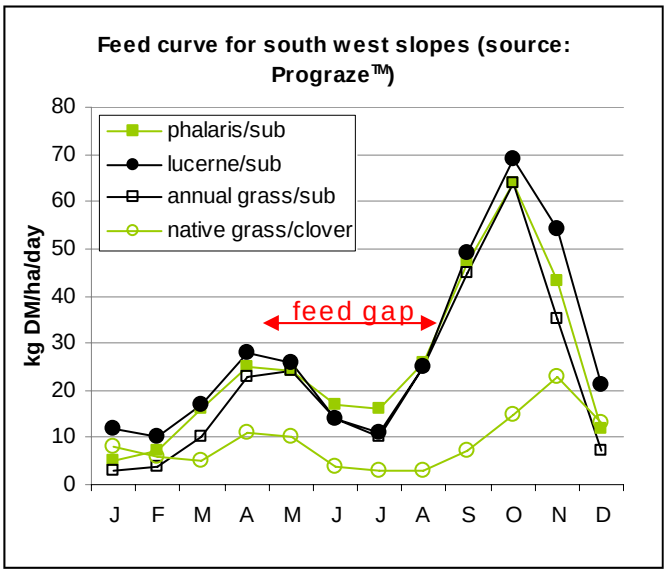
filling the feed gap

Grain & Graze

Balancing the cropping and pasture phases in mixed farming enterprises can be difficult, with one often being traded off against the other. The focus of the Murrumbidgee Grain & Graze project is on identifying profitable rotations that complement both cropping and livestock enterprises, with particular emphasis on producing late autumn/winter feed to fill the feed gap (Fig, 1), without compromising the cropping phase.

Fig. 1 - Typical feed profile for SW slopes



The Murrumbidgee Grain & Graze project is one of 9 across Australia, funded by Meat & Livestock Australia, Australian Wool Innovation, GRDC and Land & Water Australia. All projects are targeted at improving the triple bottom line of mixed farming enterprises. The Murrumbidgee project, of which FarmLink is the host agency, also involves NSW DPI, CSIRO, Charles Sturt University and the Murrumbidgee Catchment Management Authority. The project began in 2004 and will conclude in 2008.

There are 3 modules to the Murrumbidgee project:

1. R&D module - replicated trials looking at grazing wheats and short term pastures as rotation options for filling the feed gap (began in 2004 - results presented in this report)
2. Focus farms - monitoring the productivity of mixed farming systems and their impact on the natural resource base on 5 farms across the catchment.
3. Communications - including fact sheets, field days and workshops on issues relevant to mixed farmers, eg. fodder budgeting.

The treatments - grazing wheat trials

Agronomy trials:
3 sites
Yerong Creek, Marrar, Grenfell

3 sowing times
S1 - early/mid May, S2 - late May, S3 - early June (varies with site)

6 varieties

Lorikeet	Whistler
Mackellar	Wylah
Marombi	+ Wedgetail ungrazed (S2)
Wedgetail	+ Diamondbird (S2)

Additional animal preference trial:
1 site
Marrar

1 sowing time
27th May

6 varieties
as for main trial

Additional liveweight trial:
1 site
Marrar

1 sowing time
27th May

3 varieties
Whistler, Wylah, Wedgetail

General comments:

- wheat growth rates in winter 3-4 times that of perennial pastures
- Whistler, Wedgetail & Lorikeet showing benefits for early dry matter production, regardless of sowing date
- late rain favoured Marombi yields
- economics show advantage for grazing wheats, particularly those with higher dry matter production

Grazing wheat agronomy trial at Marrar (16th July 2004)

Acknowledgements: Guy McMullen (NSW DPI), Hugh Dove (CSIRO), Warren Bond (CSIRO), Jim Virgona (CSU).

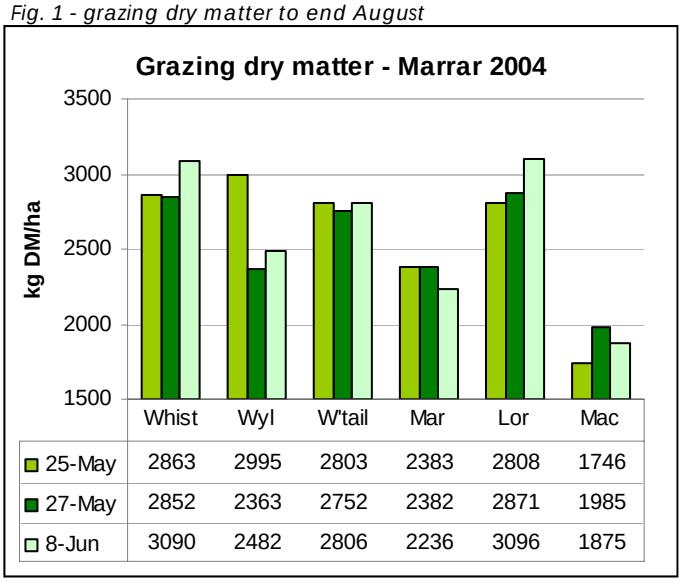
filling the feed gap

Marrar grazing wheat trial - agronomy

Despite late sowing, the Marrar trial produced an average of 2.6t dry matter/ha up until the end of August, and yielded an average of 2.6t/ha.

Grazing dry matter (to end August):
Dry matter (DM) between sowing times, particularly S1 and S2, were similar for most varieties as emergence dates were relatively close together (Fig. 1). The exception was Wylah which had a significant reduction in dry matter after the first sowing time. Feed quality was high across varieties (ave. 85% digestibility, 32% crude protein in early August).

