
UMU00043	Novel glutenin subunits for extra functionality to Australian wheat cultivars	239,660
UT00017	Biochemistry and genetics of protein modification and fermentability of malting barley	298,398
UT00018	Microbial T-RFLP (terminal restriction fragment length polymorphism) screening as a solution for premature yeast flocculation (PYF) assurance for malt and malting barley exports	77,530
WCA00002	Pilot Malting Australia (Australian Export Grain Innovation Centre Program 5)—Interim funding	142,687
WCA00003	Pilot Malting Australia—Commercial malting validation	57,200
WJM00005	Coordination of registration of grain storage chemicals and codex attendance	74,840
WQA00002	Wheat variety classification services	400,000
WQA00003	Wheat Quality Australia Limited—Director fees	3,931
THEME 1—MEETING MARKET REQUIREMENTS TOTAL		18,560,283
THEME 2—IMPROVING CROP YIELD		
ACP00002-Q	Australian Centre for Plant Functional Genomics, phase 2	1,000,000
AGP00010	Validation of late sowing to identify heat stress tolerance in wheat and investigation of quantitative trait loci for heat stress tolerance	59,700
AMC00011	Managed Environment Facility—Trial management protocol review and guideline production	35,000
ANU00017	Wheat ERECTA/ERECTA-like genes: Isolation and functional evaluation of candidate transpiration efficiency genes	150,000
ANU00020	The generation of wheat cultivars with improved drought tolerance	149,955
BA00006	Barley Australia—Annual subscription	22,500
BAR00003	Commercialisation	1,816
BAZ00001	Commercialisation	1,611
CFF00005	Novel mechanisms for enhancing wheat yield and quality	452,402
CFF00006	Novel mechanisms for enhancing yield in wheat and maize	47,598
CFF00007	Technical collaboration in wheat	500,000
CIM00015	Enhanced delivery of CIMMYT germplasm to Australia	245,096
CIM00016	Enhancement of CIMMYT wheat breeding strategy for drought tolerance and genotypes of relevance to rain-fed areas of Australia	435,152
CSA00027	Adding value to the GRDC's National Variety Trials network	505,000
CSA00041	Better irrigated wheat germplasm	341,940
CSP00101	Breeding dual-purpose feed wheats for the high-rainfall zones	325,000
CSP00130	Identification of wheat quantitative trait locus for maintenance of grain number under reproductive stage water stress conditions	200,000
CSP00133	New sources of salt tolerance for wheat and barley	105,813
CSP00143	New strategies for phenotyping reproductive stage frost and chilling tolerance in wheat	325,068
CSP00148	High-throughput and remote trait measurement	275,890
CSP00156	Engagement of the national managed environment facility in validation and delivery of key physiological traits for improved wheat performance under drought	334,020
CSP00166	Development and characterisation of a comprehensive collection of wild <i>Cicer</i> species focused on <i>C. reticulatum</i>	25,000

Number	Title	Expenditure \$
CSP00168	Photosynthesis traits for raising wheat yield potential	450,000
CSP00173	Novel overgrowth alleles for improved yield potential in cereals	210,000
CUR00021	An international collaborative effort to sequence the genome of field pea (<i>Pisum sativum</i>) a key tool for future breeding	100,000
DAN00108	National Brassica Germplasm Improvement Program	687,460
DAN00117	Development of molecular markers for application in Australian canola breeding	1,378,627
DAN00117UQ	Development of molecular markers for application in Australian canola breeding	106,730
DAN00123	Quarantine CIMMYT bread wheat germplasm	192,585
DAN00137	Managed environment facility: Yanco	188,805
DAN00151	Pulse Breeding Australia—Chickpea National Breeding Program	1,300,000
DAN00157	Evaluating remaining albus lupin breeding material at Wagga Wagga	50,000
DAN00162	Evaluation of durum material in managed environment facilities	33,022
DAN00163	Australian Durum Wheat Improvement Program	7,032
DAN00178	Curation of mapping populations—barley/wheat	225,000
DAN00179	Scoping study on canola viruses in northern Australia—Occurrence and variety performance	25,000
DAQ00155	Maize germplasm enhancement and productivity improvement	154,896
DAQ00172	National Mungbean Improvement Program	300,000
DAQ00177	Identifying candidate genes for stay-green in sorghum	200,000
DAQ00185	Queensland Department of Agriculture, Fisheries and Forestry barley germplasm progression	608,384
DAS00108	Improving yield and reliability of field peas under water deficit	150,000
DAS00112	Lupin evaluation for eastern Australia	100,000
DAS00117	New common and woolly pod vetch varieties for grain and hay/silage production for Australian farmers	251,551
DAS00117RIRDC	New common and woolly pod vetch varieties for grain and hay/silage production for Australian farmers RIRDC contribution	58,000
DAS00120	Pulse germplasm enhancement—National coordination	25,000
DAS00121	Pulse germplasm enhancement—Abiotic stresses	250,000
DAS00124	Cost-effective doubled haploids for accelerated wheat and oat breeding	60,000
DAS00129	National Oat Breeding Program—Healthy and productive grain varieties for the future	820,000
DAS00140	Improving yield and reliability of field peas and chickpeas under water deficit	150,000
DAV00085	Australian Canola Germplasm Enhancement Program	688,200
DAV00103	Establishing a single nucleotide polymorphisms genomic resource for the Australian wheat industry	45,000
DAV00118	Pulse Breeding Australia—Field pea breeding program	1,000,000
DAV00119	Pulse Breeding Australia—Lentil breeding program	700,000
DAV00124	Australian Grains Genebank—Phase 1	999,424
DAV00126	Molecular markers for pulse breeding programs	750,000
DAV00127	Using next-generation genetics to accelerate variety improvement in bread wheat, durum and barley	300,000
DAV00131	Australian Grains Genebank—Phase 2	100,576
DAW00181	National lupin breeding for southern Australia	1,257,650
DAW00198	Managed environment facility—Merredin	303,337
DAW00205	Genetic and phenological basis of head loss in malting barley	150,000
DAW00215	Characterising water deficit and benchmarking genetic diversity in wheat for key adaptive traits at Merredin, Yanco and Narrabri managed environment facilities	236,134

Number	Title	Expenditure \$
DAW00219	Characterising and exploiting genetic diversity in wheat and barley for tolerance to water deficit during germination and crop establishment	116,496
DEP00001	Australian Grains Genebank	2,824,968
FWC00002	Coordinator for Pulse Breeding Australia	82,572
GRD210-1	The assessment of International Commercial Wheat Yield Technology	237,853
GRD27-1	The assessment of International Commercial Wheat Yield Technology	1,587
GRD4-11-1	Program Review 2012—National Molecular Marker Programs—wheat and barley, canola and pulses	1,143
HEA00001	Program Review 2012—National Molecular Marker Programs—wheat and barley, canola and pulses	11,000
HOW00001	Program Review 2012—National Molecular Marker Programs—wheat and barley, canola and pulses	8,000
ICA00008	Breeding chickpea for drought tolerance and disease resistance	231,250
ICA00009	Enhancement of yield and yield stability of spring bread wheat targeted to semi-arid Mediterranean areas	249,000
ICY16-1	Coordination of Winter Cereals Pre-Breeding Alliance	14,096
IGP00003	Evaluation of barley breeding lines in the Northern Region	408,996
IGP00004	Evaluation of barley breeding lines in the Northern Region	497,125
JWS00001	Program Review 2012—National Molecular Marker Programs	15,000
MPC00004	Wheat breeding liaison	15,000
MUE00001	Program Review 2012—National Molecular Marker Programs	5,459
PBB00002	Australian Winter Cereals Pre-breeding Alliance—Executive officer	57,084
RDEM7-1	G20 Wheat Initiative	12,213
TAP00005	Program Review 2012—National Molecular Marker Programs	8,000
UA00032	Barley Breeding Australia—Southern Node	1,800,000
UA00102	Australian Wheat and Barley Molecular Marker Program—genetic analysis module	1,000,000
UA00118	Development of high salinity tolerant winter cereals germplasm	635,947
UA00123	Identification of genetic variation for heat tolerance in durum and bread wheat	249,814
UA00127	Pulse Breeding Australia—Faba bean breeding program	999,949
UA00136	Australian National Frost Program—coordination and phenotyping	500,000
UA00143	Australian Wheat and Barley Molecular Marker Program—Genetic analysis	1,000,000
UCD00001	Development and characterisation of a comprehensive collection of wild <i>Cicer</i> species focused on <i>C. reticulatum</i>	157,599
UMU00037	International Wheat Genome Sequencing Consortium assembly of chromosome 7A	150,000
UMU00038	Improved adaptation of barley to acid soils	200,000
UMU00039	Validating the role of the wheat 1-FEH (fructan exohydrolase) gene in stem water-soluble carbohydrate remobilisation to the grain	169,531
UQ00043	CIMMYT–ICARDA suite of projects: Database Project	131,651
UQ00052	Nationally coordinated frost trials and physiological studies of frost resistance in wheat and barley	80,000
US00045	CIMMYT–ICARDA suite of projects: Communication Project	301,882
US00051	National managed environment facility: Narrabri	187,362
US00056	Research Project 1: Superior water use efficiency through improved leaf mesophyll conductance	134,330
US00057	Identification of genetic variation for heat tolerance in wheat germplasm of relevance to the northern grains region	108,132
US00058	Capacity building to support research and plant breeding at the IA Watson Grains Research Centre	274,770

Number	Title	Expenditure \$
US00059	Research Capacity Building: GRDC Senior Lectureship in Agronomy/Plant–Soil–Microbe Interactions	153,123
US00060	Research Capacity Building: GRDC Senior Lectureship in Agronomy/Crop Physiology	153,123
US00061	Identification of wheat breeding targets to enhance soil function for efficient nutrient and water use	202,328
US00068	A novel mutation-based strategy to increase seed yield in canola	191,118
UT00022	Quantifying the relative contribution of physiological traits contributing to salinity tolerance in wheat and barley	179,532
UT00024	The role of canopy architecture in improving the water-limited yield of wheat lines contrasting in the 'tin' gene	62,874
UWA00140	Biotechnology tools to accelerate lupin and lentil improvement	180,012
UWA00147	Genome sequencing in narrow-leafed lupins	496,684
UWA00151	Unleashing the power of genomics for lupin marker development and crop improvement	119,925
UWA00159	In vitro tools for accelerated breeding and screening for abiotic stress in grain legumes	249,941
VIT00001	Juncea canola development for Australia	300,000
VR136-1	National phenotyping facilities for water productivity traits	963
VR174	National Variety Trials program, Round 2	6,841,124
THEME 2—IMPROVING CROP YIELD TOTAL		42,159,530
THEME 3—PROTECTING YOUR CROP		
AAG00002	Preliminary evaluation of fungicide efficacy for control of eyespot in wheat and extension of cost-effective management strategies	33,275
AKC00004	Registration for minor use chemicals for the grains industry	334,000
AKC00005	Pathways to registration—Tactical pesticide registration program	136,500
AMC00004	Spray application consultancy	2,988
AMC00008	Program Review 2012—National Plant Pathology Program	9,321
ANU00012	Disease resistance and epidemiology of scald and net form of net blotch	156,998
ANU00016	Characterisation of effector proteins from necrotrophic fungal wheat pathogens	124,990
ARN00001	Support of the Australian Glyphosate Sustainability Working Group	20,000
BGC00002	Improving Spray Drift Management Workshops 2012	450,000
BHO00001	Program Review 2012—National Plant Pathology Program	1,750
BWD00014	Benchmarking study of the economic, agronomic and environmental impacts of genetically modified herbicide tolerant canola	63,950
BWD00020	Fungicide diagnostic trials, fungicide/herbicide spray operations and crop phenology and physiology workshops	77,286
CCP00003	Developing a strategy for commercialising the MEMS-IR technology	36,000
CES00001	Surveillance and management of insecticide resistance in green peach aphids and other grain pests	332,369
CIM00014	Identification and utilisation of novel sources of resistance against soil-borne pathogens in wheat	174,000
CIM00017	Australian Cereal Rust Control Program—CIMMYT delivery of resistant germplasm and surveillance for resistance in Australian cultivars	300,000
CRA00003	Pre-breeding cultivar screening for field tolerance to crown rot	6,000
CSA00031	Next Generation Beneficial Microbes—Quantifying disease control efficacy, environmental persistence and microbial community impacts	149,699
CSE00054	Pest management in grains—research, coordination and industry engagement	956,481
CSP00142	Protecting the Australian wheat industry from the wheat streak mosaic virus	58,500
CSP00149	Develop new crown rot resistant barley germplasm	172,373

