Livestock

Simple steps to “ewe-turn” your lamb weaning percentage

Jessica Crettenden
SARDI, Minnipa Agricultural Centre

Key messages

- Weaning percentage is a major profit driver in sheep enterprises.
- Improvement requires an integrated approach to changes within sheep enterprises.
- Changes to management practices don’t necessarily have to be more time consuming or expensive. Small changes can make a great difference.
- The minimum weaning percent on Eyre Peninsula should be 100%.

Why do the trial?

Lamb wastage in sheep flocks is a major concern for the Australian sheep industry. Overcoming significant loss of lambs from conception to weaning is considered a key focus for higher rainfall zones, however, it has had less emphasis in lower rainfall regions, including the Eyre Peninsula.

Scanning percentages for summer-joined Merinos are often 120-160% but can result in weaning percentages of only 80-110%. Reduced weaning percentages occur because of a combination of many different factors. Therefore, improving efficiency involves using an integrated approach in order to achieve the best outcome.

How was it done?

The opportunity to improve reproductive efficiency was addressed in a study using the Merino flock at the Minnipa Agricultural Centre by identifying and understanding the timing and causes of lamb losses in 2012, 2013 and 2014 (EPFS Summary 2012, p 120 and EPFS Summary 2013, p 137).

Each year ewes were single-sire joined to rams for six weeks in February/March and subsequently pregnancy scanned for dries, singles and multiples in May. At lambing measurements taken included dam pedigree, date of birth, sex, birth type, birth weight, rectal temperature, lamb vigour and ewe maternal temperament. Deceased lambs were autopsied to determine cause of death. Marking and weaning numbers were recorded in August and September, respectively.

What happened?

Table 1 presents the three years of reproductive performance on the Minnipa flock with an average scanning of 147%. Note: as a consequence of single-sire joining, there was one group in 2014 that had a low scanning percentage of 16 due to a combination of heat and transport stress on the ram. On average, there was a 26% loss of lambs from scanning to weaning. Average survival at weaning was 83%.

The cause of perinatal deaths in this study have been broken down into eight categories shown in Figure 1: dystocia (difficult birth), exposure (hypothermia), starvation (causes other than mismothering), mismothering (secondary death through starvation), premature or ‘dead in utero’ (lambs born prematurely or dead), predation (primary predation only), other (including injury, infection and misadventure) and unknown (this diagnosis refers to lambs that have been scavenged and unable to be autopsied).
What does this mean?

The average lamb loss between birth and weaning in Australian Merino sheep has been estimated to be more than 30% (Minnipa flock average was 27%). The majority of these deaths occur in the early post-natal period, with more than half of all pre-weaning deaths occurring within the first 24 hours. By contrast, the number of ewes that fail to get in-lamb is normally quite low. Weaning percentages tend to be ominously lower than pregnancy scanning percentages in low rainfall areas, yet many sheep producers are not scanning and therefore do not know what they are losing, which is a concern. For a summer joining the expectation of 100% at weaning is not unreasonable on the Eyre Peninsula and should be the minimum target for all sheep enterprises, regardless of breed.

Poor weaning percentages occur because of a combination of many factors starting from pre-joining through to weaning, and the cause of the problem varies significantly from property to property. A collective management package is necessary to obtain the best weaning percentage possible. The outcomes of the lamb survival study at Minnipa show that there are several important aspects to understand about flock management during the reproductive period in sheep enterprises that can be used to improve weaning percentages.

Starvation, mismothering and exposure (SME) are generally referred to as a complex, which typically accounts for approximately 80% of perinatal deaths in the majority of studies conducted in Southern Australia. At Minnipa 41% of lamb deaths were attributed to this complex. In recent research, more dystocia cases have been identified in lamb deaths previously diagnosed as the SME complex; however the initial cause of demise has been credited to brain injury (related to bleeding in the brain caused by difficult birth and lack of oxygen in the birth canal for an extended period of time).

Table 1 Reproductive performance of the Minnipa flock from 2012-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>No. Ewes joined</th>
<th>No. Lambs scanned</th>
<th>No. Lambs born</th>
<th>No. Lambs weaned</th>
<th>Survival at birth (%)</th>
<th>Survival at weaning (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>337</td>
<td>540 (160%)</td>
<td>558 (166%)</td>
<td>439 (130%)</td>
<td>103</td>
<td>81</td>
</tr>
<tr>
<td>2013</td>
<td>350</td>
<td>534 (153%)</td>
<td>531 (152%)</td>
<td>446 (127%)</td>
<td>99</td>
<td>84</td>
</tr>
<tr>
<td>2014</td>
<td>349</td>
<td>442 (127%)</td>
<td>443 (127%)</td>
<td>366 (105%)</td>
<td>100</td>
<td>83</td>
</tr>
<tr>
<td>Average</td>
<td>345</td>
<td>505 (147%)</td>
<td>511 (148%)</td>
<td>417 (121%)</td>
<td>101</td>
<td>83</td>
</tr>
</tbody>
</table>

Figure 1 Cause of lamb deaths at the Minnipa Agricultural Centre in 2012-2014

*other includes injury, infection and misadventure
**unknown diagnosis is from lambs that have been scavenged and are unable to be autopsied

NOTE: Figure 1 does not include the 82 lambs (out of the total 279 deceased) missing between tagging and weaning.

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Calcium supplements (stock lime) are essential in late pregnancy and throughout lambing as calcium drives ewe birthing contractions and lack of it can lead to dystocia. Fibre is also important to mobilise calcium reserves. Managing lamb birth weights, ensuring sufficient ewe nutrition and regular flock monitoring throughout lambing are other options to assist an easy birthing process.

The most critical driver of lamb survival is ewe nutrition and pregnancy scanning is the initial process by which nutritional decisions need to be made. Many losses are associated with poor sustenance during pregnancy, particularly in late pregnancy and predominantly with ewes carrying multiple lambs. It is simpler, safer and generally cheaper to maintain ewe condition over joining and early pregnancy than to lose it and build it back up. Nutrition at this stage directly affects lamb birth weight, with approximately 70% of a lamb’s likelihood to survive governed by its birth weight. Major issues with nutrition include too much feed for singles resulting in dystocia issues, or not enough for multiples leading to problems associated with the SME complex, hence the importance of pregnancy scanning to adjust feed rations. Whether single or multiple pregnancies, matching condition and nutrition through reallocation of resources as well as supplying the correct balance of energy and protein is important to maximise survival, whilst resulting in additional benefits such as better milk supply, more energy for the ewe for labour and lambs less susceptible to predation.

Maintaining nutrition levels during lambing is critical, as the amount of time a ewe spends at the birth site to bond with her newborn governs the lamb’s chance of survival, particularly in the first four to six hours. Provision of shelter and paddock allocation is equally important as managing ewe nutrition. Shelter will not only protect lambs from environmental extremes, but will also provide sufficient cover to allow the ewe to give birth uninterrupted and to bond with her lamb(s).

Using genetics in ewe and ram selection can assist in controlling aspects such as lamb birth weight, difficult birthing issues and identifying good mothers. It is essential that ewes and rams are in appropriate condition through sound physiology, good health and nutrition and that the joining period is sufficient to allow two cycles for the ewes (minimum of five weeks). Peak fertility when cycling activity increases in sheep generally occurs between March and May and out-of-season joining may require teaser use or for rams to be left in for an extended time, however a lengthy joining period can be inefficient. Ensuring a regular and up-to-date husbandry program will aid a successful reproductive process.

Primary predation of otherwise healthy lambs is uncommon, although sporadic events do occur. It is essential to control pests to minimise ewe stress and to avoid leaving the lamb vulnerable to predation (secondary predation occurs on lambs that are more likely to die in the absence of predation). This is important especially in the first 24 hours, as ewes tend to give birth during the night or early morning when predators are most active. An integrated approach using control options such as baits, traps, hunting, fox lights and/or guardian animals at least a month prior to lambing is necessary.

Substantial profitability gains can be made through improved weaning percentages, especially when the cost of lamb losses, along with their potential future income is calculated; however there is no single solution to improve reproductive rates in sheep enterprises on Eyre Peninsula. Each producer needs to analyse the causes behind the problem within their flock management program and be willing to implement change – small changes can equal long term investment into the future of a sheep flock. Ignorance and complacency around the issue of lamb wastage are currently major hurdles for the sheep industry, which need be addressed in a timely fashion if considerable productivity and profitability improvements are expected.

