Livestock

Identifying causes for lamb losses in low rainfall mixed farming regions

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Why do the trial?
Survey data suggests that Merino weaning percentages in low rainfall regions vary from 80-90%. However pregnancy scanning indicates that percentages of around 130% are present in the uterus. This difference constitutes a loss of possibly 100,000 lambs annually on Eyre Peninsula (EP) alone. In most instances the failure is likely to be due to poor lamb survival which can occur due to a number of reasons involving the lamb itself, its genetics, the ewe and the environment.

Identifying the causes and timing of lamb losses may provide the opportunity to address these factors whereby a significant economic benefit accrues to the industry; however the first step is to establish where the issues are occurring in the reproductive cycle of the flock. The solutions to reduce lamb losses exist but there needs to be an accurate assessment of why the losses are occurring to implement the correct preventative strategies.

How was it done?
Research was carried out on Minnipa Agricultural Centre (MAC) through utilising the lambing program of an Australian Wool Innovation (AWI) and South Australian Research and Development Institute (SARDI) funded project ‘Best Practice Wool Innovations on Eyre Peninsula’.

The 374 MAC flock ewes, ranging from 2006-2011 drop, were joined in 7 sire groups of approximately 50 ewes from 1 February until 12 March 2012. Sire group 7 consisted of 43 ewe lambs (2011 drop) that were 6-7 months old and heavier than 40 kg at joining.

The joined ewes were pregnancy scanned at 12 weeks on 27 April. Ewes were side-branded (for dam pedigree) and drafted into their sire groups for lambing on 8 June. Dry ewes were drafted from the flock and kept in a separate paddock over the lambing period. Seven sheltered paddocks ranging from 10-20 ha in size were chosen for lambing and ewes had a feed base including mallee scrub, saltbush, olive trees and wheat stubble with an understorey of medic, broadleaved weeds and annual grasses.

Lambing began on 28 June and finished on 9 August 2012. During this time daily observations were conducted and lambs were individually identified (for pedigree) at birth and tagged. To identify the cause of lamb losses from scanning until marking the following measurements were taken; birth weight (kg), birth type (single, twin, triplet or quadruplet), rectal temperature (°C), lamb vigour and dam maternal temperament (objective 1-5 score, with 1 being poor and 5 being excellent), and in the case of death prior to weaning, an autopsy to determine the cause (date of death and autopsy result).
This methodology provided the opportunity to identify the cause and timing of lamb deaths which were documented from the beginning of lambing on 28 June until weaning on 10 October 2012.

**What happened?**

The 2006-2010 (sire groups 1-6) drop ewes had a pregnancy scanning result of 162% equating to 538 lambs from 331 ewes with the ewe lambs (sire group 7) having a lower result of 48% equating to 21 lambs from 42 ewes.

Two ewes died of unknown causes in between scanning and lambing and 8 ewes died during lambing due to dystocia (abnormal or difficult birth) or other unknown causes. During lambing 563 lambs were tagged at birth (with a result of 151% for lambing) and 119 lambs died. One lamb died between marking and weaning, leaving 443 lambs surviving (with a result of 118% for weaning).

The majority of lambs were born as twins (69%) and there were more ram lambs (53.2%) than ewe lambs (44.2%), with 2.2% of lambs born recorded as unknown sex due to predation and one lamb was born a hermaphrodite (0.2%).

Birth weight was measured from approximately 2-24 hours old and ranged from 2-8 kg, averaging 5 kg. The birth weights were also measured for lambs found deceased at the birth site. Rectal temperature was measured on living lambs only at the time of taking birth weight measurement and averaged 38.9°C (normal range 39-40°C, <37°C is critical, <35°C requires treatment).

Maternal temperament averaged 3.6 for all ewes however was better in the 2006-2010 drop ewes compared to the 2011 drop dams and the average lamb vigour was 3.9.

The dams of the deceased lambs included 6 ewes that had died during the lambing period, 20 that had mastitis (which were hesitant to let their lambs feed) and 26 that were maidens. Due to predation, autopsies could not be conducted on 14% of lambs which were consequently recorded as 'undiagnosed' due to only finding parts of their bodies intact during daily observations (Figure 1). There were another 36% of lambs that existed and were tagged but were missing at marking time (the carcasses were most likely scavenged or predated before they could be recovered). These lamb deaths were recorded as 'not found' (Figure 1).

The lamb age at time of death ranged from less than 1 day to 47 days with an average age of 2.5 days, however the age at death of 43 deceased lambs was undermined due to predation. Of the deceased lambs there were 47 females, 60 males and 13 unknown (due to predation). Over two-thirds (82%) of deceased lambs were multiples. In the 'undiagnosed' and 'not found' categories, all lambs with a known birth type were multiples with the majority recorded as twins (63%).

![Figure 1 Autopsy results for the deceased lambs in the Minnipa Agricultural Centre flock 2012 drop from birth until weaning](image-url)

Dystocia = abnormal or difficult birth
What does this mean?
The majority (72%) of known lamb deaths in the study were attributed to or associated with the complexity of issues involving starvation, mismothering and exposure (referred to as the SME complex), which is similar to industry records. It was suspected that the major cause of lamb deaths in the 'not found' and 'undiagnosed' categories could not be determined due to secondary rather than primary predation. These lambs were vulnerable and more likely to die in the absence of predation due to the relationship with multiple birth types and the SME complex, as well as other factors including maternal temperament, rectal temperature, birth weight and lamb vigour.

Nearly half of all pre-weaning deaths occur on the day of birth, therefore reducing the likelihood of lamb deaths within the first 24 hours will have a significant impact on lamb survival to weaning.

