Strategic R&D investment for the greatest benefits

The Grains Research & Development Corporation (GRDC) is one of the world’s leading grains research organisations, responsible for planning, investing and overseeing research and development, delivering improvements in production, sustainability and profitability across the Australian grains industry. The GRDC is a statutory corporation, founded in 1990, and operates as a research investment body in partnership with growers and the Australian Government.

The GRDC’s mission is to invest in research and development for the greatest benefit to its stakeholders – grain growers and the Australian Government. The Corporation links innovative research with industry needs.

The GRDC’s vision is for a profitable, internationally competitive and ecologically sustainable grains industry.

The Corporation is funded through a levy on grain growers and matching contributions (up to an agreed ceiling) from the Australian Government. The GRDC’s research portfolio covers 25 leviable crops spanning temperate and tropical cereals, oilseeds and pulses. Over the past five years the annual gross value of production from the grains industry has averaged $9.4 billion. This accounts for more than 22 per cent of the average gross value of total farm sector production ($42 billion) over the same five year period.

John Harvey
Managing Director

Keith Perrett
Chairman
Grain production and the environment

Australia is the driest continent on the planet – add to that the most variable rainfall of any country and some of the oldest soils on earth – and you have a challenging environment for agriculture. But for more than 200 years of European settlement, commercial grain crop production has been an important and highly successful component of the nation’s economy. And it is Australia’s unique physical environment that has been the major architect of how our crop and livestock production systems have evolved.

Climate

Australia’s climate is dominated by the dry, sinking air of the subtropical high pressure belt which moves north and south with the seasons. This causes the rainfall pattern over Australia to be strongly seasonal and helps to define the main climate regions.

When the high pressure systems move north during winter, southern Australia comes under the influence of westerly winds and rain-bearing cold fronts. Most of Australia’s winter grain crop production occurs in the temperate regions of the west, south and east, and relies on this winter rainfall. Cold snaps during spring may lead to damaging frosts in some parts of the grainbelt. Summers over southern Australia are mostly dry and hot.

In contrast, tropical regions of far northern Australia have wet summers as the monsoon moves in typically from October to April. Most of Australia’s summer cropping region is in the sub-tropical mid northeast where moist, northwesterly winds bring humid conditions with showers and thunderstorms over the summer months. However, summer rainfall amounts vary markedly from year-to-year.

Because of the influence of the high pressure belt, much of Australia’s rainfall is low and variable. Eighty per cent of the continent has an average annual rainfall of less than 600 mm. The average annual national rainfall is 160 mm but in most of the cropping regions, the averages range from 300 to 600 mm per year.

This rainfall pattern over much of Australia’s grain producing areas means river flows and underground water resources are low by world
standards. And these resources are fully committed in all but the wettest years. The northern tropics is the only area where annual replenishment of river and underground water reserves occurs.

Predicting the weather

Weather forecasting is notoriously difficult given Australia’s unique geography and climatic extremes. But in recent times scientists have linked weather patterns over much of Australia with various ocean and air pressure phenomena. The Southern Oscillation is now identified as a major air pressure shift between the Asian and east Pacific regions whose best-known extremes are El Niño events. The Southern Oscillation (strength and direction) is measured by a simple index, the SOI (Southern Oscillation Index).

Rural productivity, especially in Queensland and New South Wales, is linked to the behaviour of the Southern Oscillation.

Modern science coupled with computer modelling is leading to more accurate climate forecasting for all cropping regions of Australia.

Arable area and cropping regions

Australia has a total land area of 7.7 million km² which is roughly 80 per cent of the land mass of the US, Canada or Europe. But less than six per cent (or 46 million hectares) of Australia is considered to have rainfall, evaporation, temperature and soil conditions suitable for short season annual crops or improved pastures.

Of this suitable area, approximately 22 million hectares is planted annually to commercial grain crop production.

Climate/weather patterns and soil type effectively ‘split’ Australia into three major grain cropping regions.
**Physical environment of crop production**

- The northern region takes in central and southern Qld through to northern NSW. Most rainfall tends to be over the summer months allowing for dryland summer crop production. With the high moisture storing capacity of the clay-based soils of this region, supplemented by some winter rainfall, winter crops are also grown. But double cropping is largely opportunistic depending on soil moisture at planting time. The north is also home to most of Australia’s irrigated broadacre crop production – predominantly cotton and sugar. Headwater dams regulate a series of rivers, most of them flowing west from the Great Australian Divide, into the fertile, flat valleys of the interior where cotton is irrigated. With irrigation dams at full capacity, more than 400,000 hectares can be irrigated but with the highly variable climate, this area fluctuates wildly from year to year.

- The southern region stretches from central NSW through to Victoria and South Australia and has a uniform rainfall pattern through to winter dominant. This climate lends itself to more reliable winter crop production than is the case in the northern region. Summer crop production requires irrigation.

