



IRRIGATION RESEARCH & EXTENSION COMMITTEE

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FOR IRRIGATION CROPPERS

A plan for raising performance of irrigated grains

Paper prepared by

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At a glance

A study of the potential for irrigated grains in the Southern Murray-Darling Basin (SMDB) found:

- Current water use efficiency of irrigated wheat is low. Present average wheat yields of 3 t/ha achieve an Irrigation Water Use Efficiency (WUE) of 10 kg/mm/ha, i.e. yield (kg) divided by irrigation water (mm).
- Irrigated wheat has an impressive potential for improvement to 22 kg/mm/ha when yields are 10.4 t/ha - a figure being achieved in variety trials and by some farmers.
- There is a sense of urgency to lift productivity and profitability of irrigated grains as a response to cut backs in water entitlements and to achieve higher order efficiencies from the use of irrigation water.
- A quantum shift is required to achieve high returns at world's best practice across all of the studied grains. It can be achieved.
- Rationale for the 35 recommendations is of investment in research, extension and education being critical to a closing of the gap between current and potential crop yields. Or expressed as:
- Profitable irrigation farming = Farmers as enthusiastic investors in best practice = A closing of the gap between present and potential yields.
- The four goals of a major irrigated grains investment program for the SMDB are: plant breeding, grain quality, industry relationships and resource sustainability.

Irrigated grain cropping in the Southern Murray-Darling Basin

The focus of the scoping study commissioned by the Irrigated Cropping Forum was to establish the potential for irrigated grain production in the SMDB.

A full listing of crops appears in Table 4: Irrigation enterprises, SMDB. Two markets for grain of growing importance, intensive livestock and biofuels were separately investigated and reported upon.

Assessing yield potential

The present yields of grains were those used by the NSW Department of Primary Industries in their Farm Budget publications.

The potential for achieving higher yields was reviewed at up to four levels.

Yield level 1: Base. Median trial yields selected from trials conducted on 'irrigated' farms¹.

Yield level 2: Measured potential. Six grains that had had their yields calculated under a non-stressed and optimum growing environment.

Yield level 3: Achievable yield. A derived figure obtained by applying to the measured potential a 1% simple interest rise per annum from year of its measurement, e.g. wheat 1993/1994 to 2006.

Yield level 4: Possible yield. Again a derived figure by applying a further 10 years of 1% per annum growth onto achievable yield.

An illustration of the assessment methodology is presented in **Figure 1: Milling Wheat, potential yields**.

Winter cereals

Wheat is the largest crop both in terms of area and production with markets for milling, stock feeds and potentially for ethanol production.

Throughout the 2000s irrigating winter cereals has been a more widespread practice with the emphasis more upon ensuring a harvestable crop than for achieving maximum yield.

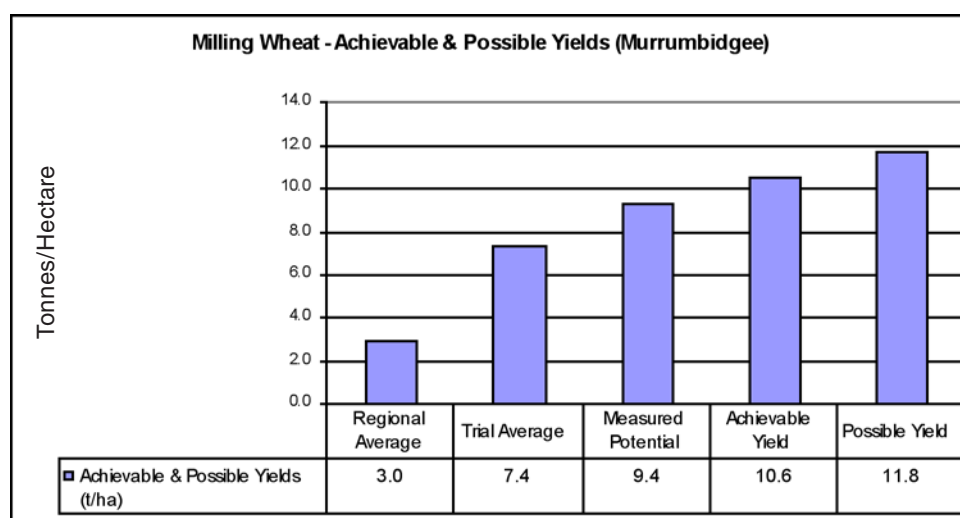


Fig 1. Milling wheat, potential yields

Notes. Regional average is assumed yield across the SMDB. Trial average is the median yield of 14 trials. Measured potential is Lamble and Hutchins assessment of the 1993/1994 Northern Region's wheat crops.

