Australia and New Zealand

Australia—New South Wales, Victoria, Tasmania, Queensland, Western Australia, South Australia; **New Zealand**

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Regional Background

Agriculture is a vital part of the economies of both Australia and New Zealand. Australia employs some 366,000 people in agriculture (3.4% of workforce) on 130,000 commercial farms over 417 million (M) ha of agricultural land, while New Zealand has around 64,000 farms employing 7% of the workforce. In Australia, grazing land accounts for 87% of agricultural land use, with 16% of land with improved pastures. Around 50 M ha of is used for cropping in Australia and 1.5 M ha in New Zealand. Around 2.5 M ha of crops and pastures are irrigated. Agriculture is undertaken predominately on family farms and contributes about $45 billion (AUD) and $7 billion (NZD) to the economies of Australia and New Zealand respectively. Total factor productivity growth is around 2.5% in both countries over the past 20 years. Both countries are highly geared to export, and producer returns are closely aligned to world market returns.

Australia produces 36 million metric tons (M t) of grains, with wheat (21 M t) and barley (7 M t), which are the main crops with a gross value of $7 billion and $2 billion respectively. Sugarcane, cotton, and viticulture are worth a total of around $3 billion, while other horticultural crops add another $8 billion. The Australian beef, sheep, and dairy industries are largely pasture-based and the gross value of slaughtering is over $9 billion, while dairy products ($2.3 billion) and wool ($2 billion) are also significant industries. Grain and red meat production is highly variable due to seasonal conditions and growers are careful with the allocation of production resources.

The dairy industry, with around 5 million cows, is the dominant agricultural industry in New Zealand, with around 40% ($2.7 billion) of the gross value at the farm gate. Sheep and beef meats make up another 30% of value of production. Grain production is relatively modest at 800,000 t, but the crops are typically intensively managed and high yielding. Horticulture, including fresh fruit and viticulture, are also high value intensive industries focused on quality products.

Both Australia and New Zealand have a strong history of agricultural research and development and have excellent public and private research organizations. Research is world class and funding models most commonly include public and private partnerships, with industry support through compulsory levies on production providing growers with leverage over the strategic and tactical issues addressed. However, declining strategic investment by government(s) have reduced the number of researcher scientists and the number of graduates entering research careers in agriculture.

Table 1 gives the key statistics in terms of production in Australia and New Zealand. Data sets are incomplete for New Zealand and are presented as totals for the country. Australian data is presented for 2010 on a state by state basis. **Table 2** gives the fertilizer consumption figures for Australia and New Zealand. It is clear that over the past decade fertilizer use has declined in both countries. Low water supply for the rice and cotton industry—due to prolonged drought—has seen these two industries decline over the decade. For the other industries, seasonal variations in rainfall have meant high variability in yields.

Table 1. The production (Prod.), areas (A) and average yields for major crops for Australia (2000, 2005 and 2010, and each state 2010) and New Zealand (2002, 2005, 2010).