Number	Title	Expenditure \$
CSP00150	Management of soil-borne <i>Rhizoctonia</i> disease risk in cereal crops	185,000
CSP00162	Inducing suppression of fusarium crown rot complexes	492,583
CSP00164	Australian Cereal Rust Control Program—Molecular Marker Programs—CSIRO/University of Sydney/CIMMYT collaborative project	566,360
CUR00012	Australian Centre for Necrotrophic Fungal Pathogens, Phase 3—Pleosporales functional genomics	607,437
CUR00014	New technologies and biological concepts for pre-breeding resistance to the ascochyta blight diseases of pea, chickpea, lentil and faba bean	320,000
CUR00016	Australian Centre for Necrotrophic Fungal Pathogens Phase 2—Fungicide benchmarks	350,320
CUR00017	Barley powdery mildew control	299,524
CUR00018	Australian Centre for Necrotrophic Fungal Pathogens; Phase 3—Pleosporales Effector Delivery	199,940
CUR00020	Managing on-farm biosecurity risk through pre-emptive breeding: The case of rust in field pea and lentil	150,000
DAN00140	New tools and germplasm for Australian pulse-breeding programs to respond to changing virus threats	100,000
DAN00142	Differential herbicide tolerance of winter crops in south-east Australia—Stage 3	195,000
DAN00143	Northern NSW integrated disease management	600,008
DAN00147	Integrated disease management for cereal and broad leaf crops in southern NSW and northern Victoria	205,185
DAN00155	Barley Scald Nursery—NSW Department of Primary Industries	62,262
DAN00164	Helicoverpa insecticide resistance: monitoring, management and novel methods of helicoverpa control on Bollgard II cotton	75,000
DAN00172	Managing crop disease—Improving chickpea pathogen resistance	250,000
DAN00174	Managing on-farm biosecurity risk in wheat through pre-emptive breeding	300,000
DAN00175	National crown rot epidemiology and management program	664,987
DAN00176	Northern NSW integrated disease management	325,000
DAN00177	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in southern NSW	200,000
DAQ00153	Northern pulse and grains integrated pest management	390,000
DAQ00164	Biological suppression of root lesion nematodes in grain-growing soils	159,704
DAQ00167	Germplasm enhancement for crown rot resistance in winter cereals	241,283
DAQ00169	Sorghum midge testing scheme	14,644
DAQ00171	Genetic options for nematode control	455,151
DAQ00178	Barley foliar pathogens—genetic control	296,371
DAQ00179	Integrated pest management training	210,000
DAQ00186	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease	384,873
DAQ00187	National barley foliar pathogen variety improvement program	1,150,000
DAS00094	Diamondback moth (<i>Plutella xylostella</i>) control and insecticide resistance management	25,000
DAS00096	Control of cereal fungal diseases	140,000
DAS00100	Herbicide tolerance screening in the Southern Region with national coordination	165,000
DAS00107	Development of herbicide-tolerant pulses	199,912
DAS00111	DNA tests for nematode community analysis	209,141
DAS00115	Molecular diagnostics centre for delivery of training and diagnostics for soil-borne disease management	300,000
DAS00116	Genetic options for nematode control in the Southern Region	300,000

Number	Title	Expenditure \$
DAS00122	Fungicide control of <i>Rhizoctonia</i> Part C	40,000
DAS00123	Fungicide control of <i>Rhizoctonia</i> Part B	110,000
DAS00125	Fungicide control of <i>Rhizoctonia</i> Part A	140,000
DAS00127	Snail and slug control scoping study	15,200
DAS00131	Improving weed management in pulse crops through herbicide tolerance—Part B	200,000
DAS00132	Improving weed management in pulse crops through herbicide tolerance—Part A	70,000
DAS00133	Improved resistance to oat pathogens and abiotic stress management	300,000
DAS00134	Improved management of snails and slugs	399,888
DAS00136	New fungicide technologies for crown rot management	150,000
DAS00137	National improved molecular diagnostics for disease management	350,000
DAS00139	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in SA	200,000
DAV00111	Victorian integrated disease management	480,000
DAV00117	Pulse germplasm enhancement program—Resistance to biotic stresses	300,000
DAV00128	National nematode epidemiology and management program	814,861
DAV00129	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease in Victoria	245,000
DAW00191	Evaluating herbicide tolerance of new crop varieties in Western Region with national coordination	192,000
DAW00206	Germplasm enhancement for yellow spot resistance in wheat	300,021
DAW00207	National modelling, risk forecasting and epidemiology of crop diseases	265,001
DAW00209	Genetic options for the management of root lesion nematode species in WA	105,000
DAW00210	Western Region fungal and viral integrated disease management research and development	850,000
DAW00212	Western Region nematology integrated disease management research and development	185,000
DAW00228	National pathogen management modelling and delivery of decision support	665,864
DAW00229	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—WA	610,001
DAW00230	PestFax map II national	225,068
DGS00001	Program Review 2012—National Plant Pathology Program	10,200
ECE00003	Testing the shelf life of nematodes	2,720
ECE00004	Production of nematodes for South Australian trials	8,655
FAR00002	Improved fungicide use for cereal rust control	100,000
FFC00008	Program Review 2012—National Herbicide Tolerance Evaluation Program	145
FOR00004	Program Review 2012—National Plant Pathology Program	31,313
FRA00001	Program Review 2012—National Plant Pathology Program	9,600
GTL00002	Endophyte cereals	450,000
IAC00002	Surveillance and forecasts for mouse outbreaks in Australian cropping systems	249,951
IAC00003	Development of a new rodenticide	575,000
IAR00002	Program Review 2013—National Invertebrate Pest Program	9,000
ICN00009	National promotion of integrated weed management in Australian cropping systems	216,551
ICN00010	Delivery of GRDC Foliar Disease Workshops	60,000
ICN00012	Development of summer weed management packages using existing knowledge	49,964
ICN00013	Weeds instructional videos, online version of the Integrated Weed Management manual, online web content updates and e-learning content and 3 weeds webinars	12,000

Number	Title	Expenditure \$
IMB00001	Insecticidal peptides from natural predators	199,726
JRS00001	National invertebrate pest formal review	9,000
LUN00001	Reducing the impact of the parasitic root lesion nematode on cereal crops	451,399
MGP00003	Australian National Blackleg Resistance Rating System	125,000
MRM00001	Pesticide research advisory support	22,600
NIN00001	Program Review 2013—National Invertebrate Pest Program	15,000
PAS00001	Program Review 2013—National Invertebrate Pest Program	30,000
PBC00001	Economic analyses of gene deployment strategies for high priority exotic pests and chemical supply to manage pest incursions	91,873
PBC00002	Extending biosecurity preparedness and surveillance strategies and developing a chemical supply framework for pest incursions	158,364
PBC00003	New tools for field grains surveillance and diagnostics of high priority pests	249,763
PHA00003	The facilitation of Category 25 submissions in the Australian grains industry	367,933
PHA00004	Provision of independent technical and secretarial services to the National Working Party for Pesticide Application	55,000
PHA00006	To facilitate a stakeholder discussion and solutions regarding the management of plant industry 'minor use' permit applications	2,500
PHA00010	Development of pre-emptive Australian Pesticides and Veterinary Medical Authority emergency permits for exotic plant pest incursion containment and control	149,990
PJS00001	Program Review 2012—National Plant Pathology Program	9,500
PR228-1	Integrated weed management engineering solutions to herbicide resistance	3,730
PYC26-1	Program Review 2012—National Plant Pathology Program	2,913
QUT00004	A new biopesticide for diamondback moth management in canola	172,036
RDP00008	Provision of independent National Integrated Weed Management Initiative chair services	50,000
RDP00011	National coordination of weeds research	80,000
RPS00002	Quantifying impacts of management on sediment, nutrient and pesticide loss from grain farms	225,000
RRR00002	Grains industry stewardship plan	47,000
RWF00021	Project Review 2012—Biopesticides for the Australian grains industry	4,000
SAC00001	Use of biopolymers as pesticides	31,002
UA00121	Managing the risks of trifluralin resistance in no-till cropping systems	150,701
UA00124	Understanding and management of resistance to group M, group L and group I herbicides	600,003
UA00125	Reduced severity of net form of net blotch disease in barley	202,589
UA00134	Improving integrated weed management practice in the Southern Region—Emerging weed issues	499,940
UA00141	Advancement of new stem genes for stem and leaf rust resistance from uncultivated relatives of wheat	269,980
UA00144	Improved herbicide efficacy and longevity in southern no-till farming systems	149,935
UCS00016	Biopesticides for the Australian grain industry	102,828
UCS00019	Project Review 2012—Biopesticides for the Australian grains industry	15,000
UCS00020	Weed management in Southern Region mixed farming systems—Strategies to combat herbicide resistance	549,947
UM00035	Impact assessment for genetically modified canola in cropping systems	129,913
UM00041	Wheat curl mite, wheat streak mosaic and high plains virus: Detection, transmission, epidemiology and management	337,434
UM00042	Staying ahead of blackleg: Monitoring and managing host and pathogen	329,787

Number	Title	Expenditure \$
UM00043	Insecticide resistance and alternative chemistries for mite control	150,689
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	148,880
UM00051	National canola pathology program including new molecular knowledge, pathogen evolution and control technologies	848,725
UM00052	Improving grower surveillance, management, epidemiology knowledge and tools to manage crop disease—National Chickpea Pathology Program	156,656
UMU00029	Pre-emptive breeding for Russian wheat aphid resistance	260,000
UNE00016	Attract-and-kill technology for diamondback moth	150,802
UQ00049	Rapid introgression of crown rot resistance into hexaploid wheat	255,608
UQ00059-DAQ	Herbicide tolerance screening of winter crops in Northern Region—Phase 4	110,000
UQ00060	Core drift reduction technologies databases to support the ground application of pesticides (boom sprayer), accommodating nozzles, formulations and adjuvants	242,500
UQ00062	Improving integrated weed management practice in the Northern Region	450,000
US00053	Adult plant resistance and strategic fungicide use for integrated management of cereal rust	484,822
US00054	Crown rot germplasm enhancement for wheat: University of Sydney and SARDI components	366,864
US00063	Australian Cereal Rust Control Program—Durable genes	899,280
US00064	Australian Cereal Rust Control Program—National breeding support	168,710
US00067	Australian Cereal Rust Control Program—Towards 2019 and a century of monitoring cereal rust pathogens in Australia	677,430
USA00008	Weed seed termination method at harvest	14,583
USA00010	Mechanical weed seed termination at harvest	283,719
USQ00012	Enhanced germplasm for crown rot in winter cereals through application of molecular markers	130,000
USQ00013	Managing crop diseases—Improving crown rot resistance in durum	200,000
UWA00124	Efficacy of the Harrington Weed Seed Destructor in targeting weed seeds during the harvest of Australian grain crops	242,208
UWA00125	Weed Seed Wizard: validation and improvement of a weed management decision support tool	200,000
UWA00129	Generation of genetically modified herbicide tolerant narrow-leaf lupin	1,062,449
UWA00145	Innovative approaches to resistance to necrotrophic pathogens and sap-sucking insect pests	597,451
UWA00146	Australian Herbicide Resistance Initiative—Phase 4	1,200,000
UWA00152	Managing soil-borne diseases with a focus on <i>Rhizoctonia</i>	60,000
UWA00155	New chemistry options for wild radish control	149,332
UWA00158	Detection and epidemiology of spring aphids and redlegged earth mites	99,996
THEME 3—PROTECTING YOUR CROP TOTAL		39,261,258
THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS		
ACC00007	GRDC Extension and Training Program	120,000
AES00006	GRDC Farm Business Management face-to-face and online training and Farm Business Management factsheets	302,630
AGG00001	Quantifying herbicide resistance in modern farming systems—Griffith region 2012	35,000
APR00001	Practical financial figures for farm business management	761,000
ARO00001	Western Region Agribusiness Trial Extension Network	12,500

