Tough break to the season - Grazing cereal crops to fill the gap

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Introduction

Another tough start to the year and a late break has seen little feed on offer for pregnant ewes. In late pregnancy, ewes have high nutritional demands and may require supplementary feeding.

A strategic and tactical option available to producers where crops and livestock coexist is the grazing of vegetative wheat, barley and oats (both dual purpose and traditional spring varieties).

The crops are an excellent source of metabolisable energy (approximately 12 MJ/kg DM) and protein (crude protein 15 to 37%), making them well suited to meet the requirements of reproducing ewes. Grazing crops also allows deferment of grazing on pastures.

The high winter growth rates of these crops offer the opportunity to fill the winter feed gap.

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Importantly, a lower biomass or feed on offer (FOO) of young vegetative crops is required for liveweight gain (less than 500kg DM/ha) compared to conventional pastures.
This was shown in recent research, led by Murdoch University in collaboration with NSW Department of Primary Industries and Charles Sturt University and funded by Meat & Livestock Australia (MLA). In these studies, pregnant ewes gained condition score (3-3.2) with FOO ranging from 200 to 3400kg DM/ha. This is a much lower FOO than is required when grazing conventional pastures.

The time to graze crops is the Z21 stage (main shoot and one tiller, approximately six-eight weeks from plant emergence depending on the variety) as any earlier and the crop may not be anchored and grazing will result in loss of the plant and hence yield from the crop.

It is recommended sheep be removed from crops before growth stage Z31 (first node formed at base of main tiller); grazing beyond this time may reduce grain yield.

In addition, grazing pregnant ewes for an extended period of time (longer than 21 days) may increase the risk of metabolic disease such as hypocalcaemia due to the mineral imbalance in cereal crops.

**Lower risk of mineral deficiencies in Western Australia**

Analysis of mineral composition in over 9500 crop samples from locations across Australia indicated wheat may be the highest risk crop whilst oats and barley have a lower incidence of concentrations of sodium, calcium and magnesium that are less than requirements for sheep.

For reasons that are not entirely clear, Western Australia (WA) was identified as having a lower risk of mineral deficiency compared to the eastern states (Figure 1). This may be related to lower potassium levels in the soil and the tendency to graze oats and barley over wheat in WA.

![Lamb in cereal crop](image)

*Figure 1 Percentage of crop samples in the deficient range for sodium (orange bars), calcium (green bars) and magnesium (open bars) in WA (graph A) and the combined eastern states (graph B)*
Materials and Methods

More recent research from the same groups of researchers investigated the mineral status of pregnant ewes grazing cereal crops and tested supplements that aimed to minimise ewe mortality and ill health in New South Wales (NSW) and WA.

The research was conducted over two years; year one determined the risk and year two tested mineral supplementation.

In the first year the mineral status of both forage and of reproducing ewes grazing wheat, oats or barley was monitored on 18 farms in WA (six farms) southern NSW (seven farms) and central NSW (five farms). The average period of grazing was 20 days.

In the second year the effectiveness of two mineral supplements was assessed on six farms over three weeks. On each farm 90 twin bearing ewes in late gestation (day 115 to day 129 of gestation) were divided into three treatment groups (n=30/treatment). The control group was given no supplement, a second group was provided with the industry standard (40% causmag, 40% limestone and 20% salt) and the third group was provided with a new formulated supplement containing the same cations but as magnesium chloride, gypsum and salt.

In both experiments samples of blood plasma and urine were collected from ewes pre and post grazing and samples of crop and soil were also collected for mineral analysis for calcium, sodium, magnesium and potassium.

Results

Figure 2 Fractional excretion of calcium from sheep fed no supplement (open bars), industry supplement (green bars) and new supplement (orange bars). Farm 2 was excluded.
Results supported the earlier crop analysis, confirming that crops grown in WA were lower risk and usually contained sufficient magnesium, calcium and sodium.

Mineral supplements increased calcium concentrations in urine, blood plasma and calcium fractional excretion (Figure 2), a reliable indicator of calcium level based on both blood and urine measures, on all but one of the six farms included in the study (Farm 2 was excluded).

**Take home messages**

- WA crops are usually suitable for grazing as there is a lower risk of mineral deficiencies and pregnant ewes gain condition on as little as 200 kg DM/ha.
- High soil potassium was associated with low sodium, magnesium and calcium in forage and an increased risk of metabolic disorders.
- **Mineral supplements will increase calcium status** and to a lesser extent magnesium status. It remains unclear if the supplements can overcome the hormonal disturbances which can result in hypocalcaemia during short periods of calcium stress. Supplements require testing on a commercial scale.
- Mineral supplements should be used in conjunction with crop grazing of pregnant ewes and any mineral supplement used should contain calcium, magnesium and sodium.
Southern WA reproductive rates based on pregnancy scanning

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Introduction

Pregnancy scanning is a useful tool available to sheep producers that can improve productivity and profitability. Scanning can assist with feed budgeting and stocking rate management especially in poorer years where paddock feed availability is low and supplementary feeding high.

