Grazing cereals

Kaylene Nuske *(BCG),* ***Dr James Hunt*** *(CSIRO) and* ***Fiona Best*** *(BCG)*

Take home messages

- *Barley produces more feed than wheat at the time of grazing and is nutritionally superior. However, Hindmarsh suffered the biggest yield reduction from grazing (0.32t/ha) but even when grazed still yielded more than all other varieties in the trial. Grazing did not reduce the yield of Buloke barley but it did increase screenings.*
- *Early maturing varieties (Hindmarsh barley, Young and Axe wheat) had the greatest yield penalties when grazed.*
- *Derrimut and Wyalkatchem wheat both yielded well and did not suffer a yield or screenings penalty when grazed. Based on 2009 results, these are the best-bet wheat varieties for grazing in the Mallee.*

Background

Farmer experience and research from grain growing regions with higher rainfall (eg south-east NSW, south-west Vic) has shown that cereals can be successfully grazed prior to GS30 without compromising grain production. The success of dual purpose crops in these regions has driven interest in assessing the suitability of grazing cereals in low rainfall areas such as the Mallee. The adoption of this practice may have several benefits to Mallee farming systems. These include helping to fill the early winter feed gap, reducing lodging in barley, reducing stubble loads and providing a technique for controlling canopy development of crops sown early into paddocks with high available nitrogen (N).

The timing and intensity of grazing cereals early in the season can influence grain yields. Greater yield penalties are likely to be seen where grazing occurs at a later time and at higher intensities. Shorter-season cereals have also had mixed results with higher yield penalties occurring in some years (GRDC 2009). The challenge of adopting this practice is to ensure correct grazing techniques are applied to the most suitable varieties to avoid compromising grain production. Grain crops intended for grazing ideally need to be sown early (last half of April, first week of May) as grazing delays crop maturity by about a week, depending on timing and intensity. Grazed crops also need time to recover. Stock can be introduced to cereal crops intended for grazing at around the 3-leaf (GS13) stage or when plants cannot be tugged from the ground. If a grain yield penalty is to be avoided, stock must be removed before the end of tillering (GS30).

Aim

To assess the suitability of different wheat and barley cultivars for both grain and grazing production in low rainfall environments.

Method

This trial was established at Woomelang. Plots (2.8m x 30m) were pegged out using a complete randomised block design with 4 replicates. The plots were sown on 7 May 2009 to various wheat and barley cultivars. Dry matter production was measured at GS14 just prior to grazing. Feed tests were taken to determine the nutritional value of feed on offer – these tests were used to determine theoretical dry sheep equivalent (DSE) grazing days.

On 23 June 2009, a fence was erected around half of the 4 replicates and 10 lambs were placed inside the grazing treatment area (equivalent to 67 lambs/ha). 4 days later the lambs had grazed the plots down to 1cm in height and were removed on 26 June 2009. Almost 3 weeks after stock removal (15 July 2009), dry matter production was measured at GS30 in both the grazed and ungrazed areas. Dry matter production measurements were repeated during flowering at GS65 (18 September 2009 for ungrazed and 23 September 2009 for grazed) and at crop maturity. Heads were also counted at flowering.

Grain yield was measured using a plot harvester and grain quality analysed (protein, screenings and moisture). Grain yields were corrected to 12% moisture.

Location:	Woomelang
Replicates:	4
Sowing date:	7 May 2009
Seeding density:	150 plants/m²
Crop types:	Wheat (Yitpi, Correll, Axe, Wyalkatchem, Young, Derrimut, CLF_STL)
	Barley (Buloke, Hindmarsh)
Seeding equipment:	BCG cone seeder (knife point, press wheels on 30cm row spacing)
Initial soil fertility:	42.7mg/kg Nitrate, 26mg/kg Colwell P
Fertiliser:	40kg/ha DAP at sowing

Results

Available dry matter at grazing

Prior to grazing at GS14, dry matter production was measured to indicate how much available feed was on offer (Figure 1). The 2 barley cultivars, Hindmarsh and Buloke, produced the greatest amount of biomass. This was more than the Derrimut, CLF_STL and Young wheat cultivars which produced less than 130kg/ha of dry matter each.