- The western region is the agricultural zone in the very southwestern corner of Western Australia. Over 7 million winter-cropped hectares enjoy a typically Mediterranean climate with very dry summers but (comparatively) reliable winter rainfall. New and modified farming systems and techniques have made the western region the nation’s most reliable, contributing around 40 per cent of Australia’s total winter crop production over the past 5 years.

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**Soils**

Australia’s soils are some of the oldest and most fragile on earth. Crop and livestock management must take account of the constant threat of soil erosion and salinity on generally shallow soils. Most southern and western region soils are also naturally low in nutrition and require the addition of phosphate, nitrogen and trace elements for successful crop production. The more fertile cropping soils in the north east also require additions of P, N and other nutrients after several years of cultivation.

Our soils generally have a poorer structure and less organic matter than in the northern hemisphere. Modern farming techniques such as crop–legume rotations and reduced tillage, recognise these limitations and are designed to conserve valuable topsoils and soil moisture through improved management of soil structure, nutrition and biotic health.

But dryland salinity, acidification and structural decline remain constant threats. Our cropping systems and techniques must continually adapt to ensure the long-term sustainability of farming our fragile soils.
What grows where?
(Based on GRDC agroecological zones)

WESTERN REGION

- **WA Northern**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola, faba beans, chickpeas

- **WA Central**
  Winter – Wheat, barley, oats, triticale, cereal rye, lupins, field peas, canola, faba beans, chickpeas

- **WA Eastern**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola, faba beans, chickpeas

- **WA Sandplain and Mallee**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola, faba beans, chickpeas

SOUTHERN REGION

- **SA Midnorth–Lower Yorke, Eyre**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola, chickpeas, faba beans, vetch, safflower

- **SA–Victoria Mallee**
  Winter – Wheat, barley, oats, triticale, cereal rye, lupins, vetch, canola, field peas, chickpeas, faba beans, safflower

- **SA–Victoria Border–Wimmera**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola, chickpeas, faba beans, vetch, lentils, safflower

- **Victoria High Rainfall**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola

- **NSW–Victoria Slopes**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola

- **NSW Central (south)**
  Winter – Wheat, barley, oats, chickpeas, triticale, faba beans, lupins, field peas, canola, safflower

- **Tasmania**
  Winter – Wheat, barley, oats, triticale, lupins, field peas, canola

NORTHERN REGION

- **NSW Central (north)**
  Winter – Wheat, barley, oats, chickpeas, triticale, faba beans, lupins, field peas, canola, safflower
  Summer – Sorghum, sunflowers, maize, mungbeans, soybeans, cotton

- **NSW North West–Qld South West**
  Winter – Wheat, barley, oats, chickpeas, triticale, faba beans
  Summer – Sorghum, sunflowers, maize, mungbeans, soybeans, cotton

- **NSW North East–Qld South East**
  Winter – Wheat, barley, oats, chickpeas, triticale, faba beans, millet/panicum, safflower, linseed
  Summer – Sorghum, sunflowers, maize, mungbeans, soybeans, peanuts, cotton

- **Qld Central**
  Winter – Wheat, barley, oats, chickpeas
  Summer – Sorghum, sunflowers, maize, mungbeans, soybeans, cotton

GRDC agroecological zones
Over the past two decades there has been a trend by Australian farmers to increase the area of annual crops sown on their farms. This has been largely at the expense of livestock production, particularly sheep. Modern grain cropping systems and management – as well as improved farming machinery – has also allowed a gradual shift into areas considered marginal, or even unsuited, for crop production less than 20 years ago. The result has been higher grain production and more area planted to grain crops.

National production of combined winter and summer crops has averaged around 33 million tonnes over the 5 year period 2006–10.

Annual winter cropped area has a current 5-year average of 20 million hectares compared to the 17.4 m hectares averaged during the 1990s.
Wheat is Australia’s main crop and accounts for more than half the nation’s annual grain production. Australia is the world’s largest producer and exporter of white wheat which is well regarded both domestically and internationally for its high and consistent quality.

The majority of our wheat grown in the southern and western regions achieves protein of 10 to 12% with medium strength. It is suited to a broad range of uses from bread making through to noodles, cakes and biscuits.

The environment of the northern region favours the production of harder, higher protein wheats (13% plus) for the premium bread market.

Durum wheat production has recently increased and varies between 400,000 to 600,000 tonnes annually.

National average wheat yields continue on a slow upward trend but this varies widely across the regions.

The 2002 and 2006 droughts were among the worst in living memory and crippled grain yields.
Recent trends in crop production

Area planted for coarse grains, oilseeds and pulses

Average yield of coarse grains, oilseeds and pulses

Australian wheat production

Australian coarse grain production (barley, oats, sorghum, maize & triticale)

Source: ABARE – BRS
Australia’s boom oilseed crop in the late 1990s was canola. In five years production increased 8-fold from 300,000 tonnes to 2.4 million. A keen overseas market and high prices, coupled with significant crop rotation benefits, encouraged huge plantings across southern Australia. But disease problems, and unfavourable seasons for oilseeds, reduced the area sown to canola. In recent times the crop has undergone a resurgence with improved international oilseed prices and seasons. State government approval for the production of GM canola has added to this resurgence.