Recommendations to come out of the study include:

- Actively managing ewe nutrition during pregnancy according to scanning results, targeting a minimum body condition score of 3. Maintaining ewes in this condition will minimise the risk of dystocia and provide extra nutrition for multiple-bearing ewes, which will assist in increased lamb vigour and likelihood of survival past the 24 hour period.
- Using lick feeders for supplementary feed over the lambing period as opposed to trailing out feed will reduce the incidence of mismothering and will reduce flock stress during this time.
- Adequate paddock size for the number of lambs expected to be born and well planned placement of feed and watering points will also reduce mismothering issues, especially if interference during lambing time is a possibility (e.g. if mothering-up lambs). Suitable paddock shelter also plays a vital role in lamb survival (to reduce exposure risk).
- Managing future reproductive efficiency can be achieved by removing poor mothers from the flock as well as selecting ewes using Australian Sheep Breeding Values (ASBVs) that are higher for number of lambs weaned. Traits can also be selected relating to birth weights if this is an issue and cannot be manipulated through ewe nutrition.
- Although predation is generally a secondary issue, predators and scavengers need to be controlled to avoid flock stress and predation on weak or abandoned lambs. A refined program needs to be in place at least a month before lambing to ensure pest numbers are controlled before lambing begins. Anecdotal evidence has indicated that alpacas and guardian dogs have an effect on reducing the losses caused by predators when placed within sheep flocks and could be used as part of the pest control program.

Opportunities arising from the results of this study are currently being assessed to minimise losses through management or genetic strategies. Identifying lamb losses will assist producers to recognise issues associated with lambing and subsequently improve sheep welfare conditions and enterprise profit.

Acknowledgements
Roy Latta for project development and delivery. Emily Litzow for her technical expertise in lamb autopsy activities. MAC staff Mark Klante, Trent Brace, Brett McEvoy and Jake Pecina for their livestock management support and Ashlee McEvoy for support during the lambing period. SASAG for providing funding support.
Using Breeding Values for genetic benchmarking in EP Merino sheep enterprises

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Key messages

- Merino sheep at Minnipa Agricultural Centre are being used as a practical demonstration and focus for discussion to assist ram breeders and buyers to gain an understanding of the Sheep Genetics system MERINOSELECT and Breeding Values.
- Breeding Values are used as a tool for benchmarking in a sheep enterprise and should be used in conjunction with visual selection.
- Minnipa flock breeding objectives have had measured success in most key traits.
  - This technology has the potential to greatly increase production and profitability through long term improvement to genetics.

Why do the trial?
Sheep Genetics Australia (SGA) is the Australian Wool Innovation (AWI) and Meat and Livestock Australia (MLA) genetic evaluation service, which calculates Breeding Values through MERINOSELECT and LAMBPLAN to assist with more accurate breeding and selection decisions. Using these tools in addition to visual selection has the potential to optimise genetic progress, which in turn will significantly improve livestock productivity and profitability. Breeding Values take into account all known environmental differences (e.g. age of dam, birth date and nutrition), all available pedigree information and any correlations between traits. The value of an animal’s genes for most production traits cannot be visually measured, however Breeding Values provide livestock producers with a unique tool for the best estimate of genetic merit.

A well-defined breeding objective will assist sheep producers to set a clear direction for their breeding program and allow them the optimum use of the SGA system. This benchmarking tool uses a combination of pedigree, raw data collation from the animal and its relatives and environmental factors to generate Flock Breeding Values (FBVs) and Australian Sheep Breeding Values (ASBVs), which provide livestock producers with a description of the potential genetic value of a breeding animal for each trait (e.g. greasy fleece weight, eye muscle depth, body weights etc.). ASBVs are breeding values provided by SGA when there are genetic linkages between flocks, which allow these figures to be benchmarked across flocks Australia wide. The gains through genetic and production improvement and subsequent increase in profit margin are significant incentives for involvement in the SGA system.

There has been limited uptake of new and more efficient technology in the livestock component of mixed farming enterprises on Eyre Peninsula (EP) in recent decades. The aim of this project is to promote the recent advances in sheep genetic research and assist livestock producers improve their system. Breeding Values have the potential to increase productivity and profitability of a livestock business, and can also be used in conjunction with other associated technologies to increase labour efficiency.

The Minnipa Agricultural Centre flock breeding objectives aim to increase body weight, fleece weight, reduce breech wrinkle and maintain micron (fibre diameter).
Table 1 Average raw measurements and Australian Sheep Breeding Values (ASBVs) of the 2010 and 2011 hoggets (11-13 months old) in the Minnipa flock

<table>
<thead>
<tr>
<th>Type of measurement</th>
<th>Year of drop</th>
<th>Fleece weight</th>
<th>fibre diameter (µm)</th>
<th>Body weight (kg)</th>
<th>Eye muscle depth (mm)</th>
<th>Breech wrinkle (score 1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. raw</td>
<td>2010</td>
<td>3.4 kg **</td>
<td>18.0</td>
<td>50</td>
<td>30.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Av. ASBV</td>
<td>2010</td>
<td>+8.5%***</td>
<td>-0.8</td>
<td>+1.4</td>
<td>0</td>
<td>-0.1</td>
</tr>
<tr>
<td>Av. raw</td>
<td>2011</td>
<td>3.6 kg **</td>
<td>18.6</td>
<td>47.1</td>
<td>34.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Av. ASBV</td>
<td>2011</td>
<td>+11.0%***</td>
<td>-0.6</td>
<td>+2.5</td>
<td>-0.2</td>
<td>-0.1</td>
</tr>
<tr>
<td>Av. Australian ASBV*</td>
<td>2011</td>
<td>+9.8%***</td>
<td>-0.9</td>
<td>+2.9</td>
<td>+0.2</td>
<td>****</td>
</tr>
</tbody>
</table>

*Australian average for medium Merino flocks in the SGA system for the 2011 drop hoggets
**Raw measurement of hogget greasy fleece weight (kg)
***ASBV presented as a percentage of clean fleece weight
****Breech wrinkle is an objective score only and therefore has no national average

How was it done?
The three-year project ‘Best Practice Wool Innovations on Eyre Peninsula’ began in 2011 using the Merino sheep flock at Minnipa to demonstrate the genetic benchmarking process that leads to the creation of MERINOSELECT Breeding Values by SGA. Measurements began on the flock in 2010 to register the sheep in MERINOSELECT and benchmark the original flock figures to track changes over the duration of the project, resulting in 4 years of genetic data.