Acknowledgements

I gratefully acknowledge Suzanne Holbery for her project development and delivery from 2012-2014. I would also like to thank Mark Klante, Brett McEvoy and John Kelsh for their livestock management support. The lamb survival projects were funded by the South Australian Sheep Advisory Group (SASAG) through the South Australian Sheep Industry Fund (SASIF) in addition to in-kind support from the South Australian Research and Development Institute (SARDI) and Grain and Graze 3 project funded through the Grains Research and Development Corporation (GRDC).
Reducing methane emissions from improved forage quality on mixed farms

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Key messages

• Significant differences were observed between forage types in total live weight (LW) gain (barley 2.9 kg vs. sulla 5.1 kg) and the average daily weight gain (ADWG) (barley 81.2 g/day vs. sulla 150.2 g/day).

• No significant treatment differences were observed between the barley and the annual medic pasture in terms of total LW gain and ADWG.

• Analysis of the production data in relation to methane emission intensity, i.e. the output of methane per unit of production, showed significant differences between the two forages grazed in spring 2013 (barley 2.9 kg vs. vetch 1.0 L CH₄/hr/100g ADWG).

• Methane yield (%) and emission (g/day) increases with digestibility and energy density of the diet.

Why do the trial?

Australia’s livestock industry produces approximately 10% of the national greenhouse gas (GHG) emissions. Livestock emissions make up around 70% of total emissions from the agriculture sector. Methane (CH₄), an end-product of natural digestion from ruminants, is approximately 25 times more potent then carbon dioxide as a thermal warming gas. It accounts for 95% of total livestock emissions with the major sources being beef cattle (60%) and sheep (23%).

Methane emissions from livestock are often closely linked (inversely) to animal productivity, and the key factors that influence methane emissions are: digestibility, crude fibre content and energy density of the diet and feeding intensity. This project will seek to measure comparative animal production, feed quality and quantity and methane emissions in response to current and improved sheep feeding strategies. Ultimately the trial will provide the mixed farming industry with potential options to fill the late-spring and autumn feed gaps with highly digestible forages through which they can improve the productivity and profitability of their sheep enterprise, whilst reducing on-farm emission intensity.

How was it done?

2013 spring (PHASE 1): The trial commenced on 8 November 2013 with 200 mixed sex Merino weaners at an average live weight of 28.2 kg, split equally into groups of 100 animals. Project activity, forage intake and live weight data presented in the EPFS Summary 2013, p 141.

2014 winter (PHASE 2): The trial commenced on 12 June 2014 with 100 Merino wether hoggets (2013 July/August drop) at an average live weight of 45 kg split into two groups of 50 animals. Both treatments were replicated twice (Table 1). After a total of 47 days, methane production measurements commenced on 29 July 2014, and were completed over four days with 20 hoggets from each replicate within each group placed in a polytunnel for three hours of gas measurement at the same time (8–11 am) each day.

2014 spring (PHASE 3): The trial commenced on 10 October 2014 with 100 Merino ewe hoggets (2013 July/August drop) at an average live weight of 62 kg split into two groups of 50 animals. Both treatments were also replicated twice. After a total of 33 days, methane measurements commenced on 12 November 2014, and were completed over four days with 15 hoggets from each replicate within each group placed in a polytunnel for three hours of gas measurement at the same time (8–11 am) each day.

All methane sampled and measured was analysed in real-time with a sensor, which logged the data onto a computer every 30 seconds. This was performed by staff from CSIRO Agriculture Flagship, Perth, WA. Each sheep group was weighed the day following the polytunnel measurement at 10:30 am after an overnight fast. Pasture cuts were done before and after the hoggets grazed the paddocks to estimate dry matter intake and pasture quality.
## Table 1 2014 treatment details

<table>
<thead>
<tr>
<th>Phase</th>
<th>Treatment</th>
<th>Paddock size (ha)</th>
<th>Sheep per rep</th>
<th>Sowing date</th>
<th>Rep</th>
<th>Grazing dates</th>
<th>Available dry matter (tDM/ha)</th>
<th>Methane measurement date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter 2014</td>
<td>young barley crop</td>
<td>2.7</td>
<td>25</td>
<td>4 May</td>
<td>1</td>
<td>12/6 - 7/7</td>
<td>0.44</td>
<td>29 Jul</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>8/7 - 28/7</td>
<td>1.38</td>
<td>31 Jul</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>12/6 - 7/7</td>
<td>0.40</td>
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</tr>
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<td></td>
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<td>2</td>
<td>8/7 - 30/7</td>
<td>1.31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>medic</td>
<td>7.5</td>
<td>25</td>
<td>self sown</td>
<td>1</td>
<td>12/6 - 29/7</td>
<td>0.83</td>
<td>30 Jul</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>12/6 - 31/7</td>
<td>0.79</td>
<td>1 Aug</td>
</tr>
<tr>
<td>Spring 2014</td>
<td>standing barley crop</td>
<td>1.4</td>
<td>25</td>
<td>4 May</td>
<td>1</td>
<td>10/10 - 13/11</td>
<td>3.87</td>
<td>14 Nov</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>10/10 - 15/11</td>
<td>3.91</td>
<td>16 Nov</td>
</tr>
<tr>
<td></td>
<td>sulla</td>
<td>2</td>
<td>25</td>
<td>20 May</td>
<td>1</td>
<td>10/10 - 12/11</td>
<td>1.71</td>
<td>13 Nov</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>10/10 - 14/11</td>
<td>1.45</td>
<td>15 Nov</td>
</tr>
</tbody>
</table>

### What happened?

**Spring 2013 Phase 1 methane results:** The average methane emission for the group grazing the standing barley crop was 0.95 L/hr (0.68 g/hr) and was significantly lower (P<0.05) than for the groups grazing the vetch crop, with an average emission of 1.81 L/hr (1.30 g/hr, Figure 1). The almost 90% higher emission observed for the vetch group is assumed to be the result of the interaction between higher dry matter (DM) intake, of higher digestibility and higher crude protein content, leading to higher fermentation rates and shorter rumen retention times compared to the sheep grazing the barley crop.

The methane emission intensity was calculated in relation to the average daily weight gain (ADWG) estimates with data presented as L CH₄/hr/100 g ADWG. The average methane emission intensity for the groups grazing the standing barley crop was 2.90 L CH₄/hr/100 g ADWG (2.07 g/hr/100 g ADWG) and was significantly higher (P<0.05) than for the groups grazing the standing vetch crop, with an average emission intensity of 1.0 L CH₄/hr/100 g ADWG (0.72 g/hr/100 g ADWG, Figure 2).

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**Figure 1 Estimates of methane output (L/hr/head) for the four sheep groups, measured in the polytunnel over three hours**
**Winter-spring 2014**: Table 2 presents the estimates of stocking rate, dry matter (DM) consumption for the various forages for Phase 2 and 3, and feed quality figures from the DM sampled, after analysis through FEEDTEST Pty Ltd, a commercial laboratory. As one dry sheep equivalent (DSE) represents the consumption of 1 kg of pasture DM, estimates of biomass loss from grazing suggest levels of DM consumption in excess of potential limits of intake by young sheep. It is assumed that a large proportion of the DM loss is associated with trampling, natural breakdown and a component of sampling error. A statistical analysis of the winter 2014 live weight data indicated that there were no significant differences (P>0.05) with the total LW gain and ADWG between the two treatments. Total LW gain was 11.4 kg and 10.7 kg for the 47 days in the paddock; ADWG was 237.7 g/head/day and 219.5 g/head/day for the barley and medic groups respectively (Table 3). However, 2014 spring LW data indicated a significant response (P<0.001) in LW gain and ADWG between the two forage treatments. Barley group hoggets gained an average of 2.9 kg/head while the sulla group gained an average of 5.1 kg/head over the 33 day trial.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Stock type/age</th>
<th>Forage</th>
<th>Stocking rate (DSE/ha)</th>
<th>DM consumption (kg/head/day)</th>
<th>QUALITY</th>
<th>Crude protein (%)</th>
<th>Digestibility DMD (%)</th>
<th>ME (MJ/kg DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>merino wether hoggets (~12 months)</td>
<td>Barley</td>
<td>9</td>
<td>2.95</td>
<td>23</td>
<td>78.1</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medic pasture</td>
<td>3</td>
<td>2.94</td>
<td>27.1</td>
<td>62</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>merino ewe hoggets (~15 months)</td>
<td>Unharvested barley crop</td>
<td>21</td>
<td>3.66</td>
<td>7.3</td>
<td>75.7</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barley grain</td>
<td></td>
<td></td>
<td>11.4</td>
<td>90</td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulla</td>
<td>15</td>
<td>3.19</td>
<td>15.3</td>
<td>60.8</td>
<td>8.9</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Forage quality and utilization in 2014