Pulse crops are also widely recognised for their crop rotation and soil nutrition benefits but they tend to have erratic market prices, are prone to disease and are often difficult to grow in the Australian climate. Lupins and field peas are particularly suited to southern Australian conditions.

Considerable research is underway to identify reliable pulse species and management to provide a winter crop rotation option for northern region growers. Chickpeas are the most popular winter pulse crop in the north.

Barley is Australia’s second biggest field crop in production and area. Both feed and malting quality are produced across Australia wherever wheat is grown but the lighter soil areas favour the production of malting quality barley for brewing. This domestic and international market attracts a price premium over feed types. Most barley production occurs in southern Australia.

Source: ABARE – BRS

Source: ABARE – BRS

Source: ABARE – BRS

Source: ABARE – BRS
Dryland sorghum, along with irrigated rice and cotton, are Australia’s major summer crops. But production levels and areas of these irrigated crops are highly erratic depending on water stored in both the soil and headwater dams at planting time. At a national average yield for irrigated cotton of 8.4 bales per hectare and 9 tonnes per hectare for rice, Australian producers are among the most efficient in the world.
In the face of mediocre world prices for our export grains, historically steady productivity gains in the Australian grains industry have been essential. Over the past 30 years total factor productivity (TFP) growth for the cropping industry has increased by an average of 1.9 per cent annually.

TFP is the ratio of all market outputs produced to market inputs used and better reflects farmers’ business decisions – for example, substituting chemical for mechanical cultivation. At an industry or regional level, improvements in TFP also capture increased adoption of ‘best practice’ and the exit of less efficient farms. Productivity growth in cropping has consistently exceeded that in other Australian broadacre industries. The wider adoption of more efficient farming systems, such as conservation tillage, has played a key role in this growth.

Finding further productivity gains, reducing costs along the marketing chain and managing sustainable resources will be central to the industry’s longer term development and is a key investment target for the GRDC.

**Profile of the average farming operation by cropping intensity 2008–09**

<table>
<thead>
<tr>
<th>Cropping intensity</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very high</th>
<th>All cropping farms 2008–09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area operated (ha)</td>
<td>6350</td>
<td>1781</td>
<td>2116</td>
<td>1493</td>
<td>2630</td>
</tr>
<tr>
<td>Area sown to crops (ha)</td>
<td>383</td>
<td>506</td>
<td>1086</td>
<td>1190</td>
<td>817</td>
</tr>
<tr>
<td>Number of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– sheep no.</td>
<td>2308</td>
<td>1828</td>
<td>1593</td>
<td>379</td>
<td>1531</td>
</tr>
<tr>
<td>– beef cattle no.</td>
<td>744</td>
<td>118</td>
<td>70</td>
<td>18</td>
<td>190</td>
</tr>
<tr>
<td>Proportion of area sown to various grain crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat %</td>
<td>62</td>
<td>57</td>
<td>58</td>
<td>55</td>
<td>58</td>
</tr>
<tr>
<td>Oats %</td>
<td>16</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Barley %</td>
<td>13</td>
<td>19</td>
<td>21</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Sorghum %</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Oilseeds %</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Pulses %</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Other grain crops %</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total grain crops %</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: ABARE – BRS

**Farm enterprise mix**

The majority of farms growing grains also have significant livestock enterprises, usually sheep or cattle or a combination of both. The combined industry grouping (ie specialist grain plus grain/livestock enterprises) currently accounts for around 25,000 farms.

A recent ABARE–BRS survey has estimated that broadacre farms with a high or very high level of cropping intensity – where more than 40 per cent of farm area is sown to grain crops – account for 74 per cent of the total Australian crop area and 80 per cent of national grain sales. These high intensity farms also represent around 58 per cent of the total number of broadacre farms.

So about 14,500 farms account for three-quarters of the area sown to broadacre crops in Australia and share in 80 per cent of the gross proceeds of that production. In the years 2007–10, the value of annual national grain production has averaged in excess of $10 billion.
The increased grain area has largely come about because of changes in relative returns from cropping enterprises and grazing-based enterprises – particularly sheep and wool production. The increase in grain production since the early 1990s reflected mixed sheep and grain producers responding to low wool prices by reducing their sheep flocks and switching to crops. But an improvement in wool and sheepmeat prices since 2008 has resulted in some renewed interest in these enterprises.

The trend towards cropping has been complemented by a continuation of productivity gains in areas such as water use efficiency. And this productivity increase has helped to improve the profitability of grains relative to livestock.

An increase in the size of the national wheat crop has been the most significant result of this enterprise shift. But new varieties of canola (including genetically modified) and pulse crops (with improved agronomic qualities and profitability) have also become more important components of the new farm mix. These crops are also highly valued in the crop rotation for their disease management and soil health/nutrition benefits.