Number	Title	Expenditure \$
ARO00002	Grazing crops for frost mitigation	35,000
BWD00012	Yielding benefits through partnerships	303,782
BWD00018	Northern Victorian Grain and Graze 2 Program	487,327
BWD00021	More Profit for Crop Nutrition II—Extension and training Southern Region	73,450
CRA00004	Cultivar crown rot tolerance trials	50,000
CRC00003	Development of best management practice for wild radish management in cereals	50,000
CSA00025	Water use efficient farming systems for the Mallee	373,325
CSA00028	Empirical studies of farming systems technology adoption	67,500
CSA00029	National integration of crop sequence strategies and tactics	252,868
CSA00032	Improving nutrient use efficiency in wheat—Postdoctoral Fellow	165,000
CSA00033	Realising yield potential through farming systems research, development and extension—Western Region	175,051
CSA00036	More Profit from Crop Nutrition II—Analysis frameworks to support profitable fertiliser use	259,191
CSA00037	More Profit from Crop Nutrition II—Reassessing the value and use of fixed nitrogen	144,468
CSA00039	Better irrigated wheat agronomy	244,336
CSE00055	Crop sequences to manage soil pathogens and reduce the yield gap of northern grain production	250,000
CSP00111	Identifying farm-scale opportunities to improve water use efficiency—a nationally-coordinated systems approach	177,676
CSP00146	Facilitating increased on-farm adoption of broadleaf species in crop sequences to improve grain production and profitability	608,042
CSP00159	Increasing water use efficiency in the northern sandplain region of WA	342,684
CSP00165	More Profit from Crop Nutrition II—Phosphorus use efficiency: Rhizosphere project	287,107
CSP00169	Achieving stable and high canola yield across the rainfall zones of WA	362,994
CSP00174	Maintaining profitable farming systems with retained stubble in NSW south-west slopes and Riverina	361,666
CWF00013	Increasing farm water use efficiency in central-west NSW	364,100
CWF00018	Maintaining profitable farming systems with retained stubble in central-west NSW	423,667
DAN00152	The strategic use of tillage within conservation farming	299,790
DAN00168	More Profit from Crop Nutrition II—Regional soil testing guidelines for the Southern Region	221,603
DAN00170	Maintaining profitable farming systems with retained stubble: A review of RD&E to guide future investment	23,968
DAN00171	Northern Pulse Agronomy Initiative—NSW	352,624
DAN00173	Management of barley and barley cultivars for the Southern Region	499,925
DAQ00170	GRDC grower solutions for central Queensland	402,562
DAQ00174	Cropping solutions for the sugarcane farming systems of the Burdekin	374,909
DAQ00176	Development, validation and delivery of a diagnostic framework to assist growers manage constraints to achieving water limited grain yield	295,650
DAQ00180	Extension of nitrogen fixation program outputs to end users—Northern Region	60,000
DAQ00181	Optimising nitrogen fixation of grain legumes—Northern Region	108,472
DAQ00183	More Profit from Crop Nutrition II—Extension and training—Northern Region	150,000
DAQ00184	Grower solution project for Queensland coastal and inland Burnett and NSW north coast	210,000
DAS00089	Improving crop and farm water use efficiency in Australia	125,001
DAS00119	Profitable crop sequencing in the low-rainfall areas of south-eastern Australia	435,000

Number	Title	Expenditure \$
DAS00126	Regional Cropping Solutions	98,875
DAS00128	Optimising nitrogen fixation of grain legumes—Southern Region	149,959
DAV00095	Improving nitrogen and phosphorus management in south-east Australian cropping systems	112,459
DAV00113	Expanding the use of pulses in the Southern Region	430,000
DAV00116	Stepping up grain production in the high-rainfall zone of southern Australia	720,821
DAV00122	Diagnostic Agronomy South: Development, validation and delivery of a diagnostic framework	400,000
DAV00125	More Profit from Crop Nutrition II—Improving nitrous oxide abatement in higher rainfall cropping systems and developing nitrogen response curves	206,667
DAW00213	Putting the focus on profitable break crop and pasture sequences in WA	1,060,000
DAW00217	Diagnostic Agronomy West	494,976
DAW00218	Wheat agronomy—Building system profitability in the Western Region	750,000
DAW00221	Optimising nitrogen fixation of grain legumes—Western Region	128,014
DAW00222	More Profit from Crop Nutrition II—Regional soil testing and nutrient guidelines: West	207,834
DAW00223	More Profit from Crop Nutrition II—Extension and training: West	100,000
DAW00224	Management of barley and barley cultivars in WA	650,000
DAW00227	Tactical break crop agronomy in WA	763,009
DER00015	Grower and adviser information products and services needs survey 2013	82,929
DMA00002	Canola establishment and best management practices in Mallee soils	18,750
EPF00001	Maintaining profitable farming systems with retained stubble—Upper Eyre Peninsula	310,000
ERM00002	Measuring soil evaporation across different soils of the northern cropping zone: Stage 2—Testing current modelling assumptions	100,000
ERM00003	Does strategic tillage undo long term improvement in soils under no-till	300,000
FBP00003	Western Region Agribusiness Trial Extension Network	12,500
FFC00005	Validate and integrate canopy management principles into Western Australian cropping systems	143,600
FFC00007	Western Region Agribusiness Trial Extension Network	12,500
FFC00009	Western Region Agribusiness Trial Extension Network	25,000
FGI00009	Effect of stubble retention on canopy temperature and frost damage in wheat	12,500
FLR00005	Catch More, Store More, Grow More: Integrating soil and crop management to improve whole-farm water use efficiency in the mixed farming zone of southern NSW	211,000
GIA00002	Delivery of GRDC/Department of Agriculture and Food WA—Western Australian agribusiness and regional crop updates	125,000
GOA00001	Grower solutions for central NSW	350,000
GPC00001	Extension of nitrogen fixation program outputs to end users—Western Region	60,000
HFG00006	Managing moisture for improved water use efficiency in the Southern Region	105,467
HGS00001	Western Region Agribusiness Trial Extension Network	12,500
ICN00014	GRDC Research Updates—Northern Region	300,000
ICN00015	National Agribusiness Reference Group 2012	55,000
IPN00001	More Profit from Crop Nutrition II—Project 16—National micronutrient survey	87,150
LEA00001	Improving water use efficiency in lower Eyre Peninsula farming systems	100,000
LEA00002	Profitable farming systems with retained stubble on lower Eyre Peninsula	153,442
MCV00008	Improving forecast accuracy, especially with improved Indian Ocean initialisation	76,600
MCV00009	Improving multi-week predictions	66,400
MFM00003	Improving farm water use efficiency on Kangaroo Island and in the south-east of SA	100,000

Number	Title	Expenditure \$
MFM00004	Regional Cropping Solutions Network	100,000
MFM00006	Maintaining profitable farming systems with retained stubble in the south-east and Kangaroo Island regions	113,875
MFS00003	Maintaining profitable farming systems with retained stubble in the Mallee	392,667
NCA00008	Improving market signals for GRDC and the grains industry to enhance delivery to customers	121,000
NGA00003	Grower solutions for northern NSW and southern Queensland	1,000,000
NPN00001	Agribusiness Trial Extension Network	8,575
NZX00001	ProFarmer market and exchange rate feeds for the GRDC website	24,000
ORM00004	Delivery of Farm Business Management Updates in the GRDC Southern Region	630,000
ORM00005	GRDC Research Updates—Southern Region	600,000
ORM00006	Online extension services trial coordination	1,776
ORM00007	Improving grower and industry adoption of new electronic technologies	240,000
PFS4-1	More Profit from Crop Nutrition II—Expenses	193
PLN00004	Regional Cropping Solutions Network	114,000
PLN00007	Break crop economics for Kwinana East	8,500
PLN00008	Seeding systems to maximise crop yield and competition with weeds	30,000
PLN00009	How to farm profitably in the eastern wheat belt	79,600
PR251-1	Water use efficient farming systems—Completing the program	12,210
PR333-1	Industry Development Award Extension Network—Advertising	5,434
PR333-2	Industry Development Extension Network—Trial signs	27,617
PR333-3	Industry Development Extension Network—Regional information acquisition and analysis	4,500
PRI00003	Regional Cropping Solutions	94,051
PTP00001	Development of a grower and industry based GRDC farm business management manual in hard copy and e-book format	345,380
RAI00003	Plant available water information and tools for Albany and Esperance Regional Cropping Solutions	59,000
RDP00010	Sustainable use of imidazole herbicide tolerant crops in South Australian farming systems	18,750
RMS00003	Improving nitrogen application decisions in cropping systems using yield prophet and plant available water capacity mapping in the Barmedman area of southern NSW	18,750
RPI00007	Improved water use efficiency in no-till cropping and stubble retention systems in spatially and temporally variable conditions in the riverine plains	202,978
RPI00009	Maintaining profitable farming systems with retained stubble in the riverine plains region	284,167
SDI00002	Regional Cropping Solutions	455,932
SDI00014	Regional Cropping Solutions, Esperance—Learning events to actively manage business risk and uncertainty	5,000
SDI00015	Summer weed spraying	26,000
SDI00016	Extension of management methods to address non-wetting soils in the Albany and Kwinana West port zones of WA	38,000
SDI00017	Evaluating management options for rhizoctonia bare patch in barley and wheat in the high-rainfall cropping zone in WA	12,500
SDI00018	Weed mapping and ecology in the central and eastern wheat belt of WA	18,000
SDI00019	Stubble management to reduce the impact of frost to crops in the Albany and Kwinana West zone of WA	40,000
SDN00001	Understanding future requirements of small plot trial equipment	22,699

Number	Title	Expenditure \$
SEP00011	Mobile devices—The next step in precision agriculture adoption	45,133
SFS00019	Optimising the profitability of high-rainfall zone cropping in south-western Victoria through improved water use efficient farming systems	208,104
SFS00022	Pastures in crop sequencing for the high-rainfall zone of Southern Australia	350,000
SFS00023	Evaluation of management strategies for the control of slugs in the high-rainfall zone region	40,000
SYN00004	Western Region Agribusiness Trial Extension Network	12,500
SYN00005	Western Region Agribusiness Trial Extension Network	12,500
TAR00001	Weed seed harvest management	24,550
UA00107	Eyre Peninsula Farming Systems 3—Responsive farming systems	385,170
UA00119	Assessing management options for enhanced soil phosphorus availability using rotations	100,000
UA00138	Extension of nitrogen fixation program outputs to end users—Southern Region	69,970
UA00139	More Profit from Crop Nutrition II—Tactical foliar phosphorus fertilisation of dryland crops	147,287
UA00140	More Profit from Crop Nutrition II—An accurate soil test for available soil sulphur and potassium	239,414
UMU00041	Assessing the nutritional benefits of clay amendment and cultivation of sands	150,000
UMU00042	More Profit from Crop Nutrition II—Managing potassium nutrition to alleviate crop stress	250,436
UNE00020	Quantifying and understanding root variation in winter cereals	498,507
UNF00001	Increasing farm water use efficiency in the upper north of SA	125,000
UNF00002	Maintaining profitable farming systems with retained stubbles in upper north SA	130,200
UNS00002	Active implements for precision seed and fertiliser placement	50,000
UQ00063	More Profit from Crop Nutrition II—Regional soil testing guidelines for the northern grains region	233,238
UQ00066	More Profit from Crop Nutrition II—Defining nitrogen response surfaces for sorghum and canola in the northern grains region	171,907
UQ00067	Queensland pulse agronomy initiative to increase the reliability and yield of summer and winter pulses	428,379
URS00007	Southern barley production briefing document preparation	3,200
USA00013	Improved skimmer and mouldboard selection to increase the effectiveness of the mouldboard plough in managing herbicide-resistant weeds	20,500
UT00016	Improved water use efficiency of rain-fed and irrigated farming systems in Tasmania	124,335
UT00026	Optimising cropping practices in mixed farming systems of Tasmania	153,354
UWA00156	More Profit from Crop Nutrition II—Nitrogen fertiliser response curves: Filling the gap for WA	206,667
UWA00160	Proof of concept—Remote sensing of frost induced stress in wheat paddocks	40,000
UWA00161	Proof of concept—Use of chemicals to increase frost hardiness in wheat	39,150
VIC00009	Regional Cropping Solutions	100,000
WAN00020	Dry seeding into crop residues in the Western Australian wheat belt	398,261
WMG00001	Western Region Agribusiness Trial Extension Network	25,000
YCR00001	Testing retained sowing seed of hybrid canola in a range of rainfall zones	36,600
YPA00002	Improving snail bait distribution	38,850
THEME 4—ADVANCING PROFITABLE FARMING SYSTEMS TOTAL		29,756,186
THEME 5—IMPROVING YOUR FARM RESOURCE BASE		
ADE00001	Salt-affected soils booklet	25,000
AEA00004	Grain and Graze 2—East SA Program	459,650