A knowledge whether ewes are carrying singles or multiples helps with strategic paddock and supplementary feed allocation. Appropriate feeding can also increase lamb survival rates, particularly for multiples.

Scanning also allows for early management decisions for dry ewes, culling in years where feed availability is low or retaining to run as wethers for shearing when feed availability is high.

Sheep pregnancy scanning data was obtained from scanning consultants across southern WA. The data available was geographically restricted to an area south of Perth, however data from all areas of WA will continue to be sought. The area with data available stretched as far west as Darkan, south to Mt Barker and east to Jerramungup and Ravensthorpe.

Reproductive Rate 2015 - 2017

Reproductive rate in ewes is calculated as the number of scanned foetuses per 100 ewes joined. Reproductive rates during 2015 remained high with an average of 122% while the percentage of dry ewes was low with an average of 15% (Figure 3).

![Reproductive rate and dry ewe percentages](image)

Figure 3 Average reproductive rate (RR) and dry ewe percentage by month of scanning
Anecdotally, the growing season in 2014 produced reasonable pasture growth and quality which is reflected in the strong reproductive rates and low percentage of dry ewes in 2015. However the growing season during 2015 was average with steady supplementation rates (light orange bars) displayed in Figure 4.

To assist in understanding the discrepancies between reproductive rates and number of dry ewes across the years, feed availability information was utilised from the Lamb Survival Initiative, which is part of the Sheep Industry Business Innovation project within the Department of Primary Industries and Regional Development.

Figure 4 illustrates the average amount of feed on offer (FOO) and supplementary feeding across both 2015 and 2016. FOO increased between 2015 and 2016 for all groups that were measured in both years.

In 2016, average FOO at lambing (dark green bars) was high for all groups measured and the difference between years was most marked for ASHEEP and Facey Group, almost reaching 1 tonne for ASHEEP and exceeding 1 tonne for Facey Group. The lowest average FOO in 2016 was 1200 kg/ha (Southern DIRT), which was actually greater than the highest average FOO in 2015 being 1060 kg/ha (ASHEEP). This may be in part due to the areas in which the groups resided experiencing decile 1 rainfall during the growing season in 2015.

Overall average FOO was higher in 2016 and supplementary feeding was higher in 2015.

Reproductive rates were high in 2016, peaking at 202% on one property in March. This was despite poor pasture dry matter growth and a dry finish in 2015. If 2015 supplementary feeding regimes in Figure 4 are assumed to be a benchmark across sheep properties, then the high reproductive rates in 2016 could be related to an increase in the supplementary feeding program.

Additionally, 2016 was an exceptional season with consistent early rain despite an average rainfall during the growing season. The timing was perfect leading to good pasture quality and growth and a higher average FOO than for 2015. Despite this reproductive rates during 2017 were far more modest than for 2016 (Figure 3).
Assuming the data collected represents the reproductive rate and dry ewe percentage across the industry, sheep producers on average achieved a reproductive rate of 122% in 2015, 139% in 2016 and 90% in 2017.

Dry ewe percentages

The percentage of dry ewes was on average 15% in 2015 and 2016 and increased to 18% in 2017 (Figure 3). The average of 18% dry ewes in 2017 is not representative of the majority of flocks scanned but rather a reflection of a few flocks with poor scanning outcomes that have affected the data. When removing these outliers the average of percentage dry ewes is 16%, close to averages for 2015 and 2016.

The higher percentage of dry ewes in some flocks in 2017 is unexpected. Good pasture growth and quality in 2016 should have allowed for sheep to remain in good condition at joining. The cause could be multifactorial and include the ewes’ nutritional requirements not being met by pasture, insufficient supplementary feeding during joining, disease status of the ewes or a stocking rate effect. However, the cause is difficult to determine.