Coarse grains, mainly barley and sorghum, have also become an integral part of crop rotations.

Around 55 per cent of the total Australian area sown to grains in recent years has been wheat and a further 20 per cent was cropped to barley. Oats, sorghum, oilseeds and pulses have a relatively smaller share of area sown.

But the high intensity cropping farms tend to have a greater number of different crops and a greater focus on higher value food and feed crops.

In the past 10 years, there have been fewer hectares sown to crops requiring relatively higher rainfall such as oilseeds and pulses. But more hectares have been sown to more drought hardy crops such as barley and sorghum.

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Reduced tillage

The way Australian farmers go about the business of cropping has also undergone major changes in a very short period of time.

For much of the last century field preparation for sowing and crop residue management was the ‘bash and burn’ approach. But this has largely given way to reduced or zero-tillage and a reliance on chemical rather than mechanical weed control. Most farmers now conserve their crop residue for its proven and crucial role in minimising soil erosion and moisture loss.

Encouraging this reduced tillage trend has been a greater availability – and affordability – of high quality locally and internationally manufactured machinery suited to Australian conditions.

Precision agriculture

Australia has also been a world leader in the research and adoption of precision agriculture (PA) techniques. Many farmers and harvesting contractors now use Global Positioning Systems (GPS) to map the variation in crop yields across their farms. Crop management can then be modified according to individual field – or zone – requirements.

Controlled traffic (tramline) farming to minimise soil compaction – along with auto-steer to help avoid ‘operation overlap’ – are increasingly popular applications of precision farming technology.

Farm size and economies of scale

As in other agricultural industries, falls in commodity prices received for grains relative to the prices paid for farm inputs, have caused grain producers to focus on improving productivity and expanding farm size to increase profitability. In the past 35 years the number of farms in the grains industry has fallen by over 40 per cent.

But over the same period, there have been large increases in the average area cropped per farm. The end result has been a near doubling, since the 1970s, of the average area sown to grains each year in Australia. With the combination of productivity gains and larger cropped areas per farm, wheat production for example, on a typical grain farm has increased by an estimated 140 per cent.

Despite dedicating a larger proportion of the farm area to cropping activities, changes in livestock and pasture and stubble management have allowed many farmers to also increase sheep and beef cattle numbers.

The national average cropped area across all farms with grain in their

<table>
<thead>
<tr>
<th>Share of crops and revenue, by cropping intensity, 2004–05 to 2008–09 (average for the four year period)</th>
<th>Average number of farms</th>
<th>Share of farms %</th>
<th>Share of area sown to crops %</th>
<th>Share of cropping revenue %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low intensity</td>
<td>4023</td>
<td>16</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Medium intensity</td>
<td>6483</td>
<td>26</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>High intensity</td>
<td>9812</td>
<td>39</td>
<td>48</td>
<td>49</td>
</tr>
<tr>
<td>Very high intensity</td>
<td>4821</td>
<td>19</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>25139</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: ABARE – BRS
enterprise mix, is more than 800 hectares each year. But this figure tends to be higher for specialist grain farms and for many farms located in the western and northern cropping regions of Australia.

The larger farms also tend to utilise larger tractors and farm machinery allowing more timely tillage and planting operations depending on soil moisture. This is a distinct agronomic and economic advantage in being able to more fully capitalise on (often fleeting) planting or weed control opportunities.

Grain farm economic performance tends to increase with cropping intensity and the scale of the farming operation. This is because farm income increases at a faster rate than costs. Over the past 20 years the largest (in cropped area) 20 per cent of grain farms have consistently earned twice the cash income of the smallest 20 per cent of farms.

Farm incomes and rates of return on investment in agricultural industries are often low when reported across a whole industry. But particularly in the grain industry, low average returns are often a consequence of the generally high proportion of small farms ‘masking’ the much higher incomes and returns from better performing and larger farms.

The top 25 per cent of broadacre farms – ranked by rate of return to capital – have consistently generated cash incomes of more than $100,000 a year over the past two decades with rates of return on capital at around 5 per cent. And there is also an upward trend in farm cash incomes for these farms.

In recent years, the top 25 per cent of farms have also accounted for around two-thirds of the net additions to farm capital.

**Farm income and costs**

Sales of cereals, oilseeds and pulses typically account for over 75 per cent of cash receipts on a high intensity grain farm.

On average over the past three seasons, a farm with at least 50 per cent of its total income being derived from grain production, has generated annual grain receipts in excess of $550,000 and has recorded healthy profits. Historically, incomes and business profits for grain farms have been higher than other broadacre industries.

Spray chemicals and fertilisers account for about a third of average grain farm cash costs. Twenty years ago the proportion was just 6 per cent.

Significant changes in farm technology and a move to conservation farming practices over the past three decades, has contributed to the increased usage of chemicals and fertilisers, while reducing inputs of fuel and labour.