Fig. 1 - grazing dry matter to end August

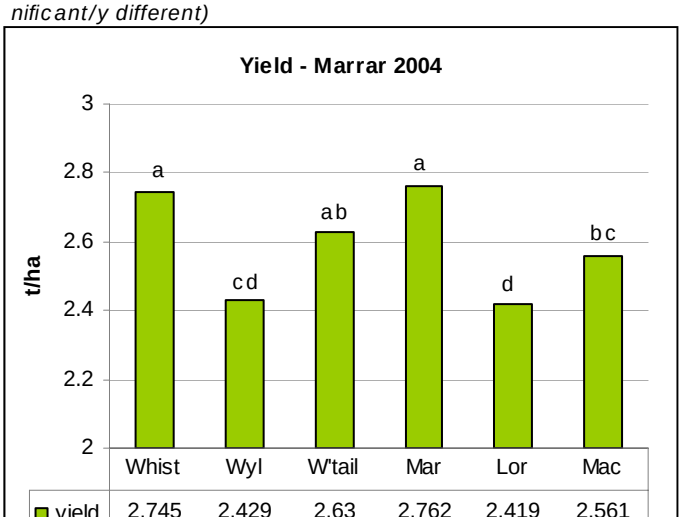


	Whist	Wyl	W'tail	Mar	Lor	Mac
25-May	2863	2995	2803	2383	2808	1746
27-May	2852	2363	2752	2382	2871	1985
8-Jun	3090	2482	2806	2236	3096	1875

LSD = 287.5 kg/ha

Yield:
There was no effect of sowing time on yield, probably due to the similarity in emergence dates and dry season. However there was a varietal effect, with Whistler, Marombi and Wedgetail producing the highest yields (Fig. 2).

Fig. 2 - Yield response across sowing times (same letters not significant/y different)



	Whist	Wyl	W'tail	Mar	Lor	Mac
yield	2.745	2.429	2.63	2.762	2.419	2.561

LSD = 0.14 t/ha

Site Stats - Marrar

Co-operator
John Pattison, "Takada", Marrar

Rotation
2003: lupins

Varieties

Lorikeet	Whistler
Mackellar	Wylah
Marombi	+ Wedgetail ungrazed (S2)
Wedgetail	+ Diamondbird (S2)

Sowing dates
S1: 13th April dry (germinated 25th May), S2: 27th May, S3: 8th June

Deep N test
159 kg/ha

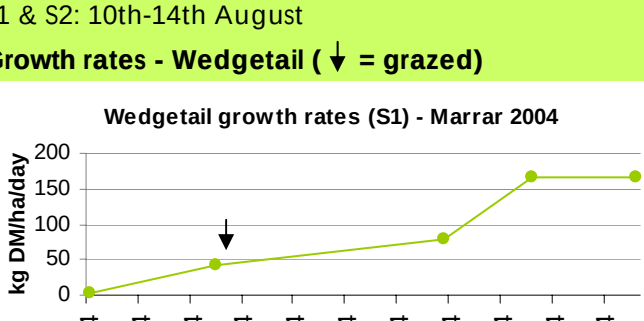
Fertiliser:
100kg/ha MAP with seed, 100kg/ha early Sept

Plant establishment (plants/m²)
S1: 140/m², S2: 170/m², S3: 190/m² (80 kg/ha)

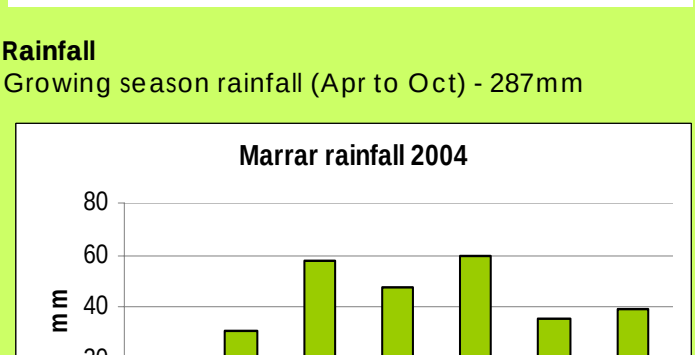
Fungicide:
triadimenol (Baytan) on seed; propiconazole (Tilt) 7/10

Grazing (crash grazed to ~500kg DM/ha):
S1 & S2: 10th-14th August

Growth rates - Wedgetail (↓ = grazed)



Rainfall
Growing season rainfall (Apr to Oct) - 287mm



Marrar grazing wheat trial - agronomy

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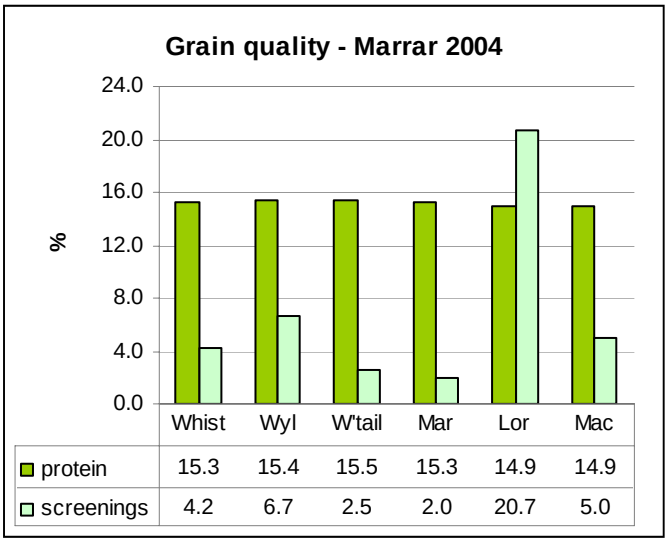
Protein & screenings

Protein was high for all varieties, above 14%. It also increased with sowing time (significantly from S1 to S2). Screenings were variable, ranging from 2% for Marombi to 21% for Lorikeet.