Throughout the year a program of measurements are carried out on the Minnipa flock including sire and dam pedigrees, birth weight and date, sex and birth type (single or multiple), breech and body wrinkle scores, body weights over several age stages, fat and eye muscle scans, wool characteristics, wool weights, pregnancy scans, visual classing scores and physical abnormalities.

Measurements are taken from the ewes and wethers for each drop and submitted to SGA at hogget age (at approximately 12 months old). Wethers are sold off after their first shearing and breeding ewes are visually and objectively classed before being admitted into the breeding flock. If flock size needs to be reduced further, ewes are selected using their ASBVs.

To increase the accuracy (linkage) of the Breeding Values from the Minnipa flock, sires are selected based on ASBVs with emphasis on traits that correlate with the flock’s breeding objectives, however sires are required to also be visually sound. Sires are sought locally from EP studs or from the Turretfield Research Centre for genetic linkage purposes.

Previous results for comparison are presented in EPFS Summary 2010, p 143 and EPFS Summary 2011, p 145.

What happened?
Measurements were submitted to SGA for the 2010 and 2011 drop hoggets and have been analysed through MERINOSELECT, generating ASBVs for these 2 years, which are presented with the average raw data figures in Table 1. Comparative results for the 2012 drop will be generated at yearling age. The ASBVs are expressed as the difference (+ or -) between an individual animal and the benchmark to which the animal is being compared. For some traits a positive ASBV is desirable (e.g. weight or eye muscle depth) and for other traits a negative is more desirable (e.g. fibre diameter). For example, an ASBV of +6 for hogget weight means that the animal is genetically better by 6 kg at this age than an animal with an ASBV of 0 (0 kg). As rams contribute half the genetics of their progeny (the ewe the other half), the resulting progeny will be on average 3 kg heavier than the animal with an ASBV of 0 at hogget age if a ram is mated to ewes of equal genetic merit.

Results have varied in the 2 years of hogget ASBVs due to lack of linkage in the Minnipa flock, however the average ASBVs of sires selected over the duration of the project shows improvements in most traits, which is presented in Table 2.
## Table 2 Average Australian Sheep Breeding Values (ASBV) of the sires used in the Minnipa flock

<table>
<thead>
<tr>
<th>Year joined</th>
<th>Clean fleece weight (%)</th>
<th>Fibre diameter (µm)</th>
<th>Body weight (kg)</th>
<th>Eye muscle depth (mm)</th>
<th>Breech wrinkle (score-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>+12.7*</td>
<td>-0.5</td>
<td>+2.7</td>
<td>-0.3</td>
<td>-0.1</td>
</tr>
<tr>
<td>2011</td>
<td>+16.2*</td>
<td>-0.2</td>
<td>+3.9</td>
<td>-0.5</td>
<td>-0.2</td>
</tr>
<tr>
<td>2012</td>
<td>+16.0*</td>
<td>-0.2</td>
<td>+7.0</td>
<td>+0.4</td>
<td>-0.2</td>
</tr>
<tr>
<td>2013</td>
<td>+18.9*</td>
<td>-0.3</td>
<td>+7.4</td>
<td>+0.5</td>
<td>-0.2</td>
</tr>
</tbody>
</table>

*ASBV presented as a percentage of clean fleece weight

### What does this mean?

Minnipa flock breeding objectives aimed to increase body weight, fleece weight, reduce breech wrinkle and maintain micron. The project has had measured success with most of these objectives, however with increased data accuracy through better linkage and more measurements we hope to see improvement in all key traits. This technology has the potential to greatly increase production and profitability through long term improvement to genetics. However, there has been some hesitation from the industry in its uptake, with many breeders and buyers yet to see the benefits of the SGA system. For effective use of the new technology, it needs to be closely aligned with visual selection and breeding objectives in each individual flock in order to see significant outcomes. It also needs to be understood that improving genetics is a slow process and a long-term investment for the sheep enterprise rather than a method of increasing the businesses profit margin immediately.

Education about this genetic evaluation service and how it can be beneficial for sheep breeders and producers is the next step towards genetic improvement for the industry. The Minnipa project is assisting the sheep industry understand this new technology and helping to provide information and a demonstration of how to overcome the issues that come with uptake of the technology and involvement in the SGA system.

### Acknowledgements

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Grain and Graze – who, what, when, where, why, how?

Jessica Crettenden and Roy Latta
SARDI, Minnipa Agricultural Centre

Try this yourself now

Location:
Minnipa Ag Centre

Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2012 Total: 253 mm
2012 GSR: 185 mm

Yield
Potential: 1.2 t/ha (W)

Paddock History
2011: Barley
2010: Canola
Pre - 2010: Varied

Soil Type
Red sandy loam
Plot Size
2.7 ha x 4

Environmental Impacts

Soil Health
Soil structure: Stable
Compaction risk: None
Perennial or annual plants: Annual

Water Use
Runoff potential: Low

Resource Efficiency
Energy/fuel use: Standard
Greenhouse gas emissions (CO₂, NO₂, methane): Cropping

Social/Practice
Time (hrs): No extra
Clash with other farming operations: Standard practice

Economic
Cost of adoption risk: Low

Key messages
• The decision of whether or not to grain and graze ultimately is an evaluation of a range of factors including seasonal influence and an assessment of the potential crop penalty of grazing against the grazing value for livestock and overall system benefit.
• A late seasonal start with subsequent poor early growth supported the decision not to graze the canola crop in 2012.