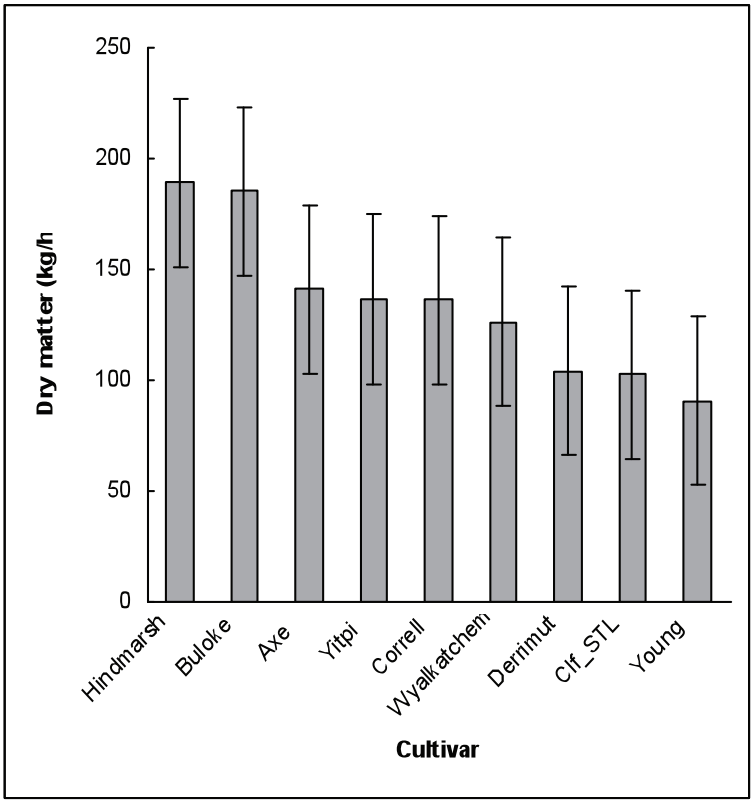

Figure 1. Dry matter (kg/ha) available for each cultivar prior to grazing at GS14. Capped bars represent LSD values showing variation around the mean of 4 replicates.

Nutritional feed values at grazing

Feed tests for each variety determined the metabolisable energy (ME) values for stock prior to grazing at GS14. Consequently, the number of grazing days was calculated assuming one DSE consumes 8MJ/day of dry matter. Hindmarsh and Buloke were the standout varieties, with Hindmarsh having the greatest ME of 2018MJ/ha. This equated to 252 DSE grazing days. The less vigorous variety Young had 700MJ/ha of ME, providing 88 DSE grazing days.

Table 1. Average ME values and corresponding number of grazing days calculated prior to grazing at GS14 (assuming 1 DSE consumes 8MJ/day).

Variety	Average of ME (MJ/ha)	Average of DSE grazing days
Hindmarsh	2018	252
Buloke	1874	234
Axe	1295	162
Yitpi	1318	165
Correll	1281	160
Wyalkatchem	1125	141
Derrimut	875	109
CLF_STL	909	114
Young	700	87
Sig. diff	**P=<0.001**	**P=<0.001**
LSD (P<0.05)	**443.5**	**55.44**
CV%	**24%**	**24%**

Biomass recovery following grazing

Three weeks after stock removal, dry matter production was measured at GS30 for both the grazed and ungrazed areas. Biomass recovery was calculated using the dry matter of grazed treatments expressed as a percentage proportional to the dry matter of ungrazed treatments (Figure 2). Wyalkatchem and Derrimut wheat cultivars recovered the best after grazing, producing comparatively more biomass than the other varieties. Correll and Buloke suffered the highest grazing effect and had less vigorous re-growth proportional to their ungrazed biomass.

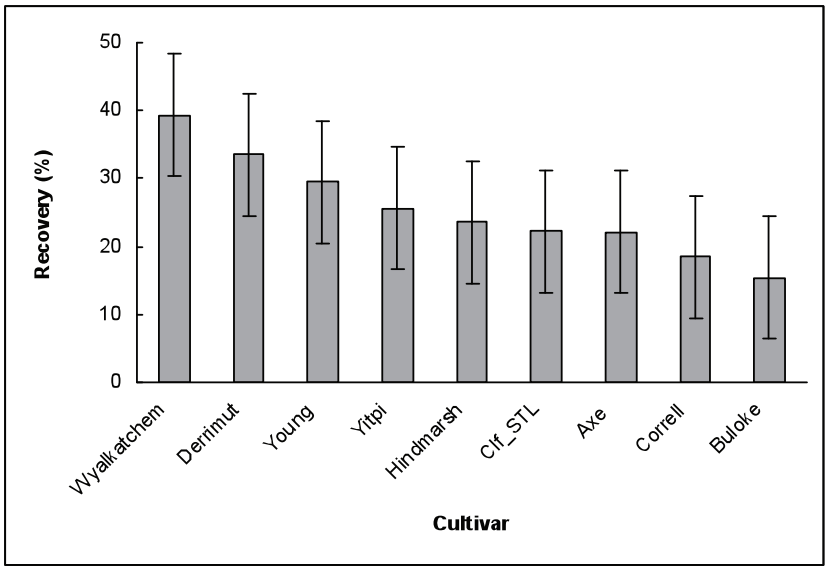

Figure 2. Recovery of grazed cultivars three weeks after stock removal at GS30 (grazed dry matter treatments expressed as a percentage of ungrazed dry matter treatments). Capped bars represent LSD values showing variation around the mean of 4 replicates.

Dry matter measurements at flowering

Dry matter production was analysed at flowering (GS65) which is a key growth stage to determine yield potential. Analysis showed that overall, grazing reduced dry matter by 615kg/ha at flowering and by 624kg/ha at maturity (P=0.002). Differences between varieties showed that barley produced a greater amount of biomass than wheat, with almost 1700kg/ha more produced on average (P=<0.001). However there was no difference between varieties and whether they were grazed or ungrazed (Table 2).

