The Grains Industry: An overview of the Australian broad-acre cropping

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Abstract

This report gives an overview of physical, socioeconomic and financial characteristics and best management practices of broadacre farming in several Australian Agroecological zones (WA Northern, WA Central, QLD Central, NSW ne/QLD se, SA-Vic Mallee and SA Midnorth – Lower Yorke Eyre zone).

Average grain yields tend to be highest in Queensland Central and NSW ne/QLD se Agroecological zones. Lowest yields are found in the SA-Vic Mallee zone. Farm business profits highly vary between zones. During the period 2006-07 to 2008-09, highest business profits were realized in the Queensland Central zone. Average yearly farm business profits for WA Northern, SA-Vic Mallee and SA Midnorth Lower Yorke Eyre zone were estimated to be negative for this same period. Next to grains production, beef cattle is an important source of income in the northern regions (Queensland Central Zone, and to a lesser extent NSW ne / QLD se). In the southern and western regions, sheep and wool production is a more common source of income on broadacre farms (next to grains).

Information about on-farm management practices that are considered to achieve enhanced productivity and environmental management is provided in this report. The most important best-management practices are no-tillage and stubble retention, which are widely adopted across Agroecological zones. We also briefly review corporate farming in Australian broadacre agriculture, showing that only 1.8% of all broadacre farms were considered to be corporate farms in 2013.

Key words: Broadacre cropping, Grains, Wheatbelt

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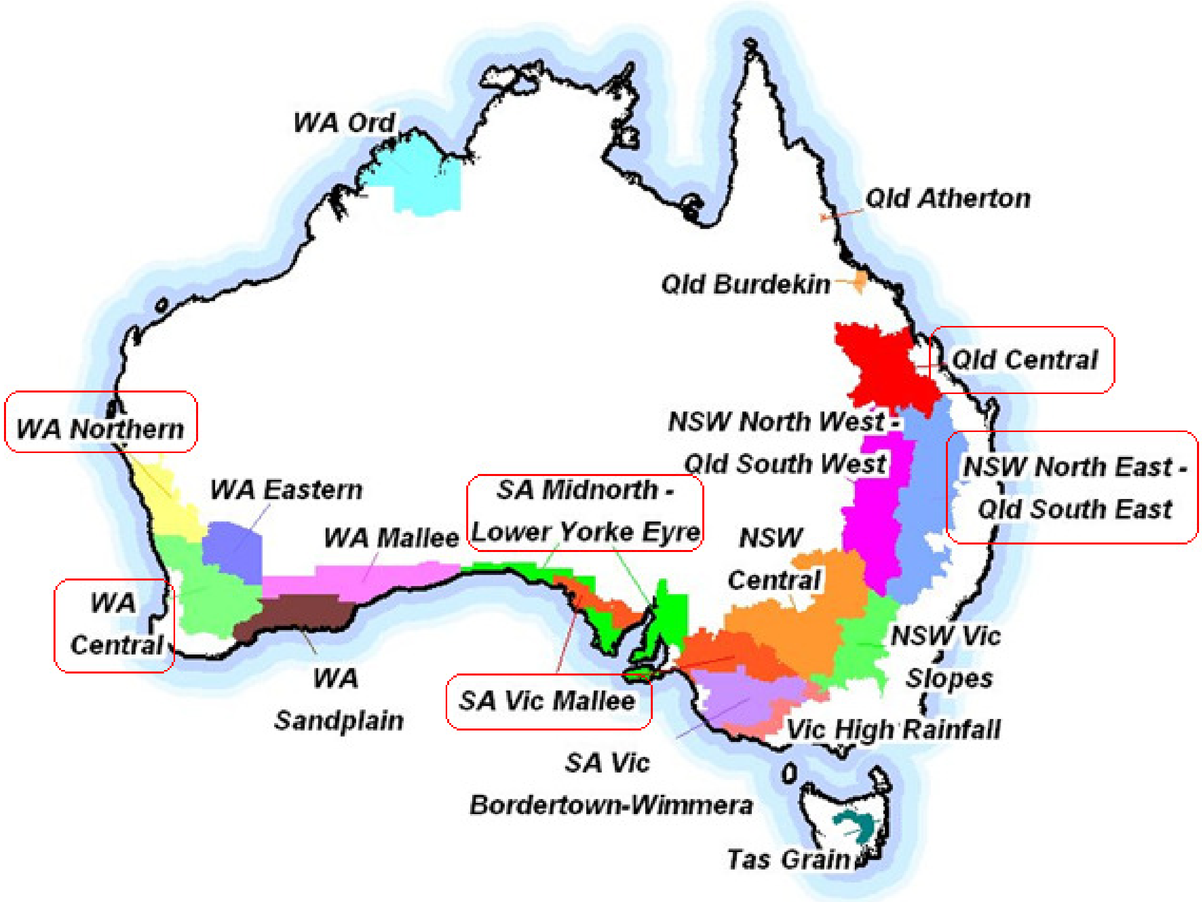
Contents

Introduction

This report aims to give an overview of broadacre farming in several Australian Agroecological zones. The targeted Agroecological zones are: Western Australia Northern, Western Australia Central, Qeensland Central, New South Wales northeast / Queensland southeast, South Australia-Victoria Mallee and South Australia Midnorth – Lower Yorke Eyre (outlined in red in the figure below).
Chapters one to six give an overview of broadacre grain farming in the targeted Agroecological zones of Australia, including climate and soil characteristics and socioeconomic, financial and physical performance data. In chapter seven, best farm management practices are discussed, including data on the adoption of different management practices in the different Agroecological zones. In chapter eight, the role of corporate farming is discussed briefly. The final chapter (nine), presents historical prices for Australia's main grain commodities and beef and wool, and gives an outlook for future price developments.



GRDC Agroecological Zones of Australia
Source: GRDC Website

Data tables in chapters one to six are adopted from ABARES reports based on GRDC's Australian agricultural grazing industries survey (AAGIS) data, available at: http://www.grdc.com.au/Research-and-Development/ABARES-GRDC-Reports . Farmers in the data are split up in specialist grain farms (SGF) and multiple enterprise grain farms (MEGF). Specialist grain farms are farms engaged mainly in growing rice, other cereal grains, coarse grains, oilseeds and/or pulses, and are classified as being in the Wheat and other crops industry (ANZSIC06 Class 0146 and 0149). Any broadacre farm that is not classified as being in the wheat and other crops industry but that planted more than 40 hectares of grain crops is classified as a mixed enterprise grain farm.

Data tables in the seventh chapter are mainly adopted from GRDC's "Farm Practice Baseline Report" by Kearns and Umbers (2010), based on a grain producers survey conducted by Solutions Market Research in 2009. The survey was based on the operations on the farms for the 2008 (winter) cropping year.

1. Northern WA

The northern West Australia Agroecological zone is a rich farming and fishing area to the north and north east of Perth (see Figure 1.1). The region is notable for its extraordinarily high levels of biodiversity, large numbers of rare and threatened animals and plants. It covers 7.5 million hectares and is characterised by coastal sandplain with considerable areas of retained natural vegetation, and a fertile low rainfall hinterland (McTaggart and Peake, 2005). Critical management issues in the area include water quality and quantity, control of introduced pests, soil quality and production levels, and loss of biodiversity (NRM Website).

Figure 1.1: Northern West Australian Central Agroecological Zone
Source: GRDC Website

Summary

- Low to medium rainfall zone (250 to 700 mm)
- Relative large grain holdings, with average grain plantings around 1560 hectares
- Produces around 6% of the Australian grain crop
- Wheat accounts for 74% of total grain production
- Lupins and canola are important rotational crop
- Wheat yields now average around 1.8 tonnes per hectare, after improving by 4.7% a year over the past two decades

- Farm cash incomes have averaged around $183,000 in recent years, with a rate of return of 7.2%
- Grain specialist farms predominate, with incomes from wool and sheep meat production of lesser importance
- Productivity advances over the past two decades have come from introducing lupins into the rotation, better disease and nutrition management, plant breeding, mimimum and no till farming, and larger scale farming
- Total factor productivity growth averaging 4% a year
- Potential risks for future productivity growth are herbicide resistant rye grass and radish, diseases such as septoria and blackleg and salinity
- Pressing need for a deep rooted perennial that can be grown in marginal areas as a disease break and for weed control (Knopke et al., 2000)

Climate

Nothern WA experiences a Mediterranean type climate. Winters are short, mild and rainy and summers warm to hot. Annual rainfall along the coast ranges from 700 mm in Lancelin to 500 mm in Geraldton. Rainfall in the eastern and northern margins of the agricultural area is 250-300 mm annually (McTaggart and Peake, 2005).

Soil

The soils in this region range from very sandy soils along the coastal areas of the western midlands and north of Geraldton, to heavier red-loams along the eastern areas. Low natural nutrition and agriculture induced acidity are major soil constraints in the region (Soil Quality website).

Farm characteristics

Physical characteristics

In the three years up to 2008-2009, there were an estimated 755 broadacre grain farms in the Northern West Australia Agroecological Zone, of which 538 (71%) specialist grain farms and 217 (29%) mixed enterprise grain farms (see Appendix Table A1). Grain crops are the most important commodity produced in this region, with an annual value of crop production of $481 million. Most important crop in the region is wheat, which accounts for 84% of total value of crop production.

Total area operated by broadacre farmers in the Nothern WA region is 8,770 ha for specialist grain farms and 3,610 ha for mixed enterprise grain farms, of which roughly one third sown to grain crops (see Appendix Table A2). Average grain yields for both types of enterprises are 1.1 tons per hectare.

Socioeconomic characteristics

The average age of SGF and MEGF operators during the period 2006-2007 to 2008-2009 is estimated to be 52 and 53 year, respectively (Table 1.1). Off-farm income is estimated to be roughly $22,000 for SGF and $31,000 for MEGF, of which the spouse's income compromising most of this.

Table 1.1: Socioeconomic benchmarks: Western Australian Northern zone, 2006–07 to 2008–09

		SGF	MEGF
Operator			
Average age	yr	52	53
Education			
– 1–4 years high school	%	22	39
– 5–6 years high school	%	60	33
– Trade apprenticeship/technical college	%	2	20
– Tertiary	%	16	8
Weeks of work off farm	wks	4	2
Spouse			
Average age	yr	50	49
Education			
– 1–4 years high school	%	40	46
– 5–6 years high school	%	30	29
– Trade apprenticeship/technical college	%	13	7
– Tertiary	%	18	18
Weeks of work off farm	wks	5	7
Operator and spouse off-farm income	$	22,228	30,981

Source: Hooper et al., 2011a

Farm financial performance

In the three years to 2008-09, farm cash receipts received by specialist grain farmers were about $1,000,000 a farm, of which the sale from crops compromising 70% of this (see Table 1.2). In this same period, average annual farm cash income was roughly $153,000 for specialist grain farmers. For mixed enterprise grain farmers, average annual farm receipts in this same period were almost $500,000 a farm. 54% of which was generated from crop sales, 14% from beef cattle and a further 11% from sheep and lambs. Annual farm cash income for mixed enterprise grain farmers was almost $80,000 a farm.

Despite the positive farm cash incomes received by SGF and MEGF, they were insufficient for covering the costs of family labour and depreciation, resulting in negative business profits for both types of enterprises ($-199,000 for SGF and $-79,000 for MEGF).

Table 1.2: Summary of financial performance: Western Australian Northern zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$	1,044,931	489,406
– Beef cattle	$	19,204	70,733
– Crops	$	734,787	263,073
– Sheep and lambs	$	50,233	54,147
– Wool	$	34,905	36,349
***less* Farm cash costs**	$	892,004	410,785
– Contracts	$	9,646	8,247
– Crop and pasture chemicals	$	102,319	37,599
– Fuel, oil and grease	$	74,111	49,256
– Fertilisers	$	191,951	79,667
– Interest payments	$	175,318	49,852
– Repairs and maintenance	$	60,694	31,318
Farm cash income	$	152,926	78,621
plus build-up in trading stocks	$	–47,970	–29,718
less depreciation	$	154,498	72,226
less imputed cost of family labour	$	68,975	55,453
Farm business profit	$	–118,517	–78,777
Farm business profit at full equity	$	82,934	–28,364
Rate of return at full equity			
– Excluding capital appreciation	%	1.2	–0.5
– Including capital appreciation	%	2.6	–4.1

Source: Hooper et al., 2011a

In the three years up to 2008-09, farm cash receipts averaged $120/ha for SGFs and $136/ha for MEGF. For SGFs crops are the largest contributor, for MEGF crops and beef cattle (see Table 1.3). Total far costs per hectare were $102/ha for SGFs and $114/ha for MEGFs. Chemicals, fertilizers and fuel are for both types of enterprises the largest contributors to farm cash costs per hectare. Both types of enterprises realized a farm business loss of $-13.5/ha for SGFs and $-21.8/ha for MEGFs.