Why do the trial?
The concept of using cereal and oilseed crops for early season grazing and subsequent grain production, also known as growing dual purpose crops, has been demonstrated successfully throughout Southern Australia for a number of years. Dual purpose crops can increase total profitability on mixed farms by providing a source of high value feed during the autumn/winter feed gap, while giving pastures a chance to establish.

However, grazing crops has always been considered too great a risk by many farmers. One of the major issues is that grazing a crop requires a decision making process that can be clouded by too much, or not enough information, which leads the concept to be put in the ‘too hard’ basket. It is perceived that grazing crops for feed requires substantial technical knowledge, but once the interactions between the crop and livestock are taken into consideration, it is simply a process of understanding who, what, when, where, why and how.

How was it done?
The 4 x 2.7 ha Minnipa Agricultural Centre ‘competition paddocks’ (refer to EPFS Summary 2010, pg 103 and EPFS Summary 2011, pg 141 for previous records and trial design) were sown with canola @ 3 kg/ha and Angel medic @ 6 kg/ha on 2 May 2012. Four permanent sampling points were marked in each paddock (each paddock representing 1 of 4 replicates) with plans to split plots for plus and minus grazing. The aim of the trial was to provide a dual purpose crop with a grazing opportunity during the autumn/winter feed gap when the canola was well anchored and at approximately the 6-8 leaf stage (with biomass of 1.5 t/ha) and for livestock to be removed after buds had elongated no more than 10 cm. A grain yield was subsequently to be harvested.

Plant counts and biomass samples (dry matter (DM)) were taken for the canola and medic from 10 x 0.1 m² quadrats across each sampling point and dried at 70°C for 48 hours on 13 July (to assess biomass available for grazing), 30 August and on 5 October (to assess biomass available for a ‘hay-cut’). A feed test was taken from the 13 July biomass samples to assist with calculating stocking rates for grazing. Canola grain harvest was undertaken on 31 October 2012.

What happened?
The 13 July feed test reported acceptable levels for grazing all sheep types at a production level (e.g. for young, quick growing lambs or lactating ewes) with 86.8% dry matter, 31.7% crude protein (target is 16% for production), 25.4% neutral detergent fibre (target over 30%, fibre would increase as plants matured and hay supplemented at grazing), 84.8% DOMD (digestibility) (75% required for production feeding) and 13 MJ /kg DM (11 MJ/kg DM required for production).

Although canola and medic plant densities were acceptable, 34 and 100 plants/m² respectively, the amount of biomass in July was not adequate to support any useful grazing (Table 1). Data presented for each treatment are a mean of the four selected permanent points in each single treatment (paddock).
Each of the four replicates had varied paddock history that impacted on the results shown in Table 1 and the lack of biomass was integral in the decision to not graze the crop early. The low canola yields measured suggested that the paddocks could have been used for sacrificial grazing (during the mid to late reproductive phase of the crop where there is a no likelihood of reaping a significant yield, to fill the feed gap or short supply over summer).

**What does this mean?**
The decision making process, which resulted in not grazing the trial in 2012, was a procedure that must take all factors of the system into account and can be broken up into the sections below:

**Who**
Livestock that have no previous grazing experience or are new to the particular paddock (e.g. weaners) are the best type of animal to use as they will graze the entire paddock more evenly and tend not to camp or rest in the same location. Another consideration is to avoid stock that may be vulnerable to stress or can be difficult to move to another paddock (e.g. ewes in late pregnancy or during lambing). Stocking rates can be calculated according to the Feed on Offer (FOO) by taking biomass samples and using a tool such as the MLA stocking rate calculator¹. Alternatively, any number of livestock can simply be used until an even and sufficient grazing has been achieved, as long as the animals are not damaging the plant’s structure. Higher stocking rates for a shorter amount of time will result in a more even grazing.

**What**
Most cereals and oilseeds can be grazed successfully if managed correctly (e.g. livestock may require supplements such as magnesium or sodium on certain crops). It does make sense to graze the crops with more biomass and vigour (e.g. barley) due to more feed being available at the early time of grazing and a faster recovery. A specific forage variety does not have to be chosen to grain and graze - crops that are chosen for grain quality are fine, though some varieties are superior in response and recovery from grazing and do have better grazing traits such as early vigour and more biomass (refer to EPFS Summary 2010, p 136). Early sowing of crops for the purpose of grain and graze and selecting longer season varieties are wise choices as it gives plants an extended recovery period.

**When and How**
Cereals: graze crops during early tillering at growth stage 18-22 (also known as jointing) when plants are well anchored, which can be measured using the pinch and twist test (pinch the top of the leaves upwards while twisting, if the leaves break and the plant does not pull out of the ground, the crop can be grazed). Take the livestock out when the crop is approaching growth stage 30 (stem elongation) and before boot formation to avoid compromising yield (use a stock exclusion area such as weldmesh to monitor crop stage).

Canola: grazing can commence at the 6-8 leaf stage when plants are well anchored. Livestock need to be removed from the paddock when buds have elongated no more than 10 cm. Grazing past this point can delay flowering and potentially reduce yield and oil content. Blackleg severity can be increased through grazing; therefore selecting a variety with a high resistance rating is necessary. Nitrate poisoning can occur if soil N levels are high and livestock are introduced to the paddock too quickly or when they are hungry. Therefore, avoid this situation by gradually introducing stock and providing roughage.

