Land fact

Managing scanned ewes – Placental development (LF-AP-S-3.3)

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Much of a lamb's lifetime production potential is predetermined prior to birth. The ewe's body condition, changes in body condition and daily feed intake throughout pregnancy, will impact on:

- placental growth (and ultimately a lamb's future wool, muscle and fat development);
- a lamb's survival and growth to weaning; and
- the ewe's own production gains or losses.

The placenta

Each foetus is encased by its own separate placenta. The placenta ensures an effective nutrient transfer from the ewe to the foetus.

Sub-optimal nutrition during the placenta's early to mid-development stages can impact on foetal development, lamb survival, weight gain and lifetime productivity.

Single-bearing ewes seldom have an issue with poor placental development. Our focus is primarily on ensuring adequate development of twin or triplet bearing ewe placentas and foetuses.

Figure 1 illustrates the major growth phases of the placenta and foetus in sheep. Initially slow to develop, the placenta will grow at an increasingly faster rate between 30 to 90 days of pregnancy. Placental growth rate far exceeds foetal growth rate at this stage.

From day 90 foetal growth begins to escalate with ~90% occurring in the last 2 months (60 days) of pregnancy.

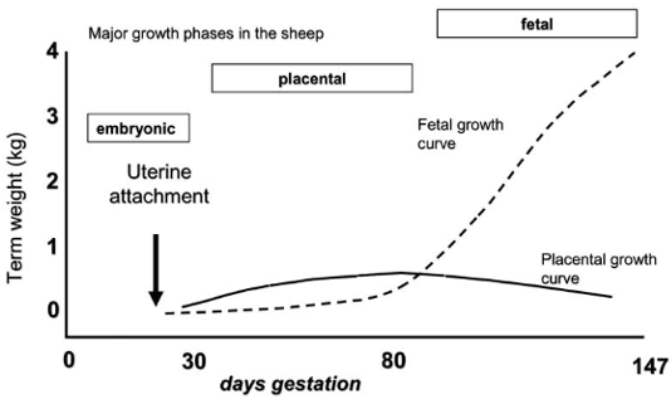

Figure 1. Major growth phases during pregnancy

A ewe's placenta consists of numerous, small contact points between the uterus and foetus known as 'placentomes'. These are the points at which the foetus receives nutrients and waste materials are removed. A pregnant ewe may have up to 125 placentomes which consist of cotyledons (on the foetal side of the placenta) and caruncles on the maternal side of the placenta.

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Undernutrition during the early to mid-placental development stage (days 30 to 100) can:

- reduce placentome numbers and affect foetal nutrient supply and growth
- lead to the development of small placentas particularly if ewes are in low body condition score (<2) or if young and still actively maturing. Small placentas supply less oxygen and nutrients to the foetus, retarding foetal growth

Good late pregnancy nutrition cannot compensate for poor placental development.

The placenta's final size will largely determine:

- a lamb's birth weight (and therefore survival)
- a lamb's potential wool quality and cut
- a lamb's muscle and fat development
- level(s) of hormones necessary for pregnancy and early lactation

The placenta – feeding for growth

If joining for 6 weeks and assuming a 'normal' conception pattern (where 65-70% of ewes conceive during the first 21 days of joining), the average placental age at scanning will be ~65 days.

This coincides with the peak of placental development and provides an opportunity to feed/manage multiple bearing ewes to ensure maximum placental growth.

Providing high rates of **bypass protein** to multiple-bearing ewes for 3 to 4 weeks post-scanning is a management tool that can help to maximise placental and foetal growth during this post-scanning period.

Protein can be defined as either rumen degradable or non-degradable ('bypass') protein.

Rumen degradable protein is broken down and used by rumen bacteria and protozoa to make microbial crude protein. Non-degradable or 'bypass' proteins are not degraded within the rumen, passing instead into the ruminant's lower gut where they are broken down into their individual amino acids.

Amino acids are 'building blocks' for tissue protein synthesis and play a vital role in development of the placenta. They also function as antioxidants, regulate many hormones and are major fuels for foetal growth.