Table 1.3: Financial performance benchmarks: Western Australian northern zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$/ha	120	136
Receipts from the main agricultural activities			
– Crops	$/ha	83.8	72.9
– Beef cattle	$/ha	2.2	19.6
– Sheep and lambs	$/ha	5.7	15
– Wool	$/ha	4	10.1
Water use efficiency	$/100 mm/ha	42	38
Farm cash costs	$/ha	102	115
– Administration	$/ha	3.2	5.9
– Beef cattle purchases	$/ha	0.8	5
– Contracts	$/ha	1.1	2.3
– Crop and pasture chemicals	$/ha	11.7	10.4
– Fertilisers	$/ha	21.9	22.1
– Fodder	$/ha	0.6	4.5
– Freight	$/ha	3	2.4
– Fuel, oil and grease	$/ha	8.5	13.6
– Handling and marketing	$/ha	1.9	2.7
– Hired labour	$/ha	3.9	1.9
– Interest	$/ha	20	13.8
– Repairs and maintenance	$/ha	6.9	8.7
– Shearing and crutching	$/ha	1.1	3.7
– Sheep purchases	$/ha	0.4	1.2
Farm financial performance			
Farm cash income	$/ha	17.5	21.9
Farm business profit	$/ha	–13.5	–21.8
Total cost to value of			
output ratio	cents / $ of output	111.9	117.1
Total farm capital	$/ha	813	1 470
Rate of return on capital at full equity			
– Excluding capital appreciation	%	1.2	–0.5
– Including capital appreciation	%	2.6	–4.1
Farm equity	$/ha	547	1 311
Return on farm equity			
– Excluding capital appreciation	%	–2.5	–1.7
– Including capital appreciation	%	–0.4	–5.8

Source: Hooper et al., 2011a

2. Central WA

The Central Agricultural region (CAR) of Western Australia covers an area of 8.8 million ha; it spans 350 km west to east and 450 km north to south (see Figure 2.1) and consists of 32 shires. There are approximately 2,900 farms in the CAR, usually ranging in size from 2,500 ha to 4,500 ha (DAFWA). Crops suitable for growing in the Central Western Australian region during winter are wheat, barley, oats, triticale, cereal rye, lupins, field peas, canola, faba beans and chickpeas (GRDC, 2010).

Figure 2.1: Western Australian Central Agroecological Zone
Source: GRDC website

Summary

- Low to medium rainfall zone (300 to 600 mm)
- Average grain plantings around 850 hectares per farm
- Produces around 17% of the Australian grain crop
- Wheat accounts for 65% of total grain production
- Barley, lupins and canola are other important grain crops
- Wheat yields now average around 2 tonnes per hectare, after improving by 3.3% a year over the past two decades
- Farm cash incomes have averaged around $99 000 in recent years, with a rate of return of 3.6%
- Includes a number of mixed grain-livestock producers with significant proportion of their incomes from wool and sheep meat production

- Productivity advances over the past two decades have come from introducing lupins, canola and clovers into rotations, minimum till farming, and larger scale farming
- Total factor productivity growth averaging 3.1% a year
- Potential risks for future productivity growth are herbicide resistant crops, crop diseases such as septoria and blackleg, and salinity (Knopke et al., 2000).

Climate

The CAR has a relatively reliable, Mediterranean climate. That is, the region experiences hot dry summers and cold wet winters. Rainfall ranges from 300mm in the east to 600 mm in the west. The last two years rainfall has been significantly below average, decreasing overall agricultural production. Climate change is a serious cause of concern. Possible reduction in growing season rainfall is pushing research into more effective management of the available moisture (DAFWA website).

Soil

Most common soil type in Central WA is sandy loams, combined with deep and shallow duplex and red and grey clays (Robertson, 2006). Soil health issues being addressed include salinity, which affects 5% of the Avon River Basin, and soil acidity which affects one half of the agricultural area (DAFWA website).

Farm characteristics

Physical characteristics

The total number of broadacre grain farms in Central WA is 2,986 of which 789 are specialist grain farms and 2,197 mixed enterprise grain farms (see Appendix Table A1) (Hooper et al., 2011b).

Despite representing a relatively small proportion of broadacre grain producing farms in the zone, specialist grain farms accounted for 51% of the value of grain production in the zone. This is due to a higher average area planted with grain crops on SGF and the slightly higher grain yields specialist grain farmers perceive. Mixed enterprise grain farms in the zone accounted for 85% of the value of livestock and wool sales (Hooper et al., 2011b). More physical performance data for SGF and MEGF can be found in Appendix Table A2.

When farms in both sectors of the grain industry were distributed by rate of return excluding capital appreciation, the top 10% of farms represented a proportionately large share of the value of agricultural sales. In the specialist grain sector, these farms contributed 33% of the sector's value of grain sales. Similarly, the top 10% of farms in the mixed enterprise grain sector contributed 29% of the value of grain sales (Hooper et al., 2011b).

Socioeconomic characteristics

The average age of SGF operators during the period 2006-07 to 2008-09 is estimated to be 50 years (Table 2.1). For MEGF operators the average age is 53 years. During this period, the operator of specialist grain farms, and their spouse, earned almost $30,000 a year from off-farm income sources, predominantly from salaries earned by the operator's spouse. In the three years to 2008–09, the operator of mixed enterprise grain farms, and their spouse, generated, on average, around $29,000 a year from off-farm income sources, mostly from the spouse's off-farm salaries.

Table 2.1: Socioeconomic benchmarks: Western Australian central zone, 2006–07 to 2008–09

		SGF	MEGF
Operator			
Average age	yr	50	53
Education			
– 1–4 years high school	%	17	30
– 5–6 years high school	%	33	34
– Trade apprenticeship	%	21	16
– Tertiary	%	29	20
Weeks of work off farm	wks	2	5
Spouse			
Average age	yr	48	49
Education			
– Primary school	%	0	2
– 1–4 years high school	%	26	21
– 5–6 years high school	%	43	32
– Trade apprenticeship	%	0	15
– Tertiary	%	30	31
Weeks of work off farm	wks	22	15
Operator and spouse off-farm income	$	29,618	29,347

Source: Hooper et al., 2011b

Farm financial performance

During the three years to 2008–09, grain producing farms in the Western Australian CAR realised substantial farm cash incomes and business profits (see Table 2.2). On average, specialist grain farms generated annual farm cash receipts of over $1 million a farm, with around 83% derived from the sale of grain crops. Sales of wheat and barley accounted for 83% of total crop receipts, with the bulk of the remaining crop receipts generated by the sale of oilseeds (principally canola) and pulses (mainly lupins but also small quantities of field peas, faba beans and chickpeas). In the three years to 2008–09, oilseeds contributed 9% of crop receipts and pulses 6%. Sales of sheep, lambs and wool contributed a further 9% of farm cash receipts during this period. In comparison, farms in the mixed enterprise grain sector of the grain industry generated large annual farm cash incomes and modest business profits during this period. These farms are generally much more diversified than specialist grain farms, with sales of grain crops contributing 58% of farm cash receipts, wool around 17%, and sheep and lambs 15%. During this period, around 73% of crop receipts came from the sale of wheat and barley, with canola contributing 15% and oats a further 7%. Pulses collectively accounted for just 2% of cropping receipts.

Table 2.2: Summary of financial performance: Western Australian central zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$	1,070,227	558,489
– Beef cattle	$	4,461	15,392
– Crops	$	886,724	322,111
– Sheep and lambs	$	53,316	86,439
– Wool	$	38,067	96,734
less **Farm cash costs**	$	770,510	419,155
– Contracts	$	22,572	11,328
– Crop and pasture chemicals	$	115,562	34,804
– Fuel, oil and grease	$	69,299	32,027
– Fertilisers	$	165,964	81,950
– Interest payments	$	89,614	50,030
– Repairs and maintenance	$	60,887	30,789
Farm cash income	$	299,717	139,334
plus build-up in trading stocks	$	–5,420	–5,923
less depreciation	$	100,241	48,749
less imputed cost of family labour	$	63,405	56,918
Farm business profit	$	130,651	27,745
Farm business profit at full equity	$	250,817	91,194
Rate of return at full equity			
– Excluding capital appreciation	%	4.6	2.1
– Including capital appreciation	%	9.2	5.5

Source: Hooper et al., 2011b

For the three years up to 2008-09, farm cash receipts averaged $329/ha for SGFs and $284/ha for MEGFs (see Table 2.3). For both types of enterprises crop receipts are the main contributor to total farm cash receipts per hectare. In this same period, farm cash costs were $230/ha for SGFs and $213ha for MEFGs, leaving a farm cash income per hectare of roughly $89/ha for SGFs and $71/ha for MEGFs.

Table 2.3: Financial performance benchmarks: Western Australian central zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$/ha	319	284
Receipts from the main agricultural activities			
– Crops	$/ha	263.5	163.2
– Beef cattle	$/ha	1.3	7.8
– Sheep and lambs	$/ha	15.8	43.8
– Wool	$/ha	11.3	49
Water use efficiency	$/100 mm/ha	99	74
Farm cash costs	$/ha	230	213
– Administration	$/ha	6.5	9.5
– Beef cattle purchases	$/ha	0.2	1
– Contracts	$/ha	6.7	5.7
– Crop and pasture chemicals	$/ha	34.3	17.6
– Fertilisers	$/ha	49.3	41.5
– Fodder	$/ha	0.5	4.7
– Freight	$/ha	9.1	5.8
– Fuel, oil and grease	$/ha	20.6	16.2
– Handling and marketing	$/ha	7.7	8.4
– Hired labour	$/ha	5	5
– Interest	$/ha	26.6	25.3
– Repairs and maintenance	$/ha	18.1	15.6
– Shearing and crutching	$/ha	3.9	12.7
– Sheep purchases	$/ha	2.2	4.5
Farm financial performance			
Farm cash income	$/ha	89.3	70.9
Farm business profit	$/ha	38.8	14.1
Total cost to value of output ratio	cents/$ of output	87.7	95
Total farm capital	$/ha	1,719	2,312
Rate of return on capital at full equity			
– Excluding capital appreciation	%	4.6	2.1
– Including capital appreciation	%	9.2	5.5
Farm equity	$/ha	348	904
Return on farm equity			
– Excluding capital appreciation	%	2.9	0.7
– Including capital appreciation	%	8.5	4.7

Source: Hooper et al., 2011b

3. Queensland central

The Queensland Central Agroecological zone is roughly the area in a 200 km radius around the town of Emerald (Figure 3.1). It comprises the Queensland Central Highland Region.

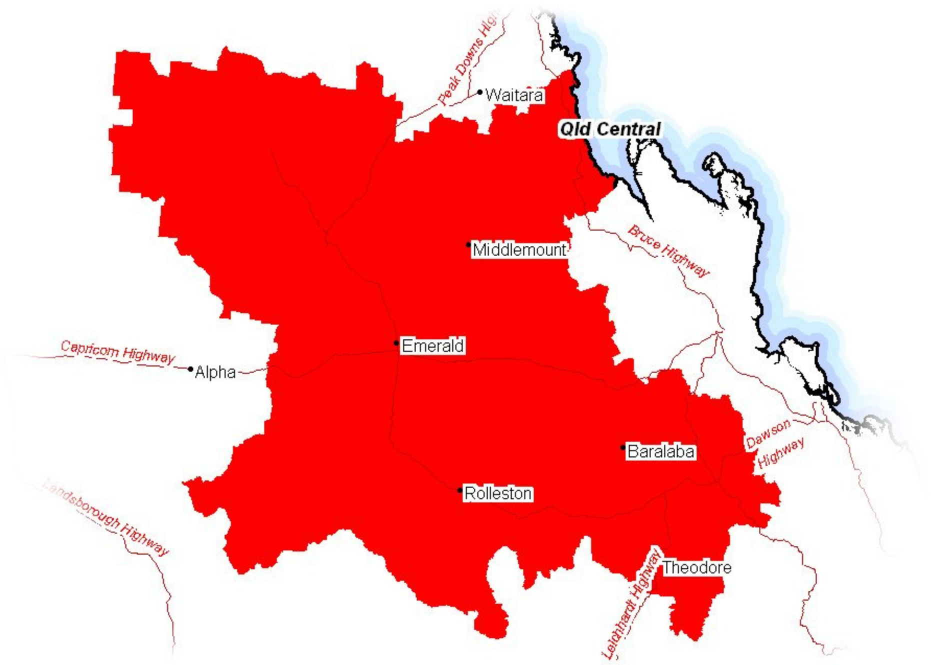


Figure 3.1: Queensland Central Agroecological Zone
Source: GRDC Website

Queenland's most widely grown winter grain is wheat, while the most widely grown summer grain is sorghum. Crops are grown across wide parts of the State ranging from broadacre farming enterprises in the southwest near Dirranbandi and St George, inland across the Darling Downs, through Central Queensland and parts of North Queensland (QFF website).