**Farm value and capital investments**

The value of grain farms is increasing. Prices range widely across the country depending on yield potential, location, soils, rainfall, water availability, existing infrastructure and so on.

Since 1999–2000, average land values in the wheat sheep zone have almost doubled to be currently around $1500 per hectare. But land values in the higher rainfall areas have skyrocketed towards $3000 per hectare, fueled largely by a swing to high yield grain production.

Capital investments, including the expansion of the operating area of farmland, are an important means of boosting farm incomes and productivity in the longer term.

The average capital value of grain farms grew during most of the 1999–2010 period reaching an average capital value of $4.8 million. This growth in capital value has been driven mainly by growth in land values.

**Indicative costs and returns on an Australian high intensity grain farm, 2008 through 2010**

<table>
<thead>
<tr>
<th>Cropped area/production</th>
<th>Total crop area (ha)</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>(400 ha x 2.5 t/ha @ $220)</td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>(200 ha x 2.7 t/ha @ $190)</td>
<td></td>
</tr>
<tr>
<td>Oilseeds</td>
<td>(200 ha x 2.0 t/ha @ $400)</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td>(200 ha x 2.0 t/ha @ $350)</td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>(200 ha x 3.0 t/ha @ $170)</td>
<td></td>
</tr>
</tbody>
</table>

**Income ($ on-farm) net of marketing**

<table>
<thead>
<tr>
<th>Income</th>
<th>Wheat</th>
<th>220,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Barley</td>
<td>103,000</td>
</tr>
<tr>
<td></td>
<td>Oilseeds</td>
<td>160,000</td>
</tr>
<tr>
<td></td>
<td>Pulses</td>
<td>140,000</td>
</tr>
<tr>
<td></td>
<td>Sorghum</td>
<td>102,000</td>
</tr>
</tbody>
</table>

**Total gross income**

$725,000

**Gross receipts/ha cropped**

$604

**Costs ($)**

<table>
<thead>
<tr>
<th>Costs</th>
<th>Hired labour</th>
<th>60,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fertiliser</td>
<td>140,000</td>
</tr>
<tr>
<td></td>
<td>Chemicals</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>Fuel/oils</td>
<td>45,000</td>
</tr>
<tr>
<td></td>
<td>Repairs &amp; Maintenance</td>
<td>40,000</td>
</tr>
<tr>
<td></td>
<td>Seed</td>
<td>70,000</td>
</tr>
<tr>
<td></td>
<td>Contracted operations</td>
<td>40,000</td>
</tr>
<tr>
<td></td>
<td>Misc costs</td>
<td>20,000</td>
</tr>
<tr>
<td></td>
<td>Interest on borrowings</td>
<td>55,000</td>
</tr>
</tbody>
</table>

**Total costs**

$520,000

**Costs/ha cropped**

$433

**Cash income**

$205,000

**Cash income/ha cropped**

$171

Source: ABARE – BRS
How important is the grain industry in the economy?

The health of the Australian economy is, in turn, very reliant on the health and performance of the agricultural and mining sectors. For much of our economic history Australia ‘rode on the sheep’s back’ reflecting our reliance on the agricultural sector, particularly wool production, for economic growth and national prosperity. In the 1950s agriculture represented 15–20 per cent of the Australian Gross Domestic Product. Agriculture was also by far our biggest export earner providing 75–80 per cent of total exports.

Sixty years on, with the economy now much more mining, manufacturing, construction and service industry-based, agriculture’s contribution to GDP is less than three per cent ($46 billion in 2010). But the farm sector remains a very important export earner for Australia and represents around 15 per cent of total annual income from commodity exports.

**Contribution from the grains industry**

Farm and fisheries exports in 2010–11 are forecast to be worth around $31.4 billion to the national economy of which the grains industry will earn an estimated $8.3 billion.

Over the past five years the annual gross value of production from the grains industry has averaged $9.4 billion. This accounts for more than 22 per cent of the average gross value of total farm sector production ($42 billion) over the same five year period. In dollar terms, the grains industry is Australia’s most valuable farm sector.

**The international marketplace**

On average, 70 to 80 per cent of farm output is exported. And over the past 10 years, agricultural exports have grown by 60 per cent and by over 90 per cent in nominal value terms. Australia is one of the world’s five major grain exporting countries. Asian and Middle Eastern countries are the major destinations for our grains, particularly wheat and barley. Sorghum, oilseeds, pulses and rice are sold into Asia and the sub-continent countries of India, Pakistan and Bangladesh.
Australia’s statutory ‘single desk’ wheat export system whereby all export wheat was marketed and managed on behalf of growers by AWB Limited, was abolished in 2008. Wheat Exports Australia is now charged with the accreditation and licencing of multiple exporters of bulk Australian wheat.

The future of our agricultural and food industries, particularly their capacity to contribute to growth and jobs, depends in large part on the conditions they face in overseas markets. Australian grain exports, notably wheat and barley, have had to compete on world markets against subsidised production by European Union countries and US farm support programs.

