Improving sheep welfare for increased production

SOUTH AUSTRALIAN RESEARCH & DEVELOPMENT INSTITUTE
PIRSA

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PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

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Government of South Australia
Primary Industries and Regions SA

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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

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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.

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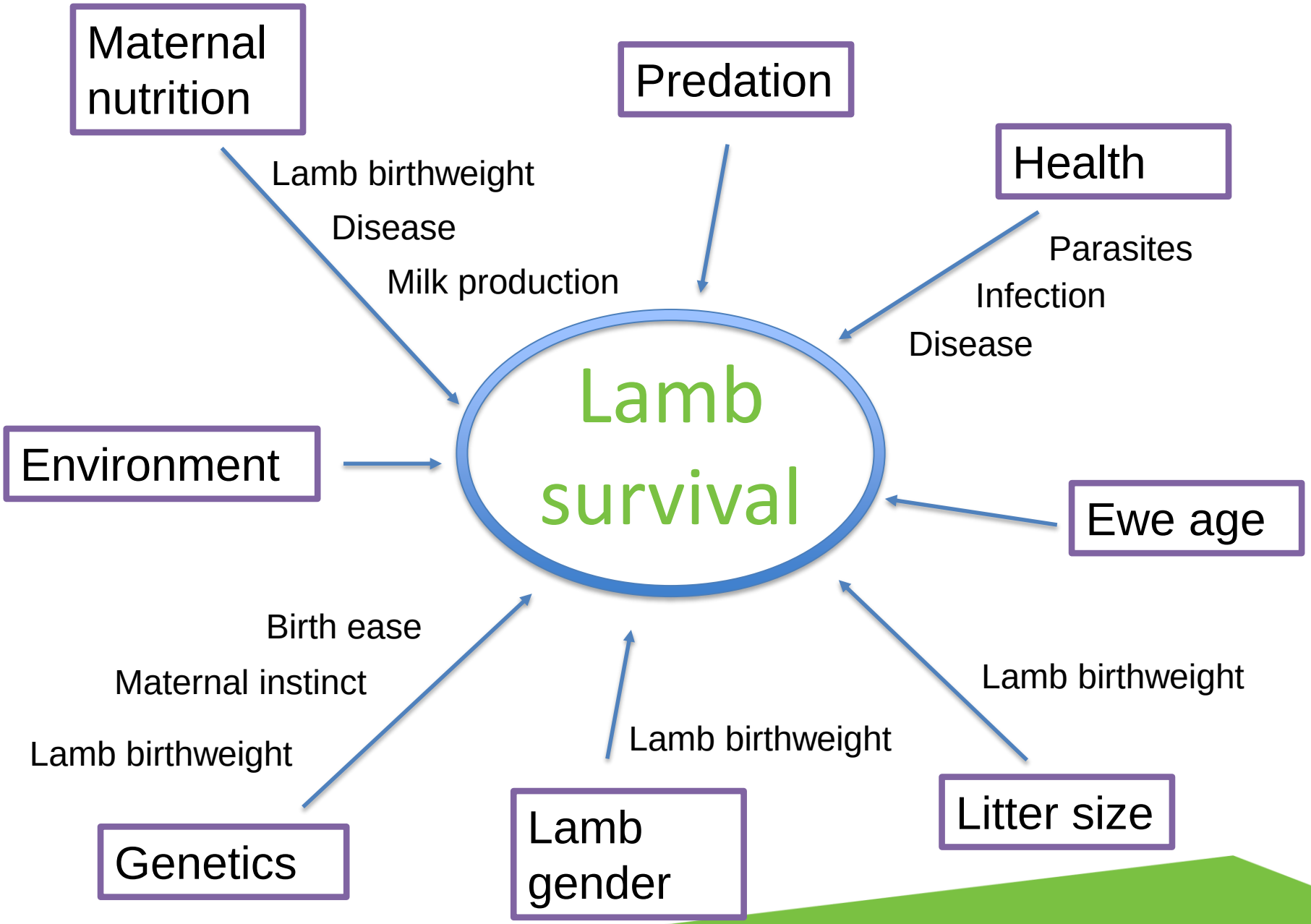
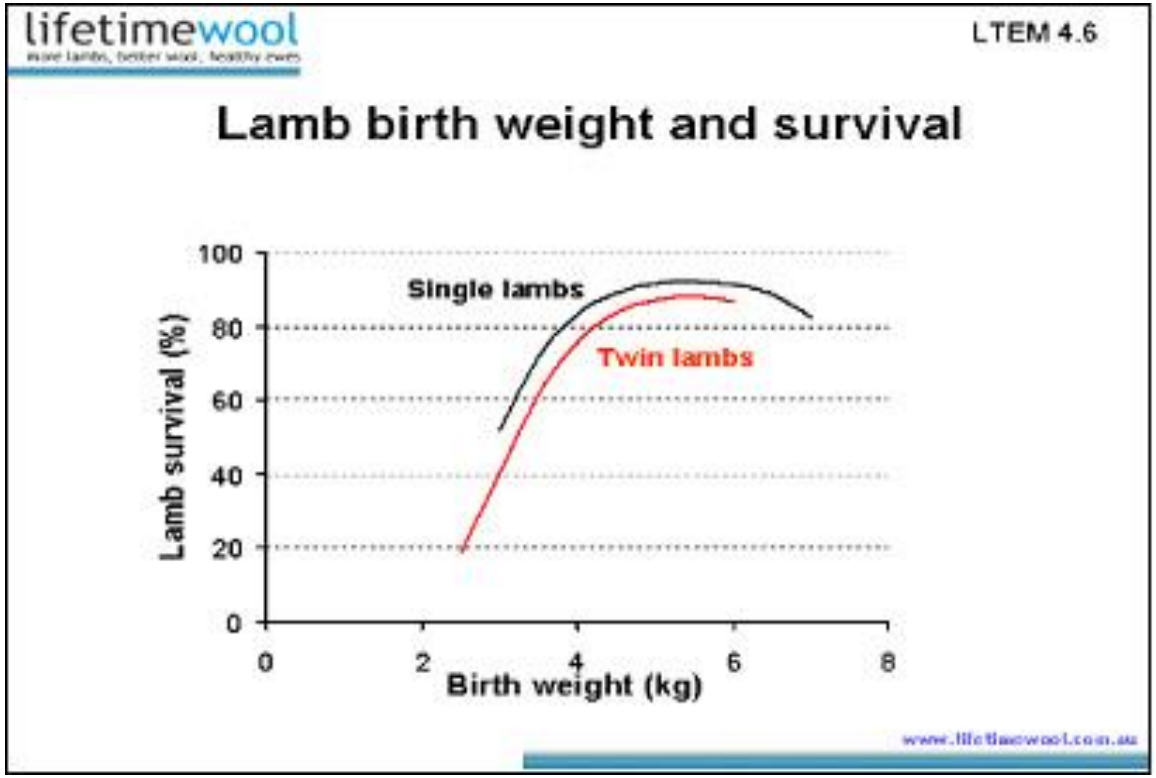
Welfare research – challenges and opportunities