Commodity	Units	2000	2005	2010	2010						2002	2005	2010
		Australia			NSW	Vic.	Qld	SA	WA	Tas.	New Zealand		
Wheat	Prod., M t	22.1	21.9	21.8	5.4	3.0	1.3	4.0	8.1	0.027	0.301	0.319	0.444
	A, M ha	12.1	13.4	13.9	4.0	1.8	1.0	2.1	5.0	0.007	a	a	0.055
	Yld, t/ha	1.8	1.6	1.6	1.3	1.7	1.4	1.9	1.6	3.8	a	a	8.1
Barley	Prod., M t	6.7	7.7	7.9	1.2	1.9	0.1	2.1	2.5	0.029	0.441	0.302	0.308
	A, M ha	3.4	4.6	4.4	1.0	1.0	0.07	1.0	1.4	0.009	a	a	0.052
	Yld, t/ha	2.0	1.7	1.8	1.3	1.9	1.6	2.1	1.8	3.3	a	a	5.9
Canola	Prod., M t	1.8	1.5	1.9	0.3	0.3	0.001	0.3	1.0	0.002	n.a.	n.a.	n.a.
	A, M ha	1.4	1.4	1.7	0.3	0.2	0.003	0.2	1.0	0.001	n.a.	n.a.	n.a.
	Yld, t/ha	1.2	1.1	1.1	0.9	1.4	0.4	1.4	1.1	1.8	n.a.	n.a.	n.a.
Cotton	Prod., M t	0.7	0.6	0.4	0.2	0	0.1	0	0	0	n.a.	n.a.	n.a.
	A, M ha	0.5	0.3	0.2	0.1	0	0.09	0	0	0	n.a.	n.a.	n.a.
	Yld, t/ha	1.2	1.9	1.8	2.0	0	1.6	0	0	0	n.a.	n.a.	n.a.
Sorghum	Prod., M t	1.9	2.0	1.5	0.6	0	0.9	0	0	0	n.a.	n.a.	n.a.
	A, M ha	0.8	0.8	0.5	0.2	0	0.3	0	.001	0	n.a.	n.a.	n.a.
	Yld, t/ha	2.6	2.7	3.0	3.6	0	2.8	0	0.1	0	n.a.	n.a.	n.a.
Lupins	Prod., M t	0.4	0.9	0.8	0.08	0.03	0	0.07	0.6	0	n.a.	n.a.	n.a.
	A, M ha	0.4	0.8	0.7	0.1	0.04	0	0.05	0.5	0	n.a.	n.a.	n.a.
	Yld, t/ha	1.2	1.1	1.2	0.8	0.9	2.0	1.4	1.3	2.2	n.a.	n.a.	n.a.
Maize	Prod., M t	0.4	0.4	0.2	0.2	0.006	0.1	0	0.004	0	0.149	0.210	0.189
	A, M ha	0.07	0.07	24	0.03	0.001	0.04	0	0.001	0	a	a	0.018
	Yld, t/ha	4.7	5.4	8.4	6.9	6.0	4.0	0	3.7	0	a	a	a
Oats	Prod., M t	1.0	1.3	1.2	0.2	0.3	0.007	0.1	0.5	0.007	0.035	0.029	0.028
	A, M ha	0.6	0.9	0.8	0.3	0.2	0.012	0.1	0.2	0.004	a	a	a
	Yld, t/ha	1.6	1.4	1.4	0.7	1.8	0.6	1.5	1.9	1.8	a	a	a
Rice	Prod., M t	1.6	0.3	0.2	0.2	0	0.002	0	0	0	n.a.	n.a.	n.a.
	A, M ha	0.2	0.05	0.02	0.02	0	0	0	0	0	n.a.	n.a.	n.a.
	Yld, t/ha	9.3	6.6	10.4	10.4	0	0	0	0	0	n.a.	n.a.	n.a.
Sugarcane	Prod., M t	28.1	37.8	31.2	1.9	0	29.3	0	0	0	n.a.	n.a.	n.a.
	A, M ha	0.4	0.4	0.4	0.02	0	0.4	0	0	0	n.a.	n.a.	n.a.
	Yld, t/ha	69.8	87.1	80	100	0	79	0	0	0	n.a.	n.a.	n.a.
Fruit[b]	Prod., M t	1.9	1.2	0.9	0.2	0.2	0.2	0.2	0.05	0.032	a	a	a
	A, M ha	*	*	0.2	0.036	0.04	0.02	0.01	0.007	0.005	0.029	0.031	0.028
	Yld, t/ha	*	*	4.7	9.7	6.8	9.4	12.4	7.1	6.2	a	a	a
Vegetables	Prod., M t	3.4	2.9	2.2	0.2	0.6	0.31	0.5	0.2	0.4	a	a	a
	A, M ha	0.1	0.1	0.2	0.02	0.3	0.034	0.02	0.009	0.02	0.022	0.023	0.023
	Yld, t/ha	26.2	28.3	11.5	13.3	20.3	8.0	30.8	19.3	26.5	a	a	a
Grapevines	Prod., M t	1.5	2.0	1.7	0.4	0.4	0.014	0.7	0.09	0.008	a	a	a
	A, M ha	0.1	0.2	0.2	0.04	0.04	0.003	0.07	0.012	0.001	0.017	0.025	0.033
	Yld, t/ha	10.4	13.2	6.8	10.1	10.8	4.8	9.9	7.3	5.6	a	a	a
Pastures[c]	Prod., M t	**	**	64.3	15.1	5.4	32.4	4.3	6.3	0.749	a	a	a
Hay Prod.	A, M ha	4.7	4.2	1.6	0.4	0.6	0.1	0.2	0.230	0.056	a	a	n.a.
	Yld, t/ha	1.1	1.0	6.5	1,067	2.6	501	1,009	1,032	248	a	a	769
Cattle Milk[d]	No, M hd	2.2	2.1	2.5	0.4	1.6	0.2	0.1	0.1	0.2	3.8	4.1	4.7
Cattle - Beef	No, M hd	27.7	24.7	24.0	5.1	2.1	11.2	0.9	2.2	0.4	4.5	4.4	4.0
Sheep	No, M hd	110.9	101.1	68.1	24.4	14.4	3.6	9.0	14.7	2.0	4.0	4.0	3.3

Notes: *a. New Zealand statistics only give areas, not production. b. Statistics combine area and per-tree data; c statistics incomplete, improved pastures cited; d. Cows in milk only given.*

Table 2. Nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) use in Australia and New Zealand. Australian data is from FIFA and the New Zealand data combined from IFA and Fertresearch statistics.