There are no export or production subsidies provided to Australian farmers.

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There are no export or production subsidies provided to Australian farmers.

### Cropping by the numbers

#### Annual volume of Australian grain exports (’000 tonnes)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>11196</td>
<td>7408</td>
<td>13410</td>
<td>13705</td>
<td>18168</td>
</tr>
<tr>
<td>Barley</td>
<td>3135</td>
<td>4050</td>
<td>3892</td>
<td>4256</td>
<td>4986</td>
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<tr>
<td>Sorghum</td>
<td>46</td>
<td>251</td>
<td>1368</td>
<td>487</td>
<td>575</td>
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<tr>
<td>Oats</td>
<td>62</td>
<td>115</td>
<td>196</td>
<td>216</td>
<td>243</td>
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<tr>
<td>Lupins</td>
<td>174</td>
<td>76</td>
<td>157</td>
<td>341</td>
<td>286</td>
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<tr>
<td>Chickpeas</td>
<td>244</td>
<td>218</td>
<td>467</td>
<td>455</td>
<td>670</td>
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<tr>
<td>Field peas</td>
<td>248</td>
<td>142</td>
<td>118</td>
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<tr>
<td>Canola</td>
<td>238</td>
<td>519</td>
<td>973</td>
<td>1238</td>
<td>1565</td>
</tr>
<tr>
<td>Other oilseeds*</td>
<td>117</td>
<td>29</td>
<td>47</td>
<td>119</td>
<td>220</td>
</tr>
<tr>
<td>Rice</td>
<td>491</td>
<td>78</td>
<td>32</td>
<td>83</td>
<td>142</td>
</tr>
<tr>
<td><strong>Total grains</strong></td>
<td><strong>15950</strong></td>
<td><strong>12886</strong></td>
<td><strong>20667</strong></td>
<td><strong>21067</strong></td>
<td><strong>27065</strong></td>
</tr>
</tbody>
</table>

*a* – Includes cottonseed. Source: ABARE – BRS

### Annual value of Australian farm exports ($A million)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2765</td>
<td>2990</td>
<td>5028</td>
<td>3688</td>
<td>5216</td>
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<tr>
<td>Barley</td>
<td>833</td>
<td>1496</td>
<td>1321</td>
<td>1098</td>
<td>1482</td>
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<tr>
<td>Sorghum</td>
<td>13</td>
<td>76</td>
<td>405</td>
<td>116</td>
<td>140</td>
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<tr>
<td>Oats</td>
<td>20</td>
<td>37</td>
<td>64</td>
<td>53</td>
<td>66</td>
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<tr>
<td>Lupins</td>
<td>38</td>
<td>31</td>
<td>61</td>
<td>109</td>
<td>89</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>168</td>
<td>139</td>
<td>275</td>
<td>252</td>
<td>359</td>
</tr>
<tr>
<td>Field peas</td>
<td>80</td>
<td>61</td>
<td>62</td>
<td>62</td>
<td>69</td>
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<tr>
<td>Canola</td>
<td>108</td>
<td>303</td>
<td>595</td>
<td>583</td>
<td>740</td>
</tr>
<tr>
<td>Other oilseeds*</td>
<td>53</td>
<td>35</td>
<td>46</td>
<td>70</td>
<td>93</td>
</tr>
<tr>
<td>Rice</td>
<td>347</td>
<td>71</td>
<td>31</td>
<td>78</td>
<td>104</td>
</tr>
<tr>
<td><strong>Total grains</strong></td>
<td><strong>4426</strong></td>
<td><strong>5240</strong></td>
<td><strong>7890</strong></td>
<td><strong>6109</strong></td>
<td><strong>8359</strong></td>
</tr>
</tbody>
</table>

*a* – Includes cottonseed. Source: ABARE – BRS

### Values of Australian grain exports (average of years 2006–10)

- Wheat
- Coarse grains
- Pulses
- Oilseeds
- Rice

### Values of Australian grain exports (average of years 2006–10)

- Wheat
- Coarse grains
- Pulses
- Oilseeds
- Rice

**Source:** ABARE – BRS
The quality and extent of Australian agricultural research, extension and education is envied throughout the world. The unique method of public research funding, national coordination and structure – and ultimately extension – provides continuing scientific and management breakthroughs for Australian farmers. As a result, the agricultural community enjoys productivity gains essential in maintaining competitiveness in world markets.

There are also private, university and state government-based research and education providers, adding to the world-class quality of agricultural research. The private sector has a major research role in plant breeding, agricultural chemicals and engineering and other commercially targeted sectors.

Australia has one of the highest rates (around 4 per cent of farm GDP) of any country in public investment into agricultural research. More than half of total agricultural research is publicly funded. For example, the grains industry, through the GRDC, invests over $120 million each year on research which is funded by a combination of:

- Growers paying a statutory levy of 0.99 per cent of the farm gate value of grain production (25 grain crops come under the levy); and,
- The Australian Government matches the grower levies up to a maximum of 0.5 per cent of the gross value of grains production. The amount of the contribution is determined annually, by the Australian Government, and based on the three-year rolling average gross value of production of the 25 leviable crops.