Fig. 3 - grain quality across sowing times

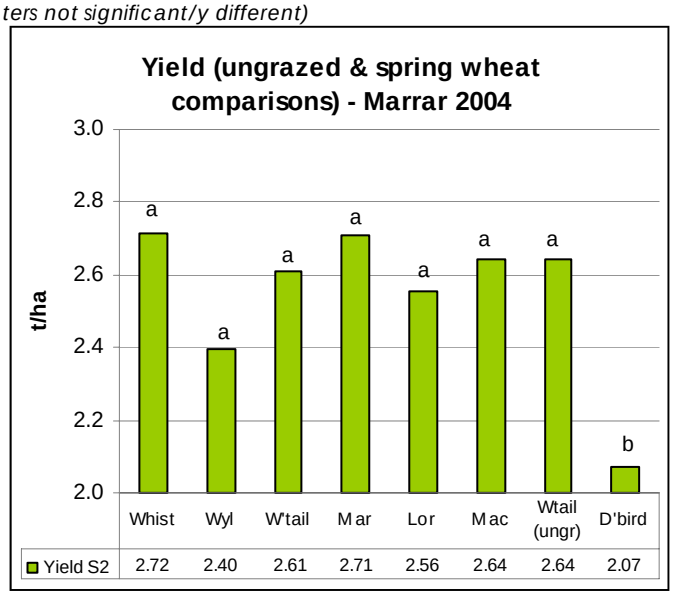


LSD (protein) = 0.4%, LSD (screenings) = 2%

Ungrazed comparisons (2nd sowing - 27th May)

There was no significant yield difference between all grazed winter wheats and the ungrazed winter wheat (Wedgetail). However the spring wheat comparison (Diamondbird) yielded significantly less than the winter wheats (Fig. 4).

Fig. 4 - ungrazed & spring wheat yield comparisons (same letters not significant/y different)



LSD = 0.36 t/ha

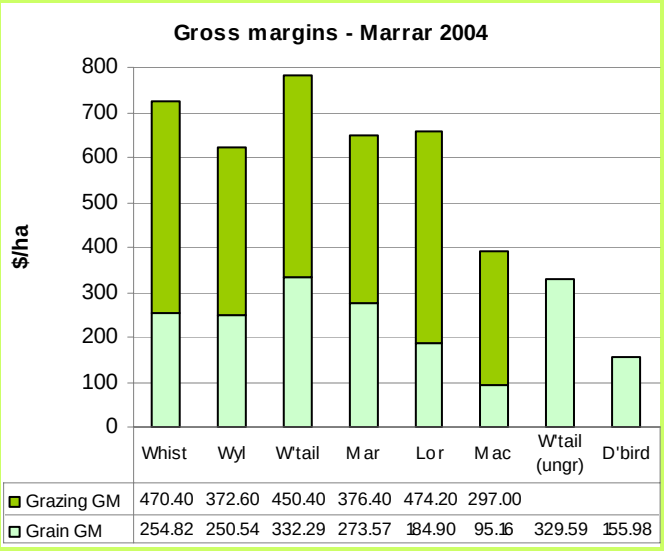
Economics

The gross margins in Fig. 5 below were calculated from yields and grazing dry matter results of the 2nd sowing time, allowing comparison between grazed vs ungrazed winter wheats vs spring wheat.

All grazed wheats gave better returns than the ungrazed comparison (Wedgetail), which in turn was better than the spring wheat (Diamondbird).

Returns were higher in grazing wheat varieties which produced more grazing dry matter (eg. Whistler, Wedgetail), despite other varieties producing equal or higher yields, (eg. Marombi). There was also an advantage to growing the Prime Hard Wedgetail over the ASW Whistler, despite Wedgetail having lower yield and grazing dry matter (note in this trial no additional urea was required to achieve Prime Hard so costs were the same).

Fig. 5 - gross margins (ungrazed & spring wheat comparisons)



The following assumptions were made in the gross margin analysis:

- liveweight gain calculated using a feed conversion ratio of 8
- liveweight gain valued at $1.60/kg
- grain variable costs valued at $275/ha
- grain income calculated from Golden Rewards Sept 04

Summary of results

grazing dry matter - Whistler, Wedgetail and Lorikeet produced the greatest grazing dry matter regardless of sowing time

yield - Whistler, Marombi and Wedgetail produced highest yields

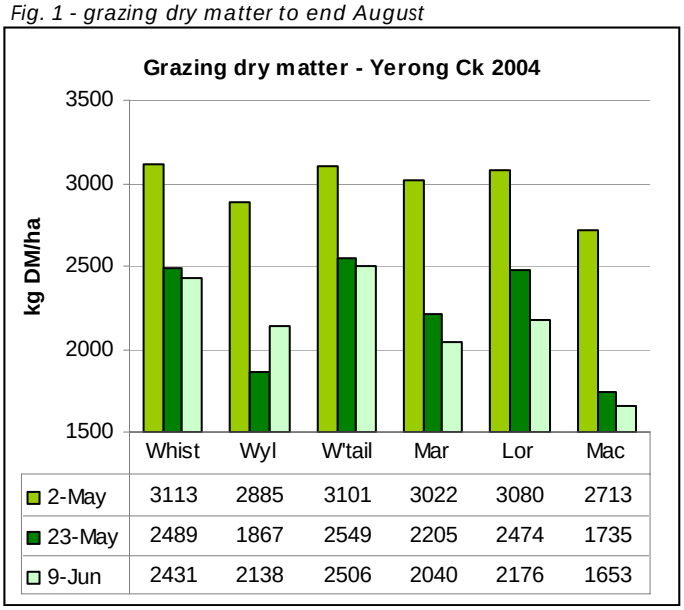
economics - grazed wheats gave greater returns than ungrazed (including spring wheat comparison). Grazing dry matter had a bigger impact on returns than yield.

Yerong Creek grazing wheat trial - agronomy

The Yerong Creek trial produced an average of 2.5t dry matter/ha up until the end of August, and yielded an average of 3.3t/ha.

Grazing dry matter (to end August):
Dry matter (DM) was significantly higher at the 1st sowing time, declining with sowing date (less of an effect in Whistler and Wedgetail). Whistler, Wedgetail and Lorikeet generally produced greater dry matter and Mackellar least. Feed quality was high across varieties (ave. 81% digestibility, 28% crude protein in early August).