Take home messages

- The value of scanning increases with a poor season or a time of likely feed shortage affecting pregnancy.
- Scanning can assist with management decisions such as whether or not to cull dry ewes or keep them as wethers for wool production
- Average reproductive rates are around 120-130% while top producers are achieving 140-165%.
- Seasonal conditions impact on joining and subsequent scanning data. Having the ewes condition scored at joining and/or scanning would add value to the pregnancy scanning dataset.
You aren’t always what you eat – minimal palatability difference from grain versus grass fed lambs

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Introduction

In Australia, finishing lambs on grain based diets is an important option during times of limited ability to finish lambs on pasture. Untrained consumer perceptions of lamb derived from different feeding finishing systems is not well published, however a higher consumer acceptability towards concentrate finished lambs compared to pasture fed lambs has been demonstrated for Spanish, German, English and French consumers.

In contrast, Australian consumers could not discriminate sensory characteristics between lambs finished on pasture and on grain, suggesting that cultural aspects and consumption habits also influence sensory preferences. Hence we hypothesised that there are no sensory differences of Australian untrained consumers tasting lamb derived from pasture and concentrate fed animals.

Materials and Methods

Animals used in this study were from the Meat & Livestock Australia Resource Flock. Lambs were separated to be finished on pasture (n=53) or grain (n=52) based diets and each group represented three different breeding types: Merino × Merino, Merino × Terminal, Border Leicester-Merino × Terminal.

The treatment and nutritional compositions of grain and pasture diets are presented in Table 1 and Table 2. Lambs were fed on the different rations for 120-160 days (pending growth rates), and slaughtered in two kill groups (July and September).

The longissimus lumborum (loin) and semimembranosus (topside) muscles were dissected from all carcases and aged for 5 days. Five steaks (15 millimetres (mm) thick) were sliced from all muscles, grilled using a Silex griller, and halved before consumption to obtain 10 consumer responses per muscle.

All samples were assessed by untrained consumers who scored (1: worse to 100: best) the samples for tenderness, overall liking, juiciness and liking of flavour. Intramuscular fat (IMF) was measured on loin samples.

Table 1 Structure of grain and pasture diets

<table>
<thead>
<tr>
<th>Pasture</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 80% mixed perennial grasses (ryegrass, paspalum, coxfoot)</td>
<td>• 90% concentration mixture (75% whole barley grain, 21% cracked lupins 4% concentrate pellets)</td>
</tr>
<tr>
<td>• 15% legumes and herbs (red and white clover and plantain)</td>
<td>• 10% chaffed oaten straw</td>
</tr>
<tr>
<td>• 5% mixed weeds</td>
<td></td>
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</tbody>
</table>
Table 2 Nutritional composition of grain and pasture diets

<table>
<thead>
<tr>
<th>Nutritional composition*</th>
<th>Pasture</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (%)</td>
<td>25.0-30.0</td>
<td>90.9</td>
</tr>
<tr>
<td>Dry matter digestibility (%)</td>
<td>66.0-79.0</td>
<td>80.9</td>
</tr>
<tr>
<td>Metabolisable energy (MJ/kg DM)</td>
<td>9.7-11.9</td>
<td>12.7</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>12.0-21.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Neutral detergent fibre (%)</td>
<td>53.0-21.0</td>
<td>25.7</td>
</tr>
</tbody>
</table>

* range in values for pasture from first half of feeding period (mid March – mid June) to second half (mid June – late August)

Linear mixed effects models in statistical software SAS (Version 9.1) included fixed effects of feed type (grain or pasture), cut (loin or topside), sex (female or male), birth type (single, multiple), sire type (Merino, Terminal), dam breed within sire type (Merino-Merino, Merino-Terminal, Border Leicester-Merino-Terminal), kill group within sire type (July-Terminal, September-Merino, September-Terminal).

Sire identification and animal identification were included as random effects. Non-significant terms were removed. IMF was incorporated as a covariate in the base models to test whether it accounted for feed differences in eating quality.

Results and Discussion

In agreement with our hypothesis, there was no difference between grain and pasture fed female lambs for any of the sensory traits (P>0.05). This aligns with previous research which found no difference among Australian consumers’ acceptability of loin samples from lambs finished on pasture or feedlot rations.

Yet contrary to our hypothesis there was a difference between the feed types in wether lambs (P<0.05) with grain fed wether lambs having 3.8, 4.1 and 4.7 more overall liking, tenderness and juiciness scores than pasture fed lambs across both the loin and topside.

When correcting for IMF, this sensory difference remained for overall liking, but was no longer significant for tenderness and juiciness indicating the effects are mostly explained by differences in IMF between grain (5.6% IMF) and pasture (4.4% IMF) fed groups.

Furthermore, Merino sired lambs had higher sensory scores than Terminal sired lambs and these differed by as much as 9.2 and 6.6 tenderness scores for the loin and topside samples. This agrees with previous findings demonstrating the better eating quality of the Merinos. Also as previously reported, across both feed types, loin cuts had 23, 30, 21 and 19 eating quality scores higher than topside cuts for overall liking, tenderness, juiciness and flavour.