![Figure 2 Emission intensity estimates of methane production per 100 g live weight gain (L/hr/100g ADWG)](image-url)
What does this mean?
There was a small difference between the barley vs. annual medic treatment (winter 2014), in relation to feed quality and availability. However there was no significant response in terms of LW gain and ADWG and hence this provides sheep enterprises with two pasture options that ultimately result in the same LW gains, particularly in a good season with good early rainfall to establish the barley. In spring 2014, the sulla group had 85% more ADWG (150.2 g/head/day) than the standing unharvested barley crop (81.2 g/head/day) and was attributed to the fact that the sulla had higher crude protein content (18.1%) than the barley crop (7.7%). Therefore sulla also represents a pasture option that farmers can adopt to fill the late spring feed gap in order to maintain and improve live weight gains in young animals. If a target of 10 kg LW gain to reach market specifications was used, the sheep grazing sulla would require 66 days, while the sheep grazing barley would require 123 days to go to market. This would have large implications for the total emissions between the two groups. We await the 2014 methane output data (from CSIRO, WA) for the barley vs. medic and barley vs. sulla trials.

Acknowledgements
Mark Klante, Brett McEvoy and John Kelsh for managing the livestock and preparing trial infrastructure. Jessica Crettenden for livestock handling and data management. This project is supported by funding from the Australian Government Department of Agriculture - Action on the Ground program.

Project codes: AOTGR 2 – 0039
Reducing methane emissions from improved forage quality on mixed farms.
Benchmarking sheep enterprises using Breeding Value technology

Jessica Crettenden
SARDI, Minnipa Agricultural Centre

Why do the trial?
The Eyre Peninsula has the proven capacity to produce productive and profitable sheep as a valuable component of the mixed farming system. Current market forces, a longer term consideration of climate change and the likely adaptations to whole farm systems provide a real opportunity for sheep to reinvigorate farming businesses in the area. Merinos have suffered from limited uptake of new technology in recent decades, but there is now good demand for medium wool, meat and restockers. For these reasons, a four year study was undertaken at the Minnipa Agricultural Centre to investigate new sheep breeding technology and management options. The project at Minnipa promoted ways to overcome barriers to new technology and aimed to show how Breeding Values could be used as a benchmarking tool to help set targets and monitor change towards achieving goals in breeding programs.

How was it done?
The project used the Merino sheep flock at Minnipa to demonstrate the genetic benchmarking system that is known as MERINOSELECT created by “Sheep Genetics” (a joint MLA and AWI project). The three main topics covered in the project were: use of the Minnipa demonstration flock to engage with ram buyers and breeders, technology transfer to ram buyers, and, technology transfer to ram breeders.

Measurements were submitted to MERINOSELECT for the 2010, 2011, 2012 and 2013 drops at yearling (Y) age (10-13 months). This process subsequently generated Australian Sheep Breeding Values (ASBVs), which are figures that aim to take the environmental effects (such as feed, birth type, seasonal conditions etc.) out of the actual measured trait and thus better reflect the actual genetic merit and potential of an animal. These Breeding Values are valuable productivity benchmarks but must also be complemented with the longstanding traditional visual assessment in order to stay “on track”.

What happened?
The Minnipa flock breeding objective was aimed to specifically increase growth rate (Ywt) (body weight at yearling age), fleece weight (Ycfw) and eye muscle depth (Yemd), reduce breech wrinkle (EBWR) and maintain micron (Yfd) and fat (Yfat). However every flock in the system has the ability to choose their own goals and relative emphasis between traits.

Key message
- Breeding Values can increase productivity and profitability of a livestock business through long term improvement to genetics of the flock by benchmarking performance, continually setting higher targets and monitoring actual progress. The technology can also be used in conjunction with other sheep husbandry activities to increase labour efficiency. To be effective, the use of technology needs to be closely aligned with visual selection and the setting of stretch productivity targets in each individual flock in order to see significant improvement.

side sampling for fleece quality measurements, ram inspection, ewe allocation and pregnancy scanning. How to efficiently collect and handle the sheep data using new technologies such as electronic ear tags, use of an auto-drafter, electronic scales, barcode reader and printer, stick reader, computer indicator and livestock management software were also demonstrated.

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ASBV results varied throughout the four years of data collection, “bouncing around” especially in the initial years of the project, as the Minnipa flock did not have good early linkage (use of sires with large numbers of progeny) in the MERINOSELECT database or good internal flock linkage between years.

Over the 4 years this was gradually resolved by increasing the number of well-linked sires. The early data and flock structure at Minnipa was in a similar state to many breeders considering adoption of Breeding Value technology.

A summary of the ASBVs using July 2014 data are represented in Table 1. It shows that the change in ASBVs were in line with the Minnipa breeding objective. Comparative results for the raw data collected from these years are displayed in Table 2, which shows a differing trend to the ASBV results and the environmental impacts (season, age, birth type, feed etc.) on actual production. A comparison of the results between Table 1 and Table 2 shows the benefits of Breeding Values over raw data for setting benchmarks and monitoring progress. Note the differences in the “Change” data in both tables.

Scanning and lamb marking results for the Minnipa flock have improved over the duration of the project (Table 3). These advances are due to better attention to sheep husbandry rather than genetic improvement. Dam ASBV for Number of Lambs Weaned (NLW) remained constant at 0.

The average ASBVs of the sires and dams used over the duration of the project reflects the Minnipa flock breeding goals and rate of gain in the flock (Table 4 and 5). The gains in their progeny are shown in Table 1. Note that the changes in ASBVs are recorded in Table 4 and 5 twice to reflect change during the project (2010-2013) and change after the project (2014-2015).

Table 5 shows the ASBVs for the dams. As many of the ewes in the early years did not have any recorded data, much of the current data comes from progeny testing (known sire and offspring performance). The rate of gain in the ewes was assisted by the high lambing results and thus high ewe culling that could take place across all ages.

### Table 1 Average Australian Sheep Breeding Values (ASBVs) of the 2010-2013 yearlings in the Minnipa flock

<table>
<thead>
<tr>
<th>Drop Year</th>
<th>Ywt (kg)</th>
<th>Yfd (µm)</th>
<th>Ycfw (%)</th>
<th>Yemd (mm)</th>
<th>Yfat (mm)</th>
<th>EBWR (visual)</th>
<th>DP+*</th>
<th>No. head**</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2.0</td>
<td>-0.9</td>
<td>12.5</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.3</td>
<td>134.4</td>
<td>361</td>
</tr>
<tr>
<td>2011</td>
<td>2.9</td>
<td>-0.5</td>
<td>13.8</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.4</td>
<td>134.3</td>
<td>414</td>
</tr>
<tr>
<td>2012</td>
<td>3.9</td>
<td>-0.4</td>
<td>14.1</td>
<td>0.2</td>
<td>-0.1</td>
<td>-0.6</td>
<td>137.5</td>
<td>546</td>
</tr>
<tr>
<td>2013</td>
<td>5.1</td>
<td>-0.4</td>
<td>16.6</td>
<td>0.1</td>
<td>-0.2</td>
<td>-0.6</td>
<td>142</td>
<td>523</td>
</tr>
<tr>
<td>Change</td>
<td>+3.1</td>
<td>+0.5</td>
<td>+4.1</td>
<td>+0.2</td>
<td>0</td>
<td>-0.3</td>
<td>+7.6</td>
<td>NA</td>
</tr>
</tbody>
</table>

*The Dual Purpose (DP+) index ranks animals on their ability to produce merinos for a dual purpose operation. An index combines the values of several ASBVs into one figure.