Number	Title	Expenditure \$
CIE00002	Analysis of the benefits of improved seasonal climate forecasting	103,550
COC00001-2A	Caring for Our Country 2—Expenditure	1,749
CRF00002	Improved management of soil organic matter for profitable and sustainable cropping—Coordination and extension	170,000
CSA00026	Grain and Graze 2—National integration	153,200
CSA00034	Development of a direct measurement methodology to quantify changes in soil organic carbon stocks	50,000
CSA00038	GRDC environmental stocktake for the Northern Region	49,552
CSA00040	Potential soil carbon sequestration in Australian grain regions and its impact on soil productivity and greenhouse gas emissions	75,000
CSE00056	Bio-routes to urea fertilisers	403,329
CSP00135	A molecular approach to unravel the dynamics of disease suppressive microbial communities	129,000
CSP00138	Manipulating biological processes that improve nitrogen supply to cereal crops	106,808
CSP00139	Novel solutions for managing non-wetting soils	224,979
CSP00163	Water balance of conservation farming systems 3	77,074
DAN00144	How much ammonia is lost from surface-applied nitrogen fertiliser in north-west NSW?	25,000
DAN00145	National independent quality assurance and germplasm maintenance for <i>Rhizobium</i> inoculants	161,776
DAN00160	Life cycle assessment for farming systems in NSW	150,000
DAN00169	Building resilient and profitable grain cropping systems through improved knowledge of soil organic carbon fractions and their functionality	300,000
DAQ00162	Grain and Graze 2—Northern Region	514,500
DAQ00182	Improved management of soil organic matter for profitable and sustainable cropping—Extension	110,000
DAV00099	Harnessing the biological potential of Australian cropping soils	119,960
DAV00102	Monitoring soil biology with high-resolution genomic technologies	125,079
DAV00105	Suppressive soils—Can we find a microbial fingerprint using 'omics' technology?	130,217
DAV00106	Managing soil biology to improve nitrogen supply in grain production systems	100,000
DAV00121	Sustaining wheat yield and quality under increasing atmospheric carbon dioxide	997,665
DAW00201	Identification and characterisation of disease suppressive soils in the Western Region	125,000
DAW00204	Delivering agronomic strategies for water-repellent soils in WA	350,350
DAW00225	Soil organic matter extension and communication in WA	110,000
DBM00001	Improved management of soil organic matter for profitable and sustainable cropping	45,454
DEF00001	Regional scenario analyses for cropping in future climates	150,000
DGR00002	Project Review 2012—UWA00133 'Improved nitrogen use efficiency in wheat and barley' and UA00115 'Improving phosphorus use efficiency in wheat and barley'	2,500
ECO00005	Climate Champions initiative	170,000
ECO00010	Managing Climate Variability change of host and Joomla upgrade for Climate Kelpie website	17,280
FFI00006	EverCrop—Delivering profitable perennial options to crop–livestock systems	750,000
FGI00007	Grain and Graze 2—WA region	504,500
FLR00006	Grain and Graze 2—Building resilient mixed farming systems in southern NSW	333,000
GRD4-14-1	Program Review 2013—Communication, extension and grower engagement in soil biology	4,983
IFI00001	Project Review 2012—UWA00133 'Improved nitrogen use efficiency in wheat and barley' and UA00115 'Improving phosphorus use efficiency in wheat and barley'	2,400
JOL00002	Project Review 2012—UWA00133 'Improved nitrogen use efficiency in wheat and barley' and UA00115 'Improving phosphorus use efficiency in wheat and barley'	3,814

Number	Title	Expenditure \$
KDI00023	Improved management of soil organic matter for profitable and sustainable cropping	80,000
MCC00011	National Agricultural Nitrous Oxide Research Program—Evaluation of performance	40,000
MCV00006	Assessing and managing heat stress in cereals	43,000
MCV00014	Managing Climate Variability—Communication support	195,900
MCV00014-2	Managing Climate Variability Program 3—Communication support—Income expenditure	32,000
MCV00015	Managing Climate Variability Program 3—Program coordinator	116,000
MCV00017	Managing Climate Variability Program 3—Communication support and administration	10,500
MCV00023	Managing Climate Variability Program 3—Program management committee	5,004
MCV00023-1	Managing Climate Variability Program 3—Program management committee expenses	109
MCV00024	Managing Climate Variability Program 3—Independent chair	8,333
MCV00031	Predictions of heat extremes on the multi-week timescale	205,108
MCV00032	Northern Australia—monsoon prediction	268,948
MCV00033	Managing Climate Variability Program 3—Climate Champion	15,000
MCV00033-2	Managing Climate Variability Program 3—Income expenditure from Australian Wool Innovation—Climate Champion	18,000
MCV00034	Multi-week climate outlook products for Australia—Phase 2	206,600
MFR5-1	GRDC contribution to the Primary Industry Standing Committee's National Soils Research, Development and Extension Strategy	120,000
NRS00009	Farm business logic application through Grain and Graze 2	100,000
PNS00015	Soil biology initiative communications program	18,182
POL00001	Polymers for improving soil moisture management and cropping productivity	300,000
PR185-3	Caring for Our Country—Set up website	1,015
ROE00001	Grain and Graze 2—Monitoring and evaluation	137,000
RPS00003	Continuation of Managing Climate Variability program CliMate application—Silo subscription	9,810
SFS00020	Grain and Graze 2—Southern Victorian program	351,946
UA00115	Improving phosphorus use efficiency in wheat and barley	298,752
UA00117	Grain and Graze 2—Eyre Peninsula	202,029
UF00007	Beneficial microbes program—Progressing new microbial products for Australian grain production to commercialisation	201,272
UM00044	Climate change research strategy for primary industries participants agreement	45,000
UMU00040	Maintenance of rhizobial germplasm resources	65,000
UNE00017	Coordination—Nitrogen Fixation in Farming Systems	118,585
UQ00061	Fertiliser from wastes—Phase II	399,918
US00050	Formulation and application of beneficial microbial inoculants for agriculturally important crops	43,030
USA00015	Development of a prototype soil sensor using the University of Western Australia micro electrical mechanical systems infrared chip	238,546
UWA00113	Demonstration of UWA microspectrometer technology for assessment of soil and grain parameters in broadacre agriculture	200,000
UWA00133	Improved nitrogen use efficiency in wheat and barley	318,968
UWA00138	A national soil quality monitoring framework	362,750
UWA00139	Harnessing the nitrogen cycle through novel solutions	76,450
UWA00142	Molecular indicators for soil quality	52,418
UWA00157	Long term no-till farming systems	250,070
UWS00008	Carbon storage: Identifying microbial drivers and key modulators in grain cropping systems	140,000
THEME 5—IMPROVING YOUR FARM RESOURCE BASE TOTAL		12,627,612

Number	Title	Expenditure \$
THEME 6—BUILDING SKILLS AND CAPACITY		
AAA00007	Agricultural Biotechnology Council of Australia 2012–13	50,000
ACC00006	Extension adoption training and support	105,000
AFQ00010	AgForce Grains Queensland grain industry awards dinner	10,000
AOZ00001	Understanding and making the GRDC website update papers accessible	22,000
ARL00008	Australian Rural Leadership Foundation	100,000
ARPO0001	Practical quantification of the soil water balance for use by growers	18,750
ATA97	Agricultural Training Award (ATA)— to study at Western Australian College of Agriculture Cunderdin	12,000
ATA98	ATA—to study at the Longerenong College Victoria	12,000
ATA99	ATA—to study at Tocal College	12,000
BSK8-1	Training awards	200
CNG00001	GRDC website performance monitoring	30,357
CQA00001	Extension provider upskilling— technology adoption	80,000
CSP00147	CSIRO Summer Student Program	35,000
DAF00002	Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry	40,000
DAS00113	Pulse Breeding Australia: PhD—Improving metribuzin tolerance in lentil	30,000
DAV00110	Pulse Breeding Australia: PhD—Improving salinity tolerance of field pea	30,000
FPL00003	Funnelback indexing of final reports, web content accessibility guidelines, compliance and YouTube indexing	13,400
GRF00001	Queensland Regional Advisory Committee coordination	44,000
GRS10004	Grains Industry Research Scholarship (GIRS)—(ANU) Identifying novel epigenetic components that regulate seed size in a model plant, <i>Arabidopsis</i>	27,145
GRS10026	GIRS—(UA) Assessing management options for enhancing soil phosphorus availability using rotations	27,145
GRS10027	GIRS—(UWA) Phosphorus use efficiency of <i>Austrodanthonia</i>	27,145
GRS10028	GIRS—(UMU) Genetic factors and genes underpinning drought response in wheat	27,145
GRS10029	GIRS—(UCS) Manipulation of phosphorus sorption in agricultural soils	27,145
GRS10031	GIRS—(UA) Use of novel wheat (waxy durum) in baking applications	27,145
GRS10034	GIRS—(UA) Identification of the controller of nitrate transport in maize	27,145
GRS10035	GIRS—(CUR) Minimising fungicide resistance	27,145
GRS10036	GIRS—(USQ) Inter-relationships between <i>Bipolaris sorokiniana</i> isolates involved in spot blotch, common root rot and black point in winter cereals	27,145
GRS10037	GIRS—(UWA) Evolved glyphosate resistance in wild radish (<i>Raphanus raphanistrum</i> L.) populations with the use of glyphosate-resistant GM canola	27,145
GRS10038	GIRS—(US) Enhancing plant nutrition with rhizosphere microorganisms	27,145
GRS10039	GIRS—(UWA) Unravelling the cause of black pod disease of narrow-leafed lupin and developing a control solution	27,145
GRS10040	GIRS—(UF) Examining the role of sucrose transporter SUT1 in increasing yield and iron/zinc content in barley	27,145
GRS10041	GIRS—(UQ) Understanding abiotic stress impacts on cereal starch structure and value-added quality through genetic and environmental screening	27,145
GRS10042	GIRS—(CUR) The integration and validation of precision management tools for mixed farming systems	27,145
GRS10044	GIRS—(UA) Evaluating the salt tolerance of transgenic wheat and barley	27,145