Fig. 1 - grazing dry matter to end August

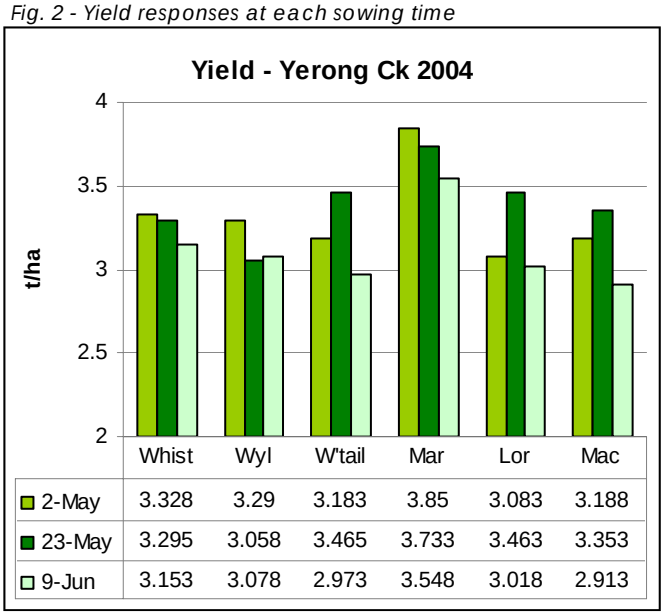


	Whist	Wyl	W'tail	Mar	Lor	Mac
2-May	3113	2885	3101	3022	3080	2713
23-May	2489	1867	2549	2205	2474	1735
9-Jun	2431	2138	2506	2040	2176	1653

LSD = 359.7 kg/ha

Yield:
Marombi yielded highest at all sowing times (Fig. 2). Yields of other varieties varied with sowing time, with differences usually less than 0.5t/ha.

Fig. 2 - Yield responses at each sowing time



	Whist	Wyl	W'tail	Mar	Lor	Mac
2-May	3.328	3.29	3.183	3.85	3.083	3.188
23-May	3.295	3.058	3.465	3.733	3.463	3.353
9-Jun	3.153	3.078	2.973	3.548	3.018	2.913

LSD = 0.34 t/ha

Site Stats - Yerong Creek

Co-operator
Peter & Mark Yates, "Barwon South", Yerong Creek

Rotation
2003: canola

Varieties

Lorikeet	Whistler
Mackellar	Wylah
Marombi	+ Wedgetail ungrazed (S2)
Wedgetail	+ Diamondbird (S2)

Sowing dates
S1: 13th April dry (emerged 2nd May), S2: 23rd May, S3: 9th June

Deep N test
250 kg/ha

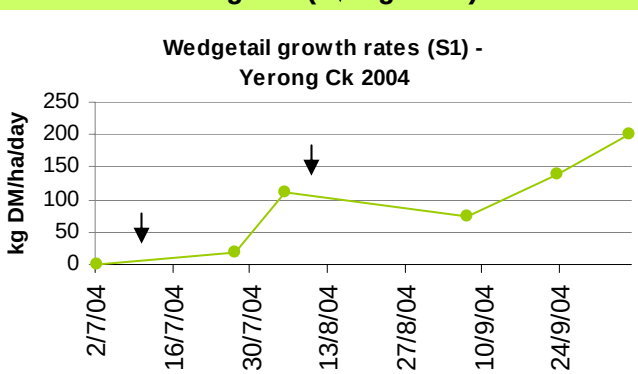
Fertiliser:
100kg/ha MAP with seed, 80kg/ha early Sept

Plant establishment (plants/m²)
S1: 140/m², S2: 160/m², S3: 180/m² (80 kg/ha)

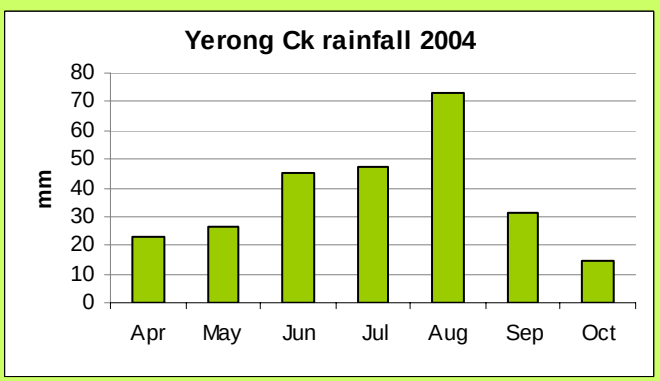
Fungicide:
triadimenol (Baytan) on seed; triadimefon (Bayleton) 2nd week October.

Grazing (crash grazed to ~500kg DM/ha):
S1: 10th-13th July, S1 & S2: 10-13th August

Growth rates - Wedgetail (↓ = grazed)



Rainfall
Growing season rainfall (Apr to Oct) - 261mm



Yerong Creek grazing wheat trial - agronomy

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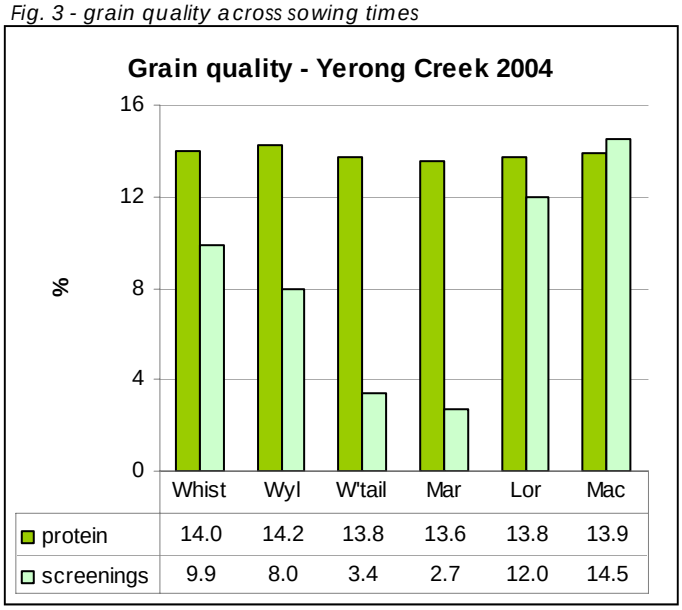
Protein & screenings

Protein was high for all varieties, above 13%, and increased significantly with sowing time. Screenings were generally high, with Wedgetail and Marombi least affected.