The potential is substantial for an expansion of irrigation of winter cereals arising from markets for AH milling wheat and durum; improvements in irrigation layouts and farmer skill and know-how.

Regional expression of potential

Farmer confidence is a way of expressing potential as measured via larger areas and tonnes of grain.

Present yields and areas, referred to a **Base Model**, and were established within each valley with an example for wheat in **Table 1: Wheat, irrigated present production**

Table 1: Wheat, irrigated present production

Wheat milling	Allocation (ML) ¹	Area (ha)	Irrigation (ML) ²	ML % of Valley	Base tonnes
Total Lachlan Valley	277,252	24,096	72,287	26	72,287
Total Murrumbidgee Valley	1,772,495	122,006	366,017	21	366,017
Total Murray Valley	1,371,967	58,428	175,283	13	175,283
Total Northern Victoria	1,488,314	6,550	19,651	1	19,651
Total Region	4,910,027	211,079	633,237	13	633,237

Note 1. Model allocation of Lachlan 50% allocation of maximum licensed; Murrumbidgee 80%; Murray 90% and Northern Victoria 75%. Note 2. 3.0 ML/ha of irrigation.

Three scenarios were established to represent what might occur when there were improvements in Water Use Efficiency (WUE) and of yields. The three scenarios were: a modest improvement (10% WUE); possible improvement (20% WUE); and real stretch (40% WUE).

At the *modest improvement* scenario summarised in **Table 2: Wheat, irrigated potential scenarios** these are the leading regional impacts relative to **Base model**:

- Irrigation WUE improves by up to 1.61 kg/mm/ha (10%).
- Sown area expands by 42 216 ha. To gain an impression of this increase the present Murray Valley is assessed as growing 58 153 ha a year.
- Milling Wheat's share of the regional irrigation base resource of 4.910 GL rises by 4% to 23.6% (Base of 966 742 ML to 1 160 090 ML in scenario 1).

Table 2: Wheat, irrigated potential scenarios

Scenario	Area (ha)	Yield (t/ha)	Production (t)	WUE Irrigation (kg/mm/ha)
10% WUE + 20% area expansion	253 295	8.14	2 061 820	17.77
20% WUE + 40% area expansion	295 511	8.88	2 624 134	19.39
40% WUE + 100% area expansion	422 158	10.36	4 373 557	22.62
Base potential model of SMDB	211 079	7.40 ¹	1 561 985	16.16

Note 1. Median trial yield of 14 trials conducted on irrigation farms in the Murrumbidgee Valley from 2002 to 2005.

Modelling was undertaken in Excel ® for 21 irrigated enterprises: 13 grains and 9 others (pastures, lucerne, rice, cotton and horticulture).

An illustration of the modelling frame is in **Figure 2: Layout of template for modelled grains**. Grain yield and irrigation water requirements are the major assumptions.

The Southern Murray-Darling Basin

The Southern Murray-Darling Basin includes the potential irrigated 'grain growing' areas of the Lachlan Valley in central NSW the Murrumbidgee and NSW Murray Valleys. Victorian component of the SMDB includes the Shepparton Irrigation Region (Shepparton, Central Goulburn and Rochester Irrigation Areas plus the Murray Valley District [draws water direct from the River Murray]) and the Loddon Region (Torrumbarry and Pyramid-Boort).

The water licences route was selected for establishing a base as to irrigation water in the SMDB.

A SMDB resource of 4.910 GL, referred to as 'base', as per **Table 3: Irrigation water resources, SMDB**.

Table 3: Irrigation water resources, SMDB

Valley	Water resources - surface and groundwater		
	Maximum allocation ¹ (ML)	Long-term average ² (ML)	Dry year ³ (ML)
Lachlan	554 503	277 252	55 450
Murrumbidgee	2 215 618	1 772 495	886 247
Murray (NSW)	1 524 408	1 371 967	457 322
Northern Victoria	2 305 920	1 488 314	977 240
Total ⁴	6 600 449	4 910 028	2 376 259

Note 1. Volume equating to a valley's maximum allocation: 75% for Lachlan and 100% Murrumbidgee, Murray and Northern Victoria, by the end of the season. Note 2. Volume available with announced allocation of Lachlan, 50%, Murrumbidgee, 80% and Murray 90%. For Northern Victoria, Water Right plus 35% sales in Murray and zero sales in the Goulburn Valley. Note 3. Volume arising from an announced allocation for the Lachlan of 10%, Murrumbidgee 40% and NSW Murray 30%. For Northern Victoria, 70% of Water Right, no Sales. Note 4. Groundwater volume available for extraction mirrors that of the respective valley for long-term average and dry year.