Number	Title	Expenditure \$
GRS10045	GIRS—(UQ) Genetic variability and physiological mechanisms controlling time to flowering in wheat under high temperatures	7,881
GRS10061	GIRS—(CUR) Comparative genomics of necrotrophic fungal pathogens	27,145
GRS10063	GIRS—(RMIT) Bread-making procedure, product digestibility and impact on sensibility to gluten proteins	27,145
GRS10248	GIRS—(US) Regulation and long-distance movement of nutrient starvation-responsive plant microRNAs	22,796
GRS10249	GIRS—(UQ) Functional pathogen genomics and characterisation of the infection mechanisms of the wheat and barley crown rot pathogen, <i>Fusarium pseudograminearum</i>	10,000
GRS10258	GIRS—(US) Characterising potential symbiosome membrane proteins essential to the legume–rhizobium symbiosis	27,796
GRS10259	GIRS—(UA) D-glucan biosynthesis in the Poaceae: Exploring transcriptional regulation, associated expression and specific activities of biosynthetic enzymes	27,796
GRS10263	GIRS—(JA) Effect of small amounts of ammonium on the total nitrogen nutrition and on overall nutrition of maize	23,164
GRS10268	GIRS—(UMU) Wheat potassium nutrition in saline and/or sodic soils and in drought-prone environments	27,796
GRS10275	GIRS—(UWA) The use of potassium to improve water usage, growth and yield of canola in European high-yielding and Australian low-yielding farming systems	27,796
GRS10290	GIRS—(RMIT) Forms, analysis and stability of vitamin E and selenium in grains and grain products	27,796
GRS10329	GIRS—(ANU) Investigating the role of root architecture regulators as mediators of environmental information in root development	27,796
GRS10335	GIRS—(UA) Foliar fertilisation of wheat plants—Phosphorus in combination with other nutrients	27,796
GRS10336	GIRS—(US) Genetics of biofortified wheat	27,796
GRS10404	GIRS—(UWA) Detection and epidemiology of spring aphids in canola	14,245
GRS10405	GIRS—(UQ) Manipulating seed storage proteins to enhance sorghum digestibility	7,122
GRS10407	GIRS—(UA) Characterisation of novel forms of beta-glucanase in malting barley	7,122
GRS10408	GIRS—(UMU) Spatial and temporal distribution of severe weather events and their impact on grain crops	14,245
GRS10421	GIRS—(UQ) Development of functional molecular markers for key agronomic traits in the cultivated peanut, using next-generation sequencing technologies	14,245
GRS10437	GIRS—(UA) Responses of maize roots to nitrogen supply	14,245
GRS10440	GIRS—(USCQ) Investigation of metabolic regulatory genes and hormones in pest snails	14,245
GRS10460	GIRS—(UWA) Characterisation of <i>Arabidopsis</i> nitrilases and interactions in the processes of photosynthetic loss, leaf senescence and plant stress	14,245
GRS10471	GIRS—(USA) Whole-of-plant study of salinity tolerance: A mathematical modelling approach	14,245
GRS10474	GIRS—(UA) Nanotechnology and chemical-free approach for the protection of stored grain	14,245
GRS10477	GIRS—(USQ) On-the-go proximal soil exchangeable ion sensing for precision management of sodicity	3,333
GRS10483	GIRS—(UCS) Determination of genetic markers for herbicide resistance in annual ryegrass using diversity array technology	14,245
GRS10486	GIRS—(ANU) Assessing the biology impact of wheat-infecting <i>Botryosphaeria</i> spp	10,683
GRS10490	GIRS—(UA) Identification of arabinoxylan biosynthetic genes in plants	24,928
GRS10501	GIRS—(UQ) Identification of quantitative trait loci associated with heat tolerance in wheat for increased fertility and grain development/genetic variability in heat responses for grain development	14,245

Number	Title	Expenditure \$
GRS10507	GIRS—(UQ) Identification of blackleg resistance genes in canola	14,245
GRS10512	GIRS—(USA) Mathematical and computational modelling for the phenotypic analysis of cereal plants	14,245
GRS10532	GIRS—(UQ) Identifying sources of resistance to necrotrophic plant pathogens using the model grass <i>Brachypodium distachyon</i>	14,245
GRS10564	GIRS—(CUR) Effector gene prediction from fungal pathogen genome assemblies	14,245
GRS10566	GIRS—(UWA) Understanding the strategies of outstanding performers in dryland farming enterprises	2,374
GRS10577	GIRS—Thesis research into the biological farming approach	1,300
GRS138	GIRS—(US) Genetic improvement of grain quality for bread making in triticale	6,250
GRS161	GIRS—(ULA) The role of intracellular localisation signals in NHX antiporter regulation in <i>Arabidopsis</i>	3,282
GRS163	GIRS—(UWA) Exploring the impact of salt stress on respiration and mitochondrial function in wheat varieties	5,000
GRS165	GIRS—(UWA) Generation of homozygosity and genome fixation in field pea (<i>Pisum sativum</i> L.)	25,000
GRS171	GIRS—(ANU) A biochemical approach to understanding <i>Stagonospora nodorum</i> toxin proteins	21,875
GRS172	GIRS—(UNE) Root vigour of cereal genotypes in response to phosphorus nutrition	15,000
GRS174	GIRS—(CSP) Effects of carbon dioxide on the epidemiology of crown rot infection in resistant and susceptible wheat cultivars	28,750
GRS175	GIRS—(US) Identifying site-specific crop production risk	12,761
GRS176	GIRS—(UA) Physiological studies on the response of wheat to short-term heat stress during reproductive development	30,000
GRS177	GIRS—(UWA) Costs and benefits of different options for WA farmers to mitigate greenhouse gas emissions	20,963
GRS179	GIRS—(ULA) Homeostatic sensing and feedback regulations of sodium-proton antiporter expression in <i>Arabidopsis</i>	30,000
GRS180	GIRS—(US) The basis of chickpea heat tolerance under semi-arid environments in India and Australia	296
GRS181	GIRS—(UA) Confirmation and characterisation of a Na ⁺ (sodium) exclusion gene in barley	30,000
GRS183	GIRS—(UWA) Uncovering changes in the molecular networks of protein oxidation underpinning cereal crop responses to environmental stress	21,875
GRS184	GIRS—(ANU) Gene regulation in plant adaptation to stressful environments and drought conditions	23,698
GRS185	GIRS—(CUR) The effect of heat treatment and processing techniques on the quality of Australian sweet lupin flour	9,583
GRS186	GIRS—(UCS) Investigating the fungal endophyte <i>Neotyphodium occaltans</i>	26,875
GRS187	GIRS—(UMU) Investigating the method of action of plant growth promoting rhizosphere bacteria-enhancing nodulation in legumes	27,145
GTA10419	Travel Award (TA) — (UA) International Workshop on Plant Membrane Biology	2,500
GTA10422	TA—(UQ) Plant and Animal Genome XXI Conference	2,500
GTA10427	TA—(DAFWA) Understanding the China market and its requirement for milling oats— Industry champion travel	10,000
GTA10428	TA—(UA) International Workshop on Plant Membrane Biology XVI 2013	2,500
GTA10430	TA—(Aglime) Gain a more detailed understanding of techniques used in encouraging farmers to apply adequate lime to remove soil acidity	6,000
GTA10475	TA—(JM) Attend conference and gain knowledge of current slug control research	3,300
GTA10498	TA—(ANU) Keystone Conference—RNA Silencing	3,000
GTA10499	TA—(ACPGF) International Workshop on Plant Membrane Biology XVI 2013	2,500

Number	Title	Expenditure \$
GTA10511	TA—(ACPFPG) International Workshop on Plant Membrane Biology XVI 2013	2,500
GTA10579	TA—(DAQ) APRES Conference, project development with University of Florida, USDA and Birdsong Peanuts	2,000
GTA10592	TA—2013 Society for Engineering in Agriculture Conference	1,550
GTA10600	TA—Genetically Modified Crops Coexistence Conference	4,323
GTA10605	TA—10th International Congress of Plant Pathology	2,792
GTA10625	TA—ICC—AGSA 2013	1,332
GTA10638	TA—Attendance at International Wheat Genetics Symposium	3,240
GTA10643	TA—Participate in the 13th ASEAN Food Conference 2013 on meeting future food demands: Security and sustainability	2,000
IDA10431	Industry Development Award (IDA)—Grower study tour to New Zealand March 2013	12,500
IDA10441	IDA—Attendance and dissemination of information from the Global Herbicide Resistance Challenge Conference	12,075
IDA10447	IDA—Precision Agriculture, Information and Communication Technology Study Tour	14,980
IDA10452	IDA—Ten Years of No-till in the Victorian Mallee 'Celebration and Demonstration'	14,440
IDA10461	IDA—Ag Excellence Alliance Annual Forum	15,000
IDA10463	IDA—Understanding and interpreting grains research and extension	7,500
IDA10482	IDA—Resistance road trip	6,000
IDA10487	IDA—Participating in the GRDC Conference	3,575
IDA10503	IDA—Global Herbicide Resistance Challenge conference	11,025
IDA10508	IDA—Pulse market and agronomic opportunities	15,000
IDA10513	IDA—North America farmers study tour	15,000
IDA10587	IDA—Continuous improvement and innovation of grower education and market development within the complex agricultural relationships between China and WA	15,000
IDA10588	IDA—Karoonda Field Day 2013	5,000
IDA10589	IDA—South Australian grain production with declining rainfall tour	15,000
IDA10596	IDA—Learning the best from the West—WA Study Tour	14,912
IDA10601	IDA—The Changing Nature of Agricultural Training	14,925
IDA10614	IDA—Farming systems and the move to continuous cropping	14,742
IDA10621	IDA—Grower attendance—Australian Summer Grains Conference June 2013	8,388
IPR00003	Vavilov–Frankel Fellowship	22,000
ITA00001	Indigenous Training Award—to study at University of Western Australia	10,000
KEN00003	South East Barley Advisory Committee Chair	4,500
MIG00012	Grower Group Alliance	326,660
MSA00001	Understanding the development of students into qualified trained agronomists in the Northern, Southern and Western regions	180,000
NFA00008	Research Advisory Committees—Northern and southern NSW	88,000
NRS00005	National leadership and mentoring	10,000
NUF00010	Nuffield Australia Farming Scholarships	150,000
NYC00002	Advisory Council of the National Science Summer School	16,565
NYS00002	National Youth Science Forum	50,000
PAL00018	Revision and updating of content for Chickpea Disorders: the Ute Guide	7,000
PIG00008	Managing the grain growing business	300,000
PR325-1	Capacity maintenance—Managing grower and adviser human capacity for long term sustainability of the grains industry	4,205
PR332-1	E-learning and electronic application training packages	15,459

Number	Title	Expenditure \$
RBC00002	Delivery of technical workshops—Understanding National Variety Trials, crop nutrition and water use efficiency	60,000
RCM00002	Decision support tools audit implementation	75,000
RDC00006	Investing in Youth initiative	10,000
RDC00008	Contribution to the collaborative venture for farming and fishing health and safety initiative 2012	60,000
RDC00010	Horizon Scholarship sponsorship	180,000
RMP00007	2011–14 Crop Update DVD and YouTube videos	75,000
RRA00045	Ute guide applications iOS 6 compatibility upgrade	12,300
RRA00046	Decision support tools portal	9,334
RRA00047	Ground Cover Sitecore migration	2,400
RRA00048	Push notifications	5,025
RRA00049	Northern weed ID and insect ID app content migration	9,300
RRA00050	Upgrade to Sitecore	2,400
RRA00051	AGROVOC meta-data integration into website	10,350
RWB00002	Rural focus interviews with the Western Panel	6,900
SAF00004	Research Advisory Committees—SA	37,080
TAS00001	Building industry capacity to adopt integrated weed management in the cotton-grains farming system through research-client linkages	75,000
TFG00001	Tasmanian Research Advisory Committee	12,360
UHS10049	Undergraduate Honours Scholarship (UHS)—(UQ) Development of rust resistant peanut genotypes through a single seed descent breeding strategy and speed breeding technologies	(54)
UHS10356	UHS—(UCS) Pulse Breeding Australia health benefits of Australian pulses	3,750
UHS10360	UHS—(UCS) Pulse Breeding Australia health benefits of Australian pulses	3,750
UHS10403	UHS—(UWA) Reducing the impact of aluminium toxicity using superphosphate as a seeding fertiliser	10,000
UHS10410	UHS—(UWA) Improving crop establishment in non-wetting soils through stubble management	10,000
UHS10411	UHS—(UWA) Monitoring the water status of wheat using novel magnetic probes	10,000
UHS10416	UHS—(UWA) Does knowledge of the soil map improve the utility of remotely sensed soil information?	10,000
UHS10418	UHS—(UNE) Signalling and nutrient partitioning during sorghum grain-fill under stress: Informing breeding strategies	10,000
UHS10444	UHS—(UA) A genetic dissection of physical grain quality in wheat	10,000
UHS10446	UHS—(CUR) Dissection of genetic factors affecting Ascochyta lentils pathogenicity and its interaction with lentil (<i>Lens culinaris</i>)	10,000
UHS10454	UHS—(US) The effect of slow release nitrogen fertilisers on biomass production, crop nitrogen content, grain yield and grain protein concentration	10,000
UHS10456	UHS—(Uni Sunshine Coast) Development of molluscan contraceptives: Investigation into the molecular basis of reproduction in invasive crop snails and slugs	10,000
UHS10457	UHS—(CSU) Components in canola oil	10,000
UHS10458	UHS—(UWA) Grain profitability maps for WA	10,000
UHS10469	UHS—(UW) Improved methods for the analysis of disease ratings, with application to the GRDC funded crown rot project	10,000
UHS10479	UHS—(UW) Improved canola variety information for farmers	10,000
UHS10480	UHS—(UA) Genetic control of heat tolerance in wheat	10,000
UHS10485	UHS—(UQ) Quantifying uncertainty in genetic map construction	10,000

