Improving sheep welfare for increased production

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SARDI - Struan sheep Research

Livestock innovation and welfare group:

- Sheep welfare and wellbeing
- Production and management
- Genetic evaluation of meat traits
- Emerging technologies
Principles of sheep welfare

- **Nutrition**
  - Feed
  - Water

- **Health**
  - Preventative management
  - Treatment
  - Husbandry procedures

- **Genetics**
  - Appropriate for the environment and level of management

*Australian Animal Welfare Standards and Guidelines - Sheep*
Animal Health Australia (AHA) 2014.
Welfare research – challenges and opportunities

• Optimising management through nutrition
• Identifying welfare challenges
  – Lamb survival

• Technologies for measuring welfare:
  – Collecting information on individual sheep
  – Using data to make decisions
  – Weighing up priorities
Lamb survival

Maternal nutrition

Predation

Health

Environment

Ewe age

Genetics

Birth ease

Maternal instinct

Lamb birthweight

Disease

Milk production

Parasites

Infection

Disease

Predation

Lamb birthweight

Lamb birthweight

Lamb birthweight

Lamb birthweight

Lamb gender

Litter size
Lamb birthweight

![Graph showing lamb birth weight and survival](https://www.lifetimewool.com.au)
Ewe nutrition

• Macro–scale:
  – Measuring condition score
  – Assessing condition score changes
  – Pregnancy requirements

• Micro–scale:
  – Mineral balances
  – Supplements
Lifetime maternals project

Lifetime wool
Lifetimewool project - Merinos

Ewe condition score at joining and pregnancy status

- Twin ewes
- Single ewes
- Dry ewes

Proportion of ewe flock (%)

Ewe condition score at joining

Ewes in better condition at lambing have heavier lambs

- Single lambs
- Twin lambs

Lamb birth weight (kg)

Ewe condition score at lambing

Ewe condition score at lambing and lamb survival

- Single lambs
- Twin lambs

Lamb survival (%)

Ewe condition score at lambing

Lamb birth weight and survival

Lamb survival (%)

Birth weight (kg)
Lifetimewool project – feed budgeting

500 FOO

1000 FOO

1500 FOO

2000 FOO
Lifetimewool project – feed budgeting

### TABLE 1a. Energy Required by Ewes @ Condition Score 3 to maintain weight

<table>
<thead>
<tr>
<th>Maintenance energy (MJ/d) for ewes under drought paddock conditions</th>
<th>Confinement Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day of pregnancy</strong></td>
<td></td>
</tr>
<tr>
<td>dry</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td></td>
</tr>
<tr>
<td><strong>days lactating</strong></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Small frame (45kg) maintain @ CS 3</th>
<th>Medium frame (50kg) maintain @ CS 3</th>
<th>Large frame (60kg) maintain @ CS 3</th>
<th>Medium frame maintain @ CS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>single    twin</td>
<td>single    twin</td>
<td>single    twin</td>
<td>single    twin</td>
</tr>
<tr>
<td>dry       7.4</td>
<td>7.4       8.0</td>
<td>9.3      9.3</td>
<td>6.7              6.7</td>
</tr>
<tr>
<td>50        7.6</td>
<td>7.8       8.4</td>
<td>9.7      9.9</td>
<td>7.0              7.2</td>
</tr>
<tr>
<td>70        8.0</td>
<td>8.4       8.6</td>
<td>10.1     10.7</td>
<td>7.4              7.9</td>
</tr>
<tr>
<td>100       9.0</td>
<td>10.2      9.9</td>
<td>11.5     12.9</td>
<td>8.6              9.8</td>
</tr>
<tr>
<td>130       11.3</td>
<td>14.1      15.4</td>
<td>14.4     17.7</td>
<td>10.9             14.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Days lactating</th>
<th>Maintain @ CS 3</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>single</td>
</tr>
<tr>
<td>10</td>
<td>17.3</td>
</tr>
<tr>
<td>30</td>
<td>18.7</td>
</tr>
<tr>
<td>50</td>
<td>15.5</td>
</tr>
</tbody>
</table>

*ask for advice on confinement feeding ewes and lambs*

**Requirement = 11.1 MJ ME/day**
**Perennial Pastures – Rules of thumb:** When pasture dries off, digestibility is around 60%. Thereafter it declines by around 5% per month until it reaches a minimum of 35%.

**Annual Pastures – Rules of thumb:** When pastures dries off, digestibility is around 70%. It declines rapidly during the first 2 months to around 50% with slow decline thereafter.