Fig. 3 - grain quality across sowing times

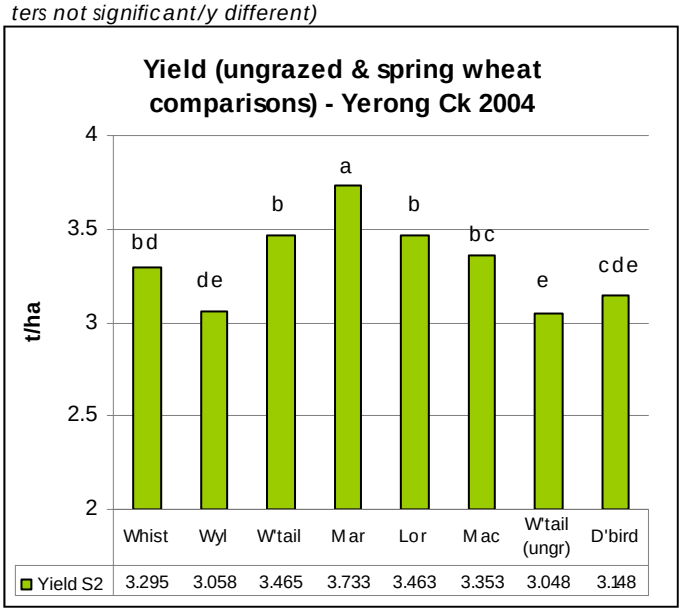


LSD (protein) = 0.3%, LSD (screenings) = 2%

Ungrazed comparisons (2nd sowing - 23rd May)

All grazed winter wheats except Wylah yielded significantly better than the ungrazed winter wheat (Wedgetail). No grazed wheat yielded less than the spring wheat (Diamondbird) but Marombi, Wedgetail and Lorikeet yielded significantly more.

Fig. 4 - ungrazed & spring wheat yield comparisons (same letters not significant/y different)



LSD = 0.24 t/ha

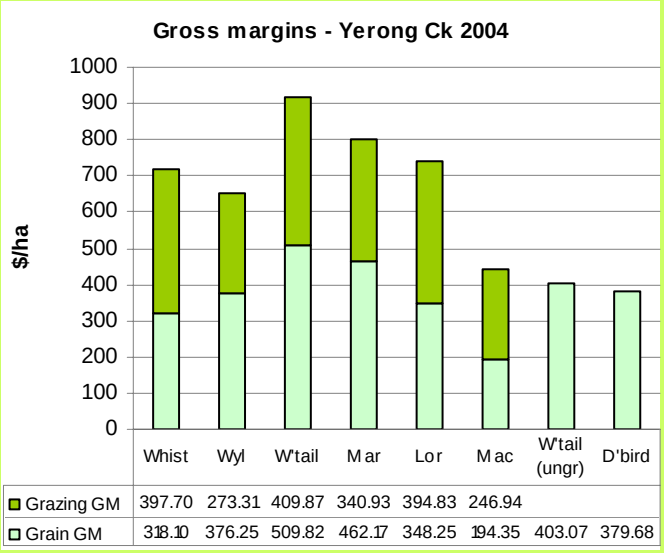
Economics

The gross margins in Fig. 5 below were calculated from yields and grazing dry matter results of the 2nd sowing time, allowing comparison between grazed vs ungrazed winter wheats vs spring wheat.

All grazed wheats gave better returns than the ungrazed comparison (Wedgetail), which in turn was better than the spring wheat (Diamondbird).

Returns were highest for Wedgetail despite a lower yield than Marombi due to its greater dry matter production. It also attracted a Prime Hard premium. However the increased dry matter production of Whistler over Marombi was not enough to make up for its lower yield.

Fig. 5 - gross margins (ungrazed & spring wheat comparisons)



The following assumptions were made in the gross margin analysis:

- liveweight gain calculated using a feed conversion ratio of 8
- liveweight gain valued at $1.60/kg
- grain variable costs valued at $275/ha
- grain income calculated from Golden Rewards Sept 04

Summary of results

grazing dry matter: declined with sowing date. Whistler, Wedgetail and Lorikeet produced the greatest dry matter.

yield: Marombi yielded highest at all sowing times.

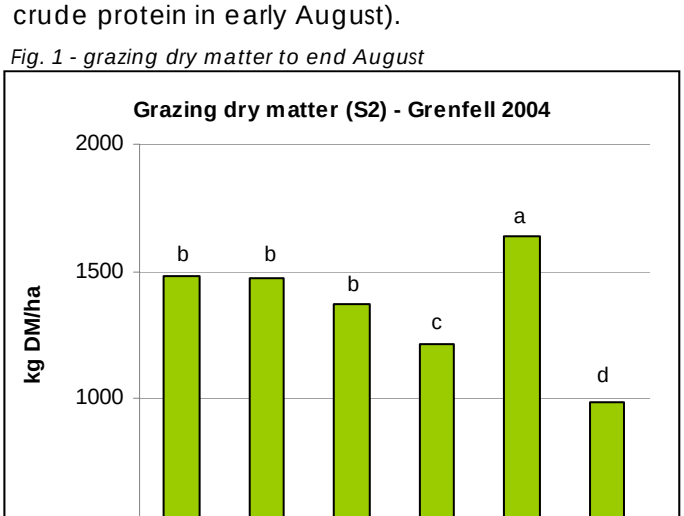
economics: despite higher yield of Marombi, gross margin of Wedgetail was greater due to better dry matter production and Prime Hard premium.