**Number of head represents all animals, including deceased, born in each drop year and submitted to MERINOSELECT.

### Table 2 Average raw data values of the 2010-2013 yearlings in the Minnipa flock

<table>
<thead>
<tr>
<th>Drop Year</th>
<th>Ywt (kg)</th>
<th>Yfd (µm)</th>
<th>Ygfw (kg)</th>
<th>Yemd (mm)</th>
<th>Yfat (mm)</th>
<th>EBWR (visual)</th>
<th>Y age (av. days)</th>
<th>No. head (Y age)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>50.1</td>
<td>18.1</td>
<td>3.4</td>
<td>30.8</td>
<td>2.9</td>
<td>2.6</td>
<td>318</td>
<td>321</td>
</tr>
<tr>
<td>2011</td>
<td>47.1</td>
<td>18.6</td>
<td>3.7</td>
<td>34.7</td>
<td>3.7</td>
<td>2.2</td>
<td>327</td>
<td>394</td>
</tr>
<tr>
<td>2012</td>
<td>51.2</td>
<td>17.4</td>
<td>3.6</td>
<td>30.9</td>
<td>2.6</td>
<td>2.9</td>
<td>333</td>
<td>429</td>
</tr>
<tr>
<td>2013</td>
<td>46.3</td>
<td>17.5</td>
<td>3.2</td>
<td>27.7</td>
<td>3.0</td>
<td>3.8</td>
<td>312</td>
<td>434</td>
</tr>
<tr>
<td>Change</td>
<td>-3.8</td>
<td>-0.6</td>
<td>-0.2</td>
<td>-3.1</td>
<td>+0.1</td>
<td>+1.2</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Number of head represents only all alive animals born in each drop year and measured at yearling age.

### Table 3 Fertility data of the 2010-2013 drop years in the Minnipa flock

<table>
<thead>
<tr>
<th>Drop Year</th>
<th>Dam preg. scanning (%)</th>
<th>Lamb marking (%)</th>
<th>Age (av. days)</th>
<th>No. head</th>
<th>Singles</th>
<th>Multiples</th>
<th>Unknown birth type</th>
<th>Annual rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>126</td>
<td>99</td>
<td>318</td>
<td>321</td>
<td>150</td>
<td>169</td>
<td>2</td>
<td>410</td>
</tr>
<tr>
<td>2011</td>
<td>126</td>
<td>121</td>
<td>327</td>
<td>394</td>
<td>96*</td>
<td>178*</td>
<td>120*</td>
<td>404</td>
</tr>
<tr>
<td>2012</td>
<td>160</td>
<td>130</td>
<td>333</td>
<td>429</td>
<td>66</td>
<td>344</td>
<td>19</td>
<td>253</td>
</tr>
<tr>
<td>2013</td>
<td>153</td>
<td>128</td>
<td>312</td>
<td>434</td>
<td>77</td>
<td>349</td>
<td>8</td>
<td>334</td>
</tr>
</tbody>
</table>

*The 2011 drop year pedigree was measured only through a DNA test; hence the number of unknown birth types due to some animals being sold off before the tests were taken.
What does this mean?
The Minnipa flock represents a flock similar to many Merino breeders on the verge of joining or those that have just joined MERINOSELECT. It offered an opportunity to demonstrate to local studs some of the vagaries that can occur in the initial years of benchmarking. Despite these challenges, over only three years considerable genetic gains were achieved in increased live weight, eye muscle depth, fleece weight, and reduced breech wrinkle in the Minnipa flock. The project also showed how MERINOSELECT can provide ram buyers with a system to benchmark their flock whilst assisting with ram purchasing decisions. Although the project aimed mainly to demonstrate MERINOSELECT as a genetic benchmarking system and what is involved in its implementation rather than simply validating the use of Breeding Values, the positive genetic changes in the Minnipa flock were an encouraging outcome.

Breeding Values have the potential to increase productivity by more accurately benchmarking performance, encouraging the setting of new targets and monitoring improvements. Much of the technology can also be used to increase labour efficiency. However, for effective use of the technology, it needs to be closely aligned with visual selection and breeding objectives to achieve long term success.

Most of the assessments were taken at young ages and the comparison of the young and older age assessments were not possible in this project. The project demonstrated how the protocols can be adopted into ram breeding businesses and showed the technology has the potential to benchmark with reasonable clarity and progress towards the chosen breeding objective.

Acknowledgements
Support and funding provided by AWI. I would like to thank Roy Latta, Dodgshun Medlin, Darryl Smith and Forbes Brien, SARDI Roseworthy and Brian Ashton, Sheep Consultancy Service Pty Ltd for project development and delivery. Leonie Mills, Chris Prime, Brenton Smith, Don Baillie and Shannon Mayfield, were members of the project consultative committee and I thank them for their contribution and support. I would also like to thank Mark Kiante for his livestock management support and MAC staff Suzie Holbery, Brett McEvoy, John Kelsh and Brian Dzoma for support in the shed and sheep yards.
Investing better in sheep through ram selection
Ken Solly
Solly Business Services, Naracoorte, SA

Key messages
• Sheep enterprises deserve the same degree of managerial input as does cropping.
• Strategic investment in livestock can pay huge dividends.
• Learn how to use genetic tools so better ram investments can be made.
• Be objective and take the guess work out of buying rams.
• Use a measure to manage approach to quantify the gains made by using better rams.

Why do the trial?
Nothing draws an argument more than the constant debate of the role of sheep on cropping properties. With the demise of 100 million sheep from the national flock it would appear that the croppers have won or are winning the debate, however like all situations there are exceptions to the rule. In lower rainfall districts it is difficult to build stocking rates to the level required to compete with cropping on a gross margin basis, however basing decisions solely on gross margin has its limitations too. Cropping income is greater but more volatile, whereas sheep income can be more reliable. Most farmers fall into either a cropper or stockman category and in many areas sheep become secondary to the crop and this is reflected in the margins achieved. If some sheep enterprises had the same level of managerial input as the crop then predictively the resultant sheep margins would be much higher. Croppers almost universally use an agronomist whereas a sheep consultant would never have set foot on most farms. This said, the sheep may not match the crops, but there may be opportunities to change the ratio of crop to sheep on some properties.

How was it done?
One area that lamb and wool producers can invest in, regardless of the size of their flock, is in the area of genetics. Regardless of whether you require six new rams per year or sixty, you can invest wisely to a higher level knowing that the returns are there. LAMBPLAN and MERINOSELECT are proven objective measurement systems, resulting in quantifiable gains in both the short and long-term.

What happened?
Those with limited knowledge of Australian Sheep Breeding Values (ASBVs) commonly say it is all well to know the figures but how much can I afford to spend on ram A over ram B? Table 1 goes part way to making that decision. In this example two terminal rams have been chosen on post weaning weight (PWWT, 200 days) for comparison. Ram A is in the top 15 percentile band and is 14 kg above the average when compared to the average ram in 1990 when the current LAMBPLAN was implemented. Ram B is in the 60th percentile and has a PWWT of 11 kg above the 1990 average. A 3 kg difference at 200 days would be difficult to assess by eye.

Table 1 Estimating ram values

<table>
<thead>
<tr>
<th></th>
<th>Ram A</th>
<th>Ram B</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASBV PWWT</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Percentile band</td>
<td>Top 15%</td>
<td>Top 60%</td>
</tr>
<tr>
<td>Difference in PWWT (A vs B)</td>
<td>+3</td>
<td></td>
</tr>
<tr>
<td>Difference in live weight at time of sale (A vs B)</td>
<td>+1.5 kg</td>
<td></td>
</tr>
<tr>
<td>Predicted difference in carcase weight (44% dressing)</td>
<td>+0.66 kg/lamb</td>
<td></td>
</tr>
</tbody>
</table>

*shows the ASBVs of the 2015 sires to be used
Although the income difference has been established between the two rams based on PWWT, it is also important to consider other traits important to your breeding objective when buying the best rams for your flock. If you were to base a decision just on PWWT then it would need to be decided how much of the $887 of additional income from ram A can afford to be spent to secure a ram purchase. To spend all of it would be futile but the fraction you need to spend and have a useful gain left over will depend on many factors. The quality of the ewes to be mated, the state of the market and the appropriateness of the traits used in relation to the target market should also be considered. Typically, the more traits you select for, the less chance you have of optimising any one trait. Other factors that will impact on your ram buying decision are your ram cost per lamb and the total returns in the lifetime of the ram. Table 3 shows the cost impact of lambs sired and weaned in a ram’s lifetime relative to the amount paid for that ram. It must be noted that individual ram cost per lamb can be twice and three times the cost depending on the price paid combined with the potency and longevity of the ram. Ram A lambs return $2.77 per head in carcase value better than ram B which is the $887 gross difference divided by the 320 of progeny.