This system of joint statutory collections is in turn invested back into the industry via the funding of hundreds of research projects. In addition, it is estimated at least another $100 million is spent by the CSIRO, state agencies and universities on grains research. To give this an international context, in terms of research dollars collected per tonne of grain sold, this system raises about 10 times that collected in Canada.

The increases in Australian grain production records would not continue without the strong impact of targeted, nationally coordinated research. In recent years, local graingrower groups have emerged as important vehicles for targeted and collaborative research work with private companies, state-based and national research providers.

**The role of the GRDC**

The GRDC’s role is to invest in research and development and related activities to benefit Australian grain growers, industry and the wider community.

In a nutshell, the GRDC strategically invests and manages research levies and Australian Government co-contributions. The aim is to produce new information and products that enhance the productivity, competitiveness and environmental sustainability of grain growers and the grain industry generally while benefiting the wider community.

Careful planning is required to achieve these outcomes – planning that is made particularly challenging by ever changing climatic, business and marketing environments.

The GRDC periodically sets various goals and plans so invested dollars are accurately aimed at favourable end results. Their strategic investment sights are set well beyond the next financial year or cropping season. The 2010–11 year

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**Leviable crops**

The 25 leviable grain crops are:

- Wheat;
- Coarse grains (barley, oats, sorghum, maize, triticale, millets/panicums, cereal rye and canary seed);
- Pulses (lupins, field peas, chickpeas, faba beans, vetch, peanuts, mung beans, navy beans, pigeon peas, cowpeas and lentils); and
- Oilseeds (canola, sunflower, soybean, safflower and linseed).
is the fourth year of the GRDC’s current five-year strategic R&D Plan, *Prosperity through Innovation*.

Key drivers of *Prosperity through Innovation* include water availability, productivity growth, growers’ terms of trade, grain market dynamics, customer expectations and farm demographics. The plan also encourages stakeholders and research partners to meet clearly defined performance measures and outcomes.

Key current priorities include working to improve grains industry productivity and to help the industry adapt to the effects of climate change; establishing a new wheat classification system; protecting the industry from exotic pest and disease incursions; building industry and research capacity; and progressing the development of a National Grains Research Development & Extension Strategy.

To provide an effective framework for managing increasing pressures on RD&E budgets and the need to continually optimise investments and demonstrate returns on investments to stakeholders, the GRDC has played a key role in the development of the National Grains RD&E Strategy, which was completed in 2009–10.

By increasing cooperation between investors and providers and sharing of capability across the grains industry, the strategy will help to ensure that RD&E programs deliver benefits to growers, industry and government stakeholders.

The GRDC is also focused on increasing the speed of development and adoption of existing technologies and providing an effective path to market for new technologies.

**Future challenges**

The grains industry environment in which the GRDC operates continues to change rapidly. The business environment will continue to be influenced by volatility in seasonal conditions, grain prices and other impacts on grower profitability.

The GRDC places a major emphasis on working with R&D partners, federal, state and territory governments and industry to implement the National Grains RD&E Strategy, to identify and prioritise issues and develop and deliver RD&E outcomes for Australian grain growers and the broader community.

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**Where grain research dollars are invested**

For the 2009–10 financial year the GRDC budgeted to spend more than $116 million on RD&E investments across the three regions and more than 860 individual research projects.

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**GRDC investments in 2009–10 by region ($m)**

- Northern Region: 26.97
- Southern Region: 50.96
- Western Region: 38.83

($116.75m total)

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**Where 2009–10 research dollars were invested ($m)**

- **WHEAT** ($6.09m total)
  - Northern Region: 1.95
  - Southern Region: 2.24
  - Western Region: 1.91

- **COARSE GRAINS** ($6.61m total)
  - Northern Region: 1.56
  - Southern Region: 3.56
  - Western Region: 1.43

- **GRAIN LEGUMES** ($5.07m total)
  - Northern Region: 0.96
  - Southern Region: 1.20
  - Western Region: 0.94

- **OILSEEDS** ($3.10m total)
  - Northern Region: 1.61
  - Southern Region: 3.56
  - Western Region: 1.43

- **CROSS-COMMODITY** ($95.88m total)
  - Northern Region: 1.95
  - Southern Region: 2.24
  - Western Region: 1.91

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The GRDC is based in Canberra and employs around 50 staff members and operates under the direction of a Board of eight directors. A team of executive managers leads the corporation's business activities. As well as advising the GRDC Board, the management team is responsible for realising the Board's priorities and managing and evaluating R&D investments in the Australian grains industry. The GRDC coordinates a national portfolio and market-driven approach to grains R&D. At the operational level, the GRDC’s organisational structure is divided into three Lines of Business (LOBs):

- Practices;
- Varieties; and,
- New Products.