Number	Title	Expenditure \$
UHS10488	UHS—(ANU) Optimising root architecture for yield and environmental benefits: identifying genetic and epigenetic targets by manipulating peptide relayed signals	10,000
UHS10504	UHS—(UQ) RNA signalling and plant disease resistance	10,000
UHS10509	UHS—(UA) Analysis and performance of key perennial forage shrub to improve production and sustainability in the mixed farming systems of the South Australian and Victorian Mallee	10,000
UHS10527	UHS—(UQ) Discovery of small RNA in the wheat transcriptome	10,000
UHS10548	UHS—(UWA) Heritability of resistance to black spot disease in a field pea recurrent enrichment and association population (Pea-REAP)	10,000
UHS10549	UHS—(UF) Micro RNAs and other phloem molecules coupled with physiological recordings of differing wheat cultivars under salinity stress	10,000
UNE00019	Graduate certificate and diploma in sustainable grains production for industry advisers and growers	346,964
UT00019	Primary Industry Centre for Science Education—Phase 3	195,000
UW00004	Capacity building for statistics	200,000
UWA00144	Building national capacity in education and research in applied entomology	157,593
VFF00006	Research Advisory Committee—Victoria	37,080
VR194-1	Capacity building—Expenses	4,238
VR234B-1	GRDC attendance registration fees Warracknabeal	118
YCR00002	Revision and updating of content for Canola: the Ute Guide	13,000
THEME 6—BUILDING SKILLS AND CAPACITY TOTAL		5,279,547
FOUNDATIONAL ACTIVITIES		
AAC00006	Conference Sponsorship (CS)—Australian Grains Industry Conference 2013	10,000
AGP2	Independent directors—Australian Grain Technologies	137,998
AMC00010	Program Review 2012—Herbicide tolerance program	2,000
AMC00012	Progress report evaluation	13,374
ANV00009	Ground Cover TV—National	385,000
ANV00010	Ground Cover TV—Electronic direct mail and web-based content	8,445
AOF00010	CS—18th and 19th Australian Research Assembly on Brassicas	3,750
ATR00015	2012 impact assessments	57,100
ATR00016	Impact assessment: More profit from crop nutrition II—Ex ante	61,548
ATR00017	Ex-ante analysis 2014–15 investments	54,150
ATR00018	Ex-ante analysis of 33 new investments commencing in the year 2013–14	70,125
ATR00019	Aggregate analysis of ex-post cost:benefit analysis and portfolio balance for investments	29,700
AUP00003	Reprint of a guide to communication for sustaining families and farms	17,550
BAE00021	Cost of grain production—Supplementary survey in Australian Agricultural and Grazing Industries Survey	37,885
BAE00022	Australian Agricultural and Grazing Industries Survey and grains reports: 2012–13	517,500
BAE00023	Australian Bureau of Agricultural and Resource Economics Sciences Harvesting Productivity initiative—2012–13 genetically modified grains project	185,347
BAE00025	Wheat variety selection—Adopting a portfolio approach to improve profitability and manage risk	148,000
BAU00001	Generate presentations for research programs	2,000
BBC00004	Project Review 2013—Putting the focus on profitable break crop and pasture sequences in WA	9,500
BBC00005	Assist in monitoring and evaluating research program portfolio	1,980

Number	Title	Expenditure \$
BBE00017	Independent director and chairman—Novozymes Biologicals Australia	40,394
BER00012	Development of growth stage app for 19 grains	18,000
BRE00006	Invertebrate pest management	22,000
CAN00003	Warehousing and distribution of the GRDC's publications, periodicals and promotional material 2009–2012	70,000
CEC00001	Integration of final reports onto the GRDC website	70,000
CFM00009	CS—Crawford Fund Annual Development Conference 2013	10,000
CIC00006	Western Region communicator services	16,669
CIC00007	Northern Region communicator services	10,399
CIC00015	Issues-based communication—Over the Fence	80,167
CIC00016	Issues-based communication—Panel profiles	7,068
CIC00020	Issues-based communication—Interactive broadcast	4,196
CIC00021	Regional communicator services—Northern	125,761
CIC00022	Regional communicator services—Western	131,411
CIC00023	Regional science writer services—Western	122,078
CIC00024	Strategic plan stakeholder briefings and information kit distribution	32,830
CIN00001	Independent Director and Chair—Wheat Quality Australia	54,048
CLA00002	Program Review 2013—Crown rot initiative projects	11,670
COR00017	<i>Ground Cover</i> —Supplements	272,000
COR00018	<i>Ground Cover</i> newspaper	1,370,599
COR00030	GRDC photo library	23,040
COR00031	Fact sheets for publication and website	207,000
COR00035	Converting of information from research reports for a grower audience	150,000
COR00036	Ground Cover direct publications catalogues	47,500
CSA00035	Tools for GRDC project evaluation: Adopt and benefit	100,000
DAP00001	Social media strategy and governance development	15,700
DAV00133	National High Rainfall Zone Workshop	14,000
DER00014	GRDC 2012 Grower Survey	25,400
DER00016	GRDC 2013 Grower Survey	86,050
DIB00002	Program Review 2013—Durum Breeding Australia	5,000
DRA00001	Program Review 2013—Crown rot initiative projects	12,385
DSP00001	Intranet requirements	14,500
ECO00007	Panel media and presentation skills training	21,000
ECO00009	Regional science writer services—Northern	137,620
EXH00001	GRDC website Hitwise accessibility	51,750
FMO00001	Project Review 2013—Putting the focus on profitable break crop and pasture sequences in WA	9,500
GCS10000	CS—Global Herbicide Resistance Challenge	2,500
GCS10362	CS—Pulse Breeding Australia National Pulse Conference	5,000
GCS10394	CS—6th International Conference on Legume Genetics and Genomics	135
GCS10420	CS—3rd Annual National Sustainable Food Summit	10,000
GCS10423	CS—19th Australasian Plant Pathology Conference	10,000
GCS10425	CS—Tasmanian Farmers & Graziers Association 2013 Policy	5,000
GCS10448	CS—2013 Hermitage Research Facility Schools Plant Science	3,500

Number	Title	Expenditure \$
GCS10465	CS—South Australian No-Tillage Farming Association Conference 2013	10,000
GCS10466	CS—1st International Controlled Traffic Farming Conference	10,000
GCS10467	CS—Women and Youth in Agriculture—Building a Resilient Farming Future	5,000
GCS10492	CS—Australian Agricultural and Resource Economics Society	5,000
GCS10495	CS—Crop Care Australasia Cropping Solutions Seminar	3,000
GCS10517	CS—Victorian Farmers Federation Annual Grains Conference	8,000
GCS10519	CS—Wheat Breeding Assembly Brisbane 2013	20,000
GCS10522	CS—16th Australian Barley Technical Symposium	20,000
GCS10524	CS—ICC Conference 2013 in Association with the 63rd Australian Cereal Chemistry Conference	5,000
GCS10530	CS—The 4th Australia–China Wheat Genetics and Breeding Forum—Climate change ready wheat cultivars for Australia and China	5,000
GCS10570	CS—Southern Precision Agriculture Association—Precision Agriculture EXPO	5,000
GCS10573	CS—Innovations in Agriculture and Natural Resource Management	5,000
GCS10574	CS—Australian Summer Grains Conference	50,000
GCS10575	CS—WA Farmers Conference 2013—Annual Grains Conference	8,000
GCS10576	CS—ANU Photosynthesis Initiative—International Advisory Group Meeting	10,000
GCS10583	CS—Workshop on the chemistry, amelioration and management of alkaline soils	3,000
GCS10590	CS—2013 Conference on Engineering in Agriculture	2,000
GCS10593	CS—Australasian Conference on Robotics and Automation	4,000
GCS10595	CS—2014 Australian Milling Conference, in conjunction with PIX 2014	8,000
GCS10602	CS—MacKillop Farm Management Group 2013 Field Days	4,000
GCS10610	CS—Esperance Downs Research Station Field Day	3,000
GCS10612	CS—South East Premium Wheat Growers Association WA Ladies Day	5,000
GCS10615	CS—Irrigated Cropping Council—Irrigation—Every drop, Every day	5,000
GCS10618	CS—2013 AgForce State Conference	8,000
GCS10619	CS—Pathways to Greening Global Markets (an LCA and Carbon Footprinting Conference hosted by the Australian Life Cycle Assessment Society)	10,000
GCS10633	CS—Digital Rural Futures (Smart Farms—Smart Regions)	5,000
GCS10634	CS—Regenerating Landscapes for a Sustainable Future	5,000
GCS10635	CS—Pesticide Resistance Workshop 2013	7,500
GCS10640	CS—22nd International Grassland Conference	5,000
GCS10644	CS—Australasia Pacific Extension Network International Conference 2013	5,000
GCS10645	CS—Universities and new graduate crop challenge	10,000
GCS10646	CS—NSW Farmers Annual Conference	8,000
GCS10651	CS—16th Symposium on Precision Agriculture Research and Application in Australasia	7,500
GCS10653	CS—11th Victorian No-Till Farmers Association Annual Conference	7,500
GGA00002	CS—Innovation Generation 2010—Building Supply Chain Solutions	100,000
GGA00005	CS—Innovation Generation Conference Partnership	50,000
GPA00002	Grain Producers Australia consultation and project work	140,193
GRD16-1	Impact assessment	1,382
GRD18-1	National Research, Development and Extension Strategy	170,325
GRD19-1	ABARES Harvesting Productivity Initiative and Australian Agricultural and Grazing Industries Survey	68

Number	Title	Expenditure \$
GRD24-1-1	Chair of Rural Research and Development Corporation Expenditure	120,000
GRD4-12-1	Program Review 2013—Crown rot initiative projects expenses	13,858
GRD4-13	Project Review 2013—Putting the focus on profitable break crop and pasture sequences in WA	983
GS22-1A	Regional publications support	44,679
GUI00002	Project Review 2013—Putting the focus on profitable break crop and pasture sequences in WA	8,000
HEU00001	Regional grower services—Portfolio monitoring and evaluation	40,000
IAR00001	Field trial database and grower engagement support	80,000
JDM00001	Industry good	20,000
JLC00013	Final report editing for GRDC website for advisers and growers	95,000
KDI00024	Revision of harvester fires report and content for a back pocket guide/checklist on how to reduce risk of a header fire	8,700
KIS00001	Kondinin Farmer of the Year Awards—Sponsorship of Grain Grower of the Year	20,000
LDP00002	Optical character recognition scanning of <i>Ground Cover</i> for the GRDC website and e-publications	14,160
MAA00007	Informing growers of GRDC investments through <i>The Cob</i> magazine	9,000
MDE00001	Database cleansing services for the GRDC customer relationship management	60,000
MDE00003	Customer relationship management consultancy and campaign development	53,000
MGS00001	Grain inventors award	15,000
MMO00006	Media monitoring and analysis services	224,400
NBC00001	Board of directors—Wheat Quality Australia	25,000
NRS00008	Supply and delivery of strategy development workshops	32,000
OBR00003	Driving Agronomy radio program	80,000
PFR00003	Independent directors—Canola Breeders WA	46,456
PNS00004	Southern regional communicator services	49,015
PNS00010	Issues-based campaigns: Getting GRDC closer to growers—Australian Year of the Farmer	37,208
PNS00012	Issues-based campaigns: In the field with John Harvey	45,111
PNS00013	Issues-based campaigns: National herbicide resistance communication campaign	53,062
PNS00014	Issues-based campaigns: Sponsorship of national Australian Year of the Farmer	15,000
PNS00016	Regional communicator services—Southern	211,013
PRO00001	Independent directors—Barley Australia	2,274
PRO00002	Independent directors—Barley Australia	36
PRS00001	Program Review 2013—Crown rot initiative projects	15,495
RBC00003	Field days support and interactive displays 2011	5,017
RCL00002	Independent director—High Rainfall Zone Wheats Pty Ltd	33,000
RCL00003	Independent director—High Rainfall Zone Wheats Pty Ltd	28,000
RDEM6-1	Contribution to Australian Centre for Plant Functional Genomics review	20,000
RHC00003	Digital publishing technical services	2,880
RRA00029	Redevelopment of the GRDC website (www.grdc.com.au) and content management system development	600
RRA00043	Image administration facility	5,500
RRA00044	Website search enhancements	11,500
SIT00001	Redevelopment of the GRDC website (www.grdc.com.au) and content management system development	11,900