Table 4 demonstrates the total financial return from lamb carcase weight and skins from progeny in a ram’s lifetime using a range of number of lambs sold per ram. Only half of this income can be attributed to the ram but at $4.20 per kg carcase weight and $6 skins it is a substantial amount of income that a ram can influence. In recent times both these prices have been higher which further increases the ram’s impact.

**What does this mean?**
Prescribing a price to pay for a given individual ASBV is not appropriate as other factors come into the decision. This is even more so in maternal flocks where replacements are being bred and retained. Understanding ASBVs in the first instance is essential to you selecting the right ram for your breeding objective and then paying a sensible price. To bury your head in the sand and just go ahead and buy the biggest and best looking ram for a very high price may get your name and photo in the Stock Journal but this decision may not impact your bottom line. If however you buy a later born twin lamb ram that is sound but may not look so grand, has higher ASBVs and you pay hundreds of dollars less, then your bank account should smile back at you. Doing the right thing is always paramount but doing things right is just as important.

<table>
<thead>
<tr>
<th>Table 2 Contribution of genetics - half from ram &amp; half from ewe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ewes joined</td>
</tr>
<tr>
<td>Weaning percentage</td>
</tr>
<tr>
<td>Number of years ram used</td>
</tr>
<tr>
<td>Total progeny per ram</td>
</tr>
<tr>
<td>Total predicted gain in carcase weight</td>
</tr>
<tr>
<td>Average price received per kg carcase weight</td>
</tr>
<tr>
<td>Difference in income between ram A &amp; B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3 Ram cost per lamb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ram purchase price</td>
</tr>
<tr>
<td>$/head</td>
</tr>
<tr>
<td>$800</td>
</tr>
<tr>
<td>$1,000</td>
</tr>
<tr>
<td>$1,200</td>
</tr>
<tr>
<td>$1,400</td>
</tr>
<tr>
<td>$1,600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4 Total lamb returns in a ram’s life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lambs per ram</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Average carcase weight per lamb</td>
</tr>
<tr>
<td>Total carcase weight</td>
</tr>
<tr>
<td>Price per kilogram carcase weight</td>
</tr>
<tr>
<td>Dollars returned per ram (and ewes)</td>
</tr>
<tr>
<td>Skin value per lamb/s</td>
</tr>
<tr>
<td>Total value carcase and skins</td>
</tr>
</tbody>
</table>

Eyre Peninsula Farming Systems 2014 Summary 183
Grazing crops – gambling with the mixed farming system?

Jessica Crettenden
SARDI, Minnipa Agricultural Centre

Key messages

• Grazing barley provided substantial feed for the sheep at a time of year when pastures were slow and accordingly it allowed pastures the opportunity for accelerated production. Removing sheep after one graze allowed the crop time to recover to produce an average yield of 2.45 t/ha, with the additional benefit of feed for 1400 DSE over one month.

• Grazing the vetch over four months allowed the feed base to establish well and bulk up, providing an exceptional feed source for ewes and lambs. The 5005 DSE had a total of two months of quality feed allowing lambs to be sold directly off the ewes due to their considerable weight gain over this period.

• The flexibility of both of these crops offers a variety of in-season opportunities and end-season uses and successful implementation of grazing crops into mixed enterprises can deliver indirect benefits to the whole farming operation.

Why do the demonstration?

Many mixed farmers have gambled with grazing crops at different times of the year with very diverse results. Numerous aspects determine whether the practice of grazing crops is a success or failure and these variants will also govern the outcome of the crop – grain, graze, hay or a combination of these. No matter how you do it, the next year will never be the same as the last, and similar to farming in general, it comes down to a throw of the dice, plus good, calculated and timely choices.

How was it done?

To help understand the variability involved in grazing crops in mixed farming systems, two demonstrations were undertaken at Lock with barley (Demonstration 1) and vetch (Demonstration 2), which were grazed throughout the growing season to determine how the sheep and cropping enterprises could best fit as a combination (Table 1).

Demonstration 1 was grazed using first cross Dohne x White Suffolk ewes and lambs for 29 days in total with an average of 31 DSE/ha from the 18 June to 4 July 2014. Demonstration 2 was grazed over five different periods from 25 June to 8 September 2014 for 66 days in total using first cross Dohne x White Suffolk ewes and lambs with an average of 21 DSE/ha.

Searching for answers

Location: Lock
Gus Glover
Rainfall
Av. Annual: 345 mm
Av. GSR: 265 mm
2014 Total: 356 mm
2014 GSR: 240 mm
Paddock History
2013: Pasture (demo 1), wheat (demo 2)
Soil Type
Grey sandy loam
Plot Size
45 ha paddock (demo 1), 48 ha (demo 2)
Yield Limiting Factors
Early finish (both demos) aphids affected early growth (demo 2)
Livestock
Enterprise type: Mixed
Type of stock/breed: First cross Dohne x White Suffolk

Biomass cuts were taken from each demonstration pre and post grazing and feed quality was analysed from the pre-grazing samples. Pasture cages (1 m³) were placed in the paddock to calculate the approximate amount of biomass removed from the paddock as a result of grazing. The grazed barley in Demonstration 1 was sampled on 15 October 2014 for yield and grain quality and was harvested by the farmer and the vetch was completely grazed until only enough biomass to cover the soil remained.

What happened?

Demonstration 1: Sheep were put on the paddock with an average 1.2 t DM/ha feed on offer (FOO) and at post-grazing there was 2.8 and 2.5 t DM/ha of barley biomass remaining in the grazed and un-grazed areas respectfully. The results from the feed analysis report for the barley showed a dry matter of 11.8%, crude protein of 23.2% of dry matter, neutral detergent fibre of 42% of dry matter, digestibility (DOMD) of 74% of dry matter and estimated metabolisable energy of 12 MJ/kg DM.
Table 1 Information for Demonstration 1 and Demonstration 2 undertaken at Lock

<table>
<thead>
<tr>
<th></th>
<th>Demonstration 1</th>
<th>Demonstration 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddock area</td>
<td>45 ha</td>
<td>48 ha</td>
</tr>
<tr>
<td>Crop type and variety</td>
<td>Fathom barley</td>
<td>Rasina vetch</td>
</tr>
<tr>
<td>Sowing date</td>
<td>5 May 2015</td>
<td>15 April 2015</td>
</tr>
<tr>
<td>Sowing/fertiliser rates</td>
<td>60 kg/ha with 60 kg/ha DAP</td>
<td>40 kg/ha with 40 kg/ha DAP</td>
</tr>
<tr>
<td>2013 paddock history</td>
<td>Pasture (self-sown medic/mixed)</td>
<td>Wheat</td>
</tr>
<tr>
<td>Weed control at sowing</td>
<td>(4 May - grass and broad-leaved) 1.5 L/ha 540 glyphosate, 100 ml/ha oxyfluorfen, 1.5 L/ha Treflan</td>
<td>(15 April - grass and broad-leaved) 1.2 L/ha glyphosate, 100 ml/ha oxyfluorfen, 500 g Simazine</td>
</tr>
<tr>
<td>Weed control in-season</td>
<td>(mid-July - turnip, mustard) 400 ml/ha LVE MCPA, zinc manganese copper blend, 400 ml/ha propiconizole</td>
<td>(19 June – grass) 400 ml Targa (24 Sept – grass) 800 ml paraquat</td>
</tr>
<tr>
<td>Disease/pest control</td>
<td>(28 Aug - net blotch, aphids) 400 ml propiconizole, 150 ml/ha alpha cypermethrin</td>
<td>(19 June – cowpea aphids) 200 ml Lemat</td>
</tr>
</tbody>
</table>

There was a large range in yields due to soil variation across the paddock with between 1.8-4 t/ha for the grazed area and 1.3-5.4 t/ha for the un-grazed exclusion cages. The un-grazed area yielded 0.1 t/ha more than the grazed paddock area on average with 2.5 t/ha and 2.4 t/ha respectfully. Grain quality was measured with 4% less screenings after grazing; however no other notable differences were measured.

