



Irrigated winter cereal trials achieve 10 t/ha

Andrew Milgate¹, Neroli Graham¹ & John Lacy²

¹NSW DPI, Wagga Wagga, ²NSW DPI, Yanco

IN A NUTSHELL

- The bread wheat trial at Griffith achieved average yields of 10 t/ha in 2008
- Twenty five triticale and two durum lines achieved over 10 t/ha at all trial sites in 2007 and 2008
- Twenty seven named bread wheat varieties, 457 breeders' lines and 21 international lines achieved over 10 t/ha at either Yanco, Coleambally or Griffith in 2008
- Key traits of lodging and maturity did not have large effects on yield in 2008

We have successfully completed the second season of the High yielding genotypes of winter cereals for irrigated regions of south east Australia project with many lines and varieties in the trials yielding over 10 t/ha in 2008.

The project commenced in 2007 and has another season to run. The project aims to harness the combined forces of all the winter cereal breeding programs in Australia to identify varieties and lines that could potentially be high yielding in the irrigated farming systems of south east Australia.

In this project we are aiming to answer the following questions:

- Can 10t/ha be achieved in south eastern Australia with current released varieties?
- How variable are varieties across the irrigation region of south east Australia?
- Which traits or genetic background within current varieties increase production under high input cereal cropping when compared with dryland cropping?

Table 1. Site details and experiment means for yield and lodging for the 2008 irrigated winter cereal trials

Crop	Location	Total nitrogen (kg/ha)	# of irrigations	Est. water usage (ML/ha)	No. of entries	Site mean yield* (t/ha)	Site mean lodging score**
Barley	Yanco	165	6	4.2	120	8.63	6.9
	Coleambally	112	6	5.7	120	6.23	6.9
	Jerilderie	103	4	5.3	120	5.64	
	Kerang	277	4	5.3	120	5.58	4.6
Triticale	Yanco	165	6	4.2	60	9.60	6.8
	Coleambally	112	6	5.7	60	9.60	4.8
Durum	Yanco	305	6	4.2	100	8.11	6.8
	Coleambally	252	6	5.7	100	8.63	3.7
	Griffith	280	4	5.1	100	8.62	5.2
	Hillston	293	3	3.4	100	7.74	3.4
Wheat	Yanco	305	6	4.2	990	8.56	7.2
	Coleambally	252	6	5.7	990	8.85	2.0
	Jerilderie	293	4	5.3	160	7.50	
	Griffith	280	4	5.1	160	10.55	4.8
	Hillston	293	3	3.4	160	8.35	
	Kerang	315	4	5.3	160	6.78	2.4
	Wagga Wagga		9	2.6	120	6.53	1.1

*Yield calculated using sowing width (Number of tynes multiplied by distance between tynes ie, for W9A08YANA, 8 x 18cm = 1.44 m)

** Lodging score 1-9 scale, where 1 equals no lodging present to 9 completely flat on the ground.



The 2008 season

In 2008, a second season of data was collected for high yielding winter cereal varieties under irrigation across seven sites (Table 1) in southern Australia. Management of the trials was carried out to the formulae John Lacy developed to achieve 10 t/ha grain yield (Table 1). Details of watering and nitrogen regimes for the season can be found in the full published report of this season's results on the GRDC website. The trials were sown from 2 to 21 May 2008 and harvested from 3 December 2008 to 5 January 2009. Reduced nitrogen application to barley and triticale trials was conducted at Yanco and Coleambally trials to limit lodging and reduce protein content in harvested grain. A fungicide regime was followed to prevent the development of any disease in the trials. The results achieved in 2008 were variable (Table 1) reflecting the ability to apply water at the optimal times.

The 2008 assessment

Lodging

The timing of lodging in the 2008 trials reflected the 2007 results with lodging occurring 5–6 weeks after flowering, potentially explaining why little impact over all sites was observed on yield due to lodging. At the Kerang site in 2007 higher levels of

lodging was actually positively correlated with yield. The reason for this was due to the over all lower yield potential of the trial due to poor establishment. In contrast to the levels of lodging recorded at Yanco, the lodging at Coleambally was much lower. This may be a result of the trials at Coleambally being sown on raised beds.

Maturity

Maturity had a mixed effect on yield at individual trial sites in 2008. The barley trial at Jerilderie, triticale at Coleambally and Yanco, and wheat at Yanco and Wagga Wagga showed a positive association between grain yield and maturity; with earlier maturing varieties showing increased yields over later maturing varieties. This was in contrast to the barley trial at Coleambally and Yanco, the durum at Coleambally and Yanco, and the wheat at Coleambally, Griffith and Kerang where maturity of the variety did not influence the grain yield.