Most rainfall in this northern region tends to be over the summer months, allowing for dryland summer crop production. But with the high moisture-storing capacity of the clay-based soils of this region, supplemented by some winter rainfall, crops that grow over the winter are also successfully produced. Winter crops in the northern region are planted across a wide time period starting in March in the Qld Central zone. Consequently, harvest of winter crops can stretch from September through to December. Summer crops are planted from September through to February with harvest spanning the February through to May period (Australian Grain, 2013). Crops suitable for growing in the Central Queensland region during the winter are wheat, barley, oats and chickpeas. Central QLD summer crops are sorghum, sunflowers, maize, mungbeans, soybeans and cotton (GRDC, 2010).

Summary

- Medium rainfall area (600 to 1300 mm)
- Highly variable rainfall patterns present risks for planting and production strategies
- Produces around 2% of the Australian grain crop
- Wheat and grain sorghum production are equally important, each accounting for around 33% of total grain production
- Wheat yields averaged 1.2 tonnes per hectare for the past four years, which is lower than that average recorded, in the 1980s, reflecting highly variable rainfall during the 1990s. Crop area has been increasing at 5.7% a year over the past two decades
- The use of crop sprays has increased 13% a year over the past two decades
- Farm cash incomes have averaged around $66,000 in recent years, with a rate of return of 2.6%
- Crops account for around 69% of total farm receipts
- Oilseeds, such as sunflowers, account for more than 22% of income
- Includes a number of farmers who derive a signification proportion of their income from beef production
- Productivity advances over the past two decades have come from farm amalgamations and increasing applications of fertilizers
- Total factor productivity growth averaging 2.9% a year (Knopke et al., 2000).

Climate

The QLD Central Zone experiences a sub-tropical climate characterised by high variability in rainfall, temperature and evaporation. Droughts, floods, heatwaves and frosts all feature as part of the local climate. The region has an average daily temperature range of 15–28.2 °C, and on average receives 707 mm of rainfall per year. Average annual rainfall varies significantly across the QLD Central region, ranging from 600 mm inland to 1300 along the coastal area (DAFF QLD, 2013). Rainfall is the most limiting factor to land use production. 70-75% of the annual rainfall occurs in the summer months (October to March). Most rain between September and December is from thunderstorms, whose high intensity produces run-off and consequent soil erosion problems (CHRRUP, 2003). January and February are the wettest months with rainfall averaging 100 to 120mm per month. August is usually the driest month averaging 18-25mm. Moreover, rainfall totals vary significantly between years, affecting dryland crop production. Severe droughts can be expected to occur once every 10 to 15 years (DAFF QLD, 2013).

The trend of increasing temperatures since 1910 is projected to continue. By 2030, average annual temperatures are expected to be around 1 °C warmer (than in the 1990s) and the average number of days over 35 °C is expected to increase. Longer dry periods interrupted by more intense rainfall events are also expected, which will affect water supply and incidence of flooding (DAFF QLD, 2013).

Soil

Most common soil type in the QLD Central Zone is vertosol (which is the most common soil type in Queensland). Vertosols are brown, grey or black soils which crack open when dry. They commonly form hummocky relief called "gilgai". Vertosols are known for its very high soil fertility (ability to supply plant nutrients) and have a large water-holding capacity (Queensland Government Website, 2013).

The QLD Central Zone is experiencing increasing production problems largely based around declining soil fertility and difficult to control weeds (GRF, 2012). It experiences many problems related to soil erosion. These include the rainfall intensity, the erodibility of the soil and the slope of the land surface. Rates of soil erosion are reduced when management practices retain cover on the surface and protect the bare soil from exposure to direct raindrop impact. Other soil problems related to this area are soils with high clay content, low amounts of surface cover and inappropriate land clearing (CHRRUP 2003).

Farm characteristics

Physical characteristics

In the three years to 2008–09, there were an estimated 417 broadacre grain producing farms in the Queensland central agroecological zone, of which around a quarter were specialist grain farms (see Appendix Table A1). Grain producers in this region operate specialist cropping and cropping–beef cattle farms, with annual sales of grain and beef cattle in the zone worth around $236 million and $152 million, respectively. During the three-year period, wheat, grain sorghum and pulses accounted for 95% of the value of grain sold. Specialist grain farms accounted for 60% of the value of grain production, while mixed enterprise grain farms accounted for 95% of the value of beef cattle sales in the zone (Hooper and Levantis, 2011a).

The total average area operated during the period 2006-07 to 2008-09 is 4,119 ha by SGF and 7,762 ha by MEGF (see Appendix Table A2). The proportion of land sown to crops is 57.2% for SGF and 9.2% for MEGF. Beef cattle are of great importance for the QLD Central region, the average number of beef cattle per farm is 411 for SGF and 1,806 for MEGF. The average grain yields realised by the specialist grain and mixed enterprise grain farms were very similar (2.1 t/ha for SGF and 1.9 t/ha for MEGF).

Socioeconomic characteristics

The average age of SGF operators during the period 2006-07 to 2008-09 is estimated to be 60 years (see Table 3.1). For MEGF operators the average age is 50 years. During this period, the operator of specialist grain farms, and their spouse, earned about $15,000 a year from off-farm income sources. However, all of this income was generated by off-farm investments rather than off-farm salaries. In the three years to 2008–09, the operator of mixed enterprise grain farms, and their spouse, generated, on average, around $45,000 a year from off farm income sources, with off-farm salaries an important source of income for both the operator and spouse.

Table 3.1: Socioeconomic benchmarks: Queensland central zone, 2006–07 to 2008–09			
		SGF	MEGF
Operator			
Average age	yr	60	50
Education			
– Primary school	%	0	3
– 1–4 years high school	%	41	35
– 5–6 years high school	%	29	33
– Trade apprenticeship/technical college	%	26	17
– Tertiary	wks	4	13
Weeks of work off farm		0	10
Spouse			
Average age	yr	55	47
– Primary school	%	0	0
– 1–4 years high school	%	55	19
– 5–6 years high school	%	10	15
– Trade apprenticeship/technical college	%	19	32
– Tertiary	%	15	34
Weeks of work off farm	wks	0	15
Operator and spouse off-farm income	$	15,429	45,028

Source: Hooper and Levantis, 2011a

Farm financial performance

Average farm cash receipts for the period 2006-07 to 2008-09 are substantially higher for SGFs compared to MEGFs (see Table 3.2), although MEGFs on average operate a higher amount of hectares compared to SGFs. Subsequently, farm cash receipts per hectare are almost four times higher for SGF compared to MEGF ($390 and $107 respectively, Table 3.3). As, especially for MEGF, beef cattle accounts for a large share of farm income, MGEF farms' financial performance in the Queensland Central Zone is heavily influenced by developments in the beef cattle industry. In the three years to 2008–09, farms in the mixed enterprise grains sector sold 515 head of beef cattle annually, at an average price of $886 a head (Hooper and Levantis, 2011a).

Table 3.2: Summary of financial performance: Queensland central zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$	1,603,965	832,703
– Beef cattle	$	81,942	456,609
– Crops	$	1,340,377	305,201
***less* Farm cash costs**	$	1,225,103	671,010
– Contracts	$	44,841	36,625
– Crop and pasture chemicals	$	145,462	38,600
– Fuel, oil and grease	$	121,112	58,613
– Fertilisers	$	59,464	18,443
– Handling and marketing	$	84,832	28,753
– Repairs and maintenance	$	95,182	65,636
– Interest payments	$	119,771	135,964
Farm cash income	$	378,862	161,694
plus build-up in trading stocks	$	107,627	57,187
less depreciation	$	139,717	71,570
less imputed cost of family labour	$	79,320	59,874
Farm business profit	$	267,451	87,437
Farm business profit at full equity	$	538,988	241,688
Rate of return at full equity			
– Excluding capital appreciation	%	6.2	2
– Including capital appreciation	%	12.6	5.3

Source: Hooper and Levantis, 2011a

Average farm cash receipts for the three years up to 2008-09 were $390/ha for SGFs and $107/ha for MEGFs (see Table 3.3), of which for SGFs the largest contributor is the receipts from crops ($325/ha). Largest contributor for MEGFs' farm cash receipts is beef cattle (almost $60/ha). Farm cash costs per hectare are $298/ha for SGFs and $86/ha for MEGFs.

Table 3.3: Financial performance benchmarks: Queensland central zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$/ha	390	107
Receipts from the main agricultural activities			
– Crops	$/ha	325.4	39.3
– Beef cattle	$/ha	19.9	59.5
Water use efficiency	$/100 mm/ha	66	20
Farm cash costs	$/ha	298	86
– Administration	$/ha	9.5	2.9
– Beef cattle purchases	$/ha	11.6	6.6
– Contracts	$/ha	10.9	4.7
– Crop and pasture chemicals	$/ha	35.3	5
– Fertilisers	$/ha	14.4	2.4
– Fodder	$/ha	2	3.6
– Freight	$/ha	11.5	1.3
– Fuel, oil and grease	$/ha	29.4	7.6
– Handling and marketing	$/ha	20.6	3.7
– Hired labour	$/ha	11.3	4
– Interest	$/ha	29.1	17.5
– Repairs and maintenance	$/ha	23.1	8.5
Farm financial performance			
Farm cash income	$/ha	92	20.7
Farm business profit	$/ha	64.9	11.3
Total cost to value of output ratio	cents/$ of output	84.4	90.2
Return on farm equity			
Total farm capital	$/ha	2,253	1,646
– Excluding capital appreciation	%	6.2	2
– Including capital appreciation	%	12.6	5.3
Return on farm equity			
Farm equity	$/ha	1,742	1,297
– Excluding capital appreciation	%	3.7	0.9
– Including capital appreciation	%	11.4	5

Source: Hooper and Levantis, 2011a

4. New South Wales North East / Queensland South East

Figure 4.1: New South Wales North East / Queensland South East Agroecological Zone
Source: GRDC Website

Summary:

- Medium rainfall zone
- Produces 11.4% of the Australian grain crop
- Crops account for around 66% of total farm receipts
- Wheat accounts for nearly 44% of total grain production
- Wheat yields now average 2 tonnes per hectare, after improving by 1.1% a year over the past 2 decades
- Farm cash incomes have averaged nearly $70,000 in recent years, with a rate of return of 2.3%
- Grain sorghum production accounts for a significant proportion of crop receipts

- Includes a number of farmers who derive a significant proportion of their income from beef production
- Productvitity advances over the past two decades have come from minimum and no tillage, precision farming, economies of scale from farm amalgamation and tramlining
- Total factor productivity growth averaging 2.7% a year
- Potential risks for future productivity growth are soil erosion, decline in soil structure and fertility
- There is a need for varieties with improved disease resistance and a sustainable, profitable rotation (Knopke et al., 2000).

Farm characteristics

Physical characteristics

In the three years up to 2008-2009, the total average number of broadacre farms in NSW North East / Queensland South East Agroecological Zone was estimated to be 4314, of which 1423 specialist grain farms and 2891 mixed enterprise grain farms (see Appendix Table A1). Grain farms in this zone produced an estimate of $965 worth of grain crops during this period, mainly wheat (44%) and grain sorghum (28%) (see Appendix Table A2). Specialist grain farmers accounted for 70% of the value of grain production. Alike the Queensland Central Agroecological zone, beef cattle is an important source of income for farmers in this region, worth an estimated $592 a year. 88% of the value of livestock and wool sales is generated by mixed enterprise grain farms.

Socioeconomic characteristics

During the period 2006-07 to 2008-09, the average age of broadacre grain farmers in the NSW NE/QLD SE Zone was estimated to be 55 years for specialist grain farmers and 57 years for mixed enterprise grain farmers (see Table 4.1). Off-farm income generated was $34,455 for SGFs and $37,910 for MEGFs, of which the spouse's off-farm income compromising most of this.

Table 4.1: Socioeconomic benchmarks: NSW NE/QLD SE Zone, 2006–07 to 2008–09

Operator		**SGF**	**MEGF**
Average age	yr	55	57
Education			
– Primary school	%	0	4
– 1–4 years high school	%	39	40
– 5–6 years high school	%	17	25
– Trade apprenticeship/technical college	%	20	12
– Tertiary	%	24	19
Weeks of work off farm	wks	4	4
Spouse			
Average age	yr	53	56

Education			
– Primary school	%	1	1
– 1–4 years high school	%	30	34
– 5–6 years high school	%	16	18
– Trade apprenticeship/technical college	%	12	10
– Tertiary	%	41	37
Weeks of work off farm	wks	18	15
Operator and spouse off-farm income	$	34,455	37,910

Source: Hooper and Levantis, 2011b

Financial performance

Average farm cash receipts received by SGFs and MEGFs from 2006-07 to 2008-09 were $655,829 and $404,587, respectively (see Table 4.2). 77% of cash receipts received by SGFs were derived from income from grain crops. Cash receipts received by MEGFs are mainly from the sale of beef cattle (44%) and grain crops (33%). In the three years up to 2008-09, SGFs realized a modest average farm business profit of approximately $25,000. In this same period, MEGFs realized an average farm business loss of -46,890.