**Demonstration 2:** There was an average of 1.1 t DM/ha of FOO prior to grazing the vetch paddock and after the first 21 days of grazing there was 2.0 and 2.1 t DM/ha remaining in the grazed and un-grazed areas respectfully. There was less than 0.5 t/ha of residual biomass on the paddock after the complete 66 days of grazing, therefore sheep were removed to avoid erosion issues. The results from the feed analysis report show that the vetch contained 12.8% dry matter and had higher crude protein content of 30.7% of dry matter, lower neutral detergent fibre of 37.5% of dry matter, lower digestibility (DOMD) of 68.5% of dry matter and lower metabolisable energy of 10.9 MJ/kg DM than the barley.

**What does this mean?**

**Demonstration 1:** Using estimated barley growth rates for the 2014 season at Lock of 50 kg DM/ha/day, approximately 1.4 t DM/ha would have been produced in the paddock over the grazing period. Therefore the assumption is that sheep removed approximately 3.0 t DM/ha over the period of grazing, equating to a feed intake of 3.3 kg DM/DSE/day. The quality of the barley was sufficient for young, quick growing lambs and lactating ewes for all results from the feed analysis. Crude protein levels were exceptional, which would have counteracted the fact that for the assumed feed intake, 2.9 kg DM/DSE/day or 88.2% of the feed content would be water, requiring a considerable amount of ingestion of barley to achieve the protein and energy levels required, which is normal for cereal crops in the vegetative phase. However, the key benefit of grazing the barley was that this provided a month of substantial feed for the sheep, equating to 1400 DSE, at a time of year when pastures were slow and thus it allowed the opportunity for pasture reserves to establish for use later in winter.

Due to the size and shape of the paddock, including scrub layout, the area was grazed quite unevenly. Once the barley had recovered after the first graze, the growth stage of the crop posed a risk to yield if grazed (nearing GS30), therefore the paddock was left to target grain production.

**Demonstration 2:** Using estimated vetch growth rates for the 2014 season at Lock of 80 kg DM/ha/day, during grazing approximately 5.3 t DM/ha would have been produced over this period. Assuming this growth rate, the sheep would have removed approximately 6.2 t DM/ha over the period of grazing, which equates to an average feed intake of 4.5 kg DM/DSE/day. Similar to the barley, the quality of the vetch was sufficient for the requirements of the sheep grazing. Results showed excellent protein and digestibility levels, which offset the large quantity of feed that needed to be consumed to gain the required nutrition due to the high moisture of 87.2% in the vetch. However the nutritive content of the feed would have changed to have a higher percentage of dry matter as this paddock was grazed over a longer period of time and into the spring when the vetch was beginning to hay off, especially with the dry finish experienced in 2014.
The method in which the vetch was grazed (five times for no longer than three weeks at a time), allowed the feed base to establish well and bulk up during the vegetative phase in order to provide exceptional feed value for the ewes and lambs when they needed it most. Visually, the sheep equating to 5005 DSE grazing the vetch did extremely well, allowing lambs to be sold directly off the ewes due to their considerable weight gain over this period. Similar to the barley, other pastures could be relieved from this grazing pressure.

The adaptability of both of these crops offers a variety of in-season opportunities and end-season uses. On any given year, the results of these two demonstrations may have been different according to the choices made with crop agronomy and livestock management as well as seasonal variability, which are the risks that mixed farmers must be willing to accept if attempting to graze crops. The successful implementation of this practice can deliver indirect benefits to the whole farming operation, as observed in these demonstrations. The secondary advantages can include management flexibility, increased stocking rates, business risk mitigation, as well as the implications for weed and disease controls, all which contribute at the whole-farm scale level. Mixed farming is a balancing act - there are both risks and rewards involved, however calculated and timely choices can provide substantial benefits and also suppress the risk associated with the integration of livestock and cropping systems through grazing crops.

Acknowledgements
I would sincerely like to thank Gus Glover and his family for the opportunity to use their property to conduct the demonstration. I also gratefully acknowledge the help of Ian Richter for his technical assistance. The Eyre Peninsula Grain and Graze 3 project is funded by GRDC.

LVE MCPA - registered trademark of Dow ArOsciences
Treflan – registered trademark of Dow Agrowsciences
Targa - registered trademark of Nissan Chemical Industries, Co Japan
Lemat - registered trademark of Bayer Crop Science
Grazing crops in practice
Alison Frischke and Dannielle Ick
BCG, Victoria

Key messages
- Forage barley variety Moby has vigorous early growth and matures quickly, and should be grazed sufficiently early to enable recovery for a second grazing.
- Spring wheat variety Bolac maintained yield when sown early and grazed in 2014.
- Winter wheat variety Wedgetail can be sown very early (March–early April) in low rainfall areas to utilise early rainfall, and widen both the sowing and flowering window of crops.

Why do the trial?
Greater attention is being paid to using late summer rainfall prior to the growing season to increase on farm water use efficiency (WUE). Earlier sowing of a cereal is one way of capitalising on early moisture. Crops emerge quickly and can grow while soils are still warm, giving mixed farmers the opportunity to fill an early winter feed gap for sheep. Cereals provide nutritious feed for all classes of sheep, including high nutrient demand ewes in late pregnancy or lactation and growing lambs.

Previous research undertaken through Northern Victorian Grain & Graze 2 program, together with local experience, has indicated that for low rainfall systems there are three options that will make the most of the grazing crop opportunity: an April sown specific forage type cereal, a mid-late April sown spring cereal, or a March sown winter-type cereal.

Careful crop and animal management is needed to make best use of the different growth types. Growers must respond to each season’s conditions in order to provide timely feed for animals, and allow for plants to recover from grazing. Crops may then be used as forage or hay, or be left to mature and fill grain. In 2014, Grain & Graze 3 followed three growers and recorded their experiences.

Aim
To monitor the feed value and grain production from different types of grazed cereal crops in low rainfall Northern Victoria.

How was it done?
Paddocks of cereal sown and managed by farmers were grazed and monitored at Patchewollock, Jil Jil and Normanville (Vic) in 2014. At Patchewollock and Normanville dry matter cuts were taken prior to grazing by sheep to estimate forage value, nutrition and dry matter. Three 2.5 x 2.5 m cages were erected across the paddock to exclude sheep and provide ungrazed crop areas.

At Jil Jil, the adjacent fenced paddocks provided the grazed and ungrazed comparisons. At crop maturity, dry matter cuts of crop were taken at all sites to estimate final dry matter production and grain production.

The Jil Jil and Normanville paddocks were harvested using farm machinery. The crop at Patchewollock was not harvested.

What happened?
Patchewollock
Kevin and Tracey Hynam had sown the forage cereal Moby barley (a fast maturing barley bred specifically for dry matter production) for two seasons and had been impressed by the amount of forage it produced for their sheep. In 2014, Moby barley was sown on 10 April into a 10 ha paddock at 40 kg/ha in 30 cm spacings (as well as four other paddocks sown into existing lucerne stands at a lighter sowing rate of 20-30 kg/ha). After receiving 30 mm early rainfall.

After eight weeks, on 12 June, when plants were 35-40 cm high and had 8–10 tillers, 130 ewes with 100 lambs at foot were allowed into the crop. There was about 0.90 t/ha of dry matter available at that time (Table 1). The sheep remained grazing the paddock until 10 July. The paddock was then broadcast with 50 kg/ha urea the same day the sheep were removed, with the expectation the crop would grow back and provide a second grazing period.
The 2014 growing season experienced above average temperatures. The warm conditions caused Moby to race through its growth stages. This was more apparent where the crop hadn’t been grazed; the crop was taller but visually it also turned off faster. Crop that had been grazed stayed greener for longer and a small amount of green remained in the stalk in October. Very little rainfall was received once the sheep were taken out in July. Unfortunately the crop was unable to recover (Table 1) and was not harvested.

Feed tests measured 18% crude protein, 9.1 MJ ME/kg and 54% NDF. Usually ME levels in Moby are adequate, but in this case the feed test (possibly due to drier conditions) suggests that a supplement would be of benefit if grazing with pregnant/lactating ewes or fast growing lambs.

One of the lucerne-Moby paddocks next to the sheep yards on higher, lighter ground recovered much better after being eaten to the ground, and grew back to about 15 cm high. It was used as a standing hay crop for joining 70 ewes in November, providing another four weeks of grazing. By then it was grazed out. The other lighter soil lucerne-Moby paddocks also performed better and were able to sustain two grazing periods during the season.