- 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*


Maternal nutrition
Lamb birthweight
Disease
Milk production
Predation
Health
Parasites
Infection
Disease
Environment
Lamb survival
Ewe age
Birth ease
Maternal instinct
Lamb birthweight
Genetics
Lamb gender
Lamb birthweight
Lamb birthweight
Litter size

Lamb birthweight



Ewe nutrition

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

- Micro–scale:
  - Mineral balances
  - Supplements

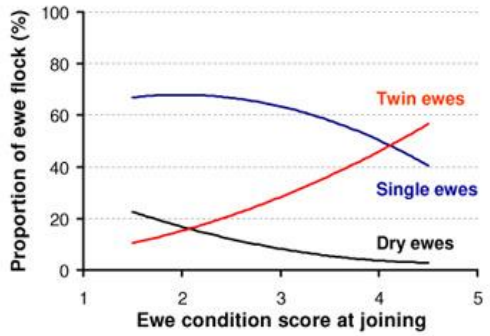
Lifetime maternals project

Lifetime wool

Lifetimewool project - Merinos

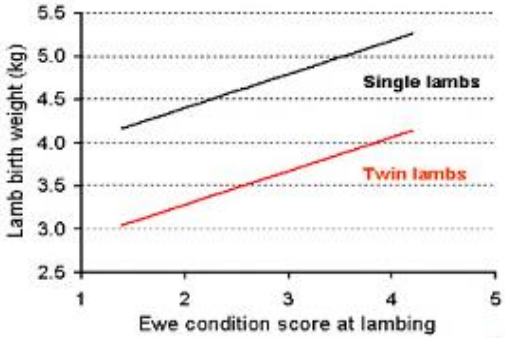
LTEM 2.2

Ewe condition score at joining and pregnancy status



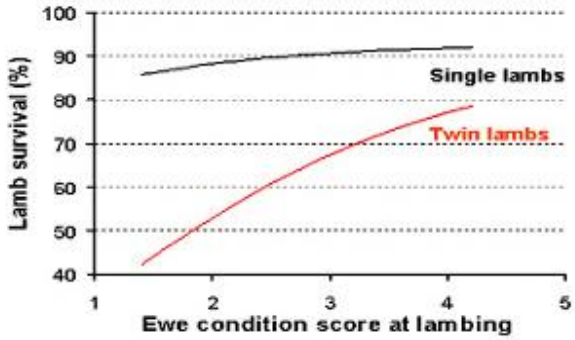
LTEM 4.5

Ewes in better condition at lambing have heavier lambs



LTEM 4.7

Ewe condition score at lambing and lamb survival



LTEM 4.6

Lamb birth weight and survival

Lifetimewool project – feed budgeting

500 FOO

1000 FOO

1500 FOO

2000 FOO

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Lifetimewool project – feed budgeting

TABLE 1a. Energy Required by Ewes @ Condition Score 3 to maintain weight								
Maintenance energy (MJ/d) for ewes under drought paddock conditions							Confinement Fed	
Day of pregnancy	small frame (45kg) maintain @ CS 3		medium frame (50kg) maintain @ CS 3		large frame (60kg) maintain @ CS 3		medium frame maintain @ CS 3	
	single	twin	single	twin	single	twin	single	twin
dry	7.4	7.4	8.0	8.0	9.3	9.3	6.7	6.7
50	7.6	7.8	8.4	8.6	9.7	9.9	7.0	7.2
70	8.0	8.4	8.7	9.1	10.1	10.7	7.4	7.9
100	9.0	10.2	9.9	11.1	11.5	12.9	8.6	9.8
130	11.3	14.1	12.3	15.4	14.4	17.7	10.9	14.1
days lactating	maintain @ CS 3		maintain @ CS 3		maintain @ CS 3		ewes and lambs	
	single	twin	single	twin	single	twin		
10	17.3	21.7	18.7	23.4	21.5	26.9	ask for advice on confinement feeding ewes and lambs	
30	18.7	23.9	20.2	25.8	23.2	29.6		
50	15.5	19.1	16.7	20.6	19.2	23.7		

Requirement = 11.1 MJ ME/day

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TABLE 2a. Metabolisable Energy Intake (MJ/day) from dry paddock feed - perennial pastures						
Feed On Offer kg DM/ha	Digestibility 35%	40%	45%	50%	55%	60%
500	0.3	0.7	1.3	1.7	2.2	2.8
1000	0.9	2.2	3.5	4.6	5.8	7.2
1500	1.4	3.3	4.8	6.3	7.8	9.3
2000	1.8	4.0	5.6	7.2	8.8	10.2

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%.

TABLE 2b. Metabolisable Energy (ME) intake from dry paddock feed - annual pastures					
Feed On Offer kg DM/ha	Digestibility 45%	50%	55%	60%	65%
500	1.8	2.3	3.0	4.0	[illegible]
1000	2.7	3.5	4.5	5.8	7.1
1500	4.4	5.7	7.1	8.3	9.5
2000	5.8	7.3	9.0	10.4	12.0

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

Table 3.3. Feed analysis for common sheep feeds showing dry matter, energy, protein and fibre content (dry matter basis). The average across the range of values is shown in brackets.

