# Grazing cereals in the Victorian Mallee 2010

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## Take home messages

- *In 2010, barley and wheat crops provided nutritious fodder for livestock in July.*
- *Early grazing and above average rainfall in spring enabled grazed barley and wheat varieties to recover and maintain yields and quality, regardless of variety or maturity. Buloke barley and Yitpi wheat had the highest feed value and gross income.*
- *Further evaluation of season, time of sowing and grazing is needed to substantiate the practice of grazing cereal crops in the Mallee and Wimmera.*

## Background

Cereal crops offer a potential forage source to fill the late autumn/early winter feed gap. Higher rainfall cropping regions, such as south-west Victoria and south-east NSW, can successfully graze cereals without compromising grain production if stock are introduced after GS13 (3=leaf stage, plants anchored by secondary roots) and are removed before GS30 (stem elongation, emergence of 1st node).

Lower rainfall environments which have more variable spring rainfall, such as upper Eyre Peninsula in SA, often suffer yield penalties but factor in many other system benefits when measuring success, such as the ability to:

- maintain stock numbers at a time when feed availability is low
- defer grazing on volunteer pasture paddocks, allowing medic and other slow growing pastures time to establish and produce more forage before introducing stock
- provide a feed paddock for stock when legume based pasture paddocks are unable to be grazed during withholding periods following grass selective herbicide application
- provide an opportunity to value-add to crops if they have the ability to recover from grazing
- maintain weed control of continuously cropped paddocks and maintain or increase the proportion of cropped land
- reduce lodging in barley and reduce stubble loads
- offer risk management strategies: a back up fodder bank option if pasture feed runs out, or an alternative end-use for a failed crop.

Currently in the Victorian Mallee region there is very little grazing of crops that are intended for grain production (sown late April onwards), particularly wheat. More information is needed about the ability of cereal varieties to recover from grazing in this region, and the response to different seasons.

## Aim

To evaluate the suitability of different wheat and barley cultivars for both grazing and grain production, when sown as part of the normal cropping program in low rainfall zones of western Victoria.

This work follows on from a trial conducted at Woomelang and farmer demonstrations at Rainbow in 2009 (BCG 2009 Research Results, pp 46-51 and pp 52-55 respectively).

## Method

| | |
|---|---|
| Location: | Culgoa |
| Replicates: | 4 |
| Sowing date: | 23 April 2010, resown 2 June 2010 after locust damage |
| Seeding density: | 150 plants/m² |
| Treatments: | (grazed vs ungrazed) x variety |
| Crop type/s: | Wheat: Axe, Derrimut, Correll, Gladius, Lincoln, Yitpi |
| | Barley: Hindmarsh, Buloke, Gairdner |
| Seeding equipment: | knife point, press wheels, 30cm row spacing |
| Rainfall: | Annual GSR 237mm, 2010 GSR 248mm |
| Initial soil fertility: | 34kg/ha total N, 34mg/Kg (Colwell P) |
| Fertiliser: | 50kg/ha MAP (at 1st sowing), resown with 43kg/ha Urea |
| | Top-dressed with 50kg/ha urea on 24 June |

This replicated small plot trial was sown at Culgoa on 23 April following 26mm rainfall for the month. Despite two applications of Alpha-Cypermetherin (a third application was not conducted due to the withholding period risk for grazing), locust damage was so great that the trial had to be sprayed out and resown on 2 June after 19mm, this time with urea only. A seed shortage meant that Urambie barley was replaced by Axe wheat in the second sowing.

Dry matter (DM) production and feed tests were measured at GS13, just prior to grazing. This was used to calculate the potential dry sheep equivalent (DSE) grazing days, calculated as follows:

DSE grazing days = dry matter (kg/ha) – 30kg/ha (physically unavailable DM) x feedtest metabolisable energy (ME) / 8MJ, which assumes that each DSE requires 8MJ/day.

On 6 – 9 July grazed treatment plots were fenced and five ewes (equivalent to 98 DSE/ha) were placed inside for three days, during which time they ate the crop down to 3cm. Once sheep were removed, crops were grown through to harvest. Dry matter was measured during flowering (barley varieties and Axe on 14 October, remaining wheats on 20 October) and again at crop maturity. Heads were also counted at maturity.

Grain yield was measured using a plot harvester (barley on 23 November, wheat on 15 December), and grain quality analyzed. Grain yields were adjusted to 11% moisture for barley and 11.5% moisture for wheat.

## Results

### *Dry matter and feed value at grazing*

Crops were grazed at the 3-leaf stage (GS13), earlier than the trials in 2009 which were grazed at GS14 (June 23), and much earlier than the recommended 1000kg/ha. Though re-sowing meant that crops were sown into colder soil and plant growth was slower, they were well anchored and grazed at this stage in order to fulfil their role of providing an alternative feed source during the early feed gap (late autumn, early winter) and still had time left in the season to recover.