Bypass protein and an increase in amino acid availability can:

- improve placental growth
- improve milk production (by up to 10%)
- improve foetal growth rates (by up to 30-40%)
- improve feed conversion efficiencies of the live lamb

Up to 85% of the total amino acid-nitrogen entering the small intestine can be microbial protein. This bypass protein is absorbed within the small intestine, converted to glucose within the liver and used by the animal.

Up to 40% more energy may be available to the animal when this occurs.

How to ensure a high bypass protein rate

Well-balanced diet

- A well-balanced diet providing adequate energy, protein, vitamins, minerals and fibre will ensure a 'healthy' gut, a large microbial protein base and a greater potential rate for bypass protein.

Quality pasture

- Green, high moisture, highly digestible, protein rich feed can provide reasonable levels of bypass protein due to a reduction in time/degradation within the rumen. Unfortunately, these pastures are not always available
- Legumes generally provide higher levels of bypass protein
- Protein and bypass rates can vary by between 20 to 30% depending on age of pasture/hay etc

Cereal grains

- Reasonable rates of bypass protein can be obtained when feeding cereal grain, however these grains generally run a higher risk of health disorders such as acidosis and are difficult to feed ad lib when high supplement intake rates are required in a short time period

Processed meals and pulses

- Feeds or supplements with a known high bypass protein component may also be used
- Providing protein rich processed meals and/or pulse grains are generally the most cost beneficial means of ensuring an across flock increase in bypass protein intakes
- Heat treatment during processing can increase bypass protein levels

A list of common bypass protein rates is shown over the page in Table 1.

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Product	Crude protein %	Bypass protein (%)	Total reaching small intestine (%)
Processed Meals			
Canola meal	38	22	8
Copra meal	21	56	12
Cottonseed meal	37	43	16
Soybean meal	45	35	16
Sunflower meal	32	26	8
Pulses			
Chickpeas	20	22	4
Faba beans	24	20	5
Lupins	35	35	12
Grains			
Barley	12	27	3
Corn	8	52	4
Oats	9	20	2
Sorghum	10	57	6
Wheat	12	22	3
Whole cottonseed	21	30	6

Table 1. Common protein, bypass protein and total protein rates reaching the small intestine in selected feeds Source: Future Beef https://futurebeef.com.au/knowledge-centre/nutrient-composition-of-feeds/

The placenta – wool production

As shown in Figure 2, most of a growing foetus' wool follicle development occurs in the second (days 51 to 100) and third (days 101 to 150) trimesters of pregnancy.

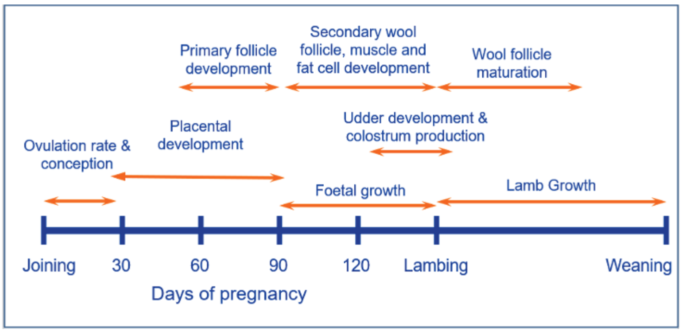

Figure 2. The relative timing of foetal organ development throughout a ewe's pregnancy

Primary follicles (broad fibres) develop in the growing foetus from around day 60 of pregnancy and are completed by about 90 days after conception.

Secondary follicles (fine fibres) develop from around day 90 to birth, with some follicle maturation occurring in the first month of the lamb's life. Secondary follicles have a direct influence on the density and fineness of the fleece.

The effects of early and late pregnancy nutrition on progeny wool production and quality are permanent and can't be fully compensated for by improved nutrition after birth.

A reduction in nutrient supply due to under nutrition or competition from multiple foetuses during secondary follicle development (day 90 to birth), can lead to:

- a reduction in secondary fibres
- broader overall fibre diameter
- lower lifetime fleece weights

These effects will persist throughout the lifetime of the progeny.