Feed type	Dry Matter (%)	Metabolisable energy (MJ/kg of DM)	Crude Protein (% of DM)	Acid detergent fibre (% of DM)
Grains				
Cereals and pulses				
Wheat	91	12.4-13.3(12.9)	7.5-15.0(11.5)	2.5-4.5(3.0)
Barley	91	11.6-12.2(11.9)	7.0-13.0(11.0)	7.0-9.5(8.0)
Triticale	90	12.0-13.0(12.5)	7.5-14.0(11.0)	3.5-5.0(4.0)
Oats	92	10.4-11.3(10.7)	5.5-13.5(9.0)	16.0-21.5(18.5)
Narrow leaf lupins	92	13.1-14.1(13.7)	27.0-42.0(34.0)	17.5-23.0(20.0)
Albus lupins	92	13.4-15.0(14.0)	34.0-44.0(38.0)	17.0-21.0(19.0)
Peas	91	12.5-13.5(13.0)	21.5-30.0(25.5)	6.0-10.5(9.0)
Vetch	91	12.4-13.2(12.8)	26.0-34.5(29.0)	7.5-9.5(8.5)
Chick Peas	91	12.0-13.0(12.4)	18.0-24.0(21.0)	12.0-16.0(14.0)
Faba beans	90	12.4-13.2(12.9)	22.0-30.0(26.0)	7.5-9.5(8.5)
Canola (>35% oil)	95	15.0-17.0(16.0)	20.0-25.0(22.0)	22.5-26.5(24.0)
Cereal seconds				
Wheat	92	11.8-12.4(12.1)	12.5-17.0(13.5)	3.5-5.5(4.5)
Barley	93	11.1-11.8(11.4)	11.0-14.5(12.5)	9.5-12.5(10.0)
Triticale	92	11.3-12.1(11.7)	10.5-15.5(13.0)	4.5-6.5(5.5)
Oats	93	9.8-10.5(10.3)	4.5-16.0(12.5)	21.0-26.0(23.5)
Sheep pellets				
Maintenance	90	8.0-9.0(8.5)	8.5-9.5(9.0)	29.5-32.0(31.0)
Production	91	10.6-11.4(11.0)	13.5-16.0(15.0)	20.0-25.0(23.0)

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

	Struan	Hamilton	Balmoral	Mount Barker (WA)
Ewe base	BLxM, Mo	Composite	Composite	Composite
Sire type	Poll Dorset	Maternal rams	Maternal rams	Maternal rams

Preg scanned at Day 50 and split into 4 CS treatments

- CS 2.5
- CS 2.8
- CS 3.2
- CS 3.6

Lifetime maternals

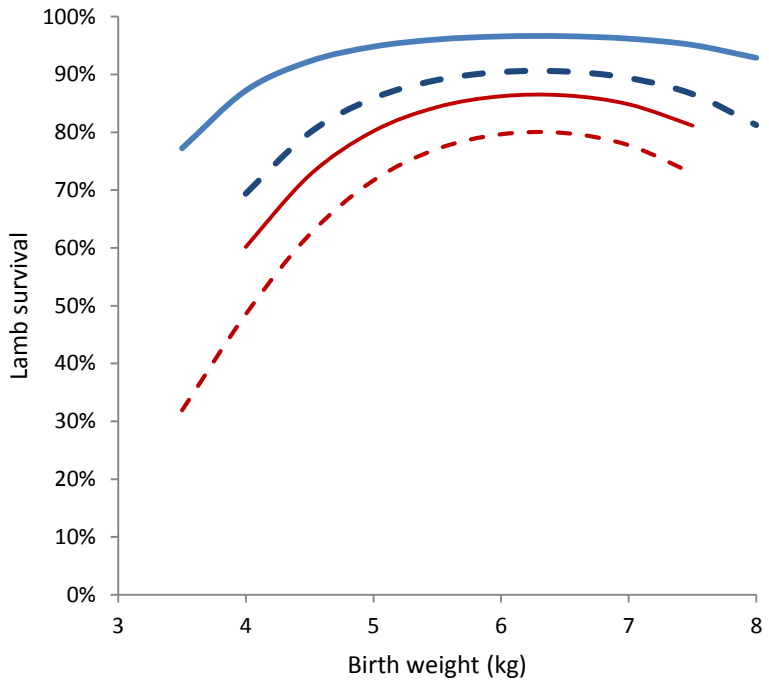
Condition score of maternal ewes at lambing and weaning rates

Btype	CS2.5	CS2.9	CS3.3	CS3.7
Single	80	90	80	82
Twin	135	145	161	169
Overall	120	127	140	142

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.