Number	Title	Expenditure \$
SMC00001	Independent director—Grains and Legumes Nutrition Council Ltd	26,497
SOL00004	Program Review 2013—Crown rot initiative projects	14,970
TAA00001	Regional science writer services—Southern	101,631
TAP00004	Independent directors—Australian Crop Accreditation System	22,022
TJH00001	Independent directors—Australian Biotechnology Council of Australia	5,000
UB00002	Online libraries for the GRDC website—Digitisation of documents for online publication	95,000
UB00003	Online farm trials research—Developing new technologies to improve access to and adoption of research findings	500,000
UQ00065	Crop modelling support for the Australian grains industry	80,000
URS00009	Farming systems evaluation	80,000
URS00010	Advancing profitable farming systems theme investment analysis	5,400
URS00011	Advancing profitable farming systems theme investment analysis	16,200
UW00005	Statistics for the Australian grains industry—II	1,144,196
WDM00009	GRDC Paddock Diary 2012–13	32,985
WZ00001	GRDC website Weatherzone	3,700
FOUNDATIONAL ACTIVITIES TOTAL		9,606,738
R&D MANAGEMENT		
AGL00019	Investigation of solutions on non-wetting soils	2,500
ANL00001	Evaluation of tender and participation in evaluation teleconference	1,800
BAR00004	Determine the priorities for GRDC's barley quality assurance	1,602
BBE00019	Genetically modified lupins business plan	14,073
BBE00020	Beneficial microbe program—Business case for further investment	2,188
BBE00021	Commercialisation plan for the metarhizium technology	8,000
BBE00022	Evaluation of new genetic technologies	8,000
BRE00007	Progress report evaluation	2,200
CSP00171	Value adding genes in wheat	150,000
CSP00172	Increasing agricultural productivity through roots and rhizospheres: Putting the small grass <i>Brachypodium</i> to work	150,000
DAS00130	Developing aptamers for rapid detection of fungal spores affecting growing and stored grain	150,000
FWC00004	Progress report evaluation	16,000
GRD207-3	Industry good consultancy expenses	2,244
JOL00003	Progress report evaluation	20,000
MCC00012	Final report evaluation of the National Adaptation and Mitigation initiative	3,600
NBA00001	Novozymes Biologicals Australia Pty Ltd	200,000
NP99-1	Conceptual scoping and market intelligence	52,843
PDH00002	Beneficial microbe program—Business case for further investment	3,000
PHA00009	Review of revised AgVet bill on research delivery	12,000
RDEM1-1	Commercialisation and plant breeding rights activities	35,704
RDEM3-1	Commercialisation and expression of interest activities	107,454
RDEM5-1	Innovation investments	33,400
TON00001	Lupin business case	21,000
UA00142	Proof of concept of the ezycross technology in canola	149,900

Number	Title	Expenditure \$
UM00047	Novel, highly targeted, low environmental impact control of pest slugs and snails	150,000
UNS00003	The Australian development of autonomous agricultural machines	8,000
URS00006	Western Australian break-crop briefing document preparation	4,800
URS00008	Progress report evaluation	4,500
USC00006	Can novel oxalate-containing metal-open-frameworks be used as fertilisers and alkalinity sources in acidic soils utilising soil bacteria?	149,720
USQ00015	Remote monitoring and automatic detection of grain crop attributes	149,990
USU00001	Harnessing molluscan neurohormones to develop new molluscicides	149,338
UT00025	Developing high-throughput technologies for assessing pre-harvest sprouting	147,271
UWA00162	Screening for drought tolerance under well-watered conditions: A rapid method to predict wilting point of grain crops	69,191
VR202-1	Conceptual scoping and market intelligence	4,947
R&D MANAGEMENT TOTAL		1,985,265
GRAND TOTAL		159,236,419

ACPPFG = Australian Centre for Plant Functional Genomics, AGSA = Australasian Grain Science Association, ANU = Australian National University, APRES = Action Programme on REsponsible Sourcing, ASEAN = Association of Southeast Asian Nations, ATA = Agricultural Training Award, CIMMYT = International Maize and Wheat Improvement Center, CRC = cooperative research centre, CS = Conference Sponsorship, CSIRO = Commonwealth Scientific and Industrial Research Organisation, CSP = CSIRO Plant Industry, CUR = Curtin University of Technology, Western Australia, DAFWA = Department of Agriculture and Food, Western Australia, GGA = Grower Group Alliance, GIRS = Grains Industry Research Scholarship, GM = genetically modified, ICARDA = International Center for Agricultural Research in the Dry Areas, ICC = International Association for Cereal Science and Technology, IDA = Industry Development Award, MEMS-IR = Micro-electrical mechanical systems infrared, NSW = New South Wales, PIX = Poultry Information Exchange, QUT = Queensland University of Technology, R&D = research and development, RD&E = research, development and extension, RMIT = RMIT University, ROE = Roberts Evaluation Pty Ltd, SA = South Australia, SARDI = South Australian Research and Development Institute, SFS = Southern Farming Systems, TA = Travel Award, UA = University of Adelaide, UCS = Charles Sturt University, UF = Flinders University, UHS = Undergraduate Honours Scholarship, ULA = La Trobe University, UM = University of Melbourne, UMO = Monash University, UMU = Murdoch University, UNE = University of New England, UQ = University of Queensland, US = University of Sydney, USA = University of South Australia, USDA = United States Department of Agriculture, USCQ = University of Sunshine Coast, USQ = University of Southern Queensland, UW = University of Wollongong, UWA = University of Western Australia, UWS = University of Western Sydney, WA = Western Australia

Summary of GRDC project expenditure	Expenditure \$
Theme 1 – Meeting market requirements	18,560,283
Theme 2 – Improving crop yield	42,159,530
Theme 3 – Protecting your crop	39,261,258
Theme 4 – Advancing profitable farming systems	29,756,186
Theme 5 – Improving your farm resource base	12,627,612
Theme 6 – Building skills and capacity	5,279,547
Foundational activities	9,606,738
R&D management	1,985,265
GRAND TOTAL	159,236,419

Appendix C—Joint R&D project list

R&D Partners	Project ID	Project	Start	Finish
ARC, DPI VIC, GRDC, SARDI, UA, UM, UQ	ACP00002	Australian Centre for Plant Functional Genomics, Phase 2	1 Jan 2008	31 Dec 2012
AEA, DAFF, GRDC	AEA00004	South-eastern Australia Grain and Graze 2 program	31 Jan 2010	31 Dec 2013
ABARES, GRDC, MLA	BAE00021	Cost of Grain Production—Supplementary Survey in AAGIS	31 May 2011	30 Jun 2014
ABARES, GRDC, MLA	BAE00022	AAGIS and grains reports: 2012–13	1 Jul 2012	30 Jun 2013
ABARES, GRDC	BAE00023	GRDC–ABARES Harvesting Productivity Initiative—2012–13 genetically modified grains project	1 Jul 2012	30 Jun 2013
ABARES, GRDC	BAE00025	Wheat variety selection—adopting a portfolio approach to improve profitability and manage risk	3 Jan 2013	31 Jul 2013
BCG, DAFF, GRDC	BWD00018	Northern Victorian Grain and Graze 2 program	31 Jan 2010	31 Dec 2013
CSIRO, DAFF, GRDC	CSA00026	Grain & Graze 2—National Integration	30 Jun 2010	30 Jun 2014
CRDC, GRDC	DAN00164	Helicoverpa insecticide resistance: monitoring, management and novel methods of helicoverpa control on Bollgard II cotton	1 Jul 2011	30 Jun 2014
CSIRO, DAFF, DAFWA, DEEDI, DERM, DPI VIC, GRDC, I&I NSW, SARDI, UNE, UWA	DAF00001	Australia's Farming Future: Climate Change Research Program	1 Apr 2009	30 Sep 2012
DAFF, GRDC	DAF00002	Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry	1 Jul 2009	30 Jun 2013
DAFF, GRDC	DAF00003-3	National Adaptation and Mitigation Initiative coordination project	1 Jul 2009	30 Jun 2013
DAFF, DEEDI, GRDC	DAQ00162	Grain and Graze 2—Northern Region	1 Apr 2010	31 Dec 2013
DEEDI, GRDC, SRDC	DAQ00173	Evaluating the role of brassica crops in south-west Queensland and northern NSW grain-cropping systems	1 May 2011	30 Apr 2014
DEEDI, GRDC, SRDC	DAQ00174	Cropping solutions for the sugarcane farming systems of the Burdekin	1 Jun 2011	31 May 2015
GRDC, RIRDC	DAS00117	New common and woolly pod vetch varieties for grain and hay/silage production for Australian farmers	30 Jun 2011	30 Jun 2014
DAFF, DPI VIC, GRDC	DAV00096	Decreasing nitrous oxide emissions in high-rainfall cropping systems	30 Jun 2009	30 Dec 2012
DAFF, GRDC	DAV00121	Sustaining wheat yield and quality under increasing atmospheric carbon dioxide	1 Jul 2011	30 Jun 2014
AVRDC, CIMMYT, DAFF QLD, DPI VIC, ICARDA, ICRISAT, GRDC, I&I NSW, USDA	DAV00124	Australian Grains Genebank—Phase 1	1 Jul 2012	30 Jun 2013
DAFF, DPI VIC	DAV00125	MPCN II—Improving nitrous oxide abatement in higher rainfall cropping systems and developing nitrogen response curves	1 Jul 2012	30 Jun 2015
AVRDC, CIMMYT, DAFF QLD, DPI VIC, ICARDA, ICRISAT, GRDC, I&I NSW, USDA	DAV00131	Australian Grains Genebank—Phase 2	30 Jun 2013	30 Jun 2017

R&D Partners	Project ID	Project	Start	Finish
DAFF, GRDC	DEF00001	Regional scenario analyses for cropping in future climates	1 Dec 2011	30 Nov 2014
DAFF, DEEDI, DERM, GRDC, QUT	ERM00001	Reducing nitrous oxide emissions from sugarcane lands	15 Mar 2009	30 Dec 2012
DAFF, FG, GRDC	FGI00007	Grain and Graze 2—WA region	1 Apr 2010	31 Dec 2013
DAFF, FR, GRDC	FLR00006	Grain and Graze 2—Building resilient mixed farming systems in southern NSW	1 Apr 2010	31 Dec 2013
DAFF, GRDC, MCC	MCC00011	National Agricultural Nitrous Oxide Research Program—Evaluation of performance	15 Oct 2012	30 Jun 2015
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00006	Assessing and managing heat stress in cereals	1 Jul 2008	30 Jun 2013
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00007	Teleconnections between climate drivers and regional climate, and model representation of links	31 May 2010	31 May 2013
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00008	Improving forecast accuracy, especially with improved Indian Ocean initialisation	31 May 2010	31 May 2013
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00009	Improving multiweek predictions	1 Oct 2009	30 Sep 2012
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00010	Understanding frost risk in a variable and changing climate	30 Jun 2010	30 Dec 2012
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00013	Temperature extremes and cropping in WA	1 Mar 2010	28 Feb 2013
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00014	Managing Climate Variability—communication support	1 Jul 2008	30 Jun 2013
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00015	Managing Climate Variability Program 3—Program Coordinator	1 Jul 2008	30 Jun 2013
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00017	Managing Climate Variability Program 3—Communication support and administration	1 Jul 2008	30 Jun 2013
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00023	Managing Climate Variability Program 3—Program management committee	1 Jul 2008	30 Jun 2013
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00024	Managing Climate Variability Program 3—Independent chair	1 Jul 2009	30 Jun 2011
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00028	Managing Climate Variability—climate analyser decision support system tools	1 Dec 2010	30 Aug 2012
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00030	Adding value to climate risk management decision support systems	1 Jan 2011	30 Jun 2012
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00031	Predictions of heat extremes on the multi-week timescale	30 Jun 2011	31 Dec 2013
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00032	Northern Australia—monsoon prediction	1 May 2011	30 Apr 2013
DA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00033	Managing Climate Variability Program—Climate Champion	1 Jun 2012	30 Jun 2013
DA, DAFWA, GRDC, HAL, MLA, RIRDC, SRDC	MCV00034	Multi-week climate outlook products for Australia—Phase 2	30 Jun 2013	30 Jun 2014
DAFF, GRDC, NRS	NRS00005	National leadership and mentoring	1 Jul 2009	30 Jun 2013
ANU, CSIRO, DEST, GRDC, UNSW, UQ, UWA	NYS00002	National Youth Science Forum	1 Jul 2011	30 Jun 2015
DEEDI, GRDC, PRC, UQ	PCL00008	Pork CRC projects related to grain handling and statistical analysis	1 Jul 2011	30 Jun 2014
GRDC, PNP, SAGIT	PNP00001	Increasing the value and marketability of feed grains for the grains industry	1 Jul 2010	30 Jun 2013