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¹MLA Stocking Rate Calculator can be found online at http://www.mla.com.au/Publications-tools-and-events/Tools-and-calculators/Stocking-rate-calculator

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**Table 1 Established canola and medic plant numbers (plants/m²) total canola, medic and weeds (tDM/ha) and canola grain yield (t/ha) in the competition paddocks for the 2012 season**

<table>
<thead>
<tr>
<th>Paddock</th>
<th>13 July (plants/m²)</th>
<th>13 July DM (t/ha)</th>
<th>30 August DM (t/ha)</th>
<th>5 October DM (t/ha)</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40</td>
<td>0.15</td>
<td>1.6</td>
<td>2.3</td>
<td>0.23</td>
</tr>
<tr>
<td>B</td>
<td>40</td>
<td>0.12</td>
<td>1.0</td>
<td>2.5</td>
<td>0.16</td>
</tr>
<tr>
<td>C</td>
<td>34</td>
<td>0.08</td>
<td>1.2</td>
<td>2.7</td>
<td>0.25</td>
</tr>
<tr>
<td>D</td>
<td>32</td>
<td>0.16</td>
<td>1.9</td>
<td>1.7</td>
<td>0.18</td>
</tr>
</tbody>
</table>
For both cereals and oilseeds ensure that sufficient biomass is available prior to grazing (seeding rates can be higher to increase plant density and early biomass), the timing of grazing allows for optimal crop recovery (choose to graze early-sown crops) and chemical withholding periods are adhered to. Consider applying more nitrogen at seeding and/or topdressing after stock removal to maximise plant regrowth and yield potential if conditions are suitable.

**Where**
The best paddocks to select are ones that are clean and do not have a grass weed issue (as livestock can exacerbate the problem due to reduced crop competition), although grazing canola crops may allow better exposure of target weeds for chemical control. Select paddocks that were sown early and with sufficient watering and/or feed points (such as lick feeders or hay racks) which are spread out to ensure an even grazing. Electric fences are worthwhile if available to force higher stocking rates and promote even grazing.

**Why**
Grain and graze is an opportunity to benefit both the livestock and cropping enterprises. Grazing crops helps fill the feed gap between the times of poor nutritive value of stubbles and while annual pastures are still establishing, and reducing supplementary feeding. Crops can also be used specifically to feed sheep in spring if adverse conditions prevent sufficient grain yield due to drought or frost. Grazing an early sown crop can also reduce the risk of frost damage by delaying flowering.

The decision of whether or not to grain and graze ultimately is an evaluation of the above factors, seasonal influence and an assessment of the potential crop penalty of grazing against the grazing value for livestock and overall system benefits.

**Acknowledgements**
We gratefully acknowledge the help of Mark Klante, Brett McEvoy, Suzie Holbery, Wade Shepperd, Ian Richter and Jake Pecina for their technical assistance and site management. The Eyre Peninsula Grain & Graze 2 project is funded by GRDC and Caring for Our Country (UA00117).
**Eyre Peninsula Farming Systems 2012 Summary**

**Key messages**

- Subsoil moisture and an early sowing opportunity meant that grazing did not affect yield or the gross income return of canola at Sea Lake in 2012.

- Dry conditions increased canola tissue nitrate levels to toxic levels as plants matured.

- Canola has a shorter grazing window than cereals, and requires careful grazing management to avoid high tissue nitrate situations, and roughage to balance fibre.

**Why do the trial?**

Canola crops are being successfully grazed in higher rainfall areas, but less is known about the ability of canola to recover from early grazing in a Mallee/Wimmera environment.

To successfully graze any dual purpose crop, it is desirable to minimise the effect on crop yield, although you may concede a small yield penalty through increased livestock returns. Research and grower experience in NSW (J. Kirkegaard, CSIRO, pers. comm.) has shown that for canola this means:

- Taking advantage of early sowing opportunities: 2-3 weeks earlier than usual. The first half of April is ideal. The later the crop is sown, the longer it takes to reach adequate biomass, and the less time it has to recover. Growing early means grazing early. Oil percentage of grain should not change with grazing, unless the flowering date is moved.

- Making the best variety choice: a variety with either a longer growing season or a dual purpose capability will recover better. However, any variety can be grazed. Choose suitable varieties for weed control; do not compromise on this. Hybrids (imi-tolerant and Roundup Ready) generally produce superior biomass, and are easier to manage weed control in relation to grazing than Triazine Tolerant varieties due to shorter chemical withholding periods.

- Increasing the best variety choice: a variety with either a longer growing season or a dual purpose capability will recover better. However, any variety can be grazed. Choose suitable varieties for weed control; do not compromise on this. Hybrids (imi-tolerant and Roundup Ready) generally produce superior biomass, and are easier to manage weed control in relation to grazing than Triazine Tolerant varieties due to shorter chemical withholding periods.

- Increasing plant density: increase sowing rates and early seedling protection to ensure sufficient plant establishment.

- Increasing available nitrogen (N): apply more nitrogen than normal to stimulate biomass production. Top-dressing is best left until after grazing to avoid nitrate toxicity.

- Tackling blackleg: use blackleg resistant varieties. Grazing can open up the stem and allow infection. Avoid MS or S varieties.

**How was it done?**

A replicated plot trial was established on vetch stubble at Sea Lake on 19 April, 43C80 hybrid canola was sown (targeted plant density 40 plants/m²) with MAP @ 55 kg/ha. Plots were rolled post sowing to facilitate seed-to-soil contact. Urea was applied @ 90 kg/ha to the mid cabbage plus nitrogen at budding treatment only. Standard in-crop herbicides were used to control weeds. A small amount of damage was inflicted on some plots early in the season by rabbits, and later galahs; some plots suffered severe damage and were excluded from the analyses.