Grain yield

At the Coleambally, Griffith and Yanco sites there are 457 breeders' lines that achieved over 10 t/ha, and 27 named varieties and 21 international lines doing the same. These results confirm that 10 t/ha is achievable under close management of inputs to ensure crop performance. These preliminary results

Table 2. The top five performing varieties and breeders lines for yield in combined 2007 and 2008 irrigated winter cereal trials.

Crop	Top 5 varieties				Top 5 breeders' lines			
	Name	Yield (t/ha)	rank in trial	Lodge** (1-9)	Name	Yield (t/ha)	rank in trial	Lodge** (1-9)
Barley	<i>LSD 0.05</i>	<i>1.20</i>						
	Capstan	8.05	3	4.2	WB261	8.39	1	1.5
	Dash	7.76	6	6.0	VB0611	8.18	2	6.4
	Hindmarsh	7.74	7	5.6	WABAR2411	7.96	4	5.6
	Vlamingh	7.64	10	5.7	WI4184	7.77	5	3.9
	Lockyer	7.47	18	7.3	WABAR2315	7.70	8	3.9
Triticale	<i>LSD 0.05</i>	<i>1.60</i>						
	Jaywick	10.75	5	7.8	JRCT101	11.39	1	6.5
	Everest	10.31	17	6.6	TSA0222	11.30	2	6.9
	Tobruk	10.31	18	6.7	TSA0105	11.00	3	4.9
	Kosciusko	10.18	23	5.4	TSA0220	10.99	4	5.1
	Speedee	9.81	31	6.2	TSA0223	10.68	6	6.2
Durum	<i>LSD 0.05</i>	<i>1.20</i>						
	Zulu	9.92	3	5.4	Hazera-13	10.16	1	6.8
	Arivato	9.56	11	3.3	LRD04-0010	10.13	2	2.6
	Bellaroi	9.42	16	4.2	LRD04-0001	9.80	4	4.7
	Kalka	9.41	18	5.3	27A02	9.75	5	4.8
	Yallaroi	8.75	50	6.1	WID22312	9.63	6	5.5
Wheat	<i>LSD 0.05</i>							
	Zebu	9.12	18		VW1192	9.52	1	4.2 [†]
	Yenda	9.05	27	4.9 [†]	VW0398	9.46	2	4.6 [†]
	Derrimut	8.88	51	6.6 [†]	HRZ03_0065	9.44	3	6.1 [†]
	Chara	8.74	83	5.3 [†]	VW1147	9.43	4	4.6 [†]
	EGA Wedgetail	8.63	109	5.3 [†]	VW1194	9.38	5	4.2 [†]

*Yield calculated using sowing width (number of tynes multiplied by distance between tynes ie, for W9A08YANA, 8 x 18 = 1.44 m)

** Lodging score 1-9 scale, where 1 equals no lodging present to 9 completely flat on the ground.

[†]Indicative bread wheat lodging score was calculated from 2007 Yanco and 2008 Yanco trial sites as these were the most lodged sites



support our belief that within the Australian breeding programs there are potential varieties with superior traits for intensive management under irrigation (Table 2).

Table 2 gives the yield performance of the five top varieties and the five top breeders lines, as well as a lodging score. Lodging was measured for all lines and varieties but the ranking of lodging in the trial is not presented in this article.


Variability across sites

High site correlation for grain yield in bread wheat (0.68) trials was observed over all sites in 2007 and 2008, meaning that yields were not influenced by location, with the exception of the 2008 Wagga Wagga trial site. There was lower correlation between trial site and years for grain yield in barley (0.32), durum (0.46) and triticale (0.44), reflecting varietal differences across the sites and years in barley and durum.

Over the duration of the project we will determine a more accurate estimate of how the varieties behave under intensive irrigation management.

Conclusion

Lodging and grain yield scores in wheat, triticale, durum and barley have seen high grain yields with high lodging, high grain yields with low lodging and low grain yields with low lodging. This indicates that these two traits are independent, and can be combined to improve yield and reduce lodging simultaneously.

Breeders' lines within Australian breeding companies show promise for future bread wheat, barley, durum and triticale varieties under high input crop management packages in the irrigated areas of south eastern Australia. Yields over 10 t/ha are achievable with current named varieties using a crop management package of timed water and nitrogen applications, as formulated by John Lacy, NSW DPI. 

Acknowledgement

This project is funded by GRDC and managed by the Irrigated Cropping Forum and NSW DPI. Site hosts are also acknowledged: Yanco Agricultural Institute (NSW DPI), Coleambally Community Demonstration Farm (Ian Sutherland), Kerang (DPI Vic), Hillston (Graham Horneman), Griffith (Glen and Julie Andreazza), Jerilderie (McCaughey Memorial Institute) and Wagga Wagga (Russell Pumpa).

Further information

Full trial results will be available through the GRDC website: www.grdc.com.au or the contacts mentioned.

*Dr. Andrew Milgate,
NSW DPI, Wagga Wagga
T: 02 6938 1990
E: andrew.milgate@dpi.nsw.gov.au*