The LOBs coordinate the GRDC research investments within their respective business areas.

The panel system

The panel system is a key strength of the GRDC. The Board makes decisions with the support of a national advisory panel, informed by the knowledge and experience of three regional panels and three program teams. This network helps to ensure that GRDC investments are directed towards the interests of all its stakeholders and the strategic objectives of its programs.

The work of the various panels, and the expertise of their members, is crucial to the corporation's success.

National Panel

The GRDC National Panel includes the three regional panel chairs, the GRDC’s Managing Director and the GRDC's executive managers. The National Panel addresses national R&D priorities across the GRDC’s investment portfolio, takes advice from program teams and advances recommendations to the Board. The National Panel also assists the Board to maintain links with grain growers, the Australian Government, state and territory governments and research partners.

Regional panels

The three regional advisory panels, covering the northern, southern and western grain-growing regions of Australia, are composed of grain growers, agribusiness representatives, researchers and the GRDC 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.

Program teams

Three program teams, each composed of program managers, members from each regional panel, an executive manager and a panel chair are responsible for developing, implementing and reviewing investment strategy and advising on proposed investments. Other activities include evaluating projects, prioritising potential investment opportunities and monitoring project performance.
GRDC investment process
Six steps in investment planning

New investment in any year needs to:
• Align with the GRDC’s overall strategy;
• Leverage inputs from other sources;
• Move outputs closer to industry adoption; and
• Refresh the research portfolio by responding to national and regional needs identified through the GRDC’s engagement processes.

STEP 1
Identify RD&E priorities (throughout the year)
• Potential issues and priorities are identified (mainly through growers, the regional panels, project reviews, project progress reports, consultants, researchers, Grain Producers Australia (GPA) and state farming organisations, Research Advisory Committees (RACs), the National and Regional Agribusiness Reference Groups (NARGs), Grower and Adviser Updates, forums, field days and survey results).
• The GRDC also takes into account the Australian Government’s National Research Priorities and Rural R&D Priorities.
• All priorities looked at are potential areas for investment in future investment cycles.
• Resource allocation recommendations are provided to the GRDC Board and then to the GPA for comment in the form of a draft GRDC Stakeholder Report.

STEP 2
Investment Planning Week (July each year)
• In consultation with Regional Panels, GRDC managers develop write-ups for new projects and those due for review for further investment evaluation (Table 1).
• These proposals outline the aims of the proposed RD&E project, its deliverables (outputs) and approximate budgets. These are discussed and refined during Investment Planning Week.
• All proposals are categorised as either national or regional investments, and the appropriate procurement method (open tender, limited tender, multi stage tender, direct negotiation) is also identified.
• The proposals are ranked by the GRDC Program Teams, which include members of GRDC’s Lines of Business (Varieties, Practices, New Products) and regional panel members.
• The Regional Panels (northern, southern and western) then rank the proposals according to their regional priorities.
• The GRDC’s National Panel makes recommendations for resource allocation to frame a high-level budget and formulates the External Investment Plan.

STEP 3
Release of External Investment Plan (August each year)
• Investment proposals identified as suitable for competitive tender are published in the GRDC’s annual External Investment Plan, which is posted on the GRDC’s website during the period of call for tenders. The External Investment Plan is based on the GRDC’s Strategic Research & Development Plan 2007–12 (www.grdc.com.au/strategicr&dplan). About half of total new investments in any given year go to tender.
• Tenders are evaluated against specific selection criteria to determine the preferred provider(s).
• Other projects are directly negotiated where there is limited expertise in a research area and/or there needs to be ongoing access to co-owned intellectual property.
• The GRDC usually invests in partnership with organisations that will deliver the RD&E.
STEP 4
Review and Priorities Meeting (March each year)
- Progress on the status and development of new investments agreed to at Investment Planning Week is reviewed.
- The resources being contributed to the project by the research partner(s) are assessed.
- Alterations to the priority of proposals (many of which are now draft project specifications) occur through Program Teams and regional panels to reflect new information.
- The high-level budget framework is reviewed in light of the latest revenue forecasts.
- The GRDC’s National Panel provides a list of projects with recommendations to the GRDC Board.
- These recommendations form the basis of the GRDC Annual Operational Plan (www.grdc.com.au/grdcaop) and the finalised GRDC Stakeholder Report.
- The GRDC Annual Operational Plan must be submitted to the Minister of the Department of Agriculture, Fisheries and Forestry by 30 April.
- Approval from the Minister is required prior to the funding of projects.

STEP 5
Contract projects (July onwards each year)
- Contracting of projects begins, based on the project specifications being agreed to by the contracting parties.

STEP 6
Assess reports
- Annual progress reports for continuing investments are received for assessment in March each year.
- Issues for GRDC managers to follow up are identified.
- Payments to research partners are made for those projects with approved progress reports.
- Project final reports are assessed at the end of the project (usually in September).
- Research project information is communicated to grain growers and industry stakeholders.