Buloke barley and Yitpi wheat were the two highest feed value cereals (Table 1). Hindmarsh barley performed poorly in feed value, in contrast to last season's trial at Woomelang.

*Table 1. Crop growth of cereal varieties at GS13, 5 July 2010, Culgoa.*

| Crop | Variety | GS13 DM (kg/ha) | ME (MJ/ha) | DSE grazing days |
|---|---|---|---|---|
| Barley | Gairdner | 42.3 | 172 | 22 |
| | Hindmarsh | 36.0 | 85 | 11 |
| | Buloke | 83.0 | 763 | 95 |
| Wheat | Correll | 61.7 | 428 | 53 |
| | Axe | 56.2 | 325 | 41 |
| | Yitpi | 79.0 | 681 | 85 |
| | Gladius | 42.7 | 174 | 22 |
| | Derrimut | 40.0 | 139 | 17 |
| | Lincoln | 46.3 | 214 | 27 |

All crops had high nutritional value with crude protein well above 16% (range 34.2-36.6%), neutral detergent fibre greater than 30% of DM (range 34.2-40.0% of DM), metabolisable energy greater than 11MJ kg/DM (range 12.4-14.4MJ/kg DM) and digestibility above 75% of DM (range 75.9-85.6% of DM), providing nutrition above minimum requirements for lactating ewes and their lambs (McInerney, 2007).

While only 7mm of rain fell after sowing in June, after grazing in July rain fell almost weekly (except a four week spell from 11 September to 6 October) for the next five months, ensuring good soil moisture and conditions for plant recovery.

## *Dry matter at flowering*

Dry matter production at anthesis, a key growth stage to determine grain yield, was on average greater for barley than wheat by 2070kg/ha, but was high across all varieties in 2010. Grazing reduced biomass for barley by 851kg/ha (P=0.062) and wheat by 676kg/ha (P=0.001).

Buloke produced on average 1369kg/ha more biomass than Gairdner and Hindmarsh (P=0.016). For wheat, Axe produced the greatest biomass, but suffered when grazed, as did Gladius and Derrimut (Table 2).

## *Grain yield and quality*

Grain yield was the same for all barley varieties, despite a lower head density for Gairdner at 363 heads/m$^2$ compared with 516 and 536 heads/m$^2$ for Buloke and Hindmarsh respectively. There was no effect of grazing on barley head density or grain production. For wheat, yield differences were measured between varieties (Table 3), but again grazing had no effect on final grain yield. Wheat head density did not vary (average 252 heads/m$^2$).

*Table 2. Dry matter comparison at flowering between grazed and ungrazed crops.*

| Crop | Variety | Grazed DM (kg/ha) | Ungrazed DM (kg/ha) | Difference in DM (kg/ha) |
|---|---|---|---|---|
| Barley | Gairdner | 8042 | 9233 | -1191 |
| | Hindmarsh | 8361 | 8324 | 37 |
| | Buloke | 9251 | 10647 | -1396 |
| | **Sig. diff (interaction)** | **NS** | | |
| Wheat | Correll | 6879 | 6820 | 59 |
| | Axe | 6752 | 7931 | -1179 |
| | Yitpi | 7221 | 6914 | 307 |
| | Gladius | 5795 | 7227 | -1432 |
| | Derrimut | 5850 | 7346 | -1496 |
| | Lincoln | 6908 | 7224 | -316 |
| | **Sig. diff (interaction)** | **P=0.026** | | |
| | **LSD (P<0.05)** | **937** | | |
| | **CV%** | **9.4** | | |

*Table 3. Grain yield and quality of varieties (grazed and ungrazed) in grazing cereals trial, Culgoa 2010.*

| Crop | Variety | Maturity | Grain yield (t/ha) | Protein (%) | Test weight (kg/hl) | Screenings (%) |
|---|---|---|---|---|---|---|
| Barley | Hindmarsh | very early | 4.73 | 10.0 | 68.2 | 2.1% |
| | Buloke | mod early | 4.65 | 9.9 | 65.4 | 2.8% |
| | Gairdner | mid-late | 4.64 | 10.1 | 67.2 | 2.7% |
| **Sig. Diff (variety)** | | | **NS** | **NS** | **P<0.001** | **P=0.002** |
| **LSD (P<0.05)** | | | | | **0.46** | **0.18** |
| **CV%** | | | | | **1.4** | **13.9** |
| Wheat | Correll | mid-late | 3.42 | 9.5 | 68.0 | 2.6 |
| | Axe | early | 3.44 | 10.1 | 66.5 | 1.6 |
| | Yitpi | mid | 3.33 | 9.9 | 69.8 | 1.8 |
| | Gladius | mid | 3.09 | 10.1 | 66.4 | 1.8 |
| | Derrimut | early-mid | 3.24 | 9.9 | 67.9 | 4.0 |
| | Lincoln | mid | 2.84 | 9.6 | 66.5 | 4.5 |
| **Sig. diff (variety)** | | | **P<0.001** | **P=0.021** | **P=0.016** | **P<0.001** |
| **LSD (P<0.05)** | | | **0.24** | **0.4** | **2.1** | **1.0** |
| **CV%** | | | **7.3** | **4.2** | **3.1** | **36.6** |

In 2010, grain quality characteristics for wheat and barley were affected mostly by variety, but there was some effect of grazing on protein.