R&D Partners	Project ID	Project	Start	Finish
GRDC, RIRDC	RDC00006	Investing in Youth initiative	1 Jan 2010	31 Dec 2013
GRDC, RIRDC	RDC00008	Contribution to the collaborative venture for farming and fishing health and safety initiative 2012	1 Jul 2012	30 Jun 2017
GRDC, RIRDC	RDC00009	National Oat Breeding Program: healthy and productive grain varieties for the future	1 Jul 2012	30 Jun 2015
GRDC, RIRDC	RDC00010	Horizon Scholarship sponsorship	1 Jun 2013	1 Mar 2018
DAFF, GRDC, ROE	ROE00001	Grain and Graze 2—Monitoring and evaluation	1 Jul 2009	30 Jun 2014
DAFF, GRDC, SFS	SFS00020	Southern Victorian Grain and Graze 2 program	31 Jan 2010	31 Dec 2013
GRDC, SRDC	SRD00004	Water use efficiency	1 Jul 2010	30 Jun 2014
DPI VIC, GRDC, UA	UA00111	Developing chemical methods to mobilise fixed nutrients in cropping soils	30 Jun 2009	31 Dec 2013
DAFF, GRDC, UA	UA00117	Eyre Peninsula Grain and Graze 2	31 Mar 2010	31 Dec 2013
DAFF, GRDC, UQ	UQ00066	MPCN II—Defining nitrogen response surfaces for sorghum and canola in the northern grains region	1 Jul 2012	30 Jun 2015
DAFF, GRDC, UWA	UWA00131	Fertiliser management strategies for decreasing on-farm greenhouse gas emissions	1 Mar 2009	28 Dec 2012
DAFF, GRDC, UWA	UWA00156	MPCN II—Nitrogen fertiliser response curves: Filling the gap for WA	1 Jul 2012	30 Jun 2015

AAGIS = Australian Agricultural and Grazing Industries Survey, ABARES = Australian Bureau of Agricultural and Resource Economics and Sciences, AEA = Ag Excellence Alliance, ARC = Australian Research Council, AVRDC = AVRDC—The World Vegetable Center, BCG = Birchip Cropping Group, CIMMYT = International Maize and Wheat Improvement Center, CRDC = Cotton Research and Development Corporation, CSIRO = Commonwealth Scientific and Industrial Research Organisation, DA = Dairy Australia, DAFF = Department of Agriculture, Fisheries and Forestry, DAFF QLD = Department of Agriculture, Fisheries and Forestry, Queensland, DAFWA = Department of Agriculture and Food, Western Australia, DEEDI = Department of Employment, Economic Development and Innovation, Queensland, DERM = Department of Environment and Resource Management, Queensland, DEST = Department of Education, Science and Training (now Department of Education, Employment and Workplace Relations), DPI VIC = Department of Primary Industries, Victoria, FG = Facey Group, FR = FarmLink Research, GRDC = Grains Research and Development Corporation, HAL = Horticulture Australia Ltd, I&I NSW = Industry and Investment New South Wales, MCC = McKellar Consulting Group, MLA = Meat and Livestock Australia, ICARDA = International Center for Agricultural Research in the Dry Areas, ICRISAT = International Crops Research Institute for the Semi-Arid Tropics, MPCN = More Profit From Crop Nutrition, NRS = Nicon Rural Services, NSW = New South Wales, PNP = Productive Nutrition Pty Ltd, PRC = Pork CRC Ltd, QUT = Queensland University of Technology, RIRDC = Rural Industries Research and Development Corporation, ROE = Roberts Evaluation Pty Ltd, SAGIT = South Australian Grains Industry Trust, SARDI = South Australian Research and Development Institute, SFS = Southern Farming Systems, SRDC = Sugar Research and Development Corporation, UA = University of Adelaide, UM = University of Melbourne, UNE = University of New England, UNSW = University of New South Wales, UQ = University of Queensland, USDA = United States Department of Agriculture, UWA = University of Western Australia, WA = Western Australia

Appendix D—Publications

The GRDC delivers a wide range of information products, in printed and electronic formats.

Most of the GRDC's electronic publications are available for download, free of charge, through the GRDC website. The website also provides a catalogue of GRDC publications and links to the GRDC's distribution service, Ground Cover Direct. Items in print or on CD or DVD can be ordered through Ground Cover Direct by phone, fax, email or post. Most are available for the cost of postage and handling only. Some books are sold at a price, to fully or partially recover the costs of publication.

Table 37 lists the new publications that were released in 2012–13.

Table 37: New GRDC publications in 2012–13	
Publications	
Booklets	
	<i>Estimating Plant Available Water Capacity</i> (revised and reprinted)
	<i>Managing Legumes and Fertiliser N for Northern Grains Cropping</i> (revised and reprinted)
	<i>Inoculating Legumes: A Practical Guide</i>
	<i>Weather Essentials for Pesticide Application</i> (revised and reprinted)
	<i>Working towards Reducing Crown Rot Impact on the Australian Grains Industry—workshop proceedings</i>
	<i>Economics of On-farm Grain Storage</i>
CDs and DVDs	
Driving Agronomy CDs	Northern Region (November 2012) Southern Region (November 2012) Western Region (November 2012)
Ground Cover DVDs	Episode 8 (September–October 2012) Episode 9 (January–February 2013) Episode 10 (May–June 2013)
Corporate publications	
Governance	<i>GRDC Annual Report 2011–12</i> <i>GRDC Growers' Report 2011–12</i> <i>GRDC Stakeholder Report 2013–14</i> <i>GRDC Annual Operational Plan 2013–14</i>
Products	Ground Cover Direct publications catalogue: <ul style="list-style-type: none"> • November 2012 – April 2013 • May 2013 – October 2013
Fact sheets	
National	Adult Plant Resistance—Adult Plant Resistance Biochar—Understanding Biochar Cracking Wheat's Toughest Nuts—Wheat Breeding's Toughest Challenges Grain Storage—Grain Fumigation—A Guide Grain Storage—Performance Testing Aeration Systems Grain Storage—Silo Buyer's Guide In-crop Herbicide Use—Application Considerations for In-crop Herbicide Use Late Season Herbicide Use—Stewardship for Late Season Application of Herbicides in Winter Crops Practical Tips for Spraying—Practical Tips to Reduce Spray Drift Rhizobial Inoculants—Harvesting the Benefits of Inoculating Legumes Slug Control—Slug Identification and Management Spray Height Control—Auto Boom Height Controllers Summer Fallow Spraying—Implications for Nozzle Selection and Spray Quality from Recent Trial Results Weed Control in Wheel Tracks—Improving Weed Control in Wheel Tracks During Summer Fallow Spraying

Table 37: New GRDC publications in 2012–13 (continued)

Publications (continued)	
Northern Region	Cereal Fungicides—Managing Cereal Fungicide Use Chickpea Disease Management—Minimising Chickpea Disease Risk through Integrated Disease Management Crop Nutrition—Phosphorus Management Herbicide Application—Effective Double Knock Herbicide Applications Insecticide Resistance Management and Invertebrate Pest Identification—Approaches to Key Insect Pests of Northern Grains Irrigated Wheat—Achievable Yields for Irrigated Wheat Irrigated Wheat—Reducing Lodging Risk in Irrigated Wheat Peanut Off-Flavour—Peanut Off-flavours (special distribution to peanut industry)
Southern Region	Cereal Fungicides—Managing Cereal Fungicide Use Chickpea Disease Management—Managing Fungal Diseases of Chickpeas Crop Nutrition—Phosphorus Management Farm Labour—Are You a Good Labour Manager? Farm Labour—Filling the Farm Labour Gap Farm Labour—Recruiting and Inducting New Employees Labour Management—Improving Time Management and Labour Efficiency
Southern and Western regions	Blackleg Management Guide—Quantify the Risk, Paddock by Paddock (online only) Insecticide Resistance Management and Invertebrate Pest Identification—Approaches to Key Insect Pests of Southern and Western Grains
Western Region	Barley Powdery Mildew—Control Strategies for Powdery Mildew Cereal Fungicides—Managing Cereal Fungicide Use Crop Nutrition—Phosphorus Management Mouse Management—Mouse Control
Guides	
Back Pocket	Diseases of Canola and their Management (national) Crop Weevils (Southern and Western regions) Crop Mites (Southern and Western regions)
Farm business management	2013 Farm Gross Margin and Enterprise Planning Guide
Varieties	<i>Wheat Variety Guide for Western Australia 2013</i> <i>Barley Variety Guide for Western Australia 2013</i> <i>Queensland 2013 Wheat Varieties Guide</i> <i>South Australian Sowing Guide 2013</i> <i>Victorian Winter Sowing Guide 2013</i>
Newsletters	
HoRiZon (high-rainfall zones)	Issue 5 (December 2012)
Grains Research Update	Northern Region: issues 65, 66, 67, 68, 69, 70 Southern Region: issues 18, 19, 20, 21, 22, 23
Farm Business Update	Issues 7, 8, 9, 10, 11, 12
CLIMAG (Managing Climate Variability program)	Issues 23 & 24
Newspapers	
Ground Cover and Ground Cover supplements	Six issues, all with supplements: <ul style="list-style-type: none"> • Issue 99: Grains and Legume Nutrition • Issue 100: Your GRDC Working With You • Issue 101: National Variety Trials • Issue 102: Emerging Issues with Diseases, Weeds and Pests • Issue 103: Water Use Efficiency • Issue 104: Herbicide Resistance
Tools	
Hard copy	2013 Ground Cover Paddock Diary
Electronic	Weeds ID: the Ute Guide app (national) Insects ID: the Ute Guide app (national) Winter Cereal Nutrition: the Ute Guide app (national) Field Peas: the Ute Guide app (Southern Region)

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Australian Herbicide Resistance Initiative researcher Mechelle Owen has found a link between herbicide resistance and seed dormancy. Photo: Evan Collis

Abbreviations list

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AgT	Agribusiness Training Program
APSIM	Agricultural Production Systems Simulator
BFDC	Making Better Fertiliser Decisions for Cropping in Australia
CAC Act	<i>Commonwealth Authorities and Companies Act 1997</i>
CAIGE	CIMMYT–Australia–ICARDA Germplasm Evaluation
CIMMYT	International Maize and Wheat Improvement Center
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBA	Durum Breeding Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FOI Act	<i>Freedom of Information Act 1982</i>
GPA	Grain Producers Australia Limited
GPS	Global Positioning System
GRDC	Grains Research and Development Corporation
GST	goods and services tax
ICARDA	International Center for Agricultural Research in the Dry Areas
IPS	Information Publication Scheme
NVT	National Variety Trials
PBA	Pulse Breeding Australia
PBR	plant breeder's rights
PHS	pre-harvest sprouting
PIERD Act	<i>Primary Industries and Energy Research and Development Act 1989</i>
QTL	quantitative trait loci
R&D	research and development
RD&E	research, development and extension
RDCs	rural R&D corporations
SLG	Senior Leadership Group
TFP	total factor productivity
WHS	work health and safety
WLYP	water-limited yield potential



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