The 'dry' year represents the 93 to 100 per cent probability, i.e. for the Lachlan River a 10% allocation can be expected in 93 years out of 100; Murrumbidgee, a 100% probability of a 40% allocation; NSW Murray, a 30% allocation can be expected in 97 years out of 100; and in Northern Victoria achieving a 70% Water Right allocation in 99 years of 100.

Strategic goals

Four strategic goals are proposed for advancing irrigated grains in the SMDB.

1. Plant breeding. Increased productivity to achieve value along the various irrigated grain supply chains.
2. Grain quality. Grain features that match the requirements of users.
3. Industry relationships. Collaboration to achieve partnerships and alliances.
4. Resource sustainability. Programs that achieve continuous improvement and innovation in water efficiency and in maintaining productive soils suited for higher yielding crops.

The achievement of the goals for irrigated grains is seen through actions (Scoping Study recommendations) within three interconnected objectives:

1. Customer value. The application/use of water to grains to achieve higher-end user demand/expectation/value.
2. Biological potential. To put in place bridges whereby present production equals the best trial yields and progressively, as superior genetic material becomes available, move to higher yields.
3. Water Resource Use. To use the water resources in a manner that recognises their scarcity and capacity to generate regional economic value.

Further reading

The report 'Irrigated Grain Crops – a scoping study of southern Murray-Darling Basin' authored by Dennis E Toohy and Stephen J Chaffey, Albury NSW, is available on the Internet at www.irec.org.au.

References

Lamble, C. and Hutchins, N. (1995). Best management practices and benchmarking study, Phase 1. Inland Agricultural Pty Ltd, Nathalia and Hutchins Agronomic Services, Darlington Point. Murray-Darling Basin Commission. Canberra.

Table 4: Irrigation enterprises, SMDB

Modelled grains	SMDB water budget: other 'crop' enterprises
Wheat - milling	Pastures - winter
Wheat - biscuit	Pastures - summer
Wheat - durum	Pastures - Victoria
Winter crops other - Barley and Triticale	Lucerne
Winter pulse - Faba beans and Chick peas	Horticulture
Winter oilseeds – Canola and Safflower	Rice
Summer oilseeds – Soybeans (culinary) and Sunflower	Cotton
Summer pulse - Azuki beans and Mung beans	Vegetables
Summer cereals - Maize	

1	Wheat - milling	Unit	Future Potential				
			Present	Base	Scenario 1	Scenario 2	Scenario 3
1	CWR Rainfall	ML/ha	3.90	3.90	3.90	3.90	3.90
2	CWR Irrigation	ML/ha	3.00	4.58	4.58	4.58	4.58
3	Total CWR	ML/ha	6.90	8.48	8.48	8.48	8.48
4	Crop WUE change scenarios	%	-	0%	10%	20%	40%
5	Yield	t/ha	3.00	7.40	8.14	8.88	10.36
6	Total WUE	kg/mm/ha	4.35	8.73	9.60	10.47	12.22
7	Irrigation WUE	kg/mm/ha	10.00	16.16	17.77	19.39	22.62
8	Change in Production	t/ha	-	0.00	0.74	1.48	2.96
9	Change in Area	%	-	0%	20%	40%	100%
10	Price	\$/tonne	\$150.00	on farm			
11	Achievable & Possible Yields (t/ha)	Year	Regional Average	Trial Average	Measured Potential	Achievable Yield	Possible Yield
		t/ha	3.0	7.4	9.4	10.6	11.8

Figure 2: Layout of template for modelled grains

Note 1. Present situation as sourced from Department of Primary Industries, informed opinion and consultant’s knowledge and experiences.

Note 2. Crop yields from highest yielding variety trials and Crop Water Requirements based upon Griffith NSW.

Note 3. Future potential based upon three scenarios.

Note 4. Crop Water Use Efficiency is yield (kg) divided by total Crop Water Requirements (mm).

Note 5. Irrigation Water Use Efficiency is yield (kg) divided by irrigation water (mm).

Note 6. Farm gate price for grain.

Note 7. Achievable and possible yields: Regional average, Trial average, Measured potential, Achievable yield and Possible yield