In the trial, dry matter production was measured, grazing simulated using mechanical removal and yield assessed for six grazing treatments:

- 6-8 leaf
- mid cabbage
- late cabbage
- 6-8 leaf and late cabbage
- mid cabbage plus nitrogen at budding
- ungrazed

Tissue samples were collected at the time of grazing and tested for nutritive value. Plots were terminated using Reglone (1.5 L/ha) on 20 November, and harvested on 30 November with a small plot harvester.
What happened?
The season at Sea Lake began with 58 mm in March, followed by only 102 mm of growing season rainfall and ended with a dry finish, resulting in a decile 1 rainfall season.

Forage value, or dry matter (DM) production, was greater for canola grazed at mid or late cabbage stage than at 6-8 leaf or if grazed twice at 6-8 leaf and late cabbage (Figure 1). At the time of the 6-8 leaf grazing, plants were small and moisture stressed due to the site receiving less than 10 mm of rain in the eight weeks post sowing. The twice grazed treatment (at 6-8 leaf and late cabbage) didn't recover well after the first graze and total DM suffered.

The mid cabbage grazed + N treatment did not respond to the extra nitrogen at bud formation. At this stage it is likely that plants already had adequate N because the season had been dry, soil N at sowing was 111 kg/ha and the crop had received a top-dress N application.

Grain yield was not affected by grazing (Table 1). Oil percentage of grain, however, was highest for the earliest grazing at 6-8 leaf, and was reduced by grazing at late cabbage. The reduction in oil in the late-grazed canola could have been due to a shift in flowering date further into the dry spring, but flowering date was not measured to confirm. All oil quality was lower than 42%, but this was not sufficient to affect the return for the canola.

Feed tests demonstrated that the forage value of grazing at all growth stages provided adequate protein and energy for lactating ewes and growing lambs. Crude protein ranged from 28-34% (require >16%) and metabolisable energy ranged from 13-14 MJ ME/kg (require >11%). While fibre increased as plants matured, fibre was low, ranging from 23-28% (require >30%) so provision of hay would be recommended. Nitrate levels in samples were generally high. At mid-cabbage, nitrate was 2600 ppm which is considered safe. All other samples were over 4000 ppm which has an impact on animal growth and can be toxic.

![Figure 1 Forage value of canola at different growth stages and subsequent grain yields, Sea Lake 2012](image)

![Table 1 Dry matter production, grain yield and quality of canola grazed at Sea Lake, 2012](table)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Date grazed</th>
<th>Grain yield (t/ha)</th>
<th>Oil (%)</th>
<th>Grain gross income* (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ungrazed</td>
<td>-</td>
<td>1.69</td>
<td>40.4&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>867</td>
</tr>
<tr>
<td>Grazed 6-8 leaf</td>
<td>2 July</td>
<td>1.88</td>
<td>41.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>965</td>
</tr>
<tr>
<td>Grazed mid cabbage</td>
<td>17 July</td>
<td>1.83</td>
<td>41.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>936</td>
</tr>
<tr>
<td>Grazed late cabbage</td>
<td>26 July</td>
<td>1.81</td>
<td>40.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>898</td>
</tr>
<tr>
<td>Grazed 6-8 &amp; late cabbage</td>
<td>2 July 26 July</td>
<td>1.64</td>
<td>38.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>804</td>
</tr>
<tr>
<td>Grazed mid cabbage + N at bud form</td>
<td>17 July</td>
<td>1.78</td>
<td>40.6&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>917</td>
</tr>
</tbody>
</table>

*LSD (P=0.05) ns, CV% ns*  

*Cash price for canola at Sea Lake on 3 December 2012 was $517/t
What does this mean?
The capacity for canola recovery depends strongly on seasonal conditions conducive to regrowth, and the time available for the crop to recover an adequate biomass to set yield. The later grazing occurs, and the longer it continues, the less time there is for this to occur.

Surprisingly, given the dry season in 2012, (simulated) grazing canola did not affect grain yield or quality. It is likely that success was due to the early sowing opportunity, and crop recovery was dependent on subsoil moisture and the ability of canola to extract moisture from depth.

When grazing canola, extra care is necessary, as it is likely that it will be a different feed source from the paddock the stock came from. If coming off grass onto canola, stock will eat out all the grass first. Introduce animals gradually for short periods at a time and observe them closely for any abnormal behaviour; ruminants will take a week or two to acclimatise to the brassica. After 2-4 weeks, weight gains will be achieved. This was seen at Birchip in the summer of 2011/12 when lambs grazing Winfred forage brassica grew at a rate of 110 g/day after 20 days and at 330 g/day after 40 days.

Nitrate poisoning can occur after a dry spell, when soil N levels (including sowing N) are higher and it is taken up by the plant after rain or irrigation. Animals begin to be affected (subclinical) at tissue nitrate levels over 2000 ppm, and toxicities occur above 4000-5000 ppm. Nitrates are also an issue in dark, overcast weather. To avoid nitrate poisoning introduce stock gradually, later in the day with full stomachs. Also provide roughage (which will also prevent scours), and observe animals closely. Wait for three weeks after top-dressing, or leave top-dressing until after grazing. Stock grazing canola doesn’t have the same sodium and magnesium supplement requirements as those grazing wheat.

If contemplating grazing a failed canola crop to recover some of the growing costs via livestock, consider the possibility of nitrate poisoning, and be aware of chemical withholding periods for both pre and post-emergent herbicides.

Grazing had no significant economic consequences on the canola crop at Sea Lake in 2012. The main value of this practice is that it provides growers with a place to put their animals while other legume pastures are establishing or while grasses are being sprayed out of pasture crops. However, with necessary introductory periods for grazing, low fibre and nitrate poisoning risk, weed management and chemical withholding periods to consider, the window for grazing canola is short. Generally, the overall risk to crop and livestock production is higher than for cereals.

Further assessment of grazing canola in a low rainfall environment is needed to properly assess the feasibility and risk of the practice. This trial will be repeated in 2013.