Grenfell grazing wheat trial - agronomy

The first sowing time at Grenfell suffered severe locust damage so results have not been used. Results from the 3rd sowing time are also not presented as it was sown very late to try to avoid locust damage. The 2nd sowing time averaged 1.4t dry matter/ha up until the end of August, and yielded an average of 3.9t/ha.

Grazing dry matter (to end August):
Dry matter (DM) was significantly higher in Lorikeet, followed by Whistler, Wylah and Wedgetail (no difference). Mackellar was lowest. Feed quality was high across varieties (ave. 86% digestibility, 30% crude protein in early August).

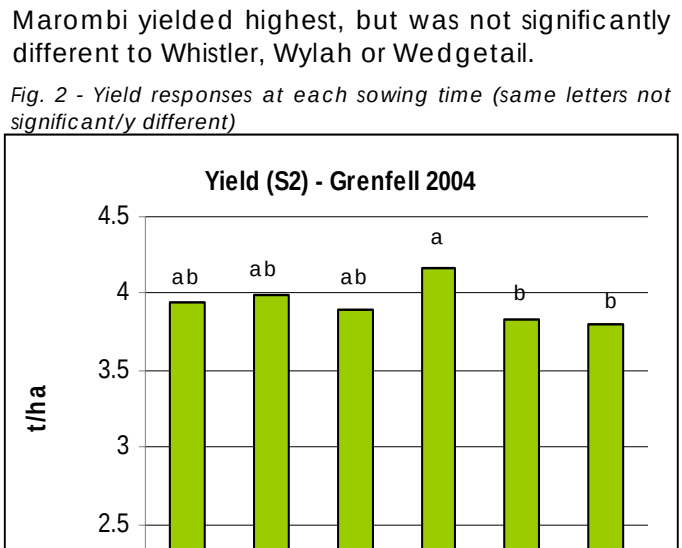
Fig. 1 - grazing dry matter to end August



LSD = 135.5 kg/ha

Yield:
Marombi yielded highest, but was not significantly different to Whistler, Wylah or Wedgetail.

Fig. 2 - Yield responses at each sowing time (same letters not significant/y different)



LSD = 0.34 t/ha

Site Stats - Grenfell

Co-operator
Duncan Lander, "Glenelg", Grenfell

Rotation
2003: canola

Varieties

Lorikeet	Whistler
Mackellar	Wylah
Marombi	+ Wedgetail ungrazed (S2)
Wedgetail	+ Diamondbird (S2)

Sowing dates
S1: 19th April (locust damage), S2: 28th May, S3: 23rd June

Deep N test
216 kg/ha

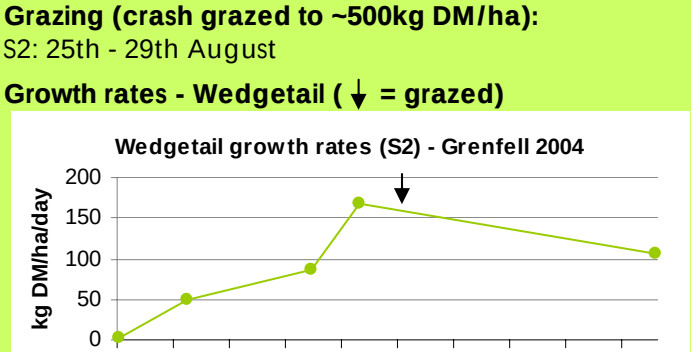
Fertiliser:
100kg/ha MAP with seed, 80kg/ha urea early Sept

Plant establishment (plants/m²)
S2: 150/m² (80 kg/ha)

Fungicide:
triadimenol (Baytan) on seed; 1L/ha (triadimefon) Bayleton 6/10

Grazing (crash grazed to ~500kg DM/ha):
S2: 25th - 29th August

Growth rates - Wedgetail (↓ = grazed)



Rainfall
NA

locust damage in S1 at Grenfell (19th Aug)

Grenfell grazing wheat trial - agronomy

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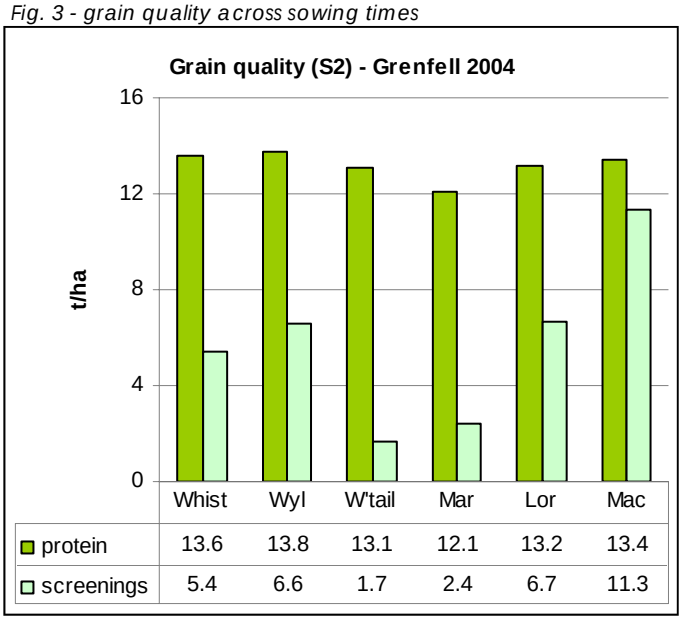
Protein & screenings

Protein was high for all varieties, above 12%. Screenings were variable, ranging from 1.7% in Wedgetail to 11.3% in Mackellar.