Table 4.2: Summary of financial performance: NSW NE/QLD SE Zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$	655,829	404,587
– Beef cattle	$	53,194	178,716
– Crops	$	506,484	135,373
– Sheep and lambs	$	4,396	20,255
– Wool	$	2,015	16,029
***less* Farm cash costs**	$	527,155	368,057
– Contracts	$	35,323	19,952
– Crop and pasture chemicals	$	59,636	21,122
– Fuel, oil and grease	$	56,191	27,762
– Fertilisers	$	48,542	18,480
– Interest payments	$	71,317	51,351
– Repairs and maintenance	$	51,247	29,044
Farm cash income	$	128,675	36,531
Plus build-up in trading stocks	$	12,170	4,733
Less depreciation	$	59,113	36,547
Less imputed cost of family labour	$	55,794	51,607
Farm business profit	$	25,937	–46,890
Farm business profit at full equity	$	112,287	12,859
Rate of return at full equity			
– Excluding capital appreciation	%	2.2	0.3
– Including capital appreciation	%	6.4	3.7

Source: Hooper and Levantis, 2011b

From 2006-07 to 2008-09, SGFs average farm cash receipts per hectare were estimated to be $426 (see Table 4.3). For MEGFs this was $203. In this same period, farm cash costs per hectare were $343/ha for SGFs and $185/ha for MEGF. Highest farm cash costs per hectare for both types of enterprises were spent on interest ($46.1/ha for SGFs and $25.8/ha for MEGF).

Table 4.3: Financial performance benchmarks: New South Wales north-east and Queensland south-east, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$/ha	426	203
Receipts from the main agricultural activities			
– Crops	$/ha	327.4	68
– Beef cattle	$/ha	34.4	91.2
– Sheep and lambs	$/ha	2.8	10.2
– Wool	$/ha	1.3	8.1
Water use efficiency	$/100 mm/ha	75	34
Farm cash costs	$/ha	343	185
– Administration	$/ha	13.5	5.7
– Beef cattle purchases	$/ha	12.5	28
– Contracts	$/ha	22.8	10
– Crop and pasture chemicals	$/ha	38.6	10.6
– Fertilisers	$/ha	31.4	9.3
– Fodder	$/ha	2.5	15.2
– Freight	$/ha	13.2	1.7
– Fuel, oil and grease	$/ha	36.3	14
– Handling and marketing	$/ha	11.1	4.6
– Hired labour	$/ha	18	7.4
– Interest	$/ha	46.1	25.8
– Repairs and maintenance	$/ha	33.1	14.6
– Shearing and crutching	$/ha	0.4	1.6
– Sheep purchases	$/ha	0.6	1.4
Farm financial performance			
Farm cash income	$/ha	83.6	18.3
Farm business profit	$/ha	16.8	23.6
Total cost to value of output ratio	cents/$ of output	96.1	111.5
Total farm capital	$/ha	3,415	163
Rate of return on capital at full equity			
– Excluding capital appreciation	%	2.2	0.3
– Including capital appreciation	%	6.4	3.7
Farm equity	$/ha	2,503	779
Return on farm equity			
– Excluding capital appreciation	%	0.7	1.3
– Including capital appreciation	%	6	2.7

Source: Hooper and Levantis, 2011b

5. South Australia / Victoria Mallee region

The Mallee region comprises 7 million hectares of land, of which three quarters are allocated to dryland agriculture (Sadras et al., 2003). It stretches out from Penong in South Australia to Kerang in Victoria (Figure 5.1).

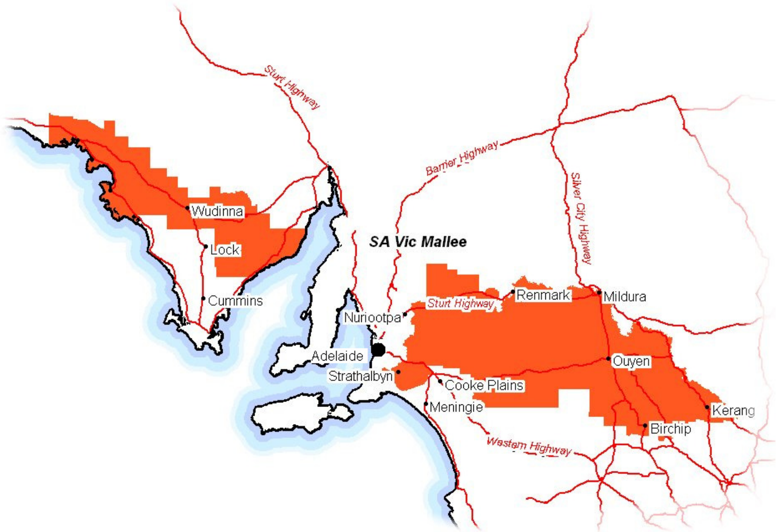


Figure 5.1: South Australia / Victoria Mallee Agroecological Zone
Source: GRDC website

Crops suitable for growing in the SA-Vic Mallee region during the winter are wheat, barley, oats, triticale, cereal rye, lupins, vetch, canola, field peas, chickpeas, faba beans and safflower (GRDC, 2010).

Summary

- Low rainfall (300 to 450 mm)
- Produces 8.5 of the Australian grain crop
- Crops account for just over 70% of total farm receipts
- Wheat accounts for just under 60% of total grain production
- Barley is also an important crop, accounting for around 24% of crop income
- Wheat yield now averages around 1.6 tonnes per hectare, after improving by 1.1% a year over the past two decades
- Farm cash incomes have averaged around $77,500 in recent years, with a rate of return of 4.6%
- Productivity advances over the past two decades have come from availability of grass selective weeds for wheat and barley crops and the introduction of minimum tillage systems that allow for better moisture conservation
- Total factor productivity growth averaging 3% a year
- Future productivity growth may be constrained by low rainfall and hence lower yield potentials for grains grown in this region and the lack of rotational crops suitable to low rainfall regions
- There is a need to use more intensive crop rotations and to be less reliant on pasture phases (Knopke et al., 2000).

Climate

The SA-Vic Mallee region has a Mediterranean type climate and experiences hot summers with average maximum temperatures of 30°C. The winters are mild with an average daily temperature around 10°C, but frosts are common. The semi-arid nature of the region is evident from the high levels of evaporation (seven times the average rainfall). Annual average rainfall varies between 331 millimetres (Vic Gov DSE, 2008) and 350-450mm (Robertson, 2006), which mainly falls in the spring and winter. On average there are only 61 days each year where at least 1 millimetre of rain falls (Vic Gov DSE, 2008).

Soil

Agricultural areas in the Mallee region typically include sandy dunes and plains that have soils with a strong texture contrast between the surface (sand through to loam) and the subsoil (heavy clay). Soils in the region generally have low plant-available water content, resulting in winter cereal crops that are often exposed to varying degrees of moisture stress, including terminal drought (Sadras, 2002).

Farm characteristics

Physical characteristics

In the three years to 2008–09, there were an estimated 2548 broadacre grain producing farms in the SA-Vic Mallee agroecological zone, of which 62% were specialist grain farms (Appendix Table A1). Grain producers in the zone predominantly operated grain, grain–beef and grain–sheep farms, with the total zone's annual crop and livestock sales worth $777 million. During the three years to 2008–09, wheat and barley accounted for almost 90% of the $562 million worth of grain crops produced. The other main crop varieties grown in the zone include canola, lupins, field peas as well as small areas of pulses like chickpeas and faba beans. Specialist grain farms accounted for almost 80% of the total value of grain produced in the zone, while mixed enterprise grain farms accounted for 53% of the value of livestock and livestock products (Hooper and Levantis, 2011c).

The total area operated in the three years up to 2008-09 is on, average per farm, 2596 ha by SGF and 1907 by MEGF (see Appendix Table A2). The proportion of land sown to crops is 60.8% for SGF and 40.9% for MEGF. Average crop yields are 0.7 t/ha for SGF, and 0.6 t/ha for MEGF, which is significant lower than in other regions.

Socioeconomic characteristics

The average age of SGF operators during the period 2006-07 to 2008-09 is estimated to be 54 years (see Table 5.1). For MEGF operators the average age is 55 years. During this period, the operators of specialist grain farms and their spouses earned an average of almost $29,000 a year from off-farm income sources, with the spouse's off-farm salaries comprising most of this. The operator of mixed enterprise grain farms and their spouse earned almost $35,000 a year from off-farm income sources.

Table 5.1: Socioeconomic benchmarks: South Australia and Victoria Mallee zone, 2006–07 to 2008–09			
		SGF	MEGF
Operator			
Average age	yr	54	55
Education			
– primary school	%	4	6
– 1–4 years high school	%	43	33
– 5–6 years high school	%	35	32
– trade apprenticeship/technical college	%	14	21
– tertiary	%	3	7
Weeks of work off farm	wks	1	7
Spouse			
Average age	yr	51	51
Education			
– primary school	%	0	5
– 1–4 years high school	%	39	25
– 5–6 years high school	%	30	24
– trade apprenticeship/technical college	%	4	9
– tertiary	%	28	36
Weeks of work off farm	wks	21	19
Operator and spouse off-farm income	$	28,835	34,638

Source: Hooper and Levantis, 2011c

Financial performance

Average farm cash receipts received by SGF from 2006-07 to 2008-09 was roughly $441,000, of which $335,000 from crops (76%) (see Table 5.2). Average cash receipts received by MEFG in this same period was roughly $278,000, of which $155,000 from crops (56%), other notable sources of income for MEGF were beef cattle ($33,724 or 12%), sheep and lambs ($39 399 or 14%) and wool ($23 518 or 8%). Average farm business profit was negative in this three year period: $-25,000 for SGF and $-40,000 for MEGF.

Table 5.2: Summary of financial performance: South Australia and Victoria Mallee zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$	440,628	277,827
– beef cattle	$	5,440	33,724
– crops	$	335,206	154,919
– sheep and lambs	$	28,372	39,399
– wool	$	19,213	23,518
***less* Farm cash costs**	$	332,883	220,889
– contracts	$	7,819	3,275
– crop and pasture chemicals	$	47,947	20,566
– fuel, oil and grease	$	43,002	25,661
– fertilisers	$	64 ,729	33,077
– interest payments	$	27,892	20,731
– repairs and maintenance	$	29,189	20,557
Farm cash income	$	107,745	56,937
plus build-up in trading stocks	$	–3,482	–8,663
less depreciation	$	70,977	37,642
less imputed cost of family labour	$	58,764	50,265
Farm business profit	$	–25,479	–39,633
Farm business profit at full equity	$	10,535	–17,013
Rate of return at full equity			
– excluding capital appreciation	%	0.4	–0.7
– including capital appreciation	%	3.6	–0.2

Source: Hooper and Levantis, 2011c

In the three years up to 2008–09, specialist grain farms spent $130 per hectare operated on farm inputs (Table 5.3). The main cost items were fertilisers, chemicals, fuel, repairs and interest payments. In the mixed enterprise grain sector, farm cash costs averaged $116 per hectare operated on farm inputs. The main cost categories were fertilisers, chemicals, fuel and repairs. In the three years to 2008–09, around 7% of farm cash costs were used to purchase beef cattle and 3% to buy sheep.