Acknowledgments
This project is supported by Northern Victoria Grain and Graze 2 (GRDC project BWD00018; funded by GRDC and Caring for Our Country).
Key messages

- Profit drivers can be identified when benchmarking your sheep enterprise. Focusing on the profit drivers in your business can really make a difference, and producers paying attention to detail can be rewarded.

- Maximising stocking rates whilst ensuring adequate nutrition and good paddock management has the greatest effect on meat and wool produced per hectare and subsequently the gross margin and income of your business.

- Improving growth rates by producing more kg/ha/yr equates to the maximum amount of wool and meat produced in the shortest possible time.

- Improving reproduction percentages results in more lambs and improved weaning rates.

- Identifying causes of death and implementing measures to curb mortality rate reduces lost income.

- 80% of the potential gains can be achieved by getting the system right then fine tuning that system rather than spending time trying to fine tune a system which is not working.

Why do the work?
The sheep and wool industry has a poor reputation for productivity gains and has lost significant ground to competing industries such as broad acre cropping. Utilising tools such as benchmarking enables producers to properly evaluate the current state of the enterprise and identify profit drivers, which highlight any opportunities where changes can occur to the business. The aim of benchmarking is to examine the technical efficiencies of the enterprise, identify the range of possible outcomes in any one environment and the potential to change and identify the key performance indicators for that enterprise.

How was it done?
Three sheep groups, established with funding from the Eyre Peninsula Grain and Graze 2 Project and Sheep Connect SA have focused on benchmarking their sheep enterprises. Eighteen properties have completed benchmarking, with one group completing benchmarking for two years and two groups for one year. Benchmarking provided group discussion on the key performance indicators of the sheep enterprise and identified opportunities for change.

What happened?
Table 1 shows that the flock structure is dominated by ewes, representing 70% and hoggets 25%. The main two enterprise structures were self-replacing merino flocks and or terminal sire over merino ewes. Some farmers purchase lambs to utilise stubbles when the opportunity presents itself. The average winter grazed (WG) area is 800 ha with a stocking rate of 2.4 dry sheep equivalent (DSE) per ha and turning off 1.3 lambs per ha. High lambing percentage is important but is not the main driver of lambs produced per ha. The number of ewes per ha plus lambing percentage, drives the number of lambs produced per ha. The average lambing percentage was 94% so there is an opportunity for producers to focus on the ewe reproduction cycle and ewe nutrition to lift the average percentage.

The returns that sheep producers in the group achieved in 2010/11 and 2011/12 were exceptional due to a combination of good seasons and high commodity prices for meat and wool. Although the returns are good, the benchmarking has highlighted there is a large variation between producers within the same rainfall environment.

What does this mean?
Many producers in the groups commented that it was good to improve their understanding of their sheep enterprise and get a handle on what their sheep enterprise is returning on a $ per DSE and $ per winter grazed hectare ($/WG ha) basis.

The variation observed between producers within the same rainfall environment provides some opportunities for producers to be more productive and profitable. Producers can control the areas where the largest variations occurred including sheep losses and marking percentages. There were some small variations in sheep sale price, wool price and kg of wool/DSE. The big influence on gross margin per ha was the stocking rate, which influenced the number of lambs per ha and the wool production per ha. Therefore pastures, grazing management, animal health and genetics are the keys to optimising income from the sheep enterprise.
### Table 1 Physical and production traits for participants surveyed in the 2010/11 and 2011/12 season

<table>
<thead>
<tr>
<th>Sheep</th>
<th>Mean</th>
<th>Range Low-High</th>
<th>Mean</th>
<th>Range Low-High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total dry sheep equivalent (DSE)</td>
<td>1780</td>
<td>1110 - 3940</td>
<td>1520</td>
<td>1300 - 5570</td>
</tr>
<tr>
<td>Ewes (%)</td>
<td>70</td>
<td>42 - 99</td>
<td>72</td>
<td>40 - 81</td>
</tr>
<tr>
<td>Ewe Hoggets (%)</td>
<td>24</td>
<td>0 - 46</td>
<td>27</td>
<td>9 - 37</td>
</tr>
<tr>
<td>Losses (%)</td>
<td>5</td>
<td>2 - 13</td>
<td>3</td>
<td>1 - 6</td>
</tr>
</tbody>
</table>

**Stocking Rate**

| Winter Grazed (WG) hectares                | 810      | 240 - 2100     | 790      | 320 - 1550     |
| DSE/WG ha                                 | 2.9      | 1.3 - 6.4      | 2.1      | 1.0 - 4.8      |
| DSE/WG ha/100 mm rainfall                 | 1.0      | 0.6 - 2.8      | 0.9      | 0.5 - 1.8      |

**Sheep Trading**

| Marking (%)                               | 92       | 78 - 103       | 96       | 73 - 120       |
| Lambs/ha (No/ha)                          | 1.5      | 0.4 - 2.3      | 1.1      | 0.3 - 2.0      |
| Sale price (av $/hd)                      | 122      | 101 - 155      | 112      | 92 - 165       |

**Wool Production**

| Wool price (av $/kg)                      | 6.23     | 5.16 - 8.44    | 7.61     | 6.71 - 8.66    |
| Total kg                                  | 9540     | 4020 - 26080   | 6780     | 4900 - 23940   |
| kg wool/DSE                               | 5.1      | 3.6 - 6.6      | 4.5      | 3.2 - 5.5      |
| kg wool/WG ha                             | 14.8     | 5.7 - 32.1     | 9.4      | 5.1 - 26.7     |