Research has shown that ewes that lose 0.5 condition score in early to mid-pregnancy may have progeny with stronger fibre diameters (+0.2 micron) and lower lifetime wool cuts (-0.2kg/year) and the ewes will cut ~0.3 kg less clean wool with a reduced staple strength (-2 to 3 N/ktex) and diameter (-0.5 micron).

To optimise both ewe and progeny's lifetime wool returns, ewes should be monitored from conception to lamb birth to make sure that her energy demands are met and/or her BCS (body condition score) increased if necessary.

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The placenta – muscle development

Skeletal muscle makes up between 50 to 60% of the carcass weight of sheep. As with wool follicle development most muscle development (or 'myogenesis') occurs during early to mid-pregnancy.

Prenatal nutrition is, again, critical in terms of determining a lamb's ultimate muscle growth and weight.

Myogenesis consists of two phases - hyperplasia and hypertrophy.

Hyperplasia is the development and increase in the number of muscle fibres.

Most of a lamb's primary muscle fibre development occurs between 30 to 50 days after conception. Secondary fibres develop during days 50 to 120 although little fibre development occurs after day 80.

Undernutrition during myogenesis (days 30 to 80) can decrease a lamb's muscle fibre number and muscle fibre mass.

Hypertrophy is an increase in the size of the muscle.

Most of a lamb's muscle fibre growth occurs during the third trimester.

Undernutrition between days 80 to 150 can decrease a lamb's muscle fibre development (hypertrophy), birthweight and marbling.

The placenta - fat

Adipogenesis is the formation of adipocytes (fat cells).

We generally supplement with a high-grain diet when looking to "finish" lambs post weaning to induce intramuscular adipocyte hypertrophy, thereby enhancing marbling fat deposition.

To be effective, however, there must be a sufficient number of intramuscular adipocytes, which allow intramuscular fat accumulation. Undernutrition during the third trimester can impact on foetal fat reserves and their lifetime fat deposition and/or marbling.

Foetal and neonatal stages are the most effective stages to alter intramuscular adipocyte formation, followed by the weaning with early weaning shown to improve intramuscular fat content.

Feed to ensure ewes maintain or gain weight.

Correct management should increase/improve:

- ewe wool cut, strength and survival
- twin lamb wool cut (+0.3kg/yr) and quality (-0.25 micron), placental and foetal growth, birth weights and survival
- colostrum and letdown
- time at birth site/lamb survival
- milk production

The placenta - hormones

Hormones produced by the placenta include progesterone and oestrogen.

Progesterone maintains pregnancy, enables the placental growth to continue, and prevents labour by preventing contraction of the uterine walls.

Oestrogen stimulates the growth of the uterus, counteracts the effect of progesterone (allowing the uterus to contract), and stimulates the growth and development of the udder.

Greater total weight of the placentas of well-nourished multiple foetuses (twins, triplets etc) leads to:

- greater levels of progesterone and oestrogen,
- greater placental and udder development,
- earlier and greater levels of colostrum production,
- higher milk yields, and
- improved ewe and lamb(s) bonding immediately after birth and
- improved lamb survival rates when compared to undernourished ewes.

Summary

Much of a lamb's lifetime production potential is determined prior to birth. The development of the placenta can influence a lamb's future wool, muscle and fat development, lamb survival, lamb growth to weaning, a lambs' lifetime wool quality and cuts as well as carcase yields.

Identifying and preferentially feeding multiple bearing ewes post-scanning can help with placental development.

The economic gain from scanning, preferentially feeding and managing multiple bearing ewes far outweighs costs incurred.

References

Gardner et al (2007) Fetal Mechanisms That Lead to Later Hypertension
https://www.researchgate.net/publication/6147512_Fetal_Mechanisms_That_Lead_to_Later_Hypertension

Contacts and more information:

Land Facts:

- Managing scanned ewes – the basics
- Managing scanned ewes - the benefits
- Managing scanned ewes – Pre-Lambing
- Managing scanned ewes – Lambing
- Managing scanned ewes – Lambing mob structure

For advice and information about improving your sheep enterprise, contact:

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