Fig. 3 - grain quality across sowing times

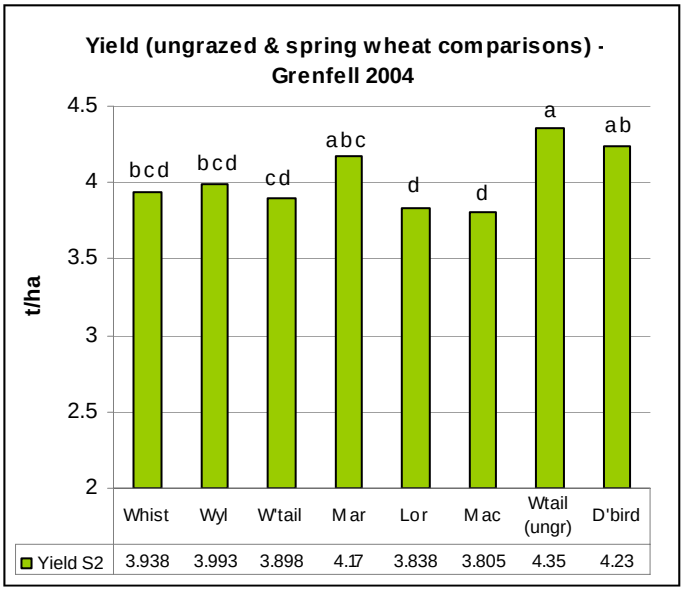


LSD (protein) = 0.6%, LSD (screenings) = 3.3%

Ungrazed comparisons (2nd sowing - 28th May)

No grazed winter wheats yielded significantly better than the ungrazed winter wheat (Wedgetail), but Marombi yielded the same. The grazed wheats also did not yield better than the spring wheat (Diamondbird) but there was no significant yield difference between it and Marombi, Whistler and Wylah.

Fig. 4 - ungrazed & spring wheat yield comparisons (same letters not significantly different)



LSD = 0.30 t/ha

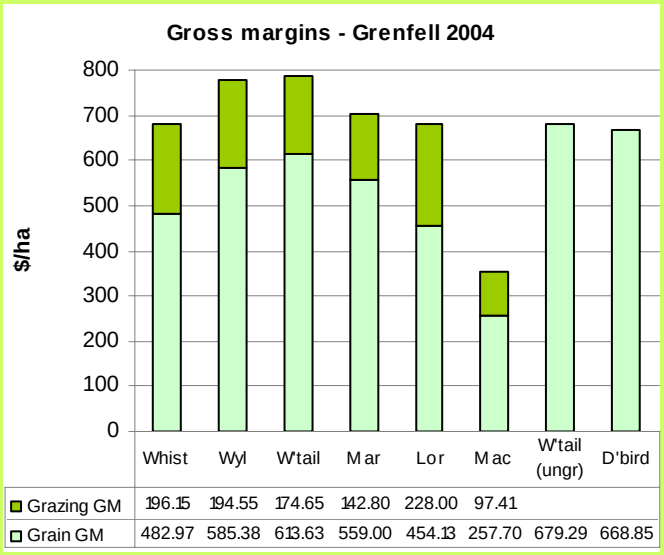
Economics

The gross margins in Fig. 5 below were calculated from yields and grazing dry matter results of the 2nd sowing time, allowing comparison between grazed vs ungrazed winter wheats vs spring wheat.

All grazed wheats except Mackellar gave better returns than the ungrazed Wedgetail comparison (despite lower yields), which in turn was slightly better than the spring wheat (Diamondbird).

As dry matter production was limited in the grazed wheats at this site, yield and to a greater extent quality grade had the biggest impact on gross margins. Wedgetail (APH) and Wylah (AH) returned more than Marombi (ASW), despite Marombi yielding higher.

Fig. 5 - gross margins (ungrazed & spring wheat comparisons)



The following assumptions were made in the gross margin analysis:

- liveweight gain calculated using a feed conversion ratio of 8
- liveweight gain valued at $1.60/kg
- grain variable costs valued at $275/ha
- grain income calculated from Golden Rewards Sept 04

Summary of results

grazing dry matter: Lorikeet produced the greatest dry matter, followed by Whistler, Wylah and Wedgetail (no difference).

yield: Marombi yielded highest, but not significantly different to Whistler, Wylah or Wedgetail.

economics: despite higher yield of Marombi, gross margins of Wedgetail (APH) and Wylah (AH) were greater due to quality premiums and higher dry matter.

agronomy trials - water use

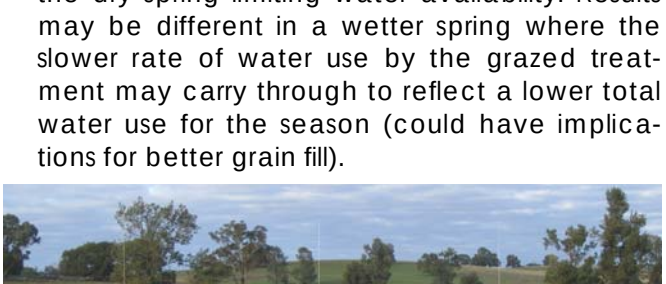
Soil water content was measured at sowing, anthesis and post-harvest at each site to compare water use between a grazed and ungrazed winter wheat (Wedgetail) and a spring wheat (Diamondbird).

Soil water sensors were also installed in the same treatments at the Marrar site to monitor soil moisture movement through the profile on a daily basis. The sensors (Watermark® gypsum blocks*) were installed at 20cm intervals to a depth of 1.6m under the plots. Every 12 hours, data loggers would automatically measure the sensors and 'radio' the results to a receiver in the shed approximately 300m away. The receiver is connected to a small computer with in-built CDMA phone, so the data was dialled in daily to a computer at CSIRO which then uploaded it to a website. Data from the previous day was then available for viewing by 7am. (Data can be viewed at www.clw.csiro.au/MoistureWeb/GrainGraze/).