### Table 2 Financial results for participants surveyed for 2010/11 and 2011/12 seasons

<table>
<thead>
<tr>
<th>%/DSE - Income</th>
<th>2010/11</th>
<th></th>
<th>2011/12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wool Proceeds</td>
<td>32</td>
<td>18 - 48</td>
<td>34</td>
<td>28 - 42</td>
</tr>
<tr>
<td>Sheep Trading Profit</td>
<td>48</td>
<td>23 - 81</td>
<td>38</td>
<td>29 - 53</td>
</tr>
<tr>
<td>Total Sheep Income</td>
<td>80</td>
<td>42 - 109</td>
<td>72</td>
<td>54 - 89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$/DSE - Expenses</th>
<th>2010/11</th>
<th></th>
<th>2011/12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Variable Costs</td>
<td>13.2</td>
<td>5.6 - 19.9</td>
<td>11.4</td>
<td>7.6 - 19.5</td>
</tr>
<tr>
<td>Gross margin/DSE</td>
<td>67</td>
<td>36 - 97</td>
<td>61</td>
<td>46 - 79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$/WGha - Income</th>
<th>2010/11</th>
<th></th>
<th>2011/12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wool Proceeds</td>
<td>92</td>
<td>29 - 199</td>
<td>71</td>
<td>34 - 207</td>
</tr>
<tr>
<td>Sheep Trading Profit</td>
<td>142</td>
<td>37 - 328</td>
<td>79</td>
<td>31 - 215</td>
</tr>
<tr>
<td>Total Sheep Income</td>
<td>234</td>
<td>66 - 527</td>
<td>150</td>
<td>66 - 410</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$/WG ha - Expenses</th>
<th>2010/11</th>
<th></th>
<th>2011/12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Variable Costs</td>
<td>37</td>
<td>9 - 66</td>
<td>22</td>
<td>8 - 82</td>
</tr>
<tr>
<td>Gross margin/WG ha</td>
<td>198</td>
<td>58 - 445</td>
<td>128</td>
<td>57 - 328</td>
</tr>
</tbody>
</table>

Risk management is also important and this will be determined by the management capabilities and the amount of risk that a producer is willing to take. The higher the stocking rate, the higher the risk and more management required. Some producers have low stocking rates as it makes it easier to get through the “poor season”. Many producers have an idea in their minds of what they will do in the “poor season” but there is no written strategy to implement “back door” or exit strategies.

Some producers have started to implement changes to their enterprise after the first year of benchmarking their sheep enterprise. These changes have resulted in an improvement in their second year figures. The changes included improving pastures, monitoring ewe condition score and focusing on genetic improvement. The local information from the group allowed these producers to focus on targets that are being achieved in their own district and give them confidence to implement the change as they have the support of the local group members and advisors.

Benchmarking has demonstrated that sheep systems should be treated more as a business opportunity with an associated profit focus rather than a historic production system.

**Acknowledgments**

This project is supported and funded by Grain and Gaze 2, Eyre Peninsula Natural Resources Board and Australian Wool Innovations. The author would like to thank all sheep producers involved in the project, Daniel Schuppan, Landmark and Naomi Scholz, SARDI Minnipa Agricultural Centre.
Livestock options in dry times
Brian Ashton
Sheep Consultancy Service Pty Ltd, Port Lincoln

Key messages

• Prepare for the next feed shortage now.
• The condition score of your stock will tell you if you are under- or over-feeding.
• Have a plan and act early.
• A containment area is a farm “risk management” asset.

What happened?
In 2011 medic pastures were hit by powdery mildew. Many sheep suffered by lack of feed over the following summer and this greatly affected staple strength, micron, wool cut and lambing percentage in 2012.

We often suffer from a feed shortage, although the reason varies. Poor spring rains have been common in recent years while late breaks, or droughts, have occurred in the past. We know that a huge range in pasture production is a feature of our climate – we have dealt with it for many years.

Management options
Farmers manage in different ways. Now that sheep are worth money it’s time to review how you plan to manage.

• Some people stock very conservatively – but they have reduced income in all the average and above average years.
• Some sell immediately while the stock are still in good condition. This is OK if the price is reasonable.
• Some feed to maintain reasonable condition and production levels. This may involve a containment area if there is an erosion risk.
• The worst case is to feed less than they require, run out of feed, and then to sell when the sheep are poor and the prices are still depressed.

What does this mean?
Stock that you keep will need to be fed enough to maintain reasonable condition and production levels. The Lifetime Wool project gave us an excellent guide to help us determine this (visit www.lifetimewool.com.au for more information on ewe management and condition scoring). From mating until lambing, ewes should be maintained in condition score 3, or better.

The cost benefit ratio for this is clear. On average Merino ewes that are score 3 from mating to lambing will rear 15 percent more lambs than ewes at score 2. If they lose one condition score during pregnancy they will produce 0.8 kg less clean wool and their lambs will produce less wool for the rest of their lives.

These condition score losses were common on upper Eyre Peninsula in the summer of 2011/12. At current prices these losses equate to about $30 per ewe. You could have bought a lot of feed for that.

If ewes drop below score 2 the production losses are even greater. As well, there will be ewe deaths. With current prices, and animal welfare concerns, I believe it is unacceptable to let ewes drop below score 2.

What to do about it?
• Condition score a race full of your ewes 3 or 4 times every year - when they are in the yards. Do it more often in tough seasons.
• Draft off the ewes that may fall below score 2 and feed them more, either through supplementary feeding or access to better paddocks.
• Monitor pastures (bulk and quality) so you are not caught out.
• Have some feed reserve – or know where you can buy it. Cereal grain is the best value but some hay is really useful too.
• Keep some grain back after harvest until after the break and when the season is assured.
• In erosion prone districts set up a containment area so you are ready to go when needed.
• Keep a young flock because old sheep can become a liability.
• Improve your water supply, and fencing, so that you can utilise all your feed reserves.
• Pregnancy scan your ewes so that in tough years empty ewes can be shorn and sold early.
• Have a plan and act on it early.