For barley, protein was higher in grazed crops (10.4%) compared with ungrazed (9.6%) (P=0.002, LSD 0.47, CV=5.4%). Barley screenings were low and were not affected by grazing, but did vary between varieties (Table 3). Barley test weights were adequate.

For wheat, protein, and test weight were influenced by variety (Table 2). Protein was affected by grazing, which like barley was higher for grazed (10.1%) than ungrazed (9.7%) wheat crops (P=0.003, LSD=0.25, CV=4.2%), while test weight was not. Screenings again were below 5%, were not affected by grazing, but varied between varieties.

### *Gross income of crops*

As barley was harvested earlier, it maintained its intended MALT 1 receival grade (exception was two Buloke plots downgraded to Feed1). Wheat, harvested following significant rainfall on ripe crops, was all downgraded to AGP1 or FED1 due to low test weights. Subsequently, variance in quality had a large impact on gross income. Gross income was not affected by grazing, but differed between wheat varieties (P=0.003, LSD=83, CV=12.5%) (Table 4).

*Table 4. Gross income (GI) of grazed and ungrazed cereals, Culgoa 2010*

| Crop | Variety | GI from grazed DM* ($/ha) | GI Grazed Grain ($/ha) | Total GI Grazed ($/ha) | GI Ungrazed Grain ($/ha) |
|---|---|---|---|---|---|
| Barley | Gairdner | 4.6 | 1183 | 1188 | 1166 |
| | Hindmarsh | 3.9 | 1071 | 1075 | 1089 |
| | Buloke | 9.1 | 1183 | 1192 | 961 |
| | **Sig. diff** | | | **NS** | |
| Wheat | Correll | 6.8 | 672 | 679 | 695 |
| | Axe | 6.2 | 606 | 612 | 722 |
| | Yitpi | 8.7 | 717 | 726 | 725 |
| | Gladius | 4.7 | 601 | 606 | 603 |
| | Derrimut | 4.4 | 660 | 664 | 703 |
| | Lincoln | 5.1 | 580 | 585 | 533 |
| | **Sig. diff** | | | **NS** | |

**GI DM based on 2011 Rural Solutions SA Farm Gross Margin Guide for self-replacing merino flock gross margin of $40/DSE/year, assuming that 1 DSE consumes 1kg DM/day.*

*Grain prices as delivered Birchip GrainFlow, 23 December 2010, sourced AWB.*

## Interpretation

At the commencement of grazing, feed value was low due to the early stage of the crop. However, it still offered some grazing value and would have contributed towards the 'mixed farming system' benefits. Both barley and wheat crops provided adequate nutrition for livestock before GS30, meeting the needs of pregnant and lactating ewes and lambs.

In 2009 early maturing crops were clearly more affected by grazing. However, in 2010, despite a dry period during September, well above average rainfall thereafter meant barley and wheat crops did not suffer a yield penalty from grazing, regardless of variety and maturity. It is likely that the early grazing meant less biomass removed and more time for plant recovery. Grain quality was maintained in grazed crops, with protein even increasing.

Buloke barley and Yitpi wheat were the best varieties to graze, offering greatest feed value and recovered grain income. There were other varieties that handled grazing well. This was different from the 2009 trial at Woomelang, (drier season with a poorer finish) in which Hindmarsh barley (greatest biomass, suffered grain yield penalty but still highest yielding barley), Wyalkatchem and Derrimut wheat (maintained yields and no screenings penalty) were shown to be the best cereals to graze (Nuske et al, 2010). The economic suitability of varieties for grazing is very dependent on how the season plays out, and the effects of grazing on grain quality.

Grain & Graze II will use computer modelling using APSIM to determine the ability of crops to recover from grazing using historical data in the Wimmera Mallee environment. Further evaluation of varieties (shorter season and dual purpose), time of sowing and time of grazing will occur.

While protein, fibre, energy and digestibility needs are met by cereals, beware of other animal health issues. Lush cereals are high in water content: ensure a slow introduction to grazing cereals to prevent scours. Also be aware of low magnesium which may result in grass tetany (cattle) or grass staggers (sheep), or lower growth rates under more marginal deficiencies. Low magnesium can be induced by increased demands for magnesium during late pregnancy and lactation, and by pastures with low levels of magnesium. Wheat forage commonly has marginal magnesium, as well as high plant tissue levels of potassium and low salt which reduces magnesium absorption in the rumen. A 1:1 mix of Causmag (MgO)/salt and the provision of sun cured hay are recommended to prevent these conditions. If animals are in late pregnancy or lactating, it is recommended that ground limestone be added to the ration.

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## References

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