Lifetime maternals



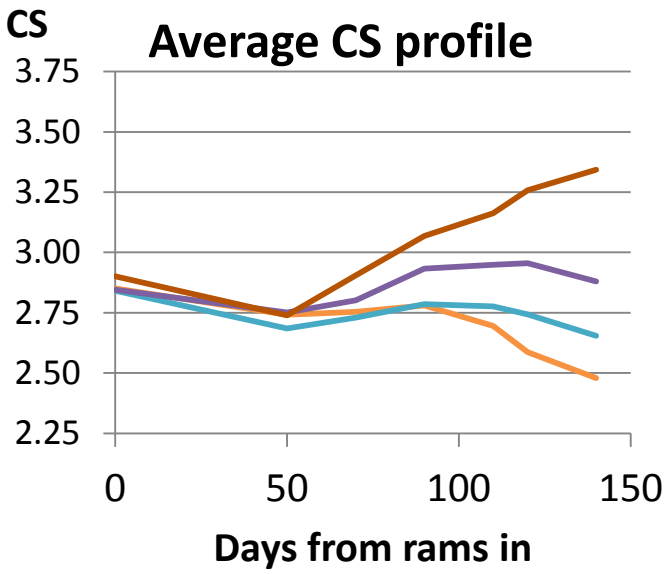
Merino
BL x M

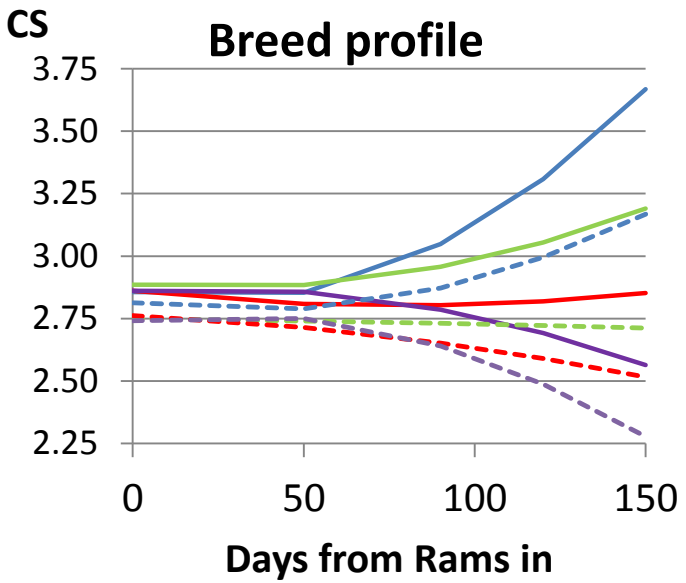
Single lambs
Twin lambs

Merino and non-Merino survival curves are essentially the same.

Ewe nutrition

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





Breed difference	CS	Liveweight
Day 0 - 50	0.1±0.02 CS	1.7±0.40kg
Lambing	0.4±0.02 CS	4.6±0.45kg

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 .07 - .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
  - *Lamb survival*

- Technologies for measuring welfare:
  - *Collecting information on individual sheep*
  - *Using data to make decisions*
  - *Weighing up priorities*

Automated condition scoring

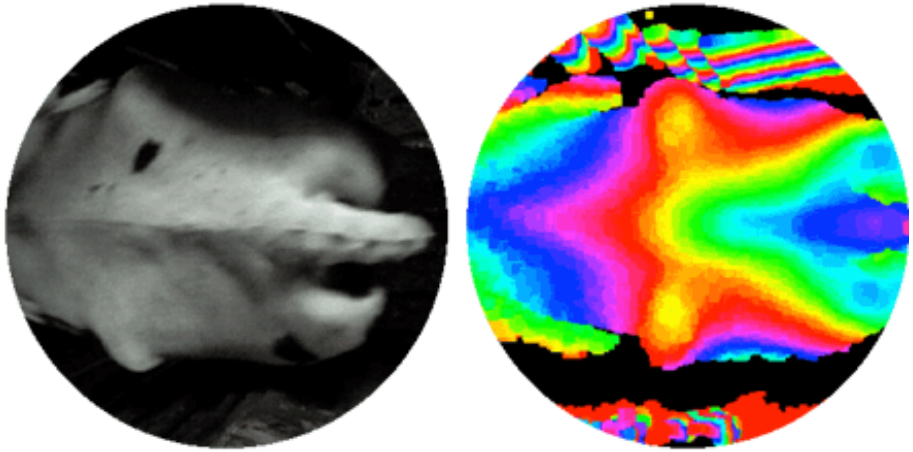
Condition scoring is essential for the optimal management of both Merino and non-Merino ewes:

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

It can be:

- time and labour intensive
- subjective

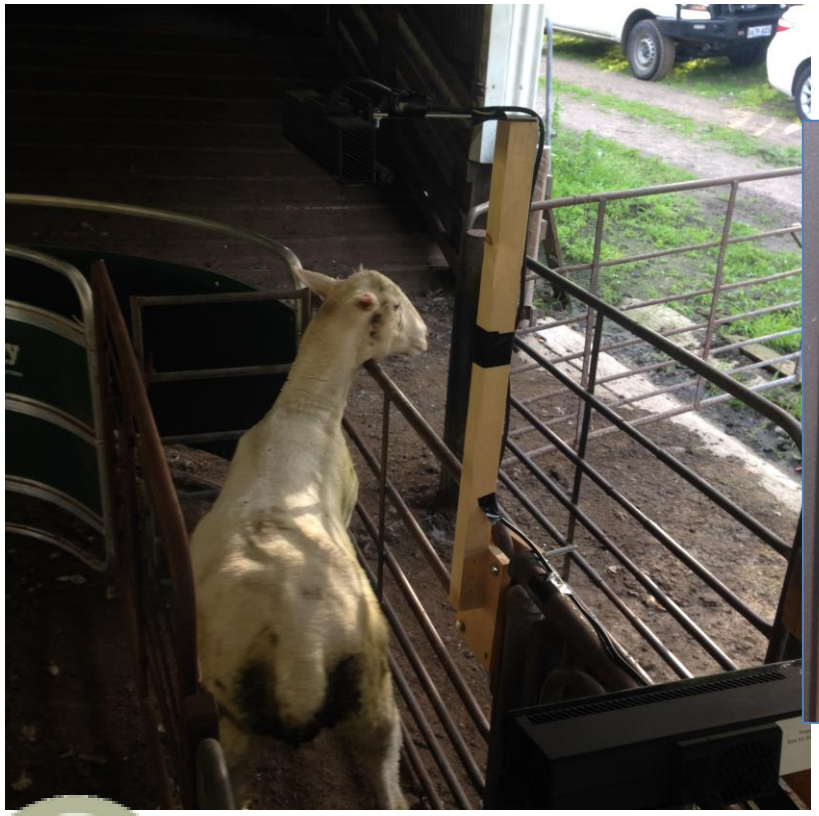
Automated condition scoring

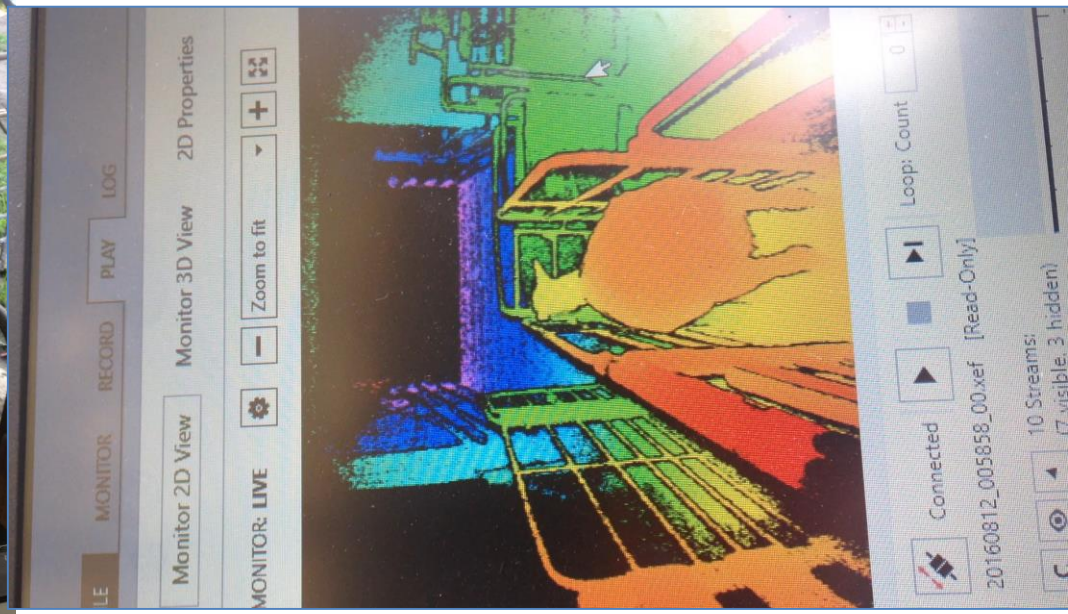


Automated condition scoring

- 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





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