A paddock of Scope barley was also grazed by cattle. The grazing period continued for a little longer than desirable, and cattle grazed the crop down to 5 cm. Cattle were taken off at the end of July but, with no further rain, recovery was poor. The grazed Scope barley yielded 0.6 t/ha, half the yield achieved by ungrazed crops. In past seasons, however, Scope has been grazed successfully without the crop suffering a yield penalty.

The Hynams use Moby and Scope according to each paddock rotation. Moby is used only for forage, and often drilled into lucerne stands. It grows faster earlier and develops a more robust plant that can be grazed two to three times. Scope, on the other hand, is predominantly a grain crop, but offers a useful single grazing opportunity.

All types of stock are grazed on the cereal crops. Kevin Hynam has noticed that cattle will graze a paddock more evenly than sheep, but sometimes will pull plants out. Sheep tend to camp in certain areas more than cattle do.

In 2015 Kevin and Tracey plan to drill Moby back into the lucerne country at 30 kg/ha sowing rate, with 50 kg/ha single super. This helps to add bulk to the lucerne stand while providing some phosphorus. Due to the farm’s rotations, there will be less Scope barley planted in 2015. The 2014 trial paddock will be sown to Wombat oats which will be harvested and used later for feeding sheep.

### Table 1 Dry matter (DM) production of ungrazed and grazed Moby barley, Patchewollock 2014

<table>
<thead>
<tr>
<th>Location</th>
<th>Pre-grazing DM (t/ha)</th>
<th>Ungrazed DM post grazing (t/ha)</th>
<th>Grazed DM post grazing (t/ha)</th>
<th>Ungrazed final DM/ha (t/ha)</th>
<th>Grazed final DM/ha (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cage 1</td>
<td>1.08</td>
<td>2.53</td>
<td>1.20</td>
<td>2.18</td>
<td>0.89</td>
</tr>
<tr>
<td>Cage 2</td>
<td>0.51</td>
<td>2.64</td>
<td>1.47</td>
<td>2.43</td>
<td>1.41</td>
</tr>
<tr>
<td>Cage 3</td>
<td>1.02</td>
<td>2.13</td>
<td>1.08</td>
<td>2.11</td>
<td>1.12</td>
</tr>
<tr>
<td>Average</td>
<td>0.87</td>
<td>2.43</td>
<td>1.25</td>
<td>2.24</td>
<td>1.14</td>
</tr>
</tbody>
</table>

### Table 2 Final dry matter production of ungrazed and grazed Bolac wheat, Jil Jil 2014

<table>
<thead>
<tr>
<th>Paddock location</th>
<th>Ungrazed final DM/ha (t/ha)</th>
<th>Grazed final DM/ha (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western end</td>
<td>1.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Eastern end</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Average</td>
<td>1.4</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Final dry matter production of the mature crops was lower for the grazed, compared with ungrazed, crop (Table 2). This didn’t translate into a yield differences, however, with crops averaging 0.88 t/ha for both paddocks. Grain quality of Bolac met APW specifications for protein, but both grazed and ungrazed crops had high screenings (6–7%).

The early sown slow maturing wheat worked well for McClellands in 2014. These crops yielded 20 per cent better than spring wheats sown in adjoining paddocks. The sheep were able to graze on the crop, letting other pasture areas bulk up, and crop yields were unaffected.

The McClellands will continue to use long season wheats in their sowing variety mix. As well as crops being valuable fodder for the sheep, the practice appeals because they are keen to capitalise on earlier rainfall events with extra varieties to extend their sowing period. A further advantage is that there will be two fewer paddocks to be sown later. In addition, by switching varieties during sowing, they can spread out flowering windows to help to manage the risk posed to crops by frosts.

In 2015, having the seed on hand they will use the spring-type Bolac again, but would consider a winter wheat if a variety with a good disease profile were made available. Grazing will be dependent on the season. They intend to take advantage of the feed potential in situations in which the crop is healthy. Sheep are highly valued as contributing positively to their farm business, providing useful cash flow when cropping seasons are poorer. They are also used to manage stubbles.

**Normanville**

Geoff and Bronwyn Hunt sowed Wedgetail wheat (APW in Victoria) on 9 March for the first time on their property. Wedgetail has a winter habit and is a slow maturing variety. It was sown into a 10.5 ha paddock following 45 mm on 4 March. Another 9 mm fell on 15 March to help establishment along. The crop was sown with 20 cm row spacings at 28 kg/ha with 30 kg/ha MAP.

When the crop was eight weeks old on 8 May, it was standing 40 cm high and had up to 20 tillers per plant. 154 agisted pregnant and lambing ewes were put into the crop and remained there until 12 June. About 1.5 t/ha of dry feed was available (Table 3), and feed tests measured adequate nutrients for the sheep with 17.5% crude protein, 11.9 MJ ME/kg and 40.4% NDF.

While on the crop, several ewes had lambs. The same day sheep were removed, 40 kg N was applied as UAN, and the paddock was locked up and left to mature.

When sheep were removed from the Wedgetail crop on 12 June, there was still plenty of feed available (8-10 cm high, with 1-2 weeks of grazing potential remaining), but plants were reaching GS31 and the Hunts didn’t want to compromise grain yield.

Bronwyn was impressed by the way the crop recovered, which is reflected in the final cut measures for dry matter (Table 3). Grain yield was reduced across the paddock by grazing, the quadrat cuts indicate from 1.23 to 0.94 t/ha. However, actual grazed paddock yields were higher at 1.74 t/ha on average. The crop had some issues with establishment (thought to be residual herbicide following chickpeas), suffered from Crown rot (about 10-20% of the paddock) and some frost damage, but in well-established areas it yielded about 2.2 t/ha. The crop was also short of nitrogen leading up to GS30, but this could not be addressed until the sheep were removed.

A nearby paddock of Grenade sown on 25 April yielded 2.72 t/ha.

The Hunts found the whole grazing crop experience interesting and feel it has potential in their farming system. While they don’t own their own sheep, they regularly agist some neighbours’ sheep to graze stubbles. They weren’t concerned about putting sheep onto their growing crop as they were aware of the theory behind the practice and knew Wedgetail was very capable of recovering biomass. Nevertheless, they were glad to see that reality endorsed theory.

In 2015 the Hunts plan to sow Wedgetail in March again if it rains as it did in early 2014. They feel that if the next sowing rain in 2014 had been in July, the yield of conventional crops would have looked quite different. As it was, they had a perfect start to the conventional year. They will use Wedgetail again as they have the seed on hand already.

Looking to the future, the Hunts would like to see a better adapted winter wheat variety available for their area. They plan to store seed wheat with a winter habit so that if the sowing rules are met early in the year, they will sow one paddock at low rates (due to high tillering potential) to spread risk. However, they are not sure whether they will always graze it; they will make that decision on a year-to-year basis. Though they do not own sheep themselves, this strategy would always be considered as an opportunistic management decision.
What does this mean?

Commercial practice on-farm

An early sown cereal crop can provide valuable feed for livestock before legume pastures are ready to be grazed. To get the best value from the cereal crop, sow early to take advantage of early moisture and produce feed sooner. Sow a forage cereal purposely bred for grazing value or a longer season oats or barley in April. Alternatively, sow dual-purpose winter wheat in March/early April or a longer-season spring wheat in April.

Spreading the window of sowing to include earlier weeks during March or April, using slower maturing varieties makes better use of early moisture, reduces pressure at sowing time and helps to spread the flowering period of crops later in the year. These strategies assist growers to manage the use of rainfall across the season and minimise the risk of frost damage during flowering.

Profitability

Improving production by increasing the survival rate of ewes and young lambs, and achieving better growth rates in lambs can be achieved by using a cereal crop to produce fast establishing feed early in the year. The cereal can be sown into existing pasture stands or as a crop that can be later harvested for grain.

Sowing slower maturing varieties early in the season can capitalise on early rainfall and help expand flowering windows, reducing the risk of frost damage.

Acknowledgements

This research was funded through GRDC’s ‘Grain & Graze 3’ project (SFS00028).