* *note that the sensors used measure soil water potential rather than soil water content, but still give a useful, low cost method of comparing water movement within the profile.*

A summary of information collected from the sensors in 2004 has been prepared by Warren Bond (CSIRO):

- wetting: winter rainfall only penetrated to an average depth of 0.8m across the plots - no obvious differences between treatments (Fig. 1).
- drying: evidence of strong water extraction by crop roots to a depth of at least 1m, and some extraction to 1.2m, in all plots - no obvious differences between treatments (Fig. 2).
- grazing effect: rate of soil drying (and therefore water use) in the grazed Wedgetail treatment slowed relative to the other treatments at and soon after grazing in August due to reduced leaf area (Fig. 3). However this had little effect on total seasonal water use, probably due to the dry spring limiting water availability. Results may be different in a wetter spring where the slower rate of water use by the grazed treatment may carry through to reflect a lower total water use for the season (could have implications for better grain fill).



left: antennae used to radio data for each treatment from loggers to nearby receiver (Marrar)

Water use - Marrar

Fig. 1 - grazed Wedgetail (Rep 1) showing wetting of profile to 80cm. Note the slight increase in soil water potential at 1m and 1.2m is due to increasing soil temperature, not moisture.

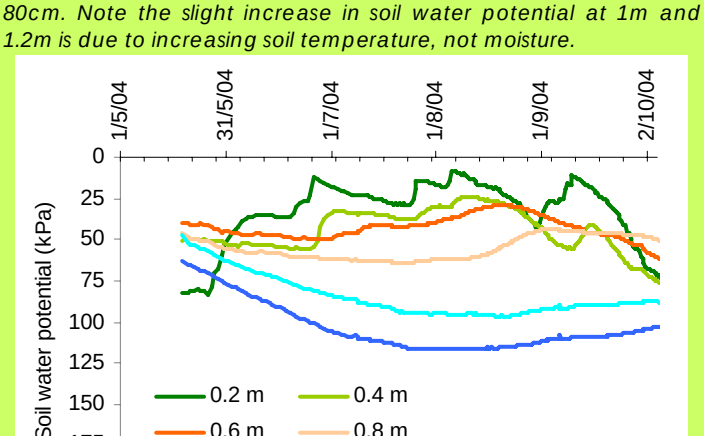


Fig. 2 - extent of drying at each depth

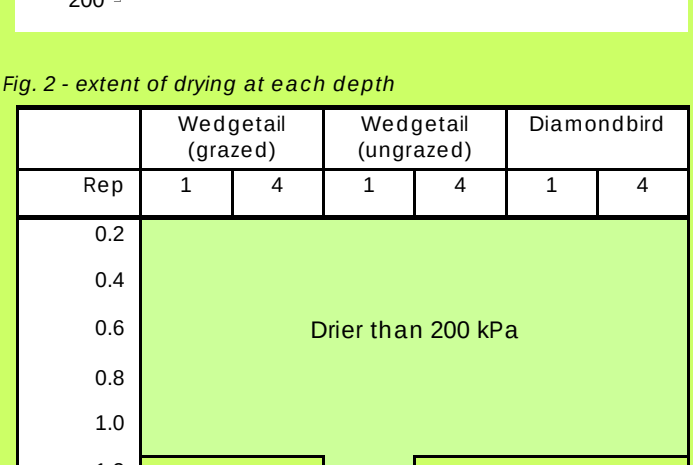
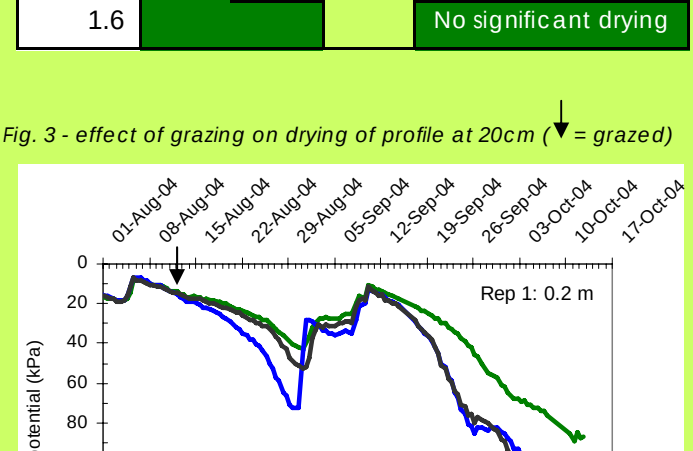


Fig. 3 - effect of grazing on drying of profile at 20cm (↓ = grazed)



Marrar grazing wheat trial - animal responses

Grazing preference:
Lambs were offered equal access to 6 grazing wheat varieties over a 24 hour period. There was no significant difference in preference for any variety.

Fig. 1 - animal preference trial, Marrar

Liveweight and intake:
Liveweight was measured in lambs (starting weight ~35kg) every 10 days for a 20 day period to determine weight gain on 3 different varieties. Animals were also dosed with alkane marker boluses to measure daily feed intake.

Liveweight gain averaged 215g/hd/day, with no significant difference between varieties. There was also no effect of variety on feed intake, averaging 1.25kg/hd/day across varieties (assuming diet contained 100% wheat), or ~3% of liveweight for 40kg lambs.

Fig. 2 - weighing lambs onto the liveweight trial, Marrar

Site Stats - Marrar

Co-operator
John Pattison, "Takada", Marrar

Animal preference trial:
1 sowing time
27th May

6 varieties

Lorikeet	Wedgetail
Mackellar	Whistler
Marombi	Wylah

plots
2.4m x 20m plots, 2 reps

Grazing
grazed with lambs for 24 hour period on 10th August - given equal access to all plots

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Liveweight and intake trial:
1 sowing time
27th May

3 varieties
Whistler, Wylah, Wedgetail

plots
0.2ha plots, 3 reps

Grazing
stocked at 25 lambs/ha (~35kg starting weight) from 10th to 30th August (stocking rate too conservative)

Summary of results
grazing preference: no significant preference differences between varieties
liveweight gain: no difference in liveweight gain between varieties. Averaged 215g/hd/day across varieties.
feed intake: no difference in intake between varieties. Averaged 1.25 kg/head/day, or 3% of liveweight for a 40kg lamb.