Commodity	2000	2005	2010	2010						2002	2005	2010
	Australia			NSW	Vic.	Qld	SA	WA	Tas.	New Zealand		
Nitrogen, M t N	1.01	1.01	0.85	0.134	0.121	0.186	0.107	0.279	0.022	0.231	0.311	0.341
Phosphorus, M t P_2O_5	1.01	1.03	0.64	0.136	0.013	0.047	0.092	0.207	0.027	0.457	0.414	0.325
Potassium, M t K_2O	0.20	0.22	0.16	0.006	0.022	0.055	0.022	0.038	0.012	0.126	0.152	0.097

Major Plant Nutrition Issues in the Region

1. There are a great many products entering the market without any substantiation of the benefits they claim. This applies particularly to trace elements and "biological" products. This challenges the scientific foundations of plant nutrition and demands good science to provide growers and advisors with independent evaluations. A key issue is that many scientists who have the knowledge and experience are at or beyond retirement and so there is somewhat of a vacuum in the provision of independent nutrition advice.

2. The use of K in both Australia and New Zealand has been declining over the past decade. There has been little recent research into K nutrition despite its importance in the dairy and sugar industries, as well as in the Western and Northern grain regions.

3. Both Australia and New Zealand have carbon trading systems that will affect agriculture and in particular the use of N fertilizers. There are challenges about measuring and then crediting any changes in nitrous oxide emissions, and there is also a need for tools and decision support systems incorporating these aspects.

4. As growers develop more sophisticated N and P management strategies, there has been a renewed interest in both micronutrient (Cu, B, Zn, Mn, and Mo) and S nutrition of crops and pastures, but diagnostic criteria and management of S deficiency and its interaction with macro- and micronutrients still require research. There is clearly a need to develop strategies to deal with multi-nutrient limitations rather than focus on single nutrients.

5. There are several areas in Australia and New Zealand that are seen as being at risk from nutrient outflows from agricultural activities. There is an incomplete understanding of farm nutrient balances and the 4R's approach is a valuable framework in which nutrient best management practices can be communicated, with improvement in both production and environmental outcomes.

Current Program Activities and Major Outcomes Expected

1. Maintain an active presence at industry meetings promoting the science behind nutrition and continue to assist younger scientists develop relevant and well designed research projects, and to demand rigor in product assessments. Outcome – nutrition addressed as all advisor and grower meetings, development of 4R management guides for major crops.

2. Current project with Canpotex initiated in Queensland that is developing strategies for enhancing subsoil K and P. Outcome – improved diagnosis and treatment of K and P in this region.

3. Continue work on the effects of climate change on wheat and pulse growth and development, including N cycling. Outcome – understanding of the effect of climate change on future nutrient demand.

4. Continue engagement with research groups working on micronutrient and sulfur nutrition, including current PhD student on ammonium sulfate, as well as those developing new soil tests. Outcome – identification of situations where particular nutrient limitations are more likely.

5. Complete Agristats data entry for Australia and compare data from the 1996 survey with the current situation. Outcome – completed data set on nutrient balanced by NRM regions for Australia.

Future Planned Activities and Expected Outcomes

1. Develop a "mythbusters" section of the website that provides easily accessed scientific information about topical issues (eg microbes, N and organic matter, Ca:Mg ratios, trace elements, etc.). Assist with the development of training materials to support fertilizer best management (Fertcare, Better Fertilizer Decisions). Consideration for the development of "apps" for nutrient deficiency diagnosis, fertilizer nutrient comparisons and accessing critical values would provide leverage for current knowledge. Outcome – improved sharing of current nutrient management strategies.

2. In collaboration with the dairy industry, nutrient best management practices will be developed – again using the 4R's framework. Outcome – toolbox of nutrient management developed and disseminated to growers and advisors in the dairy industry.

3. In collaboration with UM and UTS, research on nitrous oxide emissions will be upscaled to provide best management practice guides for growers across Australia. Methodologies for assessment need to adhere to federal government agreed protocols. These guides – again drawing on the 4R's - will include the data generated from previous IPNI research on the impacts of elevated carbon dioxide and climate on N cycling. Outcomes – best management guides for nutrient management and N_2O emissions reductions.

4. We are considering a project with the University of South Australia investigating the use of handheld XRF for in-field micronutrient tissue analysis. Outcome – in-field diagnosis of trace element deficiencies.

5. For areas where nutrients are significantly unbalanced, IPNI ANZ will develop a series of 2-4 pagers on nutrient "hot-spots" in the ANZ area and how the 4R's strategy can assist reduce losses of nutrients to the environment (Barrier Reef, Peel Harvey, Gippsland Lake, Murray Darling Basin, Koo-wee-rup Swamp, Tasmania, Lake Taupo). Outcome – reduced nutrient inflows to environmentally sensitive systems adjacent to intensive agricultural production systems.