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<thead>
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<th>Date</th>
<th>8 May</th>
<th>19 Nov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Pregrazing DM (t/ha)</td>
<td>Ungrazed final DM/ha (t/ha)</td>
</tr>
<tr>
<td>Cage 1</td>
<td>1.38</td>
<td>6.60</td>
</tr>
<tr>
<td>Cage 2</td>
<td>1.50</td>
<td>6.34</td>
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<tr>
<td>Cage 3</td>
<td>1.82</td>
<td>7.57</td>
</tr>
<tr>
<td>Average</td>
<td>1.57</td>
<td>6.83</td>
</tr>
</tbody>
</table>

Table 3 Dry matter production of ungrazed and grazed Wedgetail wheat, Normanville 2014
The effect of grazing intensity on crops
Alison Frischke and Dannielle Ick
BCG, Victoria

2 trials at Raywood in 2012 and Watchupga East 2013 (see BCG 2012 Livestock Research Results p 58 and BCG 2013 Season Research Results p 204) indicated that a crop can be safely grazed without yield penalty when a quantity of leafy material remains after grazing to aid crop recovery. This amount will vary with the crop stage of growth, and grazing duration and intensity.

BCG, through the Grain & Graze 3 initiative, conducted a trial in 2014 to further explore ‘safe’ grazing management practices.

Why do the trial?
To validate the effect of grazing intensity and growth stage on forage value and yield response of different wheat varieties, with sowing times suited to cultivar.

How was it done?
A replicated field trial was sown using a split plot trial design with time of sowing as main plots and variety x grazing as sub-plots. Winter wheat varieties Rosella and Revenue were sown (TOS1) on 1 April. TOS1 occurred after receiving 50 mm of rain during March, with 10 mm falling just prior to sowing. Mid and short season varieties Scout and Mace were sown (TOS2) on 6 May. TOS2 occurred after 30 mm of rain during April, with 13 mm falling just prior to sowing. All plots established very evenly.

Seeding equipment: Knife points, press wheels, 30 cm row spacing Target plant density: 150 plants/m²
Harvest dates: 14 November (TOS1) and 1 December (TOS2)
Fertiliser: Granulock supreme Z @ 50 kg/ha at sowing plus 180 kg/ha of urea (83 kg N/ha) top-dressed in two separate applications.

Pests, weeds and diseases were controlled to best practice commercial standards.

Assessments included crop biomass removed at each grazing time and height, nutrient value of that grazed biomass, total biomass at anthesis and grain yield and quality parameters.

Grazing was simulated using a line trimmer, cutting the crop to the treatment height.

Using dry matter (DM) and feed tests, dry sheep equivalent (DSE) grazing days were calculated as follows: DSE grazing days = DM (kg/ha) x feed test metabolisable energy (ME) / 8 MJ, which assumes that each DSE requires 8 MJ ME/day.

Treatments for each variety are presented in results Tables 2-4.

What happened?
The season began in March with welcome opening rains which continued steadily until the end of July. However, little rain fell during spring and crops were forced to rely on stored soil moisture to finish. 72 days were recorded with a minimum temperature below 2°C; many plants suffered from stem frost.

Grazing value
Early grazing of crops occurred at GS16 when plants were 25-35 cm. Late grazing occurred when plants were at GS30-32 when crops were 40-45 cm tall. All light grazes were to 25 cm, moderate to 15 cm and heavy to 10 cm. Feed tests indicated that all crops had adequate protein, metabolisable energy (ME), and fibre (NDF) to support lactating ewes and growing lambs (16% protein, 11 MJ ME/kg and >30% NDF). As crops matured, or were more intensely grazed, nutrient value reflected the change in plant structure with age and proportion of leaf: stem (Table 1).
As expected, the feed (dry matter) and subsequent grazing days value increased the more heavily the crop was grazed, and the later the crop was grazed for all varieties (Tables 2, 3 and 4). Dry matter recovery by anthesis also followed a similar trend, with a tendency to have lower dry matter when grazed more heavily and later.

**Grain value**

Rosella: Despite a reduction in anthesis dry matter for later grazed crops, grain yields were unaffected by grazing at any stage or intensity in 2014 (Table 2). The early sowing in April gave Rosella sufficient time in the season to recover and maintain production. However, Rosella yields were poor compared with the neighbouring Early Wheat Trial (av. 1.7 t/ha), for which the reason is unknown. Plants that have lower yield potential need fewer resources to be able to recover and maintain grain yield when grazed.

Grain protein was higher for ungrazed and early-light grazed crop compared with later grazed crop to 10 and 15 cm tall, but all protein levels were high, exceeding 14%. Grazing Rosella at any stage did not affect screenings.

**Revenue:** sown with the same treatments as Mace (Table 4). This variety has a higher vernalisation requirement (cold temperatures needed to trigger vegetative to reproductive growth) than Rosella, and it remained vegetative well into the season. By 22 May, 0.27 t/ha of DM had been produced and by 26 June 0.88 t/ha of DM when grazed moderately. Subsequently, Revenue flowered very late and with the dry spring conditions, failed to set grain for harvesting.

Scout: An early-mid maturing variety sown later, and hence grazed later, had similar value responses to grazing treatments to Rosella, but didn’t produce quite as much dry matter. Grain yields were maintained in early grazed plots, and the lightly grazed later timing. Yields of the later, more heavily grazed crops to 15 and 10 cm were lower than ungrazed crop.

Grain protein of Scout was unaffected by grazing. Screenings, however, were above 5% for all treatments and suffered from the late, heavy graze.

**What does this mean?**

**Commercial practice**

Early planting of wheat varieties when opportunities present, matching the month of sowing with growth type (i.e. winter wheat to late March-early April and spring wheat to late April-very early May) capitalises on early moisture, spreads the sowing window for the farm program, and presents a grazing opportunity for livestock.

### Table 1 Feed value of Rosella and Scout wheat grazed at different times and intensities, Quambatook 2014

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Early GS16</td>
<td>Mod</td>
<td>31.9</td>
<td>12.0</td>
<td>38.9</td>
<td>27.6</td>
<td>12.0</td>
<td>42.4</td>
</tr>
<tr>
<td></td>
<td>Heavy</td>
<td>30.7</td>
<td>12.1</td>
<td>34.4</td>
<td>31.6</td>
<td>12.6</td>
<td>36.7</td>
</tr>
<tr>
<td>Late GS30</td>
<td>Light</td>
<td>25.1</td>
<td>11.4</td>
<td>44.4</td>
<td>30.3</td>
<td>12.4</td>
<td>35.6</td>
</tr>
<tr>
<td></td>
<td>Mod</td>
<td>22.3</td>
<td>11.2</td>
<td>43.2</td>
<td>29.2</td>
<td>11.8</td>
<td>37.6</td>
</tr>
<tr>
<td></td>
<td>Heavy</td>
<td>20.6</td>
<td>10.6</td>
<td>48.0</td>
<td>22.4</td>
<td>11.3</td>
<td>42.7</td>
</tr>
</tbody>
</table>

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Unfortunately, in this trial Rosella did not perform as well as expected, but in the neighbouring Early Wheat trial (see article Early sowing of wheat – do winter wheats have a fit?), both winter wheats (Rosella and Wedgetail) sown early yielded as well as May sown Scout. Winter wheats are capable of producing more biomass at an earlier date, creating greater forage value at a time of increased demand.

Trial results support previous work which showed that if the crop is sown at the appropriate time, and grazed early, or lightly, as it approaches GS30, then it should recover and maintain grain production. However, the ability of the crop to recover depends on the time of grazing in the year and plant maturity, stored and in-season rainfall, and the intensity of grazing.

On-farm profitability
Livestock production is a reliable source of income for mixed farming businesses across seasons. Growing green feed for ewes and lambs with high nutrient demands when other pasture growth is limited will improve survival of ewes and lambs, and lamb growth rates.

With careful grazing management, crops can be grazed early and lightly in most years without suffering yield penalty. This will be a trade-off in the amount of feed available for stock and potential grain yield penalties later. Heavier and later grazing, when there is more feed, may increase yield penalty risk. In 2014, it was more profitable to graze Rosella and Mace as they maintained yield in addition to their forage value. Grazing Scout was profitable early, but a decline in yield and subsequent income of later and more heavily grazed crop needed to be balanced with grazing value.

Making the decision when to graze will depend on the need for feed and importance of livestock and cropping to the business.

Acknowledgments
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