Table 5.3: Financial performance benchmarks: Western Australian central zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$/ha	172	146
Receipts from the main agricultural activities			
– crops	$/ha	129.1	81.2
– beef cattle	$/ha	2.1	17.7
– sheep and lambs	$/ha	10.9	20.7
– wool	$/ha	7.4	12.3
Water use efficiency	$/100 mm/ha	60	44
Farm cash costs	$/ha	130	116
– administration	$/ha	4.3	4.1
– beef cattle purchases	$/ha	0.4	7.6
– contracts	$/ha	3	1.7
– crop and pasture chemicals	$/ha	18.5	10.8
– fertilisers	$/ha	24.9	17.3
– fodder	$/ha	0.6	1.3
– freight	$/ha	3.9	2.5
– fuel, oil and grease	$/ha	16.6	13.5
– handling and marketing	$/ha	6.1	6.4
– hired labour	$/ha	3	1.7
– interest	$/ha	10.7	10.9
– repairs and maintenance	$/ha	11.2	10.8
– shearing and crutching	$/ha	1.1	2.3
– sheep purchases	$/ha	2.3	3.5
Farm financial performance			
Farm cash income	$/ha	41.9	29.9
Farm business profit	$/ha	–9.8	–20.8
Total cost to value of output ratio	cents/$ of output	105.8	114.7
Total farm capital	$/ha	1131	1 213
Rate of return on capital at full equity			
– excluding capital appreciation	%	0.4	–0.7
– including capital appreciation	%	3.6	–0.2
Farm equity	$/ha	962	1,040
Return on farm equity			
– excluding capital appreciation	%	–1.0	–2.0
– including capital appreciation	%	2.6	–1.4

Source: Hooper and Levantis, 2011c

6. South Australia Mid North – Lower Yorke, Eyre Peninsula

The South Australia Mid North – Lower Yorke and Eyre Peninsula Agroecological zone is located in the southern coastal part of South Australia. It compromises multiple regions: the Eyre Peninsula (the area around the town of Cummins), Yorke Peninsula (from Kadina southwards), the Mid North region (roughly from Quom down to Gawler) and Kangaroo Island (see Figure 6.1).

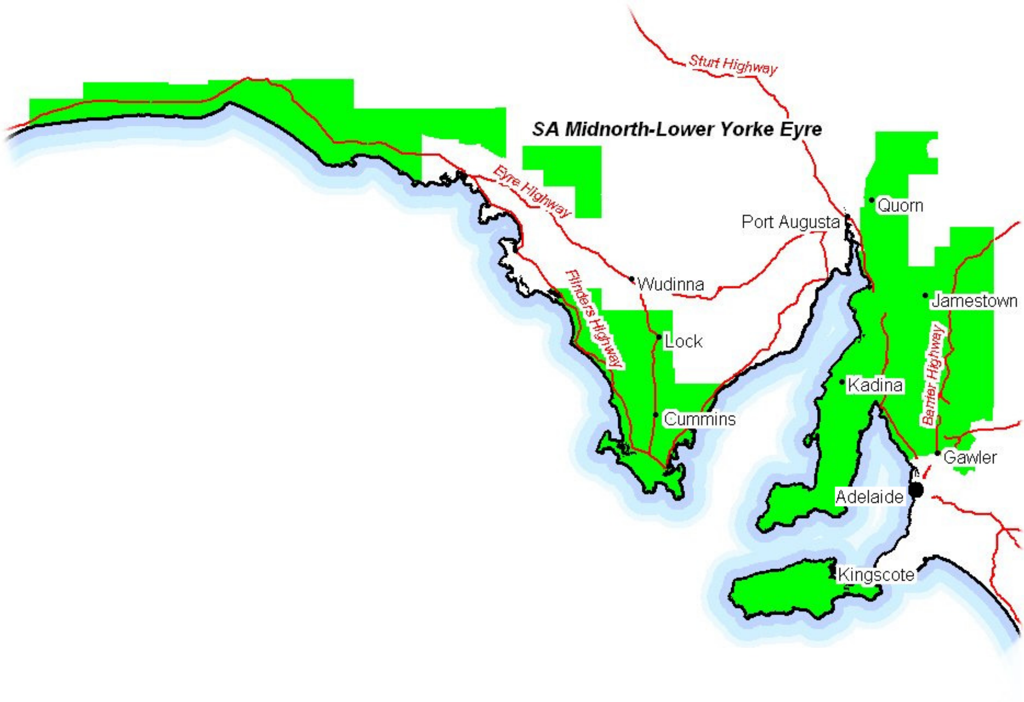


Figure 6.1: South Australia Midnorth – Lower Yorke, Eyre Peninsula Agroecological Zone
Source: GRDC website

The region has an agricultural based economy focused on viticulture, primary production of field crops and emerging agricultural activities such as hay and livestock processing, intensive farming, animal husbandry and horticulture. Agricultural land is suited to broad acre farming and supports large scale food processing and food value-adding of seafood, poultry, organic food, legumes, pulses, grains and oil seeds (SA CES Fact Sheets). The region produces grain (high protein wheat, malting barley), livestock (cattle feedlotting and fine wool), grapes, wine and vegetables (SA Gov Website).

Crops suitable for growing in the SA Midnorth – Lower Yorke, Eyre region during the winter are wheat, barley, oats, triticale, lupins, field peas, canola, chickpeas, faba beans, vetch and safflower (GRDC, 2010), the growing season ranges from six to seven months.

Summary

- Low to medium rainfall zone (350 to 550 mm)
- Produces around 9% of the Australian grain crop
- Crops account for around 76% of total farm receipts
- Wheat accounts for nearly 50% of total grain production
- Barley is also an important crop, accounting for 33% of crop income
- Wheat yields now average around 2.2 tonnes per hectare, after improving by 1.4% a year over the past two decades
- Crop area has increased at 4.4% a year over the past two decades
- The use of contracts has fallen over the past two years
- Productivity advances over the past two decades have come from improved machinery technology and the adoption of minimum or no tillage, as well as the development of higher yielding wheat varieties
- Farm cash income have averaged around $93,000 in recent years, with a rate of return of 4.7%
- Potential risks for future productivity growth are herbicide resistant weeds, continuing problems with root diseases in cereal crops, and the lack of suitable rotational crops
- There is a need for the development of suitable break crops and more robust wheat varieties, as well as cost effective weed control
- Total factor productivity growth averaging 3.2% a year (Knopke et al., 2000).

Climate

The region's climate is Mediterranean, winters are cool to cold with some frosts; summers are warm to hot. The average annual rainfall in the region is 350-550 mm (low to medium rainfall) (Robertson, 2006). Although rainfall and climatic conditions are suited to agriculture there is scarcity of fresh water resources, inhibiting diversification into water intensive crops and leaving current producers vulnerable in times of drought (SA CES Fact Sheets).

Soil

Soils in this region mainly consist of calcareous sandy loam to clay loam (red-brown) (Robertson, 2006). Salinity and declining water quality in the region are impacting on agricultural production and biodiversity conservation (SA Gov Website)

Farm characteristics

Physical characteristics

In the three financial years to 2008–09, an estimated 2490 broadacre farms produced grain in the South Australia Mid North – lower Yorke and Eyre agroecological zone (Appendix Table A1). Just over half of these farms were classified as being specialist grain farms and the remaining were mixed enterprise grain farms. During this period, grain producing farms annually produced grain crops worth an estimated $474 million. Wheat and barley were the two most commonly grown grain crops. The other crops commonly grown in the zone include canola, field peas, lupins and faba beans. In addition, broadacre grain producing farms in the zone sold a diverse range of livestock and livestock products, including beef cattle, sheep, lambs and wool, with annual sales of sheep products contributing $150 million to the value of farm output in the three years to 2008–09.

Despite representing just over half of the broadacre grain producing farms in the zone, specialist grain farms accounted for 78% of the value of grain production in the zone, while mixed enterprise grain farms accounted for 66% of the value of livestock and wool sales.

The total area operated is roughly the same for SGF and MEGF (around 1400 ha) (Appendix Table A2). There are significant differences in yields between SGF and MEGF. Average yield for SGF 1.4 t/ha compared to 0.9 t/ha for MEGF.

Socioeconomic characteristics

The average age of SGF operators during the period 2006-07 to 2008-09 is estimated to be 53 years (Table 6.1). For MEGF operators the average age is 54 years. In the three years to 2008–09, the operator and spouse of mixed enterprise grain farms generated around $29,000 a year from off-farm income sources, with the spouse’s off-farm salaries comprising most of this. Single grain farms off-farm income was about $28,000, mostly generated by the spouse.

Table 6.1: Socioeconomic benchmarks: South Australia mid-north – lower Yorke and Eyre zone, 2006–07 to 2008–09

Operator		**SGF**	**MEGF**
Average age	yr	53	54
Education			
– primary school	%	5	9
– 1–4 years high school	%	47	51
– 5–6 years high school	%	20	24
– trade apprenticeship/technical college	%	9	2
– tertiary	%	19	15
Weeks of work off farm	wks	5	3
Spouse			
Average age	yr	53	51
Education			
– primary school	%	2	1
– 1–4 years high school	%	35	35
– 5–6 years high school	%	21	21
– trade apprenticeship/technical college	%	2	6
– tertiary	%	40	38
Weeks of work off farm	wks	20	17
Operator and spouse off-farm income	$	27,909	29,159

Source: Hooper et al., 2011c

Farm financial performance

In the three years to 2008–09, specialist grain farms in the South Australia mid-north – lower Yorke and Eyre agroecological zone realised, on average, modest farm cash incomes and business losses (Table 6.2). On average, these farms annually generated farm cash receipts of around $448,000, of which almost 80% came from the sale of grain crops. Most crop receipts came from the sale of wheat (44% of crop receipts) and barley (27%). Sales of sheep, lambs and wool contributed a further 8% of farm cash receipts during this period.

Farms in the mixed enterprise sector generated, on average, modest annual farm cash incomes and substantial business losses during this period. These farms are generally much more diversified than specialist grain farms, with sales of grain crops contributing 44% of farm receipts and sheep and lambs a further 19%. Similarly to specialist grain farms, the majority of crop receipts came from the sale of wheat (45% of crop receipts) and barley (31%) during the period.

Table 6.2: Summary of financial performance: South Australia mid-north – lower Yorke and Eyre zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$	448,082	244,592
– beef cattle	$	9,586	17,226
– crops	$	349,924	106,481
– sheep and lambs	$	24,270	47,357
– wool	$	11,585	41,869
***less* Farm cash costs**	$	362,121	225150
– contracts	$	15,541	7,080
– crop and pasture chemicals	$	49,804	23,087
– fuel, oil and grease	$	31,490	20,674
– fertilisers	$	62,574	31,182
– interest payments	$	31,048	24,042
– repairs and maintenance	$	26,298	19,445
Farm cash income	$	85,962	19,441
plus build-up in trading stocks	$	–768	–5,827
less depreciation	$	61,767	37,694
less imputed cost of family labour	$	50,742	52,544
Farm business profit	$	–27,316	–76,624
Farm business profit at full equity	$	28,033	–44,489
Rate of return at full equity			
– excluding capital appreciation	%	0.7	–1.5
– including capital appreciation	%	1.4	–0.2

Source: Hooper et al., 2011c

For the three years up to 2008-09, average farm cash receipts were $344/ha for SGFs and $170/ha for MEGF (see Table 6.3), of which receipts from crops compromising most of this. For this same period, average farm costs were $278/ha for SGFs and $157/ha for MEGFs, of which chemicals, fertilizers, fuel and interest are large contributors.

Table 6.3: Financial performance benchmarks: South Australia mid-north – lower Yorke and Eyre zone, 2006–07 to 2008–09, average per farm

		SGF	MEGF
Farm cash receipts	$/ha	344	170
Receipts from the main agricultural activities			
– Crops	$/ha	263.8	73.9
– Beef cattle	$/ha	7.2	12
– Sheep and lambs	$/ha	18.3	32.9
– Wool	$/ha	8.7	29.1
Water use efficiency	$/100 mm/ha	88	38
Farm cash costs	$/ha	278	157
– Administration	$/ha	8	5.3
– Beef cattle purchases	$/ha	2.5	4.2
– Contracts	$/ha	11.7	4.9
– Crop and pasture chemicals	$/ha	37.5	16
– Fertilisers	$/ha	47.2	21.6
– Fodder	$/ha	5.2	3.2
– Freight	$/ha	5.5	2.6
– Fuel, oil and grease	$/ha	23.7	14.4
– Handling and marketing	$/ha	12.2	7.8
– Hired labour	$/ha	6	3.9
– Interest	$/ha	23.4	16.7
– Repairs and maintenance	$/ha	19.8	13.5
– Shearing and crutching	$/ha	1.4	4
– Sheep purchases	$/ha	6.2	5.9
Farm financial performance			
Farm cash income	$/ha	66	13.5
Farm business profit	$/ha	–20.6	–53.2
Total cost to value of output ratio	cents/$ of output	106.1	132.1
Total farm capital	$/ha	3,116	2,039
Rate of return on capital at full equity			
– Excluding capital appreciation	%	0.7	–1.5
– Including capital appreciation	%	1.4	–0.2
Farm equity	$/ha	2,765	1,683
Return on farm equity			
– Excluding capital appreciation	%	–0.7	–3.2
– Including capital appreciation	%	0	–1.5

Source: Hooper et al., 2011c

7. Best Management practices

The GRDC and MLA (Meat & Livestock Australia) have identified the following sustainable farm practices on mixed farming systems that can achieve on-farm impact for both enhanced productivity and environmental management (Kearns and Umbers, 2010):

1. Reduced or no-tillage. The use of minimum zero- or no-tillage systems for crop and pasture establishment
2. Stubble retention. The level of retention of crop and pasture residues following harvest or grazing.
3. Crop rotation with pastures oilseeds and pulses.
4. Controlled traffic/ precision agriculture
5. Integrated weed/pest/disease management in crops and pasture.
6. Nutrient budgeting and soil testing in crop and pasture.
7. Use of perennials in systems.
8. Livestock management
9. Managing biodiversity
10. Water budgeting

The different management practices will be explained below (including the presentation of corresponding data, if available) and are largely based on a GRDC paper by Kearns and Umbers (2010). The data regarding the adoption of different farm management is gathered by Solutions Market Research in, commissioned by GRDC in 2009. The survey was based on the operations on the farms for the 2008 (winter) cropping year (Kearns and Umbers, 2010).