Conclusion

The results show that Australian consumers have a small preference towards grain fed lamb meat, but only from wether lambs. This effect was small, and not present in female lambs, therefore while consumer perceptions are important they should not be prioritised above production costs and other growth and carcase composition traits when implementing finishing systems.
Less oxygen needed to keep meat red in modified atmosphere packaging

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Introduction

Meat colour is an important factor influencing the purchasing decisions made by consumers.

Modified atmosphere packaging (MAP) is widely utilised by the retail industry to display meat, as a high oxygen concentration sustains the cherry-red colour of meat for a longer period of time compared to traditional overwrap packaging.

Meat colour changes during retail display as the myoglobin pigment changes from primarily purple deoxymyoglobin, to red oxymyoglobin, and eventually to brown metmyoglobin upon the exposure to oxygen.

The focus of this study was the effect of oxygen concentration on the redness of lamb at the meat surface, measured by the ratio of reflectance of light at wavelengths 630 nanometres (nm) and 580 nm, also known as the oxy/met ratio.

An oxy/met ratio greater than 4 suggests that the majority of the pigment is the red oxymyoglobin, while a ratio approaching 1 suggests mostly brown metmyoglobin.

Recent evidence has shown that beef and lamb meat displayed under high oxygen MAP (typically 70-80% oxygen) have reduced eating quality, in particular reduced tenderness. Therefore, there is growing interest within the industry in using a lower concentration of oxygen to eliminate the negative impact on tenderness.

Studies in beef have shown that reducing oxygen concentration as low as 50% had no adverse effect on meat colour during retail display. Further investigation in lamb meat is needed to determine whether a reduced concentration of oxygen in MAP can still satisfy the colour requirements for consumer acceptability of colour, before examining the impact on meat tenderness.

On this basis, we hypothesised that a MAP mixture containing 60% oxygen or higher will have a similar oxy/met ratio as the standard high oxygen MAP (80% oxygen), while oxygen concentrations of 40% or lower will have a lower oxy/met ratio during simulated retail display.

Materials and methods

Male castrate and female Merino lambs (n = 50) from the Meat & Livestock Australia Resource Flock, Katanning, WA were used in this study. After slaughter all carcases were electrically stimulated with medium voltage.

Loin (M. longissimus lumborum) samples were collected from the carcases 24 hours post-slaughter. Samples were cut 50 mm in length, 50 mm in width and 30 mm in depth, vacuum packed, and then stored at 2°C and aged for 5 days. Loins were then butterflied before samples were repackaged in MAP containing 0, 20, 40, 60 or 80% oxygen (MAP0, MAP20, MAP40, MAP60 or MAP80), 20% carbon dioxide, and the balance met by nitrogen gas.
Loins were placed under simulated retail display for 2, 6 or 10 days at 2°C. MAP packaging was then removed so the surface meat colour could be instrumentally measured using a Hunterlab MiniScan EZ. Oxy/met ratio was determined using the ratio of reflectance of light at wavelengths 630 nm and 580 nm.

The oxy/met ratio was analysed using a linear mixed effect models (Statistical software SAS Version 9.1) with retail display time (2, 6 or 10 days) and oxygen concentration group as fixed effects, and animal ID within Sire ID as random terms.

Results and discussion

There were significant effects (P<0.001) between oxygen concentration and retail display time for oxy/met ratio (Figure 5). As oxygen concentration increased the oxy/met ratio also increased (P<0.05) up to the 60% oxygen inclusion, with little further improvement between 60% to 80% oxygen inclusion. This aligns well with our hypothesis that levels of 60% oxygen or higher are required to maintain meat colour.

In contrast, the MAP0 treatment had consistently high oxy/met ratios during retail display. Due to the low oxygen environment in MAP0 it suggests the samples were not necessarily redder but were less brown. This could drive a higher oxy/met ratio found with the MAP0, compared to MAP20 and MAP40 samples.

![Figure 5](image-url) The effect of oxygen concentration (MAP0, MAP20, MAP40, MAP60 or MAP80) on the oxy/met ratio after retail display times of 2, 6 or 10 days

Conclusion

Reducing oxygen concentrations in MAP from 80% to 40% resulted in a lower oxy/met ratio which depicts less red meat.

Further testing can investigate where the threshold lies between 40 and 60% oxygen to maintain meat redness and then test the impacts of this lower oxygen MAP mixture on meat tenderness.
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