Requirement = 11.1 MJ ME/day  
Energy intake from dry pasture = 2.3 MJ ME/day  
= -8.8MJ ME/day to find from supplement
Barley = 11.9MJ ME/kg
We need to find 8.8MJ ME/day
8.8 / 11.9 = 73.9

Feed 740g Barley/ day
Lifetime maternals project

Questions:

1. Optimal CS profile for lamb survival
2. Are feed budgets the same?
Lifetime maternals – design 2014

<table>
<thead>
<tr>
<th></th>
<th>Struan</th>
<th>Hamilton</th>
<th>Balmoral</th>
<th>Mount Barker (WA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewe base</td>
<td>BLxM, Mo</td>
<td>Composite</td>
<td>Composite</td>
<td>Composite</td>
</tr>
<tr>
<td>Sire type</td>
<td>Poll Dorset</td>
<td>Maternal rams</td>
<td>Maternal rams</td>
<td>Maternal rams</td>
</tr>
</tbody>
</table>

Preg scanned at Day 50 and split into 4 CS treatments

- CS 2.5
- CS 2.8
- CS 3.2
- CS 3.6
Broadly speaking, non-Merino ewes react in a similar way to what Merinos do in terms of lamb survival.

Heavier ewes have heavier lambs – heavier lambs have higher survival.
Merino and non-Merino survival curves are essentially the same.
Ewe nutrition

Maternal ewes achieved higher weights and condition scores under identical management.

![Average CS profile](image1)

![Breed profile](image2)

<table>
<thead>
<tr>
<th>Breed difference</th>
<th>CS</th>
<th>Liveweight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0 - 50</td>
<td>0.1±0.02 CS</td>
<td>1.7±0.40kg</td>
</tr>
<tr>
<td>Lambing</td>
<td>0.4±0.02 CS</td>
<td>4.6±0.45kg</td>
</tr>
</tbody>
</table>
Ewe nutrition

• Being able to accurately determine ewe nutritional requirements is key to optimizing the system
• Feed budgeting equations need to be re-examined for non-Merino breeds.

➢ What is the relationship between pasture and supplements on ewe live-weight and condition score??
Lifetime maternals – next stages

• Pasture based assessment of feed requirements
• Determination of exact requirements for non-Merino ewes

= more accurate feed budgeting for:
1. Improved production
2. Improved welfare
Ewe nutrition

• Macro–scale:
  – Measuring condition score
  – Assessing condition score changes
  – Pregnancy requirements

• Micro–scale:
  – Mineral balances
  – Supplements
Mineral balances in ewes

Mineral imbalances can cause metabolic diseases in late pregnancy:

- **Hypocalcaemia** (common leading up to lambing/ early lactation)
- **Hypomagnesaemia** (common soon after lambing)
- **Pregnancy toxaemia** (leading up to lambing)

Clinical expression most often occurs in late pregnancy (0.5 – 2% ewes).

Older ewes more susceptible.

Twin bearing ewes more susceptible.
Metabolic diseases in pregnant ewes

**Hypocalcaemia:**
Ewes grazing spring pastures or cereal crops (low in calcium) or those high in oxalates (goosefoot, soursob, buffalo) unable to maintain calcium homeostasis.

Ewes that have downregulated ability to mobilise calcium stored in bone.

**Hypomagnesaemia:**
Ewes grazing pastures with high potassium and nitrogen levels (excessive application of nitrogen and potassium based fertilisers; cereal crops/stubbles), winter grazing of lush grass based pastures.

Both respond quickly to injections of calcium/magnesium.
Metabolic diseases in pregnant ewes

Clinical expression of disease not providing the full picture.

Little is known on effects of subclinical disease (symptoms not yet showing).

Low calcium:
- Reduced blood flow to reproductive organs
- Impaired smooth muscle contractions
- Uterine inertia
- Prolonged birth
- Prolapse
- Compromised thermogenesis

Researched extensively in cattle

Feasible that lamb losses to dystocia may be due to sub-clinical hypocalcaemia/ hypomagnesaemia resulting from prolonged parturition.
Metabolic diseases in pregnant ewes

Soil and pasture analyses may be useful in predicting mineral imbalances in stock.

Soil with mineral ratios $K:(Ca + Mg)$ above $0.07 - 0.08$ may present an increased risk of hypomagnesaemia in cattle.

Herbage with mineral ratios $K:(Ca + Mg)$ above $2.2$ may present an increased risk of hypomagnesaemia in cattle.

Except where excessively high N binds available Mg.
Metabolic diseases in pregnant ewes

This trial:

• Analysis of pasture -30 days from lambing
• Analysis of pasture and soil -7 days from lambing and at marking
• Analysis of ewe plasma mineral status -10 – 7 days from lambing, and at marking
• Analysis of urine pH (slight acidosis assists cows in mobilisation of stored calcium)
• Analysis of urine specific gravity
• Analysis of urine mineral composition
Welfare research – challenges and opportunities

• Optimising management
• Identifying welfare challenges
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• Technologies for measuring welfare:
  – Collecting information on individual sheep
  – Using data to make decisions
  – Weighing up priorities
Automated condition scoring

Condition scoring is essential for the optimal management of both Merino and non-Merino ewes:

→ Maximising lamb and ewe survival
→ Increasing weaning weight
→ Improved pasture utilisation and farm efficiency

It can be:
• time and labour intensive
• subjective
Automated condition scoring
Automated condition scoring

• Capture images of freshly shorn sheep
• Correlate images to the actual condition score and weight
• Can be used in conjunction with risk analysis and production data to facilitate better management
Automated condition scoring