7.1 Reduced or no-tillage

This practice refers to the tillage system farmers use before planting. The amount of tillage, or the number of times a particular implement or combination of implements is used, on a piece of land, determines to what extent the soil is disturbed and therefore influences soil health and risk of erosion.

Using the right tillage system may contribute to profit, crop yields, soil improvement, and protection of water resources. Numerous criteria, in addition to the cost of conversion, need to be considered when weighing the advantages and disadvantages of various tillage options. A zero tillage system is said to improve soil health and reduce energy input (CHRRUP, 2003).

In recent years, farmers have been encouraged to move to one-pass sowing systems to reduce the risk of soil loss through wind and water erosion, lower greenhouse gas emissions and to improve water use efficiency (Barson et al., 2012). Regarding greenhouse gas emission however, research suggests that the reduction in greenhouse gas emissions, resulting from a reduced tillage system, is only very small. Fuel related emissions would be smaller, but agrochemical related emissions are significantly greater in a zero-tillage system compared to a conventional tillage system (Maraseni and Cockfield, 2011).

Different types of tillage systems are described below. In Table 7.1.1 and 7.1.2 data is presented for the tillage systems used in the targeted zones.

Table 7.1.1: % of crop area planted using No-Tillage, Minimum Tillage and Multiple Tillage methods as at 2008

	% No-till	% Min-till	% Multiple till
WA Northern	92.7	7.3	0
WA Central	98	2	0
QLD Central	93.5	6.5	0
NSW ne / QLD se	90.1	9.1	0.8
SA-Vic Mallee	85.6	13	1.4
SA MidNorth / Lower EP	94.1	5.9	0

Source: Kearns and Umbers, 2010

Table 7.1.2: % of crop area planted using No-Till 10, No-Till 30, No-Till DD, Min-Till 2 and Min-Till Red as at 2008

	% No-till 10	% No-till 30	% No-till DD	% Min-till 2	% Min-till Red
WA Northern	31.4	46.5	14.7	5.1	2.2
WA Central	39.1	44.1	14.8	1.8	0.2
QLD Central	53.1	33.7	6.7	2.4	4.1
NSW ne / QLD se	43.5	24.2	22.4	5.1	4
SA-Vic Mallee	24.6	30.3	30.7	10.5	2.5
SA MidNorth / Lower EP	44.1	32.1	17.8	2.5	3.4

Source: Kearns and Umbers, 2010

The levels of minimum tillage are generally very low in all AE-Zones, such that it can be claimed that no-till is now by far the most dominant crop (and perhaps pasture) establishment system in use in Australia, certainly among the larger grain-producing farmers.
The adoption of No-Till is extremely high, at over 90% of the cropped area in most AE-Zones. The data indicate the use of a multiple-tillage based systems have almost disappeared over the past 10 years.

Different types/categories of tillage are briefly described below.

No-Tillage:

- No-Till 10: Where soil engaging machinery use at planting disturbs less than 10% of the soil surface. Typically, such machinery would be a disc-based implement, where vertical or near-

vertical discs (and several combinations are available, many with leading coulter discs), effectively ‘slice’ through the soil placing seed (and fertilizer) at the desired depth, leaving very little soil actually disturbed. This tillage type also includes the use of press wheels.
- No-Till 30: Where machinery disturbs more than 10% but less than 30% of the soil surface across the planting width. Typically such machinery consists of vary narrow, or ‘knife’ soil engaging tools, whereby a relatively narrow area of soil is moved aside, seed (and fertiliser) placed in the ‘trench’, with loosened soil then falling or pushed back in to cover the seed, and press wheels commonly used to firm the soil over the seed. Row spacing is often set wider than the conventional design to allow for ease of crop residue flow.
- No-Till DD: Where machinery disturbs effectively the full width of soil across the machine. While this is still a ‘one-pass’ planting operation, often more ‘conventional’, or modified conventional machines are used, with soil engaging points that loosen the soil across the whole planting width, providing a ‘full cut’ of the soil surface. Covering devices may consist of a range of options, from press wheels, to more conventional harrows in various forms.

The use of which variant if no-till (i.e. between disc, knife or full cut) tends to be influenced by matters of soil type, climate and level of crop residue. One tends to see a greater benefit from discs in more heavily textured soils, and less so in coarser, sandy soils. This may explain the continued use of knife-based systems in WA, and discs in northern and central NSW parts of Victoria and SA. Use of discs for establishing pastures has been a technique available for some time in the higher rainfall areas, and so its use for crop establishment may be partly due to some growers’ experiences with this. In WA, the use of knife-type planting systems remains high, though disc-based implements are also significant now.

Minimum Tillage:

Minimum Tillage involves at least one full soil cultivation in advance of the planting operation, though less than the often numerous cultivations that characterize “multiple tillage’ systems.

- Min Till 2: This is where less than 2 (and most often only one cultivation) occurs prior to the planting operation, normally with a ‘full soil disturbance’ implement. Such cultivations are often used for weed control or to place previous crop residues into the soil so that planting operations (often with conventional machinery) are not impeded by such residue.
- Min Till Red: Where more than two, but less than the ‘normal’ conventional numerous multiple tillage operations occur before planting. This is a difficult category to describe, since there are no ‘set’ number of cultivations in the ‘Multiple Tillage’ category, so what constitutes ‘Min Till Red’ is often debatable.

Multiple Tillage:

This tends to be a system, often including a long, cultivation-based fallow, where tillage is the dominant method of soil preparation prior to planting. This category has previously been known as “conventional cultivation”, where the objective has been to ensure a weed and residue-free fine and loose soil at planting.

7.2 Stubble retention

This practice refers to the level of retention of crop and pasture residues following harvest or grazing. Stubble retention is frequently practiced in combination with a reduced or no-tillage system, and combined have a major impact on soil cover, erosion and thus water retention. Stubble is defined as the above-ground plant residue left in the field after harvest, including stem, leaf and glume of cereals. In conservation farming systems retained stubble can be mulched, slashed or left standing.

Retaining residues between rotations affords protection from soil loss through wind and water erosion, whilst helping to improve soil organic matter (soil carbon). While seasonal factors, such as the incidence of pests, weeds and disease, and heave stubbles (in wetter years) may affect management, the trend since 1995-96 has been for increases in the numbers of farmers and the area over which crop residue is retained (Barson et al., 2012).

Table 7.2.1: % of stubble managed by various practices as at 2008

	WA Northern	WA Central	QLD Central	NSW ne / QLD se	SA-Vic Mallee	SA MidNorth / Lower EP
Stubble intact	60.1	43.3	68.9	64.8	50.5	50
Stubble not standing	33.2	50	25.5	30.4	46.8	45.5
Stubble cool burn	0.8	2.4	0	2.6	0	0.5
Stubble hot burn	2.4	3	0	0.8	0	1.2
Stubble raked	0.9	0.6	0	1.2	0.5	1.2
Stubble other	0	0.3	5.7	0.1	1.4	0.3
Stubble windrowed	2.5	0.4	0	0.1	0.9	1.3

Source: Kearns and Umbers, 2010

Various stubble management practices are described below. Table 7.2.1 shows the different types of stubble management practices practiced in the targeted Agro Ecological zones.

- *Stubble retained intact*: stubble is retained and not grazed, slashed, or otherwise managed
- *Stubble retained – not standing*: stubble can be grazed, slashed, or otherwise managed such that, while remaining in place, is not standing as per the 'Intact' category.
- *Stubble burnt – Cool Burn*: Stubble that is burnt quite late in the season, often just before or at the point of planting. Such burns are incomplete, leaving a proportion of the stubble remaining on or attached to the soil, but removing enough stubble to allow most planting (including conventional) machinery to get through.
- *Stubble burnt – Hot Burn*: Stubble is burnt often in late summer or early autumn, such that a (more or less) complete burn of stubble takes places, effectively removing all crop residue from the previous year. When combined with a multiple tillage crop establishment system soil is exposed and vulnerable to erosion, compaction and structural decline.

- *Stubble retained – Other*: This includes methods where stubble can be rolled, crimped, or other techniques which leave the stubble on the paddock, though do not fall into the other categories.
- *Stubble – Raked*: Where stubble is harrowed or raked to spread it more evenly over the paddock
- *Stubble Windrowed*: Where stubble is either cut and placed in windrows or simply raked into windrows. In some cases windrows can be baled, or burnt, with only the windrows being burnt. The latter case is used for herbicide weed resistance management in some cases, where the weed seeds in the windrows can thus be burnt.

It is apparent that very high levels of adoption of retaining stubble are now practiced across Australia, with over 90% retained in most AE-Zones. Some reasons for this are that:

- Drought conditions have been relatively widespread through the 2000's, meaning that little crop residue has often been present, making retaining of stubble relatively easy, though the 2008 would not have been considered abnormal in this regard, suggesting that stubble retention is now, for many, a 'normal practice.

- Retaining stubble and the use of No-till planting are closely linked, being two parts of the same system. The adoption of 'No-Till' has increased dramatically through the 2000's, and so to see the retention of stubble also now widespread is likely to be linked to this.

- Continued developments in machinery design to assist with stubble flow and clearance (tyned machinery), and the use of disc-based machinery that can more easily cut through stubble.

Considering the management of soil, and the desire to minimize soil erosion and maximize moisture storage, the adoption of stubble retention practices, in partnership with No-Tillage would be seen as very strong movement by grain producers to combine productivity and environmental benefits.

7.3 Crop rotations

Crop rotation is the practice of growing a series of dissimilar/different types of crops in the same area in sequential seasons.

Rotating of grains crops with non-grain crops is promoted as being beneficial for several agronomic reasons, including:

- For managing some crop diseases by removing the same crop as a host in sequence. Most crop types are no-hosts for other crop types,
- For allowing alternative weed control measures to be used in different crops,
- For increasing soil nitrogen levels (where pulse crops are used),
- To spread financial, labour and agronomic risks (for example frost risk, time of planting).

7.4 Precision Agriculture

Precision agricultural practices include controlled traffic (CT), autosteer, yield mapping (YM) and variable rate fertilizer application (variable rate technology, VRT).

Table 7.4.1: Adoption of different precision agricultural practices, as of 2008

		WA Northern	WA Central	QLD Central	NSW ne/QLD se	SA-Vic Mallee	SA MidNorth
CT	**% Ha total**	10.6	7.4	32.3	43.4	8.4	6.8
	% of Farms	8.1	4.5	39.1	39.2	4.4	7.2
Auto-steer	**% Ha total**	52.4	52.7	70.9	64.5	53.8	55.3
	% of Farms	39.5	39	69.6	56.3	45.6	48.5
VRT	**% Ha total**	7.8	8.2	0	15.8	28.5	8.4
	% of Farms	7	8.5	0	15.2	21.1	11.3
YM	**% Ha total**	30.4	23.5	10.6	16.9	15.8	25.9
	% of Farms	25.6	19	13	13.3	10	17.5

Source: Kearns and Umbers, 2010

Controlled traffic

Controlled traffic (CT) is where the wheels on all implements and tractors, headers etc, follow the same path over the paddock, leaving the soil area between wheels untraveled.

Controlled traffic is said to have benefits for soil compaction, soil structure, increased productivity and other soil parameters.

Data shows that the adoption of controlled traffic is relatively low in the targeted Agroecological zones, except for the Queensland central zone, on which 32% of the total area of farmland controlled traffic is used by almost 40% of the farmers in the zone (see Table 7.4.1).

Autosteer

Autosteer uses GPS-based guidance to assist with guiding the tractor/header/sprayer across the cropped (or pasture) area. Autosteer is a more sophisticated level of Manual GPS guidance, where the technology steers the machine for the driver, who only has to make the turns where necessary. Autosteer can now be used to guide machinery to within 2 cm (or less) of the desired location and can be used with any implement to provide accurate steering and to avoid overlapping or missed areas.

Table 7.4.1 shows that the adoption of autosteer is high, particularly considering this technology has been available only in recent years.