Table 2. Dry matter comparison at flowering (GS65) between ungrazed and grazed treatments 3 months post-grazing.

Variety	Treatment		Difference (DM kg/ha)
	Ungrazed (DM kg/ha)	Grazed (DM kg/ha)	
Buloke	5946	4837	1109
Hindmarsh	5773	5313	460
Yitpi	4536	3516	1020
Correll	4358	3491	867
Wyalkatchem	4264	3932	332
CLF_STL	3944	3360	584
Young	3847	3061	786
Derrimut	3744	3919	-175
Axe	3684	3126	558
Sig. diff LSD (P<0.05) CV%	**NS**		

Grain yield

Yield penalties occurred for 3 varieties (figures bolded in Table 3). The greatest of these was Hindmarsh which had a yield penalty of 0.32t/ha. Even when grazed however, Hindmarsh still yielded higher than all of the other ungrazed varieties.

Table 3. Grain yield for ungrazed and grazed treatments.

Variety	Maturity	Grain yield (t/ha)		Yield penalty (t/ha)
		Ungrazed	Grazed	
Hindmarsh	**Very early**	**2.29**	**1.97**	**0.32**
Young	**Early – mid**	**1.88**	**1.59**	**0.29**
Axe	**Early**	**1.70**	**1.55**	**0.16**
Wyalkatchem	Early	1.88	1.74	0.14
Correll	Mid	1.80	1.69	0.11
Yitpi	Mid	1.58	1.48	0.10
Derrimut	Early – mid	1.83	1.76	0.07
Buloke	Mid – early	1.73	1.75	-0.02
CLF_STL	Mid	1.40	1.48	-0.08
	Sig. diff **LSD (P<0.05)** **CV%**	**P=0.027** **0.16** **6.7%**		

Grain quality

Grain analysis determined that there was no impact on protein between grazed and ungrazed treatments. Screenings however, showed that several varieties (bolded in Table 4) were higher when grazed. The stand-out variety for this penalty increase was Correll which had almost 77% more screenings when grazed.

Table 4. Grain analysis for ungrazed and grazed treatments

Variety	Protein (%)		Screenings (%)	
	Ungrazed	Grazed	Ungrazed	Grazed
Hindmarsh	13.6	14.5	1.9	2.5
Derrimut	12.5	12.5	5.5	5.8
Buloke	14.0	14.4	**2.5**	**5.8**
Wyalkatchem	13.1	13.0	1.8	2.1
Correll	13.5	12.8	**5.3**	**9.4**
Young	12.7	12.6	**3.6**	**5.6**
Axe	13.2	12.6	3.5	4.2
Yitpi	13.6	14.1	4.7	5.2
CLF_STL	14.9	14.4	**1.0**	**4.2**
Sig. diff **LSD (P<0.05)** **CV%**	**NS**		**P<0.001** **1.3** **21.4%**	

Interpretation

Previous research has shown that not all varieties can be grazed without suffering biomass, yield and/or grain quality penalties. It was evident that there were yield reductions in particular cultivars, namely Hindmarsh, Young and Axe (Table 3). These particular varieties are notably earlier maturing than most of the other cultivars in this trial. Due to their shorter growing season, the early maturing varieties did not have enough time to recover from grazing to reach their full yield potential. While Hindmarsh experienced the greatest yield penalty of 0.32t/ha, it still yielded higher than all the other grazed varieties.

Grazing did not have an effect on protein levels. The screenings however, were considerably higher when grazed for Buloke, Correll, Young and CLF_STL (Table 4). Higher screenings may have resulted because there was not enough time for the grains to fill and therefore grain ended up being small and pinched. This effect on screenings must be considered when choosing a variety to graze, as it will have economic implications if screening levels are pushed over the 5% threshold between grading qualities.

Overall, based on 2009 results, Wyalkatchem and Derrimut are the best-bet wheat varieties for grazing in the Mallee. They did not suffer a yield or screenings penalty and were among the highest yielding varieties in this trial. However, Wyalkatchem is not Cereal Cyst Nematode (CCN) resistant so this must be considered in the decision making process. The barley varieties produced more feed than wheat at grazing. Barley forage has adequate sodium and magnesium levels, unlike wheat forage which should be supplemented with a mineral product such as magnesium/sodium supplement (eg 1:1 mix of causmag and sodium chloride (salt)) to prevent sub-optimal livestock growth rates (GRDC 2009). There was no difference in feed value between Buloke and Hindmarsh. Although Buloke did not suffer a yield penalty unlike Hindmarsh, the grazed Hindmarsh still out-yielded ungrazed Buloke. Malt growers should also be careful when grazing Buloke as screenings increased.

Acknowledgments

This project was funded by the Mallee Catchment Management Authority.

References

Grains Research and Development Corporation (2009) 'Dual-Purpose Crops', Fact Sheet: July