The indication is that the larger grain farms are embracing this technology, with a suggestion that autosteer is used on all the crop area of the farms where it is used (Kearns and Umbers, 2010). This is why the total areas is larger (in proportional terms) than the number of farms. That is, the larger farms are adopting this technology, and because they are larger, a greater proportion of the crop is using this technology.

Variable rate technology as used with fertiliser application

One aspect of precision agriculture is the ability to use various sets of data about crop performance, soil tests and paddock history, along with other remote sensing data to determine the characteristics of various areas within a paddock. One application of this integrated approach is to be able to apply lower and higher rates of fertiliser to different areas of paddock using guidance from the data that is available. This technology is relatively new, and can be quite complex, resulting in relatively low levels of adoption to date.

However, as opposed to the data for autosteer, Variable Rate Technology (VRT) is not used on areas of crop as large as for Autosteer (Table 7.4.1), possibly indicating farmers are still learning how best to use this technology before using it on all of their crop area.

Yield Mapping

Yield mapping can be related to variable rate technology, though can also be used for general monitoring of crop performance, and for use in making decisions about inputs, or even choice of crop for various paddocks. It can give guidance as to further investigations (e.g zoned soil tests) and for us in looking of impediments in soil or the presence of diseases or other factors across a paddock.

It appears that (in general) CT is widely used on larger farms with larger crop areas in the eastern areas of WA and the mallee (Table 7.4.1).

7.5 Integrated pest management

Integrated pest management (IPM) is an environmentally sensitive way of managing pests. It uses a combination of practices and control methods to prevent problems from occurring rather than dealing with them after they have happened. IPM practices include forward planning, regular monitoring and timely decision-making. IPM control methods include (NSW EPA Website):

- **Biological control**, using predators, parasites or microbial pathogens to suppress pests
- **Cultural and physical control**, using methods such as barriers and traps; adjusting planting location or timing; or crop rotation and cultivation techniques which expose pests to predation or destroy their food, shelter and breeding habitats
- **Chemical control**, selecting the lest toxic pesticides and using them only when needed as opposed to regular preventative spraying
- **Plant choice**, choosing plant varieties that are resistant to diseases in an area, and matching species to the site
- **Genetic control**, releasing sterilised male insects to decrease the incidence of successful mating of pest species
- **Pheromone control**, using pheromones to monitor insect populations in a crop or orchard.

Table 7.5.1 presents data about the adoption of Integrated Pest Management in the targeted Agroecological zones.

Table 7.5.1: Use of Integrated Pest Management (IPM)

	Avg area of IPM per farm (ha)	% of Farms using IPM
WA Northern	3,422	37.2
WA Central	2,431	45.5
QLD Central	2,718	39.1
NSW ne / QLD se	1,533	37.3
SA-Vic Mallee	2,393	33.3
SA MidNorth/Lower EP	1,369	46.4

Source: Kearns and Umbers, 2010

7.6 Nutrient budgeting and soil testing

Nutrient budgeting

When grain is harvested from the paddock, nutrients are removed with the grain. If, over time, more nutrients are removed than are replaced (via fertilizer) then the soil fertility of the paddock will fall. Nutrient budgeting is a simple way to calculate the balance between nutrient removal (via grain) and nutrient input (via fertilizer) (GRDC, 2008). More information on nutrient budgeting can be found in the GRDC 2008 Grains Legume Handbook.

Soil testing

Soil testing provides an understanding of the fertility profile and is a vital step in making informed fertiliser decisions. Addressing low subsoil phosphorus (P) levels by soil testing and deep placement of P can bring yield increases across multiple cropping seasons.

- After decades of consistent phosphorus (P) application, many soils now have adequate P status.
- Before deciding on a fertiliser strategy, use soil testing to gain a thorough understanding of the nutrient status across the farm.
- If the soil P status is sufficient, there may be an opportunity for growers to save money on P fertiliser by cutting back to a maintenance rate.
- Consider other factors; if pH ($CaCl_2$) is less than 4.5, the soil is water repellent or root disease levels are high, then the availability of soil test P is reduced and a yield increase to fertiliser P can occur even when the soil test P results are adequate.
- Work with an adviser to refine your fertiliser strategy.
- Phosphorus (P) reserves have been run down over several decades of cropping.
- Adding fertiliser to the topsoil in systems that rely on stored moisture does not always place nutrients where crop needs them.
- Testing subsoil (10 to 30 centimetres) P levels using both Colwell-P and BSES-P soil tests is important in developing a fertiliser strategy.
- Applying P at depth (15 to 20cm deep on 50cm bands) can improve yields over a number of cropping seasons (if other nutrients are not limiting).
- Addressing low P levels will usually increase potential crop yields, so match the application of other essential nutrients, particularly nitrogen (N), to this adjusted yield potential.

It is estimated that about 50% of agricultural land has a surface soil pH less than or equal to 5.5, which is below optimum for extremely acid-sensitive agricultural crops, and below the optimal level to prevent subsoil acidification (National Land and Water Resources Audit, 2001). Where soil acidity moves further down the soil profile, damage may be irreparable. Very acid soils are unlikely to support good ground cover, increasing the risk of soil loss through wind and/or water erosion and reducing input soil carbon. About 36% of Australia's cropping land has been identified as having a high risk of soil acidification, 17% at moderate risk and 47% at low risk (Table 7.6.1). Areas at high risk are where the soil pH is currently low, the soil has a low capacity to buffer against pH decreases, and the dominant (current and/or past) agricultural practices are highly acidifying. Regular testing of soil pH and applications of lime and/or dolomite can be used to manage surface soil pH. Tables 7.6.2 and 7.6.3 present data on the adoption of soil testing on farms in the targeted AE zones. Testing soil nutrient levels to better match fertiliser applications to crop requirements can also help slow soil acidification (Barson et al., 2012).

Table 7.6.1: Estimated percentage of cropping area at risk of soil acidification.

	Low risk	Moderate risk	High risk
WA	8%	8%	84%
QLD	60%	23%	17%
SA	68%	25%	7%
VIC	69%	19%	12%

Source: Barson et al., 2012

Table 7.6.2: Adoption of soil testing (ST) on grain farms

	Avg Area per farm soil tested	% of farms using ST
WA Northern	4,339	74.4
WA Central	2,818	80
QLD Central	5,076	34.8
NSW ne / QLD se	1,718	62.7
SA-Vic Mallee	2,091	54.4
SA MidNorth/Lower EP	985	53.6

Source: Kearns and Umbers, 2010

Table 7.6.3: Adoption of Soil Testing on grain farms: average area soil tested per farm and % of farms, doing soil testing annually, 2-yearly and 3-yearly

	% ha annual	% farms annual	% ha 2 yrs	% farms 2 yrs	% ha 3 yrs	% farms 3 yrs
WA Northern	27.6	34.3	13.4	18.8	18.6	21.9
WA Central	31.1	31.3	19.8	14.4	24.4	30
QLD Central	15	37.5	28.2	37.5	27.2	12.5
NSW ne / QLD se	38.9	33.3	23.5	25.3	26.1	25.3
SA-Vic Mallee	48.5	33.7	15.2	19.4	18.8	23.5
SA MidNorth/Lower EP	37.6	38.5	3.6	5.8	10.4	13.5

Source: Kearns and Umbers, 2010

Table 7.6.4 shows the extent to which soil tests are used as a basis for fertiliser application, i.e., how much of the crop has a fertiliser program designed using the soil test results for guidance.

Data is presented showing the extent of the adoption of this practice in terms of the percentage of farms doing this, the area these represent and the % of crop area of these farms, expressed as a comparison with the average area of crop in the whole dataset.

These data show about 60% of farms were matching their fertiliser plans with the results from soil tests. Further, that where they do, this it is done on the majority of the crop area of the farm. Looking at the average crop area where this is done, the area where this practice is done exceeds the average crop area of the dataset, suggesting that these farms are larger in cropping terms, and are matching their fertiliser use to soil tests on most or all of their crop area.

Table 7.6.4: Use of soil testing to inform fertiliser practices, average area (ha) per farm and % of farms

	Avg Area per farm	% Farms using fert match
WA Northern	5,582	70.9
WA Central	3,516	76
QLD Central	7,599	26.1
NSW ne / QLD se	2,249	57.6
SA-Vic Mallee	2,877	48.3
SA MidNorth/Lower EP	2,238	45.4

Source: Kearns and Umbers, 2010

It is clear that where soil testing is carried out, it is heavily used to inform fertiliser use and tactics more or less across the cropping area in a general sense.

7.7 Livestock management

It is common knowledge that many (or most) grain producing farms also have one or more livestock enterprises, mainly either cattle or sheep, or in some cases both cattle and sheep.

About one quarter of grain farms have cattle and two thirds have sheep (Table 7.7.1), with 12% having both beef cattle and sheep. Beef cattle numbers are higher in the northern Agroecological zones (mainly Queensland), and sheep numbers higher in the southern areas (western NSW, SA, WA, Vic and Tasmania).

Number of farms with cattle, sheep or both, and average number of cattle or sheep per farm with livestock in 2008

	% Farms with Cattle	Avg No Cattle/farm	% Farms with Sheep	Avg No Sheep/farm	% Farms with Cattle & Sheep
WA Northern	10.50%	183	67.40%	2,390	5.80%
WA Central	7.50%	314	87%	5,593	6.50%
QLD Central	69.60%	1,010	0%	0	0%
NSW ne / QLD se	58.90%	580	19.00%	1,921	12%
SA-Vic Mallee	12.80%	134	73.30%	1,475	6.70%
SA MidNorth / Lower EP	13.40%	161	75.30%	2,206	8.20%

Source: Kearns and Umbers, 2010

Proportion of pasture area used for grazing on mixed grain and livestock farms

Another way of looking at livestock on grain farms is to consider the proportion of pasture area on those farms with livestock. These data are shown in Table 7.7.2.

Table 7.7.2: % of pasture area represented by those with cattle, sheep or both in 2008

	% Pasture with Cattle	% Pasture with Sheep	% Pasture shared
WA Northern	8.1	81.3	4.8
WA Central	6.3	95.3	5.9
QLD Central	84.3	0	0
NSW ne / QLD se	88.7	22.4	17.6
SA-Vic Mallee	13.4	89.5	8.8
SA MidNorth / Lower EP	9.8	97.8	8.1

Source: Kearns and Umbers, 2010

The areas of pastures used to support cattle or sheep on grain farms tend to follow a similar pattern as that seen with the number of farms and stock numbers, that is, more pasture is used for cattle in northern Australian and more for sheep in southern AE-Zones. The areas used for sheep approximate about double the areas for cattle as an overall average.

Proportion of mixed grain and livestock farms adjusting stocking rate for Cattle and/or Sheep to optimize ground cover

Analysing actual stocking rates does not provide meaningful information since without knowledge of the feed on offer, and ground cover, any stocking rate may be appropriate, too low or high.

However, the practice of adjusting stocking rate to match both feed on offer and ground cover is seen as a good practice from both productivity and environmental management viewpoints, since it considers both the livestock and the soil and pasture resource.

Table 7.7.3 shows the data for numbers and percentages of grain farms with livestock that are adjusting stocking rates of cattle and sheep as informed by an assessment of feed and ground cover.

Table 7.7.3: % of grain farms with cattle or sheep where stocking rate is adjusted in light of feed and ground cover in 2008

	% of Cattle farms adjusting stocking rate	% of Sheep farms adjusting stocking rate
WA Northern	44.4	72.4
WA Central	53.3	77
QLD Central	75	0
NSW ne / QLD se	84.9	83.3
SA-Vic Mallee	69.6	75.8
SA MidNorth / Lower EP	53.8	68.5

Source: Kearns and Umbers, 2010

It is apparent that over half of all grain farms with livestock have adopted this practice, with levels over 80% in some AE-Zones, notably in northern NSW and QLD, and also on sheep farms in WA and much of the southern AE-Zones. More information about stocking rate and intensity can be found in GRDC, 2010b.

7.8 Managing biodiversity

The farming practice of managing biodiversity includes establishing or maintaining areas of native and permanent vegetation on farmland; fencing off areas to protect waterways, trees, and native vegetation; replanting native vegetation; and taking land out of production.

A survey by ABS from 2006-07 identified that 94% of Australian farms employed natural resource management practices to prevent or manage weeds, pests, land and soil. 65.8% of the land managers reported that they had improved their natural resource management practices during 2006-07. Reasons for this are reported to be: to increase productivity (reported by 89% of farmers), achieve farm sustainability (88%) and to improve environmental protection (75%). Moreover, 63% of the farmers reported making one or more land management changes over the last 5 years to address land and soil related problems on their farm land (ABS Website).

7.9 Water budgeting

Water budgeting includes testing of soil moisture (pre-planting and in-crop) for Plant Available Water content (PAW) and the identification of practices that assist with optimising Water Use Efficiency (WUE) of plants, including crop yields, planting and harvest date.

Water Use Efficiency is an indicator of how effectively or efficiently crops use the water available (i.e. rainfall and stored soil moisture) in producing grain. It is commonly expressed in kg of grain produced per mm of available moisture. WUE can be influenced by a range of factors including several management practices available to grain producers, these include many agronomic and crop management practices such as the prevention and management of weeds, lower plant density, dry-period irrigation, etc.

Assessment of soil moisture at planting to assist crop decisions

In partnership with knowledge of soil moisture trough the crop season, assessing soil moisture at planting can assist with strategic decisions, including the application of in-crop fertilizer (mostly nitrogen), pesticide or herbicide application and irrigation requirements.

Table 7.9.1 shows that assessing soil moisture at planting is practiced more in SA and Queensland compared to WA. This is likely due to differences in soils and climate. Soils in SA and Queensland are known to store more moisture compared to soils in WA. Moreover, rainfall in WA tends to be received over the growing season, rather than before planting, reducing the need for soil moisture assessment at planting (Kearns and Umbers, 2010).

Table 7.9.1: Average % of crop where soil moisture is assessed at planting and % of farms using this practice

	% of crop assessing PAW at planting	% of farms assessing PAW at planting
WA Northern	4.9	9.3
WA Central	2.9	4
QLD Central	6.2	8.7
NSW ne / QLD se	32.6	34.2
SA-Vic Mallee	7.5	12.2
SA MidNorth / Lower EP	6.6	7.2

Source: Kearns and Umbers, 2010

8. Corporate farms in Australian agriculture

Australian farms have traditionally been family businesses and passed on from generation to generation. However, the number of family farms is reported to be declining and the average size of farms has increased (Muenstermann, 2013). Between 1971 and 2006, the number of farming families has declined by 46%, from 190,466 to 102,606. In comparison, the corporate farming sector (any agricultural business with an annual income greater than A$2 million) is growing fast. Although overall corporate farms only presented 1.5% of all farms in 2006, the number increased by 55% between 2001 and 2006 (Clark, 2008). By 2011, the number of corporate farming businesses has reached 2,601 (an increase by 44%). Corporate enterprises now make up 1.8% of all farms (Muenstermann, 2013). It is expected that the number of corporate enterprises will continue to increase in the future, mainly in the cropping industry. Research suggests that cropping is the industry where economies of scale are most pronounced, due to the mechanized nature of the industry. Corporate enterprises would be better equipped and have more financial resources to achieve economies of scale (PwC, 2011).

Family corporate farms are mainly found in the grain, pastoral and dairy industries; they are robust businesses with good succession planning and can withstand production variability. Corporate farms are mainly dominant entities in horticulture, cotton, pigs and poultry. Corporations are generally found in areas where there is ample irrigation water.

9. Agricultural commodity prices and outlook

Figures 9.1 and 9.2 reflect prices for Australian agricultural commodities from 2002 to 2011. Most notable for grains is the up rise of prices in 2008, when global food prices increased dramatically. Besides the international market for grains pushing up Australian grain prices in 2008, droughts in eastern Australia in 2007-08 crop season lead to poor harvests, pushing up prices as well. In general, drivers for grain prices in the last decade have been economic growth in emerging markets (mainly China) and the demand for biofuels, which will continue to drive prices in the future (Chavas et al, 2013). Prices for wool are expected to rise steadily in the coming years due to higher economic activity in Western Europe and the EU, lifting consumer demand (ABARE). It is projected that future prices for Australian live cattle are pressured. The outlook for Australia's live cattle industry will largely be determined by the allocation of import permits from Indonesia (MLA Website).

It is expected that climate change will increasingly affect the Australian agricultural sector, which will make production and prices more volatile and will increase production risk (PwC, 2011). Furthermore, volatility in global currency markets contributes to fluctuating prices Australian farmers perceive.

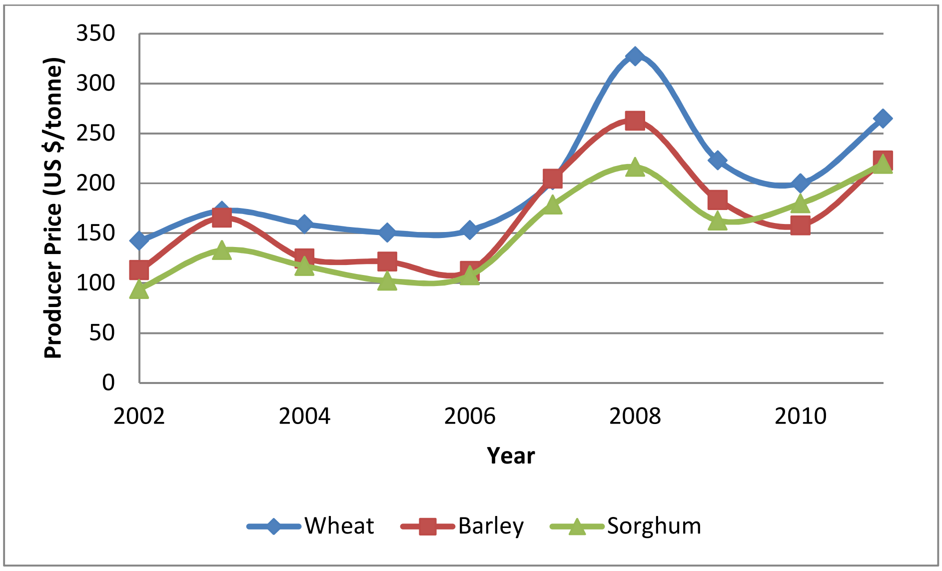


Figure 9.1: Australian wheat, barley and sorghum producer prices, 2002-2011, quantities in US $/tonne

Source: FAOSTAT

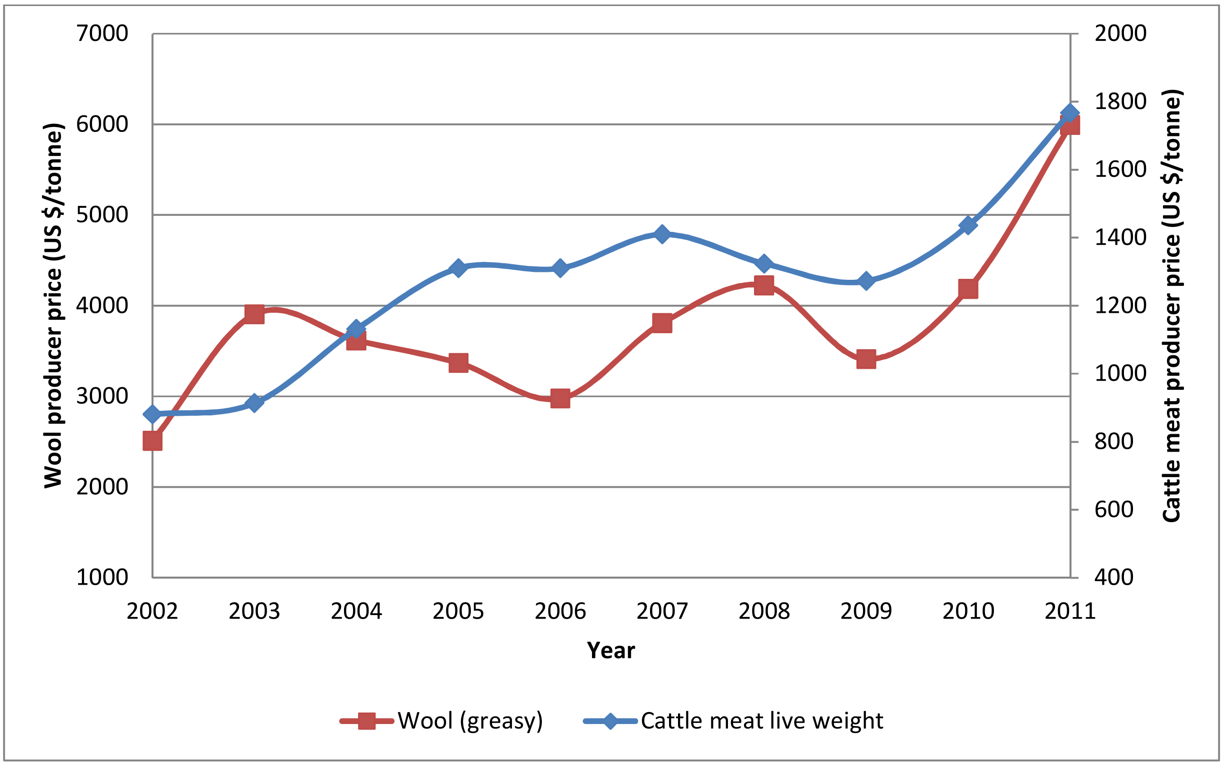


Figure 9.2: Australian wool and cattle meat producer prices, 2002-2011, quantities in US $/tonne
Source: FAOSTAT

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Appendix I - Average number of farms per Agroecological Zone and main crops grown

Table A1: Average number of farms per Agroecological Zone and main crops grown, 2006-07 to 2008-09				
	Specialist grain farms	**Mixed enterprise grain farms**	**All broadacre grain farms**	**Main crops grown**
WA Northern[1]	538 (71%)	217 (29%)	755	Wheat, barley and pulses
WA Central[2]	789 (26%)	2,197 (74%)	2,986	Wheat and barley
QLD Central[3]	102 (24%)	315 (76%)	417	Wheat, grain sorghum and pulses
NSW NE / QLD SE[4]	1,423 (33%)	2,891 (67%)	4,314	Wheat, barley and grain sorghum
SA-Vic Mallee[5]	1,569 (62%)	978 (38%)	2,548	Wheat and barley
SA Mid North Lower York, Eyre[6]	1,354 (54%)	1,136 (46%)	2,490	Wheat, barley and pulses

Sources: [1]) Hooper et al., 2011a [2]) Hooper et al., 2011b [3]) Hooper and Levantis, 2011a [4]) Hooper and Levantis, 2011b [5]) Hooper and Levantis, 2011c [6]) Hooper et al., 2011c

Appendix II - Physical performance benchmarks, 2006–07 to 2008–09, average per farm

Table A2: Physical performance benchmarks, 2006–07 to 2008–09, average per farm

		WA Northern[1]		WA Central[2]		QLD Central[3]		NSW NE / QLD SE[4]		SA-Vic Mallee[5]		SA Mid North Lower York, Eyre[6]	
		SGF	**MEGF**	**SGF**	**MEGF**	**SGF**	**MEGF**	**SGF**	**MEGF**	**SGF**	**MEGF**	**SGF**	**MEGF**
Annual average rainfall	Mm	278	343	340	419	635	628	614	612	288	330	404	427
Total area operated, 30 June	ha	8,770	3,610	3,365	1,974	4,119	7,762	1,547	1990	2,596	1,907	1,327	1,440
Land use intensity (sheep equivalents)	hd/ ha	4.2	4.7	7.4	6.8	7.7	3	7.2	4	7.6	5.8	8.3	5.1
Proportion of land sown to crops	%	33.2	30	56.8	38.8	57.2	9.2	54.7	17.3	60.8	40.9	65.3	32.5
– Wheat	%	78.6	66.9	59.4	46.7	51.5	46.5	49.8	43.9	60.7	55.3	46.1	48.3
– Barley	%	4.1	10.4	21.8	25.2	0.2	2.1	14.3	15	27.8	30.8	31.8	32.6
– Grain sorghum	%					27.5	31.8	19.7	14.5				
– Oats	%							1.7	18.2				
Grain production	t	3,060	1,088	3,009	1,169	4,744	1,115	1,674	422	1,073	471	1,010	405
Number of sheep, 30 June	no.	1,163	2,040	1,906	3,863			122	665	755	1,293	499	1,548
Number of beef cattle	no.	35	227	20	58	411	1,806	115	384	15	41	22	31
Wool production	kg	6,529	8,540	9,055	18,374			555	2,688	3,775	6,294	2,464	8,518
Yields													
Average grain yield	t/ha	1.1	1.1	1.6	1.6	2.1	1.9	2.1	1.5	0.7	0.6	1.4	0.9
– Wheat	t/ha	1.1	1.1	1.7	1.6	2	2	1.7	1.5	0.7	0.7	1.5	0.9
– Barley	t/ha	1	1.1	1.9	1.8	2	0.8	1.5	1.6	0.8	0.7	1.6	1.1
– Grain sorghum	t/ha					2.6	2.5	4	3				

Sources: [1]) Hooper et al., 2011a [2]) Hooper et al., 2011b [3]) Hooper and Levantis, 2011a [4]) Hooper and Levantis, 2011b [5]) Hooper and Levantis, 2011c [6]) Hooper et al., 2011c